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Die Alpen im Klimawandel: Modelle der Vegetationsentwicklung an Höhengrenzen pflanzlichen Lebens

Wien, 1998

High mountain areas recently gathered raising attention in the discussion on climate change. Since they show steep climatic gradients and fine-scaled abiotic and biotic patterning, and since they are unmanaged land, they can be used as sensible indicators on climate change. The upper limits of plant species distributions are temperature limited. As a consequence, the alpine Vegetation should migrate upwards as an effect of global warming. It was the aim of a 6 year project to test this hypothesis.

The seven papers presented here do verify this hypothesis. In addition, spatial explicit models of Vegetation patterns as well as climate change scenarios for these patterns are developed.

The first two papers deal with predictive modelling. A set of nearly 1000 records of vascular plant species composition serves as biotic Information. These data were sampled from 1 m² plots at the alpine and nival zone of Schrankogel, 3497 m, Tyrol, Austria, a high siliceous mountain typical for the Eastern Alps. The abiotic Information is provided by a fine-scaled Digital Elevation Model from which several environmental descriptors of the relief arc derived. A Canonical Correspondence Analysis is used to calculate correlations between the observed species distribution patterns and the relief, and, based on these correlations, to extrapolate these patterns to the entire investigation area. Predicted maps of species distribution, as well as of ecological indices, such as biodiversity, are presented, highlighting the alpine-nival ecotone as "biodiversity hot spot". Possible changes of these patterns induced by climate warming are modelled.

Five papers focus on the evidence of upward movement of the alpine and nival Vegetation, and investigate reasons for this behaviour and its implications. 30 high summits of the Alps were reinvestigated for a comparison of their historical and present species composition. The historical records were provided by early botanists between the late 19th and the mid 20th century. Compared to the old data, species richness increased on 70 % of these summits, partly remarkable so. Not only do nival species move, but alpine plants were also observed invading the nival zone of today. However, the species migration rates seem to lag behind the speed of the warming trend seen in meteorological data.