

#3 Response to: Interactive comment on “An analysis of forest biomass sampling strategies across scales” by Hetzer et al.

This manuscript details an interesting and novel approach to estimating forest biomass using a dispersed cluster of forest inventory plots. However, in a way this is a “big data” solution to a problem where the solution does not necessarily consider all the variables necessary to making appropriate and constrained biomass estimates. Forest inventory plots are often chosen based on a wide variety of information including forest, soils, hydrology, topography, climate, etc. and are often not randomly chosen. The classical approach of positioning plots in strategic, representative areas often provides constrained and informed estimates of biomass. That said, now that we have huge amounts of remotely sensed data we can apply “big data” approaches to test the extents and limits of many ecological methodologies. I think that is the advantage of this manuscript that it explores this space and does so in an interesting and informative way.

Thank your helpful comments. We will prepare a revision of our manuscript that will follow your recommendations. The main changes will be:

a) Current forest sampling strategies

We will add paragraphs on current sampling strategies in temperate forests to the introduction. Furthermore, we will discuss the feasibility of adapting those strategies in tropical forests.

We have added our responses to your comments in blue following each comment.

I am honestly torn on whether Amazonia is a perfect test or worst-case scenario for his methodology. Thinking through this, diversity is incredibly high and there are subset forest types within Amazonia. . .some that rely heavily on topography/climate such as cloud forests, while there are also dry forests, seasonally flooded forests, and also wet forests. But again, this wide variability may actually be a strength of this approach.

We investigated also the sampling strategies for other continents (see Supplements, Table S1). Results showed that the needed number of randomly sampled plots are higher for the tropical forests of South East Asia (131 plots) and Africa (185 plots) indicating that the tropical forests of Amazonia (102 plots) might be not the worst case, but the best-case-scenario.

I would like to see if compared to temperate forests regions in N. America and Europe as well as boreal areas across the higher latitudes. It would be an interesting comparison to see if those systems diverge wildly from Amazonia.

Thank you for raising this point. Comparisons with temperate regions would be very interesting even though we believe that this would go beyond the scope of this study. For higher latitudes we expect differences in the overall biomass distribution (e.g. due to a different species pool compared to the tropics) but also in the spatial distribution of biomass (e.g., due to forest management). Therefore, there might be also relevant differences in the amount of forest sampling plots needed.

However, forests in temperate regions are mostly monitored with already sophisticated sampling methods (i.e., national forest inventories in North America and Europe). In the revised manuscript,

we will add some text about state of the art sampling methods for temperate forests and discuss why these sampling approaches are more difficult to establish in tropical regions (e.g., limited accessibility).

My specific comments follow, but I think this paper has a lot of potential to drive how we think through sampling and forest inventory methodology. I applaud the creativity of the researchers.

Thank you very much. We appreciate.

Numbers indicates line nos.

14-16: 25 ha is a lot of forest to inventory. I am already thinking of the sheer amount of folks I have to hire. **We agree.**

26: Define vegetation specifically as aboveground biomass **Will be done.**

28: Qualify aboveground **Will be done.**

45: These units seem wrong. Also, this is an older citation and only one citation given for what you indicate is a widely varying range. **We will revise this statement.**

30-55: In general good content, but the case needs to be made why uncertainties in rain forests are potentially higher than other forests. That would add to this section. **We will add a section where we compare sampling strategies of tropical forests with those from temperate forest as mentioned above.**

Figure 1 : Maybe flip the scale. **Will be done**

Figure 3: What do you mean by accurate here? **With accurate we mean those samples where the mean biomass of the sample does not differ more than 10 % from the mean biomass of the original biomass map. We will revise this sentence to clarify the term.**

* A point. . .many inventory plots on the ground are circular, but I don't see specifically (unless I have missed it) but are you using circular or square estimation here? There are some deep literature that may be consulted here about the differences Lindsey, A. A., Barton Jr, J. D., & Miles, S. R. (1958). Field efficiencies of forest sampling methods. *Ecology*, 428-444.

Thank you for this comment. We are using square plots as we are limited by the spatial resolution of the biomass map. We will add this point to the methods. Nevertheless, the consequences of square vs. circular plots for the sampling effort is very interesting and we will add findings derived by Lindsey et al. to the introduction.

228-232: These section could be revisited to ensure clarity in how the results are framed. **Thank you for this comment. We will improve this section by rephrasing several sentences.**

234 – What do you mean by sampling effort increase w/ smaller sample size? **We will delete this sentence and replaced it.**