

A paradigm shift: Rethinking *Phragmites* (and *Phragmites* management) in the context of ecosystem resilience

Thomas J. Mozdzer, Ph.D.

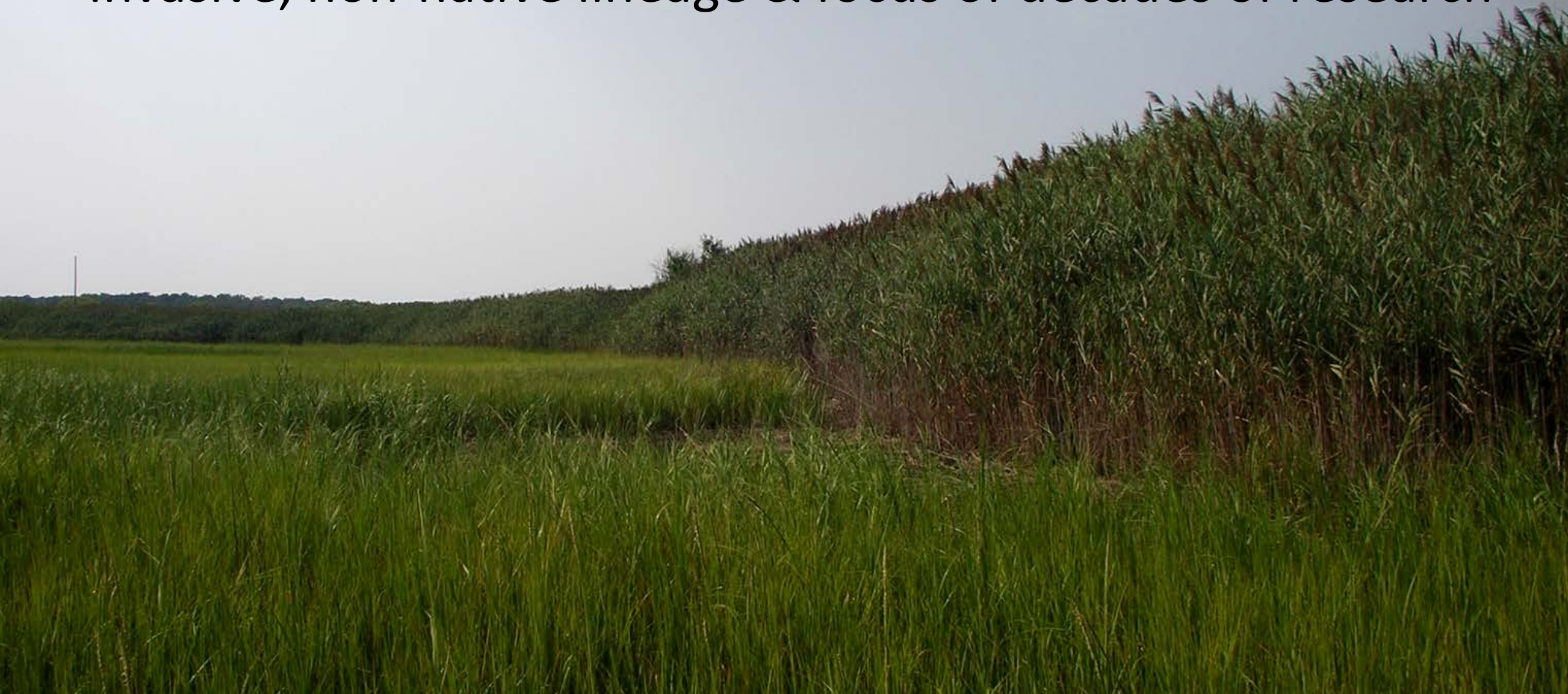
Associate Professor of Biology, Bryn Mawr College

