

14260

Southern Atlantic Coastal Plain Dune and Maritime Grassland

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Modelers		Reviewers	
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Vegetation Type

Herbaceous

Map Zones

58

Geographic Range

Covers MZs 58 and 55 from NC south to northern FL. Includes coastal dunes and flats on barrier islands, and on some mainland fringes adjacent to salt water. The northern limit is a transition zone from around Kitty Hawk, NC, to the VA-NC border (NatureServe 2006).

Biophysical Site Description

The associated system (CES203.273) for this BpS consists primarily of grasslands and related shrublands of Atlantic Coastal Plain barrier islands and related near-coastal areas. Upland plant communities and non-flooded wetlands (including "maritime wet grasslands") are included in this system as embedded or "inclusional" shrublands (NatureServe 2006).

See the NatureServe Ecological System description for this type, CES203.273. Still a fairly broad model, this covers several grassland and shrubland associations. Occurs on barrier islands and similar coastal strands, on sand dunes and sand flats (NatureServe 2006).

Soils are sandy, with little organic matter and little or no horizon development. Soils may be excessively drained on the higher dunes. Soils are low in nutrient-holding capacity, but aerosol input of sea salt provides a continuous source of nutrients (NatureServe 2006). On the loose sands, moderate diurnal winds maintained active, low and high dune fields where vegetation could not become established. Except on the most mobile sands and areas subject to semiannual salt water overwash, these communities were dependent upon a combination of salt spray and fire to prevent woody succession.

Principal gradients included a) elevation above the water table, a typical catena of soils being Newhan sand (tall dunes), Corolla sand (low dunes), and Duckston sand, the moist "basement" of Holocene and recent sands resting on the water table; b) a salt spray gradient, with highest effect closest to the ocean and diminishing inland was second; and c) a fire frequency gradient (see below). All of these factors maintained a vegetation successional and structural gradient. Vegetation density ranged from sparse beach berm and new dune colonizers to maritime grassland with succession stabilized by fire, to wet and dry shrublands.

Vegetation Description

Dune Grasslands: In the unstable coast environment dunes where new land is being created, new flats and low dunes can be seen in all stages of primary succession. This often occurs at the southern ends of barrier islands where longshore movement of sand from north to south causes accretion of sand at the southern end of each island. The islands are bounded by inlets and the process of island extension often results in closing of the inlet. This may be followed by new inlet formation somewhere north of the sand stream when storm surge back and forth across an island washes out a new channel to the ocean (Dolan et al. 1973). The new, low sands are typically first colonized by the first forbs such as sea elder (*Iva imbricaria*). Endangered species: The federally threatened *Amaranthus pumilus* is another first colonizer and the least tern (*Sterna antillarum*) shares its early successional situation as nesting habitat. Such species are quickly followed by grasses such as *Panicum amarum*, salt meadow cordgrass (*Spartina patens*) and sea oats (*Uniola paniculata*). These grasses begin to accumulate sand and small dunes, providing habitat for additional species. *Uniola paniculata* is the characteristic dominant on the youngest dunes and those most exposed to salt spray, while *Spartina patens* or *Schizachyrium littorale* tend to dominate older dunes and sand flats (NatureServe 2006).

Beach strand vegetation: The high beach, while geologically dynamic, is the first land stable enough to be colonized by pioneer vegetation such as salt meadow cordgrass (*Spartina patens*), sea oats (*Uniola paniculata*) and sea elder (*Iva imbricaria*). To the south, in FL, the appearance of tropical species such as railroad vine (*Ipomoea pes-caprae*) and sea grape (*Coccoloba uvifera*) mark the transition to modes for MZ56.

A second mechanism of primary succession occurs in the geologically unstable dune and sand flat communities of the barrier islands and strands. When sand dunes moving across the flats bury existing vegetation and come to rest at the edge of swamps or against older vegetated dunes (Latrobe 1799), they form a new substrate for colonization. New dunes are first colonized by sea oats and a handful of xerophytic coastal forbs such as *Physalis viscosa* and jumping cactus (*Opuntia drummondii*). Older dunes may have red cedar, shrubs and patches of dune grassland vegetation in gaps. These are then colonized by live oak which in time becomes the canopy dominant. Scattered individuals and small stands of longleaf pine (*Pinus palustris*) may occasionally be found in larger dune fields. On the fire-exposed mainland, maritime live oak grades into longleaf pine communities. Some typical shrubs of more protected sites grading into maritime forest include yaupon (*Ilex vomitoria*), wax myrtle (*Myrica cerifera*), and *Erythrina herbacea*. *Smilax auriculata*, other *Smilax* species, and poison ivy may be abundant in the woody transition zone where fire has no access or has been excluded.

