GOPHER TORTOISE RECIPIENT SITE ANALYSIS

Northeast District

Gopher Tortoise Recipient Site Analysis

The feasibility of using a portion of a state park, or any other state lands, as a gopher tortoise recipient site in accordance with 259.032 F.S. is dependent upon the following criteria:

- The site contains a minimum of 40 acres of contiguous suitable upland tortoise habitat that meet the criteria for soil and vegetation listed below:
    - Soil Criteria: An area on site of at least 40 contiguous acres must meet *acceptable* criteria per the Gopher Tortoise Permitting Guidelines (July 2020, subsequent revisions). *Acceptable* soils include those moderately well-drained to excessively drained, with a midpoint of the upper limit of the water table (DWT) value of 45 centimeters (18 inches) or greater.
    - Vegetation Criteria: An area on site of at least 40 contiguous acres must meet *acceptable* habitat features, including average herbaceous cover of at least 30% and average canopy cover of 60% or less. Improved pasture cannot exceed 40% of the total expected recipient site unit and must include a minimum of 10% patchy shrub cover if improved pasture is present.

Should a portion of a state park, or any other state lands in question, meet the above criteria in its current state, the FWC would consider those areas to be feasible as a potential gopher tortoise recipient site. Should a portion of a state park, or any other state lands have the potential to meet the above listed criteria in the future with appropriate habitat management, the FWC may consider those areas to be potentially feasible as a gopher tortoise recipient site at that time. Should habitat conditions improve through proper management on a public lands site to the point that those lands meet the *acceptable* criteria listed above, the public lands manager should contact FWC staff at that time. The managing agency should make the determination that gopher tortoise recipient site management does not conflict with the primary management objectives of the lands under review. If the lands meet the acceptable criteria listed above, coordinate with FWC staff on this determination.

The following Gopher Tortoise Survey Prioritization Blueprint for State Conservation Lands was prepared in September of 2018. Line Transect Distance Sampling (LTDS) surveys that have been conducted for Northeast District parks are also included in this appendix.

For further details regarding these criteria, please see pages 30-36 of the FWC Gopher Tortoise Permitting Guidelines.

DRP Northeast District Gopher Tortoise Recipient Site Analysis					
PARK	**40+ ACRES OF CONTIGUOUS SUITABLE HABITAT**	**PRIORITIZATION TIER FOR SURVEY** 1 HIGHEST 10 LOWEST	**CONFLICT WITH MANAGEMENT PRIORITIES**	**FEASIBILITY AS RECIPIENT SITE**	**COMMENTS**
Amelia Island	No	N/A	No	No	
George Crady Fishing Pier	No	N/A	N/A	No	
Big Talbot Island	Yes	3	No	No	VP
Little Talbot Island	Yes	3	No	No	VP
Fernandina Plaza Historic	No	N/A	Yes	No	
Fort Clinch	Yes	2	No	No	VP
Fort George Island Cultural	Yes	10	Yes	No	CRS
Pumpkin Hill Preserve	Yes	3	No	Yes	LPD HRR
Yellow Bluff Historic	No	N/A	Yes	No	
Cedar Key Scrub	Yes	3	No	Yes	LPD HRR
Crystal River Archaeological	No	N/A	Yes	No	
Crystal River Preserve	No	N/A	No	No	
Fort Cooper	Yes	10	No	No	VP
Homosassa Springs	No	N/A	No	No	
Rainbow Springs	Yes	1	No	No	VP
Waccasassa Bay	No	N/A	No	No	
Yulee Sugar Mill Historic	No	N/A	Yes	No	
Devil's Millhopper Geological	No	N/A	No	No	

DRP Northeast District Gopher Tortoise Recipient Site Analysis					
PARK	**40+ ACRES OF CONTIGUOUS SUITABLE HABITAT**	**PRIORITIZATION TIER FOR SURVEY** 1 HIGHEST 10 LOWEST	**CONFLICT WITH MANAGEMENT PRIORITIES**	**FEASIBILITY AS RECIPIENT SITE**	**COMMENTS**
Dudley Farm Historic	No	N/A	Yes	No	
Gold Head Branch	Yes	2	No	No	VP
Marjorie Kinnan Rawlings Historic	No	N/A	Yes	No	
O'Leno	Yes	4	No	No	VP
River Rise Preserve	Yes	4	No	No	VP
Olustee Battlefield Historic	No	N/A	Yes	No	
Paynes Prairie Preserve	Yes	1	No	Yes	LPD HRR
Price's Scrub	Yes	4	No	Yes	LPD HRR
San Felasco Hammock Preserve	Yes	1	No	Yes	LPD HRR
Big Shoals	Yes	8	No	Yes	LPD HRR
Fanning Springs	No	N/A	No	No	
Forest Capital	No	N/A	No	No	
Gilchrist Blue Springs	No	N/A	No	No	
Ichetucknee Springs	Yes	1	No	No	VP
Lafayette Blue Springs	No	N/A	No	No	
Madison Blue Spring	No	N/A	No	No	
Manatee Springs	Yes	6	No	Yes	LPD HRR

DRP Northeast District Gopher Tortoise Recipient Site Analysis					
PARK	**40+ ACRES OF CONTIGUOUS SUITABLE HABITAT**	**PRIORITIZATION TIER FOR SURVEY** 1 HIGHEST 10 LOWEST	**CONFLICT WITH MANAGEMENT PRIORITIES**	**FEASIBILITY AS RECIPIENT SITE**	**COMMENTS**
Peacock Springs	No	N/A	No	No	
Stephen Foster Culture Center	No	N/A	No	No	
Suwannee River	Yes	4	No	No	VP
Troy Spring	No	N/A	No	No	
Gainesville-to-Hawthorne Trail	No	N/A	Yes	No	
Nature Coast Trail	No	N/A	Yes	No	
Palatka-to-Lake Butler Trail	No	N/A	Yes	No	
Suwannee River Wilderness Trail	No	N/A	Yes	No	
Withlacoochee Trail	No	N/A	Yes	No	

Comments

LPD – Low Population Density

HRR – Habitat Restoration Required

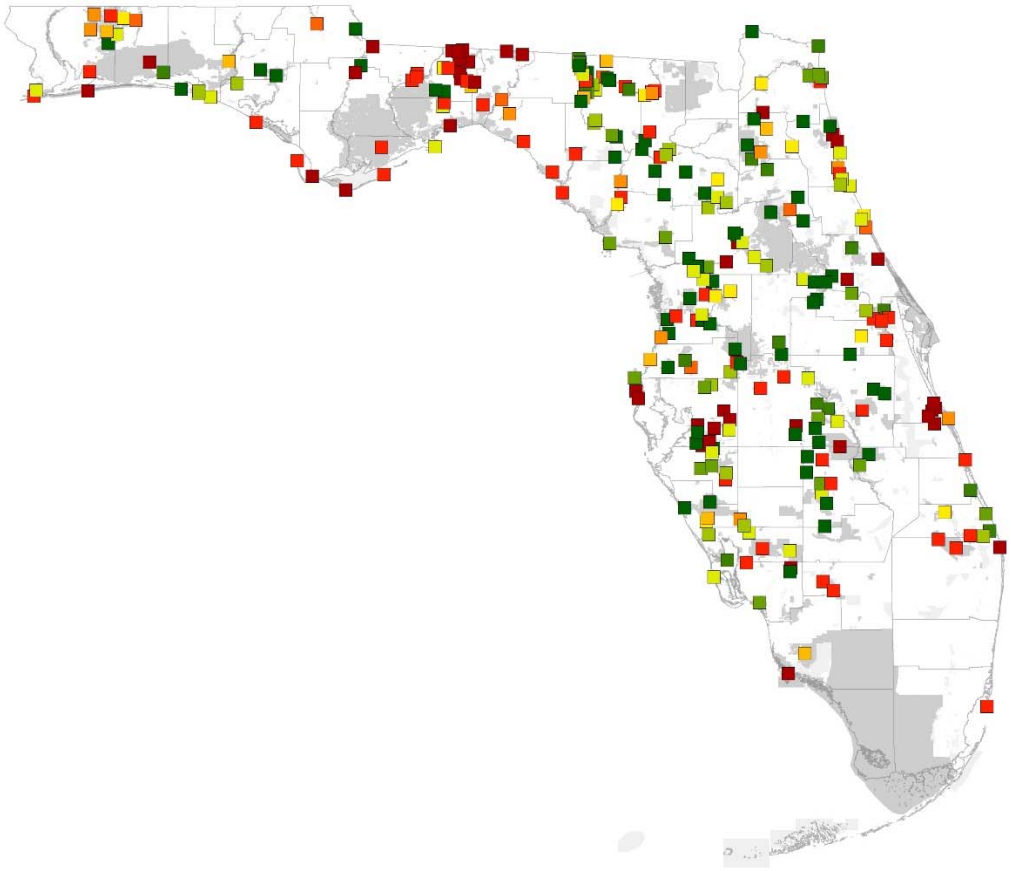
CRS – Cultural Resource Sensitivity

VP – Viable Population

Gopher Tortoise Survey Prioritization Blueprint for State Conservation Lands

Gopherus polyphemus

September 2018



Florida Fish and Wildlife
Conservation Commission

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Introduction and Purpose

The gopher tortoise (*Gopherus polyphemus*) is currently a candidate species for federal listing under the Endangered Species Act in the eastern portion of its range. Assessing gopher tortoise population status using a standardized approach range-wide is critical to determine if the species warrants federal protection. In 2012, participants in the Candidate Conservation Agreement for the Gopher Tortoise adopted line transect distance sampling (LTDS) with burrow scoping (Smith et al. 2009) as the standardized methodology to examine gopher tortoise populations (Candidate Conservation Agreement, 2012). Population survey and monitoring results using LTDS will be used to inform land management decisions, and also help inform the Florida Fish and Wildlife Conservation Commission (FWC) and the U.S. Fish and Wildlife Service (USFWS) on the status of the gopher tortoise in Florida.

The Gopher Tortoise Survey Prioritization Blueprint is intended to assist state agencies in determining where survey efforts and resources should be allocated based on each conservation land's prioritized tier rank; prioritization tiers were determined with input from multiple agencies including Florida Fish and Wildlife Conservation Commission, Florida Forest Service, Florida Park Service, Northwest Florida Water Management District (WMD), South Florida WMD, Southwest Florida WMD, St. Johns River WMD, Suwannee River WMD, and the Florida Natural Areas Inventory.

Survey Prioritization Blueprint

Included in the Survey Prioritization Blueprint are state-owned or managed conservation lands that contain more than 250 acres of potential gopher tortoise habitat, as these lands have the potential to support viable populations (≥250 adult tortoises, ≥0.16 tortoises per acre, ≥250 acres of quality habitat; Gopher Tortoise Council, 2013). Sites that meet the habitat requirement but not population or density criteria are considered support populations, which may have the potential to become viable with habitat and/or population restoration (Gopher Tortoise Council, 2014). While still important to the recovery of the species, sites with <250 acres of tortoise habitat were excluded from this effort as they may not be viable long-term.

State conservation lands were prioritized using a 10-tiered approach, with tier 1 being the highest priority for future surveys, and 10 being the lowest priority for future surveys. Each tier ideally includes a heterogeneous mix of habitat quality, habitat type, size, and spatial distribution to produce a sample representative of conservation lands in Florida. The overall goal is to determine the population status of gopher tortoises in Florida even if surveys on all state conservation lands cannot be completed. Conducting population surveys only on lands known to have superb habitat or a high tortoise density is not conducive to that task. Some state conservation lands were not prioritized. Most often this was because the conservation land, though state-owned, is managed by a local government entity. Other conservation lands that are not state-owned or managed but have received an LTDS survey are also included in this Blueprint with a tier rank of "not prioritized".

Updates and Revisions

The Survey Prioritization Blueprint is a living document and can be altered as new information becomes available. With input from cooperating state agencies, FWC will update the Blueprint annually to include survey progress and determine if changes are needed in prioritization tiers. Cooperation between state agencies is imperative to this effort, and annual updates to this Blueprint will allow agencies to provide progress on gopher tortoise surveys.

September 2017 Summary

There are 268 conservation lands included in the Survey Prioritization Blueprint. Below is a summary of conservation lands within each Tier (Table 1). The Blueprint also includes lands that have been surveyed prior to this effort, most of which were also prioritized with input from multiple state agencies. Also included are state-owned conservation lands that are not managed by state agencies, and previously surveyed sites that are not state owned; these are included in the NA tier, or not prioritized tier.

Table 1. Number of conservation lands within each prioritization tier as of 20 September 2017. Surveyed sites refer to conservation lands that have received a line transect distance sampling (LTDS) survey, or in cases of low population density, a belt transect survey with burrow scoping. Also included are pilot survey results that concluded the site had a gopher tortoise density too low to warrant an LTDS survey. These populations likely will not meet the density criteria for a viable population, but may be reconsidered for surveys following population augmentation or habitat improvement.

Tier	Surveyed	Pilot survey (low density)	Conservation lands (total)
1	30	0	59
2	4	1	14
3	2	0	18
4	3	2	24
5	2	1	25
6	0	0	14
7	0	1	9
8	1	0	11
9	0	0	7
10	4	8	47
NA	13	1	40
Total	**59**	**14**	**268**

September 2018 Summary

Large conservation lands with multiple tracts of land (e.g., Twin Rivers State Forest) were divided by tract to facilitate prioritization rankings as separate tracts may represent individual populations and thus, should be surveyed separately. Therefore, 280 conservation lands are included in the 2018 Survey Prioritization Blueprint update. Ten conservation lands were surveyed between September 2017 and September 2018, population statuses of which have been updated in the Blueprint. An additional three sites received pilot LTDS surveys, but results indicated insufficient habitat or density to be viable and did not warrant full surveys. Below is a summary of conservation lands within each Tier (Table 2). Of the 280 conservation lands included in the Survey Prioritization Blueprint, 69 (25%) have received an LTDS or belt transect survey with burrow scoping. The majority of those surveys (52%) were conducted on sites listed as Tier 1 priorities to receive an LTDS survey.

As of 18 September 2018, 37 viable, 23 primary support, and 8 secondary support populations have been documented on conservation lands in Florida via LTDS or belt transect surveys with burrow scoping. As O'Leno State Park and River Rise Preserve State Park are contiguous, this gopher tortoise population was considered a single population and received one combined survey.

Table 2. Number of conservation lands within each prioritization tier that have received a line transect distance sampling (LTDS) pilot or full survey, or comprehensive belt transect survey (with burrow scoping) as of 18 September 2018.

Tier	Surveyed	Pilot survey (low density)	Conservation lands (total)
1	36	0	66
2	4	2	17
3	2	2	18
4	3	2	20
5	2	1	27
6	0	0	14
7	0	0	9
8	1	0	10
9	0	0	7
10	6	9	50
NA	15	1	42
Total	**69**	**17**	**280**

Literature Cited

Candidate Conservation Agreement for the Gopher Tortoise. 2008. Candidate Conservation Agreement for the Gopher Tortoise (*Gopherus polyphemus*): Eastern Population. Revised 2012.

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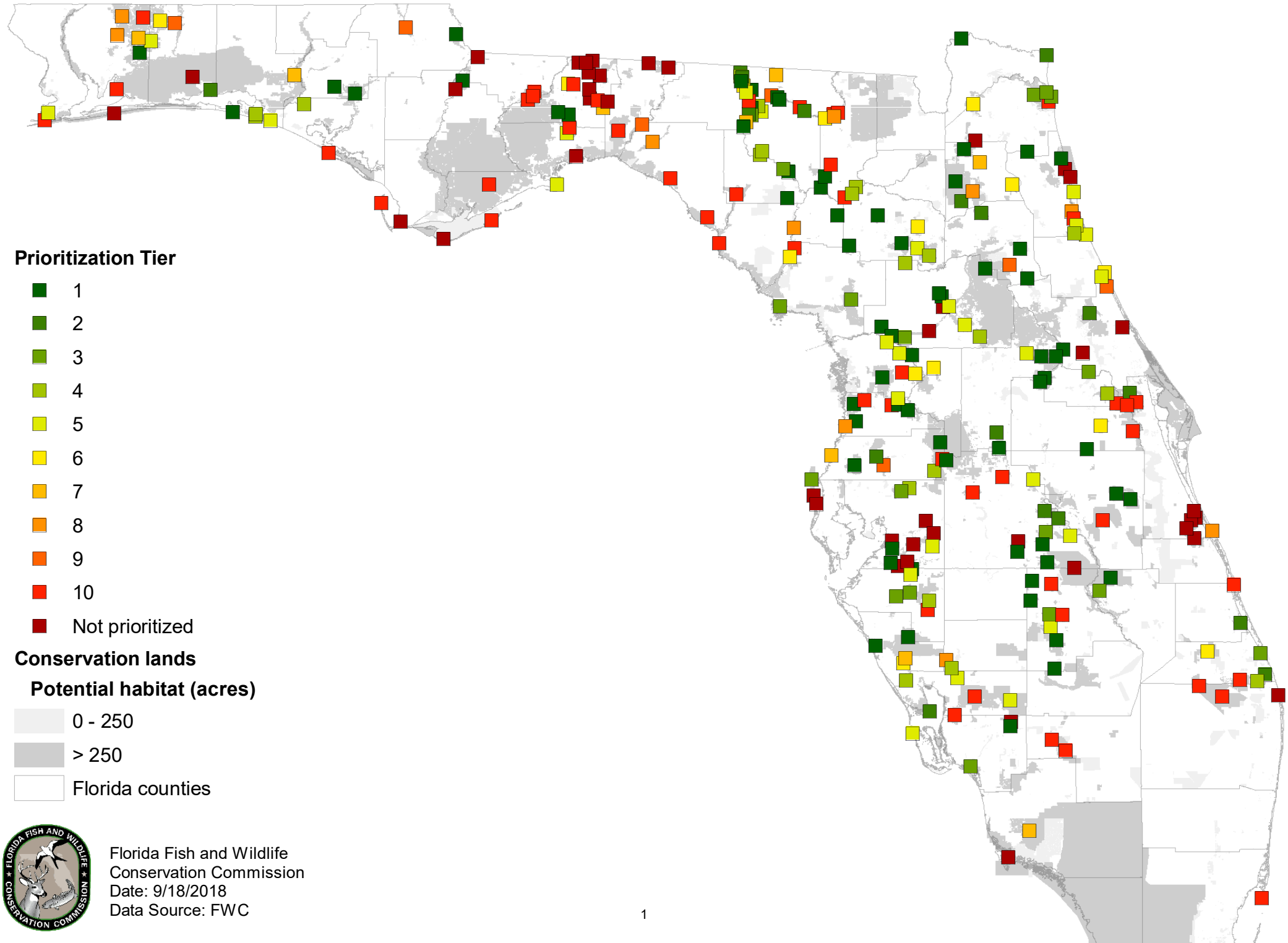

Florida Fish and Wildlife Conservation Commission
Date: 9/18/2018
Data Source: FWC

Map Label	Population Estimate?	Site Name	Prioritization Tier	Potential habitat (acres)	Predominant Natural Community	Survey Year	Population Status	Managing Agency
239	N	Alafia River Corridor	NA	1237	Mixed Hardwood-Coniferous			Hillsborough County
122	N	Alafia River State Park	5	685	Xeric Hammock			FL Dept. of Environmental Protection, Div. of Recreation and Parks
189	N	Alfred B. Maclay Gardens State Park	10	755	Mixed Hardwood-Coniferous			FL Dept. of Environmental Protection, Div. of Recreation and Parks
149	N	Allapattah Flats	6	589	Mesic Flatwoods			South Florida Water Management District
67	N - pilot survey indicates low density	Allen David Broussard Catfish Creek Preserve State Park	2	2736	Scrub			FL Dept. of Environmental Protection, Div. of Recreation and Parks
123	N	Anastasia State Park	5	849	Beach Dune, Maritime Hammock			FL Dept. of Environmental Protection, Div. of Recreation and Parks
84	N	Anclote Key Preserve State Park	3	473	Beach Dune			FL Dept. of Environmental Protection, Div. of Recreation and Parks
190	N	Andrews Wildlife Management Area	10	2938	Upland Hardwood Forest			FL Fish and Wildlife Conservation Commission
191	N	Annutteliga Hammock	10	1873	Sandhill			Southwest Florida Water Management District
240	N	Apalachee Correctional Institution	NA	1320	Coniferous Plantations, Mixed Hardwood-Coniferous			PRIDE Enterprises, Inc.
1	Y	Apalachee Wildlife Management Area	1	3068	Upland Pine, Sandhill	2017	Viable	FL Fish and Wildlife Conservation Commission
241	Y	Apalachicola Bluffs and Ravines Preserve	NA	3929	Sandhill, Mixed Hardwood-Coniferous	2014	Primary Support	The Nature Conservancy
2	Y	Apalachicola National Forest - Munson East	1	3600	Sandhill	2015	Viable	US Dept. of Agriculture, Forest Service
3	Y	Apalachicola National Forest - Munson West	1	14032	Sandhill	2015	Primary Support	US Dept. of Agriculture, Forest Service
192	N	Aucilla Wildlife Management Area	10	1327	Upland Hardwood Forest, Coniferous Plantations, Mesic Flatwoods	2012		FL Fish and Wildlife Conservation Commission
193	N – Insufficient suitable habitat	Avalon State Park	10	371	Maritime Hammock, Coastal Strand			FL Dept. of Environmental Protection, Div. of Recreation and Parks
242	Y	Avon Park Air Force Range	NA	33979	Mesic Flatwoods, Scrub, Dry Prairie, Scrubby Flatwoods	2015	Viable	US Dept. of Defense, Air Force
124	N	Babcock Ranch Preserve	5	31589	Mesic Flatwoods			FL Dept. of Agriculture and Consumer Services, FL Forest Service
125	N	Bald Point State Park	5	1240	Coniferous Plantation, Scrubby Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
243	N	Balm-Boyette Scrub	NA	2012	Mesic Flatwoods, Scrub			Hillsborough County
150	N	Bayard Conservation Area	6	856	Mesic Flatwoods			St. Johns River Water Management District
4	Y	Bell Ridge Longleaf Wildlife and Environmental Area	1	716	Sandhill	2014	Viable	FL Fish and Wildlife Conservation Commission
172	N	Belmore State Forest	8	2110	Coniferous Plantations	2011		FL Dept. of Agriculture and Consumer Services, FL Forest Service
194	N - pilot survey indicates low density	Big Bend Wildlife Management Area - Jena	10	2224	Mesic Flatwoods			FL Fish and Wildlife Conservation Commission
195	Y	Big Bend Wildlife Management Area - Spring Creek	10	722	Coniferous Plantations, Sandhill	2016	Primary Support	FL Fish and Wildlife Conservation Commission
196	Y	Big Bend Wildlife Management Area - Tide Swamp	10	342	Coniferous Plantations	2016	Primary Support	FL Fish and Wildlife Conservation Commission
197	N	Big Lagoon State Park	10	312	Scrubby Flatwoods, Coastal Scrub			FL Dept. of Environmental Protection, Div. of Recreation and Parks
198	N	Big Shoals State Forest	10	576	Mesic Flatwoods			FL Dept. of Agriculture and Consumer Services, FL Forest Service
173	N	Big Shoals State Park	8	588	Mesic Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
85	N	Big Talbot Island State Park	3	1392	Maritime Hammock, Coastal Strand			FL Dept. of Environmental Protection, Div. of Recreation and Parks
199	N	Bill Baggs Cape Florida State Park	10	253	Coastal Strand			FL Dept. of Environmental Protection, Div. of Recreation and Parks
163	N	Black Creek Ravines Conservation Area	7	449	Sandhill, Xeric Hammock			St. Johns River Water Management District
126	N	Blackwater River State Forest - Bone Creek Unit	5	9347	Upland Pine, Sandhill			FL Dept. of Agriculture and Consumer Services, FL Forest Service
174	N	Blackwater River State Forest - Coldwater Unit	8	8754	Upland Pine			FL Dept. of Agriculture and Consumer Services, FL Forest Service
164	N	Blackwater River State Forest - Floridale Unit	7	15814	Upland Pine			FL Dept. of Agriculture and Consumer Services, FL Forest Service
182	N	Blackwater River State Forest - Horse Creek Unit	9	4853	Upland Pine			FL Dept. of Agriculture and Consumer Services, FL Forest Service
5	Scheduled 2018/2019	Blackwater River State Forest - Juniper Creek Unit (includes Hutton Unit and Blackwater River State Park)	1	14331	Upland Pine, Sandhill			FL Dept. of Agriculture and Consumer Services, FL Forest Service
151	N	Blackwater River State Forest - Rock Creek Unit	6	19205	Upland Pine			FL Dept. of Agriculture and Consumer Services, FL Forest Service
200	N - pilot survey indicates low density	Blackwater River State Forest - Sweetwater Unit	10	21400	Upland Pine			FL Dept. of Agriculture and Consumer Services, FL Forest Service
175	Y	Blackwater River State Forest - West Boundary Unit	8	6984	Upland Pine	2016	Primary Support	FL Dept. of Agriculture and Consumer Services, FL Forest Service
6	Scheduled 2018/2019	Blue Spring State Park	1	1089	Scrub			FL Dept. of Environmental Protection, Div. of Recreation and Parks
244	Y	Branan Field Wildlife and Environmental Area	NA	94	Sandhill	2017	Secondary Support	FL Fish and Wildlife Conservation Commission
68	N	Buck Lake Conservation Area	2	2142	Mesic Flatwoods			St. Johns River Water Management District
7	Y	Bullfrog Creek Wildlife and Environmental Area	1	560	Mesic Flatwoods	2016	Viable	FL Fish and Wildlife Conservation Commission
127	N	Bulow Creek State Park	5	851	Mesic Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks

Map Label	Population Estimate?	Site Name	Prioritization Tier	Potential habitat (acres)	Predominant Natural Community	Survey Year	Population Status	Managing Agency
245	N - pilot survey indicates low density	Caladesi Island State Park	NA	246	Cabbage Palm, Maritime Hammock			FL Dept. of Environmental Protection, Div. of Recreation and Parks
246	N	Caloosahatchee Regional Park	NA	491	Improved Pasture, Mesic Flatwoods, Shrub and Brushland	2014		Lee County
8	N	Camp Blanding Military Reservation	1	34072	Sandhill, Pine Flatwoods and Dry Prairie			FL Dept. of Military Affairs
201	N	Camp Branch Conservation Area	10	527	Sandhill, Mesic Flatwoods, Scrubby Flatwoods			Suwannee River Water Management District
247	N	Cape St. George State Reserve	NA	816	Coastal Scrub, Scrubby Flatwoods			FL Dept. of Environmental Protection, Florida Coastal Office
152	N	Cary State Forest	6	1023	Coniferous Plantations	2011		FL Dept. of Agriculture and Consumer Services, FL Forest Service
128	Y	Cayo Costa State Park	5	1653	Maritime Hammock, Coastal Grasslands	2015	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
86	N - pilot survey indicates low density	Cedar Key Scrub State Reserve	3	1033	Scrubby Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
202	N	Charles H. Bronson State Forest	10	908	Mesic Flatwoods			FL Dept. of Agriculture and Consumer Services, FL Forest Service
69	N	Charlotte Harbor Preserve State Park	2	4979	Mesic Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
9	Y	Chassahowitzka Wildlife Management Area	1	8130	Sandhill	2017	Viable	FL Fish and Wildlife Conservation Commission
248	Y	Cherokee Plantation Conservation Easement	NA	1269	Upland Coniferous	2015	Secondary Support	Tall Timbers Research, Inc.
203	N	Chinsegut Wildlife and Environmental Area	10	550	Sandhill			FL Fish and Wildlife Conservation Commission
165	N	Choctawhatchee River Water Management Area	7	6372	Coniferous Plantation			Northwest Florida Water Management District
10	N	Colt Creek State Park	1	1906	Mesic Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
70	N	Conner Preserve	2	773	Mesic Flatwoods, Sandhill			Southwest Florida Water Management District
249	N	Crooked Lake West - Stuart Tract	NA	1180	Mesic Flatwoods			Polk County
11	Y	Crooked Lake Wildlife and Environmental Area	1	281	Sandhill, Mesic Flatwoods	2016	Primary Support	FL Fish and Wildlife Conservation Commission
102	Scheduled 2018/2019	Cypress Creek and Loxahatchee River Management Area	4	1615	Mesic Flatwoods			South Florida Water Management District
183	N	Cypress Creek Flood Detention Area	9	1341	Mesic Flatwoods			Southwest Florida Water Management District
204	N	Deep Creek Conservation Area (SRWMD)	10	332	Coniferous Plantation, Mesic Flatwoods			Suwannee River Water Management District
129	N - pilot survey indicates low density	Deer Lake State Park	5	1079	Mesic Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
153	N	Deer Prairie Creek Preserve	6	4038	Mesic Flatwoods	2008		Southwest Florida Water Management District
250	Y	Dixie Plantation Conservation Easement	NA	4615	Unimproved/Woodland Pasture, Coniferous Plantations	2015	Primary Support	Suwannee River Water Management District
251	N	Doris Leeper Spruce Creek Preserve	NA	1277	Scrub, Mixed Hardwood-Coniferous, Scrubby Flatwoods			Volusia County
205	N	Dr. Julian G. Bruce St. George Island State Park	10	1134	Coastal Grassland			FL Dept. of Environmental Protection, Div. of Recreation and Parks
12	N	Dunns Creek State Park	1	2479	Scrub, Sandhill			FL Dept. of Environmental Protection, Div. of Recreation and Parks
206	N	Dupuis Reserve	10	11581	Mesic Flatwoods			South Florida Water Management District
176	N	Econfina Conservation Area	8	920	Coniferous Plantations			Suwannee River Water Management District
13	N	Econfina Creek Water Management Area	1	20181	Coniferous Plantations			Northwest Florida Water Management District
14	Y	Econfina Creek WMA - Fitzhugh Carter Tract	1	948	Coniferous Plantations	2017	Primary Support	Northwest Florida Water Management District
130	Y	Edward Ball Wakulla Springs State Park	5	4817	Upland Pine, Mixed Hardwood Coniferous	2015	Primary Support	FL Dept. of Environmental Protection, Div. of Recreation and Parks
87	N	Edward Chance Reserve	3	3976	Mesic Flatwoods, Scrub			Southwest Florida Water Management District
252	N	Edward Medard Park and Reservoir	NA	320	Mixed Hardwood-Coniferous			Hillsborough County
253	Y	Eglin Air Force Base	NA	353116	Sandhill, Coniferous Plantations	2016	Secondary Support	US Dept. of Defense, Air Force
254	Y	El Destino Plantation	NA	1525	Upland Coniferous	2015	Primary Support	
154	N	Elinor Klapp-Phipps Park	6	411	Upland Hardwood Forest, Mixed Hardwood-Coniferous			City of Tallahassee
207	N - pilot survey indicates low density	Escribano Point Wildlife Management Area	10	454	Sandhill, Scrubby Flatwoods			FL Fish and Wildlife Conservation Commission
88	N	Estero Bay Preserve State Park	3	484	Mesic Flatwoods, Scrubby Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
71	Y	Etoniah Creek State Forest	2	4716	Sandhill, Scrub	2015	Viable	FL Dept. of Agriculture and Consumer Services, FL Forest Service
131	N	Falmouth Spring Conservation Area	5	265	Upland Pine			Suwannee River Water Management District
132	N	Faver-Dykes State Park	5	2005	Mesic Flatwoods, Coniferous Plantations, Maritime Hammock			FL Dept. of Environmental Protection, Div. of Recreation and Parks
255	N	Florida Horse Park	NA	499	Improved Pasture, Sandhill			Florida Agriculture and Horse Park Authority
155	N	Flying Eagle Preserve	6	1208	Ruderal pasture, some sandhill and scrub. Much of the habitat consists of large basin marshes			Southwest Florida Water Management District

