14700
Caribbean Coastal Wetland Systems

BpS Model/Description Version: Aug. 2020

Modelers		Reviewers	
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Reviewer: Samantha Chapman

Vegetation Type
Woody Wetland

Map Zone
56

Geographic Range
Caribbean Coastal Wetland Systems occur primarily along the subtropical south Florida coast and the Keys. NatureServe 2006 denotes this system as an aggregated system including mangrove and other tidal wetlands of four broad variants (riverine mangrove forests, fringe mangrove forests, basin mangrove forests, and barrier mangrove forests).

Biophysical Site Description
Mangrove swamp is typically located on depositional (unstable) tidal flats of the marine-terrestrial interface with anaerobic sediments and low wave energy. It may also occur as a belt along tidal rivers, in lagoons behind barrier islands and beaches, and in a natural mosaic of coastal prairie (saltmarsh) and closed mangrove forest. Freezing frequency and severity (number of days below threshold temperature) is the key regulator of distribution in the United States, according to recent work (see References).

Vegetation Description
Mangrove vegetation is easily displaced by freshwater aquatic vascular plants, suggesting to some that under pre-settlement conditions, fire and plant competition from inland areas restricted the extent of mangroves to saline-brackish zones. Principal species dominating the often dense, closed mangrove forests are: red mangrove (*Rhizophora mangle*) growing in subtidal areas subjected to regular, prolonged tidal flooding; black mangrove (*Avicennia germinans*) in the intertidal zone; and still further inland, the shade-intolerant white mangrove (*Laguncularia racemosa*), a possible indicator of recent disturbance; and buttonwood (*Conocarpus erectus*), an indicator of the freshwater ecotone. During the 2017 review, a reviewer noted that usually the black mangrove is the furthest inland because of its tolerance for salinity. All of these essentially tropical species are frost-intolerant and fire-sensitive but well adapted to anaerobic and saline (facultative halophytes) soil conditions.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
AVGE	*Avicennia germinans*	Black mangrove
LARA2	*Laguncularia racemosa*	White mangrove

RHMA2	*Rhizophora mangle*	American mangrove
SPART	*Spartina*	Cordgrass
DISP	*Distichlis spicata*	Inland saltgrass
CLMAJ	*Cladium mariscus ssp. jamaicense*	Jamaica swamp sawgrass
JURO	*Juncus roemerianus*	Needlegrass rush

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

Disturbance Description

Mangrove swamp is classified as a Group IV, stand-replacement fire. A closed mangrove forest provides an effective natural barrier to fire spread except under the most extreme drought conditions. Tidal creeks, pools, and bare hypersaline soil areas further limit fire compartment size where mangrove forests dominate. Fires in the adjacent saltmarsh (coastal prairie) communities periodically killed angrove fringes but would quickly burn themselves out in the sparse, shaded mangrove litter before penetrating more than a few meters into the adjoining closed-canopy mangrove forest. Intense (Category 4+) hurricanes and severe frost events are the main controls over mangrove forest distribution and structure. Less intense storms (Category 1-3) can "open" up portions of the previously dense, closed-canopy mangrove forests, making them more susceptible to stand-replacing fire spread during droughts. Lightning does commonly kill small areas of mangrove (0.1-0.5ac), creating small canopy gaps. In the absence of fire, mangrove forests tend to invade further inland into open marsh and prairie.

Today, fires in the salt marsh mangrove ecotone may kill back the shrubby sparse black and white mangroves that intermingle with marsh, but they often resprout from the root stocks or exhibit regrowth in other ways. One reviewer suspects this was also true in pre-settlement times.

Replacement fires are common in coastal prairies (<30% of landscape) and moderately frequent in open mangrove classes. Infrequent severe fires during extreme drought may burn through the root zone in closed mangrove classes. Non-replacement fires occur in older classes. Mosaic fires trigger class maintenance.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	126	74		
Moderate (Mixed)	360	26		
Low (Surface)				
All Fires	93	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

Gaps in the mangroves can be <1ha. Unbroken mangrove patches can be 100s of hectares. Mangrove fires are usually small since mangroves burn poorly.

