Introduction to Diatoms as Ecological Indicators in Living Shoreline Applications

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NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

Outline

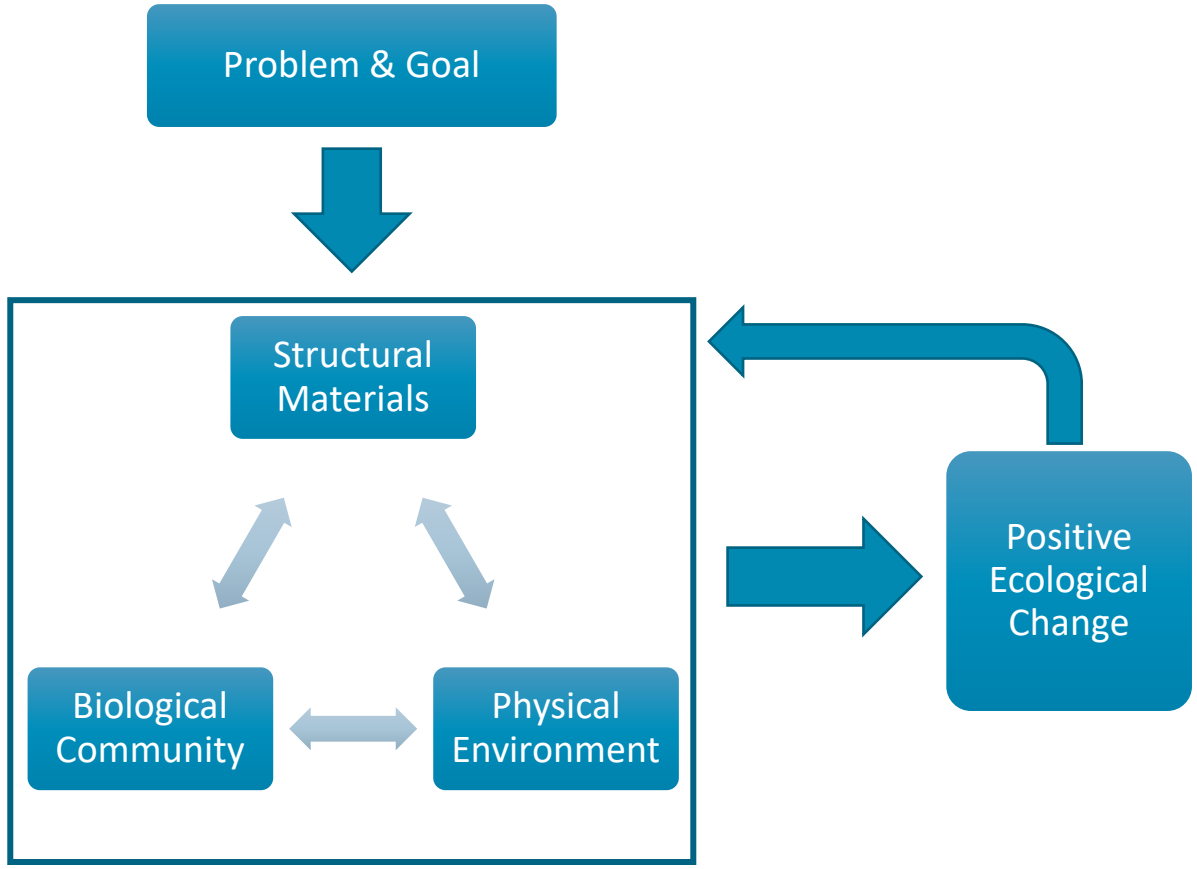
Living Shorelines Support Ecologic Function

Living shorelines should:

- Incorporate the local ecology
- Maintain intertidal connectivity
- Have ecological and erosion control goals

Design Elements may include:

- Biological Elements
  - Shellfish reefs/beds
  - Vegetation
- Structural Elements
  - Sills, toes, breakwaters
  - Shell, Oyster Castles ®, WADS™, Coir Fiber
  - Terraces, drainage channels



