Saltwater incursion alters nitrogen and carbon export from a restored coastal plain wetland

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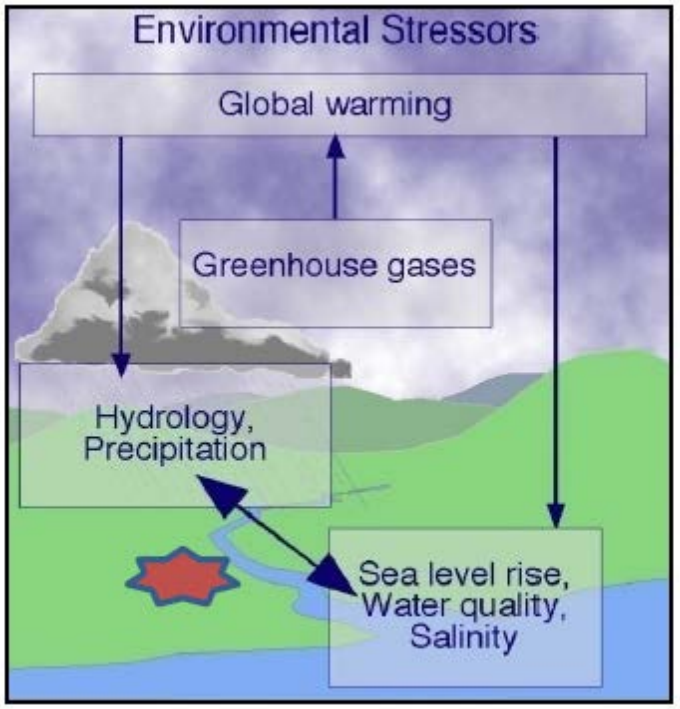
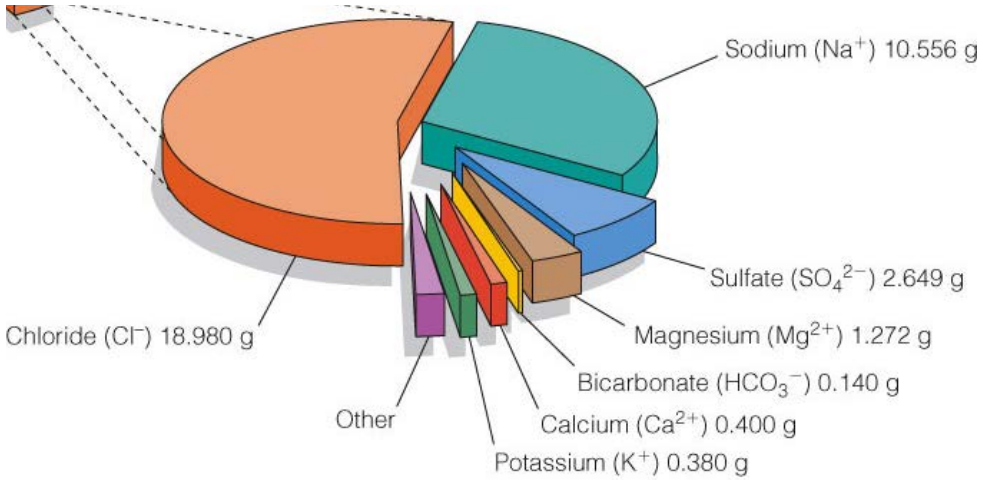
Climate change and coastal freshwater wetlands

- Altered precipitation
- Decreased river discharge
- Sea-level rise
  - Increased saltwater incursion

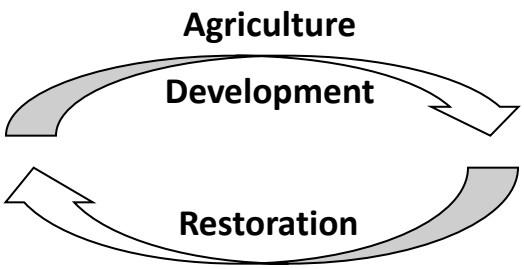


Neubauer & Craft. 2009. Global change and TFW.



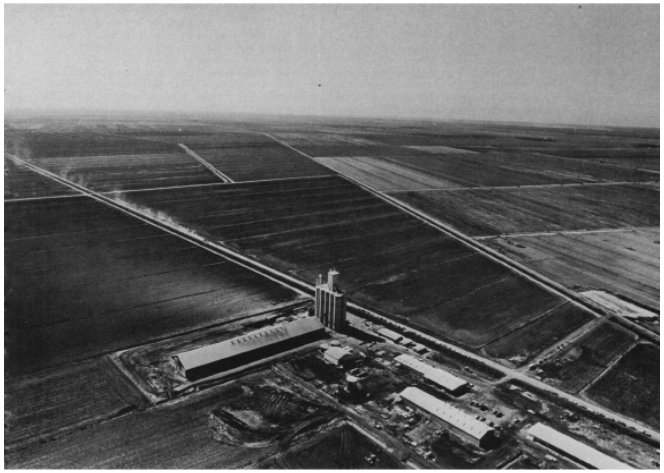
Wetland restoration

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



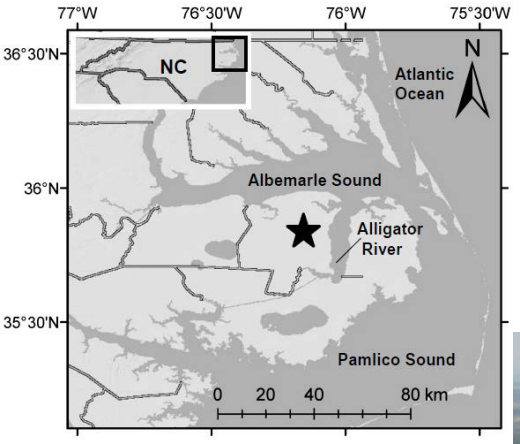
Sea level rise

Climate driven changes in hydrology



Carter 1975 Science

Timberlake Observatory for Wetland Restoration (TOWeR)



