

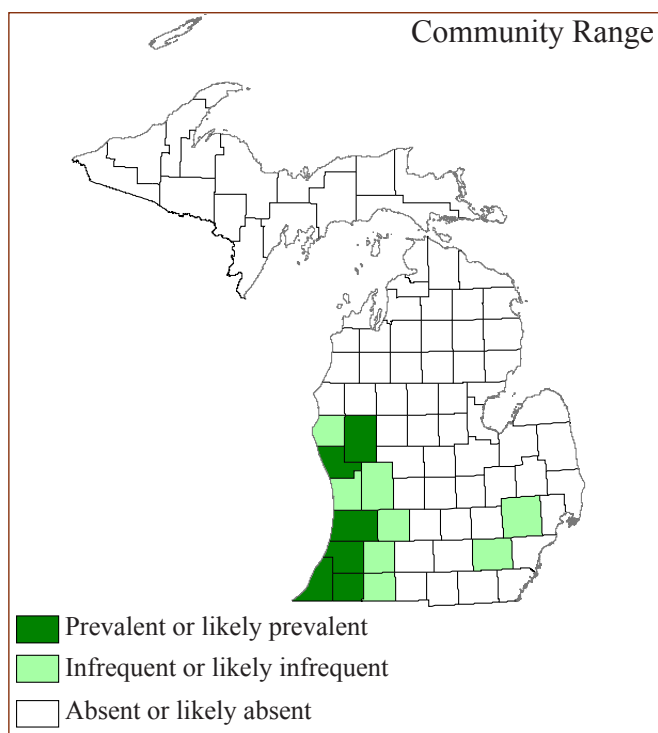


High water level, Goose Lake, 1990

Top photo by Michael R. Penskar
Bottom photo by Dennis A. Albert



Low water level, Goose Lake, 1999



Range: Coastal plain marsh is a Great Lakes Region wetland plant community comprised chiefly of species from the Atlantic and Gulf coastal plains. Coastal plain marsh occurs on sand deposits associated with postglacial lakes and outwash channels in southwest Michigan and northern Indiana, northern and central Wisconsin, and the southeastern Georgian Bay region of Ontario (Chapman 1990, Reznicek 1994). In southwest Michigan and northwestern Indiana, the greatest concentration of coastal plain marshes is found on sand deposits associated with postglacial stages of Lake Michigan (Reznicek 1994).

Global and State Rank: G2/S2

Rank Justification: Coastal plain marshes are rare in the Great Lakes Region and typically occur as small (e.g., less than 50 acres), isolated depressions. In Michigan, 42 coastal plain marshes have been identified occupying 2,500 acres (1,000 hectares) in all. Their significance as a conservation target is bolstered by the high numbers of rare plants, most of which occur as disjuncts from the Atlantic and Gulf coastal plains. More than 40 rare plants are found associated with coastal plain marsh in Michigan. The community is very sensitive to hydrologic disturbance and may be severely degraded by shoreline development, draining, damming, dredging, or filling. Species diversity may also be negatively impacted by disturbances to the seed bank from ORV use (Wisheu and Keddy 1989).

