AN ASSESSMENT OF THE LIVESTOCK PRODUCTION POTENTIAL OF COMMUNAL VS FREEHOLD FARMING SYSTEMS IN THE GANYESA DISTRICT OF SOUTH AFRICA

by

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I DECLARE THAT THIS THESIS FOR THE DEGREE MinstAgrar

ANIMAL PRODUCTION, AT THE UNIVERSITY OF PRETORIA, HAS NOT BEEN SUBMITTED BY ME FOR A DEGREE AT ANY OTHER UNIVERSITY.

SIGNATURE : .....

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ABSTRACT

Six livestock owners, who are commonly used as demonstrators, participated in the study of which three were from communal areas and three from freehold farms in the Ganyesa area. The livestock production potential in communal areas was compared with that of freehold farms. Information on livestock production, veld condition, Dry matter, crude protein- content of natural grasses and extension services were determined and evaluated for each study area.

The result of this study revealed that because of variation in climate, Ganyesa is classified as semi- arid and is mainly suitable for livestock production. The result further revealed that there were major constraints in livestock production in the study area and these were related to land tenure system and poor livestock production. In both communal areas and freehold farms, farmers were unable to invest in infrastructural development and this immensely affected production, and led to over-grazing.

The performance of the herds (calving %) in communal areas was low (54 %) as compared to that on the freehold farms (61 %). However, the results revealed that more calves that were born lived up to weaning (85 % in communal areas, 90 % on freehold farms) and this compared favourably with results from other areas. Herd mortality rates for both communal (2 %) and freehold farms (2%) were reported to be low.

The performance of smallstock was somehow lower than expected for both communal and freehold farms. The lambing/ kidding percentage was low (62 % and 69 %, respectively) and mortality rates were somewhat high (10 % and 23 % respectively). This means that many lambs/kids died due to diseases and malnutrition and thus did not reach a weaning age.

Forage DM production was reported to be higher on freehold farms than in communal areas, and this supported the argument that the latter areas are over-stocked. The CP-content of forage was high for freehold farms during December - January and low during July – August. The CP – values of forage for freehold farms were higher than those for communal areas with the highest figures recorded during January.

The veld condition score was reasonable on freehold farms with a high percentage of desirable grass species (28 %) and low in communal areas (22 %) with high percentage of undesirable grass species (52 %) recorded by the latter.

The results of this study revealed that all samples recorded high strontium (Sr) values, indicating likely contamination of the borehole sites. The high levels of titanium (Ti) and barium (Ba) on freehold farms may indicate a possibility of industrial pollution of boreholes. Most of the water sources sampled may also be utilised by humans for drinking, food preparation and drinking purposes with detrimental effects. In view of these constraints, some recommendations were made.

SAMEVATTING

Ses vee- eienaars, wat algemeen as demonstreerders gebruik het deelgeneem in die studie waarvan drie van die kommunale gebiede en drie eiendomsplase in die Ganyesa gebied. Die veeproduksie potensiaal van die kommunale areas is met die eiendomsplase mekaar vergelyk. Inligting oor veeproduksie, grasdroëmateriaal produksie (DM) en ru- proteien van natuurlike grasse is bepaal vir elke studie- area.

Die resultate van die studie dui aan dat as gevolg van klimaatsverskille, Ganyesa geklassifiseer word as 'n semi-ariede gebied en hoofsaaklik geskik is vir veeproduksie. Die resultate bewys verder dat `n aansienlike onderdrukking op veeproduksie was en dit kon teruggevoer word na die vorm van grondbesit en swak diereproduksie. In beide kommunale gebied en eiendomsplase, was boere nie in staat om te investeer in infrastrukturele ontwikkeling nie en dit het `n groot effek op produksie gehad wat gelei het tot oorbeweiding.

Die kalfpersentasie in kommunale gebied was laër (54 % as diè in eiendomsplase (61 %). Daar was egter `n toename in kalfleuring tot speen (85 % kommunale gebied; 90 % eiendomsplase) en dit vergelyk goed met resultate uit ander areas.
Kuddevrektes vir beide areas was laag (2 %). Die prestasie van die kudde was laèr as verwag vir die gebeide. Die lam presentasie was 62 en 69 % respektiewelik in die gebeide en die vrektes relatief hoog (10 en 23 %).

Dit beteken dat meer lammers dood is as gevolg van siektes en warvoedig dood is en dus nie speen- ouderdom bereik het nie. Droëmateriaalproduksie/ha was hoër vir eiendomsplase as vir kommunale gebeide en dit ondersteun die argument dat laasgenoemde gebiede oorbewei is. Die ru- proteien was hoèr by eiendomsplase ge durende Oktober – Desember en laèr gedurende Junie- Augustus. Die gemiddelde ru-proteien- waardes vir eiendomsplase was hoèr as die vir kommunale gebiede met hoogste syfers aangeteken in Januarie.

Die veldtoestande was redelik by eiendomsplase met hoë persentasie gewenste grasspesies (28 %) en laag in kommunale gebiede (22 %), met `n hoër presentasie van ongewenste grasspesies (52 %) wat aangeteken is by laasgenoemde.

Die resultate van die studie wys hoè strontium(Sr) waardes, wat aandui dat boorgate moontlik besoede is. Die hoe waardes van titanium (Ti) en barium (Ba) by die eiendomsplase dui op die moontlikheid van industrieel besoedeling van boorgate. Die meeste va n boorgate waar getoets is word ook gebruik deur mense vir kos voorbereiding en drink water met nadelige gevolge. In die lig van die hindernisse en beperkings op veeproduksie potentiaal word sekere aanbevelings gemaak.

CHAPTER 1

THE PROBLEM AND ITS SETTING

1.1. Introduction

The Drought Relief Report (1985) described the natural grazing lands in Bophuthatswana as being in extremely poor condition, and that conditions in communal areas were even reaching alarming proportions. The report goes further to state that if present conditions are allowed to continue, the results could lead to vast desertification in the area. Such veld deterioration which came about as a result of incorrect management practices, has affected animal productivity even in other developing areas as reported for KwaZulu Government (1980); and for Ciskei and Transkei by Bembridge & Tapson (1993).

Because of an ever-increasing demand to use land more economically and efficiently, procedures that result in maximum production over the years while minimizing the stress on livestock and vegetation especially during lean years, are needed. It is therefore important that stock farmers adapt their management systems, according to their own specific soil types, vegetation, climate and objectives.

This has prompted many debates about appropriate land use and management objectives especially in semi arid areas. The production potential of the Ganyesa district needs to be evaluated for different strategies, including a traditional multipurpose system as well as the commercial production of weaners/ oxen.

1.2. Problem statement

In 1980, the South African Development Trust (SADT) purchased 85 farms (226 597 ha) adjacent to the Ganyesa district and entrusted them to the then Bophuthatswana government. These farms were then advertised for occupation by farmers from within and

around the Ganyesa district. One of the objectives of allocating these farms to aspirant black farmers was to encourage them to increase farm profits.

It has not yet been established how the farmers adapted their farming practices or whether these farms are more productive than the communal grazing areas. The Ganyesa district, due to substantial variation in rainfall, is regarded as semi- arid (Williamson & Payne, 1980; Richardson, 1987) and has been characterised by relatively poor veld growth, which is affected by recurring droughts. Although, dryland cropping is taking place on a significant scale, Jocum (1992) has provided evidence that the crop yields are usually insufficient to cover production costs in this area.

The ability of ruminants to convert forage into edible products for human consumption is an important component of food security in many countries. The availability of forage is in turn dependent upon, *inter alia*, the type of soils, climate and agronomic practices (Mazengera, 1992). Fourie *et al.*, (1984) concluded that the productivity of grass species is related to palatability, biomass production, nutritive value, perenniality and tolerance to grazing and drought.

Animals in semi-arid areas such as Ganyesa are subjected to a very different nutritional environment ; Characteristics that limit animal performance (Mazengera, 1992) include:

- scarcity of herbage for shorter or longer periods that may last for more than twelve months during droughts
- herbage has a low protein and a high fibre content for a substantial part of the year leading to restricted intakes
- environmental stresses such as high temperatures, photoperiodism, internal and external parasites
- livestock diseases

Management initiatives in semi arid areas should ensure that the breed/type selection and production system are suited to these agro-climatic conditions, and should satisfy one or all of the following objectives (Van Zyl et al., 1993):

- sustainable productivity
- a product as close to the optimum marketing stage (age and condition) as economically and environmentally feasible
- a high production yield per unit area but not necessarily a high yield per animal

1.3 Purpose of the study

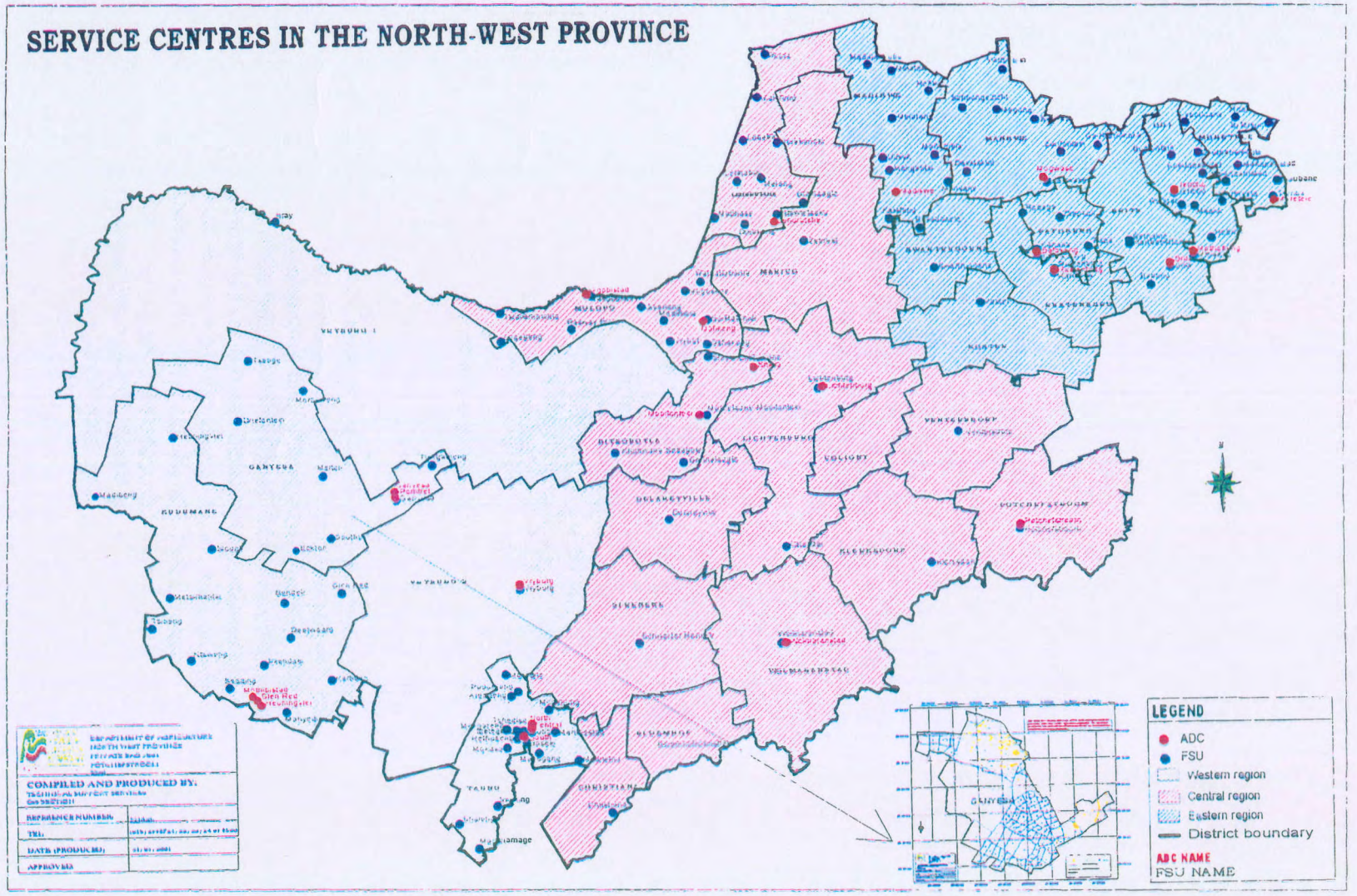
The present study was undertaken to:

- evaluate the extension approaches used by Extension Officers in the Ganyesa district to transfer technology
- evaluate and compare existing patterns of livestock production systems on free hold farms and those in communal grazing areas of Ganyesa
- identify constraints and opportunities in both communal and freehold systems
- provide a basis for suggestions/recommendations regarding appropriate livestock production systems in Ganyesa and other semi- arid areas of southern Africa.

