USDA Natural Resources
Conservation Service

Ecological site R153BY110NC
Coastal Strand, Beaches, and Dunes

Last updated: 4/02/2025
Accessed: 12/19/2025

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): 153B–Tidewater Area

The MLRA notes section provides a brief description of the entire MLRA. This brief description of the entire MLRA is intended to provide some context about the MLRA that this ecological site is within. A more complete description of the MLRA can be found in Ag Handbook 296 (USDA-NRCS, 2022).

This MLRA stretches along the Atlantic coastline from northern Florida to southern Virginia. It features young marine terrace flats, broad flood plains and deltas, tidal marshes and estuaries, barrier sea islands, and a beach ridge system that spans the length of the MLRA. Its broad, shallow valleys with large rivers, tidal marshes, swamps, estuaries, drowned valleys, sea islands, and beaches, are all features of the Late Quaternary (USDA-NRCS, 2017). The Suffolk Scarp is the upper (western) limit of this MLRA and marks the extent of the ocean shoreline before it retreated during the Wisconsin period of glaciation. Fluctuating ocean levels, along with wave and wind activity, continue to rework sand deposits that comprise the ever-changing barrier sea islands and coastline in this MLRA. The marine terraces are younger to the east and are progressively older and higher inland to the west. The youngest marine terraces adjacent to the coast are very low lying and at high risk of inundation by extreme high tides, wind tides, storm surge, and extreme precipitation events. In addition to the risks of inundation, these low-lying terrestrial and freshwater systems are at high risk of salt water intrusion.

The MLRA is characterized by a persistent high water table. The hydraulic gradient across this MLRA is very low. Overall, elevation ranges from sea level to less than 25 feet (0 to 8 meters). Local relief is mainly about 3 feet (1 meter) or less. Most of the surface water in this MLRA is either coming into the MLRA from the piedmont and upper coastal plain, is

managed by ditching, or is ponded on the surface. Surface flow channels originating within the MLRA are extremely subtle, typically blackwater, and flow generally channelizes mostly near the shoreline where tidal processes also impact flooding processes.

The dominant soil orders in this MLRA are Alfisols and Entisols. Ultisols and Histosols are important but are of lesser extent. The soils in the area are characterized by restricted drainage, a thermic temperature regime, and an aquic moisture regime. The study of subaqueous soils is of increasing importance along nearshore coastal waters.

The major soil suborders of the MLRA include: 1) Endoaqualfs, which are very deep and loamy to clayey, 2) Endoaquults, which are very deep and loamy to clayey, 3) Haplosaprists, which are extensive in North Carolina and Virginia, in the Great Dismal Swamp, and in broad upland wetlands known as pocosins, 4) Hapludults, which are in the higher areas of somewhat better drainage, 5) Psamments, 6) Sulfaquents, which are extensive throughout the brackish tidal marshes protected by the barrier and sea islands, 7) Sulfiwassents (subaqueous soils), which formed in low- to moderate-energy estuarine deposits, and 8) Umbraquults, which are very deep and loamy to clayey.

MLRA 153B has a lengthy north-south extent, and it runs parallel to the Atlantic coast. The MLRA extends from the northeastern corner of Florida to southern Virginia. Five states are intersected by the MLRA, including North Carolina (42 percent), Virginia (21 percent), South Carolina (20 percent), Georgia (14 percent), and Florida (3 percent). The MLRA extent makes up about 11,152 square miles (28,884 square kilometers).

Because of climatic differences between the northern and southern reaches of the MLRA, vegetative communities vary with latitude. Loblolly pine, red oak, and white oak are dominant in the uplands, and blackgum, sweetgum, pond pine, laurel oak, water tupelo, and bald cypress are dominant on the bottomland. Longleaf pine and slash pine were dominant historically in the southern part of the area. Understory species common to the MLRA include switchcane, inkberry, large gallberry, greenbrier, wax myrtle, and cabbage palm. Herbaceous understory species include little bluestem, and various panicgrasses.

