
ECOLOGICAL SYSTEM: ATLANTIC COASTAL PLAIN NORTHERN DUNE AND MARITIME GRASSLAND

Summary: This system consists of vegetation of barrier islands and other coastal areas, ranging from northern North Carolina northward to southern Maine (where extensive sandy coastlines are replaced by rocky coasts). A range of plant communities may be present, but natural vegetation is predominately herbaceous. Shrublands resulting from succession from grasslands may occur in limited areas, but they are generally not natural components of this system in the southern part of its range (M. Schafale pers. comm.). Both upland and non-flooded wetland vegetation are also included in this system. Small patches of natural woodland may also be present in limited areas, especially in the northern range of this system. Dominant ecological processes are those associated with the maritime environment, including frequent salt spray, saltwater overwash, and sand movement.

High-ranked Species: *Schizaea pusilla* (G3G4, curly-grass fern)

Range: This system ranges from northern North Carolina (Omernik ecoregion 63d) and southeastern Virginia to southern Maine. The southern limit is a transition zone from around Kitty Hawk, North Carolina, to the Virginia-North Carolina border. The northern limit is Merymeeting Bay, Maine. United States: CT, DE, MA, MD, ME, NC, NH, NJ, NY, RI, VA

Delaware Estuary Associations:

Atlantic Coast Interdune Swale	Beachgrass - Panicgrass Dune Grassland
Blueberry Wetland Thicket	Central Coast Beach Heather Dune Shrubland
Chesapeake Bay Tall Maritime Shrubland	Coastal Freshwater Marsh
Interdune Switchgrass Brackish Depression	Loblolly Pine Dune Woodland
Maritime Red-cedar Woodland	North Atlantic Coastal Plain Vine Dune
Northeastern Atlantic Brackish Interdunal Swale	Northern Bayberry Dune Shrubland
Northern Beachgrass Dune	Overwash Dune Grassland
Pitch Pine Dune Woodland	

Similar Ecological Systems in the Delaware Estuary:

- Northern Atlantic Coastal Plain Maritime Forest
- Northern Atlantic Coastal Plain Sandy Beach

<p>CLASSIFIERS FOR ATLANTIC COASTAL PLAIN NORTHERN DUNE AND MARITIME GRASSLAND Primary Division: 203 Land Cover Class: Mixed Upland and Wetland Spatial Scale & Pattern: Large patch Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland; Wetland Diagnostic Classifiers: Coast; Beach (Substrate); Graminoid; North Atlantic Coastal Plain Non-diagnostic Classifiers: Herbaceous; Depressional; Isolated Wetland [Partially Isolated]</p>
--

ATLANTIC COAST INTERDUNE SWALE

Morella cerifera / *Spartina patens* Shrubland

Range: This type occurs along the Atlantic Coast from New Jersey south to Florida.

Environmental Description: This association occurs on maritime barrier islands and spits, usually on more protected backdunes, barrier flats and interdunal swales. The substrate may be sand or loamy sand, sometimes with a thin layer of organic matter. The water table is often less than half a meter below the surface.

Vegetation Description: This vegetation is characterized by a moderately open to densely closed canopy of *Morella cerifera* (wax-myrtle). Other canopy associates include *Baccharis halimifolia* (groundsel-tree), *Morella pensylvanica* (northern bayberry) (from northern NC northward), *Juniperus virginiana* var. *silicicola* (coastal red-cedar) (from NC and possibly southern VA southward), and *Rhus copallinum* (winged sumac). The herbaceous layer is characterized by *Spartina patens* (saltmeadow cordgrass). Other ground flora associates include *Toxicodendron radicans* (eastern poison-ivy), *Panicum virgatum* (switchgrass), *Andropogon virginicus* (broomsedge bluestem), *Juncus dichotomus* (forked rush), *Solidago sempervirens* (seaside goldenrod), *Smilax* (greenbrier) spp., *Parthenocissus quinquefolia* (Virginia creeper), *Vitis* (grape) spp., and *Schoenoplectus pungens* (common threesquare). Small openings may have wetland graminoids, such as *Juncus roemerianus* (black needlerush), *Spartina patens* (saltmeadow cordgrass), *Fimbristylis castanea* (chestnut fimbry), *Andropogon glomeratus* var. *pumilus* (bushy broom-sedge), *Muhlenbergia filipes* (southern hairgrass), etc., and forbs, such as *Hydrocotyle bonariensis* (beach pennywort), *Sabatia stellaris* (rose-of-Plymouth), *Polygonum hydropiperoides* (swamp smartweed), *Eleocharis* (spikerush) spp., etc. In other cases, few herbs are present, because of the dense, thicket-like shrub layer.

Characteristic Species: *Morella cerifera* (wax-myrtle), *Spartina patens* (saltmeadow cordgrass)

Dynamics/Successional Trajectory: This community is not tidally flooded and occurs beyond the reach of most storm tides, but it is impacted by salt spray.

Management Concerns: Many occurrences have been destroyed by coastal development, as these soils are sandy enough and dry enough that they are often not considered "jurisdictional wetlands" and are therefore destroyed for development. Other occurrences have been left undeveloped but now occur as isolated areas fragmented by development.

Reference Sites: Great Marsh, Sussex County, DE; Prime Hook NWR, DE

Global and State Conservation Ranks and Reasons: G3G4 (1-Feb-2005). DE: SNR, NJ: SNR. This association occurs in interdune flats on barrier islands and barrier spits from New Jersey south to Florida. Fairly extensive occurrences are protected on Cape Hatteras National Seashore and Cape Lookout National Seashore, North Carolina.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.685109

References: Ambrose 1990a, Berdine 1998, Boule 1979, Bowman 2000, Breden et al. 2001, FNAI 1992a, Fleming 2001, Harrison 2004, Higgins et al. 1971, Hill 1986, Klotz 1986, Martin 1959b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Morella cerifera</i> (wax-myrtle)
Herb (field)	Graminoid	<i>Spartina patens</i> (saltmeadow cordgrass)

BEACHGRASS - PANICGRASS DUNE GRASSLAND

Ammophila breviligulata - *Panicum amarum* var. *amarum* Herbaceous Vegetation

Range: This community occurs on maritime dunes from Long Island, New York, south to North Carolina. In New Jersey this community is more common on the Atlantic Coast where dunes are more developed. It occurs in patches on smaller dunes in on the Delaware Bayshore in New Jersey.



Photo by Kathleen Strakosch Walz

Environmental Description: This dune grassland community occurs almost exclusively on sandy, unstable, droughty substrates with no soil profile development. Aeolian processes cause active sand deposition and erosion. The sand substrate is usually visible, and litter accumulation from plant debris is nearly absent. This community generally occurs on foredunes that receive the force of wind and salt spray, but is beyond the influence of most storm tides.

Vegetation Description: This community is a maritime dune grassland dominated by *Ammophila breviligulata* (American beachgrass) and *Panicum amarum* (bitter panicgrass). Plant cover is variable, ranging from 10-75%, but is usually low. Other associated species characteristic of this community include *Solidago sempervirens* (seaside goldenrod), *Strophostyles helvula* (trailing wild bean), *Triplasis purpurea* (purple sandgrass), *Cenchrus tribuloides* (dune sandbur), *Chamaesyce polygonifolia* (northern seaside spurge), *Oenothera humifusa* (seaside evening-primrose) and *Spartina patens* (saltmeadow cordgrass) are common associates of this community and differentiate it from its northern beachgrass counterpart. This association contains several species characteristic to the *Cakile edentula* ssp. *edentula* (sea-rocket) sparsely vegetated association, but the *Ammophila breviligulata* - *Panicum amarum* Herbaceous Vegetation is differentiated by (1) its location beyond storm tide influence, (2) dominance by perennial rather than annual species, (3) greater plant cover on average, and (4) greater prevalence of *Solidago sempervirens* (seaside goldenrod).

