

## ***Interactive comment on “Response of soil respiration and soil microbial biomass carbon and nitrogen to grazing management in the Loess Plateau, China” by Zhen Wang et al.***

**Zhen Wang et al.**

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Response to Anonymous Referee #1

General comments:

Dear editor, I reviewed this manuscript entitled “Response of soil respiration and soil microbial biomass carbon and nitrogen to grazing management in the Loess Plateau, China” which analyzed soil respiration, SMBC, and SMBN under different grazing intensities and seasonal grazing patterns (in summer or winter), also abiotic and biotic factors were measured. The experimental design is reasonable, the indicators and

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data collection are sufficient, the analysis and demonstration are rigorous, the quantity and quality of charts are reasonable, and this research has important theoretical and practical significance. Basing on the above comments, the manuscript is fitted to the standard of SCI journal, but there are some problems has existed, so I suggest the author revise the manuscript before publishing it.

Response from authors: We are highly grateful for the reviewer's positive comments on our work. We carefully considered your comments and will take them into account for further revisions.

Page1 L18-19 What are the specific rotational grazing methods in the 9-year grazing areas mentioned here? Are there any combinations in the design of the experiment?

Response from authors: Thanks for these constructive comments. The specific rotational grazing methods are: The experiment of the rotational grazing system started from 2001. We choose two areas which had similar topographic conditions, vegetation composition and cover for warm season (summer) grazing and cold season (winter) grazing, respectively. Each of areas was divided into twelve 0.5 ha enclosed plots comprising three replicates for four gradient of grazing, 0, 4, 8, and 13 sheep, representing stocking rates of 0, 2.7, 5.3, and 8.7 sheep/ha, respectively. Grazing rates in this context being defined as the number of animals allocated to a treatment divided by the combined area of 1.5 ha for the three replicates of each treatment in either grazing season. When sheep were allocated to a treatment, a rotational stocking system was used the same sheep grazed successive replicates rotational. Warm season grazing plots were rotationally grazed from June to September. One cycle of rotational grazing is 30 days with 10 days for grazing and 20 days for rest, three rotations for total 90 days. Cold season grazing started from mid-November to late December. One cycle of rotational grazing is 24 days with 8 days for grazing and 16 days for rest, two rotations for total 48 days. Soil respiration measurements were conducted both warm season (summer) grazing plots and cold season (winter) grazing plots after nine years rotational grazing. The rotational grazing experiment began in 2001, and the Rs and soil

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microbial C and N measurements were carried out from 2010 to 2011, the previous 9 years of field trials being used for other experimental purposes. We have revised the abstract in the revised manuscript, see P1 L20.

Page4 L26-27 Soil respiration is significantly affected by soil moisture and temperature, and whether the particularity of precipitation in September 2011 has an impact on soil respiration data measured in September?

Response from authors: We completely agree with the reviewer. We have analysed the relationship between monthly precipitation and soil respiration, soil temperature, soil moisture, soil microbial biomass carbon and soil microbial biomass nitrogen. There is a strong relationship precipitation between and those variables. We added the results in the revised version, please see P 7 L 6; P24 L2.

Page5 L2 Is there any reference or self-setting in the classification of grazing intensity? Please indicate the basis.

Response from authors: We greatly appreciate your thoughtful comments. The classification of grazing intensity (GI) was based on local habitat productivity and daily hay intake per sheep unit method grazing intensity calculation use the following formula published by agriculture industry standard NY/T 635–2002 (Ministry of Agriculture of the People's Republic of China):  $GI(\text{sheep ha}^{-1}) = (A \times Y \times R) / (D \times B)$  Where A is available rangeland area (ha), Y is edible forage yield (kg ha<sup>-1</sup>), R is proper utilization rate of rangeland (%), D is days of grazing (d), B is daily hay intake per sheep unit (kg d<sup>-1</sup>). We added the detail of grazing intensity in the manuscript, please see P11 L9

Page5 L17-18 Diurnal and seasonal variations of soil respiration were different. Did the authors consider them during the measurement period?

Response from authors: We appreciate the reviewer's comments. We conducted 22 hour (between 6:00am and 10:00pm, at 2 hour intervals) measurements each day to examine the diurnal soil respiration. The early stage of herbage growth begins

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in mid May; aboveground grassland biomass peaked in mid September; grassland dormancy occurs by mid December. For these reasons, Rs was measured in mid May, September, and December. Please see P 5 L24.

Page7 L15-17 The author can analyze the daily changes of soil respiration of winter grazing and summer grazing under the same grazing gradient to determine which grazing intensity and grazing mode has a great influence.

Response from authors: We appreciate the reviewer's comments that could help us improve our manuscript. As reviewer suggested, we analyze the daily changes of soil respiration of winter grazing and summer grazing under the same grazing gradient. We found grazing intensity with 0 sheep ha<sup>-1</sup> has a great influence on soil respiration in warm grazing plots; grazing intensity with 2.7 sheep ha<sup>-1</sup> and 5.3 sheep ha<sup>-1</sup> has a strong impact on soil respiration in cold grazing plots. We added the analysis in the revised manuscript in P 6 L 30, P 23 L2.

Page8 L5 It is suggested that divide this part into two. The first part is to analyze the change of SMBC and SMBN under different grazing intensity and grazing mode, and the second part is to analyze the interaction between abiotic and biotic factors and structural equation model.

Response 6: Thanks for these constructive suggestions. We added new subtitles which were "3.3 Effects of grazing management on soil temperature, soil moisture, aboveground biomass, belowground biomass" "3.4 Effect of grazing management on temperature sensitivity of soil respiration" "3.5 Structural equation models" in the revised manuscript. Please see P 9 L17

Page9 L27-28 The author has discussed enough. The small suggestion is that soil respiration is closely related to the change of A, and the change of the relationship between the two under different grazing intensity and grazing mode can be considered.

Response from authors: We are grateful for the reviewer's suggestion. We have dis-

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cussed the annual soil respiration between the two under different grazing intensity and grazing mode. Please see P 11 L13; P 11 L20.

Figures Fig. 2 The significance test results are not prominent, suggesting recommend the results which is marked significantly and omit unsignificantly.

Response from authors: We greatly appreciate your constructive suggestions. We added the significance test results in figure 2. Please see P 28 L 6.

Fig. 5-6 “(d) 5-10 cm in warm season grazing plots” should change to “(d) 5-10 cm in cold season grazing plots” in both Fig. 5 and Fig. 6. Response from authors: Changes were made following your advices in the revised version. Please see P 29 L 3.

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