

Interactive comment on “Differences in spatial and temporal root lifespan of temperate steppes across Inner Mongolia grasslands” by W.-M. Bai et al.

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Received and published: 31 January 2016

Anonymous Referee #3 General comments At three types of grasslands dominated by different *Stipa* species in Inner Mongolia (i.e., typical, semi-arid, and desert steppes), the authors studied the spatial changes in root lifespan and they found the order of root lifespan *S. breviflora*>*S. grandis*>*S. krylovii*. The authors also studied the temporal pattern and they found differences in lifespan among summer-, spring- and autumn-produced roots. The authors attributed the spatial and temporal differences to the differences in soil organic matter, inorganic nitrogen concentrations, aboveground NPP and in particular the soluble sugar content in roots. The authors therefore claimed that

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ecosystem models for predicting C cycling need to take into account these spatial and temporal differences. My major concern is that the authors have overstated the novelty of what they have done. As the authors stated many times in this ms, this is “first” study to compare root lifespan in different grassland types: : .(e.g., p20010, L15; p20014, L11; and p20000, L7). In my opinion this is a false statement. There are a number of related earlier studies that are not referenced in this MS. just to name a few, (Van der Krift & Berendse, 2002; Tingey et al., 2003; Graefe et al., 2008; Gaudinski et al., 2010; Krasowski et al., 2010; Moser et al., 2010; Quan et al., 2010; Gu et al., 2011; Gluszek et al., 2015). All these publications have strong relevance to this study. This study just selected different species (three *Stipa* species) and different studied regions (three sites in Inner Mongolia). However, they are not the most important points. Given the differing dominant species and differing climatic and soil conditions, it is not surprising to find differences in root lifespan among three studied sites. As the authors said, their results were “also”“consistent with” the findings in existing publications (e.g., p20011, L4 and L28). In this study, the methods for analysis, the results and the conclusions do not significantly differ from previous studies. The spatial and temporal differences in root lifespan are already well known in ecological science, the current study just chose different species and sites, therefore, provided new data to confirm what we have known. That’s not to say this analysis is good for nothing. But it’s wrong to state that it’s a first of its kind. Rather, it adds to an already rich history of similar work.

We acknowledge the positive comments on our work, and checked the references mentioned by the reviewer. We revised the manuscript by deleting “first” thorough out the manuscript. We would like to emphasize that the data on root traits in general and root lifespan of temperate steppes in particular are scarce in the literature. Therefore, our studies provide valuable information for understanding the patterns of root longevity across different communities within temperate steppes in Inner Mongolia of northern China.

Beyond the novelty issues, the authors claimed that they addressed how “botanic,

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edaphic and climatic factors” (p20002, L6) affect root lifespan, i.e., the “regulatory mechanisms” (p20001, L1). However, these issues have not been really addressed. The authors stated that they conducted a ‘stepwise multiple linear regression’ analysis (p20007, L21) to figure out the most important factors that affect root longevity, but I do not find the statistical results. The authors need to present them in Tables. As shown as Fig. 5, the authors just presented the correlations among root lifespan and SOM, SIN, ANPP and sugar contents. You can’t actually address the “mechanisms” based on these correlations/regressions. More importantly, the authors clearly claimed that they sampled 3 sites with 6 replicate plots (p20004, L20) for their analysis. However, as Fig.5 shown, n=18 of observations for their “bivariate correlation” analysis. Given that only 3 sites (DREEDS, IMGERS and IMAHRS) were investigated, relationships between root lifespan and soil/plant variables (SOM, SIN, ANPP and [sugar]) could hardly be tested and accordingly with different results. The authors have misused sub-replicates in their analysis (n is not 18 but 3!). Due to the small data size, it is certainly not suitable to conduct a bivariate correlation or stepwise multiple regression analysis. In that case, Fig.5 is not correct and the major conclusions of this paper, given the basement of the major purpose on this correlation/regression analysis, are not reliable.

