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INVENTORY OF RARE AND ENDEMIC PLANT AND ANIMAL SPECIES OF PONCE DELEON, GEMINI, AND GREEN SPRINGS
FINAL REPORT

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July 2005

Green Springs photo by Brenda Herring

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Florida Natural Areas Inventory
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EXECUTIVE SUMMARY

Demands for groundwater may reduce flows in St. Johns River Water Management District (SJRWMD) springs and their spring runs impacting rare and endemic plant and animal species and rare wetland communities. Numerous wetland dependent rare species exist within SJRWMD and are possibly at risk. Section 62-40.473, Florida Administrative Code, and section 373.042, Florida Statues, specifies that Minimum Flows and Levels (MFLs) be set to protect non-consumptive uses of water such as fish and wildlife habitats and other natural resources values. Preservation of wildlife resources by the MFLs Program also involves protection of rare plant and animal species and communities.

As a result, SJRWMD contracted with the Florida Natural Areas Inventory (FNAI) to conduct rare plant, animal, and natural community surveys at Ponce DeLeon, Gemini, and Green springs all within Volusia County and all slated for MFLs determinations.

At the conclusion of fieldwork, FNAI cumulatively documented at the three springs; five rare plant species (angle-pod, gopherwood buckthorn, hooded pitcher-plant, Okeechobee gourd and star anise); one non-rare endemic fish species (flagfish); one exotic fish species (suckermouth catfish); one rare reptile species (American alligator); and four rare bird species (little blue heron, limpkin, osprey, and snowy egret). Of these, the Okeechobee gourd and star anise plant species are Florida endemics and extremely rare. In addition, FNAI documented five rare natural community types at the three springs (Dome Swamp, Floodplain Forest, Hydric Hammock, Mesic Hammock, and Spring run Stream). Of these, the Mesic Hammock and Spring run Stream community types are considered quite rare.

This report should be of value to the SJRWMD MFLs Program because the presence of rare species and rare wetland communities in the vicinity of the springs will be considered in setting MFLs for the protection of springs.

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INTRODUCTION

Demands for groundwater may reduce flows in St. Johns River Water Management District (SJRWMD) springs and their spring runs impacting rare and endemic plant and animal species and rare wetland communities. Numerous wetland dependent rare species exist within SJRWMD and are possibly at risk. Section 62-40.473, Florida Administrative Code, and section 373.042, Florida Statues, specifies a Minimum Flows and Levels (MFLs) should be set to protect non-consumptive uses of water such as fish and wildlife habitats and other natural resources values. Preservation of wildlife resources by the MFLs Program also involves protection of rare plant and animal species and communities.

As a result, SJRWMD contracted with the Florida Natural Areas Inventory (FNAI) to conduct rare plant, animal and natural community surveys at Ponce DeLeon, Gemini, and Green springs all within Volusia County and all slated for MFL determinations. FNAI, which is part of Florida State University's Institute for Science and Public Affairs, was chosen to conduct this survey due to its mission to conserve Florida's biological diversity. FNAI maintains a statewide database on the status, distribution, and management of rare and endangered plant and animal taxa, exemplary natural communities, and managed areas.

This report should be of value to the SJRWMD MFLs Program because the presence of rare species and rare wetland communities in the vicinity of the springs will be considered in setting MFLs for the protection of springs.

METHODS

Field surveys were conducted from March to May 2005, at Ponce DeLeon, Gemini, and Green springs all within Volusia County. Search lists for rare plants and animals were utilized to set survey priorities. Locations of all historic records from FNAI's database of rare plants and animals were mapped and then visited in an effort to document whether the populations were extant and to gain a better understanding of a given species habitat requirements. The survey boundaries for each spring were predetermined in the project's Scope of Work. For Ponce DeLeon Springs, surveys took place around the immediate bank of the spring boil and the approximately 0.5 mile spring run to Spring Garden Lake and the open water area within. The survey of Gemini Springs included the immediate bank of the two spring boils and the spring run that terminates at the dam. For Green Springs the survey area included the immediate bank of the spring boil, spring run, and the open water within.

Digital Ortho Quarter Quads color aerials, were used for general navigation, and to locate historical element occurrences. When notable species or natural communities were found, their locations were recorded with a GeoExplorer GPS unit and that information was downloaded into ArcView. Each species or natural community documented during the course of this project was given an FNAI global and state rank as well as federal and

state statuses as applicable. Rankings and statuses were based on the Florida Natural Areas Inventory Tracking List of Rare, Threatened, and Endangered Plants and Animals and Exemplary Natural Communities of Florida (FNAI 2002). An explanation of ranks and statuses are in Appendix 1. In addition attribute tables for rare plants (Appendix 3), rare animals (Appendix 4) and rare natural communities (Appendix 5) are also provided. Attribute tables are spreadsheets that provide tabular data of GPSed points. The data provided are dependent on how data dictionaries are set up. Attribute tables for animals could have a "behavior" tab whereas an attribute table for plants could have a "phenology" tab, otherwise, the tabular fields for plant, animal, and natural community attribute tables can be very similar.

A variety of survey techniques were employed for this project. Field surveys for rare terrestrial plants and natural community types were conducted on foot by simply walking around the appropriate habitat and using visual observations. Various aquatic vessels were used to survey for rare aquatic and emergent plants and associated natural communities. Those same vessels were also used to survey aquatic habitats for rare animals. In addition to boats, unbaited funnel traps, dipnets, seines, snorkeling equipment, and a Smith-Root, Inc., LR-24 Electrofisher® were used to sample for rare fishes. Snorkeling equipment was also used to survey for rare invertebrates. Lists of all notable species and natural community types documented during this project will be presented in tables corresponding to the specific spring in which the species was found. Exotic plant species were identified during this survey although this was not a part of the Scope of Work. Their presence in natural communities is important to document and to consider when making management recommendations. Exotic plant species recorded during this project are identified in Appendix 2.

