

MARITIME GRASSLANDS

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MARITIME GRASSLANDS THEME

Concept: Maritime Grasslands are dry-to-moist communities of barrier island and similar coastal sites that are not dominated by shrubs or trees. Most have sparse-to-moderate herbaceous vegetation, but one is dominated by dense vines.

Distinguishing Features: Maritime Grasslands are distinguished by the combination of herbaceous, vine-dominated, or sparse vegetation in a nonwetland site on a barrier island or coastal spit.

Sites: Maritime Grasslands occur on barrier islands or spits, on sand dunes or sand flats. Salt spray and sometimes sand movement or overwash by sea water during storms are important environmental stresses.

Soils: Soils are sandy and are generally lacking horizon development. Soils are less acidic and nutrient-poor than inland sandy soils because of the presence of shell material in the sand and because of nutrient input by salt spray.

Hydrology: Maritime Grasslands are generally dry to xeric, with excessive drainage due to the coarse sandy texture and lack of clay or organic matter. A few may be moist but not wet. Moisture comes from rainfall, which rapidly infiltrates into the sand.

Vegetation: The vegetation of Maritime Grasslands is dominated by herbs or, rarely, vines. The floristic diversity is limited, confined to species tolerant of salt spray as well as of excessive soil drainage. It may range from sparse to dense. One or two species of sand-binding or salt-tolerant grasses, *Spartina patens*, *Uniola paniculata*, *Ammophila breviligulata*, or *Schizachyrium littorale*, dominate most of the communities. One unique community is dominated by dense tangles of *Smilax auriculata* or other vines. Other communities have sparse vegetation of distinctive species such as *Hudsonia tomentosa* or other species of dry sandy sites. All communities are low in species richness, but a small suite of tolerant species such as *Hydrocotyle bonariensis*, *Panicum amarum*, *Oenothera humifusa*, *Cenchrus tribuloides*, *Strophostyles helvola*, *Heterotheca subaxillaris*, and *Euphorbia polygonifolia* are present in many.

Dynamics: Maritime Grasslands are among the most naturally dynamic communities in North Carolina. Natural disturbances, including overwash by sea water, heavy salt spray during storms, and aeolian sand movement are frequent, with different disturbances predominating in different communities. Exposure to these disturbances can change quickly as a result of erosion or deposition. Locally, environments may become suitable for Maritime Grassland communities, or unsuitable, due to changes in landforms or as a result of a single storm. As long as the environment remains suitable, Maritime Grasslands recover readily from natural disturbances. They can develop quickly in new sites if the environment becomes suitable. Their habitat is some of the newest land in North Carolina, with some surfaces only a few years old and some whole islands only a few centuries old.

The individual community types each have distinctive dynamics which are discussed in detail in their descriptions. Common to all is the degree to which they are subject to the natural forces of

storms and the chronic stress of salt spray. All can be readily altered by human actions, both directly and indirectly, including both artificial disturbance and artificial stabilization.

Comments:

References:

KEY TO MARITIME GRASSLANDS

1. Rare community dominated by large patches of *Smilax auriculata*, *Toxicodendron radicans*, or other vines standing at least one meter tall, with few or no shrubs; patches at least 10 meters in size.
..... **Maritime Vine Tangle**
1. Community not dominated by large patches of vines, though patches of sprawling vines a few meters in size may be present.
 2. Community dominated by *Spartina patens*; occurring on low, though dry, sandy areas rather than on active or stabilized dunes, often visibly on overwash deposits. **Maritime Dry Grassland**
 2. Community not dominated by *Spartina patens*; dominated by sand-binding grasses such as *Uniola paniculata*, *Ammophila breviligulata*, or *Schizachyrium littorale*, or vegetation sparse and dominated by other species.
 3. Site one of the few large, unstabilized medaño dunes such as Jockey's Ridge or Run Hill; vegetation very sparse, with large portions lacking any vascular plants. **Live Dune Barren**
 3. Site foredunes or stable interior dunes, with only local unstable areas; vegetation moderate to sparse in density but without large areas devoid of vascular plants.
 4. Community on foredunes or stable interior dunes; vegetation dominated by *Uniola paniculata*, *Ammophila breviligulata*, or *Schizachyrium littorale*.
 5. Community dominated by *Ammophila breviligulata*. **Dune Grass (Northern Subtype)**
 5. Community dominated by *Uniola paniculata* or *Schizachyrium littorale*.
 6. Community dominated by *Uniola paniculata*, with *Schizachyrium littorale* absent.
..... **Dune Grass (Southern Subtype)**
 6. Community dominated by *Schizachyrium littorale* or a mix of it with *Uniola paniculata*.
..... **Dune Grass (Bluestem Subtype)**
 4. Community on stable interior dunes; *Uniola paniculata*, *Ammophila breviligulata*, and *Schizachyrium littorale* scarce or absent; vegetation sparse over most of the community; vegetation containing species such as *Hudsonia tomentosa*, *Lechea maritima* var. *virginica*, *Dichanthelium* spp., *Hexasepalum (Diodia) teres*, *Polypremum procumbens*, and *Hypericum gentianoides* that are absent on foredunes; community generally surrounded by Maritime Evergreen Forest or Maritime Shrub
 7. Community north of Cape Hatteras; *Hudsonia tomentosa* and *Lechea maritima* var. *virginica* usually present and abundant. **Stable Dune Barren (Beach Heather Subtype)**
 7. Community south of Cape Hatteras; south of the range of *Hudsonia tomentosa* and *Lechea maritima* var. *virginica*. **Stable Dune Barren (Southern Subtype)**

DUNE GRASS (SOUTHERN SUBTYPE)

Concept: Dune Grass communities are sparse-to-dense grasslands of coastal foredunes and some interior dunes, dominated by large sand-binding grasses and containing a small set of specialized plants such as *Panicum amarum*, *Hydrocotyle bonariensis*, *Strophostyles helvola*, *Smilax auriculata*, and *Solidago mexicana*. The Southern Subtype encompasses communities dominated by *Uniola paniculata* dominates and *Ammophila breviligulata* and *Schizachyrium littorale* are absent, scarce, or present only because they were planted. Most occur on the seaward side of barrier islands, as a continuous or discontinuous line of foredunes. However, patches also occur on stabilized sand dunes in barrier island interiors, where they can be distinguished by vegetation.

