Ecological site R156AY370FL
Subtropical Coastal Zones of Miami Ridge / Atlantic Coastal Strip

Last updated: 2/07/2025
Accessed: 05/10/2025

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): 156A–Florida Everglades and Associated Areas

This area makes up about 7,749 square miles (20,071 square kilometers) and is entirely in Florida. It is located at the southern tip of the State and has shoreline on both the Atlantic Ocean and the Gulf of Mexico. Lake Okeechobee borders the MLRA to the north. Aside from sugar cane plantations in the north, the Everglades National Park, Big Cypress National Preserve, and the Big Cypress Seminole Indian Reservation comprise this area. Historical ditching, berming, and canals prevent natural water flow through this delicate ecosystem. To mitigate this, extensive restoration efforts have been implemented. Urban sprawl from Miami and cities to its north on the Atlantic Ridge has encroached along the eastern boundary of this area. Most of the MLRA has resisted urbanization because of a water table that is at or near the surface, a considerable acreage of unstable organic soils, and its identity as a national treasure.

About one-third of this area is in Native American reservations, national parks, game refuges, or other large holdings. Cypress forests are extensive in the area, but mangrove forests are widespread along the eastern and southern coasts. A large part of the area is open marsh. Much of the area is used for hunting, fishing, and other recreational activities. The cropland in the area is used mainly for winter vegetables, but citrus fruits, avocado, and papaya are grown on the better drained soils. Sugarcane is an important crop on the organic soils south of Lake Okeechobee. The acreage of improved pasture is increasing. Beef cattle are the principal kind of livestock, but dairying is an important enterprise locally. Urbanization is extensive along the eastern coast.

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 and soil subsidence. Conservation practices on cropland generally include conservation crop rotations, cover crops, nutrient management, pest management, water-control structures, surface drainage systems (field ditches, mains, and laterals), pumping plants, and irrigation water management (including micro irrigation systems and surface and subsurface irrigation systems). 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, firebreaks, pest management, prescribed burning, and management of upland and wetland wildlife habitat.

LRU notes

There is not an official LRU for the MLRA 156A area. For the time being the technical team recommended to add the four terrestrial physiographic provinces ecoregions (Big Cypress, Everglades, Southern Coast and Islands, and Miami Ridge / Atlantic Coastal Strip) and one subaqueous ecoregion (Coastal Marine and Estuarine) on this section. This PES occurs within the Miami Ridge / Atlantic Coastal Strip ecoregion.

The Miami Ridge/Atlantic Coastal Strip Ecoregion, sea level to 20 m (0 to 66 ft) in elevation, is a heavily urbanized region, with coastal ridges on the east and flatter terrain to the west that grades into the Everglades. The western side originally had wet and dry prairie marshes on marl and rockland and sawgrass marshes, but much of it is now covered by cropland, pasture, and suburbs. To the south, the Miami Ridge extends from near Hollywood south to

Homestead and west into Long Pine Key of Everglades National Park. It is a gently rolling rock ridge of oolitic limestone that once supported more extensive southern slash pine forests and islands of tropical hardwood hammocks. The northern part of the region is a plain of pine flatwoods and wet prairie, and coastal sand ridges with scrub vegetation and sand pine. There are very few natural lakes in the region, but three types of ponded surface waters occur: 1) Pits dug deep into underlying "rock" containing water that is clear, high pH and alkaline, with moderate nutrients; 2) Shallow, surficial dug drains that are darker water; and 3) flow-through lakes (e.g., Lake Osborne) that are colored and nutrient rich.

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: 76 Southern Florida Coastal Plain; 76C Miami Ridge/ Atlantic Coastal Strip (Griffith, G. E., Omernik, J. M., & Pierson, S. M., 2013)

-Florida Natural Area Inventory, 2010 Edition: Coastal Uplands (FNAI ,2010)

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

Ecological site concept

The Subtropical Coastal Zones of the Miami Ridge/ Atlantic Coastal Strip are gently sloping near shore or along barrier islands vegetative communities that are found along high-energy shorelines. Within this high-energy zone this community is subject to natural events such as wave action, sand burial, and salt spray daily, acting as limitations for species growth. This site is distributed throughout all coastal Florida but is limited in width due to extensive urbanization in the Miami Ridge/ Atlantic Coastal Strip Ecoregion. The area closest to the coast is regularly disturbed by waves of high tide or storms and regularly recolonized by drift line annuals and trailing perennials, while above the reach of annual wave action are more stable coastal communities that can support larger, woody species. Fires can occasionally occur in this ecological site but is influenced mainly by intermittent severe storm disturbances and by constant or predictable coastal stresses like seasonal high tides, winter storms, sand burial and abrasion, and salt spray deposition. This community is found within protected areas such as state parks or barrier islands where development is present but can be impacted by development from parking lots or beach structures.

Associated sites

R156AY310FL	**Subtropical Tidal Saline Wetlands of Miami Ridge/ Atlantic Coastal Strip** The Subtropical Tidal Saline Wetlands of Miami Ridge / Atlantic Coastal Strip occur along the ecotone of low-energy coastlines. This may be seen in occurrence with the Coastal Zone communities along barrier islands in this ecoregion with high- energy wave action on the exposed side and low-energy wave action on the protected side.
R156AY550FL	**Subaqueous Haline Marine Habitats of MLRA 156A** The Subtropical Haline Marine Habitats of MLRA 156A occur along lower subaqueous landscape positions. Offshore winds create of high-energy wave action within this site which results in the sand deposition and erosion of the associated site.

Similar sites

R156AY140FL	**Subtropical Coastal Zones of Southern Coast and Islands** The Subtropical Coastal Zones of Southern Coast and Islands occurs in a separate ecoregion which have less amounts of urbanization and slightly lower amounts of rainfall. Resource concerns are reflected differently and require different management needs.

Table 1. Dominant plant species

Tree	(1) *Bursera simaruba* (2) *Sideroxylon foetidissimum*

Shrub	(1) *Coccoloba uvifera* (2) *Eugenia axillaris*
Herbaceous	(1) *Uniola paniculata* (2) *Spartina patens*

Physiographic features

This ecological community is constantly changing due to high wind and high wave actions that deposit sand along the beaches that can form dunes or stabilize to allow berms or maritime hammocks to establish over time further inland. These are highly fluctuating natural communities as sand can also be eroded by the high-energy wave action, often leading to changes in community composition. Salt spray limits growth of less saltwater tolerant species as well as limiting plant growth, which often appears as stunted vegetation. Dunes can rise higher than the surrounding communities, with the elevation ranging in this site from 0 to 10 ft, with gentle slopes ranging from 0 to 3%. The main differences between this ecological site and that of mangrove swamps and salt marshes is the placement along high energy coastlines rather than low energy coastlines, which allow organic sediments to build up instead of sand deposition along beaches.

