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Interactive comment on "Nitrogen mineralization, not N_2 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

F. Dijkstra (Referee)

feike.dijkstra@sydney.edu.au

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General comments Comments were made on the paper by Liang et al. (2016) who concluded that increased biological N2 fixation (BNF) and decreased nitrate leaching could alleviate progressive nitrogen limitation (PNL) under elevated CO2. In his comment, Tobias argues that in many ecosystems N2 fixation does not play an important role, and that instead, an increase in gross N mineralization under elevated CO2 could explain the absence or lag of PNL. While in general I agree with this assessment, I

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Discussion paper

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believe the example he provides does not provide strong support for his argument. He provides data about plant N uptake, N loss through leaching and gas emission under ambient from the spruce forest Höglwald, and makes predictions what would occur under elevated CO2 based on results from other studies (Table 1). While this kind of exercise can be informative, some caution is warranted, given the large uncertainties associated with estimating N fluxes under elevated CO2. He claims that the additional amount of 1.5 kg N per hectare per year that would be needed under elevated CO2 would require a 75% increase in biological N2 fixation, which seems unlikely for this system. I agree, but what this table also shows is that the increase in plant N uptake under elevated CO2 of 8 kg per hectare per year is more than offset by the reduction in N leaching. In other words, according to this example, PNL would not occur in this system mostly because of a reduction in N leaching. This is also what Ling et al. (2016) concluded, but the effect of elevated CO2 on N leaching is somewhat ignored in the comment here. I agree that BNF most likely was not the cause of the absence of PNL in this system, but to suggest that the absence of PNL is solely due to an increase in N mineralization (as the title suggests), is not well supported by the Höglwald case study.

The estimated reduction in leaching under elevated CO2 in the Höglwald forest was based on the 42% reduction observed by Liang et al. (2016). I am not sure if this 42% reduction was observed across all studies (including N limited ecosystems) or not. Perhaps, the reduction in leaching under elevated CO2 in N limited ecosystems may be smaller? Regardless, I believe the comment here could be somewhat more nuanced.

Other comments P 3, l. 30: “Even though this mechanism no N loss from the ecosystem,. . .” This is unclear. P 4, l. 13: Change “absent of” into “absence of”

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