Detroit River Coastal Wetlands

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Background

Wetlands form and exist where water saturation is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. Wetlands vary widely because of regional and local differences in soils, topography, climate, hydrology, water chemistry, vegetation, and other factors, including human disturbance. Often called "nurseries of life," wetlands provide habitat for thousands of species of plants and animals (Figure 1).

Figure 1. Coastal wetland restoration project at Gibraltar Bay Unit, Detroit River International Wildlife Refuge, Grosse Ile, Michigan (Photo Credit: Emily Wilke).

Coastal wetlands are commonly formed where there is relatively flat land, shallow water, and a barrier to wave and wind action. Wetlands are valuable resources ecologically, recreationally, and aesthetically. Wetland functions and values, often dependent upon wetland type and location, include the following:

- they provide essential breeding, nesting, resting, feeding, and nursery grounds for many fish and wildlife, including endangered and threatened species;
- they stabilize and maintain the water table by retaining water during dry periods and storing excess water during storm and flood conditions;
- they minimize bank and shoreline erosion along rivers and lakes;
- they serve as living filters by removing nutrients and sediments from upland runoff waters that could otherwise pollute lakes and rivers;
- some function as sites for groundwater recharge, replenishing and purifying the water in aquifers that supply local wells; and
- others provide recreational opportunities, such as hunting, fishing, birding, and hiking.

Despite all the benefits provided by wetlands, over half of them in Michigan have been drained, filled, and developed, particularly coastal wetlands along the Detroit River.

Status and Trends

Coastal wetlands were extensive along the Detroit River 200 years ago (Manny et al., 1988; Manny, 2003). First explorers like Father Hennepin and Antoine Cadillac described the Detroit River as a pristine "paradise" with abundant edible fruits, lush meadows, forests, fish, and wildlife (Manny, 2003). In 1815, the river shoreline consisted of contiguous, coastal wetlands up to a mile wide along both sides of the river (Figure 2). Vegetation types included submersed marsh, emergent marsh, wet meadow and shrub swamp, swamp forest, and lakeplain prairie. Since 1815, the Detroit River ecosystem has undergone dramatic changes. Habitats for fish and wildlife in the river are

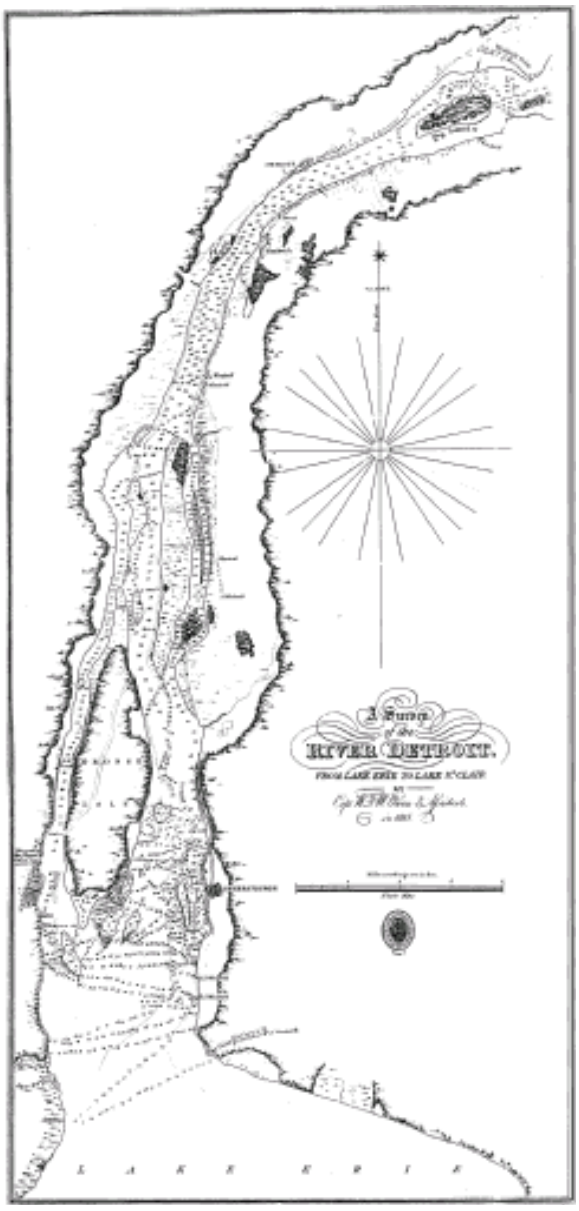

Figure 2. An 1815 map of the Detroit River showing coastal wetlands up to a mile wide along both sides of the river for most of its length, prior to shoreline development (Map Credit: Association of Canadian Map Libraries, Facsimile Number 20).

now degraded by contaminants, largely destroyed by shoreline and channel modifications, and greatly reduced in abundance and quality from historic levels. The largest habitat change has been encroachment into the river and hardening of the shoreline by the addition of steel sheet piling, concrete breakwaters, and fill material. A preliminary analysis of Figure 2 revealed 2,768 hectares (10.7 mi^2) of coastal wetlands were present along the Michigan shore of the Detroit River in 1815 (Manny, 2003).