Interdunal Swales: Numerous plant community types can be defined in interdunal swales depending particularly upon their age and depth to water table. In early primary succession those with moist sand substrate may have species dominated by graminoids such as *Muhlenbergia filipess*, *Scirpus* spp., and black needle rush. In intermediate succession these sites become dominated with wetland shrubs such wax myrtle (*Myrica cerifera*). Without fire the shrubs may be replaced with wetland pines such loblolly and slash pine. Over hundreds of years sea level will rise high enough to fill the swales with water, forming sedge bogs in more exposed areas (see Jeannette Sedge at Cape Hatteras) and interdunal freshwater ponds bordered with cypress-gum forest (*Taxodium distichum*-*Nyssa biflora*) in old, long stabilized dune fields (see Nags Head Woods and Bailey Island).

Sabal palmetto/mixed coastal graminoids and forbs: this association occurs on low mineral soils in moist flats, with palmetto the canopy dominant on marsh fringes and in sloughs. Examples can be seen at Hunting Island State Park and Bailey Island TNC preserve in SC. Historical photos show palmetto on the sound side of Hatteras Island and a written description places it possibly as far north as Old Currituck Inlet on the NC/VA line (Byrd 1728). Palmetto can be found on the margins of live oak forests and in swales on moist sands or shallow organic soils over sand. It can tolerate brackish conditions and short periods of inundation with salt water during hurricanes. Just upslope from stands having the canopy dominated by palmetto, it may occur as subcanopy and shrub layer stems beneath maritime oak-pine canopy. Typical species in palmetto stands may include small live oaks, loblolly pine (*Pinus taeda*), eastern red cedar (*Juniperus virginiana*), wax myrtle (*Myrica cerifera*), marsh elder (*Iva frutescens*), silverling (*Baccharis angustifolia*), yaupon (*Ilex vomitoria*), switchgrass (*Panicum virgatum*), giant foxtail (*Setaria magna*), black needle-rush (*Juncus roemerianus*), saltgrass (*Distichlis spicata*), sawgrass (*Cladium jamaicense*), and a variety of wetland forbs such as *Pluchea purpurascens* and *Solidago sempervirens*.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
UNPA	<i>Uniola paniculata</i>	Seaoats
SCLI	<i>Schoenocrambe linifolia</i>	Flaxleaf plainsmustard
SPPA	<i>Spartina patens</i>	Saltmeadow cordgrass
MUFI3	<i>Muhlenbergia filipes</i>	Gulfhairawn muhly
MOCE	<i>Mollugo cerviana</i>	Threadstem carpetweed
PAAM2	<i>Panicum amarum</i>	Bitter panicgrass
JUVI	<i>Juniperus virginiana</i>	Eastern redcedar
SAPA	<i>Sabal palmetto</i>	Cabbage palmetto

Species names are from the NRCS PLANTS database. Check species codes at <http://plants.usda.gov>.

Disturbance Description

There are four principal disturbances to vegetation: salt spray, sand movement and salt water overwash during storms, and fire. Since these were largely treeless systems, hurricanes had little effect except to temporarily accelerate the first three disturbances. The dune grasslands carry fire readily but historical fire frequency was highly variable and fire was absent from isolated vegetation except where burned by Indians. The most frequently burned sites were those contiguous with or connected by *Juncus* marsh with large, frequent-fire compartments on the mainland and sites regularly burned by Native Americans. Buried paleosols exposed by wind at Jockeys Ridge State Park show charcoal fragments of all sizes up to an inch and at all depths, suggest a wooded dune field with long term regular burning by Indians. The large and small islands and peninsulas make relatively small lightning targets and fire regimes supported only by lightning would have consisted of lower fire frequencies than on the mainland. Bailey Island in coastal SC has 3.7 km² of flammable area. An ignition rate from lightning alone on Bailey Island was calculated at 26.4yrs, given the density of lightning strikes and the relation of lightning strike density to actual ignitions (Frost 1994). Many grasses and forbs were once more abundant than now. Habitats for *Schizachyrium littorale* and the other seaside graminoids have been greatly reduced by succession to woody components.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	8	63	5	77
Moderate (Mixed)	14	37	10	25
Low (Surface)				
All Fires	5	100		

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is the central tendency modeled. Percent of all fires is the percent of all fires modeled in that severity class. Minimum and Maximum FIs show the relative range of fire intervals as estimated by model contributors, if known.

