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Biogeosciences Discussions

Interactive comment on "Liana infestation impacts tree growth in a lowland tropical moist forest" *by* G. M. F. van der Heijden and O. L. Phillips

G. M. F. van der Heijden and O. L. Phillips

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We thank the reviewer and the editor for their comments and consideration of this manuscript. Both the reviewer and the editor agree that the question addressed in the manuscript is important. Below we respond in more detail to the comments made by the reviewer and the editor.

Reviewer #1:

Comment 1: One limitation of this study includes the inability to tease apart whether lianas reduce tree growth from the possibility that trees may grow faster in areas without lianas for some reason other than lianas. That is, lianas may be in low abundance / biomass in areas where trees grow fast for some unexplored reason. Similarly, fast-growing trees tend to have fewer lianas. The correlative approach taken by the authors

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will always have this limitation.

Response: We agree with the reviewer that the correlative approach we have taken has its limitations, which is also discussed in the response to the comments of the editor below. However, 1) Apart from competition with lianas, we have also taken environmental and heritable tree variables into account plus other plot based variations by including plot as a random effect to explain individual tree growth rate. We therefore feel that the most important variables influencing tree growth are accounted for, including light environment and soil nutrient status 2) Liana abundance is patchy within the plots, but similar amongst the 5 plots. The patchiness of lianas is attributed to the presence of (old) treefall gaps and the amount of light on the forest floor. 3) 86% of the trees were growing within 5 metres from another tree which had either lianas growing into the tree crown or rooting within 1 m from the tree, so there were not many true liana free zones. 4) By taking a multilevel approach, differences between and within species are accounted for as each species has its own submodel. 5) Faster growing trees do tend to be less often infested with lianas. However, there is no difference in range and median liana basal area amongst trees with high, medium and low wood densities - tree species with the genetic potential to be slow, medium and fast growing, respectively. Therefore the direction of causation is more likely to be low liana infestation causing high tree growth rates, than vice versa. Although the resulting model is not perfect as it still underestimates stand-level AGB increment, for the above-mentioned reasons the analytical methodology used in the manuscript is adequate to tease apart whether lianas reduce tree growth from the possibility that trees may grow fast in areas for some other reason than lianas.

Comment 2: The statement that “dominance of liana in many neotropical forests has increased” is somewhat confusing (p. 3135, line 21). Were lianas previously dominant and now they are more dominant?

Response: Research has indicated that lianas have been increasing in density, basal area, mean size, leaf productivity and fecundity in neotropical forests over the past

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few decades, which is what we meant to indicate with the phrase “increase in dominance”. We have now explained this in more detail in the revised version of the paper.

Comment 3: The analyses were not completely understandable and thus were difficult to evaluate.

Response: To make our methods more easily understandable, we improved the structure and have extended the Data analysis section in the Methods to include more detail and information about the analytical methods used.

Comment 4: The authors state that they estimate liana biomass only on lianas $>$ 10 cm dbh; omitting more than 40% of the liana biomass which is in the smaller liana stems (3140, lines 15-20). This is cause for concern because few lianas reach 10 cm in dbh, but there are many smaller lianas. If the somewhat smaller lianas, say 5 cm dbh, are growing much faster than the 10 cm dbh lianas, then the authors may be miscalculating the true change in liana biomass. However, the authors also include biomass increment for lianas $>$ 1 cm in the results, which is not consistent with their stated methods

Response: We agree with the reviewer that focussing on lianas $>$10 cm diameter excludes the majority of the liana biomass. However, during the liana census we only collected data on the liana biomass per tree and not of the total liana biomass per plot. As part of the RAINFOR census methodology, lianas $>$10 cm diameter are measured in each census giving us an indication of the growth rate of only these lianas. In a different study in the same area, Phillips et al. (2005) established that lianas $>$10 cm diameter contribute 57% of the liana biomass of the total biomass of lianas $>$1 cm diameter. Based on this percentage we have therefore estimated the liana biomass of lianas $>$1 cm diameter for both the 2003 and 2006 census to provide us with an indication of liana growth rates of the whole liana population and their contribution to carbon uptake. This is stated in the methodology.

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We also agree with the reviewer that if smaller lianas grow faster than lianas >10 cm diameter we may have underestimated the total change in liana biomass. Similarly, if smaller lianas grew slower, we may have overestimated this true change. More detailed research focussing on liana growth rates in different size-classes is necessary to provide us with a more accurate estimate of liana growth and carbon uptake, but these data are currently lacking. We have added this to the discussion of the error in estimating liana growth.

Comment 5: I was confused when, in the Results section, the authors seem to offhandedly state that below-ground effects may be important for (p. 3144 line 12: Trees growing in favourable conditions (i.e. high light and low below-ground competition with local competitors) tended to be relatively less affected by lianas compared to trees that were experiencing low light conditions and severe competition with neighbours for below-ground resources (Fig 2)), but then in the Discussion section claim that below-ground effects are not present. Thus the authors seem to be making two contradictory claims. The below-ground competitive effect of lianas may diminish with tree size, as stated, but this may be due to a greater effect of light on adult trees.

Response: The sections in the results and the discussion the reviewer is referring to address two different types of below-ground competition. The section in the results refers to below-ground competition with neighbouring trees, which based upon our analyses clearly has an effect on tree growth. The section in the discussion refers to below-ground competition with lianas, which does not seem to affect tree growth. As this was understandably cause for confusion we have stated clearly we are referring to below-ground competition with neighbouring trees in the results section.

Editor:

Comment: In his comments, the editor has focussed on the insignificant effect of below-ground competition with lianas on tree growth rate. He stresses the importance of highlighting that, without rigorous experimental testing, a correlative approach is never

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the basis for rejecting a hypothesis.

Response: We agree with the editor. The insignificant relationship between our measure of below-ground competition between lianas (basal area of all stems rooting within a 1 metre radius from the tree trunk) and tree growth rate does not mean that below-ground competition with lianas does not affect tree growth. We have extended the relevant section in the Discussion to incorporate the importance of experimental testing of this hypothesis.

We have also added some of the references on liana-tree seedling experiments suggested by the editor to the ones we already refer to in the manuscript. Additionally, we have also included reference to the sparse number of experimental studies looking at the below-ground effect of lianas on trees.

Interactive comment on Biogeosciences Discuss., 6, 3133, 2009.