

## ***Interactive comment on “Geomorphic influences on the contribution of vegetation to soil C accumulation and accretion in *Spartina alterniflora* marshes” by Tracy Elsey-Quirk and Viktoria Unger***

### **Anonymous Referee #1**

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This manuscript covers a lot of topics and presents some interesting data, but it is difficult to follow and could be more effective in highlighting the key findings.

Three hypotheses are presented but are poorly linked to data collection and analysis (they seem like after the fact general points rather than truly testable hypotheses). From the manuscript, the hypotheses are: (1) environmental parameters are highly correlated across marshes; however, hydrology is the most important predictor of belowground productivity, decay rates, and above- and belowground biomass; (2) short-term (< 2 yr) surface accretion rates are influenced by a combination of aboveground vegetation structure, belowground productivity, decay and mineral sedimentation rate;

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and (3) longer-term (~50 years) accretion and soil C accumulation are more strongly related to belowground biomass in organogenic marshes in a coastal lagoon than in more minerogenic marshes of a coastal plain estuary, where the potential for allochthonous C contributions are greater.

When I first read these, I wondered how would these be tested? For #1: how can you determine that hydrology is the most important predictor (in part, there are many components of “hydrology”, how do you determine relative importance, and in comparison to what other factors?). For #2: this seems very open ended rather than a testable hypothesis: accretion rates are influenced by a combination of factors? And for #3, the authors come to this conclusion in the discussion, but no mention is made in the analyses of how these comparisons would be made (what is the data/statistical support for this). The manuscript would be much more effective and focused, if clear, testable hypotheses were presented. The data collection and analyses should clearly identify how these hypotheses are to be tested. This would give some structure to the results rather than the wide ranging review of results that currently are difficult to link to specific questions/hypotheses.

There are some arguments that are presented that are difficult to untangle: for example, mineral matter drives productivity. If this is the case, what is the expected “response” that supports this and what “response” would not support this (how would the measured parameters of total biomass, ingrowth, mineral matter accumulation, etc., vary if this is true and what if it is not true – or is the key in the the relationships of different parameters)? As above a clear articulation of expectations (hypotheses) is essential but lacking. Without these, it’s an interesting story but not so clear what is actually being supported from these findings/data.

Part of my confusion in interpreting the results is that this is a relatively complex set of experiments with many different factors and response parameters. In terms of factors, there are two locations, with multiple sites within each location – and many factors vary both across locations as well as within locations: tidal range, sediment inputs, salinity,

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inundation, etc. . . Plus there are many different response parameters, some closely related, some not (ingrowth, biomass, decomposition, accretion, C accumulation, mineral accumulation, etc. . .). It might be very useful to put together a summary table that links the various components of this research to the hypotheses/research questions of interest (factors, locations/sites, responses, expectations). Or at a minimum, to clearly identify in the methods what these links are: to test the hypothesis #2, we compared xxxx across sites (or across inundation conditions within sites), using xxxx analysis. . .

Overall, I found the writing difficult to follow. Many of the paragraphs are very long and cover a mix of topics. I'd suggest focused paragraphs with very clear topic sentences so that the logic of each section is clear and easier to follow than the current paragraphs that ramble over a mix of topics. In addition, there are some grammatical mistakes, dropped words, etc. that make the manuscript difficult to understand (e.g., l.66: should be wide range OF geomorphic settings) – check throughout for grammar (many compound sentences missing commas (l.212-213), etc. . .). Also some sentences are overly complex and difficult to follow (for example, the last sentence of the abstract): “These findings indicate that mineral sedimentation is of utmost importance for promoting belowground biomass and soil C accumulation in sediment-limited systems while in minerogenic systems, belowground biomass may not scale with C accumulation and accretion, which may be influenced more by smaller submillimetre-sized C particles.” (secondarily, I don't think submillimeter particles are brought up again in the manuscript, so why are they in the abstract?)

It was not entirely clear what was previously collected background information, and what was new data for this study. For example, you refer to published rates of accretion from Boyd et al. 2017: are the accretion rates here the same data or different?

The discussion of elevation is not so clear. Be more specific. I'm assuming that it is relative elevation that is critical (where within the tidal frame the marsh surface is found). For example on Figure 4, is this elevation relative MLW (see other point below about MLW)? And are positive elevations above or below MLW? I would put lower

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elevations on the left side of the x-axis (not sure if this is the case as presented). It also looks like much of this relationship is driven by the two points with zero biomass. How does this affect your interpretation: is it just a threshold relationship or is it really a linear relationship?

Also, for figure 5, organic matter inventory: the one outlier seems to be driving this relationship. Does this affect your interpretation?

It's surprising that you've found a strong fit between mineral accumulation and accretion rather than organic matter and accretion. Most others have found differently (e.g., Turner et al. 2000). How can you explain this difference?

For Figure 3: how can the decay rates and the % mass remaining not be indirectly related: How can CC have the highest decay rate, but have more mass remaining than 3 of the other sites? These should be strongly related.

Many of the figures present multiple panels, and it is not clear, what is essential to get out of a figure: seems more like a fishing expedition in presenting a wide range of results rather than targeting specific questions/hypotheses.

Details: You refer to cores of 6 cm diam. in line 144, but then 15 cm cores in l. 160. Were two different sets of cores taken? This needs to be clarified.

Be consistent in how you refer to sites: sometimes in the coastal plain site, sometime it's a minerogenic site.

paragraph starting at l.276 (and paragraph above): this all seems very exploratory, with little focus: you looked at a wide range of variables for patterns, went with MHW and MLW. As above, link the approach to the hypotheses (and move the methods to the methods section and out of the results). Also, it was not clear to me how MHW and MLW represent the range of factors (were these absolute elevations of MHW or MLW) – as you can see, I did not follow this section of the ms. very well (it was not clear to me, but maybe it is clear to others). Similarly at l.288: how does “MLW influence

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ingrowth rates"? MLW is a characteristic of a particular site, but how does it influence growth across a marsh?

Lead with the key issues in presenting the data for each section. For example, for aboveground vegetation structure (paragraph starting at l. 316): clearly stem density is important, but why include the CV here: what is the significance of this? As above, I got lost in the details of the data that were presented, and did not see the key issues from the results.

Figure 1: provide some context. Not all readers know where Delaware and New Jersey are.

Other figures: As above, be consistent in mentioning features of sites so people will remember lagoon vs. coastal, minerogenic. ... For example for Figure 3, group sites as you do for Figure 2 (or color bars or use hatching so that the two groups are obvious).

Figure 3: the dark bars on the bottom panel, make it very difficult to see the symbols for organic matter accumulation rates.

Similar to the broader point about figures with multiple panels, some multi-panel figures are not organized intuitively (at least not for this reader). For example, for Figure 7: what is mineral sedimentation the x-axis on the top two LEFT panels and the bottom two RIGHT panels? The wide mix of combinations, makes it very difficult to see patterns and follow the logic of the data presentation.

References: Some of them are out of order: See Cahoon at l. 618 and again at l. 639. In addition, some journal titles are abbreviated, some are spelled out in full (l.619 & 625).

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