

CHAPTER 2

STUDY AREA

2.1 Location and description

The trial was located at Makhi Ranch and the adjacent communal grazing area in Botswana (approximately 26.10' degrees South and 23.40' degrees East at an elevation of 1200m). The area is broadly described as a rolling flat country with dunes, wide plain depressions and pans (Weare & Yalala 1971). The soils are classified as Ferralic arenosols (FAO 1990). These are described as deep to very deep, well to somewhat excessively drained. The texture is fine sand to loamy fine sand and run – off is non – existent.

In general, the region consists of sandveld vegetation type (Weare & Yalala 1971; FAO 1991) of the Northern Kalahari tree and bush savanna (Fig. 2.1). The main tree species are T. sericea, Acacia fleckii, A. luederitzii, and Lochocarpus nelsii. Low growing shrubs, between taller trees, which often contribute significantly to canopy cover, include G. flava, G. retirnevis, B. petersiana, D. cinerea Mudulea sericea and Rhus ternunavis. The grass component has a low basal cover and consists mainly of Stipagrostis uniplumis, Eragrostis lehmanniana, Schmidtia pappophoroides, Anthephora pubescens (perennials) and Urochloa trichopus, Aristida congesta and Megaloprotachne albescense (annuals). Various families of forbs are also found.

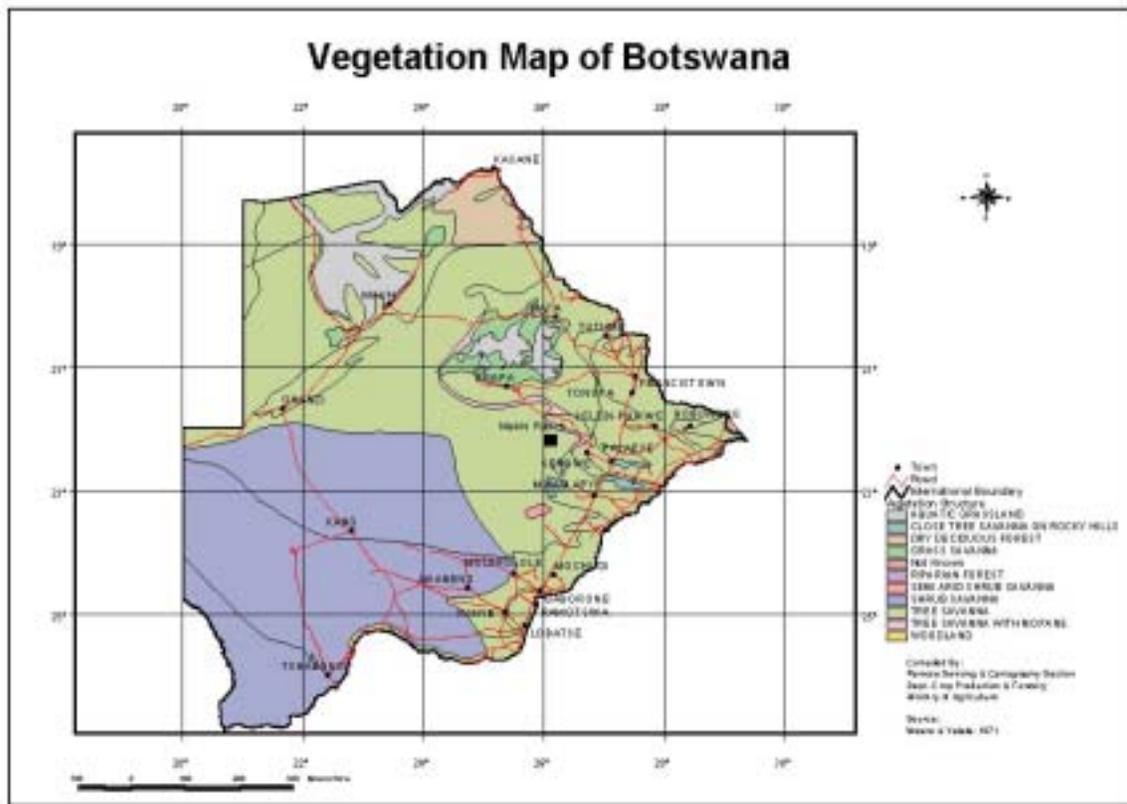


Fig. 2.1. Vegetation Map of Botswana

The mean monthly maximum temperatures range from 32 degrees centigrade in December and January to 23 degrees centigrade in June to July (measured at Serowe Weather Station). The corresponding minima are 18 and 4 degrees centigrade, respectively. Rainfall is erratic in total and distribution, with an annual long – term mean (1925 – 1998) of 451mm. Total annual rainfall during the study period (recorded at Makhi ranch) was 553 and 284mm for the 1996/97 and 1997/98 rainy seasons, respectively (Fig.2.2). Total rainfall for 1996/97 and 1997/98 was 22.6% and 20.8% above and below the long – term mean, respectively.

