Linking molecular properties of soil organic carbon to emergent ecosystem functions in a tidally influenced landscape of the Pacific Northwest

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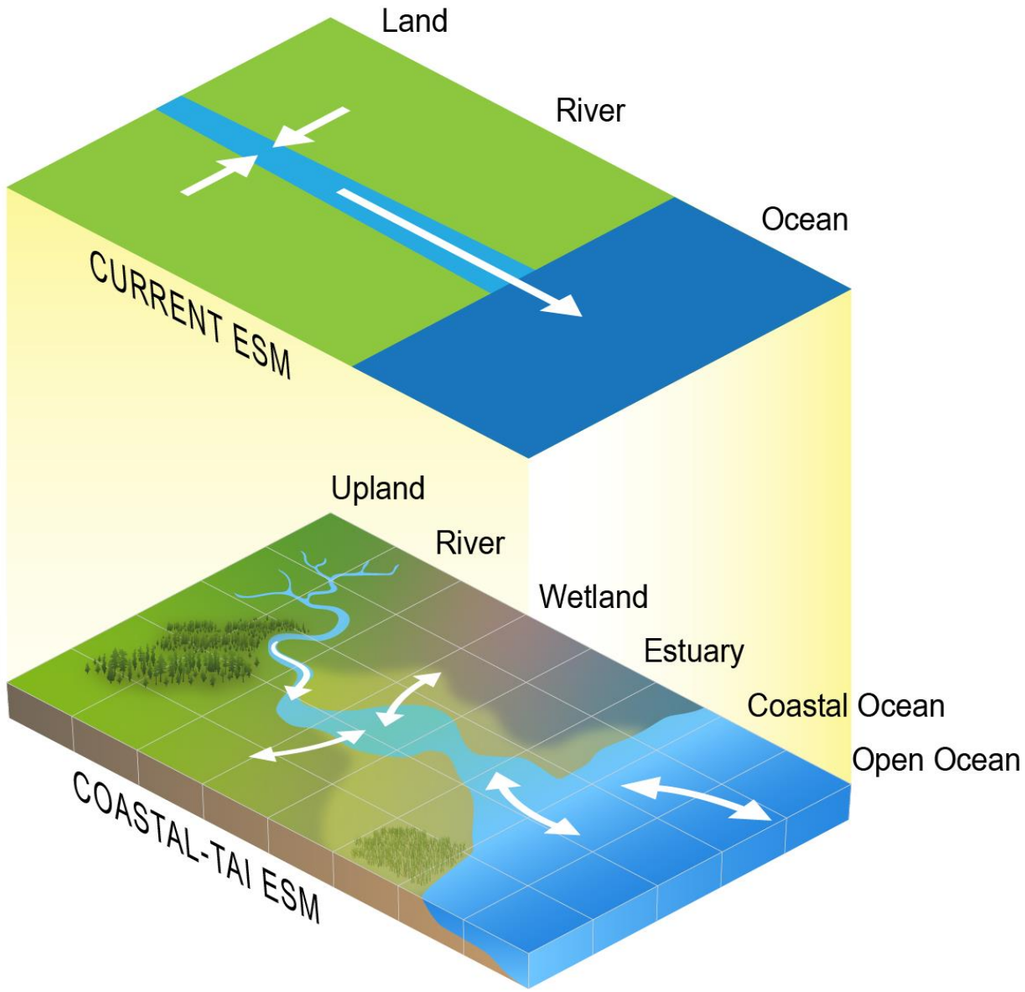
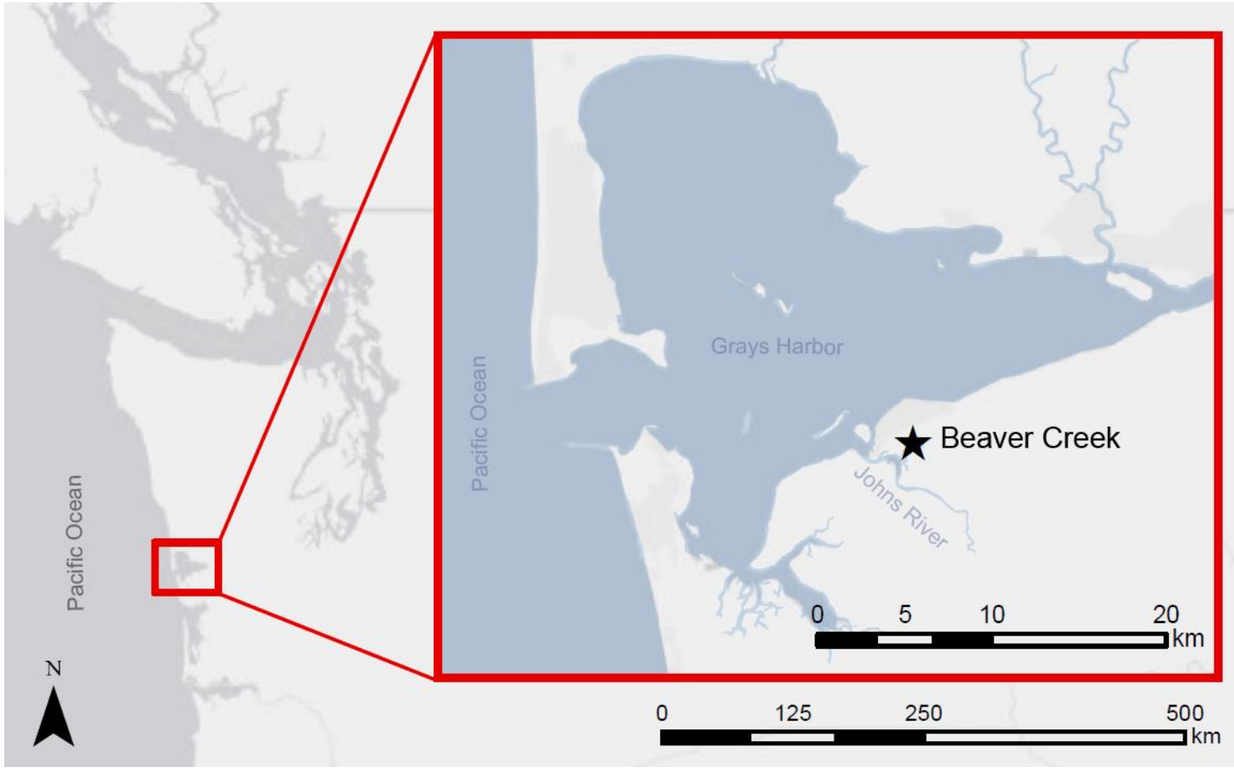
Coastal terrestrial-aquatic interfaces are important ecosystems in transition

