Assessing ecosystem processes and services in Jamaica Bay's restored salt marshes

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Baruch COLLEGE

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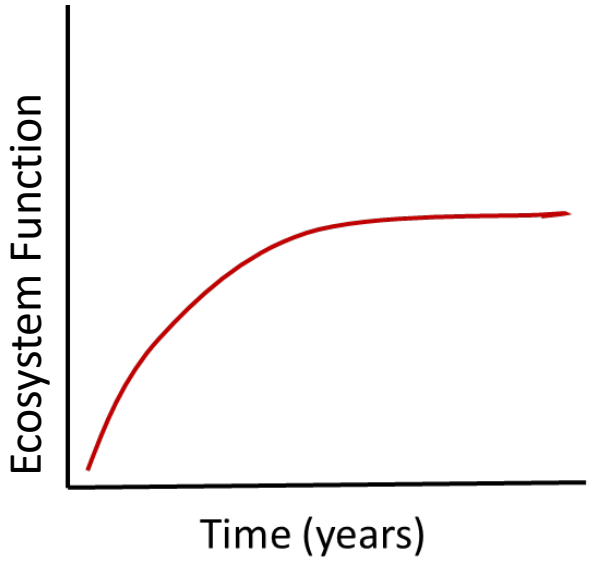
Salt marsh restoration

NYC Wetlands Strategy 2012

Ecosystem Services:

1) Habitat provisioning
2) Increasing shoreline resilience
3) Nutrient mitigation
   - Nitrogen removal
   - Carbon sequestration



