

Rapid Assessment Reference Condition Model

The Rapid Assessment is a component of the LANDFIRE project. Reference condition models for the Rapid Assessment were created through a series of expert workshops and a peer-review process in 2004 and 2005. For more information, please visit www.landfire.gov. Please direct questions to helpdesk@landfire.gov.

Potential Natural Vegetation Group (PNVG)

R7NMAR Northern Coastal Marsh

General Information

Contributors (additional contributors may be listed under "Model Evolution and Comments")

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Vegetation Type

Grassland

General Model Sources

Literature

Local Data

Expert Estimate

Rapid Assessment Model Zones

California

Great Basin

Great Lakes

Northeast

Northern Plains

N-Cent. Rockies

Pacific Northwest

South Central

Southeast

S. Appalachians

Southwest

Dominant Species*

SPPA

DISP

SPAL

LANDFIRE Mapping Zones

30

70

Geographic Range

Coastal and inland tidewater areas, including tidal fresh marshes, from the Chesapeake Bay and the coast of Virginia north to Maine.

Note: this model includes true salt marsh and the whole salinity range of marsh types on the Atlantic coast. Models R7BMAR (brackish, oligohaline and fresh marshes) and R7SALT break out the true salt marshes which are fire and storm disturbance free. These models may be useful in the finer scale LANDFIRE modeling)

This model covers only tidal marshes, it excludes all inland marshes such as those around the margins of bogs and ponds whose ecology is very different.

Biophysical Site Description

Tidal saline, brackish and oligohaline marshes (replaces the Küchler type 73 "Northern Cordgrass Prairie")

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. The attached 3 box model covers the saline (>3% salinity), brackish (5 to 30 PPT salinity) and oligohaline (0.5 to 5 PPT) salinity ranges. Marshes within this range can be strongly influenced by fire with exception of *Spartina alterniflora* marshes in full strength sea water which do not burn. Marshes beyond either end of this range (riverine emergent fresh marshes and coastal salt marshes) tend to be nonpyrophytic.

Vegetation Description

True salt marshes—those dominated by pure stands of salt marsh cordgrass (*Spartina alterniflora*) and having > 3% salinity, as well as salt flats dominated by nonflammable species such as *Salicornia* are nonpyrophytic. Neither of these saline or hypersaline types is known to burn except on margins where 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*,

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit <http://plants.usda.gov>.

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 nearest outlet to the sea.

True salt marshes in full strength sea water consist of pure stands of saltmarsh cordgrass with no other vascular plant species. Sea lettuce (*Ulva* sp.), 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 rare fires in *Spartina alterniflora* have been reported on the Gulf Coast under extreme burning conditions (Hackney, pers. Comm.). *Spartina alterniflora* marshes diurnally flooded with seawater constitute a one box model in which nothing happens! (see R7NMAR2) There is no fire and this type is unaffected by even the strongest hurricanes. Occupying 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 southern end of the range in Virginia, oligohaline marshes that have burned around every 5 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).

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 1‰ (10 PPT) may succeed after 30 years to nearly closed shrub cover with species such as wax myrtle (*Myrica cerifera*), silverling (*Baccharis halimifolia*), sea elder (*Iva frutescens*) and small red cedar (*Juniperus virginiana*), while the margins may develop 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 dilution of salinity by adjacent upland groundwater. Even in the absence of fire, however, undisturbed closed woody cover is unlikely to persist longer than about 30-50 years since saltwater input during major storms often 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 in this salinity range.

Disturbance Description

Fire regime type II, frequent replacement, mostly 2-15 years, occurred where marshes were contiguous with uplands burned by Native Americans living in coastal environments. 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 fire flow 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. Islands of high marsh would have been largely fire free unless ignited by Native Americans; Tim Simmons, however, reported a lightning ignition on a small marsh island in Massachusetts so they do occur, but as rare events.

In contrast, marshes from southeastern Virginia and south were more influenced by lightning ignited fires on flammable uplands which spread into adjacent marshes (see SMAR model by Schafale), with a lesser component of Native American ignition (Frost 1993, 1998). In the northern regions covered by this model, Native Americans were the primary ignition source (Patterson, pers. comm.).

Although occasional large diameter stems of woody plants such as red cedar along marsh fringes may survive fires, all 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. The Optional1 disturbance represents irregular salinization during storm surge that inundates woody root systems with higher salinity than that to which they are adapted, for a long enough time to kill some or all (Conner & Askew 1993).

Adjacency or Identification Concerns

Scale Description

Sources of Scale Data Literature Local Data Expert Estimate

Coastal marshes occur in all sizes from a few square meters to about 1000 acres in the largest contiguous patches. Marsh grasses form continuous, fine-textured fuel and typically burn as a complete unit except where fragmented by internal channels or grading into nonflammable *Spartina alterniflora*.

Issues/Problems

A number of rare or uncommon plant species in oligohaline marshes appear to depend upon fire to keep their habitat open. In the southern part of the range these include *Ludwigia alata*, *Cladium mariscoides*, and *Eleocharis rostellata*. The federally endangered species *Aeschynomene virginica* may be dependent upon fire to maintain open conditions in its fresh to oligohaline marshes. Some species, such as *Eryngium aquaticum*, may become conspicuous or even dominant for a year or two after fire and then fade into obscurity until the next fire.

