SUMMARY AND CONCLUSIONS

The plant communities of Great Lakes coastal wetlands are very dynamic systems because they continually respond to the fluctuating water levels of the Great Lakes (Figures 7 and 8). Current low water conditions created an opportunity to investigate the effect of fluctuating water levels on the plant community of Old Woman Creek.

As previous researchers had hypothesized, a more expansive and diverse emergent plant community developed following lower water levels. Understanding the response of wetland plant communities to fluctuating water levels may be important in light of potential long-term climate change and for the restoration of coastal wetlands.

Another consequence of declining lake water levels is the growth and proliferation of invasive plant species. Monitored stands of the invasive species, *Phragmites australis*, expanded further into the wetland and became established throughout the wetland in the emergent vegetation areas. Intensive management may be needed to control this species at Old Woman Creek.

The degree of success of invasive plants in a wetland, due to water level fluctuation or other disturbances, will be an important consideration for managers of other coastal wetlands when dealing with Phragmites or other invasive species.

FIGURE 7

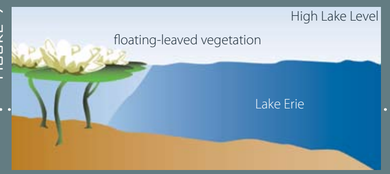

FIGURE 8

Research at Old Woman Creek has enhanced our understanding of the critical role that coastal wetlands play in the Great Lakes, particularly the Lake Erie region. These coastal wetlands are vital in protecting the health of the Great Lakes. By trapping or changing many of the pollutants and sediments that would otherwise flow into the Great Lakes, they serve as nature's last protection for the Great Lakes. In addition, wetlands are among the most productive and diverse areas on earth. A wide range of both plants and animals live in these wetlands. Many wildlife species depend upon wetlands as a food source and as habitat. The wildlife and plants of the wetlands are a significant part of the Great Lakes food web.

A change in water levels in the Great Lakes changes the type and quantity of plants growing in the adjoining wetlands. Changes in these plant communities result in changes in fish and other wildlife populations that depend upon the plants for survival. Since many of these creatures in the wetlands are important in the food web of the Great Lakes, changes in wetland plant communities reverberate throughout the ecosystem of the Great Lakes.

Wetlands are an integral part of the Great Lakes system. Conserving wetlands can help maintain the health and well-being of the Great Lakes proper. For further information on research that has been conducted on coastal wetlands in the Lake Erie region, please contact the Old Woman Creek National Estuarine Research Reserve.

CHANGES IN THE OLD WOMAN CREEK PLANT COMMUNITY FOLLOWING REDUCED WATER LEVELS

BY DAWN TREXEL-KNOLL AND DAVID A. FRANCKO

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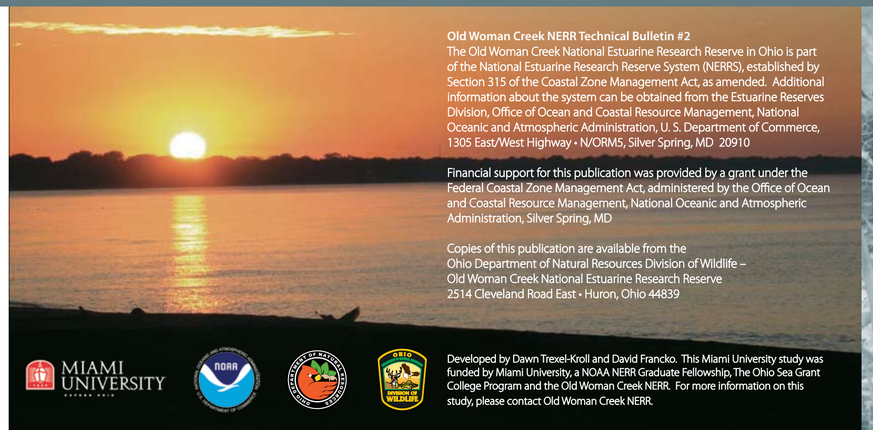

