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Circumpolar impacts of herbivores on Arctic tundra vegetation

Elin Lindén

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Fakultetsopponent: Professor Elisabeth S. Bakker,
Department of Aquatic Ecology, Netherlands Institute of Ecology (NIOO-KNAW),
Wageningen, The Netherlands.

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Elin Lindén

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Abstract

Arctic tundra vegetation provides many ecological services that have implications for the global climate. However, the tundra biome is currently changing in response to increasing temperatures. Herbivores may mitigate some of these responses to warming through their impact on Arctic vegetation. Understanding plant-herbivore interactions is therefore crucial to make better predictions of future Arctic vegetation changes and possible ecological consequences. Most current knowledge on plant-herbivore-interactions in the Arctic comes from local studies that do not allow for large-scale generalisations due to non-comparable methods. Also, existing large-scale studies of herbivory do not cover the tundra biome in a representative way. In this thesis, I used standardised methodology in biome-wide sampling across the Arctic tundra, to uncover how plant-herbivore interactions shape circumpolar vegetation patterns.

I have identified clear biogeographic patterns in plant chemical defence against herbivores that could influence the capacity of herbivores to control warming-driven increases of birch shrubs. I also found that herbivores counteract many effects of climate change on tundra vegetation by reducing vegetation greenness (NDVI), Leaf Area Index (LAI), vegetation density and shrub abundance and thereby mitigate vegetation responses to climate warming. Herbivores also increase species richness across the Arctic by suppressing dominant species but not by increasing light availability. In a detailed study, I show that the effects of large and small herbivores are similar between continents although they vary with habitat type. This thesis advances our understanding of top-down control of herbivores on tundra vegetation and provides important tools to better predict future Arctic vegetation changes.

Keywords

herbivores, grazing, Arctic, circumpolar, tundra, vegetation, plant defence, secondary metabolites, shrub birch, exclosures, vegetation, species diversity

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