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Interactive comment on "Factors controlling *Carex brevicuspis* leaf litter decomposition and its contribution to surface soil organic carbon pool at different water levels" *by* Lianlian Zhu et al.

Anonymous Referee #2

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Line 20 and 46: I recommend including (Cao et al. 2020), and references therein, that address aboveground litter decomposition on SOC pools.

Line 30: The SOC increase due to litter application (Figure 5d) appears to be calculated from Figure 5a, but I could not reconcile the value for -25 cm. While Figure 5 does seem to support that litter increases SOC, I have two concerns about this presentation. First, the differences in Figure 5a for the 0 cm water levels is labelled as significant, but the error bars clearly overlap. Please clarify. Second, and a potential fundamental flaw in the data presentation, is that the baseline SOC is not provided and there is no way to know if SOC changed throughout the course of the experiment. It appears based on

Equation 4 you did measure baseline SOC for each core (∼18 g kg-1)? Please clarify. In either case, a significant observation, which is not discussed, is that the no-litter treatments resulted in very large SOC increases and adding litter resulted in a small additional increase.

Line 40: References for this statement are inappropriate, or incorrectly cited. Means et al. 2016 does not discuss global carbon pools. Whiting and Chanton (2001) is an accurate source for the value you used for wetland carbon stocks, but they cite Schlesinger 1991 as their source, and there are more up-to-date carbon stock estimates, such as (Köchy, Hiederer, and Freibauer 2015). Cao et al., 2017, is a secondary reference, like Whiting and Chanton (2001), and neither reflect the range of wetland soil carbon (25 – 63%) you provide. The value in Whiting and Chanton (2001) is 3 – 68% (secondary references) and the value in Cao et al. (2017) is 12 – 15% (also a secondary reference). Use of the most up-to-date sources and an accurate reflection of those sources adds value to the manuscript. I recommend adding a citation such as (Kayranli et al. 2010), which could also be useful in your discussion considering what happens to the SOC after it is leached from the litter into the soil.

Line 52: The Sun et al., 2019 study does not support the statement that litter decomposition stabilized the soil organic carbon pool. Litter decomposition made DOC more mobile and labile, which the authors suggested could lead to SOC stability after processing by soil microbes. Lines 54-56: Aerts (1997) addresses litter decomposition in non-wetland sites where shredder invertebrates (detritovores) are important, but their role in wetland settings is more uncertain (Inkley, Wissinger, and Baros 2008). Shredding would be an important physio-chemical control on DOC leaching.

Line 62: Zhang 2019 supports the statement that water levels affected microbial activity, but leaching and fragmentation were only discussed, not measured.

Line 64: This is a mischaracterization of the Upton, 2018 study. Perhaps a better reference is (Hoyos-Santillan et al. 2015). However, clarification is needed because

Hoyos-Santillan states that roots (not litter) are the main source of SOC in peatlands, but litter strongly influences root decomposition rates, particularly near the surface.

Line 151. The Olson (1963) simple decay model assumes constant k, which you demonstrated is not a constant. Although use of this decay model is common in the literature, it is an oversimplification. This does not adversely affect your comparative analysis, but the paper would be strengthened with a more sophisticated analysis, such as a double exponential decay model (Berg 2014 or Wider and Lang 1982).

Line 266: Doesn't your argument imply C. brevicuspis, due to it's lower lignin content, would return less carbon to the soil compared to the other plants you cited? The manuscript may be strengthened, and have a wider inference, if you listed and compared decomposition rates and lignin contents of wetland plants including C. brevicuspis.

Line 284: Your conclusion contains a significant amount of new and largely unsupported discussion material. Conclusions should stick to what you were able to show in your experiments.

Table 1: Is the lignin content (L) in the regression model the initial lignin content?

Figure 3d (LRRI%) is nearly identical to Figure 2a (litter dry weight loss, %), which seems counter-intuitive unless lignin were the sole material being mineralized during the decomposition process. Did you measure lignin content at each time point?

technical corrections

Line 23: Carex brevicuspis may be ubiquitous to wetlands in China; however, is this true globally?

Line 25: Is "mass loss" = "carbon release"? If so, one of these phrases is redundant.

Line 82: The way you stated your hypotheses imply you have tested causal factors, which you did not. Specifically, leaching, fragmentation and infiltration.

Line 102: Did the litter bags float? Did you need to pin them in contact with the soil surface?

Line 105 - 107: Clarify how many soil cores were used in each pond for each purpose and how they were prepared (e.g. were soils blended prior to starting the experiment). The text is confusing.

Line 183: You use capital letters (Fig 2A) in text references, but lower-case letters in the Figures.

Line 187/188 and Line 247: I would not interpret your data that decomposition rates "rapidly increased" – the decomposition rate at time t=0 is undefined.

Figure 4: Are these figures reporting mass? The units are nmol g-1.

Berg, Björn. 2014. "Decomposition Patterns for Foliar Litter – A Theory for Influencing Factors." Soil Biology and Biochemistry 78 (November): 222–32. https://doi.org/10.1016/j.soilbio.2014.08.005. Cao, Jianbo, Xinxing He, Yuanqi Chen, Yuping Chen, Yanju Zhang, Shiqin Yu, Lixia Zhou, Zhanfeng Liu, Chenlu Zhang, and Shenglei Fu. 2020. "Leaf Litter Contributes More to Soil Organic Carbon than Fine Roots in Two 10-Year-Old Subtropical Plantations." Science of The Total Environment 704 (February): 135341. https://doi.org/10.1016/j.scitotenv.2019.135341. Hoyos-Santillan, Jorge, Barry H. Lomax, David Large, Benjamin L. Turner, Arnoud Boom, Omar R. Lopez, and Sofie Sjögersten. 2015. "Getting to the Root of the Problem: Litter Decomposition and Peat Formation in Lowland Neotropical Peatlands." Biogeochemistry 126 (1–2): 115–29. https://doi.org/10.1007/s10533-015-0147-7. Inkley, Martyn D., Scott A. Wissinger, and Brandi L. Baros. 2008. "Effects of Drying Regime on Microbial Colonization and Shredder Preference in Seasonal Woodland Wetlands." Freshwater Biology 53 (3): 435–45. https://doi.org/10.1111/j.1365-2427.2007.01908.x. Kayranli, Birol, Miklas Scholz, Atif Mustafa, and Åsa Hedmark. 2010. "Carbon Storage and Fluxes within Freshwater Wetlands: A Critical Review." Wetlands 30 (1): 111–24. https://doi.org/10.1007/s13157-009-0003-4. Köchy, M., R.

Hiederer, and A. Freibauer. 2015. “Global Distribution of Soil Organic Carbon – Part 1: Masses and Frequency Distributions of SOC Stocks for the Tropics, Permafrost Regions, Wetlands, and the World.” SOIL 1 (1): 351–65. https://doi.org/10.5194/soil-1-351-2015. Wider, R. Kelman, and Gerald E. Lang. 1982. “A Critique of the Analytical Methods Used in Examining Decomposition Data Obtained From Litter Bags.” Ecology 63 (6): 1636. https://doi.org/10.2307/1940104. Zhang, Quanjun, Guangshuai Zhang, Xiubo Yu, Yu Liu, Shaoxia Xia, Li Ya, Binhua Hu, and Songxian Wan. 2019. “Effect of Ground Water Level on the Release of Carbon, Nitrogen and Phosphorus during Decomposition of Carex. Cinerascens Kükenth in the Typical Seasonal Floodplain in Dry Season.” Journal of Freshwater Ecology 34 (1): 305–22. https://doi.org/10.1080/02705060.2019.1584128.

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