



***Phragmites and Rip-Rap are
not a good partnership***

Dennis Whigham

Smithsonian Environmental Research Center

Our good friend – *Phragmites australis*



How does *Phragmites* reproduce and spread?



Rhizomes - Clonal (asexual) propagation



Shoots - Clonal (Rooting at nodes)



Seeds - Sexual reproduction (outcrossing)

a) Native Haplotypes Before 1910



b) Invasive Haplotype Before 1910



c) Native Haplotypes After 1960



d) Invasive Haplotype After 1960



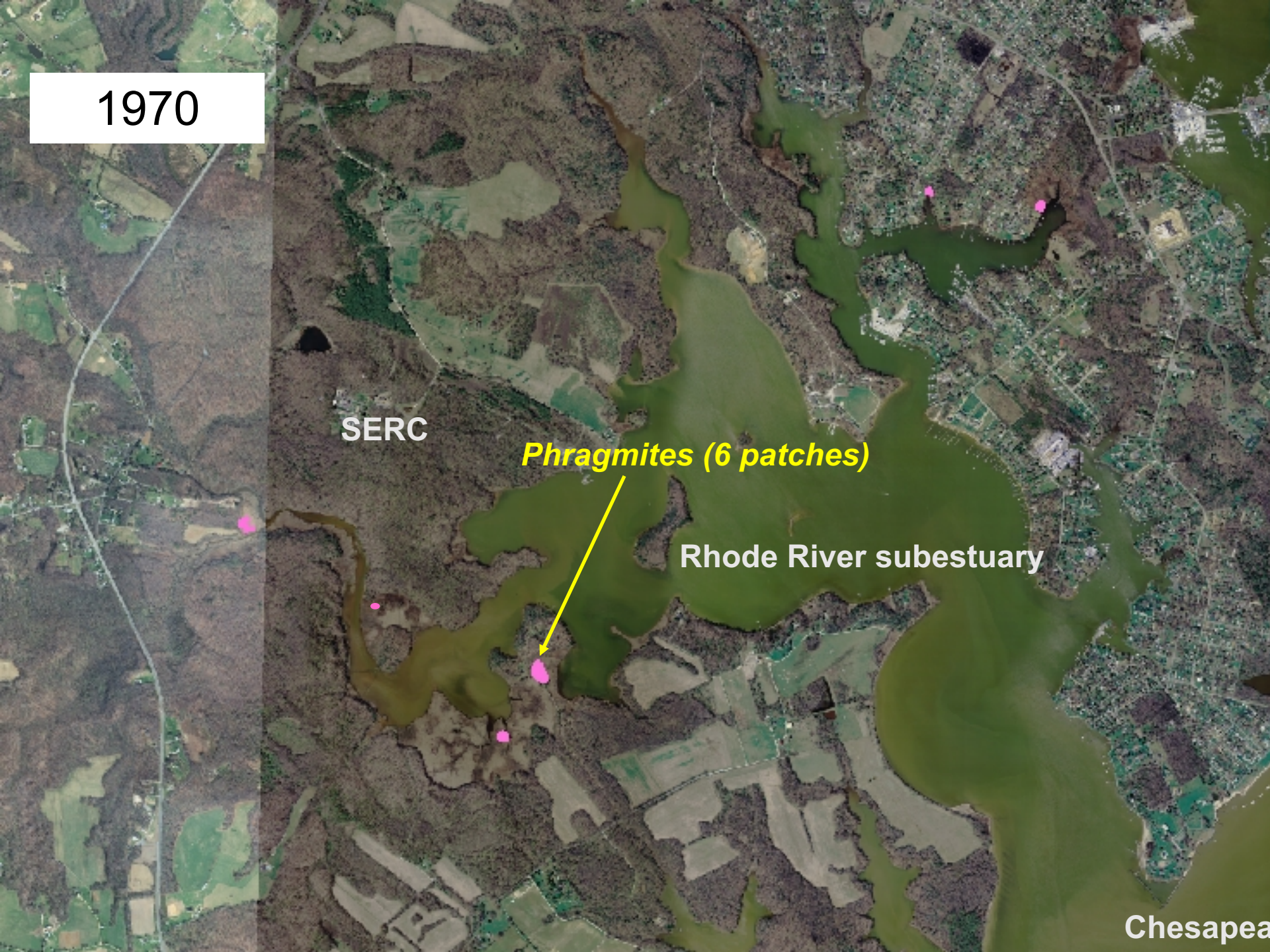
1970

SERC

Phragmites (6 patches)

