

# Saltwater intrusion alters nitrogen and carbon export from a restored coastal plain wetland (North Carolina, USA)

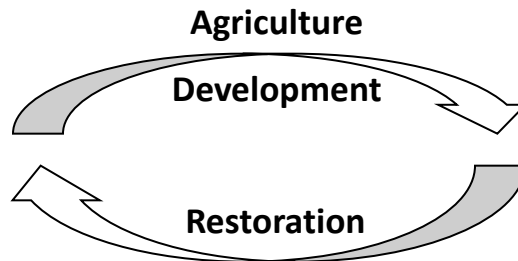


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# Wetland restoration

How do drought and saltwater intrusion alter carbon and nitrogen retention in a coastal plain freshwater restored wetland?



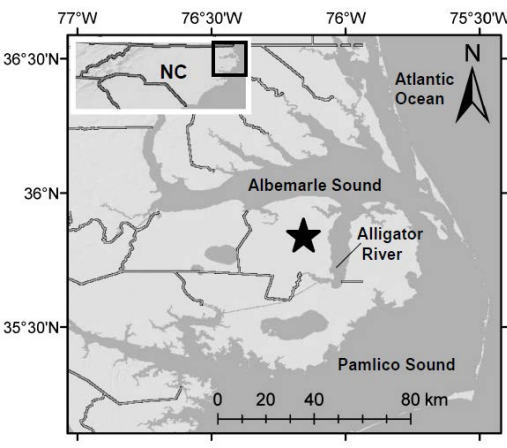
**Sea level rise**

**Climate driven  
changes in  
hydrology**



Carter 1975 Science

# Timberlake Restoration Project



- Privately owned 1000ha mitigation bank
- Focus → 440ha agricultural field (formerly pumped)
- Two constrained inflows – single outflow
- Surrounded by preservation wetlands
- <5 m range in surface elevation
- Freshwater with wind-driven tides & bidirectional flow

# Mass balance



**OUTFLOW**



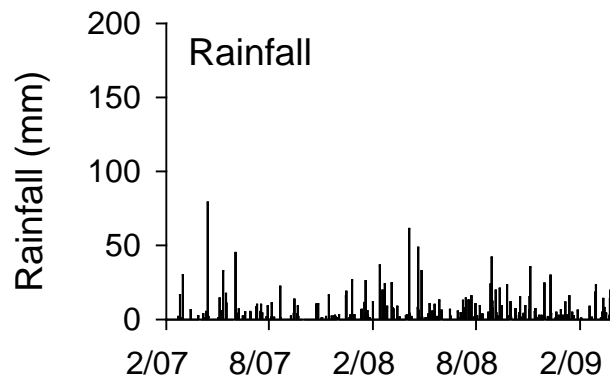
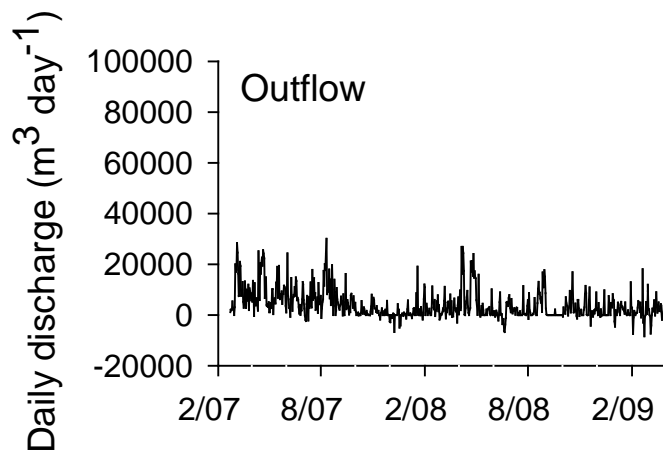
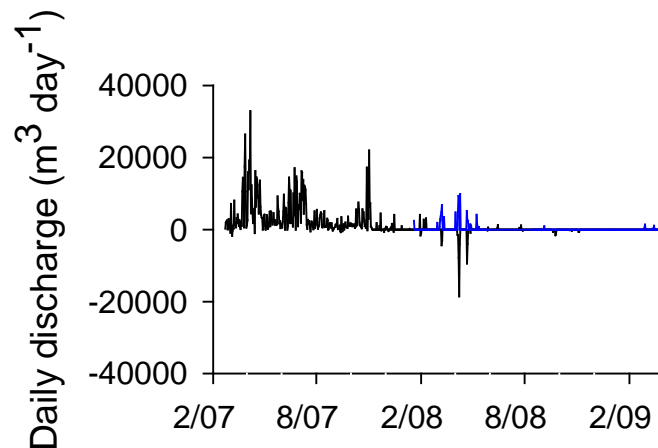
**MIDPOINT**



