Appendix D

Natural Communities

Appendix D: Natural Communities

D.1. Cape Canaveral Air Force Station (CCAFS) Natural Communities

Thirteen natural communities, as defined by the *Guide to the Natural Communities of Florida* (FNAI 2010) have been mapped and described during a site survey conducted in 2009 by FNAI within CCAFS (Gulledge et al. 2009).The identified community types and associated acreage are reflected below:

- Beach Dune (acreage not available)
- Coastal Grassland (included in Coastal Strand acreage)
- Coastal Strand (1,728 acres)
- Basin Marsh (75 acres)
- Coastal Interdunal Swale (142 acres)
- Maritime Hammock (2,291 acres)
- Live Oak/Saw Palmetto Hammock (1,237 acres)
- Live Oak/Saw Palmetto Shrubland (1,477 acres)
- Xeric Hammock (556 acres)
- Scrub (1,083 acres)
- Tropical Hammock (113 acres)
- Hydric Hammock (9 acres)
- Mangrove or Exotics (901 acres)

Beach Dune, Coastal Grassland, Coastal Strand, Coastal Interdunal Swale, Maritime Hammock, Xeric Hammock, Scrub, Estuarine Tidal Swamp/Marsh, and Shell Mound were communities that were identified within CCAFS during a previous study (unknown source) and discussed in the 2008 Integrated Natural Resource Management Plan (INRMP); acreage for these communities was not available.

The topographic position of natural communities on CCAFS reflects the various erosional and depositional processes of coastal land formation. Generally, older communities are found on the westward margin of the Canaveral Peninsula, along the Banana River; newer and successional communities are forming along the eastern coast.

The natural communities of CCAFS identified by FNAI in 2009 (Gulledge et al. 2009) and identified during a previous study are described below in the general order of the zones they occupy, from east to west. In this Appendix D, information from the Gulledge et al. 2009 survey and a previous study conducted prior to 2009 (unknown source) are combined below for the commonly identified communities.

D.1.1. Beach Dune

Of all the community types on CCAFS, the upland beach dune receives the most direct influence from primary environmental forces of water and wind. Dunes are highly unstable and dynamic communities. Two beaches on CCAFS are prograding, defined as the seaward growth of a beach by progressive deposition of sediment by rivers or shoreline processes. False Cape at the north end of CCAFS has increased approximately 0.1 mile since 1847; Cape Canaveral is also prograding as demonstrated by several parallel lines of dunes and by conspicuous offshore sand bars (Johnson and Barbour 1990). Other beach areas are eroding, with sands being deposited offshore or down shore.

The natural beach dune community within CCAFS is bounded to the east by the Atlantic Ocean. It then grades inland to coastal grassland or coastal strand communities (Gulledge et al 2009). Where the dunes are low or dissected, and storm overwash is frequent, coastal grassland has developed in flat areas directly behind the dunes. In higher or more stable areas, beach dune may grade directly into shrub dominated coastal strand (unknown source).

Beach dune is a predominantly herbaceous community of coastal specialist plants on the vegetated upper beach and first dune above the beach (foredune). Plant species in a beach dune community must be able to tolerate a constantly shifting substrate, salt deposition, and abrasion from wind-blown sands. The plants must be able to withstand the stress of the environment, or re-colonize rapidly. Typical species observed in CCAFS beach dunes included sea oats (*Uniola paniculata*), marsh elder (*Iva frutescens*), railroad vine (*Ipomoea pes-caprae*), beach croton (*Croton punctatus*), bitter panic grass (*Panicum amarum*), salt grass (*Distichlis spicata*), camphorweed (*Heterotheca subaxillaris*), and beach cordgrass (*Spartina patens*) (Gulledge et al. 2009). Additional plant species observed during a previous survey include coastal vervain (*Glandularia maritima*), beach star (*Remirea maritima*), and sea lavender (*Tournefortia gnaphalodes*).

A list of plant species observed in beach dune, coastal grassland, and coastal strand communities within CCAFS can be found in Table D-1.

D.1.2. Coastal Grassland

Coastal grassland is an upland community that occupies the drier portions of the transition zone between beach dunes on the immediate coast and more inland communities that are dominated by woody species, such as coastal strand or maritime hammock (Gulledge et al. 2009). It occurs in two types of situations: on relatively young deposits of sand on prograding beaches, and in low areas where saltwater overwash has killed woody strand vegetation. Inland, coastal grassland is bordered by coastal strand or coastal oak scrub, both of which develop on older sand deposits protected from frequent disturbance. In the absence of storm overwash or other disturbance, grassland will be colonized by woody species and eventually succeed into scrub or strand. According to Johnson and Muller (1993), this community is present only on prograding beaches, primarily on the northern Florida coast.

Coastal grassland occurs infrequently in this area of Florida due to a general lack of prograding coastline. Coastal grassland supports a high diversity of plant and animals, including some of the rare species found on CCAFS. Gopher tortoise (*Gopherus polyphemus*), southeastern

beach mouse (*Peromyscus polionotus niveiventris*), deer (*Odocoileusvirginianus*), and raccoons (*Procyon lotor*) are just a few of the wildlife species that inhabit coastal grassland. Least terns and black skimmers may nest in the transition zone between beach dune and coastal grassland if the vegetation is sparse (unknown source). See Appendix C for more on threatened and endangered species on 45 SW properties.

In areas where the beach dunes are low or dissected (primarily in the southern end of CCAFS), coastal grassland communities have grown in flat areas directly behind the dunes. Grasses and other herbaceous species are the predominant vegetation. The most frequently observed grasses were muhly grass (*Muhlenbergia capillaris*), sea oats, beach cordgrass, and sandspur (*Cenchrus* spp.) (Gulledge et al. 2009). Other identified species included beach sunflower (*Helianthus debilis* ssp. *debilis*), camphorweed, partridge-pea (*Chamaecrista fasciculata*), beach croton, railroad vine, and seaside bean (*Canavalia rosea*). Although herbaceous species represented the greater areal coverage, woody species were also observed, scattered throughout the coastal grassland community: varnish leaf (*Dodonaea viscosa*), wax myrtle (*Myrica cerifera*), and saw palmetto (*Serenoa repens*) (Gulledge et al. 2009). An additional plant species was observed in the coastal grassland community within CCAFS during a survey conducted prior to 2009: broad-leaved spiderlily (*Hymenocallis latifolia*) (unknown source).

A list of plant species observed in Beach Dune, Coastal Grassland, and Coastal Strand communities within CCAFS can be found in Table D-1.

D.1.3. Coastal Strand

Coastal strand is an upland evergreen shrub community growing on stabilized coastal dunes in the peninsula of Florida, often with a smooth canopy due to pruning by salt spray (Gulledge et al. 2009). This community develops in the absence of natural disturbance on somewhat older deposits of sand, inland of beach or coastal grassland. It is a dense, shrub-dominated community that grades landward into scrub or maritime hammock. The most distinctive feature of coastal strand is the wedge-shaped profile of its low canopy, which is constantly pruned and shaped by wind-born salt spray. Coastal strand forms a dense thicket of shrubs, but in the case of broad barrier islands or prograding coasts, the coastal strand may be patchy areas within the coastal grassland community.The estimated area of the coastal strand community within CCAFS is 1,728 acres (Gulledge et al. 2009).

Coastal strand within CCAFS was observed as a dense thicket of shrubs, usually dominated by saw palmetto and sea grape (*Coccoloba uvifera*) in the area nearest to the coast (Gulledge et al. 2009). Live oak (*Quercus virginiana*), tough bully (*Sideroxylon tenax*), and red bay (*Persea borbonia*) were observed further inland. Other species observed within the coastal strand included groundsel tree (*Baccharis halimifolia*), swampprivet (*Forestiera segregata*), Simpson's stopper (*Myrcianthes fragrans*), wax myrtle, Hercules club (*Zanthoxylum clava-herculis*), and the invasive exotic Brazilian pepper (*Schinus terebinthifolius*) (Gulledge et al. 2009). The earleaf greenbrier (*Smilax auriculata*) and muscadine grape (*Vitis rotundifolia*) vines may be locally abundant (Gulledge et al. 2009).A list of plant species identified in beach dune, coastal grassland, and coastal strand communities within CCAFS can be found in Table D-1.

Table D-1. Plant Species Observed in Beach Dune, Coastal Grassland, and Coastal Strand Communities within CCAFS (Gulledge et al. 2009) (page 1 of 2)

Scientific Name	Common Name	Protected [a]	Invasive [b]
Ambrosia artemisiifolia	common ragweed		
Ampelopsis arborea	peppervine		
Andropogon glomeratus	bushy bluestem		
Andropogon virginicus	broomsedge bluestem		
Baccharis halimifolia	groundsel tree		
Bidens alba var. *radiata*	beggarticks		
Callicarpa americana	American beautyberry		
Canavalia rosea	beach bean		
Catharanthus roseus	Madagascar periwinkle		
Chiococca alba	snowberry		
Coccoloba uvifera	sea grape		
Crotalaria pumila [c]	rattlepod		
Cyperus sp.	flatsedge		
Dodonaea viscosa	varnishleaf/hopbush	SE	
Erythrina herbacea	coralbean		
Eupatorium capillifolium	dogfennel		
Eupatorium serotinum	late flowering thoroughwort		
Eustachys petraea	pinewoods fingergrass		
Forestiera segregata	Florida swampprivet		
Forestiera sp.	swampprivet		
Galactia sp.	milkpea		
Gaura angustifolia	southern beeblossom		
Glandularia maritima	coastal vervain	SE	
Helianthus debilis	beach sunflower		
Hymenocallis latifolia [c]	broad-leaved spiderlily		
Iresine diffusa	Juba's bush		
Lantana depressa var. *floridana*	Atlantic Coast Florida lantana	SE	
Lantana sp.	lantana		
Licania michauxii	gopher apple		
Melinis repens	natal grass		I
Mentzelia floridana	poorman's patch		
Mikania cordifolia	Florida Keys hempvine		
Momordica charantia	balsampear		II
Muhlenbergia capillaris	hairawn muhly		
Myrcianthes fragrans	Simpson's stopper	ST	
Myrica cerifera	wax myrtle		
Opuntia humifusa	pricklypear		
Opuntia stricta	erect pricklypear	ST	
Passiflora incarnata	purple passion-flower		
Persea borbonia	red bay		
Phaseolus polystachios	thicket bean		
Phyllanthus abnormis	Drummond's leaf-flower		
Physalis walteri	Elliot's sticky groundcherry		
Psychotria nervosa	wild coffee		
Quercus myrtifolia	myrtle oak		
Quercus virginiana	live oak		
Rapanea punctata	myrsine		
Remirea maritima [c]	beach star		
Rhus copallinum	winged sumac		

Table D-1. Plant Species Observed in Beach Dune, Coastal Grassland, and Coastal Strand Communities within CCAFS (Gulledge et al. 2009) (page 2 of 2)

Scientific Name	Common Name	Protected (a)	Invasive (b)
Sabal palmetto	cabbage palm		
Schinus terebinthifolius	Brazilian pepper		I
Schizachyrium maritimum	Gulf bluestem		
Schizachyrium scoparium	little bluestem		
Serenoa repens	saw palmetto		
Sideroxylon tenax	tough bully		
Smilax auriculata	earleaf greenbrier		
Solanum erianthum	potatotree		
Solidago odora	sweet goldenrod		
Solidago odora var. chapmanii	Chapman's goldenrod		
Spartina patens	saltmeadow cordgrass		
Tillandsia recurvata	ballmoss		
Tillandsia usneoides	Spanish moss		
Tournefortia gnaphalodes (c)	sea lavendar		
Toxicodendron radicans	eastern poison ivy		
Trichostema dichotomum	forked bluecurls		
Uniola paniculata	sea oats		
Verbesina virginica	white crownbeard		
Vigna luteola	hairypod cowpea		
Vitis rotundifolia	muscadine grape		
Vitis shuttleworthii	calloose grape		
Ximenia americana	hog plum		
Zanthoxylum clava-herculis	Hercules club		

Source: Gulledge et al. 2009; USDA 2014; FLEPPC 2013

(a) Protected: ST = State Threatened; SE = State Endangered

(b) Florida Exotic Pest Plant Council (FLEPPC, 2013) Ranking:
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.

