USDA Natural Resources Conservation Service

Ecological site R155XY170FL
Sandy Coastal Grasslands and Forests

Last updated: 2/14/2025
Accessed: 05/13/2025

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 155X–Southern Florida Flatwoods

This MLRA makes up about 19,973 square miles (51,731 square kilometers) and is entirely in Florida. It stretches across the mid-section of the State, from the Gulf of Mexico to the Atlantic Ocean, and north and south from the Everglades (MLRA 156A) to Jacksonville. This MLRA consists of a young sandy marine plain of Pleistocene age that is underlain by Tertiary-age limestone bedrock. The terrain is nearly level to gently sloping with large areas of swamp and marsh. Sinkholes affect land use and management.

The landscape consists of nearly level to gently sloping marine terraces that have large areas of wetlands and marshes. Streams and lakes are common. Low-lying wet areas are flat with some hummocks that rise 3 feet (1 meter) above the general level of the landscape. Coastal areas consist of low beach ridges and dunes that rise 6 to 10 feet (2 to 3 meters) above the lower inland areas. Elevation ranges from sea level to less than 196 feet (60 meters), increasing gradually from the coast to inland areas.

This MLRA is underlain by sediments of the Quaternary Period (present to 2.58 million years ago) which overlie Neogene (2.53 to 23.03 million years ago) and Paleogene (23.03 to 66 million years ago) formations, including those of the Hawthorn Group. The older rocks are exposed in the north-central part of this area. The Quaternary sediments are largely undifferentiated marine deposits consisting of fine to coarse sands that are poorly to moderately sorted with variable admixtures of clay and organic material. Undifferentiated Holocene (present to 0.0117 million years ago) sediments, which include quartz sands, marls, organic material, and minor carbonate sands and mud, are in the northeast part of this MLRA. The sediments may also include freshwater gastropods. Near the southeastern coastline, the Anastasia Formation and Miami Limestone are exposed. The Anastasia Formation is made up of a variably lithified coquina of shells and sands and unlithified fossiliferous sand. The Miami Limestone is white to light gray, variably fossiliferous, oolitic and pelletal with variable percentages of quartz sand, ranging from sandy limestone to calcareous quartz sand (Scott, 1993a, 1993b; Duncan, 1993a, 1993b). Quaternary beach ridge and dune sediments, which are mapped based on topographic expression, occur throughout the MLRA, becoming more abundant toward the coast.

The average annual precipitation is 38 to 61 inches (973 to 1,559 millimeters). About 60 percent of the precipitation occurs from June through September. Most of the rainfall occurs during moderate-intensity, tropical storms that produce large amounts of rain from late spring through early autumn. Late autumn and winter are relatively dry. The average annual temperature is 69 to 76 degrees F (21 to 24 degrees C). The freeze-free period averages 335 days and ranges from 300 to 365 days.

The dominant soil orders are Alfisols, Entisols, and Spodosols. The soils in the area dominantly have a hyperthermic temperature regime, an aquic moisture regime, and siliceous mineralogy. They generally are deep or very deep; poorly drained, very poorly drained, or somewhat poorly drained; and sandy or loamy, or both. Anthroportic soils throughout the area are a result of cut-and-fill activities associated with construction and urbanization.

This area supports flatwood forest vegetation. Slash pine, longleaf pine, loblolly pine, cabbage palm, bald cypress, laurel oak, water oak, and live oak are the main species. Saw palmetto, wax myrtle, gallberry, and grasses such as bluestems, threeawns, maidencane, and wiregrasses characterize the understory. Along the coastline and around the city of Orlando, this MLRA has been heavily urbanized. However, a significant acreage remains in agriculture for the production of citrus, specialty crops, and cattle. Surface water runoff from agriculture and urbanization are carefully monitored to help mitigate sinkhole development.

The major soil resource concerns are wind erosion, maintenance of the content of organic matter and productivity of the soils, and management of soil moisture. Conservation practices on cropland generally include conservation crop rotations, cover crops, irrigation water management (including micro irrigation systems), nutrient management, and pest management. Conservation practices on pasture and rangeland generally include prescribed grazing, brush management, pest management, prescribed burning, and watering facilities. Conservation practices on forestland generally include forest stand improvement, forest site preparation, prescribed burning, firebreaks, establishment of trees and shrubs, pest management, and management of upland wildlife habitat.

Classification relationships

All portions of the geographical range of this site falls under the following ecological / land classifications including:

-Environmental Protection Agency's Level 3 and 4 Ecoregions of Florida: 75 Southern Coastal Plain; 75b Southwestern Florida Flatwoods,75d Eastern Florida Flatwoods (Griffith, G. E., Omernik, J. M., & Pierson, S. M., 2013)

-Florida Natural Area Inventory, 2010 Edition: Coastal Uplands; Coastal Grasslands, Coastal Inundated Swale, Coastal Berm, Maritime Hammock (FNAI ,2010)

-Soil Conservation Service, 26 Ecological Communities of Florida: 1- North Florida Coastal Strand, 2- South Florida Coastal Strand, 14- Tropical Hammocks (Florida Chapter Soil and Water Conservation Society, 1989)

-LandFire Existing Vegetation Type, 2020: Southeastern Ruderal Grassland, Southeastern Florida Coastal Strand Shrubland, Southern Coastal Plain Oak Dome and Hammock, Southwest Florida Dune and Coastal Grasslands.

LandFire Biophysical Setting, 2020: Southwest Florida Coastal Strand and Maritime Hammock

-Myers and Ewel, 1990: Dunes and maritime hammocks – transition zone, Maritime Hammock

Ecological site concept

This ecological site is associated with very deep somewhat poorly to moderately well drained sandy soils that exist behind active dune systems along the Florida coastline. These are found in greatest extent on barrier islands and capes along both the Atlantic and Gulf Coasts. This site often develops behind active beach dunes relying on the protection from intense sand burial and salt spray. This protection allows for the establishment of grasslands behind the dune system that support both salt and freshwater species.

Reference plant community 1.1 is primarily composed of open grasslands often large in size, narrow in width, running parallel along coastal beaches. These graminoids are well adapted to salt spray and sand burial and are able to readily re-colonize following disturbances. Disturbances that break through the protective barrier that supports these sites such as over wash and burial will often reset these areas to open bare sand until the seedbank present meets the correct conditions for growth. Without natural disturbances, the reference conditions may become encroached by salt tolerant woody species, and may transition to a closed canopy forest over time. These areas are highly urbanized due to desirable location in coastal communities and highly susceptible to degradation via foot traffic. This site may be split into two separate ecological site descriptions with future projects addressing saline influence on soil-vegetation dynamics.

