Herbivore influences on ecosystem functioning

Niels Martin Schmidt, Paul Henning Krogh and Mads C. Forchhammer

Biodiversity and its development over time is a corner stone in understanding ecosystem functioning, and biodiversity is therefore also a central issue in management and conservation across biomes. Biodiversity in a given area is the product of the area and the history of the area. For instance, the biodiversity of vascular plants in Greenland is the product of local geology, local weather, regional climate, human disturbance, and not the least, the product of the interactions between local organisms on the various trophic levels, such as the consumer-resource interaction between vascular plants and herbivore animals. Herbivores can potentially enhance or buffer changes in biodiversity induced by external forcing by e.g. climate. This project aims at quantifying the long-term effects of the largest herbivore in high arctic Greenland, the musk ox (*Ovibos moschatus*), and to assess biodiversity changes on two trophic levels, i.e. vascular plants and soil fauna, in Zackenbergdalen.

In July 2010 we established permanent musk ox exclosures in the large fen area Rylekærene at Zackenberg. The set-up consists of two treatments, exclosure (EX) and snow-control (SC), and one control (C). The EX plots inhibit musk ox grazing, while the SC plots serve as controls for the potential effects of the fence itself, whilst still allowing musk oxen to graze the plot. The C plots are unmanipulated controls. A randomized complete blocks design was established with three plots per each of 5 blocks, including the treatments EX, SC and C. Each plot measures 10x10m, and are positioned facing NNW, which is the dominating wind direction during winter. The EX plots are fenced on all four sides, while SC only has a fence towards NNW only, thereby making the potential snowfence-effect in SC and EX plots comparable. The C plots are marked by iron bars only.

Fences were established by means of 5mm V-shaped iron bars in the corners, supported by 25mm iron poles for every 2 meters. All bars and poles were forced into the permafrost. The fence used is ordinary 100cm sheep fence with 6 strings. Stiles were placed in all EX plots to reduce the wear on the fence. To minimize the potential trampling effects on the vegetation, board walks were placed in the wet parts of the plots. Additional board walks will be laid out in 2011.

In connection with the establishment of the exclosures, a suite of base line data were collected. These include data on plant diversity and species composition (frequency analysis), estimates of plant biomass, leaf area index and NDVI. Soil fauna species biodiversity and species composition, as well as their food web structure derived from natural abundances of ^{13}C and ^{15}N, were examined treatment-wise across plot replicates. In all plots we placed soil temperature loggers to allow for detection of changes sin soil temperature. Moreover, in all plots we placed nutrient sticks to examine the level of nutrients, and litter-bags to examine decomposition rates in the various treatments. Additional data collected were soil characteristics and depth of the active layer. The visual appearance of all plots was documented by detailed digital photography.

Photo: Julie Maria Falk