Major wildlife species include alligator, black bear, white-tailed deer, fox, raccoon, opossum, otter, muskrat, rabbit, mink, squirrel, quail, and mourning dove. The red wolf, an endangered species, is being reintroduced in several parts of the MLRA. The nearshore estuaries of the Chesapeake Bay, the Albemarle-Pamlico estuary systems, and Atlantic Ocean provide habitat for diverse populations of terrestrial and aquatic animal species. The subaquatic vegetation in these coastal lagoon areas provides critical habitat and cover for many shellfish and juvenile finfish. The estuaries host numerous migratory waterfowl and wading birds throughout the year and are an integral part of the Atlantic Flyway.

(USDA-NRCS, 2022)

LRU notes

Currently, Ecological Site Descriptions (ESDs) for MLRA 153B cover the full north-south range of the MLRA. However, climate variation across the north-south extent warrants the development of Land Resource Unit (LRU) classifications to support more precise Ecological Site Descriptions.

Classification relationships

MLRA 153B has overlap with two level III EPA ecoregion concepts: 63) the Middle Atlantic Coastal Plain and 75) the Southern Coastal Plain. Under ecoregions 63 and 75 are a number of lower level (IV) concepts, of which several apply to MLRA 153B. These include: 63b) Chesapeake-Pamlico Lowlands and Tidal Marshes, 63c) Swamps and Peatlands, 63d) Virginia Barrier Islands and Coastal Islands, 63f) Delmarva Uplands), 63g) Carolinian Barrier Islands and Coastal Marshes, and 75j) Sea Islands/Coastal Marsh. (U.S. EPA, 2013)

MLRA 153B overlaps a portion of the US Forest Service Outer Coastal Plain Mixed Forest province (232). The MLRA roughly corresponds to the easternmost portions of the Atlantic Coastal Flatwoods (232C) and the southeastern portion of the Northern Atlantic Coastal Flatwoods (232I) sections. In combination with MLRA 153A, these two MLRAs correspond very closely to the full extent of Sections 232C and 232I. (Cleland et al., 2007)

Based on the USGS physiographic classification system, most of MLRA 153B is in the Sea Island section of the Coastal Plain province, in the Atlantic Plain division. The northern quarter is in the Embayed section of the same province and division. The embayed barrier islands extend from the eastern shore of the Chesapeake Bay in Virginia to north of Charleston, South Carolina (Fenneman et al., 1946). The portion in North Carolina is referred to as the Outer Banks. Large bodies of brackish water, such as Pamlico and Albemarle Sounds, are on the inland side of the barrier islands. The sea islands extend from north of Charleston, South Carolina, to Jacksonville, Florida.

The reference community for this particular site is approximately aligned with Maritime Shrub (Schafale and Weakely, 1990) and Coastal Strand (FNAI, 2010).

Ecological site concept

This site represents shoreline, nearshore, and young relict shoreline features including beach, dune, and coastal strand landforms. The soils are dominantly sandy and mostly excessively drained, but this site includes all such landforms on soils that are not hydric from excessively drained to moderately well drained.

This site has the potential to support a variety of vegetation communities including dune grasses as well as maritime forests.

Associated sites

R153BY120NC	**Wet Dune Slack** Wet dune slack is a component of the coastal strand landscape and can be distinguished by soil moisture.
R153BY130NC	**Tidal Marsh on Mineral Soil** Tidal marsh is typically associated with and lower on the landscape than the coastal strand and beach landscapes.
R153BY140NC	**Tidal Marsh on Organic Soil** Tidal marsh is typically associated with and lower on the landscape than the coastal strand and beach landscapes.

Similar sites

F153BY010NC	**Dry Sands** Coastal strand landforms and relict shoreline features are often mapped as dry sands.
F153BY020NC	**Moist Sands** Coastal strand landforms and relict shoreline features are often mapped as moist sands.

Table 1. Dominant plant species

Tree	(1) *Quercus virginiana* (2) *Juniperus virginiana*
Shrub	(1) *Ilex vomitoria* (2) *Morella cerifera*
Herbaceous	(1) *Uniola paniculata* (2) *Spartina patens*

Physiographic features

This site represents shoreline, nearshore, and young relict shoreline features including beach, dune, and coastal strand landforms. Beaches and dunes are particularly dynamic ecosystems. Beaches do not typically support much vegetation, but dune dynamics are closely related to vegetation community and are distinguished by active dunes, stable foredune, and stable backdune environments. Wind-driven sand on exposed active dunes can prevent all vegetation. Less-exposed areas on active dunes can support maritime grasslands. As dunes migrate inland, they become more stable. Foredune positions that remain exposed to salt spray typically support maritime scrub, while protected and stable backdune positions can support maritime woodlands.