(c) Although species was not observed during the 2009 FNAI survey, this species was previously observed within beach communities of CCAFS.

Rare animal species previously documented in the CCAFS beach dune community include:

- Southeastern beach mouse inhabits beach dunes and adjacent communities (state and federal threatened species) (Oddy et al. 2012).
- Least tern (*Sterna antillarum*) colony nests on CCAFS beaches (state threatened species) (SpecPro 2007).
- Black skimmers (*Rynchops niger*) have been documented nesting on the beach (state Species of Special Concern) (SpecPro 2007).

And three sea turtles documented as nesting on CCAFS beaches include:

- Atlantic green turtle (*Chelonia mydas*) (state and federal endangered species),
- Atlantic loggerhead turtle (*Caretta caretta*) (state and federal threatened species), and
- Leatherback turtle (*Dermochelys coriacea*) (state and federal endangered species) (USAF 2013).

Gopher tortoise, southeastern beach mouse, deer, and raccoons are just a few of the wildlife species that inhabit the coastal grassland. Least terns and black skimmers may nest in the transition zone between beach dune and coastal grassland if the vegetation is sparse (unknown source). The Florida scrub-jay (*Aphelocoma coerulescens*) and Florida mouse (*Podomys floridanus*) have been observed in coastal strand at CCAFS, and gopher tortoise burrows are common in clearings in the strand (unknown source). Threatened and endangered plant and animal species are discussed in greater detail in Appendix C of this INRMP.

D.1.4. Basin Marsh

Basin marsh is a freshwater herbaceous marsh that is regularly inundated. The basin marsh is typically not small, nor is it found in shallow inclusions within a fire-maintained community. Vegetation in basin marsh typically occurs in zones from deepest to shallowest water: submerged, floating leaved, emergent, and grassy species. Patches of shrub may occur in any of the zones. Characteristic plant species of a basin marsh include Jamaican sawgrass (*Cladium jamaicense*), sand cordgrass (*Spartina bakeri*), American white waterlily (*Nymphaea odorata*), maidencane (*Panicum hemitomon*), pickerelweed (*Pontederia cordata*), and bulltongue arrowhead (*Sagittaria lancifolia*), giant leather fern (*Acrostichum danaeifolium*), and lemon bacopa (*Bacopa caroliniana)* (FNAI 2010).

The estimated area of the basin marsh community within CCAFS is 75 acres and was documented in the eastern portion of CCAFS (Gulledge et al. 2009). Based on the size, depth, shape, and the possibility that the water body was spring-fed, it was classified as a basin marsh. This basin marsh has been adversely impacted by construction of space launch complexes, roads, fire suppression, canals, and the presence of Brazilian pepper. In the more natural sections, notable species included the tall shrub coastalplain willow (*Salix caroliniana*) growing over Jamaican sawgrass, sand cordgrass, giant leather fern, and herb-of-grace (*Bacopa monnieri*). Table D-2 identifies species observed in this basin marsh community. No threatened and endangered species were observed in this community (Gulledge et al. 2009). A complete list of plant species observed in the basin marsh community is presented in Table D-2.

Table D-2. Plant Species Observed in Basin Marsh Community within CCAFS (Gulledge et al. 2009)

Scientific Name	Common Name	Protected (a)	Invasive (b)
Acrostichum danaeifolium	giant leather fern		
Bacopa monnieri	herb-of-grace		
Calystegia sepium ssp. limnophila	hedge false bindweed		
Cladium jamaicense	Jamaican sawgrass		
Salix caroliniana	coastalplain willow		
Sarcostemma clausum	white twinevine		
Schinus terebinthifolius	Brazilian pepper		I
Spartina bakeri	cordgrass		

Source: Gulledge et al. 2009; FLEPPC 2013

(a) Protected: ST = State Threatened; SE = State Endangered

(b) Florida Exotic Pest Plant Council (FLEPPC, 2013) Ranking:
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.

D.1.5. Coastal Interdunal Swale

The coastal interdunal swale is a freshwater wetland community that forms in linear depressions found between successive dune ridges such as sandy barrier islands, capes, or beach plains and may take the form of a marsh, damp flats, moist grasslands, or dense shrubs. The predominant vegetative species can vary depending on local hydrology, substrate, and the age of the swale (FNAI 2010). The estimated area of the coastal interdunal swale community within CCAFS is 142 acres (Gulledge et al. 2009). CCAFS is covered by a series of old dune ridges alternating with lower swales, and these relict sand deposits are usually oriented in a northeast-southwest direction. Coastal interdunal swales found within CCAFS are open, grassy habitats with very few woody plant species (Gulledge et al. 2009). The swales have been disturbed by extensive ditching within the CCAFS, but the swales are normally saturated or inundated part of the year. Most swales observed on CCAFS were dominated by grasses, primarily sand cordgrass, and muhly grass, while less frequent species include bushy bluestem (*Andropogon glomeratus*) and Carolina fimbry (*Fimbristylis caroliniana*). Wetter swales observed were often dominated by Jamaican sawgrass. A variety of herbs may be present in the wetter swales, such as late flowering thoroughwort (*Eupatorium serotinum*), axilflower (*Mecardonia acuminata*), climbing hempvine (*Mikania scandens*), starrush white-top (*Rhynchospora colorata*), sugarcane plumegrass (*Saccharum giganteum*), semaphore-plant (*Eupatorium mikanioides*), and fleabane (*Pluchea rosea*) (Gulledge et al. 2009).

The water table is low due to ditching, and combined with long term fire exclusion, it has resulted in some swales dominated by woody vegetation. Saw palmetto now fills many swales between the maritime hammock ridges in the east half of CCAFS, and a live oak canopy is not unusual. In some areas, Brazilian pepper has formed dense thickets, crowding out native vegetation. Other shrubs observed in swales within CCAFS included groundsel tree, Simpson's stopper, wax myrtle, and hog plum (*Ximenia americana*). Two additional plant species were previously observed in the coastal interdunal swale community, but were not observed during Gulledge et al. (2009): brownhair snoutbean (*Rhynchosia cinerea*) and coastal vervain

(unknown source). A complete list of plant species observed in the coastal interdunal swale community is presented in Table D-3.

Table D-3. Plant Species Observed in Coastal Interdunal Swale Community within CCAFS (Gulledge et al. 2009)

Scientific Name	Common Name	Protected [a]	Invasive [b]
Ambrosia artemisiifolia	common ragweed		
Ampelopsis arborea	peppervine		
Andropogon glomeratus	bushy bluestem		
Baccharis glomeruliflora	silverling		
Cladium jamaicense	Jamaican sawgrass		
Eupatorium mikanioides	semaphore plant		
Eupatorium serotinum	late flowering thoroughwort		
Fimbristylis caroliniana	Carolina fimbry		
Glandularia maritima [c]	coastal vervain	SE	
Mecardonia acuminata	axilflower		
Mikania scandens	climbing hempvine		
Muhlenbergia capillaris	hairawn muhly		
Myrcianthes fragrans	Simpson's stopper	ST	
Myrica cerifera	wax myrtle		
Oplismenus hirtellus	woodsgrass		
Phlebodium aureum	golden polypody		
Pluchea rosea	fleabane		
Quercus virginiana	live oak		
Rhynchosia cinerea [c]	brownhair snoutbean		
Rhynchospora colorata	starrush white-top		
Sabal palmetto	cabbage palm		
Saccharum giganteum	sugarcane plumegrass		
Schinus terebinthifolius	Brazilian pepper		I
Serenoa repens	saw palmetto		
Sideroxylon tenax	tough bully		
Spartina bakeri	sand cordgrass		
Ximenia americana	hog plum		

Source: Gulledge et al. 2009; FLEPPC 2013
(a) Protected: ST = State Threatened; SE = State Endangered
(b) Florida Exotic Pest Plant Council (FLEPPC, 2013) Ranking:
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.
(c) Although species was not observed during the 2009 FNAI survey, this species was previously observed within coastal interdunal swale community of CCAFS.

Wildlife previously observed utilizing the coastal interdunal swale include gopher tortoise (burrows are common in drier swales), wading birds, and bobcat (unknown source).

D.1.6. Maritime Hammock

The maritime hammock is an upland community; it is predominantly evergreen hardwood forest that grows on stabilized coastal dunes located at varying distances from the shoreline. The species composition changes based on latitude: north of Cape Canaveral includes temperate species (live oak, cabbage palm, red bay, and red cedar [*Juniperus virginiana*]), and south of Cape Canaveral includes more tropical plant species (gumbo limbo [*Bursera simaruba*], sea

grape, and white or Spanish stopper [*Eugenia foetida*]) (FNAI 2010). Due to the mid-point location of Cape Canaveral, temperate and tropical plant species are likely present within this natural community found within CCAFS.

The largest stand of maritime hammock is located in the southeastern area of CCAFS. The estimated area of the maritime hammock community within CCAFS is 2,291 acres (Gulledge et al. 2009). Three areas of maritime hammock were observed: north and south of the Skid Strip and in the southeast area of CCAFS. The highest quality maritime hammock communities were observed in the areas north and south of the Skid Strip. These "Skid Strip" communities had a closed canopy of mature live oak and red bay. Tropical plant species were also observed, such as marlberry (*Ardisia escallonioides*), snowberry (*Chiococca alba*), white stopper (*Eugenia axillaris*), Spanish stopper, wild coffee (*Psychotria nervosa*), myrsine (*Rapanea punctata*), and graytwig (*Schoepfia chrysophylloides*) (Gulledge et al. 2009).

The maritime hammock observed in the southeast area of CCAFS was on an undulating terrain of old dunes and swales. This community is bordered by a live oak/saw palmetto hammock community to the west and a coastal strand community to the east. (Gulledge et al. 2009) In the lower areas of this undulating terrain predominately red bay and saw palmetto with elongated stems were observed. Wet swales are also present and frequently bisect the maritime hammock. One additional plant species was documented prior to the 2009 survey (unknown source): climbing aster (*Ampelaster carolinianus*). The ground surface had a thick layer of leaf litter. Protected species and FLEPPC-categorized species were observed within the maritime hammock community within CCAFS (Gulledge et al. 2009). A complete list of plant species observed in the maritime hammock community is presented in Table D-4.

