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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Key Words
Carrying capacity, plant cover, litter, frequency, open range, pastoralists

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 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' - 28˚:30'N and latitudes 12˚:14' - 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. Plant cover %, bare soil %, litter % and animal pellets % were assessed by a quadrat. Plant density (plant/m2) and frequency (%) were assessed. Forage biomass production was measured using a quadrat (1m × 1m) placed along each of 2 transects at 50 m interval**.** Carrying capacity (CC) was calculated according to (Bartels and Perrier1993).

Results

In the enclosure, at flowering the dominant species 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, the dominant species were *Cenchrus biflorus* (24.0%), *Echniochloa colonum* (13%) and *Sida spp.* (6.5%). 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. The plant with highest density in enclosure was *Acanthus spp* (46.8 plant/m^2), while in the open range *Cenchrus biflorus* showed highest density (43.2 plant/m^2). This may be due to the effect of fencing practice. *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 3,550 and 6,400 kg/ha for the flowering and seed set stages respectively. In the open range the values were 2,200 and 3,800 kg/ha respectively ($P<0.0001$). The carrying capacity at flowering was 3.4 ha/TLU/year in enclosure and 1.8 ha/TLU/year in the open range ($P<0.0001$). Forage biomass production and CC in ha/TLU may vary from year to year in the same area as a result of fluctuating rainfall. 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).

Table 1. Range parameters at flowering and seed set stages

Site	Stage of maturity	Density	Cover	Litter	Bare land
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

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 in such environments.

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