Phragmites australis invasion into disturbances in Chesapeake Bay tidal wetlands: *Dispersal, colonization, fitness, and restoration*

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The role of disturbances across different life stages of *Phragmites* invasion

Disturbance:
Anthropogenic or natural

Dispersal:
Distances and mode

Colonization:
Seedling emergence and establishment

Fitness:
Viable seed production

Restoration:
A disturbance

Phragmites australis

Native to North America

Introduced European haplotype (Saltonstall 2002) = invasive *Phragmites*

One of the most problematic invasive plants in North American wetlands

How are disturbances related to its spread?

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What are sources of new wetland habitat in the Chesapeake Bay?

Disturbance: Anthropogenic or natural

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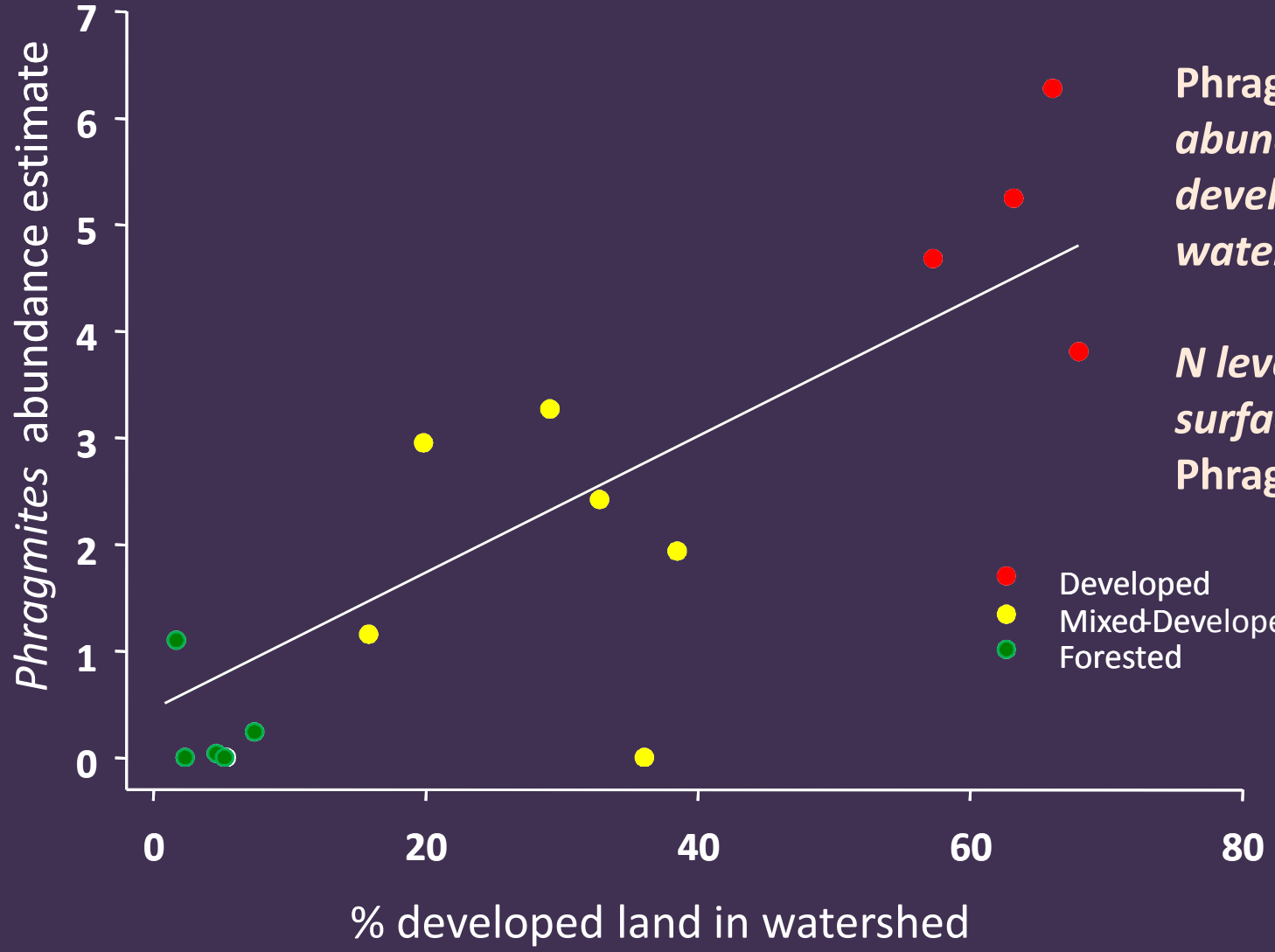
Colonization: Seedling emergence and establishment

Fitness: Viable seed production

Restoration: A disturbance

What are sources of new wetland habitat in the Chesapeake Bay? Human-derived disturbances



Phragmites *more abundant in developed watersheds.*

N levels higher in surface water and* Phragmites *leaves.