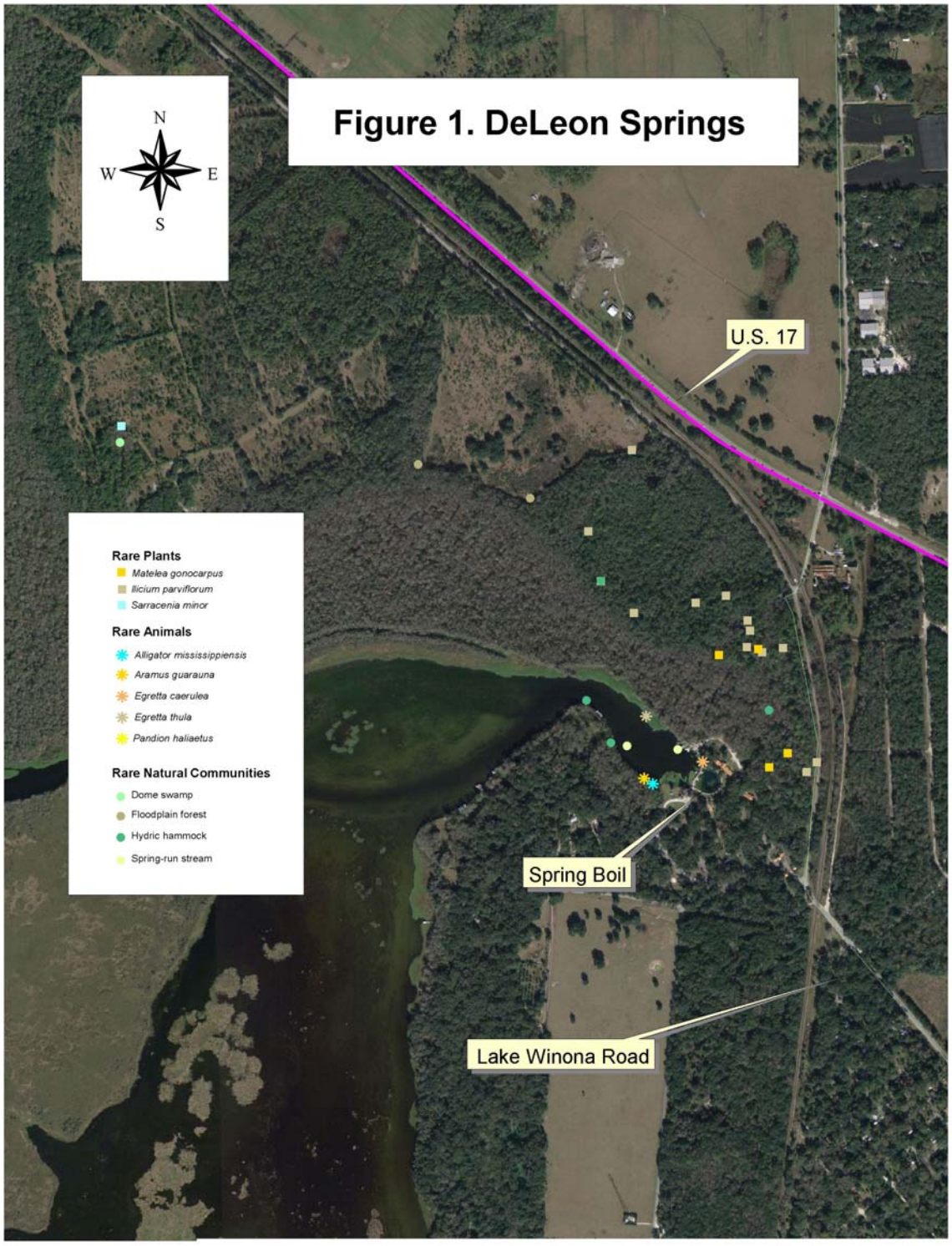
RESULTS AND DISCUSSION

At the conclusion of fieldwork, FNAI cumulatively documented at the three springs; five rare plant species (angle-pod, gopherwood buckthorn, hooded pitcher-plant, Okeechobee gourd and star anise); one non-rare endemic fish species (flagfish); one exotic fish species (suckermouth catfish); one rare reptile species (American alligator); and four rare bird species (little blue heron, limpkin, osprey, and snowy egret). Of these, the Okeechobee gourd and star anise plant species are Florida endemics and extremely rare. In addition, FNAI documented five rare natural community types at the three springs (Dome Swamp, Floodplain Forest, Hydric Hammock, Mesic Hammock and Spring run Stream). Of these, the Mesic Hammock and Spring run Stream community types are considered quite rare. Information concerning rare species and natural community types occurring at each spring are described in the text. Exotic plant species (Appendix 2) were present in rare natural communities at all three sites. There were no rare fishes or invertebrates documented at any of the three project sites.

Ponce DeLeon Springs

This is the largest of the three springs and located within DeLeon Springs State Park in north-central Volusia County, approximately 5 miles north-northwest of DeLand, and

approximately 0.5 miles south of the U.S. 17/Lake Winona Road (Figure 1). Ponce DeLeon Springs had a 170-foot diameter spring pool and a 0.5-mile spring run. The spring's pool was being used as a swimming pool encircled by a concrete walkway, with concrete steps, and other artificial access points. The surrounding "uplands" consisted of mowed grassy areas, picnic tables, and various buildings. The spring run was being used for fishing.



Note: DeLeon Springs referred to in the title of Figure 1 is synonymous with Ponce DeLeon Springs

Many artificial lures and other man-made detritus were found littering the spring run. Along the sides of the run was an abundance of emergent and floating vegetation. Among the floating/emergent vegetation mats were invasive exotic species such as water-hyacinth (*Eichhornia crassipes*) and water-lettuce (*Pistia stratiotes*) (Appendix 2).

At the conclusion of the field work, nine rare, endemic and exotic species were identified (Table 1, Figure 1). This included three plant species (angle-pod, hooded pitcher-plant, and star anise) and six animal species (suckermouth catfish, American alligator, little blue heron, snowy egret, limpkin, and osprey). Of particular note is star anise, an imperiled plant vulnerable to extinction (see description in the following "Rare Species and Natural Community Descriptions" section). In addition, four rare plant communities (Table 2, Figure 1) were documented at Ponce DeLeon Springs. Of particular note is the spring run stream, a very rare community (see description in the following "Rare Species and Natural Community Descriptions" section).

Table 1. List of rare and endemic species recorded at Ponce DeLeon Springs

Common Name	Scientific Name	FNAI Global/State Ranks	Federal Status	State Status	Location
Plants					
angle-pod	*Matelea gonocarpos*	N/N	N	LT	hydric hammock
hooded pitcher-plant	*Sarracenia minor*	N/N	N	LT	edge of dome swamp
star anise	*Illicium parviflorum**	G2/S2	N	LE	hydric hammock
Animals(Fish)					
suckermouth catfish	*Pterygoplichys* sp.**	N/A	N	N	spring run-open water
Animals (Reptiles)					
American alligator	*Alligator mississippiensis*	G5/S4	LT(S/A)	LS	spring run
Animals (Birds)					
little blue heron	*Egretta caerulea*	G5/S4	N	LS	spring run
snowy egret	*Egretta thula*	G5/S3	N	LS	spring run
limpkin	*Aramus guarauna*	G5/S3	N	LS	spring run
osprey	*Pandion haliaetus*	G5/S4	N	LS††	foraging, over spring run

* = endemic to Florida.
** = exotic species
†† = State listed as Special Concern Species in Monroe County only.
N = Not listed.
N/A = Not Applicable.

Table 2. List of rare natural plant communities at Ponce DeLeon Springs

FNAI Natural Plant Community Type	FNAI Rank Global/State	Location
Dome Swamp	G4?/S3?	north of spring run
Floodplain Forest	G4/S3	north of spring run
Hydric Hammock	G4/S4	north and south of spring run
Spring run Stream	G2/S2	spring run

Gemini Springs

Gemini Springs is located in southwest Volusia County, approximately 1 mile southeast of DeBary and 0.25 miles east of the U.S.17/Enterprise Road intersection (Figure 2). This site had two spring pools and accompanying runs. The runs emptied into a reservoir created to provide a public swimming area. However, due to high coliform counts, this area has been closed to the public. At the conclusion of fieldwork in May 2005, there still were no plans to reopen the swimming area to the public.

