

14900

Gulf and Atlantic Coastal Plain Tidal Marsh Systems

BpS Model/Description Version: Aug. 2020

Update: 6/22/2018

Modelers		Reviewers	
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Vegetation Type

Herbaceous Wetland

Map Zones

65, 66

Model Splits or Lumps

This biophysical setting (BpS) is lumped with: 1491

Geographic Range

This model covers map zone (MZ)65, the coastal Northeast from Long Island to the New Hampshire border. These systems, as broadly defined by NatureServe (2007) are found along the tidal reaches of the Gulf and Atlantic coastal plains from southern Maine to Texas.

Biophysical Site Description

Diurnally to irregularly flooded flats and shores along edges of estuaries, sheltered marine waters and tidal rivers, where salinity is sufficient, at least periodically, to restrict the vegetation to species tolerant of salt.

Vegetation Description

New England salt marshes have predominantly developed in glaciated coastal areas over the last few thousand years during a period of slowly rising local sea levels. Gradual accumulation of sediments in tidal basins has produced extensive tidal flats, often located at an elevation such that significant areas of marsh are inundated by tidal activity at frequencies that vary from twice daily to twice monthly (in association with the spring tides under the full and new moons).

Typical New England salt marshes show strong vegetation patterns with elevation and water chemistry, but these patterns can be obscured by human activity, microtopographic variation, or natural disturbance.

The elevations low enough to enable daily or almost daily inundation may support little more than *S. alterniflora*, sometimes with a sparse understory of aquatic macroalgae (*Ulva*, *Fucus*) and scattered forbs. Typically, a narrow band of *S. alterniflora* occurs along the banks of tidal channels, especially developing on the slumping banks and developing point bars of meandering channel forms. These plants may reach a height of over 2m, although a height of 1m is more typical.

As marsh elevations increase to approximately the mean high water, *Spartina patens* becomes dominant, but *Distichlis spicata* and *S. alterniflora* are common. A raft of forb species begins to appear in this zone, such as *Plantago maritima*, *Solidago sempervirens*, and *Limonium carolinianum*. Several species of *Salicornia*, *Sueda*, and *Atriplex* are likely to be present as well, especially in areas where the dominant graminoids are less abundant.

Above mean high water, in areas inundated by the tides only on the highest tides during each monthly cycle, the dominant plant is *Juncus gerardii*. Other salt marsh graminoids and an increasingly diverse group of forbs may also be found in this zone, especially in *panne*, areas that retain water after the tides retreat, where a combination of nitrogen stress, waterlogged soils, and (to the south) episodic hypersaline conditions keep the dominants in check.

In a narrow transition zone from wetland to upland, one frequently finds a shrubby border of *Iva frutescens* and *Baccharis halimifolia*, often with *Panicum virgatum*, *Toxicodendron diversilobum*, and a variety of weedy saltmarsh forbs. This border is better developed and botanically more diverse towards the south of MZ65, frequently all but disappearing towards the north.

In New England, salt marshes are dominated by similar species over a broad range of salinities, but in the oligohaline environment, vegetation is sensitive to even small changes in water chemistry. As a result, the upland edges of many salt marshes, where runoff and groundwater affect local porewater salinities, support vegetation often associated with fresh or brackish marshes.

Vegetation in brackish marshes consists of herbaceous species, usually dominated by low graminoids such as salt meadow cordgrass (*Spartina patens*) and saltgrass (*Distichlis spicata*) toward the saline end of the salinity gradient or by taller species such as cattail (*Typha latifolia* and *Typha angustifolia*), giant cordgrass (*Spartina cynosuroides*), and sedges such as three-square (*Scoenoplectus americanus*; *Schoenoplectus pungens*) toward the oligohaline end. These species often occur as monospecific patches, but complex mixtures are not uncommon.

Succession:

Spartina alterniflora marshes diurnally flooded with seawater show little in the way of successional dynamics at timescales of management interest. Fire essentially does not occur, and few of the typical short-term disturbance mechanisms common in New England salt marshes affect these areas with any regularity. (Succession does occur in these wetlands over time periods sufficient to alter marsh elevations via trapping of fine sediments.)

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
JUGE	<i>Juncus gerardii</i>	Saltmeadow rush
DISP	<i>Distichlis spicata</i>	Inland saltgrass
SPPA	<i>Spartina patens</i>	Saltmeadow cordgrass
SPAL	<i>Spartina alterniflora</i>	Smooth cordgrass
BAHA	<i>Baccharis halimifolia</i>	Eastern baccharis
IVFR	<i>Iva frutescens</i>	Jesuit's bark

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

Disturbance Description

Fire is an infrequent form of disturbance in Northeastern salt marshes, although its frequency is slightly greater in the southern portion of the region than in the north (reflecting both lower tidal amplitudes and higher summer temperatures).