Distinguishing Features: Dune Grass communities in natural condition are distinguished from all other communities by the dominance of the above species, particularly *Uniola paniculata*, *Schizachyrium littorale*, or *Ammophila breviligulata*. Live Dune Barren and Stable Dune Barren communities also occur on sand dunes in barrier island interiors but are not dominated by these grasses and usually contain little grass. Maritime Dry Grasslands may be interspersed with Dune Grass patches in island interiors but can be distinguished by the absence of *Uniola paniculata*.

The Southern Subtype is distinguished by the natural absence of *Schizachyrium littorale* and *Ammophila breviligulata*, though the latter may be present in small amounts in northerly examples. However, extensive planting of both *Uniola* and *Ammophila* confuses the distinction in some areas. The Northern Subtype does not occur south of Cape Hatteras and the Southern Subtype does not occur north of Nags Head. Dunes in the area between are typically the Southern Subtype. However, local zones of *Ammophila* dominance near Cape Hatteras, occurring seaward of *Uniola* dominance, may be a natural disjunct example of the Northern Subtype.

Synonyms: *Uniola paniculata* - *Hydrocotyle bonariensis* Herbaceous Vegetation (CEGL004040). Ecological Systems: Southern Atlantic Coastal Plain Dune and Maritime Grassland (CES203.273).

Sites: Dune Grass communities occur on foredunes and on short-to-tall dunes in the interior of some barrier islands. The dunes are relatively stable but may contain unstable blowouts.

Soils: Soils are coarse sands classified as the Newhan series (Typic Quartzipsamment).

Hydrology: Dune Grass sites are excessively drained. Rainwater infiltrates and drains through the soil rapidly.

Vegetation: Dune Grass (Southern Subtype) is dominated by *Uniola paniculata*, which may range locally from sparse to dense. Other species that occur with high frequency in CVS plot data are *Oenothera humifusa*, *Hydrocotyle bonariensis*, *Spartina patens*, *Heterotheca subaxillaris*, *Cenchrus tribuloides*, *Panicum amarum*, *Iva imbricata*, *Euphorbia polygonifolia*, *Opuntia mesacantha*, and *Conyza canadensis* var. *pusilla*. Other species that are less frequent in plot data but are often observed in sites include *Strophostyles helvola*, *Physalis walteri*, *Solidago mexicana* (*sempervirens* var. *mexicana*), and *Croton punctatus*. *Smilax auriculata*, *Chrysopsis gossypina*, *Triochostema nesophilum*, and *Euphorbia bombensis* are less frequent but are characteristic.

Range and Abundance: Ranked G3. In North Carolina, the Southern Subtype occurs throughout the length of the coast but is absent and replaced by the Bluestem Subtype on certain barrier islands. This community ranges southward to Florida.

Associations and Patterns: Dune Grass may be regarded as a matrix community, occurring as a predictable part of the landscape mosaic in the limited extent of the barrier islands. Occurrences may be fairly narrow but are continuous along miles of coastline. They occur in association with Upper Beach, Maritime Dry Grassland, Maritime Wet Grassland, Maritime Shrub, and Maritime Evergreen Forest.

Variation: Dune Grass communities are heterogeneous on a fine scale, with grass density varying in response to microtopography and local disturbance. The composition of the vegetation is fairly uniform throughout, though areas on younger dunes may be lower in species richness. There is a recognizable difference in vegetation between foredunes and interior Dune Grass communities, and these may warrant recognition as variants.

Dynamics: Sand dunes and Dune Grass communities have distinctive dynamics. Sand movement may locally bury vegetation or uproot it. Storm erosion can destroy dunes locally or over long stretches of coast. *Uniola paniculata* plays an important geomorphic as well as biological role, colonizing loose sand, stabilizing it, and catching moving sand to build dunes. Dunes can grow rapidly. On the Fort Fisher spit, the author observed that dunes completely flattened by hurricane erosion and overwash had redeveloped in just a few years. The accumulation of sand around individual surviving or newly established clumps of *Uniola* was visible very soon after the storm, and it can be seen in overwash passes and on newly deposited sand spits in many places.

Because the dunes affect the frequency and extent of overwash, Dune Grass communities influence the dynamics of all barrier island communities. Godfrey and Godfrey (1976) emphasized the role of dune configuration and the effect of artificial modification of dunes. They described dunes as discontinuous and relatively short on unmodified barrier island such as Core Banks. They indicated that dune enhancement activities such as sand fencing and planting of grasses on other islands led to taller and more continuous dunes that blocked overwash. They also noted natural variation, with barrier islands oriented perpendicular to the prevailing winds having better developed dunes. This appears to be the case on many east-west oriented barrier islands in North Carolina. Goldstein et al. (2018) noted that there is also a belief that *Uniola paniculata* and *Ammophila breviligulata* tend to form different configurations of dunes, with the latter leading to hummocky and less continuous dunes.

Artificial dune enhancement has been done in many places, to protect roads or houses behind the dunes, and relatively few dune systems other than Core Banks and islands with naturally extensive dunes may be free from it. There was an earlier belief, e.g. (Cobb 1906), that unstable dunes and actively moving sand had resulted from clearing of forest or grazing by earlier settlers. However, most such dune building was done before 1976, much of it in the 1930s and 1950s, and it appears not to have been maintained, at least on undeveloped barrier islands. It may be questioned how long the effects of these activities would persist in such a dynamic environment. Goldstein et al. (2018) mention reports of plantings of *Ammophila* being displaced by native *Uniola* in six to ten years, suggesting such altered places may naturalize quickly. The author observed that Core Banks

in the 2000s had fairly continuous dunes, with few overwash passes, despite no history of modification. It may be that the extent and continuity of dunes changes over periods of years in response to storm frequency or other variations in climate.

Interior dunes may support Dune Grass, Stable Dune Barren, or Live Dune Barren communities. The distinction may be related to stability and age of the dunes. The largest, active dunes, with vegetation kept sparse by ongoing lack of stability, are Live Dune Barrens. Recently stabilized dunes support Dune Grass communities very similar to those on the foredunes. Stable Dune Barrens appear to be of greater age and to have little tendency for sand movement. Woody vegetation has often filled the adjacent swales. They are probably maintained more by excessive soil drainage.

Salt Spray is an additional distinctive environmental factor important to dynamics. Oosting and Billings (1942) brought attention to its importance to barrier island plants. Dune Grass communities, at least on the foredunes, are among the most heavily exposed to it. Salt spray is an ongoing stress that excludes most species from the environment, and heavy deposition in storms may act as a natural disturbance. Salt spray is also an important source of nutrients. Gormally and Donovan (2010) found that many plant nutrients decreased with distance from the shore, even as saltiness of the sand decreased. *Uniola paniculata* plants were taller, had higher tissue concentrations of nutrients, and flowered more in the ten meters closest to the shoreline than farther back.