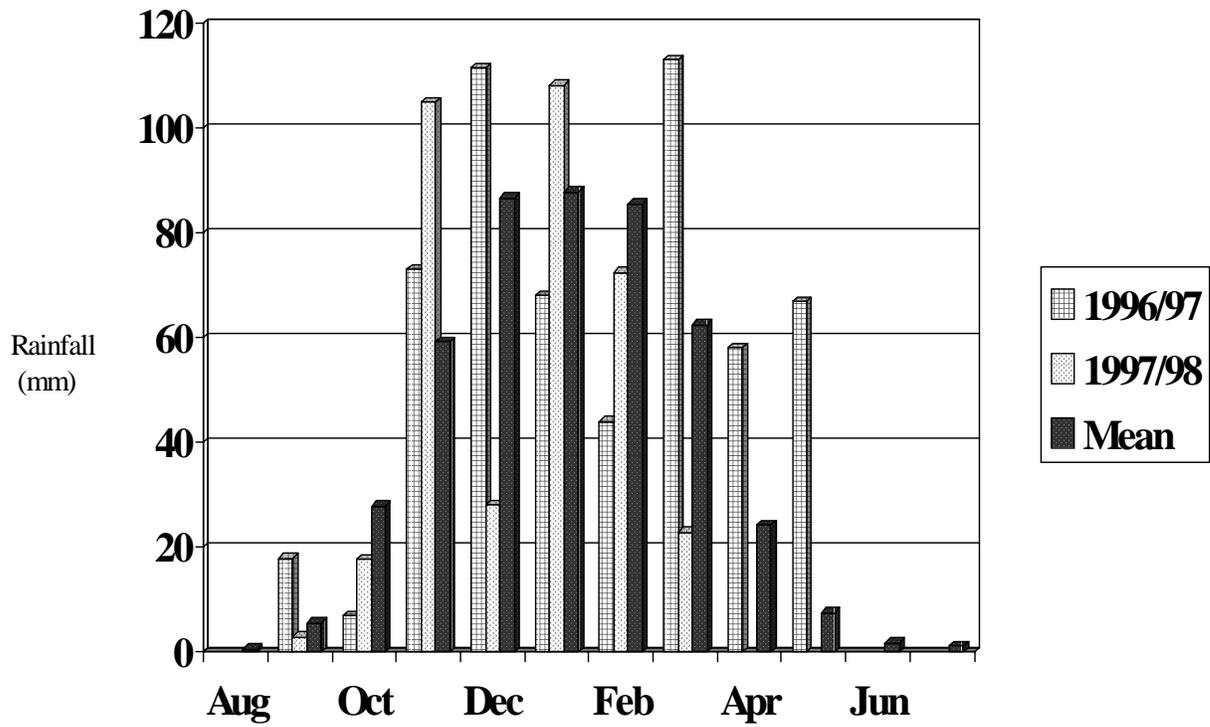


Fig. 2.2 Long-term (1925-1998) and study period monthly rainfall at Makhi Ranch

2.2 Experimental Design

The trial was conducted in two different grazing management systems; namely the communal grazing system (free range grazing – unfenced conditions) and the commercial ranching system (controlled grazing - fenced conditions). Figure 2.3 shows the location of the three boreholes where the study was undertaken, namely Makhi ranch in the controlled grazing conditions, Motshwagole and Masaane, both in the free range grazing area.

