
ECOLOGICAL SYSTEM: NORTHERN ATLANTIC COASTAL PLAIN MARITIME FOREST

Summary: This system encompasses a range of woody vegetation present on barrier islands and near-coastal strands, from Virginia Beach, the northern range limit of *Quercus virginiana* (live oak), northward to the extent of the Atlantic Coastal Plain. It includes forests and shrublands whose structure and composition are influenced by proximity to marine environments, including both upland and wetlands. Vegetation includes narrow bands of forests with often stunted trees with contorted branches and wilted leaves and dense vine layers (Edinger et al. 2002). A range of trees may be present depending upon actual location and degree of protection from most extreme maritime influences.

Range: This system ranges from Virginia Beach northward to the extent of the Atlantic Coastal Plain. United States: DE, MA, MD, NJ, NY, VA

Delaware Estuary Associations:

- Chesapeake Bay Tall Maritime Shrubland
- Coastal Loblolly Pine Wetland Forest
- Coastal Pitch Pine / Scrub Oak Barren
- Inland Dune Ridge Forest
- Loblolly Pine Dune Woodland
- Lower New England Red Maple - Blackgum Swamp
- Maritime Holly Forest
- Maritime Red-cedar Woodland
- Northern Bayberry Dune Shrubland
- Pitch Pine Dune Woodland
- Successional Maritime Forest

Similar Ecological Systems in the Delaware Estuary:

- Atlantic Coastal Plain Northern Dune and Maritime Grassland

CLASSIFIERS FOR NORTHERN ATLANTIC COASTAL PLAIN MARITIME FOREST

Primary Division: 203

Land Cover Class: Forest and Woodland

Spatial Scale & Pattern: Large patch

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

Diagnostic Classifiers: Forest and Woodland (Treed); Coast

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 LOBLOLLY PINE WETLAND FOREST

Pinus taeda / *Morella cerifera* / *Osmunda regalis* var. *spectabilis* Forest

Range: This community ranges from the coast of Delaware and New Jersey to North Carolina.

Environmental Description: This maritime/coastal wetland forest occurs in backdune depressions with high water and as an estuarine fringe along bays and sounds. Tree diameters range from 12-36 cm dbh. This community occurs primarily on the bay side of islands, barrier spits and on mainlands adjacent to salt marsh. Soils are characterized by moderately shallow muck (15 cm) overlying organic matter-stained sands. This vegetation occurs adjacent to salt marshes, sometimes even forming small "islands" within high salt marsh. In North Carolina, it may extend well inland fringing bays and sounds on wet saturated flats that are flooded by storm tides. Trees tend to occur on slightly elevated hummocks, with standing water evident in hollows.

Vegetation Description: Examples are characterized by a closed to partially open canopy dominated by *Pinus taeda* (loblolly pine). Other canopy associates may be absent or may include *Acer rubrum* (red

maple), *Persea palustris* (swampbay), or *Liquidambar styraciflua* (sweetgum). The understory is made up of vines, strongly dominated by *Smilax rotundifolia* (roundleaf greenbrier), with lesser amounts of *Toxicodendron radicans* (eastern poison-ivy) and *Parthenocissus quinquefolia* (Virginia creeper). In addition to comprising the majority of the ground layer of these forests, these vines are relatively large-stemmed lianas that contribute significant cover to the canopy by covering the lower branches of trees. *Morella cerifera* (wax-myrtle) is a typical shrub of this community. The herbaceous layer is usually relatively sparse, characterized most frequently by ferns such as *Woodwardia areolata* (netted chainfern), *Osmunda regalis* var. *spectabilis* (royal fern), or *Osmunda cinnamomea* (cinnamon fern), and farther south (in North Carolina) by *Chasmanthium laxum* (slender spikegrass). *Polygonum pennsylvanicum* (Pennsylvania smartweed) may also occur. On Assateague Island National Seashore, *Pinus taeda* (loblolly pine) dominates the canopy, with occasional *Acer rubrum* (red maple). *Smilax rotundifolia* (roundleaf greenbrier) is the strongly dominant vine of the understory, with lesser amounts of *Toxicodendron radicans* (eastern poison-ivy) and *Parthenocissus quinquefolia* (Virginia creeper). *Morella cerifera* (wax-myrtle) is also a minor component of this vegetation. *Phragmites australis* (common reed), *Rubus argutus* (southern blackberry), *Panicum virgatum* (switchgrass), and *Polygonum pennsylvanicum* (Pennsylvania smartweed) also occur within this community on Assateague Island National Seashore.