Research Associate, Smithsonian Environmental Research Center













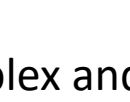


Phragmites australis

Invasive, non-native lineage & focus of decades of research



Ecosystem Services Comparison

Ecosystem Service	Phragmites		Native marsh	Citations
Wave attenuation/ Shoreline stabilization		=		Leonard et al 2002, Theuerkauf et al 2017
Vertical accretion		>		Windham and Lathrop 1999, Rooth et al. 2003, Mozdzer in prep
Nitrogen /metal immobilization		>		Windham & Ehrenfeld 2003, Windham et al 2003, Mozdzer et al 2013, Mozdzer et al in prep
Carbon sequestration		>		Caplan et al 2015, Schäfer et al 2014, Duman & Schäfer 2017
Habitat "quality"		≤		Meyerson et al 2010, Dibble et al 2013, Kiviat 2013
Fish/Benthic habitat		≤		Able & Hagan 2000, Hanson et al 2002, Meyer et al 2001, Posey et al 2003, Weinstein et al 2000, Weise et al 2002, Weis 2008,
Waterfowl habitat		<		Cross and Fleming 1989
Migratory/bird habitat		≤		Benoit & Askins 1999, Kiviat 2013
Biodiversity		≤		Bertness et al 2003, Chambers et al 1997, Kiviat 2013

Note: Ecosystems service comparisons are complex and difficult to assign benefits/losses

Smithsonian Global Change Research Wetland



**SWS
WETLANDS OF
DISTINCTION**

Recognizing the world's most valuable wetland ecosystems.

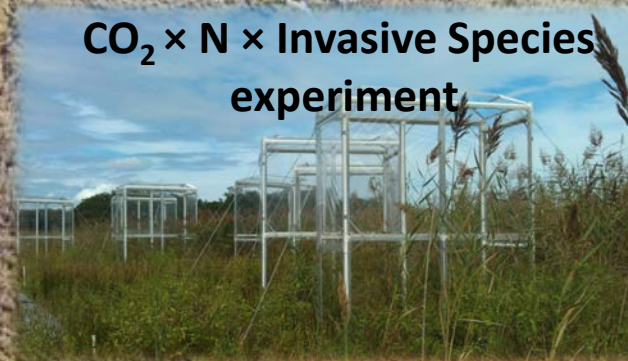
World's longest running
elevated CO₂ experiment