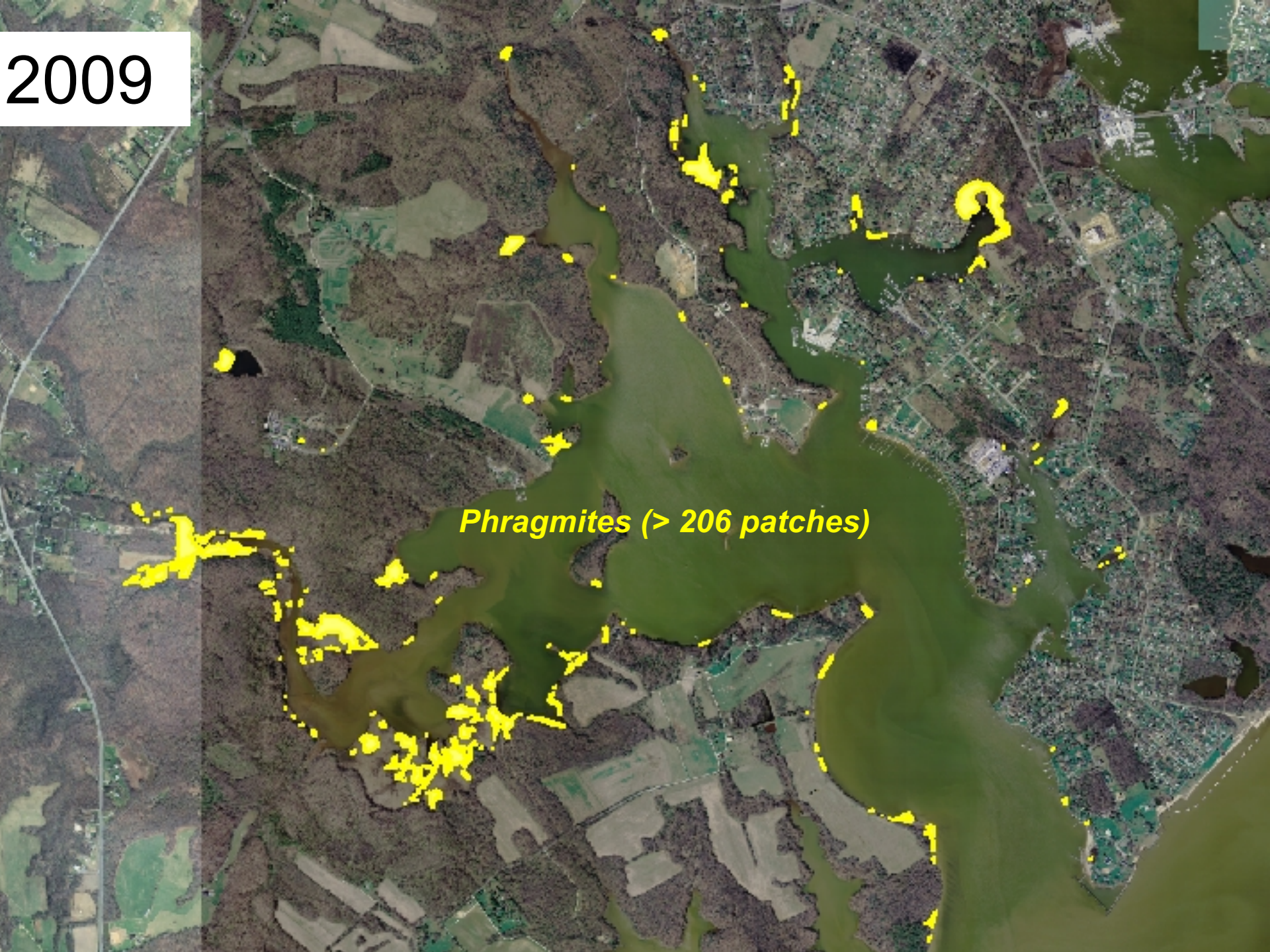
Rhode River subestuary

Chesapeake



2009

Phragmites (> 206 patches)