Table D-4. Plant Species Observed in Maritime Hammock Community (Gulledge et al. 2009) (page 1 of 3)

Scientific Name	Common Name	Protected [a]	Invasive [b]
Ageratina jucunda	hammock snakeroot		
Ampelaster carolinianus [c]	climbing aster		
Ampelopsis arborea	peppervine		
Andropogon glomeratus	bushy bluestem		
Ardisia escallonioides	marlberry		
Baccharis halimifolia	groundsel tree		
Berchemia scandens	rattan vine		
Bidens alba var. radiata	beggarticks		
Callicarpa americana	American beautyberry		
Chiococca alba	snowberry		
Cynanchum angustifolium	Gulf Coast swallow-wort		
Cynanchum scoparium	leafless swallow-wort		
Cyperus sp.	flatsedge		
Cyperus tetragonus	fourangle flatsedge		
Desmodium sp.	tick-trefoil		
Dichanthelium sp.	witchgrass		
Erechtites hieraciifolius	fireweed		
Erythrina herbacea	coralbean		
Eugenia axillaris	white stopper		

Table D-4. Plant Species Observed in Maritime Hammock Community (Gulledge et al. 2009) (page 2 of 3)

Scientific Name	Common Name	Protected [a]	Invasive [b]
Eugenia foetida	Spanish stopper		
Eugenia uniflora	surinam cherry		I
Eupatorium capillifolium	dogfennel		
Eupatorium serotinum	late flowering thoroughwort		
Forestiera segregata	Florida swampprivet		
Galactia volubilis	downy milkpea		
Galium hispidulum	coastal bedstraw		
Glandularia maritima	coastal vervain	SE	
Habenaria floribunda	toothpetal false rein orchid		
Iresine diffusa	Juba's bush		
Juniperus virginiana	red cedar		
Lantana camara	lantana		I
Lantana depressa var. floridana	Atlantic Coast Florida lantana	SE	
Lantana sp.	lantana		
Licania michauxii	gopher apple		
Melothria pendula	creeping cucumber		
Mikania cordifolia	Florida Keys hempvine		
Mikania scandens	climbing hempvine		
Morus rubra	red mulberry		
Myrcianthes fragrans	Simpson's stopper	ST	
Myrica cerifera	wax myrtle		
Oeceoclades maculata	monk orchid		
Oplismenus hirtellus	woodsgrass		
Opuntia sp.	pricklypear		
Parthenocissus quinquefolia	Virginia creeper		
Passiflora incarnata	purple passion-flower		
Passiflora suberosa	corkystem passion-flower		
Persea borbonia	red bay		
Persea palustris	swamp bay		
Phaseolus polystachios	thicket bean		
Phlebodium aureum	golden polypody		
Phytolacca americana	American pokeweed		
Pinus elliottii	slash pine		
Pleopeltis polypodioides var. michauxiana	resurrection fern		
Prunus caroliniana	Carolina laurelcherry		
Psychotria nervosa	wild coffee		
Pteridium aquilinum	bracken fern		
Quercus myrtifolia	myrtle oak		
Quercus virginiana	live oak		
Rapanea punctata	myrsine		
Rhus copallinum	winged sumac		
Rhynchosia sp.	snoutbean		
Rivina humilis	rougeplant		
Sabal palmetto	cabbage palm		
Sageretia minutiflora	smallflower mock buckthorn		
Scientific Name	Common Name		
Schinus terebinthifolius	Brazilian pepper		I

Table D-4. Plant Species Observed in Maritime Hammock Community (Gulledge et al. 2009) (page 3 of 3)

Scientific Name	Common Name	Protected [(a)]	Invasive [(b)]
Schoepfia chrysophylloides	graytwig		
Serenoa repens	saw palmetto		
Sideroxylon lanuginosum	gum bully		
Sideroxylon tenax	tough bully		
Smilax auriculata	earleaf greenbrier		
Smilax sp.	greenbrier		
Solidago odora var. chapmanii	Chapman's goldenrod		
Solidago sempervirens	seaside goldenrod		
Teucrium canadense	Canadian germander		
Tillandsia bartramii	Bartram's air-plant		
Tillandsia fasciculata	common wild-pine	SE	
Tillandsia recurvata	ballmoss		
Tillandsia setacea	southern needleleaf		
Tillandsia simulata	Florida air-plant		
Tillandsia usneoides	Spanish moss		
Toxicodendron radicans	eastern poison ivy		
Verbesina virginica	white crownbeard		
Vitis rotundifolia	muscadine grape		
Vitis shuttleworthii	calloose grape		
Ximenia americana	hog plum		
Yucca aloifolia	Spanish bayonet		
Zanthoxylum clava-herculis	Hercules club		

Source: Gulledge et al. 2009; USDA 2014; FLEPPC 2013

(a) Protected: ST = State Threatened; SE = State Endangered

(b) Florida Exotic Pest Plant Council (FLEPPC, 2013) Ranking:

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.

(c) Although species was not observed during the 2009 FNAI survey, this species was previously observed within maritime hammock habitat of CCAFS (unknown source).

Gopher tortoise burrows are common in sandy clearings of the maritime hammock, and though not observed, the burrows offer the potential for other protected commensal species (e.g. Eastern indigo snake). Neotropical birds were previously observed in the hammock, including great crested flycatcher, several warbler species, ovenbird, American redstart, and red-eyed vireo (unknown source).

D.1.7. Live Oak/Saw Palmetto Hammock

The live oak/saw palmetto hammock association is an upland forest type with low species diversity intermediate between a maritime hammock and a xeric hammock. It may be a result of long term fire exclusion and does not easily fit into any of FNAI's 2010 natural community categories (Gulledge et al. 2009). The estimated area of the live oak/saw palmetto hammock community within CCAFS is 1,237 acres. This community occurs in the center of CCAFS, with the majority located north of the Skid Strip. Some of the predominant vegetation documented was mature live oak (canopy was dominated by live oak), and occasionally a red bay, cabbage palm (*Sabal palmetto*), and Brazilian pepper were observed (Gulledge et al. 2009). The dominant species in the shrub strata was dense saw palmetto. Other shrubs include groundsel

tree, American beautyberry (*Callicarpa americana*), coralbean (*Erythrina herbacea*), yaupon (*Ilex vomitoria*), lantana (*Lantana camara*), wax myrtle, red bay, myrtle oak (*Quercus myrtifolia*), live oak, cabbage palm, Brazilian pepper, and tough bully. Simpson's stopper occurs in scattered small clumps. Herbaceous vegetation observed was minimal, but included bluestem (*Andropogon* sp.), flatsedge (*Cyperus* sp.), Florida Keys hempvine (*Mikania cordifolia*), and white crownbeard (*Verbesina virginica*) (Gulledge et al. 2009).

Protected species and FLEPPC-categorized species were observed within the live oak/saw palmetto hammock community within CCAFS (Gulledge et al. 2009). A complete list of plant species observed in the live oak/saw palmetto hammock community is presented in Table D-5.

Table D-5. Plant Species Observed in Live Oak/Saw Palmetto Hammock Community within CCAFS (Gulledge et al. 2009) (page 1 of 2)

Scientific Name	Common Name	Protected [(a)]	Invasive [(b)]
Ageratina jucunda	hammock snakeroot		
Ampelopsis arborea	peppervine		
Andropogon sp.	bluestem		
Baccharis halimifolia	groundsel tree		
Callicarpa americana	American beautyberry		
Carphephorus sp.	chaffhead		
Cynanchum angustifolium	Gulf Coast swallow-wort		
Cynanchum scoparium	leafless swallow-wort		
Cyperus sp.	flatsedge		
Erythrina herbacea	coralbean		
Eugenia uniflora	surinam cherry		I
Eupatorium mikanioides	semaphore thoroughwort		
Galium pilosum	hairy bedstraw		
Galium sp.	bedstraw		
Habenaria floribunda	toothpetal false rein orchid		
Ilex vomitoria	yaupon		
Lantana sp.	lantana		
Lyonia fruticosa	coastalplain staggerbush		
Lyonia lucida	fetterbush		
Melothria pendula	creeping cucumber		
Mikania cordifolia	Florida Keys hempvine		
Myrcianthes fragrans	Simpson's stopper	ST	
Myrica cerifera	wax myrtle		
Oplismenus hirtellus	woodsgrass		
Parthenocissus quinquefolia	Virginia creeper		
Passiflora suberosa	corkystem passion-flower		
Persea borbonia	red bay		
Phlebodium aureum	golden polypody		
Pleopeltis polypodioides var. *michauxiana*	resurrection fern		
Prunus caroliniana	Carolina laurelcherry		
Psychotria nervosa	wild coffee		

Table D-5. Plant Species Observed in Live Oak/Saw Palmetto Hammock Community within CCAFS (Gulledge et al. 2009) (page 2 of 2)

Scientific Name	Common Name	Protected (a)	Invasive (b)
Pteridium aquilinum	bracken fern		
Quercus myrtifolia	myrtle oak		
Quercus virginiana	live oak		
Rapanea punctata	myrsine		
Rhus copallinum	winged sumac		
Sabal palmetto	cabbage palm		
Scientific Name	Common Name		
Schinus terebinthifolius	Brazilian pepper		I
Serenoa repens	saw palmetto		
Sideroxylon tenax	tough bully		
Smilax auriculata	earleaf greenbrier		
Solidago odora	sweet goldenrod		
Solidago odora var. chapmanii	Chapman's goldenrod		
Tillandsia recurvata	ballmoss		
Tillandsia setacea	southern needleleaf		
Tillandsia simulata	Florida air-plant		
Tillandsia usneoides	Spanish moss		
Tillandsia utriculata	spreading air-plant		
Toxicodendron radicans	eastern poison ivy		
Tradescantia sp.	spiderwort		
Vaccinium myrsinites	shiny blueberry		
Verbesina virginica	white crownbeard		
Vitis rotundifolia	muscadine grape		
Vitis shuttleworthii	calloose grape		
Zanthoxylum clava-herculis	Hercules club		

Source: Gulledge et al. 2009; USDA 2014; FLEPPC 2013

(a) Protected: ST = State Threatened; SE = State Endangered

(b) Florida Exotic Pest Plant Council (FLEPPC, 2013) Ranking:

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.

D.1.8. Live Oak/Saw Palmetto Shrubland

The live oak/saw palmetto shrubland association is an upland forest type, and like the live oak/saw palmetto hammock community, it does not fit easily into the FNAI (2010) natural community categories. Some characteristics of this association resemble scrubby flatwoods. It may be a result of long term fire exclusion (Gulledge et al. 2009). The estimated area of the live oak/saw palmetto shrubland community within CCAFS is 1,477 acres. This plant association is located in the western half of CCAFS, and is bordered by scrub habitat on the east side (Gulledge et al. 2009). Unlike a scrub community, the live oak/saw palmetto shrubland association has little to no sand live oak (*Quercus geminata*) or Chapman's oak (*Quercus chapmanii*). Many of these shrublands were recently converted from canopied hammocks through prescribed fire and mechanical treatment. The open canopy observed was primarily scattered (immature) live oak, and the occasional red bay and myrtle oak. The shrub stratum was dominated by dense saw palmetto. Other identified shrubs included groundsel tree, American beautyberry, yaupon, lantana, wax myrtle, red bay, myrtle oak, live oak, winged

sumac (*Rhus copallinum*), cabbage palm, Brazilian pepper, tough bully, and hog plum. Small clumps of Simpson's stopper were occasionally observed near the transition to the maritime hammock community. The herbaceous layer was minimal, due to the dense saw palmetto (Gulledge et al. 2009).

Protected species and FLEPPC-categorized species were observed within the live oak/saw palmetto shrubland association within CCAFS (Gulledge et al. 2009). A complete list of plant species observed in the live oak/saw palmetto shrubland community is presented in Table D-6.