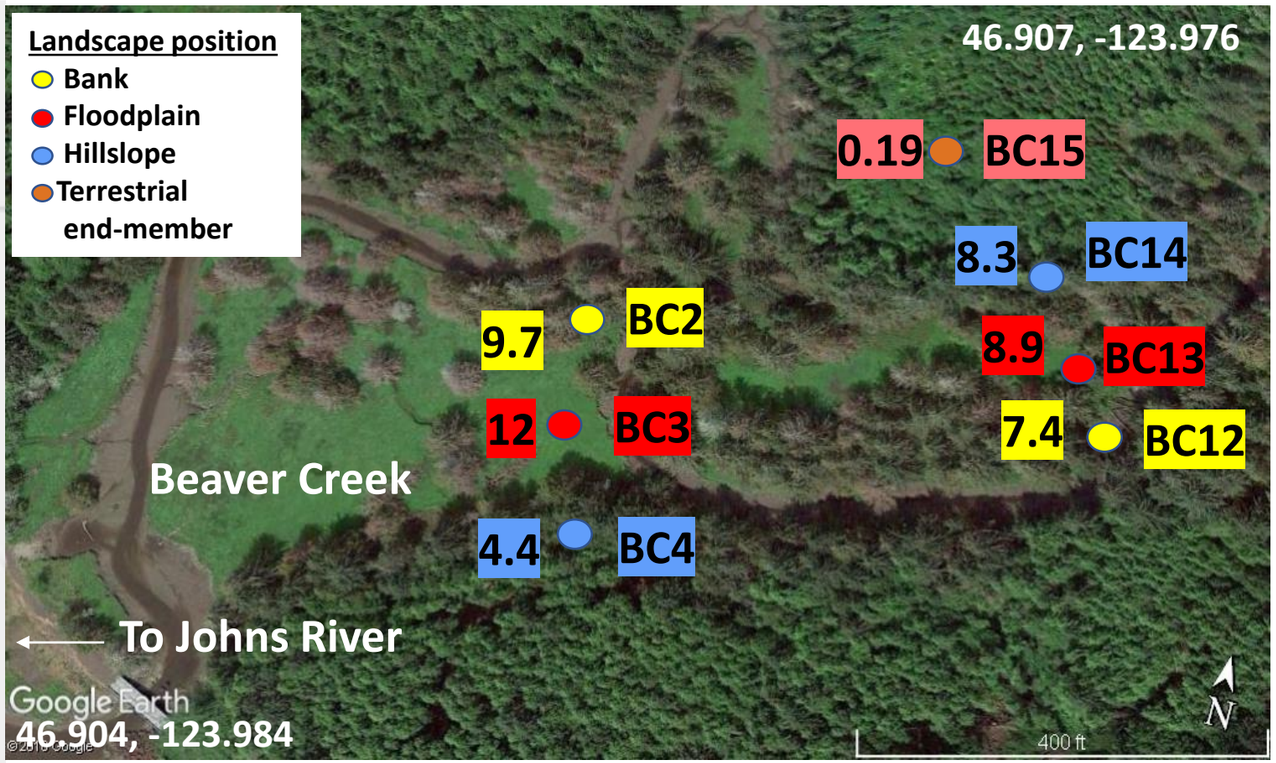
- Two-way movement of energy, nutrient, and water
- Inland extent of tidal influence predicted to increase in coastal US due to sea level rise and terrestrial and oceanic storms (Ghanbari et al., 2019, Crowell et al., 2010)
- Carbon stored, released, and transformed by pulse events (Capooci et al., 2019)



