

Interactive comment on “Fungi regulate response of N₂O production to warming and grazing in a Tibetan grassland” by Lei Zhong et al.

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A note upfront from the submitting person: This review was prepared by Oliver Vögeli and Ursina Morgenthaler, master students in geography or earth system science at the University of Zurich. The review was part of an exercise during a second semester master level seminar on “the biogeochemistry of plant-soil systems in a changing world”, which I organize. We would like to highlight that the depth of scientific knowledge and technical understanding of these reviewers represents that of master students. We enjoyed discussing the manuscript in the seminar, and hope that our comments will be helpful for the authors.

The aim of Zhong et al. (2018) is to clarify the role fungi play in the loss of N₂ and

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climate warming via N₂O production in an alpine meadow. Their investigation concentrates on changes in climate and land use management. For this, they examined the effects of 10 years' warming and winter grazing on soil N₂O emissions potential in an alpine meadow on the Tibetan plateau. Zhong et al. (2018) found, that warming and winter grazing had no effect on overall nitrification and denitrification. Warming changed only the biotic pathways from fungi domination to bacterial domination, but did not change total nitrification or denitrification. This study is important, because previous studies in Tibetan alpine grasslands mainly focused on bacterial nitrification and denitrification processes. The findings of Zhong et al. (2018) thus open new possible scenarios, which can refine greenhouse gas flux models.

The paper brings new interesting observations about the role of fungi in N₂O production in alpine grasslands. The introduction is very well and comprehensibly written and gives a complete overview on the study. The duration of the study (10 years) seems appropriate to measure microbial behaviour. The authors did an extensive laboratory examination, where they measured many soil properties (soil moisture, soil mineral N, total C and N content, soil DNA). In the discussion, the authors also consider the impact of archaea (line 319f), which are often forgotten when consider microbes.

The methods used seem appropriate in general, however some questions arise with regards to measurements and sampling. The paper leaves open why the difference was set to 1.2°C and 1.7°C during day and night respectively in summer. Furthermore, it is not clear what the effect of 1500 W are in winter. The authors mention that some thermometers are broken, but it would have been nice to get at least the data from the working thermometers. Zhong et al. (2018) mention from the beginning and in the title, that the effect of winter grazing was under investigation. However, for half of the time there was summer grazing on the sites. Please describe this treatment further.

Questions: General: Samples were taken on one only day. Would it be possible, that due to special environmental circumstances on that day, the results were in some way not representative? The authors do not explain why they chose to simulate winter

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grazing and not summer grazing. If it is the reason mentioned in line 370, the authors should explain it already in the introduction. Consider using less acronyms, it is sometimes hard to follow the story. Rethink if 'treatment' (e.g. summer grazing treatment) really needs to be used that often. In the introduction: Maybe elaborate more on the state of art and on similar studies done in other parts of the world.

259: What does (w/w) mean?

290: What does the sentence mean? There were no differences in the contribution of FNEA and FDEA to TNEA and TDEA in any treatments. There are differences, aren't there? 306: What does 'high complex compound substract substrate' mean?

336/369: Please elaborate on 'field data from 2011-2012'? It is not clear to us what this refers to.

341: We do not understand the sentence starting with "In our site. . .". Maybe you can clari-fy/reformulate that.

364f: We do not understand the sentence starting with "Additionally. . .". Please elaborate on why the effect of sheep is limited compared to other livestock?

Figure 1 and 4: The distribution of the letters indicating the significant differences is inconsistent, why do you only show it in section b of figure 1 and in section e of figure 4? Also think about using other symbols, since these letters might be confused with the letters for the figure subdivision.

Figure 5: From this figure we read that fungi and bacteria come from the hard rock substrate, that the denitrification happens in the subsoil and the nitrification in the topsoil. Is that right? Furthermore, we do not understand why W and WG are yellow shadowed and why 'bacteria' is written in purple, while the arrow is green. Also, it is not necessary to make the figure in 3D.

Typos/ remarks concerning structure: 54f: 'Potential' is used too many times. 153: This sentence is formulated rather complicated, maybe you can split it in two sentences. The

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term 'grazing treatments' is repeated a lot in those lines, maybe you can replace it?
220: Denitrification enzyme activity 278: forgot N in unit 279: forgot N in unit 316-318: Does this conclusion not contradict to line 103? 322: nitrification and denitrification. 334: fungal N₂O production potential.

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