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Biogeosciences Discussions

Interactive comment on "Regional and large-scale patterns in Amazon forest structure and function are mediated by variations in soil physical and chemical properties" *by* C. A. Quesada et al.

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All comments received during the review progress were quite positive and will definitely lead to a much improved manuscript once the necessary corrections are made. In especial, we recognize the importance of comments made by anonymous referee #3, which highlight the importance of including more detailed information on the methods section about how vegetation variables were derived. In addition, referee #3 claims for a more detailed description of measured vegetation variables, which are forest basal area, basal area growth, stem density, mortality, recruitment, height and wood density. The reason for this is that such variables are used to derive the vegetation parameters analysed in this study (above ground biomass, above ground biomass gain and tree turnover). We agree with referee #3 that our reader deserves more detailed methods. Therefore, some details on such methods are described here to clarify the most important points raised by the referee:

1. We estimate biomass by applying a single allometric relationship derived for the central Amazon near Manaus (Chambers et al., 2001), so one factor that is not accounted for is spatial variation in allometry (i.e. the tree height and biomass supported for a given tree basal area). This allometric equation uses tree diameter and tree wood specific gravity, but not height. Species identifications are required for calculating stand-level wood specific gravity values (Baker et al. 2004), and for most plots all trees were identified to species, either in the field or by collecting voucher specimens for comparison with herbarium samples. Higher-order taxonomy follows the Angiosperm Phylogeny Group (1998). 2. To attempt to control for any long-term changes in forest behaviour (e.g., Baker et al. 2004; Phillips et al., 1998; Lewis et al. 2004) variation in census dates was minimized and all forest properties reported here predate the 2005 drought event which impacted forest biomass, productivity, and forest mortality (Phillips et al., 2009). 3. AGB production was estimated as the above-ground coarse wood carbon productivity in stems and branches (Malhi et al. 2004). We define this as the rate at which carbon is fixed into above-ground coarse woody biomass structures, including boles, limbs and branches, but excluding fine litter production. This is estimated on the basis of the biomass gain rates recorded in all stems $>$10cm diameter our plots, with small adjustments for census-interval effects (Malhi et al. 2004, Phillips et al. 2009). For brevity we did refer to the aboveground coarse wood carbon productivity in stems and branches as “AGB production”, but it is important to acknowledge this excludes above-ground litter production, as well as all below-ground production. 4. Stem turnover was computed by the rate with which trees move through a population (the flux); because this is estimated as a proportion of the number of trees in the population (the pool) it is independent of stem density. Thus, annual mortality and recruitment rates were separately estimated using standard procedures that use logarithmic models which assume a constant probability of mortality and recruitment through each inventory period (Swaine et al. 1987; Phillips et al. 1994; 2004). To

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reduce noise associated with measurement difficulties over short periods and small areas, turnover rates for each period were represented by the mean of recruitment and mortality (which includes standing dead), and are our best estimates of long-term mean turnover rates. As with AGB production we accounted for census-interval effects using standard approaches (Lewis et al. 2004).

As for the claim for a more detailed description of measured variables, such as forest basal area, basal area growth, stem density, mortality, recruitment, and wood density (height data is not available), we agree with the referee about the importance of properly describe the spatial variations on such parameters. However, although regarded as an important part of the story, they were not included in the manuscript to keep it as short as possible (it is already a large paper). In particular, I agree that would be very interesting to show pan Amazonian variations in forest basal area and basal area growth (diameter growth). In our analysis, basal area did not appear as significantly influenced by any soil or climatic parameter (but do show lower values in high tree turnover regions which fits our argument), while basal area growth did show stronger relationships with soil fertility than did AGB gain, thus suggesting an effect of C allocation in different regions (fertile areas grow faster in diameter than infertile, but in terms of stem carbon the difference is shorter). Perhaps a good compromise would be to include correlation tables and some figures for soil and climate parameters against basal area, basal area growth, stem density and mortality and recruitment rates in an appendix, referring to it through the text? Fianlly, we would like to say that other valuable comments from referee #3 will be certainly incorporated into a final version of this manuscript.

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