**Biogeosciences
Discussions**

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Interactive comment on "A positive correlation between plant diversity and productivity is indirectly caused by environmental factors driving spatial pattern of vegetation composition in semiarid sandy grassland" *by* X. A. Zuo et al.

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Received and published: 27 February 2012

General comments Zuo et al. investigate the drivers of the diversity-productivity relationship in semi-arid sandy grassland ecosystems in Inner Mongolia. Although the results are not particularly novel, the use of structural equation modelling to determine the direct and indirect drivers of the relationship is both novel and interesting. Although well written in places, the bulk of the text is unfortunately very wordy and the grammar is poor, which makes the paper difficult to read and understand what the authors are trying to communicate. The main scientific issue I have is with the use of total above-

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ground biomass as a surrogate for productivity, and this needs to be carefully justified in the methods section for the reader to have confidence in the authors results.

Re: All the comments given by the reviewers are very valuable. Thanks for reviewer's valuation. Concerning the writing of paper, Knops who is one of editor in Ecology Letter, helped me revise the English Language. Also he is one of authors in this paper. The explanation for use of total aboveground biomass as a surrogate for productivity is in the following 8th.

Specific comments

1. Title – although this effectively communicates the main result it is long and cumbersome and I would recommend trying to shorten it – e.g. "Indirect drivers of diversity-productivity relationship in semiarid sandy grassland".

Re: The reviewer's comments are right. We have changed the title as the reviewer recommendation "Indirect drivers of diversity-productivity relationship in semiarid sandy grassland".

2. Abstract, P 11796, Line 11/12 – I think you should mention the use of ordination to analyse vegetation composition here.

Re: We have added the ordination method in abstract.

3. Methods, page 11799, line 5 – How is agriculture different from pasture? Do you mean cropland and pasture?

Re: Yes, it means cropland and pasture. We have changed agriculture to cropland.

4. Methods, Page 11799, line 19 – This reads like there are no non-native species present in these ecosystems – which seems unlikely. Is this correct?

Re: As we have known, there is one non-native species in grazing grassland. But we choose the fenced natural vegetation in which there are no non-native species.

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5. Methods, page 11799, Line 25 – is August the moth of peak biomass in all these ecosystems?

Re: It is peak biomass in all these ecosystems in the mid August. We collected the biomass in the mid August.

6. Methods, page 11800, line 2-10 – this seems like a very low level of sampling per site.

Re: The comment of reviewer is valuable. Because a lot of field work need to do in the mid August, we just had done three samplings per site. However, there are totally 60 sites in six vegetation types, and each vegetation type has at least 7 sites. In addition, two published references of Bai et al. (2007) and Zuo et al. (2012) cited in text had also three samplings per site. Two references are following. (1) Bai, Y.F., Wu, J.G., Pan, Q.M., Huang, J.H., Wang, Q.B., Li, F.S., Buyantuyev, A. Han, X.G.: Positive linear relationship between productivity and diversity: evidence from the Eurasian Steppe. J.Appl.Ecol., 44, 1023-1034, 2007. (2) Zuo, X.A., Zhao, X.Y., Zhao, H.L., Zhang, T.H., LI, Y.L., Wang, S.K., Li W. J. R., P.: Scale dependent effects of environmental factors on vegetation pattern and composition in Horqin Sandy Land, Northern China. Geoderma, 173-174, 1-9, 2012.

7. Please provide some indication of the level of within-site heterogeneity in soil/plant communities/biomass compared with among site heterogeneity?

Re: There are 60 sites in six vegetation types, and it's easy to calculate the level of within-site heterogeneity in vegetation or soil, but it is difficult to express them in one table or one figure due to 17 vegetation characteristics and soil properties. In order to describe the heterogeneity of vegetation and soil among six vegetation types, I had listed coefficient of variation of them in Table 1.

8. Methods, Page 11800, Lines 4-6. I am not convinced that the use of total above-ground biomass as a surrogate for productivity is appropriate in these ecosystems.