Techniques+and+Application+of+Living+Shorelines+in+Delaware.pdf

Living Shorelines don’t fit in a single design box

Photo: Partnership for the Delaware Estuary

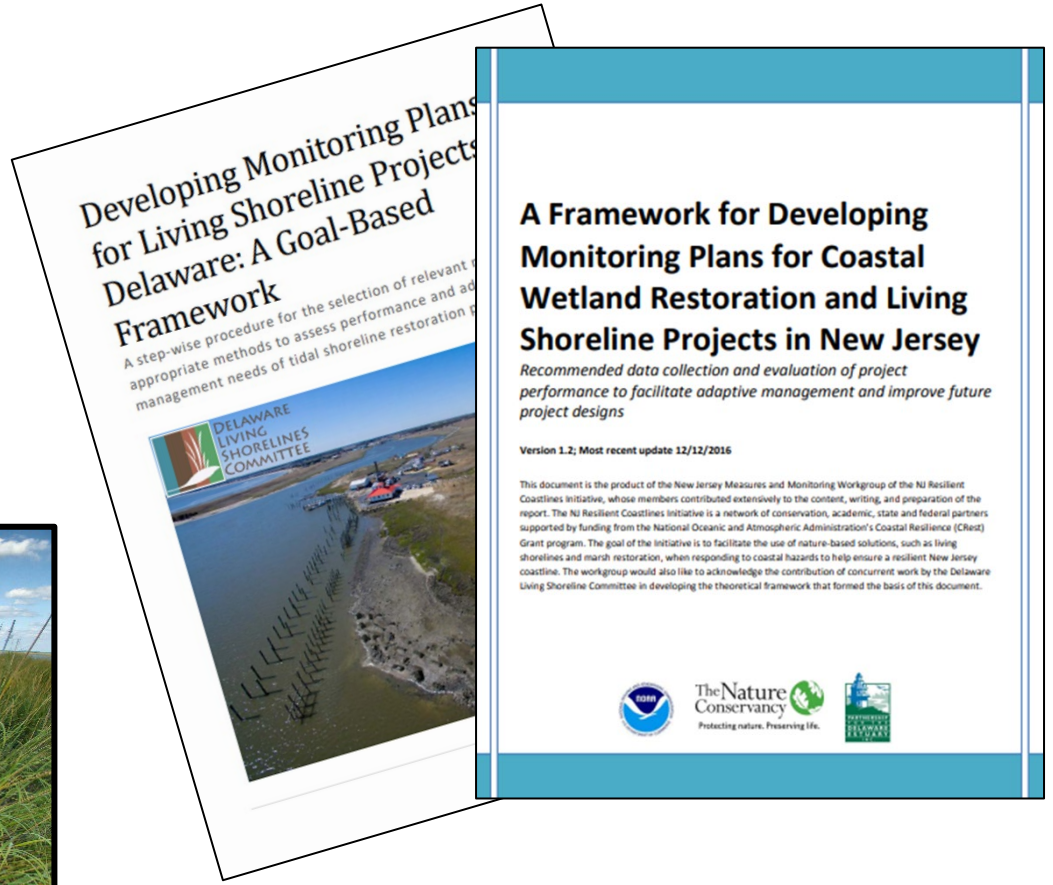
Photo: Chris Pfeifer, Integral Consulting

Photo: The Nature Conservancy

Is My Living Shoreline Working?

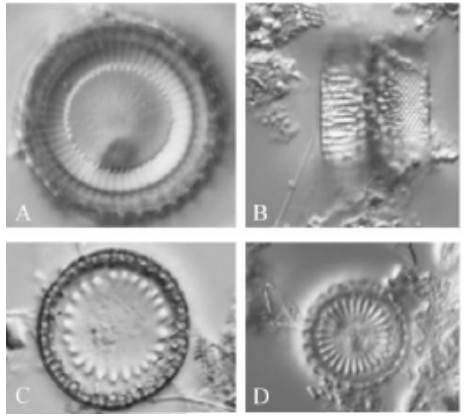
Monitoring Living Shorelines is Essential

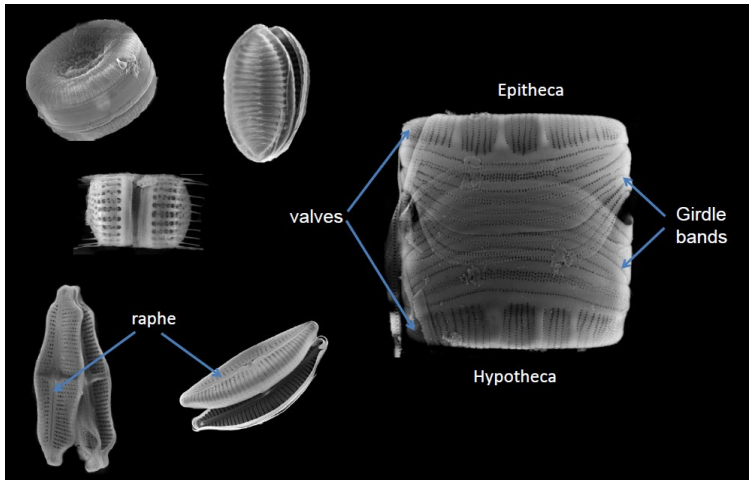
- Vegetation structure is a primary metric
- Impacted by
  - Tidal position
  - Water chemistry
  - Soil saturation
- These can be tough to measure and evaluate