- 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

FARMING

RESTORATION

1980: Pocosin wetlands drained

1985: First Crops planted

1985-2001 – Corn, soybean rotation

1996: GDSMB Purchases site

2004: Last crop

Earthmoving

750,000 live saplings planted

2007: Canals plugged Pumping stops

2007

2008

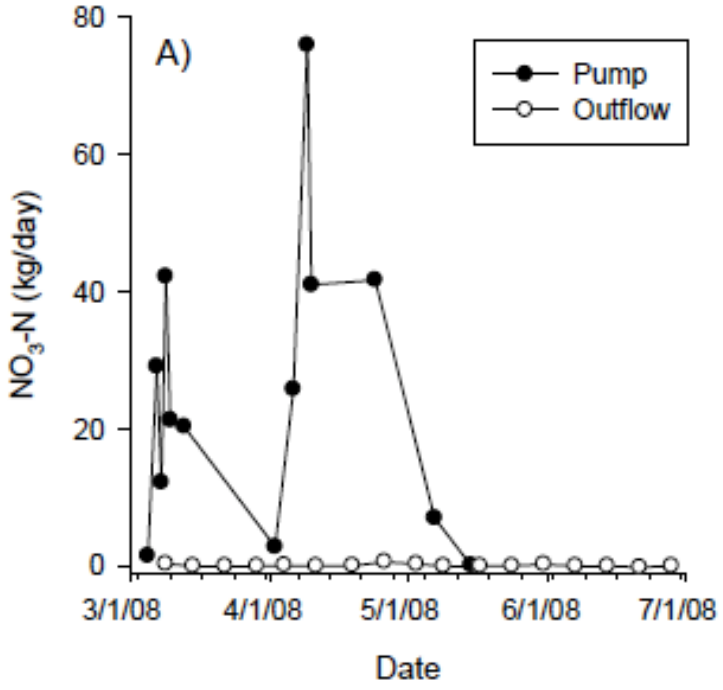
2009

2013

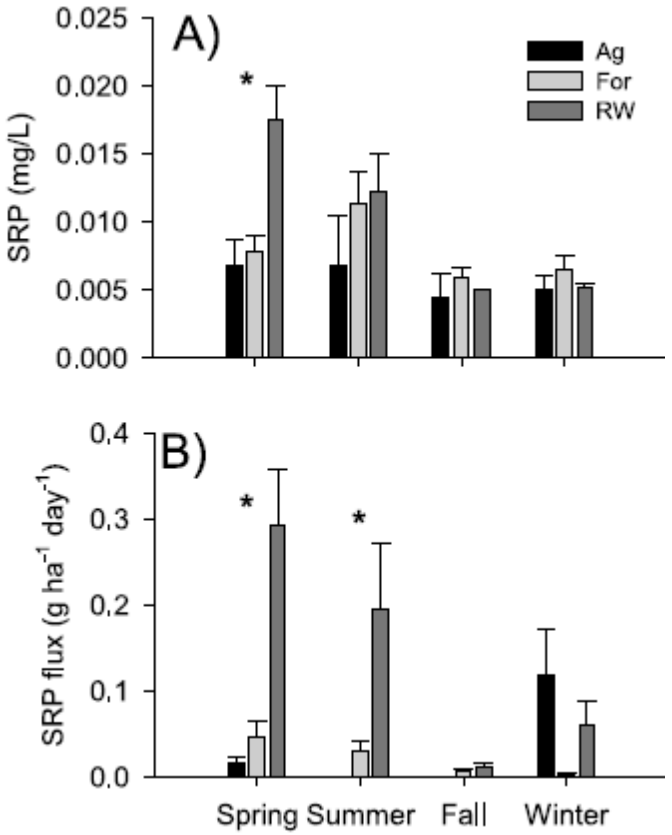
2011

Are there trade-offs when restoring water quality benefits?

NO_3-N retention



P release

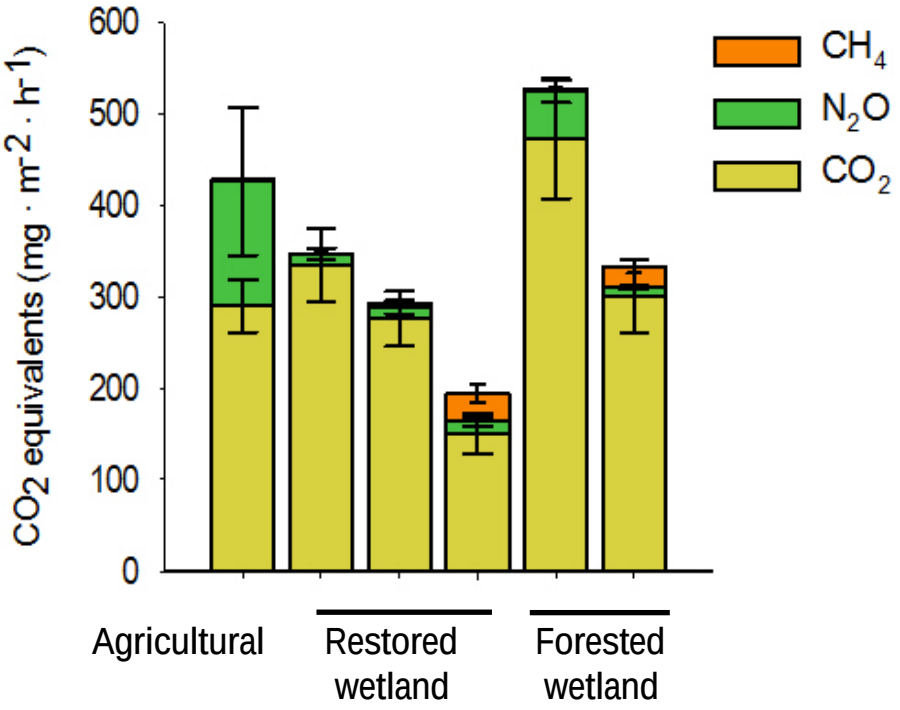


Ardón et al. 2010 *Ecosystems*

Ardón et al. 2010 *JGR Biogeosciences*

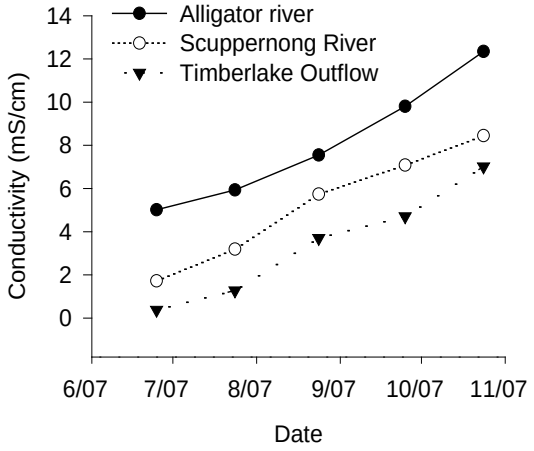
Are there greenhouse gas tradeoffs associated with wetland restoration?

