

14900

Gulf and Atlantic Coastal Plain Tidal Marsh Systems

BpS Model/Description Version: Aug. 2020

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Modelers		Reviewers	
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Vegetation Type

Herbaceous Wetland

Map Zones

55, 56, 58, 99

Geographic Range

Covers map zones (MZ)s 58 and 55 from just south of the Chesapeake Bay in Virginia, through North Carolina, south to northern Florida as well as MZ56 along the Gulf.

Biophysical Site Description

Shallow water and diurnally flooded flats along edges of estuaries, and tidal rivers. Some areas of high marsh are also flooded irregularly by lunar and wind tides. Three of the four boxes in the model cover the brackish (5-30 PPT salinity) and oligohaline (0.5-5 PPT) salinity ranges. Box D covers the nearly nonpyrophytic salt marshes—those dominated by pure stands of salt marsh cordgrass (*Spartina alterniflora*) and having greater than three percent salinity, as well as salt flats dominated by nonflammable species such as *Salicornia*.

Vegetation Description

Highest fire frequency and highest species diversity occurs in model box A, lowest in box D which typically has only one species, *Spartina alterniflora*. Box B represents marshes contiguous with A but which have a slightly lower fire frequency and lower diversity. The primary difference between A and B is that with longer fire interval, B becomes dominated by one or two tall species, suppressing others. A thatch of dead material may accumulate beneath the dense stems. Box C represents the transition zone between marshes and uplands. This type, representing only six percent of the pixels in the pre-settlement landscape model is more abundant today under fire suppressed conditions. If not burned, succession is still often set back at 20-50yr intervals by salt water flooding.

True salt marshes in full strength sea water consist of pure stands of saltmarsh cordgrass with no other vascular plant species. Sea lettuce (*Ulva* spp.), a marine alga, may be found beneath the *Spartina*, either floating or stranded at low tide on temporarily exposed mud. Such marshes do not burn on the Atlantic part of the range, but occasional fires in *Spartina alterniflora* have been reported on the Gulf Coast under extreme burning conditions (Hackney, personal communication). *Spartina alterniflora* marshes diurnally flooded with seawater constitute a one box model in which nothing happens! There is no fire and this type is unaffected by even the strongest hurricanes. Since they occupy the lowest point in the marsh landscape, they are flooded

by storm surge early in the storm cycle and remain safely under water until the storm passes, when they emerged unscathed.

Vegetation in brackish marshes consists of dense, fine-textured 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 tall species such as cattail (*Typha latifolia* and *Typha angustifolia*), giant cordgrass (*Spartina cynosuroides*) and sedges such as three-square (*Scirpus americanus*) toward the oligohaline end. These species may occur as monospecific patches, zones or diverse mixtures. Species diversity increases as fire frequency increases and as salinity decreases. Toward the northern end of the range in Virginia and North Carolina, oligohaline marshes that have burned around every five years may have up to 60 species of plants, while fire suppressed or naturally fire-infrequent marshes tend to become dominated by one or two species (Frost 1993). On the Gulf coast species such as *Spartina bakeri* (sand cordgrass) and *Spartina spartinae* (Gulf Cordgrass) occupy similar habitats to those of *Spartina patens* on the Atlantic coast.

Succession: Within the region, no woody species can tolerate the dual stresses of frequent flooding and high salinity. In the salinity mid-range, brackish marshes resist woody invasion but in the absence of fire those with salinity less than one percent (10 PPT) may succeed after 30yrs to nearly closed shrub cover with species such as wax myrtle (*Myrica cerifera*), silverling (*Baccharis halimifolia*), sea elder (*Iva frutescens*) and red cedar (*Juniperus virginiana*), while the margins may develop a closed cover of trees such as red cedar, loblolly pine, pitch pine and red maple. Succession to tree cover is most rapid on marsh/upland margins where there is a dilution of salinity by the adjacent upland groundwater pool. Even in the absence of fire, however, undisturbed closed woody cover is unlikely to persist longer than about 30-50yrs before saltwater input during major storms kills some portion of the trees (Conner and Askew 1993). In the freshwater to oligohaline range, marsh flora usually contain, at least on their margins, mildly salt-tolerant shrubs and tree saplings whose cover may increase dramatically in the absence of fire. Red maple is often conspicuous in succession.

Although occasional large diameter stems of woody plants such as red cedar may survive fires, most marsh fires are considered replacement fires for above-ground vegetation, except for a small percentage of class C that occurs in the lowest salinity situations of water and soil. The model represents an average behavior of marshes that are well connected to mainland vegetation and hence have some probability of ignition.

