

# Temporal Dynamics of Methane Fluxes in a Temperate Urban Wetland

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## Rationale

Carbon, water and especially methane fluxes, particularly in urban ecosystems, are not well understood. Especially as urban centers are increasing and are large sources of CO<sub>2</sub> emissions, understanding these dynamics become crucial. Urban Ecology is an emerging field in dire need to understand structure and function of urban ecosystems and with it occurring biogeochemical fluxes.

Ecosystem function in urban areas depend not only on biotic or abiotic factors but also sociological and economic factors. Wetlands in the Meadowlands are managed and thus their structure and function has implication to management policies.

## Hypothesis

- The Meadowlands are a CO<sub>2</sub> sink within an urban ecosystem that may offset CH<sub>4</sub> release
- The CO<sub>2</sub> fluxes depend on environmental conditions such as temperature, and light
- Changes in CO<sub>2</sub> concentration through nearby CO<sub>2</sub> sources will have consequences for ecosystem-scale processes
- CH<sub>4</sub> production and release will be coupled with CO<sub>2</sub> production and release

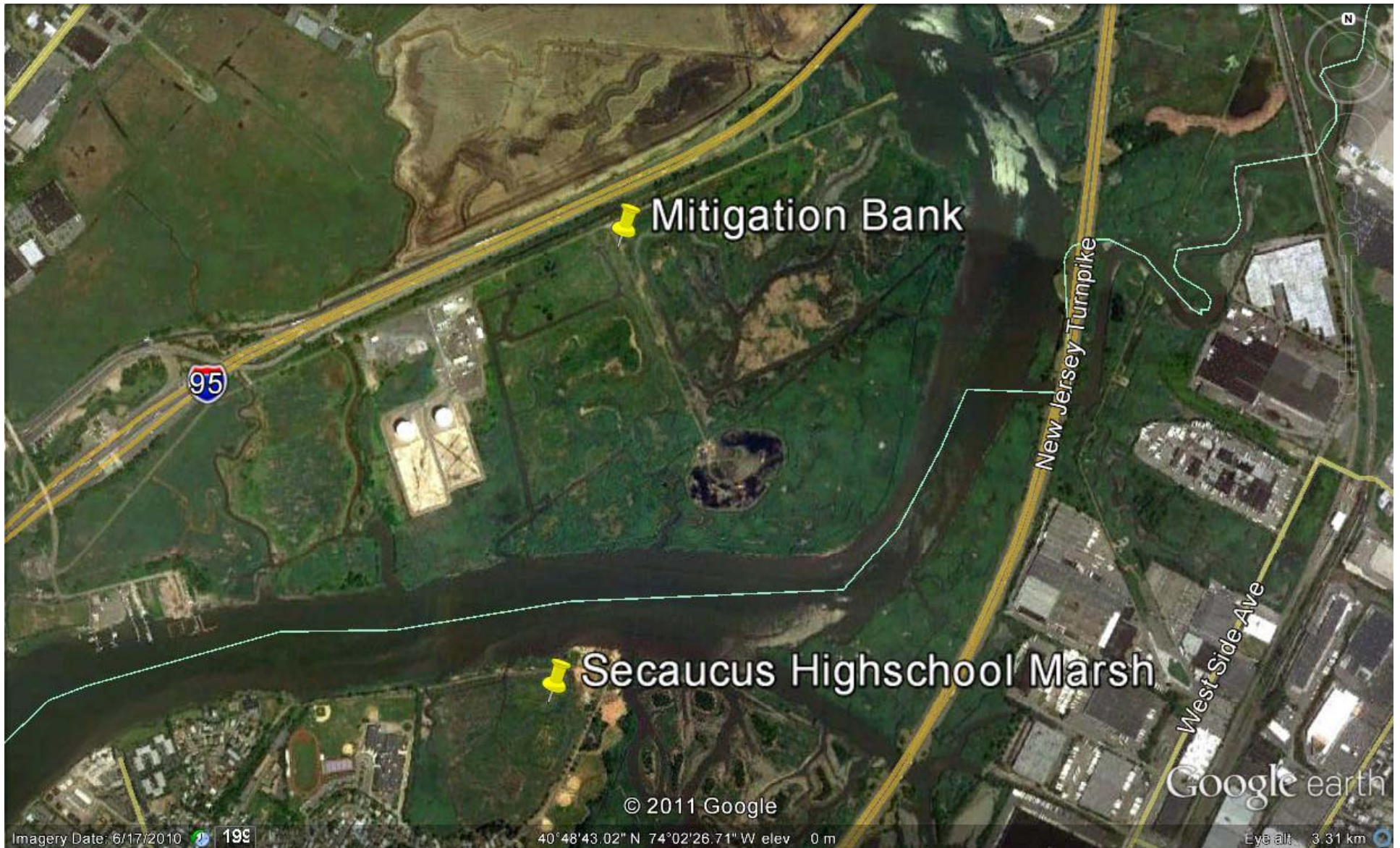
## Materials & Methods

- Eddy covariance measurements of  $\text{CO}_2$ ,  $\text{H}_2\text{O}$ ,  $\text{CH}_4$  ( $\text{CO}_2/\text{H}_2\text{O}$  – LI7500,  $\text{CH}_4$  analyzer LI7700)
- Air temperature, humidity, light, precipitation, -continuous
- Biomass harvest
- Gas-exchange measurements on leaves
- Carbon isotope measurements of leaves where gas exchange was measured
- Soil samples for C, nutrient and metal analysis
- Chamber measurements of  $\text{CH}_4$