Map Label	Population Estimate?	Site Name	Prioritization Tier	Potential habitat (acres)	Predominant Natural Community	Survey Year	Population Status	Managing Agency
72	Scheduled 2018/2019	Fort Clinch State Park	2	1118	Maritime Hammock			FL Dept. of Environmental Protection, Div. of Recreation and Parks
208	N	Fort Cooper State Park	10	373	Sandhill			FL Dept. of Environmental Protection, Div. of Recreation and Parks
209	N	Fort George Island Cultural State Park	10	625	Maritime Hammock			FL Dept. of Environmental Protection, Div. of Recreation and Parks
15	Y	Fort White Wildlife and Environmental Area	1	1277	Sandhill	2014	Viable	FL Fish and Wildlife Conservation Commission
256	Y	Foshalee Plantation Conservation Easement	NA	1463	Upland Coniferous	2015	Secondary Support	Tall Timbers Research, Inc.
210	N	Fred C. Babcock-Cecil M. Webb Wildlife Management Area	10	39621	Mesic Flatwoods			FL Fish and Wildlife Conservation Commission
73	N	Fred Gannon Rocky Bayou State Park	2	284	Scrub			FL Dept. of Environmental Protection, Div. of Recreation and Parks
89	Y	Goethe State Forest	3	11200	Sandhill	2014	Viable	FL Dept. of Agriculture and Consumer Services, FL Forest Service
257	N	Golden Aster Scrub Nature Preserve	NA	959	Mesic Flatwoods, Scrub, Scrubby Flatwoods			Hillsborough County
103	N - pilot survey indicates low density	Grayton Beach State Park	4	1302	Scrub, Scrubby Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
16	Y	Green Swamp West	1	13806	Sandhill, Improved Pasture	2018	Viable	Southwest Florida Water Management District
258	N	GTMNERR - Guana River Site	NA	1531	Maritime Hammock, Coastal Scrub			FL Dept. of Environmental Protection, Florida Coastal Office
17	Y	Guana River Wildlife Management Area	1	2003	Maritime Hammock, Scrub, Scrubby Flatwoods	2015	Primary Support	FL Fish and Wildlife Conservation Commission
259	N	Guana Tolomato Matanzas National Estuarine Research Reserve	NA	433	Coastal Uplands			FL Dept. of Environmental Protection, Florida Coastal Office
260	N	Gulf Islands National Seashore	NA	1772	Coastal Scrub			US Dept. of the Interior, National Park Service
156	N	Hal Scott Regional Preserve and Park	6	5482	Mesic Flatwoods			St. Johns River Water Management District
18	Y	Half Moon Wildlife Management Area	1	2396	Improved Pasture, Mesic Flatwoods	2016	Viable	FL Fish and Wildlife Conservation Commission
19	Scheduled 2018/2019	Halpata Tastanaki Preserve	1	1700	Sandhill, Scrub, Mesic Hammock, Rural Open	2007		Southwest Florida Water Management District
20	Scheduled 2018/2019	Herky Huffman/Bull Creek Wildlife Management Area	1	13481	Mesic Flatwoods			FL Fish and Wildlife Conservation Commission
21	Y	Hickey Creek Wildlife and Environmental Area	1	410	Mesic Flatwoods, Scrubby Flatwoods	2016	Primary Support	FL Fish and Wildlife Conservation Commission
22	Y	Highlands Hammock State Park	1	3971	Scrub, Scrubby Flatwoods, Mesic Flatwoods	2017	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
104	N	Hillsborough River State Park	4	298	Mesic Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
23	Y	Hilochee Wildlife Management Area	1	1634	Mesic Flatwoods, Coniferous Plantations	2015	Primary Support	FL Fish and Wildlife Conservation Commission
24	N	Holton Creek Conservation Area	1	1404	Upland Hardwood Forest, Coniferous Plantations			Suwannee River Water Management District
261	Y	Honeymoon Island State Park	NA	354	Beach Dune, Mesic Flatwoods, Coastal Strand	2017	Secondary Support	FL Dept. of Environmental Protection, Div. of Recreation and Parks
262	Y	Horseshoe Plantation Conservation Easement	NA	3896	Upland Coniferous	2015	Primary Support	Tall Timbers Research, Inc.
25	Y	Ichetucknee Springs State Park	1	2200	Sandhill, Upland Pine	2014	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
211	N	Ichetucknee Trace	10	345	Coniferous Plantations			FL Dept. of Environmental Protection, Div. of Recreation and Parks
26	Scheduled 2018/2019	Indian Lake State Forest	1	4074	Sandhill, Improved Pasture			FL Dept. of Agriculture and Consumer Services, FL Forest Service
263	N	J. R. Alford Greenway	NA	331	Mixed Hardwood-Coniferous			Leon County
212	N	J. W. Corbett Wildlife Management Area	10	17532	Mesic Flatwoods			FL Fish and Wildlife Conservation Commission
90	N	Jack Creek	3	464	Scrub			Southwest Florida Water Management District
27	Y	Jennings State Forest	1	11655	Sandhill	2017	Viable	FL Dept. of Agriculture and Consumer Services, FL Forest Service
213	Y	Joe Budd Wildlife Management Area	10	1137	Upland Pine	2014	Primary Support	FL Fish and Wildlife Conservation Commission
214	N	John C. and Mariana Jones/Hungryland Wildlife and Environmental Area	10	2993	Mesic Flatwoods			FL Fish and Wildlife Conservation Commission
74	Y	Jonathan Dickinson State Park	2	4559	Scrub, Scrubby Flatwoods, Mesic Flatwoods	2015	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
264	N	Jordan Scrub Sanctuary	NA	532	Mesic Flatwoods, Scrubby Flatwoods, Scrub			Brevard County
28	Y	Julington-Durbin Preserve	1	542	Sandhill	2017	Viable	St. Johns River Water Management District
265	N	Juno Dunes Natural Area	NA	369	Scrub			Palm Beach County
29	Y	Kissimmee Prairie Preserve State Park	1	23387	Dry Prairie	2017	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
91	N	Kissimmee River	3	4038	Dry Prairie, Mesic Flatwoods			South Florida Water Management District
215	N - pilot survey indicates low density	L. Kirk Edwards Wildlife and Environmental Area	10	441	Upland Pine			FL Fish and Wildlife Conservation Commission
30	Y	Lafayette Forest Wildlife and Environmental Area	1	759	Coniferous Plantations	2016	Viable	FL Fish and Wildlife Conservation Commission
31	Scheduled 2018/2019	Lake George Conservation Area	1	1660	Scrub, Scrubby Flatwoods, Sand Pine Scrub			St. Johns River Water Management District
133	N	Lake June-in-Winter Scrub State Park	5	640	Scrub			FL Dept. of Environmental Protection, Div. of Recreation and Parks

Map Label	Population Estimate?	Site Name	Prioritization Tier	Potential habitat (acres)	Predominant Natural Community	Survey Year	Population Status	Managing Agency
75	Scheduled 2018/2019	Lake Kissimmee State Park	2	1294	Mesic Flatwoods, Scrubby Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
76	Y	Lake Louisa State Park	2	1385	Unimproved/Woodland Pasture, Coniferous Plantations	2015	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
92	N	Lake Manatee State Park	3	503	Mesic Flatwoods, Scrub, Scrubby Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
93	N	Lake Monroe Conservation Area	3	562	Scrubby Flatwoods			St. Johns River Water Management District
134	N	Lake Norris Conservation Area	5	468	Improved Pasture			St. Johns River Water Management District
157	N	Lake Panasoffkee	6	1869	Improved Pasture, Mesic Hammock, Scrubby Flatwoods	2009		Southwest Florida Water Management District
216	N - pilot survey indicates low density	Lake Talquin State Forest	10	10145	Upland Pine			FL Dept. of Agriculture and Consumer Services, FL Forest Service
217	N	Lake Talquin State Park	10	295	Sandhill, Upland Hardwood Forest			FL Dept. of Environmental Protection, Div. of Recreation and Parks
32	N	Lake Wales Ridge State Forest - Arbuckle	1	1006	Scrub, Mesic Flatwoods, Sandhill			FL Dept. of Agriculture and Consumer Services, FL Forest Service
94	N	Lake Wales Ridge State Forest - Hesperides	3	418	Scrub, Sandhill, Mesic Flatwoods			FL Dept. of Agriculture and Consumer Services, FL Forest Service
135	N	Lake Wales Ridge State Forest - Prairie	5	1635	Dry Prairie			FL Dept. of Agriculture and Consumer Services, FL Forest Service
33	N	Lake Wales Ridge State Forest - Walk-in-Water	1	745	Sandhill			FL Dept. of Agriculture and Consumer Services, FL Forest Service
218	Y	Lake Wales Ridge Wildlife and Environmental Area - Carter Creek	10	1939	Scrub, Scrubby Flatwoods	2015	Primary Support	FL Fish and Wildlife Conservation Commission
34	Scheduled 2018/2019	Lake Wales Ridge Wildlife and Environmental Area - Lake Placid/McJunkin	1	2002	Scrub, Scrubby Flatwoods, Sandhill, Mesic Flatwoods			FL Fish and Wildlife Conservation Commission
219	N - pilot survey indicates low density	Lake Wales Ridge Wildlife and Environmental Area - Royce/Clements	10	1152	Improved Pasture, Scrub, Scrubby Flatwoods			FL Fish and Wildlife Conservation Commission
35	Y	Lake Wales Ridge Wildlife and Environmental Area - Silver Lake	1	353	Scrubby Flatwoods, Mesic Flatwoods, Scrub, Sandhill	2015	Viable	FL Fish and Wildlife Conservation Commission
105	N	Little Big Econ State Forest	4	1108	Scrubby Flatwoods, Scrub, Mesic Flatwoods			FL Dept. of Agriculture and Consumer Services, FL Forest Service
220	N	Little Gator Creek Wildlife and Environmental Area	10	316	Mesic Flatwoods			FL Fish and Wildlife Conservation Commission
136	N	Little Manatee River (SWFWMD)-Southfork	5	493	Unimproved/Woodland Pasture, Scrub			Southwest Florida Water Management District
266	N	Little Manatee River Corridor	NA	1308	Mesic Flatwoods			Hillsborough County
36	Y	Little Manatee River State Park	1	1430	Mesic Flatwoods, Scrub	2018	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
37	Scheduled 2018/2019	Little River Conservation Area	1	1849	Sandhill			Suwannee River Water Management District
95	Y	Little Talbot Island State Park	3	1199	Maritime Hammock, Coastal Strand	2014	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
106	N	Lochloosa Wildlife Conservation Area	4	1518	Coniferous Plantations, Scrubby Flatwoods			St. Johns River Water Management District
137	N	Longleaf Flatwoods Reserve	5	848	Coniferous Plantations			St. Johns River Water Management District
184	N	Lower Alapaha Conservation Area	9	423	Coniferous Plantations			Suwannee River Water Management District
96	N	Lower Hillsborough Flood Detention Area	3	4200	Mesic Flatwoods			Southwest Florida Water Management District
107	N	Lower Peace River Corridor (Deep Creek Tract)	4	1111	Mesic Flatwoods			Southwest Florida Water Management District
38	N	Lower Wekiva River Preserve State Park	1	846	Mesic Flatwoods, Sandhill			FL Dept. of Environmental Protection, Div. of Recreation and Parks
267	N	Lyonia Preserve	NA	308	Scrub			Volusia County
158	N	Manatee Springs State Park	6	1434	Mixed Hardwood-Coniferous, Upland Mixed Woodland			FL Dept. of Environmental Protection, Div. of Recreation and Parks
39	One tract scheduled 2018/2019	Marjorie Harris Carr Cross Florida Greenway State Recreation and Conservation Area	1	14359	Sandhill			FL Dept. of Environmental Protection, Div. of Recreation and Parks
221	N	Matanzas State Forest	10	696	Coniferous Plantations, Maritime Hammock			FL Dept. of Agriculture and Consumer Services, Florida Forest Service
268	Y	Merrily Plantation Conservation Easement	NA	1457	Upland Coniferous	2015	Secondary Support	Tall Timbers Research, Inc.
269	N	Micco Scrub Sanctuary	NA	506	Mesic Flatwoods, Scrubby Flatwoods			Brevard County
270	N	Miccosukee Canopy Road Greenway	NA	348	Upland Coniferous, Coniferous Plantations, Oak Scrub			Leon County
185	N	Middle Aucilla Conservation Area	9	1453	Coniferous Plantations			Suwannee River Water Management District
77	Y	Mike Roess Gold Head Branch State Park	2	1896	Sandhill	2014	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
40	Y	Moody Branch Wildlife and Environmental Area	1	574	Scrub, Scrubby Flatwoods, Mesic Flatwoods	2015	Viable	FL Fish and Wildlife Conservation Commission
177	N	Moses Creek Conservation Area	8	1044	Mixed Hardwood-Coniferous, Shrub and Brushland			St. Johns River Water Management District
166	N	Myakka River (Schewe tract)	7	2553	Mesic Flatwoods			Southwest Florida Water Management District
41	N	Myakka River State Park	1	19669	Dry Prairie			FL Dept. of Environmental Protection, Div. of Recreation and Parks

Map Label	Population Estimate?	Site Name	Prioritization Tier	Potential habitat (acres)	Predominant Natural Community	Survey Year	Population Status	Managing Agency
108	N	Myakka State Forest	4	4886	Mesic Flatwoods			FL Dept. of Agriculture and Consumer Services, FL Forest Service
159	N	Newnans Lake Conservation Area	6	541	Coniferous Plantations, Mesic Flatwoods			St. Johns River Water Management District
160	N	North Peninsula State Park	6	390	Coastal Scrub			FL Dept. of Environmental Protection, Div. of Recreation and Parks
42	Y	Ocala National Forest - Riverside Island Sandhill	1	286725	Sand Pine Scrub	2015	Primary Support	US Dept. of Agriculture, Forest Service
138	N	Ocklawaha Prairie Restoration Area	5	539	Coniferous Plantations			St. Johns River Water Management District
222	N	Okaloacoochee Slough State Forest	10	7431	Mesic Flatwoods			FL Dept. of Agriculture and Consumer Services, FL Forest Service
109	Y	O'leno State Park	4	1574	Scrub, Mesic Flatwoods	2014	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
43	Scheduled 2018/2019	Oscar Scherer State Park	1	1171	Mesic Flatwoods, Scrubby Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
223	N	Osprey Unit	10	1055	Mesic Flatwoods			FL Fish and Wildlife Conservation Commission
44	N	Paynes Prairie Preserve State Park	1	1647	Mixed Hardwood Coniferous, Upland Pine, Mesic Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
110	N	Peacock Springs Conservation Area	4	618	Coniferous Plantations			Suwannee River Water Management District
111	N	Pellicer Creek Conservation Area	4	1173	Coniferous Plantations			St. Johns River Water Management District
45	Y	Perry Oldenburg Wildlife and Environmental Area	1	336	Sandhill	2015	Primary Support	FL Fish and Wildlife Conservation Commission
167	N	Picayune Strand State Forest	7	1505	Mesic Flatwoods			FL Dept. of Agriculture and Consumer Services, FL Forest Service
112	N	Pine Log State Forest	4	2984	Sandhill, Mesic Flatwoods	2015		FL Dept. of Agriculture and Consumer Services, FL Forest Service
46	Y	Platt Branch Wildlife and Environmental Area	1	921	Mesic Flatwoods, Scrub, Improved Pasture	2017	Viable	FL Fish and Wildlife Conservation Commission
113	N - pilot survey indicates low density	Point Washington State Forest	4	4936	Sandhill, Mesic Flatwoods, Scrubby Flatwoods, Scrub	2014		FL Dept. of Agriculture and Consumer Services, Florida Forest Service
139	N	Potts Preserve	5	1267	Scrub, Scrubby Flatwoods, Ruderal			Southwest Florida Water Management District
140	N	Prairie/Shell Creek	5	316	Mesic Flatwoods and Scrub/Scrubby FW			Southwest Florida Water Management District
114	N	Price's Scrub	4	399	Scrubby Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
97	N - pilot survey indicates low density	Pumpkin Hill Creek Preserve State Park	3	581	Scrubby Flatwoods, Coniferous Plantations			FL Dept. of Environmental Protection, Div. of Recreation and Parks
47	Y	Rainbow Springs State Park	1	999	Sandhill	2018	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
48	Y	Ralph E. Simmons State Forest	1	787	Sandhill	2017	Viable	FL Dept. of Agriculture and Consumer Services, FL Forest Service
115	Y	River Rise Preserve State Park	4	2341	Upland Pine, Sandhill	2014	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
49	N	Rock Springs Run State Reserve	1	2247	Scrubby Flatwoods, Scrub			FL Dept. of Environmental Protection, Div. of Recreation and Parks
271	N	Rookery Bay National Estuarine Research Reserve	NA	1709	Scrub, Mesic Flatwoods, Maritime Hammock			FL Dept. of Environmental Protection, Florida Coastal Office
98	N	Ross Prairie State Forest	3	2679	Sandhill, Scrubby Flatwoods			FL Dept. of Agriculture and Consumer Services, FL Forest Service
178	N	RV Griffin Reserve (GDC)	8	1191	Dry Prairie, Mesic Flatwoods			Southwest Florida Water Management District
224	N - pilot survey indicates low density	Salt Lake Wildlife Management Area	10	992	Mesic Flatwoods	2010		FL Fish and Wildlife Conservation Commission
50	N	San Felasco Hammock Preserve State Park	1	4039	Mixed Hardwood Coniferous, Upland Pine			FL Dept. of Environmental Protection, Div. of Recreation and Parks
225	N	Santa Fe Springs Conservation Area	10	584	Coniferous Plantations			Suwannee River Water Management District
78	N - pilot survey indicates low density	Savannas Preserve State Park	2	3282	Mesic Flatwoods, Scrub			FL Dept. of Environmental Protection, Div. of Recreation and Parks
99	Scheduled 2018/2019	Seabranch Preserve State Park	3	611	Scrub, Scrubby Flatwoods, Mesic Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
179	N	Sebastian Inlet State Park	8	251	Maritime Hammock, Coastal Strand			FL Dept. of Environmental Protection, Div. of Recreation and Parks
226	N	Seminole Ranch Conservation Area	10	559	Mesic Flatwoods			St. Johns River Water Management District
51	N	Seminole State Forest	1	8791	Scrub			FL Dept. of Agriculture and Consumer Services, FL Forest Service
272	N	Silver Springs Conservation Area	NA	317	Sandhill, Mixed Hardwood-Coniferous			Marion County
141	N	Silver Springs State Park	5	955	Sandhill, Scrubby Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
142	N	Southfork State Park	5	577	Scrub, Mixed Hardwood-Coniferous, Mesic Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
227	N	Spirit of the Wild Wildlife Management Area	10	1425	Mesic Flatwoods			FL Fish and Wildlife Conservation Commission
52	Scheduled 2019/2020	Split Oak Forest Wildlife and Environmental Area	1	931	Scrubby Flatwoods, Mesic Flatwoods			FL Fish and Wildlife Conservation Commission
228	N	St. Andrews State Park	10	601	Coastal Scrub, Maritime Hammock, Beach Dune			FL Dept. of Environmental Protection, Div. of Recreation and Parks
273	N	St. Joseph Bay State Buffer Preserve	NA	421	Scrubby Flatwoods, Scrub			FL Dept. of Environmental Protection, Florida Coastal Office
274	Y	St. Marks National Wildlife Refuge	NA	8422	Sandhill	2011	Viable	US Dept. of the Interior, Fish and Wildlife Service
168	N	St. Marks River Preserve State Park	7	1027	Coniferous Plantations, Mesic Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
275	Y	St. Sebastian River Preserve State Park	NA	13686	Mesic Flatwoods, Scrubby Flatwoods	2015	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks

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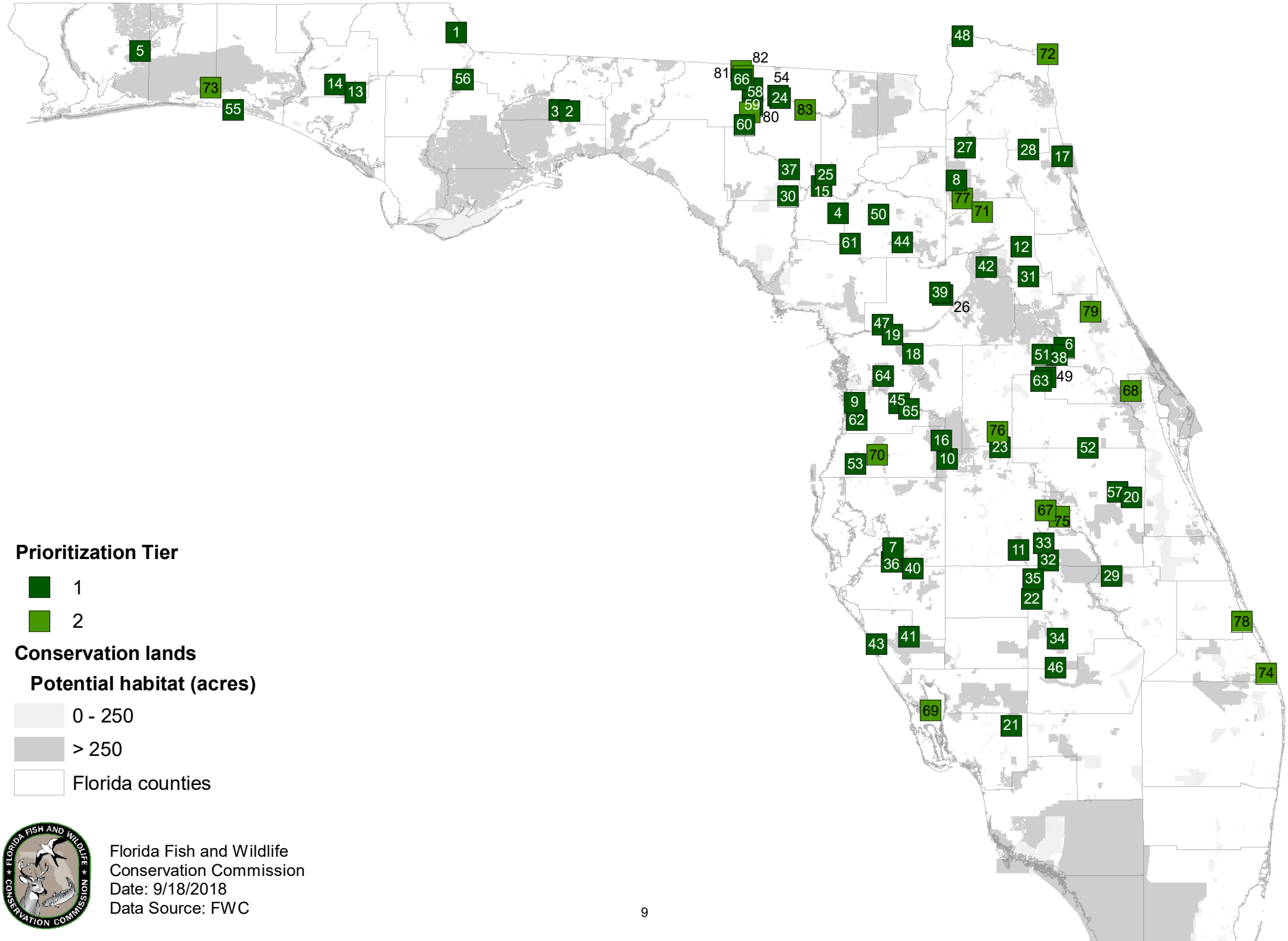
53	N	Starkey Wilderness Preserve	1	10485	Mesic Flatwoods, Scrubby Flatwoods, Scrub			Southwest Florida Water Management District
116	N	Sunnyhill Restoration Area	4	345	Scrub, Unimproved/Woodland Pasture			St. Johns River Water Management District
54	Y	Suwannee Ridge Wildlife and Environmental Area	1	1136	Sandhill	2016	Viable	FL Fish and Wildlife Conservation Commission
117	N	Suwannee River State Park	4	1163	Mixed Hardwood Coniferous, Sandhill, Upland Pine			FL Dept. of Environmental Protection, Div. of Recreation and Parks
161	N	Suwannee Valley Conservation Area	6	706	Coniferous Plantations, Mesic Flatwoods, Scrubby Flatwoods			Suwannee River Water Management District
229	N	T. H. Stone Memorial St. Joseph Peninsula State Park	10	1439	Coastal Scrub			FL Dept. of Environmental Protection, Div. of Recreation and Parks
276	Y	Tall Timbers Research Station and Land Conservancy	NA	2091	Upland Coniferous	2015	Secondary Support	Tall Timbers Research, Inc.
143	N	Tarkiln Bayou Preserve State Park	5	707	Mesic Flatwoods, Sandhill			FL Dept. of Environmental Protection, Div. of Recreation and Parks
230	Y	Tate's Hell State Forest	10	3474	Coniferous Plantations	2017	Secondary Support	FL Dept. of Agriculture and Consumer Services, FL Forest Service
231	N	Tenoroc Fish Management Area	10	778	Unimproved/Woodland Pasture, Coniferous Plantations, (Cropland/Pasture)			FL Fish and Wildlife Conservation Commission
232	N - pilot survey indicates low density	Three Lakes Wildlife Management Area	10	36121	Mesic Flatwoods, Dry Prairie			FL Fish and Wildlife Conservation Commission
79	N	Tiger Bay State Forest	2	1011	Scrub	2017		FL Dept. of Agriculture and Consumer Services, FL Forest Service
186	N	Tomoka State Park	9	462	Xeric Hammock, Maritime Hammock, Scrubby Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
55	N	Topsail Hill Preserve State Park	1	671	Beach Dune, Scrubby Flatwoods, Coastal Scrub			FL Dept. of Environmental Protection, Div. of Recreation and Parks
56	Y	Torreya State Park	1	8104	Coniferous Plantations, Upland Pine	2017	Primary Support	FL Dept. of Environmental Protection, Div. of Recreation and Parks
233	N	Tosohatchee Wildlife Management Area	10	2810	Mesic Flatwoods			FL Fish and Wildlife Conservation Commission
57	Scheduled 2018/2019	Triple N Ranch Wildlife Management Area	1	8823	Mesic Flatwoods			FL Fish and Wildlife Conservation Commission
100	N	Troy Spring Conservation Area	3	1447	Coniferous Plantations, Mesic Hammock, Upland Pine,			Suwannee River Water Management District
101	N	Twin Rivers State Forest - Anderson Springs Tract	3	719	Coniferous Plantations, Upland Pine			FL Dept. of Agriculture and Consumer Services, FL Forest Service
80	N	Twin Rivers State Forest - Black/Damascus Tract	2	862	Coniferous Plantations, Upland Pine			FL Dept. of Agriculture and Consumer Services, FL Forest Service
58	Y	Twin Rivers State Forest - Blue Springs Tract	1	845	Upland Pine, Coniferous Plantations	2017	Viable	FL Dept. of Agriculture and Consumer Services, FL Forest Service
162	N	Twin Rivers State Forest - Chitty Bend West Tract	6	291	Upland Pine, Clearcut			FL Dept. of Agriculture and Consumer Services, FL Forest Service
59	Y	Twin Rivers State Forest - Ellaville Tract	1	2570	Coniferous Plantations	2017	Viable	FL Dept. of Agriculture and Consumer Services, FL Forest Service
169	N	Twin Rivers State Forest - Mill Creek North Tract	7	362	Coniferous Plantations			FL Dept. of Agriculture and Consumer Services, FL Forest Service
60	N	Twin Rivers State Forest - Mill Creek South Tract	1	1110	Coniferous Plantations			FL Dept. of Agriculture and Consumer Services, FL Forest Service
234	N	Twin Rivers State Forest - Nekoosa Tract	10	332	Coniferous Plantations, Upland Pine, Mesic Hammock			FL Dept. of Agriculture and Consumer Services, FL Forest Service
81	N	Twin Rivers State Forest - Sullivan Tract	2	334	Coniferous Plantations, Upland Pine, Mesic Hammock			FL Dept. of Agriculture and Consumer Services, FL Forest Service
82	N	Twin Rivers State Forest - Westwood East Tract	2	374	Upland Pine, Sandhill, Mesic Hammock			FL Dept. of Agriculture and Consumer Services, FL Forest Service
118	N	Twin Rivers State Forest - Westwood West Tract	4	413	Coniferous Plantations			FL Dept. of Agriculture and Consumer Services, FL Forest Service
144	N	Twin Rivers State Forest - Withlacoochee Tract	5	896	Coniferous Plantations, Upland Pine			FL Dept. of Agriculture and Consumer Services, FL Forest Service
170	N	Upper Alapaha Conservation Area	7	1003	Mixed Hardwood-Coniferous, Coniferous Plantations, Mesic Flatwoods			Suwannee River Water Management District
187	N	Upper Chipola River Water Management Area	9	863	Coniferous Plantations			Northwest Florida Water Management District
119	N	Upper Hillsborough	4	4120	Mesic Flatwoods			Southwest Florida Water Management District
145	N	Upper Lakes Basin Watershed	5	1549	Mesic Flatwoods, Scrub			South Florida Water Management District
277	N	Upper Little Manatee River	NA	450	Mesic Flatwoods, Scrubby Flatwoods			Hillsborough County
235	N	Upper Myakka River Watershed	10	286	Mesic Flatwoods			Southwest Florida Water Management District
236	N	Upper Steinhatchee Conservation Area	10	673	Coniferous Plantations			Suwannee River Water Management District
278	N	Valkaria Expansion	NA	456	Mesic Flatwoods			Brevard County
279	N	Valkaria Scrub Sanctuary	NA	625	Mesic Flatwoods, Scrub, Scrubby Flatwoods			Brevard County
237	Y	Wakulla State Forest	10	4126	Coniferous Plantations, Upland Hardwood Forest	2016	Primary Support	FL Dept. of Agriculture and Consumer Services, FL Forest Service
180	N	Wannee Conservation Area	8	1014	Upland Hardwood Forest, Mixed Hardwood-Coniferous			Suwannee River Water Management District
146	N	Washington Oaks Gardens State Park	5	358	Maritime Hammock, Coastal Scrub, Coastal Strand			FL Dept. of Environmental Protection, Div. of Recreation and Parks
61	Y	Watermelon Pond Wildlife and Environmental Area	1	727	Xeric Hammock, Sandhill, Improved Pasture, Coniferous Plantations	2014	Primary Support	FL Fish and Wildlife Conservation Commission
62	N	Weeki Wachee Springs State Park	1	328	Scrub, Coastal Scrub			FL Dept. of Environmental Protection, Div. of Recreation and Parks

Map Label	Population Estimate?	Site Name	Prioritization Tier	Potential habitat (acres)	Predominant Natural Community	Survey Year	Population Status	Managing Agency
181	N	Weekiwachee Preserve	8	1692	Scrubby Flatwoods, Mesic Flatwoods,			Southwest Florida Water Management District
63	N	Wekiwa Springs State Park	1	3223	Sandhill, Scrubby Flatwoods	2009		FL Dept. of Environmental Protection, Div. of Recreation and Parks
188	N	Welaka State Forest	9	630	Sandhill, Scrubby Flatwoods	2011		FL Dept. of Agriculture and Consumer Services, FL Forest Service
171	N	Werner-Boyce Salt Springs State Park	7	584	Maritime Hammock, Mesic Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
120	N	Wes Skiles Peacock Springs State Park	4	625	Coniferous Plantations, Upland Pine, Mixed Hardwood-Coniferous			FL Dept. of Environmental Protection, Div. of Recreation and Parks
121	Y	Wingate Creek State Park	4	398	Scrubby Flatwoods, Mesic Flatwoods, Scrub	2015	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
64	Y	Withlacoochee State Forest - Citrus Tract	1	44229	Sandhill	2015	Viable	FL Dept. of Agriculture and Consumer Services, FL Forest Service
65	Y	Withlacoochee State Forest - Croom Tract	1	12762	Sandhill	2016	Viable	FL Dept. of Agriculture and Consumer Services, FL Forest Service
147	N	Withlacoochee State Forest - Headquarters Tract	5	1753	Sandhill			FL Dept. of Agriculture and Consumer Services, FL Forest Service
148	N	Withlacoochee State Forest - Two-mile Prairie Tract	5	2350	Coniferous Plantations			FL Dept. of Agriculture and Consumer Services, FL Forest Service
66	Y	Withlacoochee West Conservation Area - Quail Farms Tract	1	697	Coniferous Plantations, Upland Pine	2018	Primary Support	Suwannee River Water Management District
280	Y	Woodfield Springs Plantation Conservation Easement	NA	1743	Upland Coniferous	2015	Primary Support	Tall Timbers Research, Inc.
83	N	Woods Ferry Conservation Area	2	1321	Sandhill, Scrubby Flatwoods			Suwannee River Water Management District
238	N	Yucca Pens Unit	10	8190	Mesic Flatwoods			FL Fish and Wildlife Conservation Commission



Prioritization Tier

- 1
- 2

Conservation lands

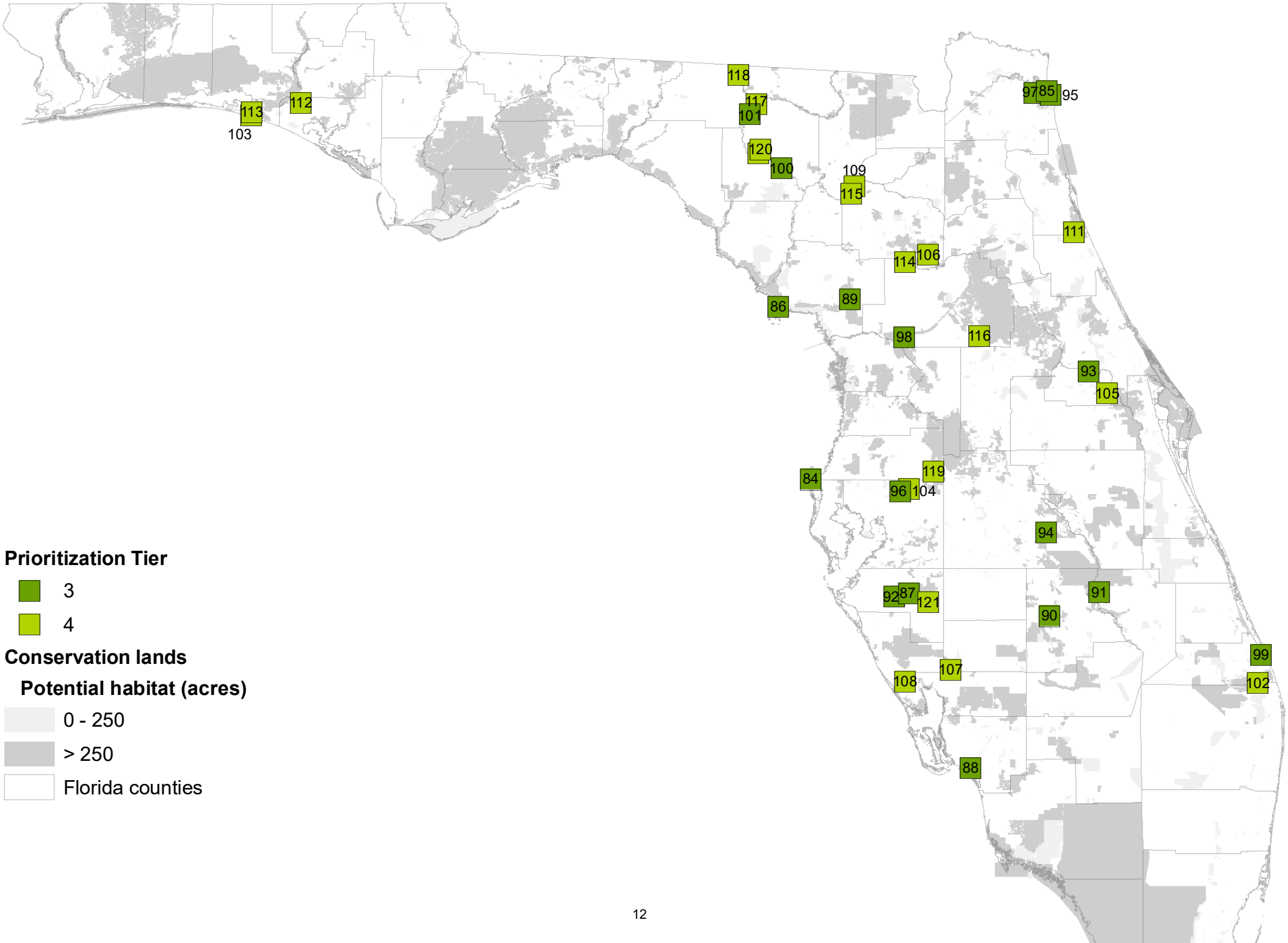
Potential habitat (acres)

- 0 - 250
- > 250
- Florida counties

Florida Fish and Wildlife Conservation Commission
Date: 9/18/2018
Data Source: FWC