Associated sites

R155XY020FL	**Haline Intertidal Marshes and Swamps** These sites are very poorly drained communities that occur in lower, wetter, intertidal landscape positions. These will occur in sheltered lower-wave energy coastlines along the backside of barrier islands not exposed to salt spray.
R155XY070FL	**Sandy Freshwater Isolated Marshes and Swamps** These sites are very poorly drained communities that occur in lower, wetter, undulating landscape positions within the associated site. These will occur as poorly defined drainageways within the associated site formed by overwash during periods of extreme storm events.
R155XY220FL	**Sandy Coastal Beach Dunes** These sites are excessively drained communities that occur in higher, drier, coastal landscape positions. These will occur immediately adjacent to the Atlantic Ocean or Gulf of Mexico, protecting the associated site found immediately behind them.
R155XY230FL	**Sandy Scrub on Ridges, Knolls, and Dunes of Xeric Uplands** These sites are excessively drained communities that occur in higher, drier, coastal landscape positions. These will occur as stabilized coastal scrub communities, a relict dune system within the associated site.

Similar sites

F155XY200FL	**Shallow to Moderately Deep Sandy over Loamy Maritime Forests** These sites have similar vegetative community composition and structure but will occur along more stabilized coastlines altered for human production. Soils materials will have fine textures at shallower depths and different bedrock (coquina), affecting the production of vegetation in both natural and altered states.
F155XY210FL	**Deep Sandy over Loamy Maritime Forests** These sites have similar vegetative community composition and structure but will occur along more stabilized coastlines altered for human production. Soils materials will have fine textures and different bedrock (coquina), affecting the production of vegetation in both natural and altered states.

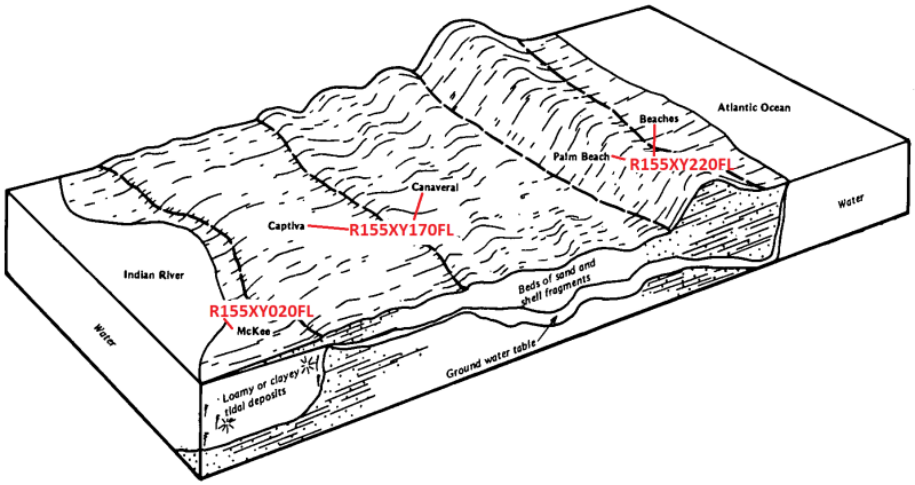


Figure 1. R155XY170FL is dependent on the formation and protection of coastal dunes(R155XY220FL), and will often boarder intertidal marshes and swamps (R155XY020FL) along protected shorelines from high energy action

Table 1. Dominant plant species

Tree	(1) *Quercus virginiana* (2) *Sabal palmetto*
Shrub	(1) *Serenoa repens* (2) *Morella cerifera*
Herbaceous	(1) *Spartina patens* (2) *Panicum amarum*

Physiographic features

This ecological site and its associated plant communities occur on flats, dunes, ridges, and knolls in coastal areas. These areas form on backslopes and summits of low stabilized dunes, as well as low broad flats and interdune areas, often seen as a gently undulating low sloping environment. This site is found along both the Gulf of Mexico and the Atlantic Ocean on large barrier islands such as Cape Canaveral, Sanibel, Cayo Costa, and Captiva.

Table 2. Representative physiographic features

Geomorphic position, terraces	(1) Riser
Hillslope profile	(1) Backslope (2) Summit
Slope shape across	(1) Linear
Slope shape up-down	(1) Linear (2) Convex
Landforms	(1) Marine terrace > Flat (2) Marine terrace > Dune (3) Marine terrace > Ridge (4) Marine terrace > Knoll
Runoff class	Negligible to very low
Flooding frequency	None
Ponding frequency	None
Elevation	0–6 m
Slope	0–5%
Ponding depth	0 cm
Water table depth	30–107 cm
Aspect	Aspect is not a significant factor

Climatic features

The climate of central and south Florida is warm to hot and temperate to subtropical, with this site getting an average annual precipitation of 52 to 56 inches (1320.8 to 1422.4 millimeters). About 60 percent of the precipitation occurs from June through September. Most rainfall occurs during moderate tropical storms that produce large amounts of rain from late spring through early autumn. Late autumn and winter are relatively dry. The average annual temperature is 69 to 76 degrees F (21 to 24 degrees C).

The following tables and graphs consist of specific climate stations found within the range of this ecological site within this MLRA.

Table 3. Representative climatic features

Frost-free period (characteristic range)	365 days
Freeze-free period (characteristic range)	365 days
Precipitation total (characteristic range)	1,321-1,422 mm
Frost-free period (actual range)	365 days
Freeze-free period (actual range)	365 days
Precipitation total (actual range)	1,295-1,600 mm
Frost-free period (average)	365 days
Freeze-free period (average)	365 days
Precipitation total (average)	1,397 mm

