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# The impact of water table level and grazing on greenhouse-gas exchange in salt marshes

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Saline wetlands play a crucial role in climate regulation through their robust cooling effect, attributed to rapid carbon sequestration and minimal methane production. Despite this, a comprehensive understanding of the mechanisms supporting such carbon exchange, and their specific contributions to greenhouse gas mitigation potential, is lacking, particularly in salt marshes facing the impacts of global climate changes. Here, we test the effects of water table levels, grazing, and plant community composition on $CO_2$ and $CH_4$ fluxes during the growing season of salt marshes by a controlled manipulative experiment and an in situ experiment. Rising water table levels resulted in higher $CH_4$ emissions but reduced photosynthesis and ecosystem respiration. Conversely, grazing enhanced ecosystem respiration but suppressed plant photosynthesis. Furthermore, $CH_4$ emissions from *Phragmites*-dominated communities were nearly a thousand times higher compared to *Spartina*-dominated communities. Our findings indicate that, throughout the growing season, lower salt marshes function as carbon sinks, whereas grazed *Phragmites*-dominated salt marshes are carbon sources. Our study accounted for $CH_4$ fluxes, $CO_2$ uptake and emission together, and identified the mechanisms controlling carbon exchange, an approach that is crucial for evaluating the potential of saline tidal wetlands as net atmospheric carbon sinks and developing scientifically sound climate mitigation policies.