Ward et al., 2020

Soil cores collected from tidally-influenced landscape and subjected to lab incubations





Beaver Creek is a first-order stream, with tidal exchange restored in 2014.

Episodic tidal inundations including king tide events are common in this landscape

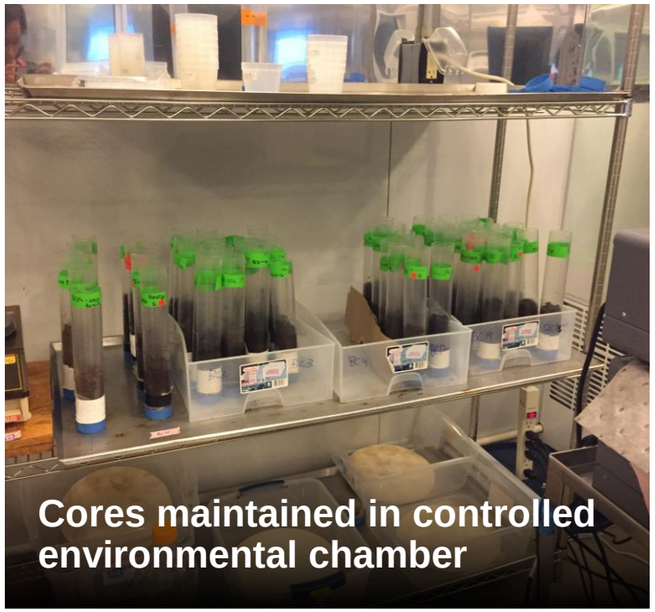
Numbers in colored boxes in the right panel indicate average specific conductivity (ms cm^{-1}) for each site