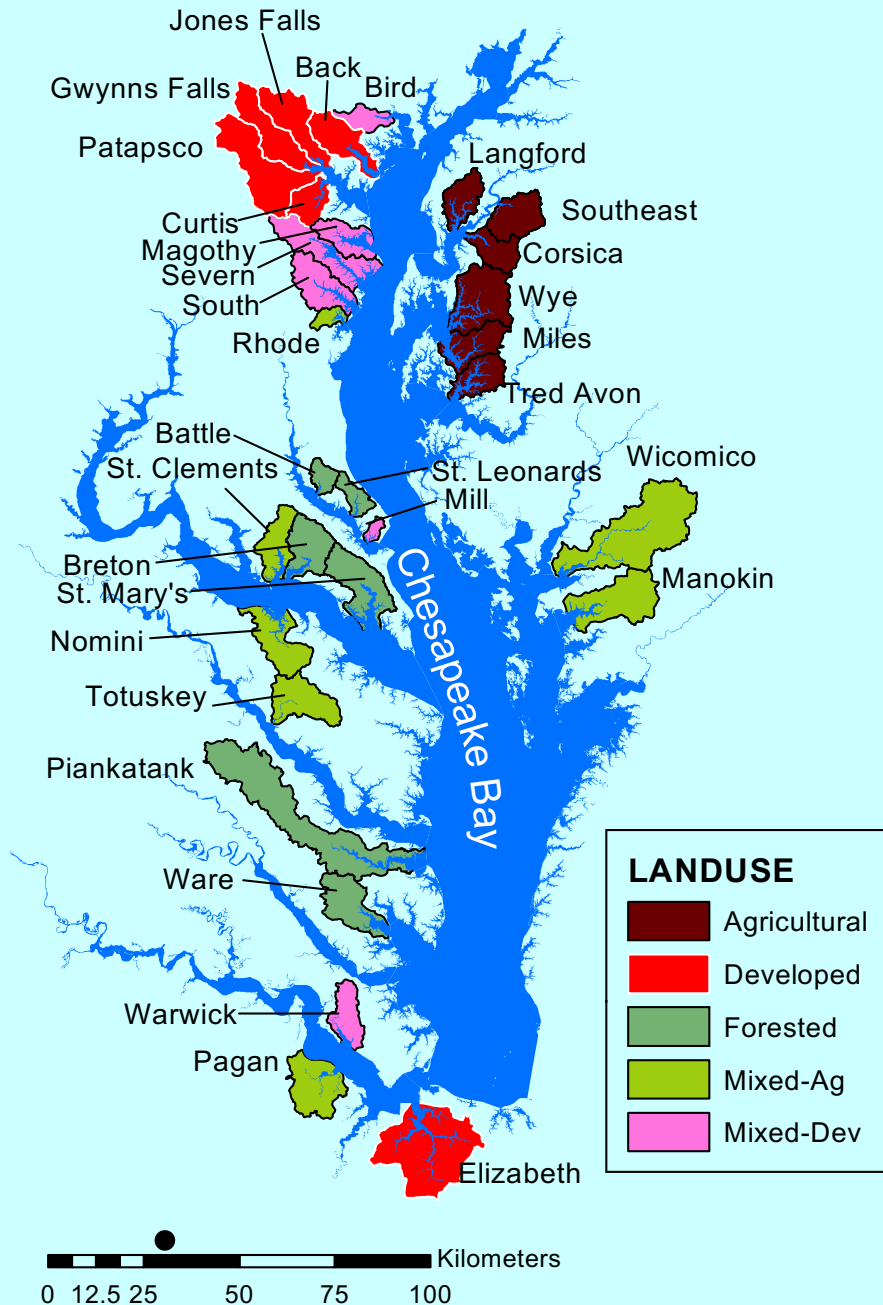


Rock Hall



Patapsco

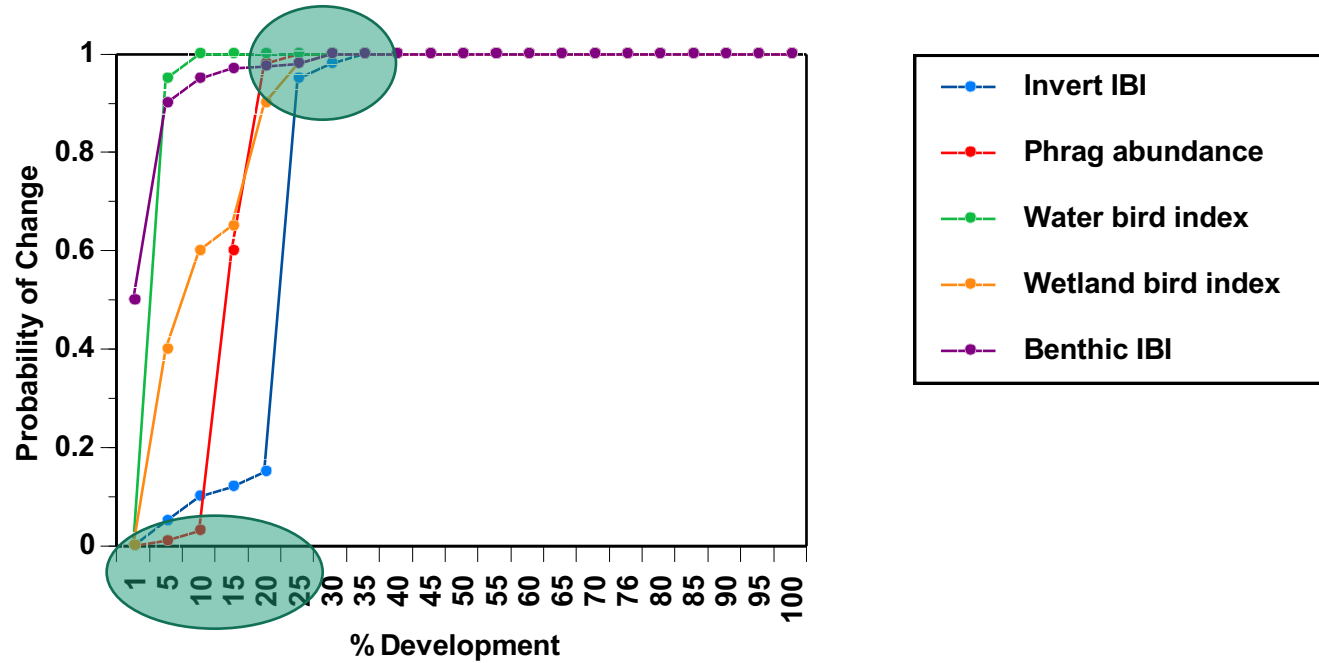




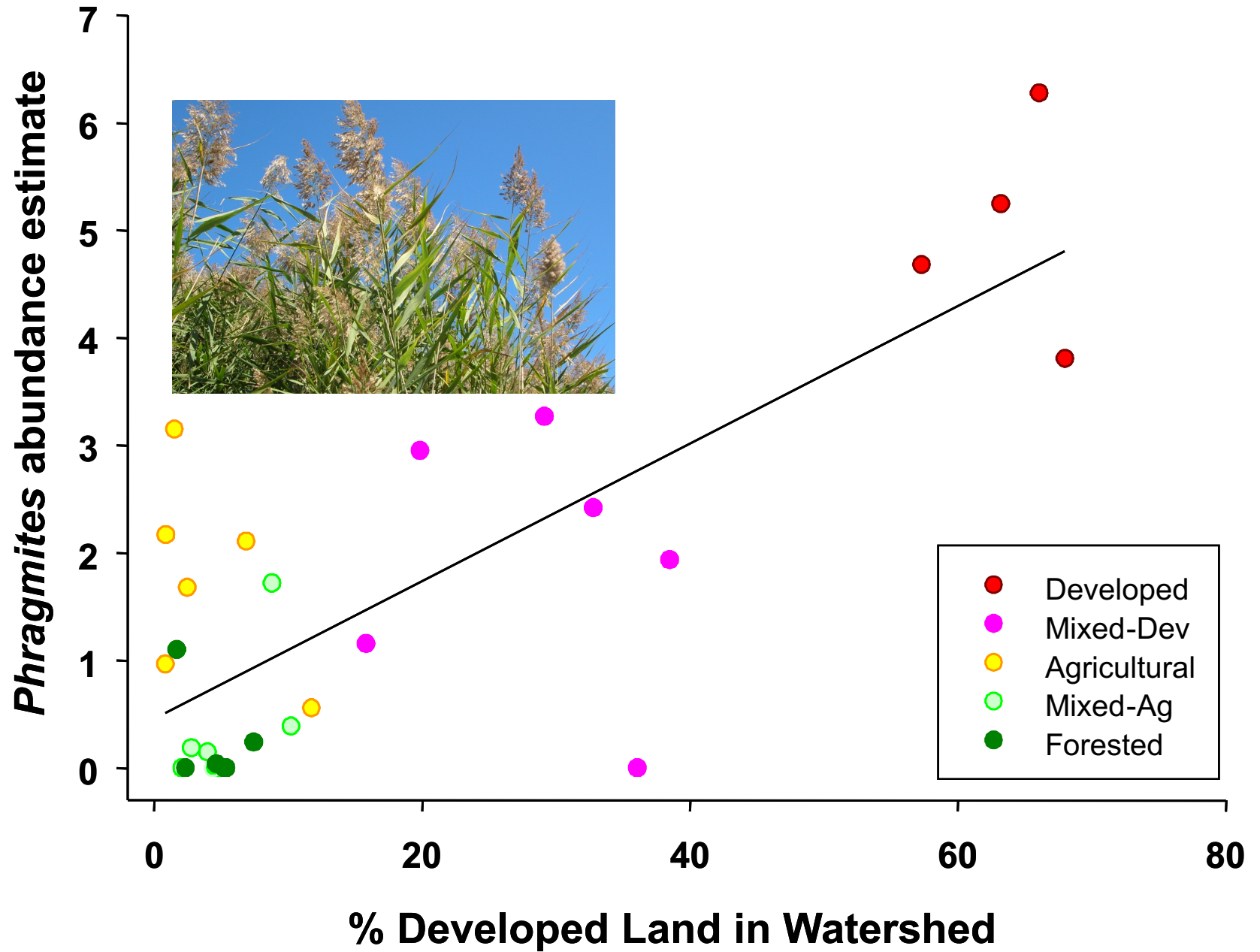
Estuarine segments: Watersheds and subestuaries of a larger estuarine ecosystem

