General Description

Communities of the Marsh (MR) System are tall forb- and graminoid-dominated wetland communities that have standing or, in the case of riverine marshes, slow-flowing water present through most of the growing season. MR communities occur statewide and are common throughout the Laurentian Mixed Forest (LMF) Province in wetland basins, along sheltered lakeshores, near stream mouths, and in river backwaters or sluggish streams. The maximum water depth is typically sustained at 20–60 inches (50–150cm) but may be higher, especially in marshes where the vegetation is rooted on floating mats. Water levels are fairly stable in settings where groundwater is a significant contributor and variable where water is supplied predominantly by precipitation and surface runoff. If water-level drawdown occurs, it coincides with drought cycles and is not seasonal as in Wet Meadow/Carr (WM) communities.

photo by S.C. Zager MN DNR

Pine River, Crow Wing County, MN

Nutrient levels are typically high in MR communities, particularly following drawdowns, which allow for oxidation of organic material in sediments and release of nutrients. Nutrient levels can be very high in riverine marshes, especially along the lower St. Louis River where regular seiches from Lake Superior reverse the flow of water and flush sediments and nutrients back upstream into estuaries and backwaters. The pH of water in MR communities is most often circumneutral to basic with high dissolved mineral content, but varies depending on properties of the substrates in the surrounding landscape. MR communities in bedrock areas in NSU have relatively low pH and dissolved minerals; marshes in the western and southern parts of the LMF Province are present in landscapes dominated by calcareous glacial deposits and are characterized by water with higher pH and mineral levels. The southern and western part of the Province also has lower precipitation and higher evaporation rates, so marshes are more likely to develop in settings fed by steady inputs of groundwater, rather than in settings dependent on direct precipitation or surface runoff for moisture. Substrates in MR communities range from mineral soil, to sedimentary peat, to floating peaty root mats. Organic matter can be abundant in substrates not exposed regularly to wave action, river currents, ice-scouring, or drawdowns and episodes of oxidation.

Plant Adaptations

The dominant plants in MR communities are tolerant of persistently deep water levels. Like many wetland plants, they have stems, leaves, and roots that contain intercellular air spaces (aerenchyma) that store oxygen and diffuse it from above-water structures to roots during water-logged conditions. Variation in species composition over time is common in marshes in response to changes in hydrological conditions. Many marsh species germinate only when seeds buried in sediments are exposed following water-level drawdown. These include annuals such as beggarticks *(Bidens* spp.) and smartweeds *(Polygonum* spp.) that germinate rapidly and profusely on freshly exposed

substrates. Reflooding of exposed substrates, however, usually eliminates annuals from the site—either drowning them if water levels rise high enough or preventing them from germinating on sites that remain inundated—or restricts them to floating mats. Perennial emergent species, once established at a site, can expand rapidly by extensive rhizomes as water levels rise. Therefore, the dominant plants in most marshes are emergent species, especially those with vegetative and flowering structures that extend well above the water level and can withstand short periods of abnormally high water. These species include cattails *(Typha* spp.), bulrushes *(Scirpus* spp.), and arrowheads *(Sagittaria* spp.). Persistent high water levels typically eliminate shorter emergent species not able to remain above the water level and favor floating species such as duckweeds *(Lemna* spp. and *Spirodela polyrhiza)* and common white water-lily *(Nymphaea odorata)*. With sustained high water levels, submerged species such as bladderworts *(Utricularia* spp.), common coontail *(Ceratophyllum demersum)*, and Canadian elodea *(Elodea canadensis)* become more frequent. These plants have little resistance to desiccation, however, and are usually eliminated during the next cyclic drawdown. In settings where water levels are stable because of steady inputs of groundwater, MR communities often become dominated by a single species and species diversity declines.

