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Understanding and Managing Local-to-Landscape Resilience for Everglades Periphyton

Thank You

Committee

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Organizations

- Everyone in the Gaiser Lab
- CREST CaCHE
- The Everglades Foundation
- FCE-LTER
- CERP

Funding

Stipend and tuition

- NSF Graduate Research Fellowship Program
- FIU Barley Chair
- SFWMD
- US Army Corps of Engineers

Research

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- ForEverglades Fellowship
- CREST Fellowship

CERP-MAP data

- SFWMD
- US Army Corps of Engineers

FIU Center for Aquatic Chemistry and Environment
NSF Center of Research Excellence in Science and Technology

What is Resilience?

The maintenance of a regime.

The ability of a system to maintain itself despite disturbances.

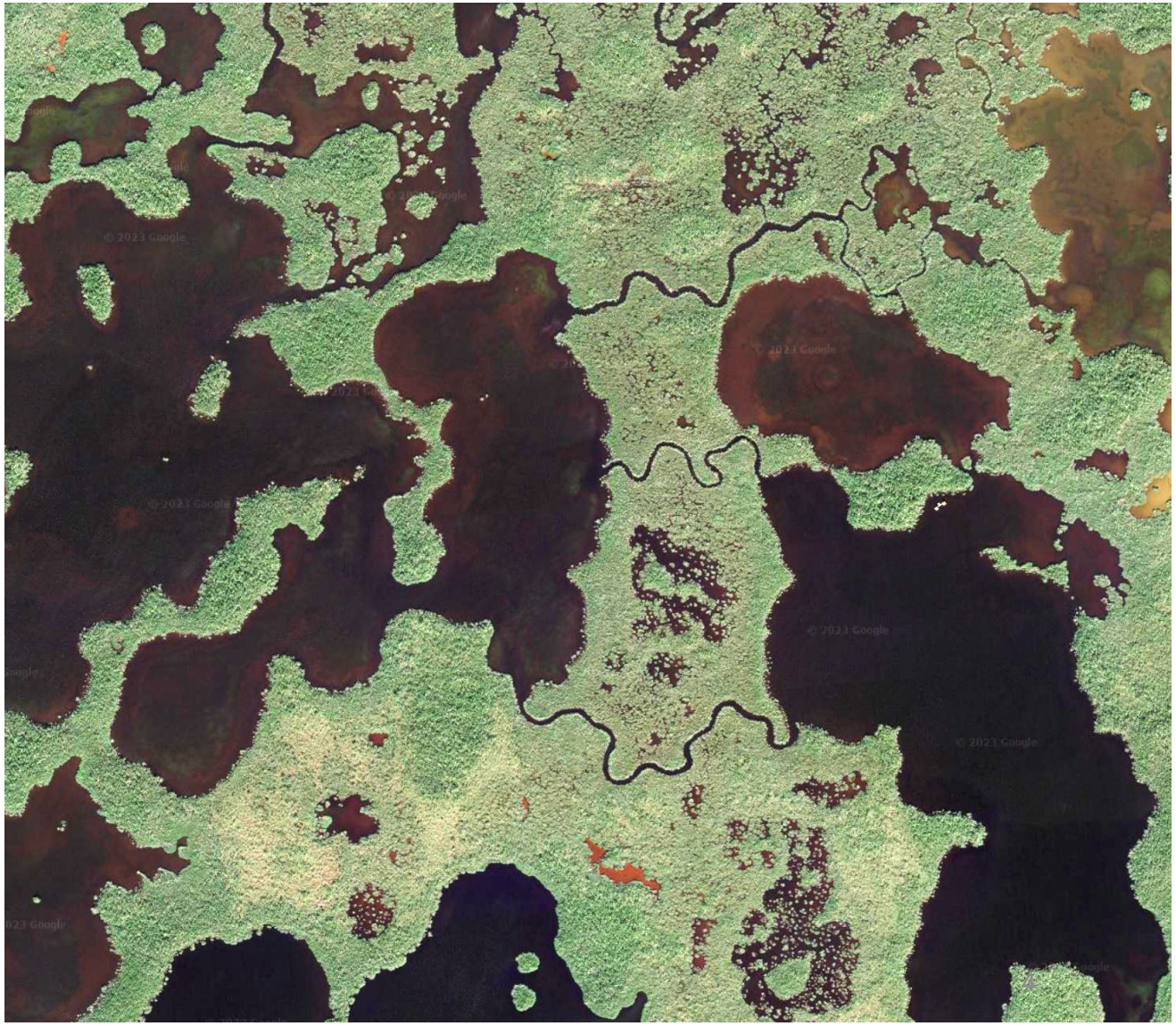
The capacity and processes an ecosystem has to maintain or restore its nominal state, stability, and trajectory in response to disturbance.

