# Coastal acidification and carbon sequestration driven by inorganic carbon export from tidal wetlands

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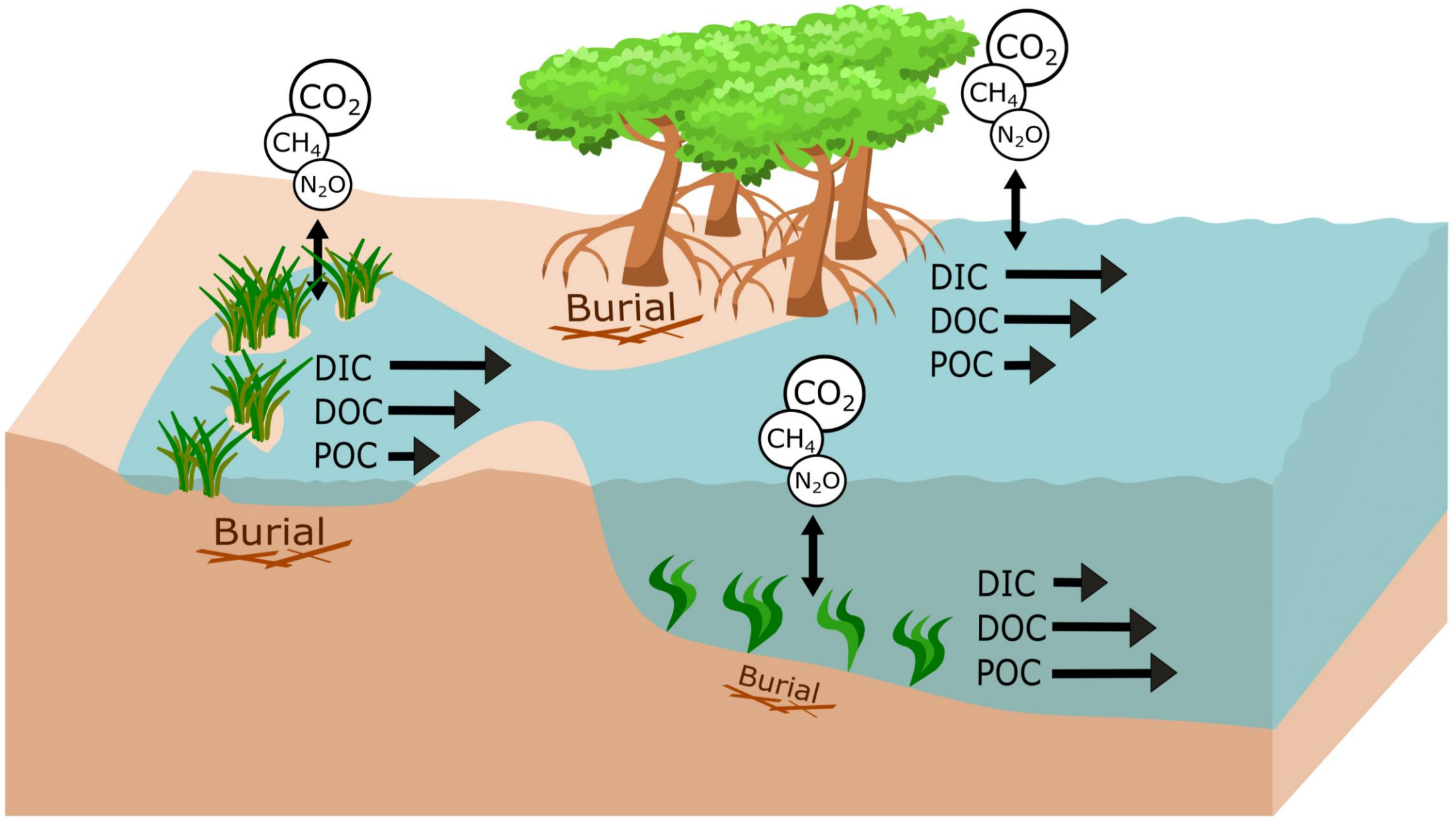
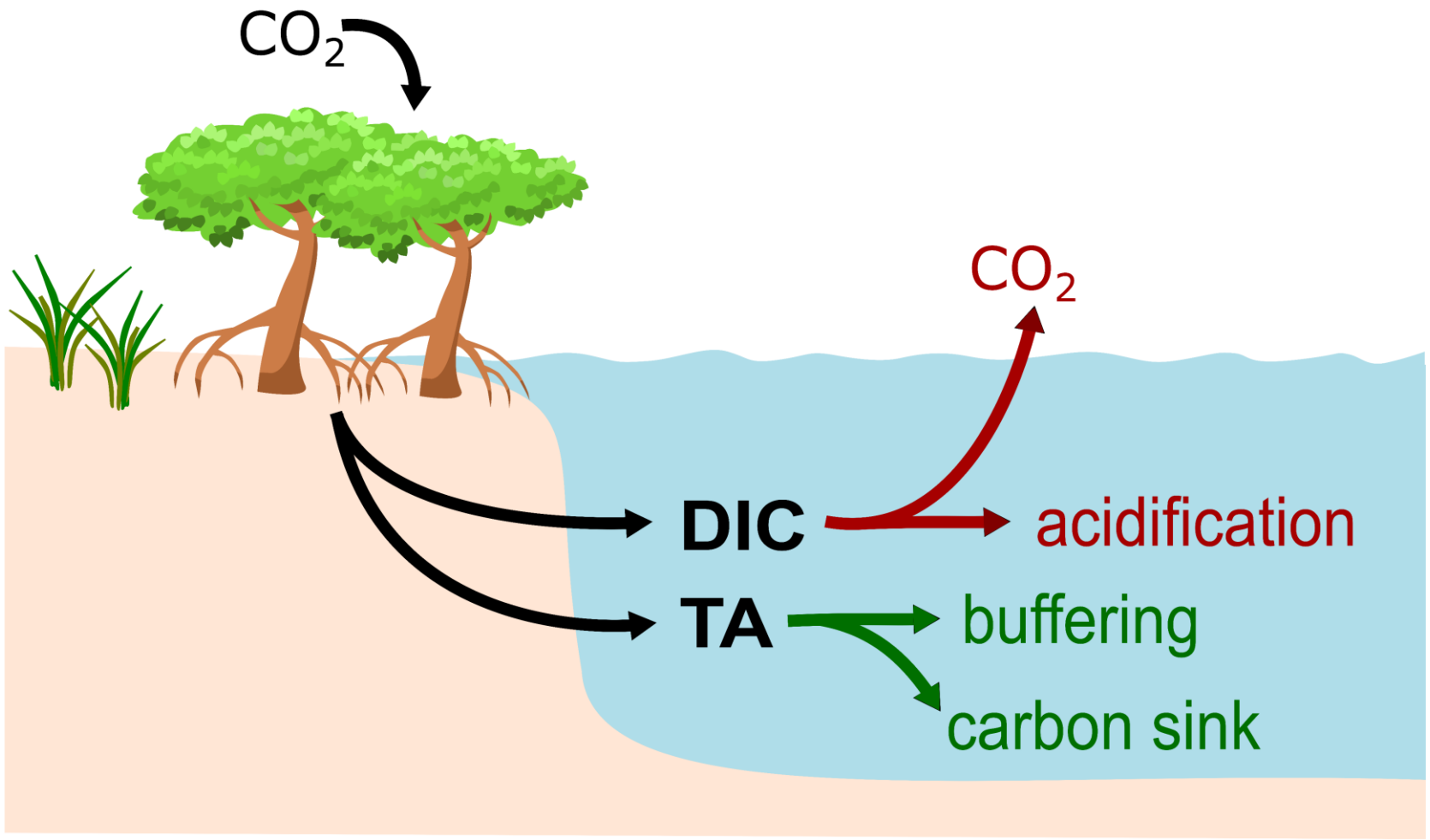
# Carbon budget of tidal wetlands



