14920

Great Lakes Coastal Marsh Systems

BpS Model/Description Version: Aug. 2020

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Vegetation Type

Herbaceous Wetland

Map Zones

41, 50, 51, 52, 63

Geographic Range

Great Lakes Coastal Marsh Systems are found throughout the northern Great Lakes Basin in the United States and Canada from New York west to Minnesota (NatureServe 2007).

Biophysical Site Description

Great Lakes marshes are found along the shoreline of the Great Lakes. Glacial landforms, in combination with recent longshore transport processes, create the prevalent physiographic features along much of the Great Lakes shoreline. Their characteristic differences in substrate, soils, slope, and drainage conditions largely determine both natural shoreline configuration and sediment composition. These, in turn, generate distinctive contexts for wetland development that vary in their exposure and resilience to lake processes and in their floristic composition.

Vegetation Description

Abiotic variables such as aquatic system, water-level fluctuations, surficial bedrock, glacial landform, and climate combine to determine the species composition and floristic quality of Great Lakes coastal wetlands. In general, Great Lakes marshes are dominated by graminoids such as *Schoenoplectis acutus*, *Schoenoplectis pungens*, *Eleocharis palustris*, *Juncus balticus*, *Carex lacustris*, and *Eleocharis rostellata*. In protected areas, algal precipitation of calcium carbonate forms marly mats that support calcium-loving plants.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| SCPU10 | *Schoenoplectus pungens* | Common threesquare |
| SCAC3 | *Schoenoplectus acutus* | Hardstem bulrush |
| JUBA | *Juncus balticus* | Baltic rush |
| TYLA | *Typha latifolia* | Broadleaf cattail |
| CACA4 | *Calamagrostis canadensis* | Bluejoint |
| CALA16 | *Carex lacustris* | Hairy sedge |
| ELRO2 | *Eleocharis rostellata* | Beaked spikerush |
| DAFL3 | *Dasiphora floribunda* | Shrubby cinquefoil |

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

Disturbance Description

Fluctuations in water levels are one of the most important influences on Great Lakes wetlands. These fluctuations occur over three temporal scales: 1) short-term fluctuations (seiche) in water level caused by persistent winds and/or differences in barometric pressure; 2) seasonal fluctuations reflecting the annual hydrologic cycle in the Great Lakes basin; and 3) interannual fluctuations in lake level as a result of variable precipitation and evaporation within their drainage basins (Minc 1997; Minc and Albert 1998). All of these scales contribute to the dynamic character of coastal wetlands, although interannual fluctuations result in the greatest wetland variability. These extreme lake-level fluctuations can range from 3.5-6.5ft (1.3-2.5m) and occur with no regular periodicity. In general, as water levels rise and fall, vegetation communities shift landward during high-water years and lakeward during low-water years. However, fluctuating lake levels effect not only a change in water depth but also a broad range of associated stresses to which plants must respond, including changes in water current, wave action, turbidity (clarity or light penetration), nutrient content or availability, alkalinity, and temperature, as well as ice scour and sediment displacement. Since individual species display different tolerance limits along one or more of these dimensions, species composition can also change dramatically within a zone. Coastal wetland systems are adapted to and require periodic inundation.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement |  |  |  |  |
| Moderate (Mixed) |  |  |  |  |
| Low (Surface) |  |  |  |  |
| All Fires |  |  |  |  |

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

This system can be a linear system occurring along the Great Lakes or a small-medium patch system found at deltas.

Adjacency or Identification Concerns

Water-level regulation has significantly reduced the occurrence of extreme high and low water levels on Lake Ontario and to a lesser degree on Lake Superior. This disruption of the natural cycle favors species intolerant of water-depth change, excludes species requiring periodic exposure of fertile substrates, and potentially leads to a reduction of species diversity. The dominance of cattails in many Lake Ontario marshes suggests a trend toward reduced species diversity following a reduction in the amplitude of natural water-level fluctuations (Wilcox et al. 1993).

Both urban and agricultural development have resulted in severe degradation and loss of coastal marshes through pollution, land management, and ecosystem alteration. Urban development has impacted coastal wetlands in the following ways:

* Armoring of the shoreline and dredging of channels to create harbors has resulted in marsh elimination.
* Dumping of waste materials, such as sawdust and sewage and a wide variety of chemicals, has mechanically and chemically altered the shallow-water marsh environment, increasing turbidity, reducing oxygen concentrations, and altering the pH.
* Shipping traffic has mechanically eroded shoreline vegetation.

