

Comments to the Authors

Journal: Biogeosciences (BG)

Title: "Effects of grazing on leaf traits and ecosystem functioning in Inner Mongolia grasslands: scaling from species to community"

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MS No.: bg-2009-210

General comments

In this work, Zheng *et al.* describe the variation in the values of 3 leaf traits (Leaf Area, Leaf Mass and SLA) in plant species from different Plant Functional Groups (PFGs) at the Xilin River Basin, northern China. Eight communities along a soil moisture gradient are analyzed, accounting for a total of 263 plant species described. For six of those communities, including 188 species, the authors also explore the effects of grazing on these 3 leaf traits. The paper denotes a hard work both at the field as well as in the laboratory, which contributes to a new valuable database for the region.

The work explores the effects of grazing on plant traits, which is a relevant scientific question considering the effects of different values of leaf traits (and their related changes as a consequence of herbivory) on ecosystem processes, in a context of global change. Although the paper doesn't present novel theoretical concepts or ideas, it provides a valuable set of data for a substantial number of species from semiarid grasslands of northern China. Nevertheless, the paper has, in my opinion, serious problems in redaction which makes it hard to be understood. Details given at methods section are not clear enough. When the readers come to either the Results or Discussion sections, they faced with new classifications and new criteria to analyze data that, even when can be inferred, had been never pointed out before.

I consider that the description of the 2 communities that are not analyzed in terms of the effects of grazing on plant traits (the *Prunus sibirica* sand dune complex and *Kochia prostrata* typical steppe) are unnecessary according to what the title reflects. If you consider important to describe these two communities, then I suggest them to separate this work in two papers. One of them, a descriptive paper, in which you describe the 8 communities in terms of plant traits and soil properties. In a second paper, you could assess the research questions concerning the effects of grazing on plant traits for the 6 communities in which they have the grazed and ungrazed plots.

I think the MS would require some work to make it clearer and to take better advantage of their findings. This is the main reason for which I cannot give you more detailed opinion about the Results and Discussion sections.

I hope the suggestions listed below could be helpful for the authors.

Methods:

The redaction of this section is in general tortuous, which makes it really hard to full understand the methodology and the experimental design. How many plots have you used, of which dimensions or area, how many replicates for each species, etc. Some points are detailed later at the Results section, but I think that pointing out those details earlier (say, at the methods section), would clarify the sampling design. I suggest a deep review in this section in order to a full understanding of the experimental design by the readers.

ANPP refers to a rate (grams of dry matter produced per area per unit of time, e.g. $\text{g m}^{-2} \text{year}^{-1}$). I understand that do you mean "...aboveground biomass reaches the peak of (or the maximum) primary productivity in these temperate...". This is, when the maximum plant productivity for the growing season at the site was reached.

The use of five different methods for measuring leaf area seems extremely accurate and reflects the great effort you have made. Nevertheless, for future works I suggest you to follow the protocols described at Cornelissen *et al.* (2003), which are simpler and had a general consensus between scientists working in plant functional traits issues worldwide.

Cornelissen, J.H.C., Lavorel, S., Garnier, E., Díaz, S., Buchmann, N., Gurrich, D.E., Reich, P.B., ter Steege, H., Morgan, H.D., van der Heijden, M.G.A., Pausas, J.G. & Poorter, H. (2003). Handbook of protocols for standardized and easy measurement of plant functional traits worldwide. *Austr. J. Bot.* 51: 335-380.

It is not clear enough the criteria you used to describe effects of grazing at the "population" level.

Results:

It is unclear if you describe plant traits of all the plots (including both grazed and ungrazed ones). This is a major point that need to be detailed at the Methods sections and to be remarked at Results and Discussion. Considering that you found that grazing has effects on the leaf traits analyzed, it is essential when you describe the communities to know if data refers to grazed or ungrazed sites.

Discussion:

I suggest to review the parallelisms between this work and others referred to. For example, in page 9959, lines 12 to 24: Publications by Diaz *et al.*, McIntyre & Lavorel and Pakeman, refers to the effects of herbivory on the abundance (relative cover) of annual or perennial species. The data presented here by Zheng *et al.*, on the other hand, showed changes in the trait values for each species, but didn't showed changes in species composition (as relative cover) between grazed and ungrazed sites.

Some citations are required to support some sentences (see Minor Comments).