Map Label	Population Estimate?	Site Name	Prioritization Tier	Potential habitat (acres)	Predominant Natural Community	Survey Year	Population Status	Managing Agency
1	Y	Apalachee Wildlife Management Area	1	3068	Upland Pine, Sandhill	2017	Viable	FL Fish and Wildlife Conservation Commission
2	Y	Apalachicola National Forest - Munson East	1	3600	Sandhill	2015	Viable	US Dept. of Agriculture, Forest Service
3	Y	Apalachicola National Forest - Munson West	1	14032	Sandhill	2015	Primary Support	US Dept. of Agriculture, Forest Service
4	Y	Bell Ridge Longleaf Wildlife and Environmental Area	1	716	Sandhill	2014	Viable	FL Fish and Wildlife Conservation Commission
5	Scheduled 2018/2019	Blackwater River State Forest - Juniper Creek Unit (includes Hutton Unit and Blackwater River State Park)	1	14331	Upland Pine, Sandhill			FL Dept. of Agriculture and Consumer Services, FL Forest Service
6	Scheduled 2018/2019	Blue Spring State Park	1	1089	Scrub			FL Dept. of Environmental Protection, Div. of Recreation and Parks
7	Y	Bullfrog Creek Wildlife and Environmental Area	1	560	Mesic Flatwoods	2016	Viable	FL Fish and Wildlife Conservation Commission
8	N	Camp Blanding Military Reservation	1	34072	Sandhill, Pine Flatwoods and Dry Prairie			FL Dept. of Military Affairs
9	Y	Chassahowitzka Wildlife Management Area	1	8130	Sandhill	2017	Viable	FL Fish and Wildlife Conservation Commission
10	N	Colt Creek State Park	1	1906	Mesic Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
11	Y	Crooked Lake Wildlife and Environmental Area	1	281	Sandhill, Mesic Flatwoods	2016	Primary Support	FL Fish and Wildlife Conservation Commission
12	N	Dunns Creek State Park	1	2479	Scrub, Sandhill			FL Dept. of Environmental Protection, Div. of Recreation and Parks
13	N	Econfina Creek Water Management Area	1	20181	Coniferous Plantations			Northwest Florida Water Management District
14	Y	Econfina Creek WMA - Fitzhugh Carter Tract	1	948	Coniferous Plantations	2017	Primary Support	Northwest Florida Water Management District
15	Y	Fort White Wildlife and Environmental Area	1	1277	Sandhill	2014	Viable	FL Fish and Wildlife Conservation Commission
16	Y	Green Swamp West	1	13806	Sandhill, Improved Pasture	2018	Viable	Southwest Florida Water Management District
17	Y	Guana River Wildlife Management Area	1	2003	Maritime Hammock, Scrub, Scrubby Flatwoods	2015	Primary Support	FL Fish and Wildlife Conservation Commission
18	Y	Half Moon Wildlife Management Area	1	2396	Improved Pasture, Mesic Flatwoods	2016	Viable	FL Fish and Wildlife Conservation Commission
19	Scheduled 2018/2019	Halpata Tastanaki Preserve	1	1700	Sandhill, Scrub, Mesic Hammock, Rural Open	2007		Southwest Florida Water Management District
20	Scheduled 2018/2019	Herky Huffman/Bull Creek Wildlife Management Area	1	13481	Mesic Flatwoods			FL Fish and Wildlife Conservation Commission
21	Y	Hickey Creek Wildlife and Environmental Area	1	410	Mesic Flatwoods, Scrubby Flatwoods	2016	Primary Support	FL Fish and Wildlife Conservation Commission
22	Y	Highlands Hammock State Park	1	3971	Scrub, Scrubby Flatwoods, Mesic Flatwoods	2017	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
23	Y	Hilochee Wildlife Management Area	1	1634	Mesic Flatwoods, Coniferous Plantations	2015	Primary Support	FL Fish and Wildlife Conservation Commission
24	N	Holton Creek Conservation Area	1	1404	Upland Hardwood Forest, Coniferous Plantations			Suwannee River Water Management District
25	Y	Ichetucknee Springs State Park	1	2200	Sandhill, Upland Pine	2014	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
26	Scheduled 2018/2019	Indian Lake State Forest	1	4074	Sandhill, Improved Pasture			FL Dept. of Agriculture and Consumer Services, FL Forest Service
27	Y	Jennings State Forest	1	11655	Sandhill	2017	Viable	FL Dept. of Agriculture and Consumer Services, FL Forest Service
28	Y	Julington-Durbin Preserve	1	542	Sandhill	2017	Viable	St. Johns River Water Management District
29	Y	Kissimmee Prairie Preserve State Park	1	23387	Dry Prairie	2017	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
30	Y	Lafayette Forest Wildlife and Environmental Area	1	759	Coniferous Plantations	2016	Viable	FL Fish and Wildlife Conservation Commission
31	Scheduled 2018/2019	Lake George Conservation Area	1	1660	Scrub, Scrubby Flatwoods, Sand Pine Scrub			St. Johns River Water Management District
32	N	Lake Wales Ridge State Forest - Arbuckle	1	1006	Scrub, Mesic Flatwoods, Sandhill			FL Dept. of Agriculture and Consumer Services, FL Forest Service
33	N	Lake Wales Ridge State Forest - Walk-in-Water	1	745	Sandhill			FL Dept. of Agriculture and Consumer Services, FL Forest Service
34	Scheduled 2018/2019	Lake Wales Ridge Wildlife and Environmental Area - Lake Placid/McJunkin	1	2002	Scrub, Scrubby Flatwoods, Sandhill, Mesic Flatwoods			FL Fish and Wildlife Conservation Commission
35	Y	Lake Wales Ridge Wildlife and Environmental Area - Silver Lake	1	353	Scrubby Flatwoods, Mesic Flatwoods, Scrub, Sandhill	2015	Viable	FL Fish and Wildlife Conservation Commission
36	Y	Little Manatee River State Park	1	1430	Mesic Flatwoods, Scrub	2018	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
37	Scheduled 2018/2019	Little River Conservation Area	1	1849	Sandhill			Suwannee River Water Management District
38	N	Lower Wekiva River Preserve State Park	1	846	Mesic Flatwoods, Sandhill			FL Dept. of Environmental Protection, Div. of Recreation and Parks
39	One tract scheduled 2018/2019	Marjorie Harris Carr Cross Florida Greenway State Recreation and Conservation Area	1	14359	Sandhill			FL Dept. of Environmental Protection, Div. of Recreation and Parks
40	Y	Moody Branch Wildlife and Environmental Area	1	574	Scrub, Scrubby Flatwoods, Mesic Flatwoods	2015	Viable	FL Fish and Wildlife Conservation Commission
41	N	Myakka River State Park	1	19669	Dry Prairie			FL Dept. of Environmental Protection, Div. of Recreation and Parks
42	Y	Ocala National Forest - Riverside Island Sandhill	1	286725	Sand Pine Scrub	2015	Primary Support	US Dept. of Agriculture, Forest Service
43	Scheduled 2018/2019	Oscar Scherer State Park	1	1171	Mesic Flatwoods, Scrubby Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
44	N	Paynes Prairie Preserve State Park	1	1647	Mixed Hardwood Coniferous, Upland Pine, Mesic Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
45	Y	Perry Oldenburg Wildlife and Environmental Area	1	336	Sandhill	2015	Primary Support	FL Fish and Wildlife Conservation Commission

Map Label	Population Estimate?	Site Name	Prioritization Tier	Potential habitat (acres)	Predominant Natural Community	Survey Year	Population Status	Managing Agency
46	Y	Platt Branch Wildlife and Environmental Area	1	921	Mesic Flatwoods, Scrub, Improved Pasture	2017	Viable	FL Fish and Wildlife Conservation Commission
47	Y	Rainbow Springs State Park	1	999	Sandhill	2018	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
48	Y	Ralph E. Simmons State Forest	1	787	Sandhill	2017	Viable	FL Dept. of Agriculture and Consumer Services, FL Forest Service
49	N	Rock Springs Run State Reserve	1	2247	Scrubby Flatwoods, Scrub			FL Dept. of Environmental Protection, Div. of Recreation and Parks
50	N	San Felasco Hammock Preserve State Park	1	4039	Mixed Hardwood Coniferous, Upland Pine			FL Dept. of Environmental Protection, Div. of Recreation and Parks
51	N	Seminole State Forest	1	8791	Scrub			FL Dept. of Agriculture and Consumer Services, FL Forest Service
52	Scheduled 2019/2020	Split Oak Forest Wildlife and Environmental Area	1	931	Scrubby Flatwoods, Mesic Flatwoods			FL Fish and Wildlife Conservation Commission
53	N	Starkey Wilderness Preserve	1	10485	Mesic Flatwoods, Scrubby Flatwoods, Scrub			Southwest Florida Water Management District
54	Y	Suwannee Ridge Wildlife and Environmental Area	1	1136	Sandhill	2016	Viable	FL Fish and Wildlife Conservation Commission
55	N	Topsail Hill Preserve State Park	1	671	Beach Dune, Scrubby Flatwoods, Coastal Scrub			FL Dept. of Environmental Protection, Div. of Recreation and Parks
56	Y	Torreya State Park	1	8104	Coniferous Plantations, Upland Pine	2017	Primary Support	FL Dept. of Environmental Protection, Div. of Recreation and Parks
57	Scheduled 2018/2019	Triple N Ranch Wildlife Management Area	1	8823	Mesic Flatwoods			FL Fish and Wildlife Conservation Commission
58	Y	Twin Rivers State Forest - Blue Springs Tract	1	845	Upland Pine, Coniferous Plantations	2017	Viable	FL Dept. of Agriculture and Consumer Services, FL Forest Service
59	Y	Twin Rivers State Forest - Ellaville Tract	1	2570	Coniferous Plantations	2017	Viable	FL Dept. of Agriculture and Consumer Services, FL Forest Service
60	N	Twin Rivers State Forest - Mill Creek South Tract	1	1110	Coniferous Plantations			FL Dept. of Agriculture and Consumer Services, FL Forest Service
61	Y	Watermelon Pond Wildlife and Environmental Area	1	727	Xeric Hammock, Sandhill, Improved Pasture, Coniferous Plantations	2014	Primary Support	FL Fish and Wildlife Conservation Commission
62	N	Weeki Wachee Springs State Park	1	328	Scrub, Coastal Scrub			FL Dept. of Environmental Protection, Div. of Recreation and Parks
63	N	Wekiwa Springs State Park	1	3223	Sandhill, Scrubby Flatwoods	2009		FL Dept. of Environmental Protection, Div. of Recreation and Parks
64	Y	Withlacoochee State Forest - Citrus Tract	1	44229	Sandhill	2015	Viable	FL Dept. of Agriculture and Consumer Services, FL Forest Service
65	Y	Withlacoochee State Forest - Croom Tract	1	12762	Sandhill	2016	Viable	FL Dept. of Agriculture and Consumer Services, FL Forest Service
66	Y	Withlacoochee West Conservation Area - Quail Farms Tract	1	697	Coniferous Plantations, Upland Pine	2018	Primary Support	Suwannee River Water Management District
67	N - pilot survey indicates low density	Allen David Broussard Catfish Creek Preserve State Park	2	2736	Scrub			FL Dept. of Environmental Protection, Div. of Recreation and Parks
68	N	Buck Lake Conservation Area	2	2142	Mesic Flatwoods			St. Johns River Water Management District
69	N	Charlotte Harbor Preserve State Park	2	4979	Mesic Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
70	N	Conner Preserve	2	773	Mesic Flatwoods, Sandhill			Southwest Florida Water Management District
71	Y	Etoniah Creek State Forest	2	4716	Sandhill, Scrub	2015	Viable	FL Dept. of Agriculture and Consumer Services, FL Forest Service
72	Scheduled 2018/2019	Fort Clinch State Park	2	1118	Maritime Hammock			FL Dept. of Environmental Protection, Div. of Recreation and Parks
73	N	Fred Gannon Rocky Bayou State Park	2	284	Scrub			FL Dept. of Environmental Protection, Div. of Recreation and Parks
74	Y	Jonathan Dickinson State Park	2	4559	Scrub, Scrubby Flatwoods, Mesic Flatwoods	2015	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
75	Scheduled 2018/2019	Lake Kissimmee State Park	2	1294	Mesic Flatwoods, Scrubby Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
76	Y	Lake Louisa State Park	2	1385	Unimproved/Woodland Pasture, Coniferous Plantations	2015	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
77	Y	Mike Roess Gold Head Branch State Park	2	1896	Sandhill	2014	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
78	N - pilot survey indicates low density	Savannas Preserve State Park	2	3282	Mesic Flatwoods, Scrub			FL Dept. of Environmental Protection, Div. of Recreation and Parks
79	N	Tiger Bay State Forest	2	1011	Scrub	2017		FL Dept. of Agriculture and Consumer Services, Florida Forest Service
80	N	Twin Rivers State Forest - Black/Damascus Tract	2	862	Coniferous Plantations, Upland Pine			FL Dept. of Agriculture and Consumer Services, FL Forest Service
81	N	Twin Rivers State Forest - Sullivan Tract	2	334	Coniferous Plantations, Upland Pine, Mesic Hammock			FL Dept. of Agriculture and Consumer Services, FL Forest Service
82	N	Twin Rivers State Forest - Westwood East Tract	2	374	Upland Pine, Sandhill, Mesic Hammock			FL Dept. of Agriculture and Consumer Services, FL Forest Service
83	N	Woods Ferry Conservation Area	2	1321	Sandhill, Scrubby Flatwoods			Suwannee River Water Management District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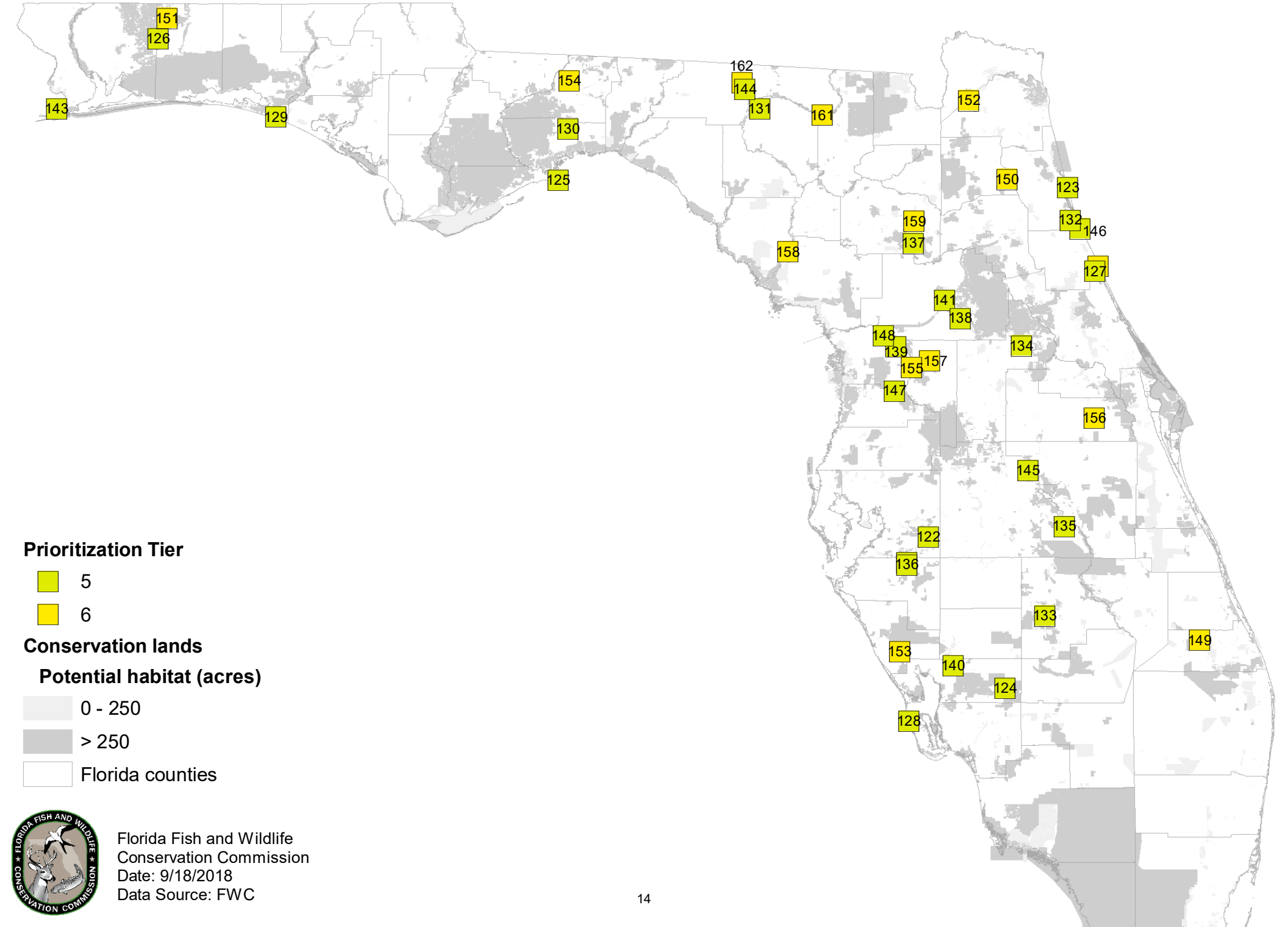
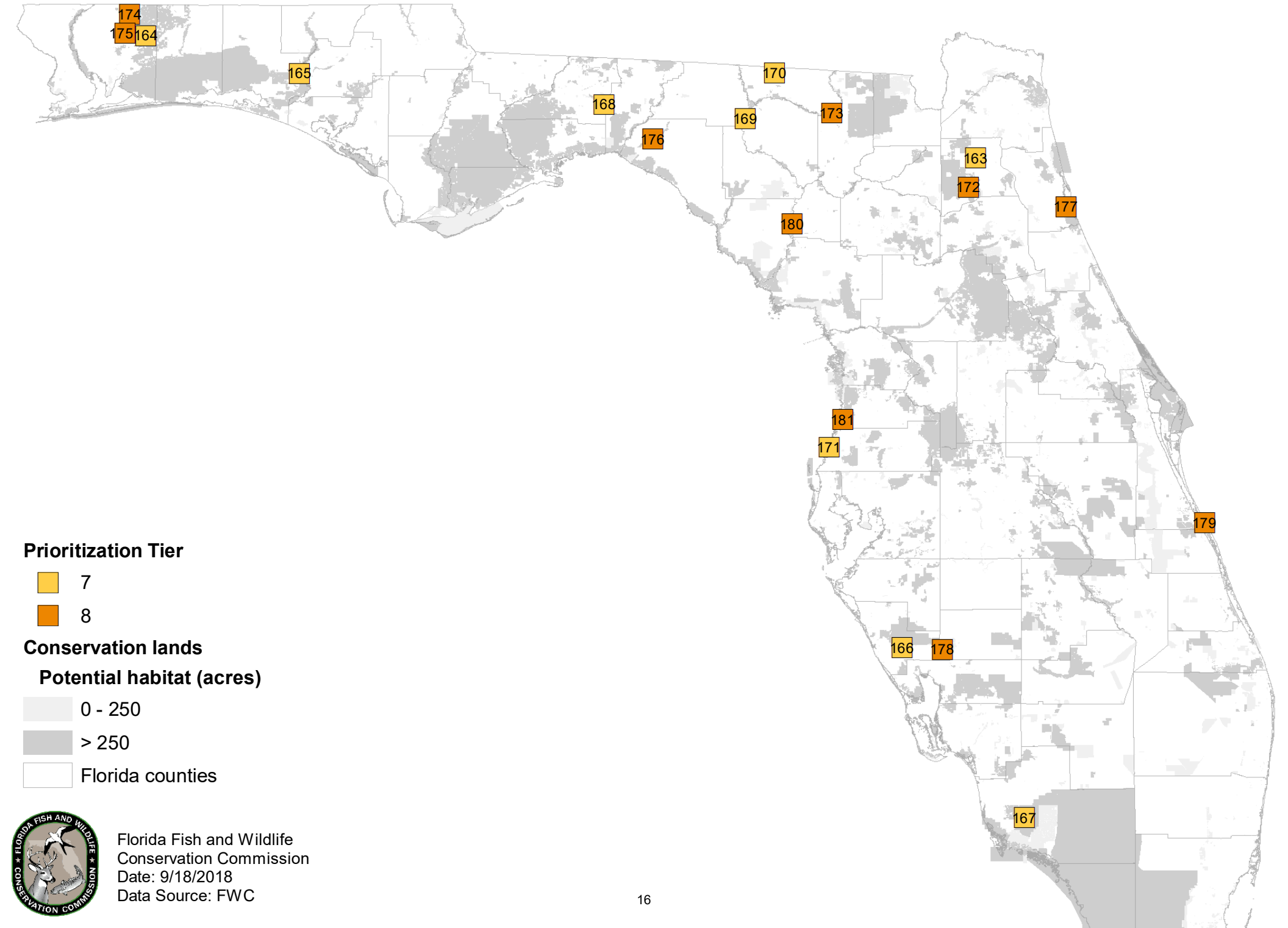
Prioritization Tier
3
4
Conservation lands
Potential habitat (acres)
0 - 250
> 250
Florida counties

Map Label	Population Estimate?	Site Name	Prioritization Tier	Potential habitat (acres)	Predominant Natural Community	Survey Year	Population Status	Managing Agency
84	N	Anclote Key Preserve State Park	3	473	Beach Dune			FL Dept. of Environmental Protection, Div. of Recreation and Parks
85	N	Big Talbot Island State Park	3	1392	Maritime Hammock, Coastal Strand			FL Dept. of Environmental Protection, Div. of Recreation and Parks
86	N - pilot survey indicates low density	Cedar Key Scrub State Reserve	3	1033	Scrubby Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
87	N	Edward Chance Reserve	3	3976	Mesic Flatwoods, Scrub			Southwest Florida Water Management District
88	N	Estero Bay Preserve State Park	3	484	Mesic Flatwoods, Scrubby Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
89	Y	Goethe State Forest	3	11200	Sandhill	2014	Viable	FL Dept. of Agriculture and Consumer Services, FL Forest Service
90	N	Jack Creek	3	464	Scrub			Southwest Florida Water Management District
91	N	Kissimmee River	3	4038	Dry Prairie, Mesic Flatwoods			South Florida Water Management District
92	N	Lake Manatee State Park	3	503	Mesic Flatwoods, Scrub, Scrubby Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
93	N	Lake Monroe Conservation Area	3	562	Scrubby Flatwoods			St. Johns River Water Management District
94	N	Lake Wales Ridge State Forest - Hesperides	3	418	Scrub, Sandhill, Mesic Flatwoods			FL Dept. of Agriculture and Consumer Services, FL Forest Service
95	Y	Little Talbot Island State Park	3	1199	Maritime Hammock, Coastal Strand	2014	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
96	N	Lower Hillsborough Flood Detention Area	3	4200	Mesic Flatwoods			Southwest Florida Water Management District
97	N - pilot survey indicates low density	Pumpkin Hill Creek Preserve State Park	3	581	Scrubby Flatwoods, Coniferous Plantations			FL Dept. of Environmental Protection, Div. of Recreation and Parks
98	N	Ross Prairie State Forest	3	2679	Sandhill, Scrubby Flatwoods			FL Dept. of Agriculture and Consumer Services, FL Forest Service
99	Scheduled 2018/2019	Seabranch Preserve State Park	3	611	Scrub, Scrubby Flatwoods, Mesic Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
100	N	Troy Spring Conservation Area	3	1447	Coniferous Plantations, Mesic Hammock, Upland Pine			Suwannee River Water Management District
101	N	Twin Rivers State Forest - Anderson Springs Tract	3	719	Coniferous Plantations, Upland Pine			FL Dept. of Agriculture and Consumer Services, FL Forest Service
102	Scheduled 2018/2019	Cypress Creek and Loxahatchee River Management Area	4	1615	Mesic Flatwoods			South Florida Water Management District
103	N - pilot survey indicates low density	Grayton Beach State Park	4	1302	Scrub, Scrubby Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
104	N	Hillsborough River State Park	4	298	Mesic Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
105	N	Little Big Econ State Forest	4	1108	Scrubby Flatwoods, Scrub, Mesic Flatwoods			FL Dept. of Agriculture and Consumer Services, FL Forest Service
106	N	Lochloosa Wildlife Conservation Area	4	1518	Coniferous Plantations, Scrubby Flatwoods			St. Johns River Water Management District
107	N	Lower Peace River Corridor (Deep Creek Tract)	4	1111	Mesic Flatwoods			Southwest Florida Water Management District
108	N	Myakka State Forest	4	4886	Mesic Flatwoods			FL Dept. of Agriculture and Consumer Services, FL Forest Service
109	Y	O'leno State Park	4	1574	Scrub, Mesic Flatwoods	2014	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
110	N	Peacock Springs Conservation Area	4	618	Coniferous Plantations			Suwannee River Water Management District
111	N	Pellicer Creek Conservation Area	4	1173	Coniferous Plantations			St. Johns River Water Management District
112	N	Pine Log State Forest	4	2984	Sandhill, Mesic Flatwoods	2015		FL Dept. of Agriculture and Consumer Services, FL Forest Service
113	N - pilot survey indicates low density	Point Washington State Forest	4	4936	Sandhill, Mesic Flatwoods, Scrubby Flatwoods, Scrub	2014		FL Dept. of Agriculture and Consumer Services, FL Forest Service
114	N	Price's Scrub	4	399	Scrubby Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
115	Y	River Rise Preserve State Park	4	2341	Upland Pine, Sandhill	2014	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
116	N	Sunnyhill Restoration Area	4	345	Scrub, Unimproved/Woodland Pasture			St. Johns River Water Management District
117	N	Suwannee River State Park	4	1163	Mixed Hardwood Coniferous, Sandhill, Upland Pine			FL Dept. of Environmental Protection, Div. of Recreation and Parks
118	N	Twin Rivers State Forest - Westwood West Tract	4	413	Coniferous Plantations			FL Dept. of Agriculture and Consumer Services, Florida Forest Service
119	N	Upper Hillsborough	4	4120	Mesic Flatwoods			Southwest Florida Water Management District
120	N	Wes Skiles Peacock Springs State Park	4	625	Coniferous Plantations, Upland Pine, Mixed Hardwood-Coniferous			FL Dept. of Environmental Protection, Div. of Recreation and Parks
121	Y	Wingate Creek State Park	4	398	Scrubby Flatwoods, Mesic Flatwoods, Scrub	2015	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks



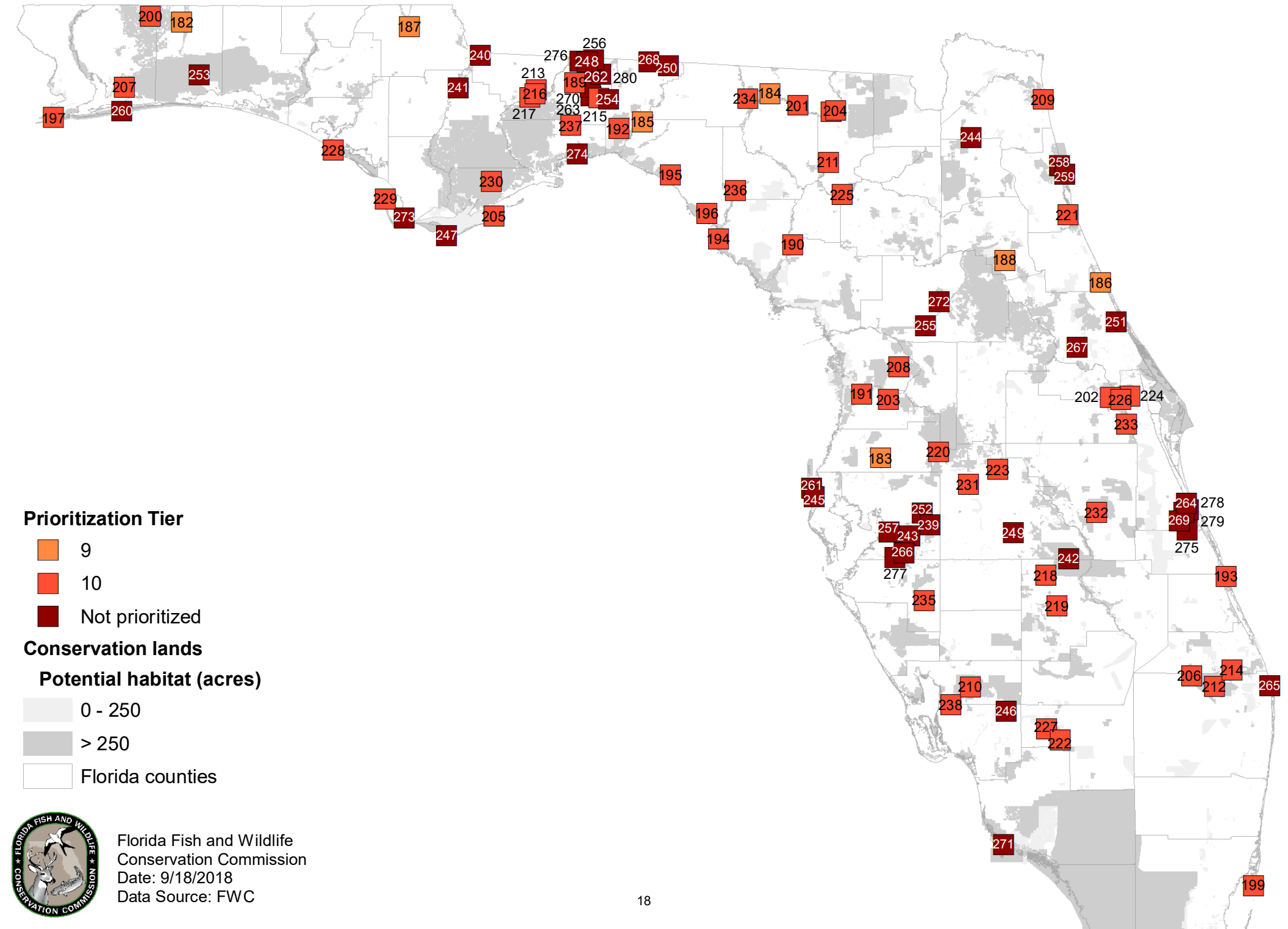
Florida Fish and Wildlife Conservation Commission
Date: 9/18/2018
Data Source: FWC

Map Label	Population Estimate?	Site Name	Prioritization Tier	Potential habitat (acres)	Predominant Natural Community	Survey Year	Population Status	Managing Agency
122	N	Alafia River State Park	5	685	Xeric Hammock			FL Dept. of Environmental Protection, Div. of Recreation and Parks
123	N	Anastasia State Park	5	849	Beach Dune, Maritime Hammock			FL Dept. of Environmental Protection, Div. of Recreation and Parks
124	N	Babcock Ranch Preserve	5	31589	Mesic Flatwoods			FL Dept. of Agriculture and Consumer Services, FL Forest Service
125	N	Bald Point State Park	5	1240	Coniferous Plantation, Scrubby Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
126	N	Blackwater River State Forest - Bone Creek Unit	5	9347	Upland Pine, Sandhill			FL Dept. of Agriculture and Consumer Services, FL Forest Service
127	N	Bulow Creek State Park	5	851	Mesic Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
128	Y	Cayo Costa State Park	5	1653	Maritime Hammock, Coastal Grasslands	2015	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
129	N - pilot survey indicates low density	Deer Lake State Park	5	1079	Mesic Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
130	Y	Edward Ball Wakulla Springs State Park	5	4817	Upland Pine, Mixed Hardwood Coniferous	2015	Primary Support	FL Dept. of Environmental Protection, Div. of Recreation and Parks
131	N	Falmouth Spring Conservation Area	5	265	Upland Pine			Suwannee River Water Management District
132	N	Faver-Dykes State Park	5	2005	Mesic Flatwoods, Coniferous Plantations, Maritime Hammock			FL Dept. of Environmental Protection, Div. of Recreation and Parks
133	N	Lake June-in-Winter Scrub State Park	5	640	Scrub			FL Dept. of Environmental Protection, Div. of Recreation and Parks
134	N	Lake Norris Conservation Area	5	468	Improved Pasture			St. Johns River Water Management District
135	N	Lake Wales Ridge State Forest - Prairie	5	1635	Dry Prairie			FL Dept. of Agriculture and Consumer Services, FL Forest Service
136	N	Little Manatee River (SWFWMD)-Southfork	5	493	Unimproved/Woodland Pasture, Scrub			Southwest Florida Water Management District
137	N	Longleaf Flatwoods Reserve	5	848	Coniferous Plantations			St. Johns River Water Management District
138	N	Ocklawaha Prairie Restoration Area	5	539	Coniferous Plantations			St. Johns River Water Management District
139	N	Potts Preserve	5	1267	Scrub, Scrubby Flatwoods, Ruderal			Southwest Florida Water Management District
140	N	Prairie/Shell Creek	5	316	Mesic Flatwoods and Scrub/Scrubby FW			Southwest Florida Water Management District
141	N	Silver Springs State Park	5	955	Sandhill, Scrubby Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
142	N	Southfork State Park	5	577	Scrub, Mixed Hardwood-Coniferous, Mesic Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
143	N	Tarkiln Bayou Preserve State Park	5	707	Mesic Flatwoods, Sandhill			FL Dept. of Environmental Protection, Div. of Recreation and Parks
144	N	Twin Rivers State Forest - Withlacoochee Tract	5	896	Coniferous Plantations, Upland Pine			FL Dept. of Agriculture and Consumer Services, FL Forest Service
145	N	Upper Lakes Basin Watershed	5	1549	Mesic Flatwoods, Scrub			South Florida Water Management District
146	N	Washington Oaks Gardens State Park	5	358	Maritime Hammock, Coastal Scrub, Coastal Strand			FL Dept. of Environmental Protection, Div. of Recreation and Parks
147	N	Withlacoochee State Forest - Headquarters Tract	5	1753	Sandhill			FL Dept. of Agriculture and Consumer Services, FL Forest Service
148	N	Withlacoochee State Forest - Two-mile Prairie Tract	5	2350	Coniferous Plantations			FL Dept. of Agriculture and Consumer Services, FL Forest Service
149	N	Allapattah Flats	6	589	Mesic Flatwoods			South Florida Water Management District
150	N	Bayard Conservation Area	6	856	Mesic Flatwoods			St. Johns River Water Management District
151	N	Blackwater River State Forest - Rock Creek Unit	6	19205	Upland Pine			FL Dept. of Agriculture and Consumer Services, FL Forest Service
152	N	Cary State Forest	6	1023	Coniferous Plantations	2011		FL Dept. of Agriculture and Consumer Services, FL Forest Service
153	N	Deer Prairie Creek Preserve	6	4038	Mesic Flatwoods	2008		Southwest Florida Water Management District
154	N	Elinor Klapp-Phipps Park	6	411	Upland Hardwood Forest, Mixed Hardwood-Coniferous			City of Tallahassee
155	N	Flying Eagle Preserve	6	1208	Ruderal pasture, some sandhill and scrub. Much of the habitat consists of large basin marshes			Southwest Florida Water Management District
156	N	Hal Scott Regional Preserve and Park	6	5482	Mesic Flatwoods			St. Johns River Water Management District
157	N	Lake Panasoffkee	6	1869	Improved Pasture, Mesic Hammock, Scrubby Flatwoods	2009		Southwest Florida Water Management District
158	N	Manatee Springs State Park	6	1434	Mixed Hardwood-Coniferous, Upland Mixed Woodland			FL Dept. of Environmental Protection, Div. of Recreation and Parks
159	N	Newnans Lake Conservation Area	6	541	Coniferous Plantations, Mesic Flatwoods			St. Johns River Water Management District
160	N	North Peninsula State Park	6	390	Coastal Scrub			FL Dept. of Environmental Protection, Div. of Recreation and Parks
161	N	Suwannee Valley Conservation Area	6	706	Coniferous Plantations, Mesic Flatwoods, Scrubby Flatwoods			Suwannee River Water Management District
162	N	Twin Rivers State Forest - Chitty Bend West Tract	6	291	Upland Pine, Clearcut			FL Dept. of Agriculture and Consumer Services, FL Forest Service



