Resilience of South African Grasslands and Savannas to Degradation

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Background and Methodology

Introduction

- In semi-arid rangeland systems, vegetation is principally affected by livestock management and variable environmental conditions.
- These drivers impact the resilience of such systems, a decrease of which can increase the risk of a system shift towards unfavourable degraded or bush encroached states.
- Our aim is to analyse and model rangeland vegetation in order to assess the impact of management and environmental conditions on the resilience and vulnerability of rangeland systems.
- We hypothesise that tenure systems differ on resilience indicators standing biomass, bare ground and extent of degradation zones around water points.

Materials and Methods - Sites

We studied two sites in South Africa, representing the grassland and the savanna biome, respectively. At each site, three land tenure systems were studied, which differed in access regime to pastures, subsistence level, and livestock management strategies.

Biome	Management	Tenure system		
		Commercial (CO)	Trust farm (TF)	Community (CU)
Savanna	Livestock rotation	Rotational	Weakly rotational	Continuous
	Stocking density	Average	High-Average	Very High
Grassland	Livestock rotation	Rotational	Weakly rotational	Continuous
	Stocking density	Average	Low-Average	Very High

- Two to three farms/communities were selected for each tenure system in each region.
- Per farm one camp (a usually fenced-off subdivision of the total grazing area) was selected containing one water point.
- From the water point a transect was measured (Fig. 1) along the degradation gradient until average field conditions were reached.
- Outside the degradation transect, 9 randomly placed plots were sampled (Fig. 1).

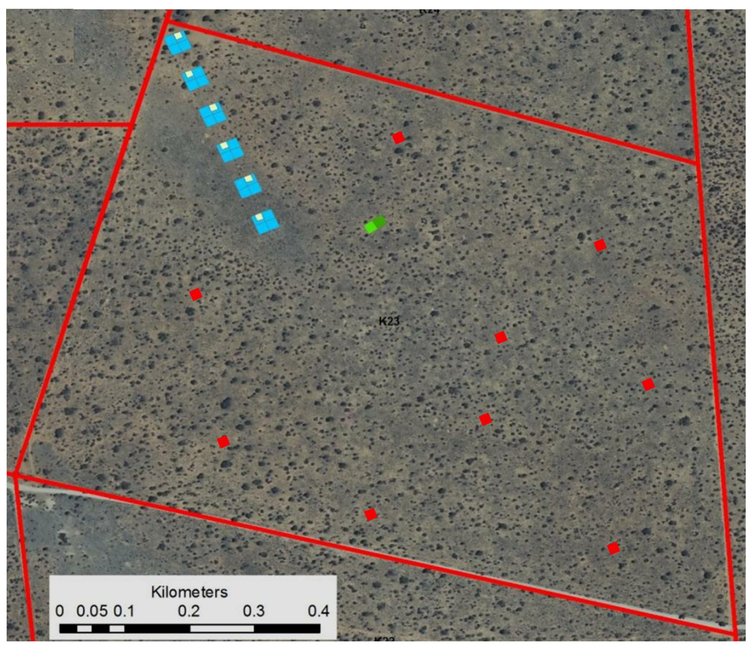

Figure 1: Position of the transect (blue) and random (red) sample plots within a camp of a commercial farm in the savanna system.

References

Brüser, K. et al. 2011. Remote Sensing Based Analysis of Spatio-temporal Vegetation Patterns in South African Rangeland at Different Scales. Oral Presentation, Tropentag, Bonn

Linstädter, A. et al. 2011. Is Degradation of South African Grasslands Related to Temporal Variability or Spatial Autocorrelation of Vegetation Parameters? Oral Presentation, Tropentag, Bonn