Table 2. Representative physiographic features

Hillslope profile	(1) Backslope (2) Shoulder (3) Toeslope
Landforms	(1) Coastal plain > Marine terrace (2) Dune (3) Barrier island (4) Beach
Runoff class	Negligible to very low
Flooding duration	Very brief (4 to 48 hours)
Flooding frequency	None to rare
Ponding frequency	None
Elevation	0–8 m
Slope	0–6%
Water table depth	61–203 cm
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Runoff class	Negligible to medium
Flooding duration	Very brief (4 to 48 hours)
Flooding frequency	None to rare
Ponding frequency	None
Elevation	0–8 m
Slope	0–30%
Water table depth	46–203 cm

Climatic features

The climate of MLRA 153B is generally warm, temperate, and humid with maritime influences along the coast. The maximum precipitation occurs in summer, and the minimum occurs in autumn. Rainfall is usually of moderate intensity. Occasionally, extreme weather events (e.g., northeasters, tropical storms, and hurricanes) produce large amounts of precipitation and destructive winds. Snowfall may occur in the northern end of the area. The average annual temperature is 57 to 70 degrees F (14 to 21 degrees C), increasing to the south. (USDA-NRCS, 2022)

The youngest marine terraces adjacent to the coast are very low lying and at high risk of inundation by extreme high tides, wind tides, storm surge, and extreme precipitation events. Hurricanes and other storms that combine strong winds with extreme precipitation

can topple trees and place this entire MLRA at risk of inundation. Furthermore, sea-level rise puts these low-lying terrestrial and freshwater systems at high risk of salt water intrusion and the damaging impacts of salinization.

Table 4. Representative climatic features

Frost-free period (characteristic range)	211-260 days
Freeze-free period (characteristic range)	261-339 days
Precipitation total (characteristic range)	1,143-1,219 mm
Frost-free period (actual range)	199-272 days
Freeze-free period (actual range)	242-359 days
Precipitation total (actual range)	1,143-1,245 mm
Frost-free period (average)	236 days
Freeze-free period (average)	300 days
Precipitation total (average)	1,194 mm