Characteristic Species: *Ammophila breviligulata* (American beachgrass), *Panicum amarum* (bitter panicgrass)

Dynamics/Successional Trajectory: This association occurs on the shifting sands of active dune systems. Sand is wind-deposited and tends to accumulate where vegetation slows the surface wind velocity (Martin 1959b). Rhizomes of *Ammophila breviligulata* (American beachgrass) stabilize the dunes, growing upward through layers of sand deposition. *Ammophila breviligulata* (American beachgrass) tends to grow best where there is relatively rapid sand deposition; it can grow through one meter of sand accumulation (Zaremba and Leatherman 1984). Species diversity of this association tends to increase landward in more protected areas where the substrate is more stable.

Management Concerns: Many of the highest quality Element Occurrences are on public land, but they continue to be threatened by trampling, ORVs, and in some cases grazing by feral horses. Waterfront development along the beach is gradually eliminating this community. The use of four-wheel-drive and off-road vehicles is eroding and degrading parts of this habitat in Delaware. The association is highly fragile and does not recover well from these actions.

Reference Sites: Henlopen State Park, Sussex County, DE; Higbee Beach WMA, NJ

Global and State Conservation Ranks and Reasons: G2 (8-Oct-1998). DE: S2?, NJ: S1S2. Although 65-100 Element Occurrences are estimated to occur over the range, total acreage likely does not exceed 3000 acres for this small patch community. Many of the highest quality EOs are on public land, but they continue to be threatened by trampling, ORVs, and in some cases grazing by feral horses. The association is highly fragile and does not recover well from these actions.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.684424

References: Bartgis 1986, Baumann 1978b, Berdine 1998, Boule 1979, Bowman 2000, Breden 1989, Breden et al. 2001, Clampitt 1991, Clancy 1993a, Clancy 1996, Eastern Ecology Working Group n.d., Egler 1962, Fender 1937, Fleming 2001, Fleming et al. 2001, Harrison 2004, Harvill 1965, Higgins et al. 1971, Hill 1986, Klotz 1986, Schafale 2000, Schafale 2003b, Schafale and Weakley 1990, Stalter and Lamont 1990

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Herb (field)	Graminoid	<i>Ammophila breviligulata</i> (American beachgrass)

BLUEBERRY WETLAND THICKET

Vaccinium corymbosum - *Rhododendron viscosum* - *Clethra alnifolia* Shrubland

Range: This type occurs from New Hampshire south to New Jersey, Delaware and possibly Pennsylvania. It has been confirmed in the New Jersey and Delaware portions of the Delaware Estuary.

Environmental Description: This community typically occurs on a shallow organic layer over sand.

Vegetation Description: This type is a tall-shrub swamp where the dominant shrubs include *Vaccinium corymbosum* (highbush blueberry), *Ilex verticillata* (common winterberry), and *Rhododendron viscosum* (swamp azalea). Scattered *Acer rubrum* (red maple) are not uncommon. Associated shrub species may include *Clethra alnifolia* (coastal sweet-pepperbush), *Chamaedaphne calyculata* (leatherleaf), *Ilex glabra* (inkberry or little gallberry), *Leucothoe racemosa* (swamp doghobble), *Lyonia ligustrina* (maleberry), *Decodon verticillatus* (swamp-loosestrife), *Cephalanthus occidentalis* (common buttonbush), *Kalmia angustifolia* (sheep laurel), and *Photinia* (redtip, chokeberry) spp. Herbaceous species commonly include *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern), *Lycopus uniflorus* (northern bugleweed), *Glyceria striata* (fowl mannagrass), and *Woodwardia virginica* (Virginia chainfern). *Sphagnum fimbriatum* (fringed bog moss), *Sphagnum rubellum* (red peatmoss), *Sphagnum magellanicum* (Magellan's peatmoss), *Sphagnum fallax* (flat-top bogmoss), and *Sphagnum viridum* (peatmoss) are characteristic.

Characteristic Species: *Rhododendron viscosum* (swamp azalea), *Sphagnum fallax* (flat-top bogmoss), *Sphagnum fimbriatum* (fringed bog moss), *Sphagnum magellanicum* (Magellan's peatmoss), *Sphagnum rubellum* (red peatmoss), *Sphagnum viridum* (peatmoss)

Dynamics/Successional Trajectory: This community is influenced by a strongly fluctuating water table with flooded conditions in spring and early summer followed by a drop in the water table below soil surface usually by late summer.

Reference Sites: Widespread in NJ and DE

Global and State Conservation Ranks and Reasons: GNR (14-Apr-1998). DE: SNR, NJ: S1S3, PA: SNR.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.685525

References: Breden et al. 2001, Conard 1935, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Fike 1999, Gawler 2002, Golet 1973, Johnson 1981b, Lynn and Karlin 1985, Metzler and Barrett 2001, Niering and Egler 1966, Reschke 1990, Schall and Murley 1984, Sperduto 2000a, Sperduto and Nichols 2004

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Ilex verticillata</i> (common winterberry)
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Rhododendron viscosum</i> (swamp azalea)
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Vaccinium corymbosum</i> (highbush blueberry)
Herb (field)	Forb	<i>Calla palustris</i> (water arum)
Herb (field)	Forb	<i>Lycopus uniflorus</i> (northern bugleweed)
Herb (field)	Graminoid	<i>Glyceria striata</i> (fowl mannagrass)
Herb (field)	Fern or fern ally	<i>Osmunda cinnamomea</i> (cinnamon fern)
Herb (field)	Fern or fern ally	<i>Osmunda regalis</i> (royal fern)
Herb (field)	Fern or fern ally	<i>Woodwardia virginica</i> (Virginia chainfern)

CENTRAL COAST BEACH HEATHER DUNE SHRUBLAND

Hudsonia tomentosa / *Panicum amarum* var. *amarulum* Dwarf-shrubland

Range: The association is restricted to barrier beaches from Delaware and New Jersey to northern North Carolina.

Environmental Description: This community is largely confined to maritime interdunes. Influenced by wind-deposited sand, the substrate is unstable and supports no soil development and large patches of sparsely vegetated or unvegetated sand are common.

Vegetation Description: This community is a maritime dwarf-shrubland characterized by *Hudsonia tomentosa* (woolly beach-heather), a species adapted to sand burial. *Hudsonia tomentosa* (woolly beach-heather) is dominant, occurring as discrete patches that may coalesce into a dense mat on older, more stabilized dunes. A number of other shrubs, such as *Morella pensylvanica* (northern bayberry), *Morella cerifera* (wax-myrtle), *Pinus taeda* (loblolly pine) saplings, and *Prunus maritima* (beach plum), may occur but in low abundance and cover. *Schizachyrium littorale* (seaside bluestem), *Ammophila breviligulata* (American beachgrass), *Aristida tuberculosa* (seabeach three-awn), *Spartina patens* (saltmeadow cordgrass), and *Panicum amarum* (bitter panicgrass) are common grasses of this community, and *Toxicodendron radicans* is a common vine. Other herbaceous associates include *Lechea maritima* (beach pinweed), *Cyperus grayi* (Gray's flatsedge), *Artemisia stelleriana* (oldwoman), *Chamaesyce polygonifolia* (northern seaside spurge), *Solidago sempervirens* (seaside goldenrod), and *Diodia teres* (rough buttonweed).