CO₂ × N
experiment

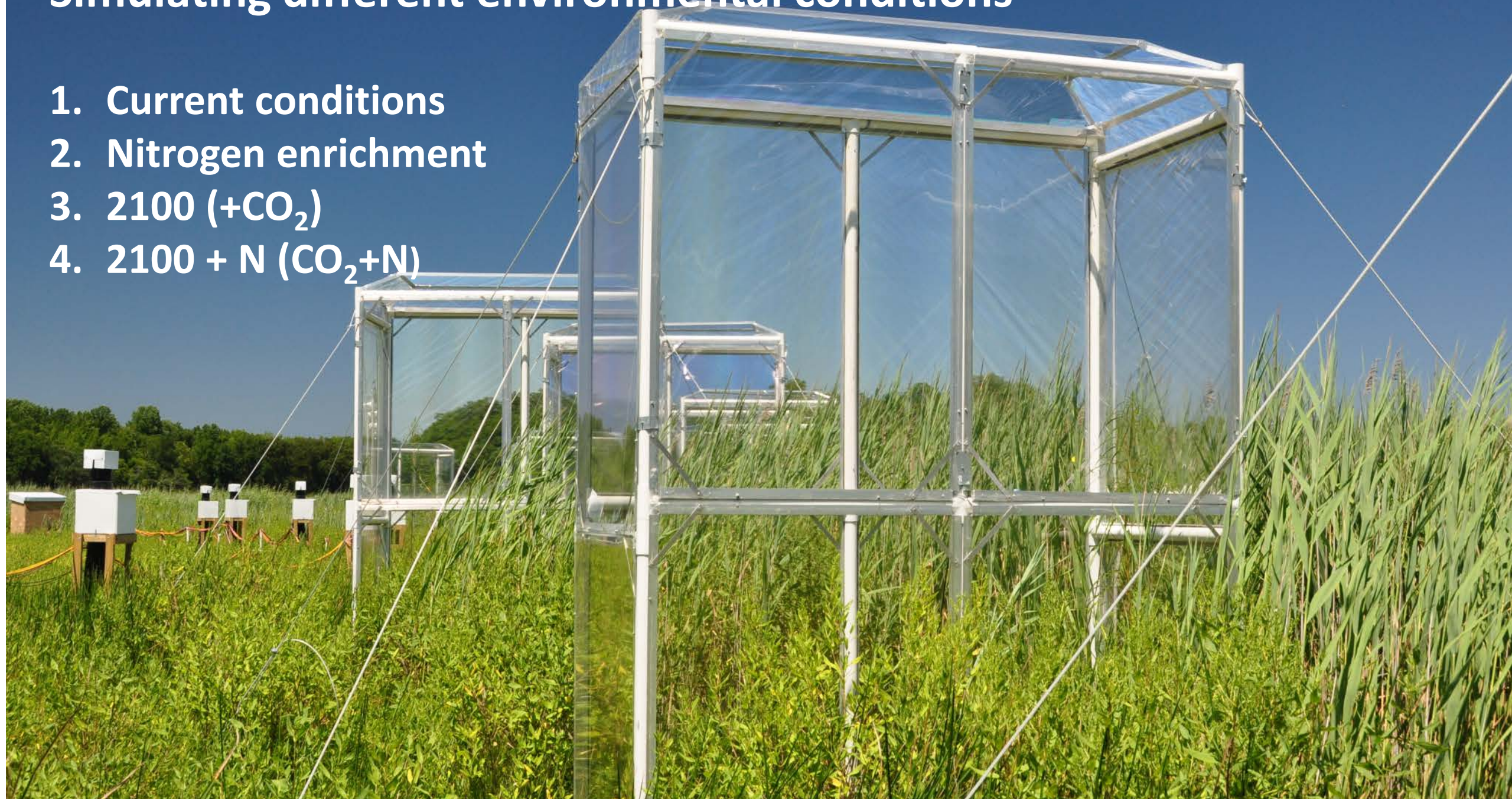


CO₂ × N × Invasive Species
experiment



Simulating different environmental conditions

1. Current conditions
2. Nitrogen enrichment
3. 2100 (+CO₂)
4. 2100 + N (CO₂+N)



Phragmites is more productive and fixes up to 3 times more carbon than native plants under current & near-future conditions