Characteristic Species: *Morella cerifera* (wax-myrtle)

Management Concerns: As a community in large part restricted to barrier islands, it is faced with threats to barrier islands in general: intense development pressures where it remains unprotected. *Phragmites australis* (common reed) occasionally occurs in this community.

Reference Sites: Prime Hook, DE; Dias Creek NWR, NJ; Mad Horse Creek WMA, NJ; Timber Creek, NJ

Global and State Conservation Ranks and Reasons: G3 (31-Jan-2005). DE: SNR, NJ: S1?. This community is restricted to barrier islands and coastal areas of the mainland that are directly influenced by the maritime climate. The range is restricted and includes coastal areas from Cape May, New Jersey, to northern North Carolina.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.684829

References: Bartgis 1986, Bratton and Davison 1987, Breden et al. 2001, Brush et al. 1980, Eastern Ecology Working Group n.d., Eyre 1980, Fleming et al. 2001, Harrison 2004, Higgins et al. 1971, Hill 1986, Schafale 2000, Schafale and Weakley 1990, Shreve et al. 1910

| MOST ABUNDANT SPECIES | | |
|-----------------------|------------------------------|--|
| STRATUM | LIFEFORM | SPECIES |
| Tree canopy | Needle-leaved tree | <i>Pinus taeda</i> (loblolly pine) |
| Tall shrub/sapling | Broad-leaved evergreen shrub | <i>Morella cerifera</i> (wax-myrtle) |
| Herb (field) | Vine/Liana | <i>Smilax glauca</i> (whiteleaf greenbrier) |
| Herb (field) | Vine/Liana | <i>Smilax rotundifolia</i> (roundleaf greenbrier) |
| Herb (field) | Vine/Liana | <i>Toxicodendron radicans</i> (eastern poison-ivy) |
| Herb (field) | Fern or fern ally | <i>Osmunda cinnamomea</i> (cinnamon fern) |
| Herb (field) | Fern or fern ally | <i>Osmunda regalis</i> (royal fern) |

COASTAL PITCH PINE / SCRUB OAK BARREN

Pinus rigida / *Quercus ilicifolia* / *Morella pennsylvanica* Woodland

Range: This community occurs in coastal areas of Massachusetts, Rhode Island, New York, and New Jersey.

Environmental Description: This community includes pine barrens in the North Atlantic Coast ecoregion characterized by droughty, fire-prone vegetation, sandy soils and maritime influence.

Vegetation Description: *Pinus rigida* (pitch pine) is strongly dominant in the canopy. *Quercus ilicifolia* (bear oak) forms a dense, 1- to 2-m tall shrub layer with occasional *Quercus prinoides* (dwarf chinquapin oak). Dwarf-shrubs, such as *Gaylussacia baccata* (black huckleberry), *Morella pensylvanica* (northern bayberry), *Vaccinium pallidum* (hillside blueberry), and *Vaccinium angustifolium* (northern lowbush blueberry), intermingle with the tall shrubs. Herbs tend to be sparse, although more open areas may support patches of *Schizachyrium scoparium* (little bluestem) and *Deschampsia flexuosa* (wavy hairgrass), or *Carex pensylvanica* (Pennsylvania sedge) and *Carex swanii* (swan's sedge). Additional scattered herbs include *Comptonia peregrina* (sweet-fern), *Pteridium aquilinum* (bracken fern), *Gaultheria procumbens* (wintergreen), and *Arctostaphylos uva-ursi* (bearberry). Diagnostic characteristics include the presence of *Morella pensylvanica* (northern bayberry) to indicate coastal setting. In New Jersey, *Morella pensylvanica* (northern bayberry) occurs more in the Atlantic coastal areas, but this type also occurs inland and lacks the local maritime influence.

Characteristic Species: *Morella pensylvanica* (northern bayberry)

Dynamics/Successional Trajectory: These are fire-maintained systems.

