

## Comments from referee 2 (in blue)

### General comments

This is a very interesting and timely paper on an important subject. The authors make use of the exciting Rwanda TREE experiment to assess the performance of a number of tree species from different climates of origin and different successional stages (early and late successional). These data are very novel, covering a large number of species and able to assess closely temperature effects with limited influence of drought. The findings are logical and supported by other literature, showing a higher sensitivity of late successional species and high elevation species to temperature, as measured with data on growth, mortality and contribution to basal area. There are some issues around the interpretation due to the experimental rather than observational nature of the study, but these are mostly sufficiently discussed and acknowledged by the authors.

**Response:** Thank you very much for appreciating our study. Thanks also for all constructive suggestions for improvements.

### Specific comments

The main issue I found with the paper is that the site is planted with early and late successional species, and therefore in a high light environment it is possible there would be poor performance of the late successional species. However, this is raised and discussed in the paper, and the crucial thing is that this would be the case at all the sites, and therefore by looking at differences across the sites at different temperatures, this becomes less important. While this is in the discussion, I think it might be useful to add something on this, justifying the approach, in the Introduction so the reader is not wondering about it throughout.

**Response:** Thanks for this suggestion. We will add a sentence on this in section 2.3 about Plant material.

I also think that because these are experimentally planted sites, it is harder to consider that composition is really being assessed. I think the study brings great insight into how different species respond, and how this affects composition within the sites, and the knowledge gained can be generalised to natural systems, but I think there needs to be a little more conservative language, for example line 134 could be phrased “tree community composition within the experimental sites”.

**Response:** Thanks for the comment. We will change the wording accordingly.

There is a lot of detail in the analysis, perhaps looking at too many variables. I am not sure the relative growth rate results are needed in addition to the analysis of final diameter and height. Unless the authors think this adds necessary insight, I suggest to remove it, or include in supplementary material. Some technical clarifications on the analysis are needed (see below).

**Response:** As the initial seedling sizes of different species were slightly different, we also included relative growth rates to show that the observed interspecific variations in height and diameter also to a large extent was independent of variation in initial sizes between species. We think the relative growth rate information therefore remove potential doubts about the validity of the results. We therefore suggest keeping this information as it is.

### Technical comments (typos and small clarifications)

line 30. not much -> had little effect

**Response:** We prefer to keep the wording as it is.

line 64. at -> within

**Response:** This will be changed accordingly

line 87. is -> are

**Response:** This will be changed accordingly

line 129. What is the difference between Afromontane and African highland? Please define.

**Response:** We agree that the differences is not clear. We will therefore change it in this sentences to only include “African highland” to emphasise that the selected species are found at high elevations.

line 150. with -> by, check spelling on approximately

**Response:** This will be changed accordingly

line 175-180. This section could be written more clearly/simply. Please state what water and nutrient treatments were applied in chronological order. It seems the plants were watered except for one dry season – has this one dry season had an impact on results?

**Response:** We will change this paragraph as follows based on your recommendations: *“The 18 plots allowed for a full factorial experimental design, with three water levels and two fertility levels and a replication of three plots for each of the six treatment combinations. Before mid-July 2019, all trees at all sites received water when needed, irrespective of the subsequent planned water treatment. During the first dry period in July-August 2018 all trees were manually irrigated, while all plants were exposed to the dry period from mid-July to end of August 2019. The water and nutrient treatments started in September and November 2019, respectively. No significant ( $P > 0.05$ ) effect on diameter and height growth of the treatments was observed during this period likely because September to December is within the rainy season and we therefore use averages of all plots. Site maps with experimental design are presented in Figures S1-S3.”*

Regarding the possible effect of the 2019 dry season this has not been analyses in this study as the there is a dry period at all sites. However, there are indications in the data shown in Figure S5 and S6 that the increment in both D and h are lower between census 6 and 7 (interval 6 - dry period 2019) compared to the before and after, but this is likely not influencing the overall result of the study. Furthermore, the mortality was not particularly high after the 2019 dry period (Table S6) indicating small effects.

No significant effect of the treatments on what?

