HABITAT STUDY ON TOOYSKRAAL (ETOSHA) FOR INTRODUCTION OF WHITE RHINO AND BUFFALO

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BY

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INTRODUCTION

In the beginning the wildlife industry started mainly from the desire of some ranch owners to have a wildlife retreat for their own enjoyment (Bothma 2010). Today, wildlife ranches are a common sight in South Africa, covering an estimated 22.5 million hectares (Du Toit 2007). One of the main reasons for this rapid growth in the industry was the introduction of the concept of exempted wildlife ranches by some of the conservation authorities, followed by the transfer of ownership of the wildlife from the state to the ranch owner. Currently, a wildlife ranch with suitable fencing (based on minimum specifications set by relevant conservation authority) can qualify in some provinces for an exemption period of 3 years. The exemption permit then entitles the holder to hunt, capture and sell wild animals year-round.

Game ranch management and the management of nature reserves are the two facets of wildlife management. The intensity of management in nature reserves and game ranches depends upon the size of the area. The smaller the game ranch, the greater the intensity of wildlife management required. Wildlife management begins as soon as an area is demarcated as a unit on a map. No development, especially that of a larger nature, should take place before the limitations and potential of the environment have been thoroughly determined. The primary point of departure for wildlife management is an inventory of all the natural resources, including the presence and numbers of game in a given area (Bothma 2010). Key aspects of game and their habitat should be monitored so that trends will be noted in time, and management adjustments can be made accordingly. This is known as an active adaptive management plan.

According to Van Rooyen (2002), a monitoring program serves as an early warning system to detect changes or trends as a result of management actions, natural events or those areas where past mismanagement took place, with the goal to adapt the management strategy where necessary. In a natural environment there are a number of key components that give a reliable indication of how healthy the system is (Bothma & Van Rooyen 2002). Aspects related to these key components should be monitored regularly.

The introduction of herbivore species in the Limpopo Province is subject to the evaluation and approval of the suitability of the habitat. These species have very specific habitat requirements and the introduction thereof should first be evaluated by the Biodiversity Directorate. The purpose of this report is thus to give the results of a habitat analysis that was conducted on the farm TOOYSKRAAL in Limpopo, South Africa during May 2011. The report will serve as a guideline for the conservation authorities for approval of the introduction of certain herbivore species to the farm, specifically the following:

- *Ceratotherium simum* (White rhinoceros)
- *Syncerus caffer* (Cape buffalo)
- *Hippotragus niger* (Sable antelope)

STUDY AREA

FARM NAME:	TOOYSKRAAL 531
TOTAL SIZE:	1284 ha
Camps	
• **Western corner (not on map):**	Approximately 150 ha
• **Central camp:**	Approximately 50 ha
TOPOGRAPHY:	Flat area with drainage line
BIOME:	Savanna
VEGETATION TYPE:	Mixed Bushveld (Low & Rebelo 1998) Central Sandy Bushveld SVcb12 (Musina & Rhutherford 2006)
GEOLOGY:	Mostly granite with some sedimentary areas
WATER:	Perennial stream and artificial waterholes pumped from borehole

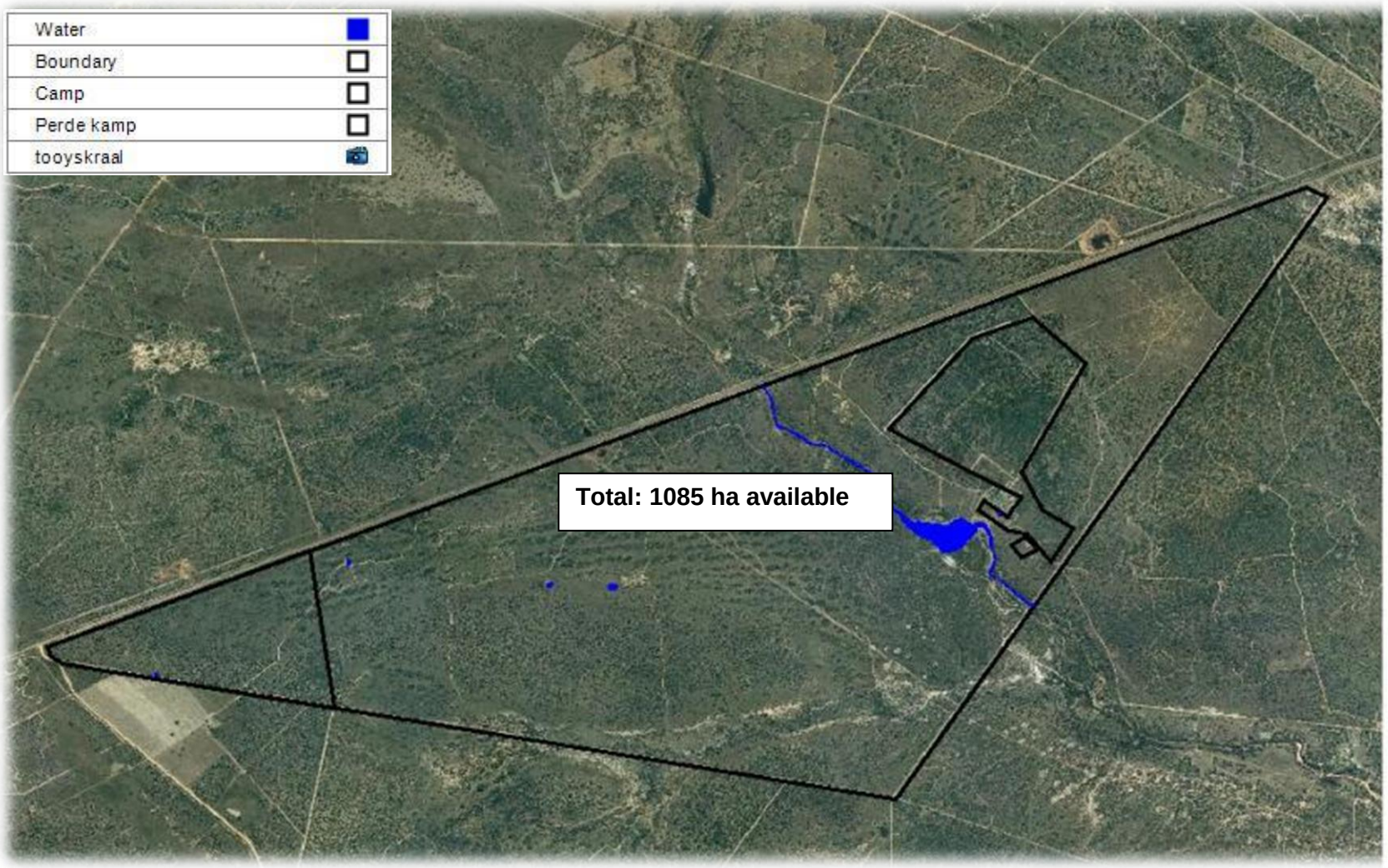

Figure 1: Fences and water distribution on Tooyskraal

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GENERAL INFORMATION

Water provision

Borehole with solar panel and tank

Artificial waterhole

Natural water hole

Permanent dam constructed in stream

Artificial through in Perde camp

Fencing

The entire farm is fenced with a 2.4 meter, 23 strand electrified game proof fence (see photo below)

PHYSICAL GEOGRAPHY, FAUNA AND FLORA OF STUDY AREA

The study area is located in the Savanna Biome. The Savanna Biome is the largest Biome in southern Africa, occupying 46% of its area, and over one-third of South Africa (Low & Rebelo 1998). Savanna is characterised by a grassy ground layer and a distinct upper layer of woody plants. Where the upper layer is near the ground the vegetation is sometimes referred to as Shrubveld, where it is dense, as Woodland, and the intermediate stages are locally known as Bushveld.

Within the Savanna Biome, altitudes ranges from sea level to 2000 meters above sea level, and rainfall are from 235 mm to 1000 mm per year. A major factor delimiting the biome is the lack of sufficient rainfall, which prevents the upper layer from dominating. Fires and grazing furthermore keeps the grass layer dominant and almost all species are adapted to survive fires, usually with less than 10% of plants killed by fire (Low & Rebelo 1998).

