Franken *Phrag* – A Monster in the Reeds: Determining the hybridization potential of *Phragmites australis* and tracing its spread

Hope Brooks, The Pennsylvania State University; Melissa McCormick, Smithsonian Environmental Research Center (SERC), Dennis Whigham, SERC

Introduction

The Common Reed, *Phragmites australis*, has a worldwide range. Recently, an invasive haplotype of *Phragmites* with Eurasian origins has begun to spread through wetlands in the United States, outcompeting native *Phragmites* and other vegetation, altering habitats and food sources for local fauna, and disrupting normal nutrient cycling.

Figure 1. Native and invasive *Phragmites*
Photo Credit: Eric Hazelton, Utah State University, Logan, Utah

Phragmites can reproduce both asexually—by rhizomes—and sexually. There is concern that native and invasive haplotypes of *Phragmites* may hybridize. Possible results of hybridization include swamping of native genotypes and heterosis of hybrids, necessitating more aggressive control of invasive *Phragmites* in areas where native *Phragmites* is present [2].

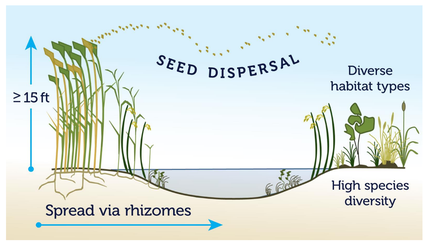

Figure 2. Mechanisms of *Phragmites* reproduction.
Photo Credit: Great Lakes Phragmites Collaborative

This study explores the possibility of hybridization between native and invasive *Phragmites* in two Maryland subestuaries of the Chesapeake Bay: Parkers Creek and Battle Creek. It also examines the genetic relatedness of *Phragmies* plants across subestuaries.

Methods

- *Phragmites* leaf samples collected and GPS points logged from Parkers Creek and Battle Creek field sites

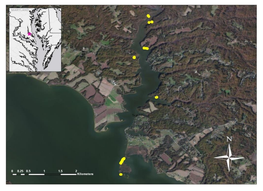

Figure 3. Sampling sites at Parkers Creek, Prince Frederick, MD

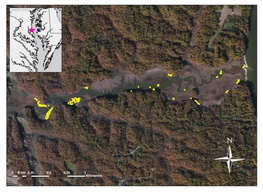

Figure 4. Sampling sites at Battle Creek, Prince Frederick, MD

- DNA extraction from 25 mg fresh tissue using a Biosprint 96 (QIAGEN, Inc., Valencia, CA) DNA Plant Kit
- PCR using eight nuclear microsatellites described by Saltonstall [4] and eight chloroplast DNA primers described by Saltonstall [3]

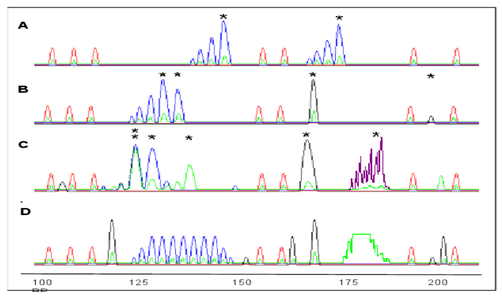

Figure 5. Nuclear microsatellite peaks

- Analysis of nuclear microsatellite PCR product using an ABI 3100 Automated Capillary DNA Sequencer with a ROX500 size standard as described by DeWoody et al [1]. GeneMapper v4.0 (Applied Biosystems, Inc.) was used to determine fragment size.
- Sequencing of chloroplast DNA PCR product using an ABI 3100 Automated Capillary DNA and analysis using Sequencer v4.10.1 (Gene Codes Co., Ann Arbor, MI).