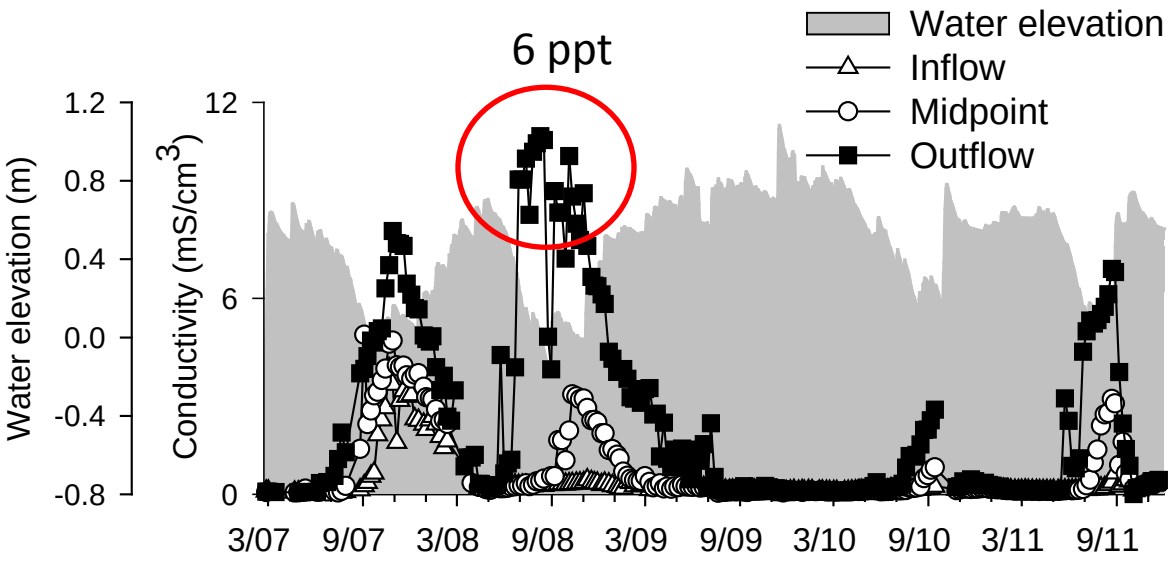
- No increase in GHG

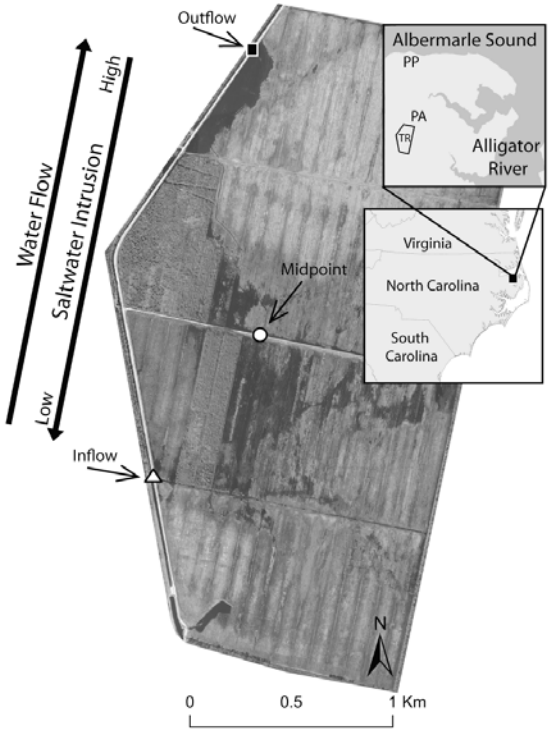


Morse et al. 2012. *Ecological Applications*

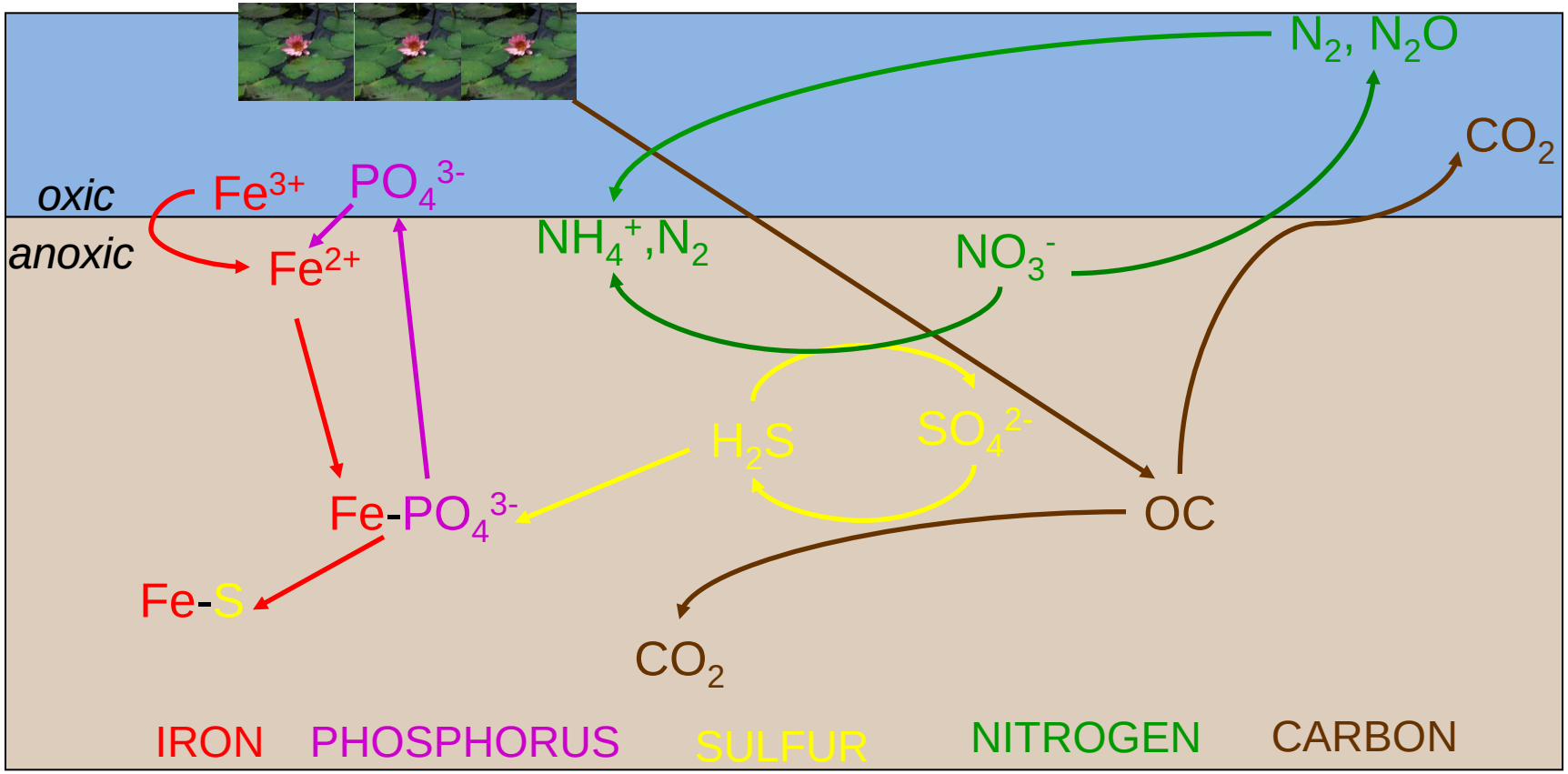
Drought-induced saltwater incursion