- Resistance
- Recovery
- Adaptability
- Redundancy

} Resilience

The Metacommunity

A dispersal-connected network of communities across a landscape



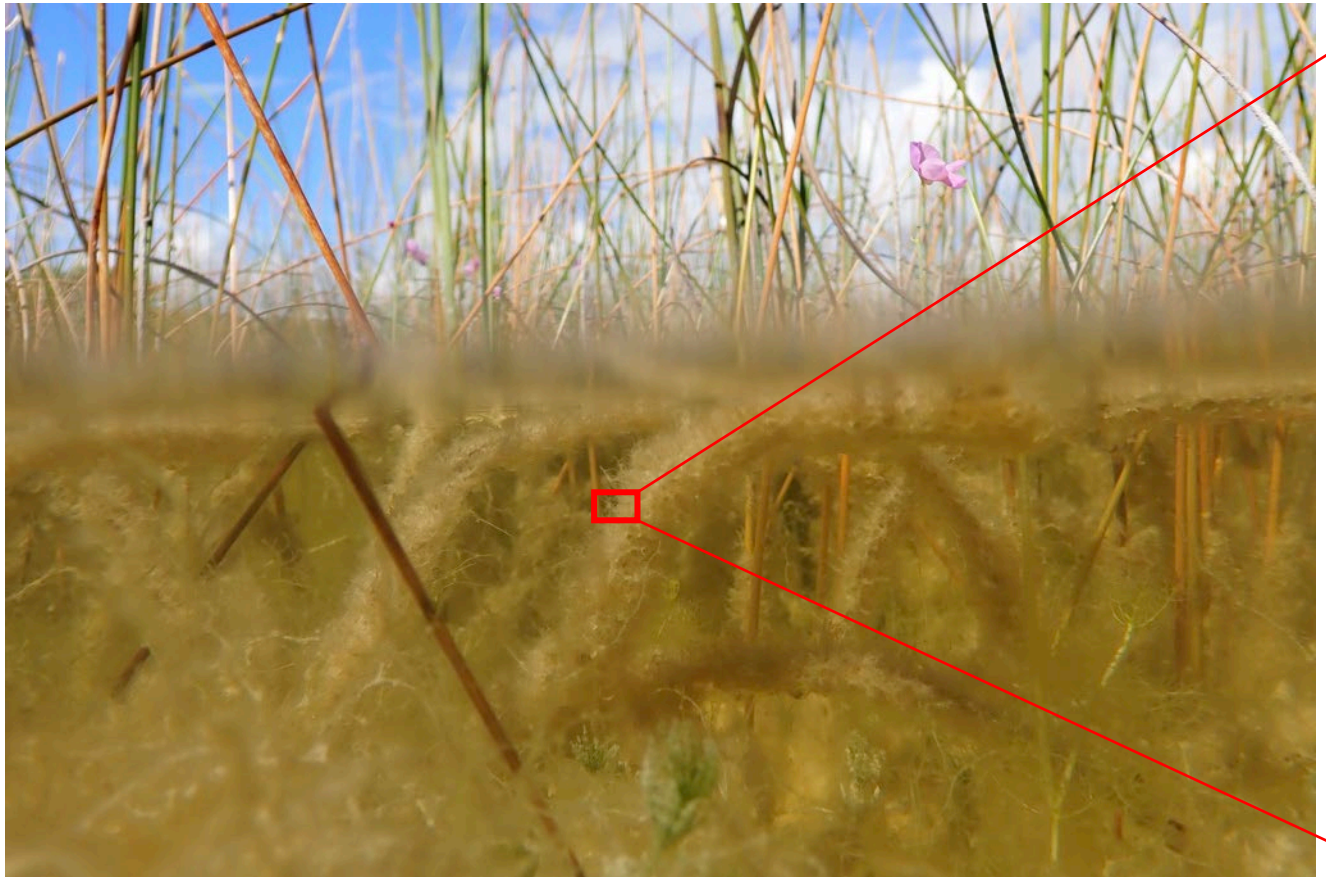
Everglades Periphyton

Calcareous

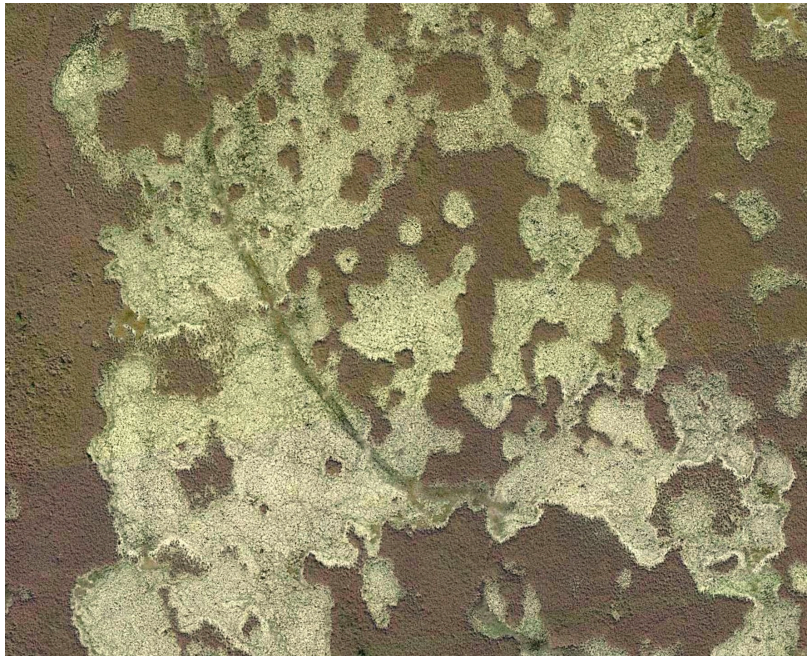
Mixed

Organic

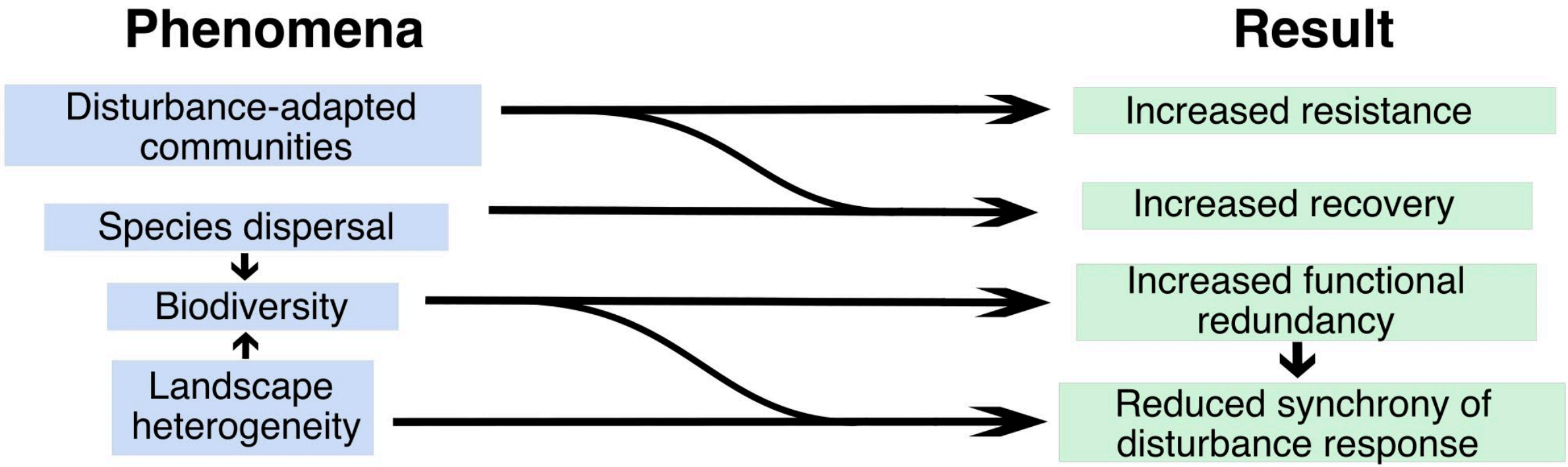
Composition & Function of the Everglades Periphyton