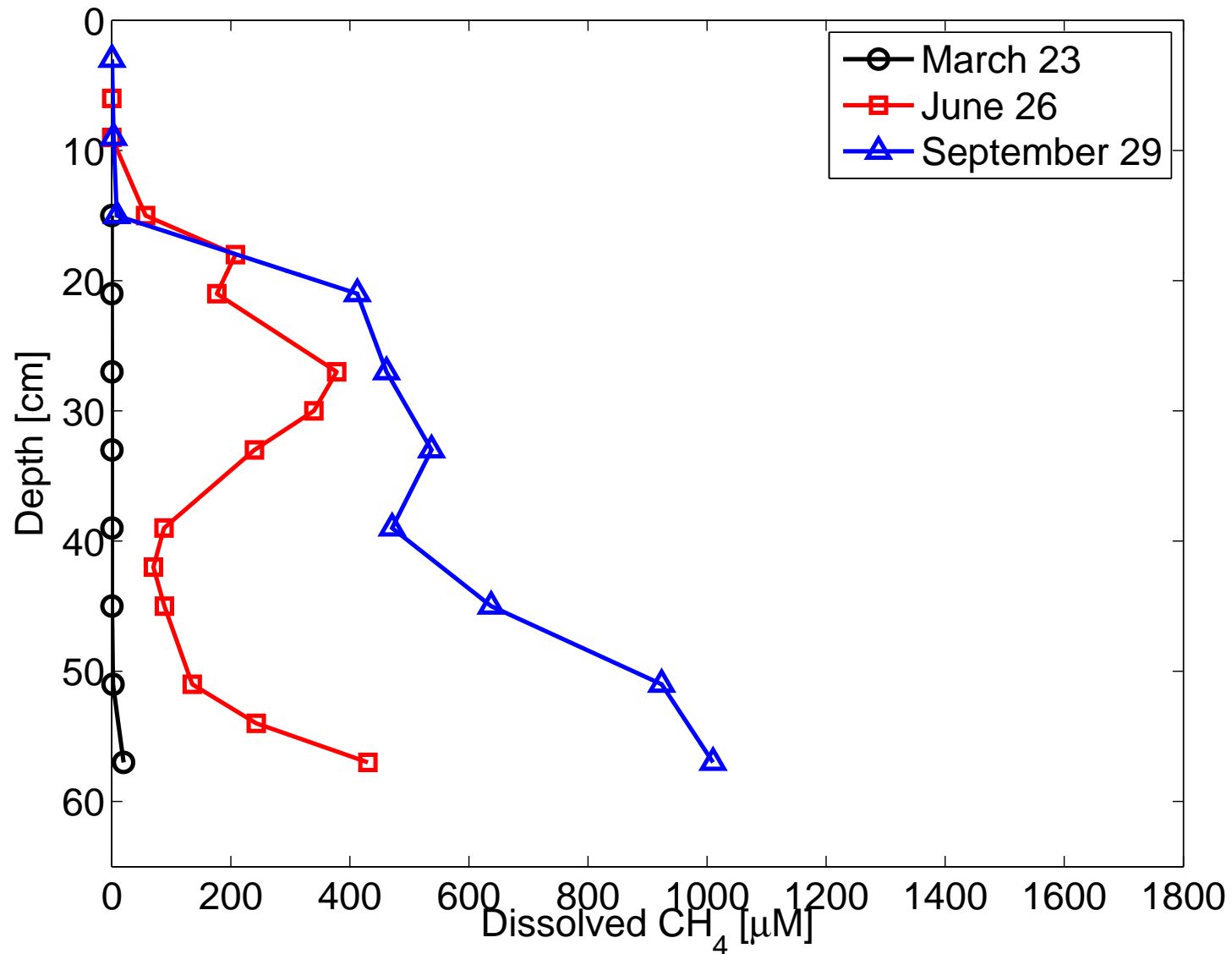
# Site



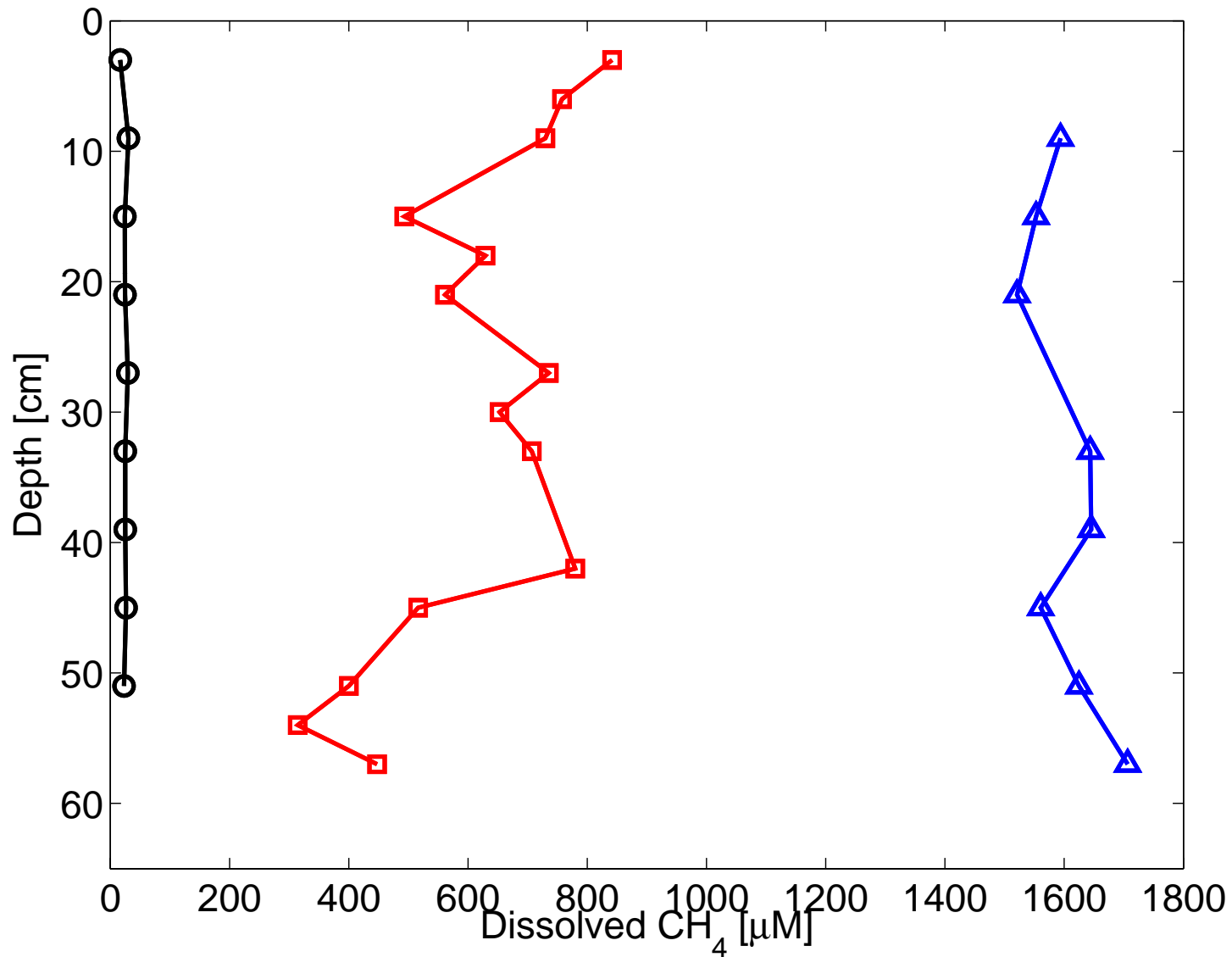




# Porewater vegetated area $F_{CH_4}$



# Porewater mud flat $F_{\text{CH}_4}$







Parameterization for  $\text{CH}_4$  fluxes through plants requires detailed anatomical and morphological data