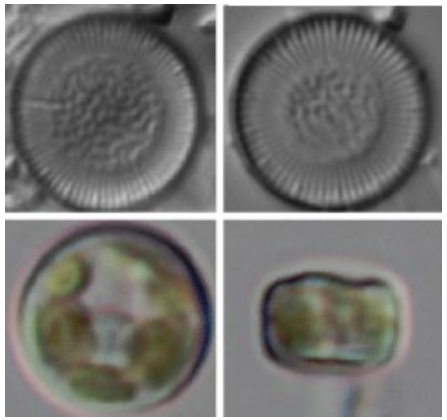


1. NJ Monitoring Framework
2. DE Monitoring Framework

What are Diatoms?







What are Diatoms?

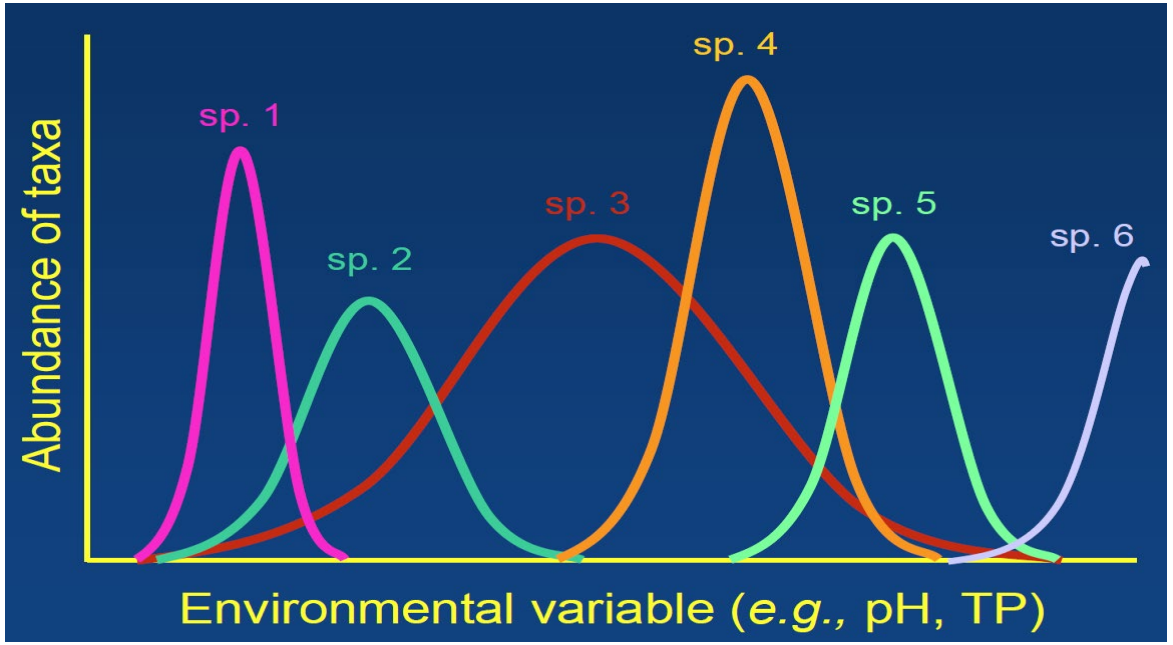
- Unicellular photosynthetic algae
- Cell walls of opaline silica
- 2 μm – 500 μm (0.5mm)