Relating periphyton metacommunity composition and function



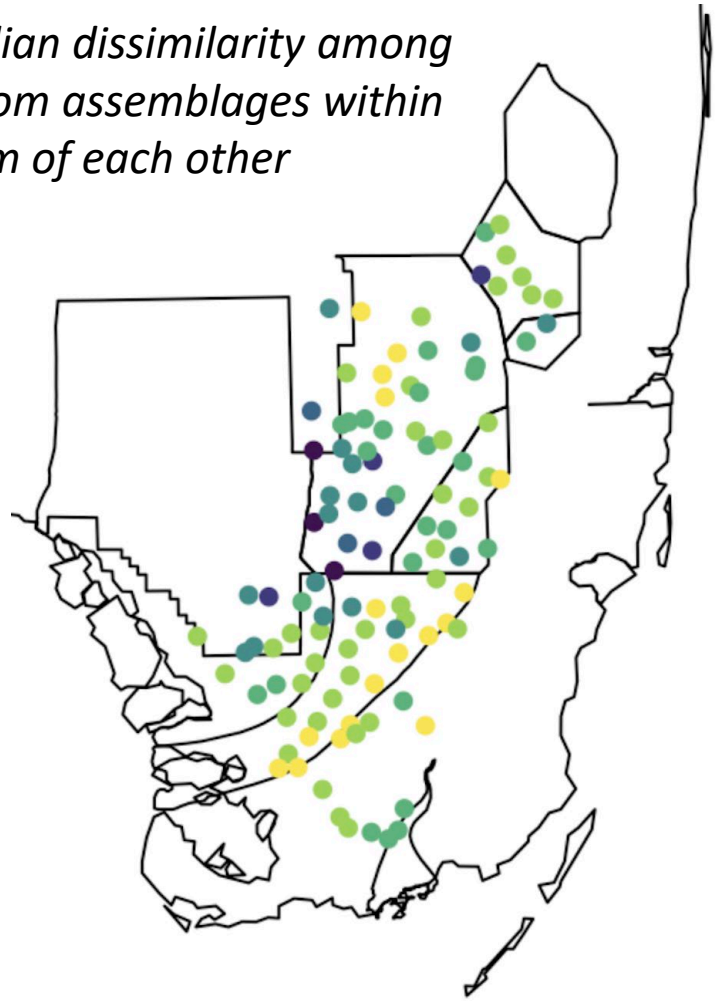
Mechanisms supporting periphyton metacommunity resilience



What regulates the Everglades diatom metacommunity?

- Abiotic conditions
- Biotic interactions
- Spatial boundaries
- Spatial scales
- Historic species conditions
- Interactions among these ecosystem realms

Median dissimilarity among diatom assemblages within 15km of each other



Median Bray-Curtis Dissimilarity

- 0.31
- 0.34
- 0.37
- 0.4
- 0.42
- 0.45
- 0.49

What regulates the Everglades diatom metacommunity?

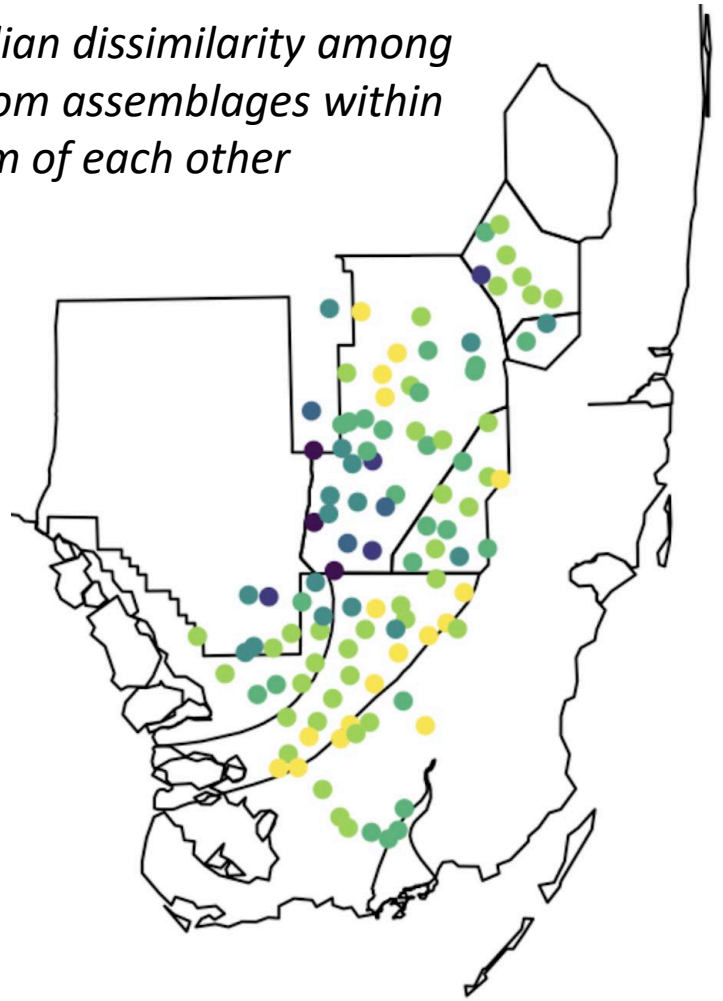
General methods:

- CERP-MAP dataset

(110 locations, 2005-2020)

- Make groups of similar observations per ecosystem realm.
- Compare similarity of diatom assemblages within vs among groups, per realm.
- Assess which realm(s) were most influential in driving assemblage similarity.