At Gemini Springs, three rare species (American alligator, little blue heron and snowy egret), one non-rare endemic fish species (flagfish) and one exotic fish species (suckermouth catfish) were documented (Table 3, Figure 2). Two rare natural communities, mesic hammock and spring run stream, were also documented (Table 4, Figure 2). Both of these natural community types are quite rare (see description in the following "Rare Species and Natural Community Descriptions" section). There was also an abundance of exotic plant species (Appendix 2). The majority of the surrounding uplands had been modified for various types of recreation such as picnicking, walking, and fishing.

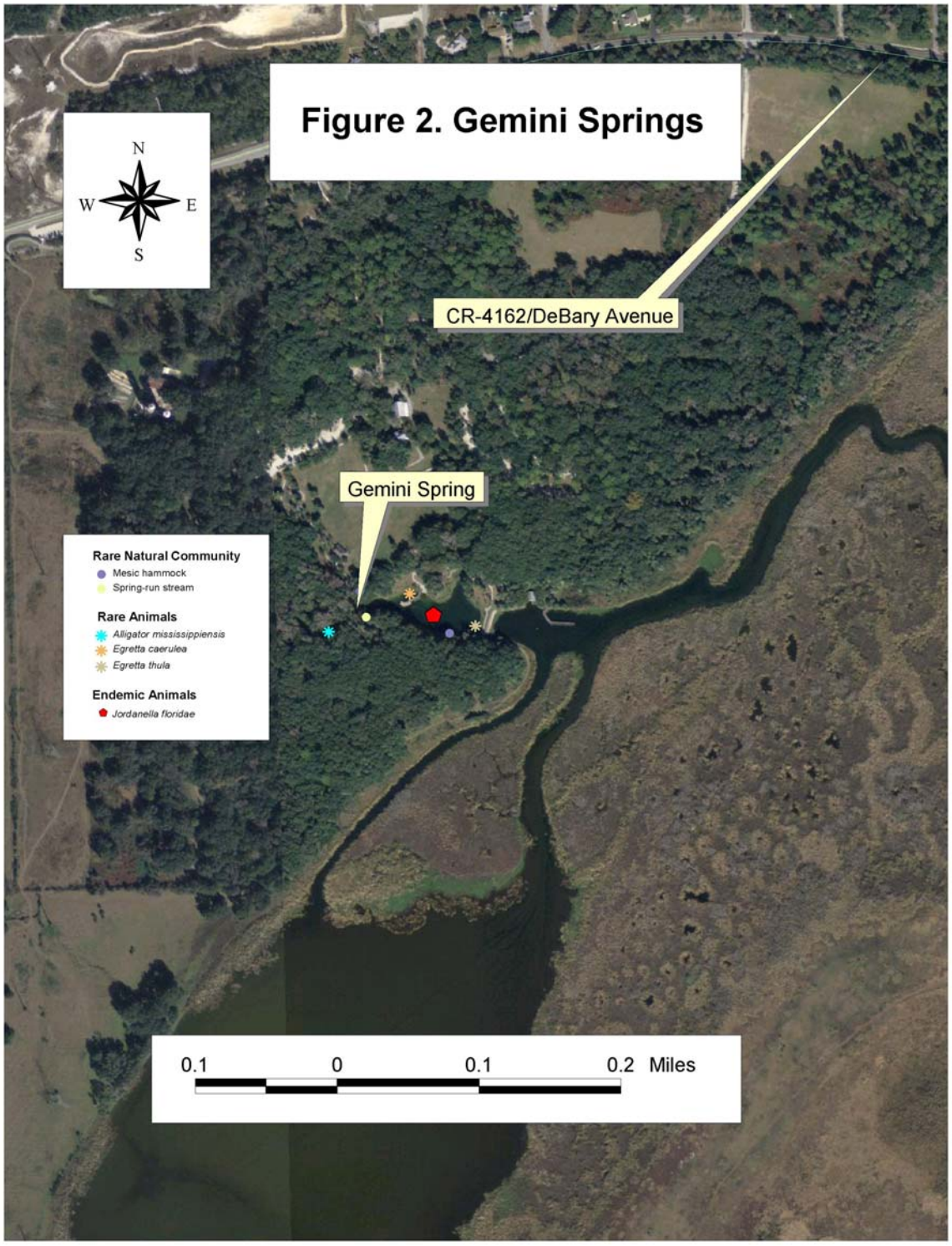


Figure 2. Gemini Springs
N
W
E
S
CR-4162/DeBary Avenue
Gemini Spring
Rare Natural Community
Mesic hammock
Spring-run stream
Rare Animals
Alligator mississippiensis
Egretta caerulea
Egretta thula
Endemic Animals
Jordanella floridae
0.1
0
0.1
0.2 Miles

Table 3. List of rare, endemic and other notable species documented at Gemini Springs

Common Name	Scientific Name	FNAI Rank Global/State	Federal Status	State Status	Location
Animals (Fish)					
suckermouth catfish	*Pterygoplichys* sp. **	N/A	N	N	reservoir-open water, submergent vegetation
flagfish	*Jordanella floridae**	N/A	N	N	reservoir-emergent vegetation
Animals (Reptile)					
American alligator	*Alligator mississippiensis*	G5/S4	LT(S/A)	LS	spring pool
Animals (Bird)					
little blue heron	*Egretta caerulea*	G5/S4	N	LS	reservoir
snowy egret	*Egretta thula*	G5/S3	N	LS	reservoir

** = exotic species
* = endemic species
N = not listed
N/A = not applicable

Table 4. List of rare natural plant communities documented at Gemini Springs

FNAI Natural Plant Community Type	FNAI Rank Global/State	Location
Mesic Hammock	G3/S2	north and south of spring
Spring run Stream	G2/S2	within the spring runs

Green Springs

Green Springs was the smallest of the three sites and is located in the southwest portion of Volusia County, approximately one mile east-southeast of Enterprise, and north of the Enterprise-Osteen Road (Figure 3). This site is also about 0.25 miles north of Lake Monroe.

Green Springs has a 90-foot diameter pool that was reported to be 125 feet deep. The spring run was roughly 50 feet long and flows through a pipe that travels underground for approximately 100 feet and exits into a small stream. Downstream of the outflow, was a persistent white coating on the detritus. This was the same white coating that was present in the spring run.