Later, more detailed analyses of the 1796 historical map, General Land Office (GLO) survey data, National Wetlands Inventory data, and recent georeferenced imagery, shows that the U.S. shoreline of the Detroit River has lost approximately 97% of its coastal wetlands to human development (Figure 3). This re-analysis of the 1796 map produced a

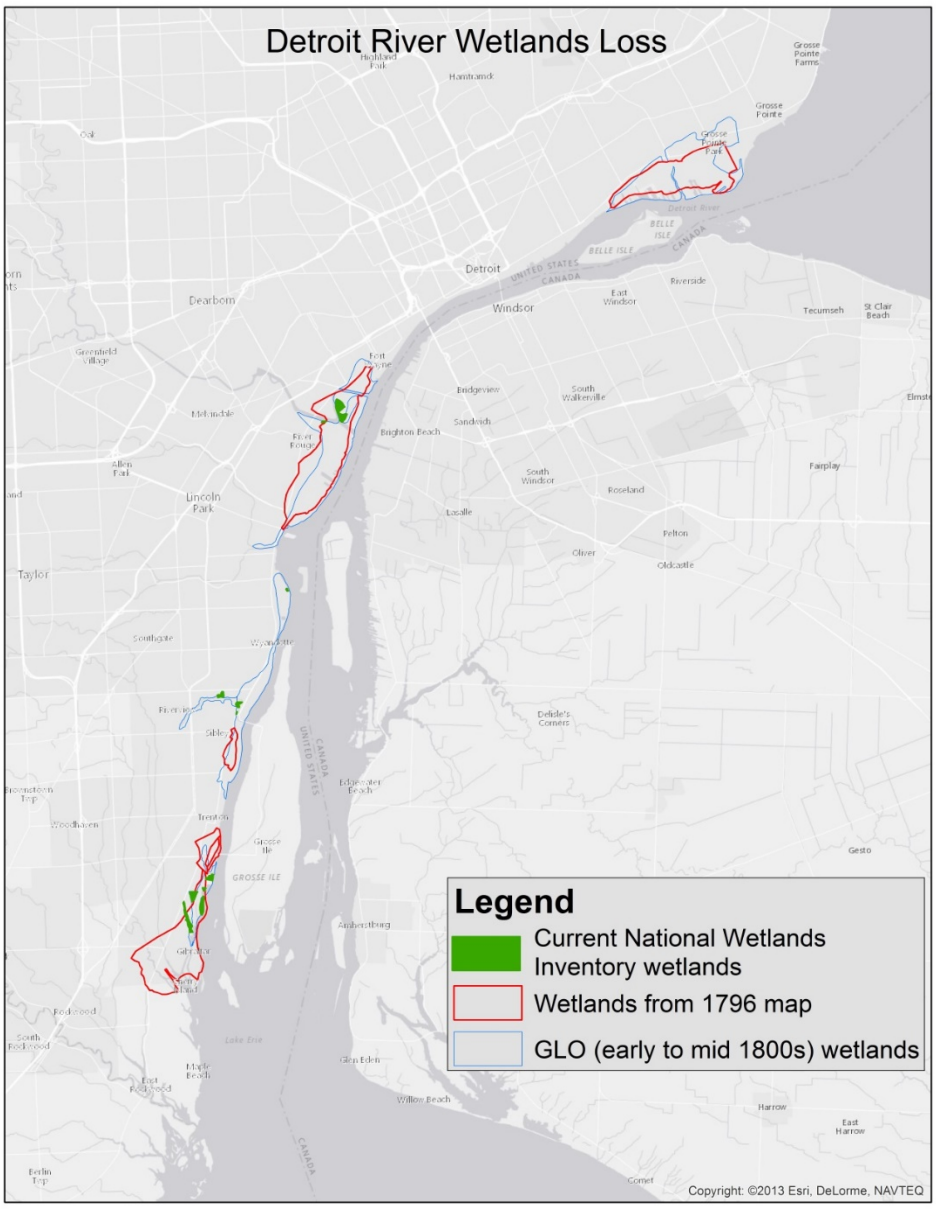

Figure 3. Extent of wetlands loss along the U.S. mainland of the Detroit River (base map credit: map created using ArcGIS® software by ESRI) (Hartig and Bennion, 2017).

total of 1,968 ha of coastal wetlands, and the GLO source indicated 2,048 ha. National Wetlands Inventory data show only 56 ha of connected wetlands remain (Hartig and Bennion, 2017).