Sengupta et al., 2019

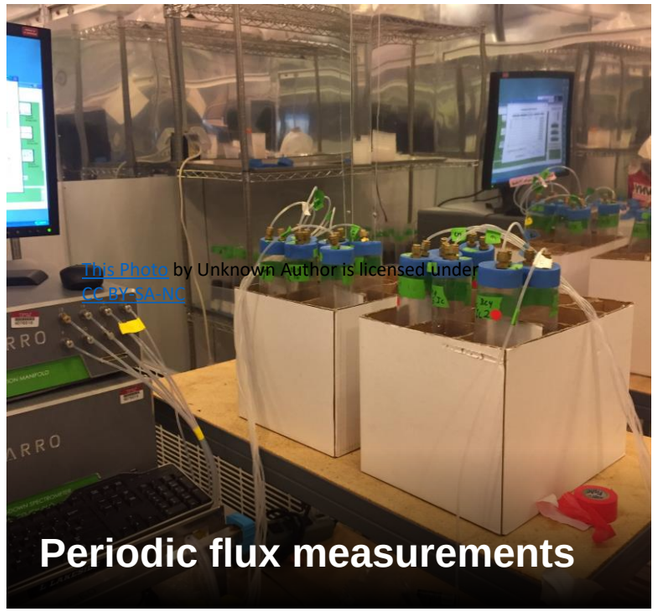
Methods

15 cm cores in 30 cm sleeves

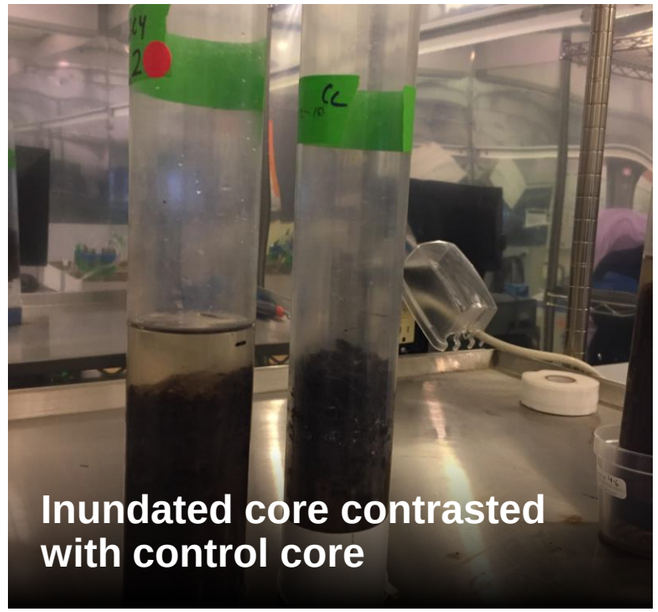
37.14 ms cm^{-1}, pH= 8.0



Cores maintained in controlled environmental chamber



