Journal title: Biogeosciences

Title: Main drivers of plant diversity patterns of rubber plantations in the Greater Mekong Sub-region

On behalf of my co-authors, we appreciate the reviewer very much for his positive and constructive comments and suggestions on our manuscript entitled “Network complexity of rubber plantations is lower than tropical forests for soil bacteria but not fungi” submitted to SOIL. We have studied the reviewer’ comments carefully and made the revision according the comments of the reviewers. The following are major changes (in blue) in the revised MS and responses to the comments.

1. There are lack of strong connection between the review in the introduction and the questions raised by the authors. The questions seems come out from nowhere. For example, there is no review about how exotic species influence plant diversity in rubber plantation, and no description on effects of deterministic and stochastic processes on artificial plantation.

Response: In the revised manuscript, we deleted the contents related to effects of deterministic and stochastic processes on artificial plantation. We have read some literatures on the impact of exotic species on plant diversity as well as the drivers for plant diversity. We have rewritten the introduction to make it logical.

Reference:

Stadler, J, Trefflich, A, Klotz, S, et al. (2000). Exotic plant species invade diversity hot spots: the alien flora of northwestern Kenya. Ecography. 23(2):169-176.

Stohlgren, T.J. , Binkley, D., Chong, G.W., et al. (1999). Exotic plant species invade hot spots of native plant diversity. Ecological Monographs, 69(1):25-46.

Han, Z.Q., Liu, T. , Wang, T. , Liu, H.F., Li, B. L. (2020). Quantification of water resource utilization efficiency as the main driver of plant diversity in the water-limited ecosystems. Ecological Modelling, 429, 108974

Xu, H.W., Liu, Q., Wang, S.Y., Yang, G.S., Xue, S. (2021). A global meta-analysis of the impacts of exotic plant species invasion on plant diversity and soil properties. Science of the Total Environment, 810, 152286

Nottingham, A., Fierer, N., Turner, B., Whitaker, J., Ostle, N., Mcnamara, N., et al. (2016). Temperature drives plant and soil microbial diversity patterns across an elevation gradient from the Andes to the Amazon. https://doi.org/10.1101/079996

Soliveres, S., Maestre, F.T. (2014). Plant-plant interactions, environmental gradients and plant diversity: a global synthesis of community-level studies. Perspectives in Plant Ecology Evolution & Systematics, 16(4), 154-163.

Soons, M.B., Hefting, M.M., Dorland,E., Lamers, L.P.M., Versteeg, C., Bobbink, R. (2017). Nitrogen effects on plant species richness in herbaceous communities are more widespread and stronger than those of phosphorus. Biological Conservation, 212, 390-397.

The authors review a lot of effects of rubber plantation on the plant diversity, however, this study is not about a comparison of diversity between rubber plantation and any other type of vegetation. Instead, all their data come from rubber plantation, their purpose is to find out the key factors in driving plant diversity within rubber plantations.

Response: Thanks for the comment. We have rewritten the introduction to make it logical.

2. The study methods are not clear.

a) There is contradiction between calculation of importance value and Shannon index. Out of importance value, the relative frequency is clearly computed based on the 240 plots, i.e. the whole study region (GMS), however, the Shannon index is used to quantify the diversity a focal plot. In another words, the importance value is computed at metacommunity level, but the Shannon index is computed at local community level.

Response: Thanks for the comments. Sorry for the errors.

For local community, there is no frequency data, therefore importance value is defined as: $IV_j = RH_j + RD_j$. For metacommunity, importance value is defined as: $IV_j = RF_j + RH_j + RD_j$.

b) The beta diversity index, Whittaker's β diversity, is not pairwise index. But Fig. 3

indicates that it quantifies the beta diversity between countries.

Response: Thanks for the comments. In the revised manuscript, we deleted contents related to Whittaker's β diversity.

c) Because there are correlations between environmental variables, doing linear regression one environmental variable by environmental variable is not appropriate.

Response: Thanks for the comments. In the revised manuscript, we used multiple linear regression to find the relationship between species richness and environmental variables (see Figure 1).

