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14th March 2023
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Dear Dr. Bahn,

We thank you for the opportunity to resubmit our manuscript bg-2022-203 *"Throughfall exclusion and fertilization effects on tropical dry forest tree plantations, a large-scale experiment"*. We also want to thank the reviewers and the Associate Editor Dr. Richard Nair for highlighting the areas in which there was room for improvement in the text. In the revised version you will find the following changes:

- Added clarity in the description of the analysis where we test the effects of the experimental treatments on tree diameter relative growth rates.
- Incorporation of the technical corrections suggested by the referees.

Below we detail the changes that we made to the manuscript in relation to these points. For clarity, the reviewers' suggestions appear in plain text, and our responses appear in blue text. If there is any additional way that I can facilitate the publication of our manuscript, do not hesitate to contact me. Thank you for your attention.

Sincerely,

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Referee: 1

Dear authors, I am very satisfied with your responses to my questions and concerns and also with the improved text. I believe that adding clarity in some parts of the manuscript was crucial to improve understanding and increase even further its quality. These data are of great value to the tropical ecology community and I really appreciate the effort of the authors in gathering years of data and telling now a nice story, strengthening the ecological implications of both nutrients and water shaping tropical dry forests. I do have very minor technical corrections that I list below and I also want to mention that in the response letter, mentions to figure/table numbers and lines were not always right so make sure to double check this for the resubmission to ease the review process.

We really appreciate, once again, the constructive feedback provided. We incorporated the suggested technical corrections in the new revised version of the manuscript. Also, to avoid issues with page numbering we indicate the line number of the changes for both the final document and the track changes document.

Technical corrections suggested:

- Line 25: Be consistent in using either throughfall or through-fall.

We replaced through-fall with throughfall in line 25 as that was a product of automatic correction in the text editor. We apologize for the confusion.

- Line 26: Sometimes control is referred to as CN, sometimes as C (for example Table S2).

To be consistent with the figures, we now refer to control plots as "control" in both the supplements and the main text. We deleted the acronym CN from the following lines:

Final document (26, 155), track changes document (26, 168).

- Line 119: "measurements of on fine roots" perhaps the "on" should be deleted.

We removed "on" as it was left out from the previous draft by mistake. Now the text reads:

Lines: final document (119), track changes document (131).

"…measurements of fine roots production…"

- Line 848: In table 1 I would suggest to add the meaning of each leaf habit (LH) also to the table caption.

We modified the table legend to improve clarity. Now the text reads:

Lines: final document (867), track changes document (918).

"…Here we present species leaf habit (LH) as deciduous (DC), semi-deciduous (SD), or evergreen (EV), whether the species is nitrogen fixer (NF), specific leaf area …"

- Line 189: I am assuming that these measurements were also performed from 2016 to 2020, following the description in line 181 for tree growth. It might be worth, however, to add this information to either description in line 124 (not only the experiment, meaning drought and

fertilisation happened for 4 years, but also the measurement?) or to each method description in case the dates are different depending on measurements.

We apologize for the confusion here. We added the months and years associated with each measurement in the text. In the example noted by the referee, the text now reads:

Lines: final document (190), track changes document (206).

"…We measured canopy productivity from January 2017 through December 2020 using two…"

- Line 225: Is there a diameter definition for "fine" root productivity or all roots inside the ingrowth core were considered?

We acknowledge the importance of defining root orders and root diameter, particularly in studying root ecology and physiology. In our case, we were only focused on the production of roots within the ingrowth core. Therefore, all the roots within the core were considered We apologize for the confusion here. We added a sentence that briefly describes what we consider fine roots:

Lines: final document (227-229), track changes document (243-245).

"…of 15 cm. With this method, we quantified fine roots as the biomass of new root growth inside an 8 cm diameter cylindrical ingrowth bag with a 2 mm nylon mesh. The cores…"

Referee: 2

The authors have done an admirable job creating a cohesive unit from their multiple response variables. This is a strong dataset which hints at some interesting trade-offs between nutrient and water limitation in tropical dry forests. With one exception, I feel the authorship team has done a sufficient job addressing my earlier concerns. The outstanding issue is the statistical justification for including plant- functional traits and canopy position as an explanatory variable in their uneven design. While this is well explained in the response-to-reviewers, much of this context is still missing from the manuscript itself (see line notes below).

We are grateful to the referee for the constructive feedback provided and the time invested in reviewing our manuscript. In this new version we try to make clear the details of the analysis that were absent in the text, we apologize for the lack of clarity.

Line Notes

- Line 68: Is the reference to water use efficiency as a trade-off with photosynthetic efficiency needed here? Could be an opportunity to simplify.

We thank the referee for pointing this out as there is also redundancy with another sentence in the paragraph. We proceeded to simplify the text by merging those two sentences as follows:

Lines: final document (67-69), track changes document (69-71).