Comments: The vegetation of this subtype is well studied in North Carolina. Publications by Au (1974) and Godfrey and Godfrey (1976) provided earlier characterizations, focusing on Cape Lookout and Cape Hatteras National Seashore, and Wagner (1964) addressed the behavior of the dominant species. A thesis by Rosenfeld (2004) revealed the distinctness of this community at the southern end of North Carolina. Numerous CVS plots and plots collected by NatureServe for the National Park Service represent it.

Uniola paniculata Herbaceous Vegetation (CEGL004038) was defined as a more depauperate dune grass association of the Outer Banks. It was provisionally accepted as the Outer Banks Subtype in earlier drafts of the 4th approximation but has been dropped. It is now inactive in NVC. Further study may prove it to be warranted, but present analysis and experience do not support it. All Dune Grass subtypes are floristically depauperate because of the harsh environment, and their flora consists mostly of specialist species not in mainland communities. Local species richness within Dune Grass communities is extremely variable over short distances. Examples on the most remote dunes of the Outer Banks do not appear to be more depauperate than many examples closer to the mainland.

Rare species:

Vascular plants: *Dichantherium caeruleum*, *Euphorbia bombensis*, *Ipomoea imperati*, *Trichostema nesophilum*, and *Yucca gloriosa*.

Vertebrate animals: *Peromyscus leucopus easti*.

Invertebrate animals: *Megathymus yuccae*

References:

- Au, S.F. 1974. Vegetation and ecological processes on Shackleford Banks, North Carolina. National Park Service Scientific Monograph Series No. 6.
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- Oosting, H.J., and W.D. Billings. 1942. Factors affecting vegetational zonation on coastal dunes. Ecology 23: .131–142.
- Rosenfeld, K.M. 2004. Ecology of Bird Island, North Carolina, an uninhabited undeveloped barrier island. M.S, Thesis, North Carolina State University, Raleigh.
- Wagner, R.H. 1964. The ecology of *Uniola paniculata* L. in the dunestrand habitat of North Carolina. Ecological Monographs 34:79–96.

DUNE GRASS (BLUESTEM SUBTYPE)

Concept: Dune Grass communities are sparse-to-dense grasslands of coastal foredunes and some interior dunes, dominated by large sand-binding grasses and containing a small set of specialized plants such as *Panicum amarum*, *Hydrocotyle bonariensis*, *Strophostyles helvola*, *Smilax auriculata*, and *Solidago mexicana*. The Bluestem Subtype covers rare examples in which *Schizachyrium littorale* is a significant component in addition to *Uniola paniculata* and other species.

Distinguishing Features: The Bluestem Subtype is distinguished from all other communities by having *Schizachyrium littorale* as a significant component in combination with *Uniola paniculata*. *Schizachyrium* is occasionally present in some other communities, but not in combination with *Uniola paniculata* on sand dunes.

Synonyms: *Uniola paniculata* - *Schizachyrium littorale* - *Panicum amarum* Herbaceous Vegetation (CEGL004039).

Ecological Systems: Southern Atlantic Coastal Plain Dune and Maritime Grassland (CES203.273).

Soils: Soils are coarse sands classified as the Newhan series (Typic Quartzipsamment).

Hydrology: Dune Grass sites are excessively drained. Rainwater infiltrates and drains through the soil rapidly.

Vegetation: The Bluestem Subtype is generally codominated by *Uniola paniculata* and *Schizachyrium littorale*, which may range from moderate to dense. Locally *Uniola* may be scarce and *Schizachyrium* strongly dominant. *Hydrocotyle bonariensis* and *Oenothera humifusa* are also nearly constant. Other species that occur with high frequency in CVS plot data include *Heterotheca subaxillaris*, *Conyza canadensis* var. *pumila*, and *Smilax auriculata*. Less frequent but characteristic species include *Cenchrus tribuloides*, *Solidago mexicana*, *Euphorbia bombensis*, *Strophostyles helvola*, *Croton punctatus*, *Commelina erecta*, *Opuntia mesacantha*, *Opuntia drummondii*, *Spartina patens*, and *Triplasis purpurea*.

Range and Abundance: Ranked G3. In North Carolina, the Bluestem Subtype is the predominant Dune Grass community on several barrier islands scattered along the coast. It is locally extensive but it is much less abundant than the Southern Subtype. It also is attributed to Virginia, South Carolina, and possibly Georgia, and occurs in a similar discontinuous range in those states.

Associations and Patterns: The Bluestem Subtype may be best regarded as a Large Patch community. Occurrences are tens to hundreds of acres but are scattered in only a few places. However, where present, it resembles a matrix community, making up a significant part of the landscape. The Bluestem subtype occurs in association with Upper Beach, Maritime Dry Grassland, Maritime Wet Grassland, Maritime Shrub, and Maritime Evergreen Forest. Areas on the foredunes may be low in *Schizachyrium* and some may be interpreted as the Southern Subtype.

Variation: Dune Grass communities are heterogeneous on a fine scale, with grass density varying in response to microtopography and local disturbance. There is a recognizable difference in

vegetation between foredunes and interior Dune Grass communities, and these may warrant recognition as variants.

Dynamics: Dynamics of the Bluestem Subtype are similar to the Southern Subtype. The factors that lead to occurrence of the Bluestem Subtype rather than the Southern Subtype are unclear. The known examples tend to be on east-running barrier islands, and it is possible that the relationship with the prevailing wind, or the presence of taller and wider dune systems on these islands, contributes to the presence of the defining species or to the development of this community. The Bluestem Subtype is somewhat more species-rich than the Southern Subtype. Unlike *Uniola*, *Schizachyrium* also will sometimes occur in Maritime Wet Grassland or Maritime Dry Grassland, suggesting it benefits from somewhat more moisture or that it is more competitive.

Comments: This subtype has not been the subject of specific published studies in North Carolina. However, a number of CVS plots represent it.

There has been some confusion of the concepts of Dune Grass subtypes. The Bluestem Subtype was initially characterized as being more southern, but *Schizachyrium littorale* has a patchy distribution rather than simply being indicative of more southern locations. It is absent from much of South Carolina but present farther south. It is unclear if its presence or absence correlates with the environment or with broader aspects of the community. The nomenclature of NVC associations also appears to have caused confusion. *Panicum amarum* var. *amarum* is a nominal in the association equivalent to the Bluestem Subtype but not in the Southern Subtype. Though the species may be present in either, it is not present in any of the North Carolina plots for the Bluestem Subtype but is in many plots of the Southern Subtype.