Estuarine segment watershed land-uses ranges from forested to highly agricultural or developed

Estuarine Indicators

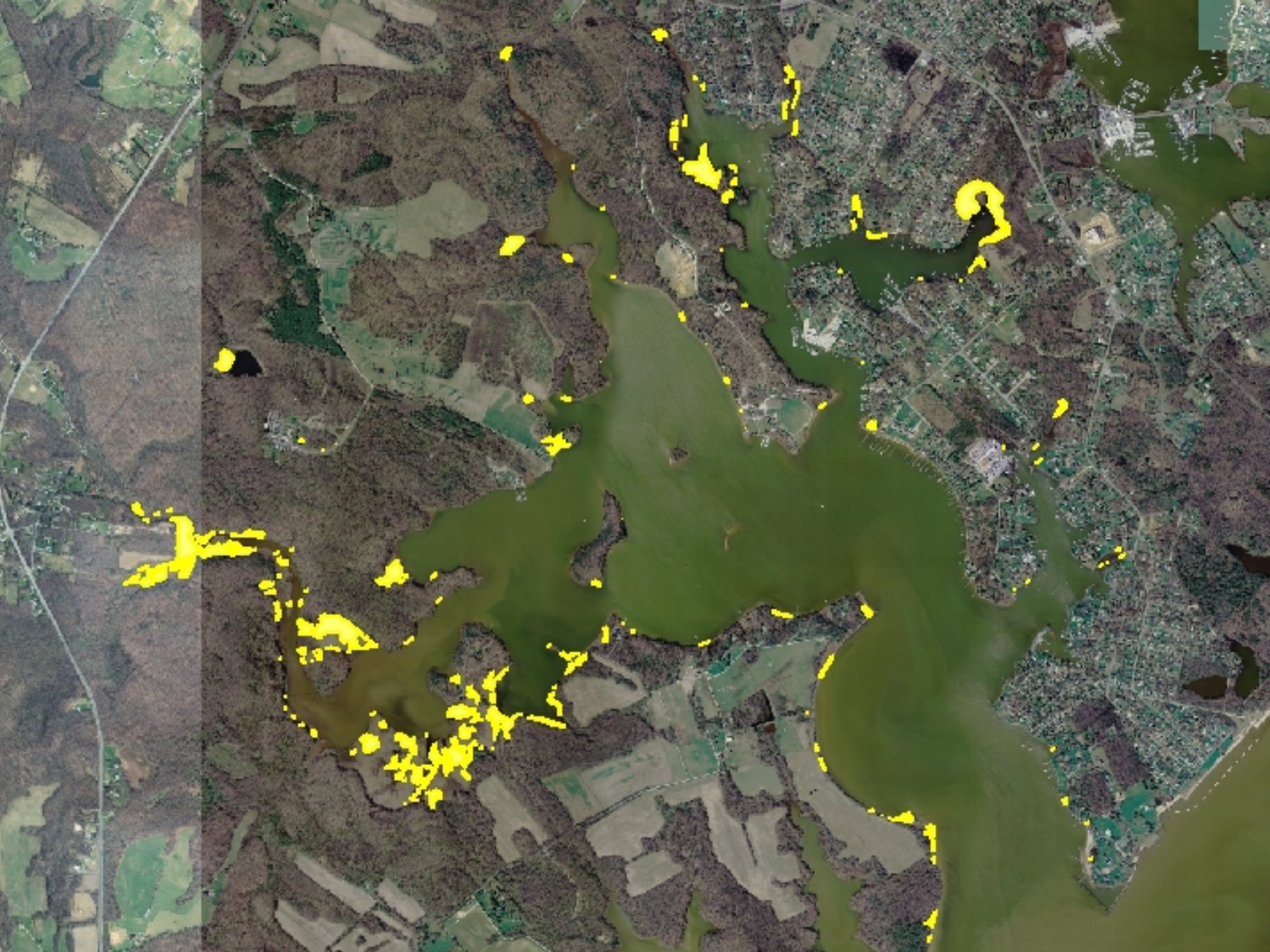


Most variables had THRESHOLD responses



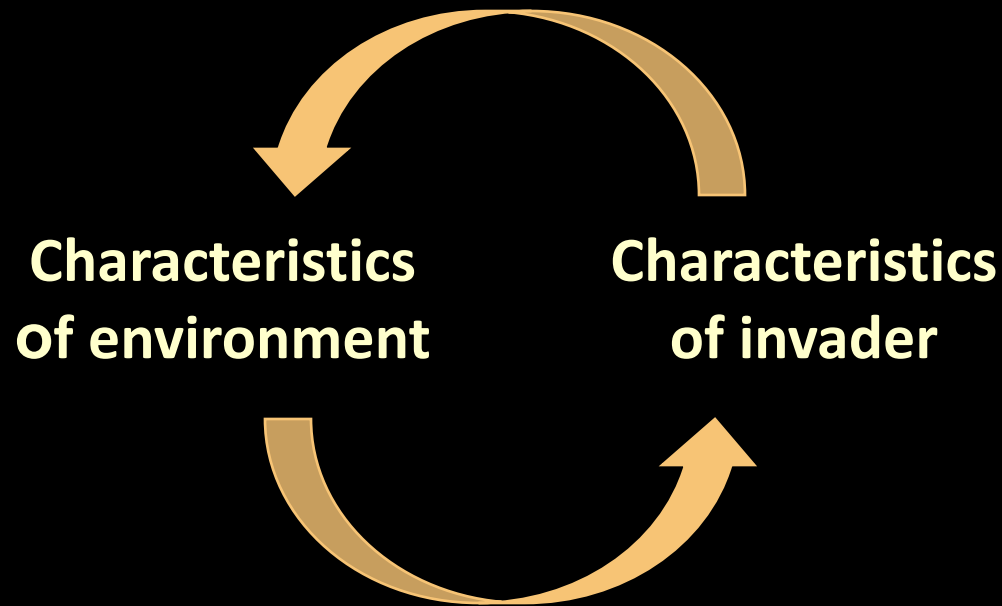
What are the causes of the rapid spread of *Phragmites* in recent years?



