Interactive comment on "Higher response of terrestrial plant growth to ammonium than nitrate addition" by Liming Yan et al.

Anonymous Referee #1 Received and published: 24 April 2018

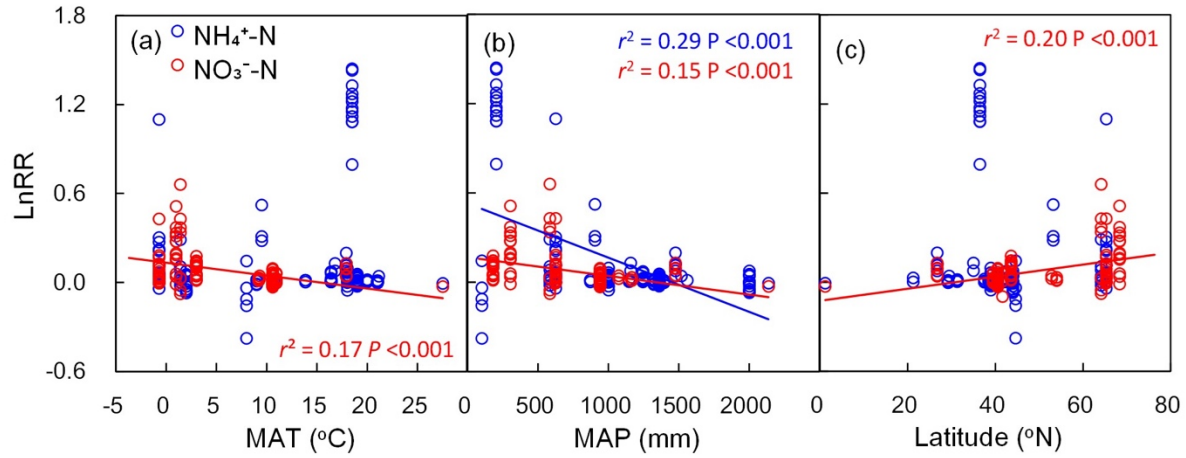
This manuscript addresses an important and interesting question whether the effect of N addition on plant growth is different for different chemical forms of N. The authors conducted a meta-analysis to compare the effect of NH_4 and NO_3 addition on plant growth. The authors found that the ratio of the effect of NH_4 to NO_3 addition depends on plant species, while the effect on below-ground and above-ground growth is different with respect to NH_4 to NO_3. Further, the authors had assessed the trends in the ratio of NH_4 to NO_3 in global total wet N deposition. As a conclusion, the authors suggest that future assessments and predictions on the vegetation response to atmospheric N enrichment could benefit from a better understanding of plant strategies for acquiring different forms of N. Overall, the results are useful. However, some key points are not supported in the paper, which should be considered before the paper can be accepted for publication.

Response: Authors thanks the reviewer for the positive comments. Please find our point-to-point replies as follows.

As a main caveat, the influence of climatology is not considered in the present analysis. It seems that the authors only compared the effect of NH_4 and NO_3 addition on plant growth across species. However, there are many factors that can affect the fertilizing effect of N, such as temperature, soil type, soil water availability, age of plants, and timescale of fertilizing experiments. Since not all the papers collected by the authors cover these information, the authors should at least use data from the literature providing this information.

Response: According to the Reviewer's suggestion, we have further collected the environmental factors. We found only mean annual temperature (MAT), mean annual precipitation (MAP) and latitude are enough for further analyses. As shown by the following figure, MAT and latitude only affected plant growth response to NO_3^--N addition, while MAP negatively influenced plant growth responses to NH_4^+-N and NO_3^--N addition. These patterns collectively suggest that plants growing in colder and drier regions are more sensitive to NH_4^+-N and NO_3^--N addition than that growing in warmer and wetter regions. This finding is inconsistent with the response patterns of net primary productivity to N addition at the global scale (LeBauer & Treseder, 2008). We have added this figure as Fig. 6 in this revised version, and added a few sentences to discuss the difference between these patterns and those in the previous studies on Lines 358-363 as:

> "5. Mean annual temperature (MAT) and latitude only affected plant growth response to NO_3^--N addition, while mean annual precipitation (MAP) negatively influenced plant growth responses to NH_4^+-N and NO_3^--N addition (Fig. 6). These patterns collectively suggest that plants growing in colder and drier regions are more sensitive to NH_4^+-N and NO_3^--N addition than that growing in warmer and wetter regions. This finding is inconsistent with the response patterns of net primary productivity to N addition at the global scale (LeBauer & Treseder, 2008)."



Please see some specific comments below.

Comments: Line 26: "plants respond differently to NH_4^+-N and NO_3^--N addition have never been quantitatively". This statement is questionable. It is clear that there are studies that compared the responses of plant preference to NH_4^+-N and NO_3^--N addition (see the sentences on line 81-83). It could be rephrased.

Response: We have removed this statement and rewritten the sentence on Lines 24-25.

Line 120-125: In their Supporting Information, I find that the authors only provide the reference list used in their meta-analysis without providing the raw data. It is useless unless the authors provide the raw data as well as the related information together. Since the main purpose of this paper is to introduce such a database as the core of the meta-analysis, the whole database must be clearly provided to ensure the repeatability of the work.
Line 127-134: Again, in their Supporting Information, I find that the authors only provide the reference list used in their meta-analysis without providing the raw data. Since the purpose of this paper is to introduce a database as the core of the meta-analysis, the whole database must be clearly provided to ensure the repeatability of the work.

Response: We have added the related information in this version. Please find them in the Supporting Information Table S1 and Table S2.