In general, the savanna regions of South Africa are the best game ranching area because of the large diversity of geology, soil, and vegetation types that can support a large diversity of grazers and browsers (Bothma 2002). In South Africa, the savanna vegetation type can be subdivided into four main types based on the floristic composition, namely:

- A fine-leaved or microphyllous type of savanna, which is dominated by *Acacia* species. It is found mostly on clayey soils, but also on the sands of the arid Kalahari region. These areas are generally known as sweetveld.
- A broad-leaved type of savanna, which is dominated by *Combretum* species and occurs mostly on sandy-loam soils of granitic origin. It is generally known as mixed or sourish-mixed bushveld.
- A mountain or sour bushveld type of savanna, which is dominated by broad-leaved species such as the wild seringa *Burkea Africana*, silver cluster-leaf *Terminalia sericea*, and Transvaal beech *Faurea saligna*.
- The mopane veld of Limpopo, which is dominated by the mopane *Colophospermum mopane*, the Lowveld cluster-leaf *Terminalia prunioides* and by species of the corkwood genus *Commiphora*.

According to Low & Rebelo (1998), the study area falls within the Mixed Bushveld vegetation type. This bushveld represents a great variety of plant communities, with many variations. The area comprises of undulating to flat plains at an altitude of 700 to 1 100 meters above sea level. Vegetation in the Mixed Bushveld varies from a dense, short bushveld to a rather open tree savanna. On shallow soils the vegetation is dominated by Red Bushwillow *Combretum apiculatum*. On deeper and more sandy soils, Silver Clusterleaf *Terminalia sericea* becomes dominant.

In the new classification of Mucina & Rutherford (2006), the study area falls within the Central Sandy Bushveld. This vegetation type occurs on low undulating areas, sometimes between mountains, and sandy plains and catenas supporting tall, deciduous *Terminalia sericea* and *Burkea Africana* woodland on deep sandy soil, and low, broadleaf *Combretum* woodland on shallow rocky or gravelly soils.

This area is highly suitable for game ranching, with a whole host of herbivores occurring in the region. The herbivores that occur naturally in this region are indicated in **Table 1**.

Table 1: Historical and present distribution of herbivores in the mixed bushveld of South Africa.

HERBIVORE	HISTORICALLY	PRESENT
Blesbok	X	√
Blue wildebeest	√	√
Buffalo	√	X
Burchell's zebra	√	√
Bushbuck	√	√
Bushpig	√	√
Common duiker	√	√
Eland	√	√
Elephant	√	√
Gemsbok	√	√
Giraffe	√	X
Grey rhebok	√	√
Hippopotamus	√	√
Impala	√	√
Klipspringer	√	X
Kudu	√	√
Mountain reedbuck	√	√
Ostrich	√	√
Reedbuck	√	√
Red hartebeest	√	√
Rhinoceros: black	√	X
Rhinoceros: white	√	X
Roan antelope	√	√
Sable antelope	√	√
Springbok	√	X
Steenbok	√	√
Tsessebe	√	X
Warthog	√	√
Waterbuck	√	√

MATERIALS AND METHODS USED

Dividing the area into homogenous units

Any particular game ranch can be divided into a mosaic of different habitat types or homogenous units. Homogenous units are units with the same plant species composition and structure and thus the same palatability, production potential and grazing/browsing capacity. Each of these habitat types again differs in their ability to sustain animals. The different homogeneous units and their total area on the ranch form the basis for determining stocking rates. The type of animals and the numbers of each type should be chosen in such a manner to prevent having a detrimental effect on the vegetation or soil. For this purpose, sampling sites are placed randomly within the homogeneous units, and surveys are carried out to assess each habitat in terms of its potential to sustain animals. It is thus of great importance that the homogenous units are identified correctly.

An aerial photograph obtained from the Google Earth Internet site (**Figure 1**) was used to divide the ranch into relatively homogenous units. The procedures of mapping out the vegetation communities by using various maps and aerial photographs are described in Bothma (2002). The first step is to become familiar with the total area of the ranch and its immediate surroundings. This was done by looking at the locality and physical geography, climate, geology and soil, vegetation, key environmental parameters, economic uses and conservation status as described in Low and Rebelo (1998) and Mucina and Rutherford (2006). After this, the aerial photograph was used to mark homogeneous units from an aerial view. The boundaries of the mapped units on the map was then subsequently verified in the veld, and changed, refined and adjusted where necessary. These final homogeneous units were then used for the completion of a map of the Study area. The total area of every individual homogeneous unit was then calculated, and is later used to estimate the grazing/browsing capacities and to evaluate the habitat for different types of game animals.

Veld condition and grazing capacity

The assessment of the veld condition is the first step towards the formulation of a veld management plan. Veld condition is regarded as the condition of the vegetation in terms of a functional characteristic like food production, resistance to soil erosion, physiognomical structure and the production of fuel for fire (Van Rooyen *et al.* 2002). For any ranch/reserve manager, it is crucial to know what the veld condition is in order to determine the grazing capacity and monitoring the effect of the animals on the vegetation. When determining the veld condition of every homogenous unit, the very first thing to do is to identify all plants present in the herbaceous layer and calculating their percentage composition. In the case of the herbaceous layer, the botanical composition of the grass sward is a good indicator of the inherent ability of the veld to produce forage for grazing ungulates (Trollope 1990).

Proportional grass species composition

The step-point method described by Mentis (1981) was used in order to determine the species composition and frequency of occurrence for the herbaceous layer in every homogenous unit. Measurement points were taken per homogeneous unit as marked on the map. Surveys was conducted along a 100 m line transect.

Surveys were done with a range rod by recording the species closes to the point of the rod with every step. For each homogeneous unit the cut-off distance for determining the nearest grass was taken as 30cm. Data was recorded on herbaceous survey sheets for further analyses.

Veld Condition score

To determine the veld condition of the area, the Ecological Index method (Vorster 1982; Danckwertz 1989) was used. Because the grazing value and ecological status of the different grass species differ from each other, the determination of veld condition rests on the plant species composition, especially of the grass species of a particular plant community. Different grass species react differently to grazing pressure, and are classified into different ecological status classes according to this. The current state of the veld can thus be evaluated on the presence or absence of these different types of grasses. By estimating the frequency of these grass species, the grazing capacity can be calculated. Grazing capacity depends on the veld condition and the rainfall of the particular habitat. Ecological status evaluation thus includes the classification of the grass species into groups on the basis of their reaction to grazing and fire. Van Oudtshoorn (1999) gives a subdivision

of grasses into ecological status classes. His definitions are as follows and were used in this study:

Decreasers: Grasses that is abundant in good veld, but that decreases in number when the veld is overgrazed or under grazed. These grasses are palatable climax grasses such as *Themeda triandra* and *Digitaria eriantha.*

Increaser I: Grasses that is abundant in under-utilised veld. These grasses are usually unpalatable, robust climax species that grow without any defoliation, such as *Hyperthelia dissoluta* and *Trachypogon spicatus.*

Increaser 2: Grasses that is abundant in overgrazed veld. These grasses increase due to the disturbing effect of overgrazing and include mostly pioneer and subclimax species such as *Aristida adscensionis* and *Eragrostis rigidior.*

Increaser 3: Grasses that are commonly found in overgrazed veld. These are usually unpalatable, dense climax grasses such as *Elionurus muticus* and *Aristida junciformis.* These grasses are strong competitors and increase because the palatable grasses have become weakened through overgrazing. In addition, it is possible that they are stimulated by light grazing during overgrazing.

Invader: Invaders are plants that are not indigenous to an area.

To determine the veld condition, a grazing value is allocated to each of the ecological status classes, or in certain regions to individual species. The most commonly used values that was also used here, are:

Decreasers…… 10
Increasers I……..7
Increasers 2……... 4
Increasers 3……... 1
Invaders……... 1

The sum of the percentage composition of each ecological status class multiplied with the weighted constant of each class represents an ecological index with a maximum value of 1000. An ecological index value of 0 – 399 broadly indicate poor veld, one of 400 – 600 indicates moderate veld and one of 601 – 1000 indicates good veld.