Median dissimilarity among diatom assemblages within 15km of each other



Median Bray-Curtis Dissimilarity

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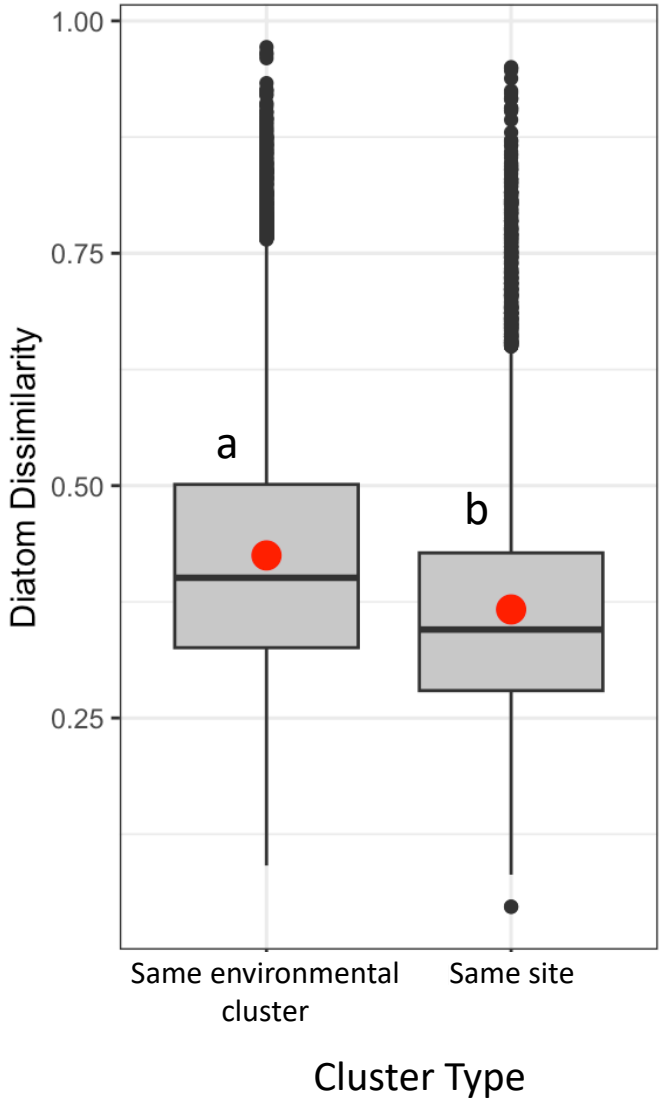
1) *Are **historical species conditions** or **dispersal and environmental conditions** greater regulators of diatom metacommunity composition?*

<u>Results</u>:

Diatom assemblages were **more similar within a single site** over many years than within environmentally similar sites in a given year.

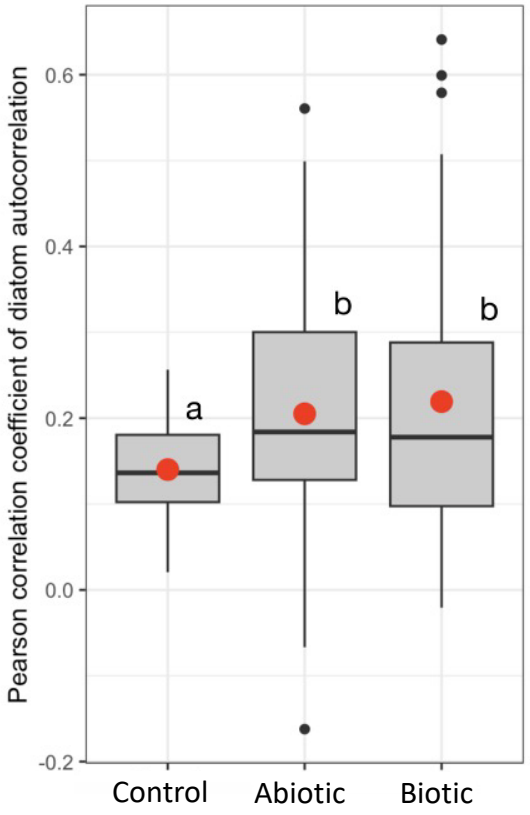


2) *Is diatom assembly and regional spatial structure more driven by **abiotic conditions,** or by **biotic interactions** with other components of the periphyton?*

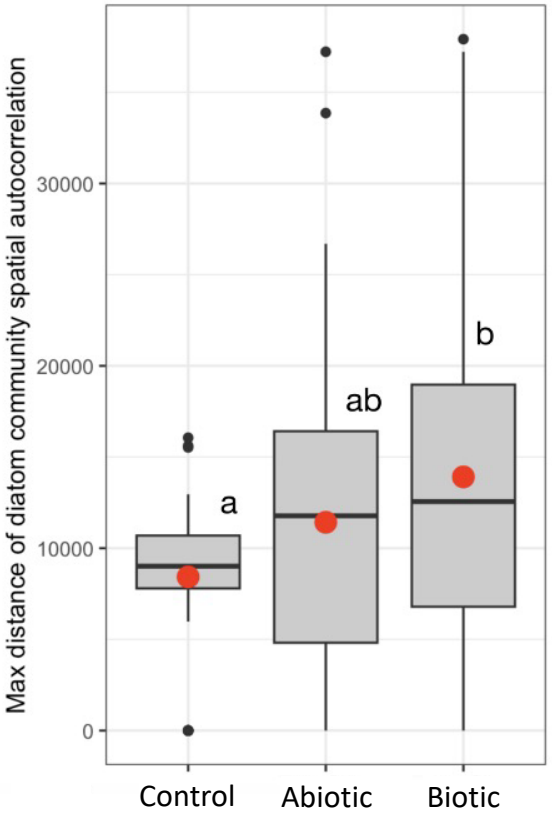
Results:

- Similar **Abiotic** and **biotic** conditions **equally increased the similarity** of diatom communities.
- **Biotically** similar periphyton mats had a **greater spatial range** at which diatom communities maintained similarity.