Importance

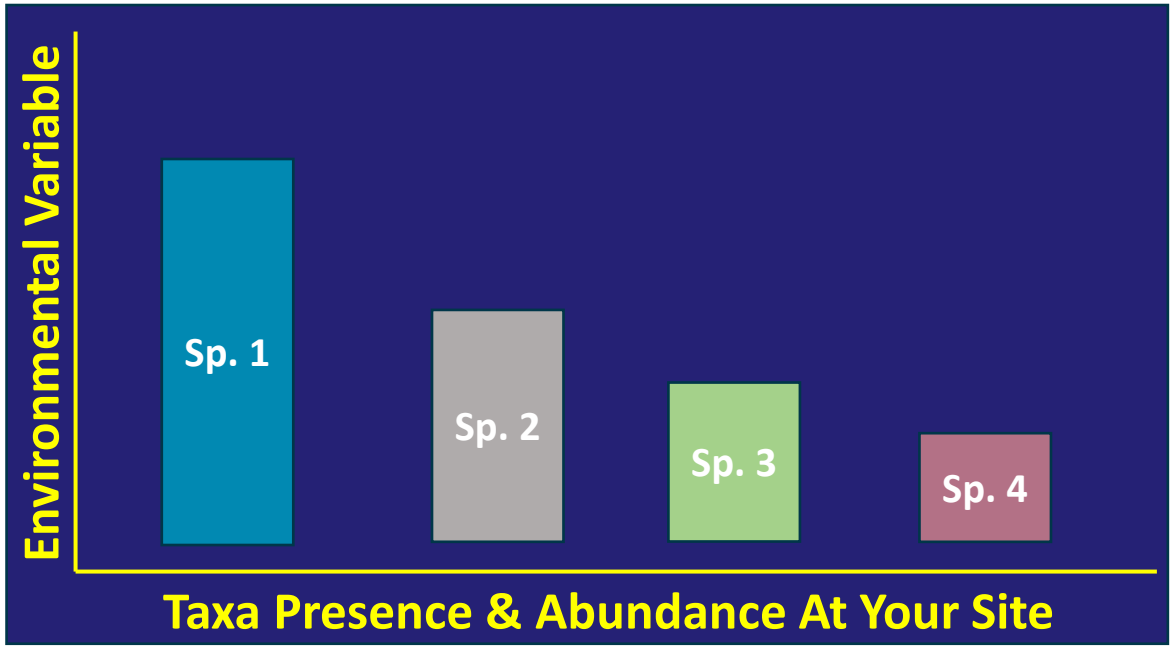
- CO_2-> O_2: 20-30% Earth's O_2
- Valves fossilized in sediments
- Environmental indicators

Diatoms as Ecological Indicators

Calibrate Local Diatom Species Abundance to Various Ecological Parameters



Estimate Your Environmental Parameters Based on Taxa Abundance



Desianti, N., Enache, M.D., Griffiths, M. et al. The Potential and Limitations of Diatoms as Environmental Indicators in Mid-Atlantic Coastal Wetlands. Estuaries and Coasts 42, 1440–1458 (2019). https://doi.org/10.1007/s12237-019-00603-4

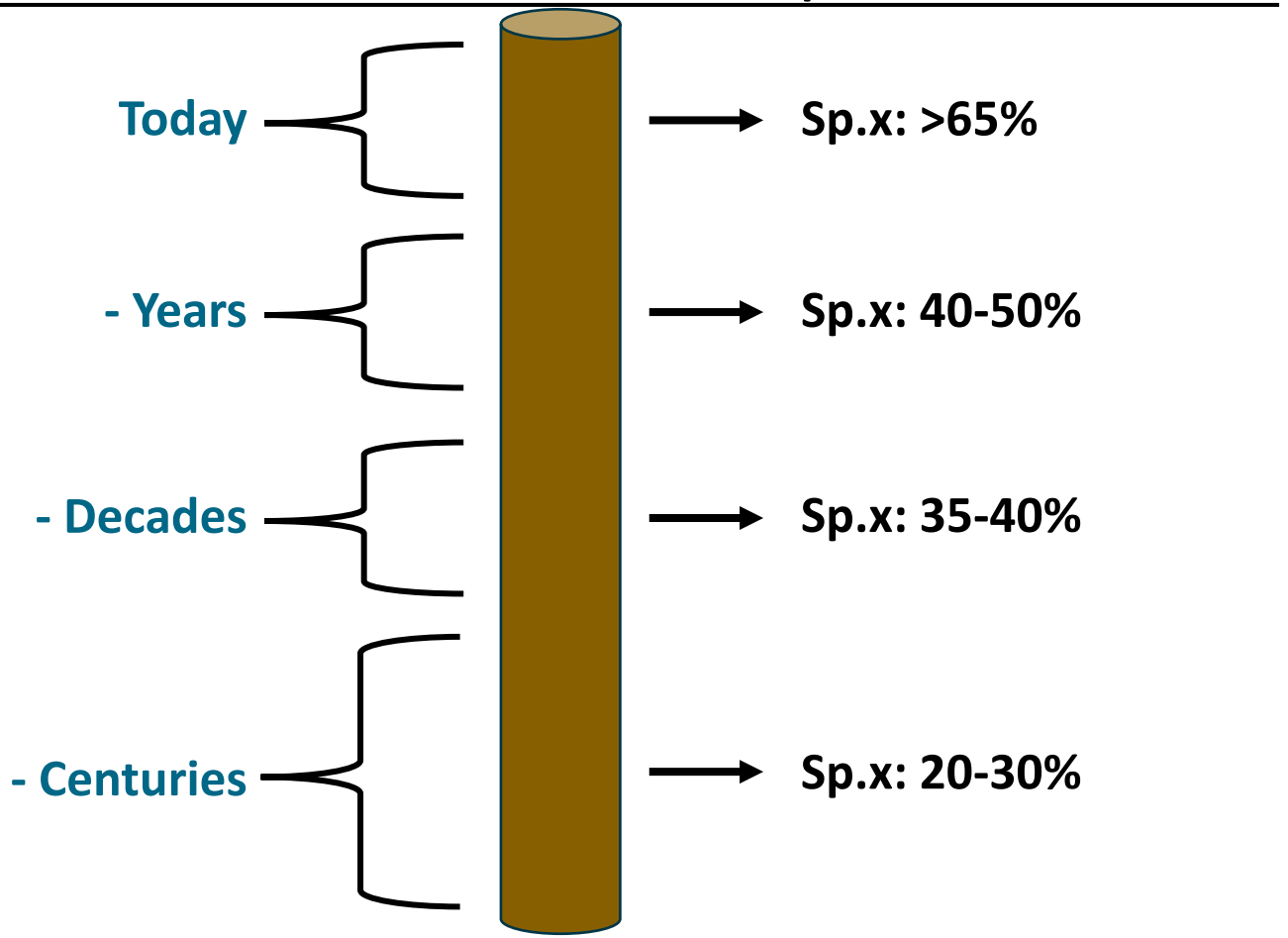
What can Diatoms tell us about living shorelines?