Florida Fish and Wildlife Conservation Commission
Date: 9/18/2018
Data Source: FWC

Map Label	Population Estimate?	Site Name	Prioritization Tier	Potential habitat (acres)	Predominant Natural Community	Survey Year	Population Status	Managing Agency
163	N	Black Creek Ravines Conservation Area	7	449	Sandhill, Xeric Hammock			St. Johns River Water Management District
164	N	Blackwater River State Forest - Floridale Unit	7	15814	Upland Pine			FL Dept. of Agriculture and Consumer Services, FL Forest Service
165	N	Choctawhatchee River Water Management Area	7	6372	Coniferous Plantation			Northwest Florida Water Management District
166	N	Myakka River (Schewe tract)	7	2553	Mesic Flatwoods			Southwest Florida Water Management District
167	N	Picayune Strand State Forest	7	1505	Mesic Flatwoods			FL Dept. of Agriculture and Consumer Services, FL Forest Service
168	N	St. Marks River Preserve State Park	7	1027	Coniferous Plantations, Mesic Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
169	N	Twin Rivers State Forest - Mill Creek North Tract	7	362	Coniferous Plantations			FL Dept. of Agriculture and Consumer Services, FL Forest Service
170	N	Upper Alapaha Conservation Area	7	1003	Mixed Hardwood-Coniferous, Coniferous Plantations, Mesic Flatwoods			Suwannee River Water Management District
171	N	Werner-Boyce Salt Springs State Park	7	584	Maritime Hammock, Mesic Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
172	N	Belmore State Forest	8	2110	Coniferous Plantations	2011		FL Dept. of Agriculture and Consumer Services, FL Forest Service
173	N	Big Shoals State Park	8	588	Mesic Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
174	N	Blackwater River State Forest - Coldwater Unit	8	8754	Upland Pine			FL Dept. of Agriculture and Consumer Services, FL Forest Service
175	Y	Blackwater River State Forest - West Boundary Unit	8	6984	Upland Pine	2016	Primary Support	FL Dept. of Agriculture and Consumer Services, FL Forest Service
176	N	Econfina Conservation Area	8	920	Coniferous Plantations			Suwannee River Water Management District
177	N	Moses Creek Conservation Area	8	1044	Mixed Hardwood-Coniferous, Shrub and Brushland			St. Johns River Water Management District
178	N	RV Griffin Reserve (GDC)	8	1191	Dry Prairie, Mesic Flatwoods			Southwest Florida Water Management District
179	N	Sebastian Inlet State Park	8	251	Maritime Hammock, Coastal Strand			FL Dept. of Environmental Protection, Div. of Recreation and Parks
180	N	Wannee Conservation Area	8	1014	Upland Hardwood Forest, Mixed Hardwood-Coniferous			Suwannee River Water Management District
181	N	Weekiwachee Preserve	8	1692	Scrubby Flatwoods, Mesic Flatwoods,			Southwest Florida Water Management District



Prioritization Tier

- 9
- 10
- Not prioritized

Conservation lands

Potential habitat (acres)

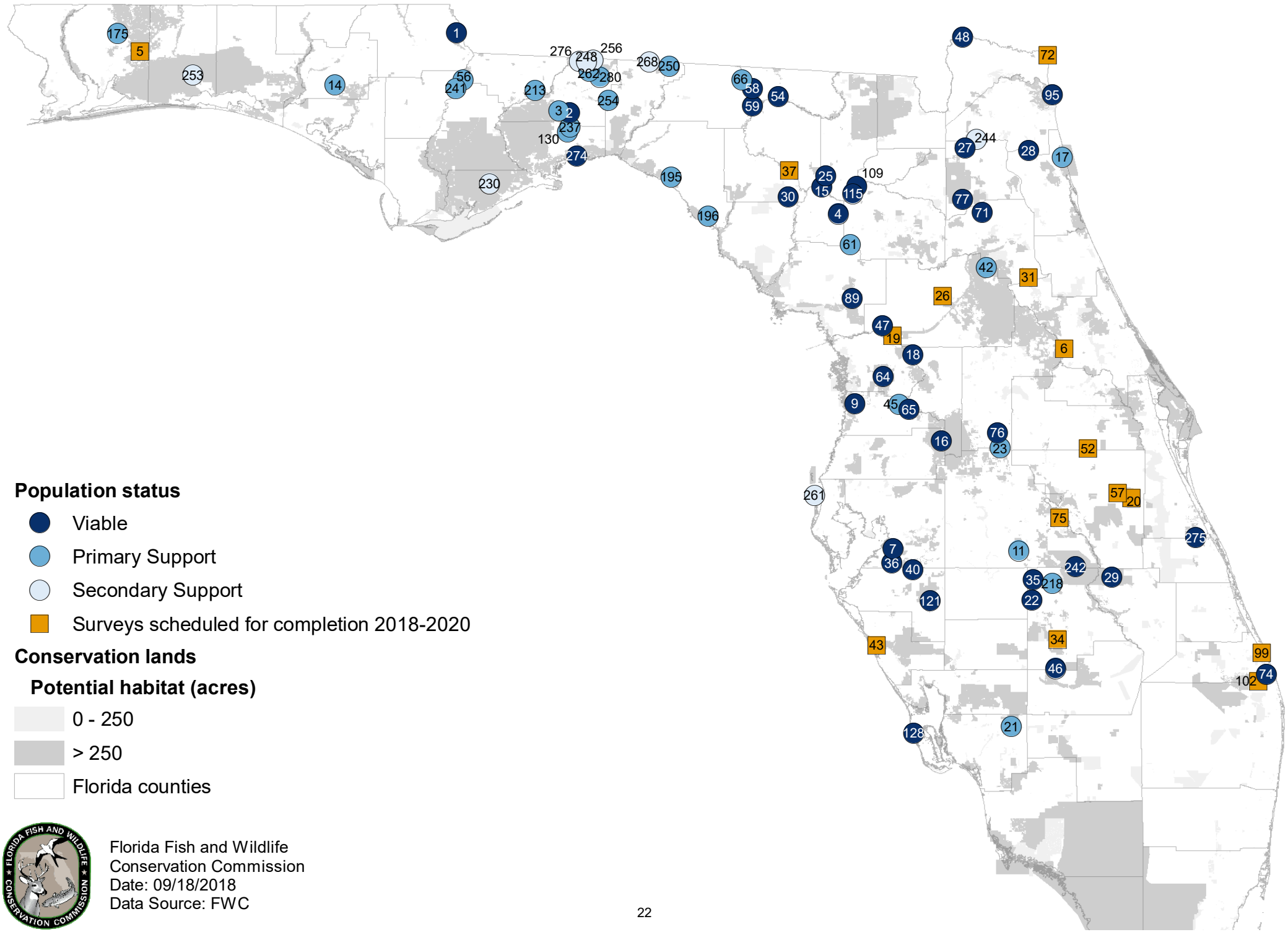
- 0 - 250
- > 250
- Florida counties

Florida Fish and Wildlife Conservation Commission
Date: 9/18/2018
Data Source: FWC

Map Label	Population Estimate?	Site Name	Prioritization Tier	Potential habitat (acres)	Predominant Natural Community	Survey Year	Population Status	Managing Agency
182	N	Blackwater River State Forest - Horse Creek Unit	9	4853	Upland Pine			FL Dept. of Agriculture and Consumer Services, FL Forest Service
183	N	Cypress Creek Flood Detention Area	9	1341	Mesic Flatwoods			Southwest Florida Water Management District
184	N	Lower Alapaha Conservation Area	9	423	Coniferous Plantations			Suwannee River Water Management District
185	N	Middle Aucilla Conservation Area	9	1453	Coniferous Plantations			Suwannee River Water Management District
186	N	Tomoka State Park	9	462	Xeric Hammock, Maritime Hammock, Scrubby Flatwoods			FL Dept. of Environmental Protection, Div. of Recreation and Parks
187	N	Upper Chipola River Water Management Area	9	863	Coniferous Plantations			Northwest Florida Water Management District
188	N	Welaka State Forest	9	630	Sandhill, Scrubby Flatwoods	2011		FL Dept. of Agriculture and Consumer Services, FL Forest Service
189	N	Alfred B. Maclay Gardens State Park	10	755	Mixed Hardwood-Coniferous			FL Dept. of Environmental Protection, Div. of Recreation and Parks
190	N	Andrews Wildlife Management Area	10	2938	Upland Hardwood Forest			FL Fish and Wildlife Conservation Commission
191	N	Annutteliga Hammock	10	1873	Sandhill			Southwest Florida Water Management District
192	N	Aucilla Wildlife Management Area	10	1327	Upland Hardwood Forest, Coniferous Plantations, Mesic Flatwoods	2012		FL Fish and Wildlife Conservation Commission
193	N – Insufficient suitable habitat	Avalon State Park	10	371	Maritime Hammock, Coastal Strand			FL Dept. of Environmental Protection, Div. of Recreation and Parks
194	N - pilot survey indicates low density	Big Bend Wildlife Management Area - Jena	10	2224	Mesic Flatwoods			FL Fish and Wildlife Conservation Commission
195	Y	Big Bend Wildlife Management Area - Spring Creek	10	722	Coniferous Plantations, Sandhill	2016	Primary Support	FL Fish and Wildlife Conservation Commission
196	Y	Big Bend Wildlife Management Area - Tide Swamp	10	342	Coniferous Plantations	2016	Primary Support	FL Fish and Wildlife Conservation Commission
197	N	Big Lagoon State Park	10	312	Scrubby Flatwoods, Coastal Scrub			FL Dept. of Environmental Protection, Div. of Recreation and Parks
198	N	Big Shoals State Forest	10	576	Mesic Flatwoods			FL Dept. of Agriculture and Consumer Services, FL Forest Service
199	N	Bill Baggs Cape Florida State Park	10	253	Coastal Strand			FL Dept. of Environmental Protection, Div. of Recreation and Parks
200	N - pilot survey indicates low density	Blackwater River State Forest - Sweetwater Unit	10	21400	Upland Pine			FL Dept. of Agriculture and Consumer Services, FL Forest Service
201	N	Camp Branch Conservation Area	10	527	Sandhill, Mesic Flatwoods, Scrubby Flatwoods			Suwannee River Water Management District
202	N	Charles H. Bronson State Forest	10	908	Mesic Flatwoods			FL Dept. of Agriculture and Consumer Services, FL Forest Service
203	N	Chinsegut Wildlife and Environmental Area	10	550	Sandhill			FL Fish and Wildlife Conservation Commission
204	N	Deep Creek Conservation Area (SRWMD)	10	332	Coniferous Plantation, Mesic Flatwoods			Suwannee River Water Management District
205	N	Dr. Julian G. Bruce St. George Island State Park	10	1134	Coastal Grassland			FL Dept. of Environmental Protection, Div. of Recreation and Parks
206	N	Dupuis Reserve	10	11581	Mesic Flatwoods			South Florida Water Management District
207	N - pilot survey indicates low density	Escribano Point Wildlife Management Area	10	454	Sandhill, Scrubby Flatwoods			FL Fish and Wildlife Conservation Commission
208	N	Fort Cooper State Park	10	373	Sandhill			FL Dept. of Environmental Protection, Div. of Recreation and Parks
209	N	Fort George Island Cultural State Park	10	625	Maritime Hammock			FL Dept. of Environmental Protection, Div. of Recreation and Parks
210	N	Fred C. Babcock-Cecil M. Webb Wildlife Management Area	10	39621	Mesic Flatwoods			FL Fish and Wildlife Conservation Commission
211	N	Ichetucknee Trace	10	345	Coniferous Plantations			FL Dept. of Environmental Protection, Div. of Recreation and Parks
212	N	J. W. Corbett Wildlife Management Area	10	17532	Mesic Flatwoods			FL Fish and Wildlife Conservation Commission
213	Y	Joe Budd Wildlife Management Area	10	1137	Upland Pine	2014	Primary Support	FL Fish and Wildlife Conservation Commission
214	N	John C. and Mariana Jones/Hungryland Wildlife and Environmental Area	10	2993	Mesic Flatwoods			FL Fish and Wildlife Conservation Commission
215	N - pilot survey indicates low density	L. Kirk Edwards Wildlife and Environmental Area	10	441	Upland Pine			FL Fish and Wildlife Conservation Commission
216	N - pilot survey indicates low density	Lake Talquin State Forest	10	10145	Upland Pine			FL Dept. of Agriculture and Consumer Services, FL Forest Service
217	N	Lake Talquin State Park	10	295	Sandhill, Upland Hardwood Forest			FL Dept. of Environmental Protection, Div. of Recreation and Parks
218	Y	Lake Wales Ridge Wildlife and Environmental Area - Carter Creek	10	1939	Scrub, Scrubby Flatwoods	2015	Primary Support	FL Fish and Wildlife Conservation Commission
219	N - pilot survey indicates low density	Lake Wales Ridge Wildlife and Environmental Area - Royce/Clements	10	1152	Improved Pasture, Scrub, Scrubby Flatwoods			FL Fish and Wildlife Conservation Commission
220	N	Little Gator Creek Wildlife and Environmental Area	10	316	Mesic Flatwoods			FL Fish and Wildlife Conservation Commission
221	N	Matanzas State Forest	10	696	Coniferous Plantations, Maritime Hammock			FL Dept. of Agriculture and Consumer Services, FL Forest Service
222	N	Okaloacoochee Slough State Forest	10	7431	Mesic Flatwoods			FL Dept. of Agriculture and Consumer Services, FL Forest Service
223	N	Osprey Unit	10	1055	Mesic Flatwoods			FL Fish and Wildlife Conservation Commission

Map Label	Population Estimate?	Site Name	Prioritization Tier	Potential habitat (acres)	Predominant Natural Community	Survey Year	Population Status	Managing Agency
224	N - pilot survey indicates low density	Salt Lake Wildlife Management Area	10	992	Mesic Flatwoods	2010		FL Fish and Wildlife Conservation Commission
225	N	Santa Fe Springs Conservation Area	10	584	Coniferous Plantations			Suwannee River Water Management District
226	N	Seminole Ranch Conservation Area	10	559	Mesic Flatwoods			St. Johns River Water Management District
227	N	Spirit of the Wild Wildlife Management Area	10	1425	Mesic Flatwoods			FL Fish and Wildlife Conservation Commission
228	N	St. Andrews State Park	10	601	Coastal Scrub, Maritime Hammock, Beach Dune			FL Dept. of Environmental Protection, Div. of Recreation and Parks
229	N	T. H. Stone Memorial St. Joseph Peninsula State Park	10	1439	Coastal Scrub			FL Dept. of Environmental Protection, Div. of Recreation and Parks
230	Y	Tate's Hell State Forest	10	3474	Coniferous Plantations	2017	Secondary Support	FL Dept. of Agriculture and Consumer Services, FL Forest Service
231	N	Tenoroc Fish Management Area	10	778	Unimproved/Woodland Pasture, Coniferous Plantations, (Cropland/Pasture)			FL Fish and Wildlife Conservation Commission
232	N - pilot survey indicates low density	Three Lakes Wildlife Management Area	10	36121	Mesic Flatwoods, Dry Prairie			FL Fish and Wildlife Conservation Commission
233	N	Tosohatchee Wildlife Management Area	10	2810	Mesic Flatwoods			FL Fish and Wildlife Conservation Commission
234	N	Twin Rivers State Forest - Nekoosa Tract	10	332	Coniferous Plantations, Upland Pine, Mesic Hammock			FL Dept. of Agriculture and Consumer Services, FL Forest Service
235	N	Upper Myakka River Watershed	10	286	Mesic Flatwoods			Southwest Florida Water Management District
236	N	Upper Steinhatchee Conservation Area	10	673	Coniferous Plantations			Suwannee River Water Management District
237	Y	Wakulla State Forest	10	4126	Coniferous Plantations, Upland Hardwood Forest	2016	Primary Support	FL Dept. of Agriculture and Consumer Services, FL Forest Service
238	N	Yucca Pens Unit	10	8190	Mesic Flatwoods			FL Fish and Wildlife Conservation Commission
239	N	Alafia River Corridor	NA	1237	Mixed Hardwood-Coniferous			Hillsborough County
240	N	Apalachee Correctional Institution	NA	1320	Coniferous Plantations, Mixed Hardwood-Coniferous			PRIDE Enterprises, Inc.
241	Y	Apalachicola Bluffs and Ravines Preserve	NA	3929	Sandhill, Mixed Hardwood-Coniferous	2014	Primary Support	The Nature Conservancy
242	Y	Avon Park Air Force Range	NA	33979	Mesic Flatwoods, Scrub, Dry Prairie, Scrubby Flatwoods	2015	Viable	US Dept. of Defense, Air Force
243	N	Balm-Boyette Scrub	NA	2012	Mesic Flatwoods, Scrub			Hillsborough County
244	Y	Branan Field Wildlife and Environmental Area	NA	94	Sandhill	2017	Secondary Support	FL Fish and Wildlife Conservation Commission
245	N - pilot survey indicates low density	Caladesi Island State Park	NA	246	Cabbage Palm, Maritime Hammock			FL Dept. of Environmental Protection, Div. of Recreation and Parks
246	N	Caloosahatchee Regional Park	NA	491	Improved Pasture, Mesic Flatwoods, Shrub and Brushland	2014		Lee County
247	N	Cape St. George State Reserve	NA	816	Coastal Scrub, Scrubby Flatwoods			FL Dept. of Environmental Protection, Florida Coastal Office
248	Y	Cherokee Plantation Conservation Easement	NA	1269	Upland Coniferous	2015	Secondary Support	Tall Timbers Research, Inc.
249	N	Crooked Lake West - Stuart Tract	NA	1180	Mesic Flatwoods			Polk County
250	Y	Dixie Plantation Conservation Easement	NA	4615	Unimproved/Woodland Pasture, Coniferous Plantations	2015	Primary Support	Suwannee River Water Management District
251	N	Doris Leeper Spruce Creek Preserve	NA	1277	Scrub, Mixed Hardwood-Coniferous, Scrubby Flatwoods			Volusia County
252	N	Edward Medard Park and Reservoir	NA	320	Mixed Hardwood-Coniferous			Hillsborough County
253	Y	Eglin Air Force Base	NA	353116	Sandhill, Coniferous Plantations	2016	Secondary Support	US Dept. of Defense, Air Force
254	Y	El Destino Plantation	NA	1525	Upland Coniferous	2015	Primary Support	
255	N	Florida Horse Park	NA	499	Improved Pasture, Sandhill			Florida Agriculture and Horse Park Authority
256	Y	Foshalee Plantation Conservation Easement	NA	1463	Upland Coniferous	2015	Secondary Support	Tall Timbers Research, Inc.
257	N	Golden Aster Scrub Nature Preserve	NA	959	Mesic Flatwoods, Scrub, Scrubby Flatwoods			Hillsborough County
258	N	GTMNERR - Guana River Site	NA	1531	Maritime Hammock, Coastal Scrub			FL Dept. of Environmental Protection, Florida Coastal Office
259	N	Guana Tolomato Matanzas National Estuarine Research Reserve	NA	433	Coastal Uplands			FL Dept. of Environmental Protection, Florida Coastal Office
260	N	Gulf Islands National Seashore	NA	1772	Coastal Scrub			US Dept. of the Interior, National Park Service
261	Y	Honeymoon Island State Park	NA	354	Beach Dune, Mesic Flatwoods, Coastal Strand	2017	Secondary Support	FL Dept. of Environmental Protection, Div. of Recreation and Parks
262	Y	Horseshoe Plantation Conservation Easement	NA	3896	Upland Coniferous	2015	Primary Support	Tall Timbers Research, Inc.
263	N	J. R. Alford Greenway	NA	331	Mixed Hardwood-Coniferous			Leon County
264	N	Jordan Scrub Sanctuary	NA	532	Mesic Flatwoods, Scrubby Flatwoods, Scrub			Brevard County
265	N	Juno Dunes Natural Area	NA	369	Scrub			Palm Beach County
266	N	Little Manatee River Corridor	NA	1308	Mesic Flatwoods			Hillsborough County
267	N	Lyonia Preserve	NA	308	Scrub			Volusia County

Map Label	Population Estimate?	Site Name	Prioritization Tier	Potential habitat (acres)	Predominant Natural Community	Survey Year	Population Status	Managing Agency
268	Y	Merrily Plantation Conservation Easement	NA	1457	Upland Coniferous	2015	Secondary Support	Tall Timbers Research, Inc.
269	N	Micco Scrub Sanctuary	NA	506	Mesic Flatwoods, Scrubby Flatwoods			Brevard County
270	N	Miccosukee Canopy Road Greenway	NA	348	Upland Coniferous, Coniferous Plantations, Oak Scrub			Leon County
271	N	Rookery Bay National Estuarine Research Reserve	NA	1709	Scrub, Mesic Flatwoods, Maritime Hammock			FL Dept. of Environmental Protection, Florida Coastal Office
272	N	Silver Springs Conservation Area	NA	317	Sandhill, Mixed Hardwood-Coniferous			Marion County
273	N	St. Joseph Bay State Buffer Preserve	NA	421	Scrubby Flatwoods, Scrub			FL Dept. of Environmental Protection, Florida Coastal Office
274	Y	St. Marks National Wildlife Refuge	NA	8422	Sandhill	2011	Viable	US Dept. of the Interior, Fish and Wildlife Service
275	Y	St. Sebastian River Preserve State Park	NA	13686	Mesic Flatwoods, Scrubby Flatwoods	2015	Viable	FL Dept. of Environmental Protection, Div. of Recreation and Parks
276	Y	Tall Timbers Research Station and Land Conservancy	NA	2091	Upland Coniferous	2015	Secondary Support	Tall Timbers Research, Inc.
277	N	Upper Little Manatee River	NA	450	Mesic Flatwoods, Scrubby Flatwoods			Hillsborough County
278	N	Valkaria Expansion	NA	456	Mesic Flatwoods			Brevard County
279	N	Valkaria Scrub Sanctuary	NA	625	Mesic Flatwoods, Scrub, Scrubby Flatwoods			Brevard County
280	Y	Woodfield Springs Plantation Conservation Easement	NA	1743	Upland Coniferous	2015	Primary Support	Tall Timbers Research, Inc.



Population status

- Viable
- Primary Support
- Secondary Support
- Surveys scheduled for completion 2018-2020

Conservation lands

Potential habitat (acres)

- 0 - 250
- > 250
- Florida counties

Florida Fish and Wildlife Conservation Commission
Date: 09/18/2018
Data Source: FWC

GOPHER TORTOISE (*GOPHERUS POLYPHEMUS*) SURVEYS AND POPULATION EVALUATIONS

QUARTER 4 REPORT

Joseph. W. Jones Ecological Research Center
Contract #13161

To

Florida Fish and Wildlife Conservation Commission

15 January 2015

Summary. This project was initiated in January 2014; the objectives are to: 1) provide gopher tortoise encounter rates and line transect distance sampling (LTDS) survey designs for 33 priority Florida state conservation lands; 2) provide estimates of gopher tortoise population size (abundance) and density for at least 25 of the state conservation lands; 3) evaluate habitat quality at all survey sites; and 4) provide training in LTDS methodology for gopher tortoises to Florida Park Service (FPS), Florida Forest Service (FFS), and Florida Fish and Wildlife Conservation Commission (FFWCC) staff.

Progress to date includes completion of pilot surveys at the 33 sites in August 2014. Pilot survey data were used to refine the sampling frames, which represent suitable gopher tortoise habitat and to design LTDS surveys for each site. Twenty-five sites were identified for full surveys, including isolated individual tracts within four of the large conservation lands: Goethe State Forest (Main Levy Co. Tract), Lake Wales Ridge Wildlife and Environmental Area (Carter Creek/Silver Lake Tracts), St. Sebastian River Preserve State Park (Northeast Unit) and Withlacoochee State Forest (Citrus Tract). Lastly, we completed full surveys at nine of the conservation lands: Bell Ridge WEA, Ft. White WEA, Goethe SF, Gold Head Branch SP, Ichetucknee Springs SP, Joe Budd

WMA, Little Talbot Island SP, O'Leno SP/River Rise Preserve SP, and Watermelon Pond WEA.

Methods

***PHASE I- Site Assessments, Pilot Surveys, and Full Survey Designs*:** See the Quarter 3 Report for details of methods utilized during Phase I (Joseph W. Jones Ecological Research Center, 2014).

***PHASE II- LTDS Sampling*:** Line transect distance sampling was initiated in August 2014 following completion of the pilot surveys using LTDS methods for gopher tortoises as outlined in the Gopher Tortoise Survey Handbook (Smith et al. 2009) and Stober and Smith (2010). We used three observers and all burrows were scoped using a burrow camera (EMS, Canton, GA) to determine occupancy. Data were collected using a Nomad 900B Hand Held Computer (Trimble Navigation, Ltd., Sunnyvale, CA) with a Hemisphere Crescent A101 smart GPS antenna (CSI Wireless, Calgary, Alberta), which has sub-meter accuracy and real-time data collection.

During surveys, the crew leader navigated the transect center line with the Nomad, which had an ArcPad™ (ESRI, Redland, CA) project containing an aerial photograph of the site, land cover data, the sample frame, and transects. For data collection, the primary responsibility of the person on the center-line was to detect all burrows on or close to the center-line; the second and third observers thoroughly surveyed the area on each side of the centerline, taking care to observe all burrows between themselves and the centerline. GPS locations were taken at the start and endpoints of each transect, which allowed us to calculate the actual transect length and correct for minor discrepancies in transect

placement in the field. GPS locations were collected for any tortoises observed above ground and at the entrance of each burrow. All burrows were searched for tortoises with a camera equipped with a 6.4 cm diameter head for adult burrows and 2.5 cm diameter camera head for juvenile burrows (EMS, Canton, GA). Based on camera scoping results we categorized each burrow as either: 1) scoped, tortoise observed; 2) scoped, no tortoise observed for entire length of burrow; 3) collapsed, could not scope; or 4) scoped, unable to determine if occupied (e.g., burrow is flooded, washed in with sand, or an obstruction is present). Burrow width was measured (to the nearest 1 cm) 50 cm inside the opening using burrow calipers to provide information about the demographic structure of the population (adults versus juveniles; Alford 1980); we also used burrow width as a co-variate in models to estimate population size because detection probability of burrows decreases with size (Ballou 2013). Distance sampling relies on the assumption that all objects on the transect are detected. Because of the extreme difficulty in detecting very small burrows (Ballou 2013) abundance estimates derived with this survey method should be considered to reflect only subadults and adults in the population.

We recorded commensal species observed with the camera scope in burrows and other noteworthy species encountered above ground during surveys. Field notes were recorded directly into the Nomad GPS/PDA during field surveys. We recorded sick or dead tortoises observed. To minimize risk of spreading pathogens, the burrow camera head and cables were disinfected using Clorox Disinfecting Wipes™ at the end of each day and between sites.

For analysis, transect end points and burrow/tortoise observations were downloaded from the Nomad into ArcGIS. Transects were generated from end points using XTools

Pro and perpendicular distances from the transect to burrow openings or tortoises above ground was determined using the NEAR tool in ArcGIS. Final transect lengths and perpendicular distances were uploaded into Program Distance ver. 6.2. Tortoise population size and density were estimated using observations of occupied tortoise burrows and tortoises above ground. We ran a series of models using both the conventional distance sampling (CDS) and the multiple covariate distance sampling (MCDS) engines in Program Distance (Buckland et al. 2001 and 2004). Burrow width was included as a covariate (Marques et al. 2007) in the MCDS engine (Buckland et al. 2001). We used Akaike's Information Criteria (AIC; Akaike 1974) for model selection.

To describe the habitat within the sampling frames at each site we used a rapid assessment method at randomly selected points along transects. Random points were generated using Hawth's Tools in ArcGIS. Data collected included: basal area measured with a 10 Factor prism held at a height of 4.5 ft (Forestry Suppliers, Inc., Jackson, MS) and percent canopy cover measured with a convex spherical densiometer (Forestry Suppliers, Inc., Jackson, MS). We also categorized the components of the overstory (e.g., primarily pine, oak, mixed, other, or none at the random point), midstory (% cover of woody perennial vegetation 1-3 m tall within a 5 m radius of point), and understory (dominant ground cover type within a 1 m radius of the point). We summarized the components of each stratum as the percent of all points. Digital photographs were taken in four cardinal directions at each random point. Upon completion of full surveys, we categorized sites as high, medium, or low quality as described below:

1) **High quality**: Likely a viable population in suitable habitat. Site requires continued management, but no population manipulation/augmentation is

necessary.

2) **Medium quality- viable:** Likely a viable population, but habitat needs management/restoration of natural vegetation. No population manipulation necessary.
3) **Medium quality- not viable**: Population likely not viable at current size and demographic conditions, but habitat is suitable without need of extensive restoration. Augmentation with translocated tortoises should be considered.
4) **Low quality-** Population likely not viable at current size or demographic conditions and habitat is in need of extensive restoration to support more tortoises. Site should be considered for future augmentation with translocated tortoises.

Results

PHASE I. Pilot survey results and projected full survey effort data are presented in Table 1. Please see the Quarter 3 Report for complete Phase I results (Joseph W. Jones Ecological Research Center, 2014).

PHASE II. Population size and density estimates for nine conservation areas are presented in Table 2; output for all models is included in Appendix I. Burrow occupancy was 35.7% at Bell Ridge WEA (358 burrows scoped; 3.1% unknown occupancy), 48.9% at Ft. White WEA (307 burrows scoped, 1.9% unknown occupancy), 43.7% at Goethe SF (238 burrows scoped, 3.4% unknown occupancy), 41.4% at Gold Head Branch SP (232 burrows scoped, 0.9% unknown occupancy), 44.2% at Ichetucknee Springs SP (292 burrows scoped, 0.7% unknown occupancy), 38.1% at Joe Budd WMA (84 burrows scoped, 3.6% unknown occupancy), 68.0% at Little Talbot Island SP (513 burrows

scoped, 1.4% unknown occupancy), 56.2% at O'Leno SP/River Rise Preserve SP (356 burrows scoped, 2.5% unknown occupancy), and 51.3% at Watermelon Pond WEA (359 burrows scoped, 3.1% unknown occupancy). Burrow size class histograms show that from 8-45% of occupied burrows were in juvenile/sub-adult size classes (<23 cm in diameter, Figure 1a-i) and very small juvenile tortoises (<12 cm burrow diameter) were present at all sites except Goethe SF.

Basal area (BA) estimates ranged from 17.3 ft^2/ac at Little Talbot Island SP to 91.1 ft^2/ac at Joe Budd WMA (Table 3); canopy cover ranged from 22.4% at Little Talbot Island SP to 71.8% at Joe Budd WMA. Little Talbot Island SP and Bell Ridge WEA had the highest tortoise densities as well as the lowest mean BA and % canopy cover among the nine sites. Joe Budd WMA had the lowest tortoise density and highest mean BA and % canopy cover. Based on estimates of population size, density, demographic structure and habitat characteristics, the following sites could be categorized as of high quality: Bell Ridge WEA, Ft. White WEA, Gold Head Branch SP, Ichetucknee Springs SP, and Little Talbot Island SP. Goethe SF Levy Co. Tract and O'Leno SP/River Rise Preserve SP were categorized as medium-high quality sites; both sites support viable populations but would benefit from additional management to reduce hardwood midstory vegetation. Watermelon Pond WEA was categorized as of medium quality- viable; ongoing restoration work should increase habitat suitability. Joe Budd WMA supports a low density, likely non-viable population (Table 5); given the overall low tortoise density and lack of juveniles this population might benefit from augmentation.

Commensal species observed in burrows are listed in Table 4. Gopher frogs (*Lithobates capito*) were particularly abundant at Ft. White WEA, Gold Head Branch SP,

and Watermelon Pond WEA. Eastern diamond-back rattlesnakes (*Crotalus adamanteus*) were relatively numerous at O'Leno SP/River Rise Preserve SP; this is likely a consequence of the cooler weather during this survey.

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Table 1. Gopher tortoise pilot survey results for 25 Florida state conservation lands selected for priority full survey in 2014 and 2015. Pilot surveys were conducted March through August 2014. Full surveys were completed in 2014 at the nine sites in bold.

	Sampling Frame	Tortoises	Length(m)	Encounter Rate	Projected Transect Length (km)		
Site	**(ha)**	n_o	L_o	L_o/n_o	**L for 15%**	**L for 17%**	**L for 20%**
Beker-Wingate Creek State Park	208.6	9	3450	383.3	51.1	39.8	28.8
Bell Ridge WEA	**292.0**	**30**	**2000**	**66.7**	**8.9**	**6.9**	**5.0**
Blackwater River SF West Boundary Unit	3023.5	2	1900	950.0	126.7	98.6	71.3
Bullfrog Creek WEA	189.9	6	2500	416.7	55.6	43.3	31.3
Cayo Costa State Park	163.5	9	2400	266.7	35.6	27.7	20.0
Edward Ball Wakulla Springs State Park	337.3	4	2210	552.5	73.7	57.4	41.4
Etoniah Creek State Forest	1636.3	4	2900	725.0	96.7	75.3	54.4
Ft. White WEA	**327.9**	**11**	**2000**	**181.8**	**24.2**	**18.9**	**13.6**
Goethe SF Levy County- Main tract	**1912**	**8**	**2100**	**262.5**	**35.0**	**27.2**	**19.7**
Goldhead Branch State Park	**761.2**	**13**	**2600**	**200.0**	**26.7**	**20.8**	**15.0**
Guana River WMA	536.3	3	2585	861.7	114.9	89.4	64.6
Hilochee WMA (non-Osprey unit)	522.5	14	3450	246.4	32.9	25.6	18.5
Ichetucknee Springs State Park	**312.0**	**37**	**2800**	**75.7**	**10.1**	**7.9**	**5.7**
Joe Budd WMA	**258.2**	**8**	**1100**	**137.5**	**18.3**	**14.3**	**10.3**
Jonathan Dickinson State Park	1130.7	8	6470	808.8	107.8	84.0	60.7
Lake Louisa State Park	750.1	8	3600	450.0	60.0	46.7	33.8
Lake Wales Ridge WEA Carter Creek	715	3	600	200	26.7	20.8	15.0
Lake Wales Ridge WEA Silver Lake	184	3	700	233.3	31.1	24.2	17.5
Little Talbot Island State Park	**162.8**	**10**	**2400**	**240.0**	**32.0**	**24.9**	**18.0**
Moody Branch WEA	181.5	8	2000	250.0	33.3	26.0	18.8
O'Leno/River Rise State Park	**464.2**	**28**	**4380**	**156.4**	**20.9**	**16.2**	**11.7**
Perry Oldenburg WEA	134.8	12	2000	166.7	22.2	17.3	12.5
Platt Branch WEA	308.5	17	3300	194.1	25.9	20.2	14.6
St. Sebastian River SP NE	1140	9	2500	277.8	83.3	37.0	28.8
Watermelon Pond WEA	**133.4**	**7**	**2400**	**342.9**	**45.7**	**35.6**	**25.7**
Withlacoochee SF Citrus	17899	13	4400	338.5	45.1	35.1	25.4
Total area	**33685**						

Table 2. Line transect distance sampling (LTDS) results for gopher tortoise populations on state conservation lands in Florida, August - December 2014. Analyses were run using the multiple covariate distance sampling (MCDS) and conventional distance sampling (CDS) engines in Program Distance (Buckland et al. 2001) and Akaike's Information Criteria (AIC; Akaike 1974) were used for model selection (see Appendix 1 for all model output). # obs= number of tortoises in burrows or at large observed from transects, Effort= total length of transect surveyed, D= Density (tortoises/hectare), N= abundance, LCL= lower confidence limit for D and N, UCL= upper confidence limit for density and abundance estimate, P= detection probability.