**2 INFLOWS**

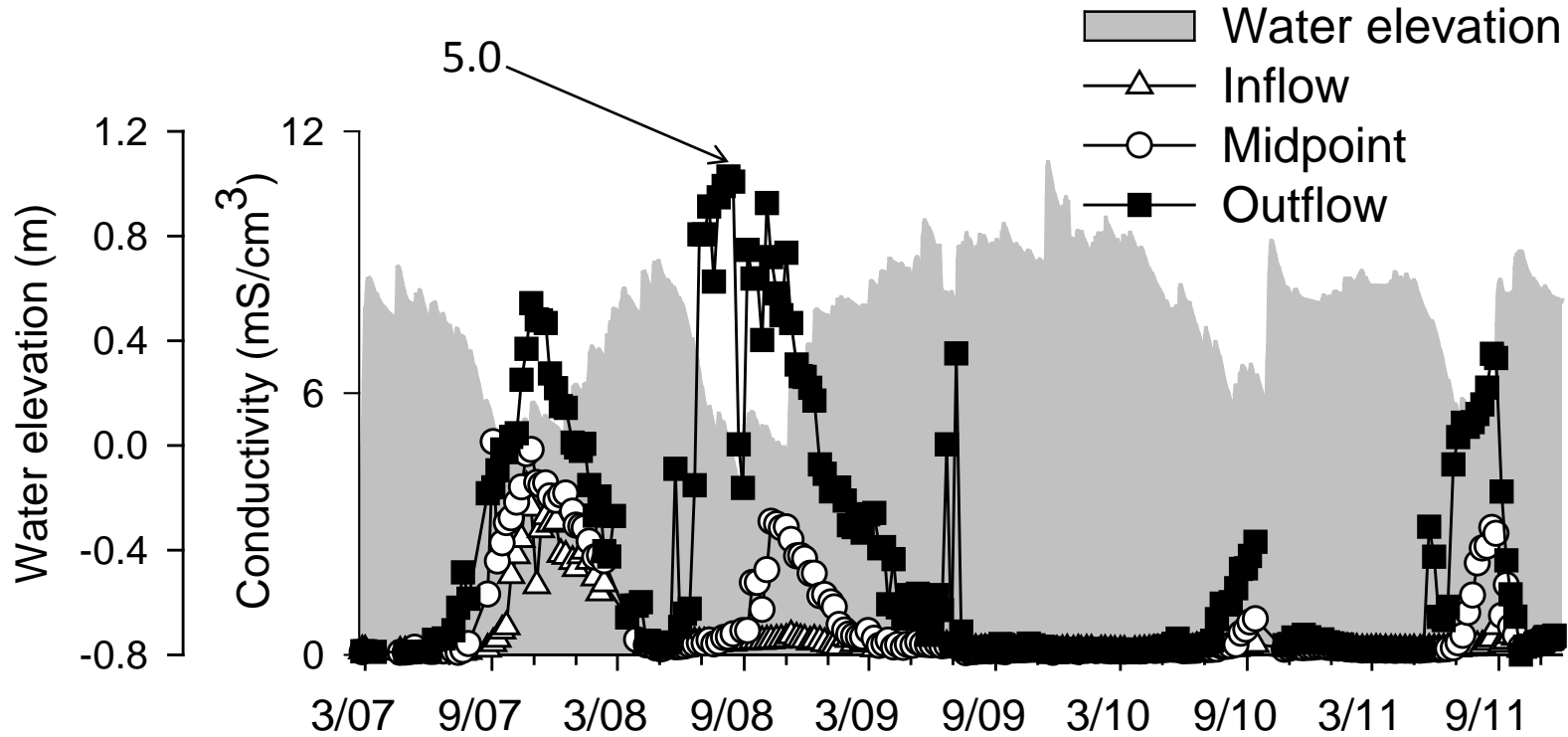


# Water budgets

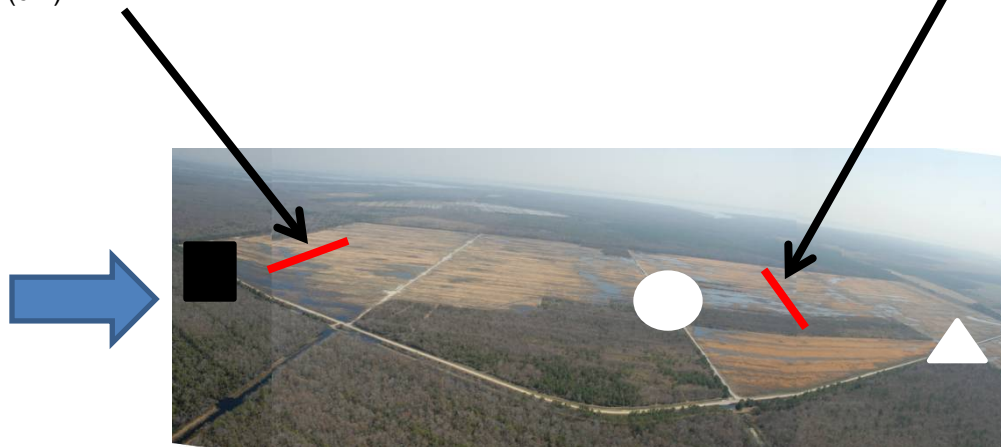
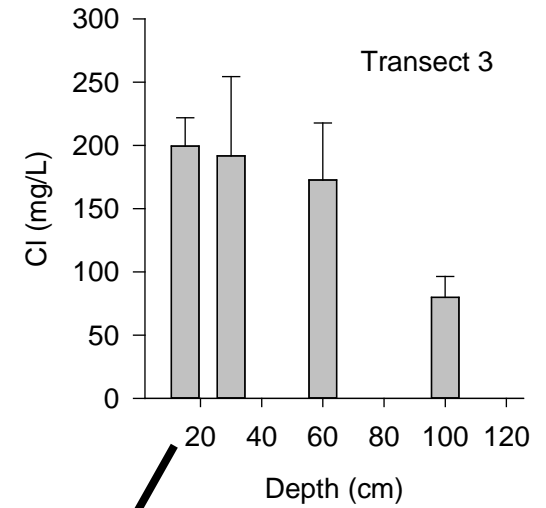
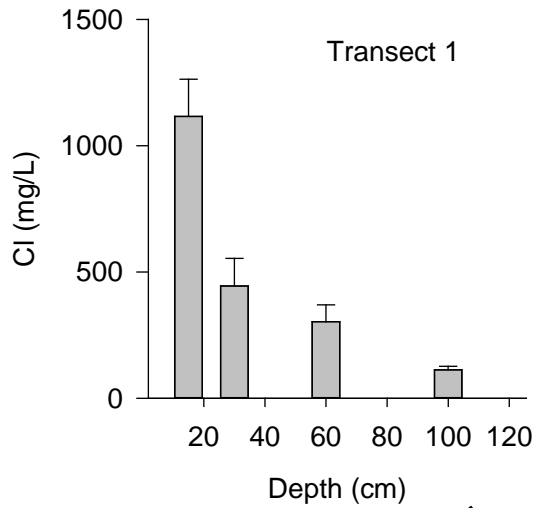


Date

# Drought-induced saltwater intrusion



# Cl<sup>-</sup> concentrations are higher at the soil surface

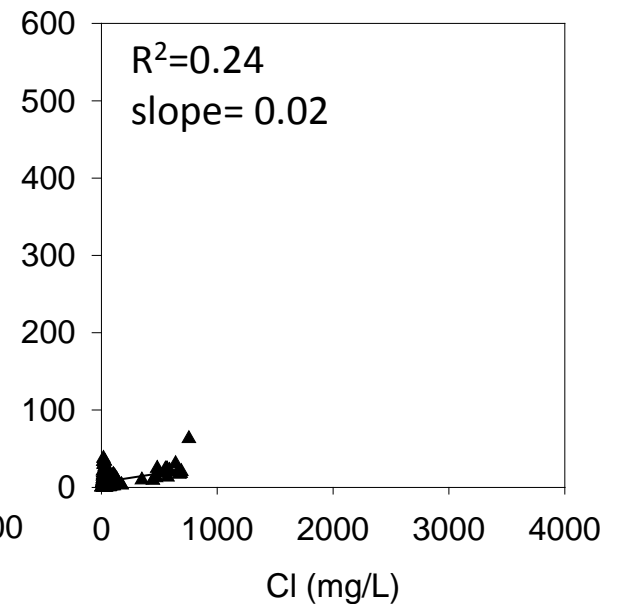
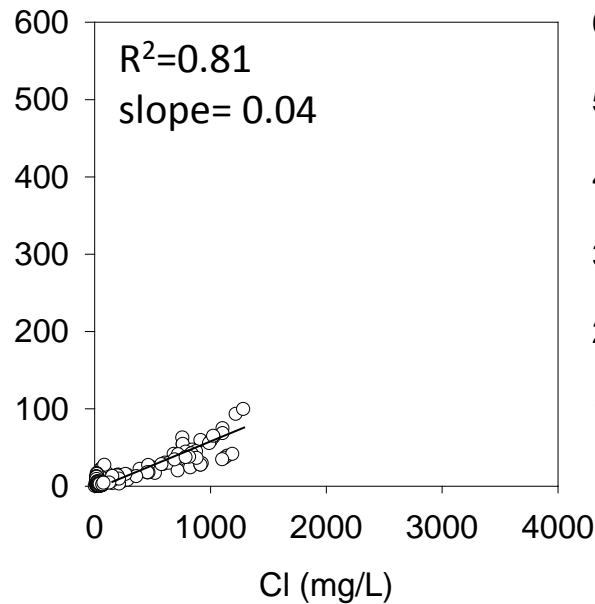
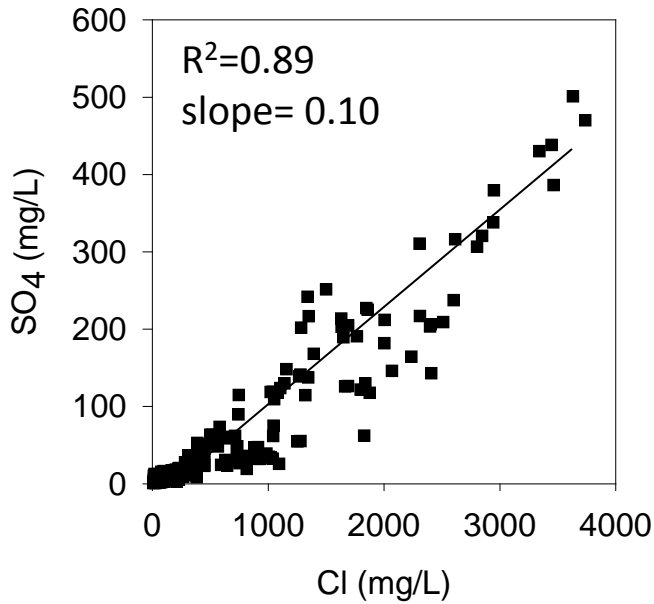