Ecological Grazing Capacity

Although it is recognised that it is impossible to accurately determine the grazing capacity of an area, it would appear as though the combined veld condition and rainfall method of Danckwerts (1989), and the modified veld-condition-index method of Bothma *et al.* (2004) are suitable for determining a first approximation of grazing capacity. The modified equation of Bothma *et al.* (2004) was used to determine the ecological grazing capacity of each homogenous unit. This equation incorporates range condition (veld condition score) the difference between the mean recent annual rainfall for the ranch measured over the past 2 years and the long-term mean rainfall of the South African savanna region, a topography index of habitat accessibility, the influence of fire on plant production, and the percentage grass cover. Grazing capacity is expressed in Grazer Units (GU`s). A Grazing Unit is the equivalent of a 180 kg animal that grazes exclusively. In South Africa, a blue wildebeest *Connochaetes taurinus* is commonly taken as 1 GU because it is an abundant, large herbivore with a mainly grazing diet.

The equation used to determine the grazing capacity is:

$$\text{GU/100 ha} = 0.547 \times \{[c + (r - 419) \times 0.23] \times a \times f \times (\log_{10} g - 1)^{0.4}\}$$

where

GU = grazer unit

c = the range condition index

r = the mean annual rainfall over the past 2 years at the ranch (mm)

419 = the mean long-term annual rainfall for the South African savannas (mm)

a = a topography index of accessibility – the degree of accessibility of the habitat to plains game on a scale of 0.1 – 1.0, with 1.0 = fully accessible

f = a fire factor on a scale of 0.8 – 1.0, with 0.8 = recent fire and 1.0 = no fire

g = the percentage grass cover

Ecological Browsing Capacity

The condition of the woody plants in a specific community is responsible for the browsing capacity of that community. The browsing capacity can be expressed as the number of animals of determined quality that can be supported by a habitat, with provision being made for specific, but not progressively increasing, impact on the natural resources (Van Rooyen *et al.* 2002). Browsing capacity is a function of many variables, including rainfall, management strategy and veld condition. It is also related to the browsable volume of trees and shrubs. For this reason it is possible to estimate the browse capacity of an area by determining the browsable volume per hectare contributed by trees and shrubs. Browsing capacity is expressed in Browsing Units (BU`s).

The Quantitative Description Index as described by Smit (1989a;1989b) was used to survey the woody plant communities in every homogenous unit. The survey was conducted in a belt transect of 100 x 2 m. With this method, the surveyor walks along a 100 m transect line with a calibrated range rod measuring 2 m held horizontally. All the rooted trees within the belt transect was identified and measured. The calibrated range rod was used to make measurements of the dimensions of all the trees rooted within a specific transect. Only live tree parts were used for measurements and were recorded on a survey sheet.

Data from the survey sheet was entered into the BECVOL computer program (Smit 1989a, 1989b). The total leaf mass for the survey area was then calculated and extrapolated to one hectare. This gave the leaf biomass in kilograms per hectare. The next step was to calculate the potential browse available for every homogenous unit as mapped. This was done by multiplication of the woody biomass with the total area of the particular homogenous unit. After calculating the total available browse, expressed in kilograms of dry leaf matter, and it has been calculated for a given habitat type, only 10% of that potential value should be used to set the actual browsing capacity (Bothma 2002). This is to compensate for the browse material out of reach of browsers; utilised by other animals and insects; and of what is left over, for retaining vigour and re-growth of the plant. The browsing capacity was calculated by dividing the amount left by the leaf dry mass requirements of one BU per year. To calculate the browsing capacity of each homogenous unit, the food requirements of a greater kudu, which is used as a BU reference value, was used. A greater kudu that weighs 140 kg (1 BU) would require an estimated 4.2 kg of dry leaf matter per day, or 1533 kg per year (Bothma *et al* 2004). It is important to remember that the stocking rate must always be conservative in order not to lead to the degradation of the habitat.

Determining stocking rates of suitable animals

The numbers of each species that can be maintained on the ranch were determined by allocating replacement values to each species. The replacement value for every animal stocked on the ranch is deducted from the total number of Grazer and Browser Units. The number of Grazer and Browser Units left can then be allocated to other animals, until the ecological capacity is reached. It is reached when no more Grazer or Browser Units are left to allocate. The types of animals to be stocked are dependent on the habitat requirements of the different species, as well as the objectives, preferences and available money of the owner or manager of the ranch.

In the current agricultural use in South Africa, carrying capacity is the area of land required to maintain a Large Stock Unit (LSU) in order to achieve maximum profit in the short term, while maintaining the condition of the vegetation and soil in such a way as to be able to fulfil the needs and aspirations of future land users (Danckwerts 1989). In Africa, wild bovid herbivores have evolved in adaptation to a wide spectrum of habitats and can be classified into six different basic dietary classes, based on their food preferences. Many of these animals furthermore switch their diet between seasons, depending on the quality and quantity of the various resources available. Broadly speaking, however, wild herbivores are either grazers, browsers, or a combination of them. The different feeding classes that can be distinguished are thus:

- Bulk (non-selective) grazer – large grazing animals; graze rough grasses with a high fibre content, normally do not exercise a wide degree of selective grazing.
- Concentrate (selective) grazer – generally small grazing animals; select certain plant species and/or certain plant parts.
- Mixed feeders – animals eating both grass and browse.
- Browser – animals that feed mostly on leaves, flowers, and fruits of woody plants and forbs.

Because of this, it was suggested that grazer stocking rates should be expressed as a grazer unit (GU), defined as the metabolic equivalent of a blue wildebeest with a mass of 180 kg that grazes exclusively. The browser unit (BU) on the other hand is defined as the metabolic equivalent of a kudu of 140 kg that browses exclusively. Mixed feeders graze and browse and it is therefore possible to use GU and BU in order to calculate a stocking rate for them. The following equations can be used to determine grazer and browser units:

Number of grazing animals in one GU of species X: **equation 1**

$$\frac{180^{0.75}}{(\text{Average body mass of species X})^{0.75} \times \%\ \text{graze in diet}}$$

Number of browsing animals in one BU of species X: **equation 2**

$$\frac{140^{0.75}}{(\text{Average body mass of species X})^{0.75} \times \%\ \text{browse in diet}}$$

When determining the stocking rate of a particular species of animals, it is crucial to take their social behaviour into account. Whether antelopes lead solitary lives or live in herds depends largely on their habitat and food requirements (Estes 1999). With few exceptions, antelopes that live in dense vegetation are solitary. The more open the habitat and the more closely spaced the food plants, the larger the herds. Behaviour patterns are important in the determination of herd size and the distribution of herds. Every animal species has its own characteristic density under optimal habitat conditions. Beyond this saturation level the social behaviour of the animal will prevent the further increase of game densities (Bothma 2002).

Number of grazing animals in one GU of species X: **equation 1**

$$\frac{180^{0.75}}{(\text{Average body mass of species X})^{0.75} \times \%\ \text{graze in diet}}$$

Number of browsing animals in one BU of species X: **equation 2**

$$\frac{140^{0.75}}{(\text{Average body mass of species X})^{0.75} \times \%\ \text{browse in diet}}$$

RESULTS AND DISCUSSION

Dividing the area into homogenous units

The topography of the study area is generally undulating plains with some drainage lines. In general the vegetation consists of open to closed woodlands. A drainage line cut across the property with accompanied higher densities of trees. The study area was subjectively divided into six homogenous units (**Figure 2**). The borders of the habitat types or homogenous units are not clearly distinguishable in the veld, and a much more intensive study of the soils and vegetation of the property will be required for a more detailed delineation of the plant communities. That is, however, beyond the scope of the present study and the homogenous units identified during this study is seen as sufficient for management purposes.

