
ECOLOGICAL SYSTEM: NORTHERN ATLANTIC COASTAL PLAIN FRESH AND OLIGOHALINE TIDAL MARSH

Summary: This system includes freshwater tidal vegetation occurring on the upper reaches of large rivers influenced by tidal flooding, but beyond the reach of the salt wedge. The system is best developed on the Chesapeake and Delaware Bay drainages, including the rivers of southern New Jersey. The system extends northeast and includes inland portions of the Hudson River, Connecticut River, and the Merrimac River and their tributaries. The vegetation includes tall marshes dominated by tall grasses such as *Zizania aquatica* (Indian wild rice), marshes of lower stature dominated by forbs such as *Amaranthus cannabinus* (water-hemp), *Hibiscus moscheutos* (eastern rosemallow) and others, and vegetation characterized by short-statured and rosette-forming forbs such as *Eriocaulon parkeri* (estuary pipewort) and *Isoetes riparia* (riverbank quillwort). Associations are distributed by proximity to tidal waters and thus duration and force of flooding. Sediments of more protected and isolated vegetation is comprised of finer-grained materials that are poorly drained, or of well-consolidated peat deposits. Vegetation exposed to greater flooding force and scouring action is supported by mineral substrates such as sand and gravel.

Range: Best developed on the Chesapeake and Delaware Bay drainages, including the rivers of southern New Jersey, but extends northeast and includes inland portions of the Hudson River, Connecticut River, and the Merrimac River and their tributaries. United States: DE, MD, VA

Delaware Estuary Associations:

- American Lotus Tidal Marsh
- Atlantic Coast Brackish Tidal Marsh
- Atlantic Coast Wild Rice Tidal Marsh
- Coastal Freshwater Marsh
- Estuary Pipewort Freshwater Intertidal Flat
- Estuary Quillwort Tidal Flat
- Freshwater Tidal Mixed Forbs High Marsh
- North Atlantic Fresh Tidal Shrub Swamp
- Oligohaline Mixed Forbs Tidal Marsh
- Pickerelweed Tidal Marsh
- Pond-lily Tidal Marsh
- Sweetflag Tidal Marsh
- Water-hemp Tidal Marsh
- Water-willow Shrub Swamp

CLASSIFIERS FOR NORTHERN ATLANTIC COASTAL PLAIN FRESH AND OLIGOHALINE TIDAL MARSH

Primary Division: 203

Land Cover Class: Herbaceous Wetland

Spatial Scale & Pattern: Large patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland

Diagnostic Classifiers: Tidal / Estuarine; Graminoid

Non-diagnostic Classifiers: Herbaceous

AMERICAN LOTUS TIDAL MARSH

Nelumbo lutea Tidal Herbaceous Vegetation

Range: This community is currently observed from Delaware, New Jersey, Maryland, and Virginia.

Environmental Description: This community type occurs as a distinct zone along tidal rivers in the Coastal Plain.

Vegetation Description: *Nelumbo lutea* (American lotus) forms a thin band of vegetation along the river that is 2-3 m deep at low tide.

Noteworthy Associated Plant and/or Animal Species: *Nelumbo lutea* (American lotus)

Characteristic Species: *Nelumbo lutea* (American lotus)

Reference Sites: St. Jones River, Kent County, DE; Mannington Meadows, Salem County, NJ; Monds Island, Repaupo/Raccoon Creek, Oldman's Creek, Gloucester County, NJ

Global and State Conservation Ranks and Reasons: GNR (1-Dec-1997). DE: SNR, NJ: SNR.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.683563

References: Coulling pers. comm., Eastern Ecology Working Group n.d., Harrison 2004, NJNHP unpubl. data, VDNH 2003

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Herb (field)	Forb	<i>Nelumbo lutea</i> (American lotus)

ATLANTIC COAST BRACKISH TIDAL MARSH

Schoenoplectus pungens Tidal Herbaceous Vegetation

Range: This association occurs along the Atlantic coast from New Hampshire to Virginia.

Environmental Description: This association occurs in oligohaline to more mesohaline reaches of tidal rivers with sandy or gravelly rivershores. It occurs in low areas where there is a longer duration of flooding. Ice scour can have a significant effect on the species composition and percent cover from year to year.



Photo by Linda Kelly

Vegetation Description: This vegetation often occurs in nearly pure stands of *Schoenoplectus pungens* (common threesquare) but can be intermixed with *Spartina alterniflora* (saltmarsh cordgrass) or *Spartina cynosuroides* (giant cordgrass) in slightly brackish areas. Species diversity tends to be low due to winter storm scour, but associates can include *Amaranthus cannabinus* (water-hemp), *Polygonum punctatum* (dotted smartweed), and *Bidens* (beggarticks) spp. *Sagittaria graminea* (grassleaf arrowhead), *Sagittaria latifolia* (broadleaf arrowhead), *Eleocharis palustris* (marsh spikerush), *Gratiola virginiana* (roundfruit hedge-hyssop), and *Cyperus bipartitus* (shining flatsedge) can occur but are absent in the northern part of the range. As the salinity decreases *Zizania aquatica* (Indian wild rice) can also be an associate. *Lilaeopsis* (grasswort) occurs on *Spartina alterniflora* (saltmarsh cordgrass) hummocks.

Noteworthy Associated Plant and/or Animal Species: *Bidens bidentoides* (delmarva beggarticks)

Characteristic Species: *Schoenoplectus pungens* (common threesquare)

Dynamics/Successional Trajectory: The species composition of brackish marsh associations is likely related to gradients in salinity and duration of tidal flooding. *Schoenoplectus pungens* (common threesquare) may dominate in areas with higher average water levels, lower salinities, and lower frequency of flooding than areas typically dominated by *Spartina patens* (saltmeadow cordgrass).

Management Concerns: Ice-scour can have a significant effect on the species composition and percent cover from year to year.