> 25 restoration sites in NYC

> $200 million

Elders East in Jamaica Bay before restoration

Elders East in Jamaica Bay during restoration

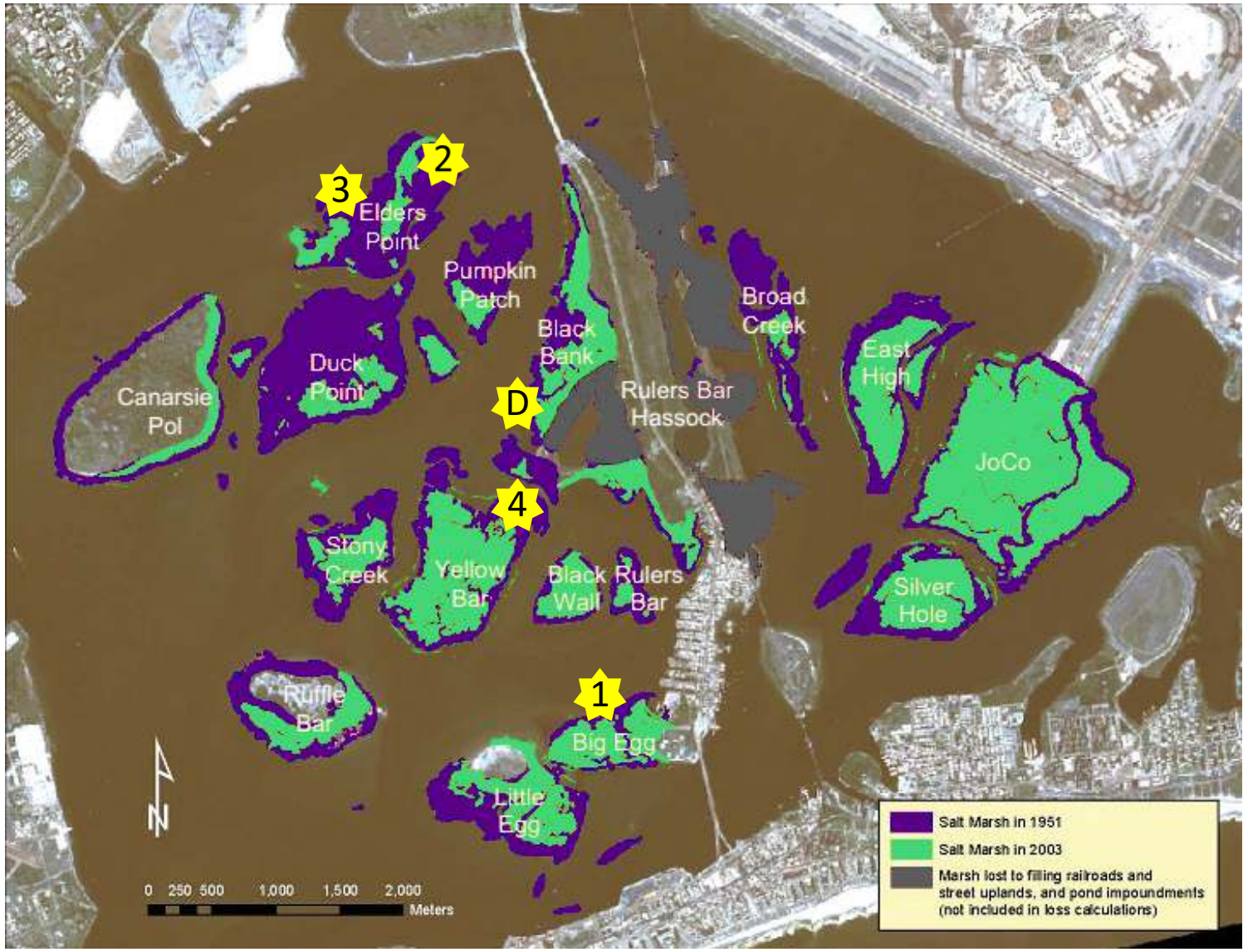
Salt marsh restoration in Jamaica Bay

Chronosequence

1) Big Egg = 2003
2) Elders East = 2006
3) Elders West = 2010
4) Yellow Bar = 2012