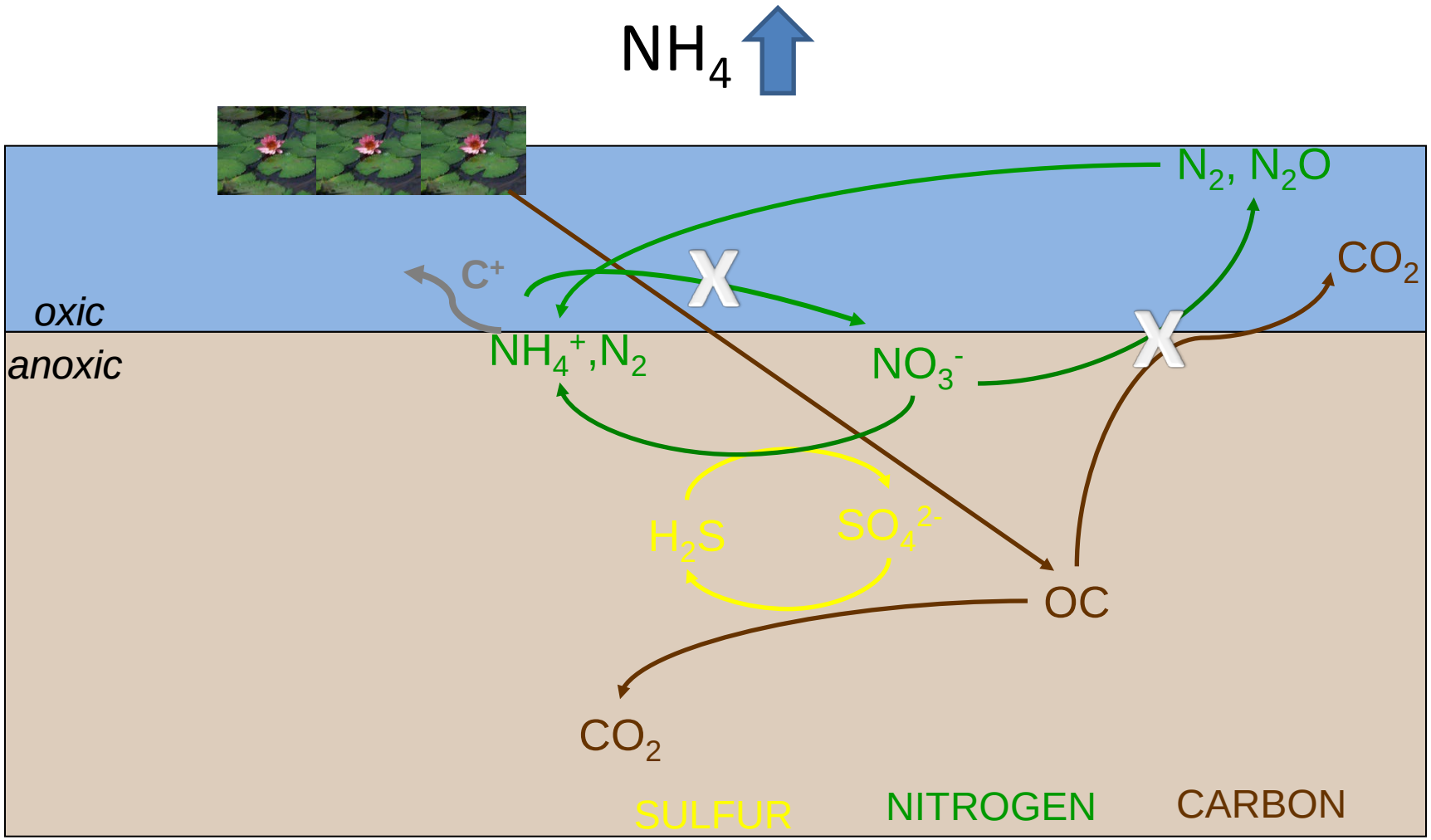




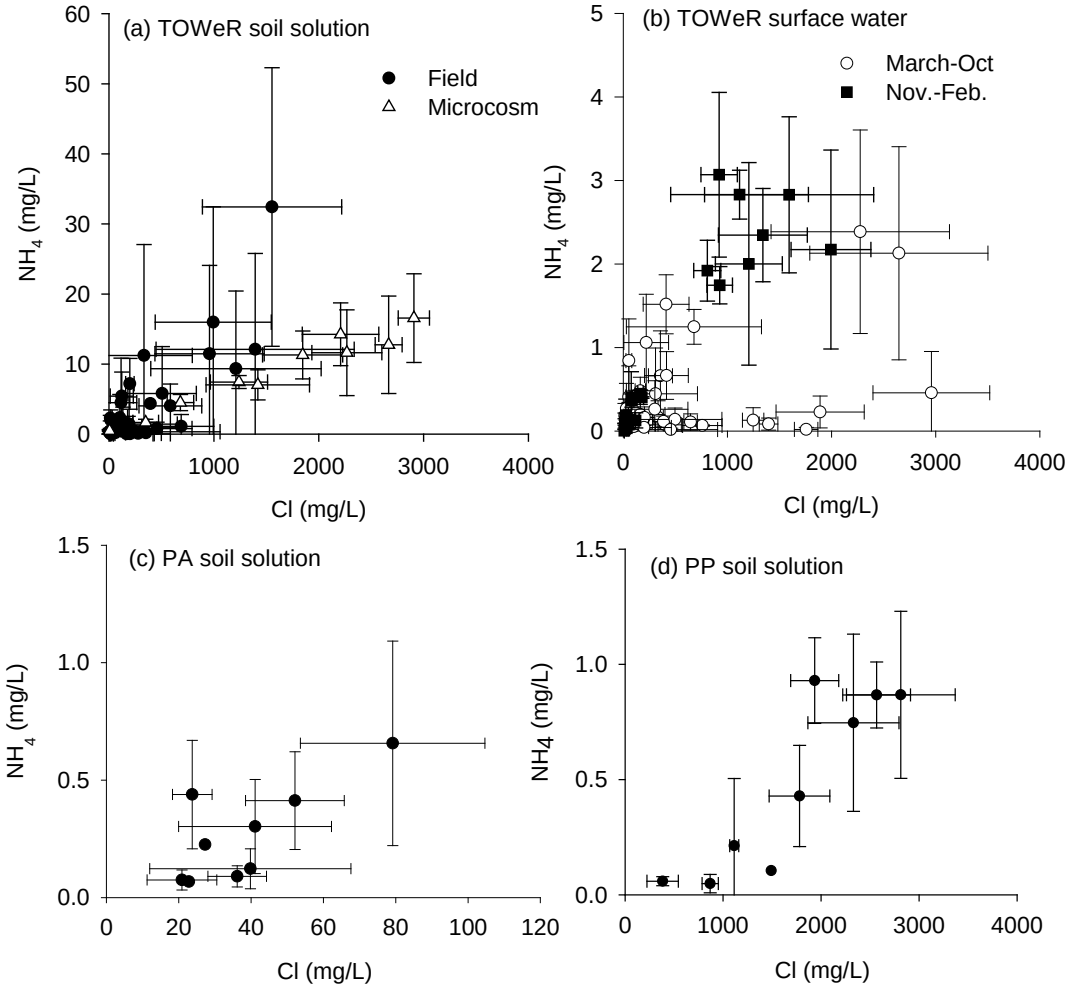
Predictions



Predictions

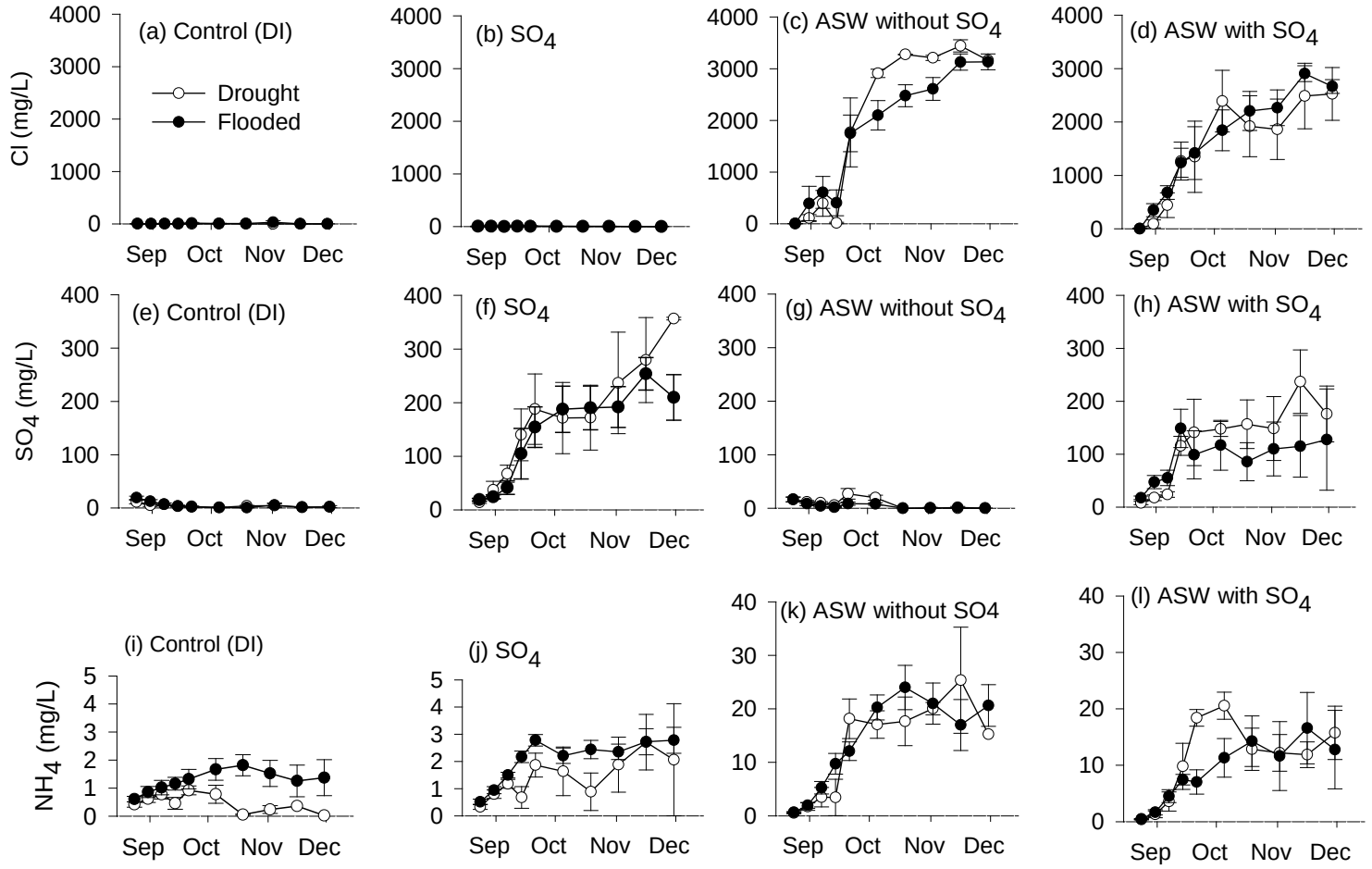


Salinity increases NH_4 in restored site more than two reference wetlands