Strength of similarity



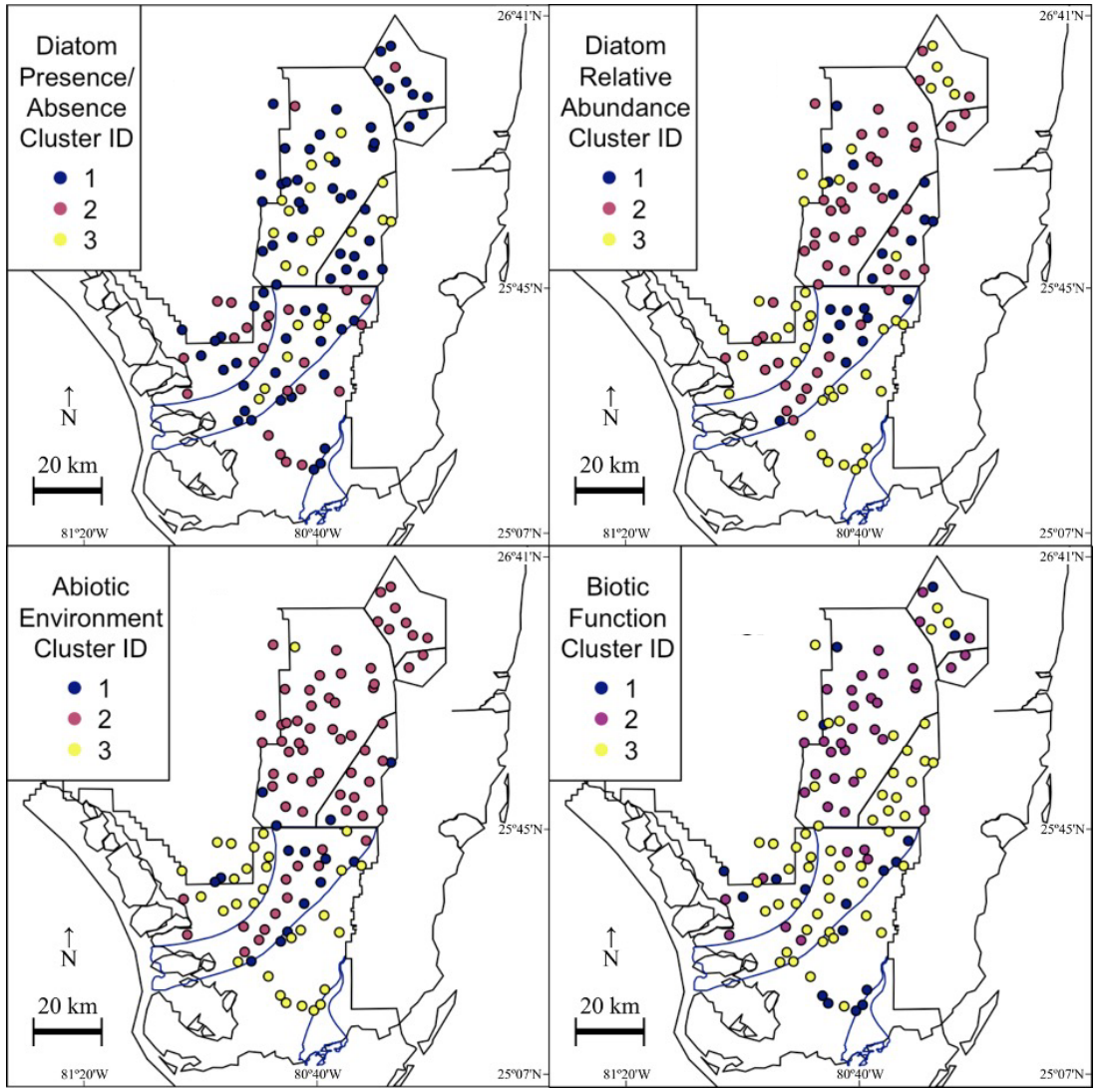
Max distance of similarity



3) *Do **landscape barriers** influence the composition of diatom assemblages within vs among dispersal-limited regions?*

<u>Results</u>

- **Yes**, assemblages are **more similar within regions** than among them.
- However, these boundaries also correlate with altered composition of abiotic conditions and biotic periphyton functions.