The Miami Rock Ridge ecoregion fall under one major geographic units, the Pleistocene series Miami Limestone, oolitic facies consisting of white to orangish gray, poorly to moderately indurated, sandy, oolitic limestone (grainstone) with scattered concentrations of fossils and bryozoan facies consisting of white to orangish gray, poorly to well indurated, sandy, fossiliferous limestone (grainstone and packstone). This formation is highly porous and permeable and is part of the Biscayne Aquifer of the surficial aquifer system.

Table 2. Representative physiographic features

Slope shape up-down	(1) Convex
Slope shape across	(1) Linear
Geomorphic position, flats	(1) Rise (2) Talf
Geomorphic position, terraces	(1) Riser
Landforms	(1) Coastal plain (2) Marine terrace > Barrier beach (3) Marine terrace > Beach (4) Marine terrace > Ridge (5) Marine terrace > Dune
Runoff class	Negligible
Flooding duration	Extremely brief (0.1 to 4 hours) to very brief (4 to 48 hours)
Flooding frequency	Very rare
Ponding frequency	None
Elevation	0–10 ft
Slope	0–3%
Ponding depth	0 in
Water table depth	18–60 in
Aspect	Aspect is not a significant factor

Climatic features

The climate of MLRA 156A is subtropical, with mild winters and hot wet summers. The average annual precipitation of this MLRA is 37 to 62 inches (950 to 1,565 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 of the MLRA is 74 to 78 degrees F (23 to 26 degrees C). The freeze-free period of the MLRA averages 355 days and ranges from 345 to 365 days.

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)	59-64 in
Frost-free period (actual range)	365 days
Freeze-free period (actual range)	365 days
Precipitation total (actual range)	54-67 in
Frost-free period (average)	365 days
Freeze-free period (average)	365 days
Precipitation total (average)	61 in