Water-level control of the Great Lakes and connecting rivers has altered natural wetland dynamics. Agriculture has had the following impacts on coastal wetlands:

* Drainage has eliminated large areas of marshes and coastal wetlands.
* Sedimentation has greatly increased turbidity, eliminating submergent species requiring clear water.
* Nutrient loading has locally reduced oxygen levels, prompted algal blooms, and led to the dominance of high-nutrient tolerant species such as cattails.
* Heavy agricultural sedimentation has led to the deposition of rich organic mud in the wet meadows and along the shoreline, favoring the dominance of early successional species.
* Introduction of exotic plants has altered macrophyte species composition.

Several exotic plants and animals pose a threat to the integrity of coastal wetlands. Exotics often outcompete native organisms, as well as altering their habitat (Hart et al. 2000). Significant exotic plants include *Lythrum salicaria*, *Phragmites australis*, *Phalaris arundinacea*, *Myriophyllum spicatum* (*Eurasian milfoil*), *Potamogeton crispus* (curly-leaf pondweed), and many less aggressive species. *Hydrocharis moris-ranae*, an aggressive floating-leaved plant, is expanding westward from the St. Lawrence River and Lake Ontario into Lake Erie and the Detroit River and has recently been documented in Michigan.

Exotic animals include *Dreissena polymorpha* (zebra mussel), *Cyprinus carpio* (common carp), *Neogobius* spp. (gobies), and *Bythotrephes cederstroemi* (spiny water flea), to name but a few. Many exotics arrive in shipping ballast, and many others were purposefully introduced.

Issues or Problems

This description and models cover a range of vegetation types including shore fens, marshes, and estuaries.

Native Uncharacteristic Conditions

Comments

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 | B | B | B | B | B | B | B | B | B | B |
| Herb | >1.0 | B | B | B | B | B | B | B | B | 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 | 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 22 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PORI2 | Potamogeton richardsonii | Richardson's pondweed | Lower |
| HEDU2 | Heteranthera dubia | Grassleaf mudplantain | Lower |
| VAAM3 | Vallisneria americana | American eelgrass | Lower |
| POOB2 | Potamogeton obtusifolius | Bluntleaf pondweed | Lower |

Description

Submergent marsh: *Heteranthera dubia*, *Miriophylium exalbescens*, *Potamogeton obtusifolius*, *Potamogeton richardsonii*, *Vallisneria americana*.

With a decrease in Great Lakes water levels, modeled using the optional 1.

*Maximum Tree Size Class*  
None

Class B 22 Early Development 2 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| TYLA | Typha latifolia | Broadleaf cattail | Low-Mid |
| SCAC3 | Schoenoplectus acutus | Hardstem bulrush | Lower |
| JUBA | Juncus balticus | Baltic rush | Low-Mid |
| VAAM3 | Vallisneria americana | American eelgrass | Lower |

Description

Emergent marsh: *Chara globularis*, *Najas flexilis*, *Nymphaea odorata*, *Potamogeton odorata*, *Potamogeton graminieus*, *Scripus acutus*, *Vallisneria americana*.

With a decrease in Great Lakes water levels, modeled using the optional 1.

*Maximum Tree Size Class*  
None

Class C 56 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| CACA4 | Calamagrostis canadensis | Bluejoint | Lower |
| ALIN2 | Alnus incana | Gray alder | Middle |
| ELRO2 | Eleocharis rostellata | Beaked spikerush | Low-Mid |
| CALA16 | Carex lacustris | Hairy sedge | Lower |

Description

Shrub swamp/wet meadow/shore fen: *Alnus rugosa*, *Calamagrostis canadensis*, *Carex lacustris*, *Carex stricta*, *Scutellaria galericulata*, *Typha latifolia*, *Potentialla fruticosa*, *Eleocharis rostellata*.

A significant increase in Great Lakes water levels, modeled using the optional 2.

*Maximum Tree Size Class*  
None

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Early1:ALL | 999 |
| Early2:ALL | 1 | Early2:ALL | 999 |
| Mid1:CLS | 2 | Mid1:CLS | 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** |
| Optional 1 | Early1:ALL | Early2:ALL | 0.025 | 40 | Yes | 0 |
| Optional 1 | Early2:ALL | Mid1:CLS | 0.025 | 40 | Yes | 0 |
| Optional 2 | Early2:ALL | Early1:ALL | 0.025 | 40 | Yes | 0 |
| Optional 2 | Mid1:CLS | Early2:ALL | 0.01 | 100 | Yes | 0 |

Optional Disturbances

Optional 1: Decline in Great Lakes water levels

Optional 2: Increase in Great Lakes water levels

References

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