A total of ten survey sites were surveyed as sample sites on the property, representing all the homogenous units present. **Figure 3** indicates the position of all the survey sites, while **Table 2** gives the coordinates of all the survey sites. The characteristics of the habitat in each homogenous unit are summarised in **Table 3.**

Table 2: Coordinates of all the survey sites on Tooyskraal

Survey site nr	Latitude	Longitude
1	**S24 50.947**	**E27 56.386**
2	**S24 51.173**	**E27 55.945**
3	**S24 52.078**	**E27 53.359**
4	**S24 52.306**	**E27 52.978**
5	**S24 51.860**	**E27 54.310**
6	**S24 52.295**	**E27 54.290**
7	**S24 52.352**	**E27 53.563**
8	**S24 51.976**	**E27 55.061**
9	**S24 52.653**	**E27 55.232**
10	**S24 51.437**	**E27 55.415**

Figure 2: Map showing the location of the different homogenous units on TOOYSKRAAL

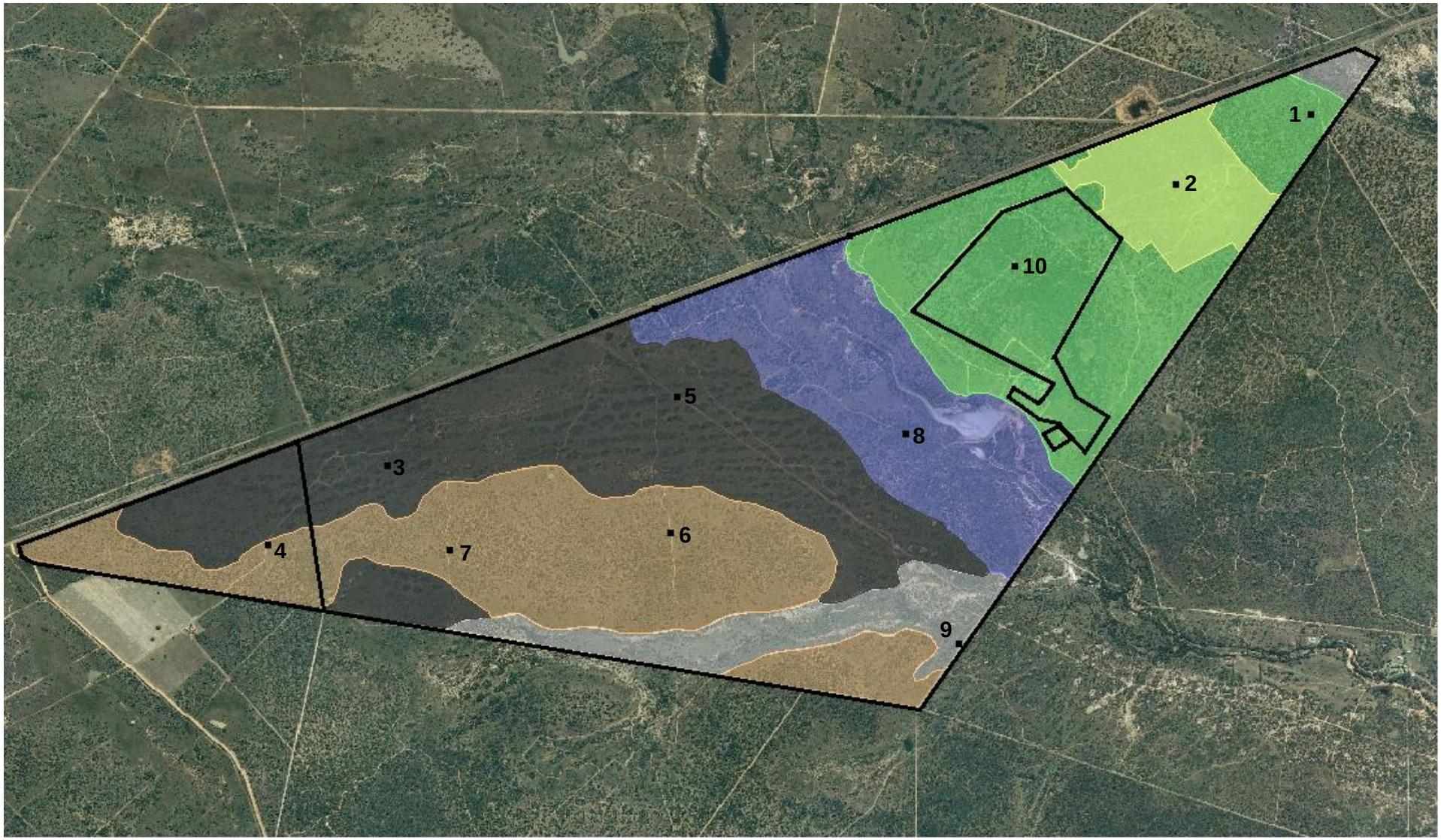

Figure 3: Location of all the survey sites on the farm Tooyskraal

Table 3: Summary of the characteristics of the habitat in each homogenous unit on Tooyskraal

Characteristics of homogenous units	Terminalia woodland	Old Land	Tamboti Bushclumps	Combretum woodland	Brackish soil	Drainage Line	Entire ranch
Size (ha)	225	60	305	250	80	165	1085
Tree density (trees/ha)	1025	200	600	450	450	900	
Tree cover (%)	60	5	30	30	25	50	
Shrub density (shrubs/ha)	275	150	275	150	300	400	
Shrub cover (%)	15	5	20	10	20	30	
Actual browse (kg/ha)	187	125	125	122	221	278	
Ecological browsing capacity:							
Browser unit / 100 hectare	12	8	8	8	14	18	
Browser unit / hectare	0.12	0.08	0.08	0.08	0.14	0.18	
hectare / Browser unit	8	12	12	13	7	6	
Total Browser units	**28**	**5**	**25**	**20**	**12**	**30**	**119**
Ecological satus class (%)							
Class 1	31	3	33	24	17	44	
Class 2	16	45	17	27	28	0	
Class 3	48	52	45	48	55	54	
Class 4	4	0	1	1	0	0	
Class 5	0	0	0	0	0	0	
Bare soil	4	0	5	6	7	7	
Range condition score	611	553	625	619	584	656	
Range condition index (%)	61	55	62	62	58	66	
Grass cover (%)	70	80	70	70	70	70	
Mean rainfall (mm/year)	630	630	630	630	630	630	
Topography index of accessibility	1	1	1	1	1	1	
Fire factor	0.8	1	0.8	0.8	0.8	0.8	
Ecological grazing capacity:							
Large animal units / hectare	0.28	0.26	0.28	0.28	0.27	0.29	
hectare / Large animal unit	4	4	4	4	4	3	
Grazer unit / 100 hectare	45	55	45	45	44	47	
Grazer unit / hectare	0.45	0.55	0.45	0.45	0.44	0.47	
hectare / Grazer unit	2	2	2	2	2	2	
Total Grazer units	**101**	**33**	**138**	**113**	**35**	**77**	**497**

Homogenous unit 1: *Terminalia* woodland	
	
Dominant grass species	**Dominant woody species**
Heteropogon contortus (12%)	*Terminalia sericea*
Pogonarthria squarrosa (11%)	*Pterocarpus rotundifolius*
Schizachyrium sanguineum (9%)	*Combretum apiculatum*
Setaria sphacelata var. *sphacelata* (8%)	*Euclea spp*

This homogenous unit covers approximately 225 hectares, representing 21% of the study area. It is found on the deeper sandy soils in the north-eastern side of the farm. A summary of the characteristics of this homogenous unit is given in **Table 3**. The tree density in this homogenous unit is 1025 trees/ha, which is the highest on the property. The shrub density (< 2m) is 275 shrubs/ha. The available browse up to 5 meters was calculated as 187 kilograms per hectare, with only 9% (18 kg/ha) available below 2 meters, and 4% (7 kg/ha) below 1.5 meters. The average browsing capacity up to 5 meters was calculated as 0.12 browser units (BU) per hectare, or 8 hectares per browsing unit. The stocking density for browsers in this habitat is thus 28 browser units.

