

Comment on bg-2021-41

Anonymous Referee #2

Referee comment on "Plant genotype controls wetland soil microbial functioning in response to sea-level rise" by Hao Tang et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2021-41-RC2>, 2021

The authors present a fascinating study that reveals compelling evidence of plant genotype mediating the influence of inundation on coastal marsh soil microbial communities. Overall, the work makes a strong contribution that substantively advances understanding of whether (and how) intraspecific variation in ecologically dominant plants influences key aspects of carbon cycling in coastal marshes, which disproportionately influence the global carbon budget. Accordingly, the work warrants publication as it will be of great interest to a broad audience, ranging from evolutionary biologists to soil biogeochemists. Before publication, the authors should make some relatively minor but important revisions that will strengthen the presentation of their work, as follows:

- Most importantly, the authors should not use terms such as 'adaptation', 'adaptive', etc. to describe functional differences in the two genotypes included in the study (and corresponding descriptions of the significance of plant intraspecific variation). These terms have very specific technical connotations, and their use requires evidence that phenotypic variation (i.e., functional variation) is (1) heritable; that the trait in question (2) responds to natural selection; and that responses in some way (3) relate to reproduction (i.e., fitness). The work presented here and elsewhere (i.e., Reents et al. 2021 <https://doi.org/10.5194/bg-18-403-2021>) does not present sufficient evidence that variation in tolerance to inundation is adaptive. Accordingly, the authors should substitute 'tolerant' and 'intolerant' (i.e., to inundation) to describe the two genotypes included in the study. Associated terms used elsewhere should be removed or replaced by technically suitable substitutes (e.g., the term 'plant intraspecific adaptations' should be replaced by 'plant intraspecific variation').
- From a methodological perspective, the source of the soil used for the experiment is somewhat concerning. It appears that the soil was not taken from the origin of either of the plant genotypes. This discrepancy should be noted as a caveat in the Discussion, as plant-microbe associations (and effects, outcomes thereof, etc.) can reflect provenance.
- From a statistical perspective, the number of correlation tests that were conducted is somewhat concerning. Further detail is warranted regarding the soil microbial parameters and plant biomass parameters that were examined. Also, depending on the number of tests conducted, significance should have been adjusted to account for

multiple testing.

Below are notes that relate these comments to specific elements of the text as well as other notes intended to improve the presentation of the authors' work.

SPECIFIC COMMENTS

ABSTRACT

L13. Topic sentence of the paragraph doesn't align with the content of the paragraph. Revise. Possibly combine and abbreviate the first and second sentences in the paragraph to create a new, more representative topic sentence.

INTRODUCTION

L33. Change sentence structure to: "...It is therefore crucial to study the direct effects of climate change on soil microbial communities and resulting changes in ecosystem functioning. It is also important to examine plant-mediated, indirect effects (Bardgett et al., 2008; Van der Putten et al., 2013). Prior work on a wide range of ecosystems indicates that changes..."

L38. Change to "...on ecosystem C as well as greenhouse-gas and nutrient dynamics..."

L40. Topic sentence of the paragraph doesn't align with the content of the paragraph. Revise. Possibly combine and abbreviate the first and second sentences in the paragraph to create a new, more representative topic sentence.

L57. Change to "These ecosystems are among the most effective..."

L67. Change to "The prevailing notion is that decomposition rates are inversely related to flooding."

L69. Change to "have demonstrated"

L75. Change to "control of microbial C cycling in wetland soils by plant processes"

L76. Change to "yet largely overlooked"

L82. Change to "we hypothesized that"

L87. Change to "by intraspecific adaptive variation"

METHODS

L97. Change to "The experiment was conducted"

L104. Methods concern: one source of soil was used for the experiment. It also appears that the soil was not taken from the origin of either of the plant genotypes. This discrepancy should be noted as a caveat in the Discussion, as plant-microbe associations (and effects, etc.) can reflect provenance.

L111. Move "(n = 4)" to L109. Place after "four unplanted mesocosms"

L115. Provide more description here detailing (1) the extent of functional differences between the two genotypes (i.e., how different is the adaptive from the non-adaptive genotype, with regard to flood tolerance?). Also, provide a brief explanation of what was done to determine that the differences are (1) genetically-based, and (2) adaptive. It appears that sufficient work was done to demonstrate that the differences reflect heritable variation, but there isn't evidence (yet) that the differences are adaptive. It is entirely possible that functional differences can reflect heritable, non-adaptive differentiation.

L172. How different were technical replicates with regard to community composition? i.e., what were the Bray-Curtis dissimilarity measures of replicates relative to other comparisons? This could be noted in the text or illustrated in a supplemental figure.

L175. What "soil microbial parameters and plant biomass parameters" were examined? Provide more detail here. Also, depending on the number of tests conducted, significance might need to be adjusted to account for multiple testing.

RESULTS

L220. The resolution of Figure 3 could be increased- the text appears a bit blurry.

L230-237. While this analysis was intended to be descriptive, the number of tests conducted warrants that significance be adjusted for multiple comparisons (i.e., Bonferonni corrections).

L240. Table 2. Presentation of significant correlations should be adjusted to reflect corrections accounting for multiple comparisons

L246. Correct typo. Should read "*sensu* Keuskamp et al., 2013))"

L256. Delete "the" before "microbial"

L262. Change to "soil microbial community structure"

L263. Delete "the" before "community"

L264. Change to "is shown"

L274-276. Long and complicated sentence structure. Trim it back by deleting "in ecosystems"

L286. Again, it might very well be that the functional differences among plant genotypes are not adaptive.

DISCUSSION AND CONCLUSIONS

L288. Topic sentence of the paragraph doesn't align with the content of the paragraph. Revise. Possibly combine and abbreviate the first and second sentences in the paragraph to create a new, more representative topic sentence.

L298. How is genotype-induced variability in plant biomass different from genotype?

L321. Change to "...proven to be a powerful tool for characterizing..."

L327. Delete "parts of the"

L329. Reference to statistically significant correlations may have to be amended to account for concerns about multiple testing.

L335. Change sentence structure to "oxygen-deficient soils, like those found in coastal marshes. This suggests that it might be the most important mechanism, but strong genotype effects..."

L338-339. To support this premise, it would be good for the authors to refer to work done by Bernick et al. (MEPS 601:1-14 (2018) - DOI: <https://doi.org/10.3354/meps12689>) that illustrates heritable variation in nutrient acquisition among genotypes of a dominant plant (*Spartina alterniflora*) that engineers coastal marsh ecosystem attributes.

L353. As already noted, the use of the terms "adaptations" and "adaptive" are not well supported and should be replaced by terms like "variation" or simply not used.

L359. Delete "neither of which were part of the present investigation"