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What Happens after Phragmites is Killed? Year 2

Findings of an Experimental Study on the Role of Native Plantings in Marsh Restoration after the Second Year in Chesapeake Bay Tidal Wetlands.

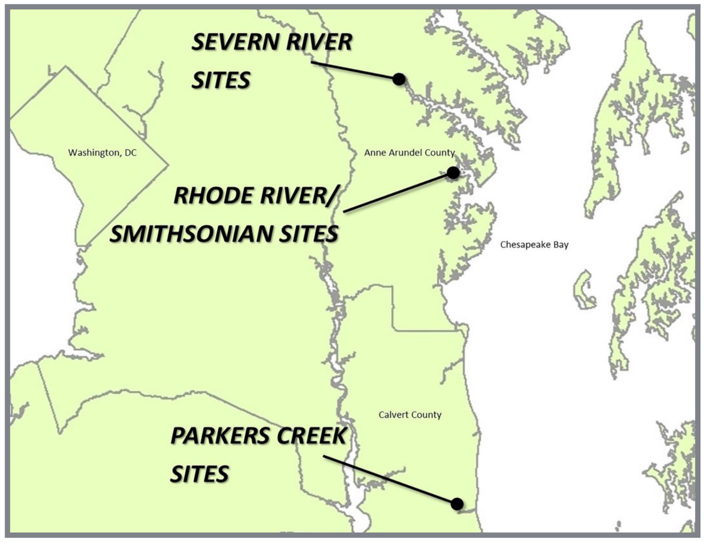
Project Activities in Year 2

Following the first year of research site and plot preparation, planting, maintenance, and monitoring, the team of researchers from the Smithsonian Environmental Research Center (SERC), the University of Maryland, and Utah State University collected data related to the sites' physical conditions such as soil pH, hydrology, and redox, and to conditions related to the plantings including plant survival, aboveground and root biomass, and plant cover. The objective of this portion of the research project is to evaluate the role of planting native wetland species in the recovery of tidal wetlands following eradication of *Phragmites*. Additional information regarding the preliminary findings from Year 1 can be found in Extension Brief EBR-59, published in July 2021.

Research continued at the same three sites in the upper Severn River (low salinity) and the three Rhode River sites (moderate salinity) in Anne Arundel County; the six

Table 1: Plant Information and preferred salinity ranges for each species. Ppt = parts per thousand

Low Salinity/oligohaline (0.5-3 ppt)	*Hibiscus moscheutos* Swamp Rose Mallow
	Peltandra virginica Arrow Arum
	Spartina cynosuroides Big Cordgrass
Brackish/mesohaline (5-9 ppt)	*Distichlis spicata* Salt Grass
	Spartina cynosuroides Big Cordgrass
	Spartina alterniflora Smooth Cordgrass



Map 1 - Researchers returned to the same Year 1 sites to continue their study for Year 2. Map by Eric Buehl.

Parkers Creek sites (fresh to moderate salinity) in Calvert County; and the two mesocosm study sites near SERC (low and moderate salinity). See Map 1. Vegetation plots that required replanting utilized a slightly modified plant palette in Year 2 (Table 1). Swamp rose mallow was substituted for switchgrass due to the low survival of the first year's plantings. Swamp rose mallow was chosen because it is common at many of the low salinity sites. Smooth cordgrass was substituted for saltmeadow cordgrass because the latter was not available for planting from the nursery in Year 2.

Summary of Year 2 Findings - Field Sites

- Native plant recovery through natural succession following *Phragmites* removal was variable across tidal wetland sites. Overall, lower salinity and drier sites had more rapid vegetation recovery, likely

Image 1 - Replanting vegetation in Year 2 at one of the higher salinity sites on Parkers Creek. Photo by S. Jacobson.

because seeds are more apt to germinate in lower salinity and less flooded areas. Drier tidal wetlands are those further inland where the tides do not rise as high and the soil surface is covered with water less often. Coastal wetlands with higher salinities or with higher levels of flooding may need more active management, such as planting native species, to accelerate vegetation recovery as part of *Phragmites* eradication (Image 1).

- Planting native species helped increase native plant cover after *Phragmites* removal at some sites but not at others. Planting had the biggest impact at brackish wetland sites with intermediate salinities (Image 2).
- Perennial plants, those that persist and live more than one year, were associated with greater root production, which means that, when successful, planting perennial vegetation can increase root growth. This can help stabilize a site and promote carbon storage following *Phragmites* removal. By contrast, annual plants, which return quickly following a disturbance, produce less root biomass.

Summary of Year 2 Findings - Mesocosm Study Sites

The Mesocosm Study, which used structures called marsh organs (image 3), occurred at two locations at SERC in the Rhode River subestuary. The marsh organs provided the opportunity to study the impact of tide depth and flooding frequency on plant growth and carbon storage. Plants were placed in plastic pots with a sand-vermiculite mixture at three different elevations at the two sites that had different salinity regimes. Researchers placed the plant species used in the field experiment in the marsh organs.

- All plant species except one (Arrow arum) produced substantial belowground biomass across the range of experimental flooding conditions, thus having the potential to support substrate stability in areas where *Phragmites* has been removed.
- The results indicated that high levels of flooding stimulated the growth of most species in a sandy substrate. This was different than findings of previous experiments with organic soils, demonstrating the influence of substrate conditions. Higher flooding levels refers to areas lower in the tidal creek (low marsh) that flood to higher depths and have water above the surface of the soil more often.