Periodic flux measurements



Inundated core contrasted with control core

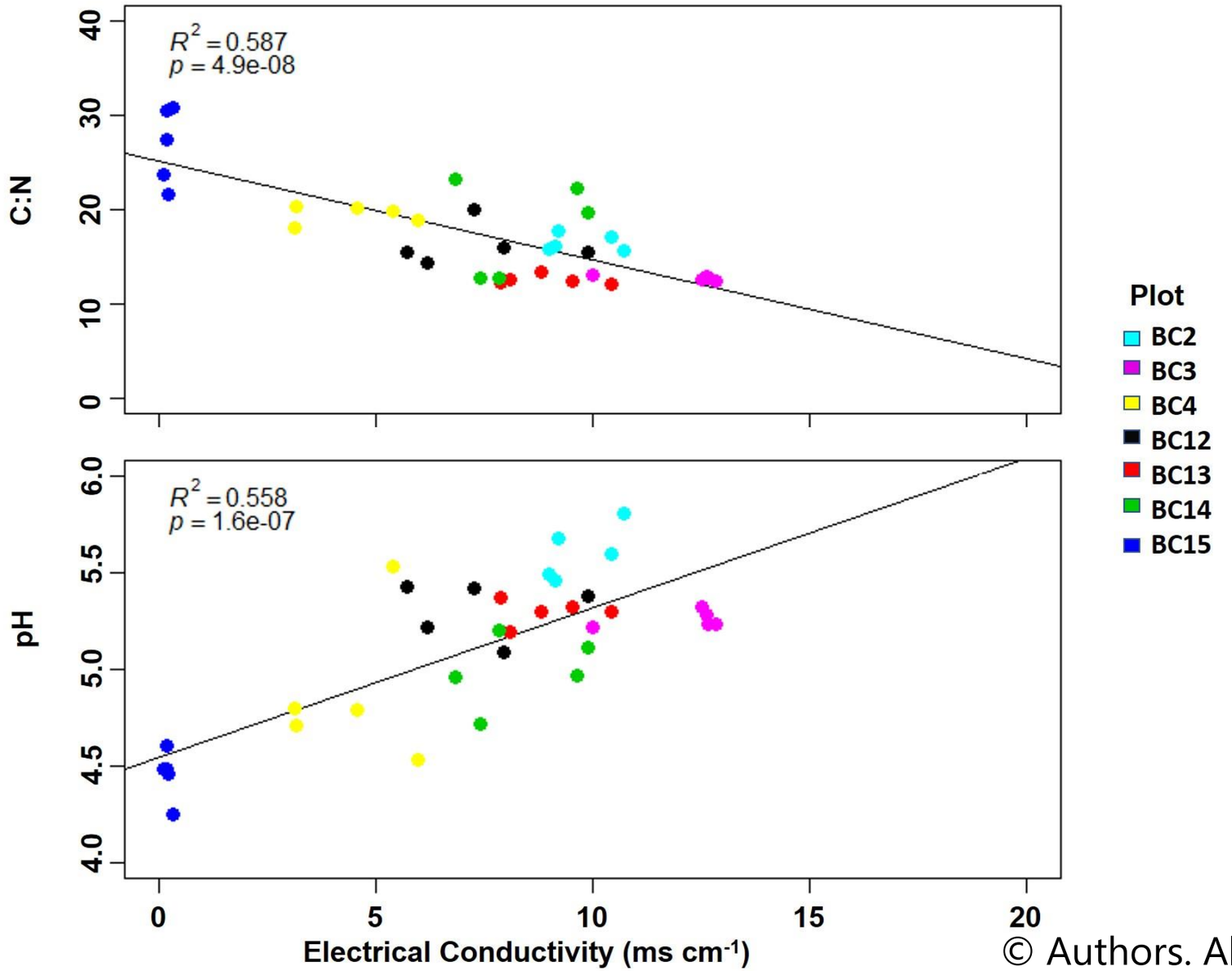
5 replicates each for **Control** and **Inundated** cores