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The Old Woman Creek National Estuarine Research Reserve in Ohio is part of the National Estuarine Research Reserve System (NERRS), established by Section 315 of the Coastal Zone Management Act, as amended. Additional information about the system can be obtained from the Estuarine Reserves Division, Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration, U. S. Department of Commerce, 1305 East/West Highway • N/ORM5, Silver Spring, MD 20910

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MIAMI UNIVERSITY

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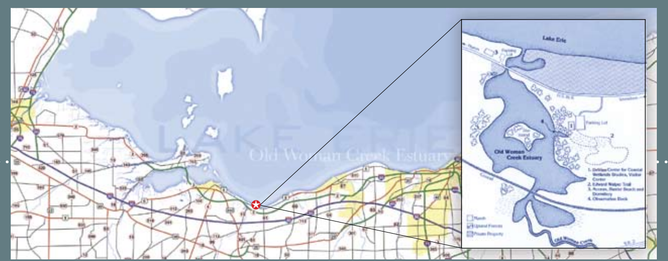
COASTAL WETLANDS OF THE GREAT LAKES

The Laurentian Great Lakes are part of an interconnected system. Water present in the Upper Great Lakes will eventually flow out through the Lower Great Lakes on its way to the Atlantic Ocean. As a result, changes in water level in the Upper Great Lakes will eventually have an effect on the Lower Great Lakes.

Coastal wetlands of the Great Lakes are different from inland wetlands because they are regularly affected by the water levels in the Great Lakes. The Old Woman Creek National Estuarine Research Reserve and State Nature Preserve (Huron, Ohio) is a freshwater estuary, which is directly connected to Lake Erie (Figure 1). This estuary is very susceptible to water level changes in the lake.

Water level fluctuations play an important role in coastal wetland plant communities. High water kills emergent and woody vegetation and promotes plant communities dominated by floating or submerged species. Low water exposes sediments and allows recruitment from the buried seed bank, thereby allowing plants less tolerant of standing water to become established. As a result of fluctuating water levels, plant communities of coastal wetlands are continually changing.

FIGURE 1



Location of Old Woman Creek

CURRENT WATER LEVELS

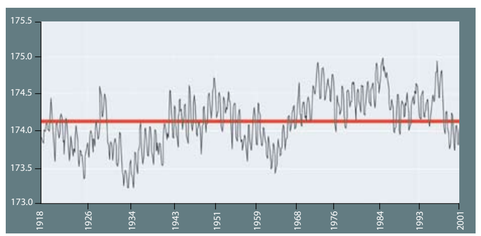
After almost three decades of high water levels, the water levels in the Great Lakes have recently declined and are now closer to the long-term average (Figure 2). This decline has been attributed to higher-than-average temperatures and lower-than-average precipitation, which increased evaporation and decreased snow pack, especially in the Upper Great Lakes.

At Old Woman Creek, the lower water levels created extensive mudflats in the wetland during the fall of 1999. It was these mudflats that set the stage for plant community changes to occur over the next few years (Figure 3).

FIGURE 2

Historic Lake Erie Water Levels

Red line indicates long-term mean.



INVASIVE SPECIES

Invasive species are plants which are not native to a given habitat and are detrimental to the natural habitat. Invasives threaten species diversity by out-competing and displacing native species.

Once introduced to a new area, the establishment of invasive species may be helped by different types of ecological disturbance, such as fire, floods, or water level fluctuations. Invasive species may occur in any type of habitat, including wetlands.

Phragmites australis (Figure 6), or common reed, is an invasive species that is a serious threat to the diversity of many wetlands in North America. It reproduces by means of vigorous rhizomes (horizontal roots) and may spread into large, dense colonies that out-compete other plants.

FIGURE 3

Dominant plant communities within the Old Woman Creek estuary.

(*A*) *The open water habitat is dominated by the American water lotus* (Nelumbo lutea)*, July 2003.*

(*B*) *Plant community changes are most evident in exposed mudflat areas where emergent vegetation flourishes, July 2003.*

Photos courtesy of R. Whyte.

FIGURE 3A

FIGURE 3B

FIGURE 6

A stand of Phragmites australis *at Old Woman Creek*

Phragmites was first reported in Old Woman Creek in the late 1980s. During high water conditions, Phragmites was confined to the shorelines at the edges of the wetland. During 2000-01, several Phragmites stands were monitored in order to see if this invasive species would take advantage of the low water conditions and exposed mudflats, and expand further into the wetland.