Table DQ-6. Plant Species Observed in Live Oak/Saw Palmetto Shrubland Community within CCAFS (Gulledge et al. 2009) (page 1 of 2)

Scientific Name	Common Name	Protected [(a)]	Invasive [(b)]
Ageratina jucunda	hammock snakeroot		
Ambrosia artemisiifolia	common ragweed		
Andropogon sp.	bluestem		
Baccharis halimifolia	groundsel tree		
Bulbostylis ciliatifolia	capillary hairsedge		
Callicarpa americana	American beautyberry		
Chamaecrista fasciculata	partridge pea		
Chamaecrista nictitans	sensitive pea		
Conyza canadensis	Canadian horseweed		
Cyperus retrorsus	pinebarren flatsedge		
Cyperus sp.	flatsedge		
Dichanthelium sp.	witchgrass		
Erythrina herbacea	coralbean		
Galactia volubilis	downy milkpea		
Helianthemum nashii	Florida scrub frostweed		
Hypericum sp.	St. John's wort		
Lantana camara	lantana		I
Lantana sp.	lantana		
Lechea sessiliflora	pineland pinweed		
Licania michauxii	gopher apple		
Lyonia fruticosa	coastalplain staggerbush		
Mikania cordifolia	Florida Keys hempvine		
Myrcianthes fragrans	Simpson's stopper	ST	
Myrica cerifera	wax myrtle		
Opuntia humifusa	pricklypear		
Persea borbonia	red bay		
Phaseolus polystachios	thicket bean		
Phyllanthus abnormis	Drummond's leaf-flower		
Physalis sp.	groundcherry		
Pityopsis graminifolia	narrowleaf silkgrass		
Polypremum procumbens	rustweed		
Quercus myrtifolia	myrtle oak		
Quercus virginiana	live oak		
Rhus copallinum	winged sumac		
Scientific Name	Common Name		
Rhynchelytrum repens	Natal grass		I
Rhynchospora megalocarpa	sandyfield beaksedge	SE	
Sabal palmetto	cabbage palm		

Table DQ-6. Plant Species Observed in Live Oak/Saw Palmetto Shrubland Community within CCAFS (Gulledge et al. 2009) (page 2 of 2)

Scientific Name	Common Name	Protected (a)	Invasive (b)
Schinus terebinthifolius	Brazilian pepper		I
Schizachyrium scoparium	little bluestem		
Schizachyrium sp.	bluestem		
Scleria triglomerata	whip nutrush		
Serenoa repens	saw palmetto		
Sideroxylon tenax	tough bully		
Smilax auriculata	earleaf greenbrier		
Solidago odora	sweet goldenrod		
Solidago odora var. chapmanii	Chapman's goldenrod		
Tillandsia recurvata	ballmoss		
Tillandsia usneoides	Spanish moss		
Toxicodendron radicans	eastern poison ivy		
Vaccinium myrsinites	shiny blueberry		
Vitis rotundifolia	muscadine grape		
Vitis shuttleworthii	calloose grape		
Ximenia americana	hog plum		
Zanthoxylum clava-herculis	Hercules club		

Source: Gulledge et al. 2009; USDA 2014; FLEPPC 2013

(a) Protected: ST = State Threatened; SE = State Endangered

(b) Florida Exotic Pest Plant Council (FLEPPC, 2013) Ranking:
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.

D.1.9. Xeric Hammock

Xeric hammock is an upland evergreen forest community found on well-drained sandy soils, in areas of fire exclusion. The tree canopy is generally low and closed, and is often dominated by sand live oak; other oak trees may be present depending on the origin of the hammock. For example, scrub-derived hammocks may have myrtle oak and Chapman's oak, while sandhill-derived hammocks may have turkey oak (*Quercus laevis*) and bluejack oak (*Quercus incana*). An emergent canopy of pine may also be present. The understory is typically open, often with saw palmetto present (FNAI 2010).

The estimated area of the xeric hammock community within CCAFS is 556 acres (Gulledge et al. 2009). Xeric hammock was observed on the west side of CCAFS in areas of overgrown scrub on the oldest dune ridges. The largest area is near the north end of CCAFS. The closed or nearly closed canopy consisted mainly of sand live oak and myrtle oak, with scrub hickory (*Carya floridana*) in some locations. Shrubs included rusty lyonia (*Lyonia ferruginea*), several oak species, saw palmetto, shiny blueberry (*Vaccinium myrsinites*), and hog plum. The herbaceous layer is negligible due to shade, but sandyfield beaksedge (*Rhynchospora megalocarpa*) and whip nutrush (*Scleria triglomerata*) were observed (Gulledge et al. 2009). Large expanses of grapevines, commonly draped across the canopy of scrub and xeric hammock on CCAFS, are evidence of fire suppression (unknown source).

The transition from scrub to xeric hammock is marked by the absence from the hammock canopy of the typical scrub oaks: sand live oak, myrtle oak, and Chapman's oak. On the eastern side of the station, xeric hammock grades into coastal strand or maritime hammock, where it may occasionally contain a typical maritime hammock species such as red bay. Many areas of xeric hammock include coastal interdunal swales (unknown source).

The xeric hammock community within CCAFS has not burned since the mid 1950's. The large, mature oaks found in these areas indicate that this community may have burned less frequently than scrub (unknown source). Both scrub and xeric hammock are difficult to ignite directly and usually burn only when adjacent pyrogenic communities carry fire into them (Myers 1990). As a result, the nature of adjacent communities influences the type and frequency of fire in scrub and xeric hammock. Xeric hammocks on CCAFS are interspersed with numerous hydric swales, which were much wetter prior to ditch and canal construction in the 1950's and 1960's. The presence of these wet communities probably acted as a seasonal barrier to the spread of fire (unknown source).

On CCAFS, soil type is also a factor in xeric hammock distribution. The soils in most xeric hammocks are neutral to moderately alkaline in all layers. Although lack of fire has certainly played a role in the development of xeric hammock on CCAFS, it is also likely that this community occupies a transition zone of moderately weathered sands between maritime hammock and scrub. In this respect, xeric hammock may be viewed as a depauperate maritime hammock lacking the soils to support the calciphilic tropical species found in maritime hammocks. Similarly, the neutral to alkaline sands in the central area of CCAFS do not support the species adapted to the acid sands that underlay scrub (unknown source).

One protected species and one FLEPPC-categorized species were observed within the xeric hammock community within CCAFS (Gulledge et al. 2009). A complete list of plant species observed in the live oak/saw palmetto shrubland community is presented in Table D-7.

Table D-7. Plant Species Observed in Xeric Hammock Community within CCAFS (Gulledge et al. 2009) (page 1 of 2)

Scientific Name	Common Name	Protected [(a)]	Invasive [(b)]
Callicarpa americana	American beautyberry		
Carya floridana	scrub hickory		
Cyperus sp.	flatsedge		
Habenaria floribunda	toothpetal false rein orchid		
Lyonia ferruginea	rusty lyonia		
Lyonia fruticosa	coastalplain staggerbush		
Scientific Name	Common Name		
Lyonia lucida	fetterbush		
Mikania cordifolia	Florida Keys hempvine		
Myrica cerifera	wax myrtle		
Opuntia humifusa	pricklypear		
Persea borbonia	red bay		
Pteridium aquilinum	bracken fern		
Quercus chapmanii	Chapman's oak		
Quercus geminata	sand live oak		

Table D-7. Plant Species Observed in Xeric Hammock Community within CCAFS (Gulledge et al. 2009) (page 2 of 2)

Scientific Name	Common Name	Protected (a)	Invasive (b)
Quercus myrtifolia	myrtle oak		
Quercus virginiana	live oak		
Rapanea punctata	myrsine		
Rhus copallinum	winged sumac		
Rhynchospora megalocarpa	sandyfield beaksedge	SE	
Schinus terebinthifolius	Brazilian pepper		I
Scleria triglomerata	whip nutrush		
Serenoa repens	saw palmetto		
Sideroxylon tenax	tough bully		
Smilax auriculata	earleaf greenbrier		
Tillandsia recurvata	ballmoss		
Tillandsia usneoides	Spanish moss		
Vaccinium myrsinites	shiny blueberry		
Vitis rotundifolia	muscadine grape		
Vitis shuttleworthii	calloose grape		
Ximenia americana	hog plum		

Source: Gulledge et al. 2009; USDA 2014; FLEPPC 2013

(a) Protected: ST = State Threatened; SE = State Endangered

(b) Florida Exotic Pest Plant Council (FLEPPC, 2013) Ranking:
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.

The gopher tortoise is occasionally seen in CCAFS xeric hammock communities (unknown source).

D.1.10. Scrub

Scrub is a community composed of evergreen shrubs, with or without a canopy of pines, and is found on dry, acid, sandy ridges. Characteristic species of this upland community include Florida rosemary (*Ceratiola ericoides*), sand pine (*Pinus clausa*), myrtle oak, sand live oak, and Chapman's oak. Rusty lyonia and saw palmetto are also frequently observed in this community (FNAI 2010). The estimated area of the scrub community within CCAFS is 1,083 acres (Gulledge et al. 2009). The scrub community is found on the oldest dune ridges in the west side of CCAFS. Much of the scrub habitat had been recently treated by chopping and sometimes burning to restore Florida scrub-jay habitat. The predominant oak scrub community observed at CCAFS was characterized by sand live oak, Chapman's oak, myrtle oak, and Scrub hickory in the canopy and shrub strata. Other shrubs observed included saw palmetto, rusty lyonia, shiny blueberry, and hog plum. Due to the density of the shrub layer, the herbaceous layer was limited. Continuing to clear and burn the scrub habitat will aid in increasing herbaceous ground cover and provided open sand gaps which are favorable for Florida scrub-jays. Sand pine was found in only one small area of scrub, which was northwest of the Industrial Area. The mature sand pines were scattered among the more numerous oak trees (Gulledge et al. 2009).

The above description is similar to the "oak scrub" description that is reflected in the 2008 INRMP from an unknown source. Oak scrub on CCAFS occupies the highest, driest habitats. It

grades westward into maritime and hydric hammock along the Banana River and eastward into maritime hammock, coastal strand, or coastal oak scrub (unknown source). The presence of sand live oak and Chapman's oak is considered diagnostic for this community type on CCAFS. Sand pine, which is found occasionally in these communities, occurs in no other community on CCAFS and is also considered indicative of scrub. Openings and edges in oak scrub, where oaks have been mechanically removed and bare sand is exposed, support a number of rare plant and animal species, underscoring the importance of introducing fire into this community. Rare plant species found in clearings in scrub habitat within CCAFS include brownhair snoutbean, Curtiss' milkweed (*Asclepias curtissii*), nodding pinweed (*Lechea cernua*), and coastal dune sandmat (*Chamaesyce cumulicola*); the last three species are state listed.

Rosemary was observed (in abundance) at only one location, the north end of CCAFS that borders the Banana River (Gulledge et al. 2009). This scrub was relatively open, with scattered clumps of rosemary interspersed with dense thickets of myrtle oak and sand live oak. Openings among the shrub clumps are either bare sand or vegetated with low shrubs such as gopher apple (*Licania michauxii*) and shiny blueberry (Gulledge et al. 2009). During a previous survey, an herb layer was observed in this rosemary scrub community, which was sparse but more diverse than in oak scrub (unknown source). Species such as partridge pea, standing cedar (*Ipomopsis rubra*), arrowfeather three awn (*Aristida purpurascens*), Florida scrub frostweed (*Helianthemum nashii*), foxglove (*Aureolaria pectinata*), and large-seeded beakrush were identified. Lichens (*Cladina evansii* and *Cladonia leporina*) were a prominent component of the rosemary scrub. Two state listed herb species - sand dune spurge, and nodding pinweed, were found along the sand road that bisects the rosemary scrub during the previous survey (unknown source).