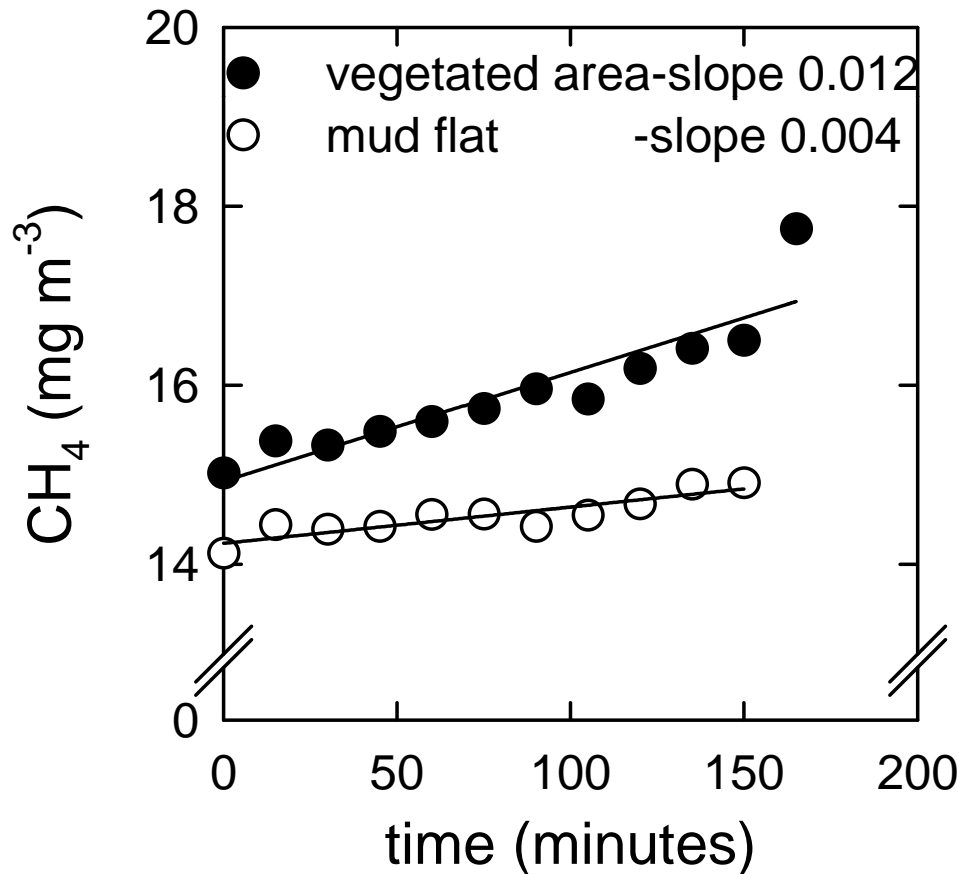






# Chamber $F_{\text{CH}_4}$

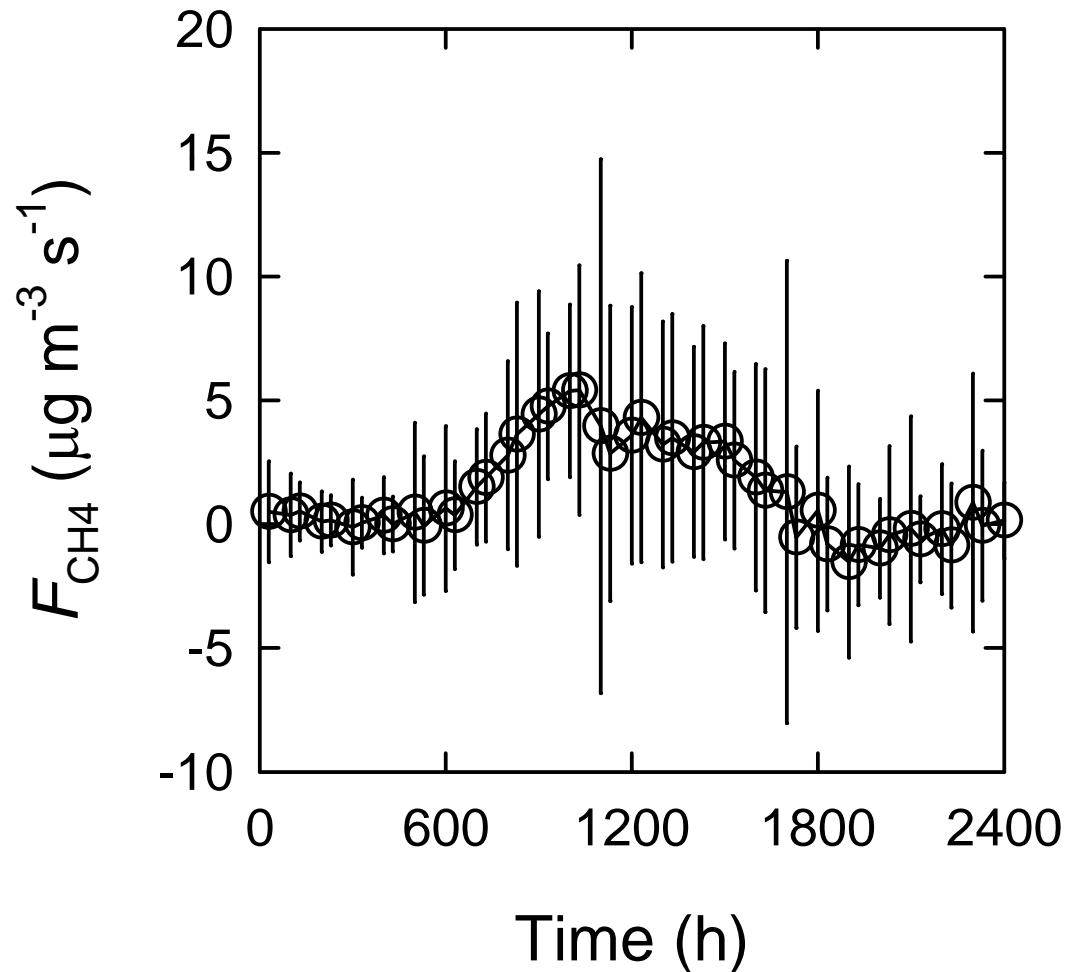
Marsh Resource Meadowlands  
Mitigation Bank





