

Dear Editor,

We think that the comments by the reviewers are generally constructive and that we can address them adequately. However, the main criticism by both reviewers is that (1) results for one species (with representing only less than 10% of the plant cover) may not be sufficiently representative to justify broader conclusions about our ecological findings; (2) the methods were not clear, such as how to differentiate between the roots of *Stipa grandis* and those of other species, and the accuracy of methods used for C and N analyses; and (3) that (therefore) the scope of our study is limited.

First of all, I would like to draw your attention to the following two points. 1) *Stipa grandis* widely distributes and often dominates in Chinese steppe zone, for instance, from 112° 07.649' N to 117° 10.744' N (ca. 500 km) along the gradient in our study. 2) Actually, the relative contribution of *Stipa grandis* to the plant community biomass in our study ranged from 1 to 80% (mean = 29.8 %, SE=3.646, N=34), which can be easily seen in the text and the Fig 1 of our original submitted manuscript (WORD File). It ("1-8% relative contribution" in the text of the PDF file of our original submitted manuscript) seemed a printer/computer error which might happen as its WORD file was converted into PDF file. Now you can see the correct again in the text and the Fig. 1 of our revision (WORD file). Therefore, we think, *S. grandis* is decently and sufficiently representative to deal with the matter.

Below are our responses to the comments by the reviewers.

Reference 1

Reference 1: The work, as said above, was done only on one species representing only less than 10% of the plant cover, thus cannot be extended to the ecosystem C and N pools.

Authors: Plant carbon and nitrogen economies are closely coupled, and this coupling has important feedbacks to terrestrial carbon budget and climate. But we found that precipitation gradients do decouple the C and N pool of *S. grandis* along a precipitation gradient in Chinese steppe zone. We were not focused on the ecosystem C and N pools, but on C and N pools of the plant population. And the relative contribution of *S. grandis* to the plant community biomass ranged from 1 to 80% (mean 29.8%), not from 1 to 8%. It was a printer error when it change to PDF paper, and we had corrected in the text following the fig 1.

Actually, we also have an add data for two more species (a grass and a shrub) along another independent precipitation gradient, but we think use one gradient can make the results more clear and convincing.

Reference 1: Estimates of root biomass are questionable, since it is not clear how the authors differentiated between the roots of the species of interest and those of other species, and there appear to be a large soil contamination, as testified by the low C% of root tissues and its high variability.

Authors: It's often difficult to differentiate the roots of each species, but it was perfectly doable to differentiate between the roots of *S. grandis* and other species by visual observation. *S. grandis* is a tall bunch-grass; its roots are fibrous and shallow. Most other species were non-grasses, such as *Allium*, *Artemisia*, *Carex*, *Euphorbia*, *Iris*, *Potentilla* and *Taraxacum*. There were also few rhizomatous grasses like *Leymus chinensis*. Only roots of *S. grandis*

were hand-sorted and washed clean for lab analyses in our study, and all other roots were mixed into one composite sample.

Reference 1: The methods used for C and N analyses are old and not very accurate.

Authors: The methods used for C and N analyses in our study were classical, but we do think they are most accurate. Our analysis center had done a comparative analysis between Elemental analyzer method and the method of $K_2Cr_2O_7-H_2SO_4$ solution digestion using grassland soil sample all over the China steppe. The results showed that there were no significant differences between the two methods (unpublished data). And in our lab analysis, standard reference materials were used to guarantee the measurement accuracy. Moreover we focus on the proportion of above C and N pool to the total C and N pool. Since the C and N of leaf and root were analyzed as the same batch, we don't think the methods used for C and N analyses would have caused any inaccuracy in our results.

Reference 1: Conclusions are highly speculative, and the claims on effects on herbivory and decomposition rates are not justified. For example, contrary to the authors' claim it could be hypothesized that herbivores may feed less of a more nutrient plant – because it satisfies earlier their nutrient requirements. Also litter C: N ratio cannot be inferred from green tissues because of N re-translocation at senescence.

Authors: We disagree. Herbivores that have a choice

Reference 1: Title: Delete “predominant plant species *Stipa grandis*”.

Authors: We have deleted the word “predominant”. Since we are focus on plant population C and N pools, it'll be clearer and necessary to hold the species name in the title.

Reference 1: P5000L22: How were the roots of *S. grandis* identified? Provide details at best

Authors: The roots of *S. grandis* were identified by visual observations. We have clarified this in the methods.

Reference 1: P5001L17/ Fig.1b: Very large variation! R2 are very low and root quantification is highly questionable.

Authors: The analysis results showed that the $p = 0.001$ (see the results).

Reference 1: P5003L4: Highly speculative. Authors just make huge claims with no foundations.

Authors: We have added two supporting references, which examined the relationship between C:N:P stoichiometry of organisms and changes in ecosystem structure and function.

Reference 1: P5004L15-20: Again highly speculative and with not support – see comment above.

