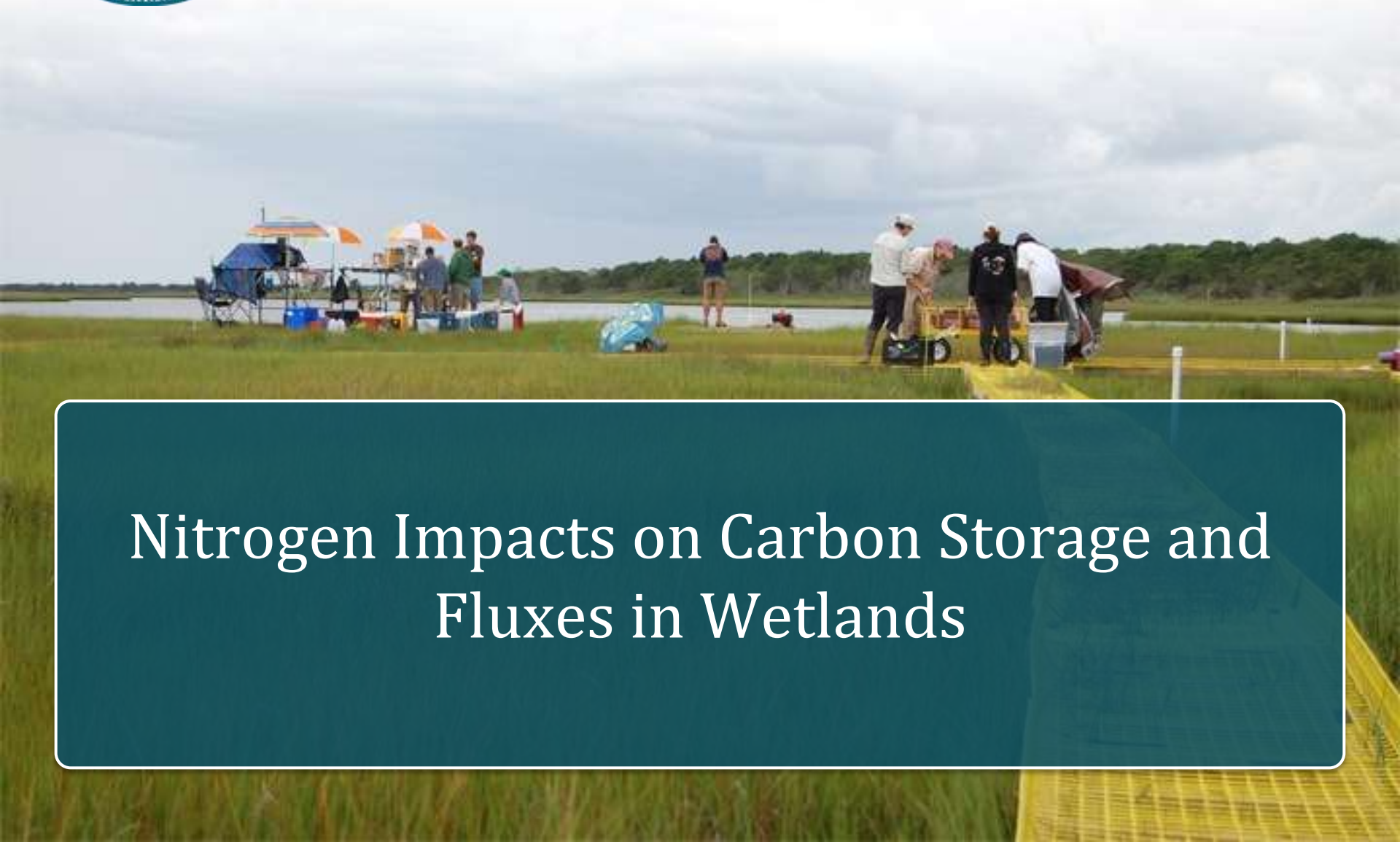
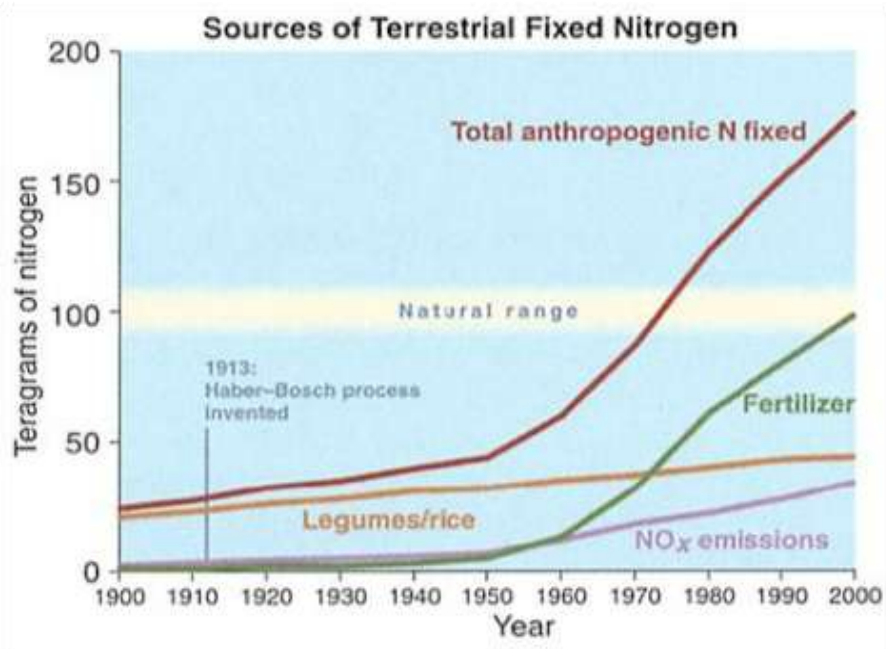
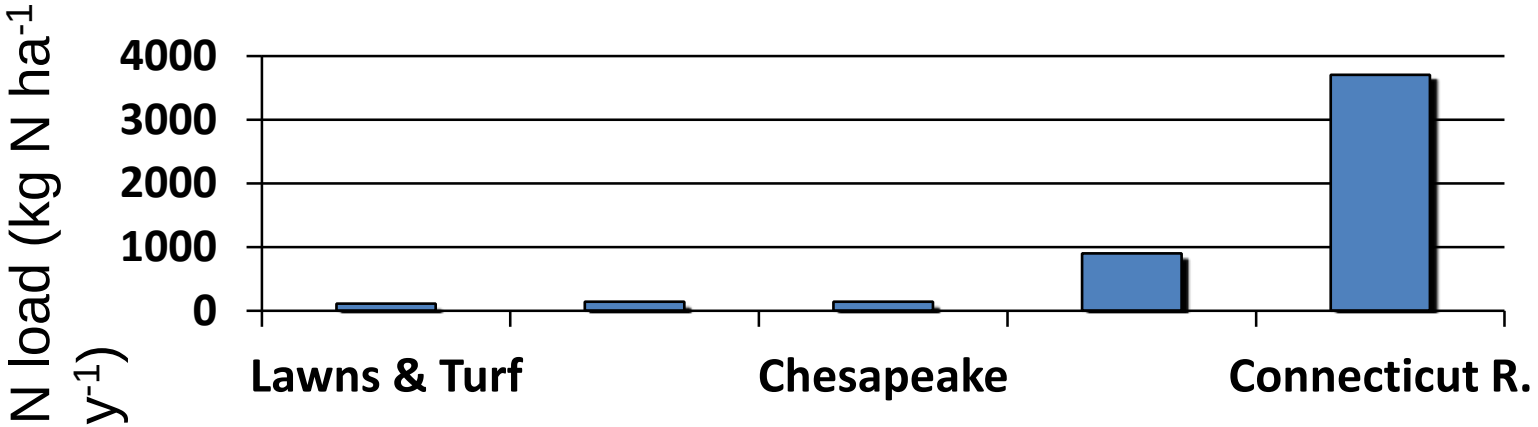
Capitalizing on Coastal Blue Carbon
The Conference Center at Massasoit Community College | May 12-13, 2015



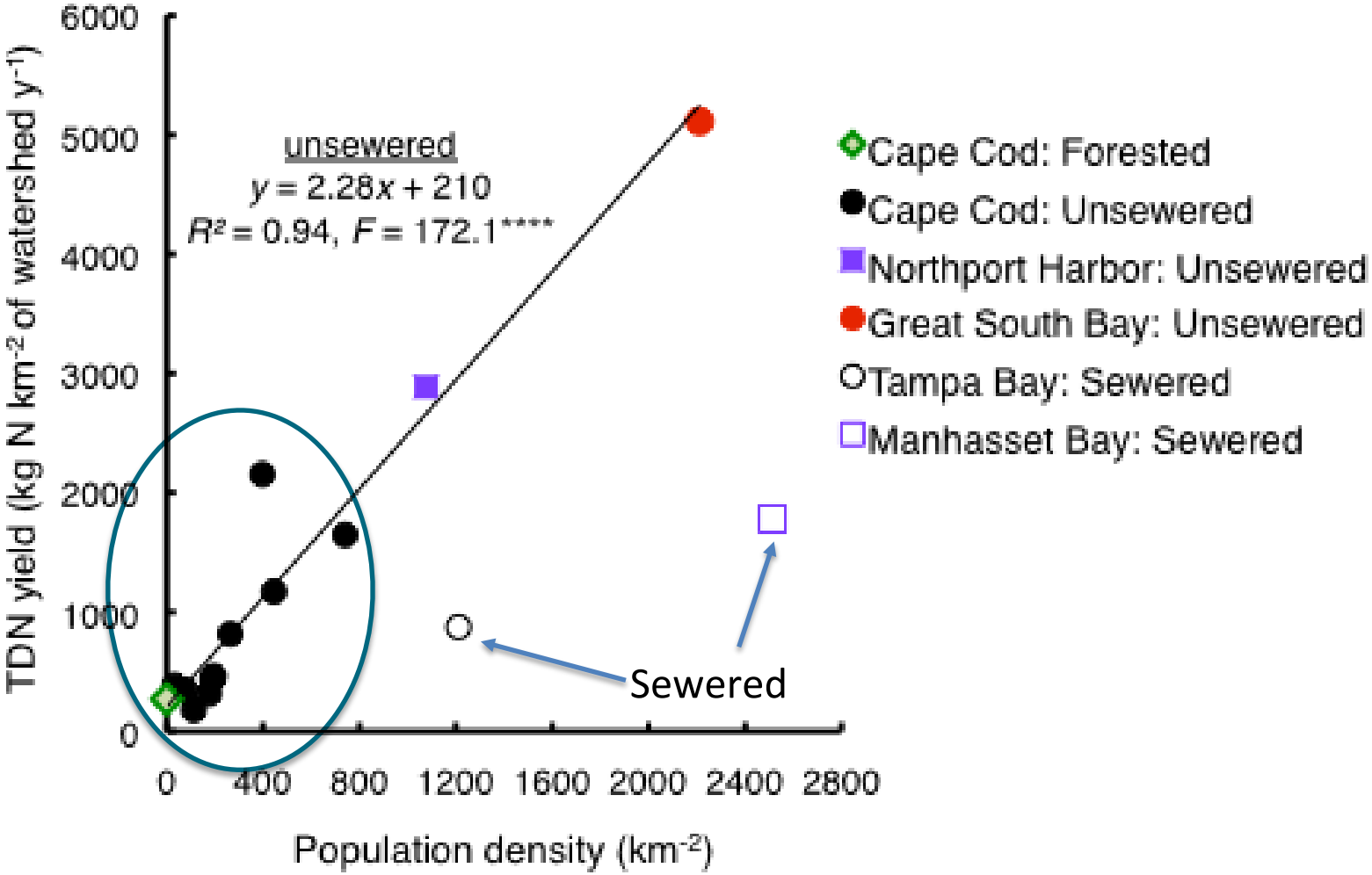
Nitrogen Impacts on Carbon Storage and Fluxes in Wetlands