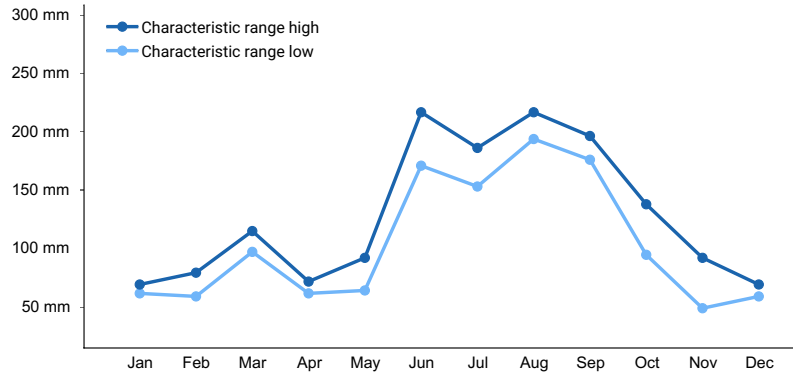


Figure 2. Monthly precipitation range

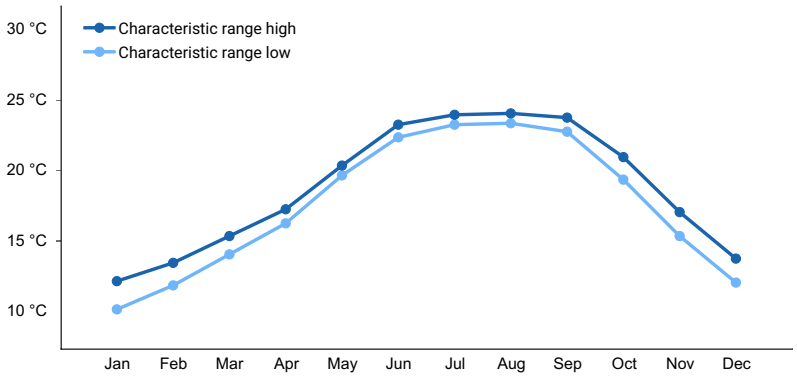


Figure 3. Monthly minimum temperature range

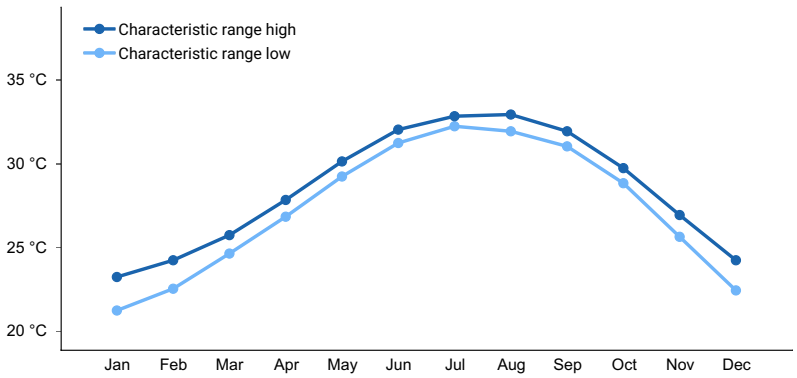


Figure 4. Monthly maximum temperature range

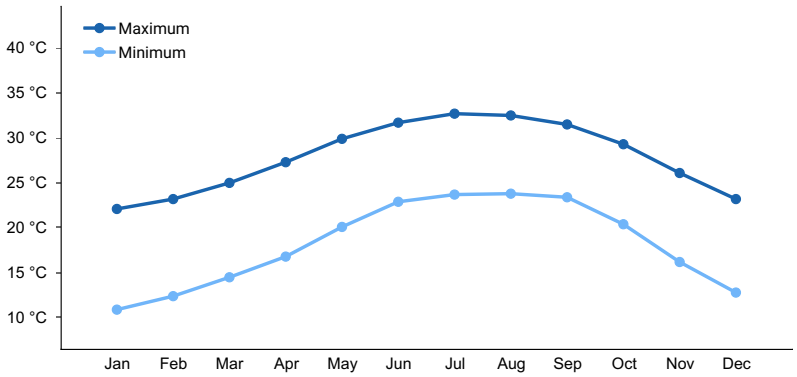


Figure 5. Monthly average minimum and maximum temperature

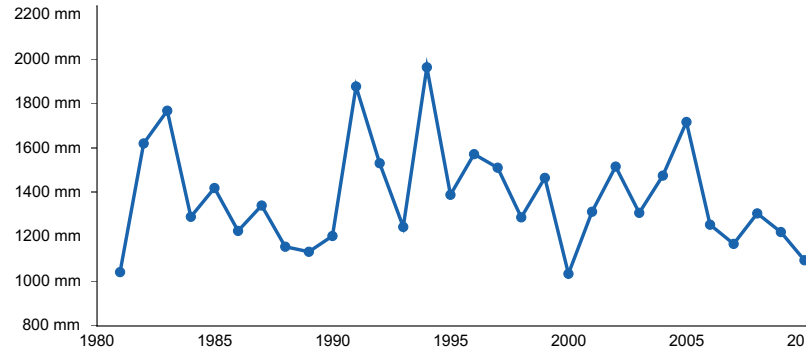


Figure 6. Annual precipitation pattern

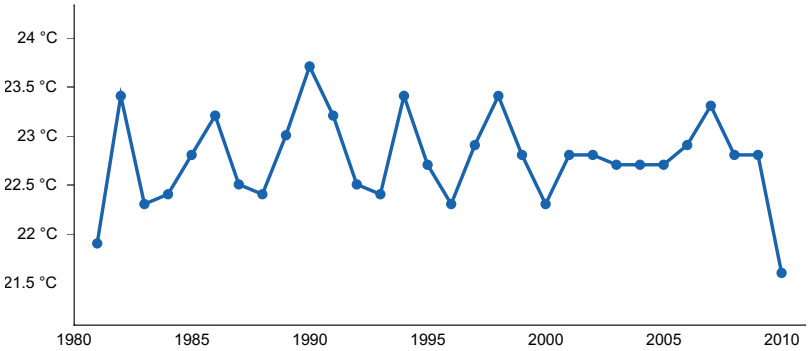


Figure 7. Annual average temperature pattern

Climate stations used

- (1) NAPLES MUNI AP [USW00012897], Naples, FL
- (2) VENICE [USC00089176], Venice, FL
- (3) SARASOTA BRADENTON AP [USW00012871], Sarasota, FL
- (4) JUNO BEACH [USC00084461], North Palm Beach, FL
- (5) VERO BEACH 4SE [USC00089219], Vero Beach, FL
- (6) TITUSVILLE [USC00088942], Titusville, FL
- (7) DAYTONA BEACH [USC00082150], Daytona Beach, FL

Influencing water features

The vegetative communities are entirely dependent on rainfall for their supply of freshwater.