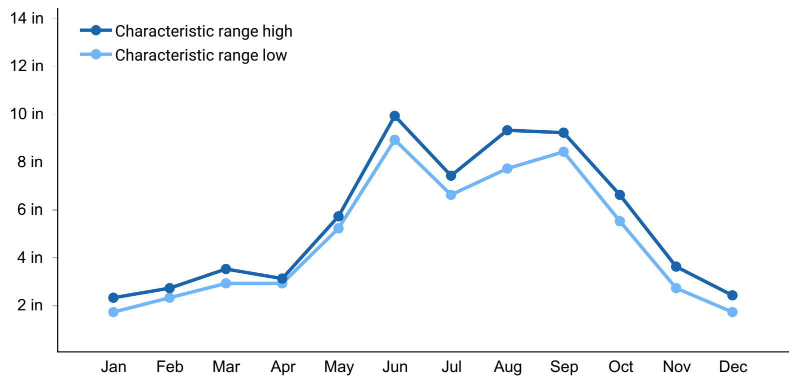


Figure 1. Monthly precipitation range

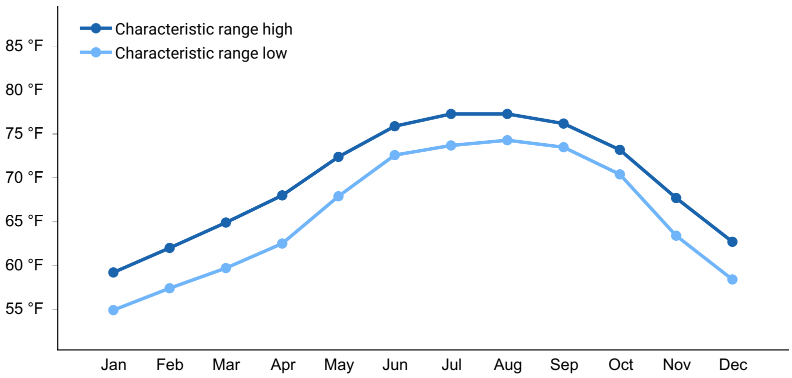


Figure 2. Monthly minimum temperature range

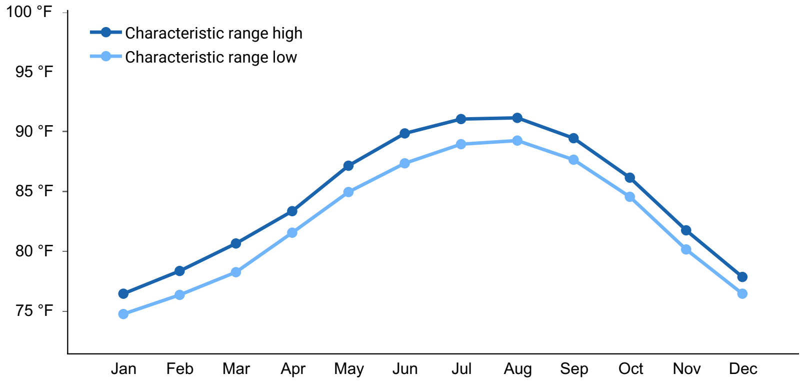


Figure 3. Monthly maximum temperature range

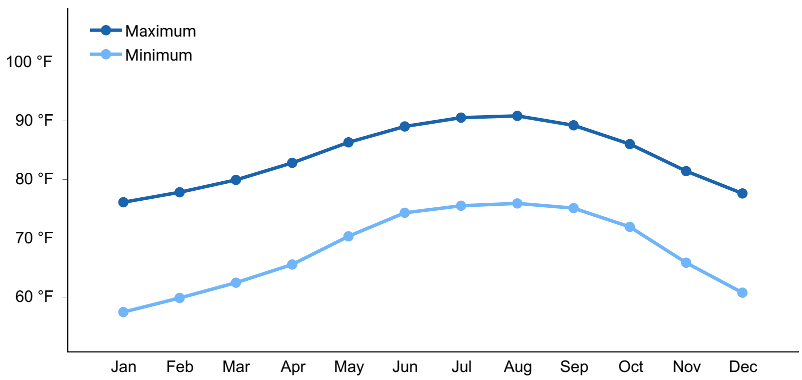


Figure 4. Monthly average minimum and maximum temperature

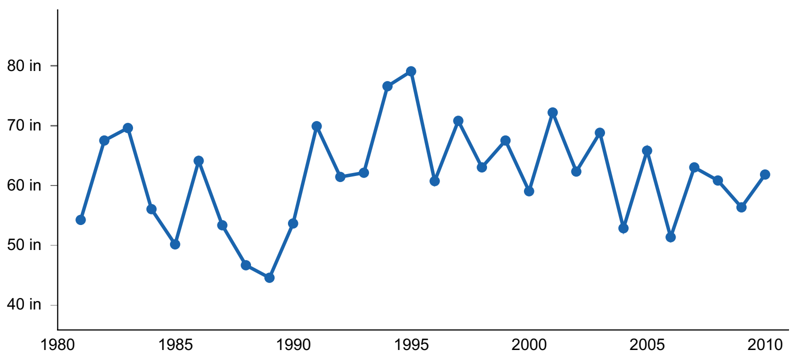


Figure 5. Annual precipitation pattern

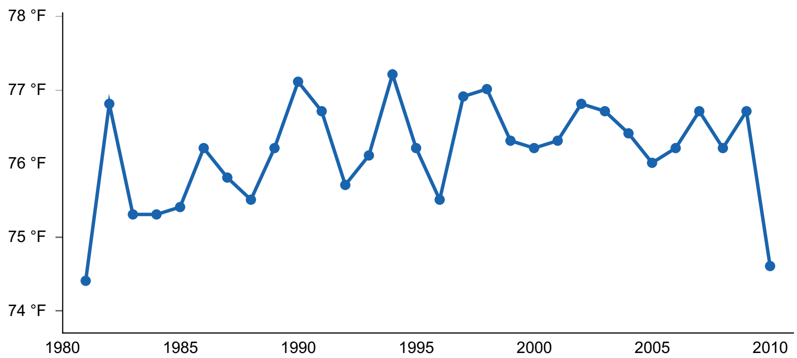


Figure 6. Annual average temperature pattern

Climate stations used

- (1) ROYAL PALM RS [USC00087760], Homestead, FL
- (2) HOMESTEAD GEN AVIATION [USC00084095], Homestead, FL
- (3) PERRINE 4W [USC00087020], Miami, FL

- (4) MIAMI KENDALL TAMIAMI EXEC AP [USW00012888], Miami, FL
- (5) CAPE FLORIDA [USC00081306], Key Biscayne, FL
- (6) MIAMI NWSFO [USC00085667], Miami, FL
- (7) MIAMI INTL AP [USW00012839], Miami, FL
- (8) HIALEAH [USC00083909], Miami, FL
- (9) MIAMI BEACH [USW00092811], Miami Beach, FL
- (10) MIAMI OPA LOCKA AP [USW00012882], Opa Locka, FL
- (11) NORTH MIAMI BEACH #2 [USC00086315], Miami, FL
- (12) HOLLYWOOD NORTH PERRY AP [USW00092809], Hollywood, FL
- (13) WESTON [USC00089511], Fort Lauderdale, FL
- (14) LOXAHATCHEE NWR [USC00085184], Boynton Beach, FL

Influencing water features

This ecological site is influenced by both freshwater and saltwater hydrology. Freshwater plays an important role via rainfall for upland species with the majority of rainfall entering the system during the months of June to October. Saltwater plays an important role in maintaining saltwater tolerant species and composition through salt spray off the Atlantic Ocean. Sand is constantly being eroded or accreted due to wave action along the shoreline, and during periods of storm events high wave action can destroy entire vegetative communities within this site. Plants found on the upper beach are subject to stress from salinity due to inundation during high seasonal or storm tides.

Wetland description

Description- Cowardian
System – Marine
Subsystem – Intertidal
Class – Unconsolidated Shore (Beach)

Soil features

Soils associate with this ecological site occur in the isohyperthermic soil temperature regime of MLRA 156A. The isohyperthermic soil temperature regime has mean annual soil temperatures of 22 °C (72^{0}F) or more and a difference between mean summer and mean winter soil temperatures of less than 5 °C (41^{0}F) at 50 cm (20 inches) below the surface.

Soils in this ecological community are composed of calcium carbonates derived from limestones along the Miami Rock Ridge and quartz sands over a marl base that are formed and rearranged by severe storms. Deposition of these soils come from strong ocean currents during winter months that deposits large quantities of silica sand into coastal bars. When the bars break the water's surface, prevailing winds may blow the sand up the shore where it accumulates and forms dunes and other coastal communities that become stabilized via coastal vegetation. These soils are usually deep and well-drained and can be somewhat alkaline; excavations of coastal dunes show layers of buried sand over another as depositions during strong storm events. Representative soils include BaggsCape and miscellaneous map units such as Beaches.

Table 4. Representative soil features

Parent material	(1) Eolian deposits (2) Marine deposits
Surface texture	(1) Fine sand
Drainage class	Somewhat poorly drained to excessively drained
Permeability class	Rapid to very rapid
Depth to restrictive layer	82 in
Soil depth	82 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%

Available water capacity (0-82in)	3.1 in
Calcium carbonate equivalent (0-82in)	0%
Electrical conductivity (0-82in)	2 mmhos/cm
Sodium adsorption ratio (0-82in)	2
Soil reaction (1:1 water) (0-82in)	7.6–8
Subsurface fragment volume <=3" (0-82in)	2–5%
Subsurface fragment volume >3" (0-82in)	0%

Ecological dynamics

The information presented in this ecological site description (ESD) and state-and-transition model (STM) were developed using archaeological and historical information, published and unpublished scientific reports, professional experience, consultation with technical experts, and NRCS inventories and studies. The information presented is represented of a complex set of plant community dynamic and environmental variables. Not all scenarios or plants are represented and included. Key indicator plants, animals, and ecological processes are described to help guide land management decisions and actions.

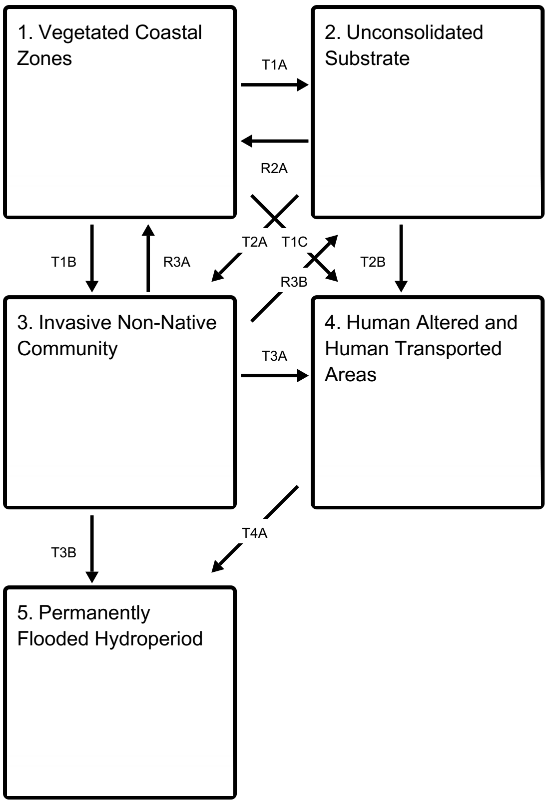
This ecological site is a highly fluctuating community that occurs along and immediately adjacent to high-energy coast lines. It is dominated by saltwater tolerant annuals and perennials closest to the ocean, grading into taller grasses and woody species the further away from the coast. These communities can range in size from the unconsolidated beach substrate to very narrow dunes to wide forested areas, and gradually move away from the ocean towards the successional climax community of maritime hammocks further inland (Belli2, 1995). They are all included in one ecological site concept due to the formation along matching soil series, similarities in management, and their succession to the climax community following dune establishment.

