# Grass species density and biomass of South African communal property association farms differing in soil properties

Ravhuhali, KE *; Moyo B†.

*Department of Animal Science, School of Agricultural Sciences, Faculty of Natural and Agricultural Sciences, North West University, Mmabatho 2735, South Africa Ravhuhalike@gmail.com

†Department of Animal production, Fort Cox Agriculture and Forestry Training Institute, Middledrift 5685, South Africa.

## Introduction

In South Africa, Communal Property Associations (CPAs) resources used for grazing such as commonages (Puttick, 2008) and communal rangelands (Lesoli, 2008) are degraded due to heavy stocking. Bush encroachment, changes in species composition, poor biomass and basal cover have been reported (Palmer & Bennett, 2013) The composition and distribution of plant species is influenced by soil nutrients (Critchley et al., 2002), soil type (Ravhuhali 2018) and animal management practices (Liu et al., 2012). It is not clear whether the observed degradation parameters manifest similar trends in CPA farms varying in soil type and grazing management. Knowledge of soil type and grazing management effect on herbaceous composition and distribution is important in developing sustainable grazing management plans in CPA farms in South Africa. Therefore, the objective of the study was to assess the grass species density as influenced by soil in selected communal property association projects of South Africa.

## Methods and Study Site

Three CPAs, Mashung Matlala (soil type = Ecca-Sandy loam; altitude- 1100 m), Mawela (soil type = Hutton-Clay loam; altitude- 1069 m), and Bela-Bela (soil type = Hutton-clay; altitude- 1121 m) were used. Mashung Matlala and Mawela CPAs were heavily grazed, while Bela-Bela CPA was moderately grazed. The areas received rainfall ranging from 500-600 mm/annum, average winter and summer temperature of 5°C, and 35° C, respectively. The vegetation type is Springbokflakte thornveld with acacia species dominating the area.

In three camps per CPA, three 500 m transects, 50 m apart were used. At 100 m intervals, grass was cut in 1m$^2$ quadrats and separated per species for biomass and grazing capacity determination (van Oudtshoorn 2014). In the same transect species were identified and counted within 10cm radius at every 50m intervals. Height, diameter, basal cover, life form, grazing value were recorded. Occurrence of species was classified as follows: dominant->13%, common- >3-13%, rare 1-3 % and present- <1%. Soil samples were collected at each 100 m interval in all transects at 0-15cm depth for minerals, and pH determination. A one-way ANOVA was used to analyse the data.

## Results

### Soil nutrients

Clay soil had the highest (P<0.05) concentration of C, K, Ca, Mg Cu, Zn when compared to two other soil types which also differed significantly from each other. Clay soil had pH value of 6.40. Clay loam had the highest (P<0.05) concentration of Mn, followed by clay (23.1 mg/kg ± 0.293) and sandy loam (15.6 mg/kg ± 0.293).

### Species frequency

Twenty-seven grass species were found across all soil types with perennials dominating (89 %). Grasses found were *Cymbopogon pospischilii, Cymbopogon caesius, Eragrostis curvula, Urochloa mosambicensis, Heteropogon contortus, Aristida congesta, Aristida stipitata, Aristida diffusa, Panicum maximum, Cynodon dactylon, Melinis repens, Eragostis rigidior, Themeda triandra, Hyparrhenia filipendula, Schmidtia pappophoroides, Inschaemum fasciculatum, Hyperthelia dissolute, Perotis patens, Setaria sphacelata, Digitaria eriantha, Eragrostis Lehmanniana, Trungus berteronianus, Pogonarthria squarrosa, Eragrostis superba, Hyparrhenia hirta, Poa Annua, Enneapogon cenchroides,* and forbs. Grass species grazing value distribution among soil types was equal (33 % / soil type). In terms of classification of species according to occurrence, *Eragrostis curvula* was dominant in clay-loam and common in clay and sandy loam. *Eragrostis rigidior* was common in clay and clay loam and rare in sandy loam. *Aristida congesta* was rare (P<0.05) in clay loam and equally dominant in clay and sandy loam (P>0.05). *Digitaria eriantha* was dominant (P<0.05) (16.68 %) in sandy loam compared to clay loam and clay (0 %).

### Dry matter (DM) yield, Basal cover, and grazing capacity

Clay soil type had the highest (P<0.05) DM yield (711.8 kg/ha) and basal cover (38%) when compared to all other soil types. Forb distribution was less in clay soil than in sandy loam soil type. Clay soil type had better (P <0.05) grazing capacity when compared to both clay loam and sandy loam which were similar. Clay loam and sandy loam had the highest (P<0.05) frequency of high grazing value species compared to clay.

### Height and Diameter

*Eragrositis curvula*, *Themeda triandra*, and *Aristida congesta* had similar height (P>0.05) across all soil types. *Hyparrhenia filipendula* and *Panicum maximum* were the tallest (P<0.05) in clay soils. *Eragrostis Lehmanniana* was the tallest (P<0.05) in sandy loam when compared to other soil types which were similar. *Eragrositis curvula* and *Themeda triandra* had the same (P>0.05) diameter across all soil types. *Aristida congesta* and *Eragrostis Lehmanniana* had a broader (P<0.05) shoot in sandy loam than in both clay and clay loam. *Cymbopogon. pospischilii* had higher shoot diameter than in clay soil type.

## Discussion and conclusion

Heavy stocking led to overgrazing in CPA farms which decreased palatable species. There was less biomass and basal cover in mostly heavily grazed low carrying capacity CPAs. Furthermore, heavy grazing had adverse effects on soil nutrients levels. Soil type has greater influence on species composition and distribution. We recommend that stocking rate determination should consider soil type as it affects herbage biomass and carrying capacity. There is also a need to assess the nutritive value of rangelands varying in soil types for proper estimation of grazing capacity.