

**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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## TABLE OF CONTENTS

	Page
<b>Thesis Abstract.....</b>	<b>I</b>
<b>Acknowledgement.....</b>	<b>IV</b>
<b>Table of contents.....</b>	<b>VI</b>
<b>List of tables.....</b>	<b>XI</b>
<b>List of figures.....</b>	<b>XIV</b>
<b>Chapter 1: Introduction and review of techniques.....</b>	<b>1</b>
1.1 Introduction.....	1
1.2 Hypotheses.....	3
1.3 Objectives.....	3
1.4 A review of techniques used in the study of grazing behaviour of ungulates .....	4
1.4.1 Forage utilization technique.....	4
1.4.2 Direct observation technique .....	5
1.4.3 Oesophageal fistula technique .....	5
1.4.4 Faecal technique .....	.6
1.5 Forage availability .....	7
1.5.1 Clipping method .....	8
1.5.2 Indirect methods .....	8
1.5.3 Estimation methods .....	9
1.6 Herbage quality .....	9
1.7 Structure of the Thesis .....	10
<b>Chapter 2: Study area.....</b>	<b>12</b>
2.1 Location and description .....	12
2.2 Experimental Design .....	15
2.3 Livestock units and grazing area .....	18
2.4 Plant species occurring in the area .....	19

<b>Chapter 3: Influence of livestock concentration at water points on the distribution of soil nutrients along the distance from the water point.....</b>	<b>20</b>
3.1 Introduction .....	20
3.2 Material and methods .....	22
3.3 Results .....	23
3.3.1 Soil particle size .....	23
3.3.2 Variation in soil nutrients along the transect from water in controlled grazing conditions – Makhi ranch.....	23
3.3.3 Variation in soil nutrients between grazing systems at Makhi ranch.....	24
3.3.4 Variation in soil nutrients in free – range grazing .....	25
3.4 Discussion .....	27
3.5 Conclusion .....	28
<b>Chapter 4 Influence of livestock grazing on the distribution and production of woody plants within biospheres.....</b>	<b>30</b>
4.1 Introduction .....	30
4.2 Material and methods .....	32
4.3 Statistical analysis .....	33
4.4 Results .....	33
4.4.1 Density of woody plants in controlled grazing conditions .....	33
4.4.2 Leaf volumes and canopy spread index in controlled grazing conditions .....	36
4.4.3 Leaf dry mass in controlled grazing conditions .....	36
4.4.4 Density of woody plants at Masaane cattle post - free range grazing .....	38
4.4.5 Leaf volume and canopy spread index at Masaane cattle post .....	41
4.4.6 Leaf dry mass at Masaane cattle post .....	41
4.4.7 Density of woody plants at Motshwagole cattle post - free range grazing.....	43
4.4.8 Leaf volume and canopy spread index at Motshwagole cattle post .....	46
4.4.9 Leaf dry mass at Motshwagole cattle post .....	46
4.5 Discussion .....	48
4.6 Conclusion .....	50

<b>Chapter 5</b>	<b>Influence of livestock grazing around water points on primary production of herbaceous plants.....</b>	<b>52</b>
5.1	Introduction .....	52
5.2	Material and methods.....	53
5.2.1	Statistical analysis.....	54
5.3	Results .....	54
5.3.1	Seasonal plant species availability in controlled grazing conditions – Makhi ranch .....	54
5.3.2	Plant species availability at points along the transect from the water point in controlled grazing conditions .....	56
5.3.3	Plant species availability on different grazing systems at Makhi ranch .....	57
5.3.4	Availability of phytomass on different plant species in free – range grazing areas .....	59
5.3.5	Seasonal availability of phytomass of different plant species in free – range grazing areas .....	60
5.3.6	Phytomass availability of different plant species along the transects from the water point in free – range grazing areas.....	61
5.4	Discussion .....	62
5.5	Conclusion .....	64
<b>Chapter 6</b>	<b>Forage quality around water points .....</b>	<b>65</b>
6.1	Introduction .....	65
6.2	Material and methods .....	66
6.2.1	Statistical analysis.....	67
6.3	Results.....	67
6.3.1	Seasonal nutrient content of forage species in controlled grazing conditions –Makhi ranch .....	67
6.3.2	Nutrient content of three forage species growing along the transect from the water point.....	69

6.3.3	Nutrient content of forage species between the grazing systems at Makhi ranch.....	72
6.4	Discussion.....	74
6.5	Conclusion.....	75
<b>Chapter 7 Forage utilization around water points.....</b>		<b>76</b>
7.1	Introduction.....	76
7.2	Material and methods.....	77
7.2.1	Statistical analysis.....	78
7.3	Results.....	78
7.3.1	Seasonal forage utilization in controlled grazing conditions.....	78
7.3.2	Forage utilization along the transect from the water point in controlled grazing conditions.....	80
7.3.3	Forage utilization between the grazing systems.....	81
7.3.4	Seasonal forage utilization in free – range grazing areas.....	83
7.3.5	Forage utilization along the transect from water in free – range grazing areas.....	84
7.4	Discussion.....	86
7.5	Conclusion.....	88
<b>Chapter 8 Diet preferences of livestock.....</b>		<b>89</b>
8.1	Introduction.....	89
8.2	Material and methods.....	89
8.3	Statistical analysis.....	91
8.4	Results.....	93
8.4.1	Livestock diets composition in free – range grazing conditions.....	93
8.4.2	Diet composition of cattle.....	94
8.4.3	Diet composition of sheep.....	96
8.4.4	Diet composition of goats.....	97
8.5	Plant species diversity in cattle, sheep and goats diets.....	99
8.6	Diet overlaps of cattle, sheep and goats in free – range grazing conditions.....	100
8.7	Relative preference indices of cattle, sheep and goats.....	101
8.8	Diet composition of cattle under controlled grazing conditions at	