Wetland description

NA

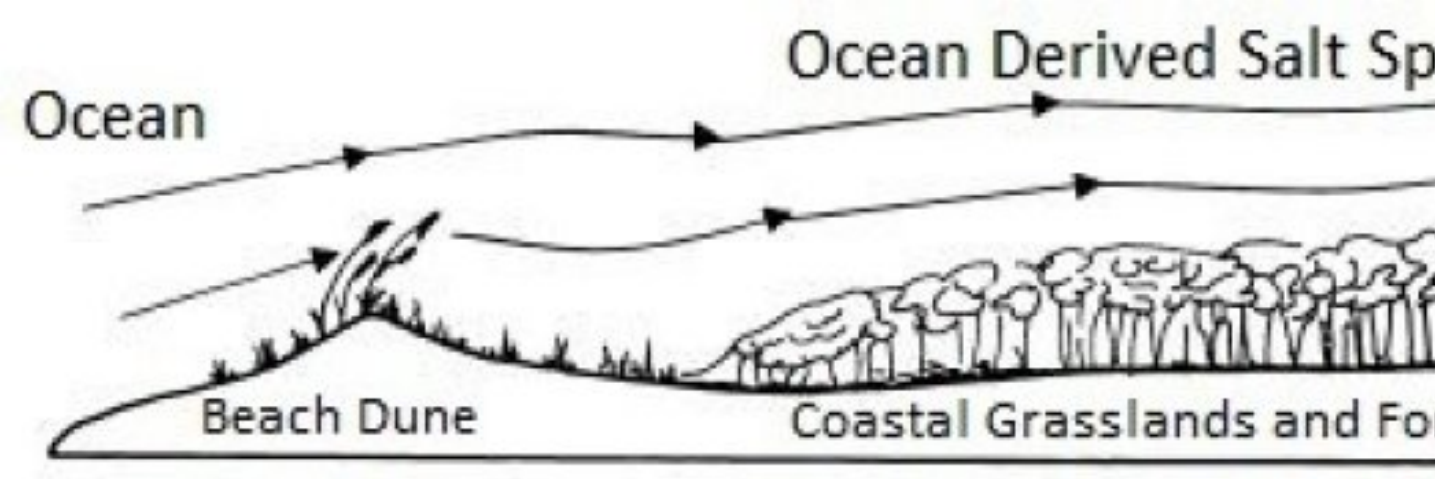


Figure 8. Exaggerated ocean derived salt spray diagram in a undisturbed setting. Image modified from Bellis, 1995.

Soil features

These soils consist of very deep, somewhat poorly drained to moderately well drained, rapid permeable soils formed in thick marine deposits of sand and shell fragments. These soils have 40 inches to greater than 80 inches of sand or fine sand with mixed shell fragments. Soils include mollic psammaquents (Captiva) and aquic quartzipsamments (Canaveral). Soil mineralogy is siliceous.

Table 4. Representative soil features

Parent material	(1) Marine deposits (2) Eolian deposits
Surface texture	(1) Fine sand (2) Sand
Drainage class	Somewhat poorly drained to moderately well drained
Permeability class	Very rapid
Depth to restrictive layer	203 cm
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	2.03–6.1 cm
Calcium carbonate equivalent (0-101.6cm)	0–10%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	1–10
Soil reaction (1:1 water) (0-101.6cm)	6.6–8.4
Subsurface fragment volume <=3" (0-101.6cm)	0–12%
Subsurface fragment volume >3" (0-101.6cm)	0%

Table 5. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Depth to restrictive layer	Not specified
Soil depth	Not specified
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	2.03–6.1 cm
Calcium carbonate equivalent (0-101.6cm)	0–10%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–10
Soil reaction (1:1 water) (0-101.6cm)	3.5–8.4
Subsurface fragment volume <=3" (0-101.6cm)	0–37%
Subsurface fragment volume >3" (0-101.6cm)	0–4%

Ecological dynamics

Water Dynamics

These areas are influenced by both freshwater and saltwater dynamics. Rainfall will replenish the shallow subsurface freshwater lens which sits above the denser salt water. In lower areas freshwater may accumulate for brief periods of time after heavy rainfall. Due to their proximity to the coastline, community structure is often influenced by sea spray or salt spray. This spray is often most intense closer to the shoreline with active dune systems protecting the grasslands (1.1) and forests (1.3) behind it. As these systems build outward with dune migration, they become less influenced by salt in both the soil pores and wind borne salts. Freshwater tolerant grasses and shrubs will begin to replace the dominant salt tolerant grasses in both density and cover further inland. In wooded areas the spray will often kill the upper buds of the plants, producing smooth, pruned canopies. Further away from the shore, the maritime forest canopy gradually assumes a more uneven surface like an inland hammock communities as individual tree height becomes more of an expression of species growth potential rather than a growth response to an inhibitory environmental factor.

Disturbances

These areas are often dependent on active beach dune systems as protection from storm surges and will often become briefly flooded if the dune system is destroyed. Intense storms which break through a dune system may allow storm surges to enter these communities, where prolonged standing water and sand deposition may kill these species. Over time, excess salt is diluted by precipitation and flushed from the system, allowing for new growth after the beach dune has been re-colonized, starting with pioneer saline tolerant species, followed by more freshwater tolerant species. Absence of disturbances from the system may allow for the encroachment and establishment of woody species, creating maritime thickets (1.2) and eventually closed canopy hardwood forests (1.3). Under natural conditions coastal forests are unevenly aged, with mature oak and palm species present. Reproduction primarily occurs through canopy gaps.

Fire is naturally rare and localized in this community with water barriers and sparse fuels combining to limit its spread.

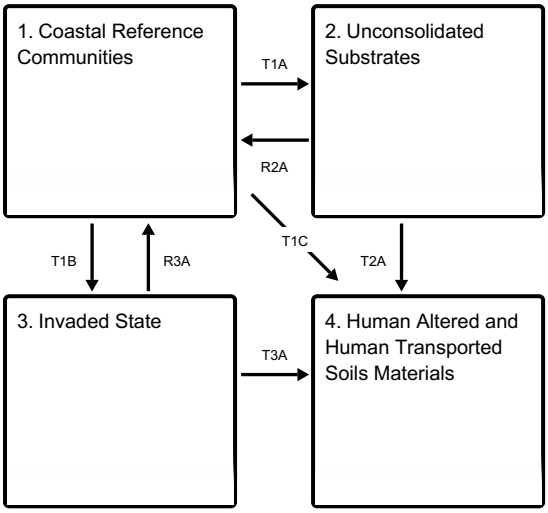
Anthropogenic Activities

Increased urbanization may lead to excessive withdrawals from the freshwater lense and coastal aquifers, lowering the water table and intensifying localized drought conditions, as well as fragmenting the habitat and allowing for invasive species dominance.

**There may be a slight change in vegetative composition and structure along the two coastlines as well as slight shifts from temperate to subtropical species found in the north to south gradient. This site reflects the range of general characteristics of these communities despite slight changes in latitudinal and longitudinal gradients and proximity to the ocean. This split may be addressed in future NRCS projects.

