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Biogeosciences Discussions

Interactive comment on "Reviews and syntheses: Hidden Forests, the role of vegetated coastal habitats on the ocean carbon budget" *by* Carlos M. Duarte

Anonymous Referee #1

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Review of Duarte – Hidden Forests

This manuscript on the role of vegetated coastal ecosystems in the ocean carbon budget is generally fine, but in my opinion does not really offer much novelty or new insights compared to a number of earlier syntheses on the same topic. The strongest point is the emphasis on the uncertainty in the area covered by these different types of ecosystems, and on the implications this has for their estimated global carbon fluxes – but these uncertainties are not consistently applied. I don't have a problem seeing this published but do feel the added contribution to existing literature is rather slim unless some new aspects are included. That being said, I do have a number of suggestions for improvement or to increase the consistency; I have listed these below.

The author correctly emphasizes the uncertainty in global areal estimates of vegetated coastal ecosystems, and that this 10-fold uncertainty implies and equally large uncertainty in e.g. global OC sequestration rates or production rates. However, I do not see this consistently emphasized in the latter data, and I suspect that the numbers that will be picked up from this work and cited later on are the maximum potential fluxes/rates – the way these are presented is somewhat biased then. To illustrate my point:

Page 1, Line 16: "representing up to 1/3 of the biological CO2 removal by marine biota". OK – but given the 10-fold range in areas, one could also write "representing as little as 3.5 % of the biological CO2 removal by marine biota" if we take the lower value of areal rates ? I'm obviously not advocating for the latter, but if the uncertainty brackets a 10-fold range, I don't feel it's fair to mention only the maximum values in abstract and conclusions, just to stress the potential importance of these ecosystems and to raise awareness. The same issue in th Conclusions, page 9 line 9-11: "contributing 10% of the oceanic NPP, 1/3 of the ocean's biological pump and >2/3 of carbon burial of sediments is now evident"

Page 4, line 19-20: NPP is ∼10% of marine net primary production globally. You refer here to Duarte & Cébrian (1996), further on to Smith (1981) for the same statement (page 9, line 10). Both are somewhat older publications, aren't there new data to revise this estimate (read: should this not be one of the objectives of this paper) and aren't those estimates based on a fixed and highly uncertain areal extent as well ? It is somewhat counterintuitive to stress the uncertainty in the role of these systems in the global (ocean) C budget due to the uncertain global areal cover, but to stick to a fixed contribution to marine NPP based on syntheses performed >20 years ago.

Page 7, line 5-10: "Hence, vegetated coastal habitats would contribute up to 1/3 of the biological CO2 removal by marine biota estimated to represent about 2000 Tg C y-1, which had hitherto been attributed entirely to phytoplankton photosynthesis (Ciais et al 2013). Several points/suggestions regarding this statement:

1/ up to 1/3rd of biological CO2 removal by marine biota: again, this is stressing the upper limit, see comment above. One could take the opposite view and claim they contribute as little as 1/30th ? 2/ Unless I'm mistaken, the numbers by Ciais refer to net CO2 uptake by the global ocean, it does not claim that this CO2 drawdown is entirely due to phytoplankton production ? 2/ Vegetated coastal ecosystems such as mangroves and salt marshes (and subtidal seagrass beds to a certain extent) take up CO2 from the atmosphere, not from the ocean water. Hence, their productivity would not directly lower pCO2 in the ocean and will not lead to CO2 uptake by the ocean, in that context comparing NPP data from all vegetated coastal ecosystems combined is difficult to compare directly with data on net ocean CO2 uptake.

Page 9, line 10: coming back to Smith (1981): while it's good to acknowledge the early work, I doubt this should be used as the most recent / best estimate of the contribution of these ecosystems to NPP. There are many more datasets published in the meantime, and Smith (1981) used a fixed area of 200,000 km^2 and included only seagrasses and macroalgae. If the objective is to provide a state-of-the-art, use the best estimates available + include the uncertainty which is a key message elsewhere in the paper.

-Table2 should be clarified:

1/ "Lower range of production values from Duarte etc": specify whether this refers to the areal rates (first column) or the total NPP range (2nd column).

2/ "Upper value for mangrove and salt marsh production calculated as the ratio between global NPP and global area in Duarte & Cebrian": this does not make sense to me. The global NPP data in Duarte & Cébrian were calculated assuming a certain area for each of these ecosystems, taking those globally integrated NPP values and dividing them by - I assume – a range of (different) area estimates is not defendible. Or perhaps I misunderstand what was done to derive these numbers – explain in more detail.

3/ % buried and exported, data from Duarte & Cébrian (1996). Here too, can these estimates not be easily refined given the large amount of studies performed in the 20

years since this publication ?

Minor issues:

-be consistent in using km^2 and not Km^2

-Page 2 line6-9: Is an alternative reason not that fitting them into the global C budget is also made complicated by the fact that they are complex ecosystems at the land-ocean interface, and that flux measurements (e.g. OC burial rates in seagrass beds, to name but one) are somewhat complicated to assign to specific sources/origin, e.g. much of the OC burial in seagrass beds may be terrestrial or mangrove carbon. This paragraph is perhaps a little to pessimistic about the recognition they receive, given the strong impetus in studies on C cycling in vegetated coastal ecosystems during the past 15-20 years.

-page 8 line 16: poleword (not poelword)

-page 8 line 9: loss rates of 0.5 – 5 % year-1, this is a different range of loss rates than that cited on page 4 line 9. Use consistent numbers and references.

-page 8, last line: "Lastly, realization of the major export of organic matter [. . .]": what is meant by this?

-page 9, first line: "available" should be "availability"

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