Reference Sites: Snickensons Landing, Salem County, NJ; Edgewater Park, Mercer/Burlington County, NJ

Global and State Conservation Ranks and Reasons: GNR (1-Dec-1997). NJ: S1S3.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.683291

References: Barrett 1989, Bartgis 1986, Breden 1989, Breden et al. 2001, Caldwell 1990, Eastern Ecology Working Group n.d., Fleming 2001, Fleming et al. 2001, Harrison 2004, Metzler and Barrett 2001, Metzler and Rosza 1982, Rawinski 1984, Swain and Kearsley 2001

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Herb (field)	Graminoid	<i>Schoenoplectus pungens</i> (common threesquare)

ATLANTIC COAST WILD RICE TIDAL MARSH

Zizania aquatica Tidal Herbaceous Vegetation

Range: This association occurs along the Atlantic Coastal Plain from Maine and Massachusetts south to South Carolina, possibly extending into Georgia. This association occurs in New Jersey and possibly Delaware in the Delaware Estuary.

Environmental Description: This association occurs in the lower reaches of freshwater tidal marshes, in fresh to slightly brackish areas that are low within the marsh and are infrequently exposed at lowest tides. It occurs on alluvial soils that are commonly silts or silty clays, although occasionally have a greater sand component. *Zizania* (wild rice) flats are best developed in quiet waters conducive to sedimentation (Barrett 1989).



Photo by Linda Kelly

Vegetation Description: This freshwater tidal marsh community can be highly variable in species composition but is characterized by *Zizania aquatica* (Indian wild rice), which is dominant and monotypic in some examples, or codominant with such species as *Pontederia cordata* (pickerelweed), *Peltandra virginica* (green arrow-arum), *Polygonum arifolium* (halberd-leaf tearthumb), *Polygonum punctatum* (dotted smartweed), and/or *Bidens cernua* (nodding beggarticks), among others. Common associates are generally a mixture of freshwater and brackish species and can include *Sagittaria latifolia* (broadleaf arrowhead), *Ludwigia palustris* (marsh seedbox), *Impatiens capensis* (orange jewelweed), *Leersia oryzoides* (rice cutgrass), *Amaranthus cannabinus* (water-hemp), *Hibiscus moscheutos* (eastern rosemallow), *Sium suave* (hemlock water-parsnip), *Acorus americanus* (several-vein sweetflag), and *Schoenoplectus fluviatilis* (river bulrush). *Nuphar lutea* ssp. *advena* (broadleaf pond-lily) is a common associate in the southern portion of the range. This plant association shows extreme seasonal variability, with *Zizania aquatica* (Indian wild rice) becoming a conspicuous component only in mid to late summer and generally senescing by mid to late autumn. This vegetation provides an important food source for migratory birds.

Noteworthy Associated Plant and/or Animal Species: *Aeschynomene virginica* (Virginia joint-vetch)

Characteristic Species: *Zizania aquatica* (Indian wild rice)

Dynamics/Successional Trajectory: Freshwater tidal marshes are naturally dynamic systems that are best developed where there is a major input of freshwater, a daily tidal range of at least 0.5 m, and a geomorphology that tends to constrict and magnify tidal influence in the upper reaches of the estuary (Odum et al. 1984). They are subject to diurnal flooding by tides and seasonal and episodic flooding from river discharge. Plant composition of freshwater tidal marshes generally occurs as a mosaic of patches dominated by a few or a single species. Species composition is determined by species life history characteristics, especially lifeform, phenology and mode of regeneration in response to microhabitat conditions, and the frequency and duration of flooding. Plant composition has seasonal variation. Landward, this community can grade into other freshwater tidal marsh associations, especially *Peltandra virginica* - *Pontederia cordata* Tidal Herbaceous Vegetation (CEGL004706).

Reference Sites: Manumuskin River (TNC Preserve), NJ; Rancocas Creek at Mill Creek (Willingboro Township) Park, Burlington County, NJ

Global and State Conservation Ranks and Reasons: G4? (13-Aug-1997). DE: S3, NJ: S2S3.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.689364

References: Barrett 1989, Barrett 1994, Bowman 2000, Breden 1989, Breden et al. 2001, Coulling 2002, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Ferren and Good 1977, Fleming et al. 2001, Gawler 2001, Gawler 2002, Glitzenstein and Streng 2004, Good and Good 1975b, Harrison 2001, Harrison 2004, McCormick and Ashbaugh 1972, McCormick et al. 1970, McCoy and Fleming 2000, Metzler and Barrett 2001, Metzler and Rosza 1982, Odum et al. 1984, Rawinski 1984, Reschke 1990, Schafale 2000, Schafale 2003b, Schafale and Weakley 1990, Swain and Kearsley 2001, VDNH 2003, Wharton 1978

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Herb (field)	Graminoid	<i>Zizania aquatica</i> (Indian wild rice)

COASTAL FRESHWATER MARSH

Schoenoplectus pungens var. *pungens* - *Juncus canadensis* Herbaceous Vegetation

Range: This association is known from Massachusetts and New Jersey but is likely to occur in other coastal states of the Northeast. It occurs in the New Jersey portion of the Delaware Estuary.

Environmental Description: This non-tidal freshwater marsh of the coastal Northeast occupies flooded depressions and swales in coastal dunes (and impoundments). This community can also occur at the mouth of large rivers, on hummocky islands in freshwater wetlands, and in transition zones. The substrate varies from sand to peat or muck, depending on hydrological regime. Water is present most of the year and does not typically exhibit a seasonal drawdown.

