

***Heart Island Conservation Area  
Flagler County, Florida  
Grazing Management Plan***



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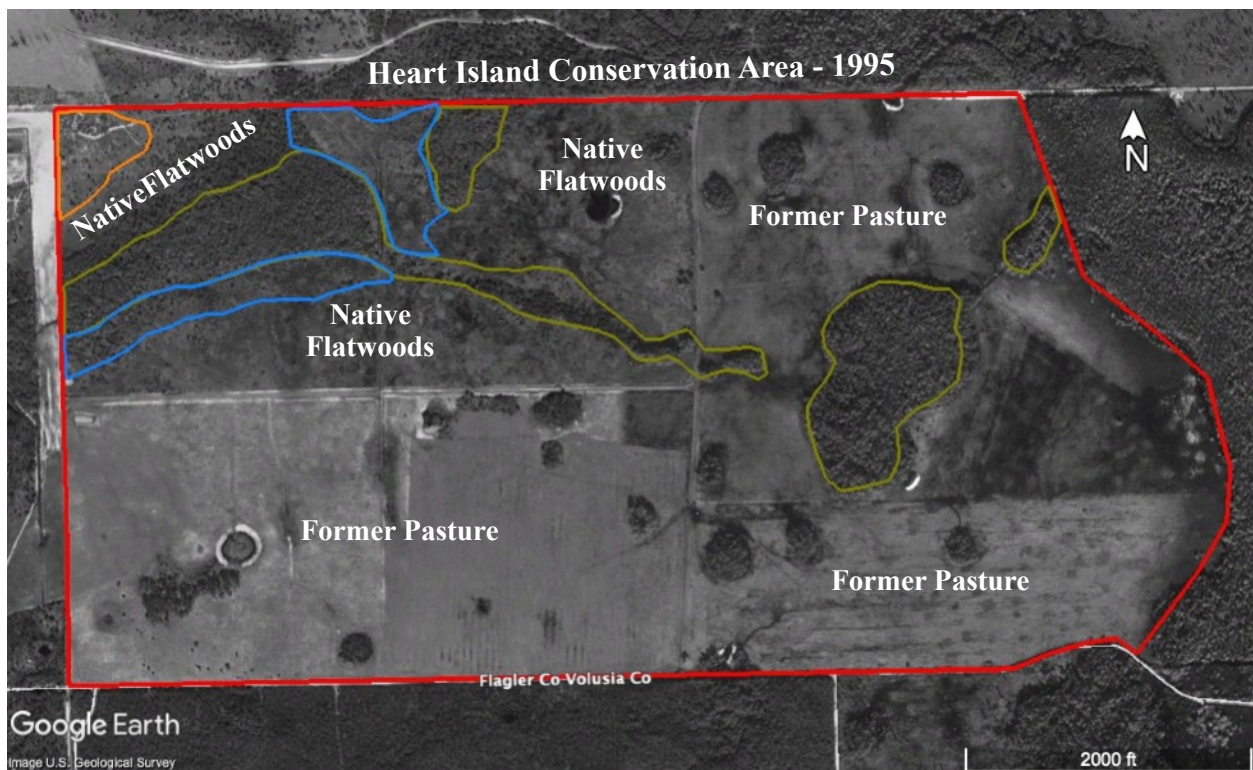
## General Property Description

The Heart Island Conservation Area is located southeast of Lake Disston along the southern boundary of Flagler County. This grazing lease consists of 690 acres of former pasture, native flatwoods, xeric - dry upland forest, hydric - wetland forest and swamp forest. Approximately 75% of Heart Island was previously planted to improved pasture, however, those areas now consist of planted slash pines at various degrees of pine density.

The ability of former pasture forages to sustain themselves under pine canopy is directly related to the amount of sunlight reaching the forest floor. In some areas where pine tree mortality is greater, considerable amounts of forage can still be found, both native and improved. In areas where pine survivability is greatest and pine needles litter the forest floor, forage production is sparse.

In the northwestern portion of the Heart Island tract, slash pines have been planted into native flatwoods. Native flatwoods are capable of producing significant amounts of desirable native forages such as lopsided indiagrass and a variety of native bluestem suitable as forage for livestock.

-  **Dry Upland Forest**
-  **Wetland Forest**
-  **Swamp Forest**



Areas of dense pines such as this have limited opportunity to produce grazable forage due to light restrictions. As trees mature we recommend selectively harvesting every 3 - 4 rows and leaving 2 rows to grow to saw or pole timber. This will optimize timber production, encourage forage yields in the space opened up from tree harvesting and improve overall wildlife habitat.



Areas of former pasture with less pine density yield adequate stands of bahiagrass along with native bluestem forages. Periodic burning combined with proper grazing management will provide excellent livestock production opportunities and enhanced wildlife habitat.



Native flatwood areas have varying amounts of pine tree density due to fire and natural mortality of trees. These native areas were never planted to pasture grasses and can be easily identified by their understory of native shrubs such as saw palmetto, gallberry, fetterbush and wax myrtle. Within these shrub dominated sites are desirable native forage grasses that will increase their yields following brush management such as roller-chopping.