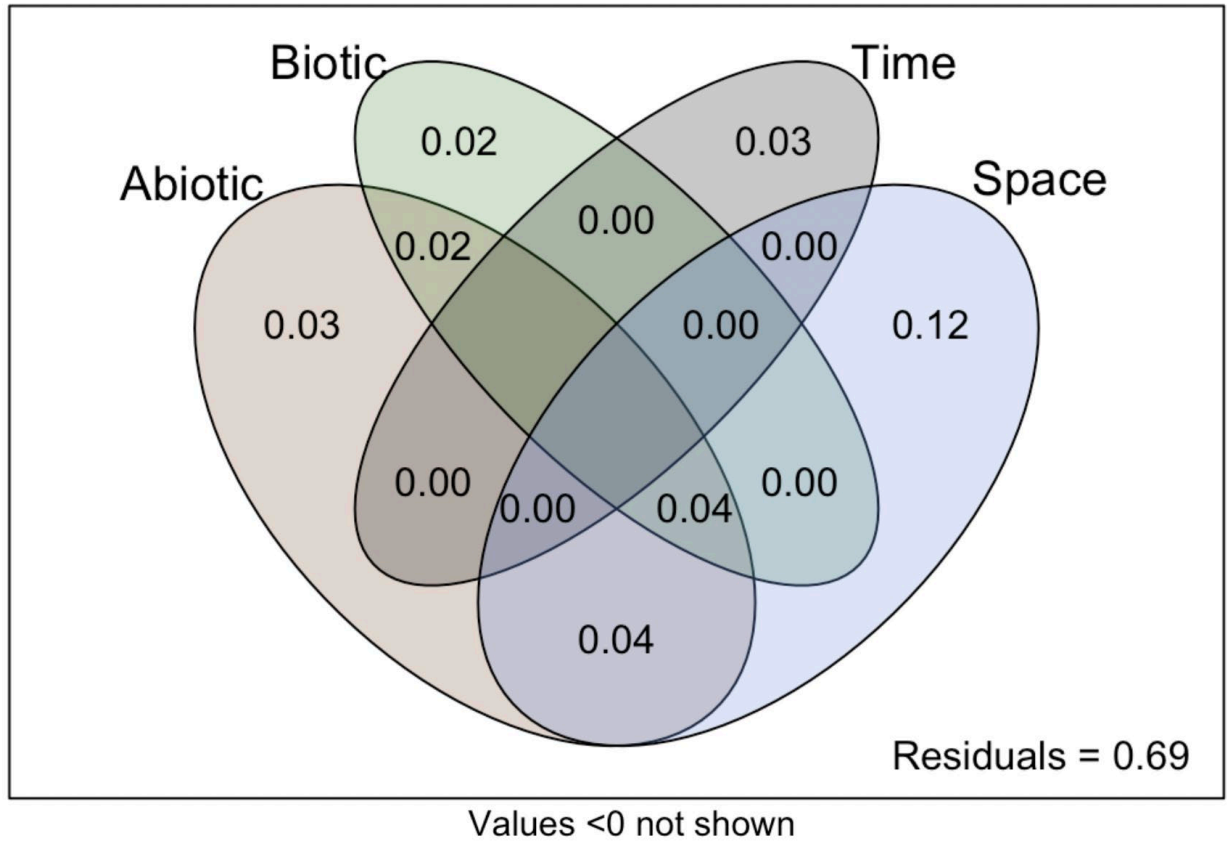


4) *What are the **relative influences** of multiple ecological realms (**space, time, abiotic conditions, and biotic interactions**) on species assembly, both independently and interactively?*

Results:

- **Space** is the **dominant driver** of diatom assembly, both independently and interactively with abiotic & biotic correlates.
- In aggregate, **abiotic** conditions and **biotic** interactions regulate the diatom metacommunity to **similar degrees.**
- Long-term directional **temporal shifts** in assembly are, so far, **uncorrelated** with shifts in aggregate abiotic conditions or biotic functions.

Diatom metacommunity db-RDA variance partitioning Venn diagram



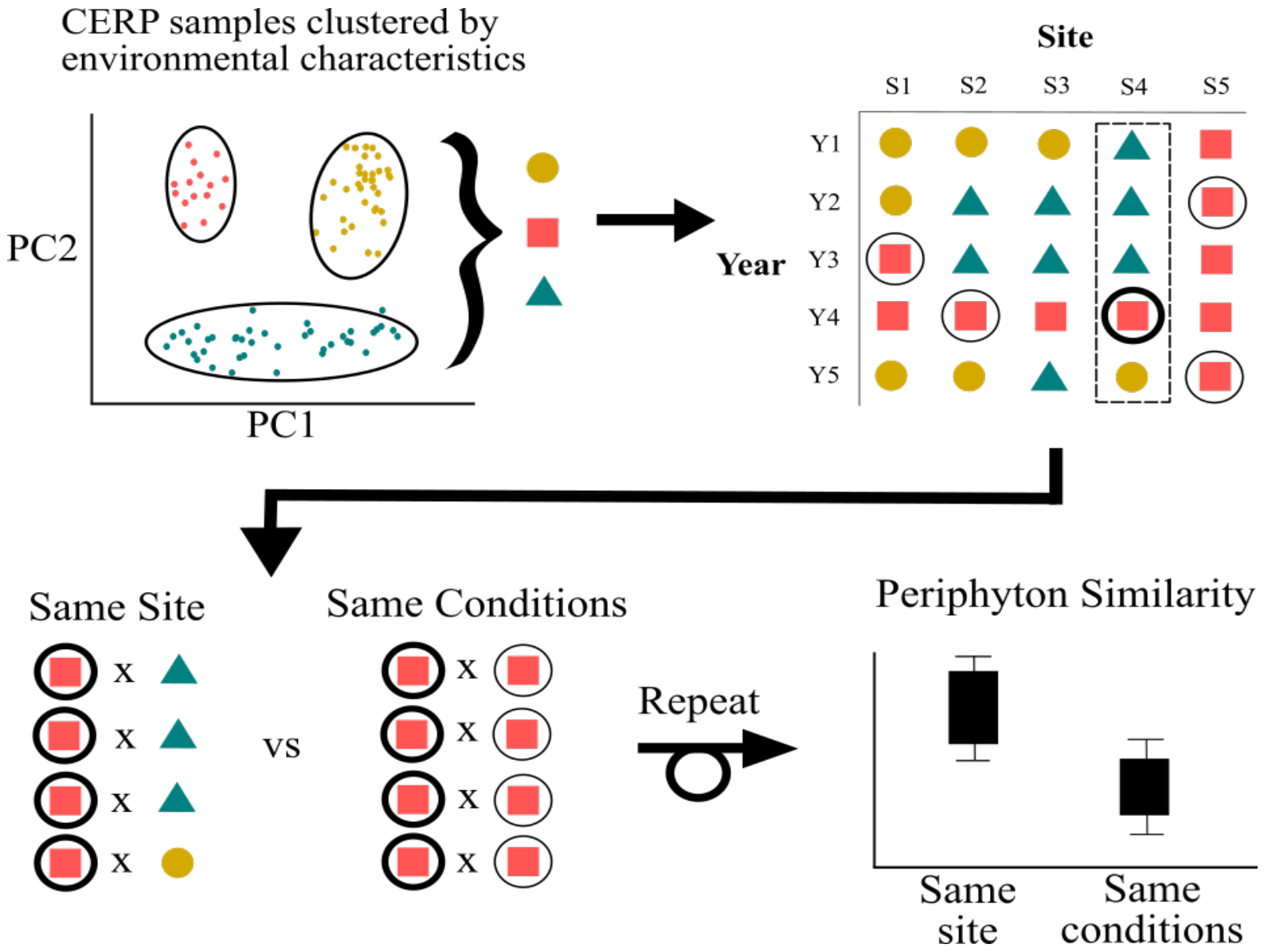
Values <0 not shown

How can management facilitate resilience?