These communities are mostly herbaceous and either complete their life cycle in one growing season or colonize vegetation by sending out low, wide-ranging runners from rooted rosettes in safe sites higher up on the foredune. Most upper beach colonists can withstand brief inundation by salt water. Beyond the annual reach of the waves, the wind constantly piles sand from the beach around plant stems to create a foredune. This habitat may persist for many years between major storms and favors perennial rhizomatous grasses whose upward growth can keep pace with sand burial and build up the height of the foredune. Aside from sand burial, plants on the foredune must be able to tolerate salt spray blown off the water. Salt from droplets deposited on the foliage may enter the cells through cuts in the cuticle (produced by sand abrasion) and kill the growing buds. Plants avoid the entrance of salt into the cells by having a tough cuticle, or by growing low to the ground out of the path of the wind, or they tolerate the entrance of salt by diluting it, producing succulence. As the foredune grasses intercept sand, they allow species less tolerant of burial such as the shrubby species of coastal strand, or the less specialized grasses of the coastal grassland, to survive landward of them. The influence of salt spray continues farther inland of the coastal stresses, producing the low evenly pruned woody canopies of coastal strand and maritime hammock communities. Their canopies gradually become taller with increasing distance from the coast as the twigs of the seaward plants comb the salt droplets out of the windstream, allowing the terminal twigs to reach progressively greater heights inland before being killed by salt. To produce spray-pruning, the wind must blow across water. Low spray-pruned canopies are much more frequently encountered along the Atlantic coast, where the prevailing easterly winds blow across the ocean, rather than on the Gulf coast, where the prevailing easterlies blow across land.

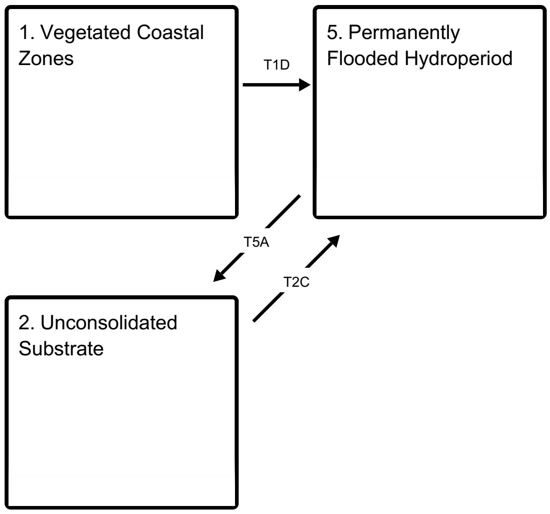
Changes in the hydrologic cycle may alter or destroy all or portions of this community. Common changes include storm events breaking through dunes and sand barriers depositing outwash and salt in further upland communities, killing them until the dune may be reestablished. Salt water intrusion from canals near the coast may weaken and kill developed hammock communities that are slightly saline tolerant, creating ghost forests. Vegetation is difficult to reestablish once destroyed due to the infertile, coarse textured saline soils and the salt spray. Without vegetation, water and wind erosion can become a problem before and after human alteration.

State and transition model

Ecosystem states

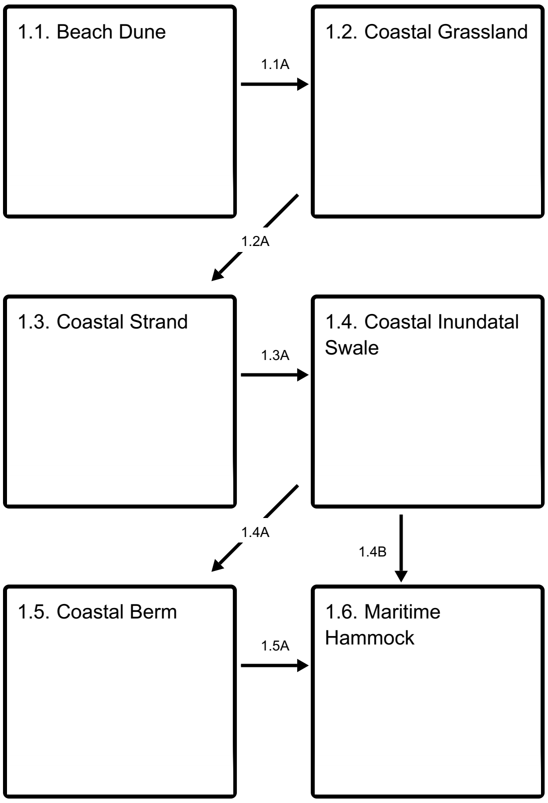


States 1, 5 and 2 (additional transitions)



T1A - Dune Destruction
T1B - Invasion of Non-Native / Exotic Species
T1C - Human Alteration / Transportation of Materials
T1D - Increase in Long-Term Hydroperiod
R2A - Undisturbed Dune Succession
T2A - Invasion of Non-Native / Exotic Species
T2B - Human Alteration / Transportation of Materials
T2C - Increase in Long-Term Hydroperiod
R3A - Mechanical / Biological / Chemical Removal
R3B - Mechanical / Biological / Chemical Removal
T3A - Human Alteration / Transportation of Materials
T3B - Increase in Long-Term Hydroperiod
T4A - Increase in Long-Term Hydroperiod
T5A - Soil Aeration

State 1 submodel, plant communities



1.1A - Undisturbed Succession on Sandy Substrates

1.2A - Undisturbed Succession on Sandy Substrates

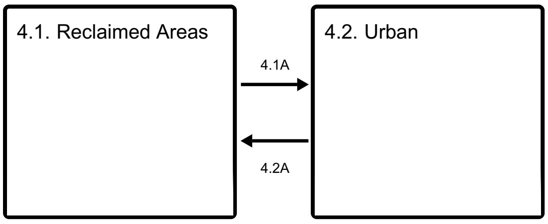
1.3A - Undisturbed Succession on Sandy Substrates

1.4A - Deposition from Storm Surges

1.4B - Undisturbed Succession on Sandy Substrates

1.5A - Undisturbed Succession of Shelly Substrates

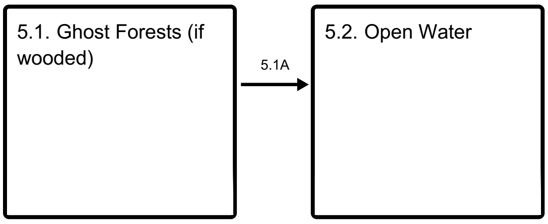
State 4 submodel, plant communities



4.1A - Urban Development

4.2A - Land Reclamation

State 5 submodel, plant communities



5.1A - Permanent Flooding

State 1
Vegetated Coastal Zones

These are highly fluctuating communities that occur along high-energy coastlines and is dominated by saltwater tolerant annuals and perennials closest to the ocean and grading into taller grasses and woody species further away from the coast. The communities in the sub-model show the undisturbed succession after the reference community (State & Community 1.1) depending on the type of substrates they are deposited on. The transitions shown are characteristic if the community is left undisturbed over time. However this is a highly fluctuating community and disturbances can affect one or all of the following communities, often transitioning it back to unconsolidated substrate (State & Community 2.1), which over time can recolonize with any of the coastal communities behind a beach dune.