The range condition index value for the *Terminalia* woodland was calculated as 611 and the range condition score as 61 % (**Table 3**). The veld in this community can thus be described as being in a good condition. Grass species in ecological status Class 3 (Increaser 2) (48%) dominate this community, followed by species in Class 1 (decreasers) (31%), species in Class 2 (Increaser 1) (16%), and species in Class 4 (Increaser 3) (4%). No species in Class 5 was recorded. The dominance of the Class 3 (increaser 2) species suggests that selective overgrazing is taking place in this homogenous unit. Increaser 2 grasses are abundant in overgrazed veld and increases due to the disturbing effect of overgrazing. The relatively high percentage Class 1 (decreaser) species does, however, indicate that this homogenous unit

has good potential. Decreaser grasses are abundant in good veld, but decrease in numbers when the veld is overgrazed or under grazed. With good veld management the condition of the grazing in this homogenous unit can thus be improved. The average grazing capacity was calculated as 45 Grazer Units (GU) per 100 hectares or 0.45 Grazer Units per hectare. 2 hectares of this habitat is thus needed to sustain 1 GU, and the stocking density for grazers in this habitat is 101 Grazer Units.

Homogenous unit 2: Old land	
	
Dominant grass species	**Dominant woody species**
Hyperthelia dissoluta (35%)	*Dichrostachys cinerea*
Heteropogon contortus (19%)	*Acacia tortilis*
Pogonarthria squarrosa (14%)	
Hyparrhenia filipendula (9%)	

This homogenous unit covers approximately 60 hectares, representing 6% of the study area. It is found on the deeper sandy soils in the north-eastern side of the farm. A summary of the characteristics of this homogenous unit is given in **Table 3**. The tree density in this homogenous unit is 200 trees/ha, which is the lowest on the property. The shrub density (< 2m) is 150 shrubs/ha. The available browse up to 5 meters was calculated as 125 kilograms per hectare, with only 27% (34 kg/ha) available below 2 meters, and 14% (17 kg/ha) below 1.5 meters. The average browsing capacity up to 5 meters was calculated as 0.08 browser units (BU) per hectare, or 12 hectares per browsing unit. The stocking density for browsers in this habitat is thus 5 browser units.

The range condition index value for the Old lands was calculated as 553 and the range condition score as 55% (**Table 3**). The veld in this community can thus be described as

being in a moderate condition. Grass species in ecological status Class 3 (Increaser 2) (52%) dominate this community, followed by species in Class 2 (Increaser 1) (45%), and species in Class 1 (decreaser) (3%). No species in Class 4 or Class 5 was recorded. The dominance of the Class 3 (increaser 2) species suggests that selective overgrazing is taking place in this homogenous unit. Increaser 2 grasses are abundant in overgrazed veld and increases due to the disturbing effect of overgrazing. The high percentage Class 2 (Increaser 1) species, however, indicate that this homogenous unit is generally underutilised. With good veld management the condition of the grazing in this homogenous unit can be improved. The average grazing capacity was calculated as 55 Grazer Units (GU) per 100 hectares or 0.55 Grazer Units per hectare. 2 hectares of this habitat is thus needed to sustain 1 GU, and the stocking density for grazers in this habitat is 33 Grazer Units.

Homogenous unit 3: Tamboti Bushclumps	
	
Dominant grass species	**Dominant woody species**
Panicum maximum (23%)	*Spirostachys africana*
Eragrostis gummiflua (16%)	*Olea africana*
Cymbopogon excavates (8%)	*Ziziphus mucronata*
Hyparrhenia filipendula (7%)	*Gymnosporia senegalensis*
Heteropogon contortus (7%)	*Carissa bispinosa*

This homogenous unit covers approximately 305 hectares, representing 28% of the study area. It is found in the central section of the farm, to the west of the drainage line. A summary of the characteristics of this homogenous unit is given in **Table 3**. The tree density in this homogenous unit is 600 trees/ha, and the shrub density (< 2m) is 275 shrubs/ha. The available browse up to 5 meters was calculated as 125 kilograms per hectare, with only 35% (44 kg/ha) available below 2 meters, and 32% (40 kg/ha) below 1.5 meters. The average

browsing capacity up to 5 meters was calculated as 0.08 browser units (BU) per hectare, or 12 hectares per browsing unit. The stocking density for browsers in this habitat is thus 25 browser units.

The range condition index value for the Tamboti Bushclumps was calculated as 625 and the range condition score as 62% (**Table 3**). The veld in this community can thus be described as being in a good condition. Grass species in ecological status Class 3 (Increaser 2) (45%) dominate this community, followed by species in Class 1 (decreasers) (33%), and species in Class 2 (increaser 1) (17%). Only 1% of the species recorded falls in Class 4 (increaser 3), and no species in Class 5 was recorded. The dominance of the Class 3 (increaser 2) species suggests that selective overgrazing is taking place in this homogenous unit. Increaser 2 grasses are abundant in overgrazed veld and increases due to the disturbing effect of overgrazing. The relatively high percentage Class 1 (decreaser) species does, however, indicate that this homogenous unit also has good potential. Decreaser grasses are abundant in good veld, but decrease in numbers when the veld is overgrazed or under grazed. With good veld management the condition of the grazing in this homogenous unit can thus be improved. The average grazing capacity was calculated as 45 Grazer Units (GU) per 100 hectares or 0.45 Grazer Units per hectare. 2 hectares of this habitat is thus needed to sustain 1 GU, and the stocking density for grazers in this habitat is 138 Grazer Units.

Homogenous unit 4: *Combretum* woodland	
	
Dominant grass species	**Dominant woody species**
Setaria sphacelata var. *sphacelata* (14%)	*Combretum apiculatum*
Hyperthelia dissolute (13%)	*Burkea africana*
Heteropogon contortus (10%)	*Faurea saligna*
Pogonarthria squarrosa (9%)	*Terminalia sericea*

This homogenous unit covers approximately 250 hectares, representing 23% of the study area. It is found on the eastern side of the farm on the slightly higher altitudes. A summary of the characteristics of this homogenous unit is given in **Table 3**. The tree density in this homogenous unit is 450 trees/ha, and the shrub density (< 2m) is 150 shrubs/ha. The available browse up to 5 meters was calculated as 122 kilograms per hectare, with only 15% (19 kg/ha) available below 2 meters, and 9% (11 kg/ha) below 1.5 meters. The average browsing capacity up to 5 meters was calculated as 0.08 browser units (BU) per hectare, or 13 hectares per browsing unit. The stocking density for browsers in this habitat is thus 20 browser units.

The range condition index value for the *Combretum* woodland was calculated as 619 and the range condition score as 62% (**Table 3**). The veld in this community can thus be described as being in a good condition. Grass species in ecological status Class 3 (Increaser 2) (48%) dominate this community, followed by species in Class 2 (increaser 2) (27%), and species in Class 1 (decreasers) (24%). Only 1% of the species recorded falls in Class 4 (increaser 3), and no species in Class 5 was recorded. The dominance of the Class 3 (increaser 2) species suggests that selective overgrazing is also taking place in this homogenous unit. Increaser 2 grasses are abundant in overgrazed veld and increases due to the disturbing effect of overgrazing. The relatively high percentage Class 2 (increaser 1) species is an indication of underutilisation, while the percentage Class 1 (decreaser) species indicate that this homogenous unit also has good potential. With good veld management the condition of the grazing in this homogenous unit can thus also be improved. The average grazing capacity was calculated as 45 Grazer Units (GU) per 100 hectares or 0.45 Grazer Units per hectare. 2 hectares of this habitat is thus needed to sustain 1 GU, and the stocking density for grazers in this habitat is 113 Grazer Units.

Homogenous unit 5: Brackish soil	
	
Dominant grass species	**Dominant woody species**
Pogonarthria squarrosa (18%)	*Dichrostachys cinerea*
Hyperthelia dissoluta (16%)	*Terminalia sericea*
Panicum maximum (16%)	*Acacia spp.*
Schizachyrium sanguineum (8%)	*Grewia spp.*
	Tarchonanthus camphoratus

This homogenous unit covers approximately 80 hectares, representing 7% of the study area. It is found on the southern side of the farm at lower altitudes, with a small section in the north-eastern corner of the property. More clay and nutrients aggregate at lower altitudes in drainage lines resulting in better quality grazing in these areas. A summary of the characteristics of this homogenous unit is given in **Table 3**. The tree density in this homogenous unit is 450 trees/ha, and the shrub density (< 2m) is 300 shrubs/ha. The available browse up to 5 meters was calculated as 221 kilograms per hectare, with only 46% (102 kg/ha) available below 2 meters, and 32% (71 kg/ha) below 1.5 meters. The average browsing capacity up to 5 meters was calculated as 0.14 browser units (BU) per hectare, or 7 hectares per browsing unit. The stocking density for browsers in this habitat is thus 35 browser units.