Acknowledgements

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Methodology

Materials and Methods - Measurements

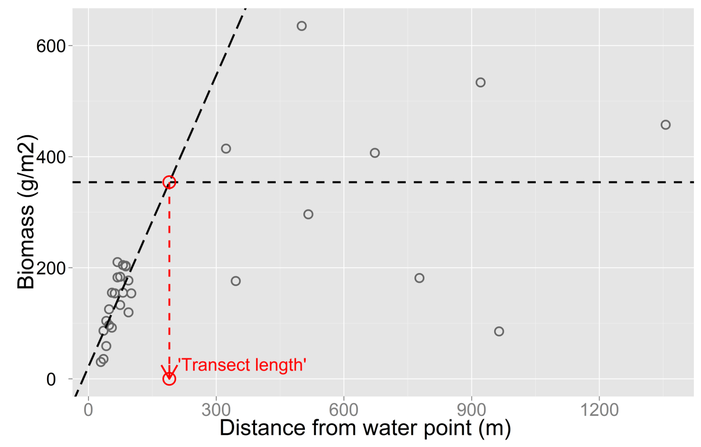
- In all plots compressed sward height (CSH) was measured using a rising plate meter.
- For each farm 16 sub-plot biomass samples were taken, together with CSH measurements, to calibrate CSH to biomass.
- In all plots the percentage of bare ground was estimated.

Results

Results

- Tenure systems did not show a difference in length of the degradation gradient as calculated according to Fig. 2.
- Significant effects of tenure system on biomass of random plots were found in savanna, but not in grassland systems (Fig. 3).
- No significant effects of tenure system on bare ground of random plots could be identified in either system (Fig. 4).

Figure 2: Transect length calculated as the intersection between a linear regression of the transect plots and the average of the random plots.



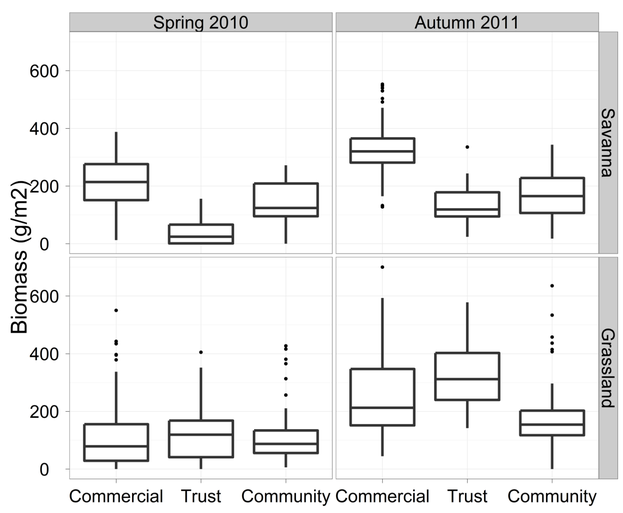


Figure 3 : Effect of tenure system on dry biomass for the random plots in the savanna and grassland systems.

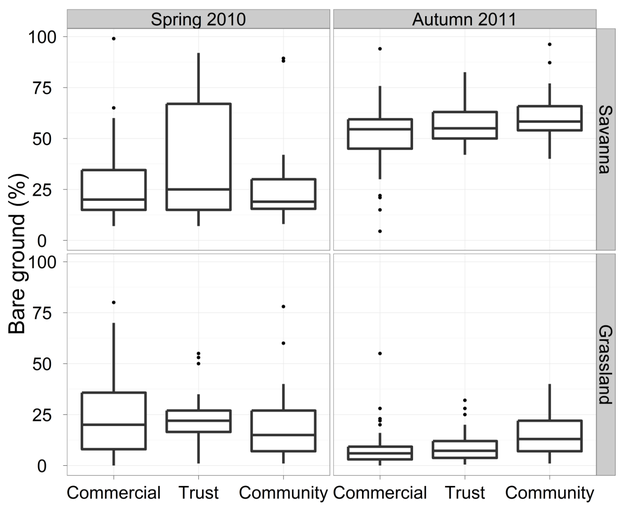


Figure 4: Effect of tenure system on bare ground for the random plots in the savanna and grassland systems.

Conclusion and future work

- Differences between tenure systems on the resilience indicators standing biomass, bare ground and degradation gradient length could only be shown for biomass in the savanna system.
- This study will be extended with analyses of species composition (Linstädter *et al.,* 2011) and remote sensing data of spatio-temporal vegetation patterns (Brüser *et al.,* 2011).
- A rangeland model to study the resilience of rangelands in response to management and climate change is in development.
- Using the rangeland model scenario analyses will be made of management options to improve resilience of rangeland systems.

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