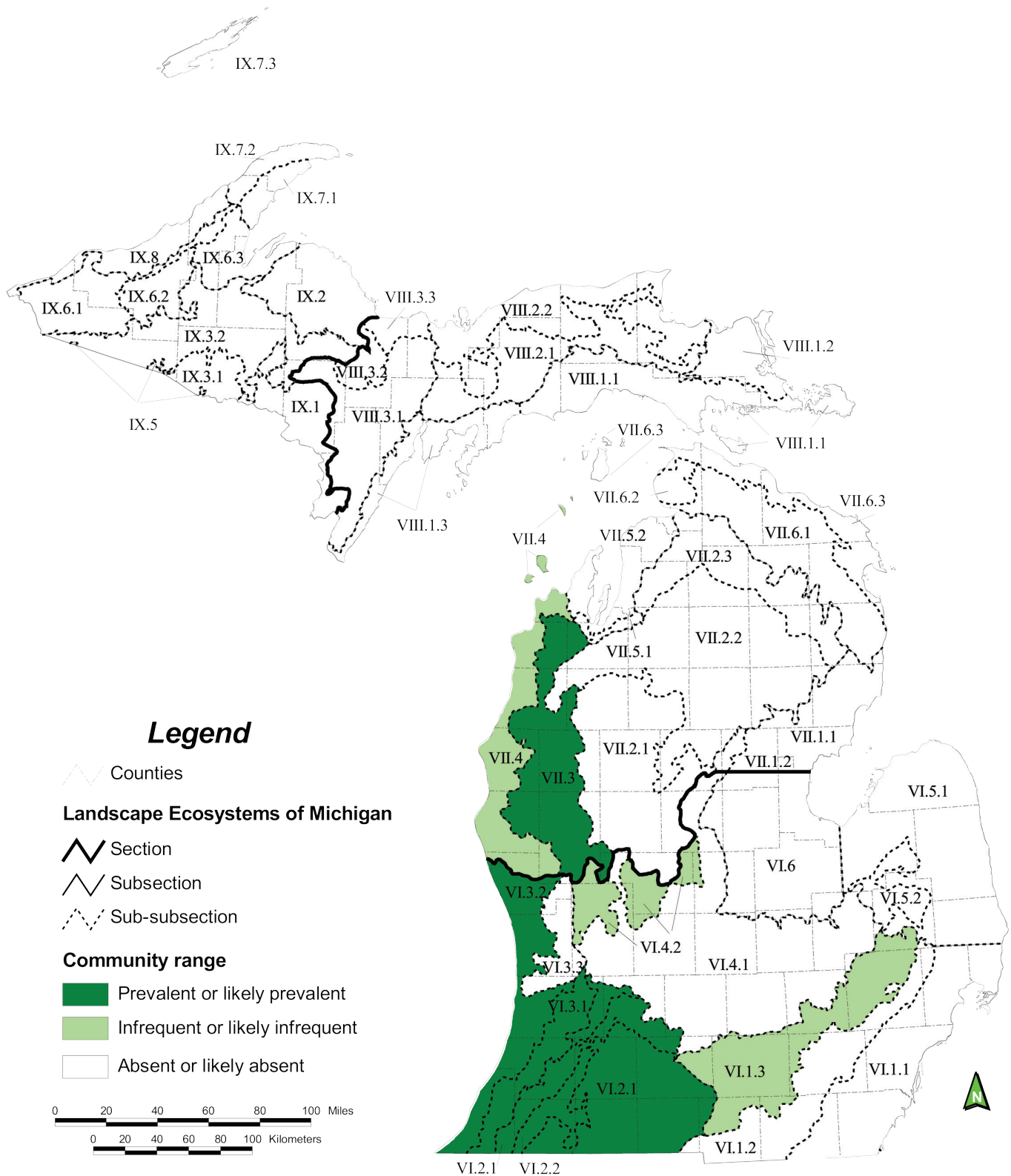
Landscape Context: Coastal plain marsh is a grass- and rush-dominated wetland community harboring numerous plant species disjunct from their primary

ranges along the Atlantic and Gulf coastal plains. In the upper Great Lakes Region this community occurs along the shores of softwater seepage lakes, ponds and depressions where water levels fluctuate both seasonally and yearly.

Coastal plain marsh occurs on sandy, pitted outwash plains and sandy lakeplains (Chapman 1990, Kost et al. 2007). Similar to the Atlantic and Gulf coastal plains, these level outwash plains and abandoned glacial lakebeds harbor shallow depressions with gently sloping sides (Brodowicz 1989, Chapman 1990). Where these depressions reach groundwater and the sandy substrate is acidic, coastal plain marsh may occur. The sandy soils underlying coastal plain marsh are strongly to very strongly acidic and nutrient poor. Organic deposits of peat, muck, or sandy peat may overlay the sandy substrate and in some basins a clay layer may occur several meters below sand (Chapman 1990).