Adjacency or Identification Concerns

Mangrove swamp occurs adjacent to salt marsh, marl prairies, Everglades sawgrass, and cypress savannas.

The boundaries of this ecosystem are dynamic and have moved substantially in the last 50yrs. This is a function both of sea level change and changes in the freshwater outflow of the Everglades due to anthropogenic alterations of the hydrology.

Issues or Problems

Native Uncharacteristic Conditions

Comments

The VDDT model for this Biophysical Setting (BpS) utilizes probabilities and proportions since Fisher was attempting to pull out the coastal prairie influence of the Rapid Assessment model. The coastal prairie component of the R9SFPM burns more frequently than the mangrove component, so Fisher tried to account for this utilizing the VDDT software capacity.

Nutrient enrichment has changed size along Indian River Lagoon and other places. Also, nutrient enrichment interacts with hurricanes

One reviewer believes shrubby mangrove/marsh ecosystems now cover a larger area in the Gulf of Mexico and Florida (both coasts) than in pre-settlement times. See Cavanaugh.

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	A	A	A	A	A	A	A	A	A	A
Shrub	0-0.5	A	A	A	A	A	A	A	A	A	A
Shrub	0.5-1.0	A	A	A	A	A	A	A	A	A	A
Shrub	1.0-3.0	A	A	A	A	A	A	A	A	A	A
Shrub	>3.0	A	A	A	C	C	C	C	B	B	B
Tree	0-5	C	C	C	C	C	C	C	B	B	B
Tree	5-10	D	D	D	D	D	E	E	E	E	E
Tree	10-25	D	D	D	D	D	E	E	E	E	E
Tree	25-50	D	D	D	D	D	E	E	E	E	E
Tree	>50	D	D	D	D	D	E	E	E	E	E

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 **17** **Early Development 1 - All Structures**

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
SPART	Spartina alterniflora	Cordgrass	Lower
JURO	Juncus roemerianus	Needlegrass rush	Lower
CLMAJ	Cladium mariscus ssp. jamaicense	Jamaica swamp sawgrass	Low-Mid
LARA2	Avicennia germinans	Black mangrove	Upper

Description

Class A includes post-replacement, bare tidal flats (seaward), gaps resulting from storm damage in mature mangrove forests or mangroves spreading into coastal herbaceous prairie (saline marsh) with only widely scattered mangrove or other woody stems. The grass *Distichlis spicata* might be included as an indicator. Some succulents are especially important on the Gulf Coast and in northeastern and northwestern Florida in this transitional habitat, including *Batis maritime*, *Sueda*, *Sesuvium*.

Maximum Tree Size Class

None

Class B **37** **Mid Development 1 - Closed**

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
AVGE	Avicennia germinans	Black mangrove	Upper
LARA2	Laguncularia racemosa	White mangrove	Upper
RHMA2	Rhizophora mangle	American mangrove	Upper
CONOC	Conocarpus	Mangrove	Upper

Description

The mid-seral closed condition has relatively high canopy cover from mangrove species. Small areas of bare tidal sediments or salt-tolerant grasses and other herbs may persist beneath the mangrove canopy, but they generally resist fire spread except under extreme drought conditions. Category 4+ hurricanes can eliminate the mangrove canopy and expose bare sediments. Category 1-3 hurricanes can create sizeable openings within the mangrove forest. Lightning creates small (0.1-0.5 acre) canopy gaps. Fires penetrate ecotones at the mangrove forest fringe adjoining prairies, especially following frost or major hurricane damage.

Maximum Tree Size Class

Sapling >4.5ft; <5" DBH

Class C **33** **Mid Development 1 - Open**

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
AVGE	Avicennia germinans	Black mangrove	Upper
LARA2	Laguncularia racemose	White mangrove	Upper
RHMA2	Rhizophora mangle	American mangrove	Upper
CONOC	Conocarpus	Mangrove	Upper

Description
Class C is characterized as the mid-seral open stage, with moderate canopy cover from mangrove species. This is often a result of lower intensity (Category 1-3) storm damage. Salt-tolerant grasses and other herbs may invade these canopy openings and foster stand-replacing fire spread, which returns the system to Class A. Succulents, such as *Batis* spp., may also invade, which would not encourage fire spread. Lightning can create additional small (0.1-0.5 acre) canopy gaps. Prairie fires periodically burn into the mangrove fringe but typically burn out before going very far into the mangroves. These fires are modeled as a mixed fire.