Characteristic Species: *Hudsonia tomentosa* (woolly beach-heather)

Dynamics/Successional Trajectory: This association grades into *Ammophila breviligulata* (American beachgrass)-dominated dunes and into maritime shrub thickets.

Management Concerns: This association has likely declined substantially due to human development and remains threatened by continuing development of prime real estate.

Reference Sites: Cape Henlopen State Park, Sussex County, DE

Global and State Conservation Ranks and Reasons: G2 (14-Oct-1998). DE: S2, NJ: S1S2. Although there are an estimated 80 occurrences of this association rangewide, this small-patch community occupies fewer than 2500 total acres. The range is moderately restricted (New Jersey to northern North

Carolina), and the habitat requirements are also relatively restricted (large mid-Atlantic sand dunes). The rank was altered from G3 as reported in TNC (1995c) upon completion of more detailed ranking procedure.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.686917

References: Bartgis 1986, Berdine 1998, Bowman 2000, Breden 1989, Breden et al. 2001, Clampitt 1991, Clancy 1993a, Collins and Anderson 1994, Eastern Ecology Working Group n.d., Fleming 2001, Fleming et al. 2001, Harrison 2004, Higgins et al. 1971, Hill 1986, Martin 1959b, TNC 1995c

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Short shrub/sapling	Broad-leaved evergreen shrub	<i>Hudsonia tomentosa</i> (woolly beach-heather)
Herb (field)	Vine/Liana	<i>Toxicodendron radicans</i> (eastern poison-ivy)
Herb (field)	Forb	<i>Lechea maritima</i> (beach pinweed)
Herb (field)	Forb	<i>Solidago sempervirens</i> (seaside goldenrod)
Herb (field)	Graminoid	<i>Aristida tuberculosa</i> (seabeach three-awn)
Herb (field) bluestem)	Graminoid	<i>Schizachyrium scoparium</i> ssp. <i>littorale</i> (seaside

CHESAPEAKE BAY TALL MARITIME SHRUBLAND

Prunus serotina / *Morella cerifera* / *Smilax rotundifolia* Scrub Forest

Range: This association occurs along the mid-Atlantic coast from Virginia north to Cape May, New Jersey.

Environmental Description: This association occurs on stabilized dunes, generally occurring leeward of secondary dunes. The substrate varies from pure sand directly adjacent to the ocean to loamy sands in more sheltered areas of the coast.

Vegetation Description: The vegetation is dominated by *Prunus serotina* (black cherry), *Amelanchier canadensis* (Canada serviceberry), *Sassafras albidum* (sassafras), *Photinia pyrifolia* (red chokeberry), and *Diospyros virginiana* (eastern persimmon) in varying proportions. *Pinus taeda* (loblolly pine) is a common associate in examples of this community south of New Jersey. *Morella cerifera* (wax-myrtle) and *Vaccinium corymbosum* (highbush blueberry) may form a subcanopy, but if the community is particularly stunted, this species may contribute substantially to the canopy. Lianas are abundant in the canopy or over the ground layer, and species include *Smilax rotundifolia* (roundleaf greenbrier), *Smilax glauca* (whiteleaf greenbrier), *Parthenocissus quinquefolia* (Virginia creeper), and *Toxicodendron radicans* (eastern poison-ivy). Herbs are generally scarce to lacking entirely, and when present are generally made up of tree and vine seedlings.

Characteristic Species: *Morella cerifera* (wax-myrtle), *Prunus serotina* (black cherry), *Smilax rotundifolia* (roundleaf greenbrier)

Dynamics/Successional Trajectory: This is a tall, deciduous shrubland or scrub forest, although physiognomy can vary dramatically, ranging from open woodland to stunted forest to dense nearly impenetrable thicket. Individual trees tend to be wind-pruned and multi-stemmed. It is subject to wind and salt spray to varying degrees. This association occupies a transitional zone between maritime forest and low maritime shrubland or dune associations.

Management Concerns: Potential or historic habitat has been reduced by extensive human development such as residential or commercial building, recreation, or road expansion.

Reference Sites: Cape Henlopen, DE; Higbee Beach, Cape May County, NJ

Global and State Conservation Ranks and Reasons: G1G2 (18-Nov-1997). DE: SNR, NJ: S1. This maritime shrubland community is restricted to a narrow range on coastal dunes of barrier islands on the mid-Atlantic coast. It does not occur north of southern New Jersey or south of Virginia. Occurrences are naturally small (a few acres), confined to the oceanward portion of barrier islands.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.684064

References: Bartgis 1986, Bellis 1992, Berdine 1998, Boule 1979, Bowman 2000, Breden 1989, Breden et al. 2001, Dunlop and Crow 1985, Eastern Ecology Working Group n.d., Fleming et al. 2001, Harrison 2004, Higgins et al. 1971, Hill 1986, Klotz 1986, Rawinski 1992, Sneddon et al. 1994, Stalter 1979

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Broad-leaved deciduous tree	<i>Amelanchier canadensis</i> (Canada serviceberry)
Tree canopy	Broad-leaved deciduous tree	<i>Prunus serotina</i> (black cherry)
Tree canopy	Broad-leaved deciduous tree	<i>Sassafras albidum</i> (sassafras)
Shrub/sapling (tall & short)	Vine/Liana	<i>Parthenocissus quinquefolia</i> (Virginia creeper)
Shrub/sapling (tall & short)	Vine/Liana	<i>Smilax rotundifolia</i> (roundleaf greenbrier)
Shrub/sapling (tall & short)	Vine/Liana	<i>Toxicodendron radicans</i> (eastern poison-ivy)
Tall shrub/sapling	Broad-leaved evergreen shrub	<i>Morella cerifera</i> (wax-myrtle)

COASTAL FRESHWATER MARSH

Schoenoplectus pungens var. *pungens* - *Juncus canadensis* Herbaceous Vegetation

Range: This association is known from Massachusetts and New Jersey but is likely to occur in other coastal states of the Northeast. It occurs in the New Jersey portion of the Delaware Estuary.

Environmental Description: This non-tidal freshwater marsh of the coastal Northeast occupies flooded depressions and swales in coastal dunes (and impoundments). This community can also occur at the mouth of large rivers, on hummocky islands in freshwater wetlands, and in transition zones. The substrate varies from sand to peat or muck, depending on hydrological regime. Water is present most of the year and does not typically exhibit a seasonal drawdown.

Vegetation Description: The vegetation is dominated by *Schoenoplectus pungens* var. *pungens* (common threesquare), in association with *Hibiscus moscheutos* ssp. *moscheutos* (eastern rosemallow), *Juncus canadensis* (Canadian rush), *Juncus effusus* (soft rush), *Eleocharis erythropoda* (bald spikerush), *Osmunda regalis* (royal fern), *Osmunda cinnamomea* (cinnamon fern), *Thelypteris palustris* (eastern marsh fern), and *Triadenum virginicum* (Virginia marsh St. John's-wort). *Typha latifolia* (broadleaf cattail) may be present but generally only occurs at low cover. A diverse range of other forbs may also be associated with this community. Shrubs may be present as sparsely distributed individuals, or more densely from the wetland edge. Typical shrubs include *Rosa palustris* (swamp rose), *Vaccinium corymbosum* (highbush blueberry), *Morella pensylvanica* (northern bayberry), and *Acer rubrum* (red maple).