Coastal plain marshes typically contain distinct vegetation zones often occurring as concentric bands around the center of depressions, lakes, and ponds. These zones may include open water, dense beds of floating aquatic plants, and grass and rush dominated moist meadow. Coastal plain marsh may be bordered by several other wetland communities. For example, coastal plain marsh along lakeshores is sometimes bordered by a floating mat of open bog. Along the upper margin of the wetland, wet-mesic sand prairie may occur. Lastly, in extensive depressions, shrub-carr and hardwood swamp are often found bordering coastal plain marshes.





Ecoregional map of Michigan (Albert 1995) depicting distribution of coastal plain marsh (Albert et al. 2008)



The level sandy outwash plains and lakeplains that contain coastal plain marsh depressions also support well drained and droughty upland communities.

The dry upland communities most commonly found bordering coastal plain marshes today are closed-canopy dry southern forest, dry-mesic southern forest, and oak-pine forest. However, in presettlement times, prior to fire suppression, the uplands bordering coastal plain marshes supported a variety of open-canopy, fire-dependent communities including oak openings, lakeplain oak openings, bur oak plains, oak barrens, oak-pine barrens, sand prairie, mesic sand prairie, and woodland prairie.

Natural Processes: Water level fluctuations occur both seasonally and yearly. Seasonally water levels tend to be highest during the winter and spring and lowest in late summer and fall. Less predictable are the yearly water level fluctuations. However, a pattern of short drawdowns of 1-3 years followed by extensive periods of inundation has been recorded for coastal plain marshes in New York (Schneider 1994). Many coastal plain marsh species exist only as dormant seeds within the soil seed bank during high-water years. Therefore, processes that enhance seed germination, seedling establishment, and flowering during low-water years are important in maintaining the seed bank.

Because water level fluctuation facilitates seed germination, seasonal drawdowns are critical to the survival on many coastal plain marsh species, especially annuals. As water levels begin to recede in early and mid-summer, direct sunlight penetrates the exposed pond shore and triggers seed germination (van der Valk 1981). In addition, with sunlight reaching the substrate, soil temperatures rise during the day before cooling at night. This diurnal temperature fluctuation also stimulates seed germination for many wetland species (Thompson and Grime 1983).

Fluctuating water levels also act to reduce competition from woody plants, which have been shown to outcompete and replace pondshore species (Keddy & Reznicek 1982). When water levels are high, woody species are unable to establish and prolonged flooding may result in tree and shrub seedling mortality.

Seasonal water level fluctuations also act as an important mechanism for seed dispersal (Schneider 1994). As water levels rise during winter and spring, seeds deposited along the ponds low-water line float to the surface and are carried by wave action to the wetland basin's outer margin. In addition to carrying dormant seeds, rising water levels also move sprouting seeds and organic matter into the upper shoreline in early spring (Schneider 1994). This seasonal movement of plant propagules and organic matter acts to maintain diversity and nutrient levels at the upper elevations of the wetland basin (Schneider 1994). Thus, the most

diverse zone of a coastal plain marsh typically occurs as a graminoid-dominated outer ring and may contain as many as 50-60 different plant species (Chapman 1990).

In the past, fire, in addition to fluctuating water levels, may have played an important role in replenishing the coastal-plain-marsh seed bank. In presettlement times, coastal plain marshes were frequently bordered by fire-dependent barrens and prairies. As fires moved through the uplands, they likely spread into adjacent coastal plain marshes, especially during drought years or when water levels were low as in late summer and early fall. Because fire has been shown to increase seed germination, enhance seedling establishment, and bolster flowering, it likely acted as an important mechanism for maintaining plant species diversity and replenishing the seed bank (Glenn-Lewin et al. 1990, Warners 1997).

Long distance seed dispersal among Midwest coastal plain marshes and between the Midwest and Atlantic and Gulf coastal plains is thought to be facilitated by migratory waterfowl (Brodowicz 1989). It is possible that waterfowl may also act to restore a species to a site where it has been depleted from the seed bank.

Vegetation Description: The flora of coastal plain marshes is characteristically dominated by monocotyledons, with annual species contributing significantly to overall diversity. For the majority of species, flowering and seed set occurs in late summer and fall, when water levels are lowest.