Vegetation Description: The vegetation is dominated by *Schoenoplectus pungens* var. *pungens* (common threesquare), in association with *Hibiscus moscheutos* ssp. *moscheutos* (eastern rosemallow), *Juncus canadensis* (Canadian rush), *Juncus effusus* (soft rush), *Eleocharis erythropoda* (bald spikerush), *Osmunda regalis* (royal fern), *Osmunda cinnamomea* (cinnamon fern), *Thelypteris palustris* (eastern marsh fern), and *Triadenum virginicum* (Virginia marsh St. John's-wort). *Typha latifolia* (broadleaf cattail) may be present but generally only occurs at low cover. A diverse range of other forbs may also be associated with this community. Shrubs may be present as sparsely distributed individuals, or more densely from the wetland edge. Typical shrubs include *Rosa palustris* (swamp rose), *Vaccinium corymbosum* (highbush blueberry), *Morella pensylvanica* (northern bayberry), and *Acer rubrum* (red maple).

Characteristic Species: *Juncus canadensis* (Canadian rush), *Schoenoplectus pungens* var. *pungens* (common threesquare)

Reference Sites: Monds Island (New Jersey Audubon Society), NJ; Raccoon Creek/Repaupo Creek, NJ; Route 44 at Birch Creek, Gloucester County, NJ; Oldman's Creek, NJ

Global and State Conservation Ranks and Reasons: GNR (8-Nov-2000). NJ: SNR.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.685545

References: Eastern Ecology Working Group n.d., Martin 1959b

ESTUARY PIPEWORT FRESHWATER INTERTIDAL FLAT

Eriocaulon parkeri - *Polygonum punctatum* Herbaceous Vegetation

Range: These intertidal flats occur in New Jersey in the Delaware Estuary.

Environmental Description: This community occurs within freshwater tidal wetland complexes in upper reaches of tides where there is seasonal flushing which removes accumulated fine-grained materials. The typical substrate consists of loamy sand with about 5% gravel. The moisture regime is very wet with the community being exposed during low tide and often remaining inundated during spring tides.

Vegetation Description: This community is an herbaceous (95% cover) wetland dominated by annuals or herbaceous perennials. *Eriocaulon parkeri* (estuary pipewort) is characteristic of this association. In the northern portion of the range, associated species include *Zizania aquatica* (Indian wild rice), *Ludwigia palustris* (marsh seedbox), *Bidens eatonii* (Eaton's beggarticks), *Bidens hyperborea* (estuary beggarticks), and *Schoenoplectus pungens* (common threesquare). Farther south, associates additionally include *Sagittaria latifolia* (broadleaf arrowhead), *Pontederia cordata* (pickerelweed), *Peltandra virginica* (green arrow-arum), and *Orontium aquaticum* (golden club). In New Jersey, associates include *Eleocharis palustris* (marsh spikerush), *Schoenoplectus smithii* (Smith's clubrush), and *Sagittaria subulata* (awl-leaf arrowhead). Vegetation cover can be highly variable, with significant fluctuations in floristic composition and species density from year to year. Seasonal variability also occurs; early in the season, *Isoetes* (quillwort) spp. can predominate.

Noteworthy Associated Plant and/or Animal Species: *Bidens eatonii* (Eaton's beggarticks), *Crassula aquatica* (water pygmyweed), *Eriocaulon parkeri* (estuary pipewort), *Limosella australis* (awlwort)

Characteristic Species: *Eriocaulon parkeri* (estuary pipewort)

Management Concerns: The vegetation is threatened by damming of tidal rivers, which causes silting and reduces the flushing of fine sediments necessary to maintain this community.

Reference Sites: Rancocas Creek at Mill Creek (Willingboro Township) Park, Burlington County, NJ

Global and State Conservation Ranks and Reasons: G2 (9-Nov-1998). DE: SNR, NJ: S2?. This freshwater to brackish-tidal vegetation is restricted to sandy, gravel or cobble shores of tidal rivers from southern Maine to North Carolina, with possible peripheral occurrences in South Carolina and New Brunswick, Canada. This community is extirpated from New York. The habitat is naturally rare and occurrences are of small size (generally a few acres or less).

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.687578

References: Barrett 1994, Bowman 2000, Breden 1989, Breden et al. 2001, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fleming et al. 2001, Gawler 2002, Haines 2001, Harrison 2004, MENHP 1991, Metzler and Barrett 2001, Rawinski 1984, Swain and Kearsley 2001

MOST ABUNDANT SPECIES

STRATUM	LIFEFORM	SPECIES
Herb (field)	Forb	<i>Eriocaulon parkeri</i> (estuary pipewort)
Herb (field)	Forb	<i>Gratiola aurea</i> (golden hedge-hyssop)
Herb (field)	Forb	<i>Ludwigia palustris</i> (marsh seedbox)
Herb (field)	Forb	<i>Polygonum punctatum</i> (dotted smartweed)
Herb (field)	Graminoid	<i>Leersia oryzoides</i> (rice cutgrass)

ESTUARY QUILLWORT TIDAL FLAT

Isoetes riparia Tidal Herbaceous Vegetation

Range: This community occurs in New Jersey and possibly Delaware in the Delaware Estuary.

Environmental Description: This association occurs on fresh tidal mud flats with soft to semi-soft substrates in shallow waters associated with embayments, occurring behind beaches and sand spits, as well as along margins of estuaries. These occur in quiet waters where fine sediments accumulate.

Vegetation Description: The vegetation is sparse but is characterized by *Isoetes riparia* (riverbank quillwort). Associated species include *Cyperus bipartitus* (shining flatsedge), *Elatine americana* (American waterwort), *Sagittaria graminea* (grassleaf arrowhead), *Sagittaria subulata* (awl-leaf arrowhead), *Sagittaria calycina* (hooded arrowhead), *Sagittaria montevidensis* (giant arrowhead), *Heteranthera reniformis* (kidneyleaf mud-plantain), *Crassula aquatica* (water pygmyweed), *Eriocaulon parkeri* (estuary pipewort), *Orontium aquaticum* (golden club), *Gratiola virginiana* (roundfruit hedge-hyssop), *Eleocharis obtusa* (blunt spikerush), and in more muddy areas, *Schoenoplectus smithii* (smith's clubrush). This may be the potential habitat of *Micranthemum micranthemoides* (Nuttall's mudflower). *Isoetes riparia* (riverbank quillwort) also occurs in non-tidal ponds in New Jersey.