Taking a closer look at the native forage grasses such as this lopsided indiagrass shows their production potential if only the presence of shrubs and pines could be reduced. This photo taken February 25, 2020 demonstrates how adapted they are to our climate yielding lush green growth during a time of the year when improved pasture species such as bahiagrass are still showing the effects of winter frosts.

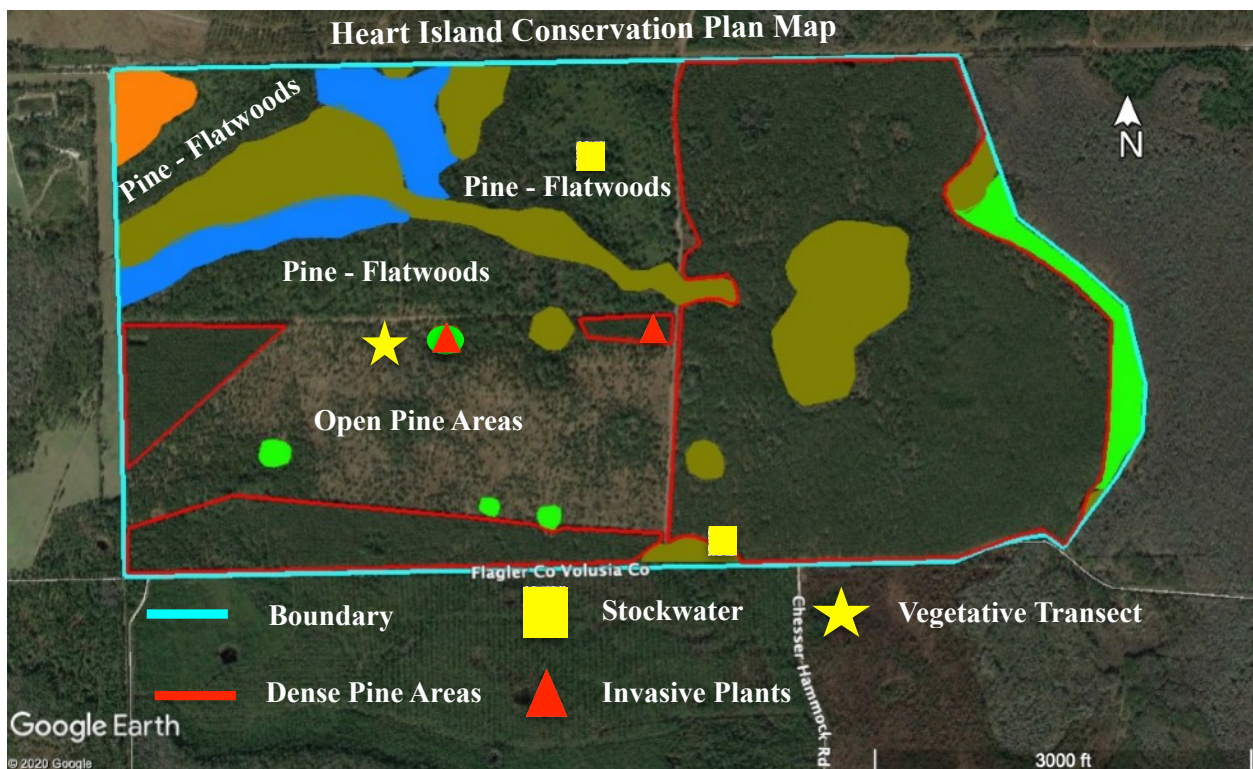


## Goals & Objectives

The objective of this grazing management plan is to provide guidance and recommendations to SJRWMD land management staff and the grazing lessee on methods and techniques that will support livestock grazing as an effective land management tool on the Heart Island Conservation Area. This grazing management plan will focus on methods, tools, and techniques that will provide a low-density livestock enterprise while supporting SJRWMD land management goals for the property.

Use of recognized grazing management principles will encourage livestock grazing as a low cost and functional land management tool. The judicious use of supporting practices such as cross-fencing, stockwater development, prescribed burning and brush/weed management will be considered where applicable. Due to the size of this land management unit, both a year-long and season-long grazing management strategy will be evaluated.

The objective of this grazing plan will be to recommend the appropriate use of existing forage resources in a manner that will meet livestock daily requirements. The ability to apply livestock grazing for the benefit of natural resource management requires having the right stock density, controlling the length of grazing duration and allowing for enough time between grazing events for recovery of key forage plants. By periodically moving portable livestock supplemental feeding stations, e.g., mineral feeders, will encourage better livestock distribution and effective grazing land management.



**To achieve land management goals & objectives the following must be accomplished:**

1. Maintain “cow-tight” boundary fences.
2. Ensure quality stockwater is available at all times.
3. Control shrubs and herbaceous weeds where needed.
4. Enhance grazing management by cross-fencing and/or movement of supplements.
5. Maintain grazing records to assist with annual grazing plan revisions.
6. Revise the annual grazing management plan in a timely manner incorporating SRJWMD management and lessee inputs.