# Cl<sup>-</sup> travels farther upstream than SO<sub>4</sub>

Outflow

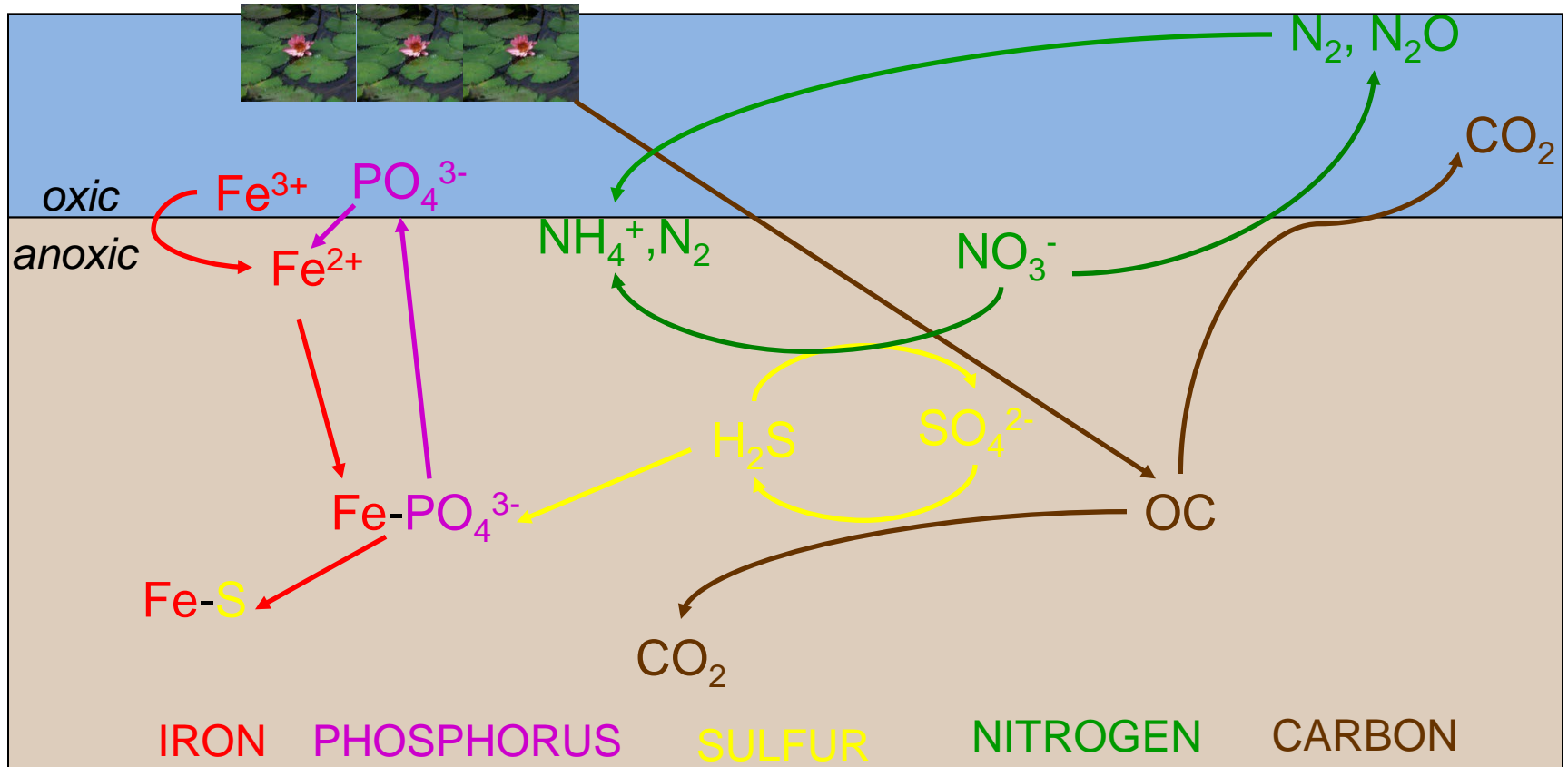
Midpoint

Inflow



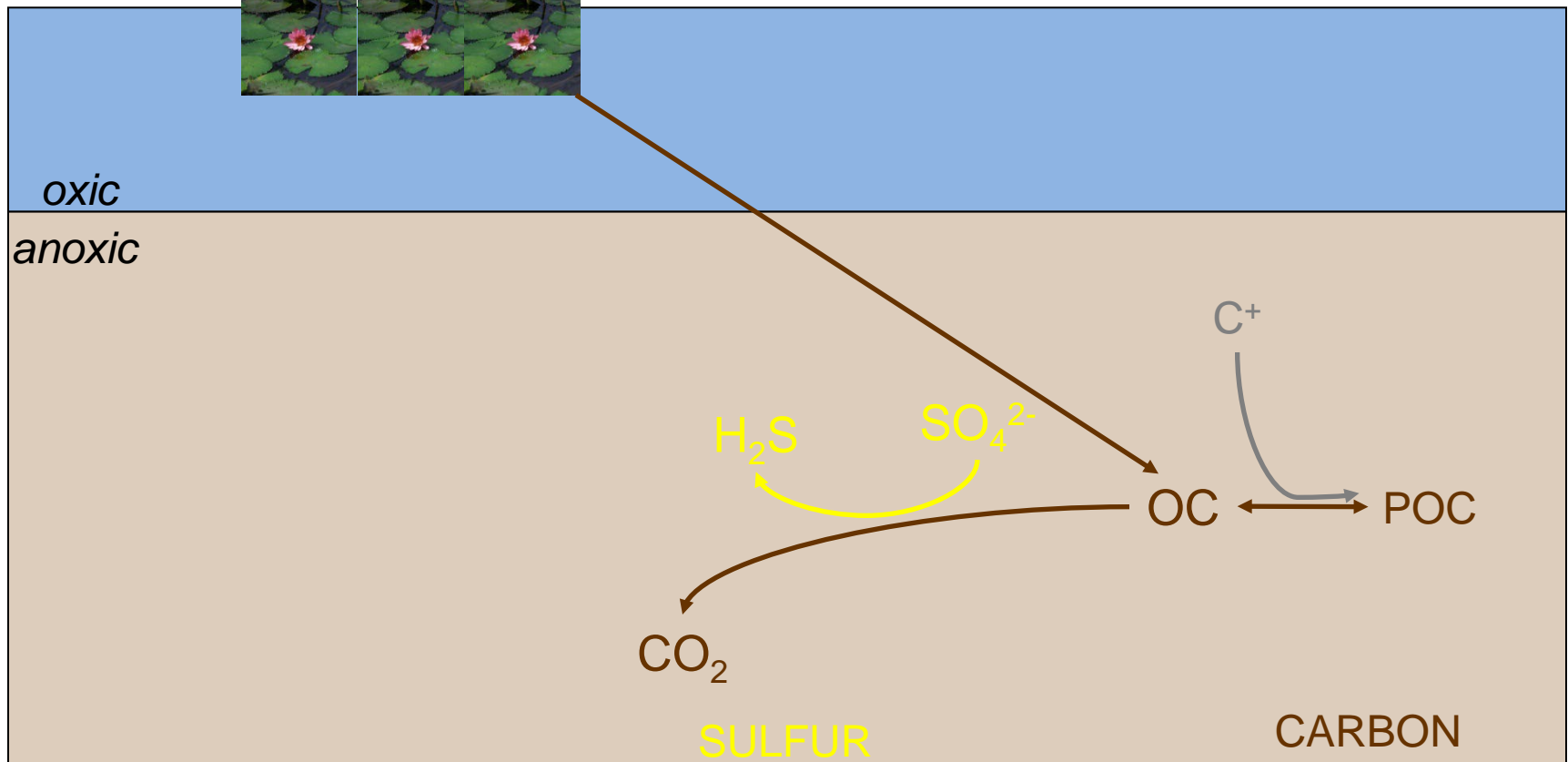


# Predictions

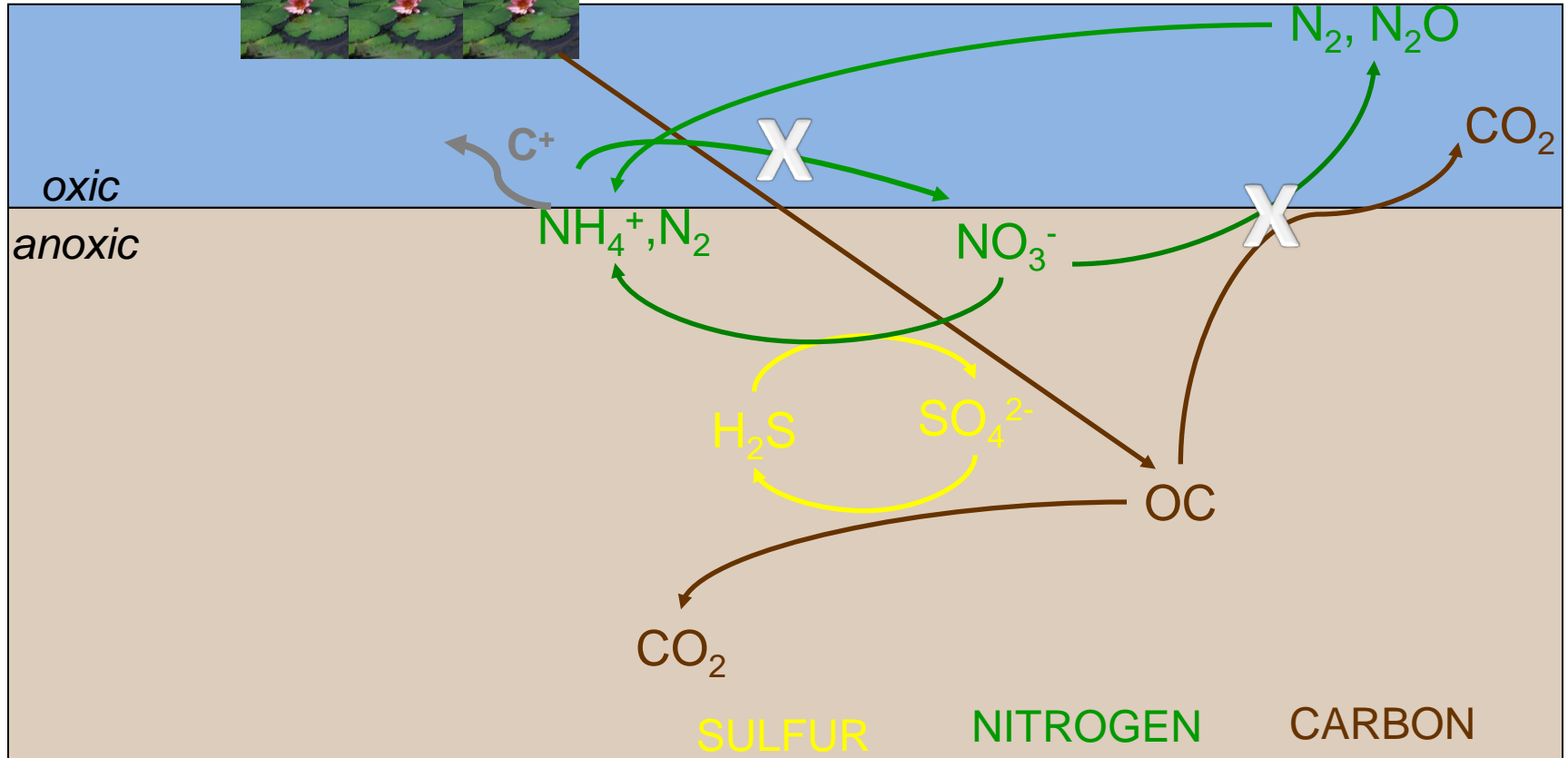