Site	Model	# obs	Effort (m)	AIC	D	D LCL	D UCL	D CV	N	N LCL	N UCL	P
Bell Ridge WEA	HN cos 5%	118	9516.1	729.499	**4.1007**	2.57797	6.52284	0.18211	**1197**	753	1905	0.6257
Ft. White WEA	HN cos 5%	142	18444.9	840.957	**2.9694**	2.36109	3.73453	0.11587	**974**	774	1224	0.5873
Goethe SF Levy Co. Main tract	UN cos 5%	99	23393.7	670.292	**1.0668**	0.72101	1.5786	0.19825	**2039**	1378	3017	0.6075
Gold Head Branch SP	HN cos 5%	88	19907.1	565.391	**1.1161**	0.78311	1.59087	0.17565	**843**	591	1201	0.7687
Ichetucknee Springs SP	HN cos 5%	121	13561.7	665.481	**3.9702**	3.00822	5.2399	0.13793	**1269**	962	1675	0.6578
Joe Budd WMA	UN cos 5%	28	27478.2	167.929	**0.2539**	0.13276	0.48591	0.33636	**66**	34	125	1
Little Talbot Island SP	HR simp 5%	301	22252.7	1844.61	**4.3562**	3.79605	4.99919	0.07014	**754**	657	865	0.65374
O'Leno SP/River Rise Preserve SP	HN cos 5%	190	21486.9	1308.97	**2.1782**	1.60291	2.96005	0.15512	**1011**	744	1374	0.54612
Watermelon Pond WEA	HN cos 5%	173	36421.1	1090.60	**1.3775**	1.11789	1.69744	0.106298	**184**	149	226	0.70632

Table 3. Habitat data for nine state conservation lands in Florida collected in conjunction with line transect distance surveys for gopher tortoises, August-December 2014.

	Bell Ridge WEA	Ft. White WEA	Goethe SF	Gold Head Branch SP	Ichetucknee Springs SP	Joe Budd WMA	Little Talbot Island SP	O'Leno-River Rise SP	Watermelon Pond WEA
# of Habitat points	5	19	28	10	17	14	84	36	71
Mean basal area (ft^2/ac)	22	39.7	50.9	46.5	41	91.1	17.3	83.8	41.1
Canopy cover (%)	33	55.6	56.7	51.2	49	71.8	22.4	69.3	47.2
Overstory composition (% of all habitat points)									
pine	60	63.2	71.4	20	23.5	64.3	1.2	27.8	21.1
oak	40	15.8	7.1	40	29.4	0	0	11.1	36.6
mixed	0	15.8	17.9	40	47.1	35.7	19	61.1	29.6
other	0	0.0	0	0	0	0	23.8	0	1.4
none	0	5.3	3.6	0	0	0	56	0	11.3
Midstory (%)	19	26.2	63	46.5	33.2	34.3	30.1	41.5	32.3
Midstory composition (% of all habitat points)									
pine	0	0	0	0	5.9	0	0	2.8	0
oak	100	47.4	25	80	29.4	14.3	0	8.3	60.6
shrubs	0	10.5	0	10	5.9	7.1	21.4	2.8	0
palmetto	0	10.5	3.6	0	0	7.1	1.2	8.3	0
mixed	0	26.3	71.4	10	47.1	64.3	47.6	52.8	28.2
other	0	5.3	0	0	5.9	0	10.7	13.9	1.4
none	0	0.0	0	0	5.9	7.1	19	11.1	9.9
Ground cover composition (% of all habitat points)									
bare ground	0	15.8	3.6	10	0	0	41.7	8.3	11
litter	0	42.1	75	30	23.5	50	22.6	61.1	59
grass	60	10.5	3.6	10	52.9	7.1	10.7	16.7	7
woody	0	0.0	0	0	0	0	0	0	0
vines	0	0.0	0	0	0	0	1.2	0	0
mixed	40	31.6	17.9	50	23.5	42.9	23.8	13.9	23

Table 4. Commensal species observed with burrow camera scope during pilot and full line transect distance sampling surveys for gopher tortoises on Florida state conservation lands from March -December 2014.

		Beker-Wingate SP	Bell Ridge WEA	Blackwater River SF	Cayo Costa SP	Ft. White WEA	Goethe SF	Gold Head Branch SP	Guana River WMA	Ichetucknee Springs SP	Joe Budd WMA	Jonathan Dickinson SP	Lake Wales Ridge SF	Lake Wales Ridge WEA	Little Talbot Is. SP	Moody Branch WEA	O'Leno-River Rise SP	St. Sebastian River SP	Watermelon Pond WEA	Withlacoochee SF	Total
Amphibians																					
Anaxyrus quercicus	Oak toad								1												1
Anaxyrus terrestris	Southern toad		5			6	1	2													14
Eleutherodactylus planirostris	Greenhouse frog		3			2	1	4		7									1		18
Lithobates capito	Gopher frog					80	12	55				2	3	2		2		3	130	1	290
Lithobates sphenocephalus	Southern leopard frog		2																		2
Pseudacris nigrita	Southern chorus frog																			2	2
Reptiles																					
Aspidoscelis sexlineatus	Six-lined racerunner		1																		1
Coluber flagellum	Coachwhip				1										2		1				4
Crotalus adamanteus	Eastern diamond-back rattlesnake										3				1		11		2		17
Drymarchon corais	Eastern indigo snake	1																			1
Pituophis melanoleucus	Pine snake			1																	1
Sistrurus miliarius	Pygmy rattlesnake						1														1

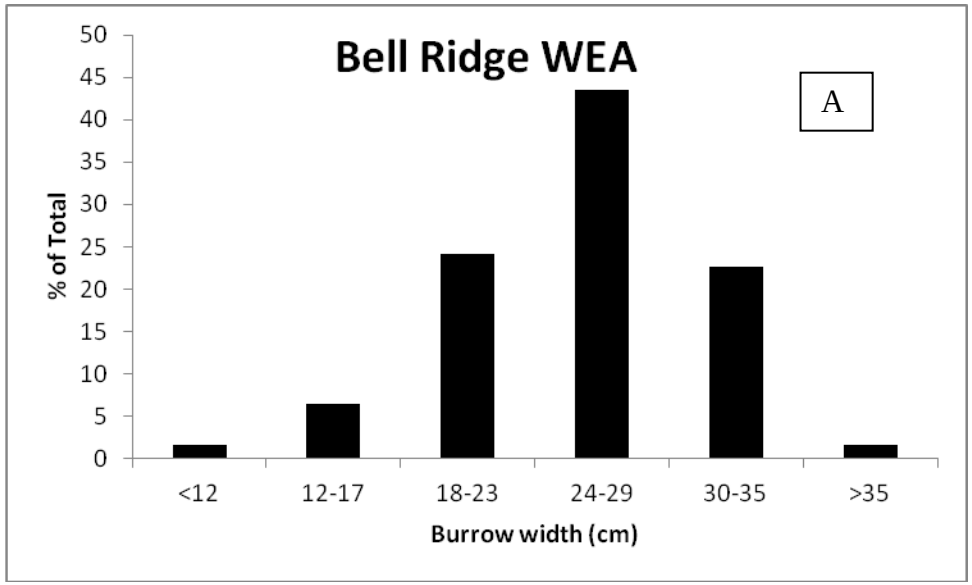
Table 4. Continued from previous page.

		Beker-Wingate SP	Bell Ridge WEA	Blackwater River SF	Cayo Costa SP	Ft. White WEA	Goethe SF	Gold Head Branch SP	Guana River WMA	Ichetucknee Springs SP	Joe Budd WMA	Jonathan Dickinson SP	Lake Wales Ridge SF	Lake Wales Ridge WEA	Little Talbot Is. SP	Moody Branch WEA	O'Leno-River Rise SP	St. Sebastian River SP	Watermelon Pond WEA	Withlacoochee SF	Total
Mammals																					
Dasypus novemcinctus	Nine-banded armadillo		1																		1
Didelphis virginianus	Opossum						1			1	1						3		1		7
Mephitis mephitis	Striped skunk									1							1		4		6
Podomys floridana	Florida mouse						3	1									4		1		9
Sylvilagus sp.	Rabbit		1														1				2

Table 5. Population evaluation and habitat suitability rankings for gopher tortoise surveys sites in Florida, 2014. (1) High quality: Likely a viable population in suitable habitat. Site requires continued management, but no population manipulation/augmentation is necessary; (2) Medium quality-viable**:** Likely a viable population, but habitat needs management/restoration of natural vegetation. No population manipulation necessary; (3) Medium quality- not viable: Population likely not viable at current size and demographic conditions, but habitat is suitable without need for extensive restoration. Augmentation with translocated tortoises should be considered; (4) Low quality: Population likely not viable at current size or demographic conditions and habitat is in need of extensive restoration to support more tortoises. Site should be considered for future augmentation with translocated tortoises

Site	**Ranking**	**Comments**
Bell Ridge WEA	1	Open canopy pine habitat with native ground cover dominated by grasses.
Ft. White WEA	1	Open canopy pine habitat with patches of native ground cover dominated by grasses.
Goethe SF Levy Co. Main tract	1-2	Northeastern parcels within tract contain highly suitable open canopy pine habitat and ground cover dominated by grasses. Parcels in the south and western portion of the site occur on less well-drained soils with greater midstory shrub cover.
Gold Head Branch SP	1	Open canopy pine habitat with patches of native ground cover dominated by grasses.
Ichetucknee Springs SP	1	Open canopy pine habitat with patches of native ground cover dominated by grasses. Isolated parcels to the north and east contain greater midstory hardwood cover.
Joe Budd WMA	3	Habitat varies from open canopy with dense herbaceous ground cover to more closed canopy pine stands with an understory of woody forbs and vines. Portions of the site on more well drained soil types could likely support more tortoises. The population is skewed toward adults (Figure 1 E). Given the overall low tortoise density and lack of juveniles this population might benefit from augmentation.
Little Talbot Island SP	1	Coastal scrub with numerous openings with bare sand and sparse ground cover vegetation.
O'Leno SP/River Rise Preserve SP	1-2	Mostly open canopy pine habitat with patches of dense herbaceous ground cover, but many areas have a more closed hardwood canopy and dense midstory of oaks and hollies (*Ilex sp.*).
Watermelon Pond WEA	2	Some open canopy pine with native ground cover vegetation dominated by grasses. But much of the site is under restoration and has an open canopy with dense midstory of oaks.

Figure 1a-i. Size class distribution of occupied gopher tortosie burrows at nine Florida conservation lands surveyed using line transect distance sampling from August-December 2014.



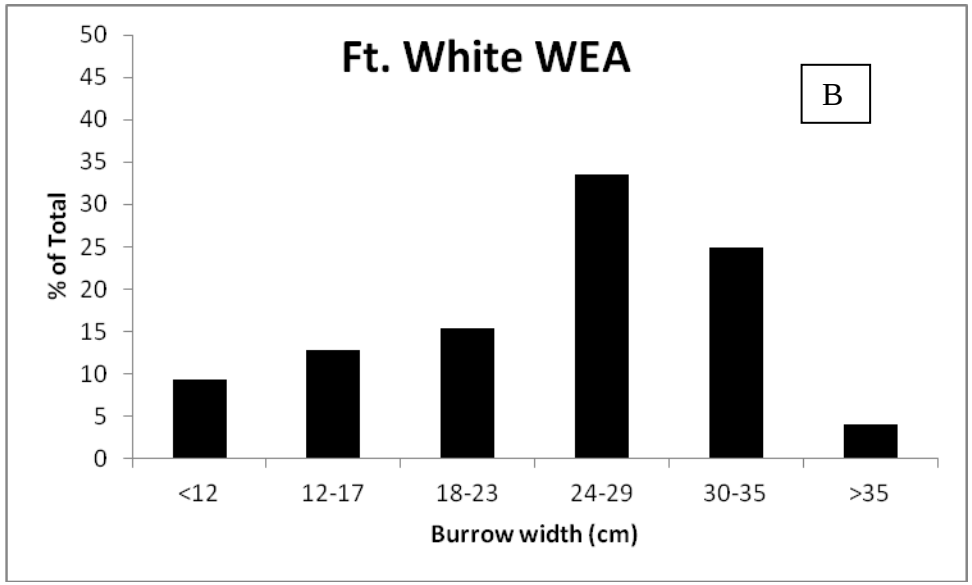
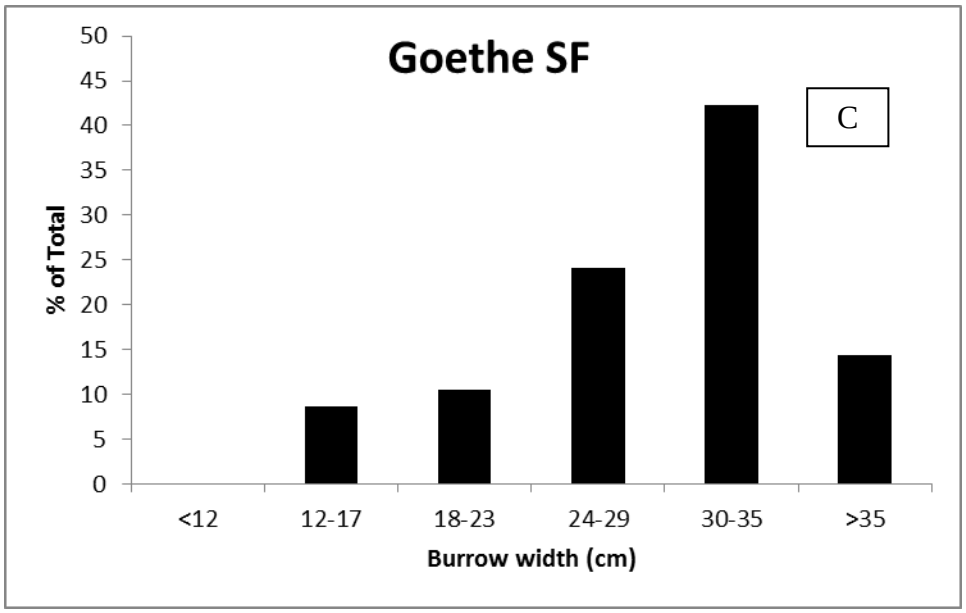
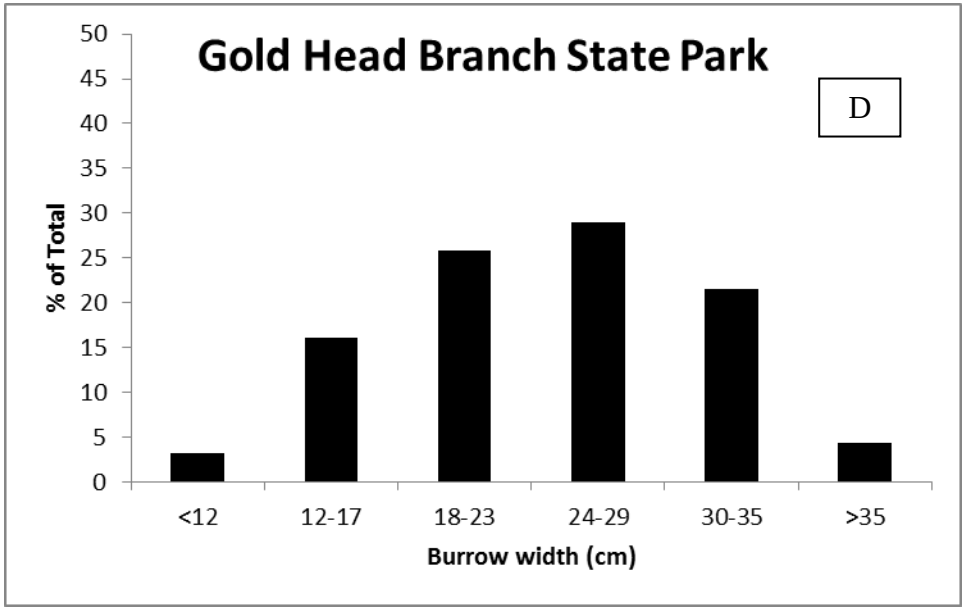


Figure 1a-i. Continued from previous page.





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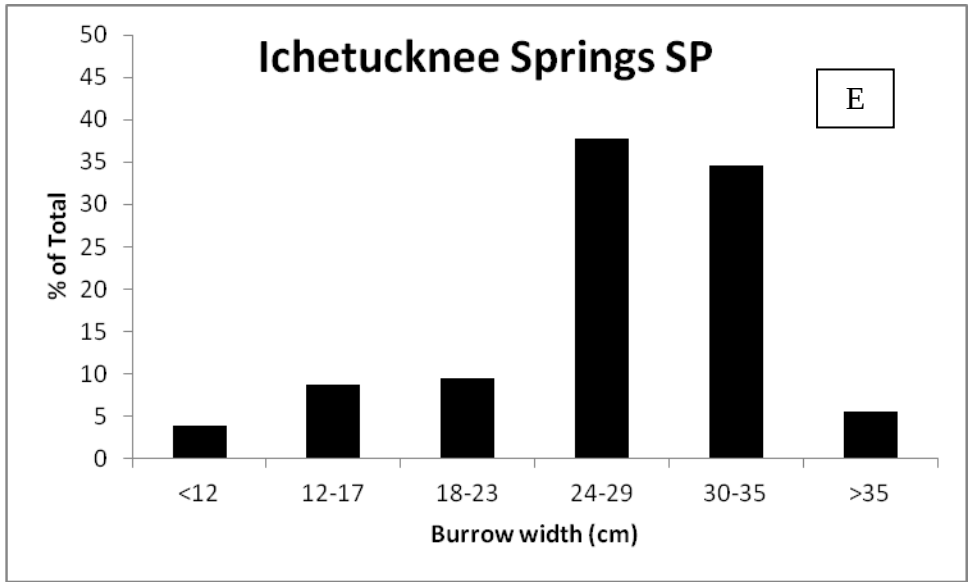

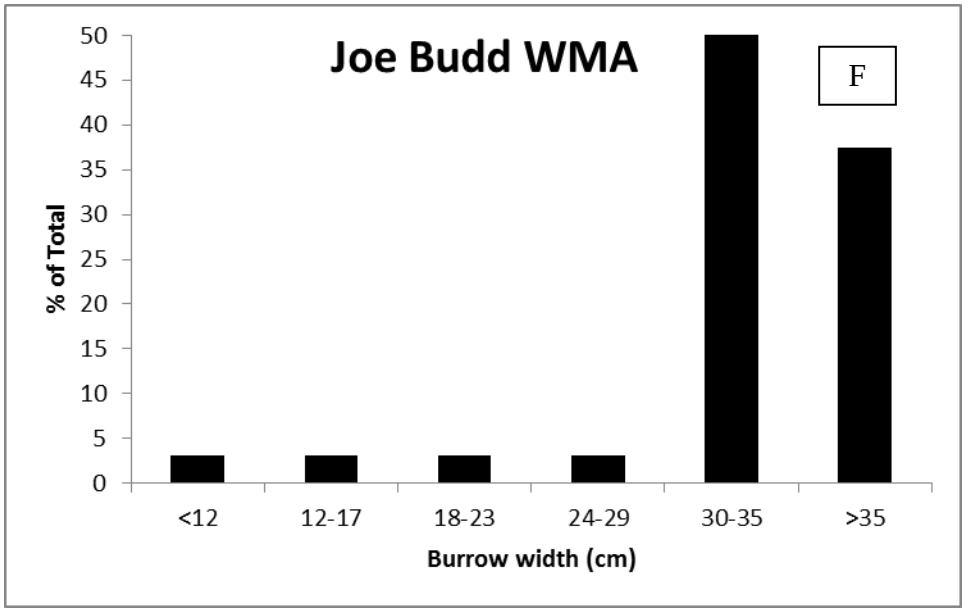

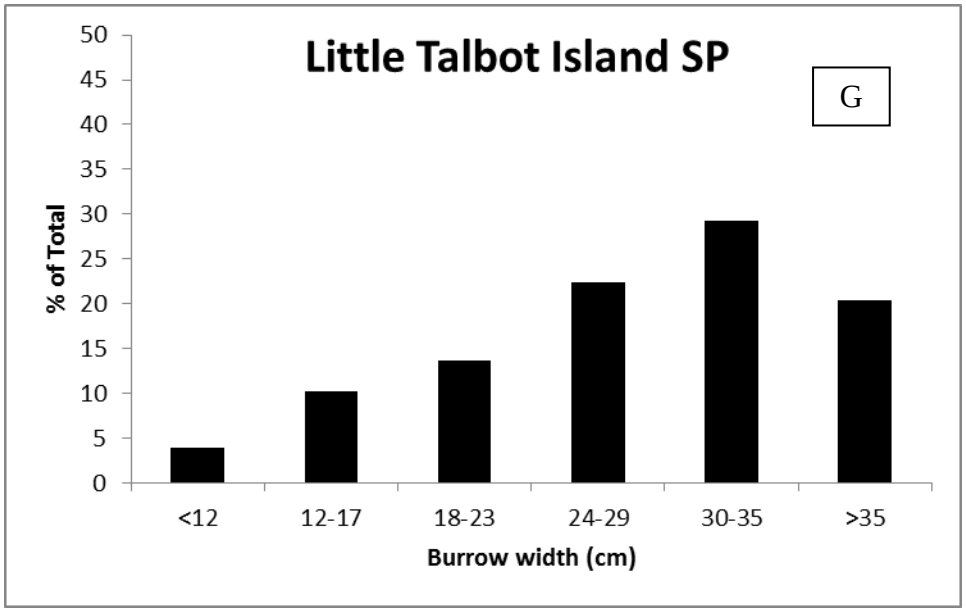

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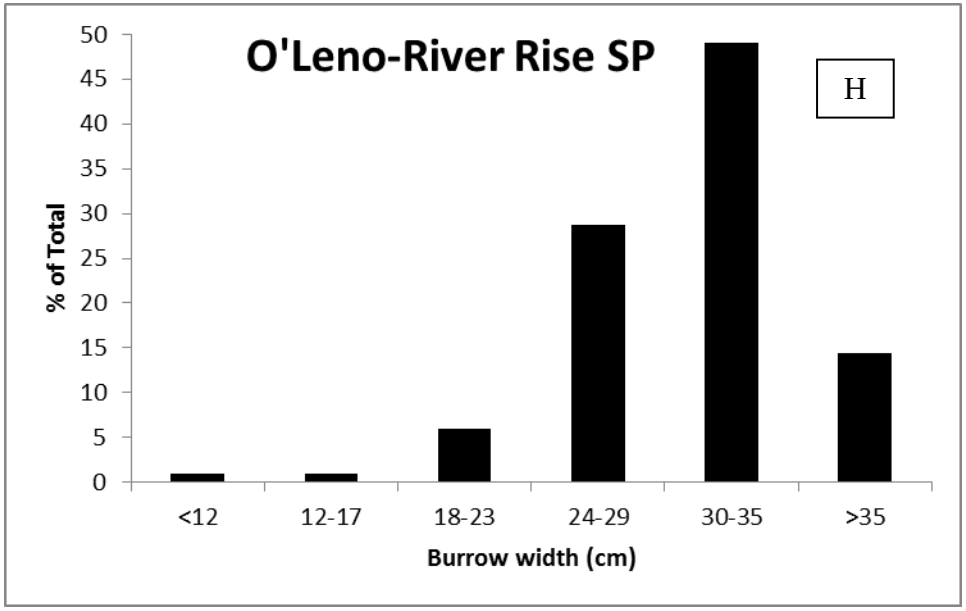

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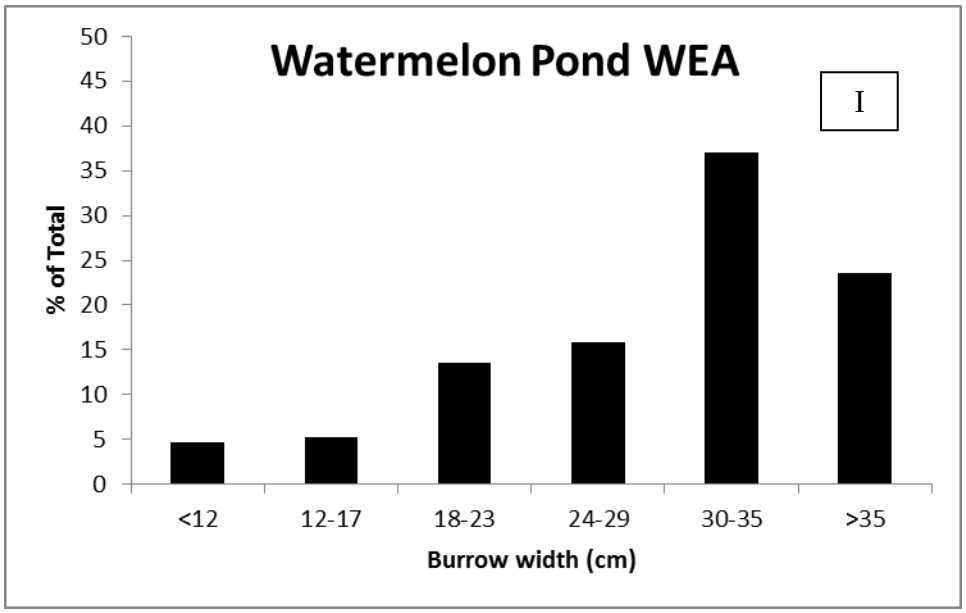

Appendix I. Model output for distance sampling for Gopher Tortoise populations on state conservation lands in Florida, August – December 2014. Methods included conventional distance sampling (CDS) and multiple covariate distance sampling (MCDS). Analyses were run using Distance software (Buckland et al. 2001). Burrow diameter was used as a covariate in all MCDS models. Best fitting models were selected using Akaike's Information Criteria (AIC; Akaike 1974) and are highlighted in yellow.
 # obs= number of tortoises in burrows or at large observed from transects, Effort= total length of transect surveyed, D= Density (tortoises/hectare), N= abundance, LCL= lower confidence limit for D and N, UCL= upper confidence limit for density and abundance estimate, P= detection probability.

Bell Ridge WEA		Method: MCDS										
Survey date	**Models**	**# obs**	**Effort**	**AIC**	**D**	**D LCL**	**D UCL**	**D CV**	**N**	**N LCL**	**N UCL**	**P**
August 2014	raw data	124	9516.1	800.8888	3.995883	2.428501	6.574869	0.1946075	1167	709	1920	0.549849
	HN cos 5%	118	9516.1	729.4993	4.100695	2.57797	6.522844	0.1821097	1197	753	1905	0.625771
	HN simp 5%	118	9516.1	729.4993	4.100695	2.57797	6.522844	0.1821097	1197	753	1905	0.625771
	HR cos 5%	118	9516.1	735.2581	4.398272	2.767267	6.990577	0.1838184	1284	808	2041	0.583433

Ft. White WEA		Method: MCDS										
Survey date	**Models**	**# obs**	**Effort**	**AIC**	**D**	**D LCL**	**D UCL**	**D CV**	**N**	**N LCL**	**N UCL**	**P**
August 2014	raw data	149	18444.9	940.4657	2.883693	2.261559	3.676971	0.1230525	946	742	1206	0.370685
	HN cos 5%	142	18444.9	840.9567	2.969436	2.36109	3.734525	0.1158722	974	774	1224	0.587376
	HN simp 5%	142	18444.9	840.9567	2.969436	2.36109	3.734525	0.1158722	974	774	1224	0.587376
	HR cos 5%	142	18444.9	842.7539	2.683807	2.141129	3.364029	0.1140906	880	702	1103	0.649889

Goethe SF Levy Co. Main Tract		Method: CDS										
Survey date	**Models**	**# obs**	**Effort**	**AIC**	**D**	**D LCL**	**D UCL**	**D CV**	**N**	**N LCL**	**N UCL**	**P**
December 2014	raw data	104	23393.68	753.5927	1.00468	0.637422	1.583538	0.2320895	1920	1218	3027	0.353196
	HN cos 5%	99	23393.68	670.9729	1.041727	0.697556	1.555712	0.2033405	1991	1333	2974	0.622112
	HN simp 5%	99	23393.68	670.9729	1.041727	0.697556	1.555712	0.2033405	1991	1333	2974	0.622112
	UN simp 5%	99	23393.68	671.9551	1.066655	0.712803	1.596168	0.2044518	2039	1363	3051	0.607573
	UN cos 5%	99	23393.68	670.2922	1.066851	0.721011	1.578578	0.1982455	2039	1378	3017	0.607462
	HR cos 5%	99	23393.68	673.5535	1.113894	0.686633	1.807022	0.2481666	2129	1312	3454	0.581807
	bootstrap 5%	99	23393.68	670.2922	1.066851	0.721011	1.578578	0.1982455	2039	1378	3017	0.607462

Gold Head Branch SP Method: MCDS

Survey date	Models	# obs	Effort	AIC	D	D LCL	D UCL	D CV	N	N LCL	N UCL	P
September 2014	raw data	93	19907.1	631.6749	1.211761	0.833387	1.761925	0.185128	915	629	1330	0.559245
	HN cos 5%	88	19907.1	565.3909	1.116167	0.783114	1.590866	0.1756474	843	591	1201	0.768704
	HN simp 5%	88	19907.1	565.3909	1.116167	0.783114	1.590866	0.1756474	843	591	1201	0.768704
	HR cos 5%	88	19907.1	570.1694	1.043765	0.744426	1.463471	0.1658594	788	562	1105	0.822026

Ichetucknee Springs SP Method: MCDS

Survey date	Models	# obs	Effort	AIC	D	D LCL	D UCL	D CV	N	N LCL	N UCL	P
Sept-Oct 2014	raw data	127	13561.7	763.1468	3.894218	2.948803	5.142742	0.1387209	1245	943	1644	0.334318
	HN cos 5%	121	13561.7	665.4805	3.970234	3.008218	5.239899	0.137926	1269	962	1675	0.657827
	HN simp 5%	121	13561.7	665.4805	3.970234	3.008218	5.239899	0.137926	1269	962	1675	0.657827
	HR cos 5%	121	13561.7	670.0611	3.878124	2.940744	5.114299	0.1374773	1240	940	1635	0.673451

Joe Budd WMA Method: CDS *repeated sampling design

Survey date	Models	# obs	Effort*	AIC	D	D LCL	D UCL	D CV	N	N LCL	N UCL	P
Oct-Nov 2014	raw data	30	27478.19	202.5086	0.303588	0.15348	0.600505	0.3554954	78	40	155	0.501008
	HN cos5%	28	27478.19	169.9292	0.254011	0.120367	0.536041	0.3914796	66	31	138	0.9999
	HN simp5%	28	27478.19	169.9292	0.254011	0.120367	0.536041	0.3914796	66	31	138	0.9999
	UN cos5%	28	27478.19	167.9288	0.253986	0.132759	0.485908	0.3363602	66	34	125	1
	UN simp5%	28	27478.19	167.9288	0.253986	0.132759	0.485908	0.3363602	66	34	125	1
	HR cos5%	28	27478.19	171.9288	0.253986	0.132756	0.48592	0.3363746	66	34	125	1

O'Leno River Rise Method: MCDS

Survey date	Models	# obs	Effort	AIC	D	D LCL	D UCL	D CV	N	N LCL	N UCL	P
Nov-Dec 2014	raw data	200	21486.93	1448.402	2.067801	1.52786	2.798555	0.1531884	960	709	1299	0.381669
	HN cos 5%	190	21486.93	1308.974	2.178231	1.602906	2.960054	0.1551151	1011	744	1374	0.546116
	HN simp 5%	190	21486.93	1308.974	2.178231	1.602906	2.960054	0.1551151	1011	744	1374	0.546116
	HR cos 5%	190	21486.93	1311.508	2.317852	1.703224	3.154274	0.1558872	1076	791	1464	0.51322

Little Talbot Island SP Method: MCDS

Survey date	Models	# obs	Effort	AIC	D	D LCL	D UCL	D CV	N	N LCL	N UCL	P
Oct-Nov 2014	Raw data	317	22252.67	2044.061	4.496084	3.913374	5.16556	0.070746	778	677	894	0.494756
	HN cos 5%	301	22252.67	1846.763	4.503578	3.923823	5.168994	0.070219	779	679	894	0.632354
	HN simp 5%	301	22252.67	1846.763	4.503578	3.923823	5.168994	0.070219	779	679	894	0.632354
	HR simp 5%	301	22252.67	1844.606	4.35628	3.796053	4.999187	0.070143	754	657	865	0.653736

Watermelon Pond WEA Method: MCDS

Survey date	Models	# obs	Effort	AIC	D	D LCL	D UCL	D CV	N	N LCL	N UCL	P
Oct-Nov 2014	raw data	182	36421.06	1210.374	1.443066	1.162211	1.791792	0.1102738	193	155	239	0.48055
	HN cos 5%	173	36421.06	1090.596	1.377518	1.117892	1.697442	0.1062975	184	149	226	0.706315
	HN simp 5%	173	36421.06	1090.596	1.377518	1.117892	1.697442	0.1062975	184	149	226	0.706315
	HR cos 5%	173	36421.06	1092.987	1.217503	0.993131	1.492567	0.1036174	162	132	199	0.799145

PILOT GOPHER TORTOISE SURVEY AT CEDAR KEY SCRUB STATE RESERVE

INTRODUCTON

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. FNAI was founded in 1981 as a member of The Nature Conservancy's international network of natural heritage programs. With funding provided through contracts and grants FNAI works cooperatively with state, federal, and other agencies on inventory and monitoring projects. FNAI has conducted gopher tortoise surveys on many state and federal conservation lands throughout Florida and has adopted Line Transect Distance Sampling (LTDS) as the standard method for conducting surveys.

To address concerns regarding survey consistency LTDS recently has been adopted as the preferred monitoring methodology through the Gopher Tortoise Candidate Conservation Agreement team. This method is widely used to estimate population size and density of wildlife species (Buckland et al., 2001) and provides a statistically valid, consistent method to evaluate tortoise populations. Standardized survey results will provide crucial baseline data, using a repeatable method, with which to compare future survey data and determine population trends or variation in response to habitat management activities.

