

Biogeosciences Discuss., author comment AC4
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Reply on EC1

Yingying Chen et al.

Author comment on "Effect of the presence of plateau pikas on the ecosystem services of alpine meadows" by Yingying Chen et al., Biogeosciences Discuss.,
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Dear Editor

Thank you for your patience with our manuscript numbered "BG-2021-313". Based on the further comments from the reviewer and editor, we have revised the manuscript carefully again. We found that these questions and comments are valuable to improving the quality of this manuscript. Here, we submit both a clean and a track changed versions of manuscript to "Biogeosciences".

The responses to the reviewer' comments are following:

Chen and others explore the role of pika presence at different densities to ecosystem services. The manuscript makes a few interesting points but could be strengthened by focusing more on fundamental ecological theory.

- I wasn't entirely sure how it was identified that pikas caused some bare patches and not others, for example if the bare patches were caused by past pika activity. Therefore it was unclear to me how controls were used to test the objectives.

Answer: this is a common comment we met. The soil bare patches caused by plateau pikas is easily to identify because one soil bare patch caused by pika is paired with a visible burrow entrance (Pang et al. Geoderma, 2021, 115098). Other soil bare patches are not paired with visible burrow entrance.

The soil bare patches caused by past plateau pika activities can be divided into two types. Some can be gradually restored, and others are still be bare.

In this field survey, we firstly identified the soil bare patches caused by plateau pikas though the paired visible burrow entrance. And then, we continued to identify whether these soil patches are bare. If bare, we divided them into soil bare patches caused by pika; if not bare, we did not divide them into soil bare

patches caused by plateau pikas. We supplemented this information into 2.3 Field sampling.

- 'plateau pika presence' in the title is a bit smoother (and section 3.1).

Answer: Thanks for your comment. We have revised "plateau pika presence' into "the presence of plateau pikas" in the title and section 3.1.

- 17: 'ecological service of' can be deleted here because it's mentioned below. Honestly the word 'ecological service' needs to only be stated once or maybe twice in the abstract; it's continued usage is redundant. Also in the main text. A previous reviewer may have recommended this but it needn't be repeated so much.

Answer: Great comment. According to you this comment, we have only stated once in the abstract, and the other have been deleted in the revision manuscript.

- The abstract doesn't contain any qualitative values and it would be of greater use to the reader if it did. 'Possible pattern' is also speculative, you can say what the pikas did in your study.

Answer: Thank you for your comment. We have revised the abstract and result sectors, in which some qualitative values are added into manuscript. This study showed that the forage available to livestock and water conservation were 19.74% and 15.86% lower in the presence of plateau pikas than in their absence, while biodiversity conservation, carbon sequestration, soil nitrogen, and phosphorus maintenance were 14.58%, 29.15%, 9.97% and 8.89% higher in the presence of plateau pikas than in their absence.

In addition, we have deleted possible, which confirmed that the findings of this study present a pattern of plateau pikas influencing the ecosystem services of meadow ecosystems in alpine regions.

- 62: 'with averaging' isn't correct usage. A few minor usage changes throughout the manuscript would make for an improvement, using an automated grammar checker will probably catch almost all instances. (see also 66 'with average' and numerous other instances, e.g. line 137 'can turn green until July'. "don't turn green until July"?).

Answer: Thank you for your suggestion. Based on your comment, we have revised "with averaging" into "with an average weight of"; We have revised "with average" into "with an average length and depth of"; we have revised "can turn green until July" into "don't turn green until July". In addition, we have used an automated grammar checker to make for an improvement throughout the manuscript.

- 192: use 'W' if it is the shape of a W. I wasn't sure if it meant "West".

Answer: Thank you for your comment. We have revised "a W pattern" into " the shape of a W pattern".

- Figure 1: why does it go 'a' then 'b' for some bars and 'b' then 'a' for others?

Answer: This is a statistical expression. Lower case represents a significant difference between the absence and presence of pika in Figure 1. Generally, bars with "a" represent the bigger value, and bars with "b" represent the smaller value.

- 2: this looks like the famous "Intermediate disturbance hypothesis" in some cases. (There's even a wikipedia page for it: https://en.wikipedia.org/wiki/Intermediate_disturbance_hypothesis). A little bit of pika activity is good but too much and they take over. De-emphasizing the comparisons against rabbits and prairie dogs and thinking more about ecological principles could structure the Discussion more and add references, which are a bit lacking. In other words, if you expand the interesting discussion beginning line 457 a bit and focus on fundamental theory in addition to these nice examples of intermediate disturbances, the Discussion could be further improved. (This paragraph is also too long; breaking it up would help the reader.)

Answer: Thanks for your comment. At the beginning line 457 in former revision (line 455 in present revision), we firstly focus on the Intermediate disturbance hypothesis. We looked up some literatures (Dial and Roughgarden, *Ecology*, 1998, 79(4), 1412-1424; Gao and Carmel, *Oikos*, 2020) to refer the methods that introduce the fundamental theory. The revision discussion is as follows:

This study also shows that the disturbance intensity of plateau pikas also affects the forage available to livestock, biodiversity conservation, water conservation, carbon sequestration, and soil total nitrogen and phosphorus maintenance. As found in plant-species richness and aboveground plant productivity (Dial and Roughgarden, 1998; Gao and Carmel, 2020), the response of plant-species richness and palatable plant biomass to the disturbance intensity of plateau pikas follow the pattern for the intermediate disturbance hypothesis in this study. In addition, the soil organic carbon stock, soil total nitrogen and phosphorus stocks at home-range scale also support the intermediate disturbance hypothesis. However, the top soil water storage does not conform the intermediate disturbance hypothesis.

At lower disturbance intensity, stronger competition of dominant sedges often restrains the grass to grow well (Pang and Guo, 2018) and the rare plants to coexist (Wang et al., 2012), which leads the forage available to livestock and biodiversity conservation of alpine meadows to be maintained at a low level. Although the presence of plateau pikas can increase the input of soil organic matter, this increase is low (Pang and Guo, 2017; Pang et al., 2020b), which enables the soil organic carbon sequestration and soil nitrogen and phosphorus maintenance of alpine meadows to maintain a relatively low level.

At intermediate disturbance intensity, the activities of plateau pikas improve the growth potential of grass plants (Wang et al., 2012), and increase the input of organic matter, soil total nitrogen (Li et al., 2014), organic carbon accumulation (Yu et al., 2017b), which contributes to higher the biodiversity conservation, forage available to livestock, carbon sequestration, soil total nitrogen and phosphorus maintenance services.

At higher disturbance intensity of plateau pikas, frequent bioturbation can enable all species to be at risk of going extinct (Dial and Roughgarden, 1998). Low soil water content in alpine meadows (Liu et al., 2013) only sustains the xerophytes and mesophytes, most of which are unpalatable (Pang and Guo, 2018). This contributes to relatively lower forage available to livestock and biodiversity conservation. Low vegetation biomass decreases the input resources of soil organic matter (Sun et al., 2015; Pang and Guo, 2017), contributing to a decrease in the soil organic carbon sequestration and soil nitrogen and phosphorus maintenance of alpine meadows.

Additionally, the linearly negative relationship between the water conservation

of alpine meadow and disturbance intensity of plateau pikas is ascribed to evaporation and more water infiltration on bare soil patches, as the amount of water evaporation and infiltration tends to increase as the area of bare soil increases (Liu et al., 2013).

The manuscript has been revised carefully and strictly according to your comments. We hope our modification and explanation is clear enough, however, if there is still any question, please do not hesitate to contact us.

Yours sincerely

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