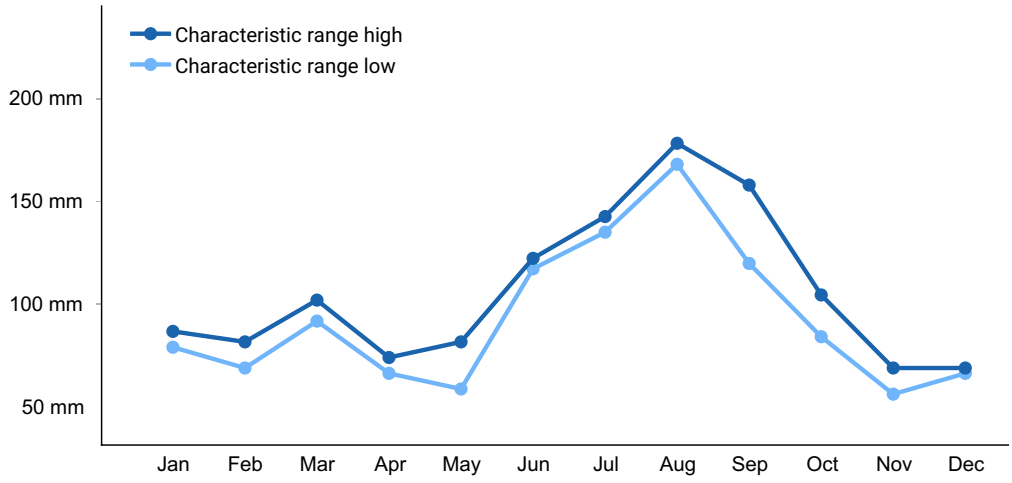


Figure 1. Monthly precipitation range

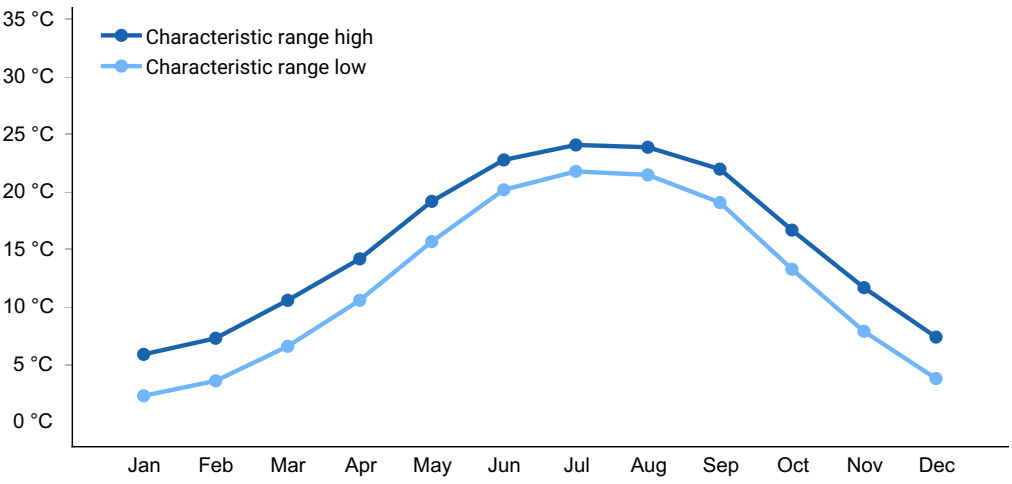


Figure 2. Monthly minimum temperature range

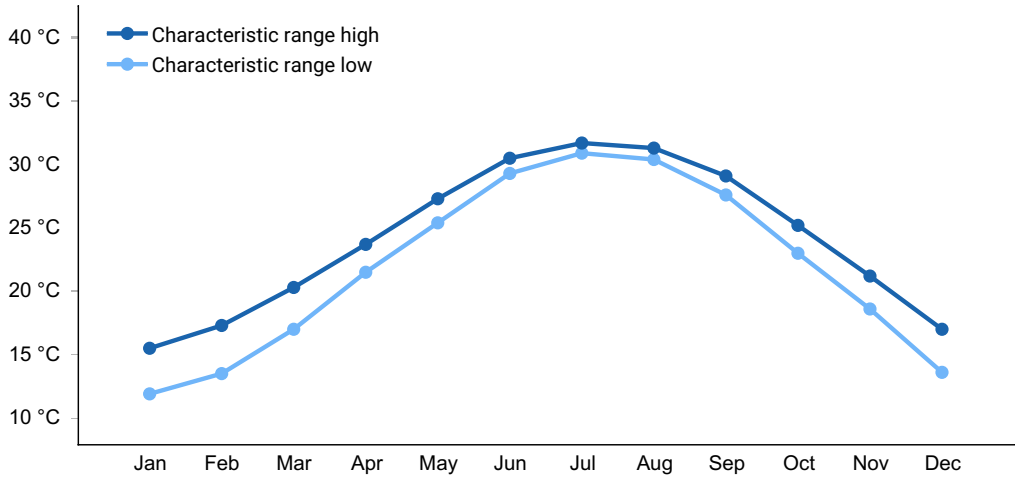


Figure 3. Monthly maximum temperature range

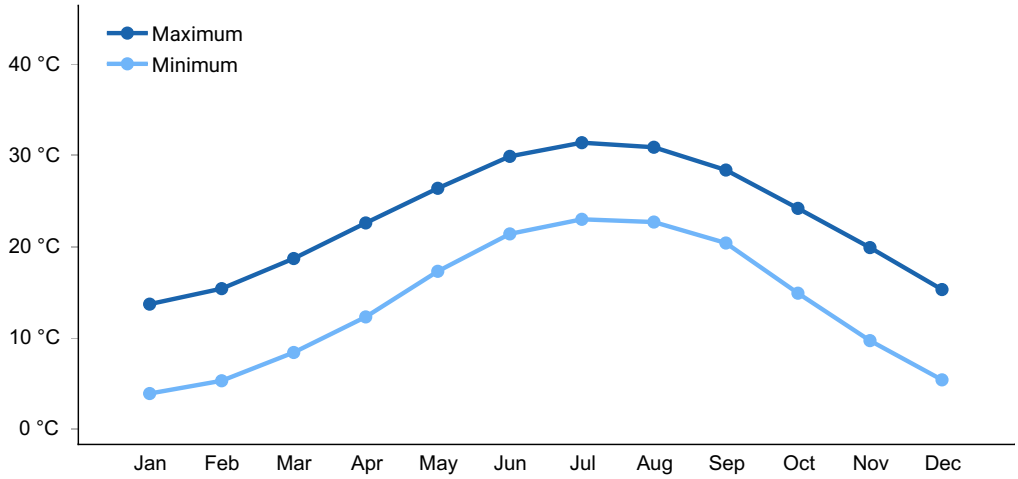


Figure 4. Monthly average minimum and maximum temperature

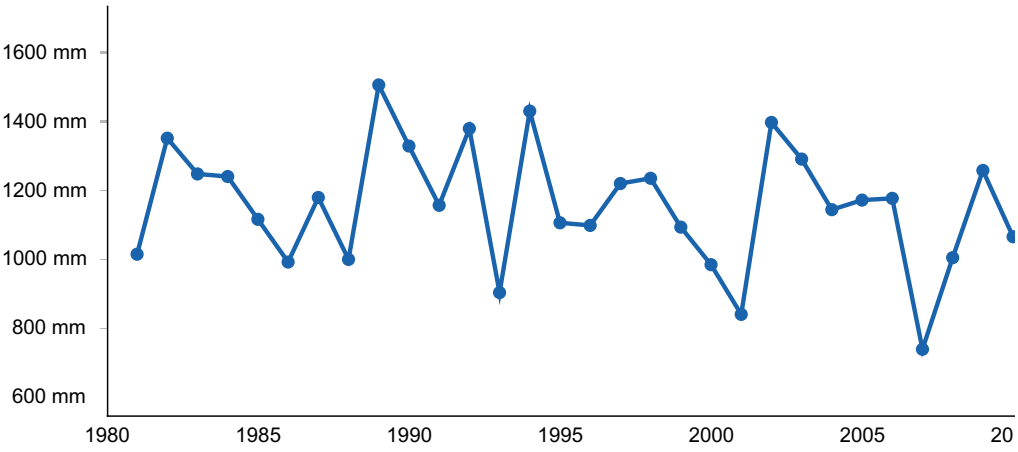


Figure 5. Annual precipitation pattern