King et al. 2007

What are sources of new wetland habitat in the Chesapeake Bay? Human-derived disturbances

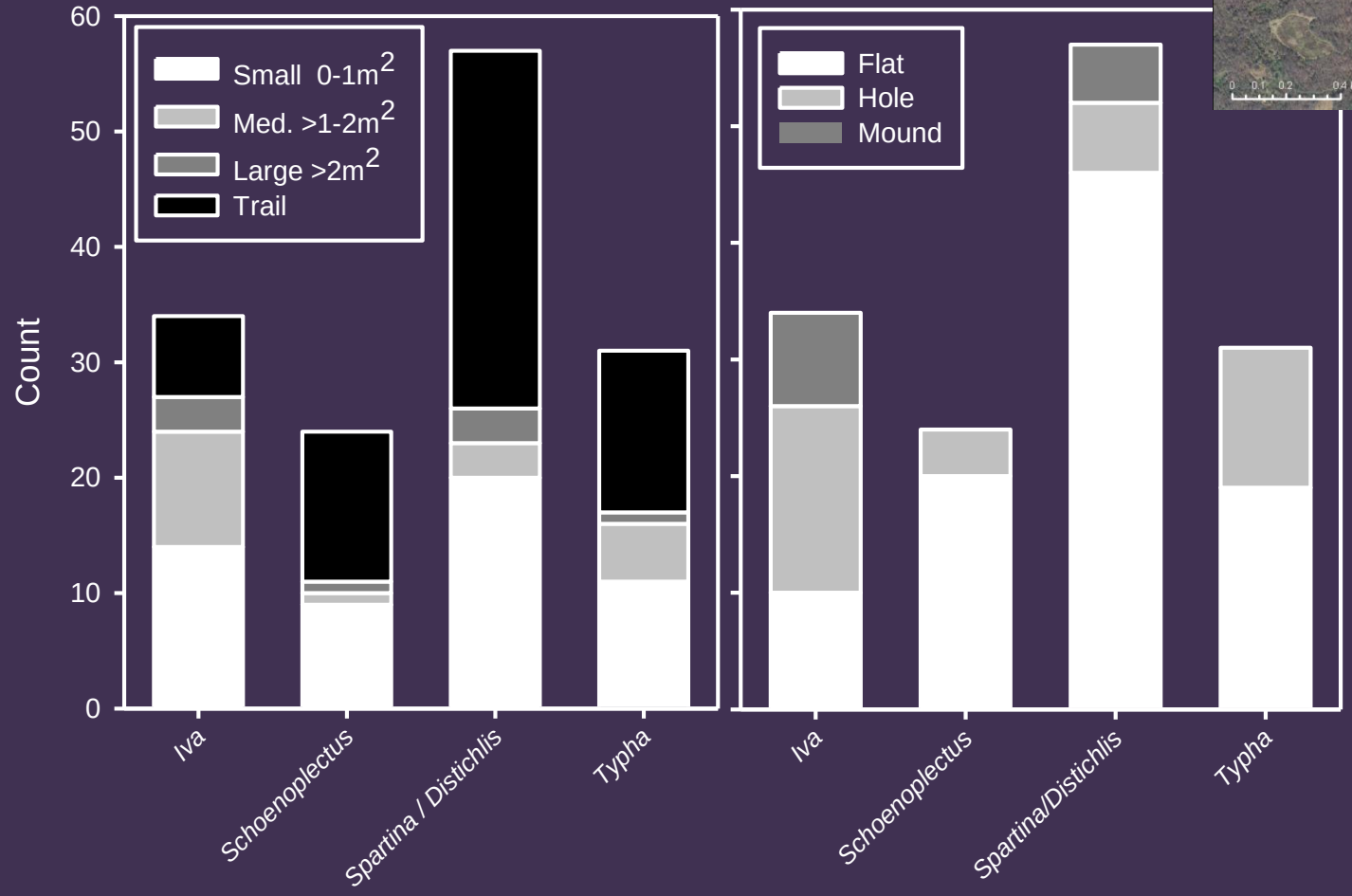
Shoreline structures = physical disturbances (vegetation removal and sedimentation)

Photo: Brandon White

What are sources of new wetland habitat in the Chesapeake Bay? Natural disturbances

What are sources of new wetland habitat in the Chesapeake Bay?

