

***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**

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The paper by van der Heijden and Phillips is a straightforward attempt to ascertain whether lianas reduce the growth of the trees in a rain forest. It is an important question, because lianas constitute a large part of the canopy of many rain forests, perhaps one-third of the leaf area (Putz 1983). Moreover, there is mounting evidence that they may be favoured in dry conditions (see the evidence reviewed in Swaine & Grace 2007), and so it seems highly likely that in a warmer and dryer climate the competition between lianas and forest trees may determine a large part of the response to future climates (a detail which, by the way, ecosystem models do not touch upon).

Van der Heijden and Phillips have attempted to quantify whether lianas reduce tree growth by competition in a set of sample plots in Amazon rain forest in Peru. They

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conclude that they do, and this effect is sufficient to reduce substantially the carbon balance of the ecosystem, as the reduction of the tree growth is only partly offset by the growth of the lianas.

In this work, they have used repeated measures of the growth of trees, and a regression technique to examine positive and negative associations between lianas and tree growth. Such regression techniques must be used cautiously, as they cannot prove a cause-and-effect relationship, only a statistical correlation. The authors have in this case concluded that above-ground competition between lianas and trees is important whereas below-ground competition is not. Normally, in ecological research it is important to try to back up any correlations revealed in this way with experimental studies where individual variables can be manipulated. It is however, very hard and costly to do this in the case of rain forest. It has sometimes been done with seedlings (Toledo-Aceves & Swaine 2007, 2008; Chen et al 2008); the results suggest that there is indeed an effect of below-ground competition on tree growth. This conclusion applies to the seedling stage only, but it is precisely at that stage in the life cycle that many ecological patterns are determined.

The method of assessing below-ground competition used by van der Heijden and Phillips is simply to record the basal area of liana species within a metre of the trees in question. This may not be a sufficiently robust way to evaluate the variable for the purposes of statistical analysis, given the sample size being used.

It is worth highlighting this problem of how root systems in rain forests compete for water and other resources, because there are ways in which it could be approached experimentally. For example, if the lianas of a sample of trees were to be cut (whilst continuing to supply water to the cut end), we might expect the water flux in the stems of neighbouring trees be increased, and their stomatal conductance and CO₂ uptake to increase. This is the basis of a hypothesis which can be tested rigorously. Correlations revealed in regression analysis cannot provide rigorous testing, and a lack of correlation (as obtained for below-ground competition in this study) is never the basis

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for rejecting a hypothesis.

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