The open source software program Distance 6 can be used to create LTDS survey designs and to analyze survey data. ArcGIS software is necessary for managing spatial data related to the survey (e.g., to define the survey area [sampling frame], and map transect and tortoise locations). The sampling frame is the extent of suitable tortoise habitat on a particular property as determined by soils, vegetation (land cover), and land-use. In some situations, it may be desirable to stratify the sampling frame to determine tortoise density in different habitats within the same site (e.g., sandhill vs. other habitat, or other situations that might have different tortoise densities); in this case, systematic stratified sampling (e.g., by habitat type) can be used to minimize within-stratum variability.

A pilot survey is generally conducted prior to the formal survey to determine the sampling intensity needed for the full survey. During the pilot survey, the length of transect surveyed per tortoise observation, called the tortoise encounter rate, is recorded. This value is used to calculate the distance of transect needed to achieve desirable results in the formal survey. There is flexibility in the amount of effort required for a pilot survey and in selecting locations for pilot survey transects, but it is important that the pilot survey captures variation in habitat type, quality, and tortoise distribution within the sampling frame.

The full LTDS survey is designed using Program Distance and incorporates the sampling frame and encounter rate from the pilot survey. The tortoise encounter rate (meters of transect sampled per tortoise observed) is used to extrapolate the total length of transect necessary to derive abundance estimates with reasonable precision. As a general rule, to detect changes in population size over time, sampling should be intensive enough to produce a coefficient of variation (CV) of 15-20 percent, which is a practical expectation for most monitoring projects. If the CV exceeds 20%, the statistical power, confidence, and ability to detect trends in monitoring data are substantially reduced.

The purpose of this project was to complete pilot transect surveys at Cedar Key Scrub State Reserve and calculate the distance of transect needed in the formal survey to achieve a coefficient of variation between 15 and 20 percent.

METHODS

Pilot Survey

Survey areas (sample frames) for this project were developed cooperatively by FNAI and FWC. We randomly distributed pilot transects throughout each sample frame; the length and number of transects were based on recommendations provided by the Joseph Jones Research Center (Table 1). These transects were developed in ArcGIS by creating a 100 or 200-meter grid (depending on the overall amount of habitat and size of the habitat polygons within the site) for each site. We then randomly selected squares from the grid (the number of which is generally based on Table 1) and clipped these with the sample frame.

Table 1. General recommendations for pilot survey effort to estimate tortoise encounter rates (tortoises/m).

Amount of habitat (ha)	Amount of habitat (ac)	Random points	Transect length (m)	Total length (m)
50	124	10	200	2000
100	247	15	200	3000
500	1236	20	200	4000
1000	2471	25	200	5000
5000	12356	30	500	15000
10000	24711	35	500	17500
20000	49422	50	500	25000

In order to ensure that a sufficient length of transect was created we added approximately 10 percent to the number of squares chosen. Additionally the total length of transect for each square exceeds the recommended length, assuring adequate transect length for each site.

Each pilot transect was walked using a Trimble Geo XT, Geo7, or Nomad datalogger paired with an R1 receiver. Each of these is capable of recording positions with sub-meter accuracy and allows for accurate walking of the transect centerline and recording of burrow locations. All potentially useable burrows observed from the transect were searched using a burrow camera scope to determine occupancy. The position of each scoped burrow was recorded along with data on burrow size, visual status, and occupancy. The survey was conducted on 31 January – 1 February 2018.

Using ArcGIS, GPS tracks were used to confirm the surveyed portion of each transect. Any unsurveyed portions (generally small wetlands) were clipped from the transect after the field survey. Overall encounter rate then was calculated.

The overall encounter rate was used to calculate the length of transect in a full survey to achieve a CV of 17 (less than 20 is generally desirable for scientific studies): $L = (b/cv(D)^2) \times (Lo/no)$ where L = sampling

intensity (total length of transects needed for full survey); b = dispersion parameter (constant value of 3); cv(D) = desired CV for density estimate; and (Lo/no) = encounter rate (E.R.).

RESULTS

A total of 5,737.3 m of transect was surveyed within a sample frame of 929.3 ha. Five burrows were scoped: 2 occupied, and 3 unoccupied. The communities surveyed included coastal scrub, scrubby flatwoods, mesic flatwoods, and coniferous plantations.

Much of the survey area, especially the mesic flatwoods was long fire-excluded. It consisted of dense saw palmetto (over six feet tall), thick smilax and a ground cover of compacted leaf litter. Efforts are underway to reduce the vegetation, but currently it is not suitable habitat for gopher tortoises. The western areas of maritime hammock were inaccessible due to surrounding marshes. Restoration efforts in the eastern portion have made that area more suitable and one occupied gopher tortoise burrow was observed near the road.

When the unsuitable habitat is excluded, the edited sample frame has an area of 550.3 ha, and a total walked distance of 4,961.9 m. The distribution of pilot transects and tortoise encounters within the sample frame is shown in Figure 1. Based on the adjusted encounter rate of 2,480.9 m/tortoise the sampling intensity for the full survey is 257,538 m. ($L = (b/cv(D)2) \times (Lo/no) = L = (3/0.17^2) \times (4,961.9/2)$ L = 257,538 m). With grid transects spaced 40 m apart the total proposed walking distance is 274,505.4 m (Figure 2).

It seems unlikely that Cedar Key State Reserve currently has a viable gopher tortoise population, and the required walking distance for an LTDS survey is probably not practical.

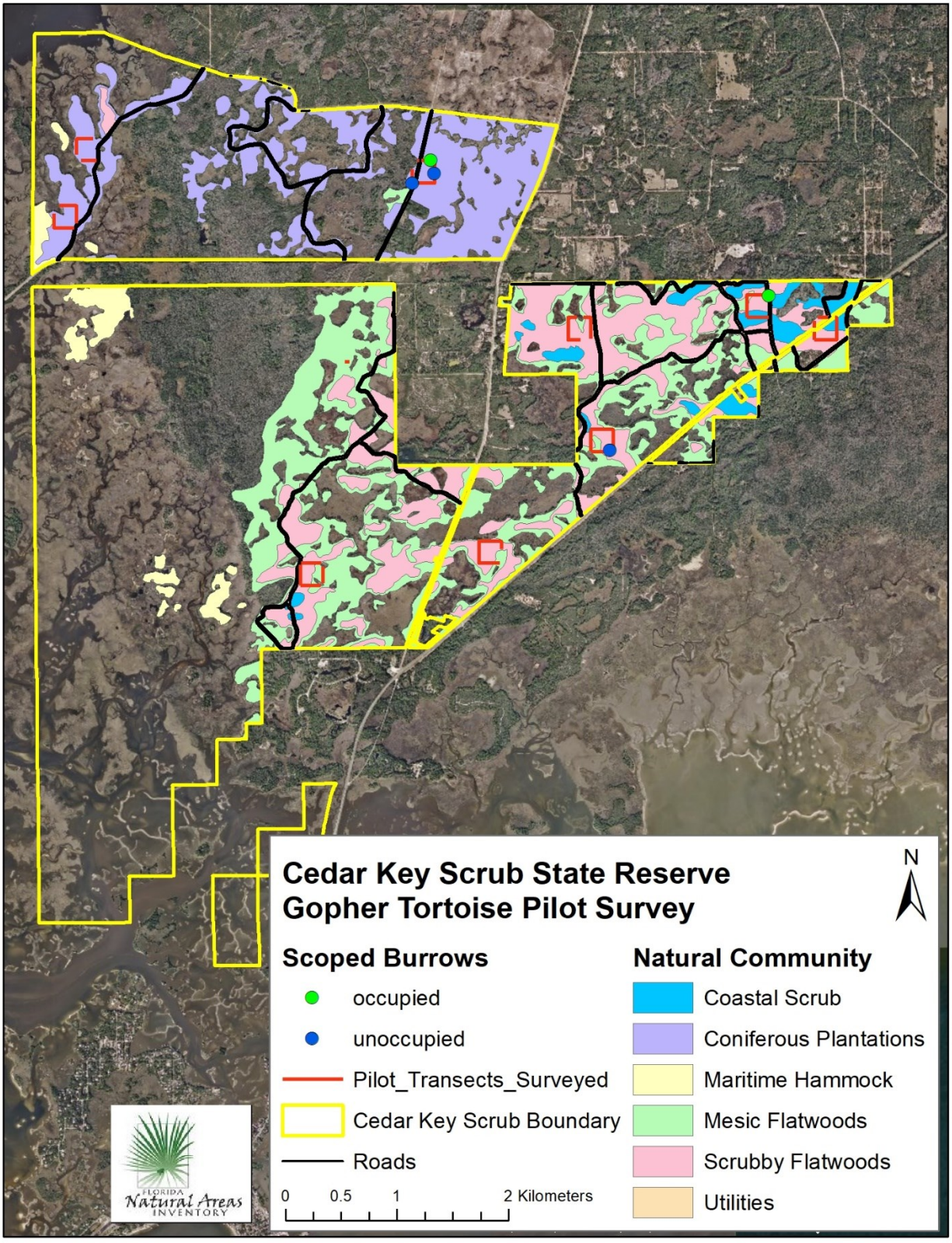

Figure 1. Pilot transects and burrow locations at Cedar Key Scrub State Reserve.

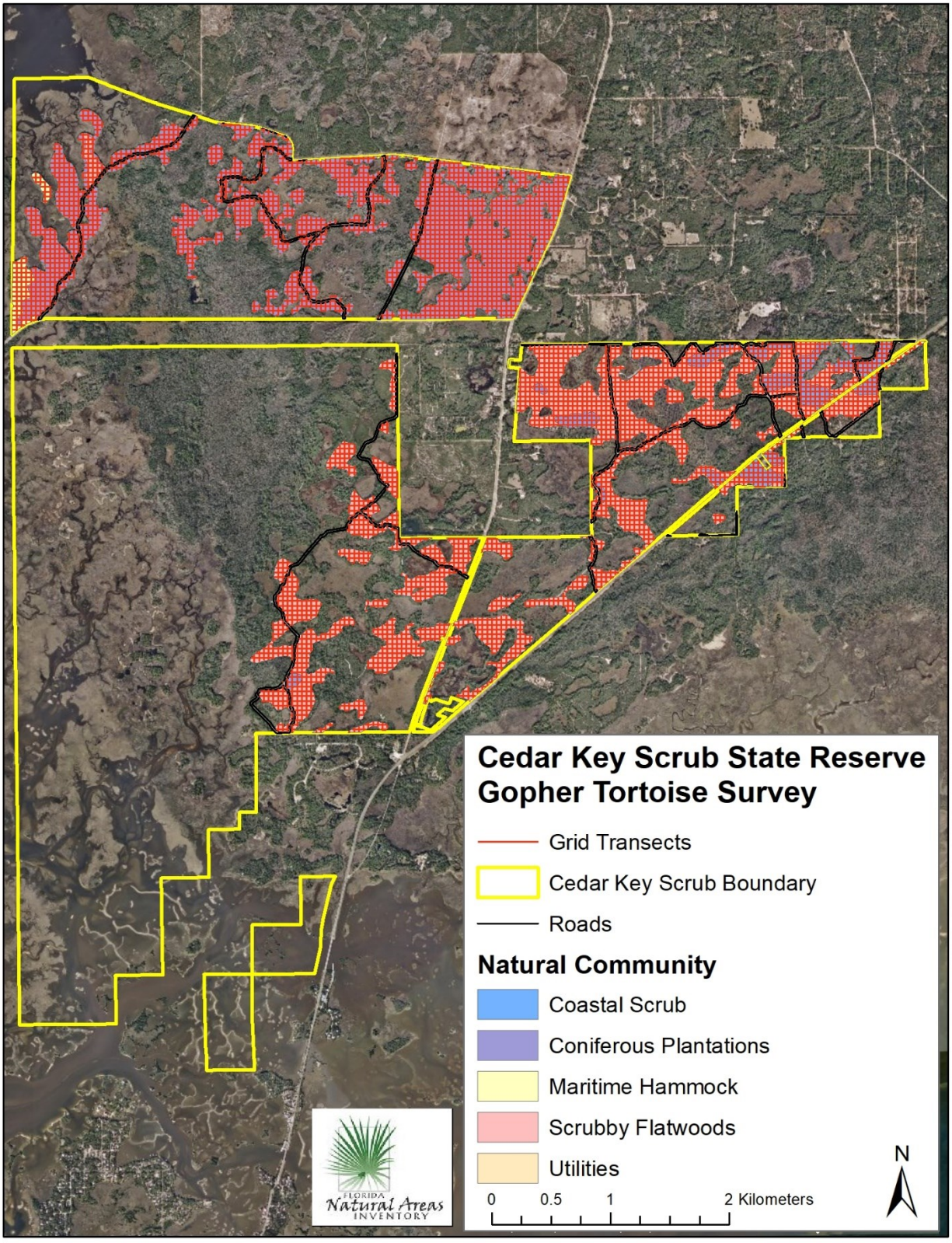

Figure 2. Proposed formal survey transect locations for Cedar Key Scrub State Reserve.

Gopher Tortoise (*Gopherus polyphemus*) Line Transect Distance Sampling Survey of Fort Clinch State Park

Final Report

8 January 2019

Florida Fish and Wildlife Conservation Commission

MyFWC.com

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Species Conservation Planning
Division of Habitat and Species Conservation

Abstract

The Florida Fish and Wildlife Conservation Commission completed a gopher tortoise (*Gopherus polyphemus*) line transect distance sampling (LTDS) survey at Fort Clinch State Park in December 2018 using a 3-person survey crew. The pilot survey was conducted February 20-21, 2018, and the full survey was conducted on November 13-16 and December 10-12, 2018. The 216 hectares (ha) of gopher tortoise potential habitat was composed of coastal grassland, coastal strand, beach dune, a spoil area, and a low intensity developed area. Because tortoises were not readily documented in coastal strand habitat during the survey, coastal strand was removed from the sample frame and analyses, resulting in 133.9 ha of suitable gopher tortoise habitat on-site. Analyses indicate a population size of 426 gopher tortoises (95% CI: 319-568) with a density of 3.18 tortoises per ha (95% CI: 2.39-4.24). Based on this analysis, Fort Clinch State Park meets the criteria of a viable gopher tortoise population. This LTDS survey should be repeated every 5-10 years to determine population trend, i.e., increasing, decreasing, or stable.

Introduction

Assessing gopher tortoise (*Gopherus polyphemus*) population status using a standardized approach range-wide is critical to accurately monitor gopher tortoise population trends over time. In 2012, participants in the Candidate Conservation Agreement for the Gopher Tortoise adopted line transect distance sampling (LTDS) with burrow scoping (Smith et al. 2009) as the standardized methodology to examine gopher tortoise populations (Candidate Conservation Agreement 2012). LTDS surveys are a statistically robust method of estimating gopher tortoise population size and density as the method relies on tortoise observations along established transects and incorporates detection probability (Smith and Howze 2016a). Population survey and monitoring results using LTDS can provide essential baseline population and density estimates and repeat surveys can be conducted to determine population trends or tortoise response to habitat management practices over time. FWC recommends an LTDS survey interval of 5-10 years.

Methods

Sample frame delineation and LTDS survey

Potential gopher tortoise habitat, or the survey's sample frame, was delineated using natural community land cover data, soils data, and input from park staff. Although maritime hammock is considered a suitable natural community for gopher tortoises, park staff indicated tortoises were uncommon within this land cover type and it was removed from the sample frame. Therefore, the sample frame included coastal grassland, coastal strand, beach dune, low-intensity developed areas, and a spoil area, resulting in 216 ha of potential gopher tortoise habitat on-site.

A pilot survey is typically conducted prior to a full LTDS survey to determine the sampling intensity, or the transect distance required, during a full survey. The length of transect surveyed per gopher tortoise observation, referred to as the tortoise encounter rate, is calculated from pilot survey results. To detect changes in population size over time, a full survey should result in the observation of >60 tortoises and produce a coefficient of variation (CV) of 15-20% (Smith and Howze 2016a). Thus, the encounter rate from the pilot survey is used to estimate how much transect should be traversed on the full survey to encounter at least 60-80 tortoises. This transect distance is often buffered to allow for removal of

transects in unsuitable habitat that may be encountered during the full survey. The Fort Clinch State Park pilot survey was conducted on February 20-21, 2018 (see survey map, Appendix 1).

The pilot survey yielded an encounter rate of 159.8, and the required transect distance for the full survey was estimated to be 16,000 m to attain a 17% CV. The full survey design encompassed 216 ha of potential gopher tortoise habitat and 18,191 m of transect spaced 120 m apart. FWC staff traversed transects using a 3-person observer method (Smith et al. 2009) with a submeter accuracy GPS unit. All potentially occupied gopher tortoise burrows were scoped with a burrow camera (Environmental Management Services, Canton, Georgia) to determine occupancy. Burrows were categorized as occupied, not occupied, unable to determine occupancy (unknown), or collapsed. The width of each burrow was also measured using calipers inserted 50 cm inside the burrow; this measurement can be used to approximate the size of the tortoise occupying the burrow (Alford 1980, Martin and Layne 1987).

Habitat assessment

We used a rapid habitat assessment protocol described in Smith and Howze (2016b). We collected data from one habitat point randomly generated along each transect prior to the survey. Data collected include overstory, midstory, and ground cover composition and percent; basal area; and percent canopy cover. We summarized these data as percent of all habitat points, and collected a digital photograph bearing North at each habitat point. These data were used to provide a qualitative assessment of habitat conditions on-site and can provide insight on any necessary management practices that may improve tortoise habitat within the conservation land.

Results and discussion

Population and density estimate

The full LTDS survey was conducted on November 13-16 and December 10-12, 2018. Following completion of the field survey, we determined that the coastal strand natural community type was less suitable for gopher tortoises than adjacent habitats; although coastal strand comprised 38% of the potential gopher tortoise habitat on-site, only 5.7% of tortoise burrows were found within this natural community (Table 1). Because inclusion of a natural community type rarely used by tortoises may reduce precision estimates of abundance and density, coastal strand habitat was removed from the analysis resulting in a sample frame of 133.9 ha and 10,170.5 m of transect walked. During the full survey, 197 burrows were scoped, of which 113 were occupied (i.e., 57.4% burrow occupancy; Table 2; Appendix 2). Burrow occupancy was unable to be determined for 8 (4.1%) burrows because of failure to navigate the scope past abrupt turns in the burrow tunnel, and one instance of burrow flooding.

Table 1. Percent of gopher tortoise burrows and burrow occupancy within each natural community land cover type, and percentage of gopher tortoise habitat by natural community type at Fort Clinch State Park, November-December 2018.

Natural community	% of total burrows	% occupancy	Total area (ha)	% of potential habitat
Beach dune	5.3	63.6	20.3	9.4
Coastal grassland	85.2	60.2	106.2	49.2
Coastal strand	5.7	45.5	82.2	38.0
Developed	1.0	50.0	2.5	1.1
Spoil area	2.9	33.3	4.9	2.3

Table 2. Burrow scoping results of line transect distance sampling (LTDS) surveys at Fort Clinch State Park, November-December 2018, after coastal strand habitat was removed from the sample frame.

Sample frame (ha)	Burrows scoped	Burrows occupied	% occupied	No. unknown occupancy	% unknown occupancy
133.9	197	113	57.4%	8	4.1%

Analyses were run on the survey data with Distance software (Buckland et al. 2001) version 7.1 using two model sets: a conventional distance sampling (CDS) model set and a multiple covariate distance sampling (MCDS) model set. The MCDS method includes burrow width (cm) as a covariate (Smith and Howze 2016a). Best fitted models were selected using Akaike's Information Criteria (AIC; Akaike 1974) and consideration of the coefficient of variation (CV) and detection probability (P). If multiple models contained AIC values ≤2, the model with the lowest CV was selected.

Upon initial analysis, the CV was unexpectedly high (20.7%) and yielded large confidence intervals, larger than expected given the number of tortoises observed during the LTDS survey. Upon review of the data, it was determined that the southern-most transect was generating a high rate of model uncertainty within the Distance analysis. This was due to a much higher encounter rate observed on this transect (20 gopher tortoises encountered along 214 m of transect, or an encounter rate of 10.7) than anywhere else in the park (88 tortoises along 9,956 m of transect, or an encounter rate of 113.1). As this transect does not appear to be representative of the density found elsewhere in the park, the transect was removed from the Distance analysis to minimize inflation of abundance and density estimates. We believe the urban interface may be artificially increasing the gopher tortoise density within this area, potentially due to tortoises being displaced by development or illegal release of tortoises by well-intentioned individuals. With the exclusion of the southern-most transect data, the best fit model was within the MCDS analysis and contained a hazard-rate distribution with a 5% right truncation (Table 3). This model estimates a population size of 426 gopher tortoises and a density of 3.18 tortoises/hectare.

Table 3. Top model results for the 2018 line transect distance sampling (LTDS) survey at Fort Clinch State Park. Model results reported include: Akaike's Information Criteria (AIC; Akaike 1974), coefficient of variation (CV), detection probability (P), # obs= number of tortoises in burrows or above ground and observed from transects, Effort= total length of transect surveyed, D= density (tortoises/hectare), N= abundance, LCL= 95% lower confidence limit for D and N, UCL= 95 % upper confidence limit for D and N.

Model	# obs	Effort (m)	AIC	D	D LCL	D UCL	CV	N	N LCL	N UCL	P
MCDS HR 5%	84	9,955.78	460.03	3.181	2.385	4.242	14.7%	426	319	568	0.84

Size class distribution

Occupied burrow size class distribution indicated a predominance of adult burrows (≥22 cm in width; 70%). However, occupied juvenile (5%) and subadult burrows (25%) were also readily detected (Figure 1), indicating recent successful reproduction and recruitment into the population. Some transects contained a dense herbaceous understory which may have impaired the surveyor's ability to detect small burrows. Thus, it is possible that the encounter rate of juvenile burrows is underrepresented as LTDS surveys may be biased toward adult burrow detection.

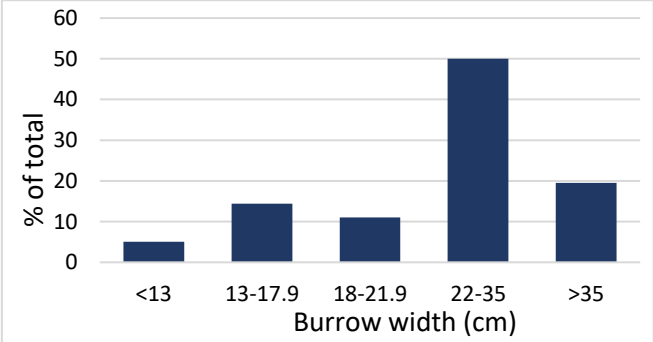

Figure 1. Size and age class distribution (juvenile: <13 cm burrow width, subadult: 13-21.9 cm, adult: ≥22 cm; Alford 1980, Diemer 1992) of occupied gopher tortoise burrows encountered during the line transect distance sampling survey at Fort Clinch State Park from November-December 2018.

Habitat suitability

Habitat data were collected from twenty-five randomly generated points along survey transects (Table 4 and 5). Coastal strand habitat was determined to be primarily unsuitable for gopher tortoises (Figure 2D) and was removed from the final sample frame and survey analysis. We parsed out habitat data collected in suitable gopher tortoise habitat from unsuitable habitat (i.e., coastal strand), and present those results separately below (see Table 4 and 5).

Within suitable habitat, average overstory and midstory percent cover were low (<10%) and mean basal area was 1.8 ft/ac^2, results which are unsurprising given suitable habitat was predominantly coastal grassland and beach dune. Over half (52.9%) of habitat points contained primarily bare ground within 1 m of the survey point, followed by grass and litter (Table 4). The majority of burrows (85%) were found in coastal grassland habitat on Fort Clinch State Park as it primarily contained a diverse herbaceous ground cover suitable for tortoises to forage, sandy soils for burrowing, and an open canopy to facilitate thermoregulation (Figure 2A, B, C).

Habitat data collected within the coastal strand natural community indicate it contained a primarily closed canopy (91.8%) on site, and ground cover within 1 m of habitat points was dominated by litter (at 100% of habitat points; Table 5). These results indicate coastal strand is primarily unsuitable for gopher tortoises at Fort Clinch State Park. Although a small number of tortoises were found in coastal strand, they occurred on habitat edges near highly suitable coastal grassland habitat, likely because tortoises residing in coastal strand must forage within the adjacent coastal grassland.

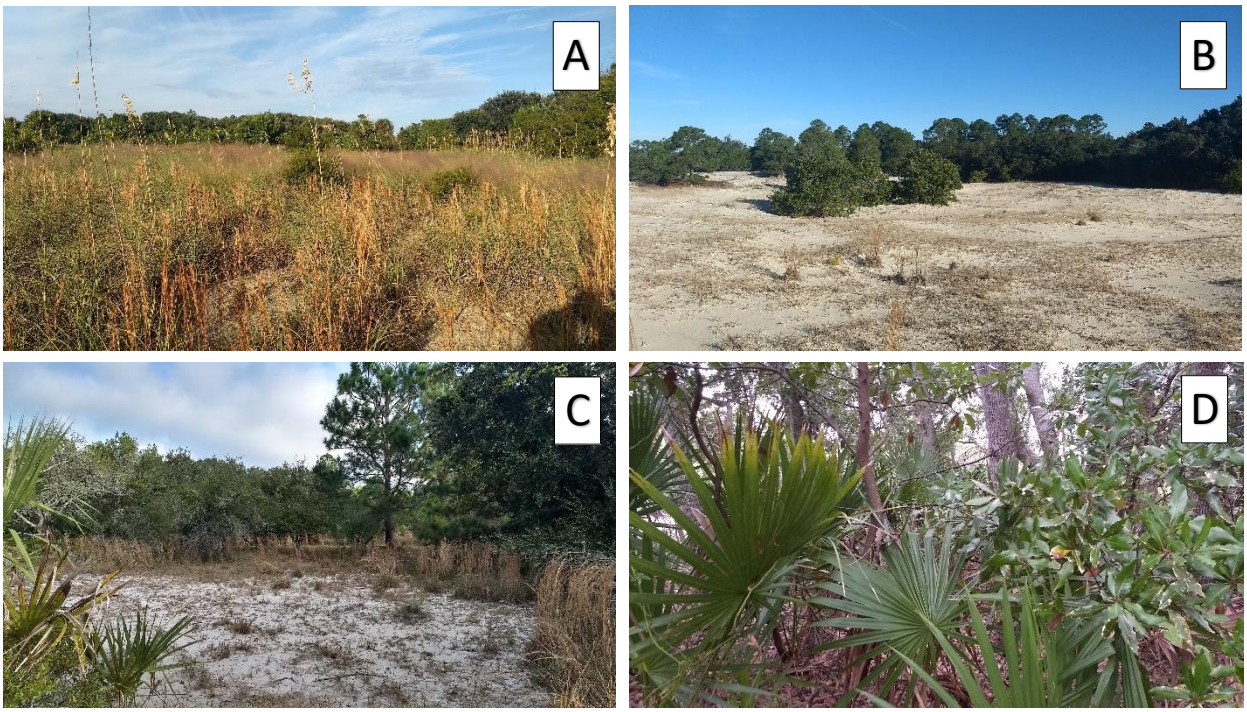

Figure 2. Photographs depicting gopher tortoise habitat on Fort Clinch Stat Park collected during the November-December line transect distance sampling survey. Tortoise abundance appeared to be greatest in coastal grassland habitat that contained very little overstory and dense herbaceous ground cover (A). Some areas contained minimal herbaceous ground cover and an open canopy (B). When present, overstory primarily comprised of mixed hardwood/pine (C). Midstory primarily consisted of oaks, palmettos, and vines including greenbriar (*Smilax* spp.), particularly in the coastal strand natural community (D).

Table 4. Results of random habitat sampling within suitable habitat (i.e., coastal grassland, beach dune, spoil area, low-intensity developed area) at Fort Clinch State Park, November-December 2018. Methodology described in Smith and Howze 2016b.

Habitat points (total)	**17**
Mean basal area (ft²/ac)	**1.8**
Canopy cover (%)	**5.7**
Overstory composition (% of all habitat points)	
Oak	29
None	71
Midstory (%)	**9.4**
Midstory composition (% of all habitat points)	
Mixed	17.6
Shrub	11.8
None	70.6
Ground cover composition (% of all habitat points)	
Litter	11.8
Bare ground	52.9
Grass	29.4
Mixed	5.9

Table 5. Results of random habitat sampling within potential habitat deemed unsuitable (i.e., coastal strand) following survey efforts for gopher tortoises at Fort Clinch State Park, November-December 2018. Methodology described in Smith and Howze 2016b.

Habitat points (total)	**8**
Mean basal area (ft²/ac)	**48.1**
Canopy cover (%)	**91.8**
Overstory composition (% of all habitat points)	
Mixed hardwood/pine	25
Oak	75
Midstory (%)	**38.8**
Midstory composition (% of all habitat points)	
Mixed	50
Shrub	25
Palmetto	12.5
Other	12.5
Ground cover composition (% of all habitat points)	
Litter	100

Population evaluation and viability

Gopher tortoise habitat within Fort Clinch State Park is primarily comprised of open canopy habitat with native ground cover dominated by grasses; the habitat condition in coastal grassland habitat, where most tortoises were encountered, appears to be excellent. The high proportion of juvenile and subadult tortoises indicates successful reproduction and recruitment, signs of a healthy and stable population. For a gopher tortoise population to be considered viable, it must contain ≥250 adult tortoises, a density of no less than 0.4 tortoises/ha (approx. 0.16 tortoises/acre), and ≥100 ha (approx. 250 acres) of contiguous suitable gopher tortoise habitat (GTC 2013, 2014). The population should also contain an approximate male-female ratio of 1:1, show evidence of juvenile recruitment into the population, variability in size classes, and the site must not have major constraints to tortoise movement. Based on survey results, this site meets criteria for a viable population.

The unusually high gopher tortoise encounter rate (10.7) observed on the southern-most transect, in conjunction with a residential subdivision located <50 m from this transect, suggests tortoises may be moving from the residential area where tortoises are known to occur into the natural habitat at Fort Clinch State Park. It is also possible tortoises are being illegally released into this area by well-intentioned individuals moving tortoises off nearby roads. Although this transect was removed from the Distance analysis, we are confident the tortoise population in this area is well represented within the confidence intervals of our analysis. Continued monitoring of this area is recommended to determine if tortoises are actively dispersing farther north into the park. FWC recommends follow-up LTDS surveys be conducted every 5-10 years to monitor population trends over time. During future surveys, the southern-most transect should be re-surveyed to determine if it is still exhibiting an unusually high density.

Commensals and field observations

Documented mortality: Two gopher tortoise shells were found while conducting the full survey. One shell was intact and appeared to be male based on concavity of the plastron. The other shell was subadult size and may have been depredated. Natural annual adult mortality rate is approximately 3% (Wendland et al. 2009); this population likely complies with the 3% annual mortality rate, indicative of a healthy, stable population.

Wildlife observations: Merlin, black scoter, turkey vulture, black skimmer, red-bellied woodpecker, red shouldered hawk, coachwhip, garter snake, Florida box turtle, deer, rabbit

Vertebrate burrow commensals: Coachwhips, Eastern diamondback rattlesnake, garter snake, Southern toad

Acknowledgements

We thank Daniel Pearson, Brandon Volbrecht, Heath Alboher, and Cody Peters with the Florida Department of Environmental Protection, Division of Recreation and Parks, for providing access to Fort Clinch State Park and assisting with survey coordination. FWC Gopher Tortoise Program staff Michelina Dziadzio, Eric Seckinger, Alex Kalfin, and Kearstin Hess conducted the pilot and full gopher tortoise surveys.

