INTRODUCTION

The Old Woman Creek National Estuarine Research Reserve (OWC-NERR) and State Nature Preserve represents one of the few remaining undeveloped coastal wetland systems along the southern shores of Lake Erie. Coastal wetlands once prevalent in Lake Erie’s Western Basin have disappeared largely through the combined effects of natural shoreline disturbance and development of the surrounding watershed. Disturbance to these biologically productive and diverse systems threatens existing plant diversity and may contribute to an overall loss of wetland biological diversity. One contributing factor to the loss of Great Lakes wetland biological diversity may be the increased presence of invasive plants such as Phragmites australis, an aggressive invader that displaces the native vegetation. Few studies have been done in the Great Lakes documenting or quantifying changes in plant species composition and community structure in response to Phragmites expansion. Better information is needed to evaluate the impact of invasives such as Phragmites to determine if its presence and spread in Great Lake systems is an ecological threat. Large-scale vegetation control programs are being implemented, yet our knowledge of overall system impacts and community dynamics resulting from an increased presence of Phragmites and other invasives is limited. Such studies will allow wetland and natural resource managers to better understand vegetation dynamics of Phragmites and subsequently enable managers to implement appropriate management strategies.

This ongoing study documents a shift in wetland vegetation distribution and community structure in response to water level fluctuations. The preliminary information presented here is particularly relevant as Lake Erie water levels return to their approximate long-term mean after an extended period of high water levels and OWC wetland species composition shifts in response to lower water levels. This ongoing research effort will also provide a foundation for additional work investigating the impact of Phragmites on community structure of the wetland plants and the overall community dynamics of the wetland.

STUDY SITE - METHODS

The present day Old Woman Creek estuary is characterized by a drowned river mouth and sand barrier-beach separating the wetland from Lake Erie. Water depths in OWC average less than 50 cm but can increase to more than 1 m in response to storm events and Lake Erie storm surges. Its geographic location is reflected in the floristic composition of the wetland plants, which contain species with a broad geographical affinity. The southern species Nelumbo lutea (American water lily) is historically the dominant macrophyte in OWC. Fluctuating water levels directly affect the macrophyte species composition.

Methods

Aerial Photography


Ground Surveys

2003–2005

GIS digitizing vegetation boundaries

RESULTS

Vegetation Dynamics - Documenting Change

Aerial photographs of OWC from as early as 1937 provide a record of plant coverage and community types. Emergent vegetation dominates the wetland in low water years such as 1937. In the 1970s, following an extended period of low water levels, the wetland shifted from a predominantly emergent community dominated by Typha latifolia, Potamogeton spp., and Polygonum amphibium to an open water community dominated by the floating-leaved plant Nelumbo lutea. Nelumbo expanded from a few beds covering less than 10 percent of the estuary (1970s) to extensive beds with an areal cover of about 36 percent in mid 1990s.

Water levels in Lake Erie have recently declined and are now closer to the long-term mean. Fluctuations in levels play an important role in coastal wetland plant community dynamics. (Dashed line on graph is long-term mean.)

Phragmites Distribution & Abundance

Phragmites was first observed in OWC in the mid-1980s in the area of the barrier-beach and has subsequently been identified as the invasive-introduced type (European) (Sultanbala 2002). Since 1993, Phragmites has expanded from a few small stands to several expansive stands (all >= 1ha).

Vegetation maps (1993, 2000, 2004 and 2005) show the change from a Nelumbo dominant, open water system to an emergent plant community dominated by Phragmites in response to low water. Other emergents characterized by the Emergent-Mix include Typha angustifolia, Sagittaria latifolia, Sparganium eurycarpum, Polygonum spp., several grasses, Scirpus spp., and Carex spp. (Transact data shown in far right panel), was used to aid in aerial photo interpretation and the digitization of vegetation boundaries.

SUMMARY, CONCLUSIONS & FUTURE RESEARCH

Great Lakes coastal wetlands such as Old Woman Creek are very dynamic systems, the result of fluctuating water levels in the Great Lakes. This is observed directly in the shifting species composition and structure of the plant communities in the wetland. The dynamic nature of the wetland tends to promote large monotypic beds which are influenced by water depth and soil moisture.

In 1999 water levels declined to levels similar to those of the 1960s driving the plant community structure from one largely composed of the floating-leaved Nelumbo to an emergent community. Total plant cover range from less than 40% in 1993 to 75% in 2005. Prior to 1999, Phragmites was restricted to several low relief shoreline areas. Phragmites distribution in OWC increased beginning in 2000 with lower water levels. This expansion has likely been exacerbated due to the presence of a non-native Phragmites strain identified in OWC.

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A few “Phragmites invasion” emergent stands remain intact indicating that established native beds may be able to resist the initial expansion of Phragmites.

It remains unclear from current Great Lakes studies and the results of this study to what extent Phragmites represents an ecological threat to these coastal wetlands. We suspect, however, that during this period of lower Lake levels, Phragmites will continue to expand.

A Phragmites control program is now underway in the wetland; however, for the control program to be effective better scientific information on Phragmites and its ecological impacts is needed to make informed management decisions.

Phragmites expansion will continue to be monitored in OWC. Work is ongoing to determine changes in plant species composition, community structure, and the relationship of the plants to the aquatic animals.

REFERENCES

Trexel-Kroll, D. 2002. Succession of Floating Leaf to Emergent plant community following reduced water levels in Old Woman Creek National Estuarine Research Reserve. M.S. Thesis. 82 pages. OWC-NERR.


Old Woman Creek National Estuarine Research Reserve, NOAA and the Ohio Department of Natural Resources, Division of Wildlife.

From 2000 to present (low water years) Phragmites has spread and significantly increased its abundance and density in the wetland. Plot data from established transects (2004-2006, above) show this increase in Phragmites and decline in other emergent species over time.