The range condition index value for the Brackish soil was calculated as 584 and the range condition score as 58% (**Table 3**). The veld in this community can thus be described as being in a moderate condition. Grass species in ecological status Class 3 (Increaser 2) (55%) dominate this community, followed by species in Class 2 (increaser 2) (28%), and species in Class 1 (decreasers) (17%). No species in Class 4 (increaser 3) or Class 5 was recorded. The dominance of the Class 3 (increaser 2) species suggests that selective

overgrazing is also taking place in this homogenous unit. Increaser 2 grasses are abundant in overgrazed veld and increases due to the disturbing effect of overgrazing. The relatively high percentage Class 2 (increaser 1) species is an indication of underutilisation, while the percentage Class 1 (decreaser) species indicate that this homogenous unit also has good potential. With good veld management the condition of the grazing in this homogenous unit can thus also be improved. The average grazing capacity was calculated as 44 Grazer Units (GU) per 100 hectares or 0.44 Grazer Units per hectare. 2 hectares of this habitat is thus needed to sustain 1 GU, and the stocking density for grazers in this habitat is 35 Grazer Units.

Homogenous unit 6: Drainage line	
	
Dominant grass species	**Dominant woody species**
Panicum maximum (19%)	*Acacia spp.*
Eragrostis gummiflua (18%)	*Euclea spp*
Digitaria eriantha (13%)	*Terminalia sericea*
Themeda triandra (9%)	*Peltophorum africanum*
	Searsia (*Rhus*) *lancea*

This homogenous unit covers approximately 165 hectares, representing 15% of the study area. It is found along the stream slightly on the eastern side of the farm at lower altitudes, running from the north to the south through the property. This habitat contains the best quality grazing on the property on the more clayey soils found at lower altitudes in the drainage line. A summary of the characteristics of this homogenous unit is given in **Table 3**. The tree density in this homogenous unit is 900 trees/ha, and the shrub density (< 2m) is 400 shrubs/ha. The available browse up to 5 meters was calculated as 278 kilograms per hectare, with only 10% (29 kg/ha) available below 2 meters, and 5% (13 kg/ha) below 1.5

meters. The average browsing capacity up to 5 meters was calculated as 0.18 browser units (BU) per hectare, or 6 hectares per browsing unit. The stocking density for browsers in this habitat is thus 30 browser units.

The range condition index value for the Drainage line was calculated as 656 and the range condition score as 66% (**Table 3**). The veld in this community can thus be described as being in a good condition (best on the property). Grass species in ecological status Class 3 (Increaser 2) (54%) dominate this community, followed by species in Class 1 (decreasers) (44%). No species in Class 2 (increaser 1), Class 4 (increaser 3) or Class 5 was recorded. The dominance of the Class 3 (increaser 2) species suggests that selective overgrazing is also taking place in this homogenous unit. Increaser 2 grasses are abundant in overgrazed veld and increases due to the disturbing effect of overgrazing. The high percentage Class 1 (decreaser) species is an indication of the quality of the grazing in this habitat. The average grazing capacity was calculated as 47 Grazer Units (GU) per 100 hectares or 0.47 Grazer Units per hectare. 2 hectares of this habitat is thus needed to sustain 1 GU, and the stocking density for grazers in this habitat is 77 Grazer Units.

Determining stocking rates

Stocking rate is the area of land allocated to each specific animal unit (Tainton 1999). The number of animals by which a given ranch surface area is stocked, is generally accepted as one of the most important factors that affect animal production and the condition of the grazing. The optimal stocking rate of different game on a ranch depends on the available habitat, the quality of the habitat and the objectives for the game. The potential ecological carrying capacity on the ranch, number of game present, composition of the herds (both sex and age ratios), social systems, habitat selection, feeding and water requirements, selectivity towards different plant species and the management objectives are all important considerations when making recommendations on stocking rates (Van Rooyen *et al.* 1996). Stocking rates must be aimed at insuring maximum animal production without causing any deterioration of the veld. The stocking density is a management decision based on the objectives of the particular ranch, but should always be within the ecological capacity of the habitat to sustain grazing and browsing herbivores.

The reliable counting of wild animals on a game ranch is one of the cornerstones of effective wildlife management because it is a yardstick to determine trends in animal population size, to calculate numbers to be harvested, to determine habitat preference, and to adapt management accordingly (Van Rooyen 2002). A summary of the game numbers as recorded

for Tooyskraal during September 2010 (as supplied by management) is given in **Table 4**. Although different techniques exist to count game, it is important that the same technique is used on a particular ranch so that results can be compared from year to year. The cost of animal counts should, however, not be more than 1% of the total value of the animals. In **Table 5**, the current stocking rate is shown in relation to the calculated ecological capacity of the ranch. According to the animal numbers from September 2010, the ranch is currently stocked at 26.81% of its grazing capacity, and 64.01% of its browsing capacity.

A recommendation for stocking rates is presented in **Table 6**. The recommendations for the number of animals to be stocked on the ranch are based on the calculated ecological capacity and the objectives of the ranch. The total number of Grazing Units that can be stocked was calculated as 497 GU. The total number of Browser Units that can be stocked was calculated as 119 BU. When stocking a specific species, social structure is usually the limiting factor and not food availability. **Table 7** gives a summary of the current stocking levels on the ranch, the maximum number of each species that can be sustained, the recommended stocking level, and the resultant recommended change in the current numbers. The farm is currently under stocked with grazers, and the percentage selective grazers are too high. This leads to selective over grazing, as seen from the habitat analysis. It is recommended to increase the amount of bulk grazers to around 20% of the ecological grazing capacity. This will help to improve the condition of the vegetation. The stocking density of browsers seems to be in line with the ecological browsing capacity.

Table 4: Game numbers as recorded for Tooyskraal during September 2010

Species	Number
Blesbok	42
Blue wildebeest	40
Giraffe	4
Impala	125
Kudu	25
Nyala	15
Red hartebeest	16
Waterbuck	8
Zebra	14

Table 5: Current stocking density as given by management (Game census September 2010) in relation to ecological capacity

Type of animal	Number of Animals	Minimum viable group size	Numer of males per group	Number of females per group	% graze in diet	% brow se in diet	% dicotyledon in diet	GU per animal	BU per animal	Equivalent GU per group	Equivalent BU per group	% of ecological graze capacity	% of ecological brow se capacity
Low selectivity grazers													
Burchell's zebra	**14**	**7**	**2**	**12**	**90**	**0**	**10**	**1.32**	**0.00**	**18.48**	**0.00**	**3.72**	**0.00**
Sub TOTAL	**14**											**3.72**	**0.00**
High selectivity grazers													
Blesbok	**42**	**10**	**4**	**38**	**100**	**0**	**0**	**0.49**	**0.00**	**20.68**	**0.00**	**4.16**	**0.00**
Blue wildebeest	**40**	**12**	**8**	**32**	**96**	**0**	**4**	**1.08**	**0.00**	**43.11**	**0.00**	**8.67**	**0.00**
Waterbuck	**8**	**6**	**3**	**5**	**92**	**5**	**3**	**1.00**	**0.07**	**7.97**	**0.52**	**1.60**	**0.44**
Sub TOTAL	**90**											**14.44**	**0.44**
Mixed feeders													
Common impala	**125**	**24**	**16**	**109**	**50**	**50**	**0**	**0.21**	**0.25**	**25.69**	**31.01**	**5.17**	**26.06**
Kudu	**25**	**8**	**6**	**19**	**18**	**61**	**21**	**0.19**	**0.80**	**4.87**	**19.93**	**0.98**	**16.75**
Nyala	**15**	**3**	**5**	**10**	**47**	**53**	**0**	**0.23**	**0.32**	**3.47**	**4.73**	**0.70**	**3.97**
Red hartebeest	**16**	**10**	**2**	**14**	**75**	**20**	**5**	**0.55**	**0.18**	**8.85**	**2.85**	**1.78**	**2.40**
Sub TOTAL	**181**											**8.63**	**49.18**
Browse feeders													
Giraffe	**4**	**3**	**1**	**3**	**1**	**98**	**1**	**0.04**	**4.28**	**0.14**	**17.13**	**0.03**	**14.39**
Sub TOTAL	**4**											**0.03**	**14.39**
TOTAL	**289**											**26.81**	**64.01**