Community compositions can change very rapidly

- Changes in wetland conditions
- Surrogate for some instrumentation
- Historical reconstructions

Sampling diatoms is very simple and easy

1. Sediment core
2. Scraping



Study Site: Nantuxent Creek Living Shoreline

Partners: TNC, USFWS, PDE, Rutgers, SIT

Funding: NFWF, USFWS

Installation: 2016

Materials: shell, coir logs, oyster castles

Configuration: Off-edge breakwaters, along-shore cusps

Monitoring Metrics: elevation (RTK-GPS), vegetation structure, shellfish community

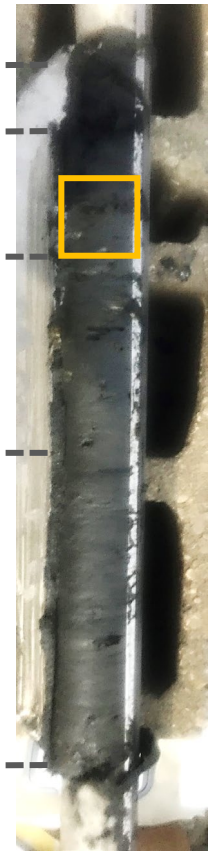
Contact LeeAnn Haaf or Ella Rothermel at Partnership for the Delaware Estuary for more info

Goal: Evaluate core at single location in a living shoreline to assess elevation and inundation changes.

