

MARITIME EVERGREEN FOREST (MID-ATLANTIC SUBTYPE)

Concept: Maritime Evergreen Forests are evergreen hardwood-pine forests of barrier islands and coastal spits. Salt spray is a major environmental factor in these communities, and its influence generally is indicated by a distinctively streamlined canopy form. The vegetation is dominated by some combination of *Quercus virginiana*, *Quercus hemisphaerica*, *Pinus taeda*, and *Juniperus silicicola*. The Mid-Atlantic Subtype covers most of the maritime forests in North Carolina, where deciduous canopy trees are largely absent and where more southerly species, primarily *Sabal palmetto*, are absent.

Distinguishing Features: The Maritime Evergreen Forest type is distinguished from all other communities by the combination of evergreen forest vegetation with a canopy greater than 5 meters tall and location on a barrier island or comparable coastal spit. Examples usually have a compact, streamlined, salt-pruned canopy, though those dominated by *Juniperus* may not. Deciduous trees are largely absent, and the characteristic evergreen trees listed above make up most of the canopy in varying abundance. Maritime Evergreen Forest is distinguished from Marsh Hammock by having a broader set of the characteristic species, by generally having a streamlined canopy, and by the general absence of marsh and shade-intolerant herbs. It also occurs in a different setting, on barrier island interiors rather than on small raised patches within salt marshes.

These communities are periodically subject to heavy disturbance by hurricanes. Hard-hit examples may take some years to recover a closed canopy but should be classified as Maritime Evergreen Forest unless major erosion has changed the environment so that forests cannot recover.

The South-Atlantic Subtype is distinguished from the Mid-Atlantic Subtype in North Carolina by the presence of *Sabal palmetto*, though that species may have limited cover. In North Carolina the subtypes can be distinguished geographically, with the southern range limit of the Mid-Atlantic Subtype north of the Smith Island complex, where the northern range limit of *Sabal palmetto* occurs. However, both subtypes apparently occur in South Carolina.

Synonyms: *Quercus virginiana* - *Quercus hemisphaerica* - *Pinus taeda* / *Persea palustris* - *Ilex vomitoria* Forest (CEGL007027).

Ecological Systems: Central Atlantic Coastal Plain Maritime Forest (CES203.261).

Sites: Maritime Evergreen Forests occur on barrier islands and coastal spits, on stabilized dunes and flats protected from salt water flooding and from the most extreme salt spray. Most examples are limited to wider barrier islands with substantial dune development.

Soils: Most examples are mapped as Newhan or Fripp series (Typic Quartzipsamments), some as Corolla (Aquic Quartzipsamment) or Duckston (Typic Psammaquent), or a few as other sandy Entisols.

Hydrology: Hydrology is typical of the theme as a whole, ranging from apparently xeric to mesic. Salt spray is significant enough to shape the canopy and to exclude many plant species but is less extreme than that in Maritime Shrub.

Vegetation: Vegetation is generally a closed forest with a dense canopy, though the canopy may be open in recently disturbed examples and in newly developed examples. The canopy is composed of varying combinations of *Quercus virginiana*, *Quercus hemisphaerica*, *Pinus taeda*, and *Juniperus silicicola*. All have fairly high constancy and any may dominate. Usually no other canopy trees are present, but occasional *Diospyros virginiana*, *Prunus serotina*, *Carya glabra*, *Xanthoxylum clava-herculis*, or species of the understory may occur. Frequent understory species in CVS plot data and site descriptions include *Persea palustris*, *Cartrema americana*, and possibly *Persea borbonia*, *Prunus caroliniana*, *Ilex opaca*, *Carpinus caroliniana*, and *Cornus florida*, as well as species also in the canopy. The shrub layer ranges from sparse under dense canopy to very dense where the canopy is open. *Ilex vomitoria* is almost always present and usually dominant. Saplings of oaks and of understory species may also be dense, and *Morella cerifera*, *Baccharis halimifolia*, or *Rhus copallinum* may be abundant in more open or recently developed examples. *Callicarpa americana* and *Hypericum hypericoides* are often present in small numbers. Vines are usually abundant, covering the ground in dense forest but sometimes draping the trees where the canopy has been disturbed. *Muscadinia rotundifolia* var. *rotundifolia*, *Toxicodendron radicans*, *Smilax bona-nox*, *Smilax auriculata*, *Smilax rotundifolia*, and *Parthenocissus quinquefolia* are the most frequent and abundant. *Berchemia scandens* also is frequent in plot data, and *Bignonia capreolata*, *Gelsemium sempervirens*, and *Nekemias arborea* are frequently observed. The herb layer is sparse to moderate in density. Plot data shows few herbs, with *Galium bermudense*, *Dichantheium commutatum*, and various other *Dichantheium* most frequent. Other species observed to be abundant in some examples or present in many include *Mitchella repens*, *Piptochaetium avenaceum*, *Asplenium platyneuron*, *Chasmanthium laxum*, *Chasmanthium sessifolium*, *Scleria flaccida*, and *Oplismenus setarius*. *Tillandsia usneoides* is sometimes abundant as an epiphyte. In open examples or examples transitional to wetter communities, additional species such as *Sporobolus pumilus* (*Spartina patens*), *Hydrocotyle bonariensis*, *Uniola paniculata*, or even *Juncus roemerianus* may be present.

