

Interactive comment on “Processes regulating progressive nitrogen limitation under elevated carbon dioxide: a meta-analysis” by J. Liang et al.

Anonymous Referee #1

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In this study Liang et al. reviewed the to date available data on CO₂-effects on ecosystem N cycling, and in particular the proposed Progressive Nitrogen Limitation (PNL). This study is a valuable contribution to the field and can possibly inform experimentalists where there are needs for further measurements and modellers on the directions of processes in response to elevated [CO₂]. I recommend some minor (or major, depending on general comment #2) changes to the manuscript.

General comments

1) One thing that strikes me, is that one of the key findings, the effect that elevated [CO₂] has on gaseous N emissions, is missing in both the abstract and the conclusions. Also the lack of comparison with for instance Zaehle et al. 2011, where the opposite effect was seen. Although not a significant response for the experiments without N

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fertilisation, there is still a trend towards higher emissions in the data. This I find as an important missing part of the manuscript that is not really covered/discussed, and also the implications for the ecosystems where N addition is most common, croplands. As elevated [CO₂] have been suggested to be positive for crop productivity, the implications from realising the potential benefits from the CO₂-fertilisation could be that we are contributing to climate change even more.

2) As mentioned in the open discussion, the fact that several of the studies are from the same group may compromise the results. If the data sets are not independent, they should be treated differently. Have you performed such a check? If not, then this would be required and possibly also redo the analysis where data that comes from the same experiment are treated as one. Either way, this has to be mentioned and possibly be discussed in the manuscript.

3) In Table S1 it would have been useful to also include the number of observations for each of the processes or pools, preferably in the head. Also, adding the ecosystem type that the study represent. It would also been useful to include the numbers as percent change instead of just a binary x. The latter just a recommendation to make the study more attractive.

Specific comments

The precision in your resulting percentage changes do not reflect the uncertainty in the data. I think the precision is too high.

The sentence on line 17, page 16962 seems to be unfinished.

In the sentence starting on line 21, page 16962, it seems to me that you are making a general statement, but discussing an observed influx and reduction in leaching. See point 4 below.

C7783

On line 11 on page 16963, it says Birth, I think you mean Birch.

On page 1694, the sentence that starts on line 11, improve is a value laden word. As it is, the word improve is not connected to the increased turnover as I suspect you are referring to. Also in the same sentence, are you talking about the microbial flora or the micro-fauna? And in the following sentence you are making a very general statement that management practices on croplands may increase the N mineralisation. Where in your findings is the data to support that? The statement is true, but it is not related to elevated [CO₂]. Either remove the sentence or relate to the study.

The paragraph on page 16965 starting on line 15, there a few questions regarding that paragraph.

- 1) would not any change in pH result in a shift in microbial community function?
- 2) I find the mix between can and could a bit confusing.
- 3) And there is probably a missing "a" in the sentence on line 21.
- 4) On line 22, I would recommend changing "the" to "a", because this is a general statement and not linked to one observation. The same reasoning applies on line 23.

On line 6 page 16966, I would change sequestration to something more general like cycle or balance, as these results do not point in a specific direction.

References Zaehle, S., Ciais, P., Friend, A. D., and Prieur, V.: Carbon benefits of anthropogenic reactive nitrogen offset by nitrous oxide emissions, *Nat. Geosci.*, 4, 601–605, doi:10.1038/ngeo1207, 2011.

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