Minor comments:

Abstract:

P9946, L1: More ---> Most

L16: "Considering water ecotypes....", or "When classifying plants in terms of water ecotypes,..."

Intro:

P9947, L25 "... suggested that..."

P9948, L5-9: This paragraph is hard to follow. I suggest to re-write it.

L 13 and L19: "Xinlin---->Xilin"

L21-23: The third research question has a grammatical mistake: "...and whether the effects..."

Methods:

The redaction of this section is in general tortuous, which makes it really hard to fully understand the methodology and the experimental design. How many plots have you used, of which dimensions or area, how many replicates for each species, etc. Some points are clarified at the Results section, but I think that pointing those details early (say at the methods section), would clarify the sampling design making the rest of the paper more friendly. I suggest a deep review in this section in order to a full understanding of your experimental design by the readers.

P9949, L17. "... complex, distributed..."

L19. Delete "were"

L24. Delete de comma before "respectively"

Some alternative ways to redact this section could be as follows:

L11-21 "The study was conducted in the areas adjacent to the Inner Mongolia Grassland Ecosystem Research Station (IMGERS), Chinese Academy of Sciences, which is located at the middle reach of the Xilin River. We selected eight grassland communities subjected to similar climatic conditions, such as temperature and precipitation, but different in terms of floristic composition and soil properties, such as soil water and nutrient content. These communities were the *Carex appendiculata* swamp meadow, *Stipa baicalensis* meadow steppe, *Leymus chinensis* typical steppe, *S. grandis* typical steppe, *Caragana microphylla* typical steppe, *Artemisia frigida* typical steppe, *Kochia prostrate* typical steppe and *Prunus sibirica* sand dune complex. For the former six communities we selected paired ungrazed and grazed sites. The ungrazed sites of communities..."

L24-27: "... 1979 and 1989 respectively, thus they have been ungrazed for about 20–30 years. The corresponding grazed sites of the former six communities were free sheep-grazed since 1950s, thus they have about 60 years of grazing history.

Unify verbal time: L19 "Eight grassland communities were subjected to..."; L28 "... communities are about 5–10 m."

P9950, L4-5: "... approximates the peak (or maximum) of primary productivity in these temperate grasslands. At each..."

L11: heights---->height; species----->individuals (do you refer to the height of all individuals of each species. Didn't you?)

L12: "...aboveground biomass of each species..."

L20: appeared--->present

L20-23: "In this study, 263 species from 51 families and 161 genera were collected, accounting for a total of 25 000 plant samples. Detailed information about sampled species at each community is shown in Supplement 1." "from the eight grassland communities in the Xilin River Basin" is redundant with details given at 2.2.

L25-26: In general, a replicate consisted of 5–20 leaves and a total of 30 replicates per species were sampled.

P9951, L3: Appendix B--->Supplement 2 (Or change the name of attached files)

L7: delete "weights"

L9: Delete space in "shoot: leaf ratio" (shoot:leaf).

L19: In fact, you selected the 2 dominant species at each of the 6 communities, totaling 8 species (2 of them repeated in 3 communities). I suggest re-writing this sentence.

P9952, L17: communities--->community

P9953, L16-17: "...five soil samples (0-20 cm depth) were collected in each sampling quadrat..."

L17: "leaf SLA" is a redundancy, just SLA.

I suggest to deeply reviewing the redaction of the remaining sections (Results, Discussion). Some suggestions are:

Results:

P9953, L24: the classification criteria in 4 steppes needs to be explained earlier, in the methods section, as you did at page 9954 (L7-8).

Tables and figures: unify the criteria to denote significance (a,b,c represents significance levels in most tables and figures, but not in Fig. 4 in which asterisks are used).

Discussion:

P9958, L16: citation after "...higher stature."

P9959, L12-24: Publications by Diaz *et al.*, McIntyre & Lavorel and Pakeman, as you well explain, refers to the effects of herbivory on the abundance (relative cover) of annual or perennial species. The data presented here by Zheng *et al.*, on the other hand, showed changes in the trait values for each species, but didn't showed changes in species composition (as relative cover) between grazed and ungrazed sites.

P9959, L3: citation after "...lower SLA values."

Supplement S1:

Species #68 in *Carex appendiculata* swamp meadow: capital letter in the genus Stachys.

Supplement S2:

The English in this section needs to be checked, for example in "... **Species** with long and narrow leaves, **such as the families** of Gramineae and Cyperaceae"