Characteristics and indicators. This state is characterized by vegetated communities directly adjacent to the ocean, often influenced by the salt spray and tidal fluctuations. The more developed communities are often found on stabilized beach dunes and can support more woody vegetation.

Resilience management. These are highly prized communities for both urbanization and recreational uses.

Community 1.1
Beach Dune

This is a predominantly herbaceous community of wide ranging coastal specialist plants found on both the vegetated upper beach and the first dune above the beach (foredune). This community is usually built by perennial rhizomatous grasses, whose stems trap the sand grains blown off the beach, building up the dune by growing upward to keep pace with sand burial. Dune and upper beach plants colonize this new area haphazardly at first, but gradually become organized into foredune and upper beach zones as waves build the beach back up and wind moves the sand inland to build a new dune ridge. Once a new foredune ridge blocks salt spray and plant cover inhibits sand movement, inland herbaceous and eventually woody species can begin to replace the coastal pioneer species of the beach dune community in the back-dune area.

Resilience management. Water and wind are the primary environmental forces that shape the ecology of beach dunes. Plants on the foredune are regularly exposed to salt spray and sand burial from onshore winds blowing across the salt water and open sandy beach; plants on the upper beach are subject to these stresses plus occasional inundation by high seasonal or storm tides and periodic destruction by waves. The plants of the beach dune community are adapted to either withstand these stresses or to rapidly re-colonize from seed or vegetative parts following destruction. Storm waves may either erode the seaward face of the foredune, moving sand offshore to form underwater bars, or break through the dune, moving sand inland as an overwash fan. Fire is naturally rare in this community. The shoreline location prevents fires from spreading from at least half the possible compass directions, and beach dunes typically lack the necessary fuel loads and continuity to carry fire for appreciable distances.

Community 1.2
Coastal Grassland

This is a predominantly herbaceous community occupying the drier portions of the transition zone between beach dunes on the immediate coast and communities dominated with more woody species, such as coastal strands or maritime hammocks, found further inland. It is similar to beach dunes by having similar vegetative species, but is protected by the dunes, allowing a more stable community.

Resilience management. Coastal grassland develops in two ways: either as a barrier island builds seaward, developing new dune ridges along the shore which protect the inland ridges from sand burial and salt spray, or as a beach recovers after storm overwash and a new foredune ridge builds up along the shore, protecting the overwashed area behind it from sand burial and salt 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. If storm waves breach the foredune and spread sand over the coastal grassland, a beach dune community will re-colonize at first. Fertilization from piles of seaweed washed up by the storm helps to speed plant growth and the re-colonization process. 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. As time passes, absent further storms, the coastal grassland community itself will gradually be replaced by woody species to form scrub, coastal strand, or maritime hammock communities. Fire is naturally rare and localized in this community with water barriers and sparse fuels combining to limit its spread.

Community 1.3
Coastal Strand

This community is an evergreen shrub community growing on stabilized coastal dunes with a smooth canopy due to pruning by salt spray. It usually develops as a band between dunes along the immediate coast, and maritime hammock, scrub, or mangrove swamp communities further inland. On broad barrier islands or protruding coasts, it may also occur as patches of shrubs within a coastal grassland matrix. Coastal strand is usually the first woody plant community inland from the coast, behind dunes or grasslands and in front of taller maritime hammocks. The width of the band of coastal strand is determined by the degree of protection from spray provided by the foredune. Coastal strand is distinguished from maritime hammock by the absence of distinct tree canopy and understory layers. It is distinguished from coastal berm and shell mound by its occurrence on sand deposits along a high-energy sandy coast, rather than on a shell deposits along a low-energy, mangrove-dominated coast. It is distinguished from coastal grassland by the dominance of woody, rather than herbaceous species.

Resilience management. Salt spray, blown off the water when the wind speed is high enough to produce white caps (ca. 16 mph), maintains a low, even canopy by killing the most seaward twigs of the shrubs. As salt spray is combed out of the wind stream by the more seaward dead twigs, those landward of them can grow a little taller to landward, producing a canopy that slants up away from the coast. Storm waves periodically destroy sea oats dunes and the coastal strand behind them, with the resulting bare area being re-colonized first by sea oats and pioneer beach species and then by coastal grassland as the sea oats foredune is re-built and provides some protection from moving sand off the beach. The resulting coastal grassland is in turn invaded by patches of woody species which eventually coalesce into a continuous woody community of coastal strand.

Community 1.4
Coastal Inundatal Swale

Coastal interdunal swales are marshes, moist grasslands, dense shrubs, or damp flats in linear depressions formed between successive dune ridges as sandy barrier islands, capes, or beach plains build seaward. They are saltwater intolerant wetlands found in depressions embedded within coastal grasslands or between beach dunes.

Resilience management. The low areas between the dunes are progressively more protected from blowing sand and seawater intrusion, allowing a succession of several associations of herbaceous species, and ending with woody species. Salt water intrusion and increased sand movement following storms can set this successional process back to its initial stages, or storm surge and storm waves may obliterate the ridge-swale topography completely, leaving a level plain, which is in turn colonized by the dune grassland community. Coastal interdunal swale differs from both coastal grassland and beach dune communities in that it lacks species intolerant of inundation.

Community 1.5
Coastal Berm

Coastal berms are short forests or shrub thickets found on long narrow storm-deposited ridges of loose sediments formed by a mixture of coarse shell fragments, pieces of coralline algae, and other coastal debris. These ridges parallel the shore and may be found on the seaward edge or landward edge of the mangroves or further inland depending on the height of the storm surge that formed them. They range in height from 1 to 10 feet. Structure and composition of the vegetation is variable depending on height and time since the last storm event. The most stable berms may share some tree species with rockland hammocks, but generally have a greater proportion of shrubs and herbs. Found along lower energy coastlines in Florida and the Florida Keys, coastal berms are formed by deposition from storm surges. Tall berms may be the product of repeated storm deposition.