Characteristic Species: *Juncus canadensis* (Canadian rush), *Schoenoplectus pungens* var. *pungens* (common threesquare)

Reference Sites: Monds Island (New Jersey Audubon Society), NJ; Raccoon Creek/Repaupo Creek, NJ; Route 44 at Birch Creek, Gloucester County, NJ; Oldman's Creek, NJ

Global and State Conservation Ranks and Reasons: GNR (8-Nov-2000). NJ: SNR.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.685545

References: Eastern Ecology Working Group n.d., Martin 1959b

INTERDUNE SWITCHGRASS BRACKISH DEPRESSION

(*Morella cerifera*) - *Panicum virgatum* - *Spartina patens* Herbaceous Vegetation

Range: The community apparently occurs in New Jersey, Delaware, Maryland, and may extend to North Carolina, but the full range will require further study.

Environmental Description: This association occurs in interdunal swales, or seasonally flooded basins, landward of maritime backdunes. The water table is at or close to the surface in the spring. Freshwater maintains these depressions as saturated or seasonally flooded and somewhat poorly drained. Soils are characterized by a shallow organic layer (usually a few centimeters in depth) overlying loamy sand or sand.

Vegetation Description: This community is generally strongly dominated by *Panicum virgatum* (switchgrass) but can be variable in its expression. Associated species include *Spartina patens* (saltmeadow cordgrass), *Juncus canadensis* (Canadian rush), *Solidago sempervirens* (seaside goldenrod), *Eleocharis palustris* (marsh spikerush), *Toxicodendron radicans* (eastern poison-ivy), *Linum medium* (stiff yellow flax), *Carex longii* (Long's sedge), and *Euthamia caroliniana* (slender goldentop). This community is typically dominated by 40-85% cover of *Panicum virgatum* (switchgrass) and occurs in larger interdunal depressions (up to one-half hectare). Variability occurs in the cover of *Panicum virgatum* (switchgrass) and the richness of associated species. When *Panicum virgatum* (switchgrass) is not as dense, it is most often associated with an even mixture of *Schoenoplectus pungens* (common threesquare) or *Spartina patens* (saltmeadow cordgrass). In some cases, *Morella cerifera* (wax-myrtle) or *Baccharis halimifolia* (groundsel-tree) will constitute less than 10% shrub cover, but shrub coverage is usually much less or none and other herbs codominate.

Characteristic Species: *Panicum virgatum* (switchgrass)

Dynamics/Successional Trajectory: This association likely comprises an intermediate phase of interdunal swale vegetation succession; as sites become less wet, shrubs invade and the community may succeed to a shrubland. This association also has similarity to, and may be a southern analog of, *Panicum virgatum* - *Spartina patens* Herbaceous Vegetation (Brackish Meadow in this report), a brackish meadow association occurring from New Jersey northward. Freshwater interdunal swale wetlands occur in large dune systems that develop freshwater aquifers. Interdunal swale wetlands develop where the freshwater lens intersects the dune surface. The water table is a balance between input from precipitation and output from evapotranspiration or from drainage outlets. Perpetual drawdown tends to invoke successional shifts in vegetation from open water with or without submerged or floating aquatic plants, to emergent herbaceous vegetation to a series of shrubland associations as the duration of soil saturation decreases. *Salix* (willow) spp. are early pioneer shrubs, which can be displaced by other shrub species like *Morella* (bayberry) spp. as peat and or sediments accumulate.

Reference Sites: Broadkill Beach to Lewes, Sussex County, DE

Global and State Conservation Ranks and Reasons: G2G4 (19-Jan-2006). DE: SNR, NJ: SNR. This small-patch wetland community is restricted to the Coastal Plain of the mid-Atlantic.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.684954

References: Berdine 1998, Bowman 2000, Breden et al. 2001, Eastern Ecology Working Group n.d., Fender 1937, Fleming 2001, Fleming et al. 2001, Harrison 2004, Harrison and Stango 2003, Heckscher et al. 1995, Higgins et al. 1971, Hill 1986, Metzler and Barrett 2001, Schafale 2000, Schafale 2003b, Schafale and Weakley 1990, Sneddon et al. 1996

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Herb (field)	Graminoid	<i>Panicum virgatum</i> (switchgrass)
Herb (field)	Graminoid	<i>Spartina patens</i> (saltmeadow cordgrass)

LOBLOLLY PINE DUNE WOODLAND

Pinus taeda / *Hudsonia tomentosa* Woodland

Range: This maritime woodland occurs on sand dunes of barrier islands in Delaware, Maryland, and Virginia.

Environmental Description: This community is a maritime woodland of sand dunes. Soils in this community are sandy and rapidly drained. This community often occurs directly adjacent to actively shifting foredune and is exposed to salt spray, winds, and storms. The community also occurs on unstable sands of protected backdunes.

Vegetation Description: This community is characterized by a very open canopy created by sparsely distributed *Pinus taeda* (loblolly pine). Hardwoods such as *Quercus falcata* (southern red oak), *Quercus phellos* (willow oak), and *Ilex opaca* (American holly) are frequent. Pines make up a sparse subcanopy. Tall shrubs are also sparse, although an occasional *Morella cerifera* (wax-myrtle), *Pinus taeda* (loblolly pine) sapling, or *Vaccinium corymbosum* (highbush blueberry) can be found. Sparse low shrubs of *Hudsonia tomentosa* (woolly beach-heather) are common. *Smilax glauca* (whiteleaf greenbrier) and *Toxicodendron radicans* (eastern poison-ivy) are typical vine species but make up less than 5% cover. Herbs are sparse, yet much varied. *Andropogon virginicus* (broomsedge bluestem) and *Smilax rotundifolia* (roundleaf greenbrier) are commonly present. The typical pattern of herb distribution is on dry open sand, in direct sunlight. Here, small patches of *Dichanthelium acuminatum* (tapered rosette grass), *Dichanthelium scoparium* (broom witchgrass), *Andropogon virginicus* (broomsedge bluestem), *Eupatorium rotundifolium* (roundleaf thoroughwort), *Erigeron* (fleabane) sp., *Euthamia caroliniana* (slender goldentop), *Solidago sempervirens* (seaside goldenrod), *Aristida tuberculosa* (seabeach three-awn), *Polygonella articulata* (coastal jointweed), and *Pseudognaphalium obtusifolium* are typically mixed with scattered *Hudsonia tomentosa* (woolly beach-heather) and *Smilax rotundifolia* (roundleaf greenbrier). In total, herb cover ranges from 5-40%, generally near the lower end of the scale.

Characteristic Species: *Pinus taeda* (loblolly pine)

Dynamics/Successional Trajectory: This community is exposed to salt spray, winds, and storms. In the denser woodlands, more pine duff accumulates and herb diversity and cover are generally higher. Where woodlands are more open and trees sparse, growing conditions are harsh, less duff accumulates, and vast areas of exposed white sand are characteristic.

Management Concerns: This community is threatened by many of the same threats common to coastal dune systems: dune stabilization, commercial and residential development, and road expansion.

