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ABSTRACT

Cryptogams (bryophytes and lichens) are important parts in many terrestrial ecosystems on Earth, and at higher latitudes and altitudes they increase in relative importance and play significant parts in ecosystem functioning. In this thesis, I first describe the patterns of species richness and vegetative performance between two vegetation types to reveal any unfavourable effects of a thick moss carpet, and to which extent the phenotypic variation in two circumpolar bryophytes (*Hylocomium splendens* and *Racomitrium lanuginosum*) vary at different spatial scales. Furthermore, at a subarctic-alpine site, I examine how a simulated environmental change (increased temperature and/or nutrient availability) may affect the bryophytes, the cryptogamic biodiversity, and the plant communities. As the cover of shrubs and trees in subarctic ecosystems are predicted to increase in response to climatic warming, I also studied the effects of shade on two bryophytes.

The results show that species richness was lower in the moss dominated vegetation type, but that vegetative performance was little affected. Patterns of morphological variation were partly similar, partly significantly different between the two species, whereas patterns of physiological variation were mostly significantly different. The bryophytes showed different phenotypic responses to environmental variation. The responses to the shade treatments suggest different shade tolerance in *Hylocomium splendens* and *Racomitrium lanuginosum*. The short-term effect of simulated environmental change (increased temperature and nutrient availability) was a decreased bryophyte growth and abundance. The effect after five seasons of experimental manipulations was a species impoverishment of the cryptogams. Bryophytes seemed to be more sensitive to changes than lichens. A general response to nutrient addition for the plant communities was that graminoids and forbs increased, whereas deciduous and evergreen dwarf shrubs, bryophytes, and lichens decreased. During the exceptionally warm study period 1995-1999, plant community dominance changed in all plots, including control plots, partly because the dwarf shrub *Betula nana* increased unexpectedly. Consequently, it seems like the climatic change is already altering the plant communities in northern Sweden.

The first initial vegetation changes in response to the climatic warming will very likely soon be followed by a shift of the biomes on the planet, that will continue as long as the rate of climatic change remains high. The intensified climatic warming will have devastating effects on subarctic cryptogams, vascular plants, ecosystems and ecosystem functioning known today and must be faced with strategies and financial support for mitigation and conservation.

Key words: *Racomitrium lanuginosum*, *Hylocomium splendens*, morphological and physiological variation, simulated environmental change, climatic warming, cryptogams, biodiversity, subarctic-alpine plant communities, shade effects.

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