

## **Carbon flux and export from a temperate tidal salt marsh: the good, the bad and the ugly**

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Coastal tidal salt marshes are disproportionately important to the global C cycle relative to their small global area, and on average they store 10 times more C per unit area than terrestrial forests. It is expected that these ecosystems are hotspots for C storage because they are sub- to anoxic, which decreases the rate of heterotrophic decomposition of soil organic carbon. Moreover, sulfate-reducing bacteria compete with methanogens for substrate, thereby lowering CH<sub>4</sub> production. That said, tidal patterns influence the redox conditions of soils by changes in oxygen concentrations and import/export of water, that ultimately influence C fluxes and export from these ecosystems.

We present results of C fluxes (CO<sub>2</sub> and CH<sub>4</sub>) and C export from a temperate tidal salt marsh in the Mid Atlantic, USA. We apply a wide array of techniques to measure fluxes, including eddy covariance flux measurements, and sediment and water CO<sub>2</sub> and CH<sub>4</sub> fluxes. Furthermore, we provide information from quality of dissolved organic matter that contributes to export of terrestrial C to the coastal ocean.

Our results suggest that this salt marsh acts as a net source of C to the atmosphere with net emissions of CO<sub>2</sub> between 42.5 and 304.2 gC m<sup>2</sup> y<sup>-1</sup> and net emissions of CH<sub>4</sub> between 10.9 to 19.2 g C m<sup>-2</sup> yr<sup>-1</sup>. Furthermore, we found high concentrations of CO<sub>2</sub> (>10000 μmolmol<sup>-1</sup>) and CH<sub>4</sub> (>6000 μmol mol<sup>-1</sup>) in a creek channel that contribute to large emissions from water to the atmosphere and potential lateral export to the coastal ocean.

Our results challenge the current paradigm that coastal salt marshes are key ecosystems for "Blue Carbon", and bring attention to better understanding of the underlying biogeochemical processes controlling the C cycle. Thus, there is a need to couple C flux and export measurements from different components of this ecosystem to close the C budget in these ecosystems.

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