Observed plant species observed within the scrub community within CCAFS are presented in Table D-8.

Table D-8. Plant Species Observed in Scrub Community within CCAFS (Gulledge et al. 2009) (page 1 of 2)

Scientific Name	Common Name	Protected [a]	Invasive [b]
Aristida tenuispica [c]	three awn		
Asclepias curtissii [c]	Curtiss' milkweed	FE	
Aureolaria pectinata [c]	foxglove		
Bidens alba var. *radiata*	beggarticks		
Callicarpa americana	American beautyberry		
Carya floridana	scrub hickory		
Chamaesyce cumulicola [c]	coastal dune sandmat	SE	
Coccoloba uvifera	sea grape		
Cladina evansii [c]	Evan's reindeer lichen		
Cladonia leporine [c]	cup lichen		
Helianthemum nashii	Florida scrub frostweed		
Ipomopsis rubra [c]	standing cedar		
Lechea cernua [c]	nodding pinweed	ST	
Lyonia ferruginea	rusty staggerbush		
Lyonia fruticosa	coastalplain staggerbush		

Table D-8. Plant Species Observed in Scrub Community within CCAFS (Gulledge et al. 2009) (page 2 of 2)

Scientific Name	Common Name	Protected (a)	Invasive (b)
Mikania cordifolia	Florida Keys hempvine		
Myrica cerifera	wax myrtle		
Opuntia humifusa	pricklypear		
Persea borbonia	red bay		
Pinus clausa	sand pine		
Quercus chapmanii	Chapman's oak		
Quercus geminata	sand live oak		
Quercus myrtifolia	myrtle oak		
Quercus virginiana	live oak		
Rhynchosia cinerea (c)	brownhair snoutbean		
Rhynchospora megalocarpa	sandyfield beaksedge	SE	
Schinus terebinthifolius	Brazilian pepper		I
Scleria triglomerata	whip nutrush		
Serenoa repens	saw palmetto		
Smilax auriculata	earleaf greenbrier		
Tillandsia recurvata	ballmoss		
Tillandsia usneoides	Spanish moss		
Vaccinium myrsinites	shiny blueberry		
Vigna luteola	hairypod cowpea		
Vitis rotundifolia	muscadine grape		
Ximenia americana	hog plum		

Source: Gulledge et al. 2009; USDA 2014; FLEPPC 2013

(a) Protected: ST = State Threatened; SE = State Endangered

(b) Florida Exotic Pest Plant Council (FLEPPC, 2013) Ranking:
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.

(c) Although species was not observed during the 2009 FNAI survey, this species was previously observed within scrub habitat of CCAFS.

D.1.11. Tropical Hammock

FNAI (2010) does not have a community description for tropical hammock**,** but indicates it is synonymous with FNAI's rockland hammock community. Rockland hammock is described as an upland rich tropical hardwood forest community that grows where limestone is very near the land surface, sometimes exposed. The canopy and shrub layer are closed, with significant leaf litter, and very few herbaceous plants. Over 120 native tree and shrub species can be found in a rockland hammock (FNAI 2010). Tropical hammock is ecologically significant as it provides habitat for numerous tropical species near the northern limits of their range. The estimated area of the tropical hammock community within CCAFS is 113 acres (Gulledge et al. 2009).

Within CCAFS, the tropical hammock community was observed in a nearly continuous band bordering the Banana River along the west edge of CCAFS, in association with Native American shell mounds which have soils with higher pH. The tropical hammock community has been heavily impacted by homesteading in the last 150 years, and currently a power transmission line corridor runs the length of these hammocks.

The dominant vegetation observed in the tropical hammock canopy was mature live oak and red bay (Gulledge et al. 2009). Other trees observed included sugarberry (*Celtis laevigata*), red mulberry (*Morus rubra*), slash pine (*Pinus elliottii*), laurel oak (*Quercus laurifolia*), cabbage palm, and Carolina laurelcherry (*Prunus caroliniana*). The shrub stratum was frequently dominated by Simpson's stopper, yaupon, or Carolina laurelcherry. Saw palmetto and the invasive exotic Brazilian pepper were also observed. Notable tropical species observed included: marlberry, bayleaf capertree (*Capparis flexuosa*), snowberry, satinleaf (*Chrysophyllum oliviforme*), pigeon plum (*Coccoloba diversifolia*), white stopper, Spanish stopper, black ironwood (*Krugiodendron ferreum*), and lancewood (*Ocotea coriacea*).

The tropical hammock within CCAFS has many exotic plant species persisting from former homesteads. Exotic fruit species observed included mango (*Mangifera indica*), papaya (*Carica papaya*), avocado (*Persea americana*), guava (*Psidium guajava*), banana (*Musa* x *paradisiaca*), sour orange (*Citrus auranticum*), and sweet orange (*Citrus sinensis*). Escaped exotic ornamentals include Mexican flame vine (*Senecio confusus*), devil's tongue (*Sansevieria hyacinthoides*), bamboo (*Arundo donax*), and cathedral bells (*Kalanchoe pinnata*).

Protected species and FLEPPC-categorized species were observed within the tropical hammock community within CCAFS (Gulledge et al. 2009). Observed plant species observed within the tropical hammock community within CCAFS are presented in Table D-9.

Table D-9. Plant Species Observed in Tropical Hammock Community within CCAFS (Gulledge et al. 2009) (page 1 of 3)

Scientific Name	Common Name	Protected [a]	Invasive [b]
Abrus precatorius	rosary pea		I
Ageratina jucunda	hammock snakeroot		
Ardisia escallonioides	marlberry		
Arundo donax	bamboo		
Bursera simaruba	gumbo limbo		
Callicarpa americana	American beautyberry		
Capparis flexuosa	bayleaf capertree		
Carica papaya	papaya		
Celtis laevigata	sugarberry		
Chiococca alba	snowberry		
Chrysophyllum oliviforme	satinleaf	ST	
Citrus auranticum	sour orange		
Citrus sinensis	sweet orange		
Coccoloba diversifolia	pigeon plum		
Cynanchum scoparium	leafless swallow-wort		
Cyperus tetragonus	fourangle flatsedge		
Dichanthelium sp.	witchgrass		

Table D-9. Plant Species Observed in Tropical Hammock Community within CCAFS (Gulledge et al. 2009) (page 2 of 3)

Scientific Name	Common Name	Protected [a]	Invasive [b]
Erythrina herbacea	coralbean		
Eugenia axillaris	white stopper		
Eugenia foetida	Spanish stopper		
Eugenia uniflora	surinam cherry		I
Forestiera segregata	Florida swampprivet		
Habenaria floribunda	toothpetal false rein orchid		
Juniperus virginiana	red cedar		
Kalanchoe pinnata	kalanchoe		II
Krugiodendron ferreum	black ironwood		
Mangifera indica	mango		
Mikania cordifolia	Florida Keys hempvine		
Morus rubra	red mulberry		
Musa x *paradisiaca*	banana		
Myrcianthes fragrans	Simpson's stopper	ST	
Myrica cerifera	wax myrtle		
Ocotea coriacea	lancewood		
Oplismenus hirtellus	woodsgrass		
Parthenocissus quinquefolia	Virginia creeper		
Pavonia spinifex	yellow hibiscus		
Persea americana	avocado		
Persea borbonia	red bay		
Phlebodium aureum	golden polypody		
Pleopeltis polypodioides var. michauxiana	resurrection fern		
Prunus caroliniana	Carolina laurelcherry		
Psidium guajava	guava		I
Psychotria nervosa	wild coffee		
Quercus laurifolia	laurel oak		
Quercus virginiana	live oak		
Randia aculeata	white indigoberry		
Rapanea punctata	myrsine		
Rivina humilis	rougeplant		
Sabal palmetto	cabbage palm		
Sansevieria hyacinthoides	devil's tongue		II
Schinus terebinthifolius	Brazilian pepper		I
Scleria triglomerata	whip nutrush		
Senecio confusus	Mexican flame vine		
Serenoa repens	saw palmetto		
Sideroxylon tenax	tough bully		
Smilax bona-nox	saw greenbrier		
Smilax sp.	greenbrier		
Tillandsia recurvata	ballmoss		
Tillandsia usneoides	Spanish moss		
Toxicodendron radicans	eastern poison ivy		
Verbesina virginica	white crownbeard		
Vitis rotundifolia	muscadine grape		
Vitis shuttleworthii	calloose grape		

Table D-9. Plant Species Observed in Tropical Hammock Community within CCAFS (Gulledge et al. 2009) (page 3 of 3)

Scientific Name	Common Name	Protected (a)	Invasive (b)
Ximenia americana	hog plum		
Yucca aloifolia	Spanish bayonet		
Zanthoxylum fagara	wild lime		

Source: Gulledge et al. 2009; USDA 2014; FLEPPC 2013

(a) Protected: ST = State Threatened; SE = State Endangered

(b) Florida Exotic Pest Plant Council (FLEPPC, 2013) Ranking:
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.

D.1.12. Hydric Hammock

Hydric hammock is a freshwater forested wetland with evergreen hardwoods and/or palm forest; the understory is variable, but often dominated by ferns and palms. The canopy is usually closed with an open understory. Cabbage palm is often the dominant plant species in Florida, but other typical species in this community include swamp laurel oak, live oak, cabbage palm, red cedar, American elm (*Ulmus americana*), and sweetbay (*Magnolia virginiana*) (FNAI 2010).

The estimated area of the hydric hammock community within CCAFS is 32 acres (Gulledge et al. 2009). Within CCAFS, the hydric hammock community was observed on the west side of CCAFS, along the Banana River, and just west of the tropical hammock edge. Elevated areas within the hydric hammock also support patches of maritime hammock and in low areas occasional swamp communities were observed, including a persimmon *(Diospyros virginiana*) dominated basin swamp (unknown source). The co-dominant species in the canopy included cabbage palm, live oak, American elm, and red mulberry. Tropical species were observed in the understory: myrsine, wild coffee, white stopper, and Simpson's stopper (state listed threatened species). Brazilian pepper was also observed in this community (Gulledge et al. 2009).

Observations during a survey prior to 2009 revealed the wetter areas had a complete canopy of cabbage palm; and that many of the American elms are large trees with very large, winged buttresses (unknown source). Tropical species were noted dominating the shrub layer, and additional species that were observed during a previous survey, but not observed during the Gulledge et al. (2009) survey included strangler fig (*Ficus aurea*), pond apple (*Annona glabra*), shoestring fern (*Vittaria lineata*) and resurrection fern (*Polypodium polypodioides*) (unknown source).

Protected species and FLEPPC-categorized species were observed within the hydric hammock community within CCAFS (Gulledge et al. 2009). Observed plant species observed within the tropical hammock community within CCAFS are presented in Table D-10.

