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“Development on the margin”

## Resilience of South African Grasslands and Savannahs to Degradation

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### Abstract

The high spatial and temporal variability of semi-arid grassland and savanna systems and the related provision of ecosystem services are well recognised. In rangeland systems, vegetation is principally affected by variable environmental conditions (mainly climate and soil) and by livestock management. The extent and interaction of these drivers, however, are not well understood, but have profound impacts on the resilience of these systems, a decrease of which can increase the risk of systems shifts towards unfavourable degraded or bush encroached states.

Within the context of an interdisciplinary research group we aim to analyse and model rangeland vegetation and to assess the impact of management and environmental conditions on the resilience and vulnerability of rangeland systems. Three indicators of resilience are used, (i) the potential of pastures to produce palatable biomass, (ii) the variability of this production, and (iii) the systems' potential to recover from disturbance impact, for which we assess the impacts of management, climate and soil variables.

Our experimental design considers two study sites in South Africa, representing the grassland and the savanna biome respectively. At each site, three land tenure systems are studied, which differ in access regime to pastures, subsistence level, and livestock management strategies.

Measurements are carried out on several farms in each tenure system and include regular biomass harvests, species monitoring, soil analysis and the recording of weather data. In addition, high-resolution remote sensing imagery (RapidEye) is used to extrapolate ecological field data in space and time. These data form the basis for a spatially explicit grassland productivity model, which will assist to achieve a functional understanding of rangeland degradation processes, and to assess the impact of management and climate on rangeland resilience.

In this contribution we present our methodological design and results from the first year of measurements. We will also inform about the larger interdisciplinary and international research project to which our results contribute, which offers diverse opportunities for collaboration and cooperation.

**Keywords:** Degradation, grassland, rangeland, resilience, savannah, vegetation modelling