# Inorganic carbon export from tidal wetlands

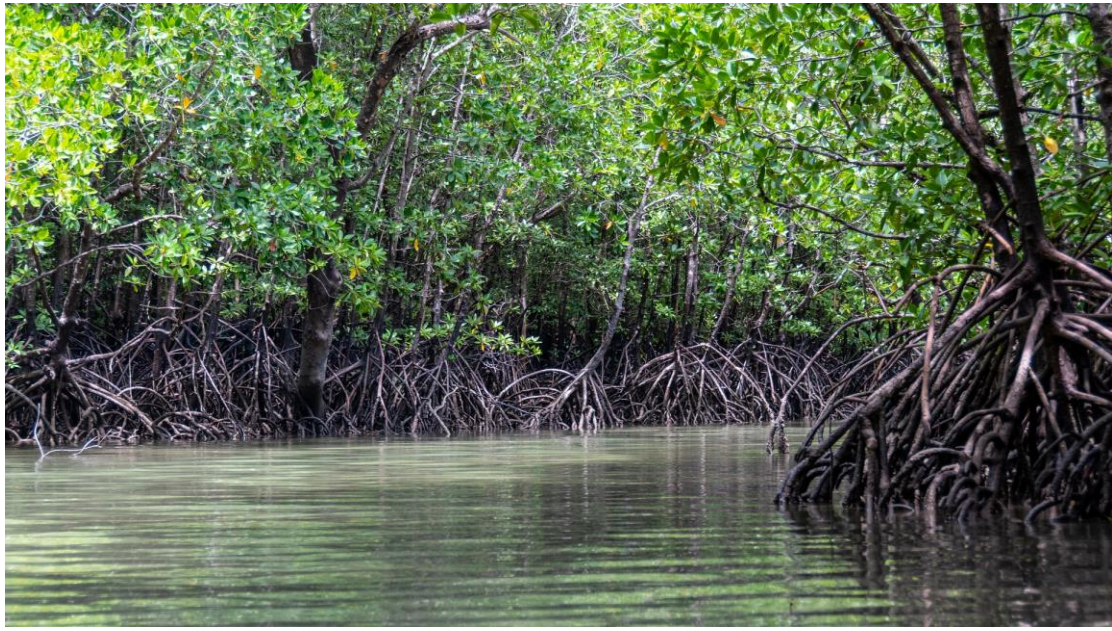



DIC = Dissolved inorganic carbon ($CO_2$ + $HCO_3^-$ + $CO_3^{2-}$)
TA = alkalinity