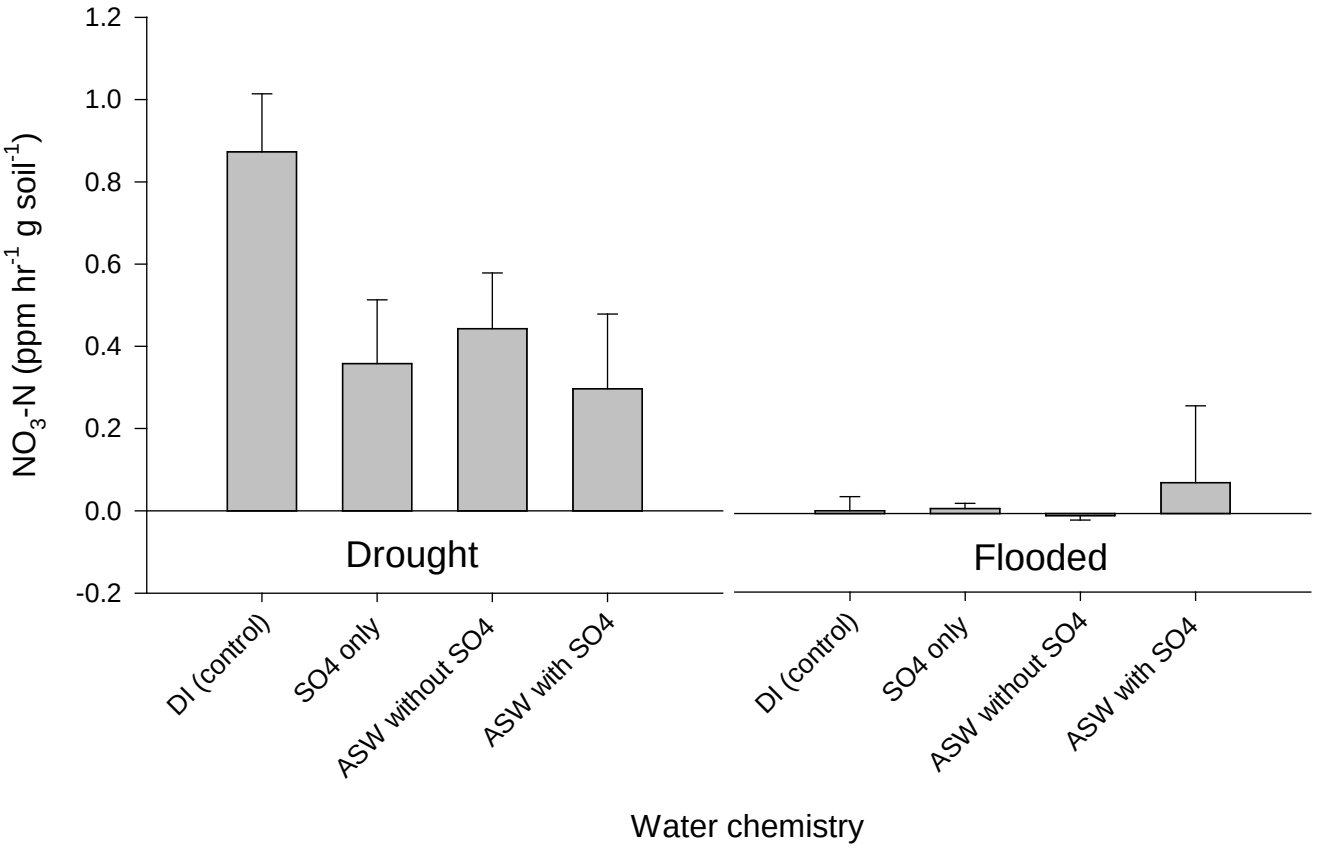
Ardón et al. 2013. *Global Change Biology*

Manipulative experiment



Ardón et al. 2013. Global Change Biology

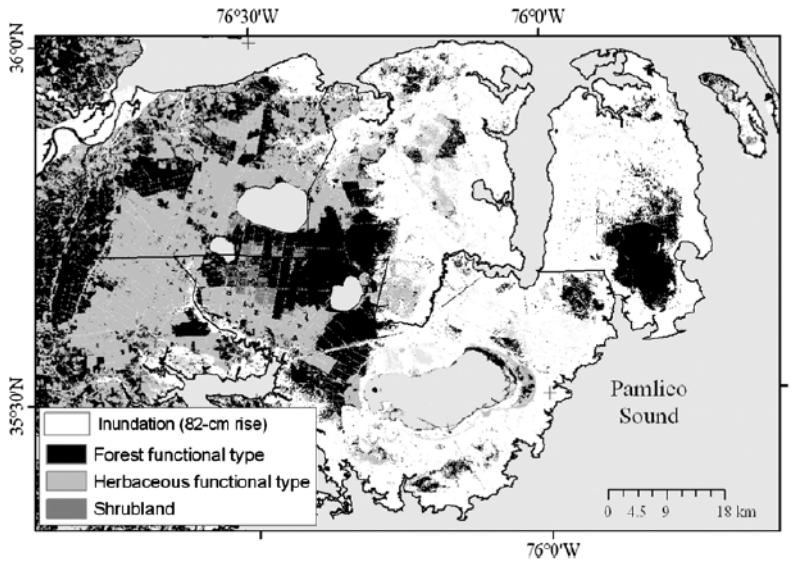
Salinity also decreases nitrification potential



