Mandy Jensen

Forecasting Potential *Phragmites* Coastal Invasion Corridors for the Great Lakes Restoration Initiative

This project is funded by the Great Lakes Restoration Initiative (GLRI), an interagency program that addresses the most significant environmental problems in the Great Lakes ecosystem. Results from U.S. Geological Survey (USGS) scientific studies and monitoring are helping guide the restoration effort. The GLRI is made up of five focus areas that address these issues:

- Cleaning up toxic substances and areas of concern
- Combating invasive species
- Promoting nearshore health by protecting watersheds from polluted runoff
- Restoring and protecting habitats and wildlife
- Tracking progress and working strategically with partners

More information is available on the USGS GLRI Web page (*http://cida.usgs.gov/glri/*).

Project Background

Invasive *Phragmites australis* (*GLPC)

Phragmites australis is a tall, rapidly growing grass found in wetlands, ditches, and roadsides. A European strain of *Phragmites,* capable of outcompeting many native species, was introduced to North America in the early 1800s and is now present throughout the continent.

Some climate-change models predict much lower water levels in the Great Lakes in the future. Extended low levels will expose large areas of fertile bottomlands that invasive *Phragmites* could rapidly populate. These aggressive invasive plants form impenetrable stands in excess of four meters tall that quickly outcompete native plants, degrade large areas of highly productive wetlands, drastically reduce habitat diversity and function, impair human use of beaches and recreational areas, and negatively impact dependent wildlife and a multi-billion-dollar regional fishery.

Controlling established *Phragmites* stands is resource intensive. In addition, public and private resource managers lack detailed maps of both existing *Phragmites* colonies and areas vulnerable to *Phragmites* invasion.

Phragmites seed dispersal diagram (*GLPC)

USGS will use remote-sensing data to establish a baseline understanding of current distributions of the invasive *Phragmites* and forecast potential invasion corridors, enabling resource managers to target and prioritize control efforts.

Objectives and Approach

Dense *Phragmites* stand

Objective 1: *Phragmites* mapping

Identify current *Phragmites* distribution in the Great Lakes coastal zone using remote sensing.

Approach

A map of current *Phragmites* distribution in the U.S. Great Lakes coastal zone will be generated.

- Michigan Tech Research Institute (MTRI) and the U.S. Fish and Wildlife Service (USFWS) will use radar data to map the current extent of large *Phragmites* stands and refine results through field measurements.

Measuring *Phragmites*

Objective 2: Vulnerability assessment (modeling expansion)

Detect potential areas vulnerable to *Phragmites* invasion based on existing distribution and environmental conditions.

Approach

- Determine the impact of environmental variables (e.g., topography, nutrient loading, and proximity to agriculture) on *Phragmites* distribution using statistics and Geographic Information Systems (GIS) analyses.
  - The most influential factors will be used to identify areas vulnerable to invasion.
- Using these results and climate-change forecasts, models will be created to identify areas vulnerable to future *Phragmites* expansion in coastal zones.

GLRI 68-2013

Outcomes

This project produced the first-of-its-kind basin-wide map of current *Phragmites* distribution, which will:

- improve *Phragmites*-control efforts, especially in areas where preservation of native biodiversity is critical
- aid in identification of wetlands with previously undiscovered stands of *Phragmites* and, as a result, provide information on where to target restoration efforts
- allow for the prediction of potential corridors for future invasion by assessing landscape conditions and vulnerability of exposed bottomlands
- allow managers to target and prioritize control efforts, especially in relation to current coastal wetland restoration efforts funded by the Great Lakes Restoration Initiative

Exposed lake bottom that could be populated by invasive *Phragmites*

This project addresses the mission, vision, and multiple priorities identified in the USGS Strategic Plan (http://pubs.usgs.gov/circ/2007/1309/).

It is consistent with the U.S. Climate Change Science Program strategic goals, the research goals of multiple programs within USGS, and the goals and objectives of the Great Lakes Restoration Initiative.

USGS has the mission, staff, facilities, and equipment to continue leading the cutting-edge research involved in this basin-wide effort.