Makhi ranch.....	104
8.9    Seasonal species diversity of steer diet under controlled grazing conditions .....	106
8.10   Relative preference indices of steers in controlled grazing conditions at Makhi ranch.....	107
8.11   Discussion.....	108
8.11   Conclusion.....	109
<b>Chapter 9    Conclusions and Recommendations.....</b>	<b>110</b>
References.....	114
Appendix 1.....	125
Directions for preparing Hoyer’s solution.....	125
Directions for preparing Hertwig’s solution.....	125

## LIST OF TABLES

Table	Page
2.1	Livestock units and drilling date of each borehole in the study area.....18
2.2	List of herbaceous and woody plant species and miscellaneous species found in the study area.....19
3.1	Particle size of soil in the Makhi area.....23
3.2	Variation in soil nutrient status along transects away from the water point in controlled grazing conditions.....24
3.3	Mean variation in soil nutrients at each grazing system in controlled grazing conditions – Makhi ranch.....25
3.4	Mean soil nutrients status along the transect from water point at Motshwagole cattle post.....26
3.5	Mean soil nutrient status along the transect from water point at Masaane cattle post.....26
3.6	Mean variation of soil nutrients at two cattle posts in free-angegrazing.....27
4.1	Individual plant species density, leaf volume and subdivision of canopy spread index height strata for each distance from the water point in controlled grazing conditions.....35
4.2	Individual plant density, leaf volume and subdivision of canopy spread index height strata along the distance from water at Masaane cattle post.....40
4.3	Individual plant density leaf volume and subdivisions of canopy spread index height strata along the distance from water point at Motshwagole cattle post.....45
5.1	Phytomass availability of individual plant species or species groups in each season over two years in controlled grazing conditions.....55
5.2	Phytomass availability of individual plant species and species group at each distance from the water point at Makhi ranch.....56
5.3	Phytomass availability of individual plant species, or groups, at each grazing system in controlled grazing.....58
5.4	Phytomass availability of individual plant species, and species group at two cattle posts in free – range grazing.....59

5.5	Phytomass availability of individual plant species, and species group, in each season over two years in free – range grazing areas.....	60
5.6	Mean Phytomass availability of plant species, and species group, at each point along the transect from water in free – range grazing areas.....	61
6.1	Seasonal concentration in crude protein, phosphorus and fibre of species occurring in controlled grazing conditions – Makhi ranch.....	68
6.2	Seasonal concentration of crude protein, phosphorus and fibre in free – range grazing areas.....	69
6.3	Concentration of crude protein, phosphorus and crude fibre between the grazing systems.....	73
7.1	Seasonal utilization of forage species in the sward over two years in controlled grazing conditions – Makhi ranch.....	79
7.2	Percent utilization of forage species at each point along the transect from water at Makhi ranch.....	81
7.3	Percent utilization of forage species in each grazing system at Makhi ranch.....	82
7.4	Seasonal utilization of forage species in the sward in free-range grazing areas...	84
7.5	Percent utilization of forage species at each point along the transect from the water point in the free - range grazing areas.....	85
8.1	List of plant species occurring in seasonal diets of cattle, sheep and goats for both controlled conditions and free – range grazing.....	93
8.2	Average relative densities of plant species in seasonal diet of cattle in free – range grazing conditions.....	96
8.3	Average relative densities of plant species in seasonal diet of sheep in free – range grazing condition.....	97
8.4	Average relative densities of plant species in seasonal diet of goats in free – range grazing conditions.....	98
8.5	Average plant species diversities of seasonal diets of cattle, sheep and goats in free – ranging conditions.....	99
8.6	Seasonal diet overlaps of cattle, sheep and goats in free – range grazing conditions.....	100
8.7	Relative preference indices of herbaceous plant species occurring in cattle, sheep and goats diets for vegetation in free-range grazing.....	102
8.8	Relative preference indices for woody plant species occurring in cattle, sheep and goats diets for vegetation in free – ranging conditions.....	103

8.9	Average relative densities of plant species occurring in seasonal diet of cattle under controlled grazing conditions.....	105
8.10	Seasonal species diversity of steer diet for three grazing systems at Makhi ranch.....	106
8.11	Relative preference indices of plant species occurring in steer diet under controlled grazing conditions.....	107

## LIST OF FIGURES

Figure	Page
2.1	Vegetation map of Botswana.....13
2.2	Long-term and study period monthly rainfall at Makhi ranch.....14
2.3	Map of the study area showing the distribution of boreholes.....15
2.4	Layout of the Makhi ranch.....17
4.1	Estimates of total leaf dry mass at peak biomass of woody plants with subdivision into height strata for each distance from water in controlled grazing conditions.....37
4.2	Estimates of leaf dry mass at peak biomass with subdivision into height strata of individual woody plant species in controlled grazing conditions – Makhi ranch.....38
4.3	Estimates of total leaf dry mass at peak biomass of woody plants with subdivision into height strata for each distance from water at Masaane cattle post.....42
4.3	Estimates of leaf dry mass at peak biomass with subdivision into strata of individual woody plant species at Masaane cattle post ..... 43
4.5	Estimates of total leaf dry mass at peak biomass of woody plants with subdivision into height strata for each distance from water at Motshwagole cattle post.....47
4.6	Estimates of leaf dry mass at peak biomass with subdivision into strata of individual woody plant species at Motshwagole cattle post.....48
6.1	Nutrient content of forage species growing along the transect from water point in both controlled conditions and free – range grazing.....71
8.1	Average seasonal plant species class distribution between diets of cattle, sheep and goats in free – range grazing conditions.....95
8.2	Seasonal plant class distribution occurring in cattle diets in controlled grazing conditions.....10