"…In low-nutrient environments, plants maximize transpiration rates to increase mass flow nutrient uptake, but variations in water availability could limit these processes with potential costs to ecosystem productivity…"

- Line 75 replace tropical with TDF

We replaced tropical with TDF. Now the text reads:

Lines: final document (73), track changes document (84).

"…it is well documented that TDF leaf phenological cycles…"

- Line 119 remove 'on'

We removed "on" as it was left out from the previous draft by mistake. Now the text reads:

Lines: final document (119), track changes document (131).

"…measurements of fine roots production…"

- Paragraph starting on 155: Seems dishonest to call it fully factorial unless this is qualified along the lines of - "The nutrient-addition and drought aspects of the experiment were fully factorial..."

We apologize if the text was misleading. Indeed, we refer here to the experimental manipulations that we performed during the four years of our study. Whereas species identity, functional type, stand, and leaf habit, were factors that we did not manipulate as they were inherent to the plantation system in which we performed the experiment. We modified the text to make this clear.

Lines: final document (154-155), track changes document (167-168).

"…We performed nutrient and drought manipulations using a fully factorial design with four treatments: fertilization (F), drought (D), drought+fertilization (D+F), and un-manipulated control…"

- Lines 226 & 235: change productivity to "production"

We updated the text accordingly.

- Line 267: How was substrate-derived microbial biomass C distinguished from other biomass?

We apologize for the lack of detail. We now updated the text to make it clear to the reader and cited Kane et al. (2023) where the method is described in greater detail.

Lines: final document (268-270), track changes document (290-292)

"…, where we distinguished substrate-derived microbial biomass C from total microbial biomass by using the atom% ^{13}C to calculate the total amount of ^{13}C-labeled biomass per gram of dry soil (Kane et al., 2023)…"

- Line 306: How does PFT and understory/plantation fit into stand here?

We acknowledge that in the last version of the text, the description of the statistical analysis in which we considered PFT and understory/plantation was not clear. We apologize for that. We proceeded to expand this section by adding lines differentiating the tree diameter relative growth analysis from the analysis used to study changes in biomass fluxes and LAI metrics. The text now reads:

Lines: final document (302-320), track changes document (324-344).

"…We tested the effects of the experimental treatments on aboveground and belowground ecosystem processes by fitting a series (one for each response variable) of a two-factorial linear mixed effects model. For tree diameter RGR, we studied responses by understory and plantation trees separately due to differences in the life history of individuals and the possible biases in growth associated with tree size (Iida et al., 2014). Moreover, in addition to the treatment effects, we quantified the effects of two plant functional type classifications. For this, we fitted a model that included leaf phenology (*e.g.*, deciduous and evergreen) and a model that included whether the species was a nitrogen-fixer or not. Functional types are linked to physiological differences among tree species (Vargas G. et al., 2021; Powers and Tiffin, 2010; Vargas G. et al., 2015), and are important drivers explaining tree growth responses to nutrient additions and water availability (Waring et al., 2019; Costa et al., 2010; Wright et al., 2011; Toro et al., 2022). In these models, RGR was the response variable, and drought, fertilizer, and functional type were the predictors. Additionally, we included the species' identity of each stem nested within the plot nested within stand as random effects. In the case of biomass fluxes, microbial CUE, and LAI-derived metrics, these processes (*e.g.*, total litterfall) were the response variables, the drought treatment was one factor, and the fertilizer treatment was the second factor, we included their interaction and the experimental unit (*e.g.*, litterfall basket) nested within the plot nested within stands as a random intercept. With these models, we were able to estimate the main effect of drought, the main effect of fertilization, and the interaction between drought and fertilization, while also accounting for the effects of the plantation stand and the plot, and in the case of RGR plant functional type. We then calculated type III sum squares and the F value for each model in an analysis of variance (ANOVA) given our unbalanced design and used Tukey's HSD test for multiple comparisons…"

- Line 401: Not clear how PFT and understory/plantation tree were analyzed, not currently included in the statistical analysis section.

See the answer to the previous comment about the same issue.

- Line 403: This is a fair and clearly stated summary of the results, well done!

Thank you!

- Line 428: Add, "although these effects were not statistically significant"

We apologize for the confusion. We were referring to the relative contribution of each biomass flux to NPP. We added the suggested line to make this clear,

Lines: final document (440-441), track changes document (473-474).

"…plots (Fig. S14). Although, the observed changes in woody and root production were not statistically significant when analyzed individually. Changes…"

- Line 436: Occam's razor would argue that effects weren't found because the manipulation was not strong enough.