Data in Table 1 indicate that all stands expanded further into the wetland, some by more than 80 meters in two years. From field observation it could be seen that Phragmites has become established throughout the wetland in the emergent vegetation areas. Now that its distribution has expanded, controlling Phragmites will be a challenging task for Old Woman Creek management.

TABLE 1

Stand	2000	2001	Total
1	4.6	13.2	17.8
2	2.9	28.8	31.7
3	17.1	26.9	44.0
4	11.7	70.8	82.5
5	4.4	2.1	6.5
6	3.5	44.5	48.0
7	10.0	38.4	48.4
8	7.8	1.0	8.8
9	3.5	0.6	4.1
10	20.4	3.0	23.4

Expansion of Phragmites australis *during 2000-01. Units are in meters.*

OLD WOMAN CREEK PLANT COMMUNITY

Most of the research conducted on Great Lakes coastal wetland plant communities has taken place since the 1970s—primarily during high water conditions. This is also true for Old Woman Creek.

During high water years the entire Old Woman Creek wetland was covered with open water; its open water habitat was dominated by the floating-leaf plant, American water lotus (*Nelumbo lutea*). Emergent vegetation, or marsh-type vegetation capable of growing in shallow water or saturated soils, was still present in high water years, but limited to the shorelines of the wetland.

FIGURE 4

Vegetation maps of the Old Woman Creek estuary, 1999 – 2001.

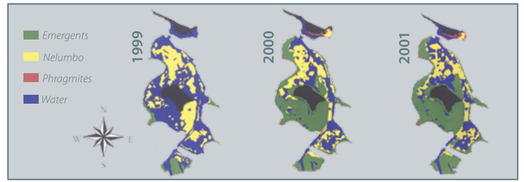
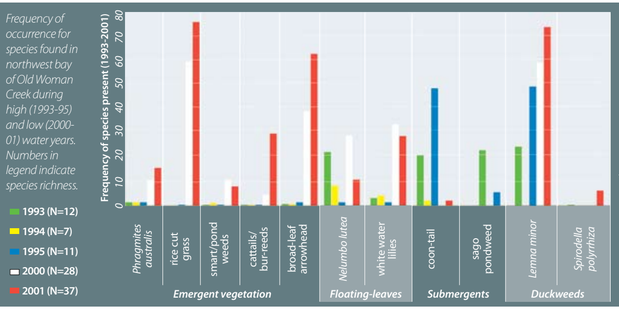


FIGURE 5

Frequency of occurrence for species found in northwest bay of Old Woman Creek during high (1993-95) and low (2000-01) water years. Numbers in legend indicate species richness.



Previous researchers hypothesized that, should lower water levels return to Old Woman Creek, an increase in the presence of emergent vegetation throughout the wetland would occur. Current low water conditions provided an opportunity to test this hypothesis and to further explain the role of fluctuating water levels on coastal wetlands.

To test this hypothesis and to investigate what changes were taking place in the wetland following water level decline, aerial photographs were used to create vegetation maps, which were digitized in a computerized mapping system. Field research was conducted during the summers of 2000 and 2001.

Vegetation maps (Figure 4) illustrate how in high water conditions, *Nelumbo* dominated the aquatic vegetation in the wetland; but in low water conditions, emergent species on the exposed mudflats became a significant part of the vegetation.

In these low water conditions, *Nelumbo* is still very abundant in the wetland, particularly in the deeper open water areas.

Comparisons between the frequency of occurrence of species found in one area of Old Woman Creek during high water years (Figure 5) also indicate that emergent species were much more abundant in low water years (2000-01) than high water years (1993-95). Duckweeds were also more abundant in low water years, possibly due to the sheltering effect of the emergent vegetation from wave and wind activity. Submergent species were more abundant in high water years, possibly due to the higher water depth and lower turbidity. Floating-leaf species exhibited varied responses to water level fluctuations. In terms of species richness, or total number of species present, the plant community was much more diverse in low water years compared to high water years.