Uncharacteristic vegetation now includes marshes that have undergone succession to woody vegetation or tall marsh species where they would have been kept open by Native American burning. Many oligohaline marshes have been invaded by *Phragmites australis*.

Model Evolution and Comments

REVIEWERS:

Courtney Hackney (south end of mapping region)
Mark Bertness (north end)

Peer reviewed by Alison C. Dibble Cooperating Research Ecologist USDA Forest Service Northeastern Research Center 5/19/05.

Succession Classes**
Succession classes are the equivalent of "Vegetation Fuel Classes" as defined in the Interagency FRCC Guidebook (www.frcc.gov).

Class A 35 %

Early1 All Struct

Description

Recently burned marshes (0-4 years) (note: the percentage of class A burned would be considerably less if the true salt marshes dominated by *Spartina alterniflora* were included. This model addresses the more flammable brackish and oligohaline marshes). More diverse herb layers occur when burned

Dominant Species* and Canopy Position

SPPA Upper
DISP Upper
SPAL Upper

Upper Layer Lifeform

- Herbaceous
- Shrub
- Tree

Fuel Model no data

Structure Data (for upper layer lifeform)

	Min	Max
Cover	25 %	75 %
Height	no data	no data
Tree Size Class	no data	

Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit <http://plants.usda.gov>.

frequently and with lower salinity. Flammable litter sufficient to carry fire accumulates after only 1 or 2 years depending upon the dominant species. Up to 50 plant species may be found a one example of a marsh. Depending upon microelevation (high marsh vs. low marsh) one or two species such as salt meadow cordgrass (*Spartina patens*), saltgrass (*Distichlis spicata*) or saltmarsh cordgrass (*Spartina alterniflora*) may be dominant. In frequently burned, species-rich marshes in the oligohaline range there may be no dominant species.

Class B 50%

Mid1 Closed

Description

4-15 years since fire. Dense marsh layer dominated by medium height species such as *Spartina patens* and *Distichlis spicata*. Oligohaline marshes may have zones and patches of tall species such as *Typha latifolia* or *Typha angustifolia* depending upon position on the salinity gradient, these may develop heavy litter buildup except where removed by storms. Invading shrubs and trees may be present where salinity is less than 1%

Dominant Species* and Canopy Position

SPPA Upper
DISP Upper
SPAL Upper

Upper Layer Lifeform

- Herbaceous
- Shrub
- Tree

Fuel Model no data

Structure Data (for upper layer lifeform)

	Min	Max
Cover	75 %	100 %
Height	no data	no data
Tree Size Class	no data	

- Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

Class C 15%

Mid1 All Structu

Description

16 years + since fire. Herb layer dominated by *Spartina patens* and *Distichlis spicata* at the high end of the salinity gradient and by large stands of tall marsh species, sometimes with a dense thatch of litter buildup, and with dense shrubs and young trees where salinity is permits. Age and

Dominant Species* and Canopy Position

SPPA Lower
DISP Lower
JUVI Upper
ACRU Upper

Upper Layer Lifeform

- Herbaceous
- Shrub
- Tree

Structure Data (for upper layer lifeform)

	Min	Max
Cover	1 %	50 %
Height	Shrub Medium 1.0-2.9m	Tree Short 5-9m
Tree Size Class	no data	

- Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

Shrub and small tree invasion occurs in oligohaline and brackish situations, especially on the marsh margins. Marsh grasses, sedges and forbs usually retain dominance except where the marsh occurs as a narrow shoreline

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structure of woody vegetation depends more upon irregular salinization events during storm surge rather than fire. Shrubs may include small red cedar, Iva frutescens, Baccharis halimifolia

fringe.

Fuel Model no data

Class D 0%

Late1 All Structu
Description

Dominant Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	0 %
Height	no data	no data
Tree Size Class	no data	

Upper Layer Lifeform

- Herbaceous
- Shrub
- Tree

Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

Fuel Model no data

Class E 0%

Late1 All Structu
Description

Dominant Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover	%	%
Height	no data	no data
Tree Size Class	no data	

Upper Layer Lifeform

- Herbaceous
- Shrub
- Tree

Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

Fuel Model no data

Disturbances

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Disturbances Modeled

- Fire
- Insects/Disease
- Wind/Weather/Stress
- Native Grazing
- Competition
- Other: Flooding of typically oligohaline or brackish areas with full strength sea water during storms.
- Other

Historical Fire Size (acres)

Avg: 5
 Min: 1
 Max: 1000

Sources of Fire Regime Data

- Literature
- Local Data
- Expert Estimate

Fire Regime Group: 2

- I: 0-35 year frequency, low and mixed severity
- II: 0-35 year frequency, replacement severity
- III: 35-200 year frequency, low and mixed severity
- IV: 35-200 year frequency, replacement severity
- V: 200+ year frequency, replacement severity

Fire Intervals (FI)

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class. All values are estimates and not precise.

	<i>Avg FI</i>	<i>Min FI</i>	<i>Max FI</i>	<i>Probability</i>	<i>Percent of All Fires</i>
<i>Replacement</i>	7	2	50	0.14286	97
<i>Mixed</i>	265	20	100	0.00377	3
<i>Surface</i>					
<i>All Fires</i>	7			0.14664	

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