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Interactive comment on "Testing functional trait-based mechanisms underpinning plant responses to grazing and linkages to ecosystem functioning in grasslands" *by* S. X. Zheng et al.

Anonymous Referee #2

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Overall comments:

This manuscript presents plant functional traits at species, plant functional groups and community level measured in paired grazed areas (60 years or longer of free grazing) and enclosures (between 18 and 28 years fenced plots), which are located in six representative vegetation communities of the Xilin River Basin, Inner Mongolia. All six sites are said to have similar climatic and soil conditions and a gradient of standing aboveground biomass (Zheng et al., 2010), soil nitrogen and organic carbon contents and field holding capacity (present manuscript). Altitude is variable.

While the title refers to linkages to ecosystem functioning, the abstract say "We test

functional trait-based mechanisms underlying the responses of different life forms to grazing and linkages to ecosystem functioning along a soil moisture gradient in the Inner Mongolia grassland". Such study of plant functional traits along a moisture gradient and contrasting land use seems to be useful investigation. [1] I missed the moisture gradient in the title and further wonder (still) what authors refer to with "trait-based mechanisms" and "ecosystem functioning". Reading the manuscript I have missed firstly [2], a concrete mention of the ecosystem functioning the title refers to – I need to assume this has to do with plant strategies and vegetation functioning, although effects on functions such as nutrient cycling and specifically, ANPP are not mentioned. [3] Secondly, I also miss a clear definition of the gradient under study, soil moisture and other associated soil properties. As reader, it is very difficult to understand why a moisture gradient would exist along sites that receive equal precipitations and are located in similar soils; in a way, I certainly missed precipitation data from these six different sites and certainly, "Field holding capacity (%)" does not clearly represents the moisture gradient or explain why this is such (Is it an acceptable proxy of moisture gradient in the Inner Mongolian grasslands?). [4] Results are not always presented following the moisture gradient (see Figs. 5 and 6) but along vegetation communities as in previous publications. This inconsistency created confusion and wonder whether discussion and conclusions can actually talk about vegetation responses to grazing along a (soil nutrient, soil water availability or ANPP?) gradient. [5] To my mind, the moisture gradient needs to be better defined at the very beginning of the manuscript and both, [6] Figures and Tables in results section adapted accordingly so this manuscript discuss strongly a gradient. The feeling is that otherwise, there has not been a significant progress from the published article Zheng et al., 2010. "Effects of grazing on leaf traits and ecosystem functioning". [7] Finally, any moisture gradient in a arid/semi-arid grassland will result in a standing biomass gradient and this is the case on this study – there is a linear association (linear regression with R2=0.77) between standing biomass and field holding capacity of these communities (combining data from Zheng et al., 2010 and the present manuscript).

[8] I found the manuscript readability fair. I got distracted with many questions and unclear statements. Several of these queries were clarified after reading Zheng et al., 2010.

Abstract: Suggest that the study will refers to life forms results.

Introduction: [9] On the one hand, this section introduces the reader to very fundamental functional concepts such as the leaf economics spectrum, leaf traits and growth rate associations, plant functional groups as well as the stress-gradient hypothesis and resource availability hypothesis. On the other hand, it presents models of plant strategies, e.g. conservative vs acquisitive, grazing tolerant vs avoidance. It also mentioned "linkages to ecosystem functioning". All these concepts are intimately related but not necessarily well connected in this manuscript.

[10] Page 13161, line 25: "we would expect that:..." these expectations cannot be depicted from your introduction. [11] It is actually confusing the use along this section of several entities such as (i) life forms and (ii) plant functional group identity, (iii) species, (iv) vegetation types and (v) grassland vegetation communities. So one cannot know where the focus of the manuscript is.

Materials and Methods: [12] Although additional reading helped me to understand this section, it is unclear yet the total number of species sampled, and the number of species present in both grazed and enclosure plots. [12] Authors used a different set of species than previous articles so I suggest including the list of species as supplementary material. [13] Nine plant functional traits are mentioned. How about palatability scores?

[14] Some traits were derived to community-weighted means (CWM). Traits were measured "For each ungrazed or grazed site...". Were CWM calculated based on traits measured on separate sites or using the mean trait values of the complete data set? Definitively, sites have different composition and traits values (intraspecific variability). We don't know if these factors were accounted.

[15] Please, consider replacing "i.e." by "e.g." in several sentences of your manuscript; for example in Page 13165-Line 21.

Results: Section 3.1. Principal component analysis:

[16] Fig. 1, why PC2 is not shown? SLA and PH are in general quite important functional traits.

[17] Unexpectedly, Fig. 1a shows low correlation of plant height and plant biomass.

[18] In Fig. 1b, dots representing species from grazed and enclosure plots share the same ordination space suggesting similar vegetation functioning. However, authors remark the different functioning in grazed/enclosure plots as results of Fig 1c ([19] please check here whether or not different letters should be used for PC2 where p=0.1011). [20] I wonder whether the PCA biplot could actually show functional difference between grazed/enclosure vegetation by displaying PC1 and PC2 instead of PC1 and PC3.

[21] Finally, the study "have examined how plant responses to grazing are mediated by resources availability..." I suggest using a constrained analysis (i.e. DCA) for assessing to what extent the moisture gradient explains functional response of vegetation. Section 3.2.

[22] In Table A2, field holding capacity (the moisture gradient under study in this manuscript) affects significantly three plant functional traits (i.e. stem-leaf biomass, specific leaf area and leaf nitrogen content, which explain functional variability of PC2. This axis is not shown and this result might be worth mentioning.

[23] This section (3.2) includes responses of functional traits by species and by functional groups, Figs. 2 and 3, respectively. The following section (3.3) presents results at species level and after all in section 3.5 results at community level (CWM) are given. This is difficult to follow and add confusion. Section 3.4 provides the relative biomass of functional groups, between results of plant functional traits responses. I suggest to rearrange the order of sections.

[24] Section 3.5. Horizontal axes of Figs. 5 and 6 show the six plant communities instead of the moisture gradient represented with the Field holding capacity. Please, consider here to use consistently the moisture gradient along results.

Discussion:

[25] Section 4.1. I agree that any reference to growth rate should be included in this section because growth rate was not measured in the present study. Unfortunately, it is not well explained how leaf traits are associated to fast/slow growth rates. Even regrowth capacity is mentioned. I found that not sufficient explaination are provided either in the introduction or discussion.

[26] Section 4.5. The third conclusion recalls to the question: Is vegetation on this study responding to grazing or to enclosure?

Interactive comment on Biogeosciences Discuss., 11, 13157, 2014.