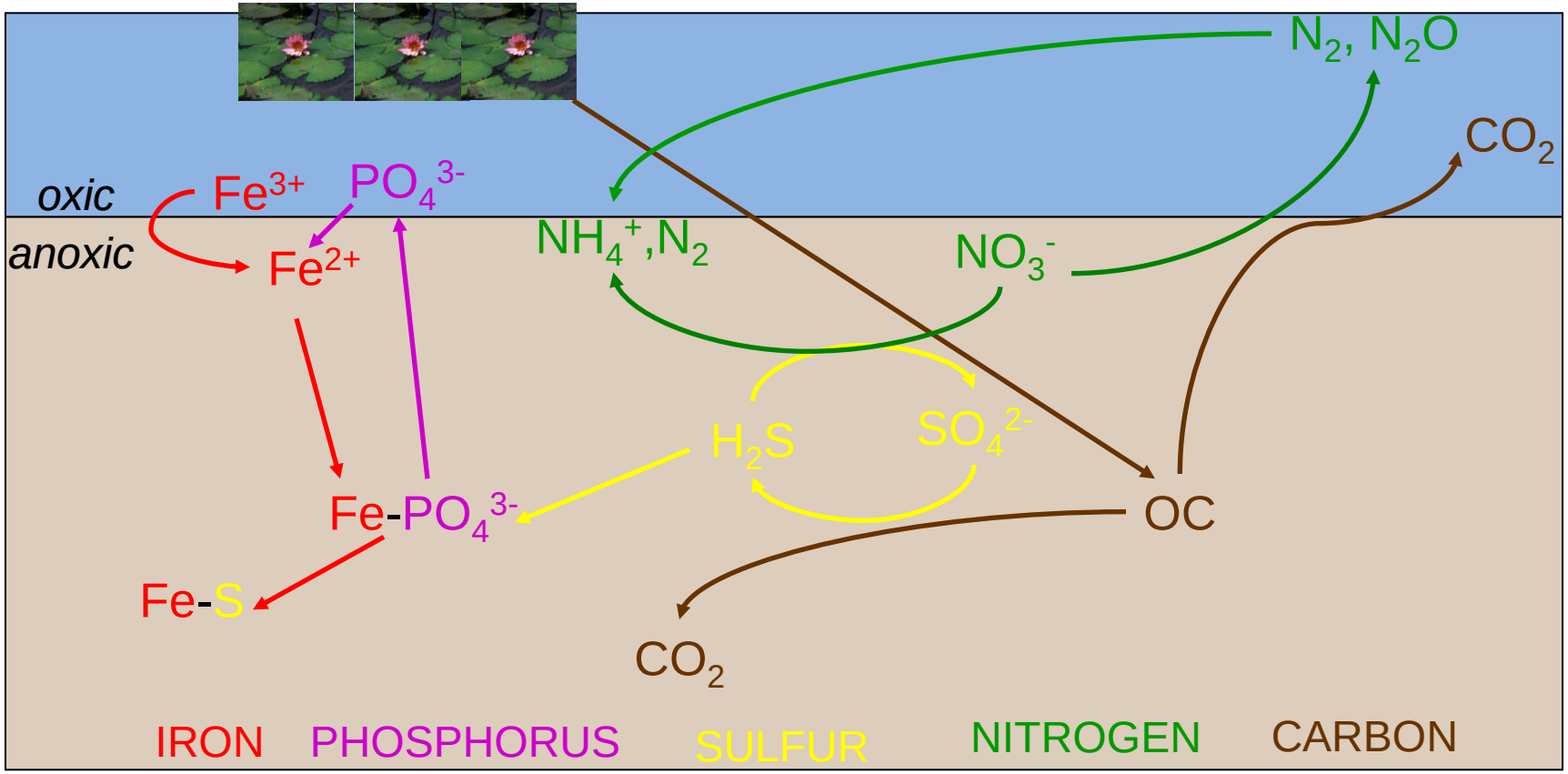
Ardón et al. 2013. *Global Change Biology*

How important could this be?

- Henman and Poulter 2008
- 1661 km^2 wetlands will be flooded by 2100
- 149 Tg C
- 18,000 Mg NH_4^+
- ½ Mississippi annual NH_4^+