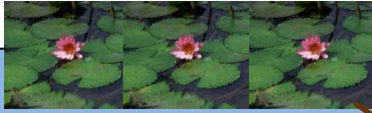
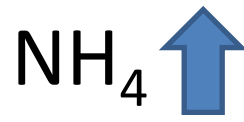


# Predictions

DOC ↓

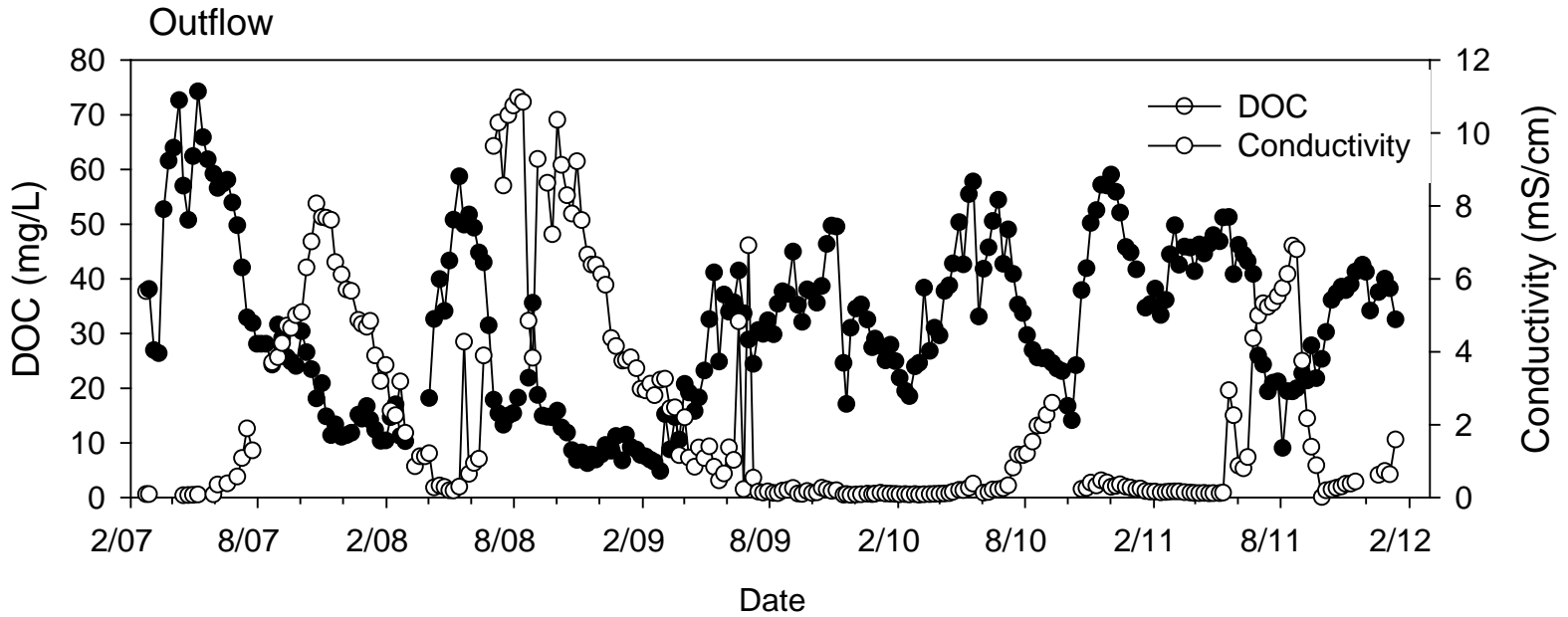
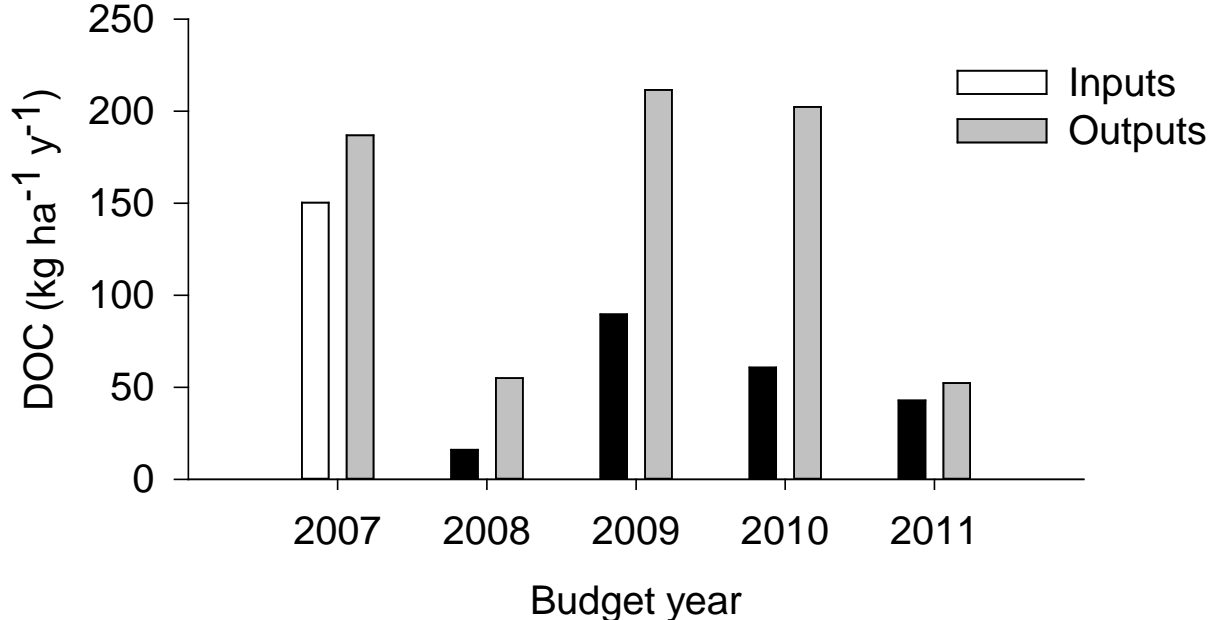