Scale Description

Because of the small fire compartment sizes, the scale of a typical wildfire would have ranged from 20-300ac. In a few cases larger fires could have spread for several miles in flammable vegetation on the sound side of the Outer Banks and coastal islands of SC and GA. In some places, brackish *Juncus roemerianus*-*Distichlis spicata* marshes may have served to carry fire around unvegetated flats and dunes from one grassland to another.

Adjacency or Identification Concerns

Dune grasslands grade into maritime forest on sites protected from salt water overwash that have had time for primary succession to progress to the forest stage. On the ocean side the model includes coastal strand (high beach) vegetation down to the vegetation-free beach and unvegetated tidal flats. On mainland fringe and slightly sheltered shorelines bordering saline environments, grades into palmetto fringes and sloughs, salt flats, brackish and salt marsh. On the wetland side bordering freshwater wetlands it grades into wetland shrubs and saplings on the margins of cypress (*Taxodium distichum*) and black gum (*Nyssa biflora*) swamps and interdunal freshwater pools.

This system is distinguished from Atlantic Coastal Plain Southern Maritime Forest (CES203.537 -- BpS 1382) by the lack of dominant woody vegetation. This distinction becomes blurred where dunes have been artificially enhanced and an unnatural succession to woody vegetation is occurring. The boundary on the southern end is based on a broad change in biogeography and climate, and a change in barrier island form, with many barrier islands to the south being perched on limestone platforms (NatureServe 2006).

Issues or Problems

There have been many changes associated with human disturbance of both fire flow and sand flow. Sand flow, required to maintain shifting, active dunes has been virtually eliminated. The tall dunes at Jockey's Ridge State Park have had their sustaining sand flow cut off by construction of businesses and dense housing and by development of woody succession in the surrounding lows. Even the highest dunes are experiencing encroachment by loblolly pine, live oak and laurel oak. Salt water overwash has been eliminated by construction of artificial barrier dunes. Salt spray is intercepted by buildings and these dunes. In the increasingly heavily populated coastal zone the few wildfires are quickly extinguished and there is little use of prescribed fire. While natural woody primary succession characterized only a small percent of stands, perhaps only 5-10% of the coastal landscape under pre-settlement conditions, most of the coastal upland environment has been colonized by the early successional variants of maritime forest and shrubs on what were open sands or maritime grasslands before the construction of man-made barrier dunes, beginning when the work of the Civilian Conservation Corps in the 1930's stopped ocean overwash and reduced salt spray (Wentworth et al. 1992). Formation of

new dune habitats by this version of primary succession has been essentially eliminated by human activities.

Native Uncharacteristic Conditions

Along the coast and the largest percent of original grasslands have been replaced with woody vegetation. One Association: Dry Maritime Grassland (shown in a Wright Brothers' Photo from the early 20th century) is now rare -- a result of woody succession resulting from the man-made barrier dunes.

Comments

Succession Classes

Mapping Rules

Upper Layer Lifeform	Height (m)	Canopy Cover (%)									
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
Herb	0-0.5	A	A	A	A	A	A	A	A	A	A
Herb	0.5-1.0	A	A	A	A	A	A	A	A	A	A
Herb	>1.0	A	A	A	A	A	A	A	A	A	A
Shrub	0-0.5	C	C	C	C	C	C	C	C	C	C
Shrub	0.5-1.0	C	C	C	C	C	C	C	C	C	C
Shrub	1.0-3.0	B	B	B	B	B	B	B	B	B	B
Shrub	>3.0	C	C	C	C	C	C	C	C	C	C
Tree	0-5	UN	UN	UN	E	E	E	E	E	E	E
Tree	5-10	UN	UN	UN	E	E	E	E	E	E	E
Tree	10-25	UN	UN	UN	D	D	D	D	D	D	D
Tree	25-50	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	>50	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN

Succession class letters A-E are described in the Succession Class Description section. Some classes use a leafform distinction where a qualifier is added to the class letter: Brdl (broadleaf), Con (conifer), or Mix (mixed conifer and broadleaf). UN refers to uncharacteristic native or a combination of height and cover that would not be expected under the reference condition. NP refers to not possible or a combination of height and cover which is not physiologically possible for the species in the BpS.