Resilience management. Coastal berms that are deposited far enough inland and remain long undisturbed may in time succeed to maritime hammock. It can be distinguished from neighboring communities by its physical features rather than species composition. This is a structurally variable community that may appear in various stages of succession following storm disturbances, from scattered herbaceous beach colonizers to a dense stand of tall shrubs. Fires are rare to non-existent in this community but are threatened by exotic species invasion following storm disturbances. Because of its proximity to ocean, sea level rise is one of the biggest environmental drivers, with inundation and impacts of storm events leading to increased habitat fragmentation and changes in the structure of the system. Increased soil salinity will lead to more salt tolerant plant dominance and eventually ghost forests where no salt intolerant species thrive.

Community 1.6
Maritime Hammock

Maritime hammocks are the climax community of the coastal zone ecological site. They are predominantly evergreen hardwood forests growing on stabilized coastal dunes lying at varying distances from the shore. They are fully developed communities with an array of tropical and temperate species that can survive in calcitic soils. While seen as the climax community, these hammocks are very sensitive to changes in the surrounding coastal communities habitat.

Resilience management. Due to their coastal location with water barriers on at least one, if not two sides, fire was probably naturally rare and very spotty in maritime hammock, especially on the narrower 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. Maritime hammocks are principally 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. 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.

Pathway 1.1A
Community 1.1 to 1.2

As a beach dune becomes more stable, the area behind the dune becomes more protected from changes, which allow for this communities to form. The following communities rely on the stabilization to allow for the growth of grassy, and eventually, woody species.

Context dependence. This community is dependent on the stabilization of sand by perennial rhizomatous grasses such as sea oats on a beach dune. As these plants grow they are able to trap more sand, creating a more stable dune over time, which will allow for the communities behind the dune to form.

Pathway 1.2A
Community 1.2 to 1.3

As a beach dune becomes more stable, the area behind the dune becomes more protected from changes, which allow for this communities to form. The following communities rely on the stabilization to allow for the growth of grassy, and eventually, woody species.

Context dependence. This community is dependent on the stabilization of sand by perennial rhizomatous grasses such as sea oats on a beach dune. As these plants grow they are able to trap more sand, creating a more stable dune over time, which will allow for the communities behind the dune to form.

Pathway 1.3A
Community 1.3 to 1.4

As a beach dune becomes more stable, the area behind the dune becomes more protected from changes, which allow for this communities to form. The following communities rely on the stabilization to allow for the growth of grassy, and eventually, woody species.

Context dependence. This community is dependent on the stabilization of sand by perennial rhizomatous grasses such as sea oats on a beach dune. As these plants grow they are able to trap more sand, creating a more stable dune over time, which will allow for the communities behind the dune to form.

Pathway 1.4A
Community 1.4 to 1.5

This mechanism is driven primarily by storm surges and other extreme weather events that are able to deposit shelly materials further inland from the coast, allowing for the establishment of a protected vegetated community found on shelly substrates.

Pathway 1.4B
Community 1.4 to 1.6

As a beach dune becomes more stable, the area behind the dune becomes more protected from changes, which allow for this communities to form. The following communities rely on the stabilization to allow for the growth of grassy, and eventually, woody species.

Context dependence. This community is dependent on the stabilization of sand by perennial rhizomatous grasses such as sea oats on a beach dune. As these plants grow they are able to trap more sand, creating a more stable dune over time, which will allow for the communities behind the dune to form.

Pathway 1.5A
Community 1.5 to 1.6

As the area becomes more stable, the area deposited with shells behind the dune becomes more protected from changes, which allow for this community to form. The following communities rely on the stabilization to allow for the growth of grassy, and eventually, woody species.

State 2
Unconsolidated Substrate

This area is typically an unvegetated community that is found in the inter- and supra-tidal zones and deposits wind blown and tidally moved sand on the shore. Unconsolidated Substrates are important in that they form the foundation for the development of other Marine and Estuarine Natural Communities (Ecological Sites R156AY500FL and R156AY550FL) when conditions become appropriate. Unconsolidated Substrate Communities are associated with and often grade into Beach Dunes (Phase 1.1) in this ecosite.

Characteristics and indicators. This area is characterized by very sparse to no vegetation in the inter- and supra-tidal zones. It is the main depositor of sand for the establishment of the vegetated coastal communities.

State 3
Invasive Non-Native Community

This state consists of Florida Department of Agriculture and Consumer Services (FDACS) Non-Native Category 1 Species list . More information on these species list can be found: https://www.fdacs.gov/content/download/63140/file/Florida%E2%80%99s_Pest_Plants.pdf or by contacting the UF / IFAS Center for Aquatic and Invasive Plants (http://plants.ifas.ufl.edu/), the UF / IFAS Assessment of Non-native Plants in Florida's Natural Areas (https://assessment.ifas.ufl.edu/), or the FWC Invasive Plant Management Section (http://myfwc.com/wildlifehabitats/invasive-plants/). This community will not represent every possibility of invasive species but rather the most common in these areas.

Characteristics and indicators. Non-Native species include species that exist outside of Florida's natural range and are introduced to the state via people, weather events, or any other means.

Resilience management. This state can be found as a part of any other state and can completely replace the native habitat if not properly managed. Restoration to natural communities after exotic non-native invasion includes practices such as mechanical and chemical removal.

State 4
Human Altered and Human Transported Areas

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 formed 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., Baggs cape fine sand- Urban land complex, 0-2% 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 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

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).

Pathway 4.1A
Community 4.1 to 4.2

This shift in communities is driven by clearing and developing the land for the desired community.

Pathway 4.2A
Community 4.2 to 4.1

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

State 5
Permanently Flooded Hydroperiod

This state describes the impact of increased hydroperiods from anthropogenic or natural causes that creates an altered hydrologic state resulting in permanent flooding. The impact of this causes destruction of the terrestrial community and may in time shift to a subaqueous community.

Characteristics and indicators. This state is characterized by permanent water levels in an area that was previously in an intertidal or supratidal zone.

Resilience management. This is a final state and unlikely and improbable to go back to the original reference state.

Community 5.1
Ghost Forests (if wooded)

Ghost forests are the remains of a wooded vegetated community after changes in the long term hydroperiod (primarily sea level rise or artificial impoundment) permanently saturate the root system and becomes too saline for the species tolerance. They appear as standing dead wood representing where once the living vegetation stood. Evidence of previous shorelines may be found in subaqueous soil cores as root matter or a buried organic horizon.

Community 5.2
Open Water

This is the final state and is when alteration of the natural hydroperiod has left an area permanently flooded. No terrestrial vegetation representative of the reference state will be present but may support rooted submerged aquatic vegetation (SAV) species if proper growth conditions are met.

Pathway 5.1A
Community 5.1 to 5.2

This is caused by anthropogenic or natural increases in hydroperiods causing the area to be permanently flooded.