Noteworthy Associated Plant and/or Animal Species: *Eriocaulon parkeri* (estuary pipewort)

Characteristic Species: *Isoetes riparia* (riverbank quillwort)

Dynamics/Successional Trajectory: The occurrence and extent of mud flats vary with coastline morphology and tidal amplitude. Mud flats are regularly flooded and exposed by diurnal tides (Whitlatch 1982).

Reference Sites: Rancocas Creek at Mill Creek (Willingboro Township) Park, Burlington County, NJ

Global and State Conservation Ranks and Reasons: GNR (1-Dec-1997). DE: SNR, NJ: S2S3.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.683281

References: Bartgis 1986, Bowman 2000, Breden 1989, Breden et al. 2001, Eastern Ecology Working Group n.d., Edinger et al. 2002, Harrison 2004, Rawinski 1984, Schafale 2000, Swain and Kearsley 2001, Whitlatch 1982

MOST ABUNDANT SPECIES

STRATUM	LIFEFORM	SPECIES
Herb (field)	Fern or fern ally	<i>Isoetes riparia</i> (riverbank quillwort)

FRESHWATER TIDAL MIXED FORBS HIGH MARSH

Impatiens capensis - *Peltandra virginica* - *Sagittaria latifolia* - (*Typha angustifolia*) Tidal Herbaceous Vegetation

Range: This association occurs in freshwater tidal marshes along the Atlantic coast from Maine to Virginia. It occurs in the New Jersey portion of the Delaware Estuary.

Environmental Description: This association occurs in reliably flooded swales or backmarshes within the upper reaches of freshwater tidal marshes and within naturally ice-scoured levees and creekbanks. Salinity is fresh to slightly brackish. These low-lying depressions are flooded for a longer duration than the surrounding habitat as they trap floodwaters as tides recede. Soils are highly variable, ranging from silts, silty mucks, peats, or sands.

Vegetation Description: Species composition and abundance in these small-patch wet depression are highly variable. They are best characterized by the presence and/or dominance of *Peltandra virginica* (green arrow-arum), *Impatiens capensis* (orange jewelweed), *Sagittaria latifolia* (broadleaf arrowhead), and/or *Typha angustifolia* (narrowleaf cattail). Associated species commonly include *Pontederia cordata* (pickerelweed), *Polygonum* (smartweed, knotweed) spp. (*Polygonum arifolium* (halberd-leaf tearthumb), *Polygonum sagittatum* (arrowleaf tearthumb), *Polygonum hydropiperoides* (swamp smartweed), *Polygonum punctatum* (dotted smartweed), *Bidens* (beggarticks) spp. (*Bidens laevis* (smooth beggarticks), *Bidens frondosa* (devil's pitchfork), *Schoenoplectus fluviatilis* (river bulrush), *Leersia oryzoides* (rice cutgrass), *Amaranthus cannabinus* (water-hemp), *Sium suave* (hemlock water-parsnip), *Apios americana* (groundnut), *Iris versicolor* (harlequin blueflag), *Echinochloa walteri* (long-awn cock's-spur grass), and others. The exotic *Murdannia keisak* (marsh dewflower) has been noted in this community in the southern portion of the range. Species of the surrounding oligohaline or mesohaline marshes or from palustrine setting can occur in these microhabitats, but are usually not dominant; these include *Zizania aquatica* (Indian wild rice), *Onoclea sensibilis* (sensitive fern), *Hibiscus moscheutos* (eastern rosemallow), *Cyperus strigosus* (straw-colored flatsedge), *Lindernia dubia* (yellowseed false pimpernel), *Equisetum fluviatile* (water horsetail), *Iris versicolor* (harlequin blueflag), *Boehmeria cylindrica* (small-spike false nettle), *Thelypteris palustris* (eastern marsh fern), or *Carex stricta* (tussock sedge).

Noteworthy Associated Plant and/or Animal Species: *Bidens bidentoides* (Delmarva beggarticks), *Justicia americana* (American water-willow)

Characteristic Species: *Impatiens capensis* (orange jewelweed), *Peltandra virginica* (green arrow-arum), *Sagittaria latifolia* (broadleaf arrowhead), *Typha angustifolia* (narrowleaf cattail)

Dynamics/Successional Trajectory: Freshwater tidal marshes are naturally dynamic systems that are best developed where there is a major input of freshwater, a daily tidal range of at least 0.5 m, and a geomorphology that tends to constrict and magnify tidal influence in the upper reaches of the estuary (Odum et al. 1984). They are subject to diurnal flooding by tides and seasonal and episodic flooding from river discharge. Plant composition of freshwater tidal marshes generally occurs as a mosaic of patches dominated by a few or a single species. Species composition is determined by species life history characteristics, especially lifeform, phenology and mode of regeneration in response to microhabitat conditions, and the frequency and duration of flooding. Plant composition has seasonal variation. This association occurs in microhabitats within freshwater tidal marsh systems. As the low-lying depressions fill with sediment, the vegetation shifts to reflect the surrounding association.

This association is also very similar to Water-hemp Tidal Marsh (oligohaline), *Amaranthus cannabinus* Tidal Herbaceous Vegetation (Water Hemp Tidal Marsh in this report), and may grade temporally with annual rainfall/tidal influence.

Management Concerns: The exotic *Murdannia keisak* (marsh dewflower) has been noted in this community in the southern portion of the range.

