

Biogeosciences Discuss., referee comment RC1
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Comment on bg-2021-286

Anonymous Referee #1

Referee comment on "Response of vegetation and carbon fluxes to brown lemming herbivory in northern Alaska" by Jessica Plein et al., Biogeosciences Discuss.,
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Plein and others explore the response of greenhouse gas fluxes to lemming herbivory on the North Slope of Alaska. Lemmings reduced NDVI and CO₂ uptake that recovered the following year due to vegetation regrowth but had little impact on CH₄ fluxes.

I found the study to be relevant and interesting to the readership of Biogeosciences; studies of the importance of herbivores on GHG fluxes are too infrequent and careful analyses like this help us appreciate the role of biology in the earth system. At the same time I was surprised at the idea that herbivory would decrease CH₄ fluxes. Is there a wounding response in the aerenchyma that blocks their role as a CH₄ conduit? All else being equal I would assume that herbivory might slightly increase CH₄ fluxes that would be very difficult to see from a signal-to-noise perspective because the path that CH₄ has to take to the atmosphere has been decreased slightly (by shorter aerenchyma, this won't be much of an effect) or possibly increased if herbivory was enough to reduce transpiration to the point that it impacts groundwater levels. It's hard to see how lemming herbivory would be sufficient to do this outside of massive lemming herbivory of which I am unaware, but if sedges simply regrow after herbivory there shouldn't be much of a methane impact, which was found. The idea that it escapes from the stem bases may hold if the stems help create preferential flow pathways in the soil, but this probably wouldn't compensate for any changes to the aerenchyma. Basically there should be no observable effect on CH₄ which is what was found. Interesting to study nonetheless. I had few other concerns and feel that the manuscript is publishable with minor revisions after finding more literature basis for the impacts of herbivory on aerenchyma and subsequent expectations for CH₄ flux.