## The critical role of snow in future of Arctic biodiversity

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Microclimate & snow



The heterogeneous snow depth and snow cover duration are the most important drivers of local microclimate in Arctic tundra. The wide environmental gradient from wind-swept ridges to late snowbeds enable a regional coexistence of a large number of species with contrasting ecology and life history strategies (Fig 1).

Here, we fitted species-environment models with temperature data from three climate scenarios and simulated up to a 40% decrease in snow cover duration. We used plot scale data on 273 vascular plant, moss and lichen species in 1200 study sites in mountainous Arctic landscape.

## **Species distributions**

Snow cover duration and winter ground temperatures are the most influential predictors for distributions of species in Arctic tundra. The snow response is strong for chionophilous snowbed species but also for species with intermediate snow optimum and for species that strictly avoid habitats with long lasting snow cover, e.g. lichens and boreal herbs.

Fig 1. Tundra consists of a diversity of habitats with contrasting snow cover duration



Fig 2. Snow cover duration change and the rates of extinctions

## Exctinctions & species richness

A rise in temperature increased overall species richness and caused only one species to lose all suitable habitat (Fig 3). In contrast, a shorter snow cover duration tempered the effect of increasing temperature on species richness and led to accelerated rates of species' local extinctions after a tipping point at 20-30% snow cover duration decrease (Fig 2). Our simulations indicate that future biodiversity patterns in Arctic regions are highly dependent on the evolution of snow conditions. Climate impact models that ignore the effects of snow cover change may provide biased biodiversity projections, with potentially erratic implications for Arctic nature conservation planning.



## References

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Fig 3. Changes in snow cover duration drive the number of extinctions but temperature has stronger effect on species richness patterns