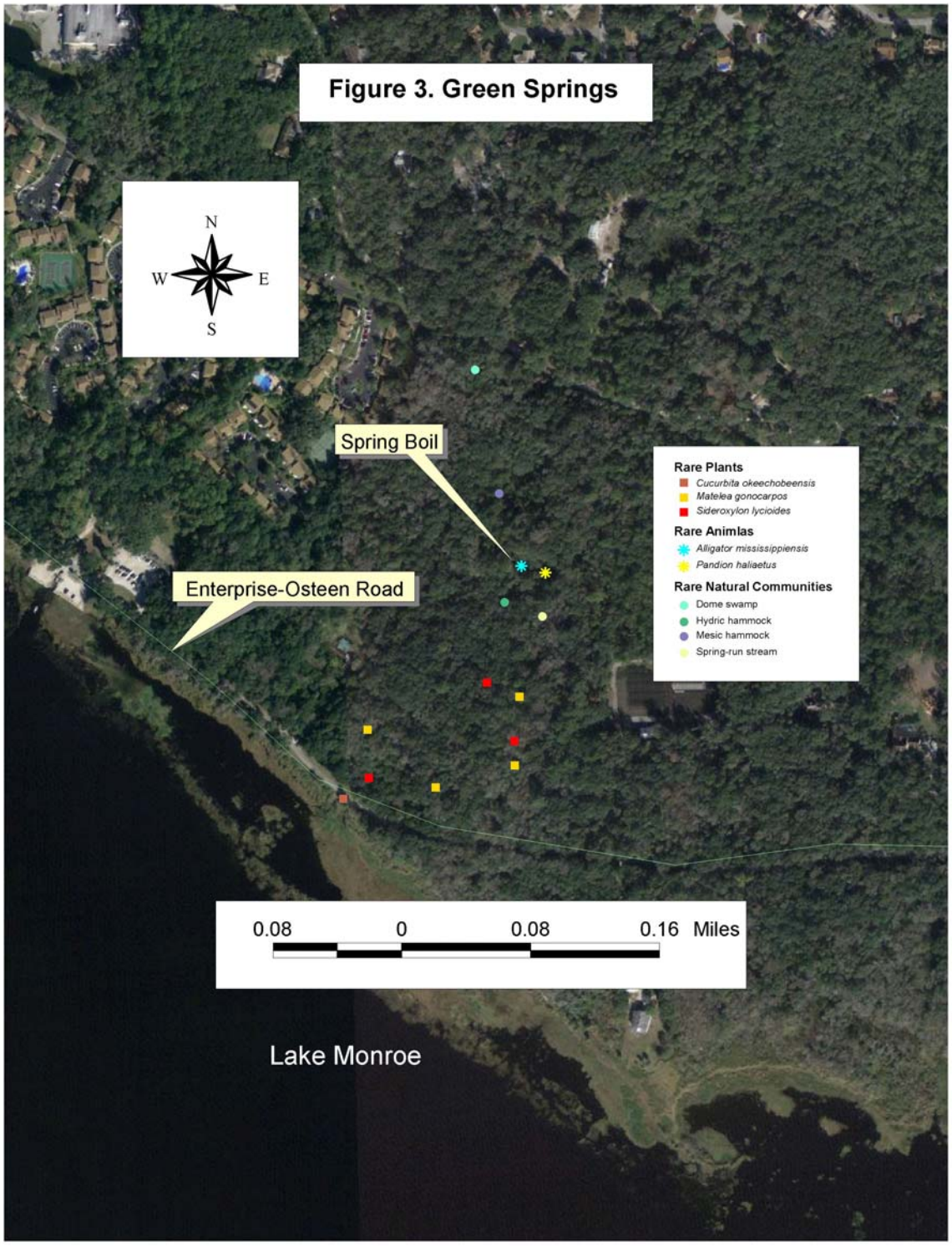


Figure 3. Green Springs
N
W
E
S
Spring Boil
Enterprise-Osteen Road
Rare Plants
Cucurbita okeechobeensis
Matelea gonocarpos
Sideroxylon lycioides
Rare Animlas
Alligator mississippiensis
Pandion haliaetus
Rare Natural Communities
Dome swamp
Hydric hammock
Mesic hammock
Spring-run stream
0.08 0 0.08 0.16 Miles
Lake Monroe

At Green Springs, five rare species were recorded that included three rare plants (Okeechobee gourd, angle pod, and gopherwood buckthorn), one rare reptile (American alligator) and one rare bird (osprey) (Table 5, Figure 3). Of the plants, Okeechobee gourd is extremely rare and imperiled (see description in the following "Rare Species and Natural Community Descriptions" section). Several exotic plant species were also recorded (Appendix 2). Four rare natural communities (dome swamp, hydric hammock, mesic hammock, and spring run stream) were also documented (Table 6, Figure 3). Of these, the mesic hammock and spring run stream community types are quite rare (see description in the following "Rare Species and Natural Community Descriptions" section).

Table 5. List of rare and endemic species documented at Green Springs

Common Name	Scientific Name	FNAI Rank Global/State	Federal Status	State Status	Location
Plants					
Okeechobee gourd	*Cucurbita okeechobeensis* ssp. *okeechobeensis**	G1T1/S1	LE	LE	Ruderal shoreline of Lake Monroe.
angle pod	*Matelea gonocarpos*	N	N	LT	hydric hammock
gopherwood buckthorn	*Sideroxylon lycioides*	G5/S2	N	LE	hydric hammock
Animals (Reptiles)					
American alligator	*Alligator mississippiensis*	G5/S4	LT(S/A)	LS	spring pool
Animals (Birds)					
osprey	*Pandion haliaetus*	G5/S3S4	N	LS††	nesting in hydric hammock

* = endemic
†† = State listed as LS (Species of Special Concern) in Monroe County only; not listed in rest of state.
N = not listed

Table 6. Rare natural plant communities documented at Green Springs

FNAI Natural Plant Community Type	FNAI Rank Global/State	Location
Dome Swamp	G4?/S3?	northwest corner of site
Hydric Hammock	G4/S4	north, south, and west of spring
Mesic Hammock	G3/S2	north of spring
Spring run Stream	G2/S2	within the spring run

Management Recommendations

For Ponce DeLeon, Gemini, and Green springs, eradication of the numerous exotic pest plants should be a priority. Some of these exotics were large populations that will require considerable effort to control. A primary target list should include coral ardisia (*Ardisia crenata),* air potato (*Dioscorea bulbifera*), and Brazilian pepper (*Schinus terebinthifolius*), as these are the fastest spreading species.

RARE SPECIES AND NATURAL COMMUNITY DESCRIPTIONS

Rare Plant Descriptions

Cucurbita okeechobeensis* ssp *okeechobeensis **(Okeechobee gourd) (G1T1/S1)** – This is a vine capable of climbing, sprawling, or creeping from long stems bearing tightly twisted tendrils. This species is a member of the squash family (Cucurbitaceae). The leaves range from 6-8 inches in width and length, alternately arranged, possess tendrils, and are roughly heart-shaped, variously lobed, have slightly toothed margins, and have a rough, course texture due to short dense hairs on the surface. The flowers are cream colored, 5-lobed, and measure from 2-3 inches across. Fruits are 3 inches wide, round, very firm, and striped when mature. Okeechobee gourd has been documented occurring in mucky soil along the shores of Lake Okeechobee within pond apple swamps. More recently it has been recorded in portions of floodplain forests that border the St. Johns River (Chafin 2000). It is endemic to Florida and known only from five counties: Glades, Lake, Palm Beach, Seminole, and Volusia. FNAI considers this species to be extremely rare (G1T1/S1). There are 5 or fewer occurrences or less than 1,000 individuals remaining. The Okeechobee gourd is listed as endangered by the state of Florida and the United States Government. This plant was found in the southern portion of the Green Springs site.