The statistical results for the stepwise regression were given in section 3.5 and in revised Figure 5. There were three types of grasslands, and six plots within each grassland in our studies. The use of 18-plot data as independent points for analyses of regression can be justified. Similar analysis’s methods have been used by others, e.g., Meier and Leuschner, (2008), *Global Change Biology*, 14:2081-2095; Burton et al., (2012), *Global Change Biology*, 18:258-266.

Specific comments Title: not accurate. Across Inner Mongolia grasslands, there are many steppe types dominated by different species such as *Stipa* and *Leymus*. This study just selected 3 sites dominated by *Stipa* species. Thus the wording of this title is too general.

We changed the title to “Differences in spatial and temporal root lifespan of three *Stipa*

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grasslands in northern China”.

Introduction: This section is not hypothesis-driven. It is hard to link the objectives to the experimental design and statistical analysis, which, in turn, resulted in a poor structure of the paper.

We revised the manuscript by addressing the concerns raised by the reviewer (lines 97-102).

P20000, L6: Use the full Latin names for the first time and then abbreviation.

We made the changes accordingly (lines 26-27).

P20001, L1: you did not address the “regulator mechanisms” in fact.

We re-worded the sentence by deleting the “and its regulatory mechanisms” (line 50-51).

L10-12, L19: you did not address these issues either. Moreover, what is your novelty given so many publications as you mentioned?

We re-worded the sentences in the revised manuscript (lines 65-67).

L22: ‘in a regional scale’ shall be ‘at : : ’

Yes, we made the change (line 71).

L22: ‘few’ does not mean ‘no’

Yes, we changed “few” to “a few” (line 66).

P20002, L6: not addressed either in your study.

Our results revealed that root lifespan was correlated with factors such as soil inorganic N contents, ANPP, BNPP/ANPP, soluble sugar contents.

L11: use abbreviation please

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Yes, we made changes accordingly (line 88).

L15: to add “of” after ‘types’

We added the “of” (line 92).

L21: add ‘method’ after ‘rhizotron’ M&M section: use FAO soil classification system
According to what did you select the 3 Stipa types? You said that they represent typical, semi-arid and desert steppes respectively. Why do not you identify them based on aridity index?

We made the revision as suggested by the reviewer (lines 100-102). The three Stipa communities are the representative communities in the Inner Mongolia grasslands.

P20003, L22: in which place of Inner Mongolia?

The information was given in Figure 1.

P20004, L6: space between TheStipa

We fixed the typo (line 136).

L19: how many years since excluded from grazing?

We included this information in the revised manuscript (lines 151-152).

P20007, L13: what is the difference between ‘lifespan’ and ‘longevity’?

The two words have same meaning.

L15: it is not suitable to use ‘effects’

The “effects” were changed to “influences” (line 244).

Results

P20009, L1-4: move to MM section

We deleted the sentences.

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Discussion: separated by sub-titles.

We do not think that addition of sub-titles in the discussion is necessary for the paper.

P20010, L13-15: why use the word 'first' repeatedly?

We deleted the word "first" in the revised manuscript.

P20011, L1-6: The readers may want to know if there are any other studies have reported the similar or different results, but we did not see such information in the discussion.

We mentioned that "There have been no reports on the studies of root lifespan of grassland at a regional scale" in the revised manuscript (lines 337-338).

L19: change explored to explore The typo was fixed (line 353).

P20012, L9-12: too long. Re-write it.

We shortened the sentence (line 373).

L25: speculation.

We do not think this statement is inappropriate.

P20014, L20-23: repeat what have said in Abstract (p20000, L18-20)

We re-worded the sentence (440-443).

References: The authors need to re-check carefully. For example, p20015, L9, L12, 'Leymus chinensis' shall be in Italic.

We made the changes accordingly (line 458 and line 461).

Interactive comment on Biogeosciences Discuss., 12, 19999, 2015.

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