



Linking rangeland condition to grazing management practices: lessons learnt from champion farmers in the grassland and savanna biomes

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Abstract

Sustainable management of rangelands plays a key role in rangeland health and the opposite leads to degradation with implications for livestock production. This study explores the relationship between rangeland condition and rangeland management practices among champion farmers within grassland and savanna biomes in South Africa. Sixty champion farmers, representing diverse livestock enterprises, were selected through workshops involving government officials, researchers, and agricultural organizations. The selected farmers were interviewed using semi-structured questionnaires, to establish their rangeland management strategies. Questions were framed around (i) current state of the rangeland in the farm (ii) farm management strategies (iii) changes over time. The vegetation condition of the farms, was assessed using a combination of ground-based techniques, including cover abundance and step point. Cover abundance was measured in 10 X 20 m plots, while the step point technique utilized 100 m line transects. Data collected from these methods provided insights into veld condition scores, grazing capacity and species diversity. A total of 35 grass species across different ecological groups were identified, with Increaser II species being the most dominant, suggesting previous over-grazing but showing signs of improvement with the presence of Decreaser species such as *Themeda triandra*. The average grazing capacity was 9.1 ha per large stock unit (LSU), with 72% of farms in good condition, indicated by an average veld condition score of 60%. These positive outcomes are attributed to the farmers' knowledge and experience in veld management. The farms with moderate rangeland condition, averaging 50% veld condition score, attributed this to limited extension support, land availability, and woody plant invasion. Key findings highlighted the importance of appropriate stocking rates, rotational grazing, and veld resting for sustainable livestock production. Overall, this study underscores the critical role of effective grazing management practices in maintaining rangeland health and provides valuable lessons for other farmers in similar biomes.

Introduction

Sustainable management of rangelands plays a key role in rangeland health and the opposite leads to degradation with implications for livestock production. Moyo (2008) notes that patterns of rangeland use and management differ according to ecological areas, tenure systems, institutions and traditional practices.

A good rangeland management strategy should take into account both the ecological processes and economic viability (Hawkins et al. 2017). The most common grazing management strategies in South Africa include rotational grazing, seasonal herding, holistic planned grazing (HPG) and continuous grazing. Rotational grazing formally implies that the rangeland is subdivided (fenced) into small areas called paddocks or camps and that the livestock are moved from one camp to another at different times of year. The camps not in use are rested to allow the grasses to renew energy reserves, rebuild vigor and deepen their root systems, so as to ensure maximum production in the long term (Oates et al., 2011). Briske et al. (2008) reports that one of the aims of such a grazing system is to improve species composition, which is achieved during the resting periods. Seasonal herding also applies the same principle as rotational grazing, however instead of the use of fences to define areas that should be grazed at certain times of the year, the herders make the informed decision based on their knowledge of the rangeland. HPG is a rotational, time-controlled grazing strategy that is commonly known as high-density, short-duration stocking (Skovlin 1987; Butterfield et al. 2006). This method employs high-density livestock management with fences or herders, imitating the natural movement of wild herbivore herds to improve rangeland condition and the health of the animals (Savory and Butterfield 2016). In this grazing system, timing is everything and livestock are kept bunched up and moving so that they cannot return to the same plant for a second bite (Kruger, 2012). HPG requires high levels of infrastructure and manpower, hence in South Africa it has mostly been applied successfully in the commercial sector but is not considered a viable strategy for communal rangelands (Hawkins et al. 2017). Lastly, continuous grazing means that the entire grazing land is grazed throughout the year, including during the dry season. Since grazing management strategies are described as ‘planned efforts by rangeland managers to leave some grazing areas unused for at least a part of the year’, continuous grazing is viewed by some as the absence of a grazing management strategy (Howery, 2000). The benefits of continuous grazing as opposed to rotational grazing include its low capital investment requirements because there is less need for fencing and the provision of water. Additionally, livestock do not have to be moved from one camp to another, making management decisions simpler (Beetz and Rinehart, 2010). This study explores the relationship between rangeland condition and rangeland management practices among champion farmers within grassland and savanna biomes.

Methods

Study Site Description

The study was conducted within the savanna and grassland biome, which combined, occur in 8 provinces, except for the Western Cape province (Figure 1). The savanna biome is the largest biome in South Africa covering about 33% and represents complex landscapes that are made up of a mosaic combination of grasses, umbrella shaped trees and shrubs (Furley, 2016). The biome is divided into dry and wet/meisic savanna receives seasonal rainfall that ranges from 400 – 1000 mm and 800 – 2000 mm respectively. While the grassland biome is the second largest biome in South Africa and covers 29% of South Africa’s land area. The grassland biome is dominated by grasses and have relatively few large trees and shrubs. Bulbs and forbs. The biome receives annual rainfall which ranges from 400mm – 2000 mm.