Tabel 6: Recommended stocking density for Tooyskraal

	497	One GU equated to the energy requirements of a blue wildebeest of 180 kg												
	119	One BU equated to the energy requirements of a kudu of 140 kg												
Type of animal	Number of Animals	Minimum viable group size	Numer of males per group	Number of females per group	Mean mass of animal in kg	% graze in diet	% brow se in diet	% dicotyledon in diet	GU / animal	BU / animal	Equivalent GU per group	Equivalent BU per group	Percentage of ecological graze capacity	Percentage of ecological brow se capacity
Low selectivity grazers														
Buffalo	**20**	**12**	**5**	**15**	**650**	**95**	**4**	**1**	**2.49**	**0.13**	**49.77**	**2.53**	**10.01**	**2.13**
Burchell's zebra	**25**	**7**	**4**	**21**	**300**	**90**	**0**	**10**	**1.32**	**0.00**	**33.00**	**0.00**	**6.64**	**0.00**
Hippopotamus	**3**	**3**	**1**	**2**	**1350**	**90**	**0**	**10**	**4.08**	**0.00**	**12.24**	**0.00**	**2.46**	**0.00**
White rhinoceros	**4**	**6**	**1**	**3**	**1800**	**100**	**0**	**0**	**5.62**	**0.00**	**22.49**	**0.00**	**4.53**	**0.00**
Sub TOTAL	**52**												**23.64**	**2.13**
High selectivity grazers														
Blesbok	**40**	**10**	**4**	**36**	**70**	**100**	**0**	**0**	**0.49**	**0.00**	**19.70**	**0.00**	**3.96**	**0.00**
Blue wildebeest	**40**	**12**	**8**	**32**	**210**	**96**	**0**	**4**	**1.08**	**0.00**	**43.11**	**0.00**	**8.67**	**0.00**
Sable	**16**	**6**	**3**	**13**	**220**	**85**	**10**	**5**	**0.99**	**0.14**	**15.81**	**2.25**	**3.18**	**1.89**
Waterbuck	**8**	**6**	**3**	**5**	**200**	**92**	**5**	**3**	**1.00**	**0.07**	**7.97**	**0.52**	**1.60**	**0.44**
Sub TOTAL	**104**												**17.42**	**2.33**
Mixed feeders														
Common impala	**100**	**24**	**13**	**88**	**55**	**50**	**50**	**0**	**0.21**	**0.25**	**20.55**	**24.81**	**4.13**	**20.85**
Kudu	**30**	**8**	**8**	**23**	**200**	**18**	**61**	**21**	**0.19**	**0.80**	**5.84**	**23.91**	**1.18**	**20.09**
Nyala	**15**	**3**	**5**	**10**	**70**	**47**	**53**	**0**	**0.23**	**0.32**	**3.47**	**4.73**	**0.70**	**3.97**
Red hartebeest	**40**	**10**	**4**	**36**	**120**	**75**	**20**	**5**	**0.55**	**0.18**	**22.13**	**7.13**	**4.45**	**5.99**
Sub TOTAL	**185**												**10.46**	**50.91**
Browse feeders														
Bushbuck	**4**	**4**	**1**	**3**	**40**	**10**	**50**	**40**	**0.03**	**0.20**	**0.13**	**0.78**	**0.03**	**0.66**
Giraffe	**4**	**3**	**1**	**3**	**1000**	**1**	**98**	**1**	**0.04**	**4.28**	**0.14**	**17.13**	**0.03**	**14.39**
Sub TOTAL	**8**												**0.06**	**15.05**
TOTAL	**349**												**51.58**	**70.41**

Table 7: Summary of the current stocking levels on the ranch, the maximum number of each species that can be sustained (if only that species is stocked), the recommended stocking level, and the resultant recommended change in the current numbers

	Current stocking density	Maximum stocking density	Recommended density	Difference
Low selectivity grazers				
Buffalo	**0**	**25**	**20**	**20**
Burchell's zebra	**14**	**35**	**25**	**11**
White rhinoceros	**0**	**4**	**3**	**3**
Hippopotamus	**0**	**4**	**4**	**4**
Sub TOTAL	**14**	**68**	**52**	**38**
High selectivity grazers				
Blesbok	**42**	**40**	**40**	**-2**
Blue wildebeest	**40**	**60**	**40**	**0**
Sable	**0**	**32**	**16**	**16**
Waterbuck	**8**	**16**	**8**	**0**
Sub TOTAL	**90**	**148**	**104**	**14**
Mixed feeders				
Common impala	**125**	**100**	**100**	**-25**
Kudu	**25**	**32**	**30**	**5**
Nyala	**15**	**20**	**15**	**0**
Red hartebeest	**16**	**40**	**40**	**24**
Sub TOTAL	**181**	**192**	**185**	**4**
Browse feeders				
Giraffe	**4**	**10**	**4**	**0**
Bushbuck	**0**	**6**	**4**	**4**
Sub TOTAL	**4**	**16**	**8**	**4**
TOTAL	**289**	**424**	**349**	**60**

BUFFALO (*Syncerus caffer*)

Status of the African Buffalo

Buffalo are today relatively common in Southern Africa and are, in fact, reasonably freely available. The important limiting factor in buffalo for game ranching purposes is, however, the availability of disease-free or "clean" buffalo. But this also creates a great economic opportunity for those ranches with "clean" buffalo. Foot-and-mouth disease, theileriosis and now also tuberculosis are the most important contagious diseases in buffalo. For this reason, a game rancher should draw a distinction between clean buffalo and infected buffalo. This classification determines the status and value of buffalo, and plays a crucial role in the economics of the industry.

Habitat

Buffalo are bulk feeders. They prefer tall grass, but will also browse leaves. They are not particularly selective feeders, however, and utilize a wide variety of veld types. The fact that buffalo will take to good quality fodder in lean times indicates the species' potential for production in a reasonably intensive game farming operation.

As buffalo normally drink water daily, controlling watering points offers a technique to ensure selective utilization of veld and the available grazing resources.

Nuclear groups for relocation

When establishing a new herd, the size of the nuclear group does not seem to be as important in buffalo as it is in most other game species. Buffalo have practically no natural enemies on most game ranches; calves accompany their mothers from shortly after birth and are therefore not vulnerable. Strange buffalo integrate readily with existing herds, although the dominant herd cow may occasionally cause problems for newcomers.

The availability and price of buffalo usually plays a far more important role in determining the size and composition of the nuclear herd. A good practical size, however, is seven animals comprising two bulls and five cows - or multiples thereof.

Breeding, Sex ratio, Genetics, Diseases, Life expectancy, Parasites

Breeding

Under normal conditions, heifers usually reach sexual maturity at three years, producing their first calves at four years. Bulls are seldom sexually active before 5 years, even in the absence of a dominant bull. For this reason it is important that a nuclear herd must include at least one mature bull (ca. 7 years old).

Buffalo calve throughout the year, but with a definite peak between February and May. The calving interval is greatly influenced by the nutritional status of the herd. Cows in good condition can calve every 12 months, provided sufficient breeding bulls are available in the herd. An inter-calving interval of 15 months is still acceptable. Occasionally, twins are born.

Under unfavorable conditions, a buffalo cow will not be able to produce sufficient milk and her calf will die. She will only come on heat again when in good condition.

Sex ratio

Due to the social structure and gregarious nature of buffalo, a clear picture as to the optimum sex ratio is yet to emerge. Based on field observations, a bull will serve no more than three or four cows per month.