The most common natural disturbance processes documented in New England marshes include scour and vegetation removal by winter ice; mortality caused by deposition of rafts of dead marine and terrestrial vegetation, known locally as "wrack," which smothers existing vegetation; grazing by muskrats and Canada geese; and mortality of vegetation caused by infrequent development of hypersaline conditions in ponded areas.

Grazing is locally important, especially in the southern portion of the mapzone. Ice scour and wrack deposition are the dominant disturbances, especially to the north. For modeling purposes, all four of these non-fire disturbance types have been lumped together.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	503	100	5	1000
Moderate (Mixed)				
Low (Surface)				
All Fires	503	100		

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

Scale Description

Many disturbances in New England salt marshes are highly localized, operating at scales of just a few meters to a few tens of meters. Less frequent storm-driven disturbance events may affect larger areas, up to and including whole marshes but these events are rare in New England.

Adjacency or Identification Concerns

The predominant structuring environmental gradients for New England Salt marshes are related to salinity and elevation and inundation. These systems grade into a variety of other vegetation types with changes in elevation and salinity (freshwater tidal wetlands, nontidal forested wetlands, vegetated dune systems). However, changes in vegetation between salt marshes and other vegetation types are often abrupt, reflecting sharp changes in elevation at the edges of the marsh system.

Issues or Problems

Uncharacteristic vegetation now includes:

Marshes (typically oligohaline to mesohaline in character) invaded by Eurasian genotypes of *Phragmites australis*, with significant attendant loss of species diversity.

Wetlands altered by ditching. Ditching was originally carried out (late 1600s through early 1900s) to manage vegetation to improve forage quality for domestic animals and simplify harvesting of salt-marsh hay. It led to increased production of *Spartina patens* and *Juncus gerardii*, and reduction of structural and habitat complexity. Ditching was also implemented throughout much of the 20th century in an effort to reduce populations of mosquitoes and other biting insects. Few New England marshes entirely escaped this form of alteration.

Marshes altered by tidal restriction. Some New England wetlands were diked off from tidal waters, often to replace saline tidal wetlands with more productive agricultural lands. Construction of causeways to support roads and railroads has also isolated many wetlands from tidal influence. Reduction in tidal influence often reduces salinities and makes wetlands susceptible to invasion by *Phragmites*, or permits expansion of monotypic stands of *Typha*.

Recently, a poorly understood phenomenon known as sudden salt marsh dieback has been documented in numerous New England marshes. This is a syndrome in which large patches of *Spartina* (typically *S. alterniflora*) die, leaving bare substrate susceptible to erosion. Its causes remain unclear, although researchers are actively investigating a number of hypotheses, especially involving pests and pathogens. The old world variety of *Phragmites australis*, invading disturbed oligohaline marshes is probably the greatest threat to species diversity.

Rising sea level will greatly affect New England salt marshes. Rising sea levels will inundate existing marshes, while not producing an equivalent area of new marsh at higher elevations. Since many of today's extensive marshes developed on quaternary sedimentary deposits accumulated over several thousand years, rapid change in sea level will reduce wetland area.

In practice, the impact of changing sea levels is likely to be even greater because many existing salt marshes are bordered by developed land, and landowners are unlikely to simply cede their land back to the sea.

Sea level rise may also cause salt or brackish marshes to spread inland into freshwater, especially freshwater tidal marsh areas and convert low marsh into tidal flats.

Native Uncharacteristic Conditions

Comments

This model was developed by Curtis Bohlen starting from LANDFIRE model 5814900, developed by Cecil Frost and reviewed by Chris Szell. Bohlen initially developed separate models for high and low salt marshes, with somewhat different disturbance regimes (the low marsh succeeds back to its undisturbed state more quickly than the high marsh). North of Cape Cod (in most of MZs 65 and 66), it is unusual to have mappable areas of both types in the same marsh. As a result, the two zones probably cannot be mapped separately at the LANDFIRE scale, so both types were included in this model.

Succession Classes

Mapping Rules

[illegible]

Herb	0.5-1.0	UN	UN	UN	UN	UN	B	B	B	B	B
Herb	>1.0	UN	UN	UN	UN	UN	B	B	B	B	B
Shrub	0-0.5	C	C	C	C	C	UN	UN	UN	UN	UN
Shrub	0.5-1.0	C	C	C	C	C	UN	UN	UN	UN	UN
Shrub	1.0-3.0	C	C	C	C	C	UN	UN	UN	UN	UN
Shrub	>3.0	C	C	C	C	C	UN	UN	UN	UN	UN
Tree	0-5	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	5-10	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	10-25	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	25-50	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	>50	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN

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

Description

Class A 11 Early Development 1 - All Structures

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
SAVI	<i>Salicornia virginica</i>	Virginia glasswort	Upper
PLMA3	<i>Plantago maritima</i>	Goose tongue	Upper
ATPA4	<i>Atriplex patula</i>	Spear saltbush	Upper
GLMA	<i>Glaux maritima</i>	Sea milkwort	Upper

Description

A typically low-growing collection of mostly annual herbs that invades bare ground in salt marshes. *Salicornia* spp. can invade very quickly. The easily recognized low canopy of the reddish photosynthetic stems of *Salicornia* spp. is usually dominant for the first few months after disturbance, with other species becoming more both common and more obvious with time. Other species frequently found in recently disturbed areas of salt marsh include *Suaeda maritima*, *Salsola kali*, *Liimonium carolinianum*, *Triglochin maritima*, and *Distichlis spicata*. Species composition varies, apparently in response to differences in soil saturation, soil nutrient availability (especially nitrogen), and salinity.

