

Answers to the questions:

Reviewer #2:

1. Response to comment 1, The paper would be clearer if the authors referred to north- and south-facing slopes, not sunny and shady. If this is wrong, the authors need to describe how a slope was determined to be either sunny or shady.

Answer: According to the reviewer's comment, we have changed shady and sunny slope to north and south slope throughly in revised manuscript.

2. Response to comment 2, The authors interpolate mean annual temperature and mean annual precipitation for each site from measurements of MAT and MAP from 4 climate stations, two of which are sunny and two of which are shady. This is not valid. The authors sites are varying by a number of factors that cannot be "interpolated" from just 4 points. Stating that sunny sites are warmer than shady sites will need other data. One recommendation would be to simply remove the MAT and MAP regressions/correlations and examine other factors.

Answer: In this paper, MAT and MAP were interpolated by two observations on each slope. We have to admit that the interpolated climatic data might be not very reliable, but we have no better ways to obtain more reliable climatic data. In fact, the case that two observations distributed at each slope is very rare in the world. Although the obtained climatic data were not very reliable, we think it is necessary to remain the regressions/correlations between $\delta^{15}\text{N}$ and MAT and MAP in this paper. The reason is that, MAT and MAP effects on leaf and soil $\delta^{15}\text{N}$ at global scale are different from that at regional scale. this led to our argument (hypothesis) that environmental effects on leaf and soil $\delta^{15}\text{N}$ could depend on local environment, thus, a comparative study between the south and north slope with significant differently climate conditions was conducted. The regressions/correlations between $\delta^{15}\text{N}$ and MAT and MAP in this study did confirm our argument. If the MAT and MAP regressions/correlations were removed, our argument (hypothesis) will loss supports. Lacking reliable climatic data is a universal and most trouble for the researchers studying global change and biogeochemistry cycles. Although the regressions/correlations between $\delta^{15}\text{N}$ and MAT and MAP obtained in this study could be not perfect or reliable due to lacking accurate climatic data, we believe that the present study is also a small progress in science because we first put forward this argument (hypothesis), and confirm it. We hope more researchers

to follow it.

Besides climatic data, vegetation types and species provide a strong support for the warmer climate on the south slope than the north slope. The main species occurred on the south slope are *Ephedra sinica*, *Stipa grandis*, *Stipa capillata*, *Achnatherum splendens*, *Nitraria tangutorum*, *Caragana sinica*, and *Suaeda glauca*, all these plants are typical xerophyte species, and they were not found on the north slope. On the north slope, the main species included *Kobresia myosuroides*, *Carex enervis*, *Poa annua* and *Thalictrum aquilegifolium*, they all are not xerophyte species. The information was added in the revised version.

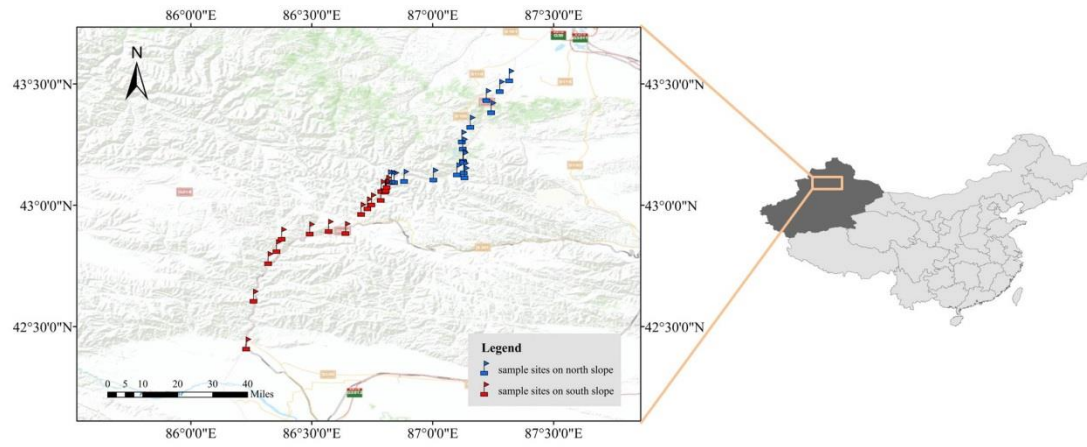
3. Response to comment 3, The authors interpret the difference of leaf and soil delta ^{15}N as "as the isotopic composition of plant-available N". There is no empirical evidence for this. Given the results of Craine et al. 2015 that examines global patterns of soil ^{15}N , there is unlikely to be evidence that the signature of available N is controlled by soil delta ^{15}N . Soil delta ^{15}N at broad scales is likely simply an index of decomposition of the soil organic matter. Unless the authors have a reference to a graph that shows directly this relationship (delta ^{15}N of available N vs. soil delta ^{15}N) this statement is poorly supported.

Answer: Amundson et al. (2003) considered that $\Delta\delta^{15}\text{N}_{\text{leaf-soil}}$ could be interpreted as the isotopic composition of plant-available N provided that isotopic discrimination does not occur during plant uptake and assimilation. In the present study, we found a highly correlation between leaf $\delta^{15}\text{N}$ and $\Delta\delta^{15}\text{N}_{\text{leaf-soil}}$ both on the two slopes, which is consistent with the result in Craine et al. (2009). As we all recognized, leaf $\delta^{15}\text{N}$ is a good indicator of plant N sources characteristics. Thus, the relationship between leaf $\delta^{15}\text{N}$ and $\Delta\delta^{15}\text{N}_{\text{leaf-soil}}$ could provide a powerful support for the opinion by Amundson et al. (2003).

Besides, even though there was no direct evidence to support the relationship between $\delta^{15}\text{N}$ of bulk soil N and $\delta^{15}\text{N}$ of available N, the statement that soil $\delta^{15}\text{N}$ could be used to index the soil N availability had been widely accepted (McLauchlan et al., 2007; Högberg, 1997). The mechanism was that, high soil N availability leads to increased soil N transformation, such as nitrification, denitrification and NH_3 volatilization, which discriminates against ^{15}N and causes ^{15}N -enrichment in soil. Thus, ecosystems with high N availability exhibit high $\delta^{15}\text{N}$ values in soil.

4. Response to comment 4, Figure 1 needs to redraw at a much larger scale, i.e over less total area. The points all overlap and it is not helpful to see where the sampling is.

Answer: Thank you for your advice, we have redrawn Figure 1 in revised manuscript.



Special thanks to you for your good comments.