Rare & Endangered species:

Ludwigia alata and *Eryngium aquaticum*.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
JURO	<i>Juncus roemerianus</i>	Needlegrass rush
DISP	<i>Distichlis spicata</i>	Inland saltgrass
SPPA	<i>Spartina patens</i>	Saltmeadow cordgrass
CLMAJ	<i>Cladium mariscus ssp. jamaicense</i>	Jamaica swamp sawgrass
SPSP	<i>Spartina spartinae</i>	Gulf cordgrass

IVFR	<i>Iva frutescens</i>	Jesuit's bark
JUVI	<i>Juniperus virginiana</i>	Eastern redcedar
SPAL	<i>Spartina alterniflora</i>	Smooth cordgrass

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

Disturbance Description

Frequent replacement occurred where marshes were contiguous with large, frequently burned longleaf pine uplands with a 1-3yr fire regime driven by lightning and Native Americans. On marsh islands and peninsulas sheltered from fire, Native Americans would have been the primary ignition source. Fires are moderate in intensity, consuming the above-ground herbaceous vegetation and top-killing most woody plants when present. This model represents an average of widely varying fire regimes, because probability of ignition is affected strongly by the presence of open water channels, the presence or absence of connection to uplands, and the natural fire regime of adjacent upland vegetation. Isolated marsh islands would have been fire free unless ignited by Native Americans. In contrast, marshes to the south were more influenced by lightning-ignited fires on flammable uplands which spread into adjacent marshes, with a lesser component of Native American ignition (Frost 1993, 1998). In more northerly regions not covered by this model, Native Americans were the primary ignition source (Patterson, personal communication). Neither of the saline or hypersaline types is known to burn except on margins where they are mixed with more flammable species. On the other end of the salinity gradient, freshwater marshes (salinity <0.5 PPT) tend to be dominated by nonpyrophytic, emergent broadleaf species such as *Pontederia cordata*, *Peltandra virginica*, *Hydrocotyle* spp., and *Polygonum* spp., and floating-leaved aquatics such as fragrant water lily (*Nymphaea odorata*), none of which support fire. These marshes, while still at sea level, represent the most upstream version of the long-attenuated salinity gradient along the margins of small streams and rivers, far removed from the outlet to the sea.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	5	98	4	25
Moderate (Mixed)	287	2		
Low (Surface)				
All Fires	5	100		

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

Scale Description

Because of the abundance of channels, marsh fires are less extensive than those on uplands. A typical fire might burn only 5-50ac (average 30ac) but in some landscapes, such as mainland Dare County, North Carolina, which have wide marshes many miles long without a major water body, wind driven fires might have once burned 3,000ac or more.

Adjacency or Identification Concerns

The description above covers the distribution of marsh communities along the salinity gradient. At the freshwater end, oligohaline marsh grades into cypress gum swamp. On the wet end marshes grade into sea grass communities including eelgrass (*Zostera marina*) and turtlegrass (*Thalassia testudinum*) on the Gulf Coast.

Issues or Problems

The old world variety of *Phragmites australis*, invading southeastern oligohaline marshes is probably the greatest threat to species diversity.

Tidal marshes throughout the region have been heavily altered by mosquito control and drainage efforts. Rising sea level will affect this systems group strongly, drowning some marsh areas, promoting shoreline erosion and causing salt or brackish marshes to spread inland into freshwater marsh areas. Significant fresh and brackish marsh loss has occurred in the deltaic plain of the Mississippi River. These losses are related to natural and anthropogenic causes. Subsidence and loss of wetlands are a natural part of the deltaic process, but they have been exacerbated by the reduction in sediment load and freshwater input into coastal areas caused by the impoundment and channelization of streams and rivers. In addition dredged channels in the marsh facilitate saltwater intrusion, and spoil banks prevent marshes from draining. Increases in salinity cause shifts in composition to species more tolerant of salinity, ultimately resulting in loss of species diversity and open saline waters (NatureServe 2006).

Native Uncharacteristic Conditions

Uncharacteristic vegetation now includes marshes that have undergone succession to woody vegetation where they would have been kept open by Native American burning, and also oligohaline marshes invaded by *Phragmites australis*.

Comments

Please note that this biophysical setting (BpS) is comprised of multiple systems and includes MZs 36, 37, 53, 55, 56, 57, 58, and 62 along tidal reaches of the Gulf and Atlantic Coastal Plain from southern Maine to Texas. However, Frost wrote this model as described in the Geographic Range field. So, this BpS needs to be reviewed for accuracy outside of MZs 55, 56, and 58.

