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Biogeosciences Discussions

Interactive comment on "Factors controlling the productivity of tropical Andean forests: Climate and soil are more important than tree diversity" *by* Jürgen Homeier and Christoph Leuschner

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Response to Reviewer #1

Reviewer#1: This manuscript presents an analysis of various factors on wood productivity and net primary productivity across a series of plots located on two transects. Although the findings appear robust, logically, and technically correct, I believe the analysis could be improved by better describing key details like the calculation of wood productivity, inclusion of additional covariates (particularly stand structural attributes), and general model behavior as well as fit statistics. In addition, a few paragraphs in the Introduction could be further expanded with key details.

Answer: Thank you for the helpful comments to our manuscript! We have now expanded the Methods section on the measurement of biomass and productivity and include more details on our calculations. The concept, where the SEM is based on, included elevation, tree diversity, soil and stand properties as predictors of productivity. We included only AGB and WSG (WSG showed a stronger correlation to stand productivity than LAI or stem density) in the SEM. Additional structural variables such as basal area or quadratic mean diameter in the model would have weakened the analysis, as they are closely related to AGB. Model fit statistics are given in the figure legends (Figure 4 and 5). The discussion of possible abiotic and biotic drivers of forest productivity in the Introduction has been expanded, as recommended.

Reviewer#1: L14: How is "productivity" being defined here? ANPP?

Answer: We changed it to "wood production" (result of the overall analysis of all plots), because ANPP was only analyzed for the Loja transect.

Reviewer#1: L50-53: Seems this paragraph and a few the other ones above it should be further expanded? How widespread are tropical montane forests? Where are they primarily located? Why specifically focus on them?

Answer: We are now introducing tropical montane forests as an ecosystem type in more detail.

Reviewer#1: L57: Don't understand the use of "rarefied" here.

Answer: We replaced "rarefied number of tree species per plot" by "tree diversity", the rarefaction method is explained in detail in the data analysis paragraph.

Reviewer#1: L60: I am confused by the "10 K" Can this be presented differently?

Answer: K (degrees Kelvin) is the SI unit for temperature differences; it should be used instead of °C, when differences are meant.

Reviewer#1: L67: TMF was not previously defined and I assume referring to tropical

montane forests?

Answer: We define TMF now earlier in the Introduction.

Reviewer#1: L106: Some additional details would be helpful here. I assume these are predicted biomass values? What was the average remeasurement length? Is annual AGB increment computed from tree rings?

Answer: The plot biomass values were calculated for each plot as the sum of the biomass of the single stems using the Chave et al (2005) equation for tropical wet forests with stem diameter, wood specific gravity (WSG) and tree height as parameters. Re-measurement intervals were between 1 and 5 years, depending on the study sites. We describe the biomass and wood production measurements now in some more detail.

Reviewer#1: L130-133: I am bit confused by this. Personally, I would use AGB to predict WP or NPP, while I would consider WSG to be more of a function of species composition than stand structure? Seems other structural attributes could be computed like total basal area, quadratic mean diameter, and measures of the diameter distribution?

Answer: We also used AGB as a predictor for WP (see Figure 4), in addition, we selected WSG from the stand properties (LAI, stem density, WSG) because it showed a stronger correlation to stand productivity than LAI and stem density. Both basal area and quadratic mean diameter are highly correlated to AGB, and we think that AGB is the most meaningful of these variables. We changed “stand structural variables” to “stand properties” in the respective sentence.

Reviewer#1: L141: What are RMSEA and CFI?

Answer: RMSEA (root mean square error of approximation) and CFI (comparative fit index) were used to assess the goodness of model fit.

Reviewer#1: Figure 2: Might not include 0 on graphs with narrow distributions like LAI

and WSG to better highlight trends.

Answer: The respective figures are improved to make the elevational trend more visible.

Reviewer#1: L276: Your LAI cover a very narrow range and often the strong relationships are observed when values are below 5-6.

Answer: We now discuss at the end of the Discussion the assumed shortcomings of optical LAI estimates in complex forests and refer to stems and branches, which are recorded by the LAI2000 systems as well. Litter trapping studies in several plots in the Loja transect confirm these assumptions about under- and overestimation of LAI by optical methods.

References: Chave J et al. (2005) Tree allometry and improved estimation of carbon stocks and balance in tropical forests. Oecologia 145:87–99

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