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Biogeosciences Discussions

Interactive comment on "After trees die: quantities and determinants of necromass across Amazonia" *by* K.-J. Chao et al.

K.-J. Chao et al.

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Here are our responses to the rest concerns raised by the referee2

11. By using equation 12 and density to estimate necromass, is this strengthening or promoting your idea of the difference between eastern and western Amazonia. I am not doubting a difference, but I think it might be using one concept where you have shown wood density differences across Amazonia, and then using that difference to promote a necromass gradient. Here is the idea. To estimate necromass you estimate necromass input and decay using wood density. Then you state that necromass is related to AGB, which is determined using wood density.

RE: We would emphasise that equation 12 is used solely for extrapolating our results and not for inferring any macro-ecological process. This is different from the purpose

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of section 3.2 and 4.1 (Determinants of measured CWD across terra firma Amazonian forests, page 1987-1989).

The confusion may arise from the order of the original section 4.5. In our revised manuscript, we will discuss the original section 4.5 after the original section 4.1 to give our readers a clearer idea of what factors can determine necromass and the uncertainties of the equations. Then, we will discuss a new method for estimating necromass (the original sections 4.2, 4.3, and 4.4) after the two sections.

The logic of the manuscript is built on the following processes. Firstly, we report the necromass pools in Peruvian and Venezuelan plots. Secondly, we set questions to test the factors that determine the necromass pool (page 1982 lines 2-12). Thirdly, we reviewed the available references to collect necromass data, biomass data, mortality mass input data, and living wood density data in the Amazon (Table 2 page 2000). Fourthly, we explored whether necromass is related to any of these factors (section 3.2 and 4.1; page 1987-1989). Fifthly, we applied a simple steady state model to estimate necromass for places where necromass measurement have not been conducted (section 4.2 and 4.3; page 1989-1990). Finally, we explore the necromass values across Amazonia (section 4.4; page 1991-1992). Equation 12 was only used in the fifth and final step of this sequence, to extrapolate necromass estimates to additional locations in the Amazon, and not to infer the mechanisms as part of step four.

We also noted the possible problem of a different circularity arising from the use of living wood density values to estimate CWD densities in some of the plots (page 1992, lines 6-12). However, when using necromass VOLUME (independent of living wood density) instead of mass, the patterns still persist (page 1992, lines 13-16). Also, the results reported from published papers (Table 2 page 2000) used in this study, are based on direct measurements of dead wood density and therefore do not potentially suffer from this limitation (page 1992, lines 12-13). Hence, it does not appear that the relationship between the gradient of necromass and living wood density is a result of circularity in our study (page 1992, line 16-17). Therefore, in our study, we do find that

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wood density gradient in the Amazon is one of the important gradients determines other forest characteristics (necromass) (see also the relationship between wood density and biomass in Baker et al., 2004),

12. How about a comparison of standing dead to fallen as a graph? You have a lot of nice data to look at this. It might even merit a statistical test.

RE: We have listed the ratio of standing to fallen in Table 2 (page 2000). Anyone who is interested in the relationship between standing and fallen wood is welcome to use the data but we did use the data to generate descriptive statistics of the average ratio of standing and fallen wood (page 2001 Average).

13. Average of sites is not representative of necromass spatially. There is a bias in plots, more work done in Manaus and Tapajos. Need a better method of estimating necromass across regional forests and forest types. This is a major issue. Your sites are not randomly selected so comparison between regions is problematic.

RE: For sure there is a bias of nonrandom dataset which is simply due to the availability of data. This is also another reason that we hesitate to present spatial extrapolation. However, we used data not only from Manaus and Tapajos (E, eastern Amazonia), but also from NE (north-eastern Amazonia), NW (north-western Amazonia), and SW (south-western Amazonia) in Table 2 (page 2000-2002). Moreover, we represented REGIONAL average in the Amazon in Table 3 which should be less susceptible to bias in one single region (page2003). Our focus is on providing readers with the actual data and to permit future analyses, so we list all the measures and estimated results in the manuscript, rather than attempt spatial extrapolation.

14. Are plots large enough? Are RAINFOR plots missing some aspects of disturbance due to scale? Do 1 ha plots miss a biomass and necromass relationship? An example is a term called the Chablis effect. Plots with high necromass might not have high biomass. Figure 1a might be showing this.

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RE: These are important issues in terms of coarse woody debris sampling strategy. Ideally it should be based on a selection of different-sized plots and distributed across the Amazon data to test what is the best size for coarse woody debris measurement. We do not rule out that necromass is related to biomass, but showed that at the plot-scale necromass is better predicted by mortality mass input and living wood density on the basis of our available data (page 1993, lines 8-9). Figure 1a shows a weak, but positive relationship between biomass and necromass. Whether this relationship will change when larger plots are available needs a designed system to examine.

When sampling our RAINFOR plots and reviewed papers, we avoid forests with significant anthropogenic disturbance histories (page 1992, lines 20-22). Forests with significant recent disturbances such as fire or logging (e.g., Cochrane et al., 1999) would pose an extra complicating factor influencing necromass pool.

Response to Referee2 OTHER COMMENTS

1. I want to stress that this is an interesting paper but needs to address some issues. These are the low r-square values in the regressions and the problems with nonrandomly selected sites and sites in literature. Are these sites representative of the areas? Does site selection create a bias in your results.

RE: Replies are given as above.

2. Another item that might be interesting to look at is in table 1A, to analyze the differences between NE and NW Amazonia sites in regard to decay classes. Since wood density has been suggested to be different between regions this might be reflective in the decay classes.

RE: An interesting point. This analysis has been done in Chao et al. (2008) where we found that across humid, lowland neotropical forests, the wood densities of intact and partially decayed CWD are significantly related to live wood density at the same site ($p = 0.026$ and 0.003, respectively).

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3. I also include here references that I mentioned in my previous comments that I did not include. Sorry about that.

RE: We have used the references in our reply.

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