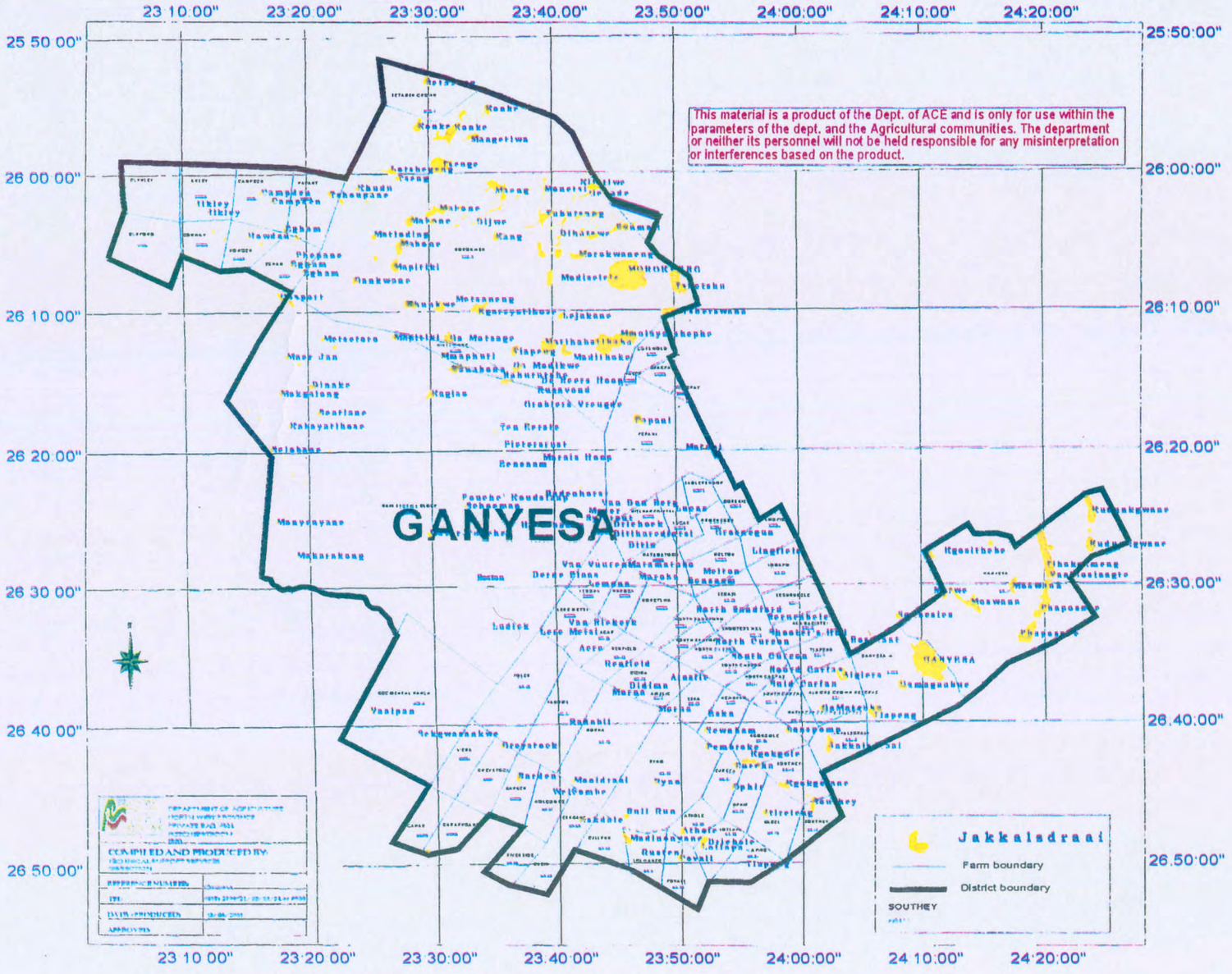
1.4 Research hypothesis based on objectives

The objectives of the study were based on the following assumptions:

- that overstocking was a result of present land tenure systems
- that there are more constraints than opportunities in communal as opposed to freehold farms
- that the extension approach used was inappropriate and resulted in farmers rejecting innovations.



MAP1: NORTH WEST PROVINCE, SA



MAP2: LOCALITY OF GANYESA DISTRICT,
IN THE WESTERN REGION OF NORTH WEST PROVINCE, SA

CHAPTER 2

DESCRIPTION OF THE STUDY AREA

2.1 Geographical location

Ganyesa district is situated to the western side of the North West Province (Map 1) and is about 70 km north of Vryburg (Map 2). The district lies between 23° 37´E longitude and 26° 21 ´S latitude. The North West Province has a total surface area of 11,6 million hectares, whilst Ganyesa district is 758 370 ha in extent. Ganyesa is at an elevation of 1000 meters above sea level and most of the land is flat and undulating (Potgieter, 1997).

2.2 Climate

For this study, the climatic data from Armoedsvlakte research station, which is about 70km to the South of the study area, was used. Rainfall occurs in summer between October and April and is extremely variable and deviation from the mean (Table 2.1) often persist for a number of years (ARC, 1999). Summers are extremely hot while winters are moderate (Fourie *et al.*, 1985). According to Motiang (1992) Ganyesa experience 90 days during which temperatures exceed 30° C and 30 days during which temperatures exceed 35° C. Cold nights with temperatures of below freezing point are common in winter.

Table 2.1
Mean monthly rainfall (mm) and number of rainy days over a period of 79 years at Armoedsvlakte Research Station

Month	Mean monthly rainfall (mm)	Mean No. of rainy days
January	80.7	9.6
February	75.5	12.6
March	76.2	9.3
April	41.2	6.5
May	14.7	2.2
June	6.3	1.2
July	3.1	0.4
August	4.5	0.8
September	11.5	3.2
October	28.6	5.9
November	46.6	7.3
December	62.4	8.0
Annual means	451	67

(Source : ARC, 1999)

2.3 Vegetation

Acocks (1975) classified vegetation in Ganyesa as Kalahari Thornveld (Veld Type 16), subdivision Vryburg Shrub Bushveld. The vegetation is dominated by Acacia species and the most common trees include camel thorn (*Acacia erioloba*) and black thorn (*Acacia mellifera*), camphor bush (*Tarchonathus camphoratus*) and brandy bush (*Grawia flava*). Common grasses occurring in the area include blue seed grass (*Eragrostis lehmanniana*); sand quick (*Schmidtia pappophoroides*) and stickgras (*Aristida congesta*). The carrying capacity of the veld has been estimated at 12 ha per LSU (Department of Agriculture[1], 1999).

2.4 Soils

The study area is dominated by continental red or brown shifting Kalahari sands except in the extreme north where the shallow calcareous soils and lithosols have a low to moderate grazing potential. Van Heerden (1995) surveyed this area and identified 23 representative sites belonging to the clovelly soil form from the Setlagole family and the Molopo soil form from the Pomfret family. Land tenure maps (1984)- Bray (2522), Morokweng (2622), Mafikeng (2524) and Vryburg (2624) also revealed that most parts of Ganyesa district are covered by both Ae3 and Ah6 land types. Soil forms such as hutton are deep soils with greater yield per unit, and also have a great influence on the palatability of the grasses. Clovelly soils are sensitive to erosion and are poor in natural plant nutrients. The main soil forms and series occurring in Ganyesa are shown in Table 2.2. These soils are susceptible to wind erosion.

Table 2.2
The main soil forms and series in the Ganyesa district

No.	Form©	Series©
1	Hutton	- Shorrocks, Mispah, Makatini
2	Clovelly	- Blinkklip, Sandbury, Denhere
3	Avalon	- Soetmelk

© Soil classification working group (1991)

2.5 Land tenure

The land tenure system in Ganyesa can be divided into three categories, *viz.* tribal land, state land, and private land (Table 2.3). Tribal land is a communal property belonging to a particular community under the leadership of the Chief (Balyamujura, 1995) and this constitute 70 % of the total surface area of Ganyesa. The tribal land tenure system whereby every married male member of the tribe is entitled to a small tract of land and unrestricted access to communal grazing is practiced in the communal areas. Because of this system communal grazing has been associated with land retrogression and overgrazing

(Hardin, 1968; Grossman, 1992). State land is all land that is registered as state property including all land transferred from SADT to the former
Bophuthatswana government and this land is leased by individuals for private use. Another type of state land is the " State tribal land" which is land purchased and allocated to the tribe for agricultural use and such land is referred to as trust land utilised as communal rangeland. Private land is land that belongs to private individuals (Balyamujura, 1995).

Table 2.3
The classification of land tenure system in Ganyesa district

Land tenure	Hectares
Tribal land	530 493
Stae land (commercial)	226 597
Private owned land	1 280
Total	758 370

(Source: Department of Agriculture[2], 1999)

The state farms in Ganyesa district were under the control of the Directorate Land Administration. These farms which constitute 30 % of the total surface area of Ganyesa (Table 2.3) were advertised in 1982 and interested farmers were invited to apply to occupy the farms. These farmers were to lease the farms for five years, after which period they would be given the option to buy the farms. The government was to assist farmers with fencing external boundaries and provision of at least one water point for livestock. The financial and other responsibilities regarding the development of the farm as a commercial ranch remained the responsibility of the lessee farmer. However, the condition of infrastructure on the farms could be described as fair to good. The only major impediment in some farms was lack of underground water, and thus farmers had to seek water from neighboring farms at a cost.

2.6 Livestock production practices

Like in other African communities livestock play an important role in the social life of the Batswana people. Various authors have proved that cattle are a form of accumulated

wealth, a source of food (milk and meat), provides status and acceptance within the community (Kuper, 1961; Coetzee, 1980; Bembridge, 1979). Although sheep and goats fulfil the same uses as cattle, they do not arouse the same emotions in rural people as cattle do (Bembridge, 1988). In African cultures, goats are more favoured than other animals, mainly because they are considered to be more intelligent than the other domesticated animals.

Different nations have their own unique cultures and traditions and sometimes even different households (families) within the nation have their own cultures and methods of performing rituals. In performing various cultural rituals families decide whether to slaughter a sheep or a goat. This is important because when a goat is slaughtered in ceremonial rituals and it cries it is believed that it had send a clear and quick message to the ancestors. It is often decided on the colour and sex of the goat to be slaughtered.

Sheep is often used for "mokwele" (present giving) to the brides family and at funerals, while goats will be used for religious rituals, asking for luck from ancestors, chasing bad luck away, asking for forgiveness and initiation ceremonies. The livestock graze collectively on the land allocated by Chiefs and the " cattle posts" type of livestock range management system is also practiced. Because of poor maintenance of livestock infrastructure, e.g. grazing camps, crushpens etc. recommended veld and livestock management practices are difficult to apply.

2.7 **Livestock numbers**

Livestock numbers for Ganyesa district have fluctuated according to the periods of low rainfall with a sharp drop experienced in the period 1983 to 1984 (Table 2.4). From there, the numbers started to increase again during 1989 to 1990 only to decline again during the dry spell of 1991 to 1992. Fluctuations in numbers of small stock have not been as dramatic as that of cattle because the predominant sheep kept is drought tolerant. Another reason may be attributed to the grazing behaviour of this livestock species. Equines serve

as modes of transport and as "beasts of burden" to the rural population. A small section of the population is also known to eat donkey meat. The numbers of donkeys have been building up since forced reduction by the Bophuthatswana authorities in 1983 in an effort to ease pressure on rangeland.

Table 2.4 Livestock numbers for Ganyesa District

	82	83	84	85	86	87	88	89	90	91	92
Cattle	63951	59193	60183	63271	65771	67191	69100	72019	73500	70110	60415
Sheep	46878	45773	44931	53453	53917	54516	55993	56450	56950	57100	57009
Goats	59774	60065	62700	62790	63915	63193	63915	64545	65110	65590	65580
Equines	3166	2241	2259	2243	2510	3100	3109	3114	3159	3260	4100

(Source: Department of Agriculture[3], 1999)

2.8 Agricultural services

Each one of the study areas has an Agricultural Technician. Each Agricultural Technician serves about 10 to 15 villages and is mainly concerned with aspects relating to livestock farming. However, from time to time, she/he is called upon to provide a service in the line of dryland cropping or horticulture. The Department of Agriculture is however, discouraging the dryland cropping practice due to frequent dry spells with the exception for producing for household use.

The Agricultural Technician operates from a service center from which all agricultural services are provided. At these centers there is an animal health officer, service center clerk, and a general worker. The Department has provided agricultural infrastructure like crushpens, dip tanks, and fences in the form of camps in each one of the study areas to facilitate livestock management practices.

2.9 Veterinary services

There is a state veterinary office at Ganyesa district. Although this position is vacant at the moment, there is one state veterinarian who visits the area upon request from Kuruman/Vryburg on a weekly basis. In each one of the study areas, there is one animal health officer who inspects and treats animals, counts, dips and immunises livestock against notifiable diseases such as brucellosis and anthrax . This service is taken seriously as those animals not immunised for the above – mentioned diseases may not be granted permits for disposal at cattle sales.

2.10 Markets

There are no readily available markets for agricultural produce in the district. The only livestock auctioneer in the district is the Tswana Livestock Co –operative that holds sales once ever month. Agricultural unions also organise special livestock sales through Northern Cape Livestock Co –operative by providing information about the number of animals to be tendered for sale. A new marketing channel is the so- called tuck shop sales where buyers visit villages on an ad hoc basis to buy livestock. This has proved to be very popular in some areas, because buyers use mobile scales where the animals are weighed and the price is fixed on the basis of live weight.

2.11 Water

Boreholes are the main source of water in the Ganyesa district. There is a small reservoir at Ganyesa village supplying residents of the Phola civil servants residential area with water. Generally, rural villages get their water supply from street taps, windmills or wells. On the freehold farms water is supplied from boreholes by motor engines and windmills but most boreholes run dry during droughts.

CHAPTER 3

MATERIALS AND METHODS

3.1 Orientation and planning of the study

Planning of this study commenced in May 1994. During this period the study area was visited to brief the extension officers of the intended study and to solicit advice as to how best to approach the study. The Agricor district management was also briefed and permission to use their extension officers for surveys was sought. The extension officers assisted in the identification of the areas to be surveyed as well as the selection of participant farmers.

Meetings were held with each farmer separately to inform them formally of the intended study and to request their co-operation and permission to use their livestock. The farmers were visited once per month and also by the extension officer of the area to collect information regarding livestock dynamics (Appendix 1). The farmers who took part in the survey were selected by extension officers based on their willingness to participate.

The questionnaire was designed to obtain accurate information from the respondents on the reductions and/or addition that had occurred in their herd during each month (Appendix 1). Although the questionnaire was prepared in English, the questions were put to respondents in their home language (Setswana) to enhance better understanding and answering of questions.

Six livestock owners participated in the study: three farmers were from a communal system and three farmers from freehold farms. These farmers were also those that extension officers used as opinion leaders to convey extension messages to target groups.

An attempt was made to select villages/farms that were remote from each other, to ensure that respondents are evenly distributed across the district.

Each respondent was briefed on the purpose of the survey and asked to confirm his/her willingness to co-operate throughout. Each respondent was interviewed individually every month, in the comfort of his/her home/farm. The interview was conducted with the assistance of the area/ward extension officer, and animal numbers were checked and confirmed after every interview. The respondents were willing to give accurate information because confidentiality of information was guaranteed.

3.2 Livestock dynamics

Information on livestock numbers, age and sex were collected on a monthly basis to determine any changes and reasons for such changes for each farmer (Appendix 1). The animals were counted physically every month to confirm the numbers as given by the farmers.