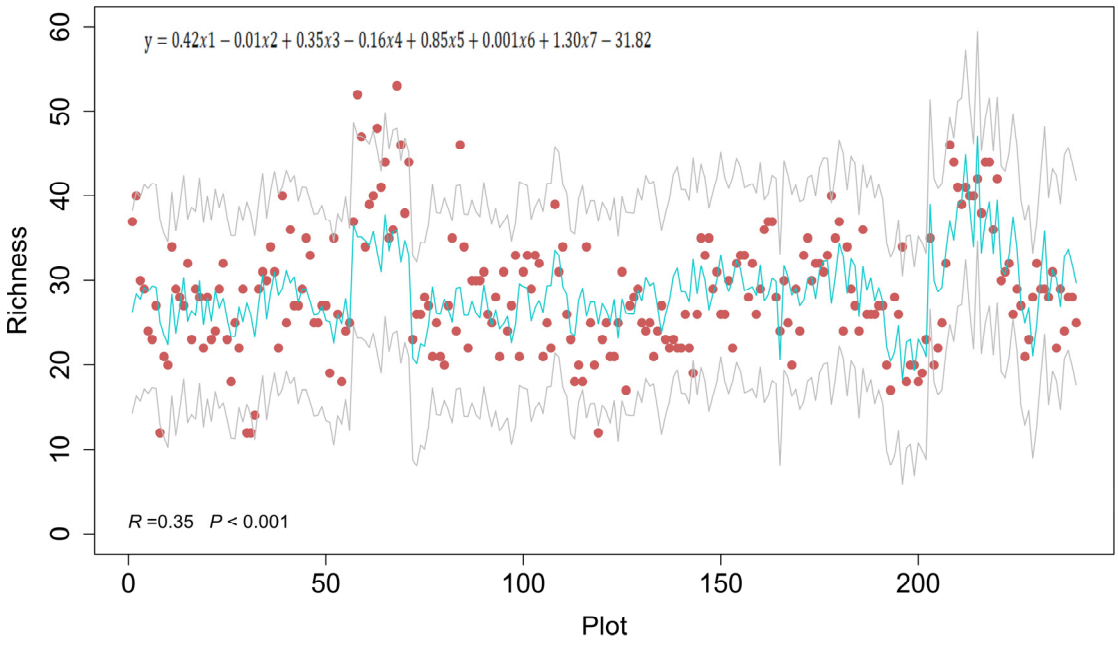

Figure 1 Predicting species richness by using multiple linear regression. The red point was the observed richness, the green solid line was the estimated richness, and the grey solid line was the 95% confidence interval. y: Richness, $x1$: Latitude, $x2$: Elevation, $x3$: Slope, $x4$: Age, $x5$: Height, $x6$: Rainfall, $x7$: Temperature

d) It not clear that Random forests is used to model alpha or beta diversity.

Response: Thanks for the comments. We have clarify it in the revised manuscript. Random forests is used to model alpha diversity.

e) I suggest use NMDS to present the ordination difference between the countries as NMDS maximum preserve the original dissimilarity between plots in two axes. The

PCoA here only explain about 13% of the community variation.

Response: Thanks for the comments. We used NMDS to present the ordination difference between the countries, however the stress is greater than 0.2 (Figure 2), therefore NMDS is not proper for this study.

Because plant diversity of rubber plantation is greatly affected by intensity of management, the explained percentage by PCoA as well as other methods is very small. Our RDA analysis results show that the explained percentage is 17.32%. Therefore, in the revised manuscript we still use PCoA to analyze beta diversity among countries. At the same time, the results of analysis of similarity showed that there were significant differences in plant composition among countries (Figure 3).

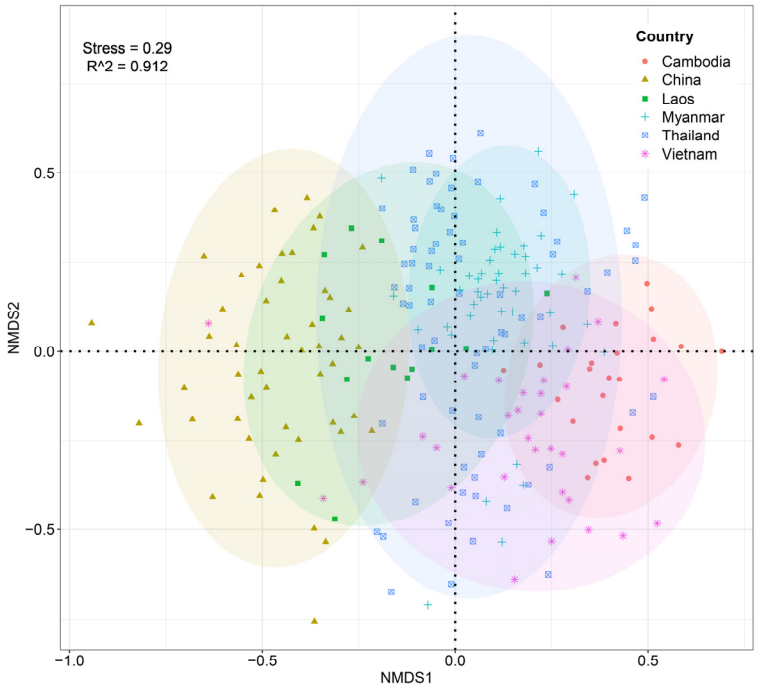

Figure 2 Non-metric multidimensional scaling analysis (NMDS) based Bray-Curtis distance for plant communities of rubber plantation in the GMS.

