Updated abstract

Challenges for carbon crediting in *Zostera marina* (eelgrass) meadows

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The protection and restoration of seagrass meadows are recognised contributions to address the combined biodiversity-, climate crises because the meadows are hotspots of biodiversity, soil carbon (OC) stocks and accumulation rate (CAR) and have experienced major global declines in response to pressures. However, their role in climate change mitigation and carbon crediting potential vary among and within seagrass species and habitats. Here we address the potential for carbon crediting in meadows of *Zostera marina* (eelgrass), the most widely distributed seagrass species, through a review of soil OC stocks, CAR, sources and stability (mineral associated organic matter - MAOM) of the organic matter inputs. We compare our findings for eelgrass, which is a fast-growing colonizing-opportunistic seagrass species, with those for *Posidonia oceanica*, typifying slow-growing, persistent seagrass species. Eelgrass soil OC stocks and CAR display a wide range of values, with median stocks 40% lower and CAR 50% lower than the median values for *P. oceanica* and median eelgrass CAR only 28% of the Tier 1 emission factor for seagrass used in the IPCC guidelines. The OC stocks under eelgrass vegetated patches were generally not significantly different from stocks of nearby unvegetated soils and only 25% of the eelgrass soil samples in this compilation would return positive OC values after subtracting the mineral-protected fraction (a requirement of some carbon market methodologies). These features may partly be due to strong spatial heterogeneity and temporal dynamics of eelgrass meadows, general eelgrass traits as well as export of eelgrass carbon beyond the meadows. We discuss how the findings inform the implementation of methodologies used in carbon crediting projects for restoration of eelgrass meadows and encourage the valuation of these meadows for all the ecosystem services they provide.