Reference Sites: Hamilton Marsh, Mercer County, NJ; Trenton Marsh, Mercer County, NJ; Pedricktown Marsh; Mill Creek (Willingboro Township) Park, Burlington County, NJ

Global and State Conservation Ranks and Reasons: GNR (1-Dec-1997). DE: S4, NJ: S3, PA?: SNA.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.689421

References: Barrett 1989, Barrett 1994, Bartgis 1986, Bowman 2000, Breden 1989, Breden et al. 2001, Clancy 1996, Coulling 2002, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fleming 2001, Fleming et al. 2001, Gawler 2002, Harrison 2001, Harrison 2004, Metzler and Barrett 2001, Metzler and Barrett 2004, Rawinski 1984, Reschke 1990, Swain and Kearsley 2001, VDNH 2003

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Herb (field)	Forb	<i>Impatiens capensis</i> (orange jewelweed)
Herb (field)	Forb	<i>Peltandra virginica</i> (green arrow-arum)
Herb (field)	Forb	<i>Sagittaria latifolia</i> (broadleaf arrowhead)

NORTH ATLANTIC FRESH TIDAL SHRUB SWAMP

Alnus (incana ssp. rugosa, serrulata) - Cornus amomum Shrubland

Range: This association is found in coastal areas with tidally influenced river systems from Maine to Delaware in the North Atlantic. It occurs in Delaware and New Jersey in the Delaware Estuary.

Environmental Description: This association occurs in freshwater tidal systems in fresh to brackish reaches of tidal rivers along the marsh-upland transition. This shrubland is best developed along major tidal river systems that have a gradual elevation gradient. The substrate is alluvial and fine silty loam, loamy sand, or fine- or medium-grained sand without significant peat deposits. There is distinct hummock-and-hollow micro-relief.

Vegetation Description: This shrubland is dominated by *Alnus serrulata* (smooth alder) and/or *Alnus incana ssp. rugosa* (speckled alder). In some examples one or both of these may be characteristically dominant or nearly so. Other examples may be more semi-open with a mixed canopy of *Alnus* (alder) with other shrubs such as *Cornus amomum* (silky dogwood), *Rosa palustris* (swamp rose), *Ilex verticillata* (common winterberry), *Viburnum dentatum* (southern arrow-wood), *Clethra alnifolia* (coastal sweet-pepperbush), and *Lindera benzoin* (northern spicebush). Other woody plants which may be present include *Sambucus canadensis* (American elder), *Salix* (willow) spp., *Amorpha fruticosa* (tall indigobush), *Cephalanthus occidentalis* (common buttonbush), *Decodon verticillatus* (swamp-loosestrife), *Toxicodendron vernix* (poison-sumac), and *Toxicodendron radicans* (eastern poison-ivy). More northern examples may contain *Viburnum recognitum* (northern arrow-wood) and *Spiraea alba var. latifolia* (broadleaf meadowsweet). *Carex stricta* (tussock sedge) may also be present, and there is a great deal of micro-relief (tussocks and furrows) leading to high species diversity. Some herbaceous associates are *Osmunda regalis var. spectabilis* (royal fern), *Thelypteris palustris var. pubescens* (eastern marsh fern), *Galium* (bedstraw) spp., *Onoclea sensibilis* (sensitive fern), *Pilea fontana* (lesser clearweed), *Polygonum punctatum* (dotted smartweed), *Apios americana* (groundnut), *Typha latifolia* (broadleaf cattail), *Peltandra virginica* (green arrow-arum), *Pontederia cordata* (pickerelweed), *Mikania scandens* (climbing hempvine), *Symphotrichum novi-belgii* (new belgium American-aster), *Boehmeria cylindrica* (small-spike false nettle), *Impatiens capensis* (orange jewelweed), *Triadenum walteri* (greater marsh-St. John's-wort), *Asclepias incarnata* (swamp milkweed), *Carex atlantica* (prickly bog sedge), *Platanthera clavellata* (small green wood orchid), and *Xyris torta* (slender yellow-eyed-grass).

Characteristic Species: *Alnus incana ssp. rugosa* (speckled alder), *Alnus serrulata* (smooth alder)

Dynamics/Successional Trajectory: This shrubland community generally occurs between mean high tide level and mean high water level of annual river flooding in the spring, and it is generally flooded irregularly by spring tides.

Reference Sites: Lewden-Greene Park, New Castle County, DE; Trenton Marsh, Mercer County, NJ; north of Old Ferry Landing, Gloucester City, NJ; Edgewater Park Coves, NJ; Maurice River, south of Millville, NJ

Global and State Conservation Ranks and Reasons: GNR (15-Aug-1997). DE: SNR, NJ: SNR, PA: SNR.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.684398

References: Bowman 2000, Breden 1989, Breden et al. 2001, Clancy 1996, Collins and Anderson 1994, Coulling pers. comm., Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Fleming pers. comm., Gawler 2001, Gawler 2002, Harrison and Stango 2003, Hart 1990, McCoy and Fleming 2000, Metzler and Barrett 2001, Metzler and Barrett 2004, Rawinski 1984, Reschke 1990, Sneddon et al. 1996, Sperduto 2000b, Swain and Kearsley 2000, Swain and Kearsley 2001, Tiner 1995

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Alnus incana</i> ssp. <i>rugosa</i> (speckled alder)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Alnus serrulata</i> (smooth alder)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Cornus amomum</i> (silky dogwood)

OLIGOHALINE MIXED FORBS TIDAL MARSH

Hibiscus moscheutos - *Polygonum arifolium* - *Leersia oryzoides* - (*Carex stricta*) Tidal Herbaceous Vegetation

Range: This community is currently described from Virginia, Maryland, and New Jersey.

Environmental Description: Most stands are located near the edge of an extensive marsh but set by the main river channel and often bordered by scattered clumps of shrubs. There is often hummock-and-hollow microtopography.