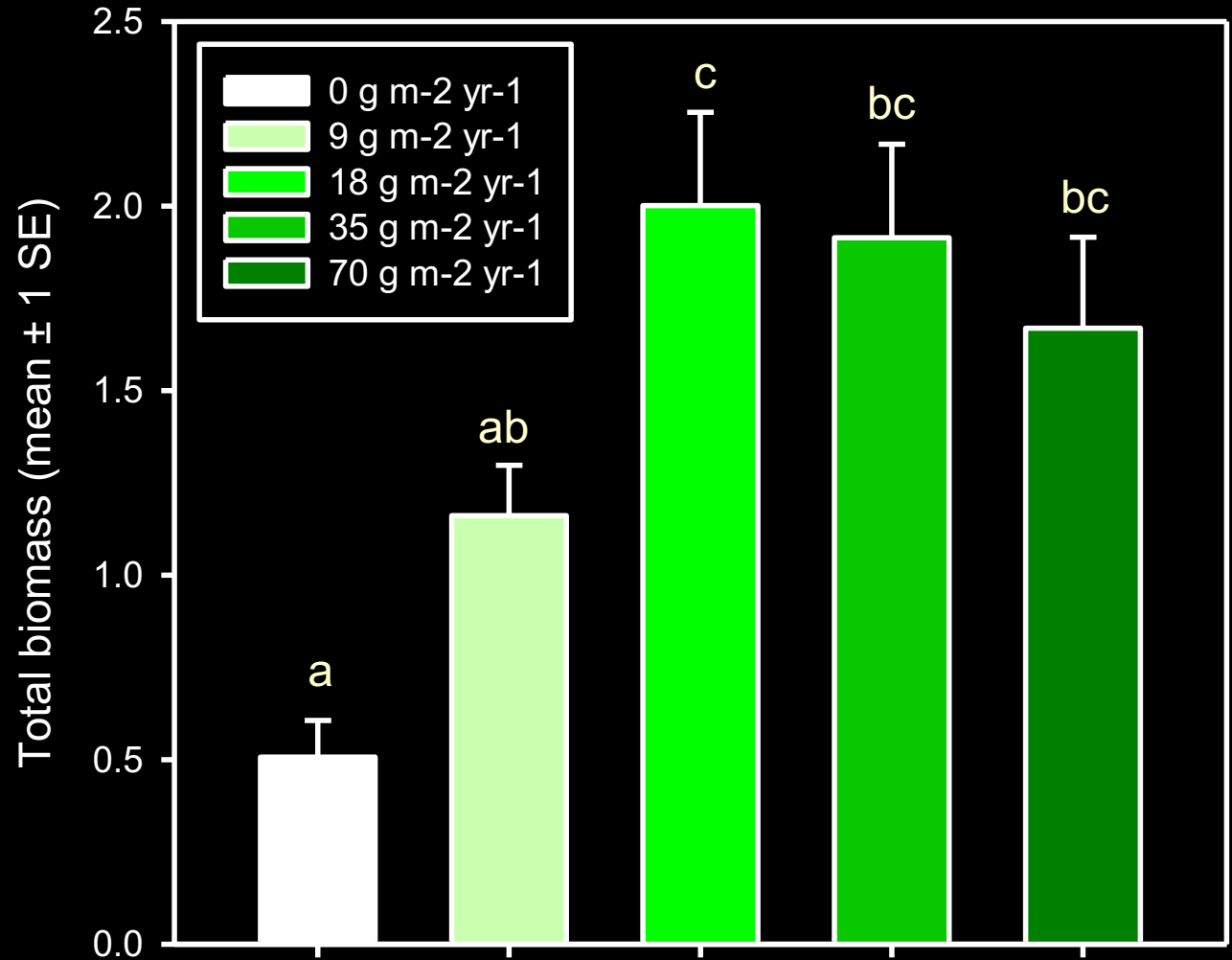


A fundamental question in ecology

What drives the (rapid) spread of invasive species?

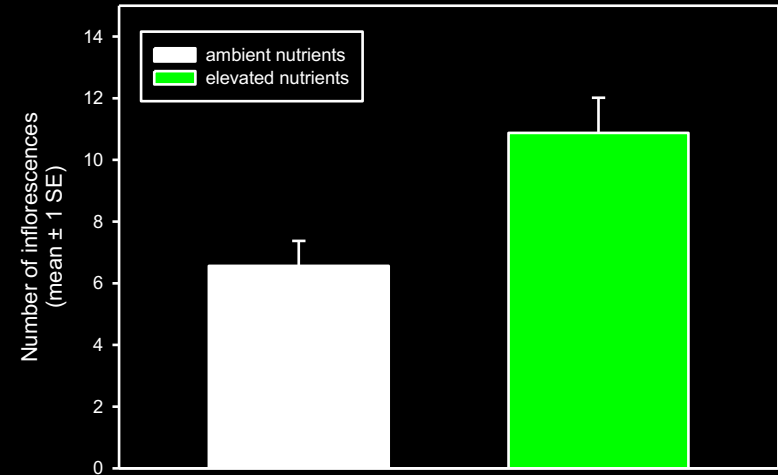
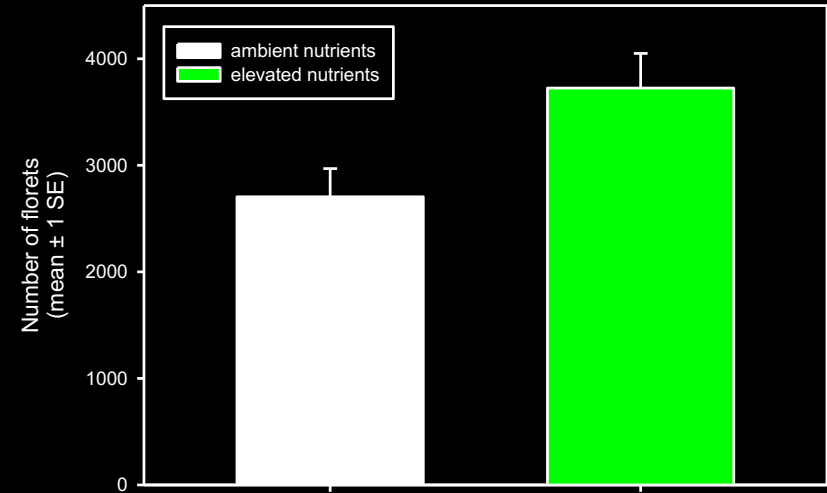