Degraded Reference

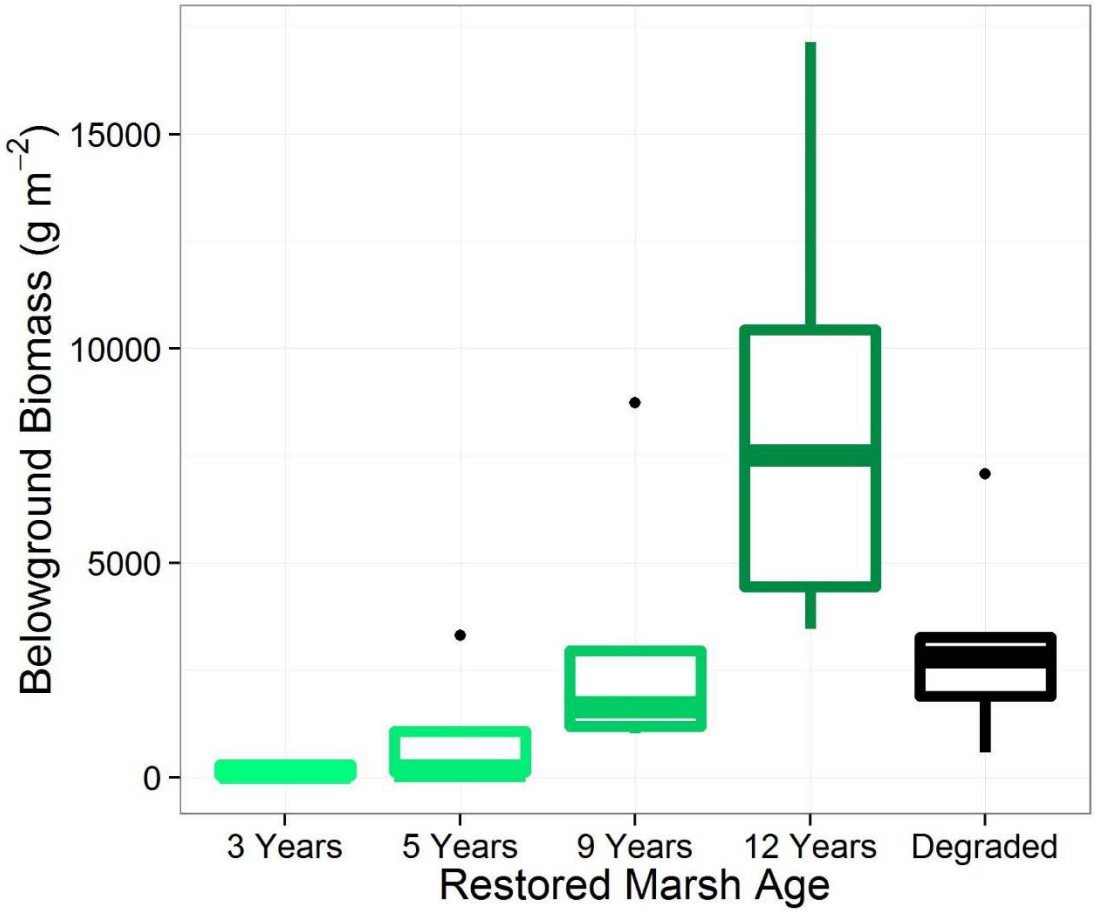
Black Bank



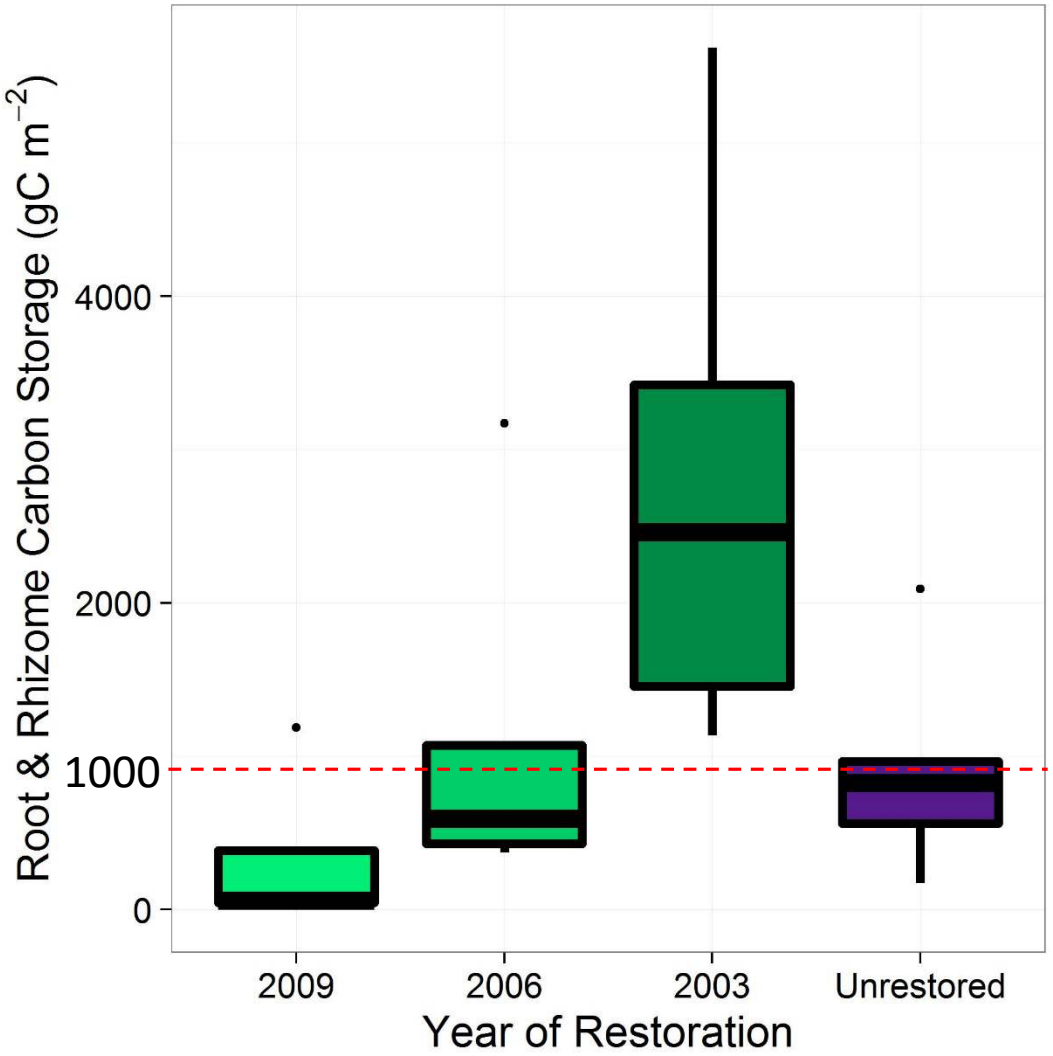
http://nbii-nin.ciesin.columbia.edu/jamaicabay/jbwppac/JBAC_NPS_SaltMarshReport_080207.pdf.

