

Interactive comment on “Disruption of metal ion homeostasis in soils is associated with nitrogen deposition-induced species loss in an Inner Mongolia steppe” by Q.-Y. Tian et al.

Anonymous Referee #2

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The manuscript from Tian et al. addressed the effects of increasing N availability on species loss based on a 9-yr and multi-level N addition experiment in a temperate steppe in Inner Mongolia. The effects of increasing N deposition on biodiversity have been received more and more attention. While many underlying mechanisms have been reported for the negative effects of N on biodiversity, this study showed that the changes of soil ions would account for such a negative effect. The experiment is well designed and performed, and the manuscript is well written.

In the third paragraph of the introduction, authors mentioned that the soil acidification-mediated processes in species loss have been evaluated in acidic grasslands. I am wondering why we need to know whether such cases are occurring in other grass-

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lands or not. What is the potential difference of acidic grassland and other types of grassland? And then, are these differences would lead to different changes of ions in soils? I think the explanations are important scientific basis for carrying out this study. Actually, they may be more important than what have been shown in the introduction (different mechanisms from light limitation to ammonia toxicity). We have known much of those mechanisms and case studies. I suggest authors to address those questions in the introduction. I also suggest authors to focus more on the ion toxicity to make the introduction more concrete.

Both in the results and discussion section, authors demonstrate that loss of forbs is not caused by the competitive exclusion from increasing growth of grass after fertilization. Instead, they concluded that mobilized Mn²⁺ after soil acidification is responsible for forb loss after N addition. While this conclusion has great scientific sense and is very interesting, authors should have more explanation (or potential reason) for the divergent responses of grass and forb to the mobilization of Mn²⁺. The explanation would be essential for this study. Authors should not simply show the phenomenon, but they should present some potential underlying mechanisms for those different responses of grasses and forbs. In my opinion, such contents would substantially improve the quality of this manuscript.

Page 1690 line 2-3 Enhanced N is a threat to biodiversity in almost all ecosystems instead of only in grassland. Page 1690 line 8-9 It is important to note that the changes in species composition do not mean changes of biodiversity. Page 1691 line 2-20 The first paragraph should be shorten. There many overlaps in the contents of this paragraph. Page 1694 line 10 Salsola collina is not a perennial species Page 1694 line 19 ‘aboveground biomass’ Page 1697 line 7 From Figure 1a, it seems that AGB peaked at 2 g m⁻² yr⁻¹. Page 1697 line 21-23 Those two sentences can be deleted from the Results section. Page 1698 line 17-20 This sentence should be shorten, as the first and second parts of this sentence are somewhat overlapped. Page 1698 line 22 ‘showed’ instead of ‘were’ Page 1698 line 25 – Page 1699 line 4 While the stepwise regression

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between ions and N addition makes sense, I don't think the similar regression between ions and pH makes any sense. Authors stated that soil acidification is a driver for the mobilization of those ions (Page 1698 line 24), it would be self-contradictory to show that any ion change is the major explanation of variation of soil pH. Page 1701 line 27 'The finding that' Page 1705 line 9 How did the soil nutrient depletion occur?

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