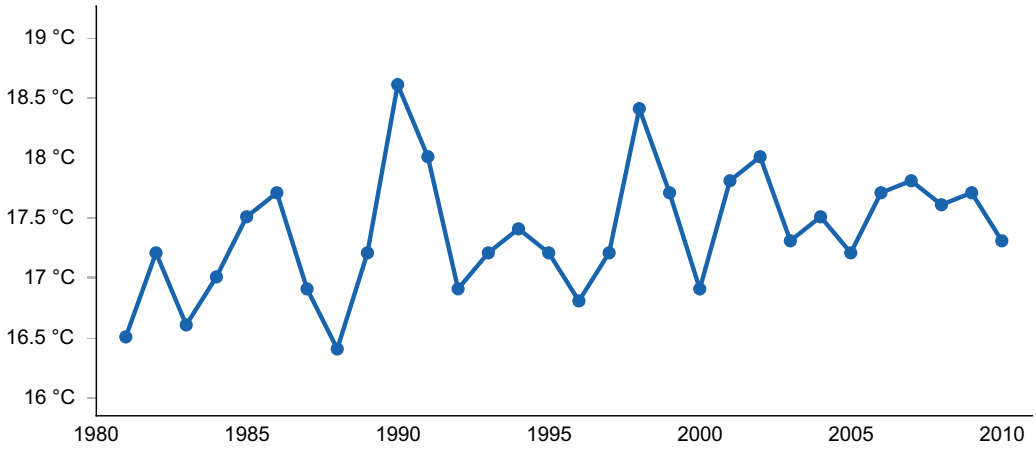


Figure 6. Annual average temperature pattern

Climate stations used

- (1) ELIZABETH CITY CGAS [USW00013786], Elizabeth City, NC
- (2) CHARLESTON CITY [USW00013782], Charleston, SC
- (3) BRUNSWICK 23 S [USW00063856], Saint Marys, GA

Influencing water features

This site is typically adjacent to Atlantic Ocean shoreline and is prone to tidal and storm surge inundation.