Nitrogen is Important?



***Phragmites* growth is higher under elevated nitrogen**

Nitrogen is Important?



Nitrogen results in more flowers, inflorescences and seeds

Disturbance is Important – Natural and Man-made?





Muskrat (*Ondatra zibethicus*)



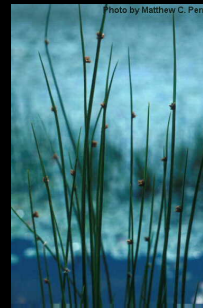
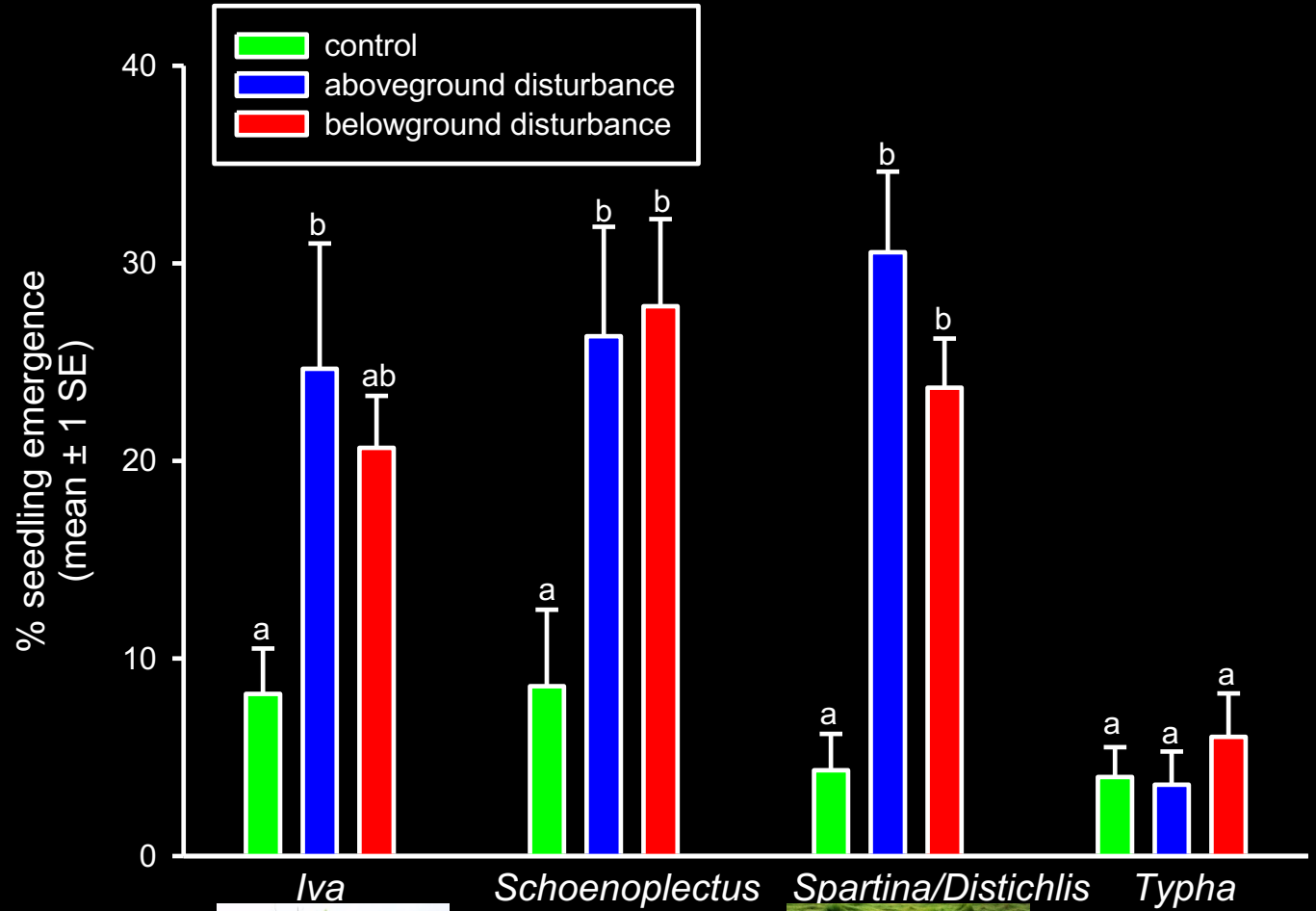
Opening
from
digging
vegetation