Reference Sites: Brendan Byrne SF, NJ

Global and State Conservation Ranks and Reasons: G3 (1-Dec-1997). NJ: SNR.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.688963

References: Breden et al. 2001, Eastern Ecology Working Group n.d., Lundgren et al. 2000, Motzkin and Foster 2002, Rawinski 1984, Swain and Kearsley 2001

| MOST ABUNDANT SPECIES | | |
|------------------------------|------------------------------|--|
| STRATUM | LIFEFORM | SPECIES |
| Shrub/sapling (tall & short) | Broad-leaved deciduous shrub | <i>Quercus ilicifolia</i> (bear oak) |
| Short shrub/sapling | Broad-leaved evergreen shrub | <i>Morella pensylvanica</i> (northern bayberry) |
| Herb (field) | Graminoid | <i>Schizachyrium scoparium</i> (little bluestem) |

INLAND DUNE RIDGE FOREST

Pinus virginiana - *Quercus falcata* - *Carya pallida* Forest

Range: This association is currently described for the central Atlantic Coastal Plain, from New Jersey, Delaware, Maryland, and Virginia. It occurs in the New Jersey portion of the Delaware Estuary and possibly the Delaware portion.

Environmental Description: This xeric pine forest occurs on inland sand dune ridges and sandy loam soils at the edge of the Pine Barrens.

Vegetation Description: *Pinus virginiana* (Virginia pine) is codominant with a variety of oak species, including *Quercus falcata* (southern red oak), *Quercus alba* (white oak), *Quercus stellata* (post oak), and *Quercus velutina* (black oak). *Carya pallida* (sand hickory) and *Carya alba* (mockernut hickory) can also occur. Other canopy and subcanopy associates may include *Sassafras albidum* (sassafras), *Pinus taeda* (loblolly pine), *Quercus prinus* (chestnut oak), *Quercus marilandica* (blackjack oak), *Prunus serotina* (black cherry), *Cornus florida* (flowering dogwood), *Nyssa sylvatica* (blackgum), and *Diospyros virginiana* (eastern persimmon). The shrub layer may include *Gaylussacia frondosa* (dangleberry), *Ilex opaca* (American holly), *Vaccinium pallidum* (hillside blueberry), *Gaylussacia baccata* (black huckleberry), *Kalmia angustifolia* (sheep laurel), *Comptonia peregrina* (sweet-fern), and *Vaccinium stamineum* (deerberry). The herbaceous layer is generally sparse but is more abundant in openings. Characteristic herbs may include *Cypripedium acaule* (pink lady's-slipper), *Carex nigromarginata* (black-edge sedge), *Carex albicans* (white-tinge sedge), *Carex albicans* var. *emmonsii* (emmons' sedge), *Tephrosia virginiana* (goat's-rue), *Dichanthelium commutatum* (variable rosette grass), *Dichanthelium ovale* (eggleaf rosette grass), *Chimaphila maculata* (striped pipsissewa), *Melampyrum lineare* (narrowleaf cow-wheat), and

Mitchella repens (partridgeberry). Less frequent species may include *Baptisia tinctoria* (yellow wild indigo), *Lupinus perennis* (wild lupine), *Pteridium aquilinum* (bracken fern), *Chimaphila umbellata* (prince's-pine), *Monotropa uniflora* (Indian-pipe), and *Desmodium strictum* (pineland tick-trefoil). Lichens of the genera *Cladonia* (cup lichen) and *Cladina* (reindeer lichen) are common. Vines such as *Smilax glauca* (whiteleaf greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), *Parthenocissus quinquefolia* (Virginia creeper), and *Vitis rotundifolia* (muscadine) are common at low cover.

Characteristic Species: *Pinus virginiana* (Virginia pine)

Reference Sites: Unexpected Refuge, Maurice River, NJ; potentially Cape Henlopen, DE

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

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.683939

References: Bartgis 1986, Berdine 1998, Bowman 2000, Breden et al. 2001, Clancy 1996, Eastern Ecology Working Group n.d., Fleming et al. 2001, Harrison 2004, Harrison pers. comm., Windisch pers. comm.

| MOST ABUNDANT SPECIES | | |
|-----------------------|------------------------------|---|
| STRATUM | LIFEFORM | SPECIES |
| Tree canopy | Needle-leaved tree | <i>Pinus virginiana</i> (Virginia pine) |
| Tree canopy | Broad-leaved deciduous tree | <i>Quercus alba</i> (white oak) |
| Tree canopy | Broad-leaved deciduous tree | <i>Quercus falcata</i> (southern red oak) |
| Short shrub/sapling | Broad-leaved deciduous shrub | <i>Gaylussacia frondosa</i> (dangleberry) |

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: The community occurs on a restricted habitat, on back dunes protected from the direct influence of wind and salt spray. 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.