Wetland description

In Florida, South Carolina, and North Carolina, beaches are listed as potentially hydric soils. These soils may be hydric, but, in order to classify as a wetland, a location must meet soils, hydrology, and vegetation criteria.

Soil features

The soils of this site are all primarily sandy, and most are Entisols. This site represents sandy shoreline features. This relative dry site can typically be found in three unique positions: 1) coastal strand, 2) coastal dunes, and 3) beaches. The soils on this site are primarily sandy and primarily excessively drained, but this site includes all such landforms on soils that are not hydric from excessively drained to somewhat poorly drained. These soils are at risk of saltwater inundation during extreme tidal or storm surge events.

The soils are dominantly sandy and mostly excessively drained

Soil series on this site include: Assateague, Cainhoy, Chipley, Cornelia, Corolla, Fisherman, Fripp, Newhan, Ousley, Pactolus, Palm Beach, and Resota.

Fripp and Newhan are modal.

Table 5. Representative soil features

Parent material	(1) Marine deposits (2) Eolian sands (3) Beach sand
Surface texture	(1) Fine sand (2) Loamy fine sand
Drainage class	Moderately well drained to excessively drained
Permeability class	Rapid to very rapid
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	1.27–8.38 cm
Soil reaction (1:1 water) (0-25.4cm)	4–7.8
Subsurface fragment volume <=3" (0-101.6cm)	0–3%
Subsurface fragment volume >3" (0-101.6cm)	0%

Table 6. Representative soil features (actual values)

Drainage class	Somewhat poorly drained to excessively drained
Permeability class	Rapid to very rapid
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	0–10.92 cm
Soil reaction (1:1 water) (0-25.4cm)	3.5–7.8
Subsurface fragment volume <=3" (0-101.6cm)	0–9%
Subsurface fragment volume >3" (0-101.6cm)	0%

Ecological dynamics

The primary ecological drivers on this site including wind driven sand, salt spray, storm winds, and storm driven inundation. Beaches and dunes are particularly dynamic ecosystems. Beaches do not typically support much vegetation, but dune dynamics are closely related to vegetation community and are distinguished by active dunes, stable foredune, and stable backdune environments. Wind driven sand can both bury plants and expose plant roots. Dune migration can bury entire vegetation communities. Salt spray limits the stature of woody vegetation, and prunes branches into a characteristic maritime shape with a canopy sloping down to the shoreline. Wind-driven sand on exposed active dunes can prevent all vegetation. Less-exposed areas on active dunes can support maritime grasslands. As dunes migrate inland, they become more stable. Foredune positions that remain exposed to salt spray typically support maritime scrub, while protected and stable backdune positions can support maritime woodlands.