- Mangroves and saltmarshes sequester carbon
- Inorganic carbon is exported as DIC and TA
- DIC partly outgasses as $CO_2$ and enhances acidification
- TA is a permanent carbon sink and buffers acidification

# Study aims

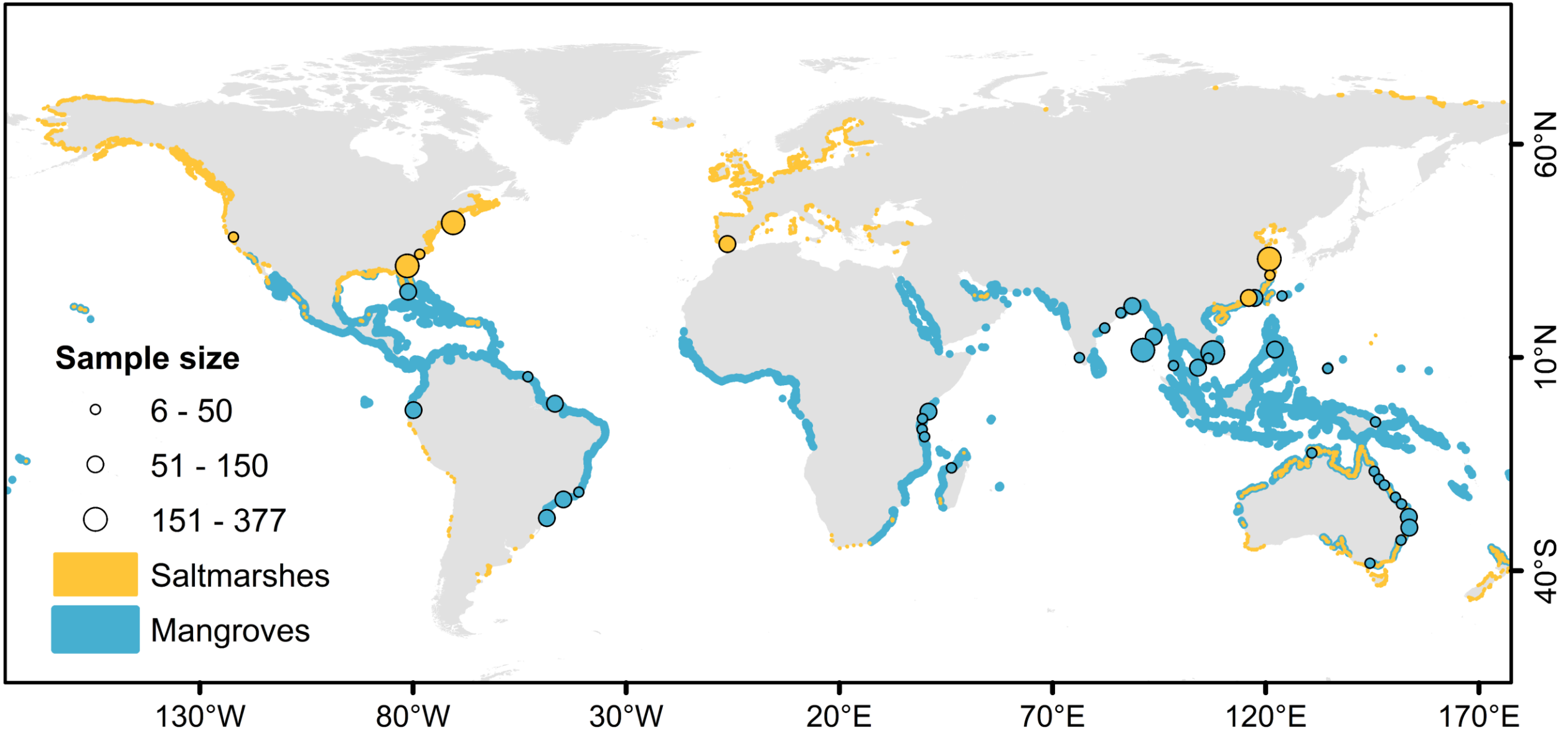
- Investigate whether mangroves and saltmarshes drive or buffer coastal acidification
- Quantify the contribution of DIC and TA outwelling to carbon budgets



# Methods

Global metanalysis of TA:DIC ratios in porewater, surface water and outwelling rates