Natural disturbances



- 5 transects / vegetation type / marsh
- 4 m * 75 m transects

Number, type, and size of disturbances varies by plant community.

Summer intern:
Sally Gallagher

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How does *Phragmites* get to these disturbances?

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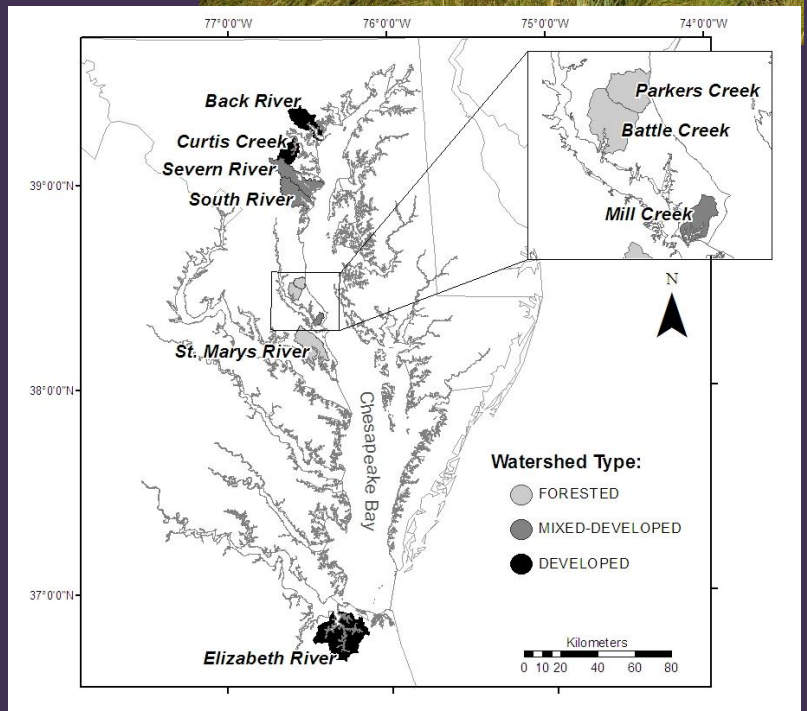
Sexual reproduction and spread

4 leaves collected



Evidence for sexual reproduction:

Substantial genetic variation within and among patches

91% of patches had >1 genotype

55% of patches had 4 genotypes

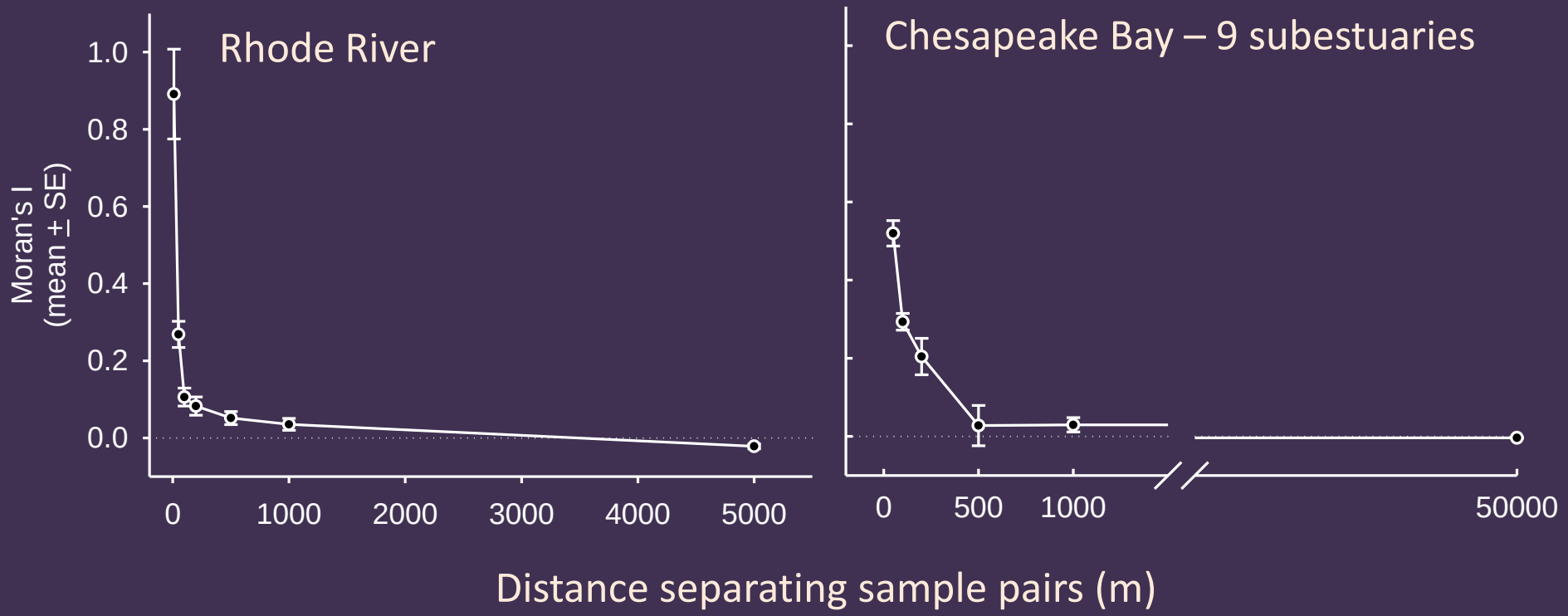
No pair of patches shared a genotype

Some clonal expansion within patches

McCormick, Kettenring, Baron, and Whigham *J. Ecology* 2011

How does *Phragmites* get to these disturbances?

Seed dispersal



The majority of dispersal is local and within subestuaries.

McCormick, Kettenring, Baron, and Whigham *Wetlands* 2010, *J. Ecology* 2011

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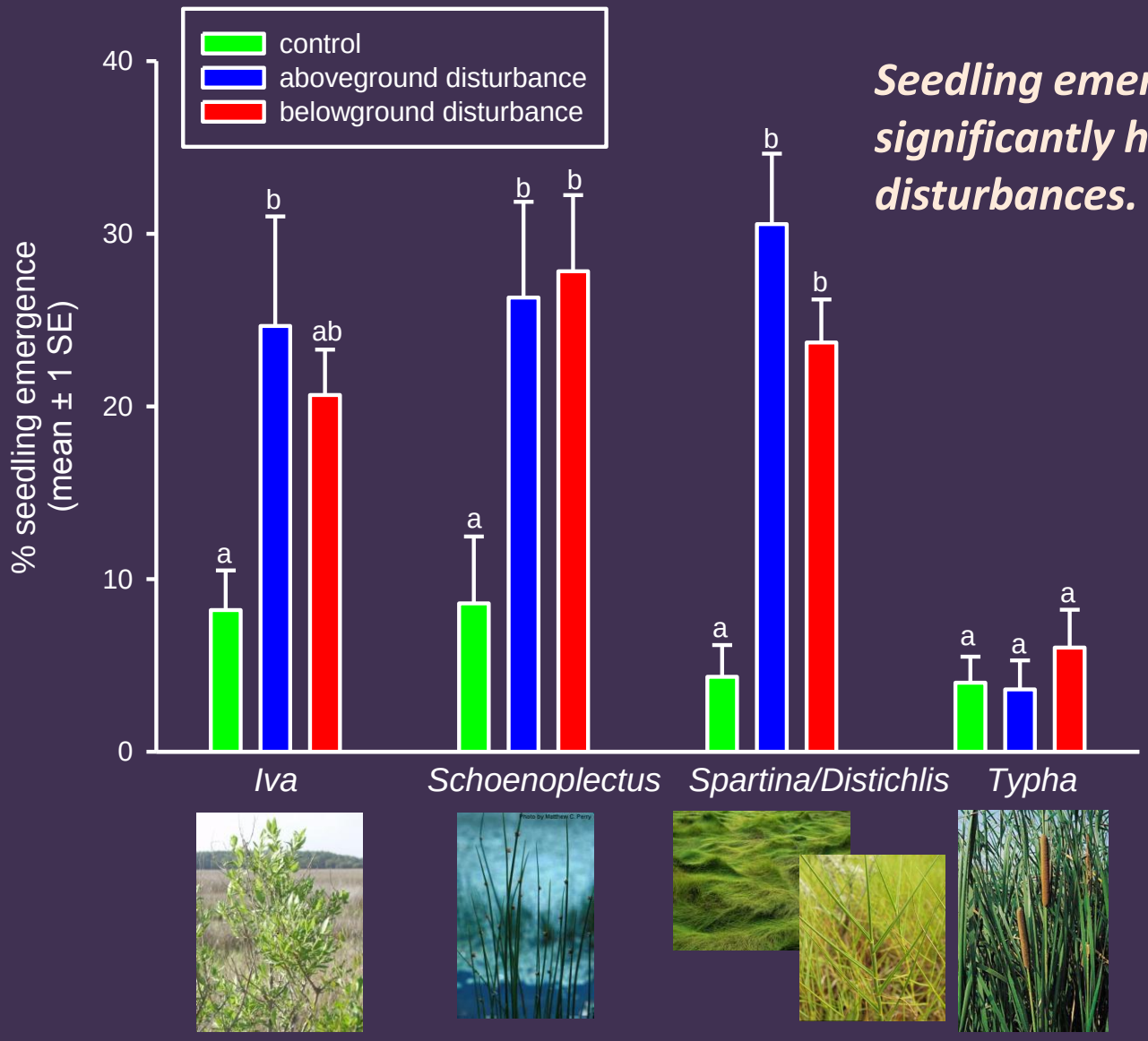
How does *Phragmites* emerge and establish in these wetlands?