Maximum Tree Size Class
Sapling >4.5ft; <5" DBH

Class D 1 Late Development 1 - Open

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
AVGE	Avicennia germinans	Black mangrove	Upper
LARA2	Laguncularia racemosa	White mangrove	Upper
RHMA2	Rhizophora mangle	American mangrove	Upper
CONOC	Conocarpus	Mangrove	Upper

Description
Class D is the late-seral open condition, with lower canopy cover from mangrove species. This is often a result of lower intensity (Category 1-3) storm damage or decades of cumulative lightning-caused small (0.1-0.5ac) canopy gaps. Succulents may be important indicator species. Accumulation of coarse woody debris and mangrove “muck” is evident. Salt-tolerant grasses and other herbs may invade these canopy openings and foster mosaic fires that maintain an open condition or stand-replacing fires. Category 4+ hurricanes can eliminate the mangrove canopy and expose bare sediments, which returns the system to Class A. Fires penetrate ecotones at the mangrove forest fringe of adjoining prairies, especially following frost or major hurricane damage.

Maximum Tree Size Class
Pole 5-9" DBH

Class E 12 Late Development 1 - Closed

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position

AVGE	Avicennia germinans	Black mangrove	Upper
LARA2	Laguncularia racemosa	White mangrove	Upper
RHMA2	Rhizophora mangle	American mangrove	Upper
CONOC	Conocarpus	Mangrove	Upper

Description

Class E is the late-seral closed stage, with higher canopy cover from mangrove species and little or no understory except in small (0.1-0.5ac) lightning-caused canopy gaps. Accumulation of coarse woody debris and mangrove “muck” is evident, but generally fires only sustain spread under extreme drought conditions. Category 4+ hurricanes can eliminate the mangrove canopy and expose bare sediments. Category 1-3 hurricanes can create sizeable openings within the mangrove forest. Fires only penetrate a few meters into the inland ecotone and mangrove forest fringe adjoining prairies.

Maximum Tree Size Class

Pole 5-9" DBH

Model Parameters

Deterministic Transitions

From Class	Begins at (yr)	Succeeds to	After (years)
Early1:ALL	0	Mid1:OPN	7
Mid1:OPN	8	Mid1:CLS	15
Mid1:CLS	16	Late1:CLS	35
Late1:OPN	36	Late1:OPN	499
Late1:CLS	36	Late1:CLS	499

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	0.1	10	Yes	0
Wind or Weather or Stress	Mid1:OPN	Mid1:OPN	0.067	15	No	0
Mixed Fire	Mid1:OPN	Mid1:OPN	0.04	25	No	0
Replacement Fire	Mid1:OPN	Early1:ALL	0.04	25	Yes	0
Replacement Fire	Mid1:CLS	Early1:ALL	0.004	250	Yes	0
Wind or Weather or Stress	Mid1:CLS	Early1:ALL	0.033	30	Yes	0
Wind or Weather or Stress	Mid1:CLS	Mid1:OPN	0.067	15	Yes	0
Alternative Succession	Late1:OPN	Late1:CLS	1	1	Yes	15

Wind or Weather or Stress	Late1:OPN	Early1:ALL	0.033	30	Yes	0
Wind or Weather or Stress	Late1:OPN	Late1:OPN	0.067	15	No	0
Replacement Fire	Late1:OPN	Early1:ALL	0.02	50	Yes	0
Mixed Fire	Late1:OPN	Late1:OPN	0.04	25	No	0
Replacement Fire	Late1:CLS	Early1:ALL	0.004	250	Yes	0
Wind or Weather or Stress	Late1:CLS	Early1:ALL	0.033	30	Yes	0
Wind or Weather or Stress	Late1:CLS	Late1:OPN	0.067	15	Yes	0

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