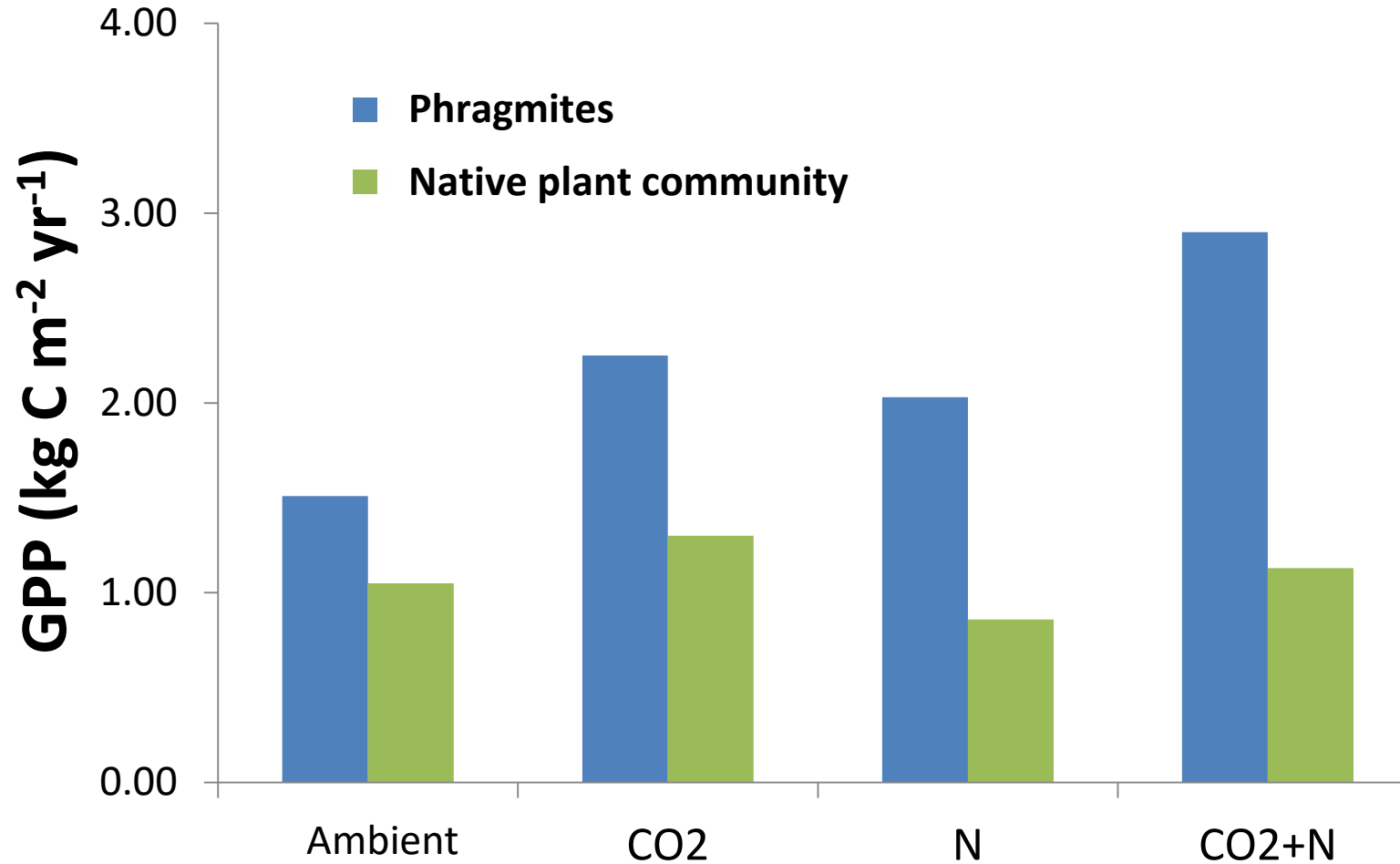