Vegetation Description: These are diverse oligohaline marshes characterized by variable dominance patterns but generally containing *Polygonum arifolium* (halberd-leaf tearthumb), *Hibiscus moscheutos* ssp. *moscheutos* (eastern rosemallow), *Polygonum punctatum* (dotted smartweed), *Peltandra virginica* (green arrow-arum), *Leersia oryzoides* (rice cutgrass), *Polygonum sagittatum* (arrowleaf tearthumb), *Mikania scandens* (climbing hempvine), and *Toxicodendron radicans* (eastern poison-ivy). *Bidens laevis* (smooth beggarticks), *Cicuta maculata* (spotted water-hemlock), *Cuscuta* (dodder) sp., *Impatiens capensis* (orange jewelweed), *Lycopus americanus* (American water-horehound), and *Sagittaria latifolia* (broadleaf arrowhead), and graminoids such as *Typha latifolia* (broadleaf cattail) and *Schoenoplectus fluviatilis* (river bulrush) may also be present, but only at low cover. All of these species are able to tolerate a broad range of halinity, and the high mean species richness of this type suggests that it is generally restricted to only slightly oligohaline habitats. Infrequently present are several species that are more specific to oligohaline conditions, including *Echinochloa walteri* (long-awn cock's-spur grass), *Kosteletzkya virginica* (seashore mallow), *Pluchea odorata* (sweetscent), *Rumex verticillatus* (swamp dock), *Sagittaria lancifolia* (lanceleaf arrowhead), and *Teucrium canadense* (American germander). *Spartina cynosuroides* (giant cordgrass) occurs in approximately two-thirds of the representative vegetation sample plots and at times codominates. The colonial sedge *Carex stricta* (tussock sedge) often forms local dominance patches, characteristically on hummocks raised 20-25 cm above the primary marsh surface. Such stands also characteristically contain scattered individuals of *Rosa palustris* (swamp

rose) or *Cephalanthus occidentalis* (common buttonbush). The creek border may be also be dominated by *Decodon verticillatus* (swamp-loosestrife).

Characteristic Species: *Carex stricta* (tussock sedge), *Hibiscus moscheutos* ssp. *moscheutos* (eastern rosemallow), *Polygonum arifolium* (halberd-leaf tearthumb)

Dynamics/Successional Trajectory: This association forms in oligohaline marshes on the Coastal Plain where gradual elevation gradients allow exaggeration of salinity gradients.

Reference Sites: Trenton Marsh, Mercer County, NJ; Taylor's Preserve, Riverton, Burlington County, NJ; Mannington Creek, NJ; Pedricktown Marsh, NJ

Global and State Conservation Ranks and Reasons: GNR (12-May-2002). NJ: SNR.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.685367

References: Bartgis 1986, Coulling 2002, Eastern Ecology Working Group n.d., Fleming et al. 2004, Harrison 2004, Harrison pers. comm.

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Short shrub/sapling rosemallow)	Semi-shrub	<i>Hibiscus moscheutos</i> ssp. <i>moscheutos</i> (eastern
Herb (field)	Forb	<i>Polygonum arifolium</i> (halberd-leaf tearthumb)
Herb (field)	Graminoid	<i>Leersia oryzoides</i> (rice cutgrass)

PICKERELWEED TIDAL MARSH

Peltandra virginica - *Pontederia cordata* Tidal Herbaceous Vegetation

Range: This community occurs from Maine to Virginia, excluding Rhode Island and New Hampshire. It occurs in the New Jersey and Delaware portions of the Delaware Estuary.

Environmental Description: This community occurs low within freshwater tidal marshes on muck substrates of variable depth. There is a long duration of tidal flooding, and the community is exposed only for a short period of time each day when the tide is out.



Photo by Kathleen Strakosch Walz

Vegetation Description: This community is dominated by leafy forbs. *Peltandra virginica* (green arrow-arum) and *Pontederia cordata* (pickerelweed) are codominant, and associated species can include *Zizania aquatica* (Indian wild rice), *Sagittaria latifolia* (broadleaf arrowhead), *Acorus americanus* (several-vein sweetflag), *Polygonum arifolium* (halberd-leaf tearthumb), *Polygonum hydropiperoides* (swamp smartweed), *Polygonum sagittatum* (arrowleaf tearthumb), and *Bidens* (beggarticks) spp. Species occurring less frequently can include *Typha* (cattail) spp. and *Impatiens capensis* (orange jewelweed).

Characteristic Species: *Peltandra virginica* (green arrow-arum), *Pontederia cordata* (pickerelweed)

Dynamics/Successional Trajectory: Freshwater tidal marshes are naturally dynamic systems that are best developed where there is a major input of freshwater, a daily tidal range of at least 0.5 m, and a geomorphology that tends to constrict and magnify tidal influence in the upper reaches of the estuary (Odum et al. 1984). They are subject to diurnal flooding by tides and seasonal and episodic flooding from

river discharge. Plant composition of freshwater tidal marshes generally occurs as a mosaic of patches dominated by a few or a single species. Species composition is determined by species life history characteristics, especially lifeform, phenology and mode of regeneration in response to microhabitat conditions, and the frequency and duration of flooding. Plant composition has seasonal variation. This community can grade into other freshwater tidal marsh associations, especially *Nuphar lutea ssp. advena* Tidal Herbaceous Vegetation (Pond Lily Tidal Marsh in this report) and *Zizania aquatica* Tidal Herbaceous Vegetation (Atlantic Coast Wild Rice Marsh in this report).

Management Concerns: Many element occurrences have been impacted by the damming of tidal rivers and by pollution in urban areas.

Reference Sites: Supawna Meadows NWR, NJ; Clinton WMA, NJ; Pedricktown Marsh Complex, NJ; Mannington Meadows, NJ; Manumuskin River (TNC Preserve), NJ

Global and State Conservation Ranks and Reasons: G3G4 (4-Nov-1998). DE: SNR, NJ: SNR. This community is restricted in range (Atlantic Coast from Maine to Virginia, not including New Hampshire and Rhode Island) and available habitat (freshwater tidal rivers with broad shoreline expanses subjected to moderate to high tidal fluctuation), with a liberal estimate of <200 EOs and <35,000 acres rangewide.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.688713

References: Bowman 2000, Breden et al. 2001, Coulling 2002, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fleming 2001, Fleming et al. 2001, Harrison 2001, Harrison 2004, McCoy and Fleming 2000, Metzler and Barrett 2004, Odum et al. 1984, Peet et al. unpubl. data 2002

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Herb (field)	Forb	<i>Peltandra virginica</i> (green arrow-arum)

POND-LILY TIDAL MARSH

Nuphar lutea ssp. advena Tidal Herbaceous Vegetation

Range: This association occurs along tidal rivers from New York to North Carolina. In the Delaware Estuary, this community occurs in New Jersey and Delaware.