Illicium parviflorum **(star anise) (G2/S2)** – This is an evergreen shrub or small tree in the anise tree family (Illiaceae). Some individuals are multi-stemmed and the branches can achieve heights up to 24 feet tall. The leaves are alternately arranged, oval to oblong in shape, have entire margins, smell like licorice when bruised, and are up to 6 inches

long. The flowers are small, with 6-12 yellow petals. Flowering occurs from April to June. Fruits are star-shaped, and woody. Star anise is known to occur in association with spring run streams, seepage streams, hydric hammocks, baygall, and bottomland forests. This species is a Florida endemic known only from five counties: Lake, Marion, Orange, Polk, Seminole, and Volusia counties. This is a very rare plant. The global and state ranks means that this species is imperiled (6-20 occurrences of less than 3,000 individuals) and is vulnerable to extinction due to some natural or human factor. The state of Florida lists it as endangered.

Two populations were documented within DeLeon Springs State Park. One population was documented along a stream west of CR-3 and north of the park's entrance gate and extends north along an old tram trail. The second population occurs further north of the park's entrance station also west of CR-3 and along the Persimmon Trail. Both populations occurred in hydric hammock communities. The southern most population has roughly 600 plants ranging from two to 12 feet tall. The majority of plants were in the bud stage. The northern most population contained approximately 3,000 individuals in an early floral stage, and ranged from 15 to 20 feet tall. The numerous exotic plant species posed the most immediate threat.

Matelea gonocarpos **(angle pod) (N/N)** - This is a perennial herbaceous vine in the milkweed family (Asclepiadaceae). Stems climb by twining and have a milky sap. Leaves are opposite, heart-shaped, deciduous, and up to 8 inches long. Flowers are in axillary cymes, with yellow or greenish-brown corollas 0.4-0.6 inches across. The fruit is a smooth, winged pod up to 4 inches long. The flowering season is from May to July.

There are 6 species of *Matelea* in Florida, and they are all listed. In Volusia County, *Matelea gonocarpos* may only be confused with *M. floridana,* which has purple-black flowers.

Matelea gonocarpos is found in bottomland forest, hydric hammocks, and upland mixed forests. It is known from the central peninsula of Florida to North Carolina. FNAI currently does not track this species, however, it is considered threatened by the state of Florida. This species was widespread within Ponce DeLeon and Green springs.

Sideroxylon lycioides **(gopherwood buckthorn) (G5/S2)** – This is a thorny shrub or small tree with milky sap and is in the sapodilla family (Sapotaceae). The leaves are alternate, elliptic, 3-5 inches long, and 0.8-2 inches wide, and are glabrous except for the midrib. The leaves are also tardily deciduous and have short petioles 0.2-0.5 inches long. Flowers are white, 0.2 inches wide, and arranged in sessile axillary umbels. Flowering season is in April. The fruits are black ovoid berries about 0.4 inches long.

Nine species of *Sideroxylon* occur in Florida. This species has been found in only eight counties in Florida. Of those eight counties, only two are in the peninsula; Marion and Putnam. This was the first documentation of gopherwood buckthorn in Volusia County. The four *Sideroxylon* species known to occur in Volusia County can be distinguished from gopherwood buckthorn as follows: false mastic (*S. foetidissimum*) doesn't have

thorns and occurs closer to the coast in hammocks; gum bully (*S. lanuginosum*) and tough bully (*S. tenax*) have reddish-brown thickly pubescent twigs; Florida bully (*S. reclinatum*) has shorter leaves (0.5-2.5 inches vs. 3-5 inches).

Gopherwood buckthorn can be found in bottomland forest, floodplain forest, and adjacent hammock, often along rivers and streams. It ranges from central Florida north to Illinois. A population of six individuals was documented at Green Springs in a hydric hammock. Of immediate threat and concern to the gopherwood buckthorn population are the following invasive exotic species: sword fern (*Nephrolepis cordifolia*), arrowhead vine (*Syngonium podophyllum*), Caesar weed (*Urena lobata*), camphor tree (*Cinnamomum camphora*), and wax begonia (*Begonia cucullata*). Control of these exotic species would be necessary to insure a healthy gopherwood buckthorn population.

Rare Animal Descriptions

Alligator mississippiensis **(American alligator) (G5/S4)** – This is a large semi-aquatic reptile that can grow to 15 feet in total length. They live in most aquatic environments and range statewide, though rare in the Keys. Range-wide they occur in the southeastern coastal plains from North Carolina to Texas. They eat turtles, fishes, wading birds and various mammals. The only other animal one could confuse for an alligator would be the American crocodile. The American crocodile's fourth lower tooth can be seen when its mouth is closed. This is not so in the American alligator. Alligators were recorded at Ponce DeLeon, Gemini, and Green springs. At Green Springs only immature alligators were documented. American alligators are common within the state of Florida occurring in every county. American alligators are considered species of special concern by the state of Florida, and legally threatened by the federal government. The threatened status is due to its similarity in appearance to American crocodiles.

Aramus guarauna **(limpkin) (G5/S3)** – This is a small to medium sized "chunky" wading bird with a down-curved bill, but not as strongly so as that of ibises. The body color is brown with white markings covering the upper chest, back and neck. In Florida this species has been recorded in 15 counties, all but two of which occur in the peninsula. Range-wide this species can be found in southeastern Georgia, south to the Greater Antilles and west to southern Mexico to central Argentina. This species nests in a wide variety of places such as mounds of aquatic vegetation, and marsh grasses among cypress knees, and high in trees. Limpkins eat primarily invertebrates with a particular liking for apple snails. A pair of limpkin was documented foraging on apple snails on emergent/floating vegetation mats along the north side of the spring run of Ponce DeLeon Springs.

Egretta caerulea **(little blue heron) (G5/S4)** – Little blue herons are medium sized wading birds that, when mature, have a dark blue body with a purplish neck and head. The bill is bicolored with a dark gray tip and light gray base. Immature little blues have white bodies, with gray bills and legs. Mature little blues resemble no other bird, but immatures resemble great egrets (see great egret species account above) and snowy egrets, which have black bills and legs, and yellow feet. Little blues have been recorded

in every Florida county except Okaloosa and Santa Rosa. Range-wide they can be found as far north as Maine, and west to southern California. They typically nest in mixed-species rookeries in flooded vegetation or on islands. They eat small fishes and other small aquatic vertebrates and aquatic invertebrates. Little blue herons are species of special concern in Florida and have no federal status.

Egretta thula **(snowy egret) (G5/S3)** – Snowy egrets (snowies) are small to medium sized wading birds with white bodies, black bills and legs, and yellow feet. This bird resembles immature little blues (see species account above) and great egrets (see species account above). Snowies are widely scattered in the panhandle, but reasonably common throughout the peninsula. Range-wide they can be found over much of the country during the summer months. Snowies feed on small fishes and invertebrates. Almost all breeding sites are over shallow water, and usually are shared with other species. One snowy egret was observed foraging at Gemini Springs.