3.3 Biomass sampling

At each site, an area of 0.1 ha (30m x30m) was sampled every month using a quadrant of 1 square meter to collect grass samples over a period of twelve months. A step point method (Mentis, 1981) was used, and all vegetation within the quadrant was collected for weighing and drying. The dried grass samples were then milled in their entirety in a "laboratory" mill to pass through a 1mm sieve. The sample was then thoroughly mixed and a homogenous sample of approximately 300g was taken for analysis.

3.4 Veld condition assessment

The ecological veld condition was assessed by analysing the benchmark and sample sites in terms of species composition by means of a step point method as described by Mentis (1981). An area of 30m x 30m was selected and species composition and basal cover at 100 systematically selected positions were assessed. The veld condition and grazing capacity were evaluated by using the method of Fourie (1976), Kruger (1985) and Van Zyl (1986). The condition of the veld was determined in each of the study areas by sampling and classifying grasses on the basis of their ecological and agricultural value. Veld condition score was calculated using a technique that provides an indication of whether the veld is well managed, under or over utilised, by recording and classifying the grass species in the area as either desirable, less desirable and undesirable (Appendix 2). Not only the veld condition score determines the grazing capacity but also by reading of the corresponding veld condition score against rainfall for specific site.

3.5 Proximate analysis of grasses

3.5.1 Determination of dry matter and crude protein contents

A wet sample from fresh material harvested was used for the determination of DM by drying to constant mass (Rethman & De Witt, 1984). The wet sample was weighed in its entirety within 12 hours after being cut before it was dried in an oven at 105° C for a minimum of 16 hours. The difference between the wet sample and weight after drying is H_20 mass. Therefore the weight of H_2O subtracted from the weight of the wet sample gives us the weight of the dry matter.

The DM production/ ha was calculated using a method as described by Bester (1988) e.g.:

$$\frac{\text{Kg/Dm /m}^2 \text{ x10 000m2}}{30\ \text{m}^2\ \text{x 1000}} = \text{Kg/Dm/ ha}$$

The sample was stored in a safe place before it was taken for milling. After milling crude protein content of the sample was determined as described by Harris (1970); Association of Official Analytical Chemists, (1990); (Robetson & Van Soest, 1981).

3.6 Water quality

Water samples were collected during January 1997 from five boreholes and two livestock drinking troughs. Samples were collected in plastic bottles and were preserved with HgCI before being brought to the laboratory for analysis. Water quality constituents were analysed using the Generic- Water Quality Guideline Index (WQGIS) software system developed for the Water Research Commission by Casey & Meyer (1996).

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Extension approach

The present study revealed that on average the livestock ownership was 63 and 106 head of cattle per respondent in communal and freehold farms, respectively (Tables 4.1 and 4.2). It was also evident from this study that a respondent in communal grazing areas (Tshaneng) was keeping equal numbers of cattle as the one on the freehold farm (Kgamadintsi). These results support the view by Bembridge and Tapson (1993) that the traditional goal of all communal livestock owners is an unlimited increase in the numbers owned, and that this practice does not only bestow upon him a position of leadership within his community but also acts as an insurance against any mishap. This view is supported by Crotty (1990) who stated that if one man decreases his animals in a communal area, someone else increases his, thus maintaining the pressure on the communal resource.

Table 4.1. Herd composition and age of cattle over twelve months for three respondents in three communal areas .

Study Area	Age (months)											
	<7			7 – 12			12 – 24			>24		
	M^1	C^2	F^3	M^1	C^2	F^3	M^1	C^2	F^3	M^1	C^2	F^3
Dipodi	3	0	3	1	1	4	0	4	7	1	2	30
Ganyesa	3	0	3	2	1	4	0	4	9	0	4	31
Tshaneng	2	0	5	3	2	2	0	2	13	0	1	48
Mean	4	0	4	2	1	3	0	3	10	1	2	36

M^1 – Males
C^2 – Castrates
F^3 – Females

Table 4.2. Herd composition and age of cattle over twelve months for three respondents on three freehold farms

Study Area	Age (months)											
	<7			7 – 12			12 – 24			>24		
	M[1]	C[2]	F[3]	M[1]	C[2]	F[3]	M[1]	C[2]	F[3]	M[1]	C[2]	F[3]
Kgamadintsi	0	10	10	0	0	2	0	2	7	2	1	41
Fielden	0	16	19	0	0	8	0	8	17	3	4	60
Stickney	0	12	15	0	0	7	0	7	14	2	4	53
Mean	0	16	15	0	0	6	0	6	13	2	3	51

M[1] – Males
C[2] – Castrates
F[3] – Females

However, the situation as reported in this study is not truly representative of the communal areas in general. In this study the emphasis was placed on these six respondents because they are the ones the extension officers use as "demonstrator farmers" to disseminate agricultural innovations. Due to deficiencies recorded in the adoption rate, the extension officers were convinced that once the more influential people adopted the innovation, then the rest are likely to follow. The farmers who were chosen as leader farmers were perceived to have a favourable attitude towards change, and are role models.

This traditional approach of using leader farmers to accelerate adoption of appropriate technology aimed at increasing farming efficiency and income, was well-documented (Van der Wateren, 1987; King & Bembridge, 1988). Leader farmers are regarded as progressive and innovative and have been able to weigh up risks and benefits associated with the new innovations and to make appropriate, independent choices (Rogers & Shoemaker, 1979, Berger & Berger 1989). The less progressive farmers are those farmers who are usually hesitant to take risks, and prefer to interact with their more innovative counterparts before adopting any particular innovation (King & Bembridge, 1988).

The essence of this extension strategy is that the farmers in a community are regarded as a homogenous target group that can be reached through a multiplier effect (diffusion) by having direct extension contact with few farmers who can be considered to be opinion

leaders. This extension strategy amounts to a situation in which extension, agricultural research and the distribution apparatus all engage a small group of farmers who have relatively more access to information and inputs than others, with the result that agricultural development efforts often only contribute to increasing disparities (Röling, 1982).

However, Düvel (1996) reported that the use of leader farmers in technology transfer does not seem to have the expected positive impact. Numerous authors (Williams & Bembridge, 1990; Bembridge & Tshokolomo, 1992; Hossain, 1997) also reported that early adopters are seen as atypical by the rest of the community and that innovations do not "trickle down" to less progressive farmers. Similarly, Garforth (1982) reported that the practice of providing intensive assistance to a small number of progressive farmers and expecting that the effect of such assistance will reach other farmers by automatic/ self driven diffusion processes is not realistic and leads to increased social and economic inequalities.

According to Garforth (1982), the whole traditional concept of extension has come under attack from radical educationists who criticise the one way flow of information from research institutions through extension services to target audiences. These educationists see the extension officer as a communicator who facilitates the learning process by helping the rural people to recognise and articulate their problems and to demand assistance from research in solving the problem. Steyn and Bembridge (1990) reported that the Farming Systems Research (FSR) technique was developed when it was discovered that the results of traditional agricultural research were disappointing in influencing the productivity of small-scale farmers.

The major reason for farmers not adopting the recommendations of the research institutions was because these "recommendations were often not consistent" with the circumstances of the farmers. There was, therefore, a need for FSR to expand and to include extension hence FSR/E. The FSR/E approach should ensure that effective research

on agricultural technology starts and finishes with farmers, and the integration of the perceptions of biological scientists and social scientists is an essential element in such research. The need for more area specific recommendations was recognised and the testing, adaptation and validation of eventual recommendations are done in the area, on small farmer holdings with farmers themselves carrying out the evaluations. Such a close involvement of the farmers in research and development work, not only ensures more relevant, viable technologies, but also provides an invaluable learning experience for the farmers involved.

The traditional approach of technology transfer for agricultural research and extension was overhauled and more participatory approaches in rural agricultural extension services proposed p. Numerous workers (Botha & Van der Wateren, 1983; Van Rooyen & Botha, 1994; Wambura, 1995; Botha, 1996; Botha & Treurnicht, 1997; Mukhala & Groenewald, 1998; Raditloaneng, 1998) have agreed that articipatory extension generates widespread and sustainable results. The participatory approach maintains that people are central to any development initiative and that people should be part of a decision making process. Röling (1982) sees the objective of making the distribution of agricultural resources more equitable, of broad-based, integrated rural development or of organizing farmers into an effective partnership in development, would require extension not to approach rural people individually, but rather in their natural groups (communities) which can engage in collective decision making.

Rapid Rural Appraisal (RRA) and the more recent Participatory Rural Appraisal (PRA) were very popular participatory techniques that emerged during 1980's, with strong similarities in principles and methods with a variety of other approaches (Botha, 1996). The RRA emerged mainly due to a growing dissatisfaction with the normal procedure of questionnaire and surveys and a need for more cost-effective methods of obtaining information.

This led to increasing awareness that rural people were knowledgeable about issues that affect their lives (Mukhala & Groenewald, 1998). Raditloaneng (1998) regarded PRA as a planning technique used to assess various features and resources of the community, identify problems and opportunities and then prioritize the actions to address the problems. The RRA enables outsiders to make use of indigenous knowledge while PRA is an approach and method for learning about rural life and conditions from, with and by rural people (Mukhala & Groenewald, 1998).

Botha & Treurnicht (1997) also reported on the Participatory Learning and Action (PLA) approach which evolved out of RRA and PRA. PLA is regarded as an ideal tool to integrate different Indigenous Knowledge Systems and as an extension tool, it is more applicable to the subsistence and emergent farmers.

In view of the deficiencies associated with the use of leader farmers in the transfer of technology, the extension officers can put into practice any of the techniques that encompass the participatory approach.

4.2 Herd performance

4.2.1 Calving percentage

The present study revealed that livestock production in communal areas was slightly lower when compared to freehold farms (Tables 4.3 & 4.4 respectively). The calving percentage in this study was 54% and 61% for communal areas and freehold farms, respectively. The lowest calving rate in a communal area was recorded at Tshaneng (48 %) while the highest was recorded at Ganyesa (61%), the latter was even higher than those of two freehold farms viz Fielden (58 %) and Stickney (51 %).

Forbes & Trollope (1991) reported calving percentage of 49% (Ciskei), Tapson & Rose (1984) recorded 31% (KwaZulu), and (Van Renen, 1997) recorded calving percentages of between 30% and 50% (Namibia) for communal areas. The low calving percentage for communal areas could be attributed to low nutritional levels, lack of adequate procedure

in the selection of bulls, unplanned breeding including wide bull: cow ratios, lack of adherence to disease control programmes and lack of mineral supplementation.

The 61% calving rate on freehold farms compares unfavourably with the 80% reported by Forbes & Trollope (1991) for commercial areas. The reproduction efficiency on the farm Kgamadintsi was far better than in the communal area of Tshaneng, even though these two areas had equal numbers of cattle. This offers proof that farmers could implement management programmes on freehold farms even though the owner resides away from the farm and only comes there occasionally.

On freehold farms, there are opportunities because there is only one operator and a sole decision-maker. However, the calving percentage reported for freehold farms (61 %) is lower than figures for commercial farms and this is attributed to poor infrastructure development e.g. very large camps that are not properly maintained, few watering points (central points), low nutritional levels, lack of mineral supplementation and lack of disease control programmes and all these impedes the implementation of the recommended livestock management practices. Freehold farmers are largely absentee farmers so despite being sole decision makers, they do not always ensure implementation. Management is, by and large left to herders and this often leads to serious mistakes e.g. breeding of heifers too early or too late, non feeding of lick supplements and lack of early detection of diseases.

Table 4.3 Cattle reproduction and off-take for three respondents in three communal areas

Study Area	Calving %[1]	Weaning %[2]	% Offtake[3]
Dipodi	53	81	9
Ganyesa	61	89	9
Tshaneng	48	86	0
Mean	54	85	9

Calving %[1] = calves born x 100
cows mated

Weaning %[2] = calves weaned x 100
calves born

% Offtake[3] = cattle sold x 100
total herd

4.2.2 Weaning rate

The weaning rate of calves born in the communal areas of this study (Tables 4.3) was reported to be 85 % a figure which is higher than the one reported by Bembridge & Tapson (1993) for communal areas in the Ciskei and Transkei (28%). The lowest weaning rates were recorded for Dipodi (81%) in communal areas, while Ganyesa recorded a slightly higher figure (89 %) than on a freehold farm, viz. Fielden (88%). The high weaning rates in communal areas recorded in this study could be attributed to better livestock management practices adopted by the respondents. The higher weaning rates were recorded for Kgamadintsi (93 %) on freehold farms. Weaning rates on both freehold and communal farms were lower (Table 4.3 & 4.4) than reported for commercial farms by Forbes & Trollope (1991) at 95 %.

4.2.3 Mortality rate

The calf mortality in the study area was higher for communal areas (15 %) than for freehold farms (9 %). The present study revealed that more calves died at Dipodi (19 %) and Tshaneng (14 %) while Ganyesa recorded more or less similar figures as the two freehold farms, viz. Fielden (11 %) and Stickney (10 %). The herd mortality of 2 % reported in this study for both communal and freehold farms respectively, compares favourably with figures reported by Forbes & Trollope (1991) for commercial areas (2 %) and is lower than figures reported by Steyn (1988) and Nthakheni (1993) for Ciskei (34%) and Venda (45 %) respectively. The calf mortality rates of 15 % for communal areas and 9 % for freehold farms is considered too high especially with relatively low calving rates as recorded in this study.

Table 4.4 Cattle reproduction, and off take rates for three respondents on three freehold farms

Study Area	Calving %[1]	Weaning %[2]	% Offtake[3]
Kgamadintsi	73	93	49
Fielden	58	88	35
Stickney	51	90	38
Mean	61	90	41

Calving %[1] = $\frac{\text{calves born}}{\text{cows mated}} \times 100$

Weaning %[2] = $\frac{\text{calves weaned}}{\text{calves born}} \times 100$

% Offtake[3] = $\frac{\text{cattle sold}}{\text{total herd}} \times 100$

The major causes of mortality in younger calves may be due to the practice of separating the cow and calf during the night for milking the next day. This practice subject the calf to malnutrition due to unequal quantities of milk received daily as a result of hand milking for home-consumption, this upset the gastrointestinal tract and lead to diarrhoea and dehydration. This practice is also stressful in that the calf will be kraaled from birth and sometimes is never allowed access to water and or grazing. With this practice the calf is also denied the opportunity to consume sufficient quantities of colostrum, which enable it to withstand diseases prevalent in the area. However, added to these, is lack of implementation of disease and parasite control programmes. In a system where calves are separated from cows over night attempts should be made to provide additional/supplementary feeding to boost body mass at weaning.