Range and Abundance: Ranked G2. North Carolina examples are scattered along the coast from the Virginia line southward to the Carolina Beach area, with a few examples on exposed islands in brackish or salt water sounds. This subtype ranges into southern Virginia. It is replaced by the South Atlantic Subtype from Bald Head Island southwestward in North Carolina. See the discussion below about areas farther south.

Associations and Patterns: Maritime Evergreen Forest usually grades into Maritime Shrub at more exposed seaward edges. However, it may abruptly border Dune Grass or Maritime Grassland on the seaward edge, and often borders them on other edges. It may grade to Salt Shrub and various marsh communities on the landward side of islands. Maritime Evergreen Forest may also grade to Maritime Swamp Forest, Maritime Shrub Swamp, or Interdune Pond in wet swales.

Variation: Wentworth, et al. (1990), analyzing woody stem data in the early CVS plots, found the most fundamental division to be between forests dominated by *Quercus virginiana* and *Quercus hemisphaerica* and those dominated by *Pinus taeda*. Medford's (2018) analysis of cover data in CVS plots recognized a different configuration of three major divisions within the range of Maritime Evergreen Forest vegetation, though not all were called by that name. One consists of plots dominated by *Quercus virginiana* or *Juniperus silicicola*, another by *Quercus hemisphaerica* or *Pinus taeda*. The third major group consisted of plots dominated by *Quercus virginiana* and

Pinus taeda with more limited species richness, all from the Currituck Banks. Subdivisions within the first two groups also show a strong geographic signal, with most of the plots from one location (Bogue Banks, Buxton Woods) clustering together. Other subdivisions reflected plots transitional to Maritime Shrub or Maritime Wet Grassland.

Because the distribution of maritime forests is discontinuous, and because natural and human disturbance history is confounded with geographic location, it is unclear how many of these differences are useful for classification. Dominance by pines is problematic for differentiating subtypes because, though relatively less tolerant of salt spray, their abundance can change drastically and persistently in response to single disturbances. Nevertheless, a division based on apparent primary successional age may be useful, and recognition of the most striking geographic break seems warranted. Based on this three variants are recognized:

1. Northern Variant includes the examples on Currituck Banks. They have more *Diospyros virginiana* and *Prunus serotina*, in common with maritime forests farther north, while lacking some of the southern species such as *Prunus caroliniana*.
2. Live Oak–Red Cedar Variant includes forests south of the Currituck Banks heavily dominated by *Quercus virginiana* or *Juniperus silicicola*, generally lacking pines and *Quercus hemisphaerica*, which tend to occur in more exposed or successional younger areas.
3. Laurel Oak–Pine Variant includes forests south of Currituck Banks with substantial *Quercus hemisphaerica* or *Pinus taeda*. *Quercus virginiana* may also be abundant, but only rarely is *Juniperus silicicola* important. This variant occurs in areas that are more sheltered or farther from the ocean and are generally later in primary succession.

Dynamics: The dynamics of this subtype are similar to the theme as a whole, especially the barrier island portion of it. Salt spray is an important factor in excluding many species, as well as in shaping the canopy.

Storm disturbance can create long-lasting changes in composition, as can historical land use. This is exemplified by Buxton Woods. Brown (1959) described it as being dominated by *Quercus virginiana* and *Pinus taeda*, but selective logging of *Quercus virginiana* as early as the 1700s (Bratton and Davison 1987) had reduced the abundance of that species and increased the pine. Brown (1959) noted that the forest was being logged. When sampled by CVS in 1988, the forest was strongly dominated by *Pinus taeda*, with an understory dominated by *Quercus hemisphaerica*. A hurricane later killed most of the pines through breakage and salt spray, leaving a shorter canopy dominated by *Quercus hemisphaerica*. Despite its greater tolerance to the salt spray that apparently killed most of the pines, *Quercus virginiana* remained a small component. Accretion of the island and concomitant increasing shelter from chronic salt spray may have changed the environment enough that it is now more favorable to *Quercus hemisphaerica*. The dramatic changes documented at Bull Island in South Carolina (Helm, et al. 1991, Conner et al. 2005), with a shift from pine dominance to oak in response to a hurricane but perhaps also in response to ongoing beach erosion, also illustrate the potential dynamics of maritime forests, though that site is the South Atlantic Subtype rather than the Mid-Atlantic Subtype. More general observations suggest that effects of storm disturbance can vary, sometimes increasing pines, sometimes decreasing them. Storms can also leave forests with broken canopies and dominance by understory

species for many years. Human disturbance such as logging or clearing usually leads to pine dominance, often initially with little understory and with dense tangles of vines.