Periodic **CO_2 and CH_4 gas flux measurements**

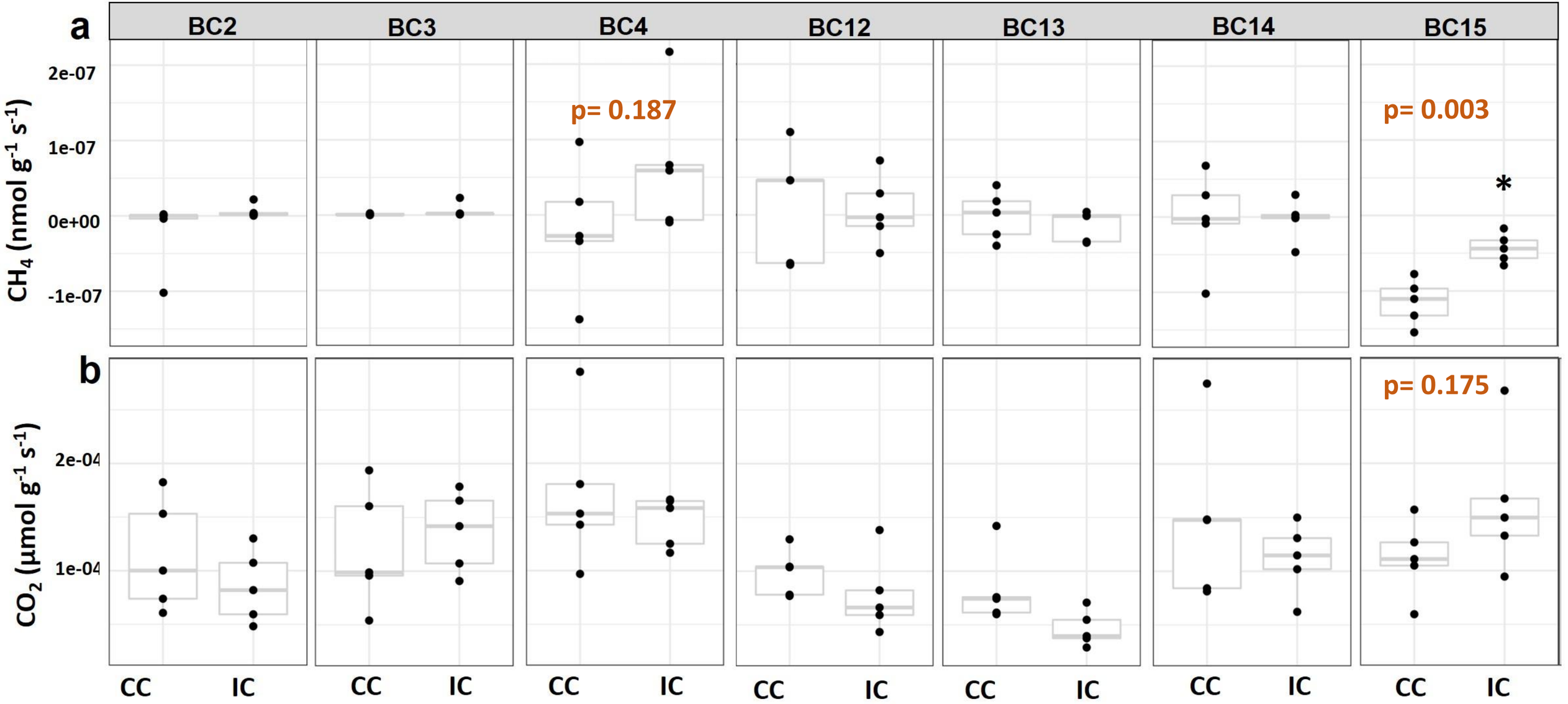
Liquid Chromatography-Mass Spectrometry: **Metabolite features**

Fourier Transform Ion-Cyclotron Resonance-Mass Spectrometry: **Thermodynamic favorability of organic C and molecular-formula informed biochemical transformations**