- **Manage holistically**: get more than just the water right.
    - Mange **biotic communities** that interact with the target community
    - Understand the impacts of **landscape barriers** on species distribution.
- **Facilitate flow and connectivity** among hydrologically isolated areas to facilitate dispersal and recovery of taxa and abiotic dynamics.
- **Consider managed dispersal** (i.e., “seeding” or “stocking”) of native communities in disturbed and isolated patches of landscape.
- **Consider managed transition** of functionally redundant species to support ecosystem functional continuity where environmental shifts are unavoidable.
- Create **restoration targets** with **historical legacies** in mind. The past influences future trajectories.

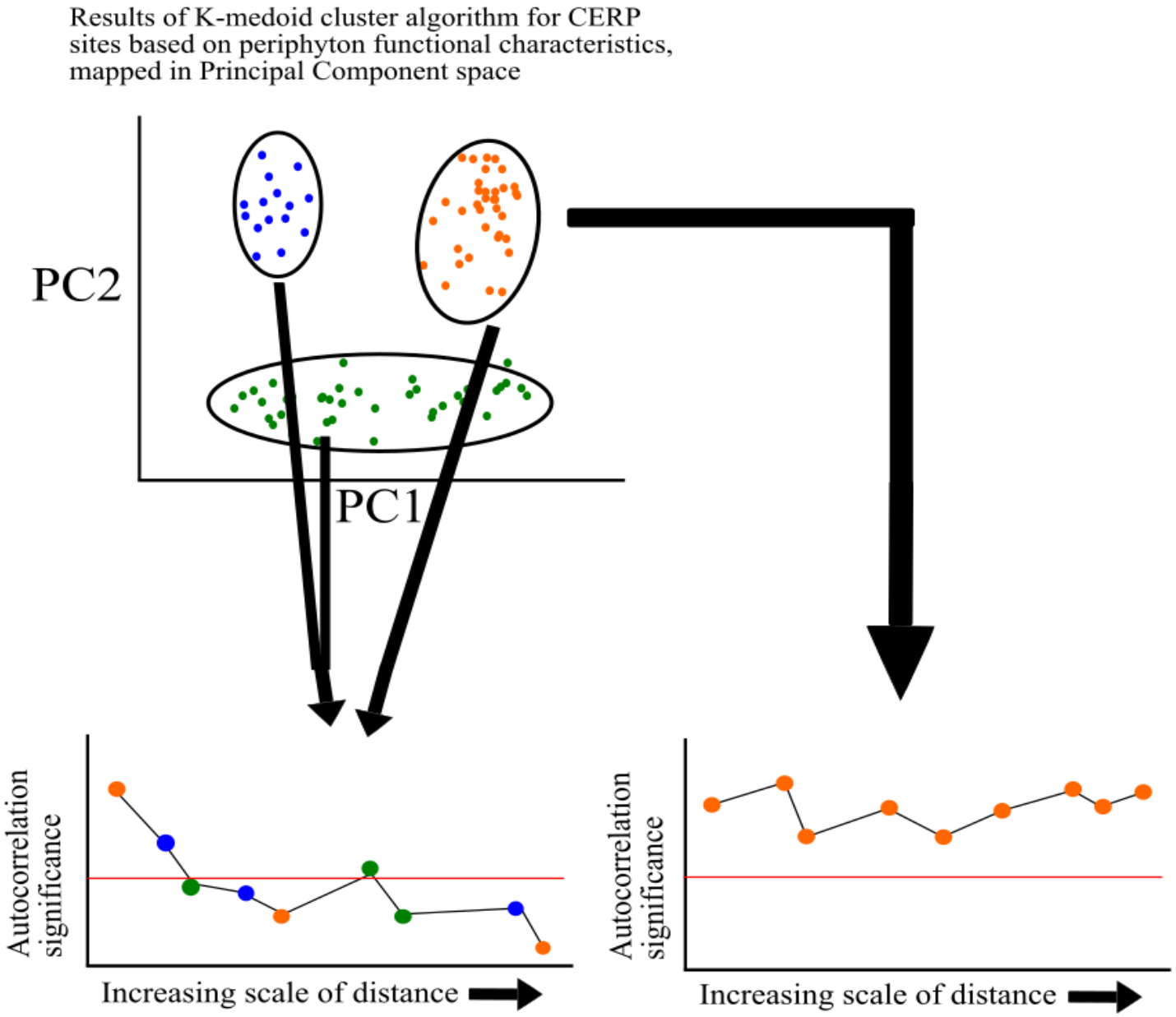
Supplemental Methods, **Q1**

Are historical species conditions or dispersal and environmental conditions greater regulators of diatom metacommunity composition?