Transition T1A
State 1 to 2

This transition from vegetated to nonvegetated communities is driven by the destruction of the beach dune. This can be from coastal erosion via naturally or anthropogenically, or from extreme storm events that destroy the beach dune and allow for washover of sand and saltwater. The rapid intrusion of saltwater and / or sand can smother the existing vegetation that depended on the beach dune for protection.

Constraints to recovery. Depending on the intensity of the destruction, the vegetated communities behind the dune may be destroyed, and will depend on the reestablishment of the dune before the following communities may be reestablished.

Context dependence. This is most often seen with extreme storm events during storm surges, blowing through the established dune to destroy the vegetated communities. It can also happen over time anthropogenically, when beachgoers create a path through the dunes perpendicular to the water, making the dune more susceptible to erosion.

Transition T1B
State 1 to 3

The invasion of non-native or exotic species can be driven by a multitude of different environmental factors such as changes in natural hydroperiods or in fire regimes. Typically once a change in one of the two factors mentioned above occurs, non-native or exotic invasive species become established and begin to compete with native species for habitat and nutrients.

Constraints to recovery. Recovery from non-native or exotic invasive species may be difficult due to many adaptations which allow them to survive and outcompete in intolerable conditions. Localized knowledge for each species must be known for best removal of it without harming the native environment, and often different treatments must be applied over one given area.

Context dependence. Growth of non-native and exotic invasive species can be rapid following a change in a natural stressor such as fire frequency or natural hydroperiods which might have once kept the invasive species at bay.

Transition T1C
State 1 to 4

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

Transition T1D
State 1 to 5

This is driven by increased hydroperiods, both anthropogenic and natural, which causes long-term flooding and permanently altering the state.

Restoration pathway R2A
State 2 to 1

This restoration strategy depends on the undisturbed succession of the vegetated communities. It depends on the recolonization of a beach dune with seaoats or another dune stabilizing grass/ forb that can protect the communities behind it. After a storm surge the deposition of shelly substrates in an area might lead to the formation of a coastal berm instead of a dune if found along a lower energy coastline.

Context dependence. Over longer periods of time if remained undisturbed this area can transition along back towards a maritime hammock. This is dependent on the community remaining undisturbed, from natural influences such as extreme weather events or from anthropogenic influences such as urbanization.

Transition T2A
State 2 to 3

The invasion of non-native or exotic species can be driven by a multitude of different environmental factors such as changes in natural hydroperiods or in fire regimes. Typically once a change in one of the two factors mentioned above occurs, non-native or exotic invasive species become established and begin to compete with native species for habitat and nutrients.

Constraints to recovery. Recovery from non-native or exotic invasive species may be difficult due to many adaptations which allow them to survive and outcompete in intolerable conditions. Localized knowledge for each species must be known for best removal of it without harming the native environment, and often different treatments must be applied over one given area.

Context dependence. Growth of non-native and exotic invasive species can be rapid following a change in a natural stressor such as fire frequency or natural hydroperiods which might have once kept the invasive species at bay.

Transition T2B
State 2 to 4

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

Transition T2C
State 2 to 5

This is driven by increased hydroperiods, both anthropogenic and natural, which causes long-term flooding and permanently altering the state.

Restoration pathway R3A
State 3 to 1

Mechanical, biological, and chemical removal strategies include removing the non-native and exotic invasive species through various mechanisms. Localized knowledge for individual non-native or exotic invasive species is needed for specific management. Sometimes introduction of fire regimes may prevent or stop the growth of non-native or exotic invasive species, but many species are fire tolerant. Mechanical removal might include cutting and removal of invasive species. Chemical removal might include spot spraying or basal bark injection treatments.

Context dependence. Mechanical, biological, and chemical removal of non-native and exotic invasive species is a time dependent process, with both removal types taking long times to be considered effective.

Restoration pathway R3B
State 3 to 2

Mechanical, biological, and chemical removal strategies include removing the non-native and exotic invasive species through various mechanisms. Localized knowledge for individual non-native or exotic invasive species is needed for specific management. Sometimes introduction of fire regimes may prevent or stop the growth of non-native or exotic invasive species, but many species are fire tolerant. Mechanical removal might include cutting and removal of invasive species. Chemical removal might include spot spraying or basal bark injection treatments.

Context dependence. Mechanical, biological, and chemical removal of non-native and exotic invasive species is a time dependent process, with both removal types taking long times to be considered effective.

Transition T3A
State 3 to 4

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

Transition T3B
State 3 to 5

This is driven by increased hydroperiods, both anthropogenic and natural, which causes long-term flooding and permanently altering the state.

Transition T4A
State 4 to 5

This is driven by increased hydroperiods, both anthropogenic and natural, which causes long-term flooding and permanently altering the state.

Transition T5A
State 5 to 2

This is driven by soil aeration which causes rapid oxidation within the community. This allows the soil to produce sulfates and cause rapid decomposition, leaving behind an area of unconsolidated substrates.

Additional community tables

Animal community

This community is used primarily by shorebirds, predatory birds, small mammals, and turtle species. Smaller mammals may be found closer to the dune communities while larger mammals may be found in the more inland climax communities. The native grasses and legumes provide good food sources and nesting sites. Species may include:

Mammals: Raccoon (Procyon lotor), southeastern beach mouse (Peromyscus polionotus trissyllepsis), Keys cotton rat (Sigmondon hispidus exputus), Opossum (Didelphis virginiana), Lower Keys marsh rabbit (Sylvilagus palustris hefneri), Silver rice rat (Spilogale putorius)

Reptiles: Mole skink (Plestiodon egregious). Loggerhead turtle (Caretta caretta), green turtles (Chelonia mydas), hawksbill turtle (Eretmochelys imbricata), leatherback turtle (Dermochelys coriacea), and Kemp’s ridley turtles (Lepidochelys kempii) utilize coastal communities for nesting grounds. Gopher tortoises (Gopherus polyphemus) and Florida box turtle (Terrapene carolina bauri) are also common in further upland coastal communities.

Birds: Many shorebirds use beaches for nesting. Some species include snowy plover (Charadrius alexandrinus), American oystercatcher (Haematopus palliatus), Perigrine falcons (Falco peregrinus), black skimmer (Rynchops niger), least tern (Sterna antillarum), roseate tern (S. dougallii), Wilson’s plover (Charadrius wilsonia), royal tern (Sterna maxima), and sandwich tern (Sterna sandvicensis). The federally listed piping plover (Charadrius melodus), which breeds further north, winters along Florida beaches. Due to the subtropical location this ecological site is home to both migratory and year-round birds, with over 250 observed species that use this habitat.

Amphibians: Southern toad (Bufo terrestris), Eastern narrow-mouthed toad (Gastrophryne carolinensis), Squirrel treefrog (Hyla squirella), and Southern leopard frog (Rana sphenocephala).