Other losses of habitat included removal of limestone spawning grounds for lake whitefish to create navigation channels, clearing of wooded areas for agriculture, introduction of invasive species, and contamination of the water by waste effluents. In the process, people lost benefits provided by wetlands along the river, such as flood control, protection from shoreline erosion, and removal of nutrients and sediment.

The Lake Erie Biodiversity Conservation Strategy (LEBCS) is a binational initiative designed to support the efforts of the Lake Erie Lakewide Action and Management Plan by identifying specific strategies and actions to protect and conserve the native biodiversity of Lake Erie (Pearsall et al., 2012). The scope of LEBCS includes the lake itself, the Connecting Channels, including the Detroit River, and the adjacent watersheds to the extent that they affect the biodiversity of the lake. The LEBCS developed target values based on a review of existing Great Lakes conservation strategies, scientific assessments of Lake Erie, and input from the project core team, conservation organizations, and other stakeholders. For the Detroit River, the following binational coastal wetland goal was established (Pearsall et al., 2012):

> *By 2030 coastal wetlands in the Detroit River will comprise at least 25% of their historical area.*

If we assume that the 1796 map is a good representation of the historical area of wetlands (i.e., a total of 1,968 ha of coastal wetlands), then meeting the 2030 LEBCS goal would require 508 ha of coastal wetlands. Again, current National Wetlands Inventory data show only 56 ha of connected wetlands remain. That means that the Detroit River would have to achieve a net gain of 452 ha of coastal wetlands over the approximately next 10 years.

Management Next Steps

Consistent with "A Conservation Vision for the Lower Detroit River Ecosystem," coordinated efforts are needed to protect, in perpetuity, remaining marshes, coastal wetlands, islands, and natural shorelines from development, and to rehabilitate degraded marsh, wetland, island, and shoreline habitats (Metropolitan Affairs Coalition, 2001). Additional management actions could include:

- developers and communities should be encouraged to protect remaining wetlands in the Detroit River watershed through adoption of best management practices;
- any new development along the Detroit River should be required to achieve a net gain of wetlands sufficient to address stormwater generated by the project;
- nonprofit organizations like International Wildlife Refuge Alliance and Friends of the Detroit River should foster volunteer programs that utilize local expertise and

interest, along with governmental technical assistance, to protect and enhance coastal wetlands on a watershed scale;
- governments should maintain a publicly accessible, comprehensive coastal wetland inventory that tracks changes in total wetland area;
- communities and private land owners should further wetland restoration using soft engineering and other techniques on river shoreline redevelopment projects; and
- regulatory agencies should proactively enforce wetland protection laws and stop the encroachment of development into flood plains.

To address the fourth action listed above, the Great Lakes Commission and The Nature Conservancy have established Coastal Wetland issue within the Blue Accounting information hub: https://www.blueaccounting.org/issue/coastal-wetlands. Blue Accounting tracks investments and progress towards shared goals for coastal wetlands, as established by the Great Lakes Coastal Assembly. As of this writing, total wetland area has not been built out, but it is a metric that Blue Accounting and the Coastal Assembly will develop in collaboration with the broader Great Lakes community.

In the LEBCS, Pearsall et al., (2012) recommended five high priority biodiversity conservation strategies for Lake Erie, including the Detroit River:

- Reducing the impact of agricultural nonpoint source pollutants;
- Preventing and reducing the impact of invasive species;
- Preventing and reducing the impacts of incompatible development and shoreline alterations;
- Reducing the impacts of urban nonpoint and point source pollutants; and
- Improving habitat connectivity by reducing the impact of dams and other barriers.

Applied specifically to coastal wetlands, the third strategy listed above could encompass activities including legal protection, restoration (from non-wetland to wetland), and enhancement (improving an existing wetland), in addition to activities that would prevent loss and degradation. To inform restoration actions, the USGS in 2017 completed a Great Lakes Coastal Wetlands Restoration Assessment along the U.S. shoreline of the Detroit River (accessible online at https://glcwra.wim.usgs.gov/). Some areas within mapped historical wetlands have been rated as medium to high restorability (Figure 4) and represent opportunities for local investment to meet the LEBCS goal.

An additional resource is being developed by Michigan Tech Research Institute (MTRI). Having already mapped *Phragmites* and coastal wetland vegetation basin-wide (Bourgeau-Chavez et al., 2015; see https://mtri.org/coastal_wetland_mapping.html), MTRI is augmenting that georeferenced imagery with connectivity modeling to distinguish coastal wetlands from those not connected to the Detroit River or the Great Lakes (Figure 4). Teasing out these hydrologic connections has been a substantial challenge to mapping coastal wetlands, and this effort will provide very useful information.