Floristic Regions

MR communities in Minnesota are grouped into three "floristic" regions, the Northern Floristic (MRn) Region, the Lake Superior Floristic (MRu) Region, and the Southern Floristic (MRs) Region (Fig. MR-1). Because of very limited plot data, the Floristic Regions in the MR System are preliminary; ECS Province boundaries were used to define the MRn and MRs Regions, while the MRu Region is based on influences from Lake Superior. Two of the Floristic Regions, the MRn and MRu, are represented in the LMF Province. The MRn Region spans the entire Province. The MRu Region is restricted to the St. Louis River estuary, which supports the only marsh system in Minnesota affected by water-level fluctuations in Lake Superior. The estuary has high nutrient levels, and estuarine marshes typically have higher biomass and higher species diversity than the marshes of the MRn Region. The marshes of the MRs Region occur to the south and west of the LMF Province and are probably subjected to more frequent drought and water-level drawdowns than marshes in either the MRn or MRu regions.

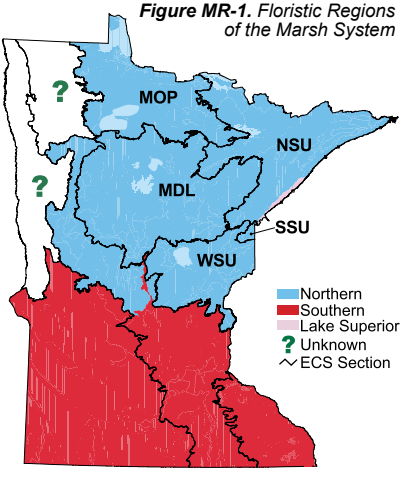

Figure MR-1. *Floristic Regions of the Marsh System*

Variation Within Floristic Regions

There are two plant community Classes in the MRn Region and one Class in the MRu Region. Floristic differences between the two MRn Classes—Northern Mixed Cattail Marsh (MRn83) and Northern Bulrush-Spikerush Marsh (MRn93)—appear to be related to degree of exposure to wave action. MRn83 typically occurs in ponds, bays of lakes, or sluggish streams where vegetation is at least partially protected from wave action or strong currents. MRn83 is dominated by cattails, sedges *(Carex* spp.), and forbs such as marsh cinquefoil *(Potentilla palustris),* northern bugleweed *(Lycopus uniflorus),* and tufted loosestrife *(Lysimachia thyrsiflora)*. MRn93 occurs along wave-washed lake shores, on sandbars, or in stream channels. This Class is dominated by bulrushes and spikerushes *(Eleocharis* spp.), with submergent plants such as pondweeds *(Potamogeton* spp.) and watermilfoils *(Myriophyllum* spp.). Water depth may also be impor-

tant in distinguishing these Classes, but there are not enough data on marshes in the MRn Region to assess the influence of water depth on species composition. Marsh communities in the MRu Region are in the Lake Superior Coastal Marsh (MRu94) Class. They typically have a dense layer of submerged plants such as eelgrass *(Vallisneria americana),* pondweeds *(Potamogeton* spp.), common coontail *(Ceratophyllum demersum),* and Canadian elodea *(Elodea canadensis)* under and between floating-leaved and emergent aquatic plants.

Succession

Marshes can develop from submerged or floating-leaved aquatic communities if depth of water is reduced by deposition of sedimentary peat, siltation, or draining, which enables persistent emergent plants to become established at the site. In situations where water levels drop and become subject to regular seasonal drawdowns, submerged and floating-leaved species may be replaced by sedges, resulting in conversion to WM communities. Marshes can develop from wet forests, peatland communities, or even upland forests in areas flooded by beaver impoundments. The creation and eventual draining of beaver ponds often result in formation of wetland complexes that contain MR communities mixed with transitional stages of other wetland communities, especially WM and aquatic communities. MR communities also sometimes develop following fire in peatlands, where peat “burn-outs” leave depressions that fill with standing water. MR communities are converted to aquatic communities in settings where water levels increase for sustained periods, drowning emergent species and favoring submerged or floating-leaved species. Increases in water level are caused most often by increased precipitation and runoff or by construction of beaver dams. Muskrats also commonly decimate marsh vegetation, leading to areas within marshes that are open and aquatic in character.