Portion of the study area on the southwestern edge of Saginaw Bay

*GLPC photo credits: Great Lakes *Phragmites* Collaborative (http://greatlakesphragmites.net/)

Recent Highlights

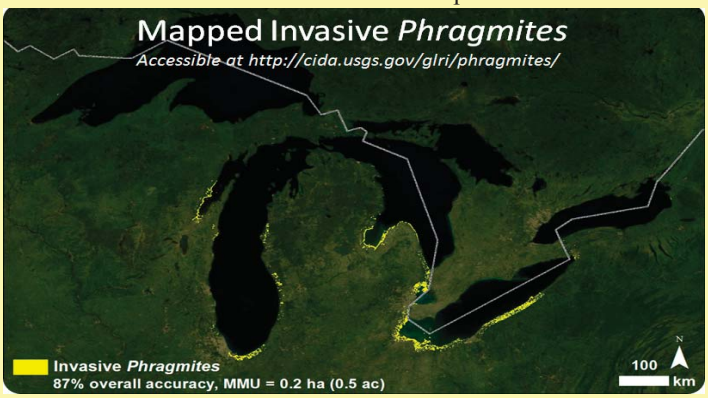
Through a cooperative effort with MTRI and the USFWS, a basin-wide map of *Phragmites* in the Great Lakes has been created!

The Decision Support Tool can be found at:

- http://cida.usgs.gov/glri/phragmites/

Publication can be found at:

- www.sciencedirect.com/science/article/pii/S0380133012002122

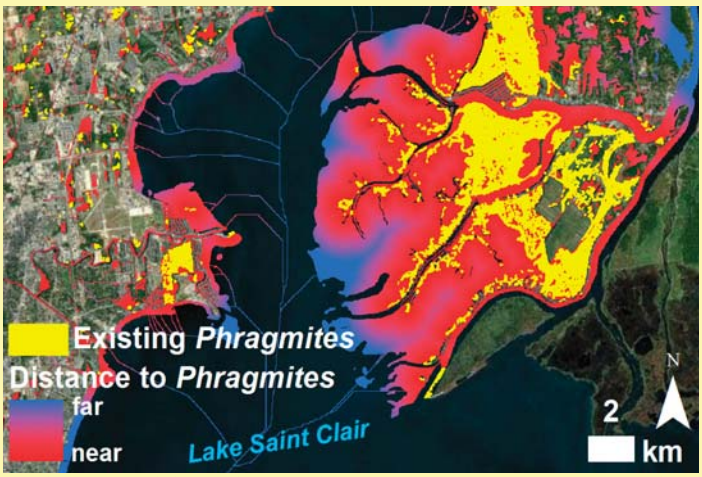


Phragmites extent in the Great Lakes coastal zone (2009/2010 data)

The basin-wide map of the U.S. coastal zone shows variability in *Phragmites* distribution, with certain regions (e.g., western Lake Erie, southern Lake Huron, Green Bay of Lake Michigan) supporting extensive dense *Phragmites* stands. This map represents mature invasive *Phragmites* stands greater than 0.2 ha (0.5 ac) in size. Overall map accuracy was 87%, based on an extensive network of field validation points (ground-truthing).

Some climate change models for the Great Lakes predict lower lake levels, which can expose fertile bottomlands to *Phragmites* and other invasive plant species. USGS used topographic and bathymetric data to identify bottomlands likely to be exposed under reduced lake-level scenarios. Bottomland areas close to existing stands and at elevations that may be exposed are most vulnerable to invasion.

Additionally, research teams have preliminary results from a more rigorous vulnerability analysis based on habitat suitability modeling. This analysis suggests that several variables (topography, proximity to development, soil hydrologic group, road density, and proximity to agriculture) have the strongest associations with invasive *Phragmites* stands. All of these analyses support the creation of maps indicating areas of high and low vulnerability to invasion. An online decision support tool was created to promote use of these maps by managers for early detection, monitoring, and control.



Predictive model simulating what a *Phragmites* invasion into inland streams, rivers, and wetlands around Lake St. Clair may look like given a 1-m drop in lake level

Great Lakes RESTORATION

Contact:
Norman G. Grannemann
6520 Mercantile Way
Lansing, MI 48911
nggranne@usgs.gov
517-887-8936