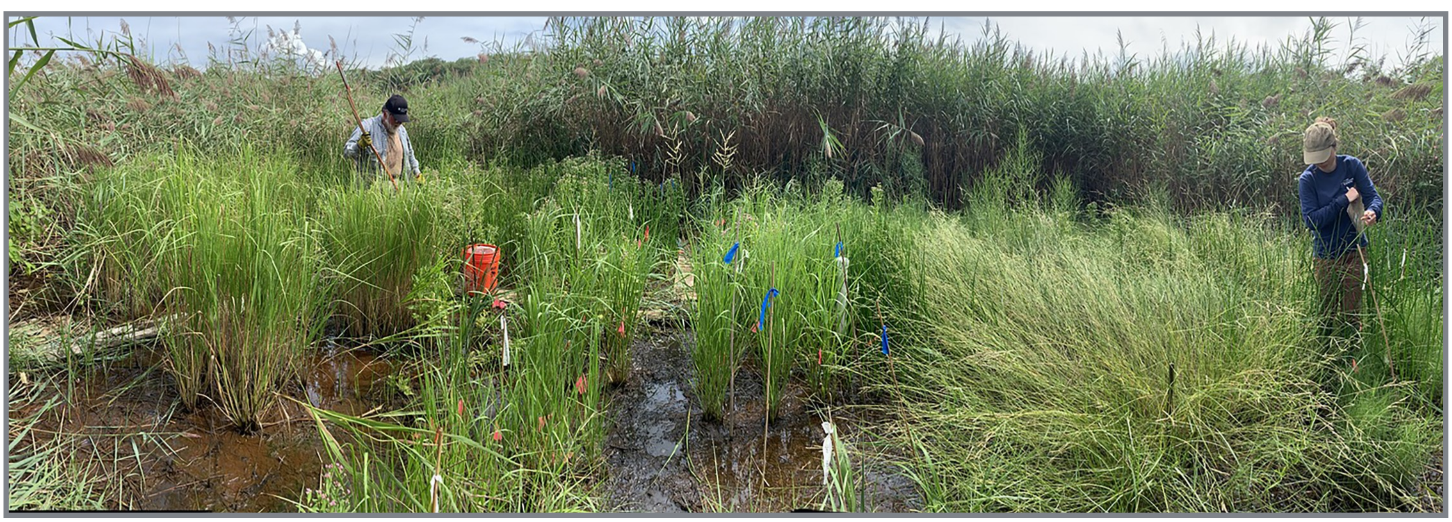


Image 2 - Perennial plant growth at one of the intermediate salinity SERC sites after slightly more than one full growing season. Photo by A. Baldwin.

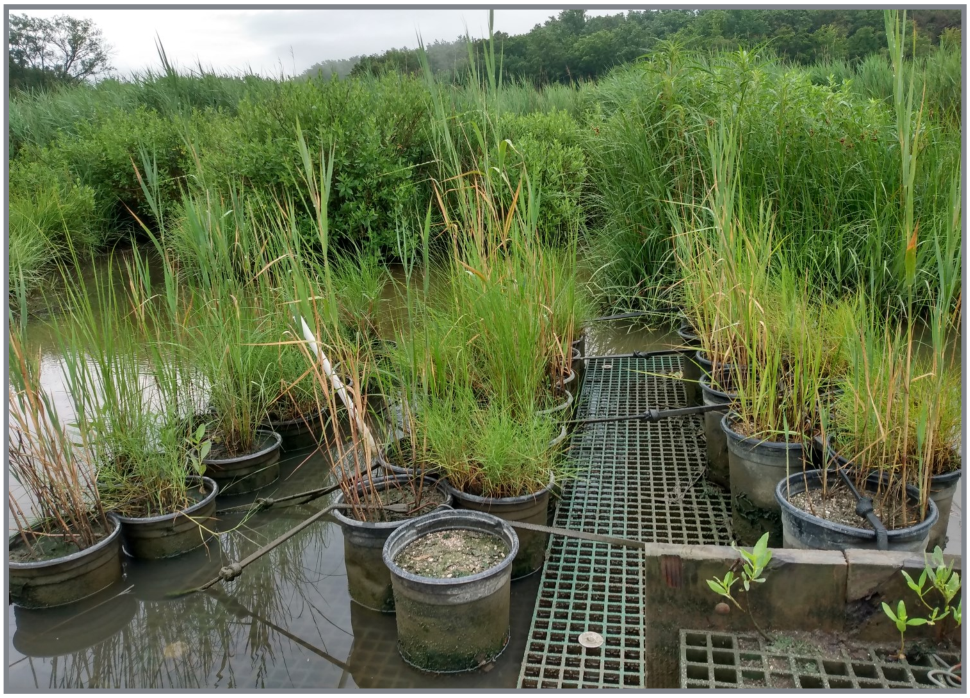


Image 3 - Marsh organ setup with native plants subjected to more frequent tides on the lower bench (left) than those on higher benches to the right. The same species were used on each bench. Photo by S. Jacobson.

A review of the Year 2 data has yielded several preliminary implications for restoration:

Implications for Restoration

- Plants may colonize higher-elevation low-salinity sites from seed, reducing the need for planting.
- In brackish sites, planting may accelerate development of native vegetation.
- Counterintuitively, at sites with well-drained mineral soils, plant growth may increase with flooding depth.

The research teams are compiling these findings, along with additional information from the research project, into a larger University of Maryland Extension Fact Sheet that will cover the entire span of the research project, along with greater detail on their findings and recommendations. Funding for this project was provided by a grant from Maryland Sea Grant College and from the Smithsonian Institution.

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