Reference Sites: Cape Henlopen State Park, Sussex County, DE

Global and State Conservation Ranks and Reasons: G1G2 (2-Dec-1998). DE: S1?. This maritime woodland community is restricted to major coastal dune systems of the mid-Atlantic region. Only 10-20 occurrences are estimated or known from Maryland, Virginia, and Delaware. Size ranges from about an acre to perhaps 30 acres. The community occurs on a restricted habitat, on back dunes protected from the direct influence of wind and salt spray.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.689830

References: Berdine 1998, Bowman 2000, Bratton and Davison 1987, Clampitt 1991, Clancy 1996, Eastern Ecology Working Group n.d., Fleming et al. 2001, Harrison 2004, Harrison and Stango 2003, Higgins et al. 1971, Hill 1986, Klotz 1986, Schafale and Weakley 1990, TNC 1995c

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Needle-leaved tree	<i>Pinus taeda</i> (loblolly pine)
Short shrub/sapling	Broad-leaved evergreen shrub	<i>Hudsonia tomentosa</i> (woolly beach-heather)
Herb (field grass)	Graminoid	<i>Dichanthelium acuminatum</i> (tapered rosette grass)

MARITIME RED-CEDAR WOODLAND

Juniperus virginiana var. *virginiana* / *Morella pensylvanica* Woodland

Range: This association occurs along the North Atlantic coast from Delaware to Massachusetts.

Environmental Description: This maritime woodland community occurs on sand dunes, the upper edges of salt marshes, and less commonly on rocky headlands. It also occurs on islands in salt marshes (relict of post-glacial forest before sea level rise). It is influenced by onshore winds and salt spray, plus infrequent sand deposition and tidal overwash from severe storms.



Photo by Robert Cox

Vegetation Description:

Juniperus virginiana (eastern red-cedar) may form pure stands but more often grows in association with *Pinus rigida* (pitch pine), *Quercus stellata* (post oak), *Prunus serotina* (black cherry), *Amelanchier canadensis* (Canada serviceberry), *Ilex opaca* (American holly), or *Quercus velutina* (black oak), which tend to have low percent cover. In the southern portion of the range, *Pinus taeda* (loblolly pine), *Quercus falcata* (southern red oak), *Diospyros virginiana* (eastern persimmon), and *Quercus phellos* (willow oak) can be infrequent canopy associates. A shrub layer may be well-developed where the canopy is more open and include *Morella pensylvanica* (northern bayberry), *Morella cerifera* (wax-myrtle) (at the southern end of the range), *Baccharis halimifolia* (groundsel-tree), *Iva frutescens* (maritime marsh-elder), or *Vaccinium corymbosum* (highbush blueberry). Vines can be dense in the shrub layer and extend into the canopy; species include *Toxicodendron radicans* (eastern poison-ivy), *Smilax rotundifolia* (roundleaf greenbrier), *Smilax glauca* (whiteleaf greenbrier), and *Parthenocissus quinquefolia* (Virginia creeper). Herbs are usually patchily distributed in openings and include many species from the surrounding dune associations, among others. They include *Opuntia humifusa* (eastern prickly-pear), *Dichanthelium ovale* (eggleaf rosette grass), *Schizachyrium scoparium* (little bluestem), *Deschampsia flexuosa* (wavy hairgrass), *Cyperus grayi* (Gray's flatsedge), *Polygonella articulata* (coastal jointweed), *Hieracium gronovii* (queendevil), *Panicum amarum* var. *amarulum* (coastal panicgrass), *Solidago sempervirens* (seaside goldenrod), *Panicum virgatum* (switchgrass), *Spartina patens* (saltmeadow cordgrass), and *Lechea intermedia* (round-fruit pinweed).

Noteworthy Associated Plant and/or Animal Species: *Ruellia caroliniensis* (Carolina wild petunia)

Characteristic Species: *Juniperus virginiana* var. *virginiana* (eastern red-cedar)

Dynamics/Successional Trajectory: The physiognomy of this association is variable, ranging from dense tall-shrub thickets to open woodlands; trees are generally shorter than 4 m. Canopy trees are stunted and salt-pruned.

Management Concerns: The habitat is threatened by many of the same threats common to coastal dune systems: dune stabilization, commercial and residential development. This community is further threatened even on "protected" lands in some cases by a lack of recognition that this vegetation is a unique community.

Reference Sites: Broadkill Beach, Sussex County, DE; Fowlers Beach south to Lewes, Sussex County, DE; Fortesque NWR, NJ; Mad Horse Creek WMA, NJ; Dias Creek NWR, NJ; Higbee Beach, NJ; Cape May, NJ

Global and State Conservation Ranks and Reasons: G2 (18-Nov-1997). DE: S1, NJ: S1. This maritime woodland community is naturally restricted to major coastal dune systems. An estimated maximum of 30 occurrences exist, ranging in size from less than an acre up to a maximum of 100, with an average size of less than 10 acres.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.689256

References: Bowman 2000, Breden 1989, Breden et al. 2001, Clancy 1996, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fleming et al. 2001, Greller 1977, Harrison 2004, Lundgren 2000, Martin 1959b, Rawinski 1984, Reschke 1990, Swain and Kearsley 2001

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy red-cedar	Needle-leaved tree	<i>Juniperus virginiana</i> var. <i>virginiana</i> (eastern red-cedar)
Shrub/sapling (tall & short)	Broad-leaved evergreen shrub	<i>Morella pensylvanica</i> (northern bayberry)
Shrub/sapling (tall & short)	Vine/Liana	<i>Toxicodendron radicans</i> (eastern poison-ivy)
Herb (field)	Graminoid	<i>Schizachyrium scoparium</i> (little bluestem)

NORTH ATLANTIC COASTAL PLAIN VINE DUNE

Smilax glauca - *Toxicodendron radicans* Vine-Shrubland

Range: This type is likely to occur in New England south to Maryland and perhaps Virginia. In the Delaware Estuary, this community is found in Delaware.

Environmental Description: This community occurs on maritime sand dunes, generally of barrier beach systems, where vegetation is exposed to wind, salt spray and periodic overwash by storm tides. Vegetation is shallowly rooted in sand or draped over living or dead shrubs. Very little soil development occurs, and the water table is well below 1 m in depth (Martin 1959b).

Vegetation Description: The dominant species of any single dune may be one of several vine species such as *Smilax glauca* (whiteleaf greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), *Vitis rotundifolia* (muscadine), *Parthenocissus quinquefolia* (Virginia creeper), or *Toxicodendron radicans* (eastern poison-ivy). In some cases, the vines are shallowly rooted in the sand or grow over older vine stems or other living or dead shrubs such as *Morella pensylvanica* (northern bayberry). Scattered dune grassland species may be present such as *Ammophila breviligulata* (American beachgrass), *Lechea maritima* (beach pinweed), *Solidago sempervirens* (seaside goldenrod), and *Hudsonia tomentosa* (woolly beach-heather).

Characteristic Species: *Smilax glauca* (whiteleaf greenbrier)

Dynamics/Successional Trajectory: Vegetation of this association stabilizes dunes. It also grades into maritime shrubland and dune grassland vegetation. The vegetation is exposed to wind, salt spray and periodic overwash by storm tides. The vegetation is generally low to the ground (less than half a meter tall) and generally covers 70-80% of the surface of the ground, the remainder being exposed sand.

Reference Sites: none identified

Global and State Conservation Ranks and Reasons: G1G2 (18-Jan-2006). DE: SNR, NJ: SNR. This small-patch community is restricted to coastal sand dunes of only four states. Total number of occurrences is 21-100, and total acreage is well less than 2000 acres.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.686350

References: Berdine 1998, Bowman 2000, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Harrison 2004, Harrison and Stango 2003, Martin 1959b, Rawinski 1984, Reschke 1990, Sneddon and Lundgren 2001, Swain and Kearsley 2001

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Shrub/sapling (tall & short)	Vine/Liana	<i>Smilax glauca</i> (whiteleaf greenbrier)
Shrub/sapling (tall & short)	Vine/Liana	<i>Smilax rotundifolia</i> (roundleaf greenbrier)
Shrub/sapling (tall & short)	Vine/Liana	<i>Toxicodendron radicans</i> (eastern poison-ivy)

NORTHEASTERN ATLANTIC BRACKISH INTERDUNAL SWALE

Spartina patens - *Eleocharis parvula* Herbaceous Vegetation

Range: This association is currently described from Maryland, New Jersey, New York, Massachusetts, and New Hampshire. It also occurs in Delaware.