Environmental Description: This association occurs at low elevations within freshwater tidal marshes, within tidal range but beyond the influence of salinity. It generally occurs below mean low water level where water depth is approximately 1-3 m or less. It receives a relatively long duration of flooding and is infrequently exposed at only the lowest tides. The association occurs on unconsolidated tidal mud flats and submerged point



Photo by Linda Kelly

bars of large coastal river meanders adjacent to open water of river or tidal creek channels. Substrate is silty alluvial mud that is high in organic matter content.

Vegetation Description: Vegetation of this association is characterized by large clonal stands of dense leafy forbs dominated by *Nuphar lutea ssp. advena* (broadleaf pond-lily). Associated species tend to occur as scattered individuals and include *Peltandra virginica* (green arrow-arum), which can also be locally codominant, *Pontederia cordata* (pickerelweed), *Zizania aquatica* (Indian wild rice), *Sagittaria latifolia* (broadleaf arrowhead), *Bidens laevis* (smooth beggarticks), *Acorus calamus* (sweetflag), and/or *Schoenoplectus fluviatilis* (river bulrush). *Nuphar lutea ssp. advena* (broadleaf pond-lily) forms nearly monotypic stands early in the growing season. Associated species emerge later in the season and can

eventually overtop *Nuphar* (yellow pond-lily) plants, which senesce and tend to become insect-infested in late summer. Submerged aquatic species can occur in this association, including *Potamogeton epiphydrus* (ribbonleaf pondweed), *Ceratophyllum demersum* (coontail), and the invasive exotic *Hydrilla verticillata* (hydrilla). In shallower waters, additional mud flat species can occur.

Characteristic Species: *Nuphar lutea* ssp. *advena* (broadleaf pond-lily)

Dynamics/Successional Trajectory: Freshwater tidal marshes are naturally dynamic systems that are best developed where there is a major input of freshwater, a daily tidal range of at least 0.5 m, and a geomorphology that tends to constrict and magnify tidal influence in the upper reaches of the estuary (Odum et al. 1984). They are subject to diurnal flooding by tides and seasonal and episodic flooding from river discharge. Plant composition of freshwater tidal marshes generally occurs as a mosaic of patches dominated by a few or a single species. Species composition is determined by species life history characteristics, especially lifeform, phenology and mode of regeneration in response to microhabitat conditions, and the frequency and duration of flooding. Plant composition has seasonal variation. Landward, this community can grade into other freshwater tidal marsh associations, especially *Peltandra virginica* - *Pontederia cordata* Tidal Herbaceous Vegetation (CEGL004706). Seaward, this association grades into submerged aquatic vegetation.

Management Concerns: The invasive exotic *Hydrilla verticillata* (hydrilla) often occurs in this community. This vegetation is vulnerable to pollution from coastal run-off as well as oil spills off the coast.

Reference Sites: Hamilton Marsh, Mercer County, NJ

Global and State Conservation Ranks and Reasons: G4G5 (19-Jan-2006). DE: SNR, NJ: S2S3, PA: SNR. This vegetation ranges from Delaware Bay to North Carolina, with a discontinuous range north to Maine. It occurs in the freshwater tidal portions of large rivers and embayments and can occupy large patches.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.688122

References: Bowman 2000, Breden 1989, Breden et al. 2001, Brumback and Mehrhoff 1996, Coulling 2002, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fleming 2001, Fleming et al. 2001, Gawler 2002, Good and Good 1975b, Harrison 2001, Harrison 2004, McCormick and Ashbaugh 1972, McCormick et al. 1970, McCoy and Fleming 2000, Odum et al. 1984, Peet et al. unpubl. data 2002, Rawinski 1984, Reschke 1990, Schafale 2000, Schafale and Weakley 1990, VDNH 2003

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Floating aquatic	Aquatic herb (floating & submergent)	<i>Nuphar lutea</i> ssp. <i>advena</i> (broadleaf pond-lily)

SWEETFLAG TIDAL MARSH

Acorus calamus Tidal Herbaceous Vegetation

Range: This community is currently described from Massachusetts to Virginia. It occurs in New Jersey and possibly Delaware in the Delaware Estuary.

Environmental Description: The association is best developed at higher, irregularly flooded elevations within fresh and oligohaline tidal marshes but can occur in areas with a wide tidal range. Substrate is generally fine-particled, but varies from silts and silty mucks to peats and sands. The setting within the tidal marsh tends to be poorly drained; tidal flooding is ponded and of longer duration than other areas. *Acorus calamus* (sweetflag)



Photo by Linda Kelly

can occur in low mid-tidal areas, but extensive colonies do not tend to develop in these situations.

Vegetation Description: This is a tall tidally flooded grassland dominated by *Acorus calamus* (sweetflag), which can form dense colonies over extensive patches within the interior of high marshes. Associated species are variable and can include *Schoenoplectus fluviatilis* (river bulrush), *Peltandra virginica* (green arrow-arum), *Sagittaria latifolia* (broadleaf arrowhead), *Polygonum punctatum* (dotted smartweed), and *Impatiens capensis* (orange jewelweed). Species that can occasionally occur include *Pontederia cordata* (pickerelweed), *Zizania aquatica* (Indian wild rice), *Leersia oryzoides* (rice cutgrass), *Typha latifolia* (broadleaf cattail), *Polygonum arifolium* (halberd-leaf tearthumb), *Bidens coronata* (crowned beggarticks), *Hibiscus moscheutos* (eastern rosemallow), and other *Schoenoplectus* (clubrush) spp. *Acorus calamus* (sweetflag) is conspicuously dominant in spring and early summer. Later in the season, culms tend to lodge and form mats and be overtopped by other species. In Delaware, *Acorus americanus* (several-vein sweetflag), the native sweetflag, is more common.