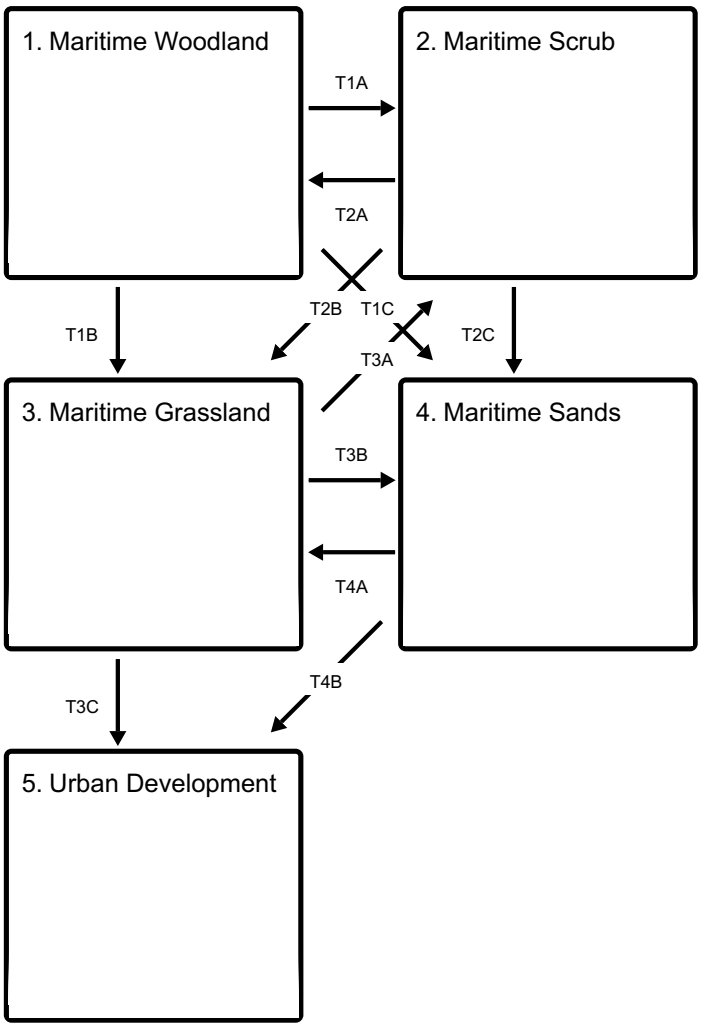
In comparison to other ecological sites on infertile sandy soils, salt spray increases plant diversity by providing a continuous input of nutrients.

While fire does occur on this ecological site, it is relatively rare. Proximity and adjacency to the shoreline limits compass directions from which a fire can encroach on this site. Furthermore, these sandy soils can limit the accumulation of ground fuels, and some communities on this site are sparsely vegetated, both of which limit the ability of fire to be carried into and across this ecological site. In the southern portions of this MLRA, cabbage palm (*Sabal palmetto*) is common in wooded communities on this site, and it burns with intensity, so fires in this community may spread more easily.

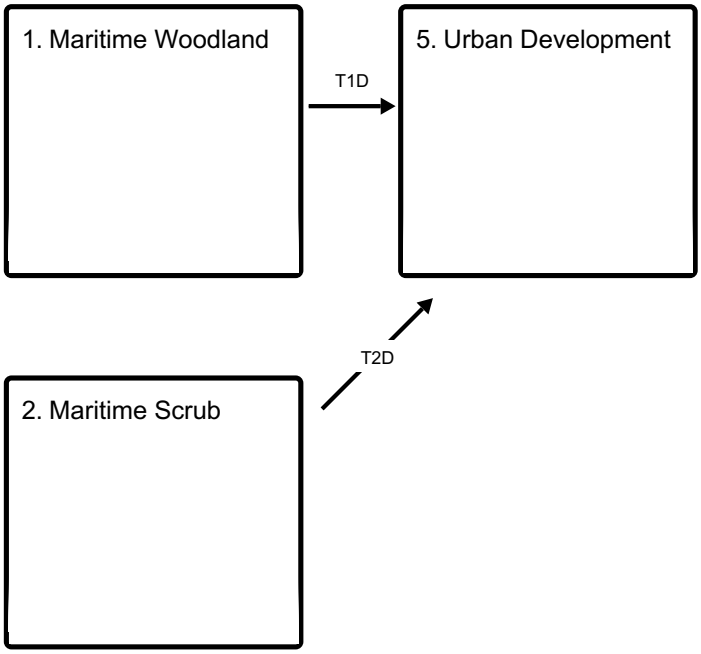
(FNAI, 2010; Schafale and Weakley, 1990)

State and transition model

Ecosystem states



States 1, 5 and 2 (additional transitions)



T1A - Decreased protection

T1B - Decreased protection

T1C - Major disturbance event

T1D - Urban development

T2A - Increase protection

T2B - Decreased protection

T2C - Major disturbance event

T2D - Urban development

T3A - Increased protection

T3B - Major disturbance event

T3C - Urban development

T4A - Increased protection

T4B - Urban development

State 1
Maritime Woodland

Maritime woodlands typically occur on the backside of relatively stable dunes that are not immediately adjacent to the shoreline. They tend to be relatively protected from wind driven sand and salt spray, but they may still display salt spray pruning and maritime wind shaping. (FNAI, 2010; Schafale and Weakley, 1990)