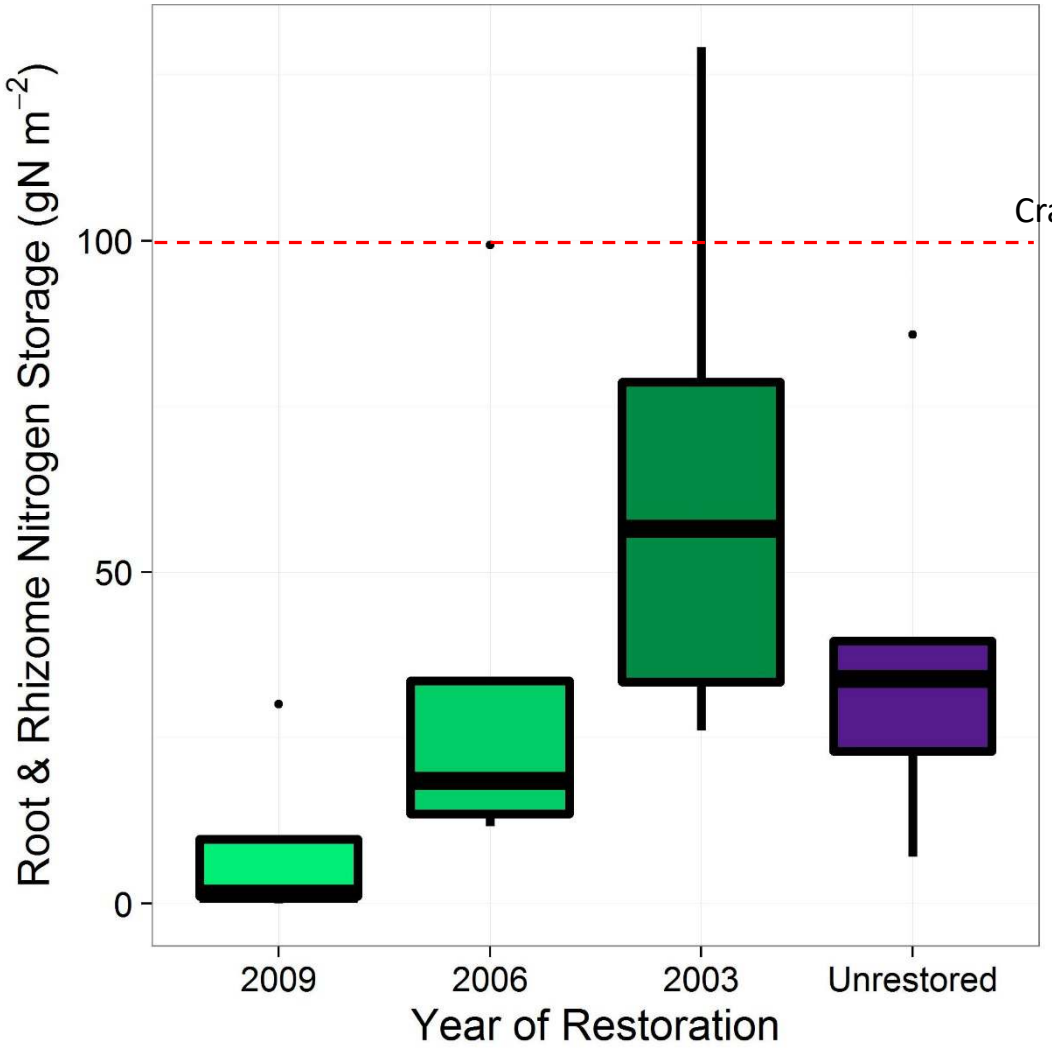
Marsh biomass increases with time

July 2015 - Surveys of marsh biomass and carbon/nitrogen storage



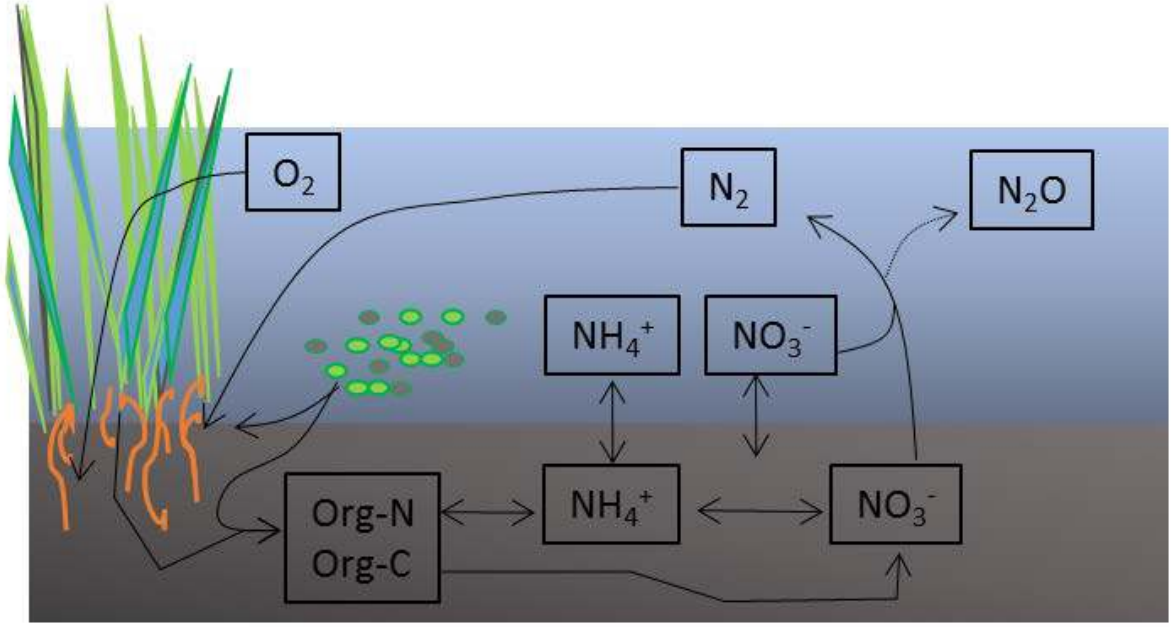
Carbon and nitrogen storage increase with time





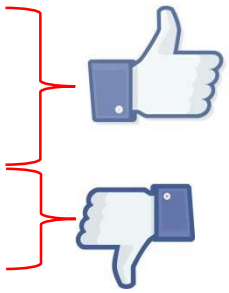
Craft et al. 2003

Will restored marshes be a N sink or N source in Jamaica Bay?



