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“Development on the margin”

Remote Sensing Based Analysis of Spatio-temporal Vegetation Patterns in South African Rangeland at Different Scales

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Abstract

Semi-arid grassland and savannah systems in South Africa are vastly used for livestock farming. Thereby, the composition of vegetation, its structure and primary production are strongly influenced by two major factors: precipitation and livestock management practices which typically vary in space and time.

Our project “Vulnerability and Resilience of Rangeland Vegetation as Affected by Livestock Management, Soils and Climate” (subproject A3 of DFG FG 1501) explores the specific influence of climate, soil and management practices on biomass production and resilience of savannah and grassland systems in South Africa. The assessment of resilience makes use of certain vegetation indicators and is based on repeated field measurements distributed along local gradients of grazing intensity in three different livestock management systems. Our data supports earlier findings that the influence of grazing and climate varies along spatio-temporal scales, thus posing a challenge to the interpretation of ground measurements restricted to scattered plots. We hypothesise, that time series of high resolution satellite imagery (RapidEye) help to overcome problems of ground truth data acquisition and interpretation. Within our ongoing work we explore time and spatial scale dependent patterns of heterogeneity of spectral reflectance as induced by the dynamics of vegetation. We specifically investigate three spatial and categorical scales: a) within-fenced-field-scale, b) within-farm-scale, and c) regional scale comprising several farms of differing types of management systems. Spatial and multivariate statistics on several measures of the vegetation signal are applied to answer the following questions: (1) How does the spectral response of vegetation differ between and within areas of the three defined scales? (2) To which extent do observed patterns of heterogeneity allow for a spatial generalisation of vegetation’s response as established in field measurements? (3) How are the observed patterns related to characteristics of climate, soil and management and their spatial and temporal patterns?

The presentation will demonstrate the potential of a remote sensing methodology for exploring scale dependent vegetation patterns and for supporting generalisations from scattered plot measurements to larger scale systems understanding.

Keywords: Grassland, heterogeneity, remote sensing, resilience, scale, South Africa, time series