Methods: Coring & Sectioning

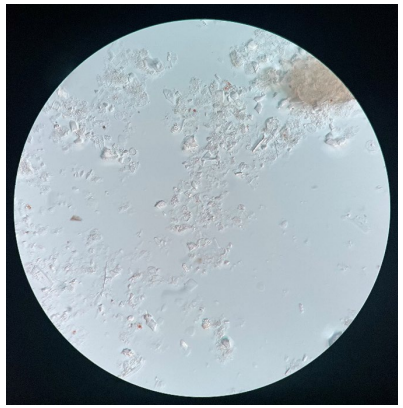
Steps

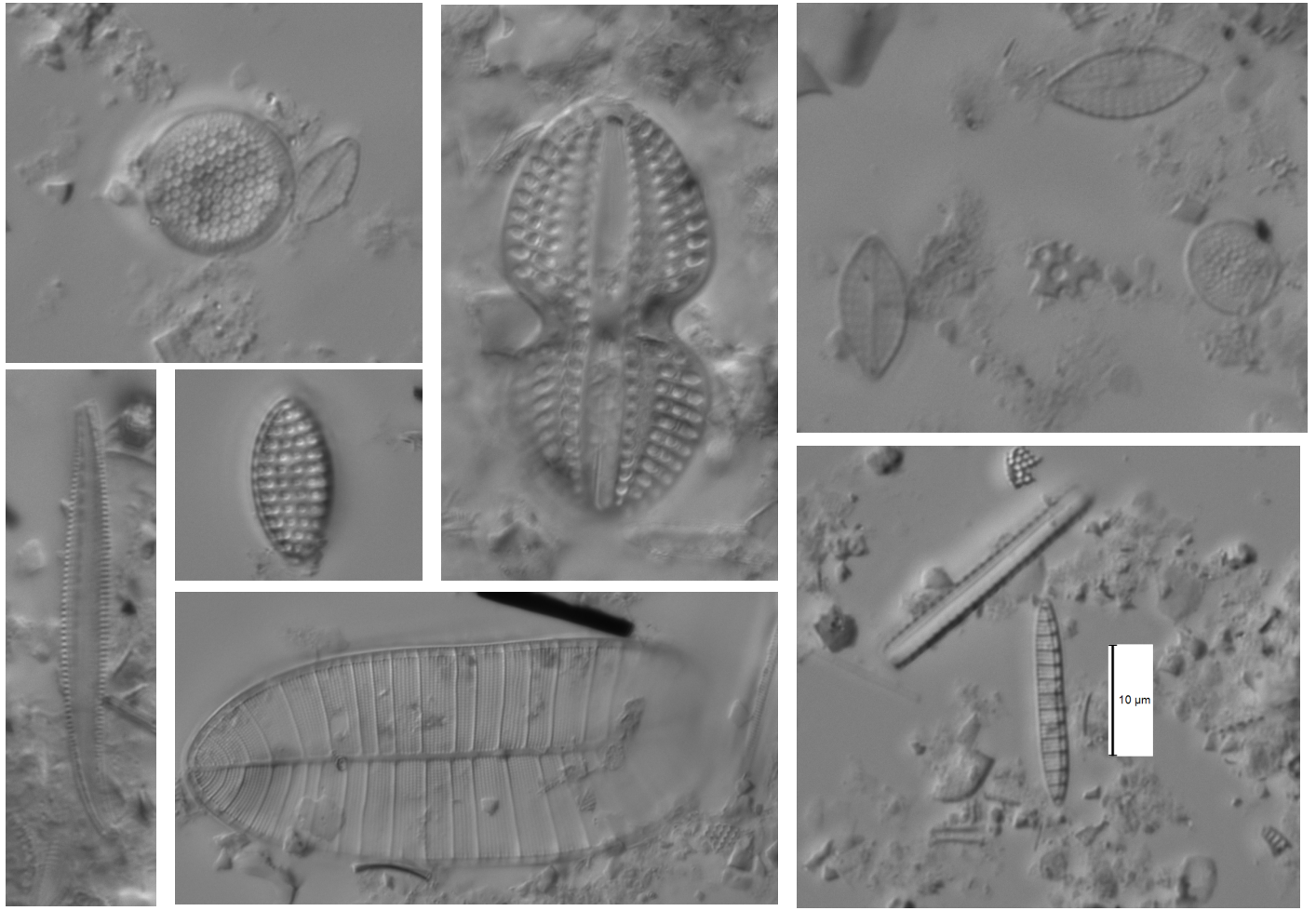
- 50cm core
- Sectioned for microscopy
- Used PDE RTK-GPS to date sections
  - Present: 0-1”
  - Post treatment: 4-6”
  - Installation: 16-18”
  - Pre- Treatment: 28-30”
  - Bottom core 48-50”



Methods: Microscopy

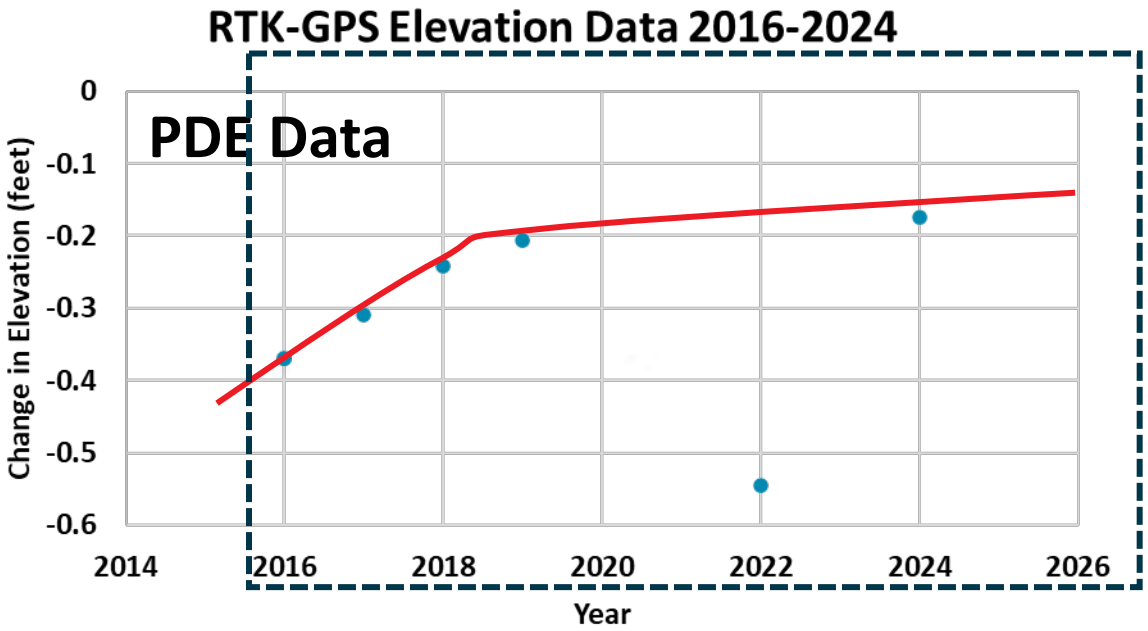
- **Species Identification**
  - Looking at diatoms under 1000 magnification
  - Counted 300 valves per slide
  - Identifies valves species level using NJ Voucher flora
  - Diatom Flora of the New Jersey Coastal Wetlands