State and transition model

Ecosystem states



T1A - Community Destroying Disturbance Event

T1B - Introduction and Establishment of Invasive / Non-Native / Undesirable Species

T1C - Human Alteration and Human Transportation of Soils Materials

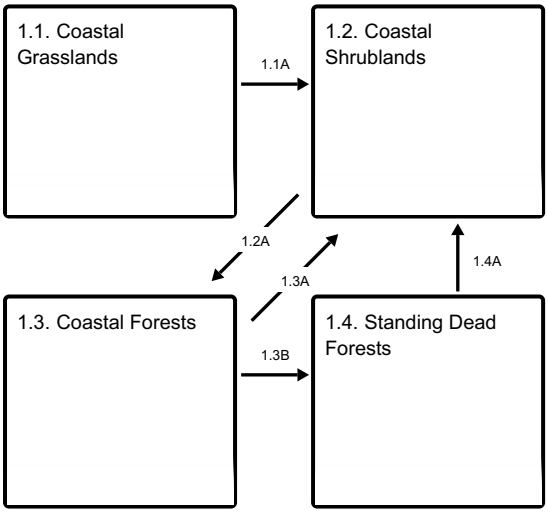
R2A - Vegetation Establishment

T2A - Human Alteration and Human Transportation of Soils Materials

R3A - Invaded / Non-Native/ Undesirable Species Removal and Restoration

T3A - Human Alteration and Human Transportation of Soils Materials

State 1 submodel, plant communities



1.1A - Shrubland Establishment through Ecological Succession

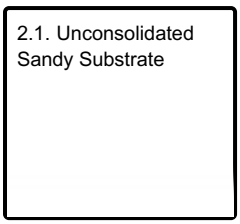
1.2A - Forest Establishment through Ecological Succession

1.3A - Overstory Mortality (Not Storm Surge Related)

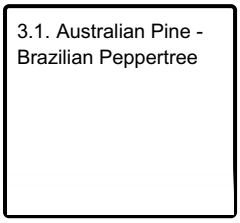
1.3B - Storm Surge Deposition (Saline Intrusion)

1.4A - Secondary Succession

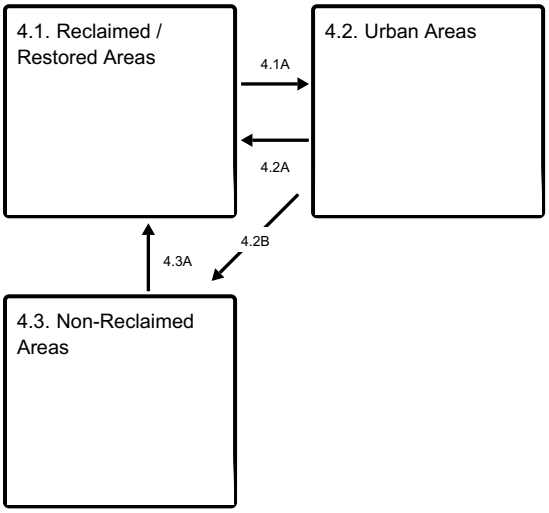
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



4.1A - Urbanization

4.2A - Land Restoration / Reclamation

4.2B - Industrialization / Urbanization to Non-Reclaimed Lands

4.3A - Land Restoration / Reclamation

Sandy Coastal Grasslands and Forests STM Key

I. Natural Stable Reference States- the ecological state that is most resistant to change, offers the most options to achieve management objectives, and reflects a defined “natural” disturbance regime.

A. Coastal Grasslands - non-forested grassland communities found on the drier portions of the transition zone behind beach dune systems. This state relies on the formation and protection of active beach dune systems from harsh wind-borne salt spray and storm wave action. These grasslands are found further inland than beach dunes but will still be adjacent to the coastline.

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1 This phase describes an open grassland along adjacent coastlines. Dominant vegetation consists of dune building grasses such as seaoats (Uniola paniculate), bitter panicgrass (Panicum amarum), and saltmeadow cordgrass (Spartina patens), as well as a variety of other herbaceous species more typical of stabilized soils such as bluestem grasses (Andropogon, Schizachyrium sp.), camphorweed (Heterotheca subaxillaris), and earleaf greenbriar (Smilax). ... Community 1 – Coastal Grasslands

2 This phase consists of sparse shrubs species growing in a matrix of a coastal grassland. These sparse shrubby communities are often the result of absence of disturbance from the reference community, allowing for woody establishment. These species will often grow on stabilized lower dune systems in the coastal grassland community where active dune systems are migrating towards the sea. ... Community 2 – Coastal Shrublands

B. Coastal Forests - low, dense shrublands and closed canopy coastal forests dominated by evergreen hardwood species.

1 This phase consists of densely packed shrub species growing where a coastal grassland was once prevalent. These are the result of absence of disturbance from the reference state, allowing for a dense shrub cover to form and stabilize an area. Vegetation will often consist of dense saw palmetto (Serenoa repens) and scattered dwarfed cabbage palm (Sabal palmetto) on the seaward edge, which are gradually joined inland by taller shrubs. ... Community 2 – Coastal Shrublands

2 This phase consists primarily of evergreen hardwood forests growing on stabilized coastal grasslands and dunes at varying distance from the shore. Characteristic species include live oak (Quercus virginiana), cabbage palm (Sabal palmetto), and red bay (Persea borbonia), combining to form a dense canopy. The low, streamlined profile deflects winds and generally prevents hurricanes from uprooting the trees. ... Community 3 – Coastal Forests

II. Alternative Ecological States- one of several potential states of an ES that is functionally different from the reference state in terms of important ecological processes, kinds and amounts of ecosystem services, and management requirements.

A. Standing Dead Forests - a coastal forest which has been killed via a storm event which has deposited sand and salt by storm surges and extreme winds. While these species of forests are tolerant of the influence of sea spray, prolonged salt exposure may kill the root system, leaving behind the standing dead tree, often giving the appearance of a standing dead forest. ... Community 4 – Standing Dead Forests

B. Unconsolidated Substrates - unconsolidated unvegetated substrate primarily consisting of sand and shell fragments.

1 This community describes the unvegetated, loose, sand and shell substrate deposited via overwash during a storm event. This substrate will partially or completely bury the existing species. These are less stable habitats that may be disturbed annually by high spring tides or storm tides, but will recolonize rapidly. ... Community 1 – Unconsolidated Sandy Substrate

C. Invaded State - consists of Florida Department of Agriculture and Consumer Services (FDACS) Non-

C. "Invaded State" consists of Florida Department of Agriculture and Consumer Services (FDACS) Non-Native Category 1 Species list.

