

# Reindeer grazing inhibits climate-driven biodiversity in the Fennoscandian tundra

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## Abstract

Herbivores in the tundra interact with vegetation through several mechanisms, especially defoliation, trampling and nutrient addition through urine and faeces. Through these mechanisms, herbivores drive shifts in plant species composition, richness and diversity. As reindeer effects on vegetation accumulate over time, they might cascade to other trophic levels, but how and when this happens is poorly understood. Since it is methodologically demanding to measure biodiversity across spatial gradients, an alternative approach is to assess it indirectly via biodiversity indices of vascular plants. Values from the Index of Biodiversity Relevance were coupled with vegetation data from a network of 96 fenced and paired grazed plots across Fennoscandia. We analysed the role herbivory has on plant richness and diversity, and on the number of organisms that depend on the vegetation according to the index values. We also explored how herbivores affect the competitive effects of shrubs on other plants since the dominance of a vegetation type links directly to biodiversity. Vegetation richness and diversity did not present any differences between treatments, yet reindeer had an increasing effect on plant diversity when testing the interaction between grazing and herbaceous vegetation. Three out of six biodiversity indexes were higher in fenced plots indicating a higher number of interactions between plants and organisms from other trophic levels. Finally, herb abundance was negatively related to shrubs in both treatments but with a faster decline in the absence of herbivores, suggesting that herbivory increases plant diversity and decreases the diversity of other taxa by reducing shrub abundance. This study highlights the importance of maintaining herbivore populations in the Arctic to prevent the expansion of climate-driven biodiversity into the tundra. The effect of herbivores on ecological communities is not merely a product of plant diversity but can be quantitatively and qualitatively different.

**Keywords:** Global change ecology; Multi-trophic interactions; Cascading effects; Species coexistence; Herbivory; Moose; Arctic; Shrub.

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