Table D-10. Plant Species Observed in Hydric Hammock Community within CCAFS (Gulledge et al. 2009)

Scientific Name	Common Name	Protected (a)	Invasive (b)
Annona glabra (c)	pond apple		
Diospyros virginiana (c)	persimmon		
Eugenia axillaris	white stopper		
Ficus aurea (c)	strangler fig		
Morus rubra	red mulberry		
Myrcianthes fragrans	Simpson's stopper	FT	
Polypodium polypodioides (c)	resurrection fern		
Psychotria nervosa	wild coffee		
Quercus laurifolia	swamp laurel oak		
Quercus virginiana	live oak		
Rapanea punctata	myrsine		
Schinus terebinthifolius	Brazilian pepper		I
Ulmus americana	American elm		
Vittaria lineata (c)	shoestring fern		

Source: Gulledge et al. 2009; USDA 2014; FLEPPC 2013

(a) Protected: ST = State Threatened; SE = State Endangered

(b) Florida Exotic Pest Plant Council (FLEPPC, 2013) Ranking:
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.

(c) Although species was not observed during the 2009 FNAI survey, this species was previously observed within hydric hammock habitat of CCAFS.

D.1.13. Estuarine Tidal Swamp and Marsh

Estuarine tidal swamp and marsh, also known as mangrove swamp, occur in areas with relatively flat, low wave energy in both marine and estuarine waters. It is typically a dense forest dominated by red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia germinans*), white mangrove (*Laguncularia racemosa*), and buttonwood (*Conocarpus erectus*). These species can occur intermixed, or in zones. Red mangrove is often found in deeper water, followed by black mangrove in an intermediate area, and white mangrove and buttonwood are found at the highest elevation with the least tidal influence. Buttonwood is often a transition species to an upland environment (FNAI 2010). Mangrove swamps within CCAFS occur in a mosaic on the northwest edge of CCAFS, at the edge of the Banana River. On CCAFS, these communities are bordered on the east by maritime hammock or oak scrub (unknown source).

All four "mangrove" species are present in the swamps: white mangrove, red mangrove, black mangrove, and buttonwood, although white mangrove and buttonwood are the most common. Other scattered shrubs include marsh elder, sea oxeye daisy (*Borrichia frutescens*), christmasberry (*Lycium carolinianum*), and saltwort (*Batis maritima*). Marsh areas also include these shrubs, along with seashore dropseed (*Sporobolus virginicus*), salt grass, sea purslane (*Sesuvium portulacastrum*), and glasswort (*Salicornia virginica*). Salt pans devoid of all species except glasswort are found within the mangrove swamp/marsh (unknown source).

All identified plant species are presented in Table D-11.

Table D-11. Plant Species Observed in Estuarine Tidal Swamp and Marsh (mangrove) Community within CCAFS

Scientific Name (a)	Common Name	Protected (b)	Invasive (c)
Avicennia germinans	black mangrove		
Borrichia frutescens	sea oxeye daisy		
Conocarpus erectus	buttonwood		
Distichlis spicata	salt grass		
Iva frutescens	marsh elder		
Lycium carolinianum	christmasberry		
Laguncularia racemosa	white mangrove		
Rhizophora mangle	red mangrove		
Salicornia virginica	glasswort		
Sesuvium portulacastrum	sea purslane		
Sporobolus virginicus	seashore dropseed		

Source: USDA 2014; FLEPPC 2013

(a) Unknown source for species observations

(b) Protected: ST = State Threatened; SE = State Endangered

(c) Florida Exotic Pest Plant Council (FLEPPC, 2013) Ranking:

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.

American alligator (*Alligator mississippiensis*), osprey (*Pandion haliaetus*), bald eagle (*Haliaeetus leucocephalus*), and northern harrier (*Circus cyaneus*) have been observed in the estuarine tidal swamps and marsh (unknown source).

D.1.14. Shell Mounds

Shell mound is one of the few anthropogenic communities included in FNAI (2010). Shell mounds, or middens, are small hills, typically in coastal locations, that are composed entirely of shells discarded by generations of American Indians. A rich calcareous soil develops on the deposited shells which develops a dense hardwood forest. Soils in shell mounds are typically circumneutral to alkaline, due to the high calcium carbonate and magnesium contribution from shells. Organic matter is usually high in the top two inches of soil, which has a high permeability due to the large shell fragments. Shell mounds support an assemblage of calciphilic plant species such as white stopper, sea torchwood (*Amyris elemifera*), wild lime, false mastic (*Sideroxylon foetidissimum*), inkwood (*Exothea paniculata*), and lancewood (*Nectandra coriacea*). Many shell mounds are surrounded by mangroves, indicating the mounds were built when the sea level was lower than the current sea level (FNAI 2010).

Shell mounds are found in a nearly continuous band on CCAFS along the western side of the station, bordering the Banana River. The middens have been investigated by a number of historical and archaeological surveys over the last 150 years; the most recent was conducted by Archaeological Consultants Inc. (ACI) in 1999 (New South Associates 1994). Because of their archaeological value and their vulnerability to pothunters, shell mounds are classified as “data sensitive” by FNAI, and access to data on these communities is limited. Therefore, only one site on CCAFS is designated as shell mound - the Naval Ordnance Test Unit (NOTU) site on the extreme south end of CCAFS.

Vegetation on the shell mound is similar to the maritime hammock on the Banana River, and includes red bay, Carolina laurelcherry and red mulberry. Other tree species present include the calciphilic species: red cedar and sugarberry. Yellow hibiscus (*Pavonia spinifex*) occurs abundantly at the NOTU shell mound, as well as satinleaf (unknown source). Shell middens have long been recognized for their tropical vegetation component. Harper (1921) recognized the role of shell middens in harboring the northernmost occurrences of tropical plant species.

Table D-12 lists the species observed within the Shell Mound community within CCAFS.

Table D-12. Plant Species Observed in Shell Mound Community within CCAFS

Scientific Name [(a)]	Common Name	Protected [(b)]	Invasive [(c)]
Celtis laevigata	sugarberry		
Chrysophyllum oliviforme	satinleaf	ST	
Ilex vomitoria	yaupon		
Juniperus virginiana	red cedar		
Morus rubra	red mulberry		
Pavonia spinifex	yellow hibiscus		
Prunus caroliniana	Carolina laurelcherry		

Source: USDA 2014; FLEPPC 2013

(a) Unknown source for species observations

(b) Protected: ST = State Threatened; SE = State Endangered

(c) Florida Exotic Pest Plant Council (FLEPPC, 2013) Ranking:

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

D.2. Patrick Air Force Base (PAFB) Natural Communities

The dune and some sections of the Banana River shoreline (estuarine wetland) are the only remaining natural communities within PAFB, although these areas are slightly disturbed. Surveys were conducted on the PAFB coastal dunes from 1995 through 1996 (Oddy et al. 1997). Aside from the beach dunes and estuarine wetlands, the majority of the base is dominated by turf and landscaped areas.

D.2.1. Beach Dune Community

Dunes on PAFB constitute a narrow strip of vegetation bordered by the Atlantic Ocean, State Road (SR) A1A, Base Housing, or areas of mowed grass. Erosion has affected these dunes, including major hurricanes in 1995 (Oddy et al. 1997), 2004 and 2005. The flora of the remaining dunes includes four major elements:

1. Common dune or coastal strand species: sea oats, bitter panicum, beach sunflower, sea grape, and railroad vine;

2. Less common, state-listed dune species: beach star, inkberry, prickly pear cactus, and spider lily;

3. Native species of disturbed or open areas: common ragweed (*Ambrosia artemisiifolia*), beggar-ticks (*Bidens pilosa*), and southern crabgrass (*Digitaria ciliaris*); and

4. Introduced species: sow thistle and simpleleaf chastetree.

Table D-13 reflects the most commonly observed plant species and the protected plant species observed within PAFB and reflected in the 1997 survey report (Oddy et al. 1997). For a complete list of plant species observed, see Oddy et al. (1997).

Table D-13. Common Observed Plants and Protected Plant Species Observed in Sand Dune Community within PAFB (page 1 of 2)

Scientific Name	Common Name	Protected [(a)]	Invasive [(b)]
Ambrosia artemisiifolia	annual ragweed		
Cakile lanceolata	coastal sea rocket		
Canavalia rosea	bay bean		
Cenchrus incertus/spinifex	coastal sandbur		
Chamaesyce mesembryanthemifolia	coastal beach sandmat		
Coccoloba uvifera	sea grape		
Digitaria ciliaris	southern crabgrass		
Helianthus debilis	beach sunflower		
Heterotheca subaxillaris	camphorweed		
Hymenocallis latifolia	broad-leaved spiderlily		
Ipomoea pes-caprae	railroad vine		
Iva imbricata	seacoast marsh elder		
Lepidium virginicum	pepperweed		

Table D-13. Common Observed Plants and Protected Plant Species Observed in Sand Dune Community within PAFB (page 2 of 2)

Scientific Name	Common Name	Protected (a)	Invasive (b)
Oenothera humifusa	seabeach evening primrose		
Opuntia stricta	erect pricklypear	ST	
Panicum amarum	bitter panic grass		
Phyla nodiflora	turkey tangle fogfruit		
Physalis walteri	Elliot's sticky groundcherry		
Portulaca pilosa	kiss me quick		
Remirea maritima	beach star	SE	
Scaevola plumieri	inkberry	ST	
Sesuvium portulacastrum	sea purslane		
Sonchus asper	sow thistle		
Sporobolus virginicus	seashore dropseed		
Uniola paniculata	sea oats		
Vitex trifolia	simpleleaf chastetree		II
Yucca aloifolia	aloe yucca		

Source: USDA 2014; FLEPPC 2013; Oddy et al. 1997

(a) Protected: ST = State Threatened; SE = State Endangered

(b) Florida Exotic Pest Plant Council (FLEPPC, 2013) Ranking:
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

During a 1997 small mammal study, Sherman traps were utilized in the PAFB beach dune area for the southeastern beach mouse. Only the black rat, house mouse, and ghost crab were captured in the traps (Oddy et al. 1997). The beach community attracted several species of shorebirds including black-bellied plover (*Pluvialis squatarola*), semipalmated plover (*Charadrius semipalmatus*), willet (*Tringa semipalmata*), ruddy turnstone (*Arenaria interpres*), sanderling (*Calidris alba*), laughing gull (*Larus atricilla*), ring-billed gull (*L. delawarensis*), herring gull (*L. argentatus*), great black-backed gull (L. *marinus*), Caspian tern (*Hydroprogne caspia*), royal tern (*Thalasseus maximus*), sandwich tern (*Thalasseus sandvicensis*), black tern (*Chlidonias niger*); as well as two state protected species: the least tern (state threatened), and black skimmer (state species of concern). See Appendix C for more on threatened and endangered species.

D.2.2. Estuarine Wetland Community

The estuarine wetland community within PAFB is associated with mangroves along the Banana River. Vegetation observed by Oddy et al. (1997) included:

- black mangrove,
- white mangrove,
- red mangrove, and
- torpedograss (*Panicum repens*).

The mangroves are in small, disjunctive areas along the shoreline of the Banana River; these small, isolated mangroves probably provide little ecological value (Oddy et al. 1997).

Torpedograss is a FLEPPC Category I plant species (FLEPPC 2013); it was observed along the fringe of the mangroves (Oddy et al. 1997). Small areas of disturbed estuarine wetlands (refer to 'Estuarine Tidal Swamp/Marsh' under CCAFS for plant composition) exist along the Banana River shoreline.

Many bird species were observed using the Banana River for foraging and resting; the brown pelican (*Pelecanus occidentalis*) (state SSC) was also observed resting on pilings and dock structures on PAFB. Other fish and wildlife species observed include: common snook (*Centropomus undecimalis*), plovers, gulls, killdeer (*Charadrius vociferous*), willet, spotted sandpiper (*Actitis macularius*), ruddy turnstone, sanderling, dunlin (*Calidris alpine*), common snipe (*Gallinago delicate*), terns (including the protected least tern), black skimmer (state SSC), West Indian manatee (*Trichechus manatus*) (state endangered), and American alligator (state threatened due to similarity of appearance). See Appendix C for more information on threatened and endangered species.