Environmental Description: This community occupies brackish interdunal swales and overwash flats between coastal sand dunes. Surface water is oligo- to mesohaline; the dune surface intersects the freshwater lens with salinity input from salt spray and/or storm tide overwash. Substrate is deep sand with or without a layer of surficial peat.

Vegetation Description: This association is dominated by graminoids, especially *Spartina patens* (saltmeadow cordgrass), *Eleocharis parvula* (dwarf spikerush), *Schoenoplectus pungens* (common threesquare), *Cyperus polystachyos* (many-spike flatsedge), and *Juncus articulatus* (jointleaf rush), although local dominance can change from year to year. Associated species depend on salinity and hydrology of a site and can include *Leptochloa fusca* ssp. *fascicularis* (maritime bearded sprangletop), *Schoenoplectus maritimus* (saltmarsh clubrush), *Juncus ambiguus* (seaside rush), *Juncus scirpoides* (needle-pod rush), *Ptilimnium capillaceum* (mock bishopweed), *Rumex maritimus* (golden dock), *Symphotrichum subulatum* (seaside American-aster), *Chenopodium rubrum* (red goosefoot), *Pluchea odorata* (sweetscent), *Hibiscus moscheutos* ssp. *moscheutos* (eastern rosemallow), *Polygonum ramosissimum* (yellow-flower knotweed), *Triglochin maritima* (seaside arrow-grass), *Panicum virgatum* (switchgrass), *Schoenoplectus robustus* (alkali bulrush), and *Argentina anserina* (silverweed). *Iva frutescens* (maritime marsh-elder) and *Baccharis halimifolia* (groundsel-tree) may occur on hummocks within the swale. Mats of blue-green and/or brown algae can proliferate across the soil surface.

Characteristic Species: *Eleocharis parvula* (dwarf spikerush), *Spartina patens* (saltmeadow cordgrass)

Dynamics/Successional Trajectory: Brackish swale vegetation can be ephemeral or can represent early stages of salt marsh or coastal salt pond development (Reschke 1990). Overwash flats can succeed into dune grasslands with sand accumulation and plant burial.

Management Concerns: *Phragmites australis* (common reed) can readily invade in this environmental setting.

Reference Sites: Blackbird Creek, New Castle County, DE

Global and State Conservation Ranks and Reasons: GNR (1-Dec-1997). DE: SNR, NJ: S1S2.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.688128

References: Breden et al. 2001, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Harrison 2004, Hunt 1997b, Lea 2002b, Lundgren 1998, Rawinski 1984, Reschke 1990, Sneddon and Lundgren 2001, Sperduto 2000b, Swain and Kearsley 2001

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Herb (field)	Graminoid	<i>Eleocharis parvula</i> (dwarf spikerush)
Herb (field)	Graminoid	<i>Spartina patens</i> (saltmeadow cordgrass)

NORTHERN BAYBERRY DUNE SHRUBLAND

Morella pensylvanica - *Prunus maritima* Shrubland

Range: This association occurs from Maine to New Jersey. It occurs in New Jersey and Delaware portions of the Delaware Estuary.

Environmental Description: This association occurs on protected slopes and hollows of dry, stabilized maritime backdunes where the water table is greater than 1 m from the surface.

Vegetation Description: This shrubland vegetation is dominated by *Morella pensylvanica* (northern bayberry) and *Prunus maritima* (beach plum). Additional shrubs that are commonly present but with low cover can include *Rosa carolina* (Carolina rose), *Rosa rugosa* (rugosa rose), *Baccharis halimifolia*



Photo by Kathleen Strakosch Walz

(groundsel-tree), or *Juniperus virginiana* (eastern red-cedar). The herbaceous layer tends to be sparse and can include dune grassland or adjacent upland species such as *Ammophila breviligulata* (American beachgrass), *Solidago sempervirens* (seaside goldenrod), *Hudsonia tomentosa* (woolly beach-heather), *Lechea maritima* (beach pinweed), *Juncus greenii* (greenie's rush), *Carex silicea* (beach sedge), *Polygonella articulata* (coastal jointweed), *Symphotrichum subulatum* (seaside American-aster), *Solidago rugosa* (wrinkleleaf goldenrod), *Achillea millefolium* (common yarrow), *Oenothera parviflora* (northern evening-primrose), *Euthamia* (goldentop) spp., *Cyperus grayi* (Gray's flatsedge), *Cyperus polystachyos* (many-spike flatsedge), and others. Typical vine associates are *Toxicodendron radicans* (eastern poison-ivy) and *Smilax* (greenbrier) spp.

Characteristic Species: *Morella pensylvanica* (northern bayberry), *Prunus maritima* (beach plum)

Dynamics/Successional Trajectory: This vegetation can be a probable intermediate in succession between beach dune and sunken forest; further dune development and protection from salt spray allow development of sunken forest vegetation (Art 1976). Large patches of open unvegetated or sparsely vegetated sand are present in some examples. Depending on exposure, these shrublands range from over 2 m tall in sheltered areas to less than 1 m tall in areas with greater exposure to winds and storms.

Reference Sites: dunes on DE Bay eastern shore; Bowers Beach south to Broadkill Beach, DE; Bowers Beach south to Lewes, DE; Kent County, DE; Higbee Beach, NJ

Global and State Conservation Ranks and Reasons: G4 (1-Dec-1997). DE: SNR, NJ: S1S2.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.685486

References: Art 1976, Breden 1989, Breden et al. 2001, Chrysler 1930, Conard 1935, Dunlop and Crow 1985, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Gawler 2001, Gawler 2002, Lundgren 2000, Martin 1959b, McDonnell 1979, Metzler and Barrett 2001, Metzler and Barrett 2004, Moul 1969, Nelson and Fink 1980, Nichols 1920, Rawinski 1984, Reschke 1990, Sneddon and Lundgren 2001, Sperduto 1997b, Sperduto 2000a, Swain and Kearsley 2001

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Prunus maritima</i> (beach plum)
Shrub/sapling (tall & short)	Broad-leaved evergreen shrub	<i>Morella pensylvanica</i> (northern bayberry)
Herb (field)	Graminoid	<i>Ammophila breviligulata</i> (American beachgrass)

NORTHERN BEACHGRASS DUNE

Ammophila breviligulata - *Lathyrus japonicus* Herbaceous Vegetation

Range: This association occurs along the northern Atlantic Coast from Maine to New Jersey and Delaware.

Environmental Description: This association primarily occurs on active maritime dunes, on both foredunes that are exposed to onshore winds and salt spray as well as more protected interdunes. This grassland generally occurs beyond the influence of storm tides. Substrate is sand with no soil profile development.

Vegetation Description: This association is characterized and dominated by *Ammophila breviligulata* (American beachgrass), which can occur monotypically, especially on foredunes or other areas of active and rapid sand deposition. *Lathyrus japonicus* (beach pea) is the most common associate and can be codominant in most examples of this community; however, it is not common in Delaware. Other associated species include *Solidago sempervirens* (seaside goldenrod), *Lechea maritima* (beach pinweed), *Aristida tuberculosa* (seabeach three-awn), *Schizachyrium scoparium* (little bluestem), *Carex silicea* (beach sedge), *Polygonella articulata* (coastal jointweed), and *Artemisia stelleriana* (oldwoman). Dwarf-shrubs, such as *Hudsonia tomentosa* (woolly beach-heather), *Rosa rugosa* (rugosa rose), *Morella pensylvanica* (northern bayberry), or stunted *Prunus maritima* (beach plum), can occur sporadically and form locally dominant patches within the grassland.