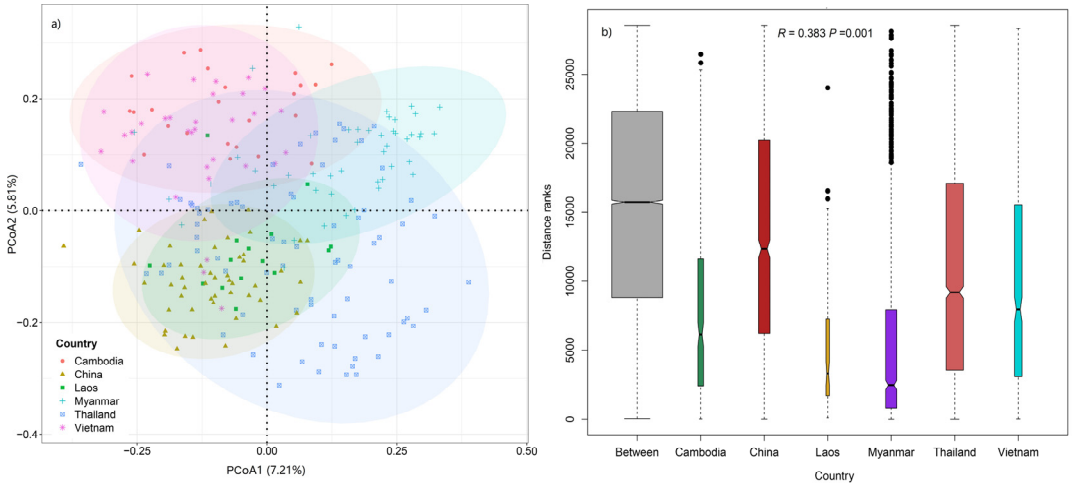

Figure 3 Principal coordinate analysis (PCoA) based on Bray-Curtis distance and analysis of similarity for plant composition of rubber plantation in the GMS

f) Personally, I don't think the null deviation can represent the effect between deterministic and stochastic processes due to many reasons which I don't want to refer to the details.

Response: Thanks. We have deleted null deviation and related contents.

3. Line 259-261 is against our common consensus that plant diversity decrease with latitude increasing.

Response: Latitudinal gradients in species-diversity are well known. They usually consist of a fairly regular increase in the numbers of species of some higher taxon from the poles to the equator. However, latitudinal gradients are known in which maximum diversity does not occur near the equator (Stehli, 1968). Our results was similar to that of the global diversity patterns that maximum diversity does not occur near equator.

4. Last but not least, I think the way and intensity of management between different plots or countries might contribute to plant diversity in rubber plantation greatly. However, the data might be not available. The effect way and intensity of management might intertwined with the measured factors in this study, how the author disentangle the effects between the factors is critical to the results and thus the conclusions.

Response: Thanks for the comments. Data about the intensity of management might be not available, thus it is difficult to distinguish the contribution of management to the diversity. In the revised manuscript, redundancy analysis were used to calculate the total contribution of main environmental factors to species composition, and most of the rest might be the contribution of intensity of management (see Figure 3).

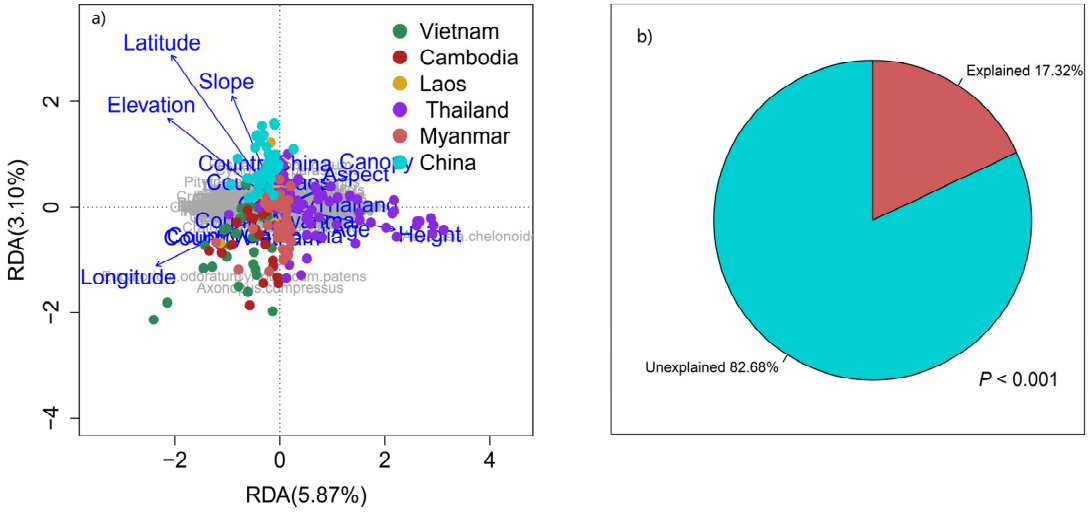

Figure3 Redundancy analysis of plant community composition of rubber plantation in the GMS (A: RDA ordination, B: proportion of explained)

5. Please revised the introduction and methods and thus the results and discussion. Moreover, there is no analysis and result can support the so called suggestions in the discussion part, unless the author provide evidences in terms of their own analyses and results. Or else, the author should reduce the length of the suggestions.

Response: Thanks for the comments. We have revised the introduction, method, results as well as the discussion to make the paper logical. We fully agree with the reviewer's comments and have reduce the length of suggestions in the discussion part.