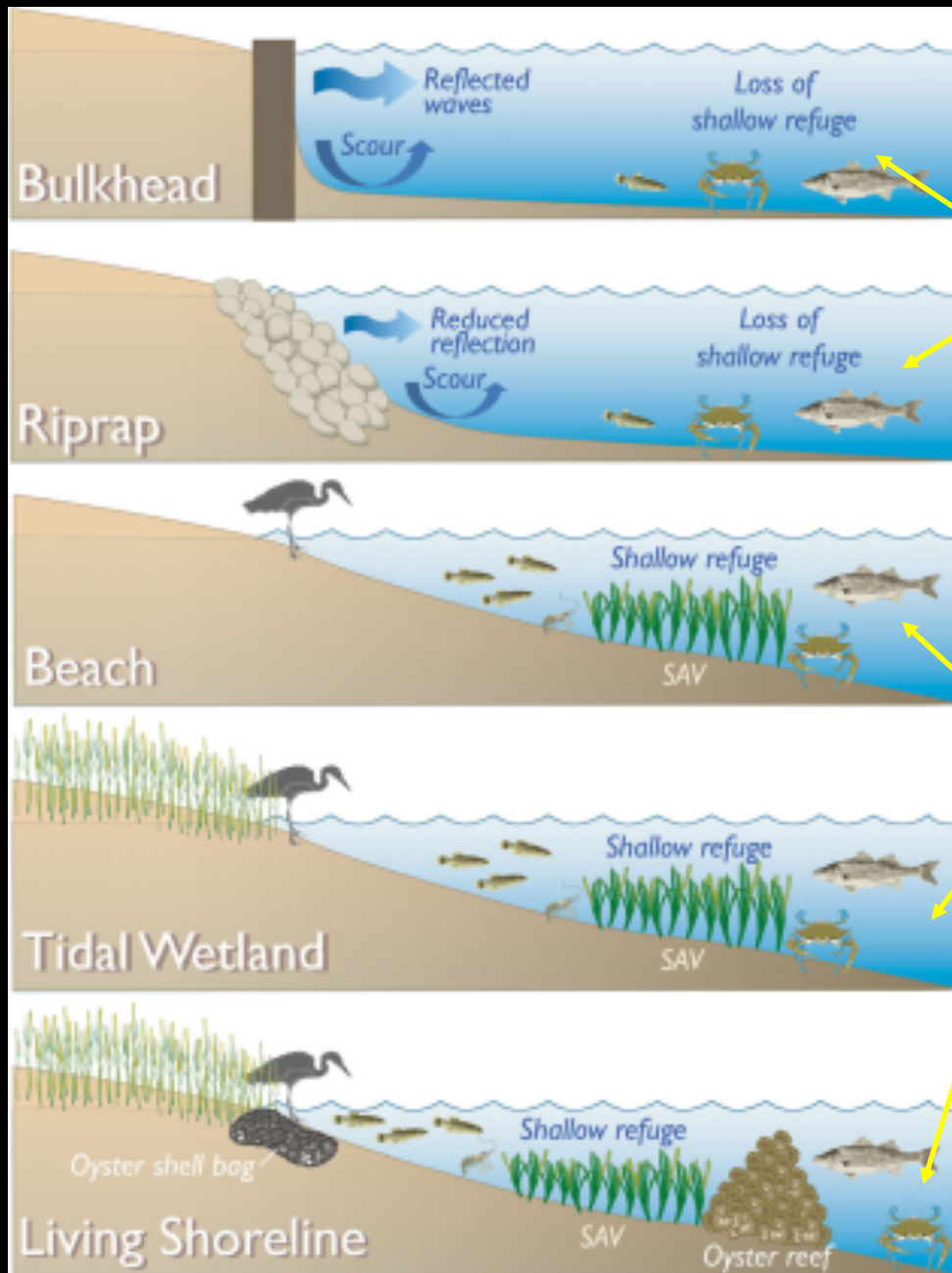
Feeding station

Lodge

Phragmites seedling emergence higher in disturbances (natural and manmade)