Anthropogenic Nitrogen Enrichment in Coastal Ecosystems

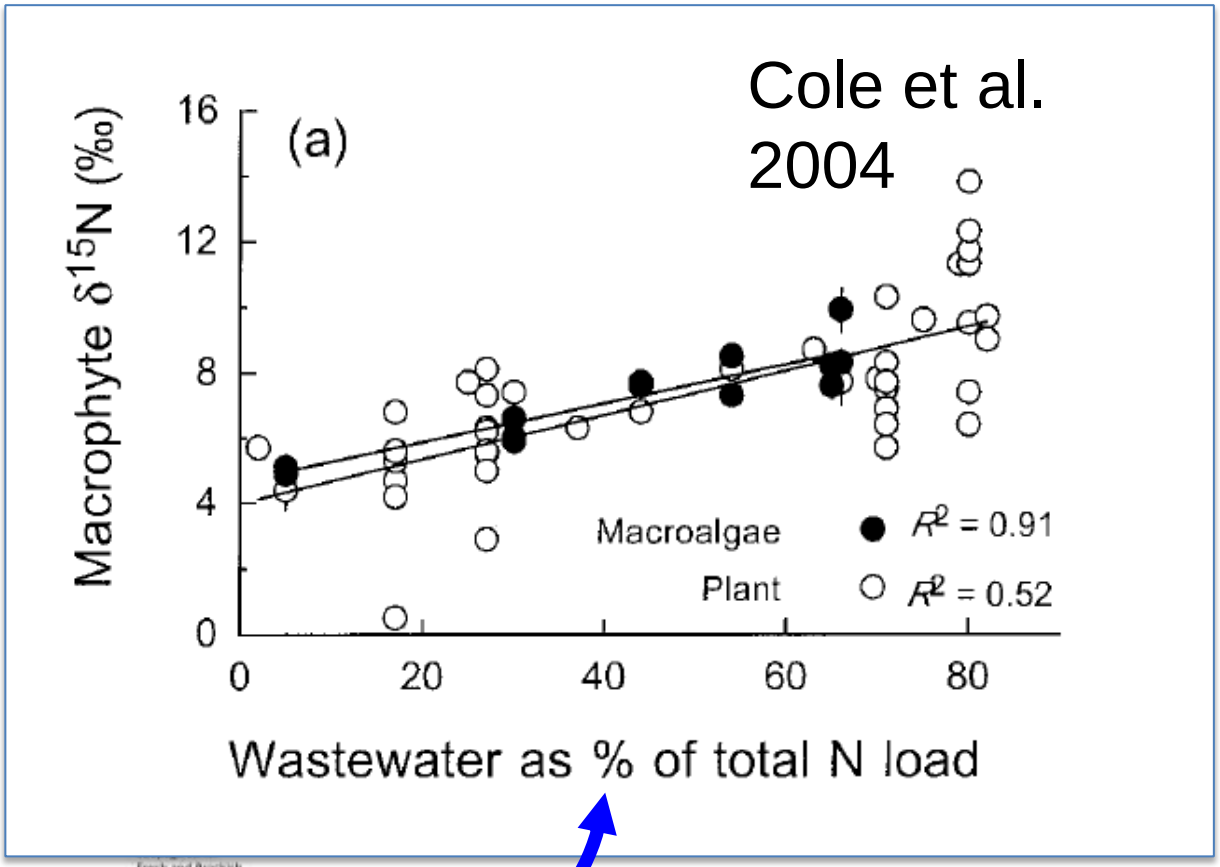


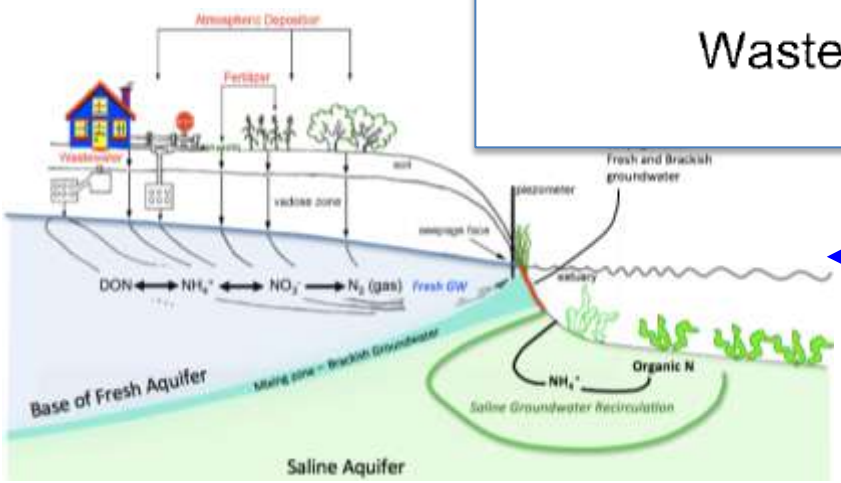


Groundwater-borne Nitrogen Yields from Coastal Watersheds



Isotopic evidence for anthropogenic N in estuarine food webs





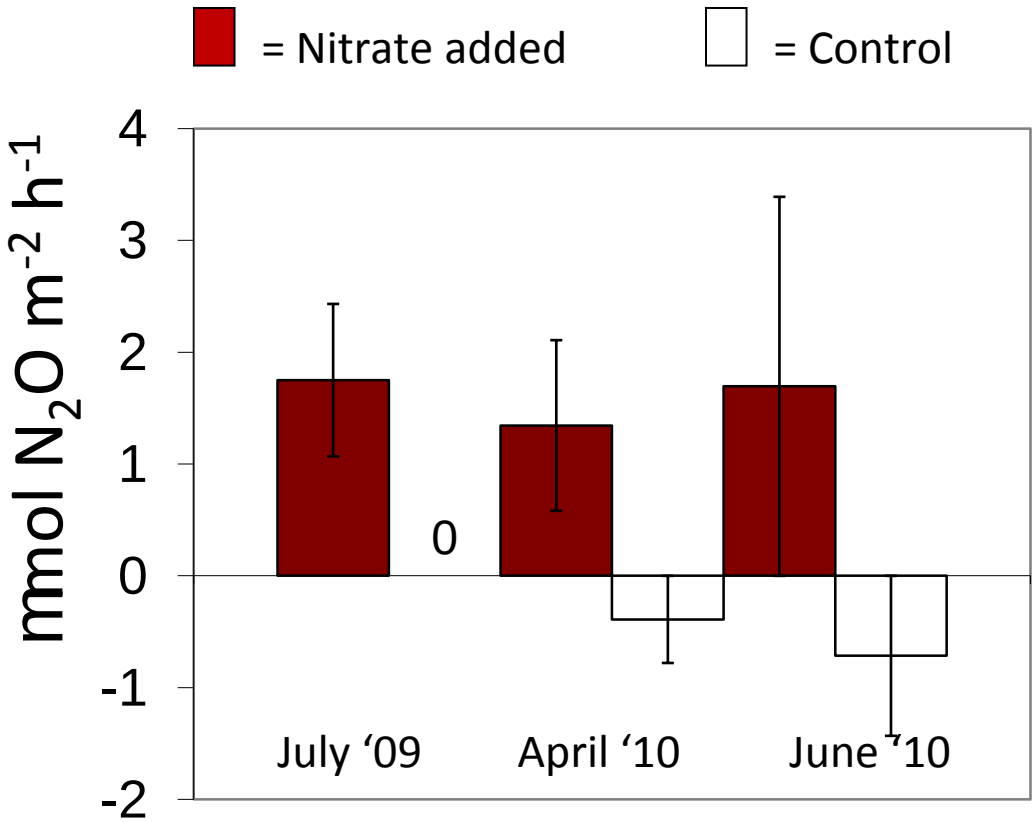
NLM: Land Use Based Model
Supported by Groundwater N Isotopic Data

