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Interactive comment on "Tropical montane forests are a larger than expected global carbon store" *by* D. V. Spracklen and R. Righelato

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General Comments

This paper presents an interesting synthesis of aboveground biomass (AGB) estimates in tropical montane forests (TMF). The analysis focuses in two main areas: (i) AGB stocks in TMF associated with tropical mountains in different parts of the world; and (ii) adjusted estimates of AGB based on topographic slope correction. The authors find that AGB stocks are often high in TMF, and not necessarily any lower than the lowlands, and that correction for slope angle results in much higher AGB stocks than would be otherwise estimated using terrain-based (plot) estimates alone. I think this paper will have lasting value, especially if a few issues can be addressed to make the results and interpretation clearer, as described below.

Specific Comments

(1) The premise and introduction to the paper make clear why this issue is interesting and of potential importance to a variety of biogeosciences-related applications. However, the methods and results sections of the paper are more difficult to follow, mainly because of the organization and perhaps a bit of missing content from other datasets.

In the methods, it would be much more clear if the authors could adjust the content of section 2.2 to describe the process of calculating the topographic adjustment and projections. As it stands now, this section lists remotely sensed data used, but it does not provide a clear procedure for how the analyses were performed so that others can adjust their data in the future. This seems very important since the authors are (rightly) pushing the need for topographic adjustment of plot- and remotely sensed-AGB estimation.

The results-discussion is where more organization would really yield a clearer analysis that can be used and cited by others. Mixing the results and discussion creates a challenge for the reader to understand what is fact and what is commentary. The authors should therefore try to create a very organized presentation in this section. I strongly recommend that the section be broken up into the following two simple sub-sections: (3.1) Plot inventory results and statistics; (3.2) Effects of slope on AGB estimates. A concluding paragraph similar to the current one can close the section. I think this would be very helpful and would yield more use of the paper by others in the future.

(2) The results shown in figure 2 are core to the outcome of the paper. The fact that lowland AGB varies as widely as TMF AGB is important, and it has been observed in other studies as well. In previous studies, we have found that AGB varies widely in the lowlands based on soils, hydrology, and floristic compositional variation. As we ascend into the mountains, variability in AGB decreases while average AGB declines slightly (or often not at all until very high altitudes are reached – e.g. > 3000 m a.s.l.). It would be helpful if the authors could describe this in more detail so that this result stands out

more. As it is written now, this important result is barely noticeable in the paper.

A supporting set of results focusing on tropical forest structural change with elevation was recently reported in Biogeosciences Discussions. See:

Asner, G. P., Anderson, C., Martin, R. E., Knapp, D. E., Tupayachi, R., Kennedy-Bowdoin, T., Sinca, F., and Malhi, Y.: Landscape-scale changes in forest structure and functional traits along an Andes-to-Amazon elevation gradient, Biogeosciences Discuss., 10, 15415-15454, 10.5194/bgd-10-15415-2013, 2013.

(3) In addition, the patterns shown for changing AGB with elevation and slope (figures 2b, 2c) have been observed in studies that have tightly calibrated plot inventory to airborne lidar. Airborne lidar produces AGB estimates that have been proven to be within 10% of field-estimated AGB (Zolkos et al. 2013, Remote Sensing of Environment 128, 2013), so excluding them here is an artificial divide. Including elevation-based AGB studies using plot-calibrated lidar would strongly support the conclusions of the paper. One clear example, of many, comes from multiple tropical forest gradients in Madagascar, which were not included in the synthesis (table 1):

Asner, G., Clark, J., Mascaro, J., Vaudry, R., Chadwick, K. D., Vieilledent, G., Rasamoelina, M., Balaji, A., Kennedy-Bowdoin, T., Maatoug, L., Colgan, M., and Knapp, D.: Human and environmental controls over aboveground carbon storage in Madagascar, Carbon Balance and Management, 7, 2, 2012.

See Figure 4 of that paper for example. Repeatedly, we see two things in high-resolution AGB mapping studies: (1) Average AGB stock decrease slightly, but often not statistically so. (2) Variance in AGB declines with increasing elevation. In other words, the AGB becomes more homogeneous at higher elevations. We have found this in the Colombian and Peruvian Andes, the Hawaiian Islands and elsewhere. It is important to the story being told here since average stock may/may not change, yet evenness seems to consistently increase with elevation.

(4) Pages 18899-18900: These pages are densely written, to the point of detracting from the main points of the discussion. Also, there seems to be over-citation of some references and a lack of citation to others.

Technical Corrections

Page 11897, lines 24-25: Since the difference it not statistically significant, the authors cannot state that Asian TMF is greater than Neotropical TMF. Please change this to state that there are simply not significant differences detectable based on the plot data synthesized in this study.

Page 18899, Line 24: It is not correct that species richness peaks in the 1000-1500 m range in the Andes-Amazon. This is an artifact of plot estimates. The truth is that we really do not know, but mounting evidence suggests uniformly high plant diversity from lowlands to about 2800 m, then a steep decline right up against treeline in the Andes (Silman 2006).

Silman, M. R.: Plant species diversity in Amazonian forests, in: Tropical rain forest responses to climate change, edited by: Bush, M., and Flenly, J., Springer-Praxis, London, 2006.

Figure 1: This figure is too small to reveal where the plots are located. Also, Hawaii seems to be missing. It would be good to enlarge the figure and to make the squares larger or somehow more prominent.

Figure 5: Again, this figure is too small to take away much of an understanding of the ratio of land-surface to planimetric surface area. It would be good to enlarge the figure.

Interactive comment on Biogeosciences Discuss., 10, 18893, 2013.