Pandion haliaetus **(osprey) (G5/S3S4)** – This is a large fish eating bird of prey with a dark brown back and white under parts and nape. Ospreys have a brown stripe that runs through each eye to the shoulders. Ospreys nest in trees and on man-made platforms on or near water. They range throughout Florida with records scattered throughout the peninsula and panhandle with seemingly a heavier concentration of records near coastal areas. Range-wide they are found throughout much of North America. One individual was documented foraging at Ponce DeLeon Springs, and one active nest was found in a hydric hammock just east of Green Springs.

Natural Plant Community Descriptions

Dome Swamp (G4?/S3?) - Two dome swamps were documented, one at Ponce DeLeon Springs and the other at Green Springs. This represents the first records of dome swamps in Volusia County. Dome Swamps have been recorded scattered over 14 counties in the peninsula. In the panhandle, they have been recorded primarily in the western panhandle.

Ponce DeLeon Springs: A dome swamp was documented north of the spring run stream. This isolated wetland was surrounded by pasture and hydric hammock. The dome swamp was dominated by bald cypress (*Taxodium distichum*), lizard's tail (*Saururus cernuus*) and maidencane (*Panicum hemitomon*). The outer rim has patches of the state threatened species hooded pitcher-plant (*Sarracenia minor*) and cinnamon fern (*Osmunda cinnamomea*). There was open, deep water toward the center of the swamp. The wetland was in good condition. The surrounding upland communities should be burned regularly.

Green Springs: Located in the northwest portion of the site, the dome swamp was dominated by bald cypress, and black gum (*Nyssa biflora*). The understory consists of cabbage palm (*Sabal palmetto*), sweetgum (*Liquidambar styraciflua*), and sweet bay (*Magnolia virginiana*). Shrubs were sparsely represented and included primarily buttonbush (*Cephalanthus occidentalis*). The herbaceous layer consisted mostly of lizard's tail, netted chain fern (*Woodwardia areolata*), Dixie iris (*Iris hexagona*), and

false nettle (*Boehmeria cylindrica*). These were scattered throughout the wetland. The dome swamp has been bisected by a road that follows the property boundary and a culvert that allows water drainage from one side of the road to the other.

Floodplain Forest (G4/S3) – Only one floodplain forest community was recorded. It was documented at Ponce DeLeon Springs. Floodplain forest is a rare community in the peninsula having only been recorded in Putnam, Marion, Sumter, and Polk counties. It is more common in the panhandle.

Ponce DeLeon Springs: This was a small community located north of the hydric hammock and south of the pasture communities. The canopy was dominated by slash pine (*Pinus elliottii*), loblolly pine (*P. taeda*), sweetgum, and diamond-leaf oak (*Quercus laurifolia*). Subcanopy dominates included cabbage palm, red maple (*Acer rubrum*), and box-elder (*A. negundo*). Dominant ground cover species included cinnamon fern and false garlic (*Nothoscordum bivalve*). This community was inundated.

Hydric Hammock (G4/S4) – Hydric hammocks were documented at DeLeon and Green springs. This community is widely scattered in the peninsula with heavier concentrations in the northern peninsula, few records in southern Florida, and no records in Dade or Monroe counties. Infrequent records occur in the panhandle for this community.

Ponce DeLeon Springs: Hydric hammock makes up the largest community at Ponce DeLeon Springs, and was found north, south, and east of the spring and spring run. Dominant overstory included Florida elm (*Ulmus americana*), cabbage palm, sweetgum, diamond-leaf oak, red maple, and bald cypress. The rare plant species star anise (*Illicium parviflorum*) occurs in this community. The state listed angle-pod (*Matelea gonocarpos*) was also documented in this community. Along with the rare species, several exotic plants (Appendix 2) were also documented and included white ginger lily (*Hedychium coronarium*), wax begonia (*Begonia cucullata*), tuberous sword fern (*Nephrolepis cordata*), and wild taro (*Colocasia esculenta*). Along some old tram rails that were being used as hiking trails within this community, there were more exotic plant species such as azalea (*Rhododendron* spp.), citrus (*Citrus* spp.), creeping fig (*Ficus pumila*), elephant ear (*Xanthosoma sagittifolium*), creeping oxeye (*Wedelia trilobata*), and coral ardisia (*Ardisia crenata*). These exotic plant species pose the most serious threat to this community.

Green Springs: Hydric hammock accounts for the largest portion of this site covering the southern half and north central regions. The canopy was dominated by live oak (*Quercus virginiana*), cabbage palm, sweetgum, sugarberry (*Celtis laevigata*), pignut hickory (*Carya glabra*), and diamond-leaf oak. The understory was dominated by younger forms of the above species with the addition of southern red cedar (*Juniperus virginiana*), box elder, and cherry laurel (*Prunus caroliniana*). A couple of rare plant species were found: gopherwood buckthorn (*Sideroxylon lycioides*), and angle-pod. Ferns and epiphytes were abundant. Also several exotic plant species were recorded (Appendix 2).

Mesic Hammock (G3/S2) – This community type was documented at Gemini and Green springs. This is a very rare community type documented in only three counties in the peninsula; Palm Beach, Osceola, and Hernando. This was the first documentation of this community type in Volusia County.

Gemini Springs: What was left of this community was found north and south of the springs and the spring runs. The canopy was dominated by large live oaks, cabbage palms, pignut hickories, and sweetgums. The subcanopy had sugarberry, cherry laurel, and beautyberry (*Callicarpa americana*). The exotic trees (Appendix 2) camphor tree and citrus were also documented. Other exotic species documented were air potato (*Dioscorea bulbifera*), Caesar weed (*Urena lobata*), and Chinese tallow (*Sapium sebiferum*) (Appendix 2).

Green Springs: This community was documented north of the spring. The canopy was dominated by live oak, laurel oak (*Quercus hemisphaerica*), southern magnolia (*Magnolia grandiflora*), and pignut hickory. The understory was comprised of loblolly pine, basswood (*Tilia caroliniana*), southern red cedar, sweetgum, cabbage palm, and wax myrtle (*Myrica cerifera*). Numerous vines were present such as pepper vine (*Ampelopsis arborea*), yellow jessamine (*Gelsemium sempervirens*), and catbrier (*Smilax auriculata*). Herbaceous members of this community included: woods grass (*Oplismenus setarius*), Carolina wild petunia (*Ruellia caroliniensis*), frostweed (*Verbesina virginica*), and Ohio spiderwort (*Tradescantia ohiensis*). Several exotic species (Appendix 2) were also recorded. They were camphor tree, coral ardisia, Caesar weed, and arrowhead vine (*Syngonium podophyllum*) (Appendix 2).

Spring run Stream (G2/S2) – This community was documented at all three sites. The G2 ranking indicates that range-wide this community is very rare with only 6 to 20 occurrences or less than 10,000 individuals. The S2 ranking indicates that on a state level this is also a very rare community with only 6 to 20 occurrences or less than 10,000 individuals. This very rare community has been documented in only five peninsula counties: Putnam, Marion, Lake, Volusia, and Orange. Spring run stream has been recorded more often in the panhandle and north Florida. The highest concentration of records has been in the Suwannee River drainage basin.