“Moderate” loads with major effects in estuaries

IMPACT OF NITROGEN

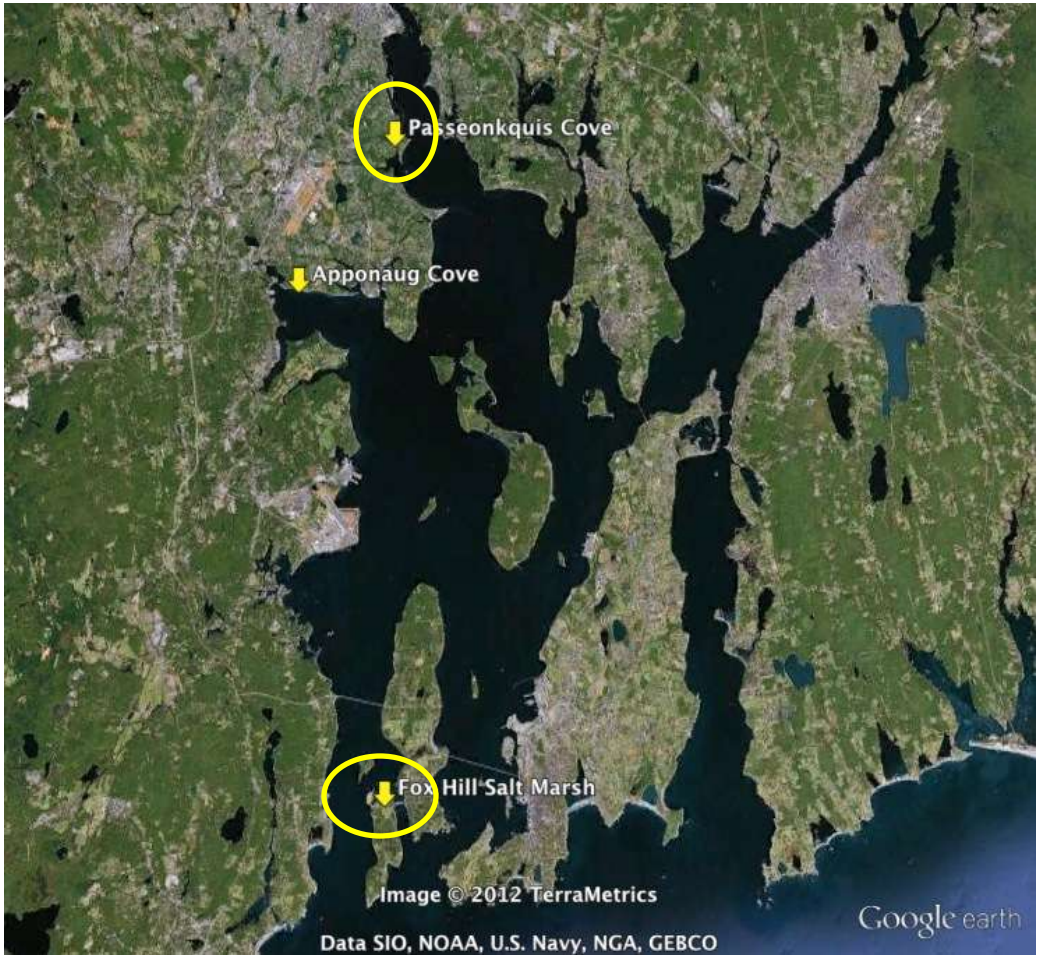
Surprising shift: N_2O sink to source in response to a nitrogen pulse

Plots received single pulses of nitrate (0.5L of 300 mM)