Coastal plain marshes typically contain four vegetation zones (Chapman 1990). 1) The deepest portion of the depression is usually inundated and supports floating aquatic plants. This zone may contain *Brasenia schreberi* (water shield), *Nuphar advena* (yellow pond-lily), *Nymphaea odorata* (sweet-scented waterlily), *Potamogeton bicupulatus* (waterthread pondweed), *P. illinoensis* (Illinois pondweed), *P. gramineus* (pondweed), *Scripus subterminalis* (bulrush), *Sparganium chlorocarpum* (green-fruited bur-reed), and *Utricularia* species (bladderwort). 2) Occurring along the lower shores and pond margins is a seasonally flooded zone with sparse graminoid cover where species such as *Eleocharis macrostachya* (tall beak-rush), *E. robbinsii* (spike-rush), *Fimbristylis autumnalis* (sedge), *Fuirena squarrosa* (umbrella grass), and *Psilocarya scirpoides* (bald-rush) may occur. *Potamogeton bicupulatus* and *Nuphar advena* are often found stranded along this lower shore. 3) In the saturated soil further from the shore, where seasonal water levels typically reach their peak, is a dense graminoid-dominated zone. This is the most floristically diverse zone and typically includes species such as *Aster dumosus* (bushy aster), *Calamagrostis canadensis* (blue-joint grass), *Carex scoparia* (sedge), *Cladium mariscoides* (twig-rush), *Eleocharis melanocarpa*



(black-fruited spike-rush), *Euthamia remota* (coastal plain flat-topped goldenrod), *Gnaphalium obtusifolium* (low cudweed), *Polygala cruciata* (cross-leaved milkwort), *Rhynchospora capitellata* (beak-rush), *Rubus hispidus* (swamp dewberry), and *Sphagnum subsecundum* (moss). 4) Lastly, many coastal plain marshes contain a temporarily flooded shrub and tree zone. Shrubs in this zone may include *Aronia prunifolia* (black chokeberry), *Cephalanthus occidentalis* (buttonbush), *Chamaedaphne calyculata* (leatherleaf), *Cornus* spp. (dogwoods), *Spiraea tomentosa* (steeplebush), and *Vaccinium corymbosum* (smooth highbush blueberry). When this zone is underlain by muck, *Decodon verticillatus* (whorled loosestrife) may occur (Brodowicz 1989). If present, the overstory is typically comprised of *Acer rubrum* (red maple), *Nyssa sylvatica* (black gum), *Quercus palustris* (pin oak), and occasionally *Salix nigra* (black willow). Common ground-layer species of this zone include *Woodwardia virginica* (Virginia chain-fern), *Bartonia virginica* (screw-stem), and *Sphagnum* mosses (Brodowicz 1989).

If the coastal plain marshes is bordered by dry, open sand above the high-water line, the following species typically occur *Aristida purpurascens* (three-awned grass), *Aureolaria pedicularia* (annual false foxglove), *Helianthemum bicknellii* (rockrose), *Lechea villosa* (hairy pinweed), and *Panicum virgatum* (switch grass) (Brodowicz 1989). The occurrence of dry, open sand above the high-water line instead of forest was probably more common prior to fire suppression.

Michigan Indicator Species: The following species are considered to be indicators for coastal plain marsh in Michigan: *Aristida necopina* (three-awned grass), *Aster dumosus* (bushy aster), *Bulbostylis capillaris* (sedge), *Cyperus rivularis* (umbrella sedge), *Eleocharis robbinsii* (spike-rush), *Eriocaulon septangulare* (pipewort), *Euthamia remota* (coastal plain flat-topped goldenrod), *Fimbristylis autumnalis* (sedge), *Hemicarpha micrantha* (dwarf-bulrush), *Hypericum canadense* (Canadian St. John's-wort), *Juncus biflorus* (two-flowered rush), *J. pelocarpus* (brown-fruited rush), *J. scirpoides* (round-headed rush), *Lycopodiella inundata* (bog clubmoss), *Panicum spretum* (panic grass), *Rhynchospora capitellata* (beak-rush), *Rotala ramosior* (tooth-cup), *Scleria triglomerata* (tall nut-rush), *Scirpus smithii* (bulrush), *Spiranthes tuberosa* (little ladies'-tresses), *Stachys hyssopifolia* (hyssop hedge-nettle), *Triadenum virginicum* (marsh St. John's-wort), *Viola lanceolata* (lance-leaved violet), and *Xyris torta* (yellow-eyed-grass).