Hydrological functions

Dependence on upland coastal community formation is highly dependent on hydrological coastal stresses such as seasonal high tides, wave action, and winter storms, with almost every community variant relying on the beach dune formation for protection from these stressors. The beach dune formation acts as a barrier as sea oats and other dune forming grasses stabilize and grow, allowing them to tolerate higher intensity coastal stressors. High-energy wave action acts as a method of deposition for sand from underwater bars which helps build beach dunes and the upland communities following it such as coastal strands, coastal grasslands and coastal interdunal swales, and eventually the transition into a maritime hammock. Whereas lower-energy wave action that depends on storm surges help form coastal berms which eventually can transition into maritime hammocks. All these communities are found above the daily high tide marks which distinguishes them from other coastal communities such as salt marshes or mangrove swamps found in the intertidal or supratidal zones.

The zonation of coastal communities at right angles to the shore reflects the decrease in type and intensity of coastal stresses as one moves away from the coast. Plants of the upper beach must be able to rapidly re-colonize this habitat after frequent periodic destruction by seasonal high tides or storm waves. Waves breaking at other than right angles to the beach tend to move sand along the coast, a process called longshore drift. In the Miami Ridge / Atlantic Coastal Strip ecoregion, the prevailing direction of longshore drift is southward. If jetties interrupt this wave conveyor belt, sand will accumulate on the updrift side of the obstruction and be carried away from the downside drift, producing erosion, especially when storms occur. This disturbs the natural process of dune formation and could lead to increased damage during large storm events such as hurricanes and tropical storms.

Along the Miami Rock Ridge ecoregion, this ecosite is more prevalent than low-energy coastal communities such as mangrove swamps or salt marshes due to the consistent blowing of easterly winds over water creating high energy wave delivery.

Recreational uses

This ecological site is a major attraction for tourism, helping drive the local economy with millions of tourists coming from all over the world to visit south Florida and its beaches. Many of these upland coastal communities in the Miami Rock Ridge are highly protected. Travel through further upland communities such as coastal grasslands and beach dunes can cause erosion that creates open paths in the vegetation making this ecosite more susceptible to storm damage. After storm events raking of beaches to clear vegetation that was deposited removes nutrients that would enter the system via decomposition, these vegetation deposits serve as important food sources for nesting and migratory birds as well as some mammals.

More upland sites such as maritime hammocks can provide suitable campgrounds and areas for urban development. Fishing off beaches are also very popular recreation uses for this site.

Other information

Many Floridian Native American Tribes were found in coastal locations pre-European colonization and would create human transported and human altered natural communities through the deposition of shells (clams, oysters, whelks) and fish bones over many generations into present day shell mounds. Shell mounds are the result of Native Americans rather than a natural physical factor. It is generally characterized as a deposition of shells and fish bones in large mounds near Native American communities in which over time we able to develop a rich calcareous layer on which closed hardwood canopies develop. These areas include typically calciphilic plant species that arrived via bird dispersal. They support tropical flora such as gumbo-limbo (Bursera simaruba), soapberry (Sapindus saponaria), strangler fig (Ficus aurea), Jamaican dogwood (Piscidia piscipula), and yellow elder (Tecoma stans). Shell mound vegetation is in constant flux and is distinguished from maritime hammock by the presence of more tropical species as well as growing on pure shells rather than sand or sand mixed with shell fragments. They are relatively small in size and are subject to marine influences, high winds, salt spray, high insolation, and storm surges. These sites give us representations into the lifestyle of Native American Tribes, and sometimes include other discarded waste such as personal items or broken fishing equipment that give insight into a specific tribes culture. These are cultural sites that are protected and preserved in State or Federal parks and are managed to prevent loss of the historic resource. Shell mounds are included in this section since it is a human altered site, not a natural ecological site, as well as their locations spanning over many different soil series, making mapping of this community very difficult. Due to rapid urbanization in the early 1800s to mid-1900s on the prime development land of the Miami Ridge, it is possible that where shell mounds might have occurred in the landscape have become replaced by the urban complexes. Evidence has shown of Native American settlement by the Tequesta tribe along the Biscayne Bay and into present day Miami, from an archeological village site excavated south of the mouth of the Miami River, known as the Miami Circle (Carr, 2012). Further north along the Miami Ridge in the MLRA 155 is the Pompano Mound in Pompano Beach, which was a settlement of the Tequesta tribe.

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.

References

. 2021 (Date accessed). USDA PLANTS Database. http://plants.usda.gov.

Other references

Carr, R. S. 2012. Digging Miami. University Press of Florida.

Conservation Collier Program Collier County. 2008. Otter Mound Preserve Land Management Plan. Prepared by Collier County Facilities Management Department. January 2008 – January 2018 (10-year plan).

Duane, D. B., & Meisburger, E. P. 1969. Geomorphology and sediments of the nearshore continental shelf: Miami to Palm Beach, Florida (No. 29). US Army, Corps of Engineers.

Florida Chapter Soil and Water Conservation Society. 1989. 26 Ecological Communities of Florida

Florida Natural Areas Inventory (FNAI). 2010. Guide to the natural communities of Florida: 2010 edition. Florida Natural Areas Inventory, Tallahassee, FL

Gann, G.D., Bradley, K.A. and Woodmansee, S.W. 2009. Floristic Inventory of South Florida Database. Institute for Regional Conservation.

Harshberger, J. W. 1914. The Vegetation of South Florida South of 27 30 North, Exclusive of the Florida Keys. Philadelphia, Wagner Free Institute of Science, 1914.

Kambly, S., Moreland, T.R., 2009, Land cover trends in the Southern Florida Coastal Plain: U.S. Geological Survey Scientific Investigations Report 2009–5054, 16 p.

McNab, W.H.; Cleland, D.T.; Freeouf, J.A.; Keys, Jr., J.E.; Nowacki, G.J.; Carpenter, C.A., comps. 2007. Description of ecological subregions: sections of the conterminous United States [CD-ROM]. Gen. Tech. Report WO-76B. Washington, DC: U.S. Department of Agriculture, Forest Service. 80 p

McPherson, B. F., Hendrix, G. Y., Klein, H., & Tyus, H. M. 1976. The environment of south Florida: a summary report (Vol. 1011). US Government Printing Office.

Scott, T. M. 2001. Text to accompany the geologic map of Florida. Florida Geologic Survey, Tallahassee, Florida.

U.S. Fish & Wildlife Service Southeast Region (FWS). 1998. Beach Dune, Coastal Strand and Maritime Hammock. Multi-Species Recovery Plan for South Florida.

Wells, M. K. 2013. Evaluating the role of vegetated dunes in ensuring the long-term preservation of the beaches in Miami Beach, Florida.

Contributors

Jack Ferrara
Craig Prink
Martin Figueroa
Jamie Bean

Approval

Charles Stemmans, 2/07/2025

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	05/10/2025
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:

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

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

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

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:**

17. **Perennial plant reproductive capability:**