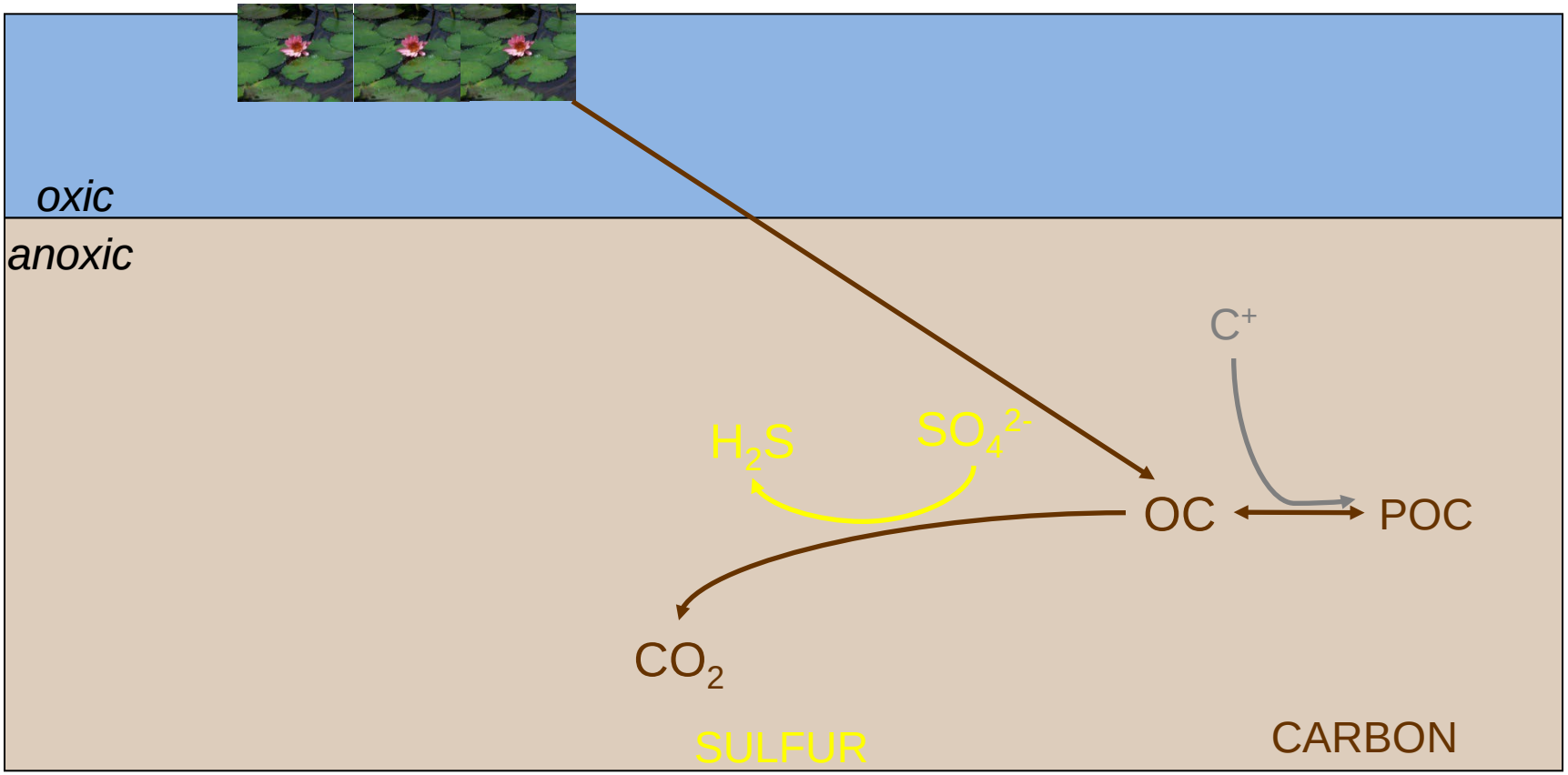


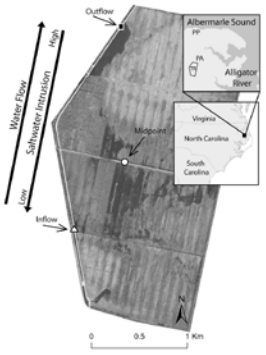
Predictions



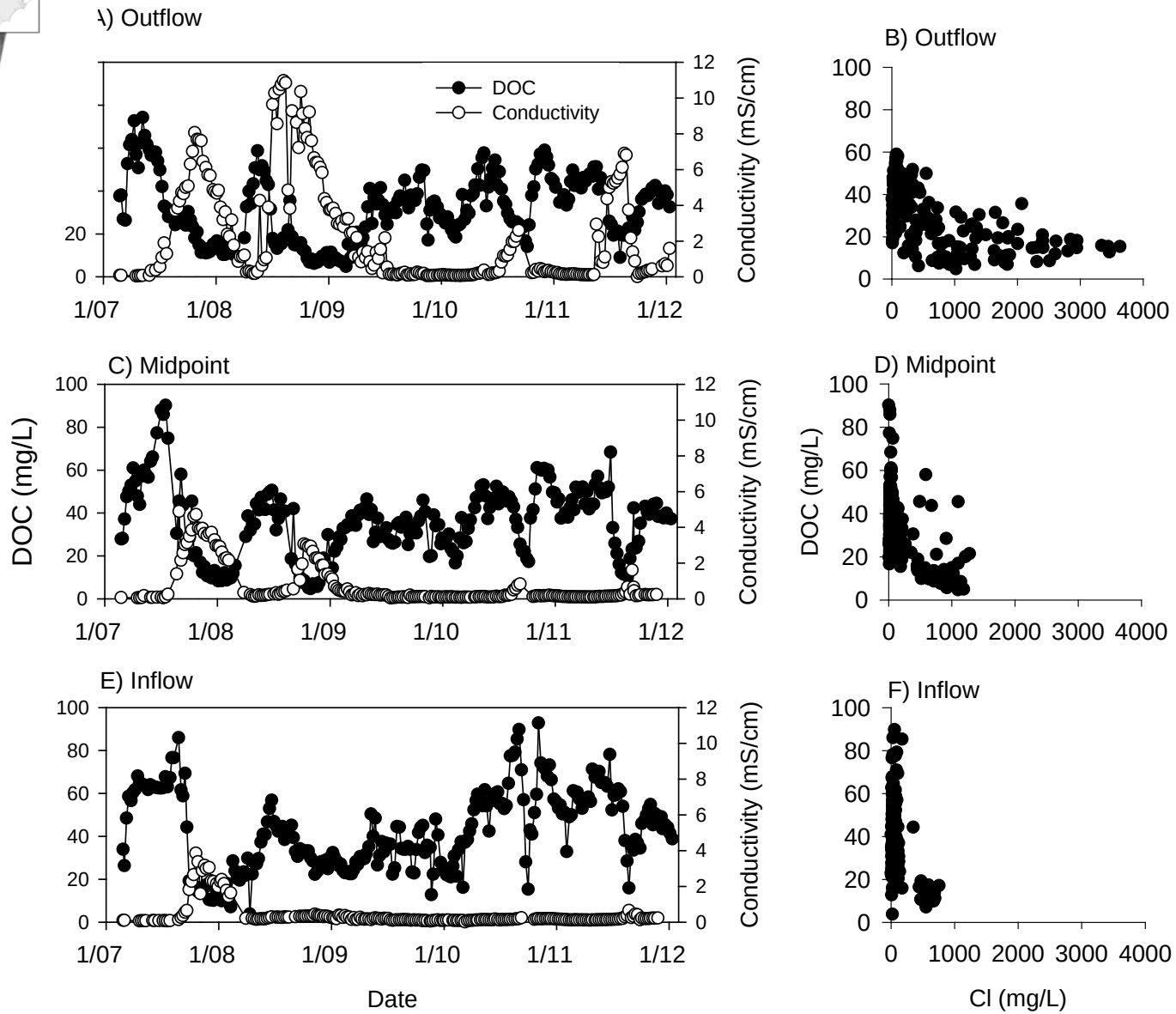
Predictions

DOM



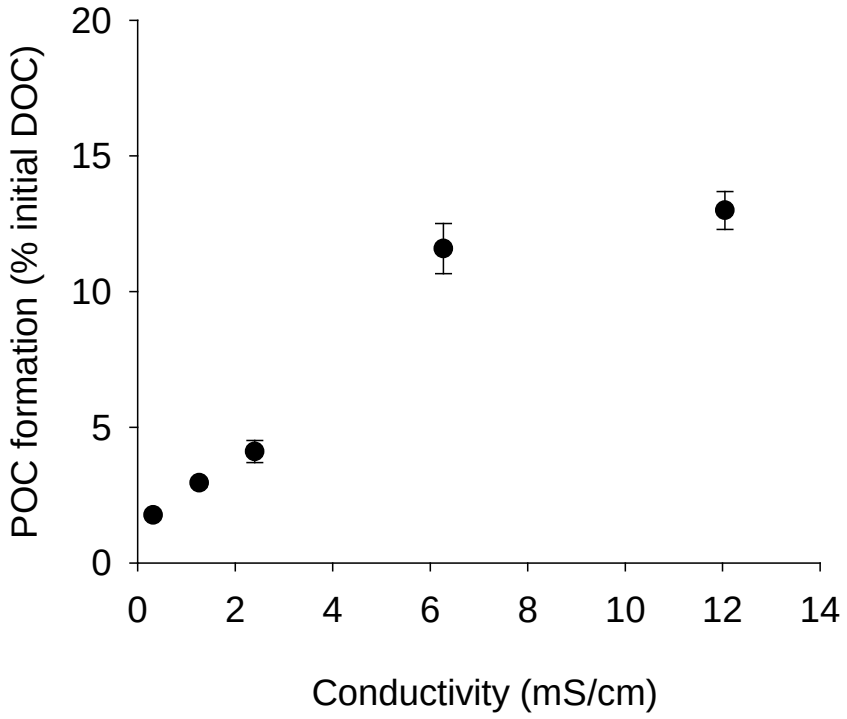


DOC declines with SWI



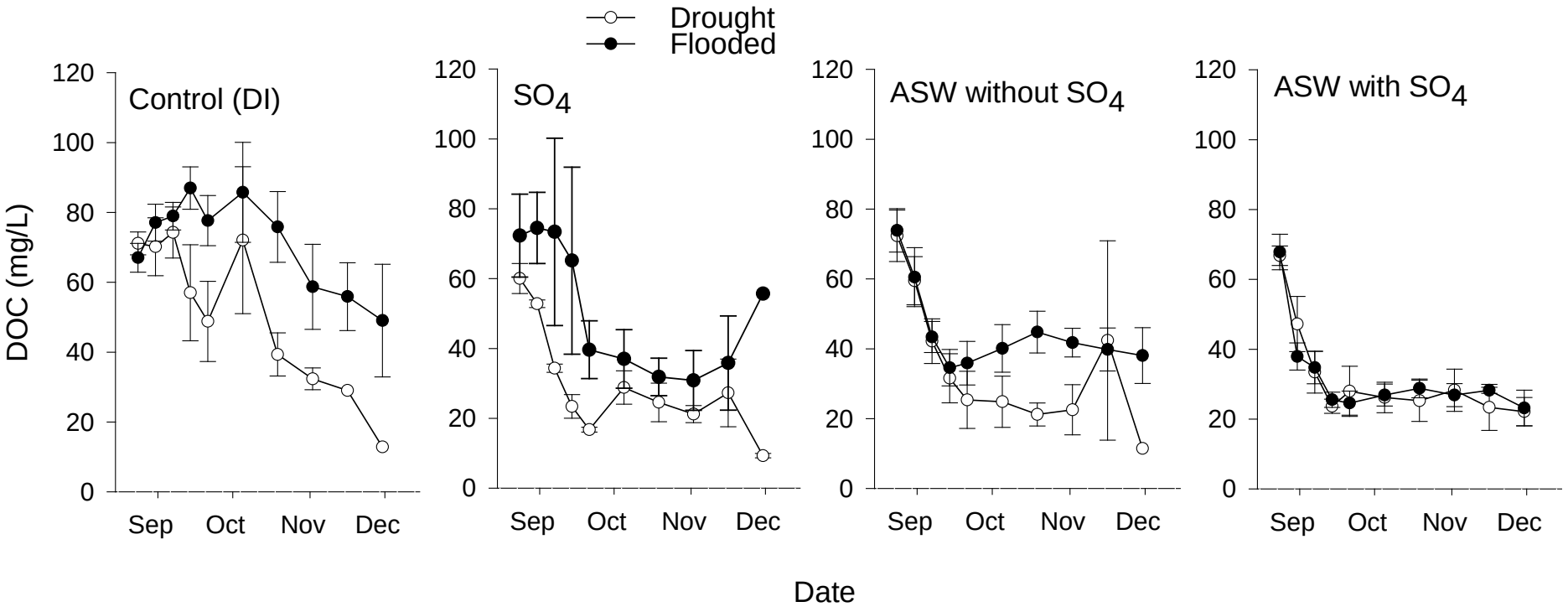
Ardón et al. in prep

POC formation increases with increasing conductivity



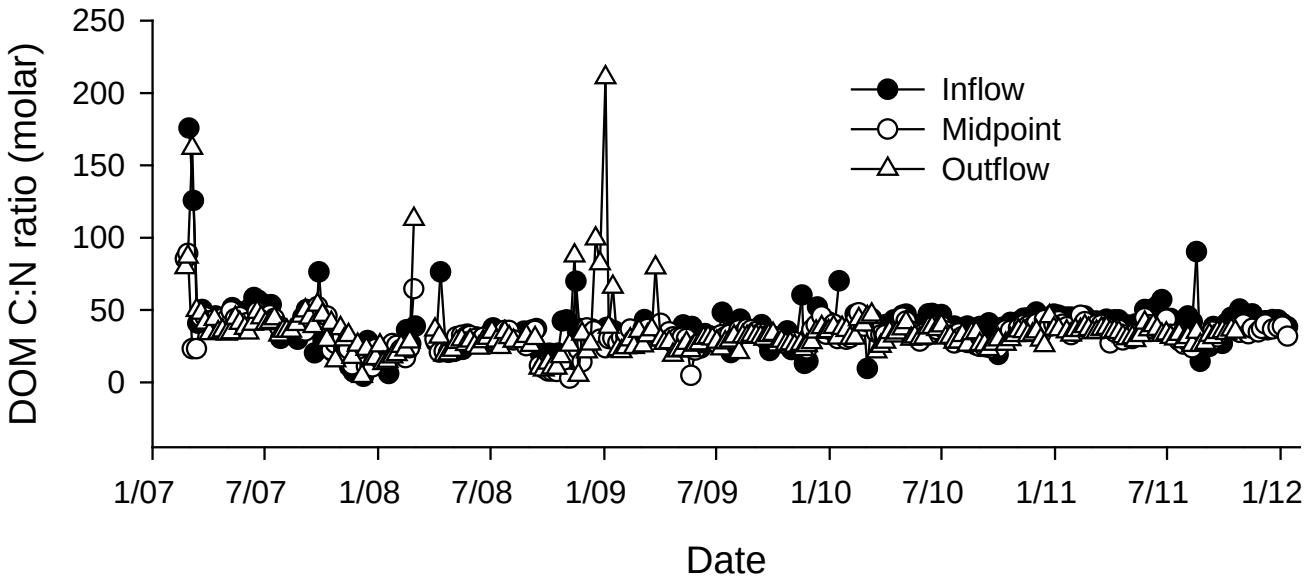
+ Conductivity

SW decreased DOC concentrations



Does salinity change the composition of DOM?

- C:N ratio
- Fluorescence