We apologize for the lack of clarity. In the text, we tried to acknowledge that the mild manipulations of soil moisture did not trigger any changes in litterfall as has been observed in other similar studies. To make this more clear, we added some text at the end of the last sentence in the paragraph.

Lines: final document (449-452), track changes document (482-485).

"…Our results are comparable to other throughfall exclusion experiments in which fine litter production was not affected by the drought treatment (Nepstad et al., 2002; Brando et al., 2006; Schwendenmann et al., 2010),

with most of its variation linked to inter-annual climatic variability rather than the experimental manipulations (Brando et al., 2008).…"

- Line 440: Add, p = 0.09

We updated the text accordingly.

- Line 444: Not sure of the grammar rules for botanical authorities, possible that A. Rich should be within ()

For *Biogeosciences* this is not specified in the author's guidelines. In the binomial system both approaches "(A. Rich)" or "A. Rich" are accepted. While arbitrary, we decided to use the approach without parenthesis as is the most used in the literature we are familiar with.

- Line 452: Similar to my comment for lines 306 and 401 above, there is no explanation of how this effect was tested. Regardless, the claim seems so weak as to not be worth mentioning?

We do acknowledge that the effects are weak. However, the growth rates of understory plant community n-fixers like *Vachellia collinsii* or *Gliricida sepium* tend to be lower than those of non-n-fixers such as *Sterculia apetala*, *Guazuma ulmifolia* or *Cecropia peltata*. The reason for this is associated with their higher wood density (Powers and Tiffin, 2010). Therefore, we considered it important to try to understand why there were no differences in their understory growth rates.

Our changes regarding this comment are threefold:

1- We updated the methods section to include a description of this analysis.
2- We simplified the discussion to make the above explanation clear. In summary, we try to explain that more than experimental manipulations there was an increase in light availability which probably trigger these changes in growth rates in D+F plots.
3- We did not consider it important to explain why there are no differences between functional groups in plantation trees. The reason for this is that in tree plantations diameter growth usually reaches a plateau and a self-thinning process kicks in. This might be the cause of the observed mortality. At the same time, two hurricanes (2016-Otto and 2017-Nate) hit the region, and in other drought experiments mortality has been observed at the beginning probably due to the installation of the treatments or sudden changes in growing conditions that affected trees that might have been already weakened by pest or competition (Rowland et al., 2015; Costa et al., 2010; Meir et al., 2018).

We streamlined the text as:

Lines: final document (466-478), track changes document (505-517).

"No species showed significant changes in RGR, but the understory trees showed a reduction in the differences between N-fixing and non-N-fixing trees. For F and D this was due to a reduction in growth rates by non-N-fixing trees, while for D+F due to an increase in the growth rates by N-fixing trees (Fig. 4). One possible reason for these patterns could be increased resource availability due to decreased competition. The D+F plots in which these three species were present experienced the highest biomass losses due to mortality during the four years of experimental manipulation (Table S5; Fig. S10). Even though it is hard to determine the cause of death, an increase in growth rates of understory trees has been observed after the mortality of larger trees (Rowland et al., 2015). The lack of responsiveness in the F and D plots, in addition to the biomass losses in some of the D+F plots (Table S5), supports the idea that the availability of resources such as light could be the cause of higher RGR in the D+F compared to the other treatments (Fig. S15). The lowest RGR were found in plots with the D treatment, with the strongest experimental effect on *D. retusa*, *E. cyclocarpum*, and *S. glauca* (Fig. S9). Yet not

significant, these results are very similar to what has been found in other tropical throughfall exclusion experiments (Meir et al., 2015), in which there is an overall negative effect on tree diameter growth by a decrease in soil moisture."

- Line 469: Results sections says that F had one nodule, and D+F had 57, please revise.

We updated the text accordingly.

Lines: final document (480), track changes document (519).

- Line 482: Remind the reader that this is a glucose-based measure of CUE

We updated the text accordingly.

Lines: final document (493), track changes document (544).

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Editor's comments to the author(s):

A small revision is still required to add a little more explanation of the interpretation of the species effects in the paper.

Additional private note (visible to authors and reviewers only):
I agree with R2 that a short justification of how the unbalanced species design is interpreted in the statistical analysis would be useful in the paper.
An attentive reader would notice that the effective sample size of these species combinations is 1 and yet there is a substantial part of the discussion about these species effects. While obviously working in the diverse tropical forests is challenging and this is a perhaps necessary limit of a valuable multifactorial experiment, this should be spelt out clearly in the text. This information is already in the response to reviewers and should be simple to quickly incorporate without any major change to the paper.

Response to the editor: We highly appreciate the comments by the Associate Editor highlighting the main areas of the text that needed clarification. In the present version, we incorporated the suggestions by the referees and highlighted that we studied diameter growth responses using functional types and not species. We also provided a justification in the analysis section of why we consider this approach.

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