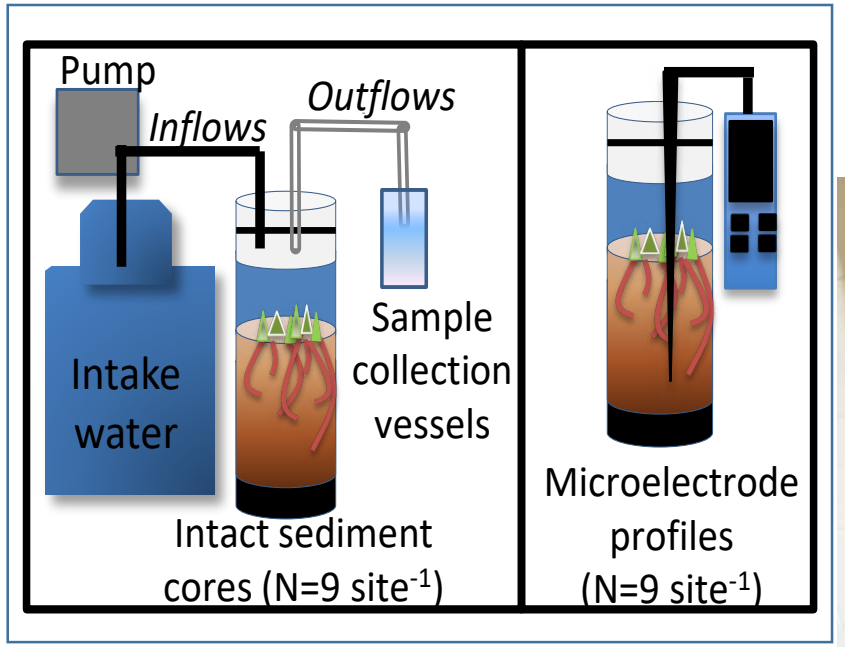
<u>Nitrogen Pathways = 3 R's</u>

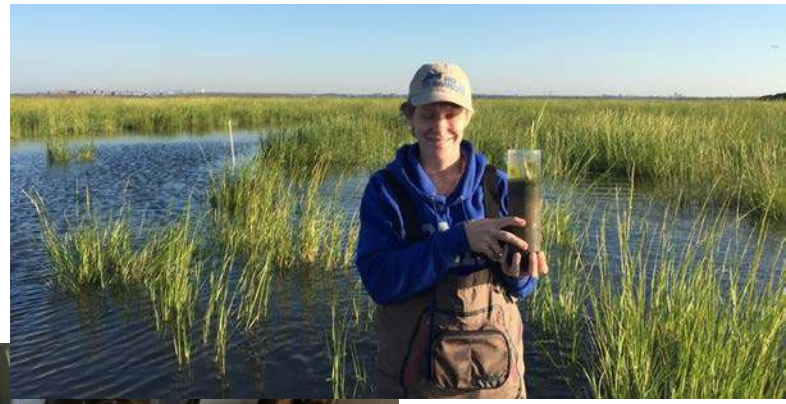
1) Retention
2) Removal
3) Recycling

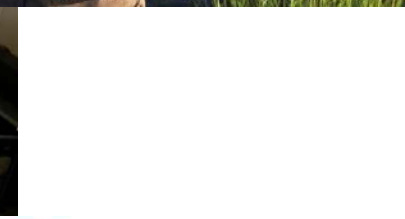


N Removal through **<u>denitrification</u>** is an ecosystem service!