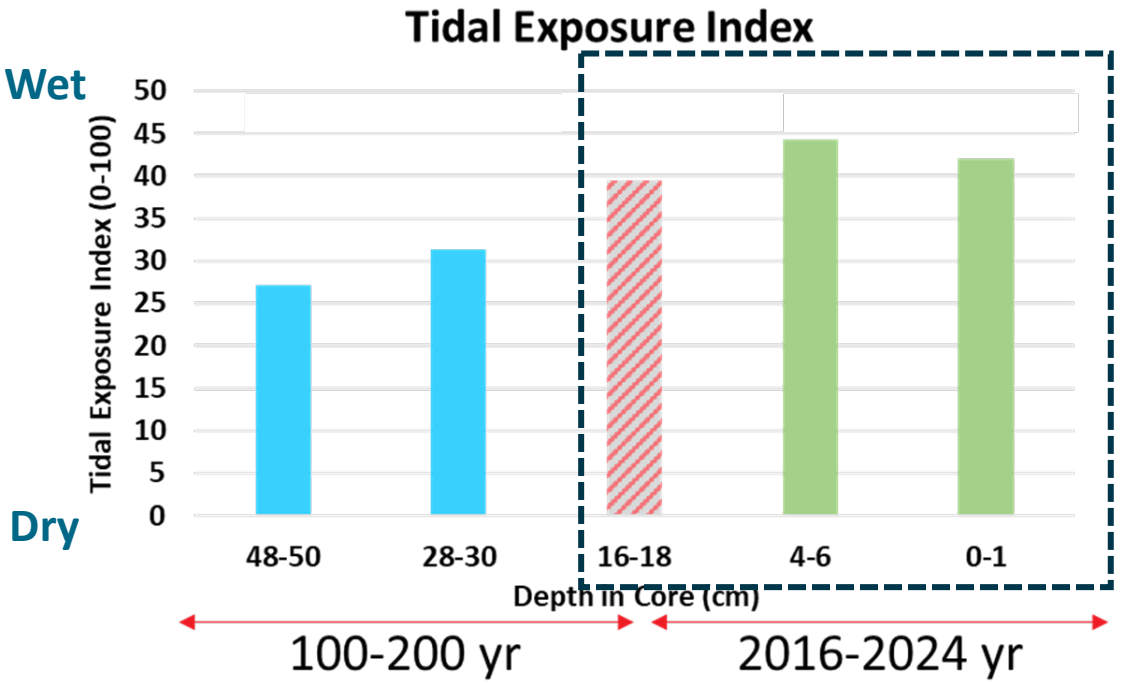


Results: Increasing Elevation and Inundation

Elevation has been increasing since installation, but….