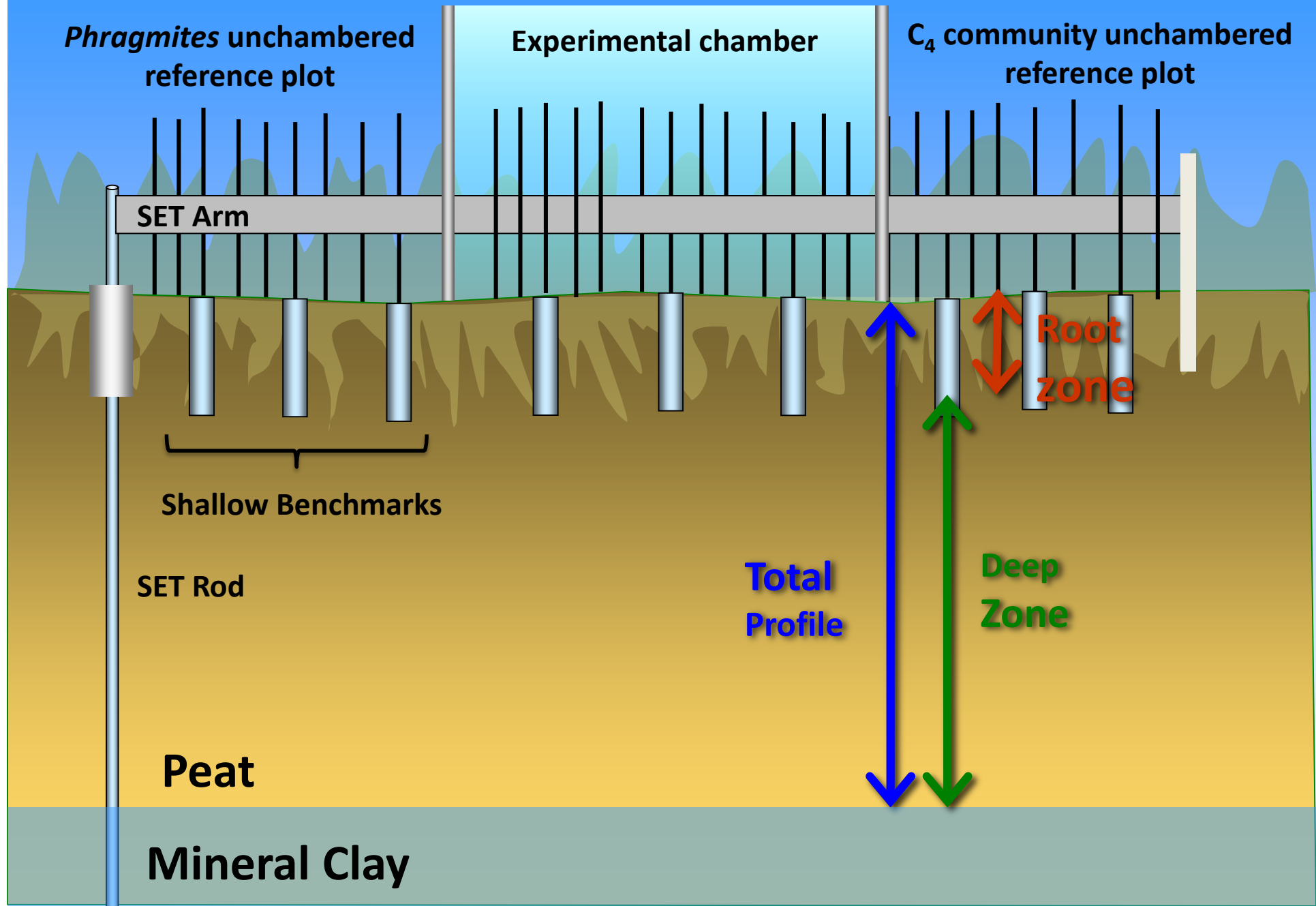




