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Biogeosciences Discussions

Interactive comment on "Height-diameter allometry of tropical forest trees" *by* T. R. Feldpausch et al.

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1) Does the paper address relevant scientific questions within the scope of BG? While height - diameter relationships are usually a foresters issue, they are of large importance for the determination of forest biomass. The paper shows that these relationships are significantly different for different regions in the world. I think that the link to biomass estimations should be more highlighted. I remember that for example biomass equations for central America give higher values than for the Amazon which seems to agree with the present data.

Response: We thank the reviewer for these thorough comments. We also think that the effect of differing height:diameter allometry on biomass estimations are an important point to address. However, when evaluating the effect of height models in biomass

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Interactive Discussion

Discussion Paper

estimates it is necessary to compare the effect of several height models within several biomass models, and do so by region, continent, and at a pantropical scale. We had originally intended to do this as part of the manuscript under review, but found that this was too much to include in the one opus. Though we do note that we are currently using the relationships developed here in addressing the biomass question in a follow-up study, just as the referee suggests.

2) Does the paper present novel concepts, ideas, tools, or data? The data are novel. The statistical concepts are standard but are used in a new global context.

3) Are substantial conclusions reached? The paper demonstrates that trees in different regions have different height diameter relationships.

4) Are the scientific methods and assumptions valid and clearly outlined? The scientific methods are valid and mostly clearly outlined. In terms of stand structure I was missing explicit competition indeces and I was wondering if tree specific competition indices (for example the basal area of all tree larger than the sample tree) were explored. The soil index also remained a bit obscure to me and should be better documented. On page 7742 the authors talk of the use of so called dummay variable for fixed effects.... I tried to understand the equation and did not understand how these dummy variables are different from standard cathegorical fixed effects. If these are not different they should be just named fixed effects since the term dummy variables is confusing (and refers usually to variables that take only values of 0 or 1. (I am not shure on the exact terminology in hte LME package since I used another R-package for mixed models). I am questioning the validity of some of the results (on different subregions) where wet, dry etc regions behave differently. There seems to be a lot of random results as seen in the table A3 where slopes and other values vary wildly with region. The use of a simple power relationship between height and diameter is a simplification and other functions have been quite frequently used in forestry (see for example Kiviste et al. 2010 European Journal of Forest Research DOI 10.1007/s10342-010-0434-8 and the literature therein). This literature should also be more referenced. The current function

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differs from the forestry functions by not having an asymptote. I am wondering what are the implications of using a simple model for the implications of the choice of the model. Especially, I am worried by the model being biased at different diameters (either high or low). These biases could then explain differences between regions (that have different average tree sizes). In the case that some of the results are due to these biases a more appropriate equation should be used and the paper should be recalculated.

Response: We have added additional information in the revised manuscript to explain the soil index developed by Quesada et al. 2010. For stand structure, we evaluated basal area and stem density. Stem density was non-significant and removed from the analysis.

Dummy variables are, indeed, indicator variables, used to denote categorical effects. We apologise for the mixed terminology and have fixed this up in the revised version.

The decision to use the power relationship to model H:D was made after exploring the ability of other published regional height models to predict tree height (e.g. Fang and Bailey 1998; Bailey 1980). While the non-linear models may improve estimates of tree height for some regions, our results showed that we were unable to use non-linear forms over large geographic regions, with the models failing to converge on realistic values through the iterative curve-fitting R-routine. This may be a result of the break-down of the H:D relationship over transitional areas, where other factors drive allometry as forests become more "savanna-like". We present a summary of the efficacy of other model forms to predict height in the supplementary information, including models that include an asymptote. We have examined the height residuals by diameter class and did not find a bias (Figure 1). We therefore retain our power relationships for region, continent and pantropical models. Section 4.1 discusses many these issues at some length.

Figure 1: Residuals of the multi-level height model that includes diameter, region, environment and forest structure.

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Bailey, R.: The potential of weibull-type functions as flexible growth curves: Discussion, Can J For Res, 10, 117-118, 1980 Fang, Z., and Bailey, R. L.: Height-diameter models for tropical forests on Hainan Island in southern China, For. Ecol. Manage., 110, 315-327, 1998.

5) Are the results sufficient to support the interpretations and conclusions? Yes 6) Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? Yes

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Interactive comment on Biogeosciences Discuss., 7, 7727, 2010.

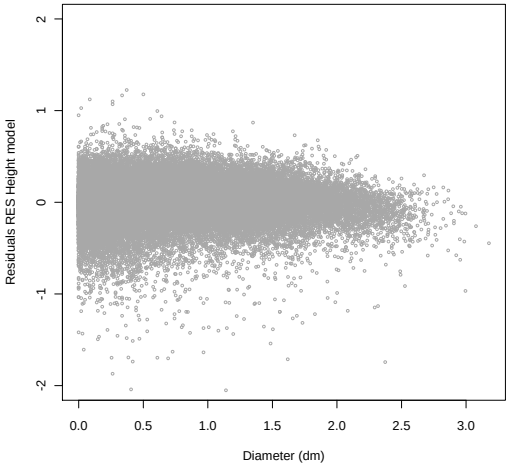

Fig. 1.

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