Moseman-Valtierra et al. 2011. Atmospheric Environment

The "Grand Experiment"
N gradient in Narragansett Bay RI



High N loading

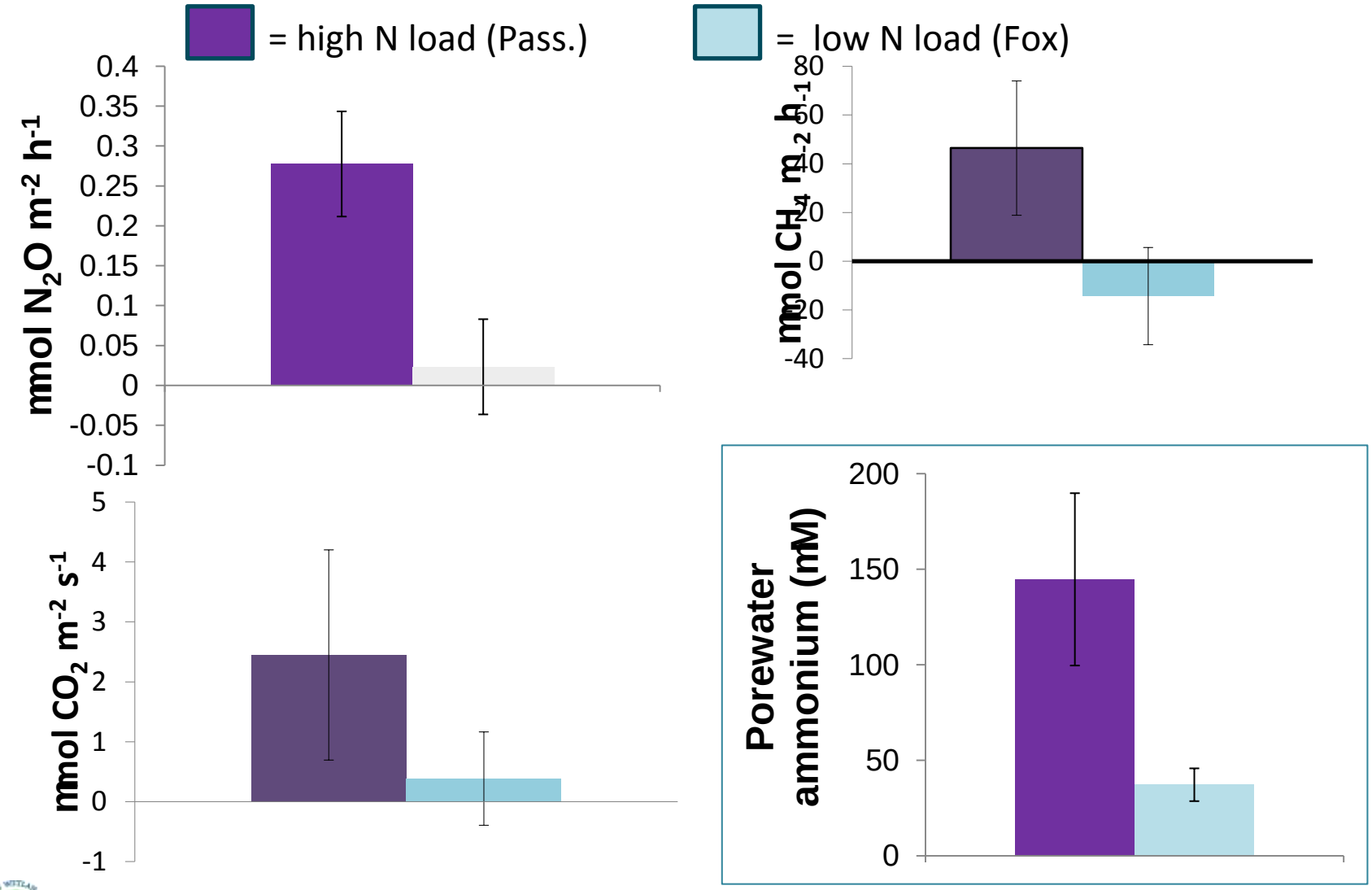
Passeonkquis:
*2418 kg N ha^{-1} y^{-1}

Fox Hill:
*10 kg N ha^{-1} y^{-1}

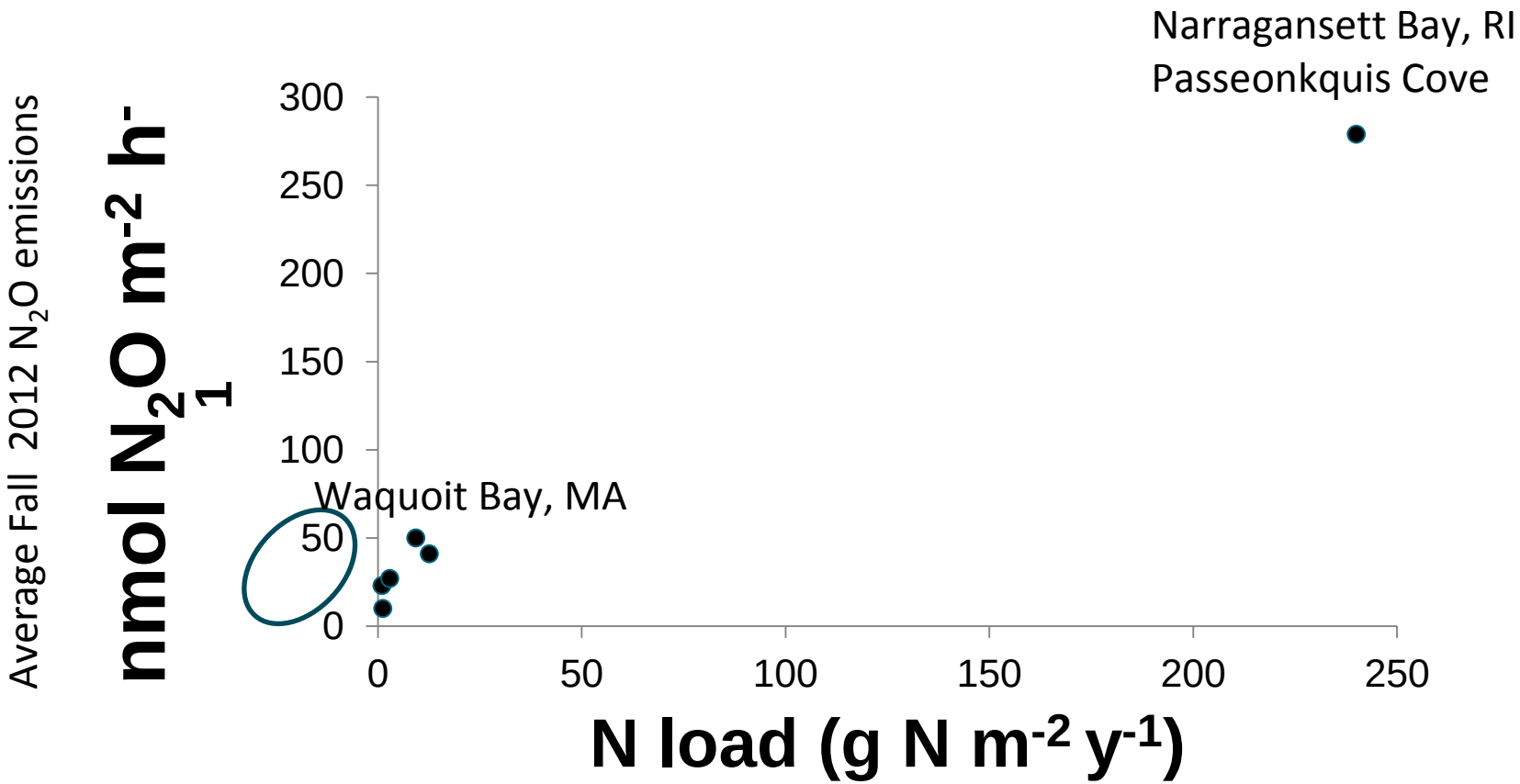
Low N loading

*=Wigand et al. 2004

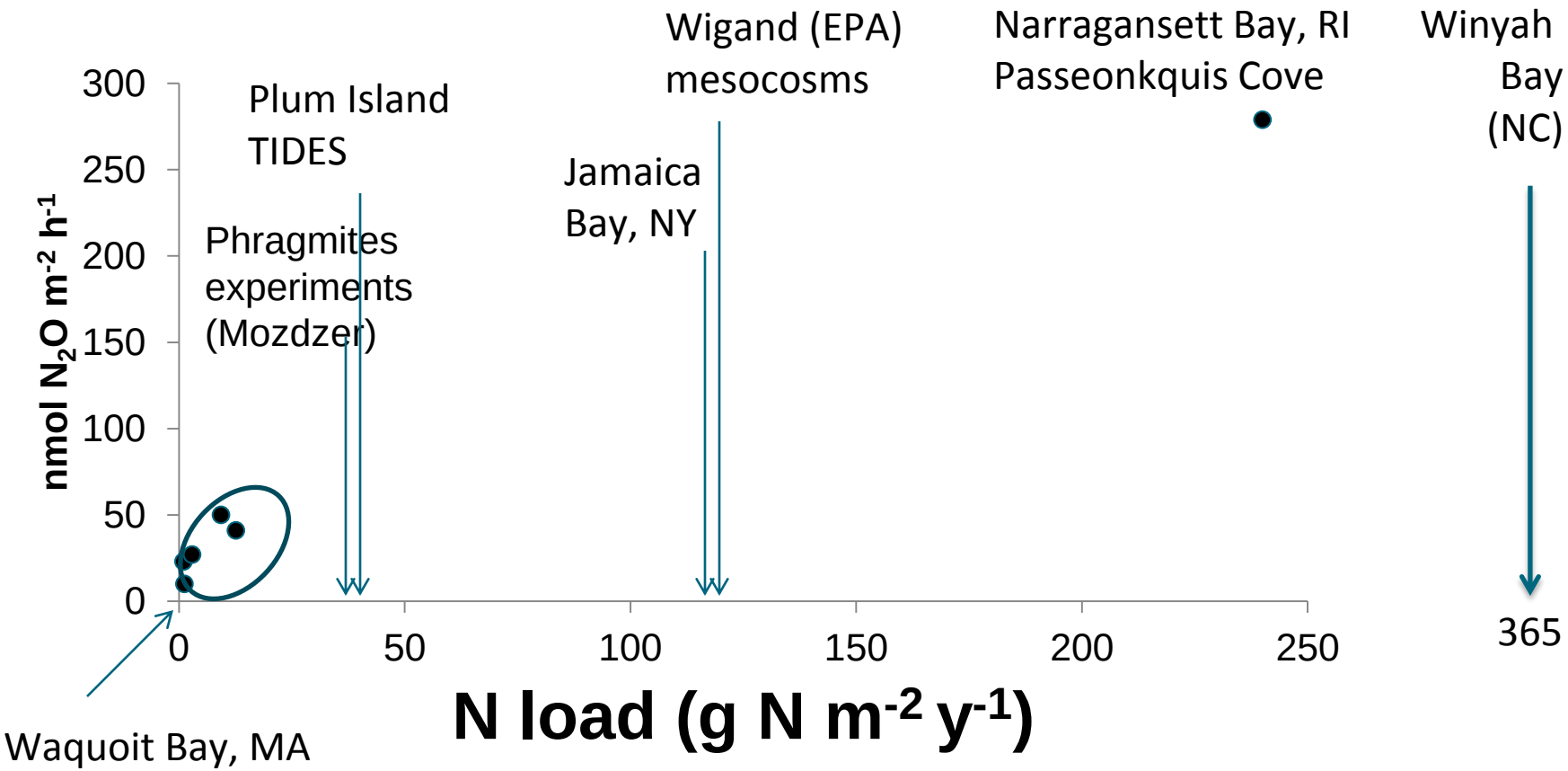
Narragansett Bay marshes



N_2O emissions vs marsh nitrogen load



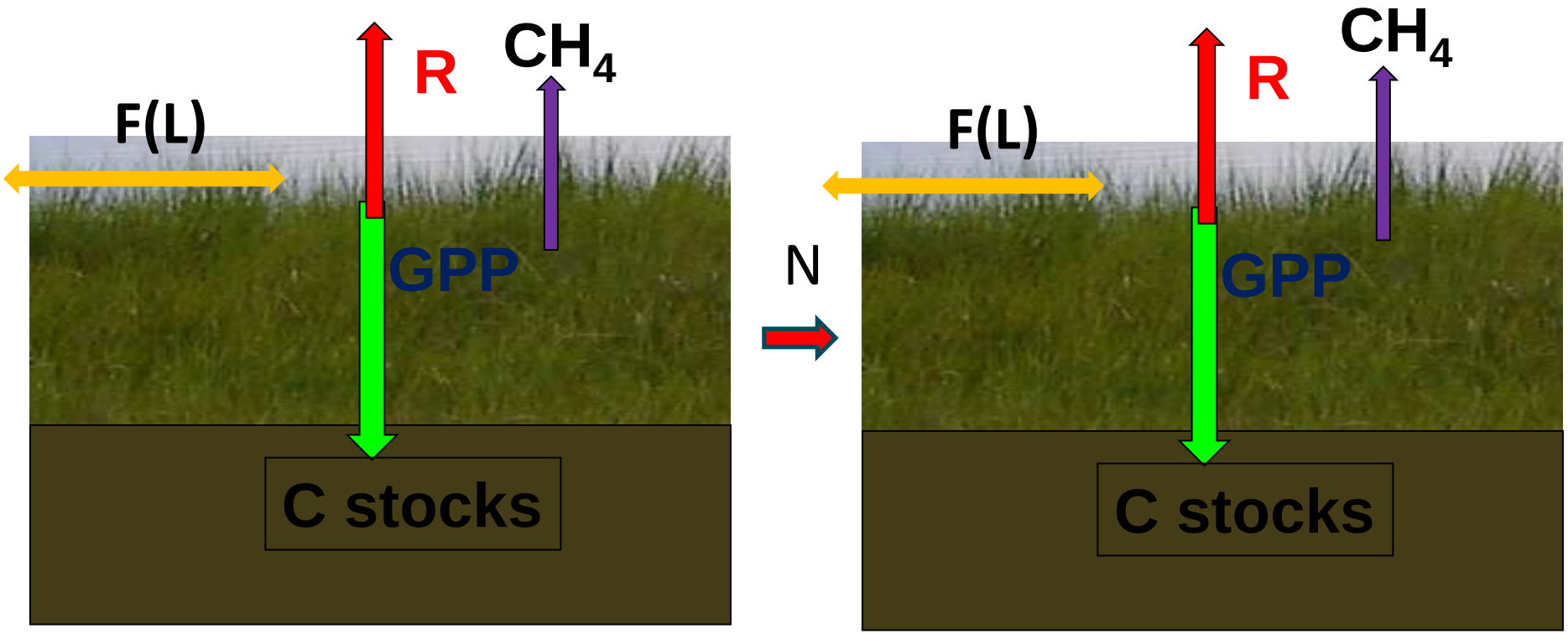
Nitrogen loads in our experiments



IMPACT OF NITROGEN

Quantify carbon credit: Net Ecosystem Carbon Balance

(NECB = dC/dt)