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) |

LOWER NEW ENGLAND RED MAPLE - BLACKGUM SWAMP

Acer rubrum / *Rhododendron viscosum* - *Clethra alnifolia* Forest

Range: This type includes red maple basin swamps of Lower New England and adjacent areas. It occurs in the New Jersey portion of the Delaware Estuary.

Environmental Description: These swamps occur in poorly drained depressions characterized by acidic, tannic water that does not receive substantial nutrient input from overland flow or groundwater seepage. The soils are comprised of peat.

Vegetation Description: *Acer rubrum* (red maple) dominates the canopy. Other common species that generally occur in low abundance include *Betula alleghaniensis* (yellow birch), *Fraxinus* (ash) spp., *Ulmus americana* (American elm), and *Nyssa sylvatica* (blackgum). The shrub layer is well-developed and often dense. *Vaccinium corymbosum* (highbush blueberry) and *Ilex verticillata* (common winterberry) are common and abundant. *Clethra alnifolia* (coastal sweet-pepperbush), *Alnus incana* (speckled alder), *Lindera benzoin* (northern spicebush), *Viburnum dentatum* (southern arrow-wood), *Viburnum nudum* var. *cassinoides* (northern wild raisin), *Spiraea alba* var. *latifolia* (broadleaf meadowsweet), *Rosa palustris* (swamp rose), and *Rhododendron viscosum* (swamp azalea) are frequent but less abundant, and on the Atlantic Coastal Plain *Ilex glabra* (inkberry or little gallberry), *Rhododendron maximum* (great laurel), and *Leucothoe racemosa* (swamp doghobble) may also be present. The herbaceous layer has scattered herbs and commonly includes *Osmunda cinnamomea* (cinnamon fern), *Symplocarpus foetidus* (skunk-cabbage), *Thelypteris palustris* (eastern marsh fern), *Dryopteris cristata* (crested woodfern), *Lycopus uniflorus* (northern bugleweed), *Impatiens capensis* (orange jewelweed), *Carex folliculata* (northern long sedge), *Carex stricta* (tussock sedge), *Carex intumescens* (greater bladder sedge),

Osmunda regalis (royal fern), and *Onoclea sensibilis* (sensitive fern). Hummock-and-hollow microtopography is evident; tree seedlings and upland species occur on the hummocks, including *Coptis trifolia* (threeleaf goldthread) (a northern affiliate in NJ), *Aralia nudicaulis* (wild sarsaparilla), *Trientalis borealis* (starflower), and *Gaultheria procumbens* (wintergreen). *Sphagnum* (peatmoss) mosses are dominant or abundant in hollows and at the bases of hummocks. This community is differentiated from *Acer rubrum* - *Nyssa sylvatica* - *Betula alleghaniensis* / *Sphagnum* spp. Forest (CEGL006014), that occurs in Pennsylvania's portion of the estuary, by the absence or low abundance of *Nyssa sylvatica* (blackgum) and *Picea rubens* (red spruce).

Characteristic Species: *Acer rubrum* (red maple), *Ilex verticillata* (common winterberry), *Vaccinium corymbosum* (highbush blueberry)

Dynamics/Successional Trajectory: These are poorly drained basins with acidic, nutrient-poor peat soils. There is little overland flow or groundwater contribution to the water budget.

Reference Sites: Brendan Byrne State Forest, NJ

Global and State Conservation Ranks and Reasons: GNR (1-Dec-1997). NJ: S4S5.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.689957

References: Breden 1989, Breden et al. 2001, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Golet et al. 1993, Metzler and Barrett 1996, Metzler and Barrett 2001, Rawinski 1984, Reschke 1990, Sperduto 2000a, Swain and Kearsley 2000, Thompson and Jenkins 1992

