



Use of environmental predictors for vegetation mapping in semi-arid mountain rangelands and the determination of conservation hotspots

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Keywords

Al Jabal al Akhdar; Arabia; CT-model; Decision tree classifier; Grazing intensity; *Juniperus excelsa* woodlands

Received 13 November 2009

Accepted 19 May 2010

Co-ordinating Editor: Ralf Ohlemuller

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Abstract

Question: Can we predict the spatial distribution of plant communities in semi-arid rangelands based on a limited set of environmental variables? Where are priority areas for conservation located?

Location: Al Jabal al Akhdar, Sultanate of Oman.

Methods: A Classification Tree Analysis (CTA) was used to model the presence/absence of seven rangeland communities and agricultural areas based on seven selected environmental predictor variables. The latter were either obtained from existing digital datasets or derived from a digital elevation model and satellite images, whereas the grazing intensity was spatially modelled with the kernel density estimation technique. The resulting decision rules of a CTA were applied for predictive mapping within the study area (400 km², resolution of 5 m) by means of ENVI's decision tree classifier. Plant communities of natural rangelands were subsequently evaluated to determine priority areas for nature conservation.

Results: Altitude, grazing intensity and landform revealed the highest predictive power. Most of the rangelands were predicted as *Sideroxylon*–*Oleetum*. The overall classification accuracy was 89%, whereby agricultural areas and the *Ziziphus spina-christi*–*Nerium oleander* community at wadi sites had no misclassification. Inaccuracies occurred mainly because of low sample numbers and errors in available maps of predictor variables. The highest rank for nature conservation was observed for the *Teucrio*–*Juniperetum* occupying 20% of the study area.

Conclusions: Vegetation mapping using CTA is a valuable tool for rangeland monitoring and identification of key representative areas for nature conservation. An extrapolation of the model used might be feasible to regions adjacent to the central Hajar Mountains.

Introduction

Land degradation increasingly threatens the vegetation resources for pasture areas in arid and semi-arid rangelands (Abahussain et al. 2002). Mapping of vegetation patterns and distribution of plant communities is therefore an important tool to design, implement and monitor ecosystems or to guide conservation management. For the rugged Hajar Mountains of northern Oman, numerous reports indicate ongoing degradation as a result of year-round grazing pressure, an increase in urbanization and road construction, littering and man-made fires

(Ghazanfar 2003; Kharbotly et al. 2003; Brinkmann et al. 2009; Patzelt 2009). While still playing a vital role as pasture areas for livestock on which traditional rural livelihoods are based, the semi-arid mountain rangelands also are important habitats for wildlife and endemic plant communities. The Al Jabal al Akhdar massif in the Hajar Mountains has been classified as a local centre of plant endemism (Miller & Nyberg 1991; Ghazanfar 2003) and belongs to the WWF's Global 200 eco-region 'Arabian Highland Woodlands and Shrublands', providing habitats for 62 species contained within the Oman Plant Red Data