

**INFLUENCE OF LIVESTOCK GRAZING WITHIN PIOSPHERES UNDER  
FREE RANGE AND CONTROLLED CONDITIONS IN BOTSWANA**

**By**

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and controlled conditions in Botswana**

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**ABSTRACT**

The study was conducted in the Eastern Kalahari sandveld of Botswana on a shrub savanna vegetation type dominated by Terminalia sericea / Boscia albitrunca / Grewia flava and Dichrostachys cinerea woodland. It was initiated in an attempt to determine the impact of livestock grazing within piospheres on soil nutrients, range condition and the influence of season on forage quality and diet composition of livestock. The study was centered around the water points and conducted on both free range grazing and controlled conditions.

Measurements on soil and vegetation attributes were recorded at particular points along the transects from the water point. Vegetation and livestock diets were measured seasonally over a period of two years.

Chemical analyses of soil revealed the low background fertility of the Kalahari sandveld. The impact of dung and urine on soil chemistry was localized in the area immediate to the vicinity of the water point. Phosphorus, pH and cation exchange capacity were the most responsive attributes to variation along the transect from the water point. High livestock units carried at any particular borehole had an influence on the level of soil nutrient status. Management plans should aim at a more even spread of nutrients by improving the distribution of water points.

The zonation of vegetation along the transect from water point reflected the type of management, indicating different class of range condition which can be used in range evaluation and planning. Heavy grazing pressure and trampling in the vicinity of the water point kills sensitive perennial grasses resulting in a zone dominated by annual plants. High amount of available biomass were recorded during summer and autumn and low biomass occurred in spring. The 3 – paddock system produced less biomass compared to other systems, while biomass of palatable species was favored by the 9 – paddock system. Forage utilization was higher following drought years, when grazing pressure was concentrated on reduced forage availability. Utilization of forage was greatest in spring and lowest in summer. Utilization along the transect from water did not taper off until after 4000m from the water point in the free range grazing situation suggesting that forage availability was limiting factor, while in the controlled conditions the influence of grazing tapered off at 1200m. Piosphere size as determined by the distance livestock can travel was greater in the free range grazing management area than in the controlled management conditions.

Canopy volumes and leaf dry mass values reflect quantitative variations in the contribution of relatively small number of woody species. In general, both leaf volume and leaf mass decrease with the increase in distance from water due to the reduced plant density. Grewia flava and D. cinerea contributed substantially to the total leaf dry mass within the height below 2m. Leaf dry mass above 2m was largely contributed by Acacia gerrardii, T. sericea

and B. albitrunca. Woody species diversity increased with the increase in distance from the water point. High density of G. flava was concentrated to the immediate vicinity of the water points, while species such as Bauhinia petersiana and Croton gratissimus occurred only at further distances from water. There was no clear pattern in the density distribution of D. cinerea along the transect from the water point.

Plants exhibit variations in the concentration of nutrients between species and season. High levels of crude protein, phosphorus and low crude fibre content occurred in summer for most species and the opposite was observed during winter or spring. Crude protein and phosphorus during dry periods were believed to be the limiting nutrients in maintaining nutritional quality in grazing animals. Mature forage generally is deficient, and may require supplementation of crude protein or phosphorus. Crude protein, phosphorus and crude fibre were not influenced by the grazing systems. The nutrient enrichment through cattle dung and urine in the vicinity of the water point was reflected in the forage nutrient content.

The micro – histological technique proved to be a useful tool for estimating the botanical composition of livestock diets. The technique, however, under-estimates the forbs in the diet of livestock. Diets of cattle were dominated by grasses all year round with a high proportion of woody plants occurred during the spring when available herbaceous biomass was low. Diet of goats was 72% and 82% browse in summer and spring, respectively. Competition for herbaceous plants was high between cattle and sheep. Seasonal species diversity was high in summer and lowest in spring. Goats are more diverse in their diets compared to cattle or sheep which have a strong similarity in their diets.

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