Photo by Kathleen Strakosch Walz

Characteristic Species: *Ammophila breviligulata* (American beachgrass)

Dynamics/Successional Trajectory: This association occurs on the shifting sands of active dune systems. Sand is wind-deposited and tends to accumulate where vegetation slows the surface wind velocity (Martin 1959b). Rhizomes of *Ammophila breviligulata* (American beachgrass) stabilize the dunes, growing upward through layers of sand deposition. *Ammophila breviligulata* (American beachgrass) tends to grow best where there is relatively rapid sand deposition; it can grow through one meter of sand

accumulation (Zaremba and Leatherman 1984). Species diversity of this association tends to increase landward in more protected areas where the substrate is more stable. This dune grassland can merge into beach strand vegetation seaward and maritime heath communities landward.

Reference Sites: Cape May, NJ, and north along Delaware Bayshore - Higbee Beach, Townsend Beach, Norbury Landing, NJ

Global and State Conservation Ranks and Reasons: G4? (1-Dec-1997). DE: SNR, NJ: S2S3.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.685381

References: Breden 1989, Breden et al. 2001, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Gawler 2001, Gawler 2002, Johnson 1981b, Johnson 1985b, Martin 1959b, Metzler and Barrett 2001, Moul 1969, Nelson and Fink 1980, Rawinski 1984, Reschke 1990, Sperduto 1997a, Swain and Kearsley 2001, Zaremba and Leatherman 1984

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Herb (field)	Graminoid	<i>Ammophila breviligulata</i> (American beachgrass)

OVERWASH DUNE GRASSLAND

Spartina patens - *Schoenoplectus pungens* - *Solidago sempervirens* Herbaceous Vegetation

Range: This community is an upland dune grassland of mid-Atlantic barrier islands from New Jersey to North Carolina. Examples of this type occur in Delaware in the Delaware Estuary.

Environmental Description: This community is an upland dune grassland of mid-Atlantic barrier islands on embryo dunes forming from overwash terraces. The plants of this community are influenced by water-deposited sand caused by storm surges. They differ ecologically from dune grasslands dominated by *Ammophila breviligulata* (American beachgrass) or *Uniola paniculata* (sea-oats), which are primarily impacted by wind-deposited sand. Storm overwash is a prevalent natural disturbance to this community.

Vegetation Description: *Spartina patens* (saltmeadow cordgrass) is dominant, ranging from quite sparse (25% cover) to dense, and can be monotypic in early successional expressions. As the vegetation develops, common associated species can include *Schoenoplectus pungens* (common threesquare) or *Solidago sempervirens* (seaside goldenrod). Less common associates can include *Cyperus grayi* (Gray's flatsedge), *Cenchrus tribuloides* (dune sandbur), *Setaria parviflora* (yellow foxtail grass), *Festuca rubra* (red fescue), and occasional scattered individuals of *Toxicodendron radicans* (eastern poison-ivy) and seedlings of *Baccharis halimifolia* (groundsel-tree). *Ammophila breviligulata* (American beachgrass) or *Uniola paniculata* (sea-oats) may invade from the surrounding dunes. This community is characterized by upland maritime dune grassland vegetation. *Spartina patens* (saltmeadow cordgrass), and sometimes *Schoenoplectus pungens* (common threesquare), or both are dominant on dunes or overwash terraces. Total vegetation cover is variable, ranging from quite sparse (25% cover) to dense. Bare sand is often visible through the vegetation, and there is no soil profile development. Species diversity is variable; although it may be quite low and confined to the nominate species in the northern part of the range, it may be of greater diversity, including *Strophostyles helvula* (trailing wild bean), *Solidago sempervirens* (seaside goldenrod), *Cenchrus tribuloides* (dune sandbur), *Setaria parviflora* (yellow foxtail grass), *Distichlis spicata* (saltgrass), *Sabatia stellaris* (rose-of-Plymouth), *Ammophila breviligulata* (American beachgrass), *Suaeda linearis* (southern sea-blite), *Bassia hirsuta* (hairy smotherweed), *Atriplex patula* (halberd-leaf orache), *Fimbristylis castanea* (chestnut fimbry), and *Cakile edentula* ssp. *edentula* (sea-rocket).

Characteristic Species: *Schoenoplectus pungens* (common threesquare), *Spartina patens* (saltmeadow cordgrass)

Dynamics/Successional Trajectory: This association forms a drier, later successional phase of an overwash community begun from water-deposited sand of storm overwash; it appears to be a successional step between interdunal herbaceous wetlands and interdunal herbaceous/shrub uplands. Undisturbed water-deposited sand is colonized by *Spartina patens* (saltmeadow cordgrass) and/or *Schoenoplectus pungens* (common threesquare) plus additional associates like *Suaeda linearis* (southern sea-blite), *Bassia hirsuta* (hairy smotherweed), *Atriplex patula* (halberd-leaf orache), and *Fimbristylis castanea* (chestnut fimbry) that have low percent cover. This wetter, early successional phase is currently covered by *Spartina patens* - *Eleocharis parvula* Herbaceous Vegetation (CEGL006342). With time since overwash, sand movement, plant burial, and dune formation rates increase, but are not so high as to form *Ammophila breviligulata* (American beachgrass)-dominated primary dunes. However, this association can be found as a fringe around the lower, outer edge of those dunes.

Management Concerns: As part of a dynamic system, the community is in a sense ephemeral, being buried over time by sand deposition, and being formed anew in other areas subjected to overwash. Because of the dynamic forces structuring the community, it requires sufficient area in large dune systems to accommodate this shifting mosaic. This community is threatened by a number of activities, including dune stabilization and outright destruction of habitat through human activities.

Reference Sites: Great Marsh, Sussex County, DE

Global and State Conservation Ranks and Reasons: G2G3 (4-Nov-1998). DE: S2S3, NJ: SNR. This dune grassland community is restricted to overwash areas of major maritime dune systems. It is typically small in extent, not usually more than a few acres in size. It is best developed on barrier islands of Delaware, Maryland, Virginia, and North Carolina; it extends sporadically farther north to Massachusetts. Although not extremely rare (an estimated 100-200 occurrence exist rangewide), the community is restricted to a specialized habitat.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.686121

References: Baumann 1978b, Berdine 1998, Boule 1979, Bowman 2000, Breden et al. 2001, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fleming et al. 2001, Harrison 2004, Harrison and Stango 2003, Higgins et al. 1971, Hill 1986, Klotz 1986, Lea 2002b, Reschke 1990, Schafale 2000, Schafale 2003b, Schafale and Weakley 1990, TNC 1995c, Travis and Godfrey 1976, Zaremba and Leatherman 1984

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Herb (field)	Forb	<i>Solidago sempervirens</i> (seaside goldenrod)
Herb (field)	Graminoid	<i>Schoenoplectus pungens</i> (common threesquare)

PITCH PINE DUNE WOODLAND

Pinus rigida / *Hudsonia tomentosa* Woodland

Range: This association occurs along the north Atlantic coast from southern Maine to Cape Henlopen, Delaware.

