Great Lakes Marshes

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Ecological Impacts And Evaluation Criteria For The Use Of Structures In Marsh Management
River and South Florida) have taken the lead in the development of a management plan for the Indian River Lagoon as part of the State’s Surface Water Improvement and Management (SWIM) Program. The basic goal of the wetland portion of the SWIM plan is “to attain and maintain a functioning macrophyte-based ecosystem which supports endangered and threatened species, fisheries and wildlife” (Steward et al., 1994). The major management objective of the SWIM plan is to rehabilitate the ecological function of impounded wetlands without compromising mosquito control, either by breaching impoundment dikes and using open marsh management (for northern temperate wetlands) or by the use of numerous gated culverts that can be opened seasonally to tidal influence (for the southern marshes dominated by mangrove forests). The seasonal change in hydrology and water management is called Rotational Impoundment Management (RIM).

Other important management objectives in the SWIM plan are the preservation of existing marshes, principally through land acquisition, and the creation of wetlands where feasible. Wetland creation is often controversial and will require understanding of the association of wetland function with geomorphology, hydrology, and other site characteristics.

6.5 Great Lakes Marshes

6.5.1 Resource Status

Including the connecting channels and islands, the Great Lakes have 10,900 miles of shoreline. Over 1300 individual wetlands cover an area of more than 470 square miles. A large area of wetland has been lost to development and drainage for agriculture, especially in certain regions, and many existing wetlands have been degraded by human activities (Wilcox, 1995). Although few wetlands could be considered pristine, a number of those in Lake Superior and northern Lakes Huron and Michigan appear to be less degraded.
Very few coastal wetlands remain in southern California, largely as a result of urbanization. SMM is practiced at a few locations in Lakes Superior, Michigan, Huron, and Ontario. It is widely practiced on the Canadian side of Lake St. Clair and the U.S. side of Lake Erie.

In the past, dike construction was a common response to the degradation of wetlands that occurred when protective barrier beaches and sand spits were eroded and not rebuilt because of an inadequate supply of sediments in the littoral drift. Such lack of sediment supply is generally caused by armoring of the shoreline to protect property from erosion. In addition, revetments and wetland dike structures are less capable of absorbing wave energy during storms and thus transfer this energy downshore where its effect on unprotected beaches, sand spits, or wetlands is magnified.

Biological communities in diked Great Lakes wetlands have been altered by isolation from the lakes. Reduced active transport of plant seeds and propagules into a diked wetland, in concert with the restricted amplitude of controlled water levels and active management for desired plant species, reduces the diversity of vegetation types and plant species richness (Stuckey, 1975, 1989). Ingress and egress of fauna are limited to organisms that can fly or traverse the dike by land. Many of these fauna can benefit from such management (Kroll and Meeks, 1985; McLaughlin and Harris, 1990), and since management efforts are generally directed toward developing waterfowl food or habitat, waterfowl almost always receive benefits. However, exclusion of certain fauna that may be important parts of food webs, either as prey or predators, can further alter biological communities. These effects can be long-lasting if hydrologic connection with the lake is not restored.

Use of diked wetlands as fisheries habitat in the Great Lakes is generally restricted to species that enter as larvae passing through screens when pumps or culverts are used to fill the wetlands (Navarro and Johnson, 1992). As a result, fish species diversity in diked wetlands is considerably lower than in undiked systems (Johnson, 1989); many of the more than 40 species of Great Lakes fish that require wetland habitat in one or more life-history stages (Johnson, 1989; Jude and Pappas, 1992) are excluded; and overall populations of certain species, such as northern pike, may be greatly reduced because of lack of access to wetland spawning areas (Herdendorf, 1987). Common carp that enter diked wetlands as larvae grow to adult size and cannot return to open waters of the lake in mid to late summer as they typically do. While feeding, these large carp can uproot or destroy wetland plants, and they stir up sediments and create turbidity problems that further reduce the ability of plants to thrive (Crivelli, 1983). In diked wetlands where carp are a problem, habitat values for target fauna, such as waterfowl, are diminished. Thus, structural management of Great Lakes coastal marshes may allow for enhancement of certain wetland functions and values for a limited period of time, but the overall wetland ecosystem can be severely compromised by this practice as it is currently conducted.

Numerous large-scale marsh management projects in one region, such as along the Ohio shoreline of Lake Erie, can have cumulative effects of endangering or eliminating populations of certain fish species that require access to wetlands, reducing the overall diversity of wetland plant species and faunal organisms that depend on lost plants, and reducing or altering...
sediment supplies in the littoral drift of the lake.

6.5.2 Management Objectives

SMM has been shown to be successful as a restoration technique to create and protect emergent vegetation in coastal areas around the Great Lakes. However, the species composition and diversity of the plant communities can differ from pre-management conditions, with a noted increase in non-indigenous plants, and other ecosystem values are nearly always compromised (Lowden, 1969; Stuckey, 1975, 1989; Kroll and Meeks, 1985; Bartolotta, 1989; Harris et al., 1991). As practiced in the Great Lakes, structural management consists of constructing dikes around wetlands or isolating an embayment wetland from the lake by placing a dike across the mouth of the bay. Water-level control is thus attained and used to create drawdown conditions that stimulate growth of emergent plants from the seed bank. Under most circumstances, hydrologic connection with the lake is not restored. Because water levels in the Great Lakes vary widely on scales of centuries, decades, years, seasons, and hours (seiches), wetland managers find it difficult to restore emergent vegetation in wetlands that have been degraded by other human activities. Given an adequate span of time, natural lake-level cycles would result in low-water years with drawdown conditions that would stimulate the seed bank. However, since these time scales generally do not match management goals, SMM has been chosen as an alternative.