Rare species:

Vascular plants: *Euphorbia bombensis*, *Ipomoea imperati*, and *Yucca gloriosa*.

Invertebrate animals: *Atrytonopsis quinteri*.

References:

DUNE GRASS (NORTHERN SUBTYPE)

Concept: Dune Grass communities are sparse-to-dense grasslands of coastal foredunes and some interior dunes, dominated by large sand-binding grasses and containing a small set of specialized plants such as *Panicum amarum*, *Hydrocotyle bonariensis*, *Strophostyles helvola*, *Smilax auriculata*, and *Solidago mexicana*. The Northern Subtype covers examples in the northern part of the state, north of Cape Hatteras, where *Ammophila breviligulata* dominant.

Distinguishing Features: The Northern Subtype is distinguished from all other communities by the natural dominance or codominance of *Ammophila breviligulata*. If *Uniola paniculata* is present, it is a minor species. The Northern Subtype is limited to the islands north of Cape Hatteras, and it is unclear how widespread it is there, as *Uniola* dominates most of the dunes from there to Virginia. Dunes dominated by *Ammophila* much south of Cape Hatteras should be treated as altered examples of one of the other subtypes rather than this subtype. The natural subtype of many northern sites may be impossible to determine because of the widespread planting of both species for dune stabilization, but see below for more discussion of the relationship between the two subtypes.

Synonyms: *Ammophila breviligulata* - *Panicum amarum* var. *amarum* Herbaceous Vegetation (CEGL004043).

Ecological Systems: Northern Atlantic Coastal Plain Dune and Swale (CES203.264).

Sites: Dune Grass communities occur on foredunes and on short-to-tall dunes in the interior of some barrier islands. The dunes are relatively stable but may contain unstable blowouts.

Soils: Soils are coarse sands classified as the Newhan series (Typic Quartzipsamment).

Hydrology: Dune Grass sites are excessively drained. Rainwater infiltrates and drains through the soil rapidly, leaving the site dry.

Vegetation: The Northern Subtype is dominated by *Ammophila breviligulata*, which may be locally sparse or fairly dense. *Uniola paniculata* or *Schizachyrium littorale* may be present in small amounts. *Panicum amarum* may codominate or be abundant. Other species may include *Strophostyles helvola*, *Hydrocotyle bonariensis*, *Cakile harperi*, *Triplasis purpurea*, *Cenchrus tribuloides*, *Euphorbia polygonifolia*, *Oenothera humifusa*, *Solidago mexicana*, *Hexasepalum (Diodia) teres*, *Spartina patens*, *Heterotheca gossypina*, *Smilax bona-nox* var. *littorale*, *Smilax auriculata*, and *Iva imbricata*.

Range and Abundance: Ranked G2. This subtype's distribution in North Carolina is poorly documented. It appears to be rare and limited to small patches in North Carolina, but its abundance is confused by widespread alteration by planting. The association ranges northward to New York.

Associations and Patterns: In North Carolina, the Northern Subtype appears to be a small patch community, though it is a matrix community farther north. It sometimes occurs in close association with the Southern Subtype, but this relationship needs further investigation. Otherwise, it may be associated with Upper Beach, Maritime Shrub, and Maritime Evergreen Forest.

Variation: Nothing is known of the range of variation in North Carolina.

Dynamics: Dynamics of the Northern Subtype are presumably generally similar to the Southern Subtype. Sand movement and storm activity are important natural disturbances, while salt spray is an environmental stress that gives the community its character.

Goldstein et al. (2018) noted that there is a belief that *Uniola paniculata* and *Ammophila breviligulata* tend to form different configurations of dunes, with the latter leading to hummocky and less continuous dunes. This cannot be observed in North Carolina, where all the dunes within the range of the Northern Subtype are continuous, but all may have been subject to artificial enhancement. However, as with the Southern Subtype, while artificial enhancement of dunes has been widespread, it is unclear that the current stable continuous dunes are completely of artificial origin. Given the dynamic environment and the long timespan since stabilization and planting was done, artificial structure may not have persisted. Since unaltered examples of the Southern Subtype appear to be more continuous and stable than in the past, this may be a natural trend.

The global distribution of the Northern and Southern subtypes presumably is related to climate in a broad sense. The dominant species have very different overall ranges. Goldstein et al. (2018) compiled literature on the range of both species and suggest there is evidence that *Uniola* is moving northward as the climate warms. However, they also found reports of *Ammophila* present well south of the widely cited Cape Hatteras limit and showing *Uniola* present throughout the eastern shore of Virginia. They note that the widespread planting of both species confuses the picture of their native ranges. However, they also cite reports of *Ammophila* plantings in North Carolina being overtaken by *Uniola* in six to ten years, suggesting altered areas can potentially naturalize fairly quickly.

Where the author has observed both species in close proximity, such as near Cape Hatteras, *Ammophila* dominated on younger seaward dunes along the accreting coast, while *Uniola* dominated on better developed older dunes close behind. This relationship should be sought on the Currituck Banks, as it may offer a clue to the patterns of occurrence of the two subtypes in their region of overlap.

Comments: This subtype is well studied in states to the north but is not well studied in North Carolina. Several CVS plots represent it.

Rare species:

Vertebrate animals: *Peromyscus leucopus easti*.

References:

Goldstein E.B., Mullins E.V., Moore L.J., Biel R.G., Brown J.K., Hacker S.D., Jay K.R., Mostow R.S., Ruggiero P., and Zinnert, J.C. 2018. Literature-based latitudinal distribution and possible range shifts of two US east coast dune grass species (*Uniola paniculata* and *Ammophila breviligulata*) PeerJ 6:e4932 <https://doi.org/10.7717/peerj.4932>.

LIVE DUNE BARREN

Concept: Live Dune Barrens are sparsely vegetated communities of rare large, unstabilized medaño dunes in the interior of barrier islands. In contrast to Dune Grass, the vegetation is affected more strongly by sand movement and less by salt spray. The vegetation consists largely of scattered patches of pioneer herbs, vines, and sub-shrubs in sheltered microsites. There is a distinctive invertebrate community.

Distinguishing Features: Live Dune Barrens are distinguished by very sparse vegetation associated with large unstabilized sand dunes. Dune Grass communities have denser vegetation dominated by *Uniola paniculata* or *Ammophila breviligulata*.