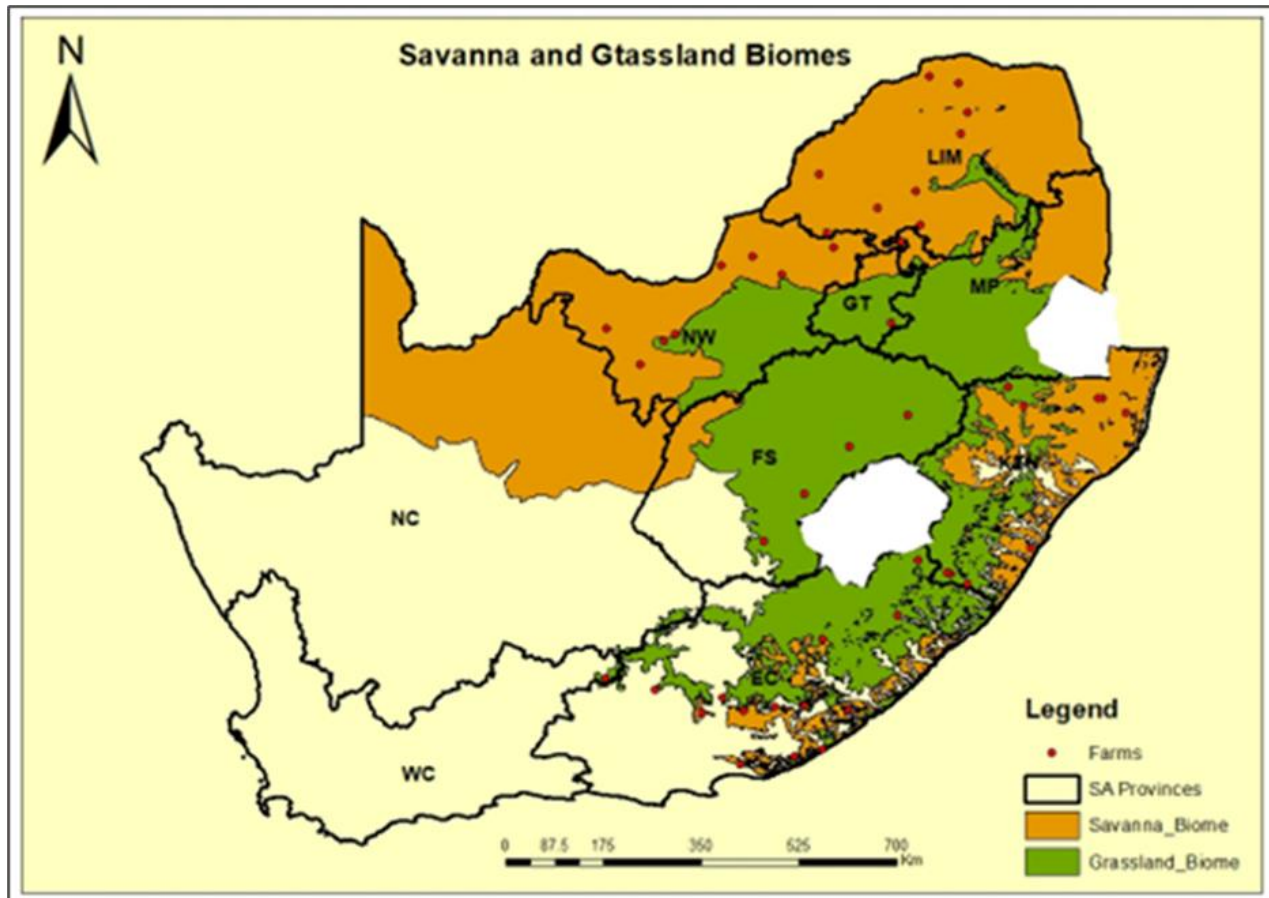


Figure 1: Biome Map showing the savanna and grassland biomes as well as the locations of surveyed famers across the provinces.