| MOST ABUNDANT SPECIES | | |
|------------------------------|------------------------------|--|
| STRATUM | LIFEFORM | SPECIES |
| Tree canopy | Broad-leaved deciduous tree | <i>Acer rubrum</i> (red maple) |
| Tree subcanopy | Broad-leaved deciduous tree | <i>Betula alleghaniensis</i> (yellow birch) |
| Tree subcanopy | Broad-leaved deciduous tree | <i>Quercus bicolor</i> (swamp white oak) |
| Tree subcanopy | Broad-leaved deciduous tree | <i>Ulmus americana</i> (American elm) |
| Shrub/sapling (tall & short) | Broad-leaved deciduous shrub | <i>Ilex verticillata</i> (common winterberry) |
| Shrub/sapling (tall & short) | Broad-leaved deciduous shrub | <i>Vaccinium corymbosum</i> (highbush blueberry) |
| Herb (field) | Forb | <i>Symplocarpus foetidus</i> (skunk-cabbage) |
| Herb (field) | Fern or fern ally | <i>Osmunda cinnamomea</i> (cinnamon fern) |

MARITIME HOLLY FOREST

Ilex opaca / *Morella pensylvanica* Forest

Range: This association is currently only known from New Jersey and Long Island, New York.

Environmental Description: This sunken forest occurs in hollows leeward of maritime backdunes where they are protected from tidal overwash and salt spray except during severe storms and hurricanes. Substrate is generally sandy loam over coarse sand with local pockets of peat. This forest also occurs in Cape May County, New Jersey, on the sheltered Delaware Bayshore where many of the tree canopy species are old-growth.



Photo by Kathleen Strakosch Walz

Vegetation Description: The dominant tree is *Ilex opaca* (American holly); stems can be 300 years old. Other canopy associates include *Amelanchier canadensis* (Canada serviceberry), *Sassafras albidum*

(sassafras), *Quercus stellata* (post oak), *Quercus velutina* (black oak). Characteristic shrubs include *Morella pensylvanica* (northern bayberry), *Gaylussacia baccata* (black huckleberry), and *Vaccinium corymbosum* (highbush blueberry). *Sambucus canadensis* (American elder), *Viburnum dentatum* (southern arrow-wood), and *Toxicodendron vernix* (poison-sumac) can occur infrequently. Vines are particularly abundant and include *Toxicodendron radicans* (eastern poison-ivy), *Smilax rotundifolia* (roundleaf greenbrier), *Parthenocissus quinquefolia* (Virginia creeper), and *Vitis* (grape) spp. The herbaceous layer is sparsely to moderately developed and includes *Aralia nudicaulis* (wild sarsaparilla), *Maianthemum stellatum* (starflower false Solomon's-seal), and *Maianthemum canadense* (Canada mayflower). In locally wetter, boggy areas within the forest *Nyssa sylvatica* (blackgum), *Rhododendron viscosum* (swamp azalea), *Vaccinium corymbosum* (highbush blueberry), *Photinia melanocarpa* (black chokeberry), *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern), and *Thelypteris palustris* (eastern marsh fern) occur abundantly.

Characteristic Species: *Gaylussacia baccata* (black huckleberry), *Ilex opaca* (American holly), *Morella pensylvanica* (northern bayberry), *Vaccinium corymbosum* (highbush blueberry)

Dynamics/Successional Trajectory: This is a late-successional expression of wet-mesic forest that develops behind protected maritime dunes. Reproduction is vegetative, not via seeds (Art 1976). On Sandy Hook, in New Jersey, the holly forest occurs just inland from a salt marsh.

Management Concerns: Deer browsing affects the shrub and herb layers of sunken forests more than canopy composition decreasing overall species diversity (Art 1992).

Reference Sites: Cape May Point, NJ; Higbee Beach, NJ

Global and State Conservation Ranks and Reasons: G1 (1-Mar-2002). NJ: S1.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.687104

References: Art 1976, Art 1987, Art 1992, Breden et al. 2001, Chrysler 1930, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Greller 1977, Reschke 1990, Sirkin 1972, Sneddon and Lundgren 2001, Stalter 1979

| MOST ABUNDANT SPECIES | | |
|------------------------------|------------------------------|--|
| STRATUM | LIFEFORM | SPECIES |
| Tree canopy | Broad-leaved evergreen tree | <i>Ilex opaca</i> (American holly) |
| Shrub/sapling (tall & short) | Vine/Liana | <i>Toxicodendron radicans</i> (eastern poison-ivy) |
| Short shrub/sapling | Broad-leaved deciduous shrub | <i>Gaylussacia baccata</i> (black huckleberry) |
| Short shrub/sapling | Broad-leaved evergreen shrub | <i>Morella pensylvanica</i> (northern bayberry) |
| Herb (field) | Forb | <i>Aralia nudicaulis</i> (wild sarsaparilla) |

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) |

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* (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 greenei* (greene'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.