# Predictions



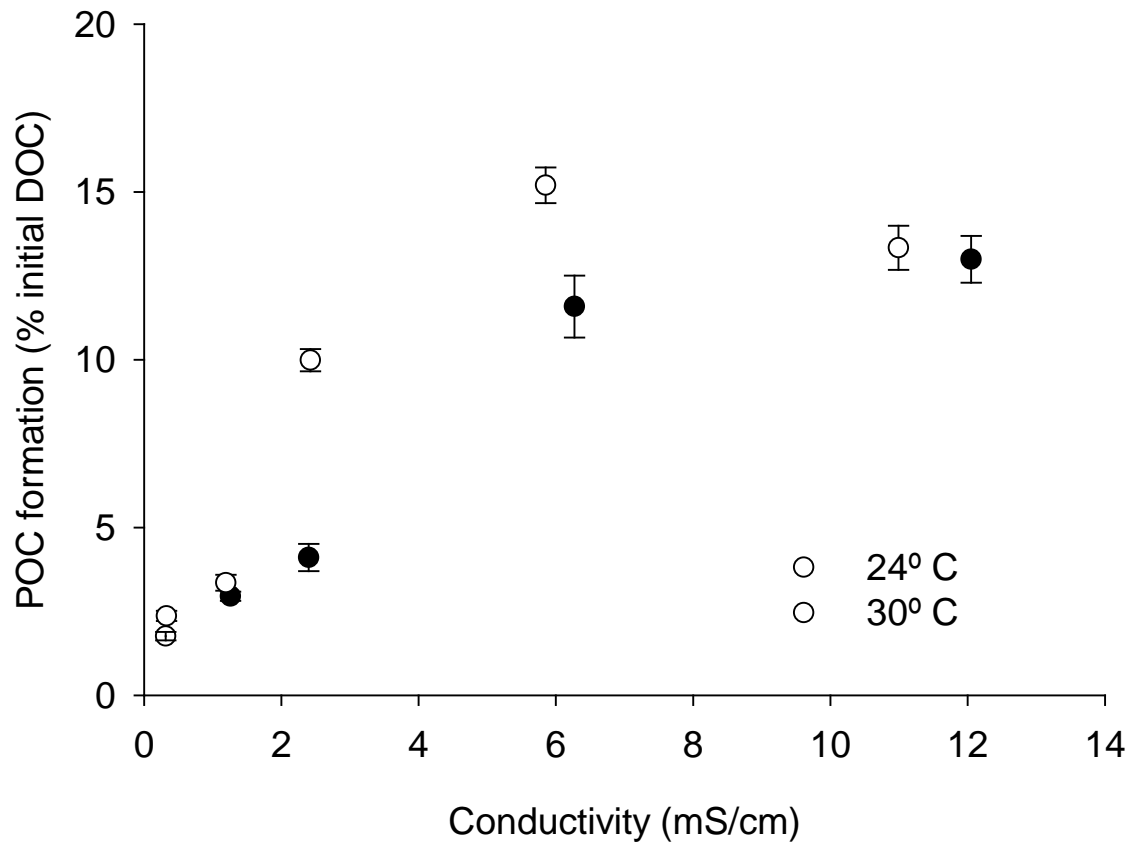
Source of DOC

DOC export ↓ with SWI



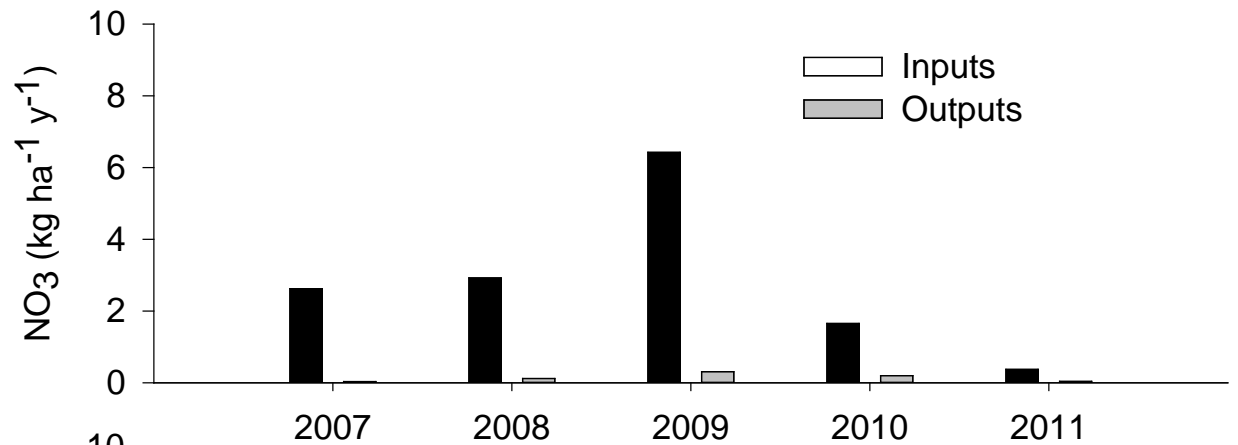
# POC formation with increasing conductivity