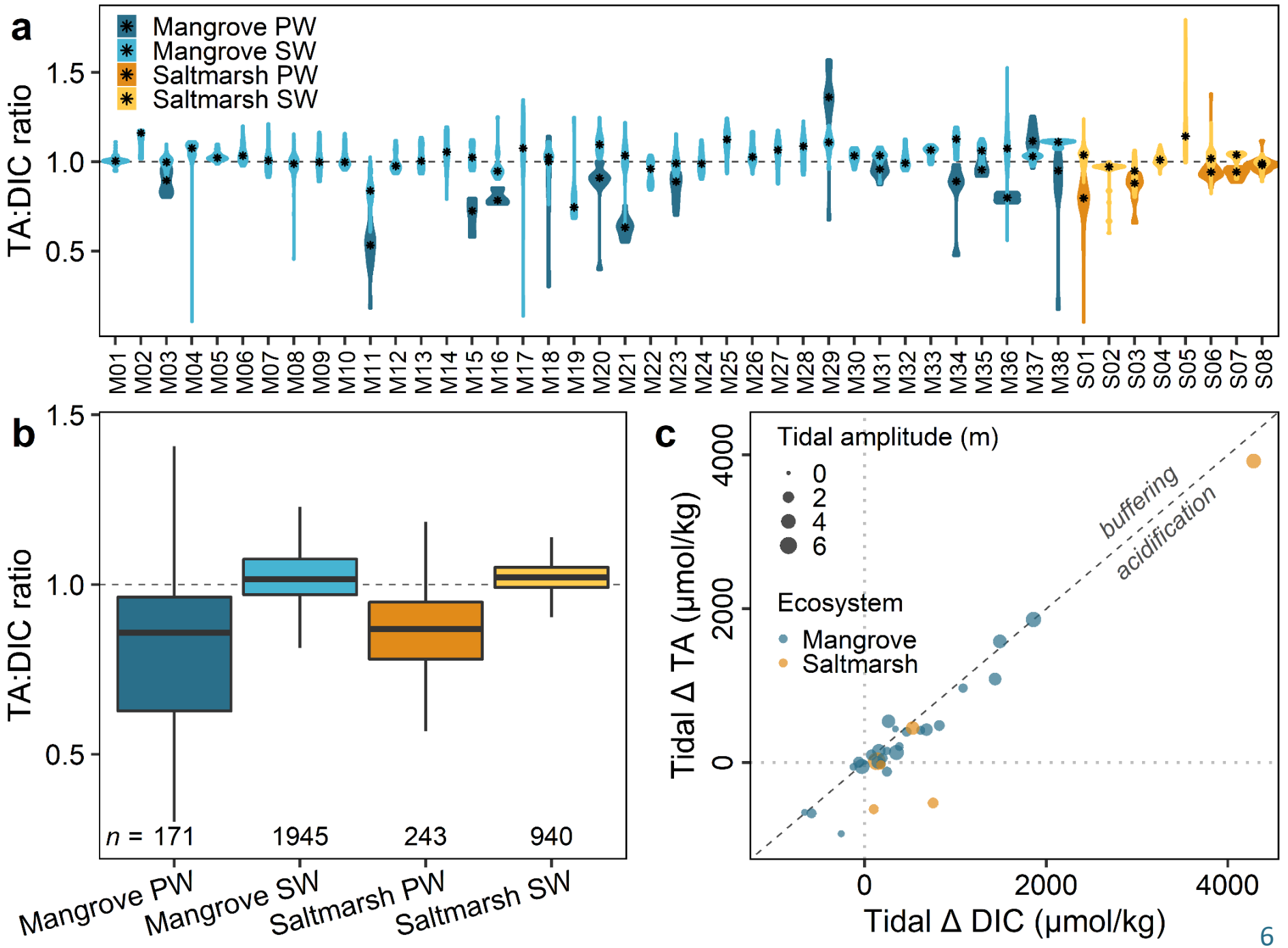
# Study sites


Sample size
6 - 50
51 - 150
151 - 377
Saltmarshes
Mangroves
130°W
80°W
30°W
20°E
70°E
120°E
170°E
60°N
10°N
40°S

# TA:DIC ratios

- TA:DIC ratios < 1 in porewater
- TA:DIC ratios > 1 in surface water
- More DIC export during tidal pumping
- Higher estuarine DIC input