How does *Phragmites* emerge and establish in these wetlands? Disturbance: seedlings, not rhizomes



Seedling emergence significantly higher in disturbances.

Summer intern: Sally Gallagher

How does *Phragmites* emerge and establish in these wetlands? Disturbance size and frequency

Undisturbed control
Small, single clip
Small, frequent clip
Large, single clip
Large, frequent clip

Transplant survivorship 64%.
No treatment effect.

Ph.D. student: Eric Hazelton

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How does *Phragmites* reproduce once established?

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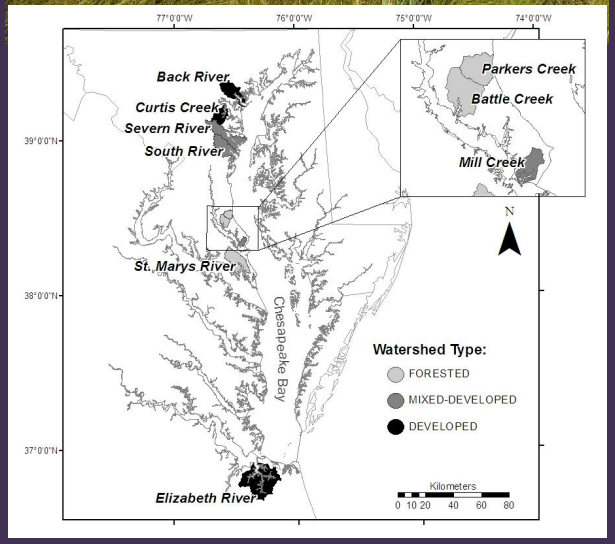
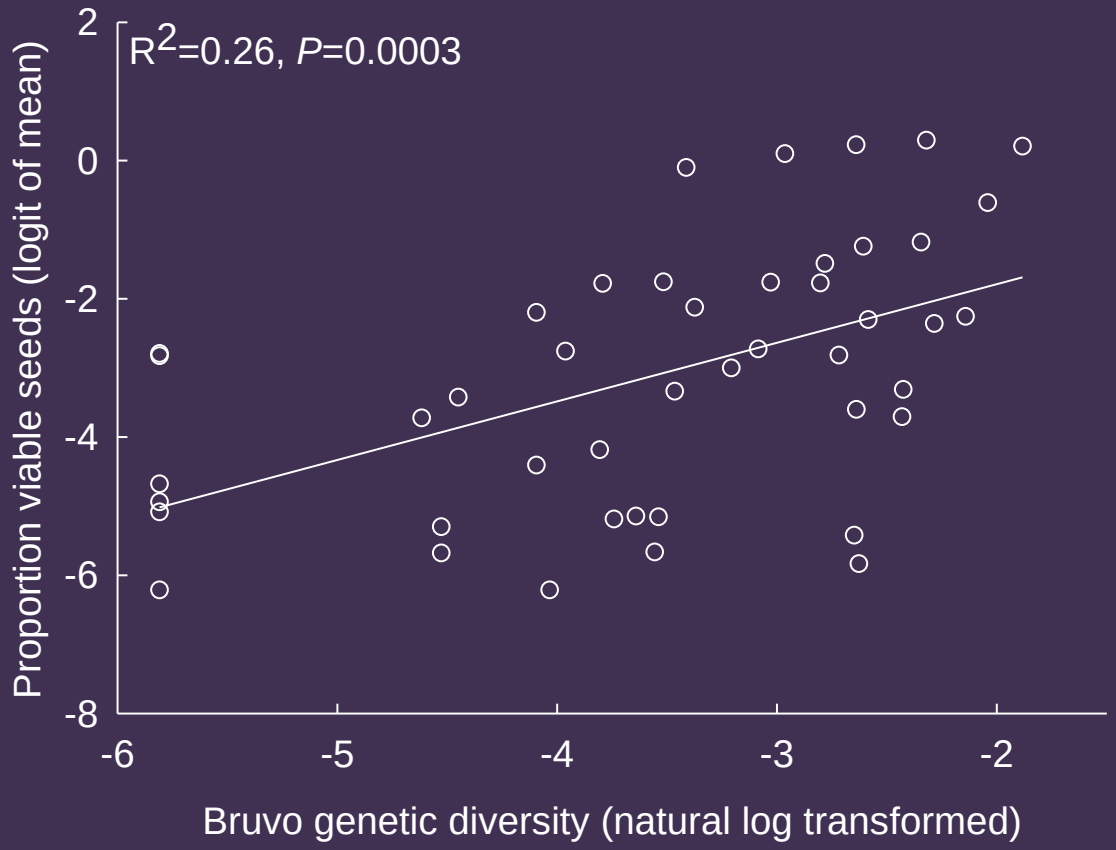
Cross pollination