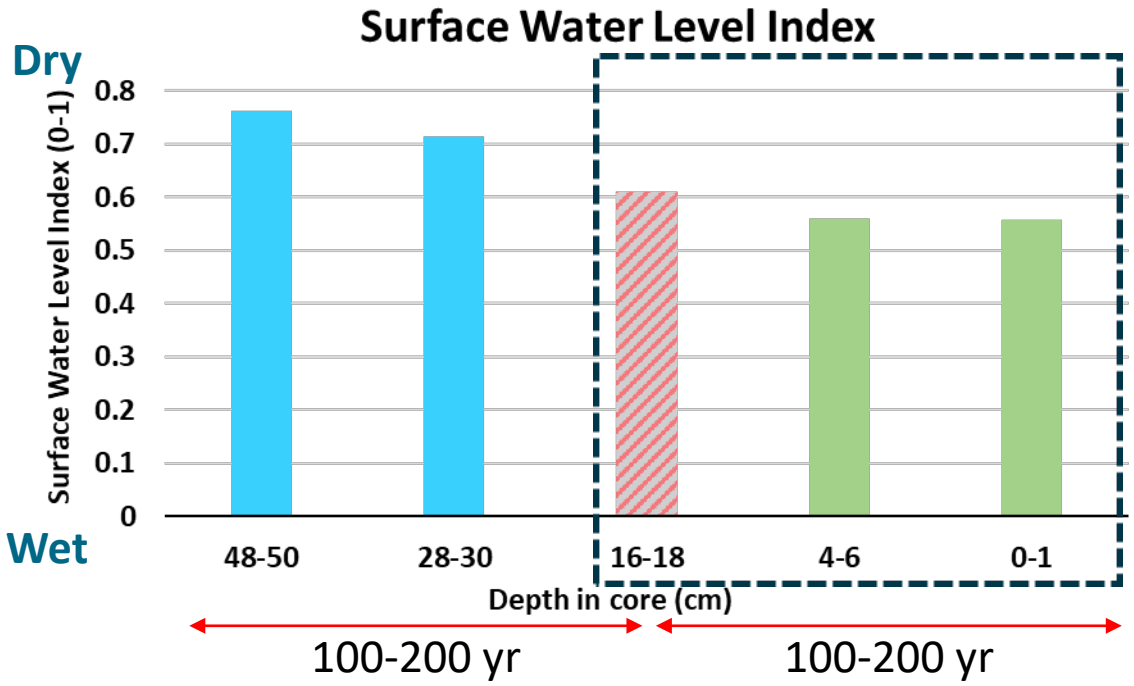


Diatom Community Composition showed inundation is increasing

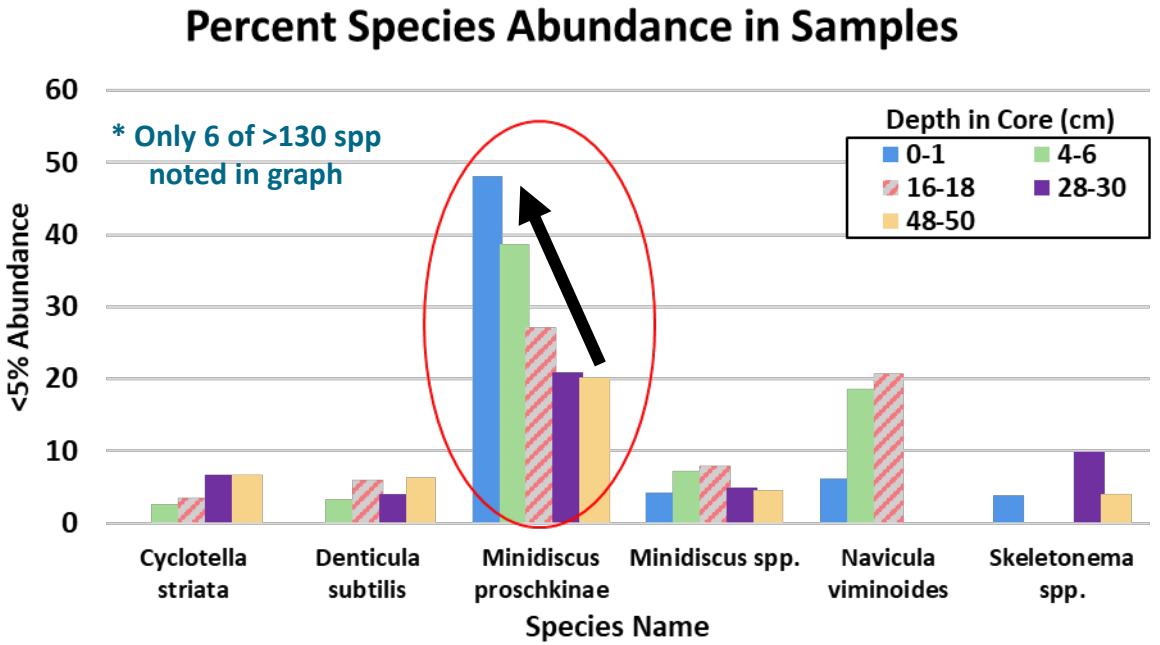


Confidence: Multiple Supports

SWLI supports TEI Findings



"Wet" species was main species in core & increased over time



Conclusions

1. Diatoms can be successfully used as environmental indictors
   - Past & present ecosystem states
2. Potential surrogates for other instrumentation
   - Water-level loggers
   - Soil nutrients
   - Variety of biological and physiochemical parameters
3. Requires high level of expertise for species ID
   - Few scientists in this field
4. This opens opportunity for upcoming scientists looking for new niches in restoration science

Questions & Discussion

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