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Biogeosciences Discussions

Interactive comment on "Modelling the demand for new nitrogen fixation by terrestrial ecosystems" *by* Xu-Ri and I. Colin Prentice

Anonymous Referee #1

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This is an interesting and, for the most part, well written paper. It addresses an important and timely question. The analysis is logical and informative. I recommend publication with minor revisions as specified below.

page 2 line2 5-7: It would be good to quantify this recycled N; It is on the order of 98% of the N requirement of NPP in arctic systems, maybe 95% in temperate systems, and I suspect less in tropical systems. On the other hand, disturbance can result in substantial losses that have to be re-accumulated before full recovery. This disturbance-driven loss probably drives most of the NNF. And indeed, outside of the tropics, symbiotic N fixation is usually restricted to early succession.

page 3 lines 11-22; As I interpret this paragraph, the N demand is calculated based on soil N demand alone and does not include plant N demand. I agree that most of

the N is in the soil (except perhaps in tropical systems), but you need to state explicitly that you are ignoring N demand associated with any increase in plant biomass or with changes in plant stoichiometry.

page 4 line 2: I don't think this is true; see Schimel and Bennett 2004 Ecology 85(3):591-602. But the immobilization of inorganic N by microbes is undeniable

page 4 lines 13-14: I am confused by "vary systematically". Surely this ratio changes between bacteria versus fugus dominated decomposition communities

page 4 line 24: what is Rs? Not defined until pater on page 5 line 19

page 5 lines 6-11: these results are interesting in that the NNF seems to vary inversely to the fraction of total N stocks in soil. If the analysis were based on plant N demand, it would suggest that the increased soil ability to meet demand precludes a NNF. However, the analysis is based on soil N demand. Like I said, interesting. Emphasize this point here and expand on it in the discussion.

Throughout; it is difficult for the naive reader to follow all the symbols. A short word description rather than the symbol would make the manuscript easier to read e.g., like you do on page 5 line 19 for Rs (...ooh that's what Rs means) and line 20 for RL

page 6 line 3: these numbers might be easier to interpret if they were expressed as C:N rather N:C ratios. Maybe provide both? These C:N rations are very woody. you might point this out and expand on it in the discussion...Most of the increase in NPP is in woody tissue, as would be expected with a closed canopy?

page 6 lines 6-11; Again I wonder about the role of disturbance in driving N losses from real ecosystems. Even the scattered effects of gap-phase dynamics would add up.

page 6 lines 20-23. I got confused here interpreting "litter" as litter fall or litter production. I'd clarify by changing the wording to "Mineralization from Litter and SOM".

page 6 lines 23-25 again I am confused by the previous description of NNF based on

soil demand and independent of plant demand. Yes I understand that N cycles and anything that goes into the soil will eventually be available to plants. It might just be the wording that has thrown me off. But if I am having trouble interpreting what you did, so will other readers.

page 8 lines 1-8. I think your assessment of resorption versus immobilization in litter works if the vegetation biomass and soil organic mass remain constant, but as fertility increases, I would expect resorption to decline, vegetation biomass to increase and soil organic mass to increase. It is not clear to me that your analysis still holds under those conditions.

Copy editor issues Use of () in citations if the authors name is part of the sentence or not. e.g., page 3 lines5, 32

hanging "this" e.g., page 2 line 22 "but this is a small flux" v. "but this flux is small"

page 3 line 21 this acronym has already been defined on page 2 line 13.

page 3 lines 31-32; the first two sentences of this paragraph are empty and could be deleted by modifying the parenthetical in the next sentence to "described by Xu-Ri and Prentice (2008: see Fig. 1 and Appendix S1)"

page 8 line 26 and perhaps elsewhere: usage "due to" means "caused by" not "because of"

page 9 line 29 "requires" to "require"

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