

PREPARING FOR DUNE SWALE WETLAND RESTORATION AT INDIANA DUNES NATIONAL LAKESHORE

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EXTENSIVE WETLANDS ONCE OCCUPIED interdunal swales in the Calumet region of northern Indiana, on the southern shore of Lake Michigan. The Great Marsh within present-day Indiana Dunes National Lakeshore is a good example of this distinctive ecosystem type.

During the late 1800s, the Great Marsh was drained, filled, dredged, and then dissected by railways, highways, and industrial and municipal development. Originally stretching 34 miles (55 kilometers) with a total area of 1,336 acres (3,300 hectares), the wetland has been reduced to 607 acres (1,500 hectares). Nevertheless, it is an outstanding natural area and provides an opportunity for NPS and NBS staff to test a landscape-based restoration.

The Great Marsh is made up of several distinct watersheds that drain into Lake Michigan: one containing the natural Dunes Creek, and two containing constructed ditches (Derby Ditch, and Kintzele Ditch) that cut through sand dunes. High fecal coliform levels in all three drainages have caused the park to close intermittently several popular swimming beaches. Research on wetlands has shown that increased water retention in wetland areas decreases bacteria levels that flow out of the system. Restoration of a more natural hydrologic regime would increase the time it takes for bacteria-laden waters to flow through the Great Marsh into Lake Michigan, theoretically allowing the bacteria to decompose before reaching swimming beaches. Additionally, changes in the hydrologic regime, fire frequency, and water quality in disturbed areas of the Great Marsh have caused displacement of native sedges and bluejoint grass by cattails and woody shrubs.

Dunes Creek is the least impacted of the Great Marsh watersheds, although minor ditching has occurred in some sections of its drainage. Still, it contains a state nature preserve with an extremely diverse array of plant communities and is the best available model for restoration of the marsh within the Derby and Kintzele Ditch watersheds.

The park has targeted the Derby Ditch watershed for wetland restoration first. In assessing impacts of the restoration, national



This scene west of Derby Ditch exhibits typical present-day conditions within the Great Marsh. The predominance of cattails indicates that water levels are below the historic target levels sought in the restoration effort at nearby Derby Ditch.

lakeshore staff are monitoring hydrology and vegetation here. This enables us to determine the variance of present conditions at Derby Ditch from the target conditions at Dunes Creek that we hope to emulate.

We also want to determine the impacts of water level changes on roads and structures. We estimated these impacts using the GIS at the national lakeshore. We noted that a 1-foot water level increase above the present Great Marsh water level, as simulated using digital elevation models, resulted in minimal detrimental consequences to roads, houses, and national lakeshore property.

After one year of premanipulation monitoring, we plan to install a water control structure on Derby Ditch or one of its tributaries. This structure will enable us to gradually raise water levels while monitoring hydrologic and vegetative changes and impacts to roads. We hope to accomplish the hydrologic monitoring through the use of automated water level recorders and soil moisture sensors.

We will use the results of this experiment to calibrate a predictive computer model for the response of the entire Great Marsh ecosystem to hydrologic changes. The model will allow simulation of both short- and long-term land use and weather-climate scenarios that would result in specific water levels, allowing us to predict the effects of these conditions on the biological communities. The model will do this by providing estimates of the amount of time that parts of the watershed are saturated.

The model will be flexible and interactive and will be interfaced with the park GIS. The eventual goal is direct communication between the GIS and the monitoring network via telephone modem connections. The model will be capable of operating on a real-time basis; given current initial conditions (as indicated by the monitoring network), we will be able to predict the hydrologic response to forecasted weather conditions. The hydrologic response to storms could be monitored from the research station as it occurs in the field sites. This capability will allow us to avoid impacts to roads and private property.

In addition to computer modeling, GIS analyses, and vegetation and hydrology monitoring in the present-day Great Marsh, we are interpreting aerial photographs and other historical information to provide an early picture of the Great Marsh. Examining past and present environmental conditions will enable better estimation of the hydrologic and other management conditions necessary to achieve the desired plant communities and reduce bacteria discharges. By restoring the Great Marsh, we hope that Indiana Dunes National Lakeshore will support safer swimming opportunities for the public while increasing the size, quality, and biological diversity of a significant wetland ecosystem. §

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