Dominant plant species

- live oak (*Quercus virginiana*), tree
- redbay (*Persea borbonia*), tree
- pignut hickory (*Carya glabra*), tree
- eastern redcedar (*Juniperus virginiana*), tree
- American holly (*Ilex opaca*), tree
- yaupon (*Ilex vomitoria*), shrub
- wax myrtle (*Morella cerifera*), shrub

State 2
Maritime Scrub

Maritime scrub occurs on relatively stable dunes exposed to the pruning impacts of salt spray. It typically occurs on foredune positions and often occurs between maritime grassland and maritime woodland across a gradient of protection from wind driven sand and salt spray. The canopy height of maritime scrub is specifically less than 5 m. Taller canopy height classifies as maritime woodland. The maritime scrub community can either be a developmental stage as woody vegetation establishes and grows on a site as it ultimately develops into a maritime woodland, or salt and sand spray can maintain this community and prevent it from ever developing to a maritime woodland. (FNAI, 2010; Schafale and Weakley, 1990)

Dominant plant species

- yaupon (*Ilex vomitoria*), shrub
- Hercules' club (*Zanthoxylum clava-herculis*), shrub

- eastern redcedar (*Juniperus virginiana*), shrub
- live oak (*Quercus virginiana*), shrub

State 3
Maritime Grassland

Maritime grasslands typically occupy environments where aeolian processes are most active including active dune settings. They tend to form in two ways. As barrier islands build seaward, they develop new dune ridges along the shore which protect inland ridges. Alternatively, as a beach recovers from an over wash event, it will develop a new foredune which will protect the over wash area behind it. The vegetation community of maritime grasslands is very similar to the vegetation community on coastal sands, but with the addition of some species more characteristic of more stable soils.

Dominant plant species

- earleaf greenbrier (*Smilax auriculata*), shrub
- seaoats (*Uniola paniculata*), grass
- bitter panicgrass (*Panicum amarum*), grass
- saltmeadow cordgrass (*Spartina patens*), grass

State 4
Maritime Sands

This community occupies the most stressful environments on this site most exposed to wind driven sands, salt spray, and over wash. This community tends to be located on the upper beach or first fore dune of a coastal strand, beach, dune complex. Vegetation cover tends to be relatively sparse.

Dominant plant species

- seacoast marsh elder (*Iva imbricata*), shrub
- seaoats (*Uniola paniculata*), grass
- bitter panicgrass (*Panicum amarum*), grass
- saltmeadow cordgrass (*Spartina patens*), grass
- American searocket (*Cakile edentula*), other herbaceous
- dixie sandmat (*Chamaesyce bombensis*), other herbaceous

State 5
Urban Development

Urban development on the coastal strand can be a risky proposition. Aeolian sands are constantly shifting, and these locations are highly exposed to the risks of sea-level rise and storm events.

Transition T1A
State 1 to 2

Decreased protection from wind driven sand and salt spray or storm damage.

Transition T1B
State 1 to 3

Decreased protection from wind driven sand and salt spray or storm damage.

Transition T1C
State 1 to 4

Major disturbance event including hurricane and/or storm surge washover.

Transition T1D
State 1 to 5

Urban development.

Transition T2A
State 2 to 1

Increased protection from wind driven sand and salt spray.

Transition T2B
State 2 to 3

Decreased protection from wind driven sand and salt spray or storm damage.

Transition T2C
State 2 to 4

Major disturbance event including hurricane and/or storm surge washover.

Transition T2D
State 2 to 5

Urban development.

Transition T3A
State 3 to 2

Increased protection from wind driven sand and salt spray.

Transition T3B
State 3 to 4

Major disturbance event including hurricane and/or storm surge washover.

Transition T3C
State 3 to 5

Urban development.

Transition T4A
State 4 to 3

Increased protection from wind driven sand and salt spray.

Transition T4B
State 4 to 5

Urban development.

Inventory data references

Data collection and analysis of field data will be performed during the Verification Stage of ESD development.

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Contributors

Matthew D. Duvall

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	12/19/2025
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:**

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

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

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

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

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

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

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

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

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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:**
