Classification and Predictive Vegetation Mapping of Rangelands at the Jabal al Akhdar Mountain, Northern Oman

Katja Brinkmann[1], Eva Schlecht[2], Andreas Buerkert[1]

[1] University of Kassel, Organic Plant Production and Agroecosystems Research in the Tropics and Subtropics, Germany
[2] University of Kassel / University of Göttingen, Animal Husbandry in the Tropics and Subtropics, Germany

Abstract

Little is known about the distribution and the ecology of plant species as well as the response of the vegetation to environmental conditions in the mountains of northern Oman. Data on the distribution of vegetation are vital for the conservation and the development of sustainable management strategies for rangelands. The aim of this study was to investigate the vegetation patterns of open woodlands along an altitudinal and a grazing gradient on the Jabal al Akhdar and to predict the distribution of vegetation across the rangelands based on the relationship between the spatial distribution of vegetation and environmental variables.

Predictive vegetation modelling requires digital maps of the environmental variables, as well as spatial information on the vegetation attribute of interest. Species composition and vegetation structure were investigated for 62 samples (20×30 m) using a nested plot design. The environmental data were either obtained from existing digital datasets or derived from a Digital Elevation Model. Five different vegetation groups were distinguished on the basis of a two-way cluster analysis and an indicator species analysis. Canonical Variate Analysis was used to determine which linear combinations of explanatory variables discriminated best between those groups. An automatic forward selection and associated partial Monte Carlo permutation tests (999 permutations) were performed to test the discriminatory power of the explanatory variables [altitude (m a.s.l.), aspect (°), grazing intensity (from $0 =$ no grazing to $3 =$ high intensity), geology (limestone, siltstone, greywacke and basalt), topographic location (wadi or plateau site) and the distance to the settlement (m)]. The topographic location on wadi sites ("wadi", F $= 21.83$; $p = 0.001$), altitude (F $= 17.26$; $p = 0.001$) and grazing intensity (F $= 14.88$; p.0.001) were found to be the most important variables distinguishing between clusters. A modelling approach based on discriminant analysis and logistic multiple regression in combination with a geographic information system was applied to predict the spatial distribution of vegetation types within the study area.

Keywords: Canonical variate analysis, cluster analysis, Hajar Mountains, open woodlands, vegetation mapping