**Soils**

Review of the county-level published soil survey for the Heart Island Conservation Area is an important part of inventorying the natural resources and for making forage production predictions. The USDA - NRCS Soil Survey recognizes 12 different soil map units within this 690 acre parcel. Soils provide valuable information pertaining to present and former natural ecological communities, their ability to growth native and domestic forages and to manage for better wildlife habitat.

In **Appendix I** of this management plan is a list of soils found on the property and their soil map symbols, soil names and native plant communities correlated to each soil. Native plant communities are divided into frequent fire/fire dependent, infrequent fire/fire sub-climax and those that experience rare or no fire/climax communities. Following this table of information is a soil map of the property.

**Grazing Management & Supporting Practices**

USDA - NRCS conservation practice Prescribed Grazing - Code 528, is the application of managing the harvesting of vegetation with grazing and/or browsing animals. This practice combined with Prescribed Burning - Code 338, Firebreak - Code 394, Brush Management - Code 314, Herbaceous Weed Control - Code 315, Fence - Code 382, Integrated Pest Management - Code 595 and Watering Facility - Code 614 should be incorporated within this grazing management plan to ensure healthy livestock, sustainable forage resources and desirable wildlife habitats.

**Fencing**

Interior cross-fencing provides the ideal method of controlling livestock grazing and allows the ranchers to graze and defer grazing as needed. Due to Florida’s poor soil nutritional qualities, a complete mineral supplement should be provided for livestock throughout the year. In lieu of crossing fencing to control livestock access, movement of mineral feeders every 1 - 2 weeks will improve livestock grazing distribution and assist the rancher in applying better grazing management. See **Appendix V** of this management plan for USDA - NRCS constructions specifications for barbwire fencing.

### **Stockwater Development**

Beef cattle consume 12 - 15 gallons of water daily for optimum performance. Having stockwater located in such a manner that will aid in livestock distribution will result in less stress on the cattle, less trailing and trampling of native vegetation and promote better forage utilization.

Livestock water is commonly provided in two ways, 1) excavate a stockwater pond or 2) install a trough and well using a submersible solar pump. Stockwater ponds when large enough can provide suitable livestock water. The minimum size of each stockwater pond should be 1/4 acre in size and a 10 foot maximum depth with one end of the pond's sides sloped at 4:1 for cattle access and the remaining three sides sloped at 2:1. Using these dimensions, approximately 2,433 cubic yards of material will be required to be excavated to create a 1/4 acre stockwater pond.

The most desirable stockwater is generated from a well and trough system. This ensures the best quality water available to livestock and minimizes livestock diseases and other pathogens. Larger troughs provide good storage and adequate linear head-space for cattle to have access to good quality water when needed. See **Appendix VI** in this management plan for more information on stockwater development alternatives.

### **Brush Management**

Native Flatwoods were naturally open savanna grasslands with low density pines scatter across the landscape. Through centuries of open-range grazing and burning followed by close uncontrolled grazing has resulted in the shrub dominated understory that characterize pine flatwood communities throughout the state today. In an effort to restore pine flatwoods to their more natural plant structure and promote plant composition dominated by desirable native grasses such as bluestems and indiagrass ranches have embraced the used of roller-choppers. A tandem set of roller-choppers large enough to deliver 1,500 pounds per linear foot will effectively reduce saw palmetto and gallberry to a desirable level and encouraging desirable native grass restoration. The objective of mechanical brush management is not shrub eradication. A good balance of shrubs, native grasses, sedges, rushes and flowering forbs plants should be the overall goal.





## Herbaceous Weeds

Herbaceous weeds observed within the Heart Island Conservation Area included, dogfennel, ragweed, cogongrass and West Indian marshgrass. Dog fennel and ragweed are common pasture weeds and will need to be monitored in the application of this grazing management plan. If needed, mechanical and/or chemical treatments should be applied where applicable. Of greater concern are the two Category I invasive species observed on the property, i.e., cogongrass and West Indian marsh grass.

Cogongrass, a native to southeast Asia is a very aggressive plant that invades mesic and xeric upland sites throughout Florida at the expense of desirable plant species. Cogongrass was observed on approximately 2 acres within planted pines making control of this species problematic. University of Florida recommendations include a combination of burning and/or mechanical treatments followed by herbicide applications on cogongrass regrowth 4 - 6 weeks post-treatment.

West Indian marsh grass is native to central and south America and produces vast amounts of biomass and seed in wetland-hydric areas. This invasive grass has become dominant on an isolated depressional marsh approximately 1 acre in size. Unlike Cogongrass, West Indian marsh grass is readily consumed by cattle as a forage source that will assist in controlling the accumulation of its biomass. However, of concern is livestock spreading seed to other wetland areas within the property and/or release of seed off-site. Control of West Indian marsh grass with chemicals is extremely difficult since desirable native species that would be the objective to promote such as maidencane are susceptible to the same herbicides.