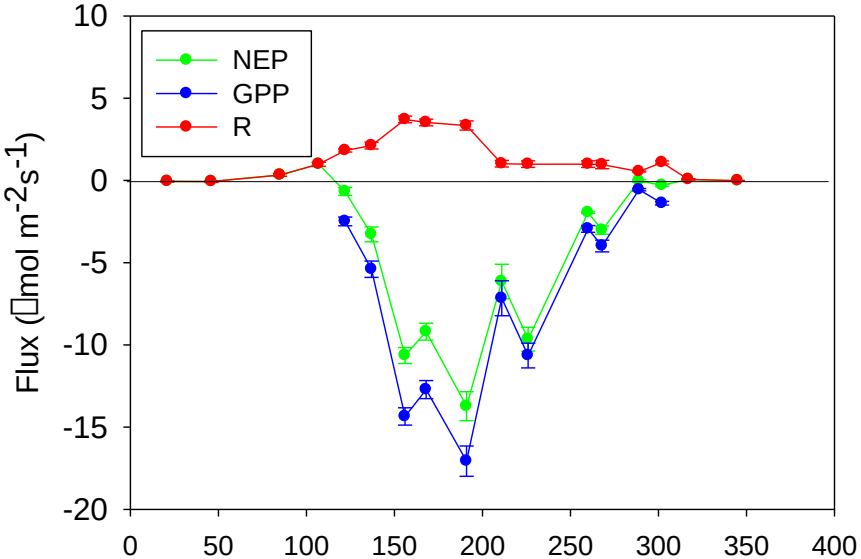


$$NECB = dC/dt = GPP - R - F(CH_4) - F(L)$$

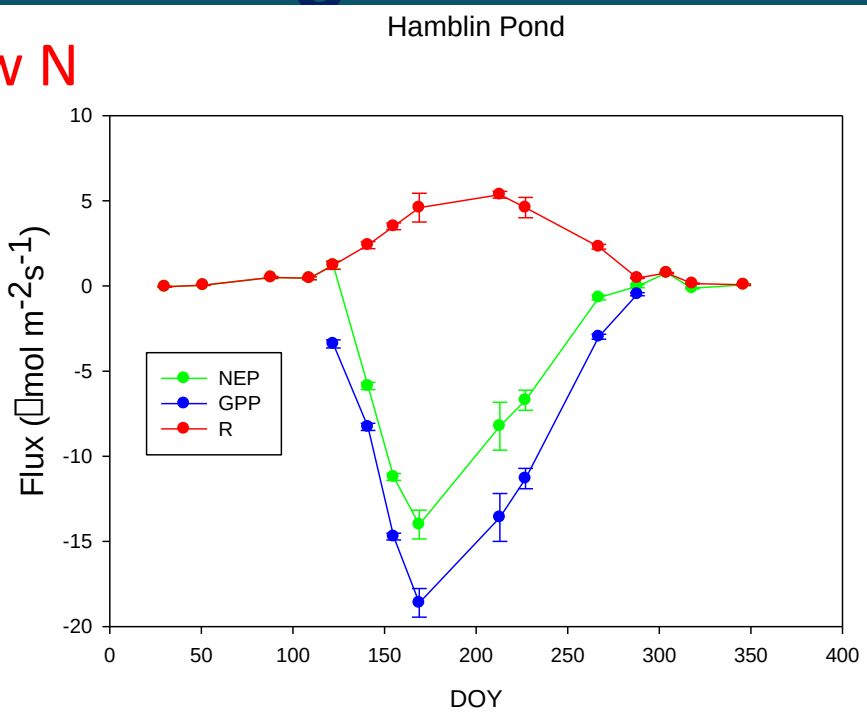
NEP

CO_2 fluxes across N gradient

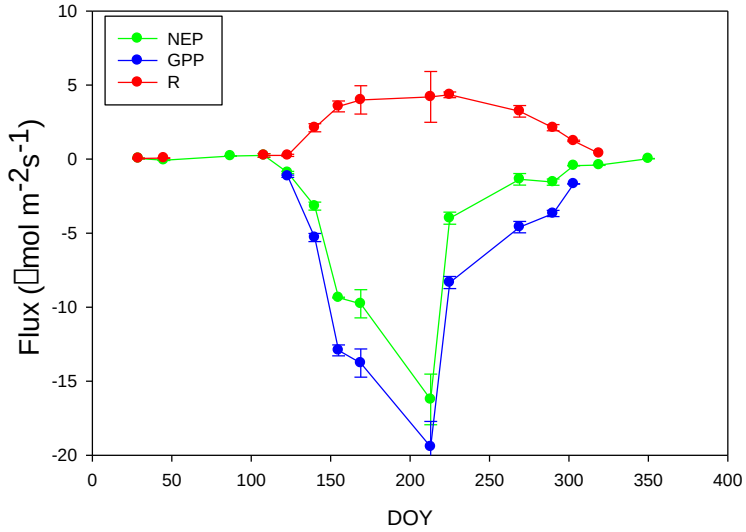
Low N

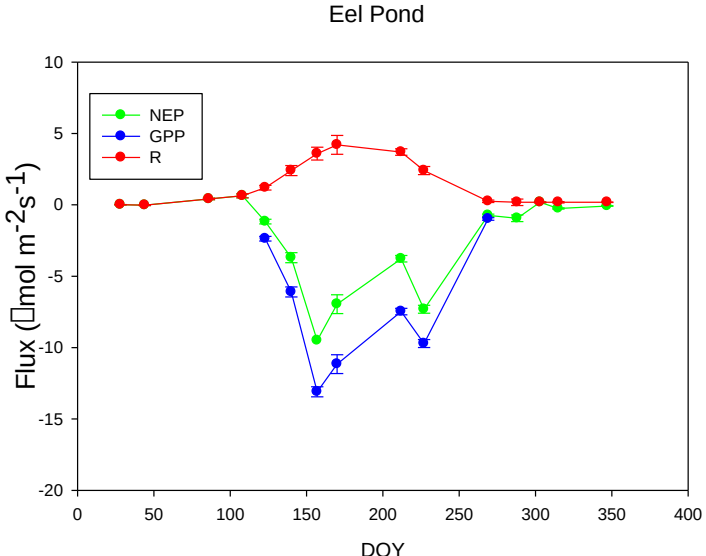


Great Pond



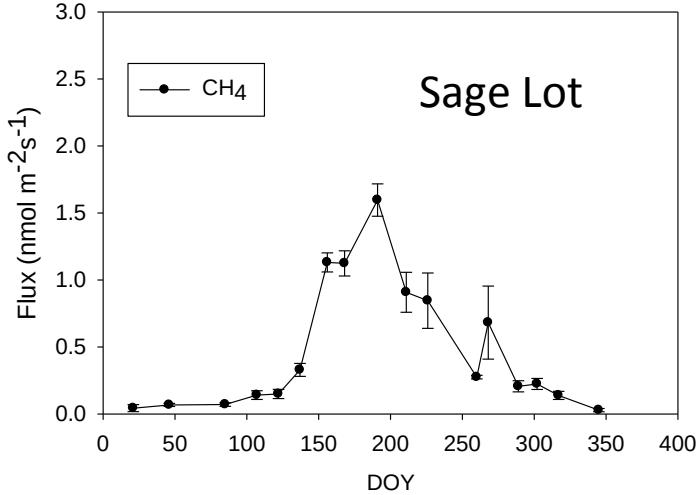
High N

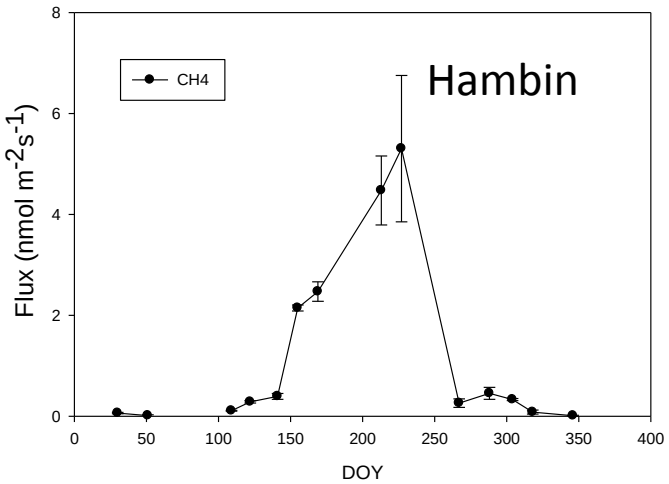




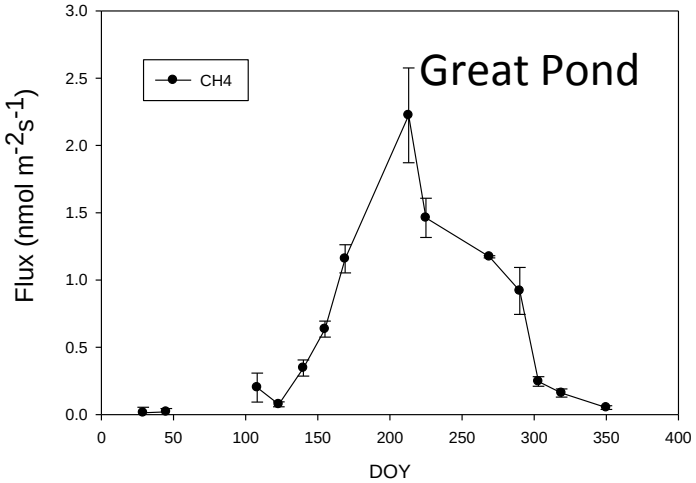
CH_4 fluxes across N gradient

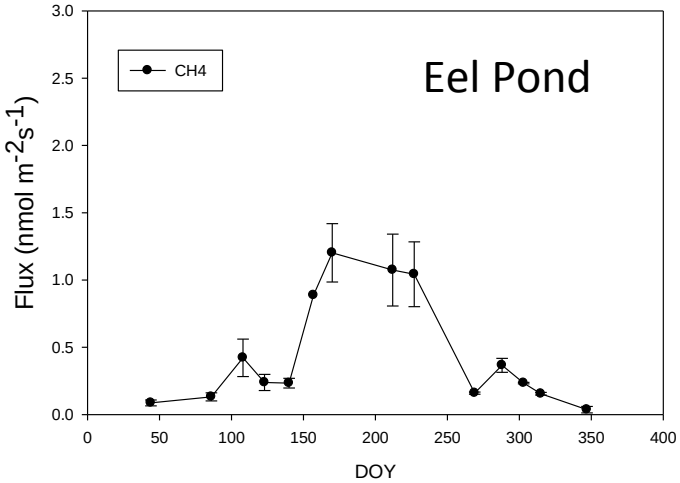
Low N





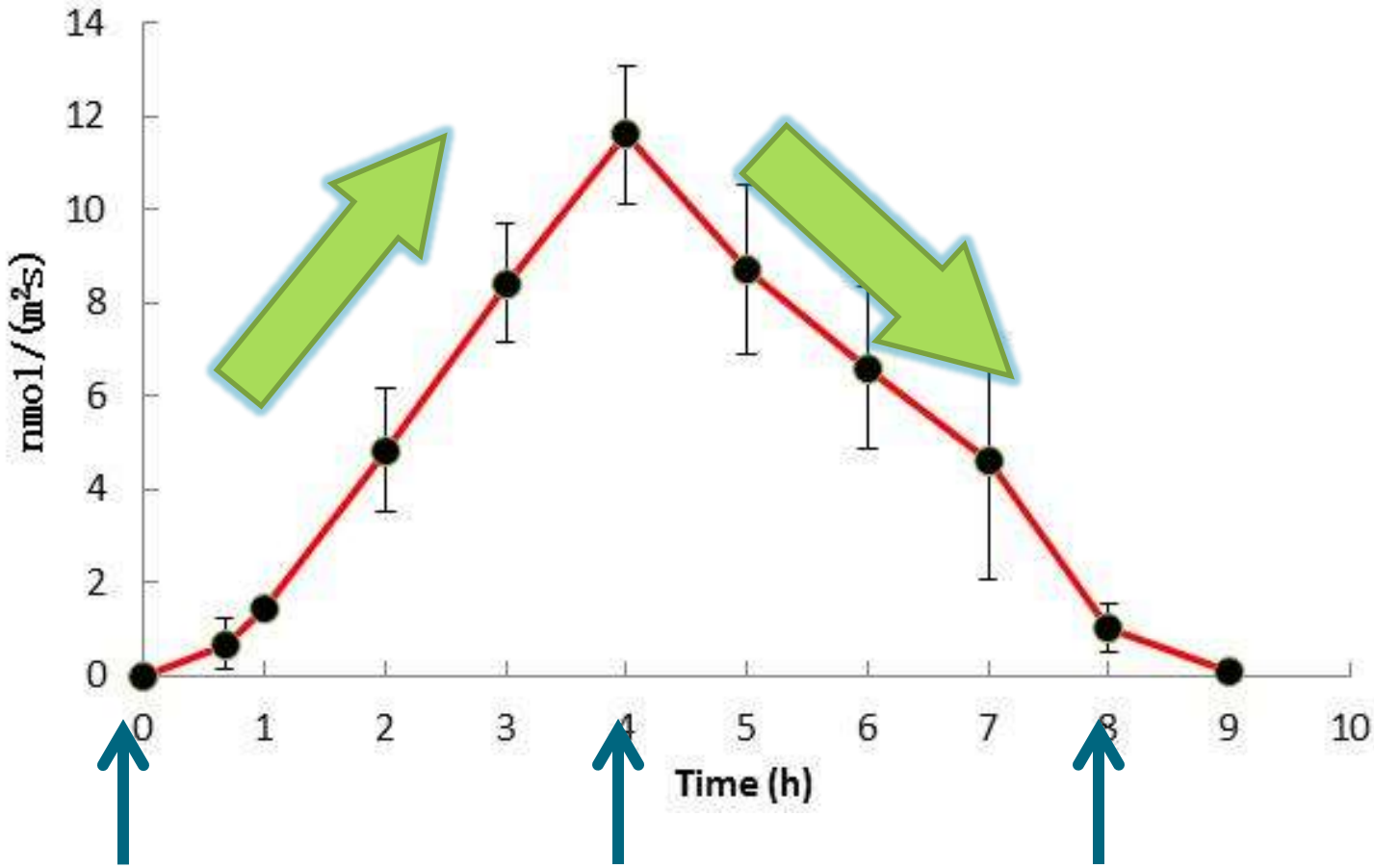
High N





Short-term N addition experiment:

N_2O fluxes responding to 1.4 gN/m^2



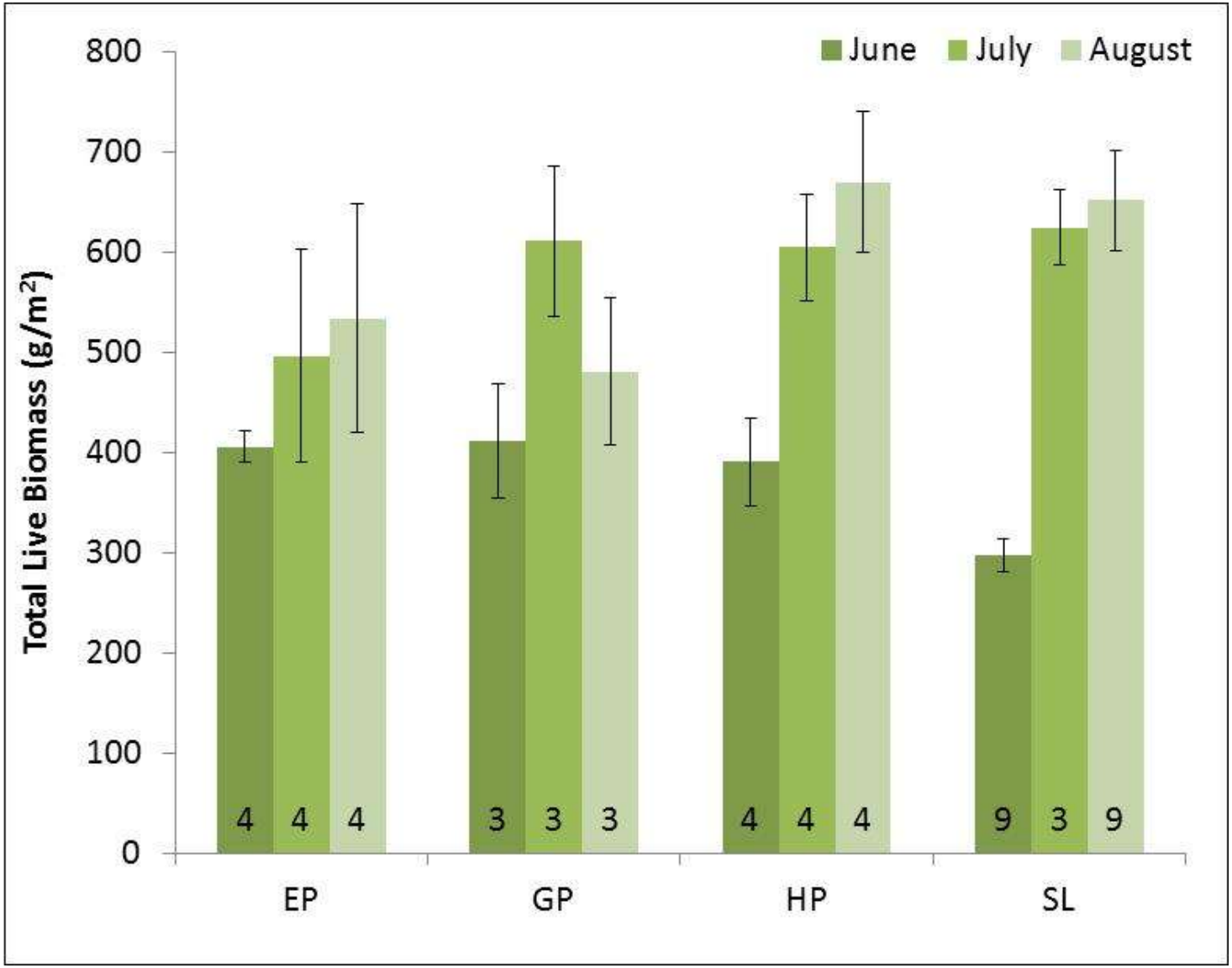
Adding time ： 11:50-11:55 am

High tide started

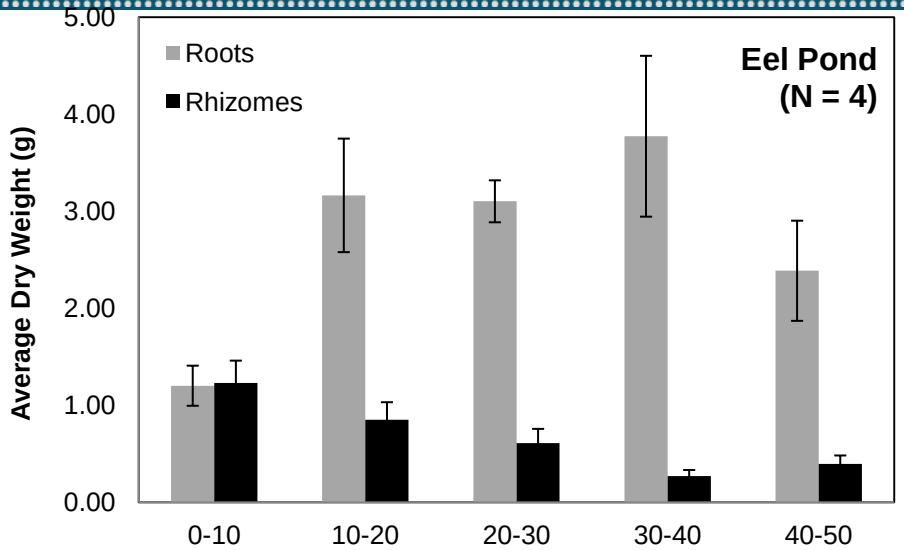
Marsh platform was flooded

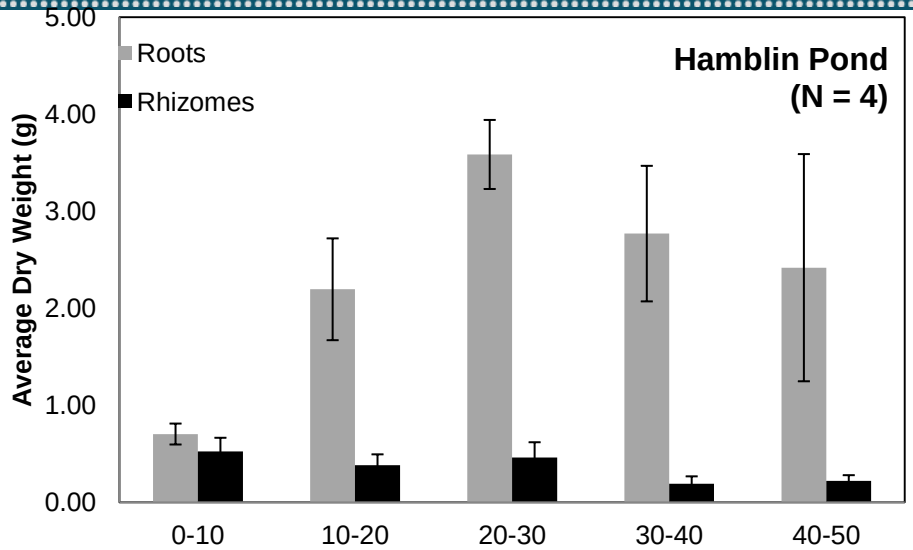
Aboveground biomass

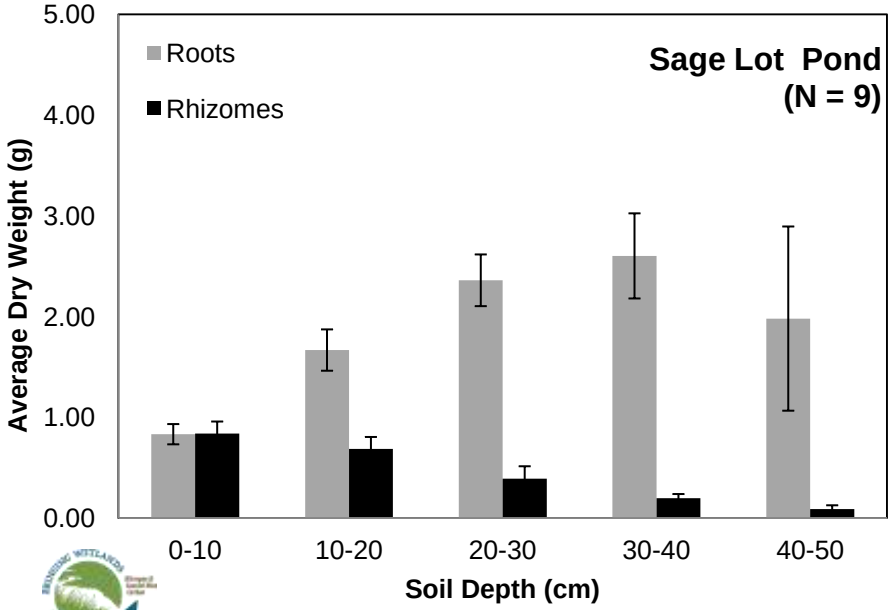
gC ≈ g biomass/2

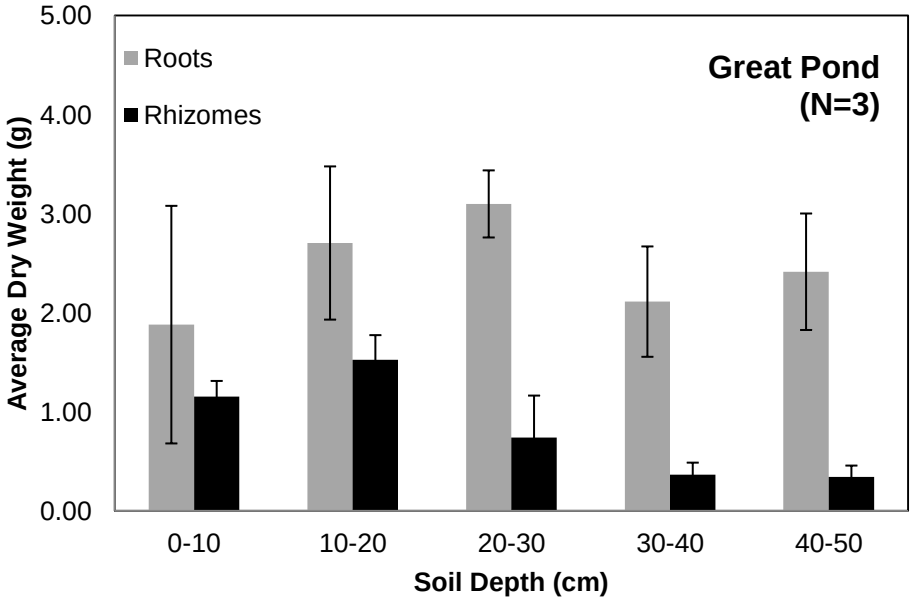


Root and Rhizome biomass

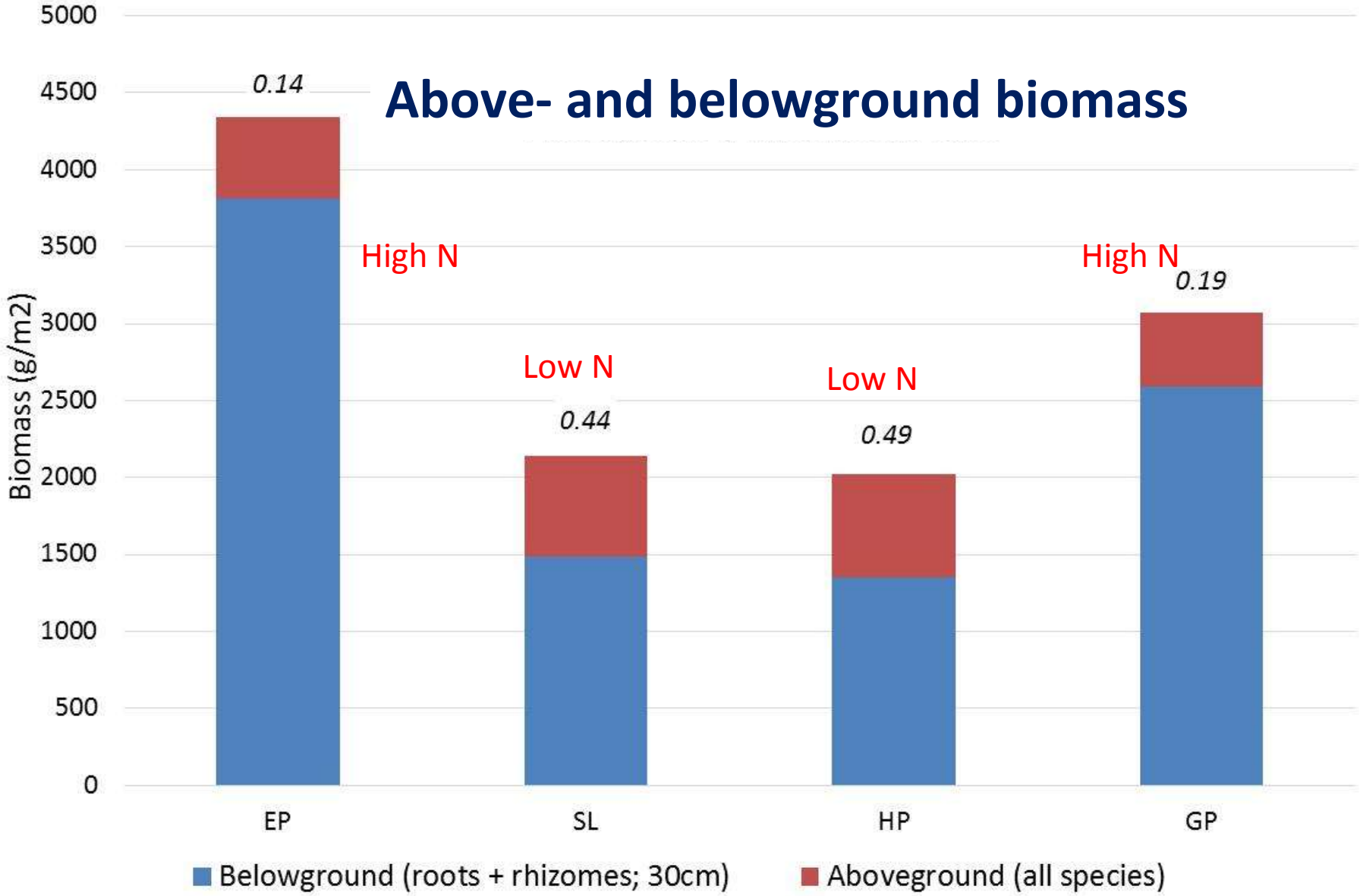






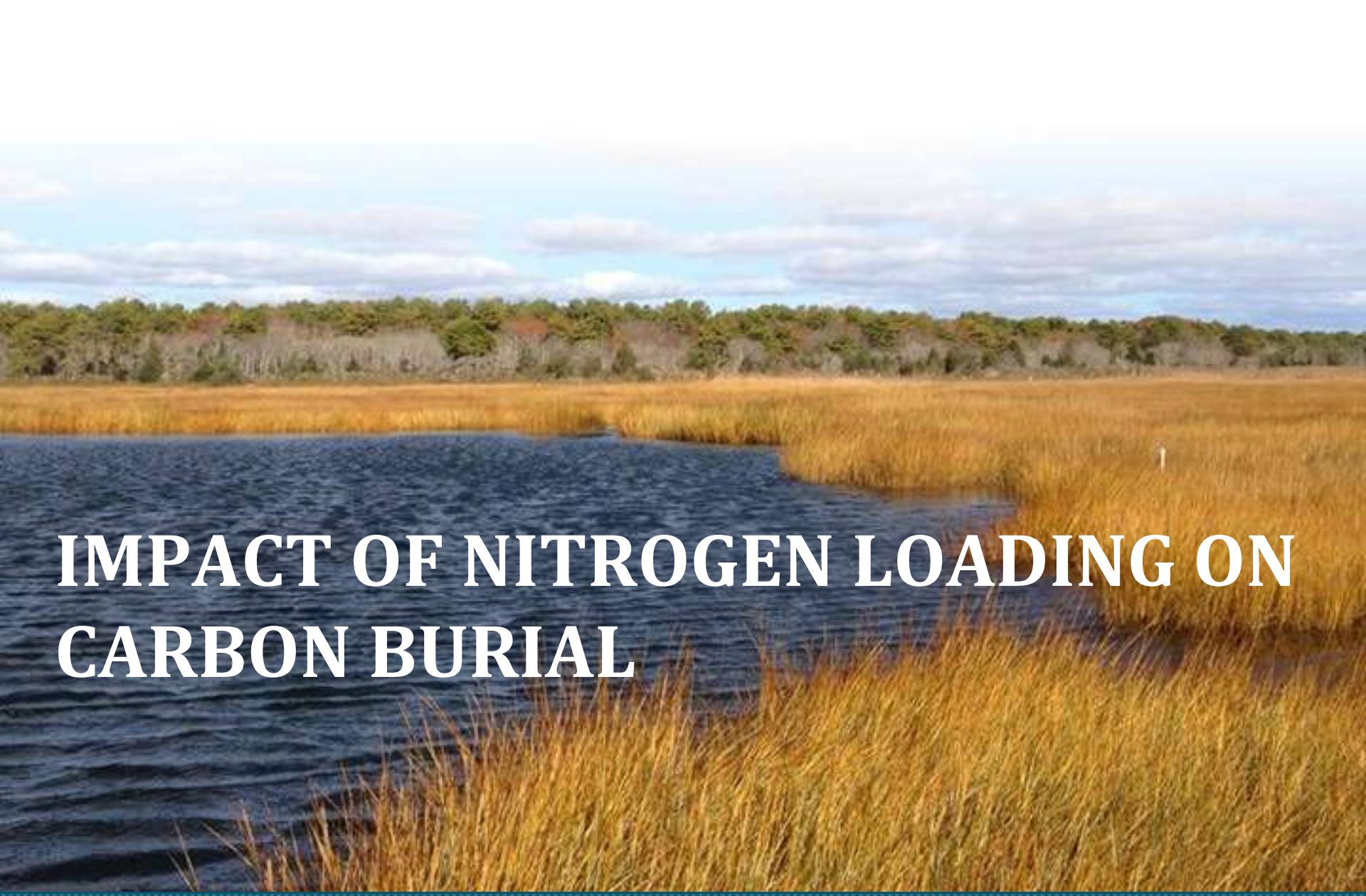


Above- and belowground biomass



Preliminary conclusions

- Small amounts of N loading (1-10 gN $m^{-2}y^{-1}$) did not change the carbon fluxes, likely because N loaded via groundwater was primarily used by microbes and phytoplankton. Salt marsh and GHG emissions may be significantly changed when N loading increased to a threshold level.
- N_2O fluxes are not significant in these salt marshes, but adding N may result in high N_2O fluxes.
- Higher belowground biomass were found in relatively high N loading marshes, but not seen for aboveground biomass.

