Effect of enclosure on botanical composition, forage biomass and other range productivity parameters in a semi-arid area of El-Khuwei Locality, North Kordofan State, Sudan

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Introduction

Animal production in North Kordofan State is mainly traditional depending on natural rangeland (Cook and Fadlalla 1987), (DHP, 1998). The State has an area of about 25 million ha of which 14.5 million ha is rangeland (Africover 2004). It is among the leading Sudanese States in animal and range resources. It contains more than 13 million heads of sheep, goats, camels and cattle (IFAD 2011). This paper deals with the effect of enclosure and stage of maturity on botanical composition, forage biomass production and other range productivity parameters in this semi-arid area.

Methods

The study area lies between longitudes 28°33' and 28°30'N and latitudes 12°14' and 14°12'E. It has an average monthly temperature of 34.6°C. Soils are mainly stabilized sand dunes locally known as "Goz". The study was conducted in 2010. Herbaceous vegetation was sampled in 2 plots of 1 km^2 each representing enclosure and open range at flowering and seed set stages of growth. The loop method (Parker and Harris 1959) was used to measure botanical composition of the herbaceous layer. The percentage cover of plant, bare soil, litter and animal pellets were assessed by in quadrat (1m × 1m) placed along each of 2 transects at 50 m interval. Plant density (plant/m^2) and frequency (%) were also assessed in these quadrats. Forage biomass production was measured using a carrying capacity (CC) calculator described by Bartels *et al.* (1993).

Results

In the enclosure, at flowering the dominant species based on cover were *Cenchrus biflorus* (27.6%), *Ipomea eriocarpa* (20.2%) and *Eragrostis tremula* (19.2%). At seed set the dominant species were *Acanthus* spp. (18.5%), *Cenchrus biflorus* (15.0%) and *Merremia omarginata* (7%). In the open range, at flowering, *Cenchrus biflorus* (24.0%) and *Echniochloa colonum* (13%) were still the dominant species together with *Sida* spp. (6.5%). However, *Ipomea eriocarpa* was absent. At seed set the dominant species were *Cenchrus biflorus* (24.0%), *Echniochloa colonum* (13%) and *Sida* spp. (6.5%).

There were differences in plant density between the two range sites at the two stages of plant growth. *Acanthus* spp. (46.8 plant/m^2) had the highest density in enclosure whereas in the open range *Cenchrus biflorus* showed highest density (43.2 plant/m^2). This may be due to the effect ofdifferent utilisation levels. *Cenchrus biflorus* had highest frequency in the enclosure, while *Sida spp.* had highest frequency in the open range, 85.0 and 67.5 %, respectively.

Forage biomass production in the enclosure was 3.6 and 6.4 t DM/ha for the flowering and seed set stages, respectively. In the open range yield was significantly lower (P<0.001) with 2.2 and 3.8 t DM/ha, respectively. The CC expressed in Tropical Livestock Units (TLU) at flowering was 3.4 ha/TLU/year in enclosure and 1.8 ha/TLU/year in the open range (P<0.01). Forage biomass production and CC in ha/TLU may vary from year to year in the same area as a result of rainfall variation. The higher percentage of bare land in open range site compared with enclosure may be due to overgrazing, agriculture practices and pastoralists' settlements in the area (Table 1).

Conclusion

It was concluded that enclosure of range in semi-arid environments contributed positively to increased forage biomass productivity and protected the land from erosion and degradation. The proportion of bare land was substantially decreased due to enclosure which suggests that this practice may be a suitable option for grassland rehabilitation in such environments.

Table 1. Range parameters at flowering and seed set stages.

Site	Stage of maturity	Density (plants/m^2)	Cover (%)	Litter (%)	Bare land (5)
Enclosure	Flowering	87.29	71.5	11.5	15.5
	Seed set	59.29	61.5	15.5	20.0
Open range	Flowering	98.00	57.0	10.0	32.2
	Seed set	23.40	58.0	7.0	33.5

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