Synonyms: *Vitis rotundifolia* / *Triplasis purpurea* - *Panicum amarum* - *Schizachyrium littorale*
Mid-Atlantic Coastal Medaño Sparse Vegetation (CEGL004397).
Ecological Systems: Northern Atlantic Coastal Plain Dune and Swale (CES203.264).

Sites: Live Dune Barrens occur on the few large, unstabilized medaño dunes.

Soils: The soil consists of deep loose sand.

Hydrology: Live Dune Barrens are excessively drained. Rainwater rapidly sinks into the sand, leaving the upper portions dry.

Vegetation: The vegetation of Live Dune Barrens is very sparse, with large areas devoid of plants. Small amounts of plants typical of Dune Grass communities are present, including *Uniola paniculata*, *Ammophila breviligulata*, *Schizachyrium littorale*, *Panicum amarum*, *Chrysopsis gossypina*, and *Oenothera humifusa*. Other herbs of open sandy areas may also be present, such as *Paronychia baldwinii* ssp. *riparia* and *Hexasepalum teres*. Woody species may also be present. *Smilax bona-nox* var. *littorale*, *Muscadinia rotundifolia*, *Morella cerifera*, and shrub-sized *Prunus serotina* have been noted.

Range and Abundance: Ranked G1. Only two examples are known to remain, at Jockeys Ridge and Run Hill. Another may possibly remain on northern Currituck Banks. This community is endemic to North Carolina. Other states in the region lack large active dunes.

Associations and Patterns: Live Dune Barrens are large patch communities. Examples cover hundreds of acres. They are associated with a variety of other maritime communities, including Dune Grass, Maritime Wet Grassland, Maritime Shrub, and Maritime Deciduous Forest. The mobile dunes may be burying adjacent communities along their edges.

Variation: There is little variation in the sparse vegetation.

Dynamics: Live Dune Barrens are maintained in a largely unvegetated state by instability and movement of the sand. Human traffic may also contribute to barrenness. Medaños can migrate across the landscape or can shift back and forth over time, in response to changes in prevailing winds.

Comments: Live Dune Barrens were not recognized as distinct in the 3rd Approximation but were treated as a subset of Dune Grass.

Rare species:

Vascular plants: *Hudsonia tomentosa*.

Invertebrate animals: *Ellipsoptera lepida*.

References:

STABLE DUNE BARREN (SOUTHERN SUBTYPE)

Concept: Stable Dune Barrens are sparsely- to moderately-vegetated communities of inactive dunes and high sand flats of barrier island interiors, not dominated by *Uniola paniculata*, *Ammophila breviligulata*, or *Schizachyrium littorale*. While *Uniola paniculata* and other Dune Grass species may be present in small amounts, the vegetation is predominantly species that are not found in Dune Grass communities. The community often includes substantial bare sand but also may include open or patchy cover of woody vines, shrubs, and even trees. It occurs on broader barrier islands, in association with Maritime Evergreen Forest and Maritime Shrub.

The Southern Subtype encompasses those examples from Cape Hatteras southward, which are outside the native range of *Hudsonia tomentosa*.

Distinguishing Features: Stable Dune Barrens are distinguished from Maritime Dry Grassland and Dune Grass by the scarcity of the grasses characteristic of those types. They are distinguished from Live Dune Barrens by a stable substrate and well-established, if sparse, vegetation. They are distinguished from all other barrier island communities by low plant cover and abundant dry, bare sand. These communities often occur in fine-scale mosaics with Maritime Dry Grassland, Maritime Wet Grassland, Maritime Shrub, Maritime Vine Tangle, and young Maritime Evergreen Forest in the heterogeneous environment created by irregular interior dunes. They may contain small inclusions of less barren woody or herbaceous vegetation.

The Southern Subtype is distinguished by occurrence from Cape Hatteras southward and by the absence of *Hudsonia tomentosa*.

Synonyms: *Smilax auriculata* / *Heterotheca subaxillaris* - *Strophostyles helvula* - (*Uniola paniculata*) Herbaceous Vegetation (CEGL004234).

Ecological Systems: Southern Atlantic Coastal Plain Dune and Maritime Grassland (CES203.273).

Sites: Stable Dune Barrens occur on the tops of stabilized interior dunes that are somewhat sheltered from salt spray. They are well behind the foredunes and usually are also not close to the back of the island. They occur only on the broader barrier islands.

Soils: Soils are coarse sands classified as the Newhan series (Typic Quartzipsamment).

Hydrology: Stable Dune Barren sites are excessively drained. Rainwater infiltrates and drains through the soil rapidly, leaving the site dry.

Vegetation: Stable Dune Barrens have sparse vegetation in the center, though they may have more plant cover around the edges. Plants include *Dichanthelium aciculare*, *Commelina erecta*, *Euphorbia (Chamaecybe) sp.*, *Pycnanthemum flexuosum*, *Polypremum procumbens*, *Opuntia humifusa*, *Opuntia pusilla*, and occasionally *Trichostema nesophilum*. *Uniola paniculata* may be present in small amounts. *Smilax auriculata* is common in sprawling patches, most representing a single individual. These patches grade into larger patches that can be recognized as Maritime Vine Tangle occurrences. Occasional individuals of *Morella cerifera*, *Ilex vomitoria*, or *Quercus*

virginiana may occur. Near the edges of patches, clumps of *Quercus virginiana* are common; these appear to be trees from the adjacent forest spreading by layering.

Range and Abundance: Ranked G2G3. Only a couple of examples are known in North Carolina, on Ocracoke Island, but a few more may be found southward. The NVC association ranges southward to Florida, but it is unclear how precisely equivalent it is to this subtype.

Associations and Patterns: Stable Dune Barrens are small patch communities. Individual patches are usually just a of couple acres. They tend to occur as a series of openings surrounded by Maritime Evergreen Forest or large expanses of Maritime Shrub.

Variation: This community is very variable, and the variation is not well characterized. Examples can be very heterogeneous over short distances. Patches may have heavy cover of *Smilax auriculata* only a few centimeters tall, may have substantial cover by *Dichanthelium aciculare*, or may have sparse vegetation dominated by any of several herbaceous species.