Characteristic Species: *Acorus calamus* (sweetflag)

Dynamics/Successional Trajectory: Freshwater tidal marshes are naturally dynamic systems that are best developed where there is a major input of freshwater, a daily tidal range of at least 0.5 m, and a geomorphology that tends to constrict and magnify tidal influence in the upper reaches of the estuary (Odum et al. 1984). They are subject to diurnal flooding by tides and seasonal and episodic flooding from river discharge. Plant composition of freshwater tidal marshes generally occurs as a mosaic of patches dominated by a few or a single species. Species composition is determined by species life history characteristics, especially lifeform, phenology and mode of regeneration in response to microhabitat conditions and the frequency and duration of flooding. Plant composition has seasonal variation. *Acorus calamus* (sweetflag) forms large, clonal patches (Barrett 1989). Its rhizomes can locally raise the surface of the marsh, effectively ponding tidal waters and trapping debris and sediments in backmarsh areas (Caldwell 1990).

Management Concerns: *Phalaris arundinacea* (reed canarygrass) is present in New Jersey examples of this community.

Reference Sites: Trenton Marsh, Mercer County, NJ; Crosswicks Creek Greenway at Provinceline Road, NJ; North Branch of Rancocas Creek, NJ

Global and State Conservation Ranks and Reasons: GNR (10-May-2002). DE: SNR, NJ: SNR.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.683165

References: Barrett 1989, Barrett 1994, Caldwell 1990, Coulling 2002, Eastern Ecology Working Group n.d., Fleming 2001, Fleming et al. 2004, Harrison 2001, Harrison 2004, McCormick and Ashbaugh 1972, Metzler and Barrett 2001, Odum et al. 1984

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Herb (field)	Forb	<i>Acorus calamus</i> (sweetflag)

WATER-HEMP TIDAL MARSH

Amaranthus cannabinus Tidal Herbaceous Vegetation

Range: This association occurs along tidal rivers from Maine to Virginia. It occurs in the Delaware and New Jersey portions of the Delaware Estuary.

Environmental Description: This association occurs along mid-tidal sections of wave- and ice-scoured riverbanks or on eroded remnants of dikes and natural levees. It occurs where tidal floodwater is oligohaline to mesohaline. The association occasionally occurs in freshwater tidal backmarsh settings in local patches where the substrate is firm and gravelly. Substrate is generally coarse but ranges from fine sand to peaty mud to gravel to rocky shores. There is regular inundation by tides, but floodwaters freely drain.



Photo by Linda Kelly

Vegetation Description: The community is predominantly comprised of annual species, especially *Amaranthus cannabinus* (water-hemp). Associated species include, but are not limited to, *Bidens connata* (purple-stem beggarticks), *Bidens laevis* (smooth beggarticks), *Bidens cernua* (nodding beggarticks), *Polygonum punctatum* (dotted smartweed), *Sagittaria latifolia* (broadleaf arrowhead), *Zizania aquatica* (Indian wild rice), and *Schoenoplectus pungens* (common threesquare). Other species that may occur infrequently include *Polygonum arifolium* (halberd-leaf tearthumb), *Polygonum sagittatum* (arrowleaf tearthumb), *Acorus calamus* (sweetflag), *Pilea pumila* (Canadian clearweed), and *Leersia oryzoides* (rice cutgrass).

Characteristic Species: *Amaranthus cannabinus* (water-hemp)

Dynamics/Successional Trajectory: This association occurs on wave- and ice-scoured mid-tidal shores of rivers and tidal creeks. Having a strong component of annuals, the species composition and abundance can change dramatically from year to year.

Management Concerns: This community is exposed to a relatively high degree of natural disturbance from wave and ice scour.

Reference Sites: Blackbird Creek, New Castle County, DE; Manumuskin River (TNC Preserve), NJ; Trenton Marsh, Mercer County, NJ

Global and State Conservation Ranks and Reasons: G3G5 (1-Dec-1997). DE: SNR, NJ: S2S3.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.689238

References: Bartgis 1986, Bowman 2000, Breden 1989, Breden et al. 2001, Caldwell 1990, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Gawler 2001, Gawler 2002, Harrison 2004, Metzler and Barrett 2001, Metzler and Barrett 2004, Rawinski 1984, Reschke 1990, Swain and Kearsley 2000, Swain and Kearsley 2001

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Herb (field)	Forb	<i>Amaranthus cannabinus</i> (water-hemp)

WATER-WILLOW SHRUB SWAMP

Decodon verticillatus Semipermanently Flooded Shrubland

Range: This community occurs in the New Jersey portion of the Delaware Estuary and may also occur in Delaware.

Environmental Description: This shrubland forms as a fringe along aquatic edges of lakes and streams.

Vegetation Description: *Decodon verticillatus* (swamp-loosestrife) forms a dense, often monotypic tangle. *Cephalanthus occidentalis* (common buttonbush) can occur but with less abundance than *Decodon verticillatus* (swamp-loosestrife). Herbaceous species vary widely but may include *Nuphar lutea* ssp. *variegata* (variegated yellow pond-lily), *Nymphaea odorata* (white water-lily), *Peltandra virginica* (green arrow-arum), *Pontederia cordata* (pickerelweed), *Utricularia* (bladderwort) spp., and *Potamogeton* (pondweed) spp.

Characteristic Species: *Decodon verticillatus* (swamp-loosestrife)

Reference Sites: (NJ and DE - no sites identified)

Global and State Conservation Ranks and Reasons: GNR (15-Dec-1994). DE: SNR, NJ: SNR, PA: SNR.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.685207

References: Bowman 2000, Breden et al. 2001, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fike 1999, Harrison 2004, Metzler and Barrett 2001, Swain and Kearsley 2001

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Decodon verticillatus</i> (swamp-loosestrife)