The high mortality is a great loss to communal farmers in terms of the total number of calves lost when converted to cash. Although it is an acceptable practice among rural

people that the best way to dispose of dead cattle is to eat it (Lebitla la Kgomo Ke mpa), the calf meat is normally found unacceptable and tasteless and thus a dead calf is buried. The differences in calf mortality between communal and freehold farms show differences in the management of livestock over the two systems.

4.2.4 **Herd off-take**

In the present study herd off-take (Table 4.3) in the form of sales was high on freehold farms (41%) and (Table 4.4) low in communal areas (9%). On freehold farms animals that were sold were unproductive such as cows that had not conceived, weaners, steers and some old cows, but few heifers were found to have been sold. In communal areas animals that were sold included heifers , males and mature cows depending on what is available when cash is most needed. The time of selling mostly coincided with the festive season or beginning of the year for communal areas when cash is needed for school fees, while on freehold farms the animals were sold mostly during the beginning of the winter months immediately after weaning and identification of non pregnant cows.

On average, stock off-take in the form of slaughtering for funerals was low (1%) while no other form of cattle off-takes were reported. This study suggests that sales are the most common way of disposing of cattle. Off-take decisions are motivated by a variety of factors. The availability of marketable surplus and alternative sources of income was found to determine off-take rates. Smallholders are usually known to be price responsive (Van Renen, 1997), but access to markets is a major constraint in most cases.

It is suggested that herd size affects off-take, as this determine the availability of a marketable surplus. Low reproductive rates limit the numbers to be sold without decreasing the herd size. The reason for poor off-take in communal areas may be due to the desire to have increased numbers of animals (Steyn, 1982). However, Nkosi (1994) presented a strong argument that without proper marketing channels people in communal areas will remain reluctant to sell their livestock.

4.2.5 Herd composition

According to the present study, 57% of the herd in the communal areas (Fig 4.1) was comprised of the breeding cows as compared to 48% on freehold farms (Fig.4.2). However, Bembridge (1987) reported low percentages (34%) of cows in communal herds for Transkei. The high percentage of breeding cows in communal areas is a reflection of low reproduction and off-take rates, and also communal farmers are keeping high percentages of breeding cows deliberately in order to enhance their chances of increasing their herd numbers. It is evident from this study that even with a high percentage of breeding cows communal areas performed poorly in terms of reproductive rates and that the practice of culling sub- fertile cows is non existent. The percentage of breeding cows on freehold farms compares favourably with figures reported by Tapson & Rose (1984) for KwaZulu communal areas, and is in line with a figure (46,6 %) which is considered optimal in commercial herds (Department of economics and marketing, 1983).

farms (6 %) thus suggesting that these animals are The present study revealed that only a small number of steers were kept in both communal areas (9 %) and freehold retained only to be exchanged for heifers or to be used when there is a crisis within the family e.g. when there is immediate need for cash or when death has struck. More heifers were kept in communal areas (15 %) than on freehold farms (7 %) because in communal areas farmers are aiming to maximise their stock numbers.

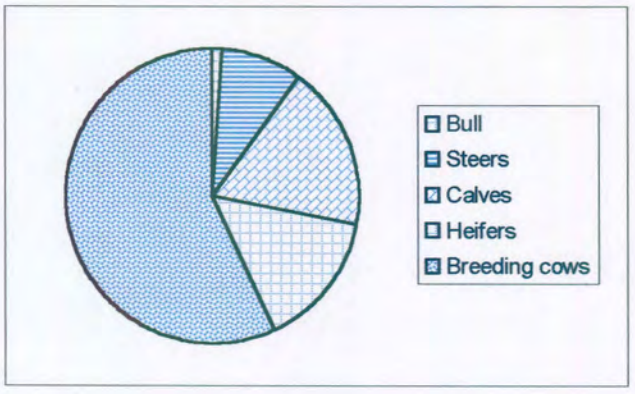


Figure 4.1 Herd composition in communal areas

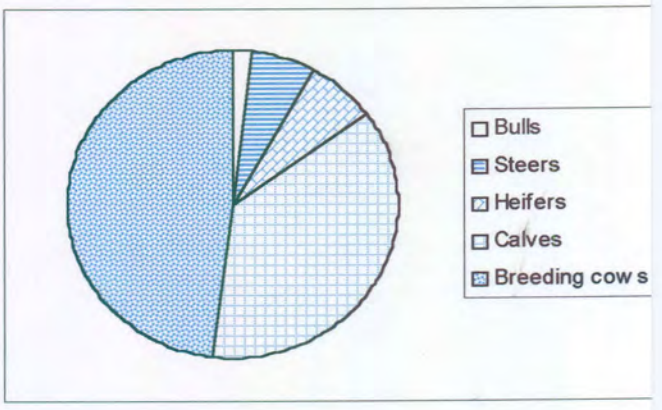


Figure 4.2. Herd composition on freehold farms

Table 4.5 Smallstock reproduction for three respondents in three communal areas (sheep)

Study Area	Lambing %[1]	Weaning %[2]	% Offtake[3]
Dipodi	63	89	5
Ganyesa	61	91	4
Tshaneng	0	0	0
Mean	62	90	5

Lambing %[1] = $\frac{\text{lambs born}}{\text{ewes mated}} \times 100$

Weaning %[2] = $\frac{\text{lambs weaned}}{\text{lambs born}} \times 100$

% Offtake[3] = $\frac{\text{sheep sold}}{\text{total flock}} \times 100$

Table 4.6 Smallstock reproduction for three respondents on three freehold farms (sheep)

Study Area	Lambing %[1]	Weaning %[2]	% Offtake[3]
Kgamadintsi	0	0	0
Fielden	69	94	4
Stickney	0	0	0
Mean	69	94	4

Lambing %[1] = $\frac{\text{lambs born}}{\text{ewes mated}} \times 100$

Weaning %[2] = $\frac{\text{lambs weaned}}{\text{lambs born}} \times 100$

% Offtake[3] = $\frac{\text{sheep sold}}{\text{total flock}} \times 100$

Table 4.7 Smallstock reproduction for three respondents in three communal areas (goats)

Study Area	Kidding %[1]	Weaning %[2]	% Offtake[3]
Dipodi	67	75	10
Ganyesa	77	87	3
Tshaneng	62	88	7
Mean	69	83	6

Kidding %[1] = $\frac{\text{kids born}}{\text{does mated}} \times 100$

Weaning %[2] = $\frac{\text{kids weaned}}{\text{kids born}} \times 100$

% Offtake[3] = $\frac{\text{goats sold}}{\text{total flock}} \times 100$

Table 4.8 Smallstock reproduction for three respondents on three freehold farms (goats)

Study Area	Kidding %[1]	Weaning %[2]	% Offtake[3]
Kgamadintsi	0	0	0
Fielden	85	93	3
Stickney	82	89	4
Mean	84	91	3

Kidding %[1] = $\frac{\text{kids born}}{\text{does mated}} \times 100$

Weaning %[2] = $\frac{\text{kids weaned}}{\text{kids born}} \times 100$

% Offtake[3] = $\frac{\text{goats sold}}{\text{total flock}} \times 100$

4.3 Flock performance

4.3.1 Lambing and kidding rates

The lambing and kidding percentage for communal areas within the study areas (Tables 4.5 & 4.7) was recorded at 62 and 69% respectively, while freehold farms (Tables 4.6 & 4.8) recorded 69 and 84% respectively, for both variables. However, other workers (De Haas & Horst, 1997; Havenga, 1997; Mahanjana, 1999) reported figures that are significantly higher than this study in their respective areas. The reason for the low lambing and kidding percentage in this study may be ascribed to lack of proper ram selection, low nutrition and low fecundity among ewes and does.

4.3.2. Weaning rates

The weaning rate of lambs and kids in the study was reported to be low (83 %) in communal areas (Table 4.7) and slightly higher (91 %) on freehold farms (Table 4.8). The low weaning rates may be attributed to the practice of separating the kids/ lambs from their mothers during the day. This practice denies the lamb/kids free access to their

mother's milk at the time when they want to suckle. In the absence of any additional feeding provided to the lambs /kids low growth rates are bound to result and this often lead to mortalities. The weaning rates in the study area revealed that more offspring were weaned on freehold farms than in communal areas.

4.3.3 **Flock and infant mortality**

High flock mortality of 13 and 9% in communal areas and 4 and 7% on freehold farms for sheep and goats respectively, was reported in the study area. The present study also revealed that more sheep died than goats in the communal areas than on freehold farms. The reason for such high mortalities among sheep could be ascribed to the fact that sheep succumb quite easily to diseases and parasites than do goats. The lamb mortality was also shown to be lower than the kid mortality for both communal and freehold farms . The reason for such high kid mortality may be due to poor breeding where lambs/kids are born during the time of the year when diseases are rife.

4.3.4 **Flock off-take**

Flock offtake in the present study (Tables 4.5 & 4.6) was 5 and 4% for sheep in communal areas and freehold farms, respectively. The offtake rate recorded for goats (Tables 4.7 & 4.8) was 6 and 3% in communal and freehold farms, respectively. The study further revealed that 23% of sheep offtake (wethers) were slaughtered for domestic use, while 77% was sold (wethers) to locals for cultural rituals in communal areas, while on freehold farms 76% was sold locally and 24% slaughtered for domestic use. The study also revealed that among the goats sold, 84% (kapaters) were purchased by locals for ritual purposes and 16% for domestic consumption. The present study revealed that more sheep were disposed of than goats even though the current prices for goats are higher than for sheep.

4.4. Discussion

The productivity of the livestock industry in Ganyesa is not realising its potential and makes a relatively small impact on the improvement of the lives of the rural people. It is clear from the present study that the extension services will have to change its techniques in their transfer of technology to the farmers. The present study revealed that the production performance within the study area was disappointing and that the whole production system in the communal and freehold areas needs to be revamped, so that it could start to benefit all members of the community, even those without livestock. The herd and calf mortality figures were 2 and 15 % respectively for communal areas and 2 and 9 % respectively for freehold farms and these were in line with figures reported for communal areas by Forbes & Trollope (1991). The death of a cow is not much of a loss in terms of cash as its meat is usually consumed or sold to the neighbourhood.

The present study revealed that the breeding cows constituted a high percentage in both communal (57 %) and freehold farms (48 %) indicating a fairly good herd structure. The high percentage of breeding cows in communal areas suggest that these farmers are aiming at maximising their herd numbers. A small numbers of steers is kept mainly to exchange for heifers with other farmers and/ or for use when there is a crisis.

In drier areas there is a strategy of keeping the breeding herd below 50 % of the total herd and increasing steers component to about 20 % in order to provide safety valve in the event of a drought when it becomes extremely difficult to dispose of nursing cows. This implies the implementation of a specific strategy aimed at marketing steers which in turn implies the need for farmers to become producers not mere livestock holders.

With regard to the profitability of different beef production systems, Louw *et al.*, (1977) found in a study in the north western Transvaal sweetveld bush-veld of South Africa, that under circumstances of low and variable rainfall, a 26 to 28 month ox production system generated the highest average income.

It emerged from this study that the weaning rates recorded for communal areas were higher than those by Bembridge & Tapson (1993) for Ciskei and Transkei and this suggests that there is potential to increase it even higher to improve the standard of living of the farmers. The calving rate in communal areas can be improved to much higher levels if a recommended breeding programme can be put in place, so that calves are born during the time when there is plenty of herbage for suckling cows to produce more milk and recycle again. A calf that is exposed to favourable conditions (more milk and treatment for diseases) is likely to have higher weaning weights than those that are not exposed to these chances.

Apart from the breeding program attention must be paid to the nutritional levels of breeding cows, fertility levels of breeding herds, adherence to disease control programme (May & T'Jonk, 1990) and feeding of mineral supplementation especially phosphorus (Read et al., 1986)

The reproduction figures for smallstock are much lower than those for cattle and maybe serious considerations need to be given to this area. The improvement in the nutritional levels of breeding ewes, adherence to recommended disease control programmes especially parasites, breeding policies and the introduction of improved sires will probably lead to desired results.

The results revealed that offtake rates were low and that few smallstock (sheep) were slaughtered for domestic use (77 %), while 23 % were sold for cultural rituals in communal areas. Freehold farms showed a different picture with 76 % sold locally and 24 % used for domestic purposes. This means that there is a market- oriented approach on freehold farms and very little in communal areas. There was however, the reluctance on the part of the farmers to exploit the goat market, because only a few goats were tendered for sale or slaughtered for home consumption.