Dynamics: The dynamics of Stable Dune Barrens and the environmental factors that lead to their occurrence are not well known. Interior dunes may support Dune Grass, Stable Dune Barren, or Live Dune Barren communities, or may be covered in Maritime Shrub or Maritime Evergreen Forest. The distinction probably is related to stability and age of the dunes. The largest, active dunes, with vegetation kept sparse by ongoing sand movement, are Live Dune Barrens. Recently stabilized dunes support Dune Grass communities very similar to those on the foredunes. Stable Dune Barrens appear to be of greater age and to have little tendency for sand movement. Woody vegetation has developed in the lower areas around them. Known examples occur in areas where alteration of dunes may have blocked overwash, but their location high on dunes would protect them from overwash anyway.

Stable Dune Barrens remain open without sand movement or overwash, despite succession in adjacent lower areas. They are probably maintained by excessive soil drainage, but greater stress from salt spray at their relatively high location may contribute. They probably are undergoing slow primary succession and will eventually become more vegetated. Edges of patches often appear to be being invaded by vegetative reproduction from adjacent trees or shrubs.

Comments: Stable Dune Barrens were not well accommodated in the 3rd Approximation, where they were unclearly covered under Dune Grass or Maritime Dry Grassland. The Southern Subtype was not included in early drafts of the 4th Approximation Guide, though the Beach Heather Subtype was recognized. It was added later to accommodate related communities farther south and linked to the NVC association first described in Florida. In North Carolina at least, it appears to be a more depauperate version of the Beach Heather Subtype, lacking the distinctive northern species but without corresponding addition of southern species.

It is not certain that the synonymy to the *Smilax auriculata* / *Heterotheca subaxillaris* - *Strophostyles helvula* - (*Uniola paniculata*) Herbaceous Vegetation association is appropriate. That association appears to be more like Dune Grass than the well-developed examples of Stable Dune Barren in North Carolina. Multiple CVS plots attributed to that association in South Carolina also appear not to be as distinctive as well-developed Stable Dune Barrens.

Rare species:

Vascular plants: *Trichostema nesophilum*.

References:

STABLE DUNE BARREN (BEACH HEATHER SUBTYPE)

Concept: Stable Dune Barrens are sparsely- to moderately-vegetated communities of inactive dunes and high sand flats of barrier island interiors, not dominated by *Uniola paniculata*, *Ammophila breviligulata*, or *Schizachyrium littorale*. While *Schizachyrium littorale* and other Dune Grass species may be present in small amounts, the vegetation is predominantly species not found in Dune Grass communities. The community often includes substantial bare sand, but also may include open or patchy cover of woody vines, shrubs, and even trees. It occurs on broader barrier islands, in association with Maritime Evergreen Forest and Maritime Shrub.

The Beach Heather Subtype covers examples from Bodie Island northward, where *Hudsonia tomentosa* is a prominent component.

Distinguishing Features: Stable Dune Barrens are distinguished from Maritime Dry Grassland and Dune Grass by the scarcity of the grasses characteristic of those types. They are distinguished from Live Dune Barrens by a stable substrate and well-established, if sparse, vegetation. They are distinguished from all other barrier island communities by low plant cover and abundant dry, bare sand. These communities often occur in fine-scale mosaics with Maritime Dry Grassland, Maritime Wet Grassland, Maritime Shrub, Maritime Vine Tangle, and young Maritime Evergreen Forest in the heterogeneous environment created by irregular interior dunes. They may contain small inclusions of less barren woody or herbaceous vegetation.

The Beach Heather Subtype is distinguished by the presence of *Hudsonia tomentosa*, *Lechea maritima*, or other species confined to more northern locations.

Synonyms: *Hudsonia tomentosa* / *Panicum amarum* var. *amarulum* Dwarf-shrubland (CEGL003950).

Ecological Systems: Northern Atlantic Coastal Plain Dune and Swale (CES203.264).

Sites: Stable Dune Barrens occur on the tops of stabilized interior dunes that are somewhat sheltered from salt spray. They are well behind the foredunes and usually are also not close to the back of the island. They occur only on the broader barrier islands.

Soils: Soils are coarse sands classified as the Newhan series (Typic Quartzipsamment).

Hydrology: Stable Dune Barren sites are excessively drained. Rainwater infiltrates and drains through the soil rapidly, leaving the site dry.

Vegetation: Stable Dune Barrens have sparse vegetation in the center, though they may have more plant cover around the edges. *Hudsonia tomentosa* and *Lechea maritima* var. *virginica* are in all or most examples. Herbaceous species frequent in CVS plot data or site reports include *Crocantemum canadense*, *Hypericum gentianoides*, *Hexasepalum (Diodia) teres*, and *Schizachyrium littorale*. Other characteristic herbs include *Panicum amarum*, *Chrysopsis gossypina*, *Polypremum procumbens*, *Krigia virginica*, *Cyperus grayi*, *Dichanthelium* spp. (including *arenicoloides* and *fusiforme*), *Rumex acetosella*, *Oenothera humifusa*, *Euphorbia polygonifolia*, and *Opuntia drummondii*. A few species notable for their inland affinities, such as

Stipulicida setacea, *Bulbostylis coarctata*, or *Pityopsis graminifolia*, may occur. *Smilax auriculata* or *Smilax bona-nox* var. *littorale* are common in sprawling patches, most representing a single individual. These patches grade into larger patches that can be recognized as Maritime Vine Tangle occurrences. Occasional individuals of shrubs or vines may occur, including *Quercus virginiana*, *Pinus taeda*, *Diospyros virginiana*, *Quercus hemispherica*, *Morella cerifera*, or *Morella pensylvanica*.

Range and Abundance: Ranked G2G3. Fewer than ten examples occur in North Carolina, scattered from Currituck Banks to northern Bodie Island. The equivalent association ranges northward to New Jersey.

Associations and Patterns: Stable Dune Barrens are small patch communities. Many are complexes of multiple patches, individually mostly a couple acres or less, but sometimes adding up to dozens of acres. They are generally surrounded by Maritime Evergreen Forest or Maritime Shrub.

Variation: This community is very variable, and the variation is not well characterized. Examples can be very heterogeneous over short distances.

Dynamics: The dynamics of Stable Dune Barrens and the environmental factors that lead to their occurrence are not well known. See the discussion for the Southern Subtype.

Comments: These communities were not well accommodated in the 3rd Approximation, where they did not quite fit Dune Grass or Maritime Dry Grassland.

Rare species:

Vascular plants: *Crocantemum carolinianum*, *Dichantheium fusiforme*, *Hudsonia tomentosa*, and *Lechea maritima* var. *virginica*.