Photo by Kathleen Strakosch Walz

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) |

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) |

SUCCESSIONAL MARITIME FOREST

Prunus serotina - *Sassafras albidum* - *Amelanchier canadensis* - *Quercus velutina* / *Smilax rotundifolia*
Forest

Range: The range of this community is from southern New Hampshire to New Jersey, but it is restricted to the New Jersey and possibly the Delaware coasts in the Delaware Estuary.

Environmental Description: This association occurs most often on stabilized backdunes, generally leeward of secondary dunes or in protected hollows. It also occurs on bluffs or in more interior coastal areas. It is subject to varying degrees of wind and salt spray. Soils are coarse, well-drained sand subject to considerable shifting during coastal storms, or till and sand deposits of terminal moraines.

Vegetation Description: This association is generally a maritime forest or scrub forest, although physiognomy can vary considerably. Trees found in this community are usually stunted and flat-topped; the canopy may be only 3-7 m tall. Dominant trees vary locally but often include *Prunus serotina* (black cherry), *Sassafras albidum* (sassafras), and *Amelanchier canadensis* (Canada serviceberry), with admixtures of *Pinus rigida* (pitch pine), *Juniperus virginiana* (eastern red-cedar), *Acer rubrum* (red maple), *Amelanchier stolonifera* (running serviceberry), and in southern occurrences *Quercus coccinea* (scarlet oak), *Quercus falcata* (southern red oak), and/or *Ilex opaca* (American holly). Additional shrub species may also contribute substantially to the canopy and include *Vaccinium corymbosum* (highbush blueberry), *Morella pensylvanica* (northern bayberry), *Gaylussacia baccata* (black huckleberry), *Viburnum recognitum* (northern arrow-wood), *Viburnum dentatum* (southern arrow-wood), and *Rosa virginiana* (Virginia rose). A true shrub layer is generally not present. Lianas are common and can be dense in the canopy or in the ground layer; species include *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison-ivy), *Smilax rotundifolia* (roundleaf greenbrier), and *Smilax glauca* (whiteleaf greenbrier). The understory is generally sparse with tree or vine seedlings plus herbaceous species including *Aralia nudicaulis* (wild sarsaparilla), *Moehringia lateriflora* (grove sandwort), *Maianthemum stellatum* (starflower false Solomon's-seal) and *Maianthemum canadense* (Canada mayflower).

Characteristic Species: *Amelanchier canadensis* (Canada serviceberry), *Prunus serotina* (black cherry), *Sassafras albidum* (sassafras), *Smilax rotundifolia* (roundleaf greenbrier)

Dynamics/Successional Trajectory: This association occupies a transitional zone between dune grasslands or low dune shrublands and maritime forest. Physiognomy is highly variable depending on degree of exposure to wind and salt spray and depending on the overall height of the surrounding dunes.

Management Concerns: Several invasive species can be prevalent in this association, including *Lonicera morrowii* (Morrow's honeysuckle), *Lonicera japonica* (Japanese honeysuckle), *Ligustrum vulgare* (European privet), *Berberis vulgaris* (European barberry), and *Celastrus orbiculata* (Asian bittersweet). Northeastern coastal areas in general are under significant threat from housing development.

Reference Sites: Cape May Point, NJ

Global and State Conservation Ranks and Reasons: G2G3 (22-Oct-1997). DE?: SNA, NJ: S1S2. This maritime forest community is restricted in range to the coastal areas of six northeastern states. Average occurrence size is estimated to be 20-100 acres, but many are substantially below this in size. The potential habitat of this community is naturally restricted to areas directly affected by maritime processes, e.g. salt spray and winds.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.684643

References: Art 1987, Bellis 1992, Breden 1989, Breden et al. 2001, Burk 1968, Dowhan and Rozsa 1989, Dunlop and Crow 1985, Eastern Ecology Working Group n.d., Edinger et al. 2002, Greller 1977, Martin 1959b, McDonnell 1979, Metzler and Barrett 2001, Rawinski 1984, Reschke 1990, Sperduto 1997b, Stalter 1979, Svenson 1970, Swain and Kearsley 2001

| 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>Quercus velutina</i> (black oak) |
| 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) |