On the Conservation Plan Map a red-triangle located at the center of the property, just west of the north/south access road indicates the location of the cogongrass colony observed, while the red-triangle west of this location describes the West Indian marsh grass site.



### Prescribed Burning

Prescribed burning is often used to reduce biomass accumulation, retard woody brush encroachment, minimize wildfire threats and to mimic natural ecological functions that fire provides to Florida’s fire-dependent ecological communities. The Heart Island Conservation Area currently applies control burns and should continue these treatments under a long-term burn management plan.

### Grazing Height Tolerances

To sustain and optimize forage species production, grazing utilization needs to be maintained within proper stubble heights or grazing tolerances of the species consumed. Following these guidelines will ensure rapid recovery and regrowth of forages following grazing periods, improved forage quality and sustain forage productivity.

<i><b>Forage Species</b></i>	<i><b>Begin Grazing</b></i>	<i><b>Begin Resting</b></i>
Bahiagrass	6 - 8 inches	2 - 3 inches
Bluestems	12 - 14 inches	6 - 8 inches
Indiangrass	12 - 14 inches	6 - 8 inches
Longleaf Woodoats	14 - 16 inches	8- 10 inches
Maidencane	24 - 26 inches	10 - 12 inches
Blue Maidencane	10 - 12 inches	4 - 6 inches

### Animal Unit Equivalents (AUE’s)

Animal Unit Equivalents are used to develop a unit of measure across multiple classes of livestock based upon the animal’s body weight. AUEs assists in preparing livestock forage inventories and estimates of livestock carrying capacity based upon the ability of each pasture to produce forage. Animal unit day (AUD), animal unit month (AUM) and animal unit year (AUY) estimates the amount of forage available to sustain a 1000 pound cow with calf-at-side for 1, 30 and 365 days respectively.

<b>Livestock Class</b>	<b>Average Weight (pounds)</b>	<b>Animal Unit Equivalent</b>	<b>Forage Consumed *</b>		
			<b>AUD</b>	<b>(Pounds) AUM</b>	<b>AUY **</b>
<b>Cow w/ calf</b>	<b>1000</b>	<b>1.0</b>	<b>26</b>	<b>790</b>	<b>9490</b>
<b>Dry Cow</b>	<b>900</b>	<b>0.9</b>	<b>24</b>	<b>730</b>	<b>8760</b>
<b>Bull</b>	<b>1500</b>	<b>1.5</b>	<b>39</b>	<b>1187</b>	<b>14,235</b>

\* Forage consumed based upon daily intake of 2.6% of livestock body weight.

\*\* AUY assumes calf-at-side is restricted to 6 months

## Livestock Forage Inventory

The livestock forage inventory estimates the current livestock carrying capacity for the Heart Island Conservation Area. In the following table the grazing lease area is described by the forage yield potential on the different plant communities/land cover categories. In columns 3, 4 and 5 are carrying capacity estimates in acres per animal unit (Ac./AU), animal unit months (AUMs) and total animal units (AU's), or the total number of livestock estimated that can be supported on the property over a 12 month period.

Heart Island Conservation Area	Acres	Ac/AU	AUMs	Total AUs
Dense Pine Areas	292.5	40	88	
Open Pine Areas	123.7	15	99	
Pine Flatwoods	146.3	20	88	
Marsh	14.1	12	14	24
Xeric Forest	7.0	35	2	
Hydric Forest	26.0	0	0	
Swamp Forest	80.4	0	0	
<b>Total</b>	<b>690</b>		<b>291</b>	

## Annual Grazing Plan

Livestock forages, both native and introduced provide the essential resources critical to the health and productivity of livestock. The interaction of the cattle upon the landscape, i.e., grazing, trampling, trailing, controlling of invasive plant species and cycling of nutrients contribute greatly to the health and ecological functions of the property. The goal of this annual grazing plan is to improve the forage resource base while benefiting wildlife habitat values.

The following grazing schedule provides a guide to the lessee to manage livestock within the estimated carrying capacity and to provide strategic rest-periods or deferments to ensure adequate recovery of forage species.

To assist the rancher to meet land management goals and objectives, adjustments to the livestock forage inventory and this grazing management plan should be done annually based upon forage utilization monitoring and grazing records kept by the lessee. See **Appendix III** in this management plan for more information on creating grazing management records and use of the USDA-NRCS form developed for collecting this information.

## Annual Grazing Schedule

Pasture	Acres	AUM	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<b>Alternative 1</b> 12 Month Grazing Plan	690	291	<b>Year-Long Grazing - Herd Size = 24 Animal Units</b>											
<b>Alternative 2</b> Dormant Season Grazing Plan	690	534	<b>Grazing Period 48 Animal Units</b>									<b>Grazing Period 48 Animal Units</b>		
<b>Alternative 3</b> Growing Season Grazing Plan	690	534					<b>Grazing Period 48 Animal Units</b>							
* Supplements	X - Protein Y - Mineral H - Hay		X Y H	X Y H	X Y H	X Y H	Y Y H	Y	Y	Y	Y	Y	X Y	X Y

G = Grazing Periods

\* Recommended livestock supplements

The annual schedule provide above describes three independent alternatives for applying grazing management to the Heart Island Conservation Area.