4.5 Results of proximate analysis

Brand *et al.*, (1991) reported that chemical composition of pastures follows seasonal variation of rainfall trends. Various workers agreed that the CP content of grasses tend to decline with advanced plant maturity especially during winter when the plant is dormant (Elliot, 1967; Engels, 1967; Faure *et al.*, 1983; Cilliers, 1984; De Waal, 1990; De Brouwer *et al.*, 1993)

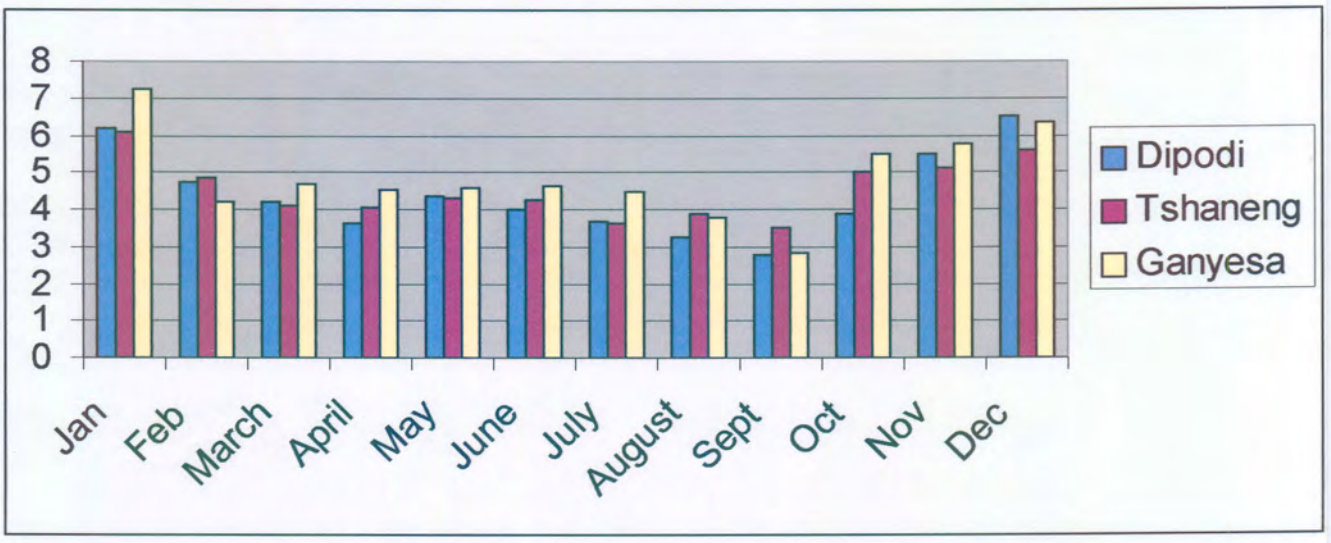


Figure4 3 Crude Protein values for grasses in the communal areas of Ganyesa

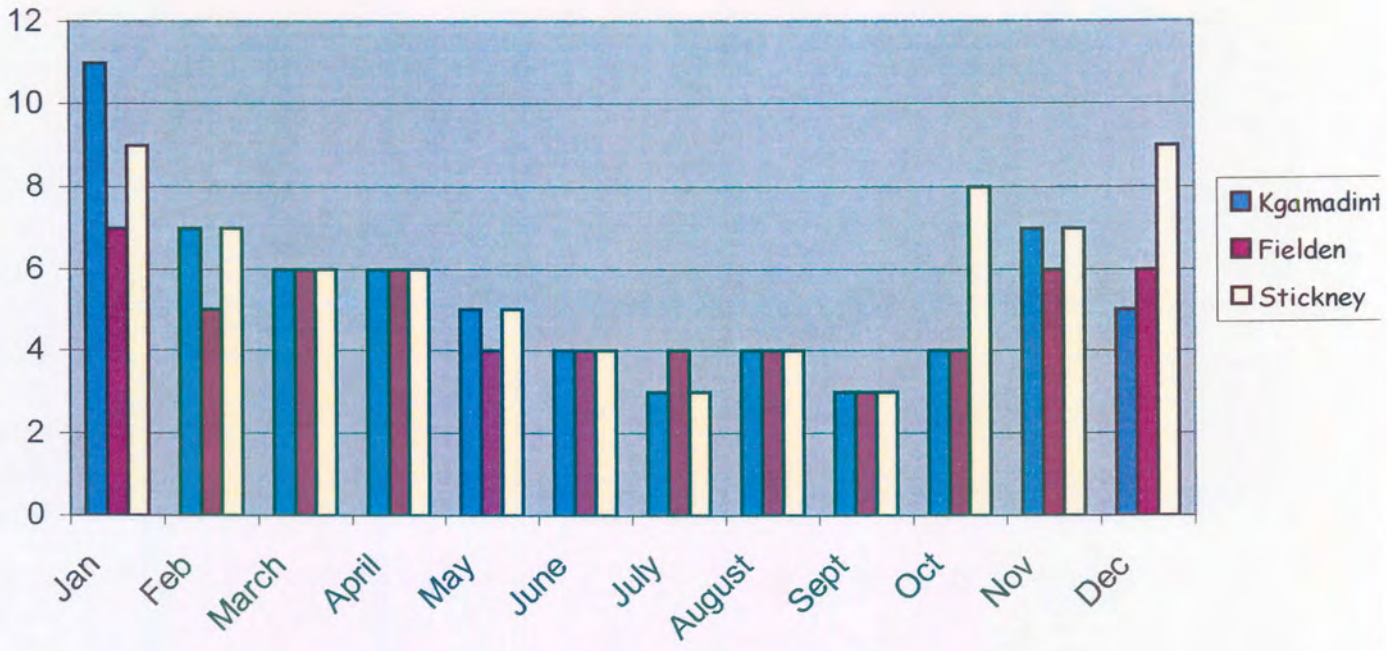


Figure 4.4 Crude Protein values for grasses on freehold farms

In the present study the crude protein content of grass samples was highest during December/ January

(± 9 %) and reached a low of ±3 % in September. The study revealed that the average CP content of grass samples was low at 3.0% of DM (Figure 4.3) in September for both communal areas and freehold farms. The results showed an increase in CP content starting from October and reaching the peak of about 7.2 % for Dipodi (Figure 4.3) in communal areas during December while freehold farms recorded 11 % for Kgamadintsi (Figure 4.4.) during January. The result further showed that there were no difference in CP content of grass samples for communal areas and freehold farms during winter and that only a slight difference in CP was noticed between the two areas during summer, with the former recording lower values than the latter in all cases. The low CP values for the study area could be a result of the extend of over-grazing taking place in the area which suggest that the leaves and seed bearing parts of the plant are badly defoliated and the stems containing very low CP level are left.

The increase in CP values from October to February could be ascribed to efficient precipitation received during these periods (Griffiths *et al.*, 1999; Le Roux *et al.*, 1999). Although the results of this study are in line with similar studies elsewhere (Faure *et al.*, 1983; De Waal, 1986; De Waal, 1990; De Brouwer *et al.*, 1993) the actual figures recorded for CP for this study were lower than the rest. The reason could be that those results were from government experimental plots where grazing conditions are not similar to those in communal areas. Also, some results were obtained through experiments carried out with oesophageal fistulated animals and thus eliminating the limitation inherent in using hand-cut samples (De Waal, 1990). This view emphasises the ability of ruminants to select food with a higher nutritive value. This suggests that although the samples recorded less than 6% CP content which is less than the animal requirement for maintenance (Mazengera, 1992), the animals may actually have been deriving sufficient crude protein for maintenance than otherwise suggested by the report. Another possibility may be that animals were resorting to feeding on pods of certain Acacia species, thus overcoming the protein deficit as reported in this paper (Dugmore & Du Toit, 1988).

4.6 Veld condition

In extensive grazing areas the outcome of a particular land use or management strategy cannot be predicted with any degree of certainty without proper assessment of the veld condition (Dankwerts & Teague, 1989). Veld condition is a term widely used to describe the condition of the vegetation in relation to some functional characteristics (Trollope et al, 1990). Stuart–Hill (1989) indicated that there are three reasons for conducting veld condition assessment, and of these, monitoring of vegetation change and prediction of stocking rates were found to be applicable to this study.

The method which is currently used to assess veld condition is based on the measurement of the species composition of the veld and its basal cover (Tainton, 1981). Danckwerts & Teague, (1989) prefer to class grass species according to their response to defoliation as either Decreasers or Increasers when assessing veld condition.

In this study grass species will be classified into desirability groups on the basis of palatability, production and ecological status (Kruger, 1998).

According to the data obtained in this study for communal areas, the percentage undesirable grass species (41%) was higher than the percentage desirable grass species (22%) suggesting that the area has been over-grazed (Table4.9). Tshaneng village (communal area) recorded the highest percentage (52 %) of the undesirable grass species with Dipodi and Ganyesa recording figures below 50 %. The study further revealed that Dipodi (23 %) and Ganyesa (22 %) recorded slightly higher percentages of desirable species than Tshaneng (21 %). Based on undesirable grass species these results suggest that Tshaneng should be more over-grazed than both Dipodi and Ganyesa. The undesirable grass component consists of grass species that are at pioneer stage of plant succession and are not at all palatable to cattle and are less productive. The undesirable grass species recorded in this study are *Aristida congesta, Aristida vestita, Pogonathria squarossa* and *Cymbopogon plurinodis.*

Table 4. 9 Classification of grass species within the study areas into undesirable, less desirable and desirable species

(a) Undesirable grass spp.

	Communal areas				Freehold farms			
Grass spp.	**Dipodi**	**Ganyesa**	**Tshaneng**	**Ave.**	**Kgamadintsi**	**Fielden**	**Stickney**	**Ave.**
Aristida congesta	37	21	55	38	15	15	48	26
Aristida vestita	39	17	49	35	19	19	27	22
Pogonathria squarossa	14	0	0	5	19	24	24	22
Cympopogon plurinodis	0	13	0	4	0	0	0	0
Total	90	51	104	82	53	58	99	70
Average	45	26	52	41	27	29	50	35

(b) Less desirable grass spp.

Grass spp.	Communal areas				Freehold farms			
	Dipodi	Ganyesa	Tshaneng	Ave.	Kgamadintsi	Fielden	Stickney	Ave
Aristida stipitata	36	34	26	0	18	16	28	21
Cynodon dactylon	0	0	0	33	10	0	0	3
Eragrostis	28	43	27	0	25	53	15	31
lehmanianna	0	28	0	9	30	24	0	18
Eragrostis pallens	0	28	0	0	0	0	0	0
Aristida meridionalis								
Total	64	105	53	74	83	93	43	73
Average	32	52	27	32	41	47	21	36

(c) Desirable grass spp.

Grass spp.	Communal areas				Freehold farms			
	Dipodi	Ganyesa	Tshaneng	Ave.	Kgamadintsi	Fielden	Stickney	Ave.
Schmidtia pappophoroides	35	33	28	32	40	25	40	35
Stipagrostis uniplumis	11	11	15	12	24	24	18	22
Total	46	44	43	44	64	49	58	57
Average	23	22	21	22	32	24	29	28

The basal cover in communal areas was poor with a high percentage of bare patches (Appendix 2). The tussocks were not close together and thus do not provide sufficient protection against erosion. With an average veld condition score of 33%, the communal areas were rated as very poor and the grazing capacity was estimated at 16 ha/LSU as compared to the present stocking rate of 6ha/ LSU. The results revealed that the basal cover for Ganyesa, Tshaneng and Dipodi was poor, with the lowest veld condition score of 25 % at Tshaneng and the highest for Dipodi (45 %) and Ganyesa (30 %). These results therefore support the suggestion that CP content of grass is low where veld is denuded.

On freehold farms the percentage less desirable grass species are higher than the desirable grasses (Table 4.9 b & c), suggesting that the veld is moderately over-grazed. The less desirable grass species are *Aristida stipitata, Cynodon dactylon, Eragrostis lehmanniana, Eragrostis pallens* and *Aristida meridionalis* and as the name suggest are less palatable and lower in ecological status than the desirable species. These are reported to form the

bulk of the diet of livestock in most parts of our ranches (Kruger, 1998). The study recorded the highest figure for undesirable species at Stickney (50 %) and Fieldin (29 %) and the lowest figure of 27 % for Kgamadintsi. On the other hand Kgamadintsi recorded a highest figure (32 %) for desirable species with Stickney and Fielden recording the lowest figures at 29 % and 24 % respectively.

The percentage desirable grass species was found to be lower than either undesirable or less desirable species in communal areas except at Kgamadintsi on freehold farms where desirable species were higher than either undesirable or less desirable speceis (Table 4.9c). The desirable grass species are *Schmidtia pappophoroides* and *Stipagrostis uniplumis*. These are highly palatable climax species but are very sensitive to changes in rainfall and increased stocking rates.

The basal cover on freehold farms was satisfactory with very little bare patches in places. With tussocks not sufficiently close together, thus providing insufficient protection against erosion. With an average veld condition score of 43% the veld on freehold farms was rated as poor and the grazing capacity was estimated at 12 ha/LSU.

Table 4. 10 Number largestock units per month on three freehold farms of Ganyesa

Farm (ha)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Kgamadintsi (910 ha)	118	118	118	118	118	91	91	91	96	110	118	118
Stickney (1925 ha)	228	233	233	230	226	211	195	200	203	210	228	228
Fielden (1850 ha)	185	196	196	196	195	195	161	161	161	157	175	194

4.11.1 Average stocking rates in hectares per large stock unit (ha/LSU) on the three freehold farms of Ganyesa

Farms	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	A
Kgamadintsi	7.7	7.7	7.7	7.7	7.7	10	10	10	9.5	8.3	7.7	7.7	8.
Sydney	8.4	8.3	8.3	8.4	8.5	9.1	9.1	9.6	9.6	9.2	8.4	8.4	8.
Fielden	10	9.4	9.4	9.4	9.5	9.5	9.5	11.6	11.5	11.8	10.6	9.5	10

The results of the study (Table 4.11) revealed that the two farms viz. Kgamadintsi and Stickney were slightly over-stocked at 8.5 ha/LSU and 8.8 ha/LSU, respectively. The other farm, viz. Fielden, was relatively stocked at 10.3ha/LSU, especially during the winter months. The fact that Fielden recorded less desirable grass species may be attributed to the fact that these species were not grazed and thus not stimulated to grow as much as was the case in Kgamadintsi and Stickney, which although slightly over-stocked recorded more desirable species. The low stocking rates at Kgamadintsi and Stickney during winter is due mainly to the fact that animals that are weaned and culled are placed for sale.

The practice of using fire during late winter to stimulate out of season green bite is also responsible for drastic deterioration of veld condition in Ganyesa . According to Trollope (1989) this practice is unacceptable especially in the sweet veld areas because it reduces vigour of grass sward and basal cover and exposes soil to erosion.

4.7 The dry matter production

Variation in DM yield and forage palatability occurs as a result of variation in rainfall and stocking rates in most semi-arid areas (De Waal, 1994; Behnke & Scoones, 1993). Furthermore, Fourie *et al.*, (1985) and Danckwerts & Stuart-Hill (1988) found that semi-arid grass veld is highly susceptible to droughts with the resultant limited dry matter production. Numerous workers (De Villiers *et al.*, 1994; Mentis, 1984; Kreuter *et al.*, 1984; Behnke & Scoones, 1993) have documented evidence of the negative effects of

continuous over-stocking and over-grazing on DM production potential and stability of the veld and also on animal production. According to Behnke & Scoones (1993) natural forage begins to decline when production of forage equals the rate of its consumption by the animals.

