Title:

Comparing Warming and Grazing Effects on Birch Sapling Growth in the Tundra Environment – a 10 Year Experiment

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Background: Tree encroachment of tundra is a generally predicted response to climate warming. However, herbivory play an important role in structuring tundra systems and responsiveness to warming.
Aims: To experimentally test how grazing and increased growing season temperature influence growth and physiognomic stature of birch in the alpine zone.
Methods: Trait responses, of natural regenerated birch saplings, to warming (OTCs), changed grazing regime (exclosures) and unmanipulated conditions were analysed over a 10 year period (1999-2008). Effect of treatment over time and differences between treatments was analysed with repeated measures GLM and simple contrasts in GLM.
Results: Warming alone had no major effect on trait response, however significantly smaller leaves and increased number of short-shoots indicated warming related growth constraints. Grazing showed a strong hampering effect on most traits, conserving a low stature sapling stage characterized by fewer shoots and larger leaves, compared to non-grazed treatments.
Conclusions: The results points to a grazing controlled response to environmental change in the alpine tundra, with climate (warming) as a secondary force. This herbivore-driven concealing of expected climate-driven tree expansion emphasizes the necessity to consider changes in grazing regimes along with climate change, in order to avoid misleading interpretations regarding climate-driven tundra encroachment.

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