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# *Interactive comment on* "The interaction between nitrogen and phosphorous is a strong predictor of intra-plant variation in nitrogen isotope composition in a desert species" *by* J. Zhang et al.

**J. Zhang et al.**

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Responses to Anonymous Referee #1 Comment: This paper aims to investigate the mechanisms controlling intra-plant variations in $\delta$15N of a desert species grown in natural conditions. The study focused on the intra-plant variations in $\delta$15N and N/P ratio of organs and discussed the plant nitrogen volatilization as a possible mechanism making intra-plant variations in $\delta$15N. The experimental design and data presented in this manuscript are very interesting and worth for reporting. Authors were successful to show interesting patterns and reasonable discussion as a whole. Response: Many thanks for appreciating our study and for the constructive comments and suggestions.

Comment: However the data are not entirely satisfactory to be evidence for newly finding possible mechanisms. For example, the authors did not show N source of studied species such $\delta$15N value of soil N, precipitation, ground water etc. Furthermore vertical distribution pattern of available soil P was not also shown. So data of this study seems too narrow to conclude the "new" mechanism. Furthermore the manuscript includes many problems and need considerable revisions as follows. The manuscript needs considerable revision before publishing. Response: We agree that our present study cannot conclusively reveal the mechanisms responsible for the identified pattern in the intra-plant variation in $\delta$15N and its relationships with organ N and P contents. As the relationships are first reported in this study (we believe), we have not had opportunities to conduct in-depth controlled experiments to explore the underlying mechanisms. We hope our manuscript, if published, can stimulate more studies in this direction. We have revised the manuscript according to this reviewer's suggestion. The revised manuscript should reflect better the fact that there are uncertainties regarding underlying mechanisms at the present time. Addition revisions have been made to address other comments made by this reviewer (see below).

Major points: Comment: 1. Need more data for $\delta$15N of N source such as soil, precipitation and ground water etc. The $\delta$15N of plant organs can vary with N source such as precipitation vs soil water, NO3-N vs NH4-N, soil depth, and dependence of mycorrhiza interaction, N fixation etc. This study did not show these data and did not discuss about another possibilities of the mechanisms making intra-plant variations in $\delta$15N. Response: Information about the $\delta$15N of nitrogen sources available to plant uptake at our study sites is certainly important for interpreting the nitrogen isotopic signature of the overall plant and can be useful to the present study. Plants absorb nitrogen primarily through roots and possibly also through leaves for dissolvable nitrogen. Most nitrogen in plants likely has a single entry point. Thus any differences in nitrogen isotope compositions among different plant organs should occur after nitrogen absorption at this entry point. It is conceptually difficult to explain intra-plant variations in $\delta$15N based on variations in external nitrogen sources.



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Comment: 2. Need more discussion for another possibilities such as N fixation, re-translocation and metabolism. For N fixation, Li et al 2015 recently reported the relationship between Nitraria palnts and endophytic N-fixing microbes in related Salin-Alkaline stress. For re-trainslocation, Wang et al. (2014) reported root and leaf stoichiometry of same species, N. tangutorum, suggesting the importance of relative availability of P and N along aridity gradient and diffusion process within the plant organs. Furthermore Nitraria is halophyte, so N based osmotic adjustment substance such as betaine seems affect N metabolism within plant organs. REF: Li et al (2015) doi:10.2991/cmfe-15.2015.15 . Wang et al. (2014) Contemporary Problems of Ecology, 2014, Vol. 7, No. 3, pp. 308–314. Response: Thanks for letting us know about these two papers, which we have overlooked. The N/P variations at our two study sites seem to be consistent with the finding in Wang et al. (2014). Currently not enough is known about how endophytic microbial nitrogen fixation affects isotopic compositions of desert plants. Any discussion of such issues would have to be very speculative and be premature for the present study.

Minor points: Comment: P18774 L13: How about discuss more about relationship between the results of carbon isotope ratio and this study, because same samples were used in this study. Response: We already reported results on carbon isotopes in another paper (Zhang et al. (2015) Nitrogen control of 13C enrichment in heterotrophic organs relative to leaves in a landscape-building desert plant species. Biogeosciences 12: 15-27). We have not found any direct relationship between carbon and nitrogen isotopes that may be helpful for explaining the patterns reported in the present study.

Comment: P18778L2: “80 mesh” need more information. Response: Thanks. Additional information is provided in the revision.

Comment: P18778L9-11: What method was used for ashing samples? Response: Thanks. Additional information on ashing is provided in the revision.

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Interactive comment on Biogeosciences Discuss., 12, 18769, 2015.