Description

Class A 55 Early Development 1 - Open

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
UNPA	Uniola paniculata	Seaoats	Upper
SPPA	Spartina patens	Saltmeadow cordgrass	Upper
PAAM2	Panicum amarum	Bitter panicgrass	Upper
MUFI3	Muhlenbergia filipes	Gulfhairawn muhly	Upper

Description

Open grassland on low and high dunes, colonizers on upper beaches and new sands, grasslands on the backside of relatively stable dune lines and dune fields, and flat to gently rolling maritime dry grassland some distance back from the sea. Also, *Muhlenbergia filipes*--sedge communities of moist interdune flats and marsh/upland transitions.

Maximum Tree Size Class

None

Class B	9	Mid Development 1 - Open
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
JUVI	Juniperus virginiana	Eastern redcedar	Upper
QUVI	Quercus virginiana	Live oak	Upper
UNPA	Uniola paniculata	Seaoats	Lower
PITA	Pinus taeda	Loblolly pine	Upper

Description

Alternate succession on dry sites, closed pathway, with fire frequency too low to exclude shrubs and tree saplings. Mostly early primary succession with colonization by shrub sized red cedar, live oak, laurel oak on dry sites with remnant *Uniola* and other dune graminoids and forbs in openings.

Maximum Tree Size Class

Sapling >4.5ft; <5" DBH

Class C	14	Mid Development 2 - Open
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
MOCE2	Morella cerifera	Wax myrtle	Upper
SAPA	Sabal palmetto	Cabbage palmetto	Upper
CLMAJ	Cladium mariscus ssp. jamaicense	Jamaica swamp sawgrass	Lower

Description

Highly variable fire interval on moist sites, open. Colonization by low shrub communities dominated by *Morella (Myrica) cerifera* with succession to trees prevented by fire on moist Duckston interdune flats. Palmetto flats with grassy and low shrub understory maintained in an open condition by fire. In palmetto, one of the communities included in this stage, Sabal palmetto (a tree) is the upper layer lifeform but the others lack trees. Typical soils are moist, dark sands with varying organic content. Palmetto flats and sloughs carry fire in understory grasses

From Class	Begins at (yr)	Succeeds to	After (years)
Early1:OPN	0	Mid2:OPN	9
Mid1:OPN	10	Late2:CLS	20

Mid2:OPN	10	Late1:CLS	30
Late2:CLS	21	Late2:CLS	999
Late1:CLS	31	Late1:CLS	999

Probabilistic Transitions

Disturbance Type	Disturbance occurs In	Moves vegetation to	Disturbance Probability	Return Interval (yrs)	Reset Age to New Class Start Age After Disturbance?	Years Since Last Disturbance
Alternative Succession	Early1:OPN	Mid1:OPN	1	1	Yes	8
Mixed Fire	Early1:OPN	Early1:OPN	0.1	10	No	0
Replacement Fire	Early1:OPN	Early1:OPN	0.2	5	Yes	0
Replacement Fire	Mid1:OPN	Early1:OPN	0.08	13	Yes	0
Wind or Weather or Stress	Mid2:OPN	Mid2:OPN	0.03	33	No	0
Replacement Fire	Mid2:OPN	Early1:OPN	0.05	20	Yes	0
Mixed Fire	Mid2:OPN	Mid2:OPN	0.07	14	No	0
Wind or Weather or Stress	Late1:CLS	Mid2:OPN	0.02	50	Yes	0
Wind or Weather or Stress	Late1:CLS	Late1:CLS	0.03	33	No	0
Mixed Fire	Late1:CLS	Late1:CLS	0.05	20	No	0
Replacement Fire	Late1:CLS	Early1:OPN	0.05	20	Yes	0
Replacement Fire	Late2:CLS	Early1:OPN	0.013	77	Yes	0
Wind or Weather or Stress	Late2:CLS	Mid1:OPN	0.02	50	Yes	0
Mixed Fire	Late2:CLS	Late2:CLS	0.04	25	No	0

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