Approach







AREAC
Brooklyn College
Aquatic Research and Environmental Assessment Center

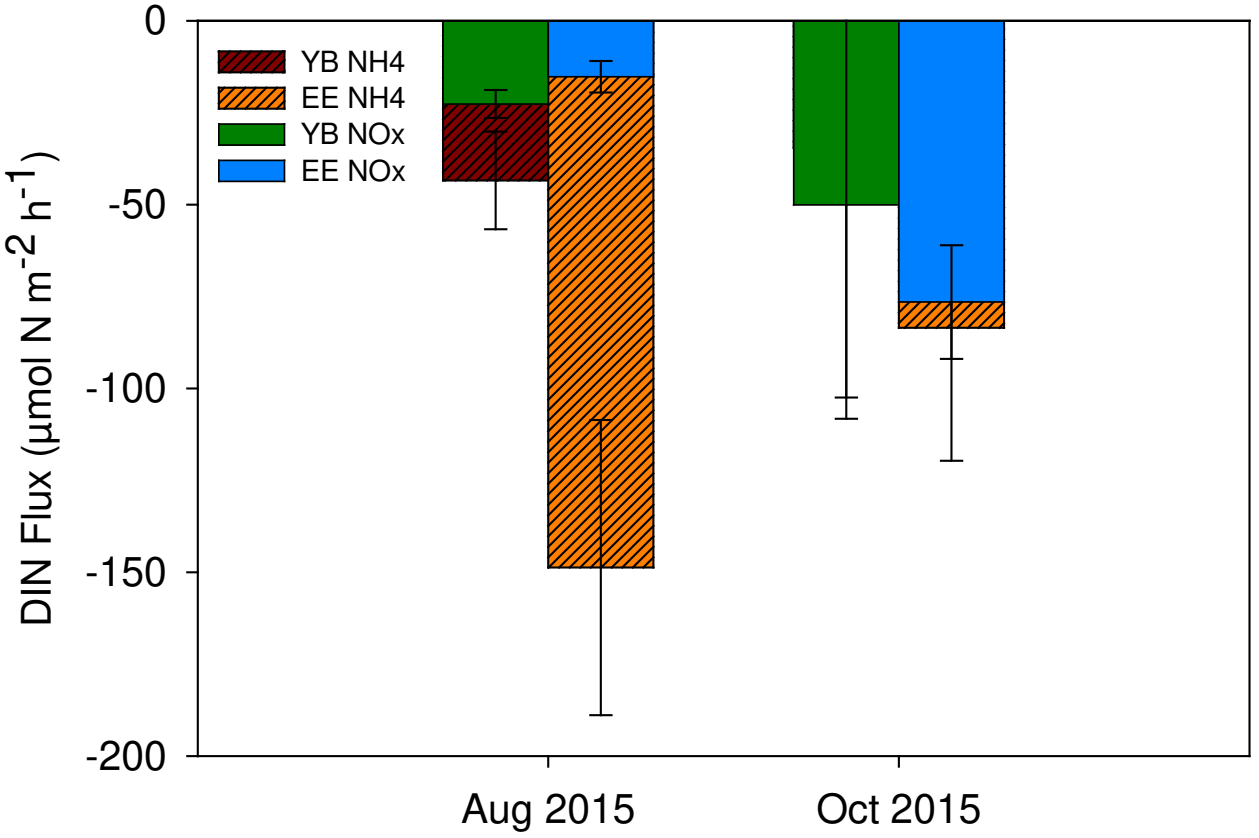
Continuous flow-through sediment cores

1) Control
2) Enriched +40 µM $^{15}NO_3^-$
3) Enriched + 8 µM $^{15}NH_4^+$

2015 - Yellow Bar and Elders East

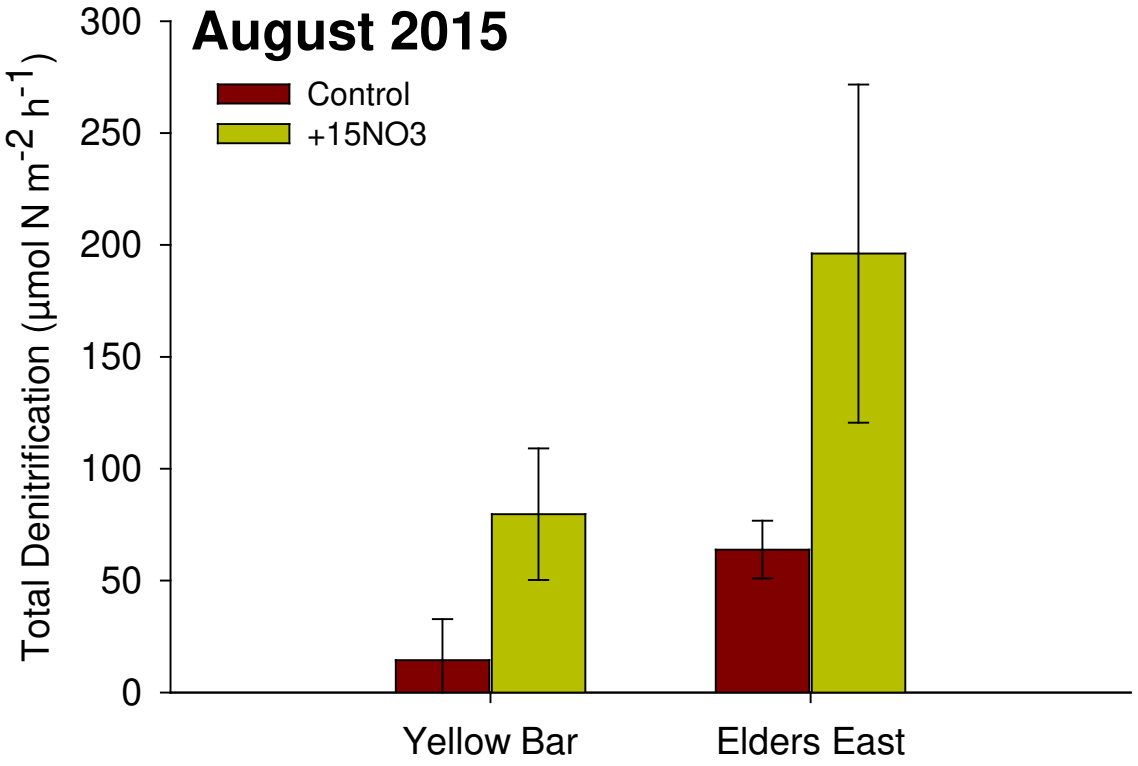
Dissolved inorganic N (DIN) flux in restored marshes