$F_{\text{CH}_4}$  daily

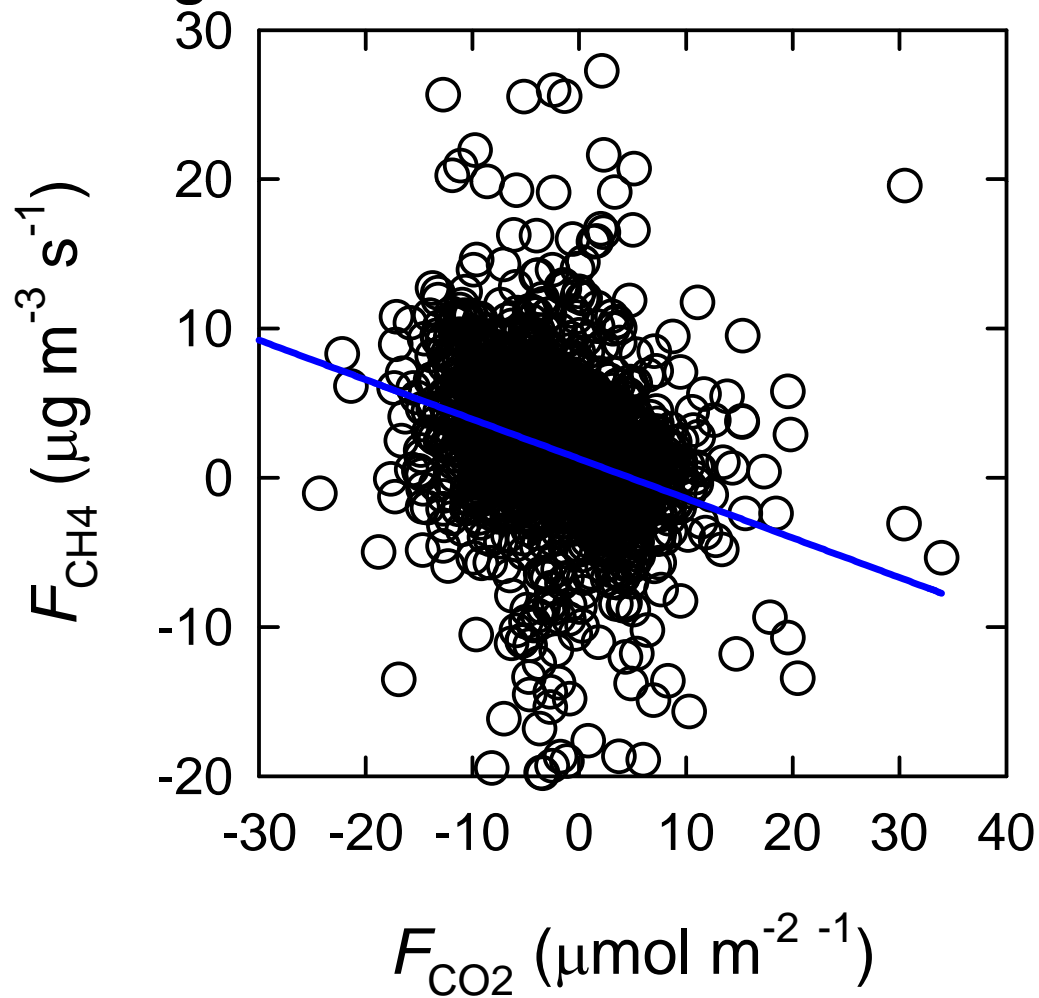
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mean –  
120 mg  $\text{CH}_4$   
per day