Other Noteworthy Species: Rare plants associated with coastal plain marsh in Michigan include: *Aristida longespica* (three-awned grass, state threatened), *A. tuberosa* (beach three-awned grass, state endangered), *Bartonia paniculata* (panicked screw-stem,

state threatened), *Carex albolutescens* (greenish-white sedge, state threatened), *Echinodorus tenellus* (dwarf burhead, state endangered), *Eleocharis equisetoides* (horsetail spike-rush, state special concern), *E. melanocarpa* (black-fruited spike-rush, state special concern), *E. microcarpa* (small-fruited spike-rush, state endangered), *E. tricostata* (three-ribbed spike-rush, state threatened), *Fuirena pumila* (umbrella grass, state threatened), *Gratiola virginiana* (round-fruited hedge-hyssop, state threatened), *Hemicarpha micrantha* (dwarf bulrush, state special concern), *Hypericum adpressum* (creeping St. John's-wort, state threatened), *Isoetes engelmannii* (Engelmann's quillwort, state endangered), *Juncus brachycarpus* (short-fruited rush, state threatened), *J. vaseyi* (Vasey's rush, state threatened), *J. scirpoides* (round-headed rush, state threatened), *Lechea pulchella* (Leggett's pinweed, state threatened), *L. stricta* (bushy pinweed, state special concern), *Ludwigia sphaerocarpa* (globe-fruited seedbox, state threatened), *Lycopodiella margueritae* (northern prostrate clubmoss, state threatened), *Lycopodiella subappressa* (northern appressed bog clubmoss, state threatened), *Panicum longifolium* (long-leaved panic grass, state threatened), *P. verrucosum* (warty panic grass, state threatened), *Polygala cruciata* (cross-leaved milkwort, state special concern), *Potamogeton bicupulatus* (waterthread pondweed, state threatened), *Platanthera ciliaris* (yellow-fringed orchid, state endangered), *Pycnanthemum verticillatum* (whorled mountain mint, state special concern), *Rhexia mariana* (maryland meadow beauty, state threatened), *R. virginica* (meadow beauty, state special concern), *Rhynchospora macrostachya* (tall beak-rush, state special concern), *R. nitens* (short-beak beak-rush, state endangered), *R. scirpoides* (bald-rush, state threatened), *Sabatia angularis* (rose pink, state threatened), *Schoenoplectus hallii* (Hall's bulrush, state threatened), *Scirpus torreyi* (Torrey's bulrush, state special concern), *Scleria pauciflora* (few-flowered nut-rush, state endangered), *S. reticularis* (netted nut-rush, state threatened), *S. triglomerata* (tall nut-rush, state special concern), *Sisyrinchium atlanticum* (eastern blue-eyed-grass, state threatened), *Sporobolus heterolepis* (prairie dropseed, state special concern), *Triplasis purpurea* (sand grass, state special concern), *Utricularia inflata* (floating bladderwort, state endangered), and *U. subulata* (bladderwort, state threatened).

Rare animal species associated with coastal plain marsh in Michigan include: *Lepyronia gibbosa* (Great Plains spittlebug, state special concern), *Orphulella pelidna* (green desert grasshopper, state special concern), *Papaipema beeriana* (blazing star borer, state special concern), *P. sciata* (culvers root borer, state special concern), *Spartiniphaga inops* (Spartina moth, state special concern), *Acris crepitans blanchardi* (Blanchard's cricket frog, state threatened),



Clemmys guttata (spotted turtle, state threatened), *Emydoidea blandingii* (Blanding's turtle, state special concern), *Terrapene c. carolina* (Eastern box turtle, state special concern), *Pantherophis spiloides* (gray ratsnake, state special concern), *Sistrurus c. catenatus* (Eastern massasauga, state special concern), *Botaurus lentiginosus* (American bittern, state special concern), *Buteo lineatus* (red-shouldered hawk, state threatened), *Haliaeetus leucocephalus* (bald eagle, state special concern), *Nycticorax nycticorax* (black-crowned night heron, state special concern), *Rallus elegans* (king rail, state endangered), *Cryptotis parva* (least shrew, state threatened), and *Microtus pinetorum* (woodland vole, state special concern).

