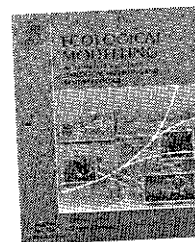




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Adaptation of a grazing gradient concept to heterogeneous Mediterranean rangelands using cost surface modelling

A. Röder^{a,*}, T. Kuemmerle^b, J. Hill^a, V.P. Papanastasis^c, G.M. Tsiourlis^d

^a Remote Sensing Department, FB VI Geography/Geosciences, University of Trier, Campus II, D-54286 Trier, Germany

^b Geomatics Department, Humboldt-Universität zu Berlin, Germany

^c Faculty of Forestry and Natural Environment, Laboratory of Range Ecology, Aristotle University Thessaloniki, Greece

^d Forest Research Institute, Laboratory of Ecology, National Agricultural Research Foundation (NAGREF), Vasilika-Thessaloniki, Greece

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ABSTRACT

Livestock grazing has been an important factor in shaping Mediterranean rangelands. Despite their long history of utilisation, recent changes in socio-economic frameworks and the intensification of grazing systems have frequently caused rangeland ecosystems to depart from equilibrium states and initiated degradation processes. Remote sensing allows quantifying temporal and spatial trends of vegetation cover as an indirect indicator of land degradation. Moreover, vegetation cover can reveal gradients of attenuating grazing pressure away from places where animals are concentrated. Adapting such grazing gradient approaches to Mediterranean rangelands, however, is difficult due to the heterogeneity of these ecosystems. We selected a study area in the county of Lagadas in Northern Greece to evaluate how grazing gradient approaches may be adapted to small-structured rangelands, where grazing areas are interwoven with agriculture and other land use types. A cost surface model was parameterised to represent driving factors of grazing pressure. Woody vegetation cover as an indicator of grazing pressure was derived from Landsat-TM imagery. Results prove decreasing grazing pressure away from points of livestock concentration, which is characterized by distinct zones. We suggest our method can be used as a management tool to detect areas of over- and undergrazing and to test different grazing regime scenarios.

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1. Introduction

Land degradation may result from a combination of climatic, ecological and socio-economic determinants (Stafford-Smith and Reynolds, 2002). Although natural conditions in the Mediterranean explain its general disposition to degradation, it is most frequently human land use that initiates land degradation (Hobbs et al., 1995). In the Mediterranean Basin, rangelands are highly heterogeneous, small-structured ecosystems, often interwoven with cultivated areas (Di Castri, 1981). Although these are marginal lands, they serve a variety

of uses, including forage production. Mediterranean rangelands have a very long land-use history, often resulting in an equilibrium state of semi-natural ecosystems (Di Pasquale et al., 2004). However, in the last decades, widespread land-use transformations have affected many regions of the European Mediterranean, leading to both, intensification and extensification of land use and frequently causing conflicts between ecological and economic priorities (Hobbs et al., 1995; Noy-Meir, 1998).

Livestock husbandry is a vital element of rural economies in Mediterranean rangelands (Le Houérou, 1981; Naveh, 1988).

* Corresponding author. Tel.: +49 651 2014606; fax: +49 651 2013815.

E-mail address: roeder@uni-trier.de (A. Röder).

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6. Conclusions

Cost surface modelling proved an efficient means to spatially represent livestock distribution in heterogeneous rangelands and meets important criteria to be used as a management tool (Kareiva and Wennergren, 1995). We extended the concept of Euclidian distance buffers by calculating buffer zones adapted to specific local properties. The successful implementation of the model required knowledge of driving factors of the local grazing scheme, in this case distance, topography, attractiveness and accessibility. This allowed deriving a grazing gradient based on woody vegetation cover derived from a Landsat-TM image.

Relating the results gained in this study with other approaches that focused on long-term dynamics of grazing-driven rangelands (Hill et al., 1998; Hostert et al., 2003b), it can be concluded that the rangelands of Lagadas County do not suffer from general overstocking of grazing animals. Rather, their uneven distribution causes both over- and undergrazing to occur in close proximity, which negatively affects the ecosystem through various feedback loops. Our approach supports the identification of these areas, which is an important step towards the sustainable management of Mediterranean rangelands.

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