# $F_{\text{CH}_4}$ response to $F_{\text{CO}_2}$

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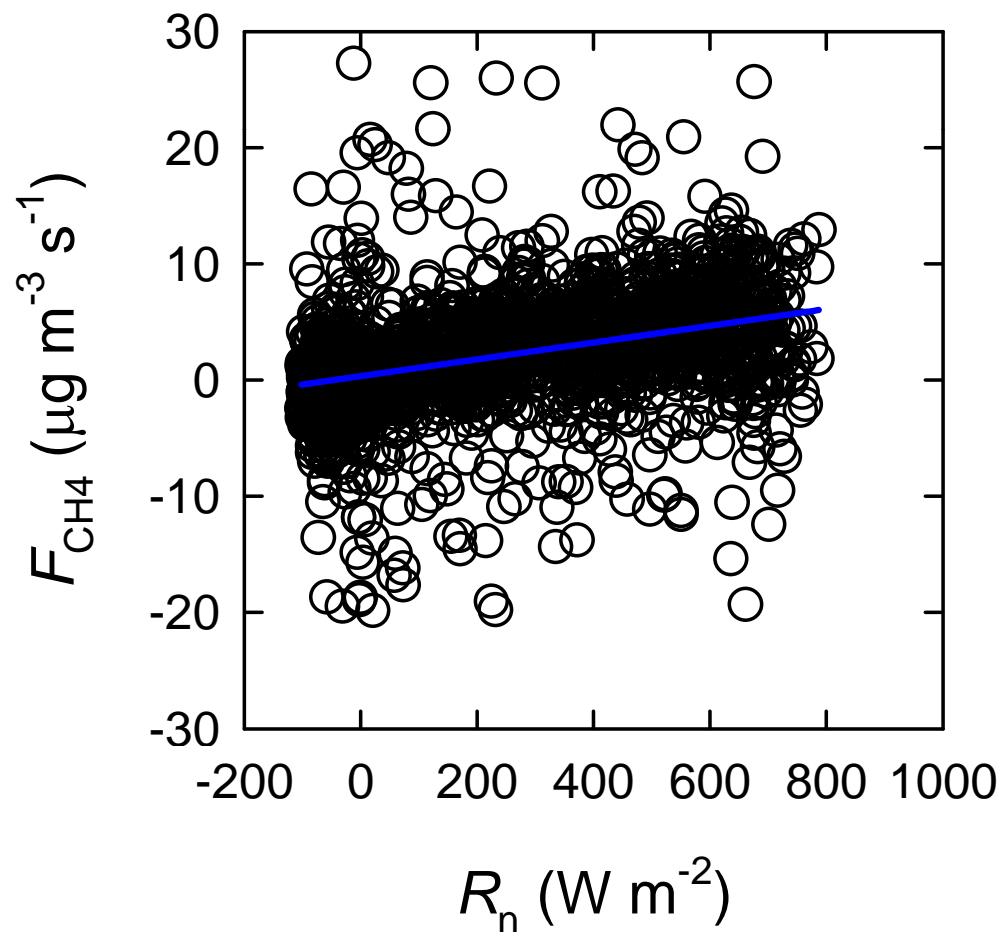