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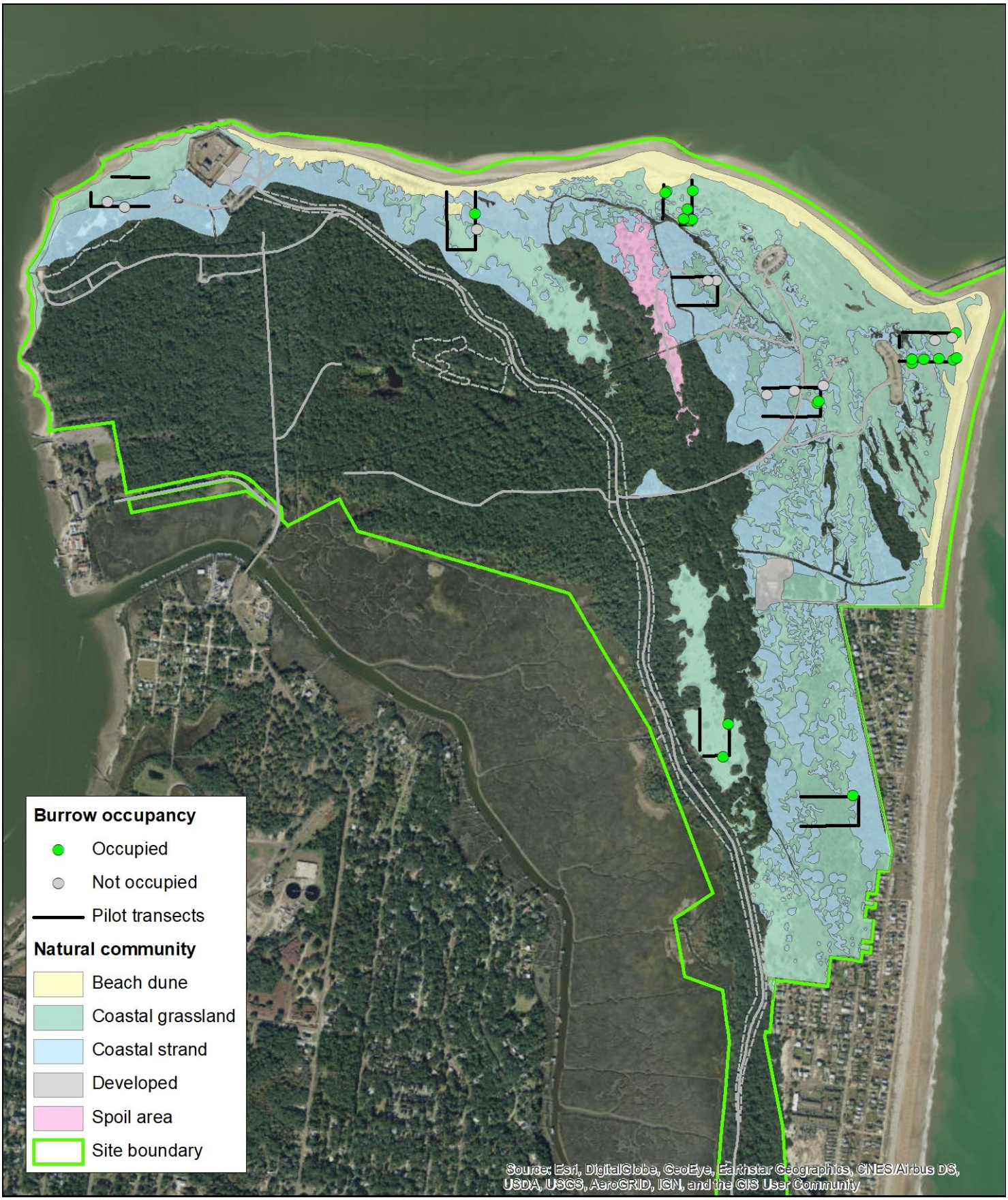
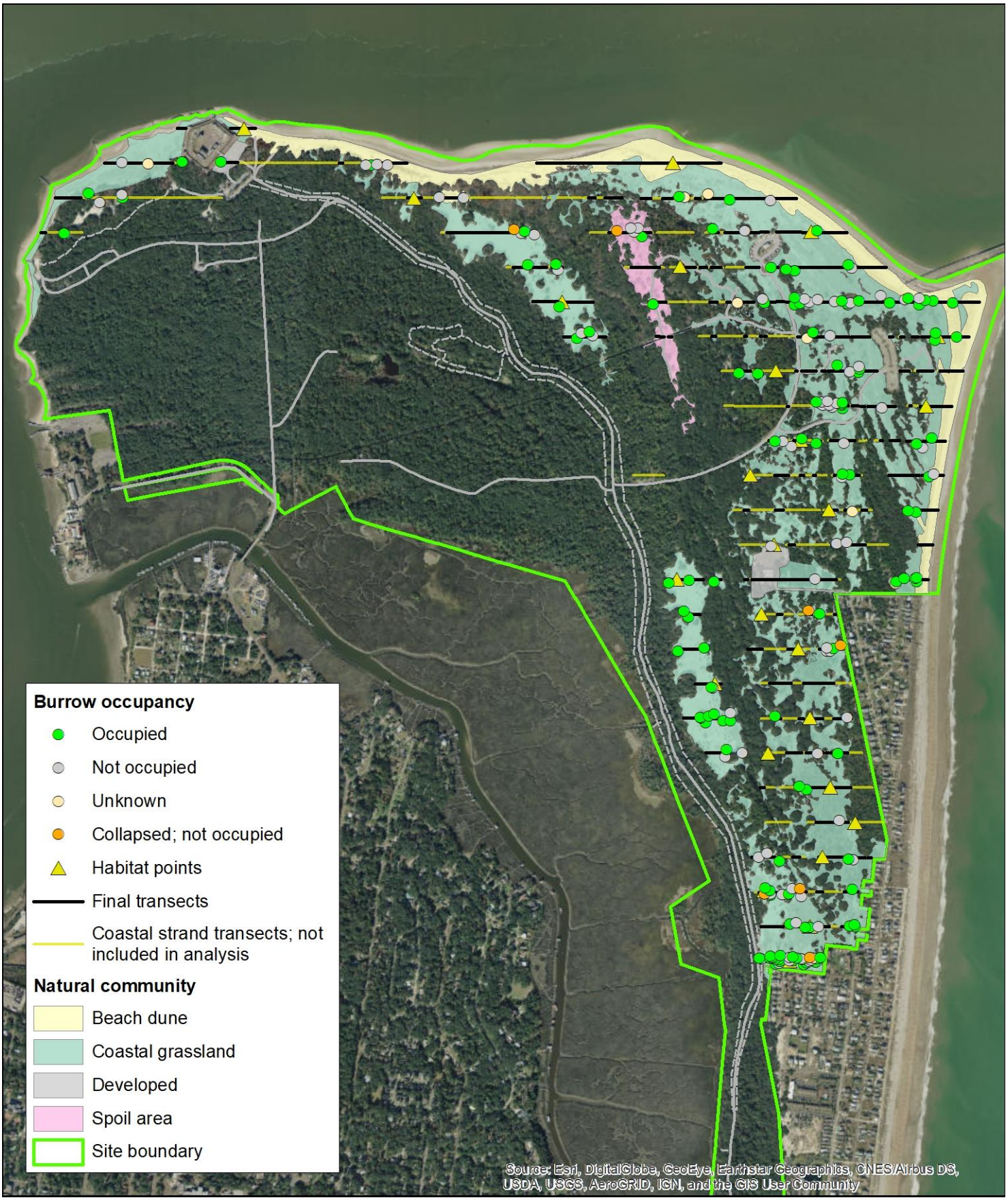
Appendix 1. Results of gopher tortoise line transect distance sampling (LTDS) pilot survey completed February 20-21, 2018 at Fort Clinch State Park.



Appendix 2. Results of gopher tortoise line transect distance sampling (LTDS) survey completed in December 2018 at Fort Clinch State Park.



Appendix 3. Fort Clinch State Park gopher tortoise line transect distance sampling analysis results (analyzed using Distance 7.1 software)

Selected model: Multiple covariate distance sampling (MCDS) with burrow width as a covariate, Hazard Rate, 5% truncation

```
Parameter Estimation Specification
 ----------------------------------
 Encounter rate for all data combined
 Detection probability for all data combined
 Density for all data combined

 Distances:
 ----------
 Analysis based on exact distances
 Width: use measurement/interval endpoint which represents 95.0 percentile.

 Estimators:
 -----------
 Estimator 1
 Key: Half-normal
 No adjustment terms

 Covariates: DIAMETER

 Estimator selection: Choose estimator with minimum AIC
 Estimation functions: not constrained to be monotone

 Variances:
 ----------
 Variance of n: Empirical estimate from sample
                (design-derived estimator R2/P2)
 Variance of f(0): MLE estimate

 Goodness of fit:
 ----------------
 Cut points chosen by program

 Glossary of terms
 -----------------

 Data items:
 n    - number of observed objects (single or clusters of animals)
 L    - total length of transect line(s)
 k    - number of samples
 K    - point transect effort, typically K=k
 T    - length of time searched in cue counting
 ER   - encounter rate (n/L or n/K or n/T)
 W    - width of line transect or radius of point transect
 x(i) - distance to i-th observation
 s(i) - cluster size of i-th observation
 r-p  - probability for regression test
 chi-p- probability for chi-square goodness-of-fit test

 Parameters or functions of parameters:
 m    - number of parameters in the model
 A(I) - i-th parameter in the estimated probability density function(pdf)
 f(0) - 1/u = value of pdf at zero for line transects
 u    - W*p = ESW, effective detection area for line transects
 h(0) - 2*PI/v
 v    - PI*W*W*p, is the effective detection area for point transects
 p    - probability of observing an object in defined area
 ESW  - for line transects, effective strip width = W*p
 EDR  - for point transects, effective detection radius  = W*sqrt(p)
 rho  - for cue counts, the cue rate
```

DS   - estimate of density of clusters
E(S) - estimate of expected value of cluster size
D   - estimate of density of animals
N   - estimate of number of animals in specified area

Detection Fct/Global/Model Fitting

Effort   :   9955.767
samples   :   168
Width   :   15.80355
observations: 84

Model
   Hazard Rate key, k(y) = 1 - Exp(-(y/s)**-A(2))

   s = A(1) * Exp(fcn(A(3)))
   Parameter A(1) is the intercept of the scale parameter s.
   Parameter A(2) is the power parameter.
   Parameter A(3) is the coefficient of covariate DIAMETER.
      A(1) bounds = (0.15804   , 0.10000E+07)
      A(2) bounds = (1.0000   , 20.000   )

Iter	LN(likelihood)	Parameter Values		
1	-227.429	11.9761	5.00000	0.000000
2	-227.329	12.0235	6.15988	0.503503E-03
3	-227.296	12.0672	6.70983	0.829219E-03
4	-227.292	12.0971	7.15833	0.106515E-02
5	-227.283	12.1197	7.35999	0.124853E-02
6	-227.270	12.1310	7.37069	0.139082E-02
7	-227.253	12.1297	7.20609	0.150032E-02
8	-227.238	12.1142	6.93631	0.158123E-02
9	-227.226	12.0846	6.63968	0.163962E-02
10	-227.217	12.0439	6.35792	0.168531E-02
11	-227.196	11.9957	6.10306	0.172867E-02
12	-227.094	10.3257	6.30487	0.650763E-02
13	-227.015	10.3295	5.03024	0.651766E-02
14	-227.015	10.3295	5.03024	0.651766E-02

      Results:
      Convergence was achieved with   14 function evaluations.
      Final Ln(likelihood) value = -227.01550
      Akaike information criterion =   460.03101
      Bayesian information criterion =   467.32346
      AICc =   460.33099

Detection Fct/Global/Parameter Estimates

Effort   :   9955.767
samples   :   168
Width   :   15.80355
observations: 84

Model
   Hazard Rate key, k(y) = 1 - Exp(-(y/s)**-A(2))

   s = A(1) * Exp(fcn(A(3)))
   Parameter A(1) is the intercept of the scale parameter s.
   Parameter A(2) is the power parameter.
   Parameter A(3) is the coefficient of covariate DIAMETER.

Parameter	Point Estimate	Standard Error	Percent Coef. of Variation	95 Percent Confidence Interval	
A(1)	10.33	1.262			
A(2)	5.030	9.364			
A(3)	0.6518E-02	0.1020E-01			
f(0)	0.75396E-01	0.34280E-02	4.55	0.68878E-01	0.82530E-01
p	0.83926	0.38158E-01	4.55	0.76671	0.91868
ESW	13.263	0.60304	4.55	12.117	14.518

Sampling Correlation of Estimated Parameters

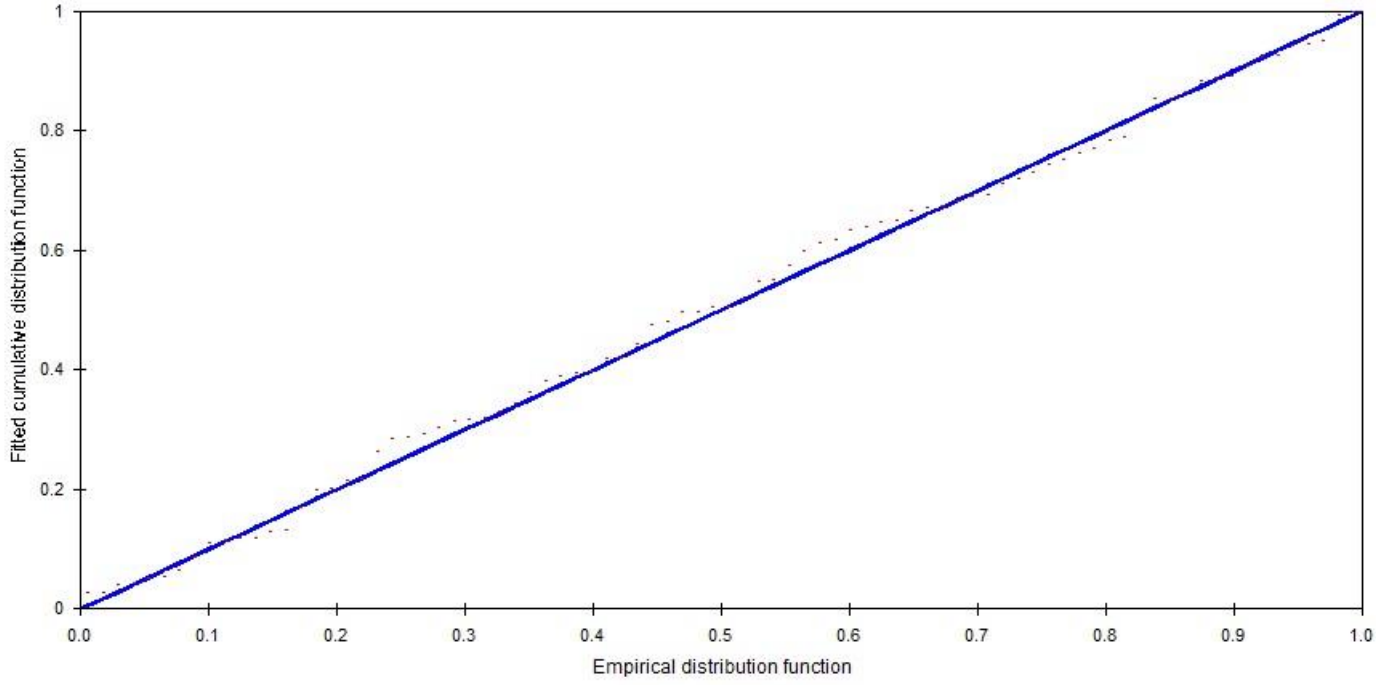
	A(1)	A(2)	A(3)
A(1)	1.000	0.008	-0.949
A(2)	0.008	1.000	-0.062
A(3)	-0.949	-0.062	1.000

Distribution of estimated detection probabilities given covariates, p(z)

p(z)	Number	Proportion
0.0-0.1	0	0.0000
0.1-0.2	0	0.0000
0.2-0.3	0	0.0000
0.3-0.4	0	0.0000
0.4-0.5	0	0.0000
0.5-0.6	0	0.0000
0.6-0.7	0	0.0000
0.7-0.8	13	0.1548
0.8-0.9	69	0.8214
0.9-1.0	2	0.0238

Smallest value of p(z): 0.7599

Detection Fct/Global/Plot: Qq-plot



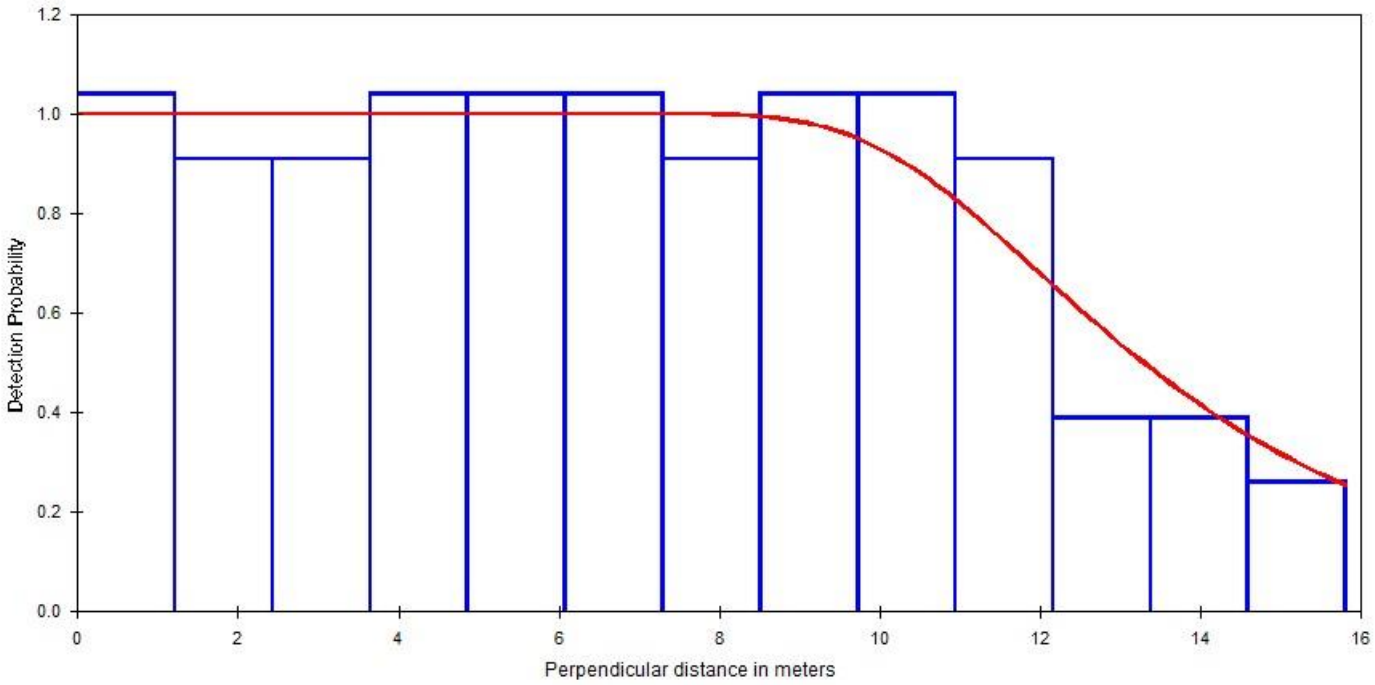
Detection Fct/Global/K-S GOF Test

```
 Kolmogorov-Smirnov test
 -----------------------
 D_n                       = 0.0478                  p  = 0.9906

 Cramer-von Mises family tests
 -----------------------------
 W-sq (uniform weighting) = 0.0241          0.900 < p <= 1.000
   Relevant critical values:
     W-sq crit(alpha=0.900) = 0.0000

 C-sq (cosine weighting)    = 0.0166          0.900 < p <= 1.000
   Relevant critical values:
     C-sq crit(alpha=0.900) = 0.0000
```

Detection Fct/Global/Plot: Detection Probability



Detection Fct/Global/Chi-sq GOF Test

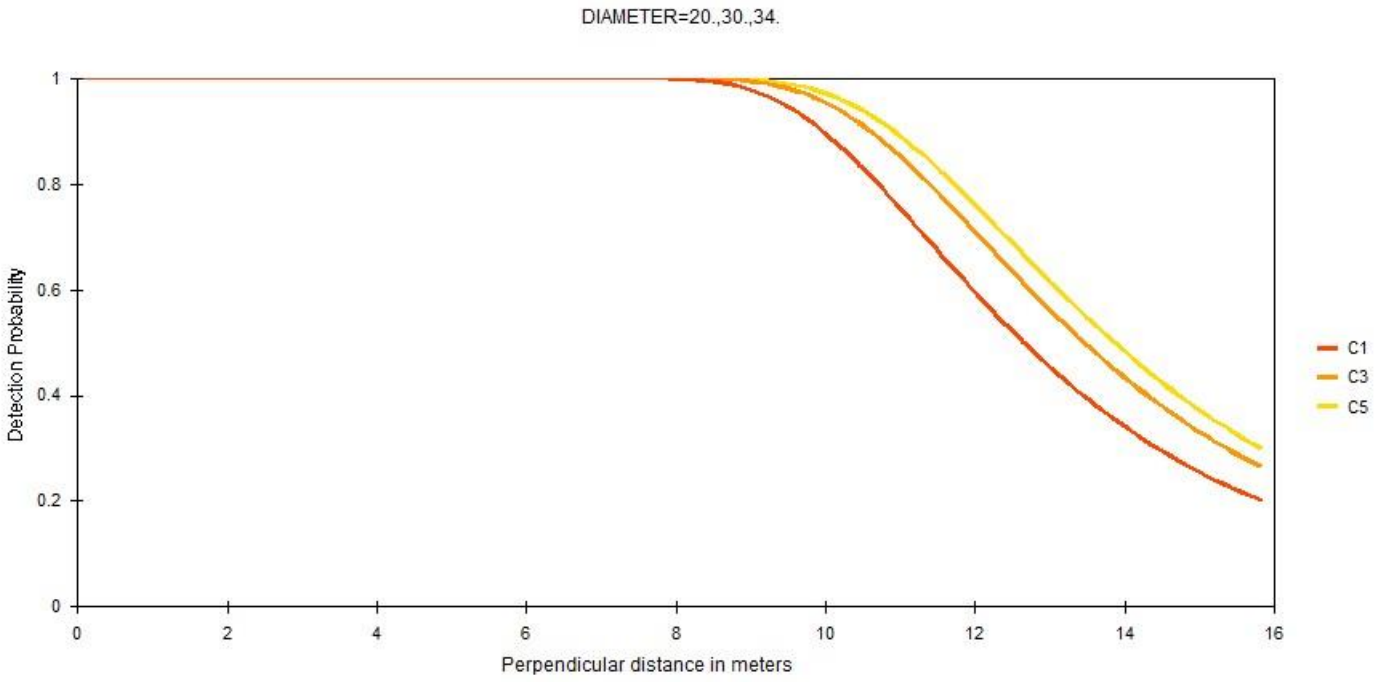
Cell i	Cut Points		Observed Values	Expected Values	Chi-square Values
1	0.000	1.22	8	7.70	0.012
2	1.22	2.43	7	7.70	0.063
3	2.43	3.65	7	7.70	0.063
4	3.65	4.86	8	7.70	0.012
5	4.86	6.08	8	7.70	0.012
6	6.08	7.29	8	7.70	0.012
7	7.29	8.51	7	7.69	0.062
8	8.51	9.73	8	7.53	0.029
9	9.73	10.9	8	6.90	0.177
10	10.9	12.2	7	5.73	0.283
11	12.2	13.4	3	4.40	0.444
12	13.4	14.6	3	3.23	0.016
13	14.6	15.8	2	2.33	0.047

Total Chi-square value = 1.2322 Degrees of Freedom = 9.00

Probability of a greater chi-square value, P = 0.99869

The program has limited capability for pooling. The user should
judge the necessity for pooling and if necessary, do pooling by hand.

Detection Fct/Global/Plot: Examp Det Funcs/DIAMETER=20, 30, 34



Density Estimates/Global

```
Effort         :    9955.767
# samples      :    168
Width          :    15.80355
# observations:    84

Model
   Hazard Rate key, k(y) = 1 - Exp(-(y/s)**-A(2))

   s = A(1) * Exp(fcn(A(3)))
   Parameter A(1) is the intercept of the scale parameter s.
   Parameter A(2) is the power parameter.
   Parameter A(3) is the coefficient of covariate DIAMETER.
```

Parameter	Point Estimate	Standard Error	Percent Coef. of Variation	95% Percent Confidence Interval	
f(0)	0.75396E-01	0.34280E-02	4.55	0.68878E-01	0.82530E-01
p	0.83926	0.38158E-01	4.55	0.76671	0.91868
ESW	13.263	0.60304	4.55	12.117	14.518
n/L	0.84373E-02	0.11782E-02	13.96	0.64128E-02	0.11101E-01
D	3.1807	0.46712	14.69	2.3846	4.2425
N	426.00	62.562	14.69	319.00	568.00

```
Measurement Units
---------------------------------
Density: Numbers/hectares
    ESW: meters

Component Percentages of Var(D)
-------------------------------
Detection probability   :   9.6
Encounter rate          :  90.4
```

Estimation Summary - Encounter rates

	Estimate	%CV	df	95% Confidence Interval	
n	84.000				
k	168.00				
L	9955.8				
n/L	0.84373E-02	13.96	167.00	0.64128E-02	0.11101E-01
Left	0.0000				
Width	15.804				

Estimation Summary - Detection probability

		Estimate	%CV	df	95% Confidence Interval	
Hazard/Cosine						
	m	3.0000				
	LnL	-227.02				
	AIC	460.03				
	AICc	460.33				
	BIC	467.32				
	f(0)	0.75396E-01	4.55	81.00	0.68878E-01	0.82530E-01
	p	0.83926	4.55	81.00	0.76671	0.91868
	ESW	13.263	4.55	81.00	12.117	14.518

Estimation Summary - Density&Abundance

		Estimate	%CV	df	95% Confidence Interval	
Hazard/Cosine						
	D	3.1807	14.69	199.66	2.3846	4.2425
	N	426.00	14.69	199.66	319.00	568.00

PILOT GOPHER TORTOISE SURVEY AT SAN FELASCO HAMMOCK PRESERVE STATE PARK

INTRODUCTON

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. FNAI was founded in 1981 as a member of The Nature Conservancy's international network of natural heritage programs. With funding provided through contracts and grants FNAI works cooperatively with state, federal, and other agencies on inventory and monitoring projects. FNAI has conducted gopher tortoise surveys on many state and federal conservation lands throughout Florida and has adopted Line Transect Distance Sampling (LTDS) as the standard method for conducting surveys.

To address concerns regarding survey consistency LTDS recently has been adopted as the preferred monitoring methodology through the Gopher Tortoise Candidate Conservation Agreement team. This method is widely used to estimate population size and density of wildlife species (Buckland et al., 2001) and provides a statistically valid, consistent method to evaluate tortoise populations. Standardized survey results will provide crucial baseline data, using a repeatable method, with which to compare future survey data and determine population trends or variation in response to habitat management activities.

The open source software Distance version 7 can be used to create LTDS survey designs and to analyze survey data. ArcGIS software is necessary for managing spatial data related to the survey (e.g., to define the survey area [sample frame], and map transect and tortoise locations). The sample frame is the extent of suitable tortoise habitat on a particular property as determined by soils, vegetation (land cover), and land-use. In some situations, it may be desirable to stratify the sample frame to determine tortoise density in different habitats within the same site (e.g., sandhill vs. other habitat, or other situations that might have different tortoise densities); in this case, systematic stratified sampling (e.g., by habitat type) can be used to minimize within-stratum variability.

A pilot survey is generally conducted prior to the formal survey to determine the sampling intensity needed for the full survey. During the pilot survey, the length of transect surveyed per tortoise observation, called the tortoise encounter rate, is recorded. This value is used to calculate the distance of transect needed to achieve desirable results in the formal survey. There is flexibility in the amount of effort required for a pilot survey and in selecting locations for pilot survey transects, but it is important that the pilot survey captures variation in habitat type, quality, and tortoise distribution within the sample frame.

The full LTDS survey is designed using Distance version 7 and incorporates the sample frame and encounter rate from the pilot survey. The tortoise encounter rate (meters of transect sampled per tortoise observed) is used to extrapolate the total length of transect necessary to derive abundance estimates with reasonable precision. As a general rule, to detect changes in population size over time, sampling should be intensive enough to produce a coefficient of variation (CV) of 15-20 percent, which is a practical expectation for most monitoring projects. If the CV exceeds 20%, the statistical power, confidence, and ability to detect trends in monitoring data are substantially reduced.

The purpose of this project was to complete a pilot survey at San Felasco Hammock Preserve State Park and to calculate the distance of transect needed in the formal survey to achieve a coefficient of variation between 15 and 20 percent.

METHODS

Pilot Survey

The sample frame for this project was developed cooperatively by FNAI and Florida Fish and Wildlife Conservation Commission. We randomly distributed pilot transects throughout the sample frame; the length and number of transects were based on recommendations provided by the Joseph Jones Research Center (Table 1). These transects were developed in ArcGIS by creating a 100 or 200-meter grid (depending on the overall amount of habitat and size of the habitat polygons within the site) for each site. We then randomly selected squares from the grid (the number of which is generally based on Table 1) and clipped these with the sample frame.

Table 1. General recommendations for pilot survey effort to estimate tortoise encounter rates (m/tortoise).

Amount of habitat (ha)	Amount of habitat (ac)	Random points	Transect length (m)	Total length (m)
50	124	10	200	2000
100	247	15	200	3000
500	1236	20	200	4000
1000	2471	25	200	5000
5000	12356	30	500	15000
10000	24711	35	500	17500
20000	49422	50	500	25000

In order to ensure that a sufficient length of transect was created we added approximately 10 percent to the number of squares chosen. Additionally, the total length of transect for each square exceeds the recommended length, assuring adequate transect length for each site.

Each pilot transect was walked using a Trimble Geo XT, Geo7, or Nomad datalogger paired with an R1 receiver. Each of these is capable of recording positions with sub-meter accuracy and allows for accurate walking of the transect centerline and recording of burrow locations. All potentially useable burrows observed from the transect were searched using a burrow camera scope to determine occupancy. The position of each scoped burrow was recorded along with data on burrow size, visual status, and occupancy. The survey was conducted on 19-20 April 2021.

Using ArcGIS, GPS tracks were used to confirm the surveyed portion of each transect. Any unsurveyed portions (generally small wetlands) were clipped from the transect after the field survey. The overall encounter rate was then calculated.

The overall encounter rate was used to calculate the length of transect in a full survey to achieve a CV of 17 (less than 20 is generally desirable for scientific studies): $L = (b/cv(D)^2) \times (Lo/no)$ where L = sampling

intensity (total length of transects needed for full survey); b = dispersion parameter (constant value of 3); cv(D) = desired CV for density estimate; and (Lo/no) = encounter rate (E.R.).

RESULTS

A total of 6,579.4 m of transect was surveyed within a sample frame of 989 ha. A total of 8 burrows were scoped: 5 occupied, 2 unoccupied, and 1 undetermined. The communities surveyed included pasture – improved, abandoned field/abandoned pasture, upland mixed woodland, upland pine, sandhill, and mesic flatwoods. The distribution of pilot transects and tortoise encounters within the sample frame is shown in Figure 1.

The western portion of upland pine and upland mixed woodland was too wet for gopher tortoises and was eliminated from the sample frame. Small areas of isolated or wet habitat were also eliminated.

The initial encounter rate was 1,315.9 m/tortoise (6579.4 m/5 tortoises). When the unsuitable areas were eliminated the adjusted sample frame area was 776.4 ha, and the adjusted encounter rate was 1,008.1 m/tortoise. The sampling intensity for the full survey is 104,651.2 m. ($L = (b/cv(D)2) \times (Lo/no) = L = (3/0.17^2) \times (5040.7/5)$ L = 104,651.2 m). Based on Distance version 7 calculations the proposed walking distance is 111,834.2 m, with transects spaced 70 meters apart (Figure 2).

The park manager stated that the southern portion of sandhill, upland pine, and upland mixed woodland is currently undergoing restoration efforts after many years of fire-exclusion. The park manager also stated that most of the tortoises are probably located along the power line (utility corridor), which is 40.2 ha. Based on the results of this pilot survey it is unlikely that a full LTDS survey would find a viable population. If restoration efforts continue the site should be reevaluated in a few years' time.

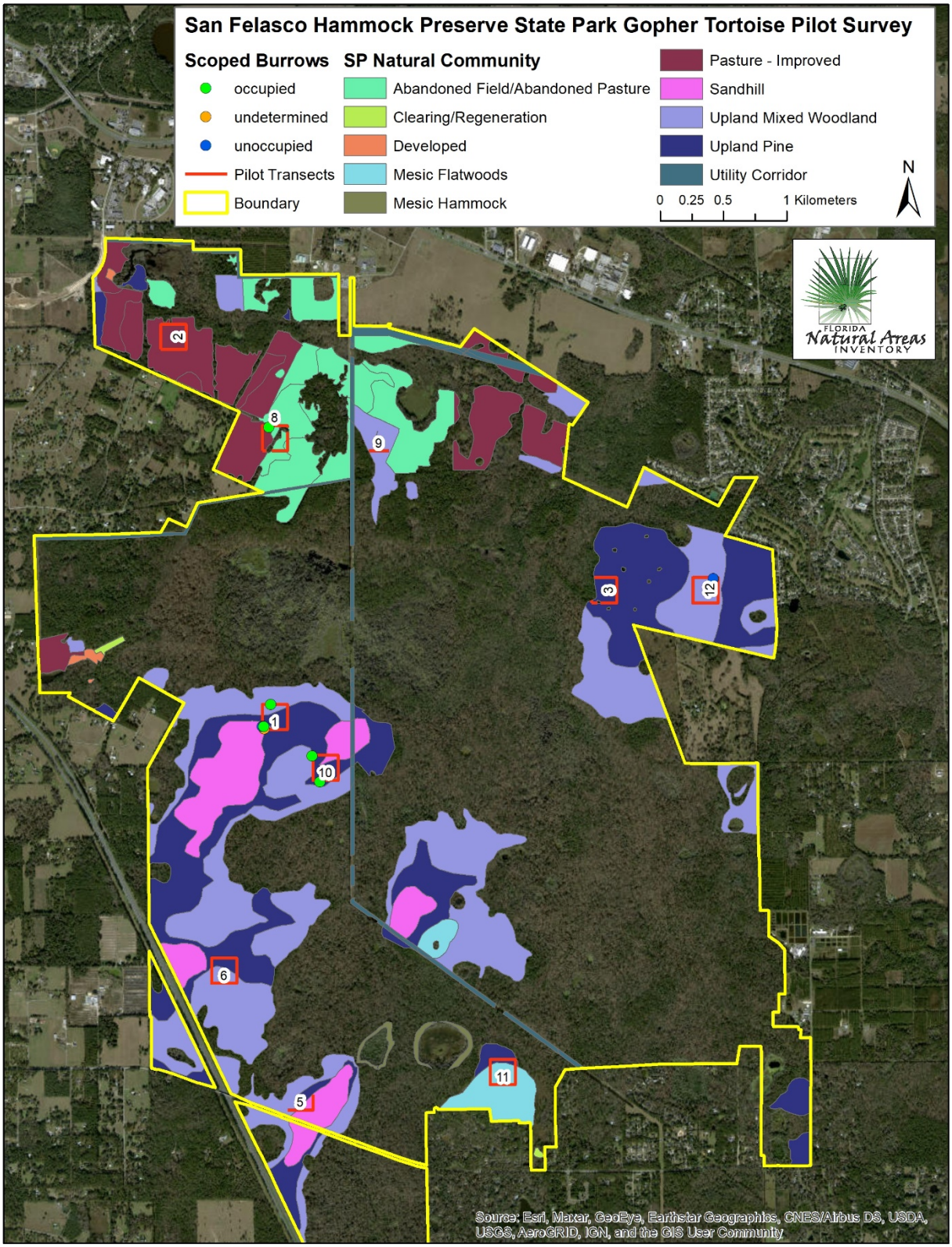


Figure 1. Pilot transects and burrow locations at San Felasco Hammock Preserve State Park.

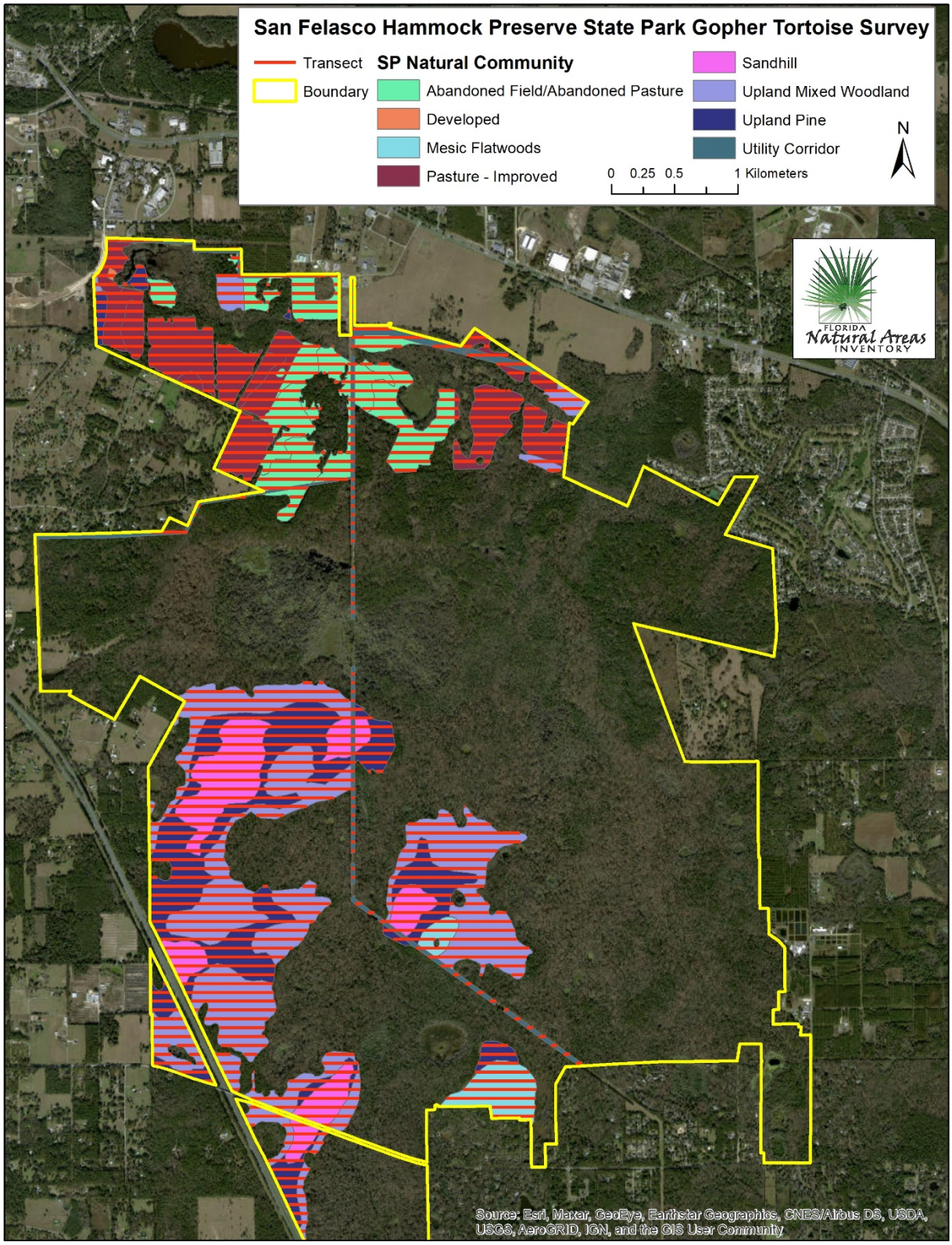


Figure 2. Proposed formal survey transect locations for San Felasco Hammock Preserve State Park.