### Alternative 1:

12 Month Year-Long Grazing Plan incorporates the estimated annual forage productivity to support the livestock herd throughout 12 months of grazing.

### Alternative 2:

Dormant Season Grazing Plan incorporates the year-long forage accumulation for a 6 month grazing duration starting in October through March.

### Alternative 3:

Growing Season Grazing Plan incorporates pervious year's roughage with new forage growth produced during the active growing season from May through October.

Adherence to grazing tolerances to ensure key forage species are not over grazed is extremely important. One method to achieve better grazing distribution and to avoid over-grazing key forage species without interior cross-fencing is to rotate supplemental feeding station, e.g., hay, protein, or a well balanced mineral throughout the grazing season. Consequences of weather, markets and other unexpected factors may cause the lessee to deviate from the grazing schedule for short periods of time. However, the overall concept of applied grazing management by providing key deferment periods to promote desirable grassland health and vigor should always be part of the overall management philosophy.

## Monitoring Plan

Evaluation of this annual grazing management plan should be performed in coordination with the lessee and SJRWMD land management staff. This evaluation should be conducted following the completion of the winter dormant season prior to the on-set of the spring/summer growing season. Evaluations should focus on total animal units days grazed, condition and trends of key forage resources, grazing use intensity and other issues pertinent to the management of livestock on the property.



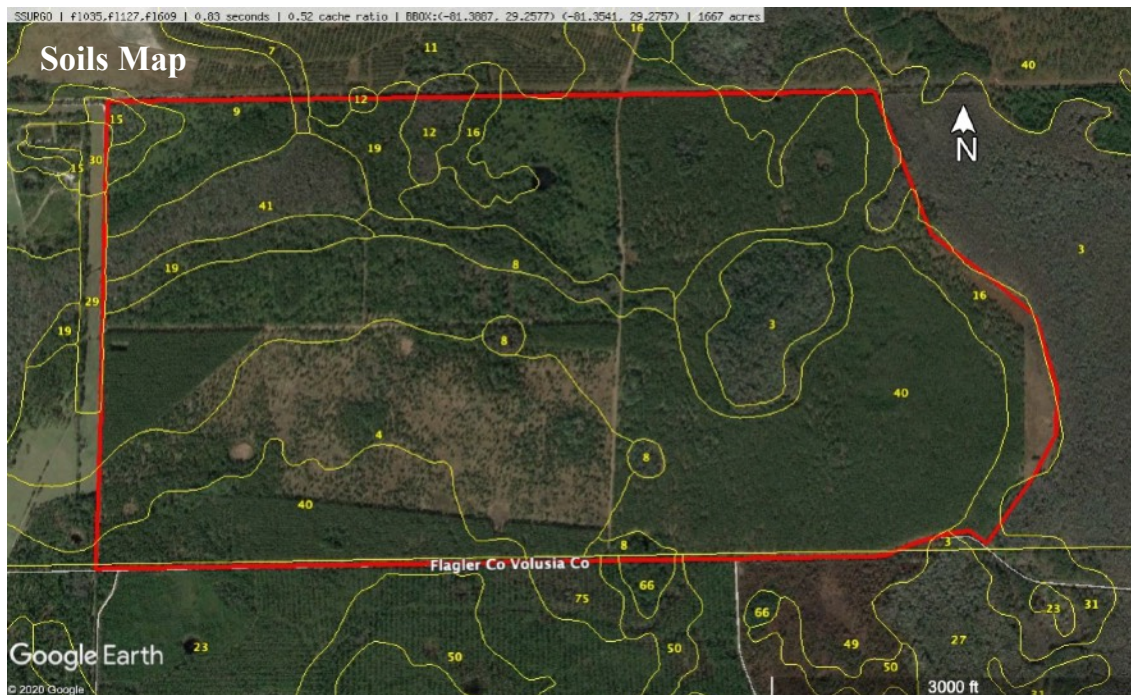
A vegetative transect was established in an areas of former pasture land planted to pine characterized as “open pine areas”, see Conservation Plan Map for specific location. On this transect we found the following composition of ground vegetation along a 50 meter transect. It was encouraging that we observed a dominance of forages such as bahiagrass still present on the site. Also, of importance was the natural recruitment of desirable native grasses such as the bluestems and blue maidencane.

Bahiagrass	74%
Purple Bluestem	8%
Broomsedge Bluestem	2%
Blue Maidencane	6%
Sedge Species	4%
Rush Species	2%
Blackberry	2%
Sensitive Briar	2%

To further assist in evaluating the effects of livestock grazing on desirable forages and the ecological health of the conservation area, vegetative transects should be established to monitor the intensity of forage utilization, the condition and trends of native forages and other important native plant species. See **Appendix IV** within this management plan for more details on monitoring methods and techniques.

