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Assessing the contribution of beach-cast seagrass wrack to global GHGs emissions: experimental models, problems and perspectives

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Carbon stock in coastal seagrass ecosystems is estimated to be 4.2-8.4 Pg C. While covering less than 0.2% of the ocean floor, seagrasses store about 10% of the carbon buried in the oceans each year. However, such a potential contribution is reduced by the annual loss of seagrasses globally (-1.5% per year) mainly because of anthropogenic coastal development and climate change. Like many terrestrial higher plants, marine seagrasses lose their old leaves during annual or inter-annual senescence, and a significant proportion of these residues is transported in surface waters and washed up on shores by surf, tides and winds. This beach-cast seagrass wrack provides important ecosystem services, such as reducing wave impact, protecting beaches from erosion, providing habitat to bird and invertebrate species that colonize shorelines, and being a primary food resource for beach detritivores. However, accumulation of seagrass wrack on beaches, following degradation of meadows, can negatively impact tourism. Therefore, wrack piles are frequently collected and disposed of in landfills or biomass waste facilities, and the adoption of these management practices implies substantial environmental and economic costs. On the other hand, wrack piles might be a significant source of greenhouse emissions (GHGs). Recent studies reported CO_2 emission rates and suggested possible mitigation options, such as energy conversion and biochar production through pyrolysis. Even though quantitative estimates of both seagrass coastal distribution and residues disposal to seashores are partially available, at least at regional level, the assessment of their contribution to global GHGs emissions is still lacking, due to a knowledge gap about the effects of peculiar environmental conditions of beach ecosystems on seagrass decay rates.
In this framework, we propose an experimental model to assess seagrass wrack decomposition dynamics in both controlled conditions and experimental fields in North-East Italy, with focus on CO_2 and CH4 emissions, as a function of temperature, salinity, water supply and physical properties of the wrack piles. After presenting preliminary results, we highlight problems and perspectives concerning the assessment of beach-cast wrack contribution to the global GHGs emissions.