Seeds and leaves collected





Viable seed production positively related to patch-level genetic diversity.

Kettenring, McCormick, Baron, and Whigham *J. Applied Ecology* 2011

How does *Phragmites* reproduce once established?

Cross pollination

Nutrients

Ambient

4g N m^{-2} $year^{-1}$

0.4g P m^{-2} $year^{-1}$

Elevated

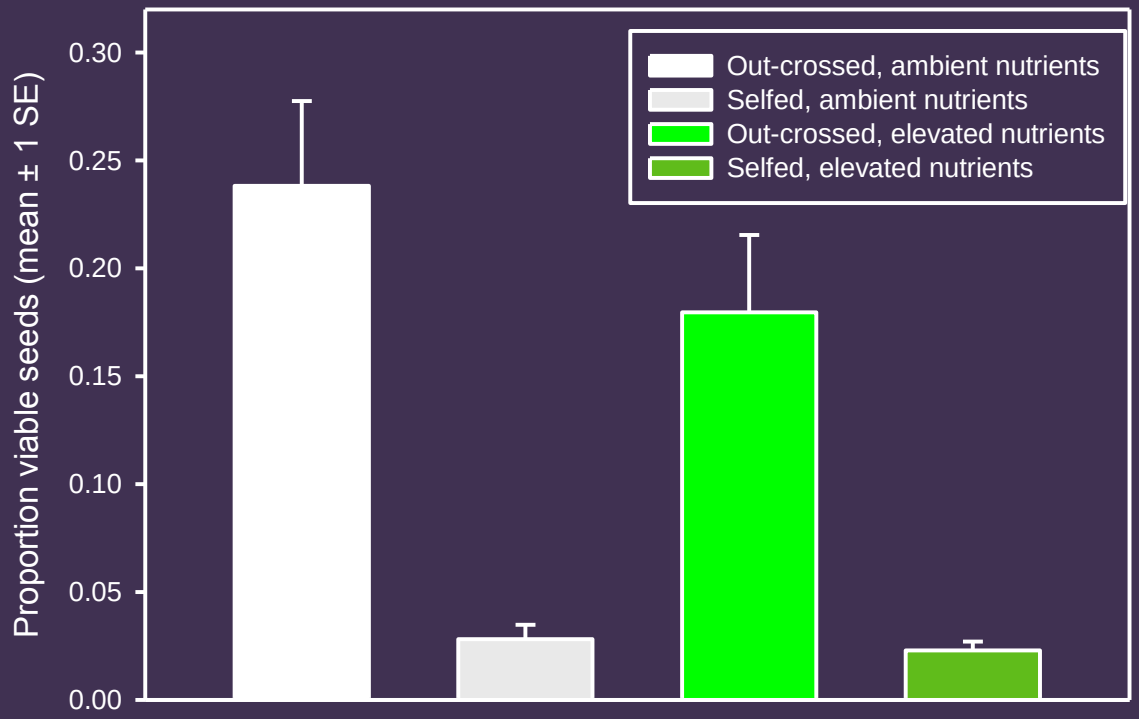
8g N m^{-2} $year^{-1}$

0.8g P m^{-2} $year^{-1}$

Pollination

Self

Cross



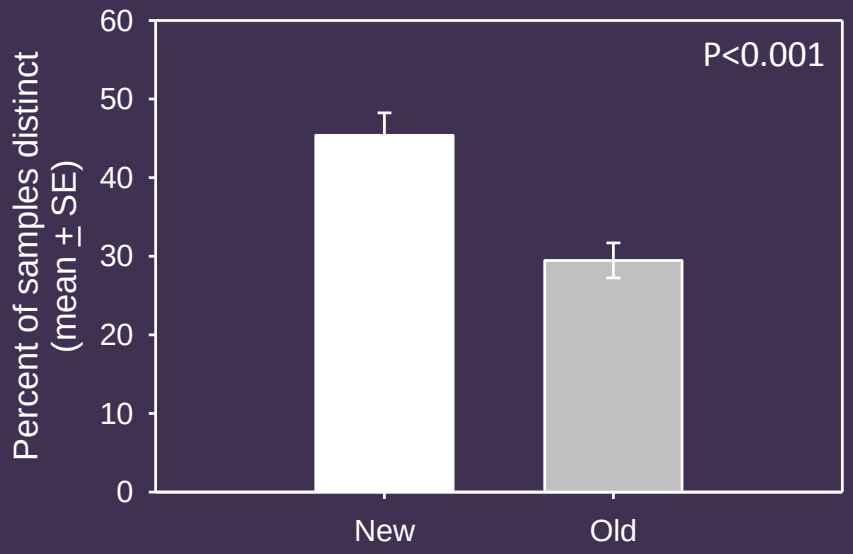
Viable seed production positively related to cross pollination.