1 This phase describes the introduction and establishment of common invasive species to this ecological site. Australian pine (Casuarina equisetifolia) and Brazilian peppertree (Schinus terebinthifolia) are the two most common species. In many areas, these species will be found along the edge habitat due to higher soil disturbance, a result of urbanization. ... Community 1 – Australian Pine - Brazilian Peppertree

D. Human Altered and Human Transported Areas - areas that were intentionally and substantially modified by humans for an intended purpose, commonly for terraced agriculture, building support, mining, transportation, and commerce. The alteration is of sufficient magnitude to result in the introduction of a new parent material (human-transported material) or a profound change in the previously existing parent material (human-altered material).

1 Areas that have been modified through anthropogenic means that are restored to a natural or second-hand natural community ... Community 1 – Reclaimed / Restored Areas

2 Areas developed for human use. These include a variety of land uses, e.g., inner city or urban core, industrial and residential areas, cemeteries, parks, and other open spaces; the overall function which may benefit the quality of human life ... Community 2 – Urban Areas

3 Areas that have been modified through anthropogenic means that are unable to be restored to a natural or semi-natural community (Active mines / mined areas before Phosphate Land Reclamation Act in 1975) ... Community 3 – Non-Reclaimed Areas

State 1
Coastal Reference Communities

This state consists of reference coastal non-forested and forested communities. Changes in community phase will follow succession as distance from saline influence increases.

Resilience management. This state develops usually in one of two ways: either as a barrier island builds seaward, developing new beach dune ridges along the shore, protecting the inland ridges from sand burial and salt spray, or as a beach recovers from a storm event as a new foredune protects the overwashed area from sand burial and sea spray. Distance from the coast and the physical barrier of the first dune ridge above the beach (foredune) diminish the intensity of sand burial and salt spray, which affect the coastal grassland community to a lesser extent than they do the beach dune community. Once a new foredune ridge builds up above the beach and plant cover inhibits further sand movement behind this ridge, other herbaceous species can colonize and occur with the coastal pioneer species to form the coastal grassland community.

Community 1.1
Coastal Grasslands

This community describes a open grasslands along adjacent coastlines. This community correlated with the Florida Natural Area Inventory Community "Coastal Grassland" (FNAI, 2010).

Resilience management. Most of these species are good colonizers and will re-vegetate an area naturally after storm events. If restoration plantings are used, care should be taken not to plant coastal endemics outside their range. If these areas are absent of disturbances over long periods of time, herbaceous species of coastal grasslands will slowly be replaced by woody species to form coastal shrubland and eventually coastal forest communities.

Forest understory. Dominant vegetation consists of dune building grasses such as seaoats (Uniola paniculate), bitter panicgrass (Panicum amarum), and saltmeadow cordgrass (Spartina patens), as well as a variety of other herbaceous species more typical of stabilized soils such as bluestem grasses (Andropogon sp., Schizachyrium sp.), camphorweed(Heterotheca subaxillaris), and earleaf greenbriar (Smilax auriculata).

Community 1.2
Coastal Shrublands

This community consists of sparse to densely packed shrub species growing where a coastal grassland was once prevalent. These are the result of absence of disturbance from the reference state, allowing for shrub cover to form and stabilize an area. This community correlates with the Florida Natural Area Inventory community "Coastal Strand" (FNAI, 2010)

Resilience management. Along the eastern coast, these communities will often have a smooth canopy due to pruning by salt spray. Along the western coast, where prevailing easterlies do not blow across the water and create intense salt spray, this community will not reflect a low, even, spray-pruned profile seen on the eastern coast. Fire frequency in these communities are unknown, but estimated may occur due to the flammability of some shrub species such as saw palmetto.

Forest understory. Vegetation will often consist of dense saw palmetto (Serenoa repens) and scattered dwarfed cabbage palm (Sabal palmetto) on the seaward edge, which are gradually joined inland by taller shrubs, including tough bully (Sideroxylon tenax), yaupon (Ilex vomitoria), Hercules' club (Zanthoxylum clava-herculis), and shrubby forms of red bay (Persea borbonia), redcedar (Juniperus virginiana), and live oak (Quercus virginiana). Sparse graminoids reflecting the reference community may still be present between shrub patches.

Community 1.3
Coastal Forests

This site consists primarily of evergreen hardwood forests growing on stabilized coastal grasslands and dunes at varying distance from the shore. This community correlated with the Florida Natural Area Inventory community "Maritime Hammocks" (FNAI, 2010).

Resilience management. These communities are primarily influenced by wind-borne salt spray, storm waves, and sand burial. Salt spray from both the ocean and bay sides of islands can enter and kill the upper buds, producing smooth, "pruned" canopies of evenly increasing height away from the coast. Along the eastern coast, these communities will often have a smooth canopy due to pruning by salt spray. Along the western coast, where prevailing easterlies do not blow across the water and create intense salt spray, this community will not reflect a low, even, spray-pruned profile seen on the eastern coast. If storm waves destroy the protective dunes seaward of the hammock, sand can blow inland, burying the trees. In addition to physical destruction by storm waves, hammock trees are susceptible to being killed by standing salt water deposited in low areas by storm surge. Fires are naturally rare in this community, but probably occurred infrequently on larger barrier islands. Fires may weaken the canopy trees making them more susceptible to damage by other coastal stresses, such as salt spray and storm winds.

Forest overstory. Characteristic species include live oak (Quercus virginiana),cabbage palm (Sabal palmetto), and red bay (Persea borbonia), combining to form a dense canopy. Additional canopy species include pignut hickory (Carya glabra) and southern magnolia (Magnolia grandiflora).

Forest understory. Characteristic subcanopy species are red cedar (Juniperus virginiana) and American holly (Ilexopaca). Yaupon (Ilex vomitoria), tough bully (Sideroxylon tenax), wax myrtle (Myrica cerifera), and saw palmetto (Serenoa repens) are typical shrubs. The herb layer is sparse to absent.

Community 1.4
Standing Dead Forests

This community represents a coastal forest which has been killed via a storm event which has deposited sand and salt by storm surges and extreme winds. While these species of forests are tolerant of the influence of sea spray, prolonged salt exposure may kill the root system, leaving behind the standing dead tree, often giving the appearance of a standing dead forest. This may also be seen along the edge of fragmented areas (i.e. road cutting through the forest) as sea spray from onshore winds may kill the exposed edge, creating a standing dead forest of the canopy species until shearing and regrowth form a early successional shrubland. These areas are characterized by standing dead trees with little to no living vegetation. Arboreal epiphytes such as airplants (Tillandsia spp.) may be present on the limbs.