- EEMs and PARAFAC



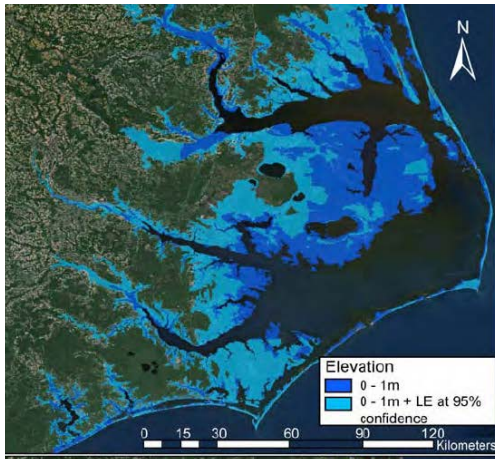
Summary

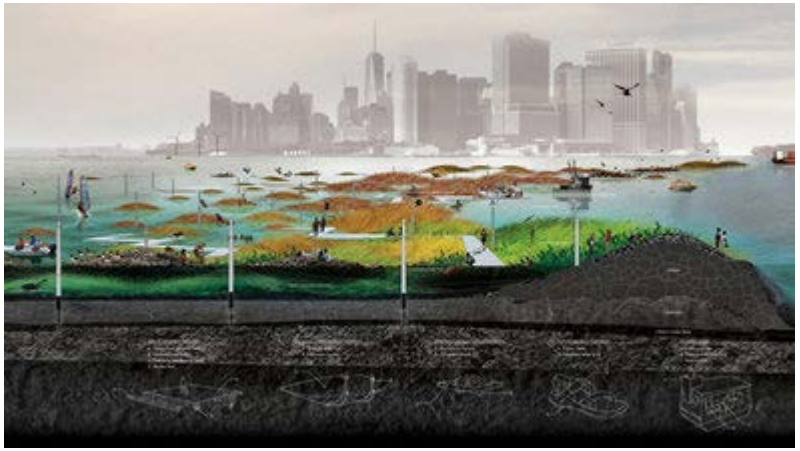
- Increased salinity
  - Increased NH_4
  - Decreased DOM export
  - Decreased tree growth (Powell poster)
  - Increased decomposition (Korn poster)

Restoration as climate change adaptation

- Marsh restoration in NYC
- LA master plan
- NC coast

NY Times 2012





Acknowledgments

- Great Dismal Swamp Mitigation Bank

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Questions?