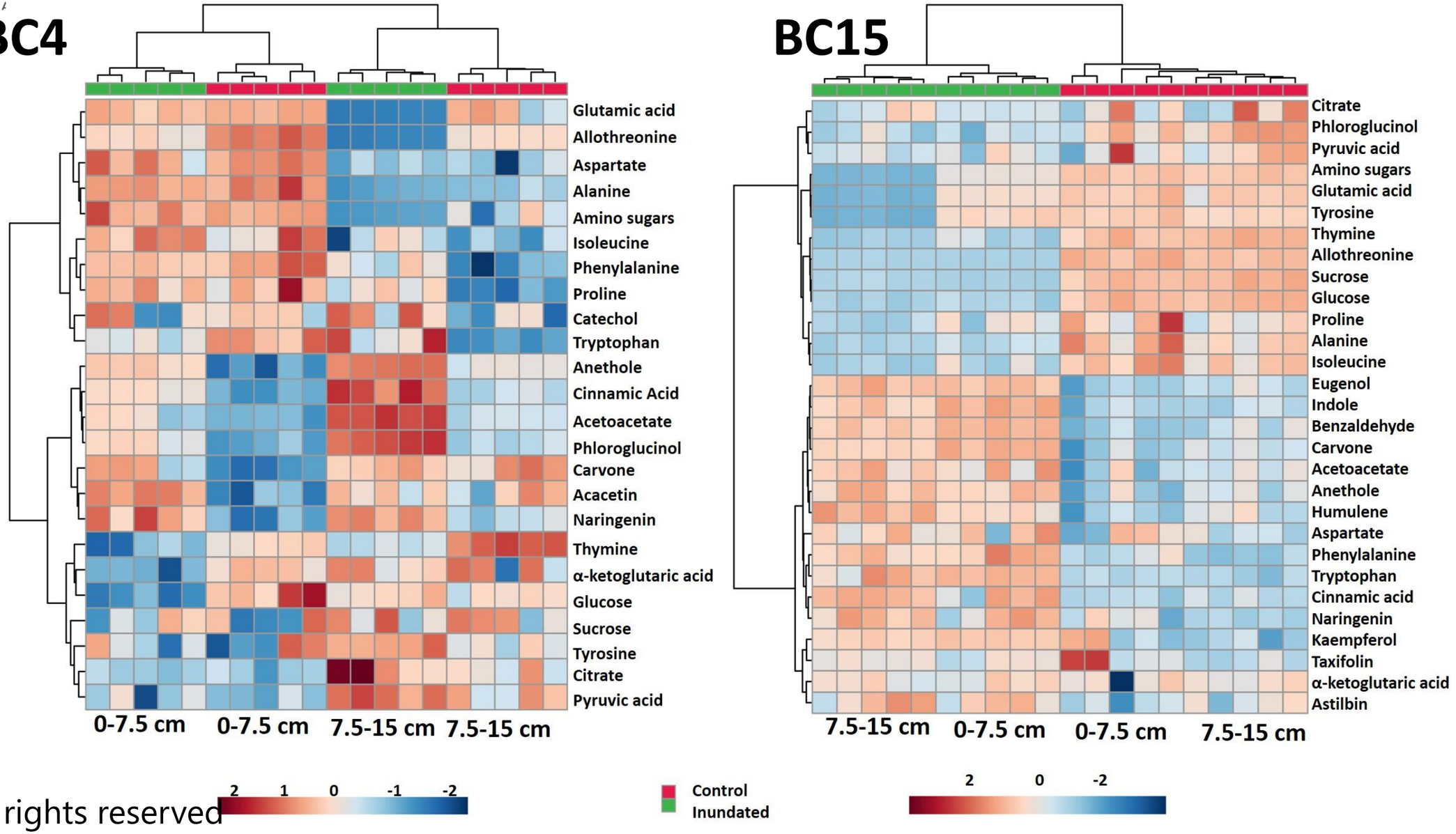
Contrasting trends in field C:N and pH with conductivity