Maritime Evergreen Forests can potentially develop quickly from Maritime Shrub if an area becomes more sheltered, with stunted trees growing to forest stature. More often, it seems to occur gradually through a process of scattered trees coalescing into more continuous canopy. It may be that common processes of primary succession, such as accumulation of nutrients and soil organic matter and amelioration of the environment by vegetation, are needed to facilitate forest development. It may also be that in environments that are only marginally suitable for this community, tree establishment is a rare event, leaving the closure of the canopy to occur through vegetative spread rather than extensive establishment from seed. The first trees to establish seem to be *Juniperus silicicola* or *Quercus virginiana*, the most salt-tolerant trees, with *Pinus taeda* and *Quercus hemispherica* appearing later.

Maritime Evergreen Forests are very susceptible to alterations in wind flow patterns, because of the effect on salt spray deposition. Breaks in the canopy can potentially create eddies that concentrate salt spray deposition and lead to death of trees around the opening. Loss of the Maritime Shrub community on the seaward edge of the forest can lead to canopy death or severe salt-pruning, effectively turning part of the forest into a new Maritime Shrub edge. This was documented by Lopazanski (1987) on Bogue Banks and can be observed in other developed areas.

Comments: This subtype is what most people think of as the typical maritime forest in North Carolina. It was the primary focus of the early ecological studies such as Wells and Shunk (1931), Wells (1939), Bordeau and Oosting (1959), and Brown (1959), as well as the primary focus of most later studies.

With their restriction to the most stable, sheltered parts of barrier islands, these communities have always been very limited in extent. This sheltered environment has long been the focus of habitation and other human activities on the islands, and the destruction of maritime forests by development accelerated in the late 1900s. While some developments were created with efforts to minimize clearing and to retain the forest canopy, the creation of numerous small clearings for houses will probably have far-reaching effects on the dynamics of the forests.

The range and ecology of this subtype south of North Carolina is somewhat unclear. In North Carolina, it is distinguished by the absence of more southern species such as *Sabal palmetto* and represents a latitudinal shift in communities. However, the corresponding NVC association is attributed to South Carolina and questionably to Georgia, within the range of these southern species. Some South Carolina plots were clustered with the North Carolina plots for this subtype in the Medford (2018) analysis. The low cover of the indicator species may make recognition in plot data difficult; however, some barrier islands in South Carolina apparently have maritime forests resembling this subtype, lacking *Sabal palmetto*, *Pinus elliottii*, and other southern species. The distinction between subtypes may thus be ecological as well as biogeographic.

Pinus taeda / *Hudsonia tomentosa* Woodland (CEGL006052) is an open maritime forest described from southeasternmost Virginia. Comparable vegetation may occur on the Currituck Banks, but none is known. Maritime Forests on the Currituck Banks tend to be more open than farther south,

and have openings containing *Hudsonia tomentosa*, but have more *Quercus virginiana*. They are considered part of this Maritime Evergreen Forest community. However, interpretation is confused by the tendency of pines to increase in examples that have been artificially cleared in the past.

Pinus taeda - *Quercus (falcata, nigra)* / *Morella cerifera* / *Vitis rotundifolia* Forest (CEGL006040) is another pine-dominated open forest that occurs in maritime areas of Virginia. No natural vegetation of this kind is believed to exist in North Carolina, though it appears more closely related to Maritime Deciduous Forest than Maritime Evergreen Forest.

Rare species: Vascular plants: *Asplenium platyneuron* var. *bacculum-rubrum*, *Cyperus tetragonus*, *Erythrina herbacea*, *Hudsonia tomentosa*, *Iresine rhizomatosa*, *Listera australis*, *Parietaria floridana*, *Parietaria praetermissa*, *Sabal palmetto*, *Sageretia minutiflora*, *Sideroxylon lycioides*, *Sideroxylon tenax*; nonvascular plants: *Cheilolejeunea rigidula*, *Lejeunea dimorphophylla*, *Syrrophodon incompletus*, *Teloschistes flavicans*.

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