Farmer surveys

In-person interviews were conducted with 60 farmers who were selected within the grassland and savanna biomes. The selection process involved multiple stakeholders who were working closely with the farmers in the respective provinces (agricultural extension officers, researchers, retired scientist etc.). Farmers who met the selection criteria were then contacted for their consent to participate in the study and these included both male and female farmers, represented across the different livestock farming enterprises (large, small and game stock) and the different production systems (communal, small-scale and commercial). A semi-structured questionnaire with open-ended questions framed around (i) current state of the rangeland in the farm (ii) farm management strategies and (iii) changes over time, were administered to participating farmers.

Vegetation survey methods

A combination of ground-based techniques, employing an agronomic approach (cover abundance) (Westfall et al. 1996) and ecological approach (Step point) (Hardy and Tainton 1993) were used to assess the vegetation condition of the 60 farms that were selected for this study (35 in the savanna and 25 in the grassland biome). These two techniques were used concurrently at each site chosen as representative of various homogenous vegetation units. Due to temporal and spatial constraints, only two or three sites were surveyed in each farm or communal grazing area. At each site a 250 m transect (5 x 50 m) was laid out where the step-point method was conducted. Along each transect, grass species were identified and recorded

as either a hit (when the spike strikes into the plant) or nearest plant (when the spike hit next to a particular plant species). Bare ground was recorded if no grass species were found within a 0.5 m radius from the point. Through the step-point method, Ecological Index (EI) was determined by classifying species into their ecological index groups (Vorster, 1982). The EI was then used to determine veld condition score (%) and grazing capacity (ha/LSU) for every sampled site (farm).

For the cover abundance sampling technique, plots of 10 X 20 m (200m²), were used. All identifiable grass, tree and shrub species rooted in each of these plots were identified following Westfall et al. (1996). This method was used to determine plant canopy cover which is based on mean crown diameter and mean crown-to-crown spacing, derived from Edwards (1983). The mean crown diameter was used to determine cover using Plant Number Scale (Westfall et al. 1996), while the transect width was based on 4/5th of the intra-species mean crown-to-crown gap. The number of individuals of species of interest were counted within this transect length and width to determine individual species frequency.

Results and Discussion

Results from the interviews showed that a majority of farmers participating in this study have grazing plans which are informed by their rangeland condition and 70% (especially commercial and land reform farms) used a rotational grazing system. This grazing system was favoured because it allows the rested areas sufficient time to recover. The farmers shared that they divided their farms into three or more camps with each having drinking water. According to some farmers, they rotate their animals three to four months between camps depending on the condition of the grass. Other types of rangeland management systems used by farmers included herding, holistic planned grazing and adaptive management. The communal areas that were part of this study shared that they used herding to conduct rotational grazing without fences. Eighty-two percent of the farms surveyed keep livestock records and regard it as the best way to manage livestock. About 85% of the farmers mentioned that they keep rainfall records which assist with predicting droughts so proper planning can be implemented. They mentioned that they collected their rainfall data from their rain gauges and weather Apps. Microsoft Excel was the most favoured program for record keeping, while some used different phone applications. Farmers indicated that keeping farm records is important for proper planning, managing risks and overall management of their farms. The access and use of different information sources also emerged as a way to supplement the farmer's knowledge on good management practice. The most used sources of information included the internet, farming magazines and agricultural agencies. There were a few farmers who also make use of drones and remote sensing on their farms. According to one farmer, he uses drones for security purposes, monitoring watering points, livestock and even vegetation.

The results from the vegetation surveys showed that the average grazing capacity, veld condition score and farm size varied among the different farming systems (Table 1). Based on the grazing capacity and veld condition score the commercial and land reform farms were in good condition while the communal farms were in moderate condition. A total of 35 grass species across different ecological groups were identified, with Increaser II (grass species that increase when the rangeland is over grazed) species being the most dominant, suggesting previous over-grazing but showing signs of improvement with the presence of Decreaser (grass species that decrease in population when grazing pressure increases) species such as *Themeda triandra*.

Table 1: The average farm size, cover abundance and average veld condition score of the different farming systems.

Farming system	Average Farm size (ha)	Average Grazing capacity (ha/LSU)	Average veld condition score (%)	Veld condition status
Commercial	2180	6.7	61	Good
Land Reform	1056	8.8	63	Good
Small scale	897	11.9	52	Moderate

Conclusions

Farmers have shown they possess the knowledge and skills to manage their livestock and rangelands under the different tenure types and farming systems. The best lessons learned from farmers in these biomes was on the importance of applying good veld management principles in order to maintain the rangeland in a good condition.

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