Pathway 1.1A
Community 1.1 to 1.2

This transition is driven by the absence of disturbance events. Without storm surges and destruction of coastal grasslands, these species will begin to allow woody species to become established forming a coastal shrubland. As distance from shoreline increases with beach migration, these areas have become less influenced by salt water and allow for the growth of more freshwater tolerant low shrubs.

Pathway 1.2A
Community 1.2 to 1.3

This transition is driven by the absence of disturbance events. Without storm surges and destruction of coastal grasslands and shrublands, these species will begin to allow more woody species to become established forming a coastal forest. As distance from shoreline continues to increases with beach migration, these areas have become less influenced by salt water and allow for the growth of more freshwater species that can penetrate the deep freshwater lense.

Pathway 1.3A
Community 1.3 to 1.2

Canopy gaps can be created through overstory mortality that would create light availability allowing shrubs to become dominant before overstory trees become reestablished. Overstory mortality may be naturally influenced by insects, disease, windthrow, or age, or may be anthropogenically influenced by selective logging.

Pathway 1.3B
Community 1.3 to 1.4

The climax forest phase is destroyed through an extreme storm event. Deposition of sediment and prolonged inundation of salt water will kill the root system of freshwater forest species, creating a standing dead forest. Distance from the coast and the physical barrier of the first dune diminish the intensity of sand burial and salt spray as well as intensity of the event.

Pathway 1.4A
Community 1.4 to 1.2

As salt is diluted from the system via precipitation, species with an existing viable seedbank may become reestablished in the understory of standing dead forests, allowing for the re-establishment of a sparse shrubland.

State 2
Unconsolidated Substrates

This state encompasses unconsolidated unvegetated substrate primarily consisting of sand and shell fragments. This community shift is typically driven by the destruction of a dune system during a storm event, when storm waves breach a dune and spread sand over the coastal grassland, killing the existing species through intensive burial and prolonged inundation of saltwater. Amount of substrate is dependent on the local intensity and destruction of the storm.

Resilience management. Once a new foredune ridge builds up above the beach and plant cover inhibits further sand movement behind this ridge, other herbaceous species can colonize and occur with the coastal pioneer species to reform the coastal grassland community.

Community 2.1
Unconsolidated Sandy Substrate

This community describes the unvegetated, loose, sand and shell substrate deposited via overwash during a storm event. This substrate will partially or completely bury the existing species. Once the storm surge has subsided and the soil looses excess moisture, the existing seedbed will begin to grow with pioneer dune building species such as

seaoats, building a foredune adjacent to the shoreline. These are less stable habitats that may be disturbed annually by high spring tides or storm tides, but will recolonize rapidly.

Resilience management. Time to recovery of a coastal grassland following a disturbance will be dependent on the ability of pioneer dune building grasses to build above the beach and protect the overwash areas behind it, allowing for a more protected environment for the coastal grassland species to grow. With storm events depositing unconsolidated substrate, piles of seaweed are often washed ashore by the storm, fertilizing and assisting in plant growth and the re-colonization process.

State 3
Invaded State

This state represents the dominance of one or multiple non-native or exotic species which outcompetes the native natural community and may significantly alter the composition and structure of the invaded stand by overshading the canopy and understory components and preventing regeneration of native species.

Community 3.1
Australian Pine - Brazilian Peppertree

This phase describes the introduction and establishment of common invasive species to this ecological site. Australian pine (*Casuarina equisetifolia*) and Brazilian peppertree (Schinus terebinthifolia) are the two most common species. In many areas, these species will be found along the edge habitat due to higher soil disturbance, a result of urbanization. These species are adapted to droughty conditions and have high salt tolerance. They may typically become prevalent following storm disturbances and will often outcompete native vegetation. These species often displace native vegetation by creating dense shade and litter in habitats which frequently have sun all day, as well as dropping leave which have allelopathic properties which suppress the growth of other plant life. These may also displace wildlife due to the shallow root system which may affect some animal's ability to nest in the sand and displace native habitats. Less dominant invasive species may also include Periwinkle (*Catharanthus roseus*), Century Plant (*Agave neglecta*), Lantana (Lantana camera), Cat's eye (*Abrus precatorius*), and Life Plant (*Kalanchoe pinnata*). Other undesirable species may be present in this community that have not been mentioned,

Resilience management. Restoring native habitat may be very difficult with these species. These species responds to herbicide application strategies such as frill/ girdle, basal bark, foliar, and soil herbicide application methods. Mechanical removal can be used with mulchers and stump grinders to eliminate and remove these species.

Dominant plant species

- beach sheoak (*Casuarina equisetifolia*), tree
- Brazilian peppertree (*Schinus terebinthifolius*), shrub
- Madagascar periwinkle (*Catharanthus roseus*), other herbaceous
- wild century plant (*Agave neglecta*), other herbaceous
- lantana (*Lantana camara*), other herbaceous
- rosarypea (*Abrus precatorius*), other herbaceous
- cathedral bells (*Kalanchoe pinnata*), other herbaceous

State 4
Human Altered and Human Transported Soils Materials

These areas include soils that were intentionally and substantially modified by humans for an intended purpose, commonly for terraced agriculture, building support, mining, transportation, and commerce. The alteration is of sufficient magnitude to result in the introduction of a new parent material (human-transported material) or a profound change in the previously existing parent material (human-altered material).They do not include soils modified through standard agricultural practices or farmed soils with unintended wind and water erosion. When a soil is on or above an anthropogenic landform or microfeature, it can be definitely be associated with human activity and is assigned to a unique taxa, usually found as an "Urban land complex" within that communities' natural soil properties (e.g, Canaveral fine sand-Urban land complex, 0 to 2 percent slopes).

Characteristics and indicators. Evidence of these areas include soils with manufactured items (e.g. artifacts)

present in the profile, human altered-materials (e.g., deeply excavated or deeply plowed soil) or human-transported material (e.g., fill), and position on or above anthropogenic landforms (e.g., flood-control levees) and microfeatures (e.g., drainage ditches). Detailed criteria regarding the identification of anthropogenic (artificial) landforms, human-altered materials, and human-transported material are in the "Keys to Soil Taxonomy" (Soil Survey Staff, 2014).