D.3. Malabar Transmitter Annex (MTA) Natural Communities

A baseline biological survey conducted within MTA in 2014 (VZ Technologies et al. 2014) documented the following natural land cover areas, based on the Florida Land Use, Cover and Forms Classification System (FLUCFCS); FLUCFCS is in parentheses:

- Mixed rangeland (code 330)
- Pine flatwoods (code 411)
- Cabbage palm hammock (code 428)
- Streams and waterways (code 510)
- Hydric pine flatwoods (code 625)

The previous INRMP (2008) listed the following as natural communities within MTA:

- depression marsh,
- hydric hammock,
- mesic flatwoods, and
- wet flatwoods.

D.3.1. Mixed Rangeland

Mixed rangeland was observed within the central portion of MTA and on the west side of MTA. The western area of mixed rangeland appeared drier than the central area of mixed rangeland (VZ Technologies et al. 2014).

Some of the tree species identified in the mixed rangeland located on the west side of MTA included sand live oak, slash pine, and cabbage palm. Ground cover plant species included lovegrass (*Eragrostis* sp.), natalgrass (*Rhynchelytrum roseum*), wire grass, and shiny blueberry. Some of the understory species observed included: fetterbush (*Lyonia lucida*), rusty lyonia,

gallberry (*Ilex glabra*), pricklypear (*Opuntia humifusa*) and gopher apple. Evidence of severe fire impacts was evident in the western mixed rangeland area (reportedly caused be a wildfire in 2003).

In the central area of mixed rangeland, canopy trees were sporadic and the canopy included sand live oak, laurel oak, and cabbage palm; a variety of plant species were observed in the ground cover such as lovegrass, natalgrass, wire grass, and shiny blueberry. Table D-14 lists all the identified species observed in the two mixed rangeland communities during the 2014 baseline study (VZ Technologies et al. 2014).

D.3.2. Cabbage Palm Hammock

This community is dominated by cabbage palm with some associated slash pine. Small areas (< one acre) of cabbage palm hammock are embedded in the pine flatwoods community. The canopy observed during the 2014 study was mature slash pine with an occasional live oak, and a midstory of cabbage palm. The state endangered species, hand fern, was observed growing on palm tree trunks in this community (VZ Technologies et al. 2014); the hand fern had been absent from this community for several years due to hurricane impacts (unknown source). Table D-14 lists the identified species observed in the cabbage palm hammock community during the 2014 baseline study (VZ Technologies et al. 2014). During a previous study (unknown source) conducted at MTA, the following species were observed in this community, but were not observed during the 2014 survey of MTA: herb wood sage (*Salvia riparia*) and the common terrestrial toothed orchid (*Habenaria odontopetala*) (unknown source).

D.3.3. Streams and Waterways

Two ditches approximately 20 feet wide are located within MTA, with an approximately 50 foot wide canal adjacent to MTA (offsite). The ditches on site appear to hold water year round, but water levels fluctuate throughout the year. The majority of vegetation observed in this community is floating, emergent, and submerged wetland plant species (see Table D-14 for a list of identified plant species observed in the streams and waterways community (VZ Technologies et al. 2014).

D.4. Hydric Pine Flatwoods

Hydric pine flatwoods is a wetland community located primarily in the southeast of MTA. The canopy cover is sparse to moderate and is dominated by slash pine. The midstory contains slash pine and cabbage palm, and the understory is sparse with saw palmetto and gallberry present. Groundcover vegetation was very diverse, with a many herbaceous species identified. Table D-14 for a list of identified plant species observed in the hydric pine flatwoods community (VZ Technologies et al. 2014). See Section 3.5.3 below for information regarding a community similar to hydric pine flatwoods, mesic flatwoods observed during a previous study at MTA (unknown source).

Table D-14. Identified Plant Species Observed within MTA (page 1 of 2)

Scientific Name	Common Name	Protected [a]	Invasive [b]
Alternanthera philoxeroides [e]	alligatorweed		II
Amphicarpum muhlenbergianum [f]	blue maidencane		
Andropogon virginicus var. glaucus [c] [f]	chalky bluestem		
Andropogon virginicus var. virginicus [c]	broomsedge bluestem		
Aristida purpurascens [f]	arrowfeather three awn		
Aristida stricta [c]	wire grass		
Asimina reticulata [g]	netted pawpaw		
Axonopus affinis [f]	carpet grass		
Bejeria racemosa [c]	tar flower		
Cheiroglossa palmata [d]	hand fern	SE	
Cladonia evansii [c]	Evan's reindeer lichen		
Coreopsis gladiate [f]	tickseed		
Dichanthelium dichotomum	cypress panicgrass		
Dichromena latifolia [f]	white bracted sedge		
Drosera capillaris [f]	sundew		
Eragrotis sp. [c]	lovegrass		
Euthamia caroliniana [c]	flattop goldenrod		
Fuirena scirpoidea [f]	rush-fuirena		
Helenium pinnatifidum [f]	swamp sneeze weed		
Hydrocotyle umbellata [e]	pennywort		
Hypericum sp. [f]	St. Johns wort		
Hypoxis juncea [f]	common stargrass		
Ilex glabra [c] [f]	gallberry		
Imperata cylindrical [e]	cogongrass		I
Lachnocaulon anceps [f]	bog button		
Lantana sp. [c] [d]	lantana		
Licania michauxii [c]	gopher apple		
Ludwigia peruviana [e]	Peruvian primrose willow		I
Lygodium microphyllum [e]	Old World climbing fern		I
Lyonia ferruginea [c]	rusty lyonia		
Lyonia lucida [c]	fetterbush		
Myrica cerifera [c] [e]	wax myrtle		
Nymphaea odorata [e]	American white waterlily		
Oeceoclades maculata [d]	African spotted orchid		
Opuntia humifusa [c]	pricklypear		
Panicum hemitomon [e]	maidencane		
Phlebodium aureum [d]	golden polypody		
Pinus elliottii [c] [d] [f]	slash pine		
Pinus palustris [g]	longleaf pine		
Pityopsis graminifolia [c]	narrowleaf silkgrass		
Polygala lutea [f]	bog bachelor button		
Polygala nana [f]	bachelor button		
Pontederia cordata [e]	pickerelweed		
Psidium guajava [d]	guava		I
Quercus geminata [c]	sand live oak		
Quercus laurifolia [c]	laurel oak		
Quercus minima [g]	dwarf live oak		
Quercus virginiana [d]	live oak		

Table D-14. Identified Plant Species Observed within MTA (page 2 of 2)

Scientific Name	Common Name	Protected (a)	Invasive (b)
Rhus copallinum (c)	winged sumac		
Rhynchelytrum roseum (c)	natal grass		
Sabal palmetto (c) (e) (f)	sabal palm		
Sabal palmetto (d)	cabbage palm		
Sabatia sp. (f)	marsh pinks		
Sagittaria latifolia (e)	duck potato		
Salix caroliniana (e)	coastal plain willow		
Sapium sebiferum (e)	Chinese tallow tree		I
Scirpus californicus (e)	giant bulrush		
Serenoa repens (c) (f)	saw palmetto		
Smilax sp. (d)	greenbrier		
Sporobolus floridanus (f)	Florida dropseed grass		
Stillingia sylvatica (f)	queensdelight		
Typha sp. (e)	cattail		
Urochloa mutica (e)	paragrass		I
Vaccinium myrsinites (c)	shiny blueberry		
Vitis rotundifolia (d)	muscadine grape		
Vittaria lineata (d)	shoestring fern		
Xyris caroliniana (c) (f)	Carolina yellow-eyed grass		
Zanthoxylum clava-herculis (c)	Hercules club		

Source: USDA 2014; FLEPPC 2013; VZ Technologies et al. 2014

(a) Protected: ST = State Threatened; SE = State Endangered

(b) Florida Exotic Pest Plant Council (FLEPPC, 2013) Ranking:
CATEGORY I = Invasive exotics that are altering native plant communities by displacing native species, changing community structures or ecological functions, or hybridizing with natives.
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(c) Vegetation observed in mixed rangeland community

(d) Vegetation observed in cabbage palm hammock

(e) Vegetation observed in streams and waterways

(f) Vegetation observed in hydric pine flatwoods

(g) Netted pawpaw, longleaf pine, and dwarf live oak were previously observed in this community type (unknown source), but were not observed during the 2014 survey of MTA.

D.5. Communities Identified within MTA during a Previous Study

In addition to the baseline biological survey conducted in 2014 (VZ Technologies et al. 2014), previous study(ies) have been conducted on MTA that also documented vegetative communities (unknown source and date). The following communities, which appear to be FNAI communities, were documented during these previous studies on MTA.

- depression marsh,
- hydric hammock (similar to cabbage palm hammock, VZ Technologies 2014),
- mesic flatwoods (hydric pine flatwoods community (VZ Technologies et al. 2014), and
- wet flatwoods.

The previous study also included a discussion of invasive, exotic plant species found on MTA.

D.5.1. Depression Marsh

The depression marsh community was not identified during the 2014 survey of MTA (VZ Technologies et al. 2014). Small depression marshes are scattered within MTA (unknown source).

- Depression marsh was observed (approximately 1.5 total acres) in the northeast quarter of the northwest section of MTA. These somewhat continuous shallow depressions form a mosaic within the prevalent mesic flatwoods.
- A small isolated depression marsh of poor quality and less than 0.25 acres was observed west of the runway near the middle of MTA.
- Several other small depression marshes were observed in the southeast corner of MTA within the wet flatwoods. Long-term drainage has blurred the boundary between these community types.
- An approximately two-acre marsh near Minton Road and south of the entrance to MTA was observed.
- Four small wet depressions were observed in the southern part of MTA. These small remnants barely function as marshes and are of poor quality due to long term drainage.

All the depression wetlands have been adversely affected by drainage and fire suppression. The functional value of the depression wetlands observed on MTA is generally low, and the depression marshes were primarily detected by persisting wetland plant species (unknown source). None of the plant species observed previously in the depression marsh community were protected or considered invasive exotic species. Plant species observed during the previous study are listed in Table D-15.