Kettenring et al. 2015. *Ecological Applications* 25: 466-480

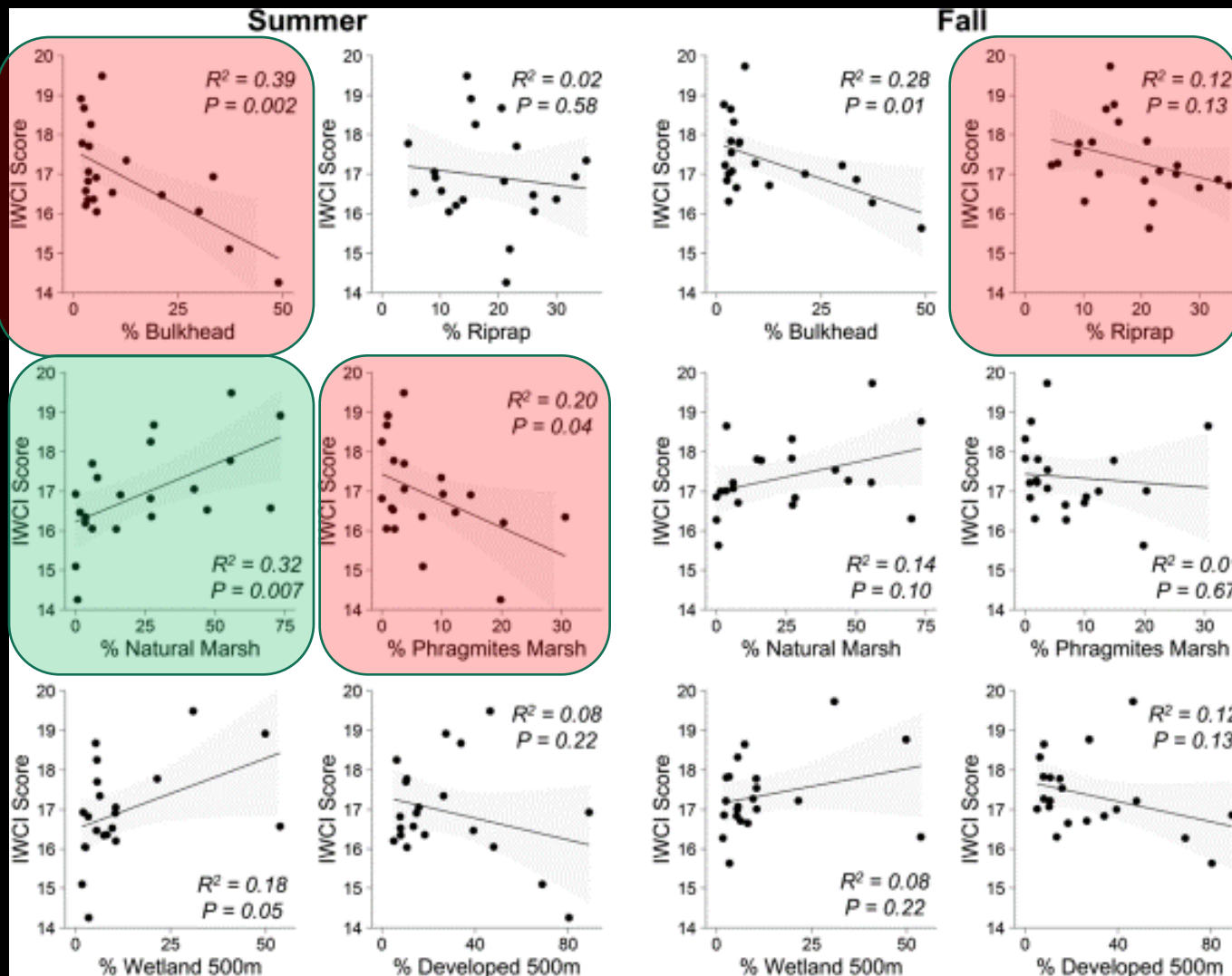




High energy system with loss of shallow refuge for animals and loss of habitat for submersed aquatic vegetation

Provide refuge for animals and habitat for wetlands and submersed aquatic vegetation

Responses of birds to shoreline features (Prosser et al. 2018)



Rip-Rap Shorelines and *Phragmites*



How does *Phragmites* reproduce and spread?



Rhizomes - Clonal (asexual) propagation



Shoots - Clonal (Rooting at nodes)

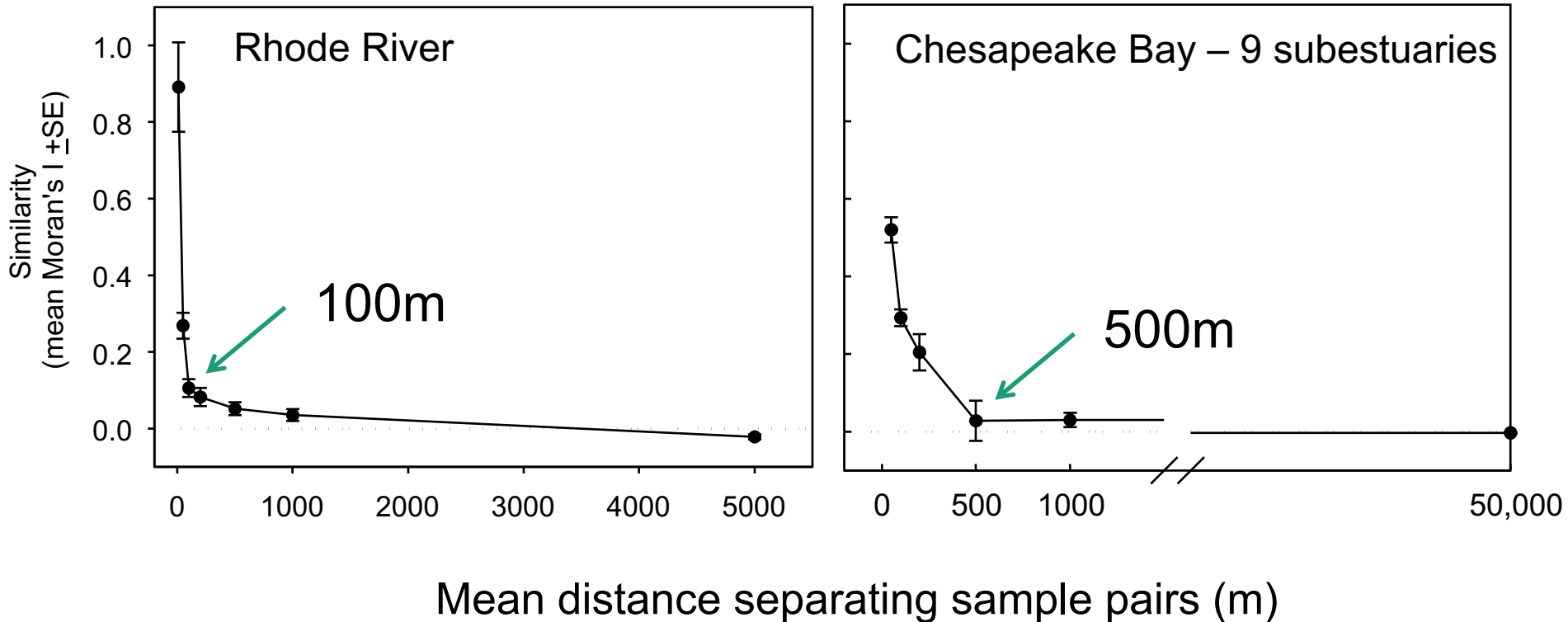


Seeds - Sexual reproduction (outcrossing)

Linking biology to disturbance



Where do the seeds establishing patches on hardened shoreline come from?



The majority of dispersal is local and within subestuaries and clonal expansion of patches and patch age plays a role in this process.

McCormick et. al. 2010. *Journal of Ecology* 98: 1369-1378

Hazelton et al. 2015. *Wetlands* 35: 877-888.

McCormick et al. In press. *Biological Invasions*

St. Leonard Creek



Patch History

1970 – 1 patch ■

Mid-1990s – 1
shoreline patch
(VIMS) ■

2013 – 12
patches

Management



- In most subestuaries of C. Bay, *Phragmites* is likely to appear at sites where shorelines have been modified with Rip-Rap – most likely from seeds.
- Active management is required until the disturbed areas are stabilized to preclude establishment from seed.
- Persistence is required as seeds will appear at the site if there is any *Phragmites* in the subwatershed.
- Removal is difficult – likely will require herbicides as it won't be possible to remove rhizomes.