Rainbow Springs State Park

Gopher Tortoise LTDS Survey Results
April 2018

Summary

A line transect distance sampling (LTDS) survey was completed at Rainbow Springs State Park in March and April 2018 by Florida Fish and Wildlife Conservation Commission (FWC) staff using a 3-person survey crew. The pilot survey was conducted 22 and 23 February, 2018, and the full survey was conducted on 28-30 March, and 23-25 April, 2018. During the full survey, 146 burrows were scoped, of which 81 were occupied (i.e., 55% burrow occupancy; Table 1; Appendix 1). Burrow occupancy was unable to be determined for 3 burrows due to 1) the length of the burrow exceeding the length of the burrow scope, or 2) failure to navigate the scope past abrupt turns in the burrow tunnel.

Table 1. Burrow scoping results of line transect distance sampling (LTDS) surveys at Rainbow Springs State Park, March-April 2018.

Sample frame (ha)	Burrows scoped	Burrows occupied	% occupied	No. unknown occupancy	% unknown occupancy
239.02	146	81	55%	3	2%

Analyses were run on the survey data with Distance software (Buckland et al. 2001) version 7.1 using two model sets: a conventional distance sampling (CDS) model set and a multiple covariate distance sampling (MCDS) model set. The MCDS method includes burrow width (cm) as a covariate (Smith and Howze 2016). Best fitted models were selected using Akaike's Information Criteria (AIC; Akaike 1974) and consideration of the coefficient of variation (D CV) and detection probability (P). If multiple models contained AIC values ≤2, the model with the lowest D CV was selected. The best fit model was within the CDS analysis and contained a uniform distribution with a 5% right truncation (Table 2). This model estimates a population size of 479 gopher tortoises and a density of 2.004 tortoises/hectare.

Table 2. Top model results for the 2018 line transect distance sampling (LTDS) survey at Rainbow Springs State Park. Model results reported include: Akaike's Information Criteria (AIC; Akaike 1974), coefficient of variation (D CV), detection probability (P), # obs= number of tortoises in burrows or above ground and observed from transects, Effort= total length of transect surveyed, D= density (tortoises/hectare), N= abundance, LCL= lower confidence limit for D and N, UCL= upper confidence limit for D and N.

Model	# obs	Effort (m)	AIC	D	D LCL	D UCL	D CV	N	N LCL	N UCL	P
CDS UN 5%	76	13947.41	459.45	2.004	1.471	2.730	0.155	479	352	653	0.55

For a gopher tortoise population to be considered viable, it must contain ≥250 adult tortoises, a density of no less than 0.4 tortoises/ha, and contain ≥100 ha (approx. 250 acres) of contiguous suitable gopher tortoise habitat (GTC 2013, 2014). The population should also contain an approximate male-female ratio of 1:1, show evidence of juvenile recruitment into the population, variability in size classes, and the site must not have major constraints to tortoise movement. Based on survey results, this site meets criteria for a viable population as it contains ≥100 ha (approx. 250 acres) of contiguous suitable gopher tortoise habitat and ≥250 adult tortoises.

Commensals and Field Observations

Wildlife observations: Swallow-tailed kite, pileated woodpecker, black racer, coachwhip snake, scrub lizard, rabbit

Documented mortality: Five gopher tortoise shells were found on Rainbow Springs State Park while conducting the full survey. All the shells were in pieces scattered around and the cause of death was unknown. Natural annual mortality rate is approximately 3% (Wendland et al. 2009). As the tortoise mortalities likely occurred over several years, this population likely complies with the 3% annual mortality rate. However, continued monitoring is encouraged to ensure the long-term health of the population.

Commensals: gopher frog, rabbit, spiders, crickets

Population Evaluation and Habitat Suitability Ranking

(1) High quality: Likely a viable population in suitable habitat. Site requires continued management, but no population manipulation/augmentation is necessary;

(2) Medium quality- viable: Likely a viable population, but habitat needs management/restoration of natural vegetation. No population manipulation necessary;

(3) Medium quality- not viable: Population likely not viable at current size and demographic conditions, but habitat is suitable without need for extensive restoration;

(3) Low quality: Population likely not viable at current size or demographic conditions and habitat is in need of extensive restoration to support more tortoises. Site should be considered for future augmentation with translocated tortoises.

Ranking	Comments
2	Many areas of the park contain an abundance of oaks which are not suitable for gopher tortoises. It is recommended that these areas continue to be maintained, preferably with the use of prescribes burning.

Size Class Distribution

Occupied burrow size class distribution indicated a predominance of adult burrows (>23 cm in width; 84%). However, occupied juvenile burrows were infrequently encountered (Figure 1). Some transects contained a dense understory of oak and wiregrass, which may have limited the surveyor's ability to detect small burrows. It is also possible that this low encounter rate of juvenile burrows is underrepresented as LTDS surveys may be biased toward adult burrow detection.

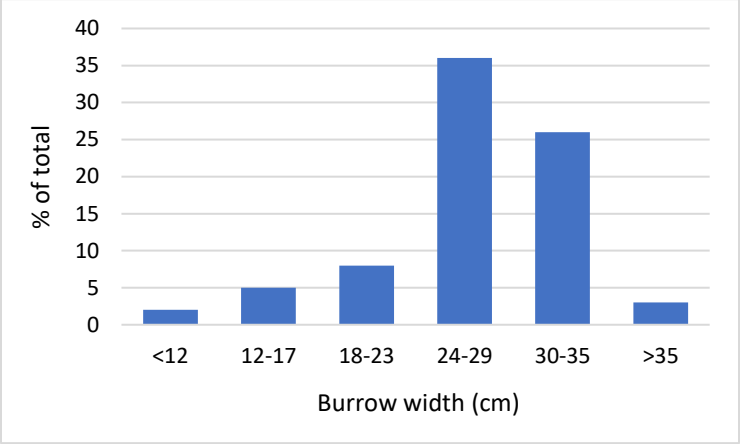


Figure 1. Size class distribution of occupied gopher tortoise burrows encountered during the line transect distance sampling (LTDS) survey at Rainbow Springs State Park from March-April, 2018.

Table 3. Results of random habitat sampling at Rainbow Springs State Park, March-April, 2018. Methodology described in Smith and Howze 2016.

Habitat points (total)	**31**
Mean basal area (ft^2/ac)	**39**
Canopy cover (%)	**59**
Overstory composition (% of all habitat points)	
Pine	10
Oak	23
Mixed	61
Other	0
None	6
Midstory (%)	**35**
Midstory composition (% of all habitat points)	
Pine	0
Oak	61
Shrub	3
Palmetto	3
Mixed	20
Other	3
None	10
Ground cover composition (% of all habitat points)	
Bare ground	7
Grass	35
Litter	16
Mixed	26
Vines	0
Woody	16

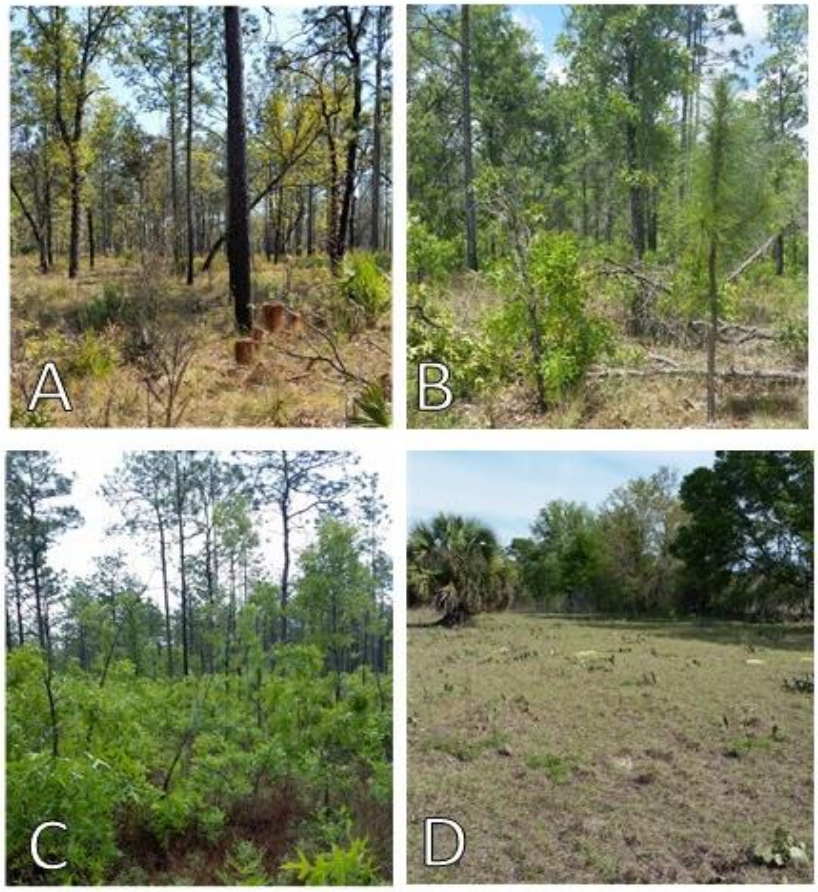


Figure 2. Photographs depicting gopher tortoise habitat on Rainbow Spring State Park collected during the March-April 2018 line transect distance sampling (LTDS) survey. Overstory primarily comprised of mixed pine and oak (A, B, C). Midstory was fairly open, though areas with thick oak midstory were encountered (C). Small areas of no overstory, limited midstory, and grassy understory were also occasionally encountered (D).

Literature Cited

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Buckland, S.T., D.R. Anderson, K.P. Burnham, J.L. Laake, D.L. Borchers, and L. Thomas. 2001. Introduction to Distance sampling: estimating abundance of biological populations. Oxford University Press, Great Britain. 432 pp.

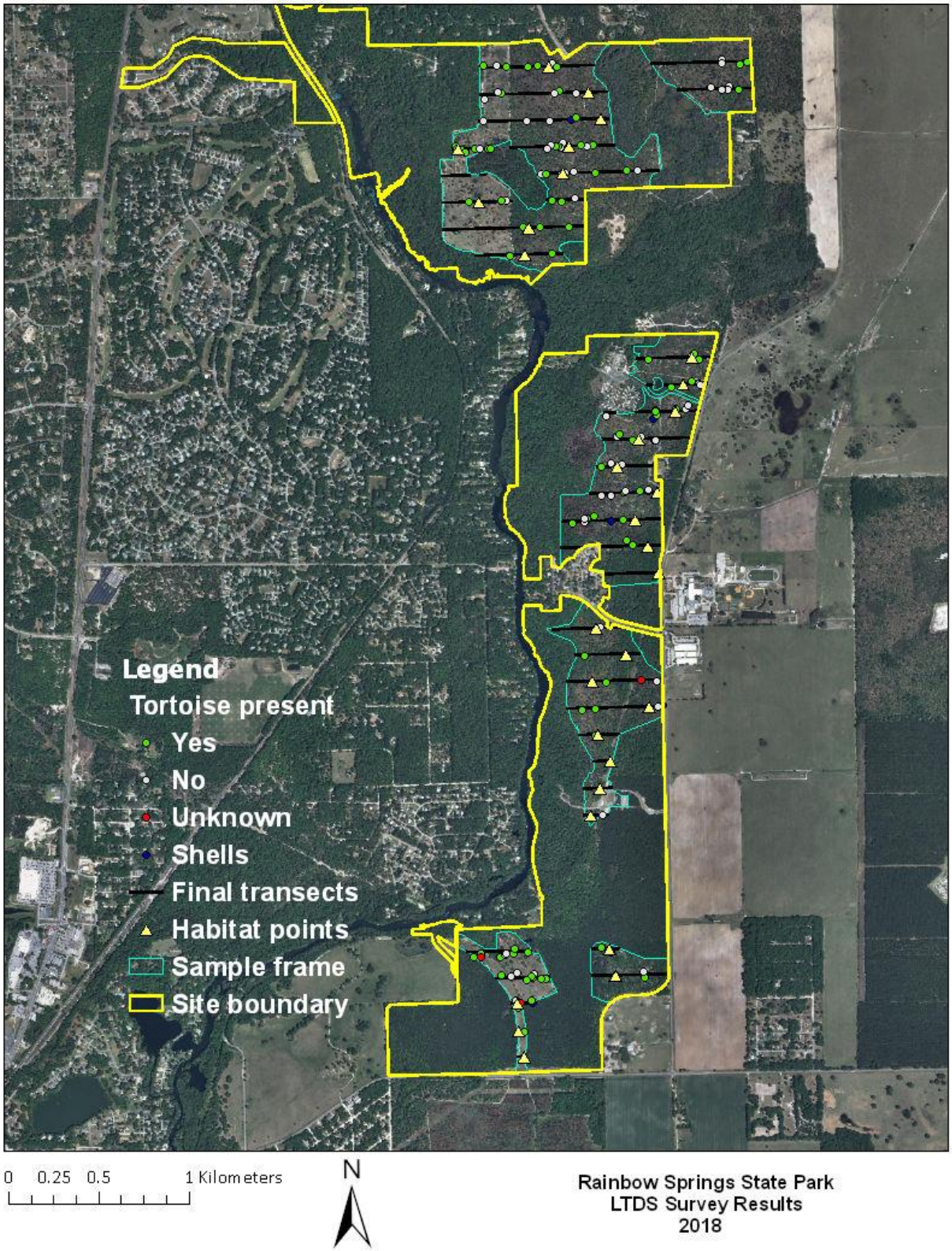
Gopher Tortoise Council (GTC). 2013. Gopher tortoise minimum viable population and minimum reserve size working group report. Mansfield, Georgia, USA. 7pp.

Gopher Tortoise Council (GTC). 2014. Gopher tortoise minimum viable population and minimum reserve size working group report II. Andalusia, Alabama, USA. 7pp.

Smith, L.L., and J.M. Howze. 2016. Gopher tortoise (*Gopherus polyphemus*) surveys and population evaluations. Final report to the Florida Fish and Wildlife Conservation Commission. Joseph W. Jones Ecological Research Center, Newton, Georgia, USA.

Wendland L, Balbach H, Brown M, Berish JD, Littell R, Clark M. 2009. Handbook on gopher tortoise (*Gopherus polyphemus*) health evaluation procedures for use by land managers and researchers. ERDC/CERL TR-09-1. US Army Corps of Engineers, Washington, DC, 82 pp.

Appendix 1. Results of line transect distance sampling (LTDS) survey completed in April 2018 at Rainbow Springs State Park.



Appendix 2. Rainbow Springs State Park. Gopher tortoise line transect distance sampling analysis results (analyzed using Distance 7.1 software).

Selected model: Conventional Distance Sampling (CDS) with Uniform distribution and 5% truncation.

```
Parameter Estimation Specification
 ---------------------------------
 Encounter rate for all data combined
 Detection probability for all data combined
 Density for all data combined

 Distances:
 ----------
 Analysis based on exact distances
 Width: use measurement/interval endpoint which represents  95.0 percentile.

 Estimators:
 -----------
 Estimator  1
 Key: Uniform
 Adjustments - Function                 : Cosines
             - Term selection mode      : Sequential
             - Term selection criterion : Akaike Information Criterion (AIC)
             - Distances scaled by      : W (right truncation distance)
 Estimator  2
 Key: Uniform
 Adjustments - Function                 : Simple polynomials
             - Term selection mode      : Sequential
             - Term selection criterion : Akaike Information Criterion (AIC)
             - Distances scaled by      : W (right truncation distance)

 Estimator selection: Choose estimator with minimum  AIC
 Estimation functions: constrained such that f(0)>=f(x) for nearly all x

 Variances:
 ----------
 Variance of n: Empirical estimate from sample
                (design-derived estimator R2/P2)
 Variance of f(0): MLE estimate

 Goodness of fit:
 ----------------
 Cut points chosen by program



 Glossary of terms
 -----------------

 Data items:
 n    - number of observed objects (single or clusters of animals)
 L    - total length of transect line(s)
 k    - number of samples
 K    - point transect effort, typically K=k
 T    - length of time searched in cue counting
 ER   - encounter rate (n/L or n/K or n/T)
 W    - width of line transect or radius of point transect
```

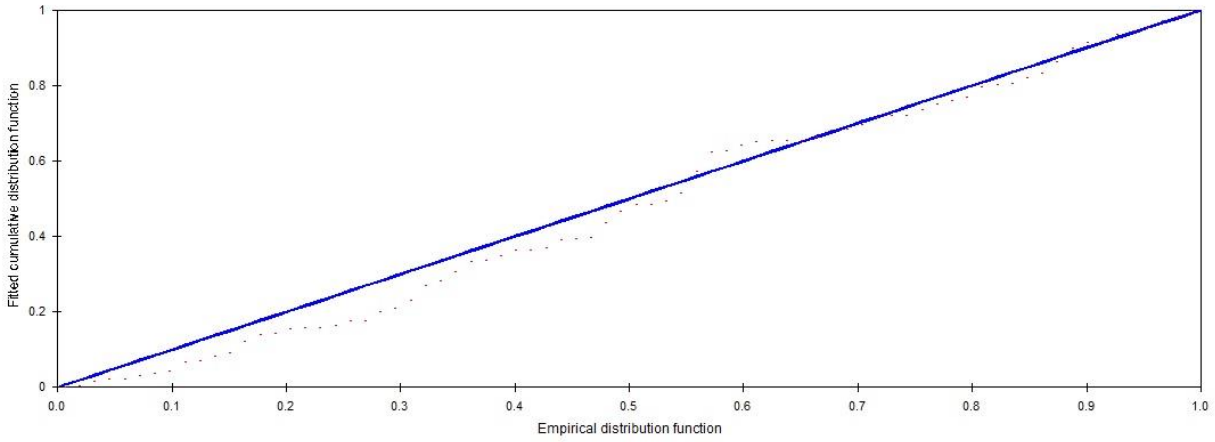
```
 x(i) - distance to i-th observation
 s(i) - cluster size of i-th observation
 r-p  - probability for regression test
 chi-p- probability for chi-square goodness-of-fit test


 Parameters or functions of parameters:
 m    - number of parameters in the model
 A(I) - i-th parameter in the estimated probability density function(pdf)
 f(0) - 1/u = value of pdf at zero for line transects
 u    - W*p = ESW, effective detection area for line transects
 h(0) - 2*PI/v
 v    - PI*W*W*p, is the effective detection area for point transects
 p    - probability of observing an object in defined area
 ESW  - for line transects, effective strip width = W*p
 EDR  - for point transects, effective detection radius  = W*sqrt(p)
 rho  - for cue counts, the cue rate
 DS   - estimate of density of clusters
 E(S) - estimate of expected value of cluster size
 D    - estimate of density of animals
 N    - estimate of number of animals in specified area

Effort        :    13947.41
 # samples     :    43
 Width         :    24.53247
 # observations:    76



 Model  1
    Uniform key, k(y) = 1/W
       Results:
       Convergence was achieved with    1 function evaluations.
       Final Ln(likelihood) value =  -243.19982
       Akaike information criterion =   486.39966
       Bayesian information criterion =   486.39966
       AICc =   486.39966
       Final parameter values:


 Model  2
    Uniform key, k(y) = 1/W
    Cosine adjustments of order(s) :  1
       Results:
       Convergence was achieved with   14 function evaluations.
       Final Ln(likelihood) value =  -228.72653
       Akaike information criterion =   459.45306
       Bayesian information criterion =   461.78378
       AICc =   459.50711
       Final parameter values:  0.80453457

    Likelihood ratio test between models  1 and  2
       Likelihood ratio test value    =    28.9466
       Probability of a greater value =   0.000000
 *** Model  2 selected over model  1 based on minimum AIC
```

```
 Model  3
    Uniform key, k(y) = 1/W
    Cosine adjustments of order(s) :  1, 2
       Results:
       Convergence was achieved with   18 function evaluations.
       Final Ln(likelihood) value =  -228.52931
       Akaike information criterion =   461.05862
       Bayesian information criterion =   465.72009
       AICc =   461.22302
       Final parameter values:  0.84904874     0.88836745E-01

    Likelihood ratio test between models  2 and  3
       Likelihood ratio test value    =     0.3944
       Probability of a greater value =   0.529978
 *** Model  2 selected over model  3 based on minimum AIC

Effort        :    13947.41
 # samples     :    43
 Width         :    24.53247
 # observations:    76



 Model  1
    Uniform key, k(y) = 1/W
       Results:
       Convergence was achieved with    1 function evaluations.
       Final Ln(likelihood) value =  -243.19982
       Akaike information criterion =   486.39966
       Bayesian information criterion =   486.39966
       AICc =   486.39966
       Final parameter values:


 Model  2
    Uniform key, k(y) = 1/W
    Simple polynomial adjustments of order(s) :  2
       Results:
       Convergence was achieved with   37 function evaluations.
       Final Ln(likelihood) value =  -231.79002
       Akaike information criterion =   465.58005
       Bayesian information criterion =   467.91080
       AICc =   465.63409
       Final parameter values: -0.93212005

    Likelihood ratio test between models  1 and  2
       Likelihood ratio test value    =    22.8196
       Probability of a greater value =   0.000002
 *** Model  2 selected over model  1 based on minimum AIC


 Model  3
    Uniform key, k(y) = 1/W
    Simple polynomial adjustments of order(s) :  2, 4
       Results:
       Convergence was achieved with   45 function evaluations.
       Final Ln(likelihood) value =  -228.57091
```

```
      Akaike information criterion =   461.14182
      Bayesian information criterion =   465.80328
      AICc =   461.30621
      Final parameter values:  -2.1952002      1.3819603

   Likelihood ratio test between models  2 and  3
      Likelihood ratio test value    =     6.4382
      Probability of a greater value =   0.011169
*** Model  3 selected over model  2 based on minimum AIC


 Model  4
   Uniform key, k(y) = 1/W
   Simple polynomial adjustments of order(s) :  2, 4, 6
      Results:
      Convergence was achieved with   37 function evaluations.
      Final Ln(likelihood) value =  -228.53606
      Akaike information criterion =   463.07211
      Bayesian information criterion =   470.06433
      AICc =   463.40546
      Final parameter values:  -2.4875706      2.1992301    -0.55160281

   Likelihood ratio test between models  3 and  4
      Likelihood ratio test value    =     0.0697
      Probability of a greater value =   0.791777
*** Model  3 selected over model  4 based on minimum AIC

Effort        :    13947.41
 # samples     :    43
 Width         :    24.53247
 # observations:    76


 Model Selection
 ---------------
 Minimum AIC  =    459.4531
 Estimator chosen based on minimum AIC :
 Model
   Uniform key, k(y) = 1/W
   Cosine adjustments of order(s) :  1

 Effort        :    13947.41
 # samples     :    43
 Width         :    24.53247
 # observations:    76
```

Model
    Uniform key, k(y) = 1/W
    Cosine adjustments of order(s) : 1

Parameter	Point Estimate	Standard Error	Percent Coef. of Variation	95 Percent Confidence Interval	
A(1)	0.8045	0.1068			
f(0)	0.73557E-01	0.43541E-02	5.92	0.65382E-01	0.82754E-01
p	0.55416	0.32803E-01	5.92	0.49257	0.62345
ESW	13.595	0.80473	5.92	12.084	15.295



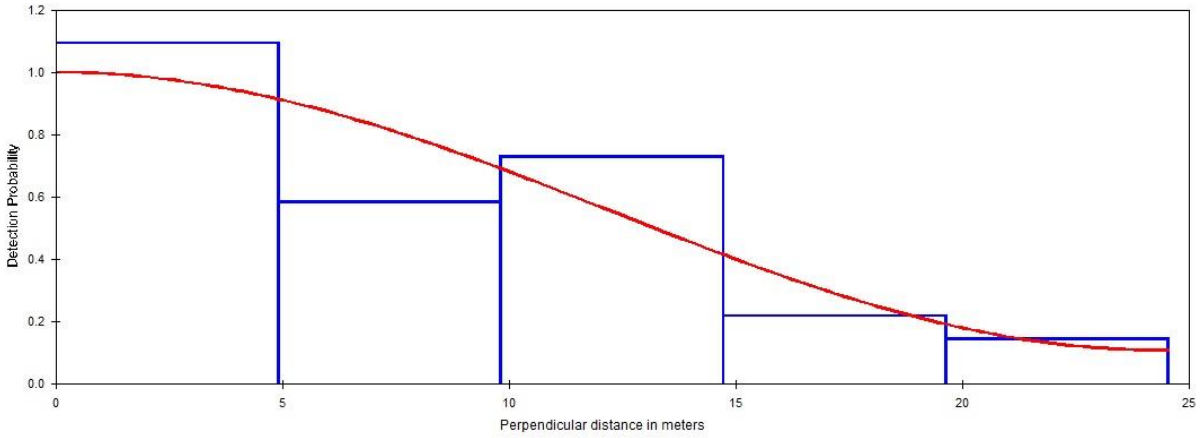
Kolmogorov-Smirnov test

 D_n   = 0.0984   p = 0.4531

 Cramer-von Mises family tests

 W-sq (uniform weighting) = 0.1320   0.400 < p <= 0.500
   Relevant critical values:
     W-sq crit(alpha=0.500) = 0.1189
     W-sq crit(alpha=0.400) = 0.1465

 C-sq (cosine weighting) = 0.1128   0.300 < p <= 0.400
   Relevant critical values:
     C-sq crit(alpha=0.400) = 0.0960
     C-sq crit(alpha=0.300) = 0.1218

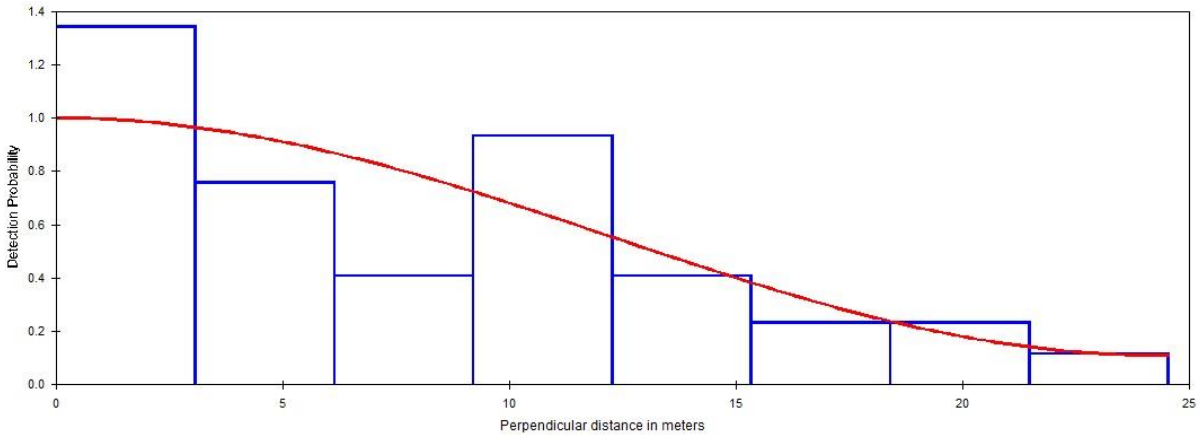


Cell i	Cut Points		Observed Values	Expected Values	Chi-square Values
1	0.000	4.91	30	26.64	0.424
2	4.91	9.81	16	22.27	1.766
3	9.81	14.7	20	15.20	1.516
4	14.7	19.6	6	8.13	0.558
5	19.6	24.5	4	3.76	0.015

Total Chi-square value = 4.2782 Degrees of Freedom = 3.00

Probability of a greater chi-square value, P = 0.23295

The program has limited capability for pooling. The user should judge the necessity for pooling and if necessary, do pooling by hand.

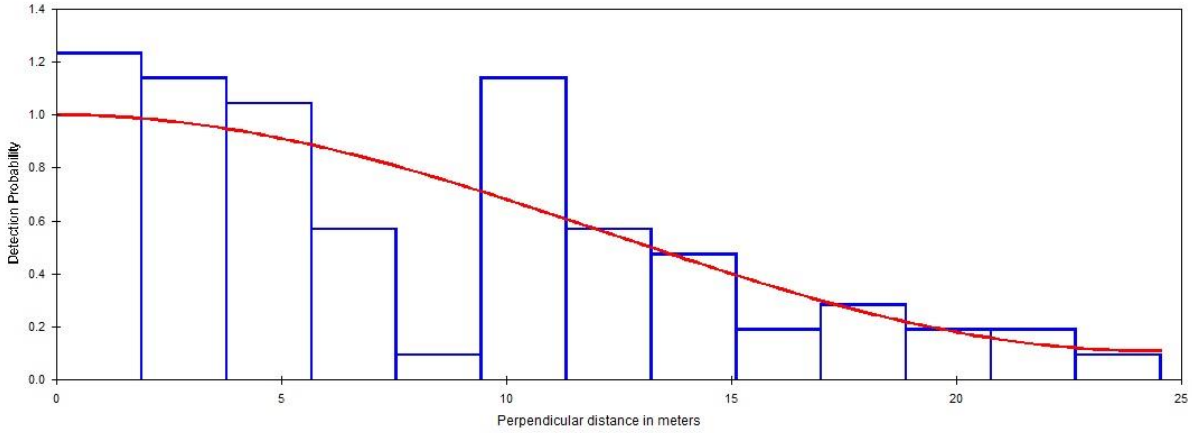


Cell i	Cut Points		Observed Values	Expected Values	Chi-square Values
1	0.000	3.07	23	16.95	2.161
2	3.07	6.13	13	15.81	0.501
3	6.13	9.20	7	13.72	3.291
4	9.20	12.3	16	10.98	2.293
5	12.3	15.3	7	8.02	0.129
6	15.3	18.4	4	5.28	0.311
7	18.4	21.5	4	3.19	0.208
8	21.5	24.5	2	2.05	0.001

Total Chi-square value = 8.8954 Degrees of Freedom = 6.00

Probability of a greater chi-square value, P = 0.17955

The program has limited capability for pooling. The user should judge the necessity for pooling and if necessary, do pooling by hand.



Cell i	Cut Points		Observed Values	Expected Values	Chi-square Values
1	0.000	1.89	13	10.50	0.593
2	1.89	3.77	12	10.23	0.305
3	3.77	5.66	11	9.71	0.172
4	5.66	7.55	6	8.96	0.977
5	7.55	9.44	1	8.03	6.151
6	9.44	11.3	12	6.97	3.632
7	11.3	13.2	6	5.85	0.004
8	13.2	15.1	5	4.72	0.016
9	15.1	17.0	2	3.67	0.757
10	17.0	18.9	3	2.73	0.026
11	18.9	20.8	2	1.98	0.000
12	20.8	22.6	2	1.46	0.201
13	22.6	24.5	1	1.19	0.030

Total Chi-square value = 12.8632 Degrees of Freedom = 11.00

Probability of a greater chi-square value, P = 0.30236

The program has limited capability for pooling. The user should judge the necessity for pooling and if necessary, do pooling by hand.

Goodness of Fit Testing with some Pooling

Cell i	Cut Points		Observed Values	Expected Values	Chi-square Values
1	0.000	1.89	13	10.50	0.593
2	1.89	3.77	12	10.23	0.305
3	3.77	5.66	11	9.71	0.172
4	5.66	7.55	6	8.96	0.977
5	7.55	9.44	1	8.03	6.151
6	9.44	11.3	12	6.97	3.632
7	11.3	13.2	6	5.85	0.004
8	13.2	15.1	5	4.72	0.016
9	15.1	17.0	2	3.67	0.757
10	17.0	18.9	3	2.73	0.026
11	18.9	20.8	2	1.98	0.000
12	20.8	24.5	3	2.65	0.047

Total Chi-square value = 12.6798 Degrees of Freedom = 10.00

Probability of a greater chi-square value, P = 0.24213

Effort : 13947.41
samples : 43
Width : 24.53247
observations: 76

Model
Uniform key, k(y) = 1/W
Cosine adjustments of order(s) : 1

Parameter	Point Estimate	Standard Error	Percent Coef. of Variation	95% Percent Confidence Interval	
D	2.0041	0.31115	15.53	1.4712	2.7299
N	479.00	74.369	15.53	352.00	653.00

Measurement Units
Density: Numbers/hectares
ESW: meters

Component Percentages of Var(D)
Detection probability : 14.5
Encounter rate : 85.5

		Estimate	%CV	df	95% Confidence Interval	
-						
	n	76.000				
	k	43.000				
	L	13947.				
	n/L	0.54490E-02	14.35	42.00	0.40847E-02	0.72690E-02
	Left	0.0000				
	Width	24.532				

		Estimate	%CV	df	95% Confidence Interval	
-						
Uniform/Cosine						
	m	1.0000				
	LnL	-228.73				
	AIC	459.45				
	AICc	459.51				
	BIC	461.78				
	Chi-p	0.24213				
	f(0)	0.73557E-01	5.92	75.00	0.65382E-01	0.82754E-01
	p	0.55416	5.92	75.00	0.49257	0.62345
	ESW	13.595	5.92	75.00	12.084	15.295

		Estimate	%CV	df	95% Confidence Interval	
-						
Uniform/Cosine						
	D	2.0041	15.53	56.59	1.4712	2.7299
	N	479.00	15.53	56.59	352.00	653.00