## Floc yeah!

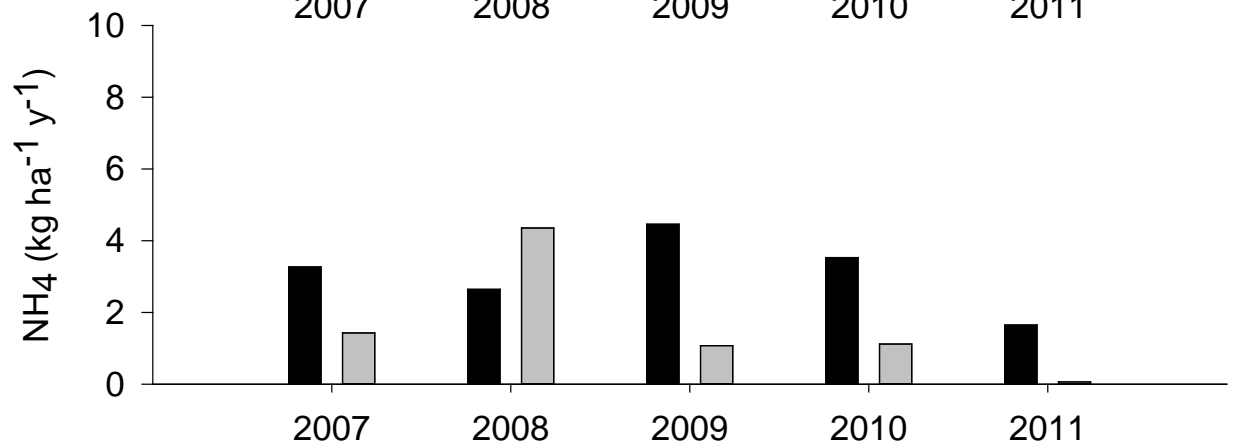


→  
+ Conductivity

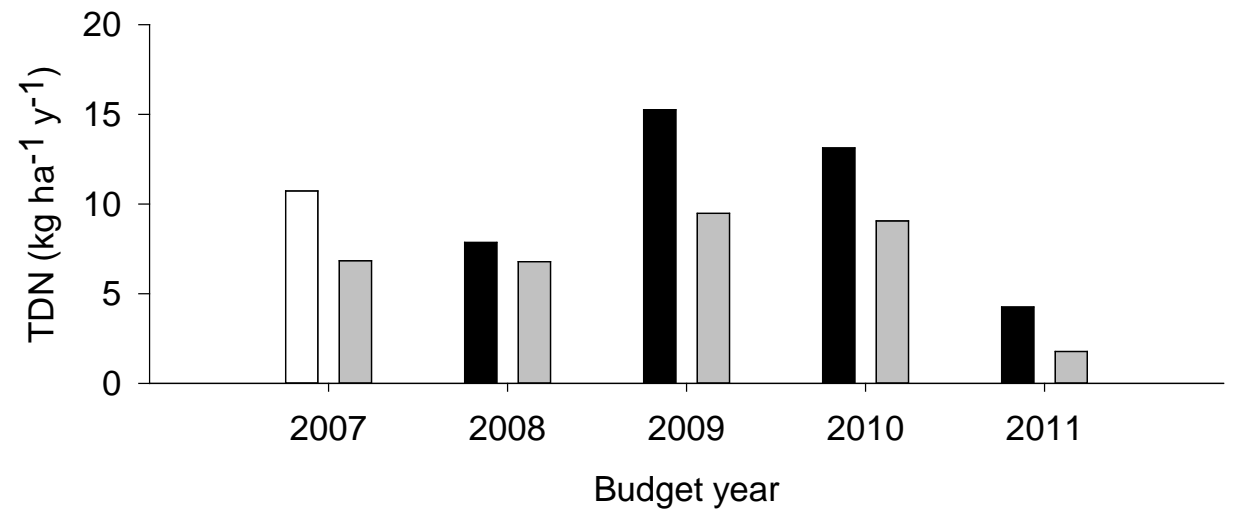
NO<sub>3</sub> sink



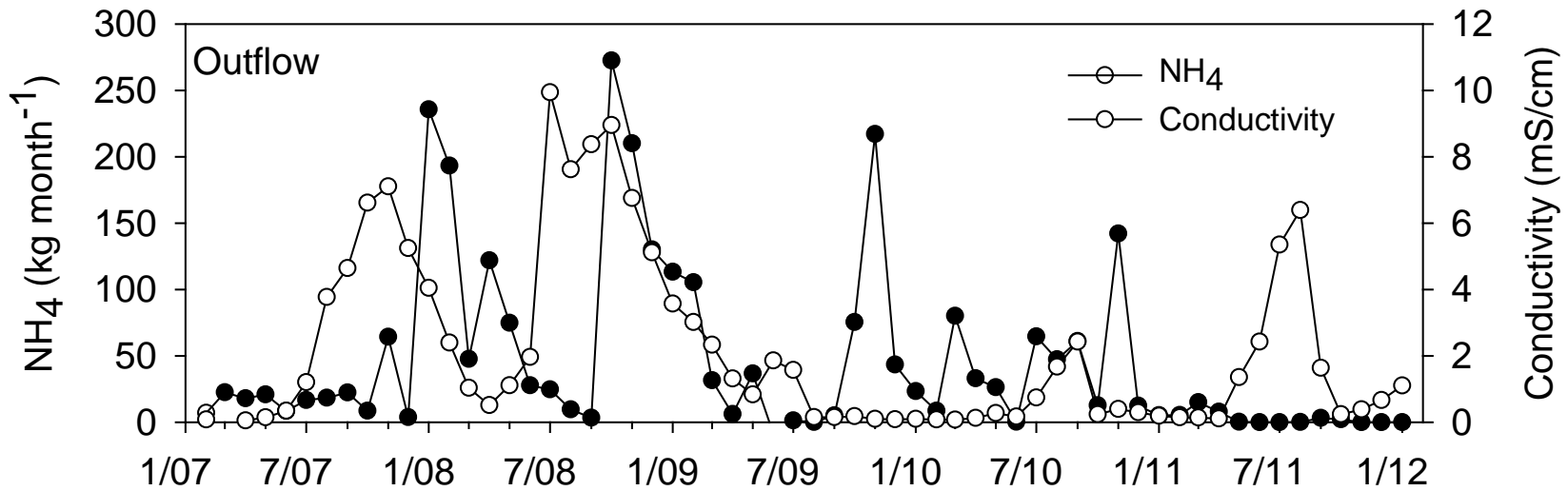
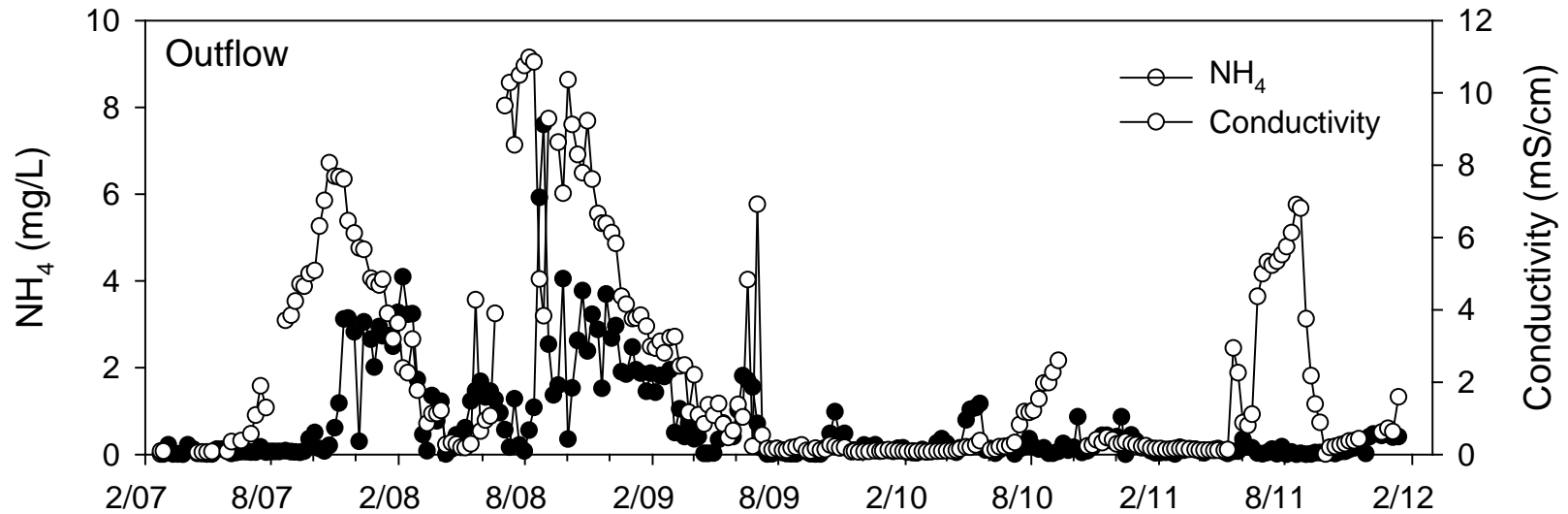
NH<sub>4</sub> sink/source



