

Interactive comment on “Nitrogen mineralization, not N₂ fixation alleviates progressive nitrogen limitation – Comment on “Processes regulating progressive nitrogen limitation under elevated carbon dioxide: a meta-analysis” by Liang et al.” by Tobias Rütting

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This manuscript by Rütting is a response to “Processes regulating progressive nitrogen limitation under elevated carbon dioxide: a meta-analysis” by Liang et al. that came to the conclusion that increased biological nitrogen fixation (BNF) and decreased nitrogen leaching will likely alleviate progressive nitrogen limitation (PNV) under elevated CO₂ (eCO₂). Rütting claims that the dataset used in Liang et al. favours ecosystems where BNF is an important process, which is not the general case. He instead claims that

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increased gross nitrogen mineralisation could be the main PNV alleviating process.

I would generally agree with Rütting’s claims that increased gross nitrogen mineralisation is the most likely driver for alleviating PNV. But I think both Rütting and Liang et al. misinterpret the results presented in Liang et al. In Liang et al. all results are presented as relative changes between ambient CO₂ (aCO₂) and eCO₂ experiments and not changes in the actual flux. So a small relative change to a large flux (e.g. mineralisation) could actually be larger than a large relative change to a small flux (e.g. BNF). So the finding by Rütting for the Höglward site in table 1 for gross mineralisation (increase of 0.3%) is in line with Liang et al. findings for net mineralisation in their figure 1 (small increase ~5%). The same logics can be used for assessing nitrogen leaching and its importance. This would need to be revisited in this manuscript.

I will not really comment on the conclusions drawn from the Höglward experiment as the review by Dijkstra covers it well and I agree on most things he mentions. I would rather bring up other processes which could also be of importance for alleviating PNV that both Liang et al. and Rütting missed to mention. Observations have shown that structural and biochemical plasticity with changes in NUE as a consequence could be another reason many free-air CO₂ enrichment (FACE) treatment does not experience any PNV. The importance of this process might be hard to draw from the data presented in Liang et al. but would be worth mentioning in Rütting as another process missed in Liang et al. that might play an important part in the puzzle.

P 1, L12: “. . . due to elevated CO₂ leads . . .” Add abbreviation eCO₂ here instead of in Table 1 as elevated CO₂ and eCO₂ is used arbitrarily throughout manuscript. P 2, L 11: “. . . Face and OTC studies . . .” Add abbreviation OTC here instead of in Figure 1 would make the text easier to read “. . . FACE and Open-top chamber (OTC) studies . . .” P 3, L 30: “Even though this mechanism . . .” Hard to understand this sentence.

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