## Appendix I: Soils

Soil Map Symbol	Soil Map Name	Fire Dependent (Frequent Fire)	Fire Sub-Climax (Infrequent Fire)	Climax (Rare or No Fire)
3	Samsula & Hontoon, dep.	Marsh	Cypress Swamp	Swamp Forest
4	Wabasso fine sand	Mesic Flatwoods	Mixed Pine/Mesic Hardwoods	Mesic Hardwoods
7	Favoretta, Chobee & Winder, Freq. Flooded	Wet Flatwoods	Mixed Pine/Hydric Forest	Hydric Forest
8	Hicoria, Riviera & Gator, dep.	Marsh	Cypress Swamp	Swamp Forest
9	Eau Gallie fine sand	Mesic Flatwoods	Mixed Pine/Mesic Hardwoods	Mesic Hardwoods
12	Placid, Basinger & St. Johns, dep.	Marsh	Cypress Swamp	Swamp Forest
15	Pomello fine sand	Scrubby Flatwoods	Mixed Pine/Xeric Forest	Xeric Forest
16	Malabar fine sand	Mesic Flatwoods	Mixed Pine/Mesic Hardwoods	Mesic Hardwoods
19	Valkaria fine sand	Wet Prairie	Mixed Pine/Hydric Forest	Hydric Forest
27	Cassia fine sand	Scrubby Flatwoods	Mixed Pine/Xeric Forest	Xeric Forest
40	Pomona fine sand	Mesic Flatwoods	Mixed Pine/Mesic Hardwoods	Mesic Hardwoods
41	Terra Ceia Muck, Freq. Flooded	Floodplain Marsh	Cypress Swamp	Hardwood Swamp



## **Appendix II: Grazing Land Resources & Natural Ecological Communities**

**Plant Pine / Bahiagrass Pasture** - Approximately 60% of the Heart Island Conservation Area is composed of planted slash pine on a 6' X 8' spacing. In areas referred to as "open pine areas" that have become more open due to fire, natural pine mortality or for other reasons, greater sunlight striking the forest floor has sustained considerable amount of the former bahiagrass pasture, a non-native warm-season perennial forage species. Bahiagrass along with natural recruitment of desirable native grasses such as indiagrass, bluestems and longleaf woodoats (*Chasmanthium laxum var. sessiliflorum*) contribute to the overall carrying capacity. When forest canopies exceed 60%, little to no forage production can be expected and this can be observed in many areas throughout the property referred to as "dense pine areas."

**Pine / Flatwoods** - Approximately 21% of the conservation area is composed of planned slash pine on a 6' X 8' spacing into native flatwoods. The understory of the areas varies from saw palmetto to gallberry and varies of other native species that have sustained their presence. This former open forest / graminoid dominated savanna plant community has become shrub dominated. Opening the forest canopy and implementing brush management would simulate the former native grasses in these areas.

**Marshes** - are found in isolated depressions throughout the conservation area. These areas under natural conditions are dominated by maidencane, a predominant native forage resource along with other desirable wetland species. As noted within this plan, one depressional marsh area has become dominated by West Indian marsh grass, a category I invasive species.

**Xeric Forest** - Are located on the higher position soils and are restricted to the very northwest corner of the conservation area. Depending on the frequency of fire, these areas are characterized as scrubby flatwood to sites dominated by sand live oak, bluejack oak, longleaf pine and sand pine.

**Hydric Forest** - These native wetland forested communities are dominated by hardwood species such as swamp laurel oak, live oak, water oak, sweet gum, sweetbay magnolia, red cedar, cabbage palm and a variety of shrubs and ground vegetation tolerant of hydric soil conditions and occasional inundation. These forest plant communities provide excellent habitat and mast production supporting a variety of important wildlife species such as turkey, deer and important predator species. These areas provide little to no grazing value due to their dense forest canopy.

**Swamp Forest** - These seasonally to year-long inundated forested wetlands when not disturbed by fire, wind damage or other disturbances are typically occupied by climax forest species with little to no ground cover. The forest community is commonly dominated by cypress, red maple, pop ash, bay trees, and swamp dogwood. Sites that experience a rare fire are often dominated by cypress, however, as fire frequency lessens, hardwood species become dominant.

### Appendix III: Grazing Records

It is recommended that the lessee use the USDA-NRCS FL-ECS-3 form for keeping grazing records. Animal Unit Day information can be analyzed to determine if modifications are needed to make adjustment to the annual grazing plan.

