

This manuscript provides informative and interesting data on grassland management (grazing and N application) effects on ecosystem respiration and its heterotrophic and autotrophic components. However, there are some serious problems with the discussion and conclusions that are drawn from the data that must be addressed. First, and most serious, is that the main conclusions are contradictory and in some cases are not supported by the data. In particular, figures 2, 3, and 4 all indicate that there were no statistically significant effects of either grazing management or N application rate on ecosystem respiration or either of its components. This fact is confirmed in the first sentence of the conclusions (P.12299. L. 20-22), yet later in that same paragraph the authors state “Our observations strongly indicate that grazing exclusion and N addition played a critical role in accumulation of soil organic C”. How is it possible for the treatments to have no effect on ecosystem respiration but play a critical role in the accumulation of soil organic C, especially when no data were presented on soil organic C to show whether it changed or not?

**Response: Agreed and revised accordingly. Soil organic carbon was absent and the response of ecosystem respiration to grazing management and N fertilization was not statistically so we have deleted the statement.**

In addition, Figure 5 should be removed from the manuscript. If there are no significant differences among treatments then there is no reason to construct a figure showing percentage change.

**Response: Agreed and revised accordingly. Figure 5 has been deleted.**

Another serious problem is with the Discussion section. There is really no discussion presented at all. Instead, additional data on plant cover and biomass, which should have been included in the Results section, are presented along with a reiteration of data previously presented. A proper discussion needs to put the results in context of other published results and provide some explanation of why they matter. This section needs to be completely rewritten.

**Response: Agreed and Discussion rewritten.**

Finally, the authors tend to make broad sweeping statements about grasslands and ecosystems that may be appropriate for the cold, dry grasslands that they work with but do not necessarily apply to all grasslands or ecosystems. They need to be more careful in specifying which grasslands their comments apply to.

**Response: Agreed and revised accordingly. We specifically compared our results with alpine meadow and grasslands in Europe, North America and the Tibetan Plateau because these ecosystems also have cold and dry climatic conditions.**

Specific Comments:

P.12288 L.3-4: The range in soil C flux from grasslands is much greater than suggested here. This is one instance where the authors need to be more careful in specifying the type of grassland they are referring to. A more comprehensive summary of ecosystem respiration for all grasslands can be found in Gilmanov et al. *Rangeland Ecol Manage* 63:16-39 (2010). They show that grassland ecosystem respiration can range from less than 50 to more than 2000 g C/m<sup>2</sup>/yr.

Response: Agreed.

P.12288. L.11-12: Again, this may be true for some grassland but certainly not for all grasslands (see Skinner *Crop Sci* 53:1-8 (2013) for an example where soil respiration can be 25% or less of ecosystem respiration in managed grassland). Be specific as to what type of grassland you are referring to.

Response: Agreed and revised accordingly.

P.12290. L.5-7: The authors are ignoring the extensive work on grassland respiration in Europe. If they are only referring to rangelands they need to specifically say so.

Response: Agreed and revised accordingly. We have indeed compared our respiration rate with that in European grassland.

P.12290. L.20: Chose a better term than “indispensable”. “Substantial” might be a better choice.

Response: Agreed and revised accordingly.

P.12291. L.15-16: Does grazed in a full year mean continuous, year-round grazing including the non-growing season?

Response: Yes, full year grazing denotes year-round grazing; this includes both growing seasons and time outside the growing seasons.

P.12292: Were living plants left intact in the static closed chamber plots?

Response: All the plants in our static closed chamber were intact and undamaged.

P.12293. L.3: Should read  $R_a = R_e - R_h$

Response: Agreed and revised accordingly.

P.12293.L.14-16: Please identify the sensors that were used to monitor soil temperature and water content.

Response: Agreed and paragraph rewritten.

P.12294. L.16-18: Why do you conclude that annual emissions will be underestimated by 6.3% if the non-growing season respiration was 7.1 and 6.4% of growing season respiration? What about respiration during the two months that you did not measure? Are you assuming it was zero? Is that a valid assumption?

Response: Measurements of ecosystem respiration in January and February 2010 were limited by low temperatures during this period. Although monthly ecosystem respiration was absent in our study a previous study demonstrated that winter ecosystem respiration in grasslands is controlled mainly by air and soil temperatures (Wang et al., 2011. Biogeosciences, 2009-2025). Given that the air temperatures in January and February in 2011 were extremely low (mean air temperatures of -33.3 and -23.0 °C, respectively), we assume that the missing ecosystem respiration in our study is correspondingly low relative to total annual respiration. Even so, the carbon flux outside the growing season was equivalent to at least 9.4% of that during the growing season.

P.12294- 12295: The seasonal totals did not significantly differ among any of the treatments but what about the monthly fluxes? Were there any significant treatments x month interactions?

Response: We used repeated measures analysis of variance (RMANOVA) to test the effects of treatment on ecosystem respiration and the monthly fluxes exhibited a clear seasonal pattern but no significant interactions between treatment and month were detected.

P.12295. L.11 and 18-19: Here is an example of a contradiction. L.11 states there were no significant differences under different N addition rates yet L.18-19 states that ecosystem respiration increased for each N addition rate. When differences are not significant you cannot talk about them as if they are.

Response: Agreed. The Results and Discussion have been revised with some new text reflecting the statistical analysis.

P.12299. L.9-10: How can you conclude there was a net C sequestration without measuring soil C content?

Response: Soil carbon content under grazing-exclusion was absent and we have deleted the statement about net C sequestration.

Figure 1c: Change y-axis units from degree C to %. Figures 2, 3, 4: Are the data presented the averages of all measurements taken within a given month? Figure 3a: Why not separate the two growing seasons like you did for Figures 2 and 4? Figure 5: Remove this figure from the paper. Figure 6: Which treatments are included in this figure?

Response: Agreed and appropriate revisions made.