The present study revealed that the lowest DM production /ha was recorded from June to September in communal areas with the lowest figure recorded for Tshaneng (123 kg DM /ha) and Ganyesa (150 kg DM/ ha). The study further showed that the highest DM production/ha were reported from October to December with Ganyesa recording the highest figures (947 kg DM/ha) during October, and Tshaneng recording the lowest (633 kg DM/ha) figures for the same month (Figure 4.5.). However, overall the freehold farms produced more DM/ha than the communal areas (Figure 4.6).

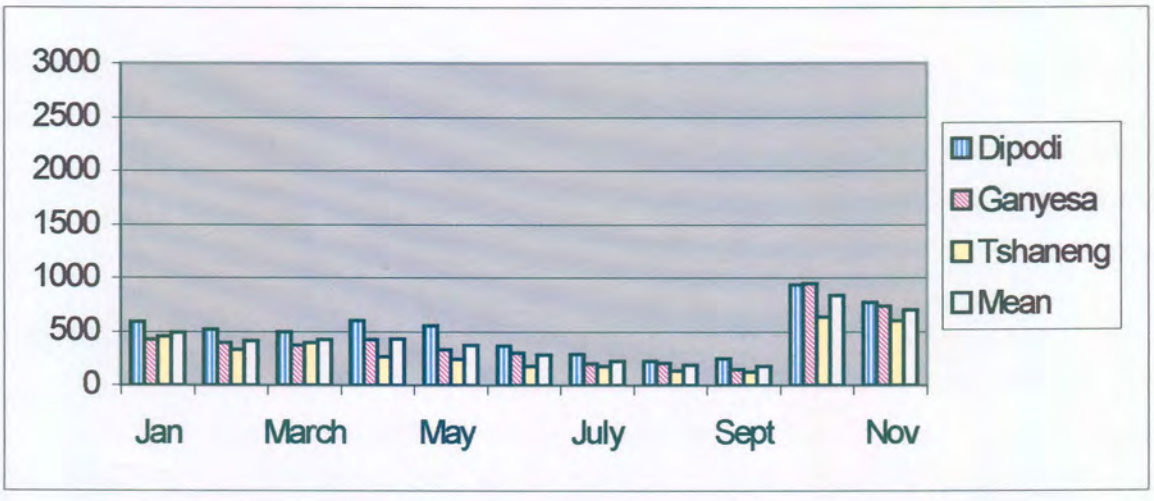


Figure 4.5 DM production per hectare per month in three communal grazing areas of Ganyesa (DM/kg/ha)

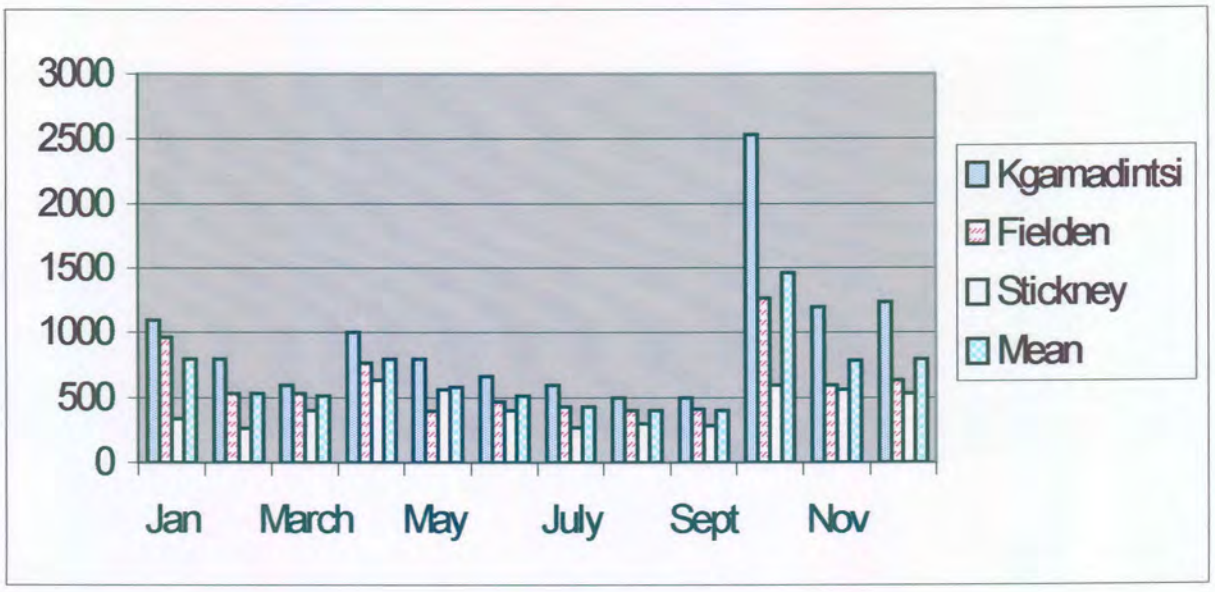


Figure 4.6 DM production per hectare per month on three freehold farms of Ganyesa (DM/kg/ha)

In the present study the highest DM was produced during the summer months (October-December) for both communal areas and freehold farms with a distinct low DM yield during July and August (Figure 4.5 & 4.6). These results are in agreement with those reported by De Waal (1990) for the Free State, which proved that weaning mass of calves decreased by 2,8 kg/week for calves born after October. This evidence suggests that calving season for beef cattle should commence in spring so that calf births coincide with emergence of spring growth.

On the other hand, there was a sharp decline in DM production/ha during the winter months due to the fact that the plant is dormant during this period (Fig.4 5 & 4.6). The areas with lowest DM production/ha were in the communal areas with the lowest figures recorded around July to August. The results for freehold farms followed a similar trend with July to August recording low figures and October to December highest figures. On freehold farms the study revealed that the lowest DM production/ha were recorded during July for Stickney (500 kg DM/ha). It was further evident in this study that Kgamadintsi

and Stickney (Figure 4.6) recorded higher DM/ha throughout the year than Fielden which also performed worse than Dipodi in communal areas (Figure 4.5).

The low DM production/ha in communal areas is in support of evidence provided by Behnke & Scoones (1993); De Villiers *et al.*, (1994); Kreuter *et al.*, (1984) and Mentis (1984) that over-grazing does adversely affect DM production/ha and this can also result in low levels of reproduction reported on earlier.

Table 4.12. DM production (ton/ha) per month on freehold farms

Farms	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Kgamadintsi	31.0	20.4	16.9	27.3	22.6	18.2	16.9	14.1	13.7	71.5	32.8	34.8
Stickney	55.2	27.5	30.4	42.3	22.4	25.8	24.7	22.8	22.8	72.8	33.1	36.1
Fielden	19.4	14.1	23.3	35.7	33.0	22.6	15.9	16.2	16.2	35.0	32.0	31.1

Table 4.13. DM requirements (ton/ha) per month for livestock on freehold farms

Farms	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Kgamadintsi	36.6	33.1	36.6	35.4	46.6	27.2	28.1	28.1	28.8	34.1	36.6	36.6
Stickney	57.3	54.8	60.6	58.7	60.5	44.2	49.9	49.9	48.3	48.7	52.6	60.0
Fielden	70.7	65.2	72.1	69.1	70.1	65.4	60.4	62.1	61.0	65.1	67.3	68.3

According to information provided in Table 4.12 less DM was produced than what is actually required by animals on freehold farms (Table 4.13). Although various workers (Danckwerts & Barnard, 1981; Mentis, 1984) suggested that there is a strong relationship

that exist between forage yield and veld condition score, Stuart-Hill (1984) argued that no such relationships exist in semi-arid areas. Maybe the best relationship could be found between the stocking rates (Table 4.11) and the DM requirements (Table 4.13), which clearly shows that at high stocking rates veld gets badly denuded and thus production *per se* is reduced which adversely affects animal performance.

The results revealed that Stickney (Table 4.12) was performing dismally with production for January to February and July to September disappointing, and animal requirements were triple that which was produced. Kgamadintsi and Fielden were not better than the former, emerging the better of the two where there was a small difference between what was required (35 kg) and what was produced.

4.8 Water quality

Livestock watering system can be adversely affected by the presence of certain WQCS, to the extent that water is rendered unsuitable for human/ animal consumption. Previously, watering systems that used asbestos and steel components encountered problems, especially clogging and corrosion but currently the use of PVC and PE components overcomes such problems.

The increase in pollution levels, intensity of livestock production systems and their expected production levels and economic returns have placed more emphasis on the essential need for good quality water, as a prerequisite for livestock watering (Meyer, 1998). Unfortunately, livestock producers tend to under-estimate the influence of water quality on livestock for various reasons.

Next to air and food, water is the most essential requirement for life and more fresh water is located underground. With increase in the number of population there is no doubt that the demand for drinking water for both livestock and humans will continue to rise. In assessing the quality of water, the variation in the environment in which livestock

production is practised is one of the main factors to consider. Quite often the ideal or desirable quality of water is not available for the majority of the time in many of the extensive ranges, and therefore, water with a quality less than the "ideal" must be acceptable. The maximum permissible level for many variables change accordingly, and therefore, it is important that the lowest or poorest quality that can be used be known before any steps are taken to improve it (Meyer, 1998).

Water quality guidelines can also change dramatically for different livestock species mainly because of the different environments in which they exist and the different tolerance levels related to the physiology of the species.

The water quality results conducted in the study area by Casey & Meyer (2000) revealed that all the samples except Dipodi recorded high strontium (Sr) values, with some also recording high zinc values (Table 4.14), indicating likely contamination of the borehole site. According to Casey *et al.*, (1998) such contamination could be quite recent or may be due to infrequent use of the borehole as indicated by high Ca-levels recorded in the drinking troughs. At the levels recorded in this study, strontium will most likely interfere with calcium metabolism (IAEA, 1966). Smith (1998) also reported that strontium levels below 1 mg/l may be protective of radioactive and as such desirable but some of the values obtained are in excess of this.

Table 4.14.Water quality results obtained from the boreholes in three communal areas of Ganyesa district(PHC)

Sample site	WQC	Results mg/l	TWQR MG/l	Species affected	Effects
Dipodi	TDS	351.1	0-1000	ALL	None
	Ti	0.286	0-0.1	ALL	None
	Se	0.003	0-50	ALL	None
	Sr	0.467	0-1000	ALL	None
	U	0.010	0-0.02	ALL	None
	Ba	0	0-0.5	ALL	None
	Zn	0	0-20	ALL	None
Tshaneng	TDS	854.6	0-1000	ALL	None
	Ti	0.594	0-0.1	ALL	None
	Se	0	0-50	ALL	None
	Sr	1.069	0-1000	ALL	None
	U	0.083	0-0.2	ALL	None
	Ba	0.741	0-0.5	ALL	None
	Zn	0.006	0-20	ALL	None

The study also recorded high levels of titanium (Ti) and barium (Ba), especially on freehold farms (Table 4.15) and this may indicate a possibility of industrial pollution (Quality of Domestic Water Supplies, 1998) for boreholes. The lower values recorded for Ti, Ba and Sr for the drinking troughs (Table 4.16) compared with those for the boreholes support the conclusion made by Casey *et al.*, (1998) that these boreholes are used quite infrequently.

Table 4.15 Water quality results obtained from boreholes on freehold farms of Ganyesa district (PHC)

Sample site	WQC	Results mg/l	TWQR	Species affected	Effects
Kgamadintsi	TDS	1293.7	0-1000	All	None
	Ba	1.157	0-0.5	All	None
	Ti	1.335	0-0.1	All	None
	Zn	1.381	0-20	All	None
	Sr	1.921	0-1000	All	None
	U	0.062	0-0.02	All	None
(COC)	Se	0.046	0-50	All	None
Fielden	TDS	1090.6	0-1000	All	None
	Ba	0.164	0-0.5	All	None
	Ti	0.633	0-0.1	All	None
	Zn	0.024	0-20	All	None
	Sr	1.529	0-1000	All	None
	U	0.037	0-0.02	All	None

Table 4.16. Water quality results obtained from drinking troughs on three freehold farms of Ganyesa district (HPC)

Sample site	WQC	Results mg/l	TWQR mg/l	Species affected	Effects
Kgamadintsi	TDS	696.1	0-1000	All	None
	Ti	0.447	0-0.1	All	Nor
	Zn	0.013	0-20	All	Non
	Sr	0.856	0-1000	All	Non
	U	0.049	0-0.02	All	Non
	Se	0.046	0-50	All	Non
(COC)	Ba	0.149	0-0.5	All	Non
Fielden	TDS	1197.3	0-1000	All	None
	Ti	0.845	0-0.1	All	None
	Zn	0.053	0-20	All	None
	Sr	1.650	0-1000	All	None
	U	0.045	0-0.02	All	None
	Se	0.005	0-50	All	None
	Ba	0.149	0-0.5	All	None
Stickney	TDS	3159	0-1000	All	None
			0-3000	All	None
	Ti	1.935	0-0.1	All	None
	Zn	1.375	0-20	All	None
	Sr	5.437	0-1000	All	None
	U	0.150	0-0.2	All	None
	Ba	0.005	0-0.5	All	None
	Se	0.062	0-0	All	None

The results further reported low values for Total Dissolve Substances (TDS) suggesting that water sources are palatable (Wilson, 1966). The implications for this are that livestock will preferably consume large quantities of water from these sources, with the resultant ingestion of potentially hazardous trace minerals as opposed to water with higher TDS values (Casey *et al.*, 1998).

The selenium (Se) values recorded for this study also suggested that the borehole had been abandoned due to adverse effects. Van Ryssen (1996) concluded that Se deficiency or toxicity cases are seldom reported in South Africa and that production losses due to marginal deficiencies could occur unnoticed. The uranium values obtained also posed a significant health risk when compared to guidelines by the Environmental Protection Agency (1996) and Quality of Domestic Water Supplies (1998).