Table D-15. Plant Species Identified in Depression Marsh within MTA (previous study)
(page 1 of 2)

Scientific Name	Common Name	Protected [(a)]	Invasive [(b)]
Amphicarpum muhlenbergianum	blue maidecane		
Carphephorus carnosus	bald-headed carphephorus		
Centella asiatica	coinwort		
Cephalanthus occidentalis	buttonbush		
Cladium jamaicense	Jamaican sawgrass		
Eleocharis sp	spikerush		
Erianthus giganteus	sugarcane plumegrass		
Eriocaulon sp.	pipewort		
Hypericum sp.	St. John's wort		
Lachnanthes caroliniana	redroot		
Panicum hemitomum	maidencane		
Pinus elliottii	slash pine		
Pontederia cordata	pickerelweed		
Proserpinaca pectinata	mermaid weed		
Rhynchospora sp.	beakrush		

Table D-15. Plant Species Identified in Depression Marsh within MTA (previous study) (page 2 of 2)

Scientific Name	Common Name	Protected (a)	Invasive (b)
Sagittaria lancifolia	bulltongue arrowhead		
Spartina bakeri	sand cordgrass		
Syngonanthus flavidulus	yellow hatpins		
Thalia sp.	alligator-flag		
Woodwardia virginica	Virginia chain fern		
Xyris sp.	yellow-eyed grass		

Source: USDA 2014; FLEPPC 2013; unknown source
(a) Protected: ST = State Threatened; SE = State Endangered
(b) Florida Exotic Pest Plant Council (FLEPPC, 2013)

D.5.2. Hydric Hammock

Hydric hammock was documented in the previous study and is similar to the cabbage palm hammock community (VZ Technologies et al. 2014) (see Section 3.2 above). This community was described as a discontinuous canopy consisting of dense clusters to widely scattered palms. Live oak, slash pine, and Hercules club were scattered and sparse (within the palm trees). The ground cover was sparse in most areas with the herb wood sage locally abundant and the common terrestrial toothed orchid (*Habenaria odontopetala*) observed as scattered specimens. The terrestrial orchid was not observed in 2005 or 2006, but will continue to be monitored for re-colonization of MTA (unknown source). The 2014 baseline biological survey did not identify the terrestrial toothed orchid (VZ Technologies et al. 2014). Historically, a small but healthy population of the state endangered epiphytic hand fern grew on cabbage palms in three locations within this community. The hurricanes that struck Florida in 2004 appeared to have blown all of the fern material from the palms. Specimens were not observed from 2005 to 2007 (unknown source). As indicated above in Section 3.2, Cabbage Palm Hammock, the hand fern was observed again in 2014 within MTA (VZ Technologies et al. 2014).

During the previous study, small fragments of hydric hammock covered about one acre along the north boundary in the northwest section of MTA. The hammock fragments were situated between mesic flatwoods and a depression marsh. The hydric hammock was bisected by the perimeter security fence and patrol road, therefore a portion of the hydric hammock was onsite, and a portion was offsite. The larger hammock area with more diverse vegetation was north of the perimeter fence (offsite). In this offsite area, the closed canopy of mature live oak (up to 50 feet tall and 24 inches diameter breast high [dbh]) covered numerous mature and immature cabbage palms. Three tropical shrub species were observed (beyond the perimeter fence): Simpson's stopper, a Florida listed threatened species (approximately 25 feet tall) is abundant north of the perimeter security fence, wild coffee was common, and wild lime (*Zanthoxylum fagara*) was rare (represented by only one 5 foot tall plant) (unknown source).

D.5.3. Mesic Flatwoods

Mesic flatwoods were documented in the previous study and is similar to the hydric pine flatwoods community (VZ Technologies et al. 2014) (see Section 3.4 above). Mesic flatwoods made up most of the forested areas within MTA. Slash pine (mature) was observed in the canopy with a light to dense saw palmetto understory. The ground cover ranges from good to

poor quality in different areas, reflecting past land clearing and fire suppression. Flatwoods of good quality were also observed in the northeast corner and the west central area of MTA. The largest area was approximately 20 acres observed along the border of Minton Road in northern MTA. This area had a canopy of mature slash pine averaging 30% cover, ranging from six to 20 inches dbh, and from 40 to 60 feet high. One longleaf pine (*Pinus palustris*) was also observed (along Minton Road about 200 feet south of the north boundary fence). The subcanopy included immature slash pine, groups of cabbage palm, widely scattered laurel oak and live oak. The shrub stratum was dominated by dense saw palmetto (six to 10 feet tall), with occasional open areas, and with significant areal coverage. In the open areas of the saw palmetto, gallberry and dwarf live oak (*Quercus minima*) were abundant and the ground cover consisted of wiregrass and broomgrass. Muscadine grape vines cover the ground in some locations. Occasionally, old pine stumps were observed in the mesic flatwoods (unknown source).

The vegetation in the southeast corner (about 10 acres) and west central area (about 2 acres) was dominated by five to eight feet tall dense saw palmetto. Small openings in the middle of these areas have natural ground cover of wiregrass plus the low shrubs, dwarf live oak and pawpaw (*Asimina reticulata*). The slash pine canopy was very sparse with trees mainly restricted to the openings or the periphery. Old pine stumps were commonly observed (unknown source).

Similar but less diverse flatwoods cover another 20 acres just south of the entrance road. Most of this area had dense saw palmetto (unknown source).

D.5.4. Wet Flatwoods

Wet flatwoods were observed on approximately 30 acres in the southeast corner of MTA (unknown source). The poor condition of the wet flatwoods made the boundaries of this community difficult to discern. This community was assigned a marginal-poor ranking due to fire suppression and disturbances such as drainage, mowing, and land clearing (unknown source). The canopy was intermittent and included immature slash pine; vegetation in the shrub stratum was sparse and included wax myrtle and cluster-leaf St. John's wort (*Hypericum cistifolium*). Tthe ground cover vegetation was diverse including commom carpetgrass, big carpetgrass (*Axonopus furcatus*), coinwort (*Centella asiatica*), bald-headed carphephorus, and pink sundew (*Drosera capillaris*) (unknown source).

D.5.5. Invasive Species observed within MTA during a Previous Study

The exotic, invasive Brazilian pepper was noted as the most problematic invasive species at MTA, but other FLEPPC Category I invasive plants (FLEPPC 2013) of concern at MTA included: Australian pine (*Casuarina glauca*; along the canals), cogongrass (*Imperata cylindrica*), strawberry guava (*Psidium cattleianum*), common guava, melaleuca (*Melaleuca quinquenervia*), camphor tree (*Cinnamomum camphora*), earpod tree (*Enterolobium contortisiliquum*), climbing fern (*Lygodium* sp.), and simpleleaf chastetree (*Vitex trifolia*). Australian pine occurred in two locations in the northwest quarter of the installation. A narrow band of Australian pine was observed: approximately 150-feet long along the canal on the western boundary of MTA, and a second area (approximately 50-feet long) along a nearby east-west grassy road. Small patches of cogon grass were observed along the old runway system. Two small clumps of melaleuca trees were observed at opposite ends of a depression marsh in

the southeast area of MTA. An individual strawberry guava was observed between the clumps of melaleuca trees. The closely related common guava was abundant, and was observed along the edge of the northeast-southwest oriented runway. A few isolated specimens of camphor tree were observed, and an earpod tree was noted on the eastern side of the south end of the northeast-southwest oriented runway (near the southern end of the runway, eastern side). Feral hogs are also an issue at MTA, which cause ground disturbance and vegetation impacts (unknown source).

D.6. Jonathan Dickinson Missile Tracking Annex (JDMTA) Natural Communities

JDMTA is surrounded on three sides by the Jonathan Dickinson State Park (JDSP). This park has 13 natural communities, including sand pine scrub, pine flatwoods, mangroves, and river swamps (http://www.floridastateparks.org/jonathandickinson/). The community type in JDSP in the vicinity of JDMTA is sand pine scrub.

The majority of land use within JDMTA is infrastructure related to the tracking annex; such as roads, parking, and the radar site. The only natural area within JDMTA is rosemary scrub, occurring in islands. Vegetation previously observed in the rosemary scrub community within JDMTA includes (unknown source):

- scrub oak (*Quercus inopina*);
- sand live oak;
- sand pine;
- Florida rosemary;
- saw palmetto; and
- wild blueberry (*Vaccinium* spp.).

The U.S. Air Force, 45th Space Wing (45 SW) cleared approximately 16 acres along the entire fence line/perimeter of JDMTA to replace 3,300 linear feet of an 8-foot-tall chain link fence and enclose a 200-foot boresight tower. Clearing to bare ground in a 30-foot wide clear zone was established as part of the fence replacement (in accordance with USFWS guidance). This clear zone will be maintained for security purposes and vegetation will be cleared and mowed regularly. A 70-foot clear zone was established adjacent to the fence clear zone for Florida scrub-jay (scrub-jay) habitat enhancement. This 70-foot area will be maintained on approximately five-year cycles with a mosaic restoration using prescribed burning by Jonathan Dickinson State Park (JDSP) (in accordance with the JDSP burn plan) to maintain natural vegetation at heights preferable to the scrub-jay.

Lichen species, including the endangered lichen, Florida perforate lichen (*Cladonia perforata*) was present within JDMTA, almost entirely limited to a relatively open area at the edge of pine and oak tree line near the boresight tower with some areas of the lichen nearer to the fence line. Impacts from the JDMTA fence and tower replacement project to this protected species were addressed on a project specific basis under USFWS Section 7 consultation (7 Feb 2005). The lichen at JDMTA was relocated to an offsite location within JDSP through coordination with the JDSP biological staff. Global Positioning System (GPS) coordinates of the recipient sites were

recorded and provided to JDSP for locations to prevent fire impacts from their controlled burns. Only fragments of the lichen that were too difficult to retrieve/remove still remain on JDMTA.

Smaller projects that involve impacts to areas where any remaining lichen may be found at JDMTA will be reviewed by 45 CES/CEIE-C; consultation will occur if it is determined that impacts to the lichen cannot be avoided. Generally, impacts will be avoided by prohibiting mowing and foot and vehicular traffic in the areas where lichen is located. It is possible that the lichen may disperse back into JDMTA with wind and rain; JDMTA will be surveyed annually to determine if new populations of the lichen have established on this 45 SW property.

The 45 SW determined that the fence line and boresight tower project "may affect, but is not likely to adversely affect" the endangered Florida perforate lichen. The 45 SW proposed the following conservation measures to minimize adverse effects to the Florida perforate lichen:

(1) Lichen occurring in large aggregates, and in which hand cutting is feasible, will be avoided by heavy equipment during clearing;

(2) Other small groupings or individual specimens would be removed from the site to an approved relocation area outside the project's zone of influence. The relocated lichen would remain at the new site to prevent potential damage that may occur if moved back to the original location; and

(3) The 30-foot-wide clear zone will be maintained according to USFWS-recommended protocol regarding maintenance of scrub habitat. This habitat clearing protocol is expected to provide ideal growing conditions of the Florida perforate lichen.

The area surrounding JDMTA (within JDSP) is scrubby flatwoods habitat, and the state threatened species, Florida scrub-jay, nests in JDSP in this area. Although the scrub-jay does not nest within JDMTA, it does periodically cache acorns with JDMTA (Keitha Datillo-Bain, personal communication, 29 October 2013). The federal candidate species, gopher tortoise, uses the swales within JDMTA for burrowing (GTCCA 2013).

The 45 SW determined that the proposed fence line and boresight project "may affect, but is not likely to adversely affect" the threatened Florida scrub-jay. The 45 SW proposed the following conservation measures to minimize adverse effects to the Florida scrub-jay:

(1) All land clearing and/or vegetation cutting will be conducted outside of the scrub-jay nesting season (March 1 to June 30). If any scrub-jay nests are encountered in the project vicinity, they will be surveyed before clearing begins to identify early nest attempts;

(2) A 30-foot-wide clear zone will be created adjacent to the existing perimeter fence. The clear zone would be maintained annually or semi-annually by the U.S. Air Force and will provide a firebreak that would facilitate prescribed burning conducted by JDSP for scrub habitat enhancement; and

(3) A 70-foot-wide strip, adjacent to the 30-foot-wide clear zone, will be selectively cut to create a mosaic of scrub habitat. Scrub vegetation in this zone will be allowed to regenerate to a height preferred by nesting scrub-jays. When the majority of scrub oaks grow beyond the preferred nesting height, the 70-foot-wide strip would be mechanically treated, on a rotational schedule with previously untreated areas, to maintain heterogeneity within the treated scrub habitats.