Estimation of the tundra vegetation to environmental changes: The width of the spatial and time windows matters

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Abstract

Understanding of ecosystem response to changing environment has been improved by the convergence of observational and experimental approaches. However, spatio-temporal scales of experiment often do not match larger patterns and deepen our understanding of underlying processes context-dependence of might be the major challenge of community ecology.
Using several transplant experiments of heath communities in the Northern Fennoscandian during the last two decades we investigated the relative importance of abiotic and biotic drivers and the plant functional response. The plant community composition of blocks transplanted in contrasted abiotic and biotic conditions was monitored from 6 to 23 years depending on the design.

The transplantation along altitudinal gradient constituted major habitat perturbation. In addition, the joint effects of multiple drivers associated to grazing pressure and abiotic micro heterogeneity resulted in divergent community in the long-term. However, the different factors operated on different temporal scales. The vegetation depending on functional type also showed contrasted patterns from immediate and transient response to strong biological inertia.
Our results reveal the potential for alternative response of plant communities depending on the interplay between the multiple drivers and the functional attributes of the vegetation. This interplay should drive plant communities toward divergent alternative states, but our ability to extrapolate longer-term trajectories from partial dynamics is challenged by the temporal differences in drivers pressure and plant response. The responses to manipulation appear as successional processes and long-term experiments might be inescapable to bridge process and pattern in the response of ecosystem to changing environment and provide reliable upscaling.

Keywords: Alternative states, Assymmetric response, Joint effects, Long, term experiment, Multiple drivers

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