U.S. Department of Agriculture  
Natural Resources Conservation Service

FL-ECS-3  
9/2000

#### RANGELAND AND PASTURELAND STOCKING ASSESSMENT RECORDS

PASTURE NO. : \_\_\_\_\_ ACRES: \_\_\_\_\_ YEAR: \_\_\_\_\_

1. Date In: _____ Date Out: _____ Animal Units: _____ Animal Unit Days _____	8. Date In _____ Date Out _____ Animal Units _____ Animal Unit Days _____
2. Date In _____ Date Out _____ Animal Units _____ Animal Unit Days _____	9. Date In _____ Date Out _____ Animal Units _____ Animal Unit Days _____
3. Date In _____ Date Out _____ Animal Units _____ Animal Unit Days _____	10. Date In _____ Date Out _____ Animal Units _____ Animal Unit Days _____
4. Date In _____ Date Out _____ Animal Units _____ Animal Unit Days _____	11. Date In _____ Date Out _____ Animal Units _____ Animal Unit Days _____
5. Date In _____ Date Out _____ Animal Units _____ Animal Unit Days _____	12. _____ Date Out _____ Animal Units _____ Animal Unit Days _____
6. Date In _____ Date Out _____ Animal Units _____ Animal Unit Days _____	13. Date In _____ Date Out _____ Animal Units _____ Animal Unit Days _____
7. Date In _____ Date Out _____ Animal Units _____ Animal Unit Days _____	14. Date In _____ Date Out _____ Animal Units _____ Animal Unit Days _____

Animal Unit Days (AUD) = No. Days x Animal Units

TOTAL AUD(s): \_\_\_\_\_

Animal Units Month(s) (AUM) =  $\frac{\text{AUD(s)}}{30(\text{days})}$

TOTAL AUM(s) \_\_\_\_\_

AUM(s) per Acre =  $\frac{\text{Total AUM(s)}}{\text{No. Acres}}$

AUM(s) per Acre \_\_\_\_\_

Dates and Amounts of Fertilizer: \_\_\_\_\_

Date of: First Frost: \_\_\_\_\_ Last Frost \_\_\_\_\_

Monthly Rainfall: J : \_\_\_\_\_ F \_\_\_\_\_ M \_\_\_\_\_ A \_\_\_\_\_ M \_\_\_\_\_ J \_\_\_\_\_ J \_\_\_\_\_ A \_\_\_\_\_ S \_\_\_\_\_ O \_\_\_\_\_ N \_\_\_\_\_ D \_\_\_\_\_

Yearly Rainfall Total \_\_\_\_\_



## Appendix IV: Monitoring Plan

**Vegetative Transects:** A T-Post is placed in the ground to establish a permanent reference point. From the T-Post a line intercept transect is established for 50 - 100 meters depending on the site location. At 1 - 2 meter intervals, the nearest rooted plant is tallied to assess the plant composition of the pasture. Ideal times to collect this information is just prior to the initiation of grazing and immediately following a grazing event.

**Grazing Utilization:** Grazing enclosure cages provide an opportunity to evaluate the forage utilization levels by the livestock. Once cattle have entered the tract, periodically monitoring grazing enclosure cages during the grazing season will assist in recognizing areas that are being over-grazed and under utilized. Moving mineral feeders or other supplements to under utilized area will improve animal performance and the overall carrying capacity of the conservation area.

Cages need to be placed over good examples of desirable forage species. During the evaluation process, compare forage species within the enclosure cage to grazed forage of the same species outside the cage. The percent difference in plant height or weight of the vegetation outside the cage compared to forage inside the cage provides an estimate of the forage utilization by the livestock. The rule-thumb for proper grazing utilization is to never graze more than 50% of the available forage by weight. Ensuring enough leaf-area remains following grazing is critical to support rapid regrowth of forages and to maintain a strong plant vigor of desirable forage plants.

Below is a grazing enclosure cage design that has worked well in Florida to determine forage utilization rates on grazed pasture and rangelands.



## Appendix V: Barbwire Fence Guidance

**This information should be used as guidance or for reference purposes, unless USDA-NRCS cost-sharing is a consideration. Please refer to SJRWMD performance measures and construction specifications for all practices under consideration.**

This sheet lists the minimum requirements to meet Florida Fence Standard (FL 382) for barbwire fence *if USDA Food Security Act costing-sharing is a consideration*. Variances in fence design may be allowed if requested. All variances requests shall be submitted to the State Rangeland Management Specialist or an individual with proper job approval authority for approval. All barbed wire fences will be installed using braces that meet Florida NRCS specifications for braces. Please note, SJRWMD may have standards that exceed the following.

### Wire and Spacing

Use only new wire composed of two twisted strands of minimum class 3 galvanized 15.5 gauge high tensile steel barbwire.

### Number of Wires

Interior cross fence - 3 wires (minimum) to manage movement of larger livestock such as cattle and horses.

Boundary fence - 4 wire (minimum) are required for boundary fences and next to highways.

### Fence and Wire Height and Placement

Cattle and Horses-

- The minimum top wire height for 4 and 5 wire fences is 42 inches above ground level.
- The minimum top wire height for 3 wire fences is 38 inches above ground level.
- Install wires with a minimum of 10-12 inches spacing between the top 2 wires.

Note: Inline fence wire spacing shown below are recommendations only.