Ponce DeLeon Springs: The spring run was approximately 0.5 miles long and ended at Spring Garden Lake. Along the edges of the spring run there were copious amounts of emergent vegetation including cattail, many flower marsh pennywort (*Hydrocotyle umbellata*), pickerel weed (*Pontederia cordata*), bull-tongue arrowhead (*Sagittaria lancifolia*) ,and southern amaranth (*Amaranthus australis*). Three emergent exotic species (Appendix 2) were also documented: water lettuce (*Pistia stratiotes*), water-hyacinth (*Eichhornia crassipes*), and alligator weed (*Alternanthera philoxeroides*). The dominant submergent species were eel grass (*Vallisneria americana*), and coontail (*Ceratophyllum demersum*). Two submergent exotic species were recorded: Brazilian waterweed (*Egeria densa*) and parrot feather water milfoil (*Myriophyllum aquaticum*). Removal of the exotics would be beneficial to the native plants.

Gemini Springs: The spring runs for the two spring pools were flowing and relatively clear. Some algae persisted within both of their spring runs. Both runs were flanked by relatively steep banks. The natural vegetation along the banks of the spring runs indicates that a mesic hammock may have been the natural community type that surrounded these springs and their runs at one time.

Green Springs: This spring run was short and ended at a concrete pipe that was buried underground for approximately 100 feet and exited at a small stream. The substrate and detritus downstream of this outflow are coated with a white residue; this is the same white residue that was present within the spring run. Some Brazilian pepper (*Schinus terebinthifolius*) (Appendix 2) grows along the banks, and the endangered Okeechobee gourd (*Cucurbita okeechobeensis*) was found straddling the stream at the point where it flows through a culvert and into Lake Monroe. Okeechobee gourd was not found immediately around the spring pool or run.

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Appendix 1

Using a ranking system developed by the Nature Conservancy and the Natural Heritage Program Network, The Florida Natural Areas Inventory assigns two ranks to each element. The global rank is based on an element's worldwide status; the state rank is based on the status of the element in Florida. Element ranks are based on many factors, the most important ones being estimated number of Element Occurrences (EOs), estimated abundance (number of individuals for a species; area for natural communities), range, estimated adequately protected EOs, relative threat of destruction, and ecological fragility. For more information on ranks and statuses, visit our website (www.fnai.org)

FNAI GLOBAL RANK DEFINITIONS

G1 – Critically imperiled globally because of extreme rarity (5 or fewer occurrences or less 1,000 individuals) or because of extreme vulnerability to extinction due to some natural or man-made factor.
G2 – Imperiled globally because of extreme rarity (6-20 occurrences or less the 3,000 individuals) or because of vulnerability to extinction due to some natural or man-made factor.
G3 – Either very rare and local throughout its range (21-100 occurrences or less then 10,000 individuals) or found locally in a restricted range or vulnerable to extinction from other factors.
G4 – Apparently secure globally (may be rare in parts of range).
G5 - Demonstrably secure globally.
G#T# – Rank of a taxonomic subgroup such as a subgroup or variety.
G#? – Tentative rank (e.g., G2?)

FNAI STATE RANK DEFINITIONS

S1 – Critically imperiled in Florida because of extreme rarity (5 or fewer occurrences of less than 1,000 individuals) or because of extreme vulnerability to extinction due to some natural or man-made factor.
S2 – Imperiled in Florida because of rarity (6 to 20 occurrences or less than 3,000 individuals) or because of vulnerability to extinction due to some natural or man-made factors.
S3 – Either very rare or local throughout range (21-100 occurrences or less than 10,000 individuals) or found locally in a restricted range or vulnerable to extinction from other factors.
S4 – Apparently secure in Florida (may be rare in parts of range).
S5 – Demonstrably secure in Florida

FEDERAL LEGAL STATUS

Definitions derived from U.S. Endangered Species Act of 1973, Sec. 3.

LE – Legally Endangered: species in danger of extinction throughout all or a significant portion of its range.
LT – Legally Threatened: species likely to become Endangered within the foreseeable future throughout all or a significant portion of its range.

T(S/A) – Threatened due to similarity of appearance.

STATE LEGAL STATUS

LE – Legally Endangered: species, subspecies or isolated population so few or depleted in number or so restricted in range that it is in imminent danger of extinction.
LT – Legally Threatened: species, subspecies, or isolated population facing a very high risk of extinction in the future.
LS – Species of Special Concern: species, subspecies, or isolated population which is facing a moderate risk of extinction in the future.

Note: the above definitions apply to ranks and definitions of target species documented during this project or ranks and statuses commonly used. For a complete list and definitions of all ranks and statuses, visit our website www.fnai.org.

Appendix 2

List of exotic plants documented during the survey of Ponce DeLeon, Gemini, and Green springs.

	Ponce DeLeon Springs	
Latin name/common name	**FLEPPC Category***	**Location**
Alternanthera philoxeroides alligator weed	II	spring run
Begonia cucullata wax begonia	II	along small stream
Citrus spp. citrus	Not listed	along small stream
Colocasia esculenta wild taro	I	along small stream
Eichhornia crassipes water-hyacinth	I	spring run
Egeria densa Brazilian waterweed	not listed	spring run
Ficus pumila creeping fig	not listed	along old tram road/trail
Hedychium coronarium white ginger lily	not listed	along small stream
Myriophyllum aquaticum feather water milfoil	not listed	spring run
Nephrolepis cordata tuberous sword fern	I	along small stream
Pistia stratiotes water lettuce	I	spring run
Rhododendron spp. azalea	not listed	along old tram road/trail
Wedelia trilobata creeping oxeye	not listed	along old tram road/trail
Xanthosoma sagittifolium elephant ear	II	along old tram road/trail
	Gemini Springs	
Cinnamomum camphora camphor tree	I	mesic hammock
Citrus sp. citrus	not listed	mesic hammock
Dioscorea bulbifera air potato	I	mesic hammock
Sapium sebiferum Chinese tallow tree	I	mesic hammock
Urena lobata Caesar weed	II	mesic hammock

	Green Springs	
Ardisia crenata coral ardisia	I	throughout hydric hammock
Begonia cucullata wax begonia	II	scattered along creek north of culvert
Cinnamomum camphora camphor tree	I	throughout hydric hammock
Dioscorea bulbifera air potato	I	ruderal clearing south of main spring
Livistona chinensis Chinese fan palm	II	hydric hammock in southwest corner
Melia azedarach chinaberry	I	hydric hammock south of Osteen-Enterprise road
Nephrolepis cordifolia sword fan	I	southeast section of hydric hammock
Psidium guajava guava	I	northwest section of hydric hammock
Ruellia brittoniana Mexican petunia	I	banks adjacent to spring runs
Schinus terebinthifolius Brazilian pepper	I	hydric hammock along Lake Monroe and beside Osteen-Enterprise Road
Stenotaphrum secundatum St. Augustine grass	not listed	along banks adjacent to spring runs
Syngonium podophyllum arrowhead vine	I	southeast part of hydric hammock
Urena lobata Caesar weed	II	ruderal area by main spring and in clearing to the north

* = Florida Exotic Pest Plant Counsel definitions: Category I- Invasive exotics that are altering native plant communities by displacing native species, changing community structures or ecological functions, or hybridizing with natives. Category II- Invasive exotics that have increased in abundance or frequency but have not yet altered Florida plant communities to the extent shown by Category I species.

