

Response to referee comments “Response of Ecosystem Respiration to Experimental Warming and Clipping in Tibetan Alpine Meadow at three Elevations” by the anonymous referee #2

Dear Referee,

We thank you for your valuable suggestions. We have tried to address your comments in the revised manuscript. Detailed responses are as follows.

Yours sincerely,

Gang Fu, Yangjian Zhang, Xianzhou Zhang, Peili Shi, Yuting Zhou, Yunlong Li, Zhenxi Shen

**Comment 1:** *The abstract is ok in its detail. I would suggest however that the authors added a sentence at the beginning of the abstract to set the stage for their experimental warming study. This sentence should be related to grasslands, climate change and carbon cycling.*

We added ‘The alpine grasslands are terrestrial ecosystems highly sensitive to climate change, whereas how their carbon cycling respond to climate change and human activities are not very clear.’ at the beginning of the abstract.

**Comment 2:** *The introduction does not develop a storyline for the study. The authors need to place the study into the greater scientific arena by focusing on grassland ecosystem and climate change. When the authors redevelop the manuscript they must find literature to cite that is more related and relevant to their study. The authors cite studies by Welker and Oberbauer that are conducted in true arctic tundra. These sites are high latitude but are not high altitude ecosystem and the finding of these study do not relate very well to those of the TP. In addition the authors use citation from studies that have no relationship to their finding. One example that stands out is their*

*use of Allaire et al 2008, which focuses on urban turf grasses. The authors need to search the literature and use the appropriate studies that give support to their findings.*

We removed Allaire et al. (2008), Welker et al. (1999, 2004) and Oberbauer et al. (2007). We added some references conducted in high-altitude and grasslands and redeveloped our manuscript to place our study into the greater scientific arena by focusing on grasslands and climate change.

**Comment 3:** *It is also unclear in the introduction the importance of the clipping manipulation, is this simulation associated with herbivory since the authors do mention the TP is used for grazing?*

The clipping was used to mimic grazing.

**Comment 4:** *The hypotheses also need additional detail. How do the authors think their sites will respond to warming and clipping and why? Please justify your reasoning.*

We rewrote our hypothesis as ‘Firstly, we hypothesized that response of  $R_{eco}$  to warming differed among the three elevations. A recent meta-analysis showed that warming significantly increased  $R_{eco}$  by 27% (Wu et al., 2011). Moreover, the temperature sensitivity of  $R_{eco}$  increases with decreasing temperature in the alpine meadow on the Tibetan Plateau (Bai et al., 2011; Lin et al., 2011), while temperature decreases with increasing elevation in our study alpine meadow sites (Fu et al., 2012). Therefore, warming would increase  $R_{eco}$  and the increase magnitude would decline with decreasing elevation. Secondly, we hypothesized that clipping could decrease  $R_{eco}$  at all the three elevations. In this alpine meadow,  $R_{eco}$  increases with increasing aboveground biomass (Jiang et al., 2013; Shi et al., 2006), which implies that removal of aboveground biomass by clipping could decrease  $R_{eco}$ . Thirdly, we hypothesized that soil water content could regulate the effect of warming on  $R_{eco}$ . Our previous

studies showed that warming could result in soil drying and  $R_{eco}$  is positively correlated with soil moisture in this alpine meadow (Fu et al., 2013; Shi et al., 2006). Our previous warming experiments also demonstrated that warming-induced soil drying could suppress microbial biomass, primary production and aboveground biomass (Fu et al., 2012b, 2013), all of which are positively correlated with  $R_{eco}$  (Jiang et al., 2013; Fu et al., 2009). That is, warming-induced decline in soil moisture could dampen the positive effect of enhanced temperature on the substrate supply of  $R_{eco}$ , which in turn regulates  $R_{eco}$ .

**Comment 5:** *Materials and methods: Experimental manipulation should focus on the study development. On page 13019 lines 17 – 24 and page 13020, line 5 – 13 should be move to a new section in the results and stats should be run on the temperature sensors.*

We moved the related contents into results section.

**Comment 6:** *The soil sampling section gives very little information to the study since measurements were taken at the end of the last year of the study. For this data to add value to the manuscript the authors would have needed baseline data prior to the start of their manipulations. I would suggest the authors remove this data from the manuscript and focus the manuscript on the ecosystem respiration.*

We removed the data related to soil sampling in the revised manuscript.

**Comment 7:** *The authors also need to reanalyze their results since they should have considered their design, a split plot design, with elevation as their main treatment effect since elevation cannot be fully randomized. This is reflected in elevation having the same denominator degrees of freedom at the other treatments in table 2.*

We reanalyzed our data by considering our design as a split plot design. The new results were shown in Table 2.

Table 2 Repeated-measures analysis of variance for the main and interactive effects of year (Y), elevation (E), experimental warming (W) and clipping (CL) on growing-season average ecosystem respiration ( $R_{eco}$ ) in the alpine meadow along an elevation gradient (4313-4693 m) ( $n = 3$ )

Model	<i>df</i>	<i>F</i>	<i>p</i>
W	1, 18	1.62	0.08
CL	1, 18	<b>41.43</b>	<0.01
E	2, 6	<b>53.74</b>	<0.01
Y	2, 48	<b>42.41</b>	<0.001
W×CL	1, 18	0.01	0.10
W×E	2, 18	<b>4.54</b>	<0.05
CL×E	2, 18	<b>6.69</b>	<0.01
W×Y	2, 48	<b>7.57</b>	<0.01
CL×Y	2, 48	<b>5.95</b>	<0.01
E×Y	4, 48	<b>2.64</b>	<0.05
W×CL×E	2, 18	2.22	0.07
W×CL×Y	2, 48	0.44	0.65
W×E×Y	4, 48	0.46	0.77
CL×E×Y	4, 48	1.02	0.41
W×CL×E×Y	4, 48	0.26	0.90

**Comment 8:** *Results: Until the stats are run based on the suggested study design the finding of the study cannot be concluded.*

We reanalyzed our data based on the split plot design. Then we found that there are no changes for the significant level of all the main and interactive effects. That is, our findings did not change.

**Comment 9:** *Discussion: The discussion rehashes the results without giving much support from other studies. Again there is not a storyline developed and the paper does not have a logical organization.*

We redeveloped the discussion and tried to obtain support from previous studies.