Succession Classes

Mapping Rules

Upper Layer Lifeform	Height (m)	Canopy Cover (%)									
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
Herb	0-0.5	A	A	A	A	A	A	A	A	A	A
Herb	0.5-1.0	A	A	A	A	A	A	A	A	A	A
Herb	>1.0	D	D	D	D	D	D	D	D	B	B
Shrub	0-0.5	C	C	C	C	C	C	C	C	C	C
Shrub	0.5-1.0	C	C	C	C	C	C	C	C	C	C
Shrub	1.0-3.0	C	C	C	C	C	C	C	C	C	C
Shrub	>3.0	C	C	C	C	C	C	C	C	C	C
Tree	0-5	C	C	UN	UN	UN	UN	UN	UN	UN	UN
Tree	5-10	C	C	UN	UN	UN	UN	UN	UN	UN	UN
Tree	10-25	C	C	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	58	Early Development 1 - Open
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
JURO	<i>Juncus roemerianus</i>	Needlegrass rush	Upper
DISP	<i>Distichlis spicata</i>	Inland saltgrass	Middle
SPPA	<i>Spartina patens</i>	Saltmeadow cordgrass	Upper
CLMAJ	<i>Cladium mariscus</i> ssp. <i>jamaicense</i>	Jamaica swamp sawgrass	Upper

Description

Recently burned marshes, ignited originally both by lightning and Native Americans. More diverse herb layer when burned frequently and with lower salinity. Flammable litter sufficient to carry fire accumulates after only one or two years depending upon the dominant species.

Maximum Tree Size Class

None

Class B	26	Mid Development 1 - Open
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
JURO	<i>Juncus roemerianus</i>	Needlegrass rush	Upper
CLMAJ	<i>Cladium mariscus</i> ssp. <i>jamaicense</i>	Jamaica swamp sawgrass	Upper

Description

Dense herb layer dominated by one or two medium and tall species, with heavy litter buildup except where removed by storms. A few invading shrubs may be seen where salinity is less than one percent. Above that concentration extensive pure stands of species such as black needle rush may develop in the absence of fire.

Maximum Tree Size Class

None

Class C	5	Mid Development 2 - Open
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Indicator Species

Indicator Species	Symbol	Scientific Name	Common Name	Canopy Position
Shrub	JUVI	<i>Juniperus virginiana</i>	Eastern redcedar	Upper
	BAHA	<i>Baccharis halimifolia</i>	Eastern baccharis	Mid-Upper
	IVFR	<i>Iva frutescens</i>	Jesuit's bark	Mid-Upper

MOCE	Mollugo cerviana	Threadstem carpetweed	Mid-Upper
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Description

Herb layer dominated by tall species, with deep, loose litter buildup with dense shrubs and young trees where salinity permits. With fire suppression today, age and structure of woody vegetation depends more upon irregular salinization events during storm surge rather than fire.

Maximum Tree Size Class

Pole 5-9" DBH

Class D 11 Early Development 2 - Open

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
SPAL	Spartina alterniflora	Smooth cordgrass	Upper

Description

Spartina alterniflora marshes do not burn at all in most cases. Fire has some effect upon the upslope side in a few very limited areas. Hurricanes have little effect as this lowest marsh type is inundated in the earliest stages of storm surge and simply rides out the storm under water.

Maximum Tree Size Class

None

Model Parameters

Deterministic Transitions

From Class	Begins at (yr)	Succeeds to	After (years)
Early1:OPN	0	Mid1:OPN	5
Early2:OPN	1	Early2:OPN	150
Mid1:OPN	6	Mid2:OPN	18
Mid2:OPN	19	Mid2:OPN	50

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
Optional 1	Early1:OPN	Early2:OPN	0.008	125	Yes	0
Replacement Fire	Early1:OPN	Early1:OPN	0.25	4	Yes	0
Replacement Fire	Early2:OPN	Early1:OPN	0.04	25	Yes	0
Replacement Fire	Mid1:OPN	Early1:OPN	0.15	7	Yes	0
Optional 2	Mid2:OPN	Mid1:OPN	0.04	25	Yes	0
Mixed Fire	Mid2:OPN	Mid2:OPN	0.07	14	No	0
Replacement Fire	Mid2:OPN	Early1:OPN	0.07	14	Yes	0

Optional Disturbances

Optional 1: Salinity 3-4%

Optional 2: Storm salinization

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