

## Spatio-temporal structural equation model: Ecology of wet heathlands

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Structural equation models are highly suited for evaluating ecosystem-level hypotheses, but to be effective structural equation models need to be able to accommodate spatial and temporal data. Here, the importance of different abiotic and biotic drivers on wet heathland vegetation is investigated using a spatio-temporal structural equation model in a hierarchical Bayesian framework.

Ecological data from 39 Danish sites, each with several wet heathland plots, were sampled in the period 2007 to 2014. Including resampling over the years, 1322 plots were sampled. Plant cover was measured using the pin-point method and the joint distribution of the key plant species in the wet heathland ecosystem, *Erica tetralix*, *Calluna vulgaris*, *Molinia caerulea*, and an aggregate class of other higher plants was estimated assuming a Dirichlet-multinomial mixture distribution. The investigated drivers of wet heathland vegetation include nitrogen deposition, soil type, pH, precipitation and grazing.

The study demonstrated that important insight of ecosystem dynamics and regulation can be obtained by spatial and temporal structural equation modelling in a hierarchical Bayesian framework and that the proper statistical modelling of the joint species abundance is a key feature of such models. Furthermore, the advantages of partitioning different types of uncertainties become clear when the fitted structural equation model is used for predictive purposes at a specific site.