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Restoration of native saltmarshes enhances carbon sequestration and mitigates warming effects following *Spartina alterniflora* removal

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The overwhelming dispersion of exotic species *Spartina alterniflora* threatened the structure and function in native coastal ecosystems. Consequently, native saltmarshes restoration has emerged as a nature-based solution following the removal of invasive species. However, given *S. alterniflora* as a high carbon sequestration species, it remains uncertain on the impacts of native saltmarshes restoration on coastal blue carbon benefits following its eradication. Here, this study quantified atmospheric carbon uptake and organic carbon storage in restored saltmarsh to assess whether native saltmarsh (*Phragmites australis* and *Bolboschoenoplectus mariqueter*) restoration can compensate for the carbon sinks and the climate effects following *S. alterniflora* eradication. The results showed that removal of *S. alterniflora* drastically reduced atmospheric carbon uptake, with unrestored bare mudflat turning into carbon sources. After restored native saltmarsh, the atmospheric carbon uptake remained lower than pre-eradication levels of *S. alterniflora* but provided significant greater carbon sink benefits compared to unrestored bare mudflat. Additionally, the total organic carbon density of soil and vegetation at 50 cm depth in restored native saltmarsh (*P. australis* and *B. mariqueter*) exceeded that of unrestored bare mudflat by over 1.4 times, restoring over 70% that observed before eliminating *S. alterniflora*. Considering the sustained global warming potentials (SGWP) of CH₄ over the 100-year timescale, both restored native saltmarsh communities exhibited a net cooling effect for mitigating climate warming, compared to invasive *S. alterniflora* community and unrestored bare mudflat after *S. alterniflora* removal. Our findings not only reveal that saltmarsh restoration provides a substantial route to mitigating climate change, but also highlight the trade-off between the carbon losses from eliminating invasive species and the carbon offset achieved through restoring native vegetation in affected ecosystems. This study provides actionable insights for regions confronting analogous challenges with invasive species and restoration scenarios, enabling the development of more comprehensive strategies to ensure effective carbon compensation. Future restoration efforts in invaded ecosystems should prioritize co-benefits such as conserving native ecosystems and enhancing carbon sequestration.