**Response:** On tree diameter and height. We will add that.

line 201. Define wildling

**Response:** Wildling is naturally generated seedlings. The species that was noted as saplings in Table S1 were wildlings, and we will change this in the table to be consistent between text and supplement information.

section 2.5 This section could be written more concisely.

**Response:** We will try to make it a bit more concise

line 248. know -> known

**Response:** Thanks, this will be changed accordingly

line 259. 3+ superscript

**Response:** Thanks, this will be changed accordingly

line 290. The basal area approach is somewhat confusing, but I understand the intention to standardize for different initial number of stems of each species group, but I think it could be explained better. The text mentions the dead tree contribution to basal area – presumably here considering the loss of trees to basal area composition, rather than basal area of dead trees? Clarify that only living trees are used for basal area. The approach to considering mortality impact on basal area was not easy to understand.

**Response:** Thanks for point this out. We will make it clear that only living trees were included in the basal area.

line 301. Here and other places it looks like there is a typo with repeated D-RGR\_D10-25.

**Response:** No, it is not a typo. The D-RGR means that relative growth rates were calculated from diameter increments, and D10-25 means that it was bas on trees in size classes of 10-25 mm diameter. We will consider to remove the second D.

line 301. It needs to be specified that the D and h information is used only from the final census, so looking at the total effect of the two year study period. For the growth rates, is this averaged across all the census intervals?

**Response:** Thanks, you are right. To make this clear we will add that D and h were analysed only from the 8 census and number of stems from the 7 census, while all RGR values were analysed as average values of all intervals between all 8 censuses.

line 302. Here mentions both species and species group for the ANOVA models. Presumably this is then two separate analyses? The results seem to just report statistical results of species (e.g table 3, figure 2) and not species groups. If they are not included, perhaps remove mention on species groups here. If the are included, differences between groups could be added to Figure 2 with another set of letters.

**Response:** Thanks, groups should be deleted from this sentences and should read. *“...with site and species/species-group as fixed factors.”*

line 307. Using plot level means. This is ok, but individual tree data could be used within mixed effects models, with a random effect for block. This would account for multiple trees within the same block.

**Response:** Yes, true but it would also add another source of variance and potentially lead to lower level of homogeneity in the dataset.

Table 3. Details of the anova results here and in other tables could be moved to the Supplement.

**Response:** Yes, if the editor suggests to do that we will move the details to the supplement. However, some journals prefer to show the details also in the main text.

Fig 3. The axis labels are difficult to read.

**Response:** We will increase the font size of the labels.

line 369/370. Are these numbers referring to D and h or ME and LE? Not clear.

**Response:** To make this clear we will slightly change this sentence: *On average, Dbase and h after two years for ES species increased by 12% and 43% at the ME and LE sites, respectively, compared to the HE site.*

line 378. species name spelling and formatting needs correction.

**Response:** We don't understand what's wrong with spelling and formatting.

Fig4. X-axis could be relabelled with month/year.

**Response:** We will add year/month to the top x-axis and measuring intervals on the bottom x-axis to make this clear.

Line 415. Why is this important, does it mean it is before the irrigation was stopped and therefore that the results are temperature rather than moisture driven?

**Response:** We don't understand this comment in relation to the text on line 415. Has the line number been wrong in the version sent to this reviewer?

line 481. support -> supports

**Response:** Thanks, this will be changed accordingly

line 505. There is interesting discussion here. Over time, with a more closed canopy the LS species could increase following successional process, is this relevant here?

**Response:** This is likely but here we rather want to make the point that if large LS species trees are disfavoured at early successional stage, then that will have lasting effects into later successional stages.

line 586. divers -> diverse

**Response:** Thanks, this will be changed accordingly

line 593. The text could be more explicit about the implications of the results for biodiversity, carbon, species selection, e.g. which species types does this research suggest would be best for restoration projects.

**Response:** The Conclusions section is perhaps not the best place to develop this but we will try to do it elsewhere, if there are such places. The importance of large and long-lived LS trees for carbon storage is obvious, and LS trees with larger seeds/fruits are also important for many species. For plantation species selection it is more difficult to say as there are many different purposes for this.