Photo: Bob Meadows

Modified Surface Elevation Table





***Phragmites* builds more elevation than native plants at GCREW
N addition increases *Phragmites* productivity & elevation gain
Native communities are NOT keeping pace with RSLR**

Data available upon request

>5 million USD per year are spent on herbicides to control *Phragmites*



A **Guide** to the
Control and Management
of
**INVASIVE
PHRAGMITES**



Martin & Blossey 2013

***Phragmites australis* management in the United States:
40 years of methods and outcomes**

Eric L. G. Hazelton^{1,2*}, Thomas J. Mozdzer^{2,3†}, David M. Burdick⁴, Karin M. Kettenring^{1,2} and Dennis F. Whigham²

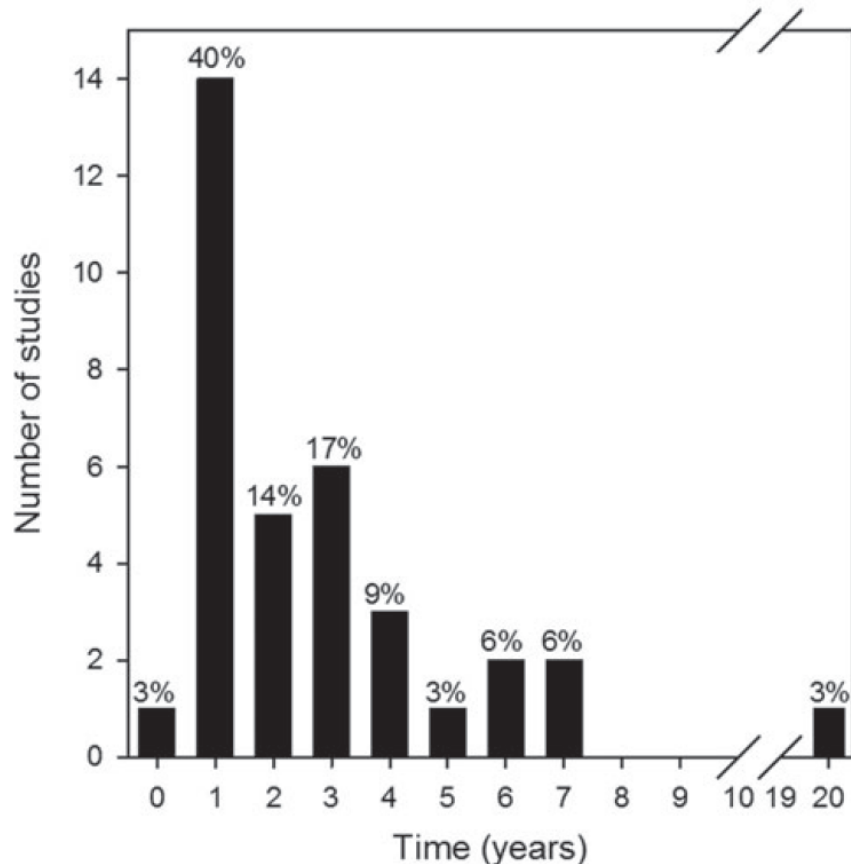


Figure 1. Duration of studies included in review. One study conducted a single survey and is denoted with the time = 0 bar.

Lessons learned from 40 years of *Phragmites* management

- Studies do not last long enough
- Herbicides are most common approach & are effective at removing *Phragmites*
- However, we do not typically track recovery well

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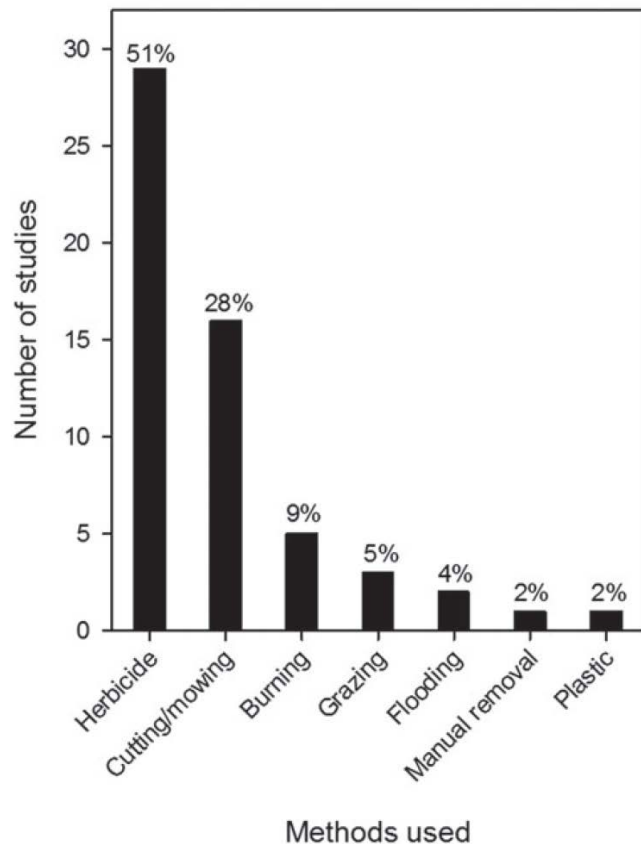


Figure 2. Management methods used in reviewed articles. Methods used in combination are counted individually.

Lessons learned from 40 years of *Phragmites* management

- Wetlands/watersheds should be prioritized to identify ecosystems that would benefit most from management and where the **negative effects of management would be minimal**