References:

MARITIME DRY GRASSLAND

Concept: Maritime Dry Grasslands are communities of sand flats in the interior and back side of barrier islands, where periodic saltwater overwash in storms and salt spray prevent woody vegetation development. Vegetation is typically sparse- to moderate-density grassland dominated by *Spartina patens* or other grasses not in the Dune Grass type.

Distinguishing Features: Maritime Dry Grasslands are distinguished from all other communities by the dominance of *Spartina patens* in a dry, if often low-lying, setting. Wetland plants such as *Muhlenbergia filipes*, *Rhynchospora colorata*, *Fimbristylis castanea*, and *Juncus* spp., which indicate Maritime Wet Grassland, are absent or only incidentally present. Species that indicate Brackish Marsh, such as *Juncus roemerianus* and *Distichlis spicata*, are also scarce or absent. Maritime Dry Grassland sites may be overwashed during storms but do not show evidence of being flooded by tides. Despite the NVC name, *Schoenoplectus pungens* is not characteristic of this community in North Carolina but may sometimes spread from wetter communities nearby.

Maritime Dry Grasslands have very limited presence of species dominant in Dune Grass, such as *Uniola paniculata*, *Ammophila breviligulata*, and *Schizachyrium littorale*, though they may share other species such as *Panicum amarum* and *Heterotheca subaxillaris*. Live Dune Barren and Stable Dune Barren communities may share some species but lack appreciable *Spartina patens* and occur on obvious dune topography.

Some areas where dunes have become more continuous may have vegetation transitional between Maritime Dry Grassland and Maritime Shrub, with substantial cover of woody shrubs. These may be classified by the predominant vegetation but may need to be regarded as naturally transitioning or artificially altered examples.

Synonyms: *Spartina patens* - *Schoenoplectus pungens* - *Solidago sempervirens* Herbaceous Vegetation (CEGL004097).

Ecological Systems: Northern Atlantic Coastal Plain Dune and Swale (CES203.264). Southern Atlantic Coastal Plain Dune and Maritime Grassland (CES203.273).

Sites: Maritime Dry Grasslands occur on sand surfaces that are well above the seasonal high water table but tend to be flat and lower than the dunes. They may be in broad expanses at the back of barrier islands, in overwash passes between dunes, in dry dune swales, or potentially covering much of the area of low barrier islands.

Soils: Maritime Dry Grassland soils are sandy, often with abundant shells or shell fragments. They are typically the Corolla series (Aquic Quartzsammment).

Hydrology: Maritime Dry Grasslands are dry to mesic but are not saturated for appreciable periods of time. Most, but not all, are subject to overwash by sea water during storms, or were at times in the past.

Vegetation: Maritime Dry Grassland vegetation is generally moderate to low in density. *Spartina patens* is constant and is usually dominant in CVS plots. *Hydrocotyle bonariensis* is frequent and

sometimes abundant. Other fairly frequent species in plot data include *Oenothera humifusa*, *Heterotheca subaxillaris*, *Solidago mexicana*, *Croton punctatus*, *Cenchrus tribuloides*, *Fimbristylis castanea*, *Strophostyles helvola*, *Eustachys petraea*, and *Conyza canadensis* var. *pusilla*. *Uniola paniculata* may be present in small amounts, often forming incipient dunes that appear to be small inclusions in the community. Other species that are often observed include *Panicum amarum*, *Commelina erecta*, *Gaillardia pulchella*, *Eragrostis spectabilis*, *Setaria parviflora*, *Physalis walteri*, *Cakile harperi*, *Cakile edentula*, *Opuntia mesacantha*, and *Opuntia drummondii*. Shrubs may be present in small to moderate amounts. These may include species indicative of developing Maritime Shrub, such as *Morella cerifera* and *Ilex vomitoria*, or species shared with wetlands, such as *Iva imbricata* and *Baccharis halimifolia*. In examples that are undergoing succession, trees, especially *Juniperus silicicola*, may be present.

Range and Abundance: Ranked G2G3. Maritime Dry Grasslands are present intermittently throughout the coast of North Carolina. The synonymized association reaches its southern range limit in North Carolina and ranges northward to Massachusetts.

Associations and Patterns: Maritime Dry Grassland appear best regarded as large patch communities. Occurrences potentially range from a few acres to over 100 acres, but they are not a predictable part of the landscape of barrier islands.

Variation: Maritime Dry Grasslands are highly variable and heterogeneous, but no variants have been recognized. Plots and local patches vary with the transition to adjacent communities, and inclusions of both wetter and drier vegetation are common. Some examples are successional to Maritime Shrub and contain substantial woody vegetation. Examples also vary with recency of overwash and amount of recent sand deposition. Where a Maritime Dry Grassland has formed by burial of a marsh by overwash, some wetland species may grow through the sand deposit and be present in the community.

Dynamics: Maritime Dry Grasslands have distinctive dynamics among maritime communities. In addition to salt spray and sand movement, which are less intense than in Dune Grass, overwash is a crucial natural disturbance and environmental factor. Silander and Antonovics (1979, 1985) suggested that *Spartina patens* is most successful in the marshes, that populations in dry grasslands are peripheral and can be limited by competition, but that they are successful through high phenotypic plasticity. Godfrey and Godfrey (1976) emphasized the importance of overwash in maintaining the character of Maritime Dry Grasslands. Overwash sand deposits may temporarily bury the vegetation, but *Spartina patens* is well adapted to both the salt exposure and the burial and quickly grows up through all but the thickest sand deposits. Many other species are short-lived and reestablish on new deposits.

Without overwash, shrubs can establish and Maritime Dry Grasslands can begin succession to Maritime Shrub and Maritime Evergreen Forest. The sand flats where Maritime Dry Grasslands occur can also begin developing dunes, with sand accumulating around individual clumps of *Uniola paniculata* that become established. Overwash may set back this success as well. Conversely, if the protecting dunes are eroded and overwash increases, woody maritime communities can be killed and marshes may be buried, and Maritime Dry Grassland can develop quickly.

Overwash dynamics depend both on storm frequency and on the configuration of the dunes. Godfrey and Godfrey (1976) emphasized that on islands where sand fencing and grass planting had occurred, the dunes were larger and more continuous than on the unaltered Core Banks, and that this had halted natural overwash and led to artificially induced woody succession behind the dunes. However, most of the artificial enhancement of dunes was done long ago, in the 1930s and 1950s, and it is unclear how well its effects would persist in this dynamic environment. The author has observed that, in recent years, Core Banks has fairly continuous dunes despite lack of enhancement, and that woody vegetation is widely established on the sand flats behind them. This may be a natural trend in response to climate patterns or a period with few storms.