Line 205-207: "In the manipulative experiments, the ratio of NH_4^+-N/ NO_3^--N in the soil was differently influenced by N deposition (Fig. 3).". I cannot find the difference in the ratio of NH_4^+-N/NO_3^- -N changed by N deposition in Fig 3. Please explain it more clearly.

Response: The increasing ratio of NH_4^+-N/NO_3^--N in wet deposition usually enhances the NH_4^+-N/NO_3^--N ratio in the soil. However, synthesized analysis by the data from the recent manipulative fertilization experiments shown that the ratio NH_4^+-N/NO_3^--N in the soil was reduced under N fertilization. We have rewritten these sentences on Lines 210-213 as:

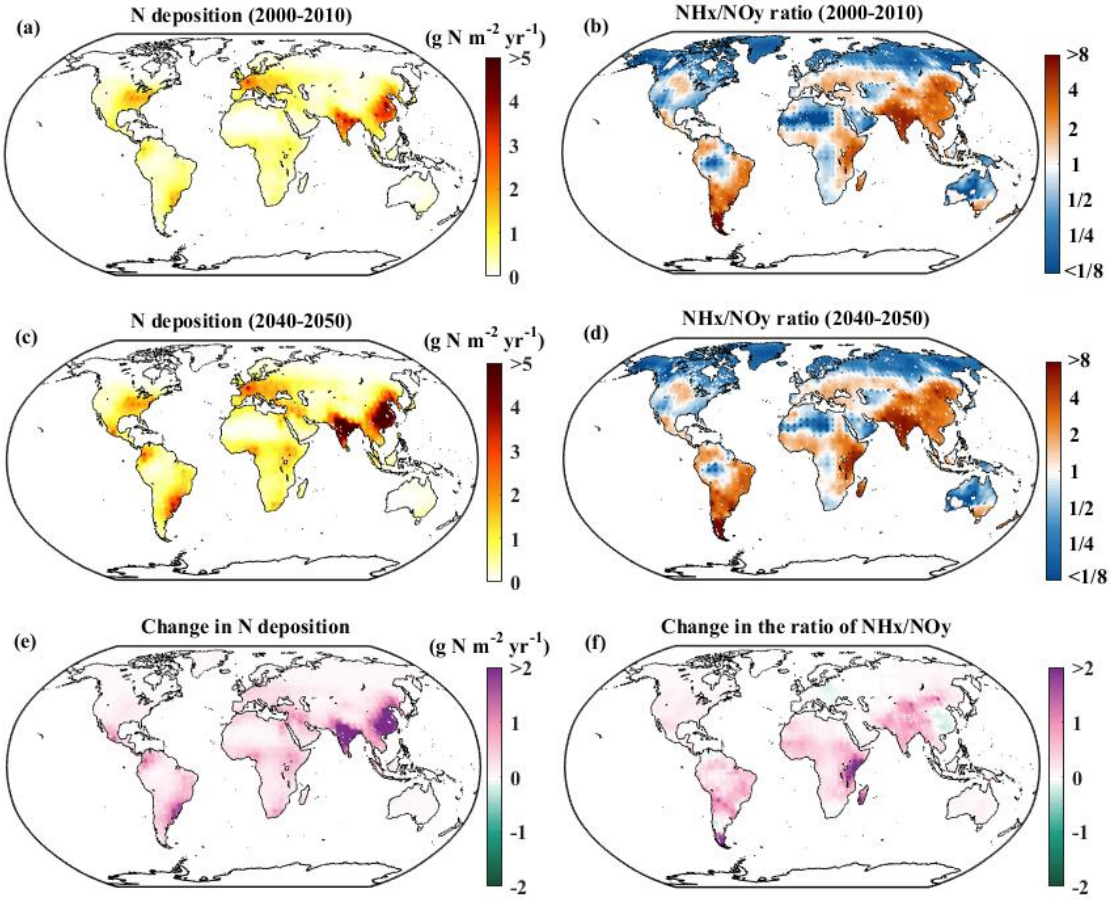
> "However, synthesized analysis shown that the ratio of NH_4^+-N/NO_3^--N in the soil was significantly decreased by N addition in the manipulative fertilization experiments (Fig. 3). This decrease was attributed to the greater stimulation of NO_3^--N (+356.0%) than that of NH_4^+-N (+60.0%; Fig. 3a)."

Table 1: does not support the conclusion that "These results imply that the global accelerating

N deposition could stimulate plant growth more in regions with increasing (e.g., North America) than decreasing (e.g., eastern China) NH_4^+-N/ NO_3^--N ratio.", because only N deposition over terrestrial ecosystems affects plant growth. The authors should provide the numbers of NH_4^+-N/NO_3^--N deposition over terrestrial ecosystems.

Response: Thanks. We have removed this conclusion in this revised version. We also provided the total N deposition and its NH_x/NO_y ratio over 2000-2010 (Fig. 2, panel a, b) and 2040-2050 (panel c, d) as well as their changes between the two periods (panels e and f). We suggest that although the N deposition increases fastest in eastern China, its positive effect on plant growth could not increase in the same pace due to the reducing NH_4^+-N/NO_3^--N ratio in that region. These sentences were shown on Figure 2 and Lines 204-209 as:

"As shown by the Fig. 2, the eastern Asia had the highest N deposition rate (panel a, c), which was dominated by NH_x deposition (panel b, d). The increase in N deposition is also the fastest in the eastern Asia (panel e). The fast increase in global NH_x/NO_y in the future was consistent with that derived from the MsTMIP environmental data (Fig. 2f). However, the trend of NH_x/NO_y was decreasing in some regions, such as the southeastern China and western Europe (Fig. 2f)"



Minor comments: Line 66: "affect" -> "affected".
Line 278: "Given to" -> "Given"

Response: We have checked and revised these in the new version.