Conservation and Management: Protection of the regional and local hydrologic regime is critical to the long-term preservation of coastal plain marsh communities (Schneider 1994). When the water levels are stabilized, perennials and woody species may become established displacing less competitive annuals. Conversely, water level fluctuation promotes domination by coastal plain marsh annuals. Even small changes in hydroperiod may cause significant shifts in wetland community composition and structure. Thus, conservation strategies aimed at protecting coastal plain marsh ecosystems must address groundwater management.

During extended periods of inundation many coastal plain marsh species may exist only as seeds within the seed bank. Seed bank maintenance, including periodic expression and rejuvenation during low water years, is critical to the long-term survival of many coastal plain marsh species, especially annuals. Soil erosion resulting from ORV use within the wetland or surrounding uplands may greatly disturb the seed bank, reducing plant density and diversity (Wisheu and Keddy 1989). For species that depend on recruitment from the seed bank such as annuals, significant soil disturbances may result in extirpation from the site.

Because most coastal plain marshes occur adjacent to fire-dependent communities such as oak barrens, oak-pine barrens, and sand prairies, it is likely that in the past, fires commonly spread through the wetland, especially during droughts or in late summer and fall when water levels are lowest. Though there has been no specific research directed at the impacts of fire on coastal plain marshes, fire does promote seed bank expression and rejuvenation in other wetland community types. Thus, seed bank maintenance using prescribed fire may be a desirable management objective. In addition, fires during drawdown years or during times of extended drought may help prevent woody species from establishing.

Dispersal of plant propagules among coastal plain marshes may allow for the restoration of species that have been lost from a site (Schneider 1994). The loss of any single coastal plain marsh may negatively impact population dynamics at other sites by eliminating opportunities for long distance dispersal of propagules which otherwise may have diversified the gene pool or replaced depleted species.

Research Needs: Because many rare, disjunct species occur only within a site's seed bank during extended periods of inundation, studies aimed at determining factors affecting seed viability and seed bank maintenance are critical research needs. Long-term studies of seed viability under both flooded and dry conditions for rare, disjunct coastal plain marsh species are especially needed. Seed bank studies of historical sites which have been permanently flooded or drained may help answer questions of long-term seed viability for some species.

Because coastal plain marshes occur within a fire-maintained landscape, studies aimed at understanding the effects of fire on species composition and its role in seed bank expression and maintenance are also needed.

Studies comparing species genetic diversity within sites and among sites will help managers better understand the importance of long-distance propagule dispersal in maintaining species genetic diversity.

Similar Communities: Intermittent wetland, wet-mesic sand prairie

Other Classifications:

Michigan Department of Natural Resources

(MDNR): L, lowland brush; N, marsh; V, bog; Z, water.

Michigan Resource Information Systems (MIRIS):

6 (Wetlands), 612 (Shrub/Scrub Wetland), 6129 (Shrub Swamp, Other), 62 (Non-Forested (non-wooded) Wetlands), 621 (Aquatic Bed Wetland), 622 (Emergent Wetland), 623 (Flats).

The Nature Conservancy National Classification:

CODE; ALLIANCE; ASSOCIATION; COMMON NAME

V.A.5.N.k.23; *Rhynchospora* spp. - *Rhexia virginica* seasonally flooded herbaceous alliance; *Rhynchospora capitellata* - *Rhexia virginica* - *Rhynchospora scirpoides* - *Scirpus hallii* Herbaceous Vegetation; Beak rush - Meadow beauty - Beak rush - Bulrush sp. Herbaceous Vegetation; Inland Coastal Plain Marsh.

Related Abstracts: Lakeplain wet prairie, lakeplain wet-mesic prairie, oak barrens, oak-pine barrens, panicked screw-stem, appressed bog club moss, meadow beauty, blazing star borer, culvers root borer, Blanding's turtle, Eastern box turtle, Eastern massasauga, red-shouldered hawk, woodland vole.



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