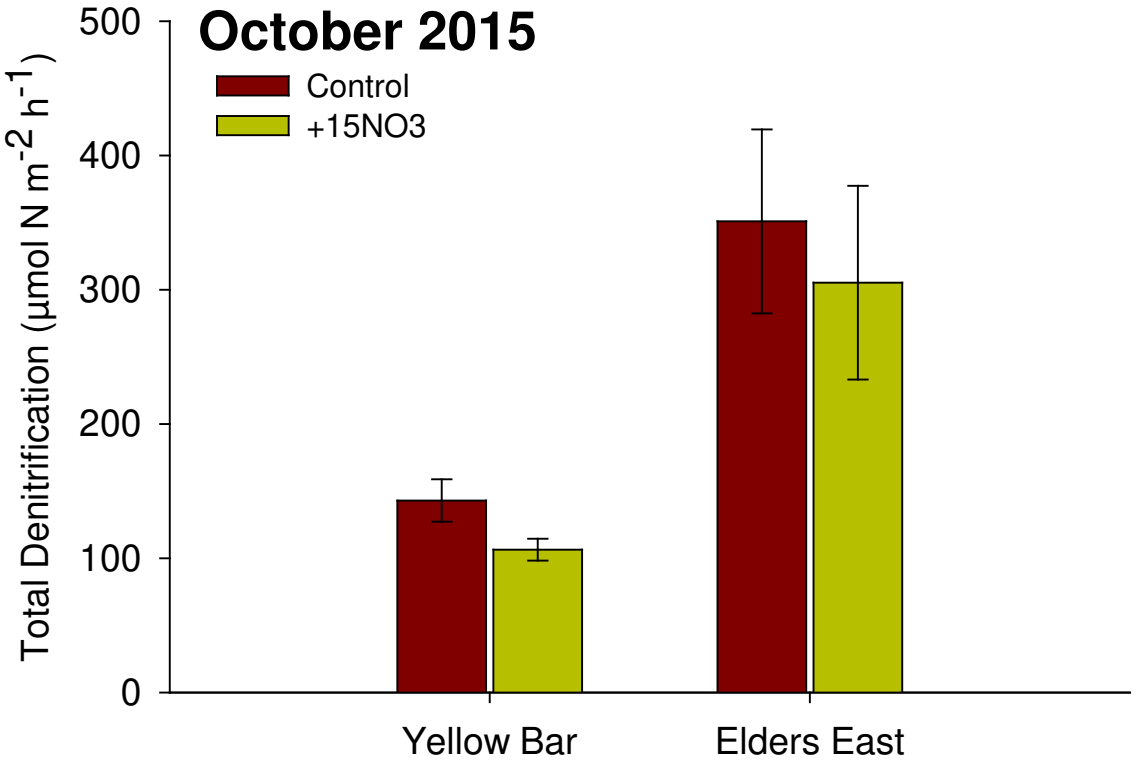
Yellow Bar (YB) = 3 y/o
Elders East (EE) = 9 y/o