$$R^2 = 0.11$$

$$p < 0.0001$$

# $F_{\text{CH}_4}$ response to $R_n$

Marsh Resource Meadowlands  
Mitigation Bank

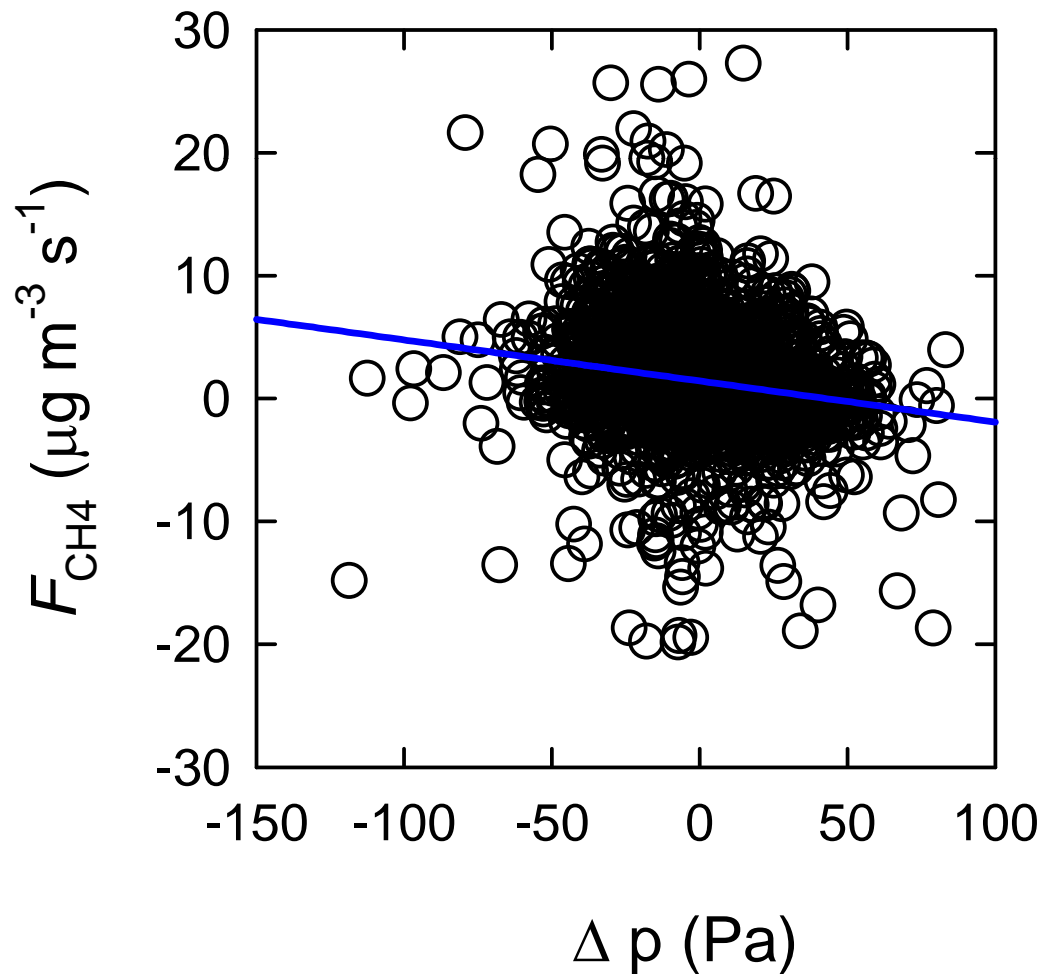


$R^2 = 0.16$   
 $p < 0.0001$



$$F_{\text{CH}_4} = f(\text{pressure differential})$$

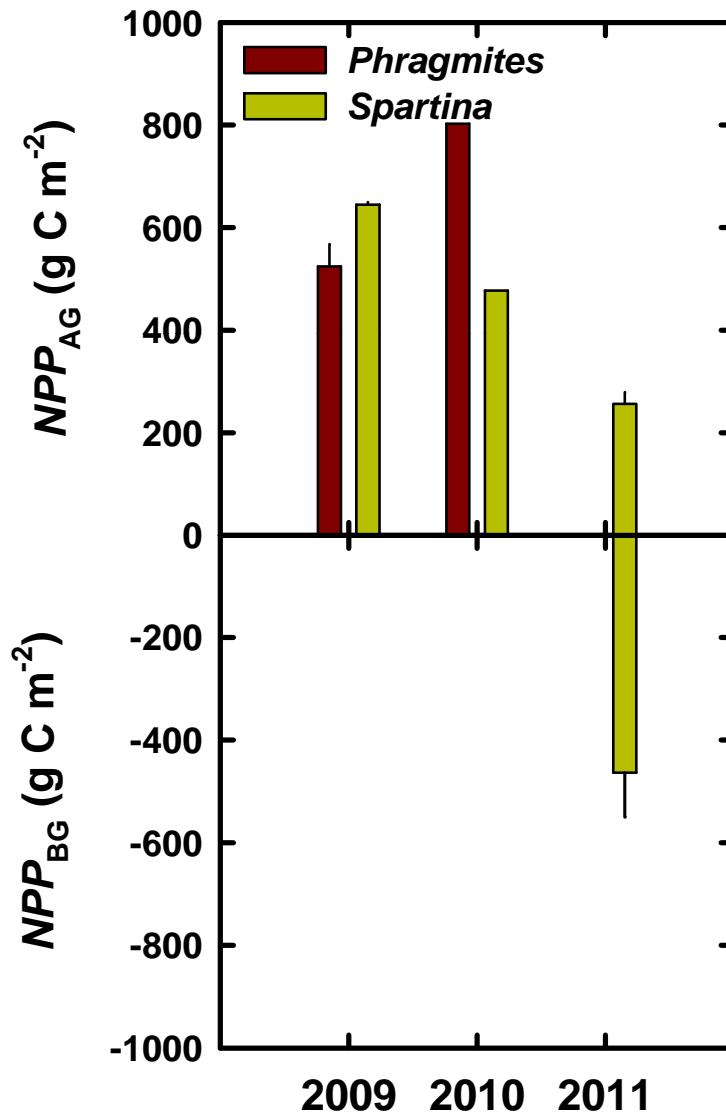
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$R^2 = 0.04$   
 $p < 0.0001$

# Biomass – *NPP*

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- Actively managed area where *Phragmites* was eliminated in 2011

- Belowground assessment in 2011 for *Spartina* only

## Summary

- The NJ Meadowlands are a significant CH<sub>4</sub> source, but CH<sub>4</sub> production and release seems to be only weakly correlated to environmental drivers, shows strongest correlation to CO<sub>2</sub> fluxes
- Marked differences in space and time of CH<sub>4</sub> fluxes



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