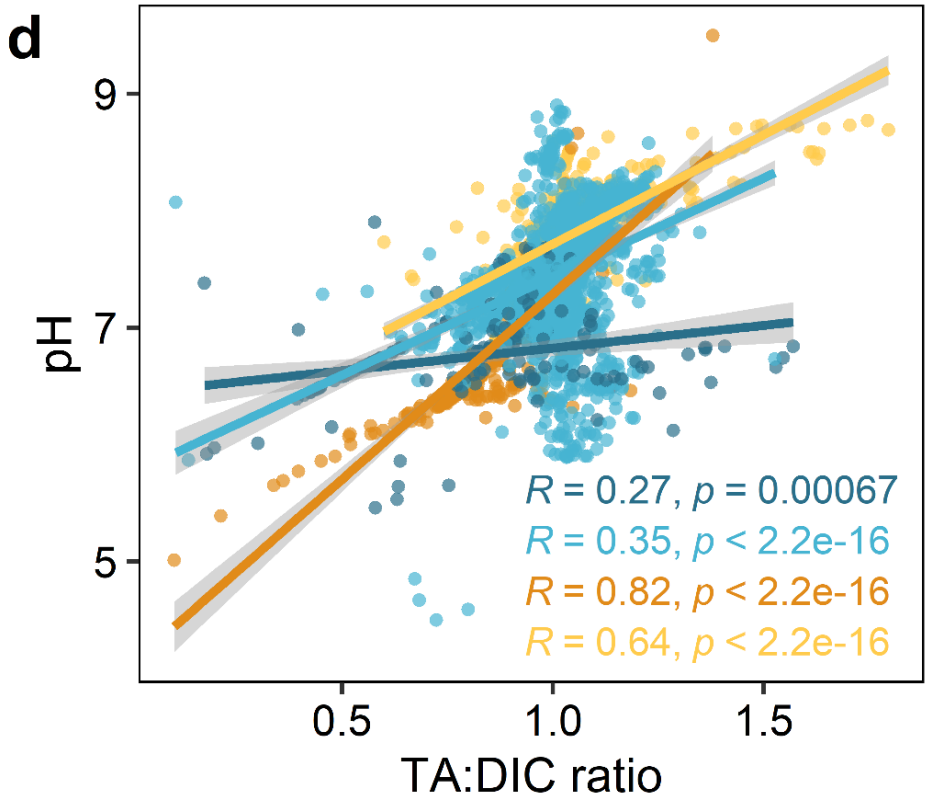
→ Higher DIC production and export than TA