Supplemental Methods, **Q2**

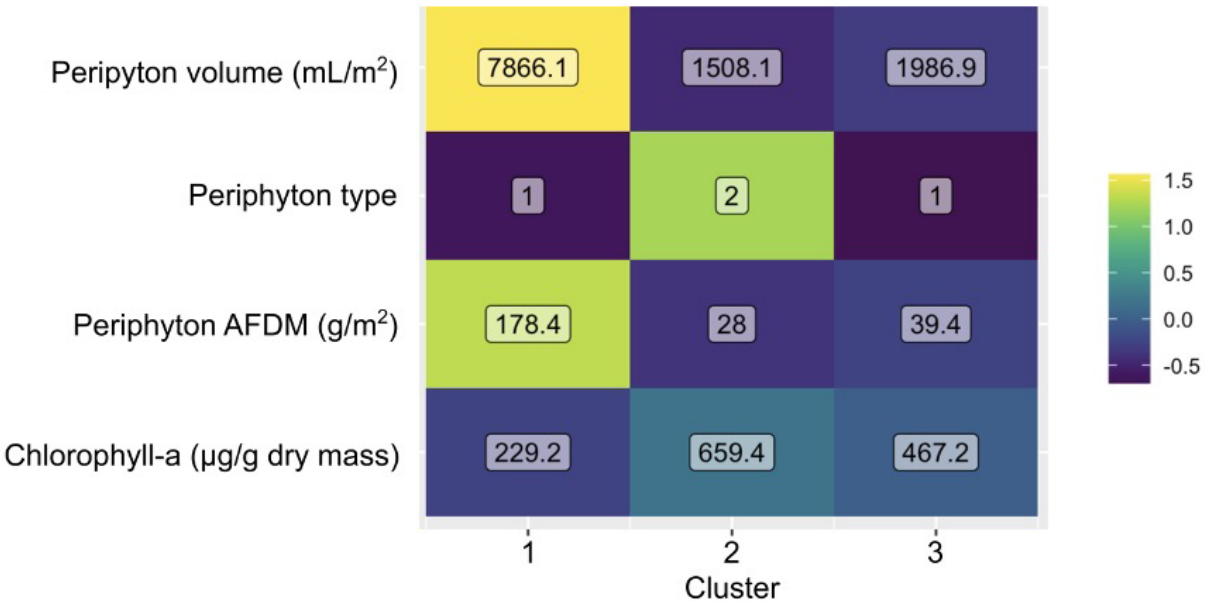
Is diatom assembly and regional spatial structure more driven by abiotic conditions, or by biotic interactions with other components of the periphyton?



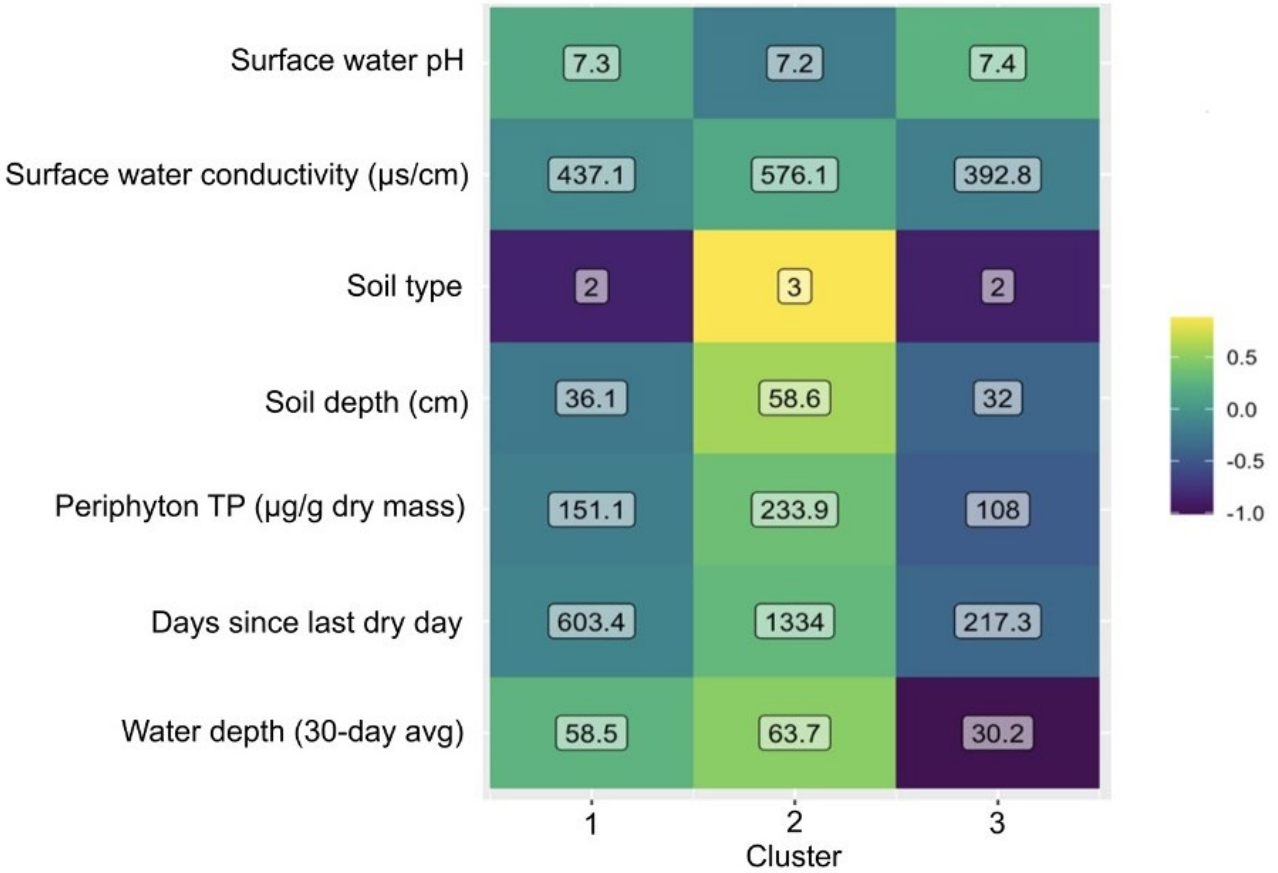
Supplemental Methods / Results:

Cluster ID

Biotic Factors



Abiotic Factors



Supplemental results, **Q4**:

Nonlinear temporal trends show influence of largescale events that alter metacommunity structure.