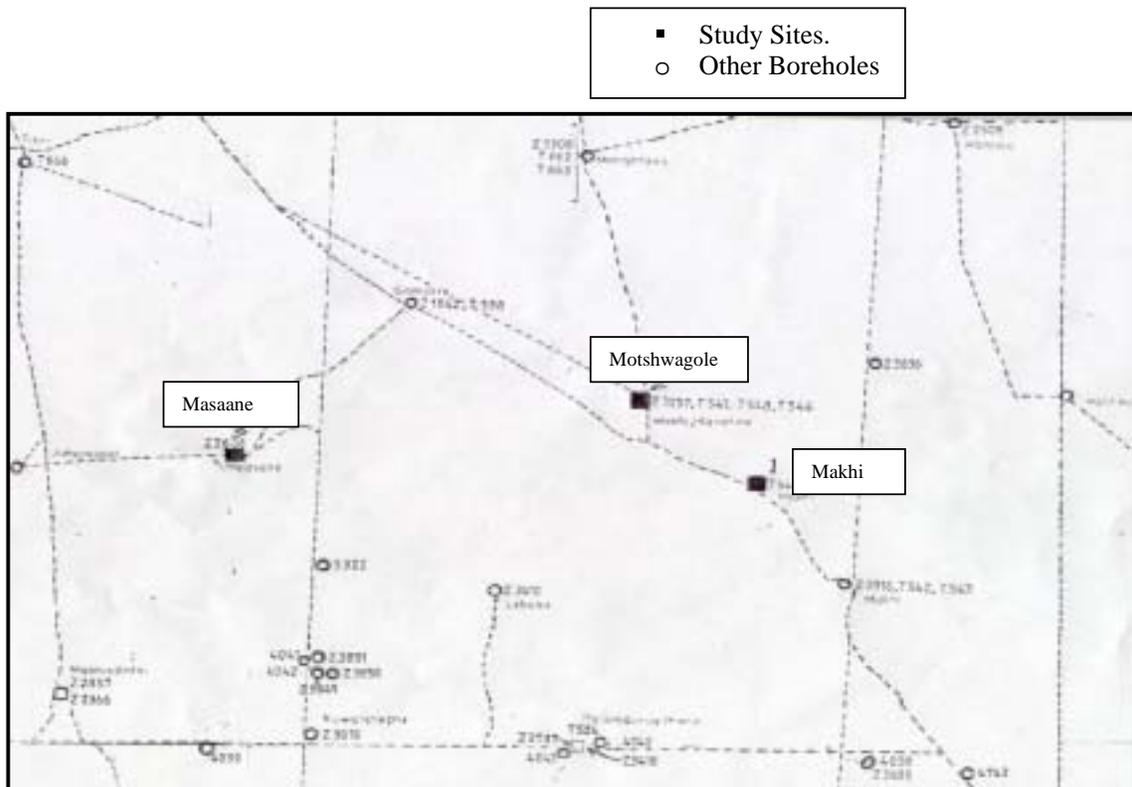


Fig. 2.3. Map of study area showing distribution of boreholes

The Makhi borehole had been under traditional unfenced cattle – post management for many years and it was converted into a ranch in 1980. On the ranch the trial made use of a wagon – wheel layout. A 2340 hectare hexagon was constructed with dividing fences radiating out from the central water hub (Fig. 2.4). Each radiating fence was 2.5 km from the hub to the perimeter fence. The trial incorporated three grazing systems that were replicated twice. These systems were as follows:

- System 1. Continuous grazing – where a paddock was grazed continuously throughout the year.
- System 2. 3 – paddock rotational grazing – where a paddock was grazed for one month and rested for two months.
- System 3. 9 – paddock rotational grazing – where a paddock was grazed for 4 days and rested for 32 days.

Continuous grazing = 4 & 17
3 – paddock grazing = 1, 2, 3, 14, 15 & 16
9 – paddock grazing = 5 – 13 & 18 -26

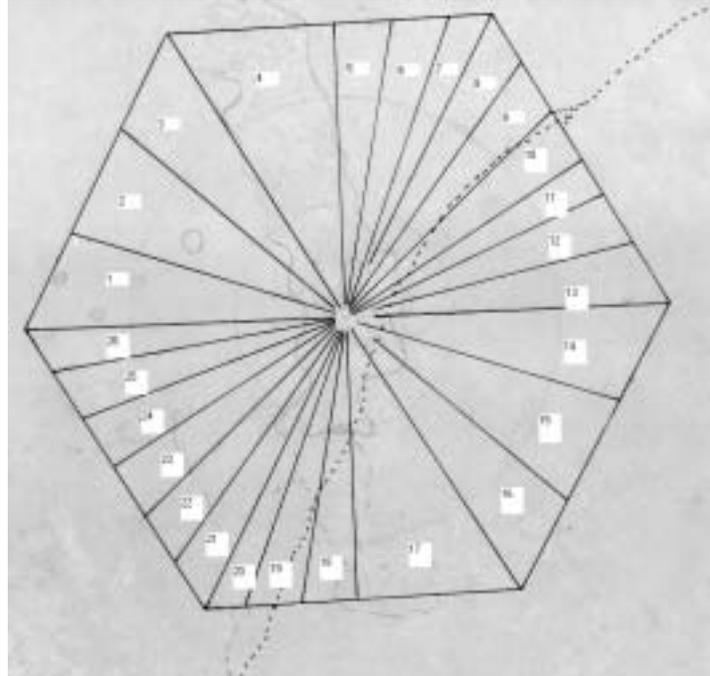


Fig. 2.4 Layout of the Makhi ranch

There were, therefore, a total of 26 paddocks in this trial. Unreplicated non – grazing exclosures in each treatment were used as controls. Vegetation and soil data were collected in 14 paddocks (2,6 and 6 paddocks of the continuous grazing, 3 – paddock grazing system and 9 – paddock grazing system, respectively). The trial was stocked with one and two years old Tswana – type steers at 12ha per livestock unit. Mature steers were replaced annually.