Most of the borehole samples on freehold farms (Table 4.15) recorded high levels of Ti, Ba, Sr and Se as compared to the drinking troughs thus suggesting a possibility of industrial pollution due to infrequent use of these boreholes. On the other hand, lower values recorded for TDS at drinking troughs for both communal and leased farms suggest that animals will consume large quantities of water containing potentially hazardous trace minerals.

It is known that most of the water sources sampled may also be utilised by humans for drinking, food preparation and irrigation purposes. For many water quality constituents, the South African guidelines for domestic users offer stricter cut-off values, and none of the samples surveyed would be fit for long-term use by humans (Department of Water Affairs and Forestry, 1996).

4.9 Discussion

The results of the present study revealed that the CP content of grass in the Ganyesa district was low for both communal areas and freehold farms. The CP content were low in winter, reaching 3.0% for both communal areas and freehold farms and these values increased with the onset of rainfall in October only to reach a peak of 7.2% in communal areas and 11.0% on freehold farms during January. Although this study recorded CP-values of less than 6% during winter which is less than the animals requirement for maintenance, the only explanation one can give is the ability of animals to select food with high nutritive value (De Waal, 1990; Mazengera, 1992), and the limitation associated with hand-cut samples.

The results of the veld condition score revealed that communal areas had a higher percentage of undesirable grass species (41%) and lower percentage of desirable grass species (22%). The higher percentages of undesirable grass species suggest that the veld is not in a healthy state and need to be rested. The basal cover was poor with a high percentage of bare patches, and with an average veld condition score of 33% this area is rated as very poor and the grazing capacity is estimated at 16ha/LSU.

On freehold farms, the proportion of less desirable grass species are also higher (36%) than desirable grass species (28%). The basal cover was satisfactory with very few bare patches, and with an average veld condition score of 45% this area is rated as reasonable and grazing capacity is estimated at 12ha/LSU.

The study revealed that communal areas produced lower DM/ha throughout the year than freehold farms. The increase or decrease in DM/ha was linked with rainfall, with an increase in DM production during October to December and a decrease during June to September when the plants are dormant. Various authors e.g. De Villers *et al.*, (1994) and Mentis (1984) provided evidence to prove that over-grazing does adversely affect DM/ha

and this can negatively affect the reproduction performances of livestock. The present study suggest that these areas are actually producing less than what the animal requires.

Most researchers regard the nature of the present land tenure system as the main reason for land degradation. Bennett (1984) maintained that the combination of individual herd ownership and communal grazing land is seen as the root of the over-grazing problem. He argued that the introduction of fences and demarcation of grazing areas eroded a system of collective responsibility for basic resources that existed before.

There are, however, some opportunities inherent in communal grazing systems that can be explored and used to the benefit of all the community members. In most communal areas it can be argued that there is maintenance of tribal unity and authority. This is not applicable to some communities especially where traditional leadership is lacking. Where there is such unity and authority it is quite possible to get the community to agree on how best to utilise their resources to the advantage of all.

There is also an opportunity for elderly tribesmen to obtain rights of use to tribal land for a subsistence level of income. This also prevents the possibility of certain individuals becoming greedy landowners while the majority of the people are landless. And lastly, it provides the opportunity for development of a collective nature (Afful, 1995).

In assessing the water quality, the variation in the environment in which livestock production is practiced, is one of the main factors to consider. Quite often the ideal or desirable water quality is not available for the majority of the time in many of the extensive ranges, and therefore water quality less than the 'ideal' must be acceptable.

The results of the study revealed that all samples except for Dipodi recorded high strontium (Sr) values, indicating likely contamination of the borehole site. Such contamination may be due to recent rainfall or due to infrequent use of the borehole. The high levels of titanium (Ti) and Barium (Ba) on freehold farms may indicate a possibility of

industrial pollution of boreholes. The lower values for Ti, Ba and Sr for drinking troughs compared with those of the boreholes, support the conclusion that these boreholes are used quite often. Most of the water sources sampled may also be utilised by humans for drinking, food preparation and irrigation purposes with detrimental effects.

CHAPTER 5

SUMMARY AND CONCLUSIONS

Although large variations in climate occurs, Ganyesa is well suited for livestock farming with very little cropping taking place. But because of poor management of resources, resulting in over-stocking, this area can now be described as being of low grazing potential. The situation in communal areas is different from that on freehold farms, and this is because this study concentrated on leader farmers whose level of skills and knowledge was assumed to be on par.

The result of this study support evidence in literature which suggests that communal areas are overgrazed, and the primary aim of livestock owners in these areas are security, saving, subsistence and that these aims will remain logical for them unless their production goals change (Abel, 1993). On communal areas if there is no agreement among livestock owners to reduce stock (Düvel & Afful, 1994), it is only rational for each of them to enter drought with as many animals as possible, so that the chances of herd survival are increased. Another reason for overstocking is due to a few animals been kept by many livestock owners and the fact that those who hold many animals are politically powerful and can halt any attempts directed at reducing stock, while those with few animals, to reduce, would plunge them deeper into poverty.

The communal farmer in Ganyesa does not operate alone in making decisions regarding the management of the grazing resource. Various authors demonstrated that the communal grazing system discourages investment in land improvement (Parson, 1971; Barrows, 1973) and because there is no individual ownership attached to communal grazing areas, land is very seldom seen as an economic production factor which has to be used optimally in order to ensure success (Afful, 1995). Consequently, there is lack of improved agricultural productivity due to inability of farmers to implement recommended livestock management programmes e.g. application of rotational grazing/ resting,

adherence to breeding programmes, adherence to disease control programmes, and mineral supplementation.

5.1 Livestock production

The present study recorded low calving rates for freehold farms when compared to commercial farms whereas the calving rates for communal areas were higher than those reported elsewhere. The herd and calf mortalities could be attributed to diseases, theft and predation especially among smallstock. The weaning rates were higher in communal areas than figures reported for other areas, and this may be attributed to the fact that those are leader farmer and as such are early adopters of technology. The difference in calving and weaning rates in communal and freehold farms show differences in control over livestock. High offtake rates were recorded for freehold farms than communal areas.

The higher percentage of breeding cows in communal areas suggest that farmers aim to maximise their herd numbers. The results reveal that only few steers were kept mainly for exchange with heifers. On freehold farms the ultimate goal for keeping livestock should be profit orientated. Farmers on such farms must be encouraged to adopt technologies with greater economic returns like correct culling and selection practices, adherence to parasite control programmes, better knowledge on market dynamics, improved nutrition and use of improved sires, but infrastructure development must be improved. In communal areas none of the above goals will be attained without a system of collective responsibility towards use of resources.

The high mortality rates were recorded in communal areas than on freehold farms these were attributed to deaths due to parasites and diseases, theft and predation. The lambing and kidding percentage for communal areas was lower than figures recorded for freehold farms. The weaning records in this study revealed that more offspring were weaned in freehold farms than on communal areas. Low offtake rates were recorded for smallstock for both communal and freehold farms, with low numbers slaughtered for home consumption in communal areas and high numbers sold locally for cash on freehold farms.

There has been very little evidence to suggest that there was effort on part of communal farmers to improve their present livestock management practices. The practice of planned breeding where there are enough and competent bulls, is absent. The practice of allowing the bulls to be with the cows for a unspecified period is also disturbing. This result in cows calving in winter months, a period when stocking rates are high to grazing availability and quality.

5.2 Veld production

Overgrazing which manifested itself in the form of poor dry matter production, leading to inadequate dry matter intake by animals was highlighted in this report. Over-grazed veld have insufficient herbage that is also deficient in nutritive value. This study have indicated that there are inadequate DM production per ha and insufficient CP content in grasses especially during the winter months. There was clear indication of the decrease in percentage desirable grass species and an increase in percentage undesirable species with high bare patches especially in communal areas signifying over-grazing.

The results from this study revealed that although producers tend to under-estimate the influence of water quality on livestock production, poor water quality has been reported to result in poor livestock performance or even diseases. The results of this study revealed that some of the boreholes may be contaminated due to infrequent use of the borehole. The high levels of Ti and Ba on leased farms also suggested that there may be a possibility of industrial pollution. The results revealed, that most of the water sources that were sampled may also be utilised by humans for drinking, food preparation and irrigation with potential ill effects.

Camps unavailability rendered rotational grazing and resting impossible. But there is evidence from the Department of Agriculture officials that even if infrastructure is

provided the community does not regard it as theirs and it get vandalised, and no one comes forward to account.

The major problem identified on freehold farms was the lack of commitment/presence of farmers on the farms to ensure the smooth running of these enterprises. The reason these farmers are always absent is because they are engaged in other income generating activities because they are not sure what will happen to this land at the end. Although, there was a commitment from government from the beginning that they are the first to be given the option to buy, government have been silent on illegal squatting by farmers on legally leased freehold farms.

Another constraint identified in both communal and freehold farms was lack of infrastructure e.g. handling facilities, livestock watering points and fencing to enable efficient veld utilisation and application of recommended livestock management practices. Farmers in both communal and freehold farms also faces problems with regard market (which are too far), credit facilities (credit worthiness), cooperatives to get inputs.

It is important for livestock owners to recognise shortcomings in the traditional approach of managing communal areas. Such recognition will result in these farmers aspiring for change and they will be committed to adhere to such changes. The local people must therefore, act together to form the rule and regulations that will govern the use of the grazing resource.

Various authors believed that (Simpson, 1984; Bennet, 1984) the present dilemma in addressing the livestock development in communal areas should focus on land tenure, subsistence and commercial mode of production, and group farming/ranching (Schmidt, 1991).

Subsistence farming as practiced in communal areas has been reported to be far below standard when compared to commercial farming. No formal management programme was followed in the communal areas as dehorning and castration of calves were done when

they were already five to six months old. On commercial farms some forms of livestock management were evident.

On freehold farms the ultimate goal for keeping livestock should be profit-oriented. Farmers on such farms are therefore encouraged to adopt technologies with greater economic returns like correct culling and selection practices, adherence to parasite control programmes, better knowledge on market dynamics, improved nutrition and the use of improved sires. In a subsistence form of production none of the above goals will be attained due to the absence of a system of collective responsibility towards the use of resources.

CHAPTER 6

RECOMMENDATIONS

In view of the results obtained and observations made, the following recommendations may go a long way to address constraints identified. The first step that needs to be taken is to address the question of land tenure by both traditional leadership and politicians. Policy should be formulated to regulate the use of communal grazing areas and the following are a few options that could be investigated.

6.1 Establishment of grazing schemes

It has been widely observed that communal farmers cannot continue to operate as individuals in making decisions regarding their flock or herds. Recommendations for destocking proved unrealistic in the past because no incentives were provided for those who comply and deterrent for those who do not (Vink & Van Zyl, 1993). The major problem in communal areas is that too many households are keeping too few animals. With the establishment of grazing schemes it was envisaged that the communities would be able to manage and conserve their rangelands as they will bear the costs and benefits (Bembridge & Tapson, 1993).

In establishing grazing schemes two approaches can be followed, viz.:

(a) A system whereby grazing rights are registered and permits issued by the tribal authority to ensure equitable distribution of benefits among users and can act as a source of income for non-livestock owners. Livestock owners with large herds will be encouraged to commercialise their production. The system of grazing rights will ensure that all members of the community would have an equal and marketable right, irrespective of land ownership (Shone, 1993).

(b) Another system would be to make each adult member of the community a shareholder in all communal assets, viz. grazing land, water supplies, infrastructure for livestock, wood, fuel, etc. This requires community agreement

and economic criteria and rules for the exchange of grazing rights. There will need to be an upper limit on the grazing rights held by any household.

6.2 Tribal ranches

This concept was adopted in the former Bophuthatswana homeland as a form of development intervention, which could maximize the productive value of land. With this intervention (Perkins, *et al.*, 1991), livestock owners in the community were expected to display some sort of commitment and a sense of belonging to the project by paying a user charge or levy proportional to the size of their herd. It was hoped that such a levy would discourage the participants from keeping unproductive stock and thus contribute to destocking. The spin-off from this concept could be seen in the development of both the human and institutional resources in order to ensure greater economic benefits to participants and the community directly involved. This concept involved the provision of livestock infrastructure by government in the form of camps, cruh pens, dip tanks and water etc. to participants in the project to facilitate the application of sound livestock and veld management practices. Stock reduction is encouraged by providing incentives or subsidy for those who are found to be keeping to the recommended stock numbers.

6.3 Group ranches

The introduction of group ranching is an alternative approach that can be applied on leased farms. These farms can be divided into units of 1000 ha and allocated to stock farmers from the neighbouring villages to lease. As it is now, these farms are not used mainly due to the fact that farmers lack the necessary skills to run them economically. Furthermore, farms of this size require that the operators be personally involved in decision making regarding their management or someone with the necessary skills be charged with the responsibility to manage them.

But with smaller units, more people will be accommodated and because they will be sharing a unit, they may encourage each other to get involved. A group ranch is a production enterprise in which a group of people jointly have title to land, organise to

market their produce together, herd their stock collectively and continue to own the livestock as individuals. Stock owners participating on group ranches should only be allowed to lease these units for a certain number of years (e.g. 10 years), thereafter he/she should be in a position to buy his/her own piece of land on the open market.

6.4 Land ownership

One of the solutions to address the question of land tenure in Ganyesa is to privatise all state land in the area, more so because the state find it expensive to maintain such farms. By privatising state land, access to farm land would be given to communal stock farmers with proven knowledge in farming and willing to buy land and engage in farming on a full-time basis. In disposing off such land, the state must ensure that people, who can afford it, do not grab more land than is necessary.

6.5 Privatisation of grazing rights

Although the communal grazing areas have a number of inherent weaknesses, it will be unwise to do away with the system altogether. Some radical changes need to be introduced into the system to make it more beneficial to all members of the community. With this approach the grazing capacity of the area is first established and the exact number of LSU's the area can carry are divided by the total number of members of the community to determine the grazing rights each member is entitled to. All household heads of the community, irrespective of whether they own livestock or not, will receive equal grazing rights with those who own livestock. Those who do not have live stock or do not want to use all their grazing rights, will then lease them to those who need them.