WIRE HEIGHT AND SPACING OF WIRES IN INCHES (“)			
Number of Line Wires	5 Strand	4 Strand	3 Strand
Boundary Fence Top Wire Height (minimum)	46	46	<b>Not Acceptable</b>
Boundary Fence Bottom Wire Height (minimum)	6	12	<b>Not Acceptable</b>
Recommended Inline Fence Wire Spacing (inches)			
Cattle and Horses	6, 16, 26, 36, 46	16, 26, 32, 44	16, 26, 38
To Allow For Wildlife Movement	<b>Not recommended</b>	18, 24, 30, 42	18, 26, 38

## LINE POSTS MATERIALS, POST SPACING AND INSTALIATION DEPTH

- **Steel** - Use only new, painted or galvanized T or U posts.
- **Wood**- Treated with 0.4 lbs/ft<sup>3</sup> of chromate copper arsenate (CCA type A, B or C or equivalent). Minimum size, 3" top-diameter X 6.5' length.
- **Post Spacing** - The maximum distance between line posts is 16 feet without the use of stays, or 30 ft. with a minimum of 1 stay between posts.
- **Installation** - Drive or bury wood posts at least 24 inches into the ground in sandy or loamy soils. Install posts to a 42 inch depth in muck soils. If post holes are dug, backfill by tamping the soil around the post at every 4 in. depth.
- **Fastening** - Attach wires to the side of the post receiving the most livestock pressure. Drive staple diagonally to the wood's grain and at a slight downward angle (upward if the pull is up) such as in low places to avoid splitting posts and loosening of staples. Space should be left between staple and post to permit free movement of wire.
- **Wood posts** - Use 1.5 inch (minimum), 9 gauge (minimum), class 3 galvanized staples.
- **Steel posts** - Use manufactured clips or wire posts.

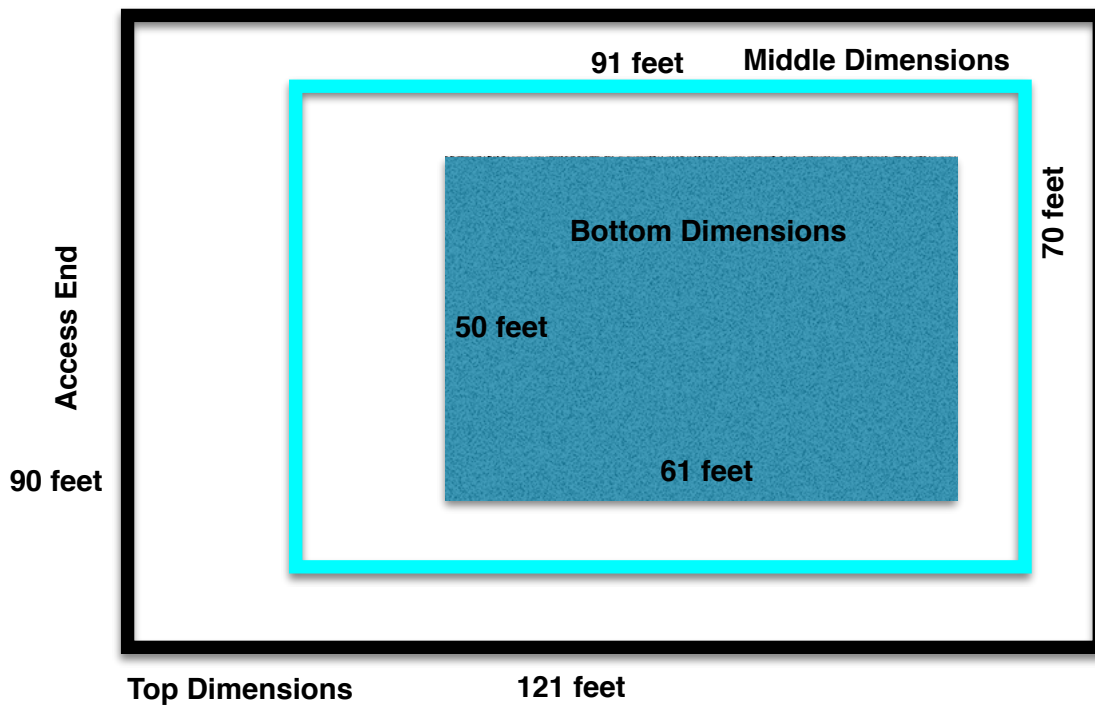
## Appendix VI - Stockwater Development Alternatives

### Stock Pond Design (1/4 Acre)

Access end sloped 4:1

Other sides sloped 2:1

Total volume excavated: 2,433 yds<sup>3</sup>



### Solar Stockwater Systems

Solar stockwater systems with large troughs positioned on a level, solid foundation provides the best quality water for livestock. Solar submersible pumps are cost-effective and can deliver water from shallow wells.

Automatic shutoff valves maintain desired water levels in the trough while keeping water readily available for the animals. Having an overflow outlet directing water away from the trough and its foundation is important to minimize washouts around the trough and its base.

