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Interactive comment on "Contrasting photosynthetic characteristics of forest vs. savanna species (far North Queensland, Australia)" *by* K. J. Bloomfield et al.

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We thank the anonymous reviewers for their comments and address them in turn below:

Referee #1

1. Need for greater focus and concision – the manuscript has been extensively revised as later responses will show. Two main aims throughout those revisions have been to remove unnecessary or confusing detail and to render the text more concise. The Results section, for example, has been reduced from four to three pages.

2. Introduction, research questions – we accept the element of redundancy in the phrasing of questions one and three. The former question three has been removed. The proposed new wording for the research questions is:

i. Are there differences in photosynthetic capacity and nutrient use efficiency between adjacent forest and savanna vegetation types?

ii. And if so, are these distinctions associated with systematic differences in leaf structural traits?

iii. Is there evidence of a greater role for P rather than N (or vice versa) in determining photosynthetic capacity across both sites and species?

iv. Can a simple classification system based on light requirement and adult stature help to describe observed variation in photosynthetic traits of tropical forest trees?

The text of the Introduction has been revised to illustrate existing gaps in our knowledge that the current study attempts to fill. Question one is posed specifically in the context of our study area across Zones of (Ecological) Tension where forest and savanna vegetation types co-occur over short spatial scales and is, in our opinion, central to the main aim of the manuscript. That Australian savannas are dominated by eucalypts then raises the question of how far sclerophylly, and its component traits, may have an effect on leaf physiological processes. The new question three, addressed most fully through the mixed effect modeling exercise, is again directed to our study area on young basaltic soils in tropical far north Queensland.

Question four looks at the utility of Plant Functional Type in helping to explain variation for the forest species. We agree that savanna trees may experience a very different light environment from forest trees and so are a special case for our study. The goal of developing a classification system that is at once instructive, widely applicable and simple to employ remains attractive and is of great interest to climate and vegetation modellers. For our forest sites in FNQ, Australia, we here try to apply a four-class

system proposed for Amazon forests by Fyllas et al. (2012) – that reference is now provided in the Introduction. We do not here seek to treat savanna as a separate PFT, but variation in the light environment through the canopy profile and within tree gaps remains central to many of the influential PFT systems (references in text).

3. Materials and Methods

a. Quantitative site characteristics of climate and soil variables (Table 1) – our analysis has been extended to explicitly include these site variables. In the revised manuscript, non-parametric correlations with photosynthetic capacity are presented for each site variable. Our Results section now includes the following paragraphs (with two supporting tables and a figure in Supplementary Material):

"Considering the dataset as a whole (i.e. F and S trees combined), significant correlations of Amax,a with environmental variables such as elevation, temperature and soil cation status were found. But with these mirrored by significant correlations of the same sign for both leaf [P]a and [N]a (Supporting Information Table S3). In investigating the underlying sources of our dataset's tree-to-tree variation in photosynthetic properties, we therefore focussed (using the mixed effects model) on associated tree-to-tree variations in leaf-based nitrogen and phosphorus concentrations; checking for any edaphic or climatic effect beyond that through an examination of model residuals in relation to the site-associated climate and soil covariates."

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"Model output indicated that, after controlling for Đň and leaf nutrient levels, less than 10% of variation in Amax,a was attributable to site effects. The environmental influence on photosynthetic capacity noted above (Table S3) was, however, adequately captured by our mixed model's fixed term (which incorporates leaf N and P), as shown by the absence of any relationship between model residuals and those same site variables relating to climate and soil conditions (Table S5 and Figure S4)."

b. Photosynthetic parameters Vcmax and Jmax – all references are now removed from the manuscript and we focus on measures of photosynthetic capacity at saturating light and elevated CO2 (Amax). Table 2 is now made shorter as a consequence.

4. Results

a. Cross-site comparisons that included results from an earlier greenhouse study have been removed (former Figure 7). No reference to the greenhouse work remains in the revised manuscript.

b. Figure referencing has been double-checked – some mistakes (Referee #2) had been made, and are now corrected. The sequence of the figures has changed in the revised manuscript with our attempts to improve the structure and flow of the text.

c. Sub-headings have been included.

5. Discussion

a. Sub-headings have been included here as well.

b. The sentence commenting on area- versus mass-based approaches to analysis and modelling has been moved further up the Discussion to a section dealing with comparisons among competing photosynthetic models.

6. Conclusion - we have not changed the concluding paragraph, but believe that revisions to the research questions in the Introduction as well as the structure of the Results and Discussion sections mean that there is now a consistent framework that leads the reader up to these concluding remarks. Three of the four research questions are revisited in the Conclusion – many of these same points also appear in the Abstract.

Referee #2

There was much agreement in the comments made by the two referees and we hope that the responses outlined above may serve for both in those instances where they

coincide.

Some specific comments remain:

1. We have revised the text of the Introduction in an attempt to highlight current gaps in our knowledge or areas of uncertainty that then lead up to the research questions posed. In particular, we try to emphasise the Australian context of this study and possible forest - savanna contrasts across the ZOT.

2. Question four is now explicitly addressed in our Discussion under a sub-heading: Describing trait variation using plant functional types.

3. Technical corrections

i. We note the comments on font size for certain figures and tables – these will be increased;

ii. The caption for Figure 1 related to an earlier version and has now been corrected;

iii. We have double-checked the spelling and acted on the cases cited of missing words;

iv. All cross-referencing has been double-checked and the noted error corrected.

For and on behalf of all the authors

Keith Bloomfield and Jon Lloyd

References: Fyllas, N. M., Quesada, C. A., and Lloyd, J.: Deriving Plant Functional Types for Amazonian forests for use in vegetation dynamics models, Perspectives in Plant Ecology Evolution and Systematics, 14, 97-110, 2012.

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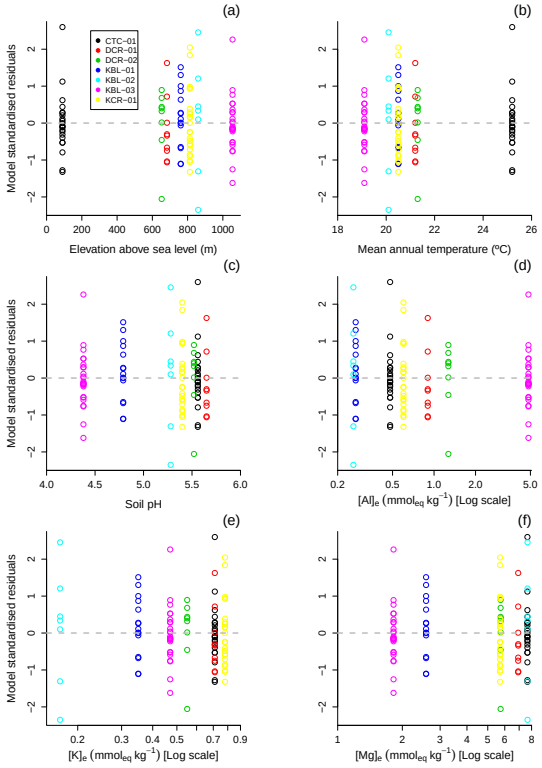

Fig. 1. Proposed supplementary figure S4