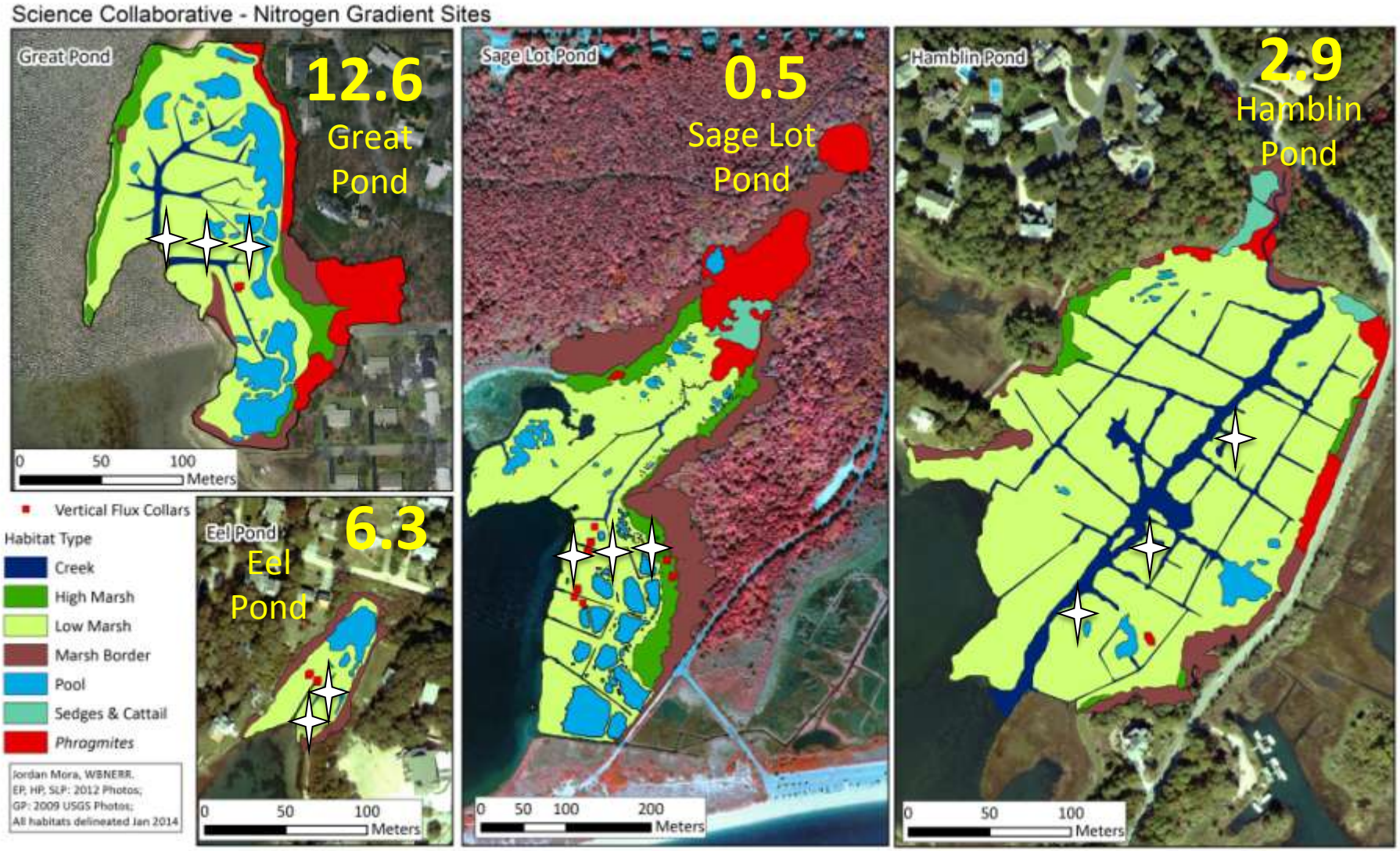


IMPACT OF NITROGEN LOADING ON CARBON BURIAL

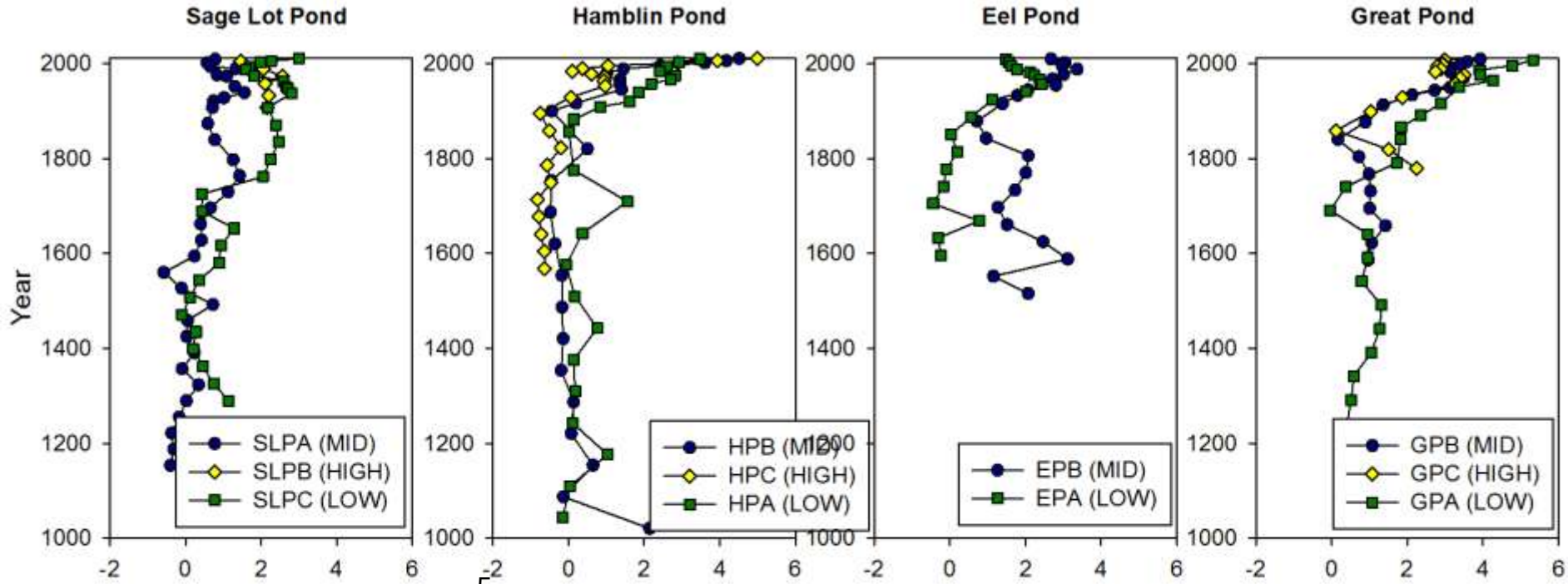
There is a moderate nitrogen loading gradient to Waquoit Bay marshes.

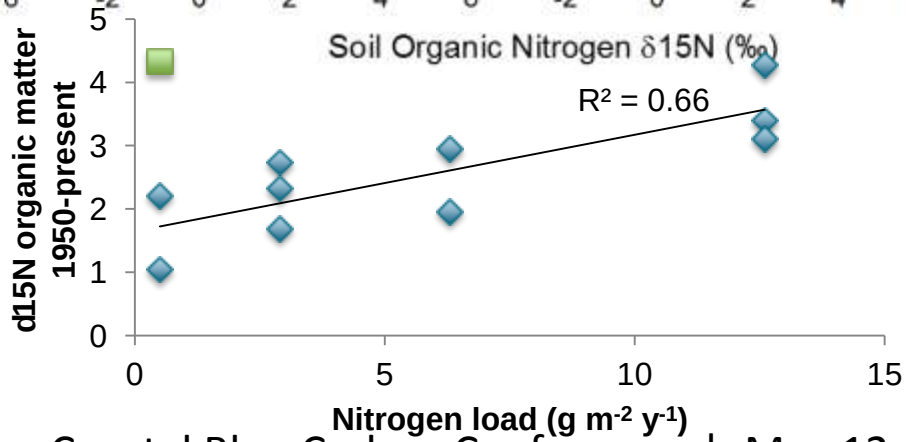
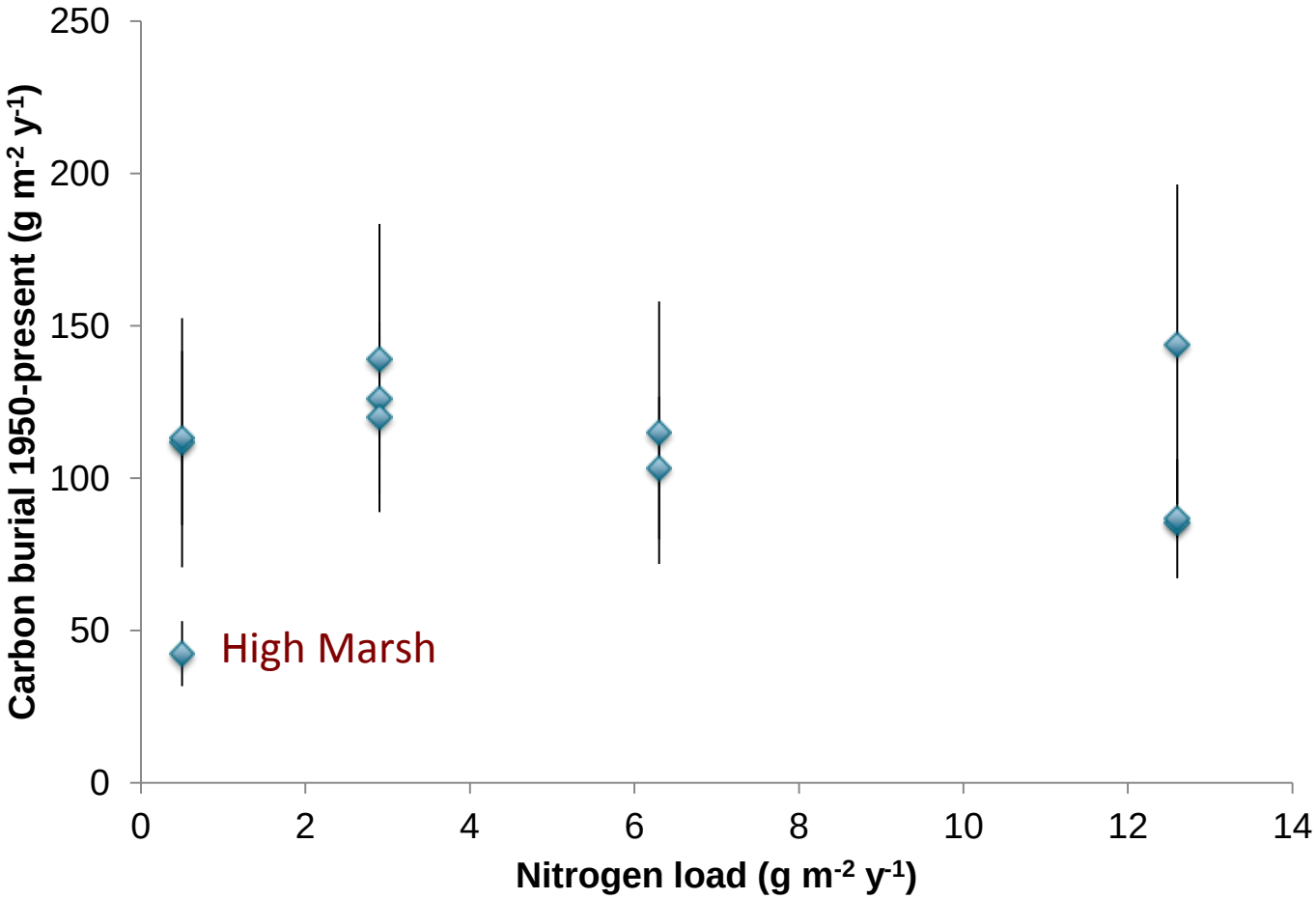
Core locations

0.5 N Loading g/m²/year



Nitrogen isotopes indicate anthropogenic additions are increasing across the salt marshes.





There is no difference in carbon burial across the nitrogen gradient within Waquoit Bay.