Maximum Tree Size Class

None

Class B 16 Mid Development 1 - Open

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
DISP	<i>Distichlis spicata</i>	Inland saltgrass	Mid-Upper

SPAL	<i>Spartina alterniflora</i>	Smooth cordgrass	Mid-Upper
SPPA	<i>Spartina patens</i>	Saltmeadow cordgrass	Mid-Upper

Description

In the high marsh, the grass *Distichlis spicata*, which is a sub-dominant throughout the high marsh, invades open patches largely from their edges via rhizomes. After a few years it all but eliminates the annuals that first colonize bare soils in the marsh and forms dense, low stands. These stands may appear to contain nothing by *D. spicata*, but on close examination, they usually retain some remnant forbs. Other salt marsh grasses, especially *S. patens*, gradually increase in abundance until this community is replaced by typical high marsh vegetation.

In the low marsh, *Spartina alterniflora* is among the first species to recolonize disturbed areas. However, *Distichlis spicata* can survive in the low marsh environment. Recently disturbed sites thus may show an increase in the relative abundance of *D. spicata* in comparison to undisturbed low marsh. Abundance of *D. spicata* is highly variable.

Maximum Tree Size Class

None

Class C	73	Late Development 1 - Open
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
SPPA	<i>Spartina patens</i>	Saltmeadow cordgrass	Mid-Upper
JUGE	<i>Juncus gerardii</i>	Saltmeadow rush	Mid-Upper
SPAL	<i>Spartina alterniflora</i>	Smooth cordgrass	Mid-Upper
DISP	<i>Distichlis spicata</i>	Inland saltgrass	Mid-Upper

Description

The typical New England high salt marsh is dominated by either *Juncus gerardi* or *Spartina patens*, depending on elevation. *Distichlis spicata* is frequent minor constituents in the dominant graminoid matrix. Other frequent constituents include *Triglochin maritima*, *Glaux maritima*, *Plantago martima*, *Limonium carolinianum*, and *Solidago sempervirens*. Along the upland edge of this vegetation type, plant species diversity increases. The shrubs *Baccharis halimifolia* and *Iva frutescens* are abundant, as is Switchgrass, *Panicum virgatum*. Where freshwater runoff from adjacent uplands is significant, the wetland may be invaded by a variety of species more typical of freshwater wetlands, such as bulrushes (e.g. *Schoenoplectus robustus*, *Sch. Pungens*), cattails (*Typha latifolia*, *Typha angustifolia*), and sedges (*Carex paleacea*).

New England low marsh communities are dominated by a single vascular plant species: *S. alterniflora*. The plant can reach heights of over two meters, although heights close to one meter are more common. The low marsh environment is flooded too frequently for most vascular plants to survive. Vegetation may include some annuals and other forbs at low abundance, typically on (relatively) dry microsites such as adjacent to tidal channels. Marine algae, including

rockweeds (*Fucus* sp.), sea lettuce (*Ulva lactuca*) and filamentous algae (many species) may also be present. Other salt marsh grasses are present but uncommon.

Maximum Tree Size Class

None

Model Parameters

Deterministic Transitions

From Class	Begins at (yr)	Succeeds to	After (years)
Early1:ALL	0	Mid1:OPN	2
Mid1:OPN	3	Late1:OPN	5
Late1:OPN	6	Late1:OPN	999

Probabilistic Transitions

Disturbance Type	Disturbance occurs In	Moves vegetation to	Disturbance Probability	Return Interval (yrs)	Reset Age to New Class Start Age After Disturbance?	Years Since Last Disturbance
Replacement Fire	Early1:ALL	Early1:ALL	0.002	500	Yes	0
Optional 1	Early1:ALL	Early1:ALL	0.06	17	No	0
Replacement Fire	Mid1:OPN	Early1:ALL	0.002	500	Yes	0
Optional 1	Mid1:OPN	Early1:ALL	0.06	17	Yes	0
Replacement Fire	Late1:OPN	Early1:ALL	0.002	500	Yes	0
Optional 1	Late1:OPN	Early1:ALL	0.06	17	Yes	0

Optional Disturbances

Optional 1: Ice scour, wrack deposition, hypersalination, or local grazing.

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