Community 4.1
Reclaimed / Restored Areas

Reclaimed areas are areas that have been modified through anthropogenic means that are restored to a natural or second-hand natural community. Areas that can be reclaimed are any intensity urban areas, and may be required to be reclaimed after urban use (e.g., active mines must be reclaimed). These practices include the identification, removal, and stockpiling soil materials before altering the land, and revegetation and replacement of soil materials after altering the land. This also applies to nearby urban areas that have been adversely affected by the anthropogenic activities.

Community 4.2
Urban Areas

This urban community consists of development for human use. Urban areas include a variety of land uses, e.g., inner city or urban core, industrial and residential areas, cemeteries, parks, and other open spaces; the overall function which may benefit the quality of human life. These often form an urban soil mosaic, where the natural landscape has been fragmented into parcels with distinctive disturbance and management regimes and, as a result, distinctive characteristic soil properties.

Resilience management. Within this community there are three different levels of urbanization, based off population dynamics, residential density, and intensity of development. These are labeled as low-intensity, medium-intensity, and high-intensity urban areas, which can eventually be split apart into its own separate state. Low-intensity urban areas may consist of single dwelling homes with little impact on the surrounding community which still somewhat represents the natural community (e.g., represents natural landscape, hydrology, and vegetation) , other examples of this are urban parks, cemeteries, or campgrounds with little urban development. Medium-intensity urban areas consist of larger urban dwellings with some natural features but have been modified to meet urban needs (e.g., towns). High-intensity urban areas are areas of heavily modified areas with complete alterations of the natural landscape, hydrology, and vegetation to support a very large population, which once constructed is permanently altered (e.g., metropolis areas/ active mines).

Community 4.3
Non-Reclaimed Areas

Non-reclaimed areas are areas that have been modified through anthropogenic means that are unable to be restored to a natural community. Areas that cannot be reclaimed in this ecological site are areas that are currently utilized as military bases and installations.

Pathway 4.1A
Community 4.1 to 4.2

This transition is driven by clearing and developing the land for low-, medium-, or high-intensity urban areas.

Pathway 4.2A
Community 4.2 to 4.1

This transition is driven by the revegetation, reestablished hydroperiods, and replacement of displaced soil materials after urbanization of the land.

Pathway 4.2B
Community 4.2 to 4.3

This transition is driven by heavy industrial or urban development which causes the land to become non-

reclaimable. This transition is rare due to the many environmental laws and regulations that must be followed when developing land.

Pathway 4.3A
Community 4.3 to 4.1

This transition is driven by the revegetation, reestablished hydroperiods, and replacement of displaced soil materials after urbanization of the land.

Transition T1A
State 1 to 2

This transition is driven during high intensity storm events when the protective dune system is destroyed, the storm surge deposits overwash of marine deposits. This deposition of sediment and prolong inundation of salt water will kill existing reference species and replace the area with unconsolidated substrate. Distance from the coast and the physical barrier of the first dune ridge above the beach diminish the intensity of sand burial and salt spray.

Transition T1B
State 1 to 3

This transition represents proliferation and dominance of an invasive species. Soil mechanical disturbances can compound this effect and create suitable conditions for invasive species.

Transition T1C
State 1 to 4

This transition is driven by the alteration and/ or transportation of materials via anthropogenic means.

Restoration pathway R2A
State 2 to 1

This restoration is often driven naturally due to an abundance of salt tolerant seeds present in these communities. For vegetation establishment to thrive in these systems, a dune system must first be rebuilt to protect these communities that form immediately behind it.

Transition T2A
State 2 to 4

This transition is driven by the alteration and/ or transportation of materials via anthropogenic means.

Restoration pathway R3A
State 3 to 1

The establishment of, or a return to, natural habitat conditions following a previous invasive / non-native / undesirable species infestation may be possible in some areas. Successful actions will require relentless efforts that include removal of the species via chemical or mechanical or biological means. In some extreme cases, restoration attempts could result in greater erosion and worsening of local conditions. Please consult with District and Soil Conservationists at local NRCS Field Offices for advice and guidance on land restoration attempts on invaded areas.

Transition T3A
State 3 to 4

This transition is driven by the alteration and/ or transportation of materials via anthropogenic means.

Additional community tables

Animal community

A major influence on the distribution of coastal forest plants is attributed to deposition from birds, primarily foraging acorns and other seeds. While providing habitat for both year-round and migratory species, maritime forests will often have a greater assemblage of migratory species compared to year-round species which may be found in habitats further inland. Species richness increases with the greater size of the forest. Common species may include Black-and-white Warbler (Mniotilta varia), Ovenbird (Seiurus aurocapillus), Northern Parula (Parula americana), Northern cardinal (Cardinalis cardinalis), Summer Tanager (Piranga rubra), Mourning Dove (Zenaida macroura), Fish Crow (Curvus ossifragus), blue-gray gnatcatcher (Polioptila caerulea), Carolina wren (Thryothorus ludovicianus) and Brown-headed Cowbird (Molothrus ater).

These areas are often frequented by small mammals which are preyed upon by snakes and raptors. These grasslands and forests on barrier islands are the primary habitat for gopher tortoises (Gopherus polyphemus) due to deep sandy soil characteristics allowing for suitable burrowing sites. The absence of larger predators as well as abundant edible food supply in natural habitats make these areas very suitable for gopher tortoise habitats. Tortoise clutches are known prey to small mammals such as racoons (Procyon lotor) and cats, predatory birds such as red-shoulder hawks (Buteo lineatus), and crows (Corvus brachyrhynchos), and the indigo snake (Drymarchon couperi).

Recreational uses

These are highly recreated areas where hiking, birdwatching, and camping are the major uses in natural areas. Many of these areas are in an urbanized state or semi-developed state found on the barrier islands such as Sanibel Island. Natural areas used for recreation include JN “Ding” Darling National Wildlife Refuge (Lee County), Cayo Costal State Park (Lee County), Maritime Hammock Sanctuary (Brevard County) and Pelican Island National Wildlife Refuge (Indian River County).

Other products

These areas are not generally used for agriculture, pastureland, rangeland, or woodlands.

Other information

Plants native to these communities often receive preference for beautification and landscaping of urban areas because they are more easily established and require less maintenance. These species will also provide habitat and food sources for urban wildlife.

Inventory data references

Information presented was derived from NRCS clipping data, current and historical literature, field observations, and personals contacts with local, state and federal partners. This is a provisional level ESD and is subject to change as more information becomes available, for any questions please contact your local NRCS office.

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Approval

Marji Patz, 2/14/2025

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	

Date	05/13/2025
Approved by	Charles Stemmans
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

Dominant:

Sub-dominant:

Other:

Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**