Preliminary Results

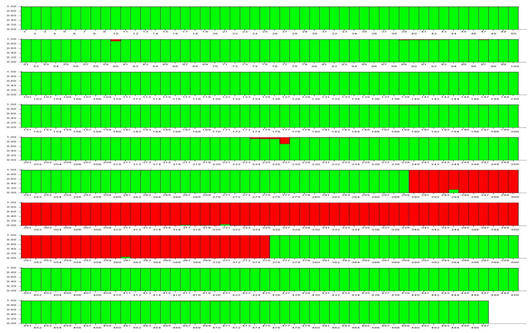

Figure 6. Structure data for Parkers Creek and Battle Creek samples. Red and green areas indicate potential hybrids.

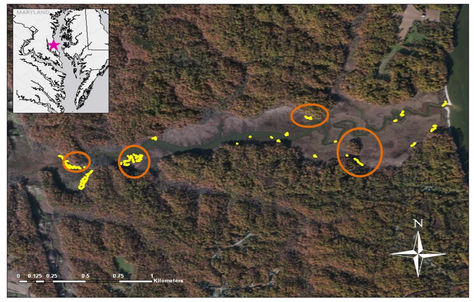

Figure 7. Location of potential hybrid *Phragmites* at Parkers Creek

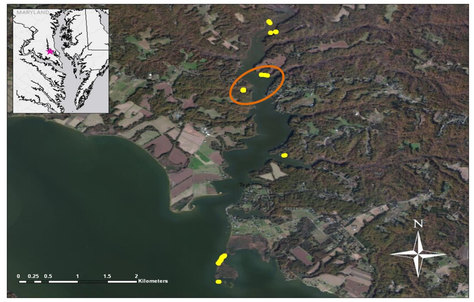

Figure 8. Location of potential hybrid *Phragmites* at Battle Creek

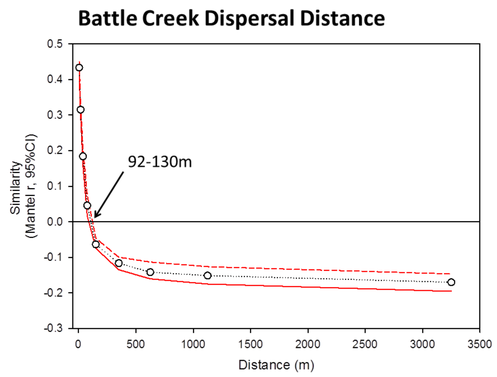

Figure 9. DNA dispersal distance of *Phragmites* at Battle Creek

Conclusions

- Preliminary findings indicate that native and invasive *Phragmites* are hybridizing with one another at Parkers Creek and Battle Creek.
- The majority of *Phragmites* seed dispersal occurs at distances less than 92-130 meters.

Future Directions

- Chloroplast DNA analysis for seed and pollen flow, tracking spread, and identifying parentage
- Further nuclear microsatellite analysis
- Analysis of genetic and geographic distance for Parkers Creek

References

[1] DeWoody, J.A, J. Schupp, L. Kenefic, J. Busch, L Murfitt, P. Keim. 2004. Universal method for producing ROX-labeled size standards suitable for automated genotyping. *BioTechniques* 37: 348-352.

[2] Meyerson, Laura A., David V. Viola, and Rebecca N. Brown. "Hybridization of Invasive Phragmites Australis with a Native Subspecies in North America." *Biological Invasions* 12.1 (2010): 103-11. Print.

[3] Saltonstall, Kristin. "A Set of Primers for Amplification of Noncoding Regions of Chloroplast DNA in the Grasses." *Molecular Ecology Notes* 1.1-2 (2001): 76-78. Print.

[4] Saltonstall, K. "Microsatellite Variation within and among North American Lineages of Phragmites Australis." *Molecular Ecology* 12.7 (2003): 1689-702. Print.

Acknowledgements

Sponsored by the National Science Foundation. Many thanks to Melissa McCormick, Dennis Whigham, Jay O'Neill, John Bakker, Eric Hazelton, Liza McFarland, Wes Hauser, and Katie Sinclair. Additional thanks to the American Chestnut Land Trust and Battle Creek Cypress Swamp Sanctuary.