Appendix 3

Attribute Table. List of rare plants documented at Ponce DeLeon, Gemini and Green springs.

Date	Species	Common Name	Tally	Diameter (in.)	Area of Cover (ft./2)	Phenology	Distribution	Primary Disturbances	Natural Community	Site Name
4/27/2005	*Illicium parviflorum*	star anise	500	1	60000	Bud	Scattered	Trail	Hydric Hammock	DeLeon Springs State Park; Persimmon Trail
4/27/2005	*Illicium parviflorum*	star anise	500	1	40000	Bud	Scattered	Trail	Hydric Hammock	DeLeon Springs State Park; Persimmon Trail
4/27/2005	*Illicium parviflorum*	star anise	500	1	200000	Bud	Scattered	Trail	Hydric Hammock	DeLeon Springs State Park; Persimmon Trail
4/27/2005	*Illicium parviflorum*	star anise	500	1	40000	Bud	Scattered	Trail	Hydric Hammock	DeLeon Springs State Park; Persimmon Trail
4/27/2005	*Illicium parviflorum*	star anise	300	1	20000	Bud	Scattered	Trail	Hydric Hammock	DeLeon Springs State Park; Persimmon Trail
4/27/2005	*Illicium parviflorum*	star anise	500	1	10000	Bud	Scattered	Trail	Hydric Hammock	DeLeon Springs State Park; Persimmon Trail
4/27/2005	*Illicium parviflorum*	star anise	100	1	5000	Bud	Scattered	Trail	Hydric Hammock	DeLeon Springs State Park
3/31/2005	*Illicium parviflorum*	star anise	100	1	10000	Bud	Widely scattered	Land clearing, off-road trail	Hydric Hammock	DeLeon Springs State Park
3/29/2005	*Illicium parviflorum*	star anise	70	1	5000	Bud	Scattered	Urban interface, road, fence line	Hydric Hammock	DeLeon Springs State Park

3/30/2005	*Illicium parviflorum*	star anise	500	1	20000	Bud	Scattered	Trail, exotic plants (Ardisia crenata)	Hydric Hammock	DeLeon Springs State Park
5/10/2005	*Cucurbita okeechobeensis*	Okeechobee gourd	0	0	100	Fruiting	Scattered	Ditching/hydrologic, plowing mowing, road, Hurricanes 2004	Ruderal	Green Springs; south of Enterprise Rd. and north of Lake Monroe
5/10/2005	*Matelea gonocarpos*	angle pod	2	0	50	Vegetative	Single	Exotic plants, Hurricanes (2004)	Hydric Hammock	Green Springs
5/13/2005	*Sideroxylon lycioides*	gopherwood buckthorn	1	0	5	Vegetative	Single	Exotic plants, Hurricanes (2004)	Hydric Hammock	Green Springs
5/13/2005	*Sideroxylon lycioides*	gopherwood buckthorn	1	0	25	Flower/bud	Single	Exotic plants, Hurricanes (2004)	Hydric Hammock	Green Springs
5/13/2005	*Sideroxylon lycioides*	gopherwood buckthorn	3	0	100	Flower/bud	Scattered	Exotic plants, Hurricanes (2004)	Hydric Hammock	Green Springs
5/13/2005	*Sideroxylon lycioides*	gopherwood buckthorn	1	0	5	Bud	Single	Exotic plants, Hurricanes (2004)	Hydric Hammock	Green Springs
5/13/2005	*Matelea gonocarpos*	angle pod	1	0	100	Flower/bud	Single	Exotic plants, Hurricanes (2004)	Hydric Hammock	Green Springs
5/13/2005	*Matelea gonocarpos*	angle pod	1	0	50	Flower/bud	Single	Exotic plants, Hurricanes (2004)	Hydric Hammock	Green Springs
5/13/2005	*Matelea gonocarpos*	angle pod	1	0	30	Flower/bud	Single	Exotic plants, Hurricanes (2004)	Hydric Hammock	Green Springs
3/31/2005	*Sarracenia minor*	hooded pitcherplant	2	0	100	Vegetative	Scattered	Fire suppression	Dome swamp	Ponce DeLeon Springs

Appendix 4

Attribute Table. List of rare animals documented at Ponce DeLeon, Gemini and Green springs.

Date	Species	Common Name	Count	Primary Disturbance	Behavior	FNAI_Natural Community	Site
3/29/2005	*Alligator mississippiensis*	American alligator	1	boats	commuting	Spring run Stream	Gemini Springs
3/31/2005	*Alligator mississippiensis*	American alligator	2	not apparent	loafing	Spring Pool	Green Springs
3/29/2005	*Aramus guarauna*	limpkin	2	boats	foraging	Spring run Stream	Ponce DeLeon Springs
5/10/2005	*Ardea alba*	great egret	1	boats	foraging	Spring run Stream	Ponce DeLeon Springs
3/29/2005	*Egretta caerulea*	little blue heron	1	boats	foraging	Spring run Stream	Ponce DeLeon Springs
3/30/2005	*Egretta caerulea*	little blue heron	1	coliform	foraging	Reservoir	Gemini Springs
3/30/2005	*Egretta thula*	snowy egret	1	coliform	foraging	Reservoir	Gemini Springs
3/29/2005	*Pandion haliaetus*	osprey	1	not apparent	foraging	N/A	Ponce DeLeon Springs
5/11/2005	*Pandion haliaetus*	osprey	1	not apparent	nesting	Hydric Hammock	Green Springs

Appendix 5

Attribute Table. List of rare of natural communities documented at Ponce DeLeon, Gemini, and Green springs.

Survey Date	FNAI Natural Community Type	Field Description	Primary Disturbance	Site Name
3/31/2005	Dome Swamp	north of spring run	fire suppression	Ponce DeLeon Springs
5/10/2005	Dome Swamp	northwest portion of site	not apparent	Green Springs
4/27/2005	Floodplain Forest	small community north of hydric hammock	not apparent	Ponce DeLeon Springs
3/29/2005	Hydric Hammock	largest community at Ponce DeLeon Springs, north, south, and east of spring and spring run	exotic plants	Ponce DeLeon Springs
5/10/2005	Hydric Hammock	covers large area, occupies southern and north-central regions of site	exotic plants	Green Springs
3/29/2005	Mesic Hammock	covers small area, north and south of springs, and spring runs, several exotic species.	exotic plants	Gemini Springs
5/10/2005	Mesic Hammock	north of the spring, several exotic species	exotic plants	Green Springs
3/29/2005	Spring run Stream	free flowing, abundant floating and emergent vegetation	litter	Ponce DeLeon Springs
3/29/2005	Spring run Stream	free flowing, some algae and coliform	algae/coliform	Gemini Springs
3/29/2005	Spring run Stream	short run, proceeds underground through a pipe	obstructed flow	Green Springs