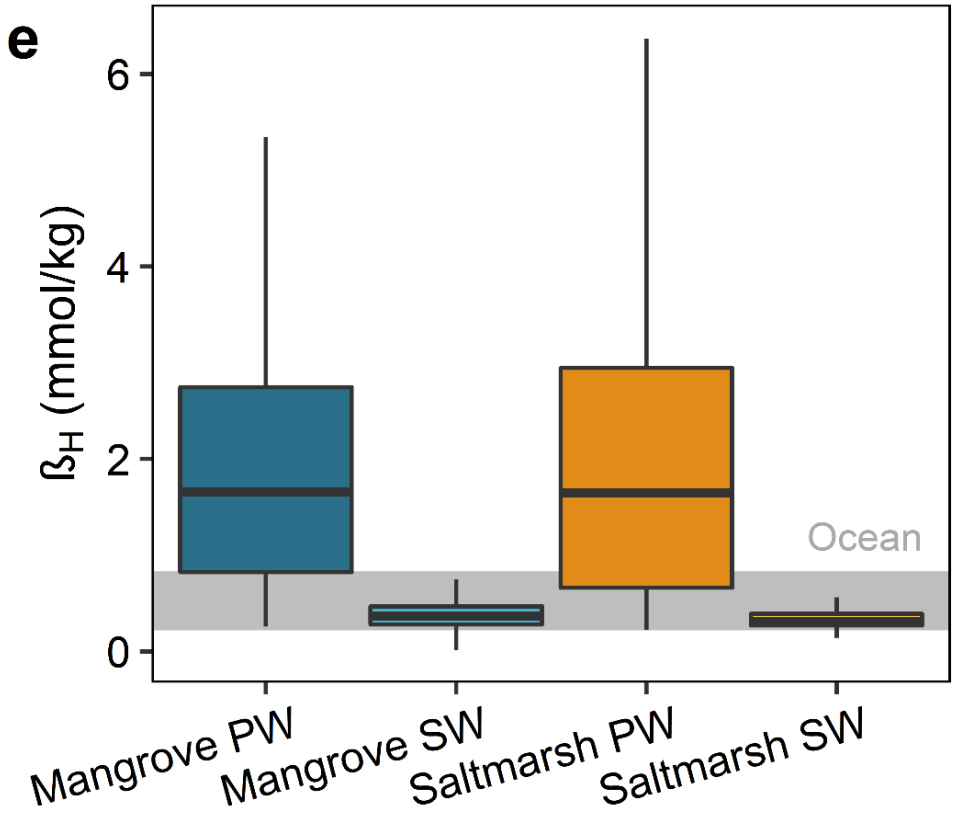


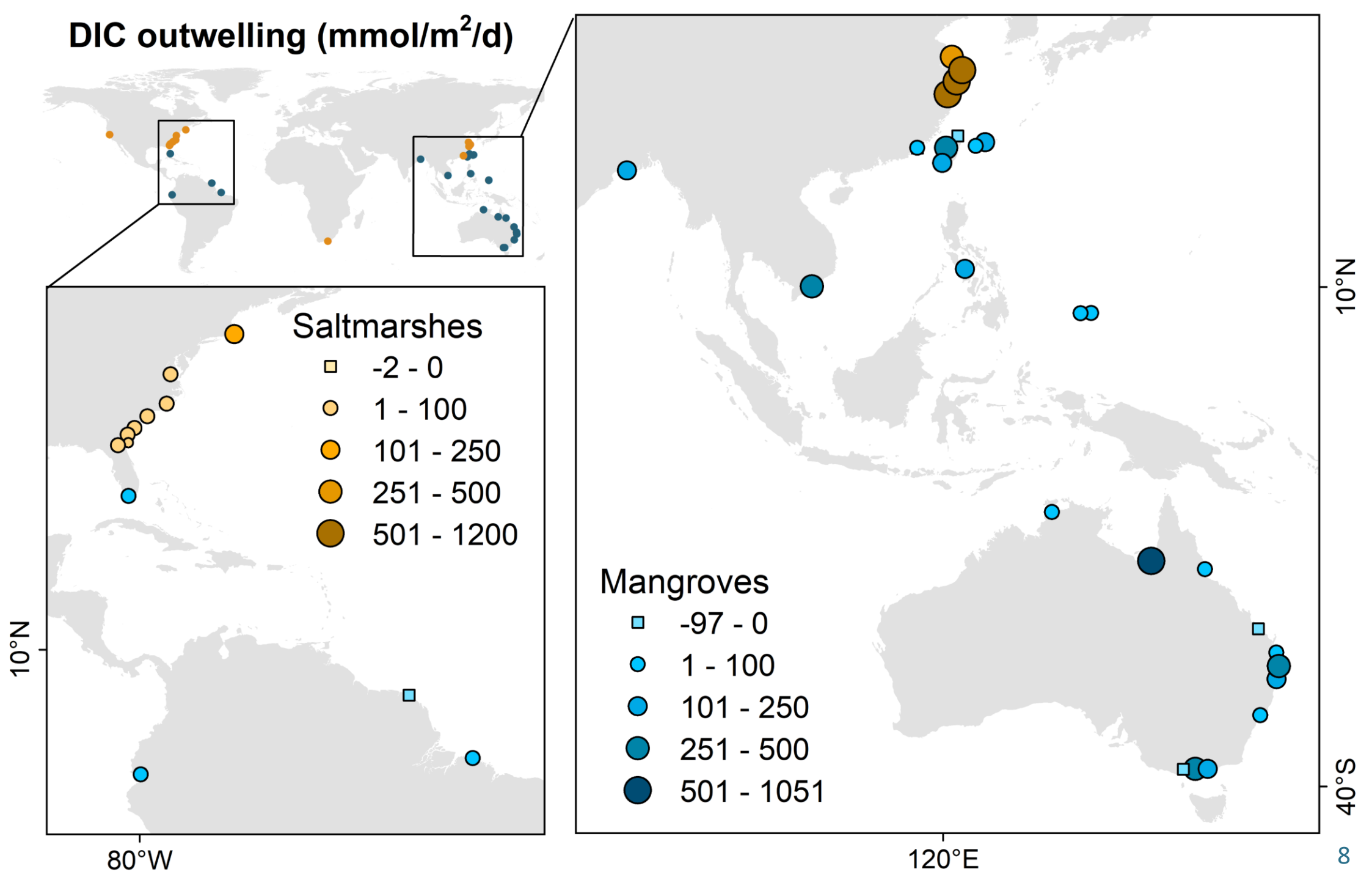
# Tidal wetlands enhance coastal acidification