TDN sink

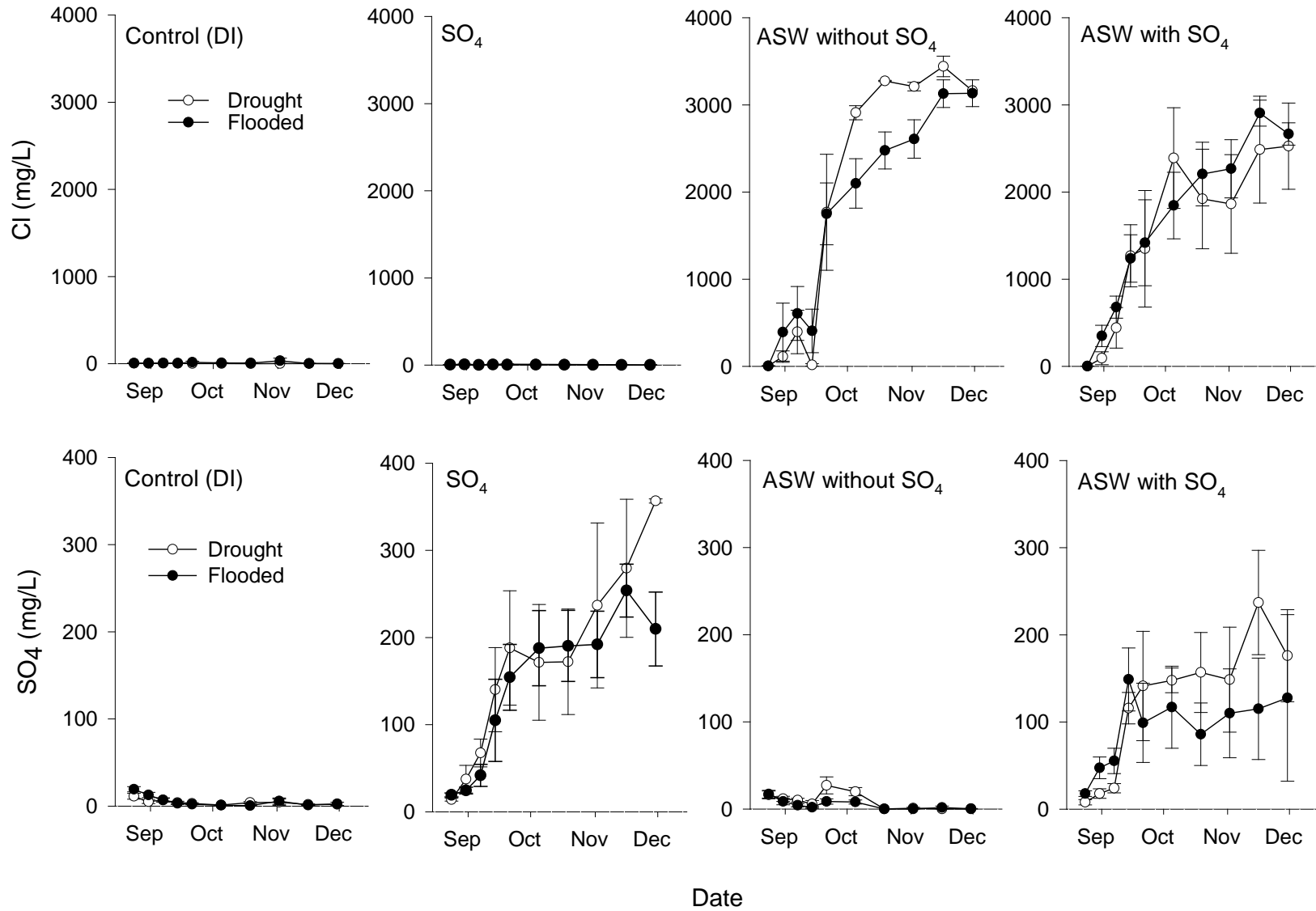


# ↑ [NH<sub>4</sub>] with ↑ Conductivity



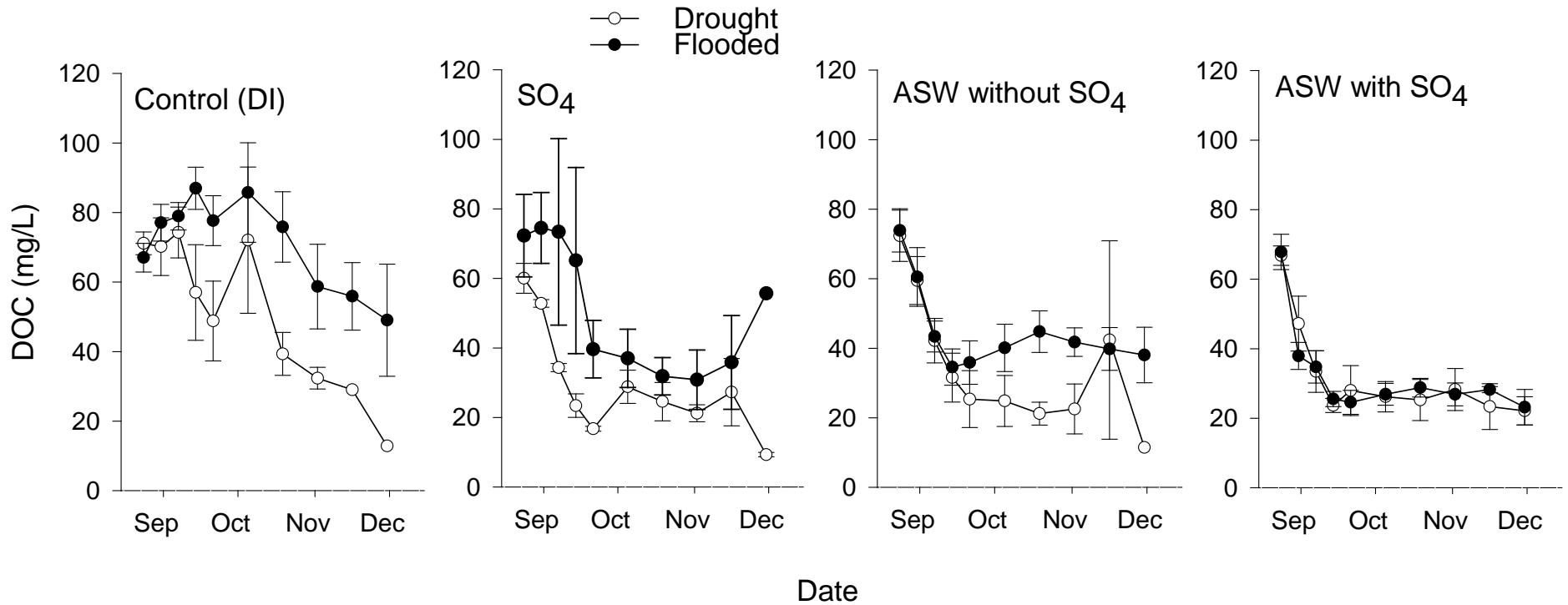
# Manipulative Experiments

## Hydrology x Water chemistry

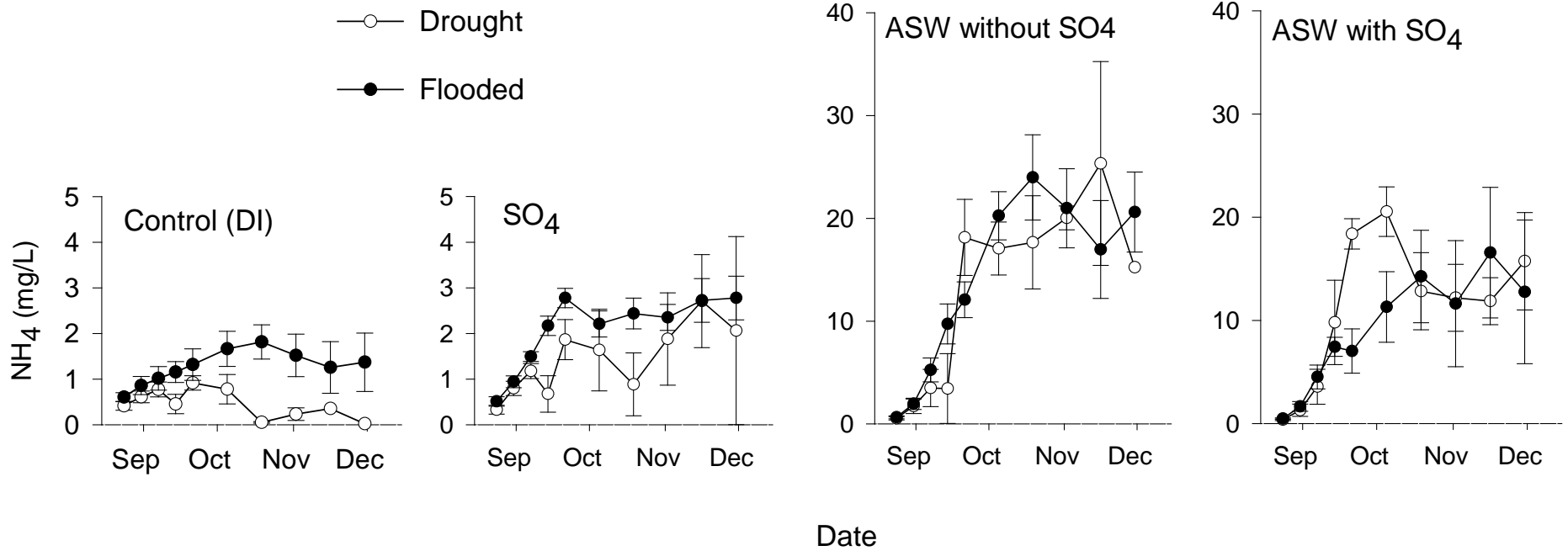




# SW decreased DOC concentrations

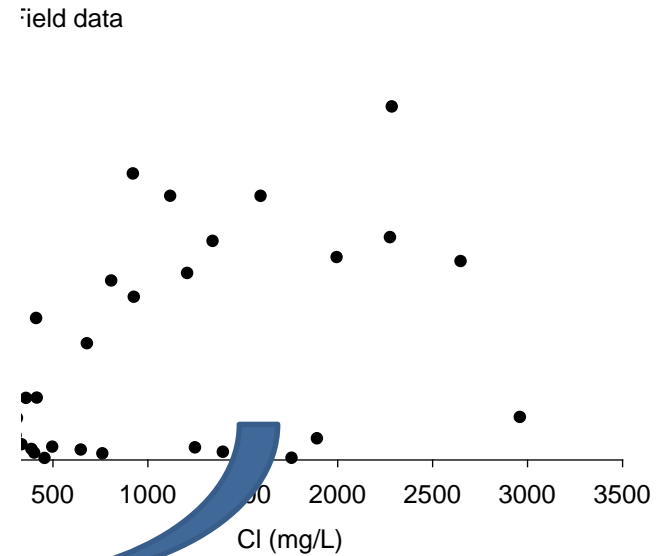
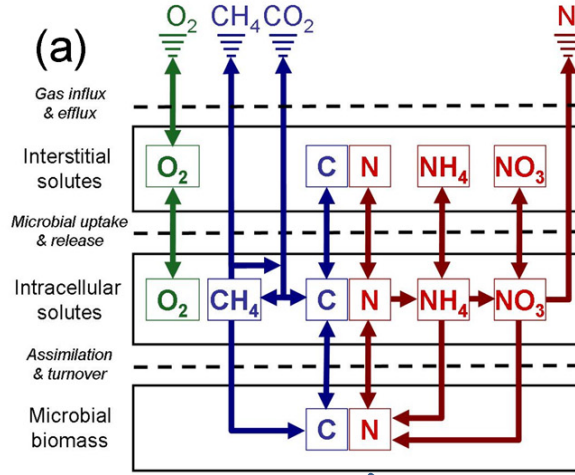
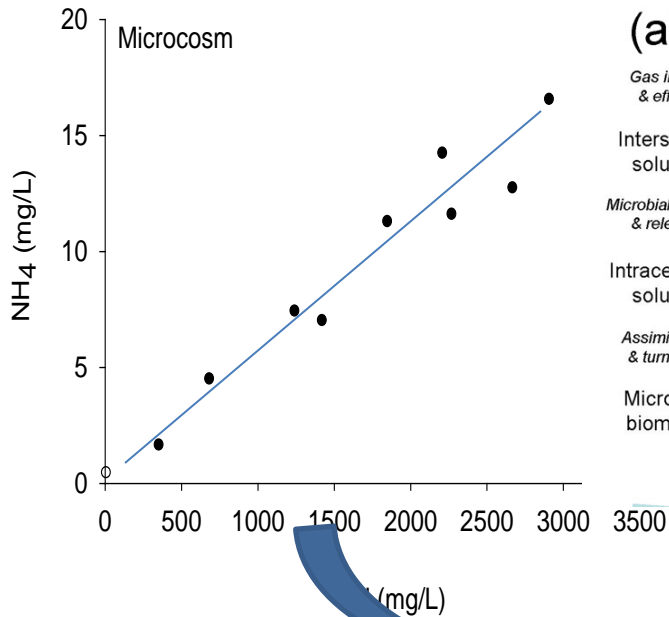
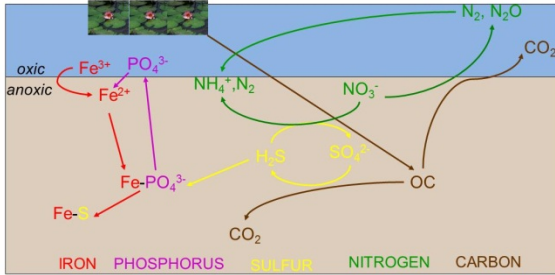


# SWI with and without SO<sub>4</sub> increase NH<sub>4</sub><sup>+</sup> concentrations



# Predictions

- DOC decline
- $\text{NH}_4$  increase



# Conclusions

- Saltwater intrusion decreases DOC export and N retention
- Saltwater intrusion can lead to  $\text{NH}_4$  release
- Caution for wetland restoration and hydrologic reconnection
- Important to understand both the biotic and geochemical effects of saltwater intrusion



# Acknowledgments

- Great Dismal Swamp Mitigation Bank
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