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# Large mammalian herbivores increase the stability of soil carbon in grazing ecosystems

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Grazing by mammalian herbivores can serve as a climate mitigation strategy as it influences the size and stability of a large soil-C pool (more than 200 Pg C in the world's grasslands, steppes, and savannas). With the continuing decline in large mammalian herbivores, the resultant loss in grazer functions can be consequential for this soil-C pool, and ultimately for the global carbon cycle. While herbivore effects on the size of the soil-C pool and conditions under which they lead to gains/loss in soil-C are well known, their effects on the equally important aspect of stability of soil-C remain unknown. Also unknown is whether herbivore effects on soil-C and soil-N are related to each other. We use a replicated long-term grazer-exclusion experiment in the Trans-Himalayan ecosystem of northern India to evaluate the consequences of herbivore-loss on the stability of soil-C by quantifying interannual fluctuations (2006-2021). We test how grazers influence the stability of soil-C due to their impacts on both soil-C and soil-N. We find that experimental herbivore-exclusion raises inter-annual fluctuations in both soil-C and soil-N. Importantly, structural equations modelling show that herbivore-exclusion increases the soil-C and soil-N coupling, and weakens the stabilizing effect of soil-N on soil-C. Herbivore-loss, and consequent decline in grazer functions in soil, can therefore undermine the stability of soil-C. Conserving and restoring the functional role of large mammalian herbivores is critical for this valuable ecological service and towards climate mitigation.