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Although this is an established method for assessing productivity of (annual) grasslands, there are a number of perennial shrub species listed as being present in the study areas. The use of total above-ground biomass is likely to vastly overestimate annual productivity where these shrubs are present. Did the authors separate out current year's growth from previous season's growth as per Bai et al. (2007) (cited in text)? How was this done for perennial grasses (if any were present)? Were the sites grazed and what effect did this have on peak standing biomass? This is a key issue that needs to be properly explained in the methods section so that readers have confidence that the measure of productivity is accurate.

Re: The reviewer's comments are right. Yes, we also separate out current year's growth from previous season's growth for shrub as describing in Bai et al. (2007) (cited in text). We have added the description in methods "The leaves and current-year twigs of each shrub species in each quadrat were collected to estimate its annual productivity". However, perennial grass is very few in our experiment sites, we use the total above-ground biomass as a surrogate for productivity, which is also same method to estimate the productivity of perennial grass in Bai et al. (2007). Some studies have showed that above-ground biomass was sampled at its peak time, which approximated the above-ground net primary productivity (ANPP) in temperate grasslands (Sala Austin 2000; Bai et al . 2004). In addition, the 60 fenced sites we chose are excluded land use. There is no grazing in study sites we chose. We had added this section description in experiment design.

(1) Bai, Y.F., Wu, J.G., Pan, Q.M., Huang, J.H., Wang, Q.B., Li, F.S., Buyantuyev, A. Han, X.G.: Positive linear relationship between productivity and diversity: evidence from the Eurasian Steppe. J.Appl.Ecol., 44, 1023-1034, 2007. (2) Bai, Y.F., Han, X.G., Wu, J.G., Chen, Z.Z. Li, L.H. (2004) Ecosystem stability and compensatory effects in the InnerMongolia grassland. Nature, 431, 181–184. (3) Sala, O.E. Austin, A.T. (2000) Methods of estimatingaboveground net primary productivity. Methods in Ecosystem Science (eds O.E. Sala, R.B. Jackson, H.A. Mooney R.W.Howarth), pp.

31–43. Springer, New York, USA.

9. Methods, Page 11800, Line 22. What is the difference between relative abundance and relative cover? This, and the following sentence (lines 23-25), is unclear.

Re: It is obvious different between relative abundance and relative cover. In plant ecology, abundance means how many plants for one species in one quadrat and is similar to plant density which just has the area unit. We have revised the sentence in lines 23-25.

10. Results, page 11805, line 11-12, it seems a bit weird that you were able to explain 100

Re: It is right that "Two axes (site 1–2) were extracted from the PCA, explaining 100

11.Results/Discussion – this all hinges on the assumption that your use of total above-ground biomass is an accurate measure of productivity. I am not convinced, given the information presented currently. Also, much of this text is wordy and unclear and could be shortened.

Re: We have revised them.

12.Discussion, page 11810, lines 1-12 – this is good discussion and is comparatively well written.

Re: Thanks for reviewer evaluation.

13.Technical comments There are numerous grammatical flaws throughout the text – and I strongly recommend professional editing to improve the English. Some examples from abstract and introduction: Abstract "The analysis from optimization model of structural equation suggests" should be "The analysis from the optimal structural equation model suggests" or even better "Structural equation modelling suggests". Abstract, final sentence "vegetation composition determined by environmental gradients" should be "vegetation composition which, in turn, is determined by environmental gra-

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dients" Intro, Page 11797, Line 2, "..ecosystems include.." should be "..ecosystems. These include.." Intro, Page 11797, lines 11-18, This whole paragraph is unclear due to poor grammar. Intro, Page 11797, line 19 – "environmental gradient" should be "environmental gradients", and also which gradients are being referred to here? Intro, Page11797, line 24-27 – this is a question and needs a question mark (?). Also "how environmental factors" should be "how do environmental factors" Intro, page 11798, line 1 "compositions" – should be "composition" Intro, page 11798, line 20-21. Point (1) needs re-wording There are numerous other examples throughout the text that I have not listed here.

Re: We have revised them in paper.

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