General comment to the reviewer: We thank the reviewer for his/her constructive comments and we address the various concerns below. The original comments of the reviewer are highlighted in red and our responses are in black. When text is copied directly from the revised paper the words are italicized.

Comment 1: Ali et al. set up an optimality criterion: available leaf N is allocated in such a way as to "maximize the photosynthetic carbon gain". As a result of applying this criterion they can account for key features of observed patterns today. But then when applying the optimization principle to a climate-change scenario they find a substantial reduction in future global photosynthesis, compared to a reference simulation in which photosynthetic capacities were held constant. This does not appear to me to make any sense. How can optimizing carbon gain lead to reduced carbon gain? I have tried to trace how the result arises but I am still not clear, and therefore I would like the authors to clarify the result, and especially to comment on its plausibility.
Based on the text as it is, my understanding is that it may result from the restriction in TRF2 (applied in warmer climates) that optimization of photosynthetic capacity does not continue to temperatures above 33 C (although leaf temperatures higher than this are commonly encountered in tropical forest canopies!) whereas respiration, much of which happens at night, continues to increase with temperature. If this is the explanation, then the result is an artefact of the assumptions of the study: i.e. that photosynthetic acclimation stops at 33 C, while respiration will continue to increase with temperature – even if the additional respiration has no useful function for the plant.

RESPONSE: We thank the reviewer for highlighting his concern.

Thank you very much for identifying this important confusion point in your reading of our paper. It is important to point out that the "optimization" in LUNA model is to maximize the net photosynthetic carbon gain (defined as gross photosynthesis minus the maintenance respiration for photosynthetic enzyme) given the plant's strategy of leaf nitrogen use built into LUNA model. Namely, it is a conditional optimization. Thus, it is possible that values of $V_{c,max\,25}$ and J_{max25} other than the "optimal" values predicted by LUNA model could have a higher net photosynthetic rate, if the plant does not follow the prescribed plant nitrogen use strategy built into the LUNA model. For a better understanding of the conditional optimization, we incorporate the following section under "model description section" in the revised paper.

"… *It is important to point out that the optimization in LUNA model is a conditional optimization given the plant's nitrogen use strategies built into the model. Thus, it is possible that "optimal" values of $V_{c,max\,25}$ and J_{max25} predicted by the LUNA model for future climate conditions could have a lower net photosynthetic carbon gain compared to fixed values of $V_{c,max\,25}$ and J_{max25}, where the plant does not follow the nitrogen use strategies built into the LUNA model. An example is shown in Fig. S1 where the "optimal" net photosynthetic carbon gain using the nitrogen allocation predicted by LUNA model for the elevated temperature is lower than that using fixed nitrogen allocation predicted for the ambient temperature.* "

The new Figure S1 is as follows:

Figure S1 *Illustration of conditional optimization in the LUNA model. In the model, the nitrogen use patterns vary under different environmental conditions. For example, the net photosynthetic carbon gain vs nitrogen allocation to light capture under ambient temperature* *(mean daytime temperature at 14.75 °C and mean night time temperature at 11. 45 °C; blue line) is different from that under the elevated temperature (+5 °C; red line). Therefore, the "optimal" net photosynthetic carbon gain under elevated temperature (red point) could be lower than the net photosynthetic carbon gain (green point) under elevated temperature using optimal parameters (the nitrogen allocations) under ambient temperature.*