Environmental Description: The community occurs on backdunes that are more stabilized than foredunes. It occurs on stabilized, parabolic dunes. The substrate is wind- and wave-deposited sand which is characteristically excessively well-drained and nutrient-poor.

Vegetation Description: There is generally significant cover of bare sand, but where more stabilized, species diversity tends to increase. *Pinus rigida* (pitch pine) dominates the canopy and averages 10-15 m

in height, but is quite variable, ranging from 1 m in an unusual shrub form in Delaware to over 20 m. Canopy associates are few but include *Juniperus virginiana* (eastern red-cedar), and occasionally *Sassafras albidum* (sassafras), with scattered individuals of *Quercus velutina* (black oak) in the northern part of the range, and *Quercus falcata* (southern red oak) and *Pinus virginiana* (Virginia pine) to the south. At Cape Henlopen, the subcanopy is sparse but may also include *Quercus marilandica* (blackjack oak), *Quercus stellata* (post oak), *Nyssa sylvatica* (blackgum), and *Prunus serotina* (black cherry). The shrub layer, if present, may include *Hudsonia tomentosa* (woolly beach-heather), *Morella pensylvanica* (northern bayberry), *Gaylussacia baccata* (black huckleberry), *Gaylussacia frondosa* (dangleberry), *Vaccinium pallidum* (hillside blueberry), and occasionally *Hudsonia ericoides* (pine barren golden-heather), or *Viburnum nudum var. cassinoides* (northern wild raisin). Vines may be present but scarce and include *Smilax rotundifolia* (roundleaf greenbrier), *Smilax glauca* (whiteleaf greenbrier), *Parthenocissus quinquefolia* (Virginia creeper), and *Toxicodendron radicans* (eastern poison-ivy). The herbaceous layer is sparse but can include *Aralia nudicaulis* (wild sarsaparilla), *Dichanthelium ovale var. addisonii* (eggleaf rosette grass), *Solidago odora* (anise-scented goldenrod), *Chimaphila maculata* (striped pipsissewa), *Lechea maritima* (beach pinweed), *Pteridium aquilinum* (bracken fern), and *Trientalis borealis* (starflower), *Maianthemum canadense* (Canada mayflower), *Deschampsia flexuosa* (wavy hairgrass), *Carex lucorum* (Blue Ridge sedge), and *Arctostaphylos uva-ursi* (bearberry) in the north. Lichens are common; at Cape Henlopen State Park, Delaware, species included *Cladonia strepsilis* (olive cladonia), *Cladina terrae-novae* (reindeer lichen), *Lepraria incana* (dust lichen), and *Cladonia squamosa* (dragon cladonia).

Noteworthy Associated Plant and/or Animal Species: *Carex silicea* (beach sedge)

Characteristic Species: *Hudsonia tomentosa* (woolly beach-heather), *Morella pensylvanica* (northern bayberry), *Pinus rigida* (pitch pine)

Dynamics/Successional Trajectory: Active sand movement occurs with storm activity, causing the boundaries of the community to migrate over time. Maritime occurrences are subjected to a number of environmental stresses such as high winds, "sand-blasting " by salt spray, shifting substrate, and both water and nutrient stress. All of these factors appear to be important in structuring the form and composition of the community.

Management Concerns: This community is threatened by a host of threats common to coastal dune systems in general: dune stabilization, residential and commercial development, and road expansion.

Reference Sites: Cape Henlopen State Park, Sussex County, DE

Global and State Conservation Ranks and Reasons: G2 (8-Dec-1998). DE: S1, NJ: S1?. This maritime woodland community is restricted to major coastal sand dune systems. It ranges from southern Maine to Cape Henlopen, Delaware; it does not occur in Connecticut or Rhode Island. Occurrences are generally small, ranging from 5 or 10 acres to a few hundred acres at maximum. 25-30 occurrences covering 1000-1200 acres are estimated rangewide.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.687760

References: Art 1976, Bennett et al. 1998, Bowman 2000, Breden 1989, Breden et al. 2001, Clancy 1996, DNHP 1998, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Gawler 2001, Gawler 2002, Godfrey et al. 1978, Johnson 1985b, MENHP 1991, Martin 1959b, McDonnell 1979, Motzkin and Foster 2002, Nelson and Fink 1980, RINHP n.d., Rawinski 1984, Reschke 1990, Swain and Kearsley 2001, Trudeau et al. 1977

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Needle-leaved tree	<i>Pinus rigida</i> (pitch pine)
Short shrub/sapling	Broad-leaved evergreen shrub	<i>Hudsonia tomentosa</i> (woolly beach-heather)

ECOLOGICAL SYSTEM: ATLANTIC COASTAL PLAIN NORTHERN PITCH PINE LOWLAND

Summary: This system is comprised of wetland pine barrens vegetation, best developed in the New Jersey Pine Barrens. Although this system can be extensive, components of this system often co-occur as a mosaic with upland pine barrens vegetation as well. The vegetation is characterized by associations having variable hydroperiods, occurring on a range of substrates from saturated deep peats to seasonally saturated mineral soils. Physiognomy of the component associations is similarly widely variable, ranging from wet grasslands dominated by *Calamovilfa brevipilis* (pinebarren sandreed) to seasonally saturated pine forests characterized by mesic species. Fire frequency, as well as hydrology, has a profound influence on the vegetation. Where fire frequency is high, woody vegetation is impeded, favoring the development of large wet grasslands.

High-ranked Species: *Cirsium virginianum* (G3, Virginia thistle), *Coreopsis rosea* (G3, pink tickseed), *Eupatorium resinosum* (G3, pine barren thoroughwort), *Gentiana autumnalis* (G3, pine barren gentian), *Juncus caesariensis* (G2, New Jersey rush), *Muhlenbergia torreyana* (G3, New Jersey muhly), *Narthecium americanum* (G2, bog asphodel), *Platanthera integra* (G3G4, yellow fringeless orchid), *Rhexia aristosa* (G3, awned meadowbeauty), *Rhynchospora knieskernii* (G2, knieskern's beakrush), *Rhynchospora pallida* (G3, pale beakrush), *Rubus hypolasius* (G1?Q, pineland dewberry), *Scirpus longii* (G2G3, Long's bulrush)

Range: Best developed in the New Jersey Pine Barrens. United States: NJ

Delaware Estuary Associations:

- Highbush Blueberry Bog Thicket
- Pine Barrens Bog
- Pine Barrens Floodplain Forest
- Pine Barrens Sandreed Savanna
- Pitch Pine - Reedgrass Savanna
- Pitch Pine Bog
- Pitch Pine Lowland
- Pitch Pine Subhydric Lowland
- Southern Red Maple - Black Gum Swamp Forest
- Upper South Switchgrass Wet Prairie

CLASSIFIERS FOR ATLANTIC COASTAL PLAIN NORTHERN PITCH PINE LOWLAND

Primary Division: 203

Land Cover Class: Woody Wetland

Spatial Scale & Pattern: Large patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland

Non-diagnostic Classifiers: Woody-Herbaceous; Extensive Wet Flat

HIGHBUSH BLUEBERRY BOG THICKET

Vaccinium corymbosum / *Sphagnum* spp. Shrubland

Range: This association occurs from Pennsylvania and New Jersey north to New Hampshire and Maine and possibly Vermont.

Environmental Description: This tall-shrub bog thicket occurs on oligotrophic to weakly minerotrophic peat soils, commonly as a border thicket around more open dwarf heath shrub peatlands or within small, isolated basins. Significant seasonal water level fluctuation can occur, especially in isolated basins without inlet or outlet streams.