- Negative flux = DIN uptake
- Marsh sediment is a DIN sink

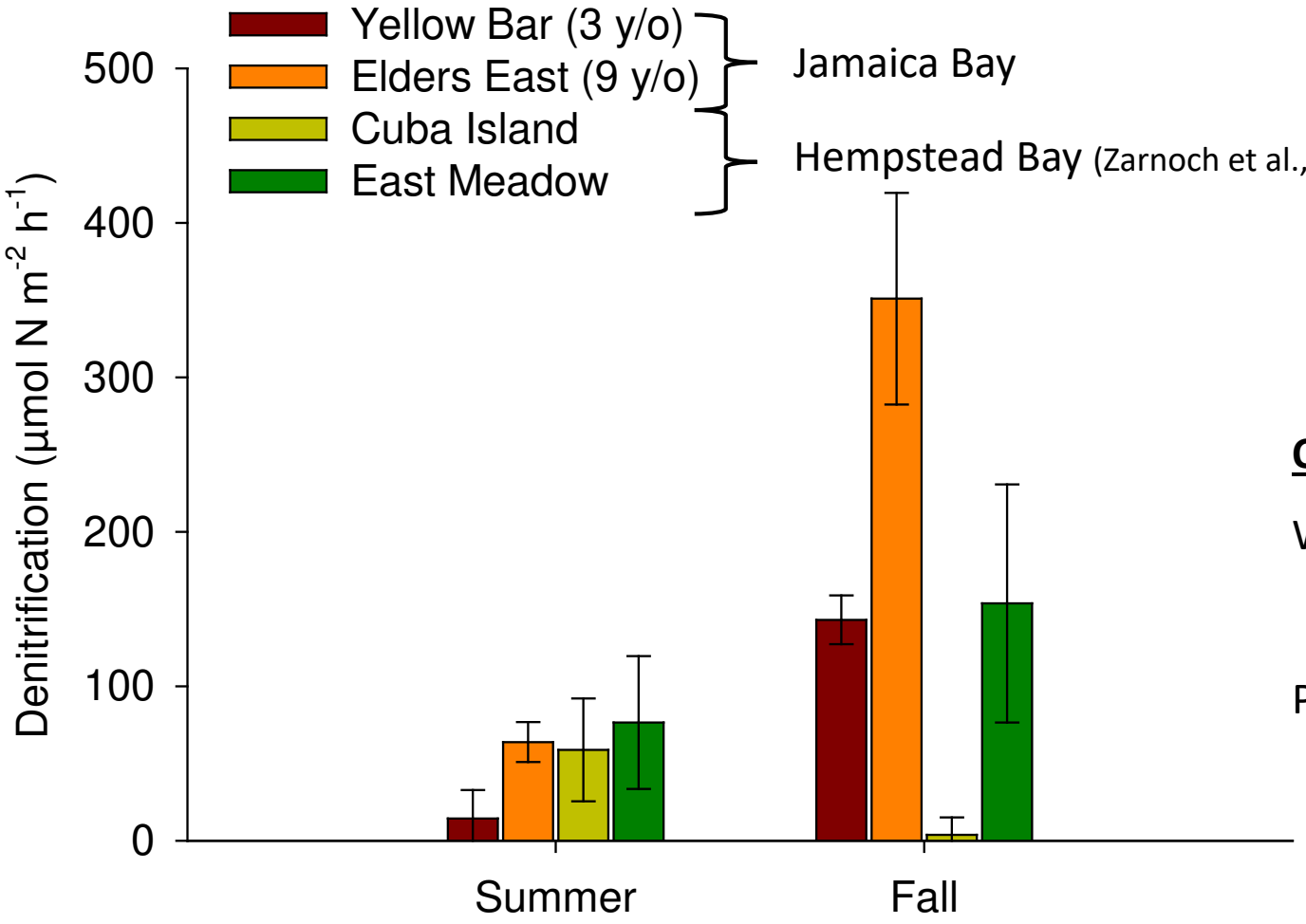
Denitrification (N removal) in restored marshes





- Older marsh had higher rates than younger marsh
- Rates were limited by NO_3^- in summer
- Rates were higher in fall
- N_2 flux positively related to sediment carbon in fall

Restored marsh sites in Jamaica Bay have denitrification rates similar to natural marshes



Other studies:

White and Howes 1994 = ~75 µmol N m^{-2} h^{-1})
(Cape Cod, MA)

Piehler and Smyth 2011 = ~100µmol N m^{-2} h^{-1})
(Bogue Sound, NC)

Summary of Results

Marsh Ecosystem Services

- N removal is greater than N recycling
- N removal and C sequestration varies with marsh age and/or season
- Summer and fall 2015 estimated N removal
  - YB = 1,653 lb N, EE = 4,218 lb N
  - How to value marsh ecosystem services?

Marsh Long-Term Sustainability

- Denitrification rates are quite high at older restored marsh
- Balance of denitrification and carbon accumulation?

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