2.3 Livestock units and grazing area

In the free range grazing area, both Motshwagole and Masaane cattle posts were chosen to investigate the influence of livestock concentration around water point on soil and vegetation condition. Data were collected on three transects radiating from each borehole. The standard grazing area in the communal grazing land of the sandveld is 6400 ha per borehole (8 x 8 km). However, old boreholes (drilled before the country attained its independence) may be less than 8 x 8km and in such cases livestock from neighbouring boreholes may overlap their grazing before returning to their cattle – posts. The livestock type utilizing the range around these boreholes include cattle, sheep, goats and a few donkeys.

Numbers of livestock utilizing each borehole was considered to be of great importance to any attempt to relate variation in soil and vegetation variables measured. Table 2.1 shows the borehole name, date of drilling and numbers of livestock units.

Table 2.1 Livestock units and date of drilling each borehole in the study area

<u>Borehole name</u>	<u>Drilling date</u>	<u>Livestock units</u>	<u>Stocking rate</u> (ha / livestock unit)
Makhi	1954	217.44 (since 1980)	11.0
Masaane	1973	547.04 (5 years mean)	unknown*
Motshwagole	1957	379.23 (5 years mean)	unknown

*Animals in the free range grazing area (unfenced). Animals from each water point may overlap their range of grazing making difficult to estimate the stocking rate.

Livestock numbers for both Masaane and Motshwagole Boreholes were obtained from the veterinary office records in at Serowe. These figures were based on counts made by veterinary staff following the vaccination of livestock in the field. Although these statistics may be under – estimates, due to the impossibility of collection and vaccination of all cattle dispersed over the open free range grazing at any one time, they present the most accurate assessment of livestock numbers available. Records for the past five years only for the cattle posts in the free – range grazing could be obtained.

2.4 Plant species occurring in the area

The major herbaceous and woody plant species plus the miscellaneous species class (miscellaneous grasses and forbs) found in the study area are shown in Table 2.2. Grasses in the miscellaneous class included Aristida congesta, Aristida graciliflora, Eragrostis pallens, Pogonanthria squarrosa, and Melinis repens. Forbs in the miscellaneous class included several families or genera.

Table 2.2 List of herbaceous and woody plant species and miscellaneous species class found in the study area

<u>Code</u>	<u>Grasses</u>	<u>Code</u>	<u>Woody plants</u>
<u>D. aeg</u>	<u>Dactyloctenium aegyptium</u>	<u>A. fle</u>	<u>Acacia fleckii</u>
<u>D. era</u>	<u>Digitaria eriantha</u>	<u>A. ger</u>	<u>Acacia gerrardii</u>
<u>E. leh</u>	<u>Eragrostis lehmanniana</u>	<u>B. alb</u>	<u>Boscia albitrunca</u>
<u>E. rig</u>	<u>Eragrostis rigidior</u>	<u>B. pet</u>	<u>Bauhinia petersiana</u>
<u>E. afr</u>	<u>Eleusine africana</u>	<u>C. gra</u>	<u>Croton gratissimus</u>
<u>M. alb</u>	<u>Megaloprotachne albescens</u>	<u>D. cin</u>	<u>Dichrostachys cinerea</u>
<u>P. max</u>	<u>Panicum maximum</u>	<u>G. fla</u>	<u>Grewia flava</u>
<u>S. pap</u>	<u>Schmidtia pappophoroides</u>	<u>G. ret</u>	<u>Grewia retinervis</u>
<u>S. uni</u>	<u>Stipagrostis uniplumis</u>	<u>M. ser</u>	<u>Mudulea sericea</u>
<u>U. tri</u>	<u>Urochloa trichopus</u>	<u>R. bra</u>	<u>Rhigozum bravispinosum</u>
Miscellaneous grasses		<u>T. ser</u>	<u>Terminalia sericea</u>
<u>Code</u>	<u>Forbs</u>	<u>Com</u>	<u>Commiphora pyracantoides</u>
<u>A. thu</u>	<u>Amaranthus thumbergi</u>	<u>O. plu</u>	<u>Ochna plucra</u>
<u>C. bie</u>	<u>Cassia beiscensis</u>	<u>P. afr</u>	<u>Peltophorum africanum</u>
<u>I. dal</u>	<u>Idingofera daleoides</u>	<u>R. ten</u>	<u>Rhus tenunervis</u>
<u>T. ter</u>	<u>Tribulus terrestris</u>	<u>Z. muc</u>	<u>Ziziphus mucronata</u>
Miscellaneous forbs			

Miscellaneous grasses included: A. con = Aristida congesta, A. gra = A. graciliflora, E. pal = Eragrostis pallens, P. pat = Perotis patens, P. squ = Pogonanthria squarrosa, M. rep = Melinis repens