Authors: We have improved the discussion, focusing on the implications of changes in the stoichiometry and balance between these pools owing to differences or changes in precipitation regime.

Reference 2

Reference 2: pg 5000 ln 21-22: are there defining features of *Stipa grandis* roots that makes their identification easy? Do vertical cores capture a representative portion of the plant root system?

Authors: It's difficult to differentiate the roots of each species, but it's ok to differentiate between the roots of *S. grandis* and other species by visual observations. *S. grandis* is a tall bunch-grass; its roots are fibrous and shallow. Most other species were non-grasses, such as *Allium mongolicum*, *Artemisia scoparia*, *Carex duriuscula*, *Euphorbia esula*, *Iris lacteal* var. *chinensis*, *Potentilla chinensis* and *Taraxacum mongolicum*. There were also few rhizomatous grasses like *Leymus chinensis*. Only roots of *S. grandis* were hand-sorted and washed clean for lab analyses in our study, and all other roots were mixed into one composite sample. From each 1 m × 1 m quadrat, roots were collected by taking three 10-cm diameter soil cores which were uniformly distributed over the quadrat. We think the root sample we got was representative.

Reference 2: pg 5000 ln 26: do you have any measurements of standards or some comparison between these methods and more recent methods of elemental analysis?

Authors: The methods used for C and N analyses in our study were classical, but we do think it is most accurate. Our analysis center had done a comparative analysis between Elemental analyzer method and the method of $K_2Cr_2O_7-H_2SO_4$ solution digestion using grassland soil samples from all over the China steppe. The results showed that there were no significant differences between the two methods (unpublished data). And in our lab analysis, standard reference materials were used to guarantee the accuracy of the measurement.

Reference 2: pg 5001 ln 12: much is made of the fact that *S. grandis* is a predominant species of the steppe, but relative contribution in the study was only 1 - 8 %. Are these sites, and the results, therefore really representative? Analysis from more than one species / functional group could be beneficial to this study (it seems roots at least of all species were collected, but the remainder pooled, which is a bit unfortunate).

Authors: The relative contribution of *S. grandis* to the plant community biomass ranged from **1 to 80% (mean 29.8 %, SE=3.646, N=34)**. It was a printer error when it change to PDF paper, and we had corrected in the text following the fig 1.

We were not focused on the ecosystem C and N pools, but the plant population C and N pools. Actually, we think that the decoupling of above and belowground C and N pools may be species-specific. In the revision with a second gradient added our results for this are much more robust.

Reference 2: pg 5001 ln 18: looking at the relationship between MAP and proportion of AG biomass (Fig 1b) I wonder if this is really a significant trend with MAP? There appear two distinct groups of data: MAP < 230 mm where prop AG is constant, and > 230 mm where the proportion decreases with MAP. At this 230 mm point there is the full range. Is this

associated with some important change in the landscape that maybe influencing the results (e.g. soil type)? This trend is also evident in all nutrient AG proportion data: less so in the N data, but this means the results have large variation as well.

Authors: In total 35 sites were chosen along the precipitation gradient from east to west, each two adjacent sites at intervals of more than 10 km. But this transect was not an exactly east-west transect in an accurate latitude, so the sampling sites were not evenly distributed with different precipitation. At the 230 mm point there were more sampling sites for its south-north sway.

Reference 2: pg 5001 ln 19: the proportion of aboveground biomass increases by 22 percentage points with an increase in 100 mm yr⁻¹ precipitation (but see comment above).

Authors: see the reply above.

Reference 2: pg 5002 ln 17: Why are the P and K data put in an appendix figure and not referred to in the discussion? The paper is limited enough as it is.

Authors: We tried to focus on the C and N pools and did not want to inflate the number of figures, but we are happy to include P and K figures in the main text

Reference 2: Pg. 5003 ln 19 : Results are qualitatively similar to other studies regarding trends in AG-BG biomass allocation with precip. How do they compare quantitatively? Likewise for the tissue [N] (and other nutrient) trends.

Authors: We have added some references. But we don't think it is necessary to compare quantitatively, since the studies were conducted under great different precipitation and other conditions.

Reference 2: Pg 5004 ln 13 : The authors raise an interesting possible implication of their results, but only one, and this seems a little speculative and a bit outside the scope of the journal. It is not clear what sort of herbivory or livestock grazing the authors are referring to. If it is grazing for meat consumption (ie net removal of N from the system) they could be correct, if it is for wool or milk this effect will be less, but to confirm this this would some estimates on the rate of N removal to see if plant uptake would 'not keep up' with the loss. It seems this issue might be something more relevant for a rangeland management focussed journal. I would have thought a discussion on the the implications for some of the points raised at the start of the discussion (eg pg 5003 ln 1-5) might be more relevant, if they could be supported with evidence.

Authors: We have improved the discussion, focusing on the implications of changes in the stoichiometry and balance between these pools owing to differences or changes in precipitation regime.