Comments: Maritime Dry Grasslands are often not distinguished from Maritime Wet Grasslands in site descriptions, and the relative abundance of these two types is not well known. The nature of the transition to Maritime Wet Grassland needs further investigation. While there has been less scientific interest in Maritime Dry Grasslands than Dune Grass, they were well described by Au (1974) and Godfrey and Godfrey (1976), focusing on the middle Outer Banks, and were included in Rosenfeld (2004) at Bird Island. A moderate number of CVS plots and plots collected by NatureServe for the National Park Service represent it.

The synonymized NVC association name is somewhat misleading. Though *Schoenoplectus pungens* is part of the name, this species is uncommon in North Carolina examples, and generally indicates wetter conditions. The NVC description indicates that it represents remnant individuals where sand movement has buried a dune swale, suggesting it may be of low constancy throughout the range of this association.

The synonymy of this subtype with a northern association may not be entirely appropriate. It is not clear that Maritime Dry Grasslands have more northern affinities than other North Carolina maritime communities, which are linked to associations that range to the south. However, it is possible that different overwash dynamics in the Sea Islands of South Carolina and Georgia creates a natural break.

Morella (pensylvanica, cerifera) / Schizachyrium littorale - Eupatorium hyssopifolium Shrub Herbaceous Vegetation (CEGL004240) is another northern maritime grassland community that was treated as a Northern Subtype in earlier drafts of the 4th Approximation. This has been dropped because it does not appear that any distinct examples are present in North Carolina. A couple of CVS plots attributed to it appear to be better treated as other communities.

Rare species:

Vascular plants: *Euphorbia bombensis* and *Trichostema nesophilum*.

Vertebrate animals: *Charadrius melodus*.

References:

Au, S.F. 1974. Vegetation and ecological processes on Shackleford Banks, North Carolina. National Park Service Scientific Monograph Series No. 6.

Godfrey, P.J., and M.M. Godfrey. 1976. Barrier island ecology of Cape Lookout National Seashore and Vicinity. National Park Service Scientific Monograph Series No. 9.

Rosenfeld, K.M. 2004. Ecology of Bird Island, North Carolina, an uninhabited undeveloped barrier island. M.S, Thesis, North Carolina State University, Raleigh.

Silander, J.A., and J. Antonovics. 1979. The genetic basis of the ecological amplitude of *Spartina patens*. I. Morphometrics and physiological traits. *Evolution* 33:1114-1127.

Silander, J.A., and J. Antonovics. 1982. Analysis of interspecific interactions in a coastal plant community – a perturbation approach. *Nature* 298:557-560.

MARITIME VINE TANGLE

Concept: Maritime Vine Tangles are communities of barrier island sand flats or stable dunes, dominated by woody vines but persistently lacking more than a few trees and shrubs. Patches are small but can be larger than would typically be regarded as a simple inclusion in another community.

Distinguishing Features: Maritime Vine Tangles are distinguished from all other communities by the dominance of *Smilax*, sometimes codominant with *Toxicodendron*, in tangles a meter or more tall. Sparse shrubs may be present beneath the vines, but many tangles appear to be self-supporting masses of vines that may be up to 2 meters tall. Maritime Shrub communities and canopy gaps in Maritime Evergreen Forest often have heavy vine cover, but Maritime Vine Tangles should be recognized only for apparently persistent vegetation consisting almost solely of vines. Barren sand areas with only small patches of vines running along the ground should not be classified here; they should be treated as part of the grassland or dune barren community.

These communities often occur in fine-scale mosaics with Maritime Dry Grassland, Maritime Wet Grassland, Maritime Shrub, Stable Dune Barren, or Maritime Evergreen Forest, in the heterogeneous environment created by irregular interior dunes. Interpretation of communities will depend on the scale at which these areas are viewed, with the smaller clumps of vines best regarded as part of the surrounding community.

Synonyms: *Smilax auriculata* - *Toxicodendron radicans* Vine-Shrubland (CEGL003885).
Ecological Systems: Southern Atlantic Coastal Plain Dune and Maritime Grassland (CES203.273).

Sites: Maritime Vine Tangles occur in the interior of barrier islands, on stabilized dunes or sand flats that are somewhat sheltered from salt spray.

Soils: Soils are coarse sands that are dry to moist. This community might occur on Newhan (Typic Quartzipsamment) or Corolla (Aquic Quartzipsamment).

Hydrology: Sites for Maritime Vine Tangles potentially range from moist to xeric, varying with height above the seasonal high water table. They are in areas not subject to overwash or tidal flooding.

Vegetation: Maritime Vine Tangle vegetation consists of a dense mass of *Smilax auriculata*, potentially mixed with *Toxicodendron radicans*, *Muscadinia rotundifolia*, or other vines. The vines stand at least a meter tall, and potentially 2 meters or more, primarily supported by the mass of vines itself. Sparse shrubs such as *Morella cerifera*, or trees, such as *Juniperus silicicola*, may be present but do not dominate the ground cover or provide most of the support for the vines. Species of other communities may be present in small numbers in openings.

Range and Abundance: Ranked GNRQ but perhaps G1 if valid. The range and abundance in North Carolina are not well known. Well-developed examples have been found only on Ocracoke Island. Abundance will depend heavily on the interpretation of marginally developed examples

and of what size is accepted as an occurrence. This community is presently known only in North Carolina but may be sought in other south Atlantic or mid-Atlantic states.

Associations and Patterns: Maritime Vine Tangles are small patch communities. They may occur in complexes adding up to several acres, but individual patches are generally less than ten meters wide. They may occur in a mosaic, most likely with Stable Dune Barren or Maritime Dry Grassland.

Variation: Little is known of the variation in this community.

Dynamics: Nothing is known of the dynamics of these communities. They mostly likely develop from open communities such as Stable Dune Barren or Maritime Dry Grassland, but given that small vine patches are common in those communities, it is unclear why a few places would become dense tangles while their surroundings stay open. A few dead shrubs are present in some examples, but not enough to suggest the Vine Tangle developed from Maritime Shrub.

Comments: This type is somewhat marginal for recognition as distinct, with most patches very small. However, it can be a prominent part of the mosaic of communities in barrier island interiors. It should be used only for the more extremely developed cases. It needs more investigation to determine its abundance and better understand its environmental relationships.

Rare species: No rare species are known in the community.

References: