Blue carbon stocks in Baltic Sea eelgrass (Zostera marina) meadows

Although seagrasses cover only a minor fraction of the ocean seafloor, their carbon sink capacity accounts for nearly one-fifth of the total oceanic carbon burial and thus play a critical structural and functional role in many coastal ecosystems. We sampled 10 eelgrass (Zostera marina) meadows in Finland and 10 in Denmark to explore seagrass carbon stocks (C-org stock) and carbon accumulation rates (C-org accumulation) in the Baltic Sea area. The study sites represent a gradient from sheltered to exposed locations in both regions to reflect expected minimum and maximum stocks and accumulation. The C-org stock integrated over the top 25 cm of the sediment averaged 627 g C m(-2) in Finland, while in Denmark the average C-org stock was over 6 times higher (4324 g C m(-2)). A conservative estimate of the total organic carbon pool in the regions ranged between 6.98 and 44.9 t C ha(-1). Our results suggest that the Finnish eelgrass meadows are minor carbon sinks compared to the Danish meadows, and that majority of the C-org produced in the Finnish meadows is exported. Our analysis further showed that >40% of the variation in the C-org stocks was explained by sediment characteristics, i.e. dry density, porosity and silt content. In addition, our analysis show that the root : shoot ratio of Z. marina explained >12% and the contribution of Z. marina detritus to the sediment surface C-org pool explained >10% of the variation in the C-org stocks. The mean monetary value for the present carbon storage and carbon sink capacity of eelgrass meadows in Finland and Denmark, were 281 and 1809 EUR ha(-1), respectively. For a more comprehensive picture of seagrass carbon storage capacity, we conclude that future blue carbon studies should, in a more integrative way, investigate the interactions between sediment biogeochemistry, seascape structure, plant species architecture and the hydrodynamic regime.

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