Large Scale Phragmites Removal Experiment: Before

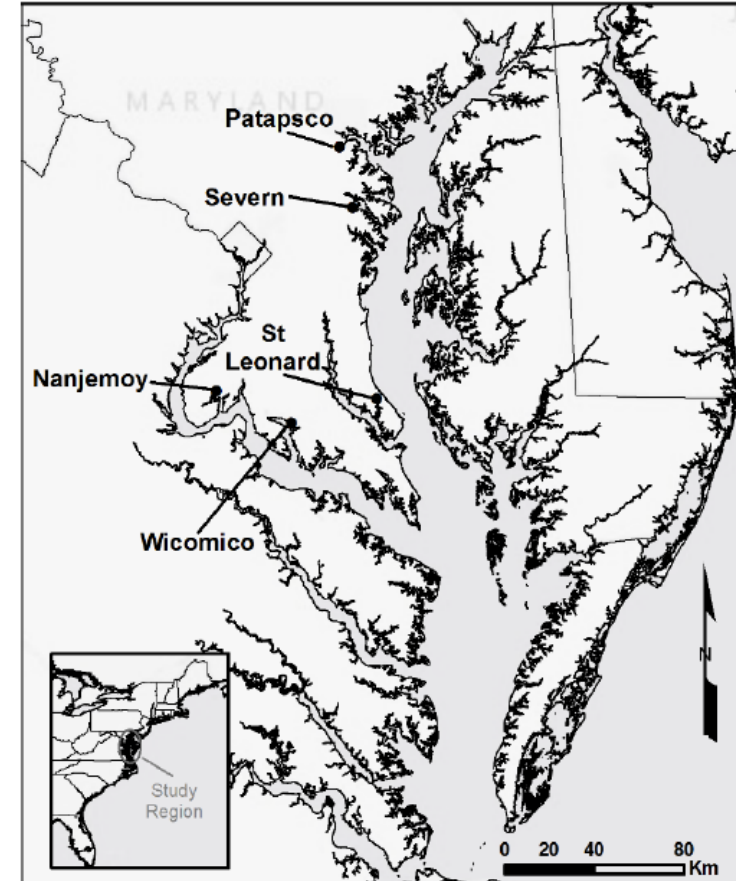


Figure 3.1. Map of sampling sites on the Western Shore of Chesapeake Bay.

Nanjemoy River removal site. Photo: Marine Ecology lab SERC, Figure: Hazelton Dissertation 2018

Large Scale Phragmites Removal Experiment: After Lessons learned (Hazelton 2018)



- Large monocultures may not be able to recover or return to native state
- 37.5% sites never recovered

Nanjemoy River removal site. Credits: Eric Hazelton



Nipponaclerda biwakoensis

Photo: Dr. Rodrigo Diaz

INSECTS FEAST ON LOUISIANA WETLANDS, INVITING THE GULF IN

A pest known as a scale appears to be killing off reeds that bind the state's coast together, speeding land loss and endangering oil wells, shipping routes and fishing grounds.

By TRISTAN BAURICK FEB. 24, 2018

Source: <https://www.nytimes.com/interactive/2018/02/24/us/louisiana-wetlands-insects.html>

Phragmites herbivory is resulting in further destabilization of the Gulf Coast



Credit: William Widmer for The New York Times

Die off is exposing gas and oil infrastructure that can lead to increased risks of spills



Credit: William Widmer for The New York Times

Loss of *Phragmites* can be reshaping and clogging shipping channels

Phragmites Biocontrol

- Proposed biocontrol agents are **not** host-specific at the lineage level
 - May adversely affect native lineages
- First instar larvae survived on the foundation species *Spartina alterniflora* and *S. cynosuroides*
- Biocontrol ignores decades of science and implementation of adaptive management because it can NEVER be removed once released.
- **Limits our management toolbox** if we ever want to use *Phragmites* to maintain existing marshes that would otherwise drown to RSLR