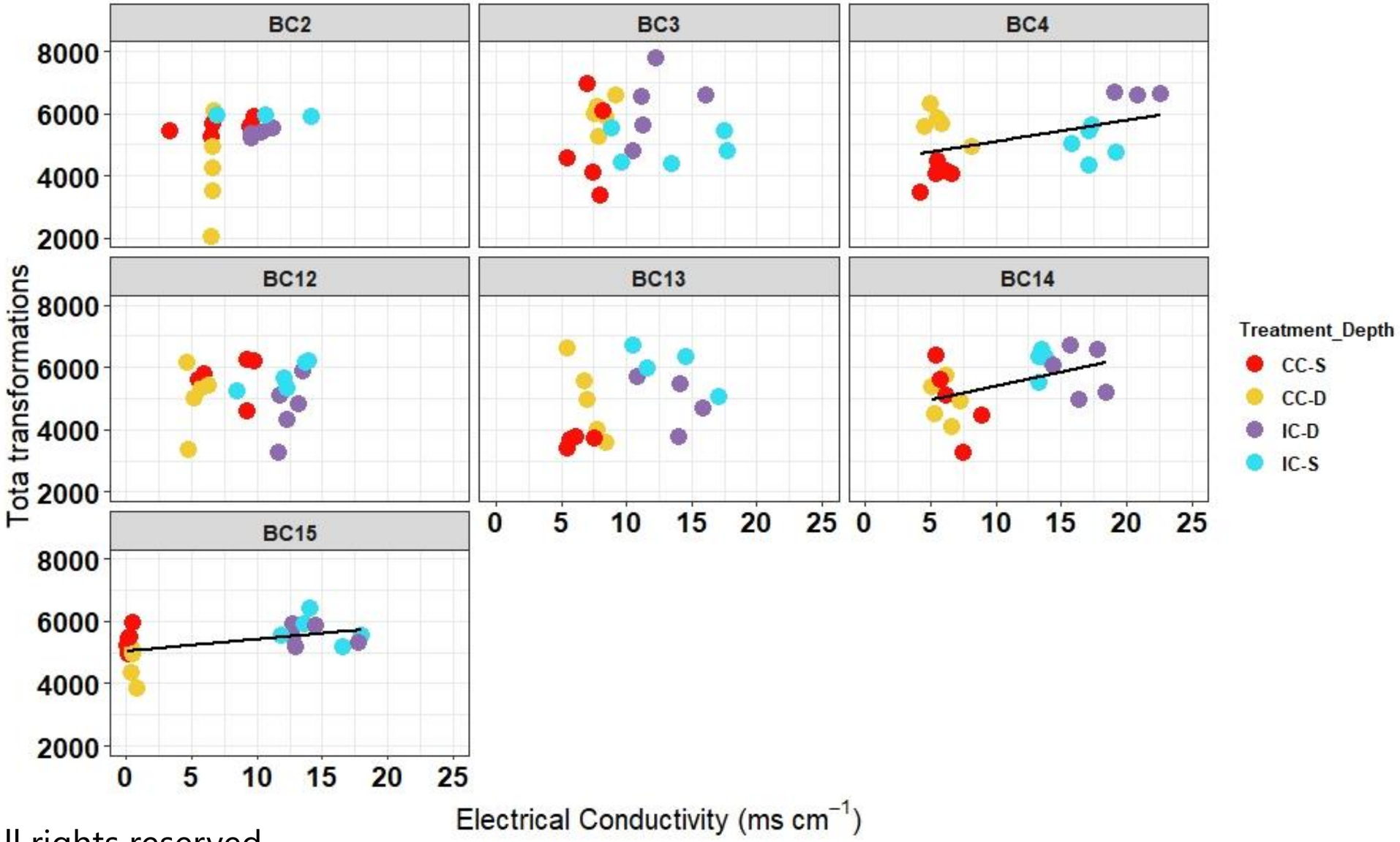
Low salinity soils show higher average flux compared to high salinity soils following periodic inundation events



Inundation significantly impacts metabolite features in low-salinity soils



Biogeochemical transformations increased in inundated cores for end-member soils



Conclusions

- Periodic seawater inundations preferentially impact low salinity soils
- Surficial soils get enriched in phenolic compounds, hydrophilic compounds are lost
- Biochemical transformations of low-salinity soils increase with seawater addition; likely suggests higher microbial activity.
- Terrestrial soils are acting as carbon source upon seawater exposure

References

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