The determinants of multi-trophic interactions in a High Arctic landscape

Ecologists have long debated the significance of trophic interactions in determining the distribution and abundance of organisms [1-7]. The question of which factors determine when and where predators (top-down forces), resources (bottom-up forces), or climatic influences will be predominant in different ecosystems remains one of the great problems in ecology. The answers are essential for predicting ecosystem responses to disturbance, and for developing viable strategies for conserving biodiversity, restoring degraded habitats, and managing the consequences of climate change. Unfortunately existing ecosystem data from the High Arctic consists mostly of summer data. This calls for a year round field study unravelling the ecosystem dynamics and animal behaviour during the eight month of snow cover.

The collared lemming (ecological key species) and the musk oxen (ecologically most important High Arctic ungulate) both show discrete seasonal related habitat use. Their effect on winter pastures and the combined effect of the seasonal shifts in habitat use is poorly known and need a year round study on marked animals and plant enclosures to enlighten the seasonal variability in habitat use, activity pattern, food quality, resource utilisation, predator abundance, snow distribution, and temperature all affecting the ecology of herbivore and plant systems. The High Arctic research station at Zackenberg is probably the only place in the Arctic where trophic interaction like the one in focus can be studied building on nine years of ecological background data from the summer season.

Plant-herbivore interactions:

The last decades of research on plant-herbivore interactions [8-12], unambiguously point to four aspects of central importance to evaluate to what extent multi-trophic interactions are inherently stable or unstable. Specifically, such trophic models must account for (i) spatial gradients in herbivory, (ii) variation in species life history strategies and sensitivity to seasonal changes in food resources, (iii) the pattern of grazing history, and (iv) the environmental context in which herbivory occurs (i.e. species and its abundance, habitat type and season). All of these conditions and considerations needs a comprehensive data base to draw from, which in most Arctic places is insufficient but can be found at Zackenberg.

The present project will contribute with highly valuable knowledge on selected ecological year-round ecosystem data to the co-submitted proposal Proposal for Polar Year: Ecosystem processes across climatic gradients and could as such be regarded as two back to back projects.

References