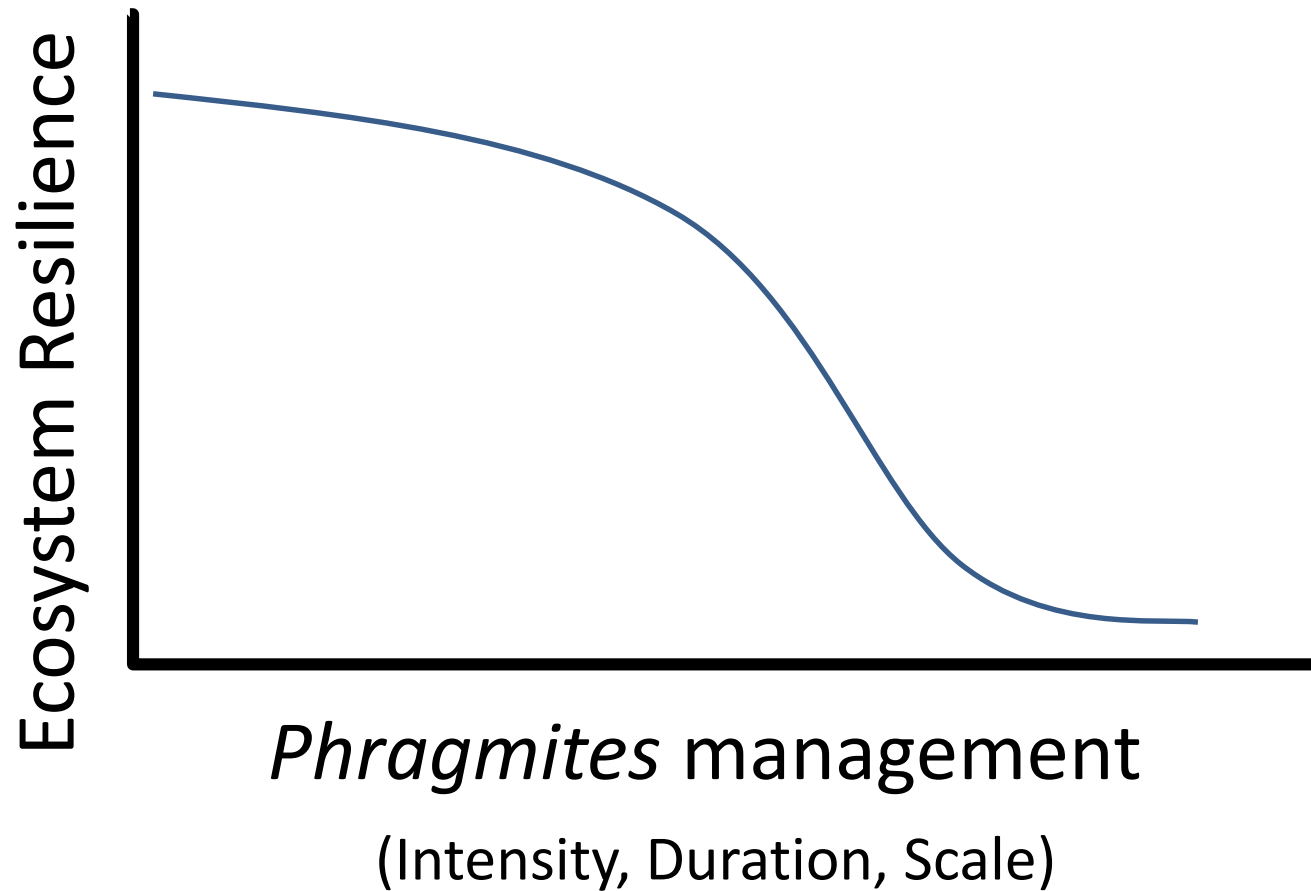


Archanara geminipuncta



Archanara neurica

Ecosystem Resilience & Management



Summary

- *Phragmites*-dominated wetlands provide many comparable or superior ecosystem services
- NOT advocating for a cessation of *Phragmites* management - but a reevaluation of where and when we manage with respect to maintaining ecosystem resilience acknowledging potential benefits of *Phragmites*
- Acknowledge that management may destabilize wetlands lowering marsh resilience

Final thoughts

- *Very interested in developing partnerships with managers and policy makers to evaluate how management practices influence ecosystem resilience*
- If *Phragmites* is superior in terms of keeping pace with RSLR, is there a scenario when management should prioritize maintaining marsh integrity over maintaining native species/habitat?
- Can *Phragmites*-dominated wetlands be considered a viable alternate stable state in terms of management & policy goals?



Smithsonian Environmental
Research Center



Twitter: @tjmozdzer

Facebook: MozdzerEcologyLab

Email: tmozdzer@brynmawr.edu