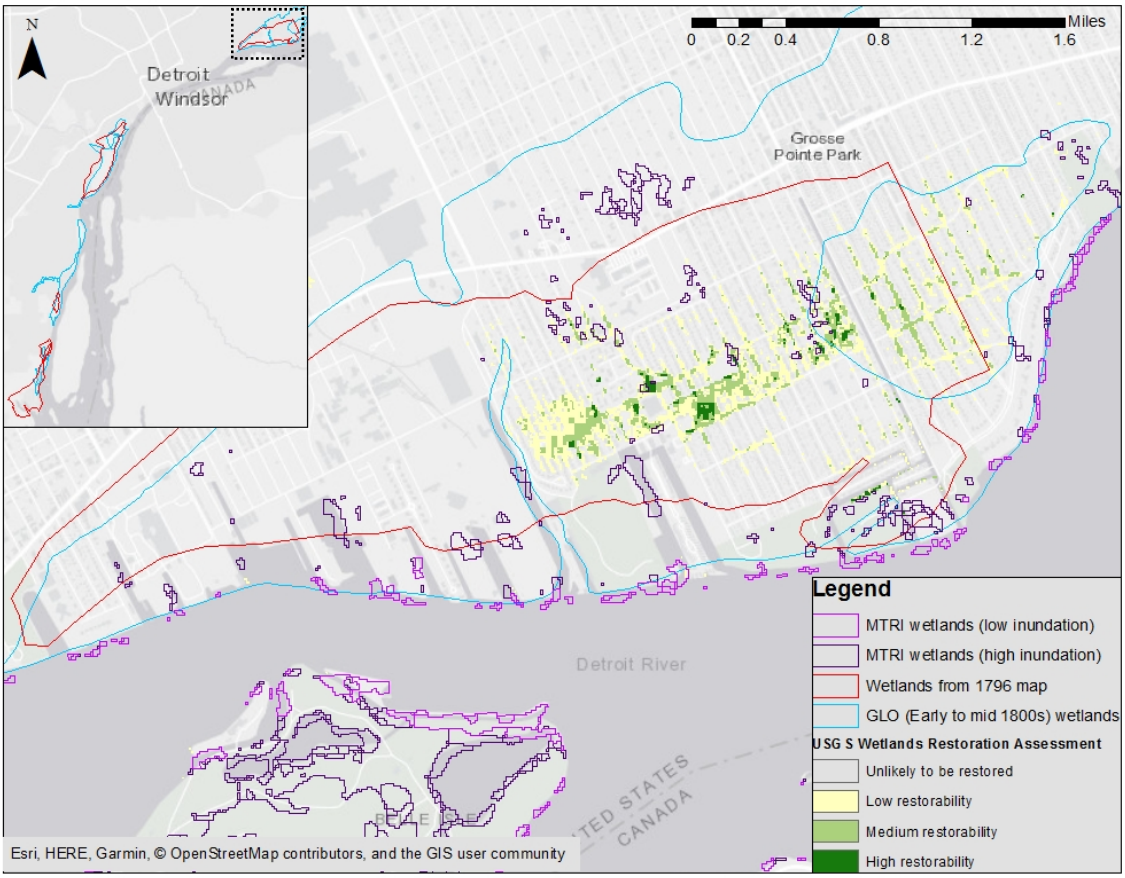

Figure 4. Historical coastal wetlands from a 1796 map and the GLO, and areas that could be restored to coastal wetlands based on a USGS assessment of restorability within a historical coastal wetland footprint and connected wetlands at low and high inundation levels identified by MTRI (base map credit: map created using ArcGIS® software by Esri)(Bourgeau-Chavez et al., 2015).

Research/Monitoring Needs

There is a need to increase research and monitoring programs to quantify wetland losses, establish cause-and-effect relationships, evaluate and select appropriate wetland rehabilitation techniques, and quantify ecosystem services of wetlands (Tulen et al., 1998). The Great Lakes Coastal Assembly is developing an ecosystem services' valuation for coastal wetlands from Saginaw Bay to Sandusky Bay, including the Detroit River (US only). When available, this valuation should help inform Wetland restoration and conservation projects. Further, wetland restoration and conservation projects should be treated like adaptive management experiments that explicitly link research/monitoring with restoration and management of wetlands. Finally, available data on ways to protect and enhance wetland ecological functions need to be pooled and synthesized to prioritize the most successful tools. For example, resource managers could:

- assess the quality of wetland habitats for production of fish and wildlife to better rank candidate sites for wetland protection and enhancement;
- describe and characterize biodiversity in Detroit River coastal wetlands, and habitats they provide for young fish and wildlife; and,
- quantify economic, social, and ecological benefits resulting from wetland restoration and conservation projects.

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