It is for the Tribal Authority and the Communal Land Management Committee to decide on the value of the grazing rights. Because the recommended carrying capacity of the Ganyesa area is 10 ha/LSU, it will only be proper to allocate grazing rights according to 10 ha units so that it can become easy for the authorities to determine charges. All members allocated grazing rights will be expected to pay R5-00 per ha per year to the Tribal Authority for the administration and maintenance of the infrastructure within the

grazing resource. For community members who do not own livestock, they can lease their rights to others at R10-00 per ha per year so that they can afford to pay the levy and be left with profit. This concept is very similar to the democratic company model as described by Reynolds (1993).

The major shortcoming associated with this approach is that no provision is made for new entrants, i.e. young members from within the community or people moving in from outside and seeking residential rights in the community. But because rural people always know what their principle problems are (Viet, 1993), with strong leadership and dedication and desire to solve problems, meet priorities and take advantage of opportunities, they can succeed (Behnke, *et al*, 1993).

6.6 Institutional support

Extension services need to be improved so that greater emphasis is placed on more people centered, adaptive type of extension approach that work towards greater participation of rural communities. There is a need to work through existing structures in establishing rural organisations and leaderships. The existence of strong structures is important in creating awareness, leadership development, horizontal communication, group cohesiveness and other group attributions which can enhance the ability of rural people to identify, prioritize and solve their own problems. The main task of the Extension Officer is to identify useful information regarding the upliftment of the rural communities, as well as encouraging active participation and developing links with external organisations (Bembridge & Tshikesho, 1992).

The farmer's first and most frequent point of contact with the extension system is with the extension agents. These front staff have limited formal training, but they do have one particular advantage in that they can interact with farmers on a daily basis. This potential capacity for acquiring local knowledge and determining the needs of the farmers is very often neglected and rarely acknowledged. Yet, extension agents should be critical

facilitators in development activities and efforts should be made to stimulate and motivate them.

There are several ways in which extension staff can be empowered (Cheatle, 1993; Segerros & Cheatle, 1993), viz.:

- Training extension agents in how to listen and learn from farmers.
- Encourage improved reporting of field conditions and responses.
- Organise regular in-service-training in participatory development and sustainable livestock production.
- Develop PRA for routine investigations and monitoring and thereby involving researchers and extension supervisors in regular collaborative work with frontline staff.

There is however a need for in depth research on livestock production potential especially in semi- arid areas. The research should focus on soil, veld and livestock production potential and also the human potential.

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APPENDIX 1 (a)

GANYESA SURVEY : CATTLE
Farmer :.....
Date of visit :

	<7 mo			7-12 mo			12-24 mo			> 24 mo			TOTAL	REFERENCE CODES
	M	C	F	M	C	F	M	C	F	M	C	F		
CARRIED OVER														
Entries														
Born														
Brought														
Bartered														
Other														
TOTAL														
LOSSES														
Died														
Sold														
Slaughtered														
Stolen														
Bartered														
Predator														
Other														
TOTAL														

GENERAL REMARKS	

APPENDIX 1 (b)

GANYESA SURVEY : GOATS
Farmer :.....
Date of visit :

	<7 mo			7-12 mo			12-24 mo			> 24 mo			TOTAL	REFERENCE CODES
	M	C	F	M	C	F	M	C	F	M	C	F		
CARRIED OVER														
TOTAL														
Entries														
Born														
Brought														
Bartered														
Other														
TOTAL														
LOSSES														
Died														
Sold														
Slaughtered														
Stolen														
Bartered														
Predator														
Other														
TOTAL														

GENERAL REMARKS	

APPENDIX 1 (c)
GANYESA SURVEY : SHEEP
Farmer :.....
Date of visit :

	<7 mo			7-12 mo			12-24 mo			> 24 mo			TOTAL	REFERENCE CODES
	M	C	F	M	C	F	M	C	F	M	C	F		
CARRIED OVER														
TOTAL														
Entries														
Born														
Brought														
Bartered														
Other														
TOTAL														
LOSSES														
Died														
Sold														
Slaughtered														
Stolen														
Bartered														
Predator														
Other														
TOTAL														

GENERAL REMARKS	

APPENDIX 1 (d)
GANYESA SURVEY : HORSES
Farmer :.....
Date of visit :

	<7 mo			7-12 mo			12-24 mo			> 24 mo			TOTAL	REFERENCE CODES
	M	C	F	M	C	F	M	C	F	M	C	F		
CARRIED OVER														
TOTAL														
Entries														
Born														
Brought														
Bartered														
Other														
TOTAL														
LOSSES														
Died														
Sold														
Slaughtered														
Stolen														
Bartered														
Predator														
Other														
TOTAL														

GENERAL REMARKS	

APPENDIX 1 (e)
GANYESA SURVEY : DONKEYS
Farmer :.....
Date of visit :

	<7 mo			7-12 mo			12-24 mo			> 24 mo			TOTAL	REFERENCE CODES
	M	C	F	M	C	F	M	C	F	M	C	F		
CARRIED OVER														
TOTAL														
Entries														
Born														
Brought														
Bartered														
Other														
TOTAL														
LOSSES														
Died														
Sold														
Slaughtered														
Stolen														
Bartered														
Predator														
Other														
TOTAL														

GENERAL REMARKS	

APPENDIX 1 (f)

REFERENCE:	
FARMER:	
DATE:	
SPECIES:	
AGE:	
SEX:	

DESCRIPTION OF EVENT:

REASONS FOR EVENTS

Reference code .....

Cross- reference information given by farmer .....on (date).....with regard to (species).....

1. Entry
   a. Born
   b. Bought
      i. Reason for buying
      ii. Price paid
   c. Bartered
      i. Reason for bartering
      ii. What was exchanged

d. Other

2. Losses
   a. Died
      i. Reasons for death
      ii. Was medication given
         (1) If so what medication/
      iii Was a veterinarian consulted/
      iv. Was an extension officer consulted/
   b. Sold
      i. Reason for selling
      ii. Price obtained
   c. Slaughtered
      i. Reason for slaughter
   d. Stolen
   e. Bartered
      i.. Reason for bartering
      ii. What was exchanged
   f. Predator
      i. Name of predator
   g. Other

APPENDIX 2

VELD CONDITION ASSESMENT

(Van Zyl E.A. 1986)

MAGISTERIAL DISTRICT: ..... RHF NO:..... LAND TYPE NO: .....
FARM TYPE :.....ASSESSOR:.....
SURVEY POINT/CAMP.....DATE:.....

A. VEGETATION SURVEY

-indicate positive condition
-motivation for better score

PLANT TYPE	DESIRABLE	LESS DESIRABLE	UNDESIRABLE
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
TOTAL.			
% OCCURRENCES			

B. VISUAL ASSESSMENT

1. VEGETATION COVER

CRITERIA	YES	NO
Are there any bare patches/		
Are plants close enough together/		
Is cover stable, i.e. perennial		

Cover		Score
Very poor:	Many bare patches	0-3,5
Poor:	Bare patches	3,5- 4,5
Satisfactory:	Almost no bare patches Tussocks not close together	4,5- 5,5
Good:	Tussock close together	5,5- 6,5
Very good:	Tussock touching	6,5- 7,5
Excellent:	Soil not visible Tussock not distinguishable	7,5- 10

Score allocated =.....
Score allocated x 10 = ...(a)

2. BOTANICAL COMPOSITION

CRITERIA	YES	NO
Are desirable perennial grass species plentiful?		
Are there sufficient desirable perennial grass species?		
Are there too many less- desirable and undesirable plants?		
Are there more desirable than undesirable plants?		

Botanical composition	Score
Only undesirable plants	0- 3,5
Mainly undesirable plants	3,5- 4,5
Desirable and undesirable plants mixed	4,5- 5,5
Mainly desirable plants	5,5- 6,5
Only desirable plants	6,5- 10

DEFINITION OF DESIRABILITY CLASSES

Highly desirable:	Sturdy perennials, highly productive and very palatable
Desirable:	Perennials, palatable and highly productive, very palatable and less productive
Less desirable:	Perennials, unpalatable and highly productive; palatable and less productive
Undesirable:	Annual or weak perennial species, low productive

Score allocation = ...
Score allocation x10 =.....(b)

3. VIGOUR

CRITERIA	YES	NO
Are there dead or dead portions of tussocks : □ the perennial, desirable species? □ the undesirable species?		
Are there : □ sufficient young plants of the perennial, desirable species? □ few young plants of the undesirable species?		
Is there : □ sufficient new growth of the perennial, desirable species? □ little growth of the undesirable species?		

Vigour		Score
Very weak:	Mainly annual species and dead tussocks of the perennial species	0-3,5
Weak;	Numerous annual specie and partly dead tussocks of the perennial species	3,5- ,5
Satisfactory	Annual and perennial species	4,5- 5,5
Good:	Numerous perennials with perennial seedlings predominating	5,5 – 6,5
Very good:	Predominantly vigorous perennial plants	6,5 – 7,5
Excellent:	Only vigorous perennial plants	7,5 – 10

Score allocation = ...
Score allocation x 10= (c)

4. SOIL SURFACE CONDITION

CRITERIA	YES	NO
Are there any signs of soil loss: water or wind erosion, e.g. soil loss around the base of plants?		
Are there signs of drift sand?		
Is there sufficient organic material (litter) on the soil surface		

Soil surface Condition		Score
Advanced Deterioration:	Distinct erosion	0- 3,5
High degree of Deterioration:	Distinct erosion around tussocks, no organic material	3,5- 4,5
Moderate degree: Of deterioration:	Little organic material	4,5- 5,5
Slight degree of Deterioration	Moderate amount of organic material	5,5- 6,5
Insignificant : degree of deterioration	Sufficient organic material	6,5-7,5
No deterioration :	Soil surface covered with layer of humus	7,5- 10

Score allocation =.....
Score allocation x10 = ...(d)

5. INSECT AND/OR RODENT DAMAGE

CRITERIA	YES	NO
Are there signs of insect or rodent damage?		
Specify (e.g. termites, hares etc)		

Damage		Score
Very severe:	Tussocks totally ravaged	0- 3,5
Severe:	Only stems still visible	3,5- 4,5
Moderate:	Clipped leaves still visible	4,5- 5,5
Slight:	A few anthills or nest present	5,5- 6,5
Insignificant:	Not clearly visible	6,5- 7,5
None		7,5- 10

Score allocation =.....
Score allocation x 10 = ...(e)

6. VELD CONDITION SCORE AND GRAZING CAPACITY

The total veld condition score (V) is calculated as follows:

$$V = (a \times 0{,}3) + (b \times 0{,}3) + (a \times b \times 0{,}002) + (c \times 0{,}05) + (d \times 0{,}1) + (e \times 0{,}05)$$

V = (....x 0,3) + (.....x 0,3) + (....x...x 0,002) +(.....x 0,05) + (....x 0,1) + ...x 0,05)
= .....+.....+.....+.....+
= .....

where a = score allocation to vegetation cover
b = score allocation to botanical composition
c = score allocation to vigour
d = score allocation to soil surface condition
e = score allocation to insect and/or rodent damage

Grazing capacity (GC) is read off against the veld condition class and average rainfall for the specific area from Table 1.

TABLE 1: GRAZING CAPACITY IN HECTARES PER LARGE STOCK UNIT (HA/LSU) ACCORDING TO RAINFALL AND VELD CONDITION SCORE GRASSVELD IN THE CENTRAL SEMI-ARID GRASSLANDS

VELD CONDITION CLASS	VELD CONDITION SCORE	AVERAGE RAINFALL (MM/YEAR)																
		350	375	400	425	450	475	500	525	550	575	600	625	650	675	700	725	750
		GRAZING CAPACITY (HA/LSU/YEAR)																
Very poor	20	52,6	36,7	28,6	23,6	20,3	18,0	16,2	14,8	13.7	12,7	12,0	11,3	10,7	10,2	9,8	9,4	9,1
	25	42,1	29,3	22,8	18,9	16,3	14,4	13,0	11,8	10,9	10,2	9,6	9,0	8,6	8,2	7,8	7,5	7,2
	30	53,1	24,4	19,0	15,8	13,6	12,0	10,8	9,9	9,1	8,5	8,0	7,5	7,2	6,8	6,5	6,3	6,0
Poor	35	30,1	20,9	16,3	13,6	11,6	10,3	9,3	8,4	7,8	7,3	6,8	6,5	6,1	5,6	5,6	5,4	5,2
	40	29,3	18,3	14,3	11,8	10,2	9,0	8,1	7,4	6,8	6,4	6,0	5,6	5,4	5,1	4,9	4,7	4,5
Reasonable	45	24,4	16,3	12,7	10,5	9,0	8,0	7,2	6,6	6,1	5,7	6,3	5,0	4,8	4,5	4,4	4,2	4,0
	50	21,0	14,7	11,4	9,5	8,1	7,2	6,5	5,9	5,5	5,1	4,8	4,5	4,3	4,1	3,9	3,8	3,6
	55	19,1	13,3	10,4	8,6	7,4	6,5	5,9	5,4	5,0	4,6	4,3	4,1	3,9	3,7	3,6	3,4	3,3
	60	17,5	12,2	9,5	7,9	6,8	6,0	5,4	4,9	4,6	4,2	4,0	3,0	3,8	3,4	3,3	3,1	3,0
Good	65	16,2	11,3	8,8	7,3	6,3	5,5	5,0	4,5	4,2	3,9	3,7	3,5	3,3	3,1	3,0	2,9	2,8
	70	15,0	10,5	8,2	6,8	5,8	5,1	4,6	4,2	3,9	3,6	3.,4	3.2	3,1	2,9	2,8	2,7	2,8
Very good	75	14,0	9,8	7,6	6,3	5,4	4,8	4,3	3,9	3,6	3,4	3,2	3,0	2,9	2,7	2,6	2,5	2,4
	80	11,2	9,2	7,1	5,9	5,1	4,5	4,0	3,7	3,4	3,2	3,0	2,6	2,7	2,6	2,4	2,4	2,3

Sources : Fourie J. 1976. Selection chart Kruger J.A. 1985. A simplified technique to determine