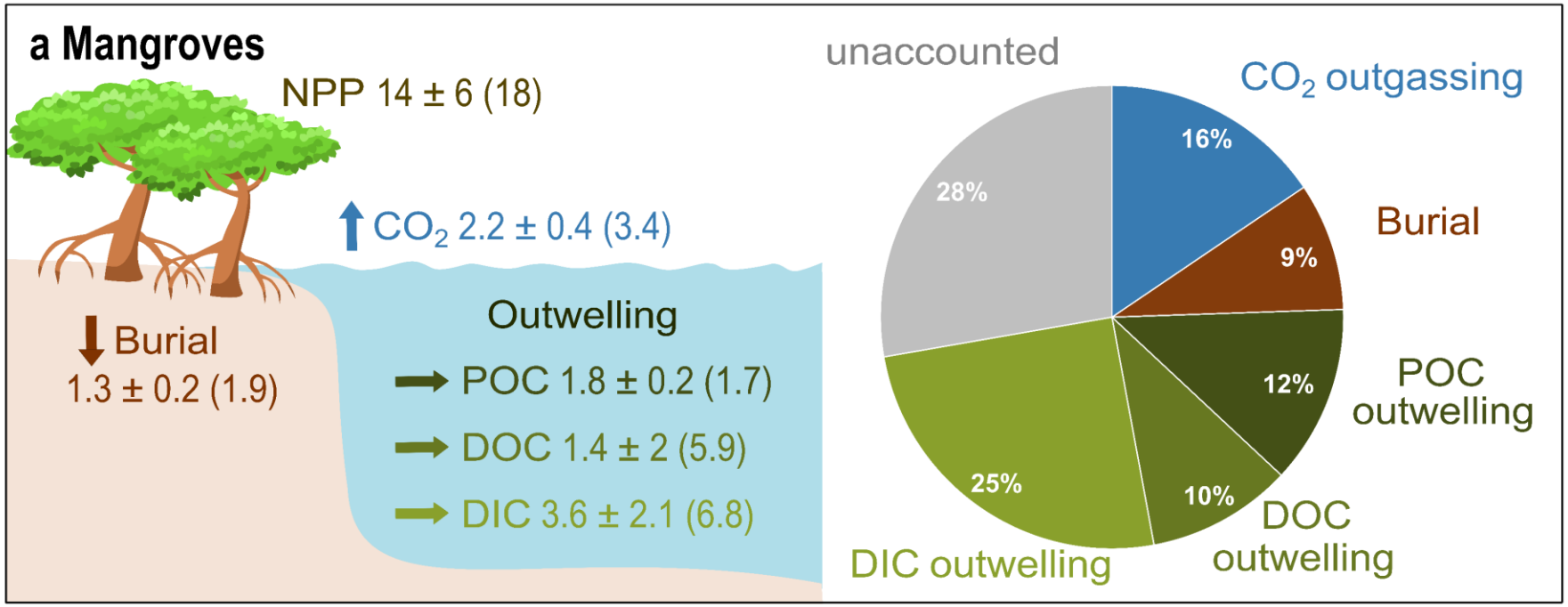
- pH correlated with TA:DIC ratios but scattered around ratio = 1
- Porewater has higher buffer factor than surface and ocean waters

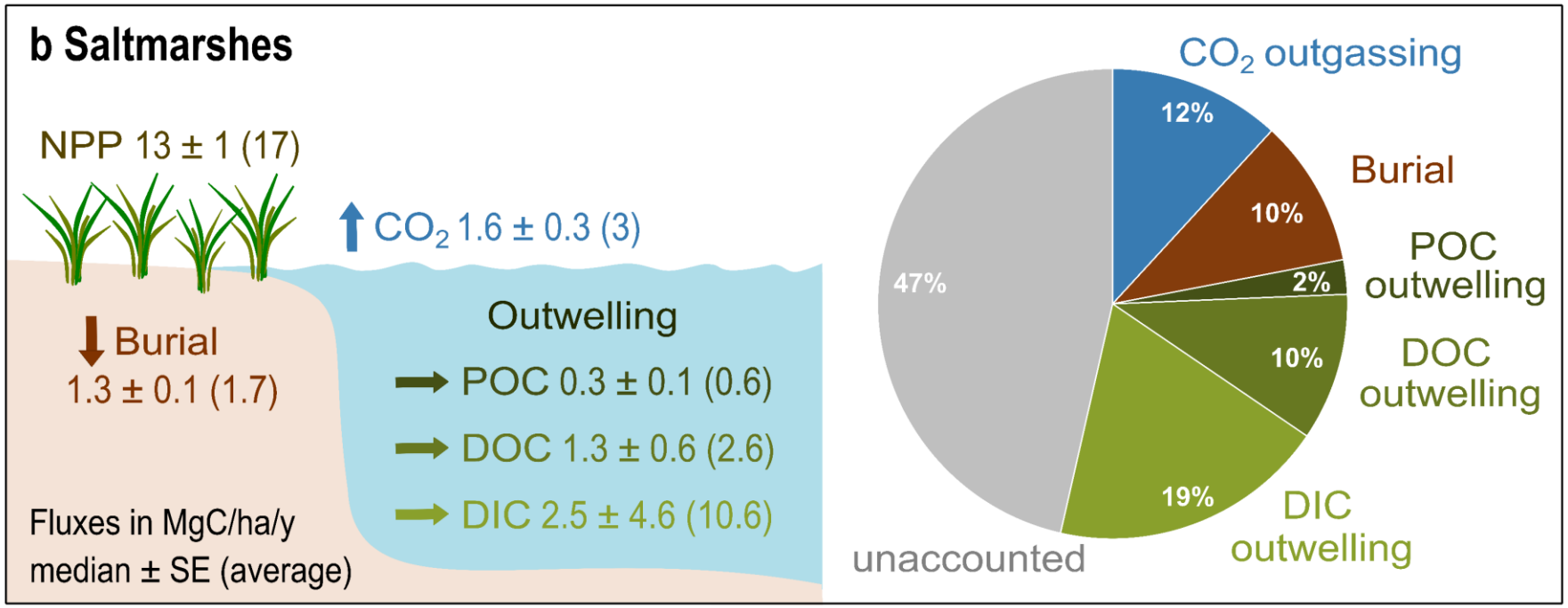
→ Acidification by mangroves and saltmarshes is hampered by high buffer capacity