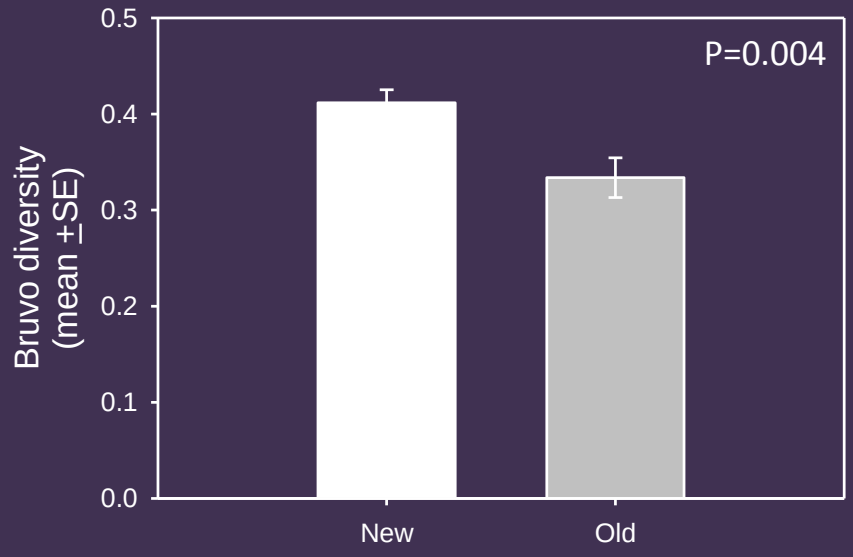
Disturbance / diversity feedback: seed production

Kettenring, McCormick, Baron, and Whigham *J. Applied Ecology* 2011

How does *Phragmites* reproduce once established?

Genet diversity and stand age





Patch age

Diversity within patches declines with age (1970 vs. 2011). Leads to decline in seed production?

Summer intern: Matt Sievers

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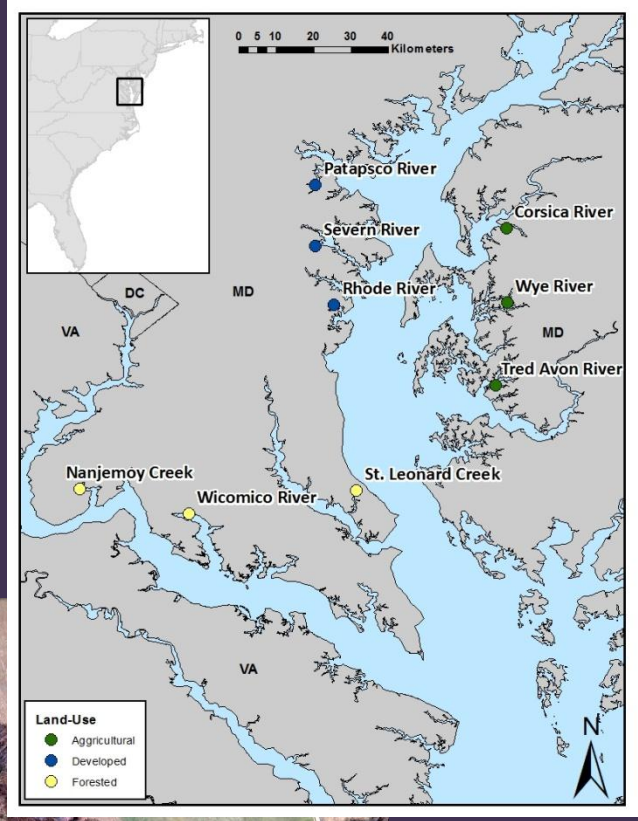
Does restoration create a disturbance that favors *Phragmites* invasion?