DIC outwelling (mmol/m²/d)
Saltmarshes
-2 - 0
1 - 100
101 - 250
251 - 500
501 - 1200
Mangroves
-97 - 0
1 - 100
101 - 250
251 - 500
501 - 1051
10°N
80°W
120°E
10°N
40°S



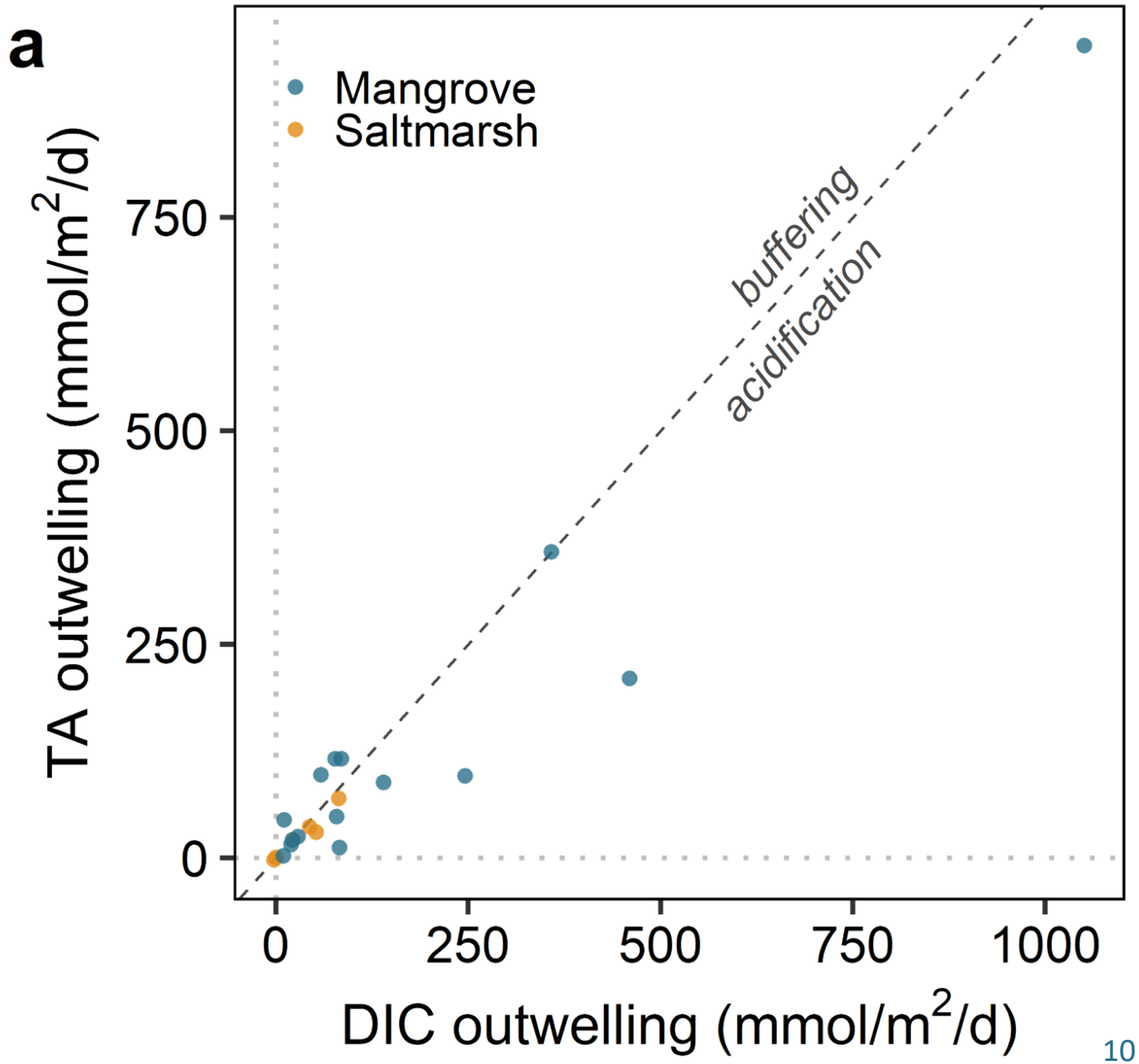




# Carbon budget of tidal wetlands

- DIC outwelling dominates budget
- Large unaccounted carbon fate when using medians
- $CO_2$ outgassing from sediments potential sink

# TA:DIC outwelling ratios

- 70% DIC > TA outwelling
- TA outwelling is 3x higher than burial in mangroves and similar in saltmarshes → unaccounted carbon sink
- TA outwelling is equivalent to 7% of the total TA sources into the ocean



# Conclusions

- Most (70%) tidal wetlands enhance coastal acidification
- Acidification is hampered by high buffer capacity
- DIC outwelling is dominant fate of carbon
- Large unaccounted carbon fate
- TA outwelling > burial → represents unaccounted carbon sink