Does restoration create a disturbance that favors *Phragmites* invasion? Disturbance / diversity feedback



- 9 marshes, 3 treatments per marsh
  - *Phragmites* removed; *Phragmites* intact (control); Native vegetation (reference)
- Fall 2011: Herbicide *Phragmites*
- Monitoring: genet diversity, reproduction for 4 years

Ph.D. student: Eric Hazelton

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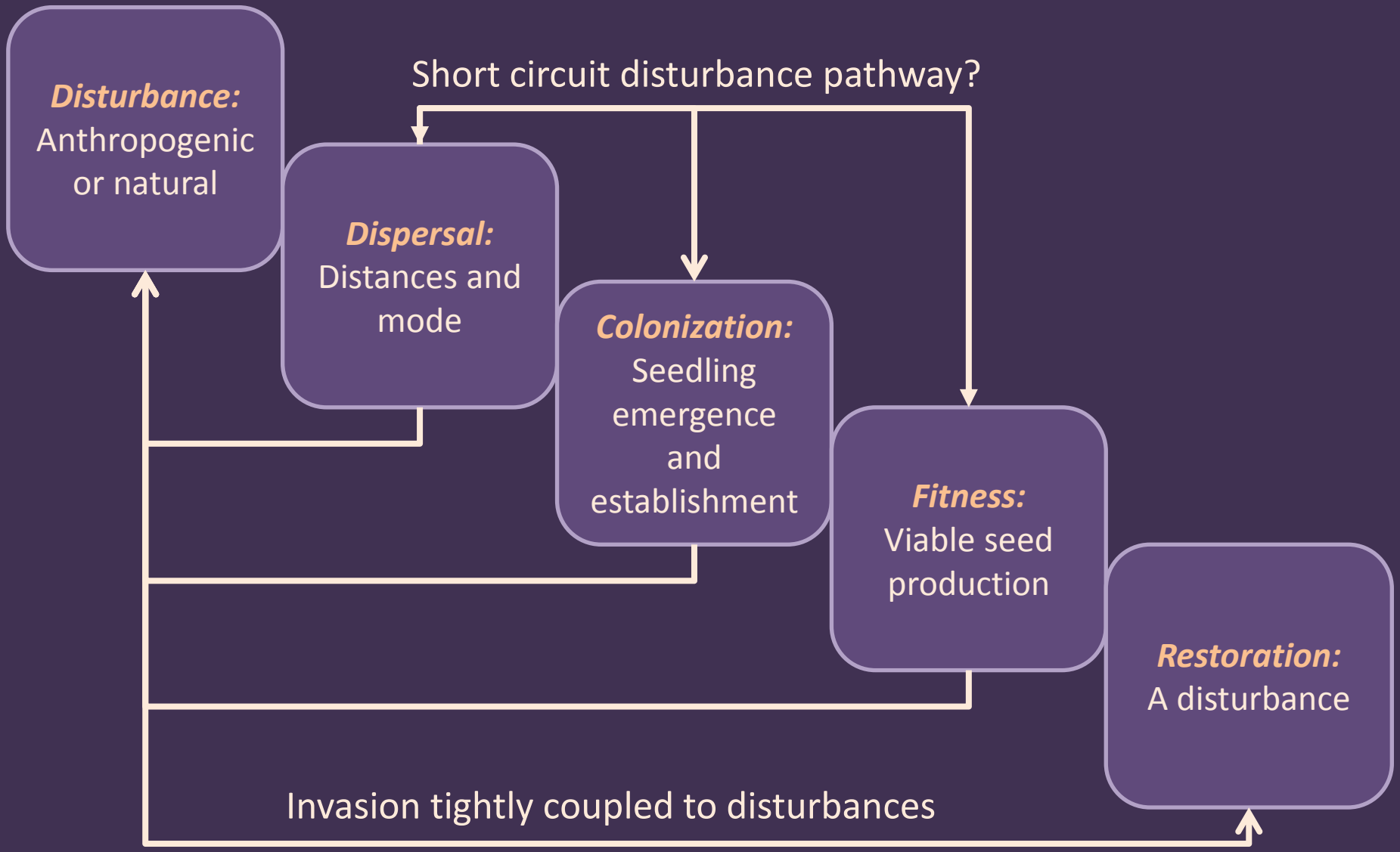


Questions?
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