Genetics

This is a tricky subject that elicits considerable differences in opinion from experts. It remains a good principle, however, to obtain animals from different gene pools when establishing a new herd. It is equally obvious that genetic diversity plays a less important role in wild animals than in domestic animals. Natural selection processes are highly efficient, ruthlessly weeding out weaknesses and unfavorable characteristics. However, certain characteristics deemed desirable by game ranchers, such as trophy quality, temperament, carcass mass and even color variations, may in future attract increasing attention in breeding programs.

Diseases

Disease resistance is a positive factor in indigenous game species. Diseases normally only become significant when the animals are subjected to stress such as overstocking, feed shortages, extreme weather conditions, and unsuitable or insufficient habitat. As a rule, an animal in good condition is usually a healthy animal.

Life expectancy

The average life expectancy of buffalo varies between 18 to 20 years, with maximum life expectancy between 22 and 25 years. Cows have been known to calve at 22 years. From the age of around 15 years, bulls start leaving the herd to start a solitary life, or join up with old bulls to form small groups.

Parasites

Ectoparasites seldom pose a serious problem in buffalo, as the thick skins of these animals are not easily damaged. Oxpeckers are starting to return to many game ranches, these birds efficiently control ticks and other ectoparasites, and seem to favor buffalo.

SPECIFICALLY FOR TOOYSKRAAL

The farm is currently under stocked with bulk grazers like buffalo, and the addition of these animals will have a positive effect on the veld condition. The recommendation is to introduce a herd of 12 animals (9 cows and 3 bulls). The necessary veterinary permits need to be obtained before animals are purchased.

Maximum number: 25 animals

Size of farm: 1085ha – adequate size for buffalo

Suitable habitat in areas: All the habitats present on Tooyskraal is suitable for buffalo with medium to tall grass and enough trees for shade.

Topography: Very suitable since only flat areas occur.

Carrying capacity: Current stocking rate below carrying capacity. Suitable.

Water: Very suitable – permanent stream and dam, with two artificially pumped waterholes.

Precipitation: Suitable – approximately 630mm per year.

Fencing: Well fenced with standard game fencing. Additional electrified fencing. Suitable for buffalo.

Suitability of grazing:

Grass height between 50mm and 2000mm.

Grass cover: High

Grass species: Mostly dominated by medium to high climax grass species, suitable for buffalo.

Woody plant cover: Mostly open woodland with small areas moderately encroached.

Conclusion: Habitat is highly suitable for buffalo with enough tall climax grass and adequate water. Tooyskraal has suitable habitat to meet the requirements and sustain a group of up to 25 buffalo

WHITE RHINOCEROS (*Ceratotherium simum simum*)

Introduction

South Africa is the last stronghold of rhinos in Africa. No less than 80% of all remaining rhinos on the continent occur in this country. It is imperative that the private land owner become fully acquainted with the management of the rhino on private land and with a wide range of related issues, such as carrying capacities, capture and care before translocation, habitat requirements and medical treatment.

Define the objectives of your rhino ranching before purchasing any animals. If you want to breed rhinos, buy combinations of adult cows with calves. Animals for tourism should preferably come from ranches where they have become accustomed to vehicles or bomas.

Prospective buyers should purchase animals which have been in a boma for longer than 6 weeks. These animals are feeding well and are already gaining weight.

Suitable habitat and nutritional requirements

White rhino prefer a landscape with a good grass cover where the shrub cover is not dense and also where an average rainfall is not less than 450mm per annum, sufficient permanent water and sufficient shade are also needed.

There are four basic habitat requirements: areas of short grass, for which they have a marked preference; stands of medium tall *Panicum maximum* which they find under trees; the availability of water for drinking and in which to wallow; adequate bush cover, and relative flat terrain. White rhinos prefer *Panicum maximum, Digitaria eriantha*, *Urochloa mossambicensis, Sporobolus nitens*, *Dactyloctenium aegyptium, Chloris pygnotrix* and *Themeda triandra.*

Minimum ranch size

White rhino are a high density species and their numbers on small farms are determined by the carrying capacity of the area. In literature it is recommended that the minimum size farm needed is between 1000 and 2000 ha. This is at a maximum capacity of 4 rhino per 1000 hectares.

Social behaviour

White rhino occurs in small groups. The territorial bull will defend its territory against other bulls, but will tolerate subsidiary bulls. The home range of a cow will overlap with those of other cows and with those of more than one bull.

Rhino bulls inhabit home ranges of 75-12000 ha, depending on the density of the population. Home ranges are demarcated by dung heaps and urine marking sites. Home ranges of cows are up to four times larger than bulls (up to a 1000 ha).

The ideal minimum number for re-establishing a rhino population on a game ranch is one dominant bull, one subadult bull, two cows and two heifers.

A cow reaches sexual maturity at 5-6 years. When an adult cow (> 5 years) is approached by an adult bull, it is a sign that she is in estrus. After a gestation period of 16 months the cow gives birth. The calving interval is between 2-3.5 years which results in a low production tempo of 8-9 %.

SPECIFICALLY FOR TOOYSKRAAL

Species recommended: *Ceratotherium simum simum*

Number recommended: 1 adult bull, 2 adult cows or one cow and one heifer

Size of farm: 1085ha – adequate size for rhino

Suitable habitat in areas: All areas on Tooyskraal are suitable for the white rhinoceros. The topography is flat with enough suitable grass and trees for cover.

Topography: Very suitable - 100% of the area is flat.

Carrying capacity: Current stocking rate equal to below carrying capacity. Suitable.

Water: There is a permanent stream with two permanent dams in present on the farm, as well as two waterholes that are pumped from a borehole.

Precipitation: Acceptable – approximately 630mm per year.

Fencing: Well fenced with standard game fencing. Additional electrified fencing. Suitable for white rhino.

Suitability of grazing:

Grass height varies between 30mm and 2000mm.

Grass cover: High

Grass species: All areas have suitable grass species with *Panicum maximum* present in all habitats.

Woody plant cover: The vegetation is generally open woodland with shading trees found in all habitats on Tooyskraal. There are small areas where bush encroachment took place, especially within the fenced of camp and along the drainage line.

Conclusion: Despite the relatively small size of the farm, in terms of the four basic habitat requirements of the white rhinoceros, namely:

1. Areas of short palatable grass;
2. The availability of water for drinking and in which to wallow;
3. Adequate bush cover; and
4. Relatively flat terrain,

the habitat is considered suitable for the white rhinoceros as free roaming animals. The fact that the northern border runs along the national road does, however presents a security risk and a proper poaching risk analysis should be done by the Endangered Species Protection Unit of the South African Police Service before releasing white rhinoceros on the farm.

THE SABLE ANTELOPE (*Hippotragus niger niger*)

Distribution

The geographical distribution of the sable antelope reaches central, eastern and southern African Savanna to the northern and eastern parts of South Africa. In the past few years the distribution has increased substantially due to the growth in the game industry. Today they have been reintroduced on many farms in South Africa.

Habitat requirements

The following factors were regarded as important for sable habitat:

- grass height
- density of shrubs and trees
- landscape

The sable antelope prefers open savanna woodland with adjacent vleis and water. Sables prefer habitat with medium to tall grasses which consists mainly of climax grass species. They are selective feeders and prefer grasses with a high protein and low fibre content. They avoid thickets and overgrazed areas.

The daily water requirement of an adult sable is 20.4liters. Sables are daylight drinkers with a peak between 13:00 and 14:00, and are never further than 2.5 km from water points. Sables prefer natural water points.

Social behaviour

The population structure of sables consists of territorial bulls, bachelor groups and breeding herds. Territorial bulls inhabit an area of 25-40 ha, which they will defend against other bulls during the mating season.

The territorial bull defends the herd but its main function is breeding. One or more of the females in the breeding herd will act as leaders and lead the herd to feeding areas and water points. The breeding herd consists of females and 1-2 year old calves. Bull calves will leave the breeding herd after 2 years to join the bachelor herds. Research has shown that an average breeding herd size is 15.2 animals. Herds with less than 6 animals have no calves.

Game farmers buy sable at great costs and find out that the animals do not breed, although the habitat is suitable. A minimum herd size is important for sable to maintain their social behaviour. Average herd size of 15 animals is a guideline and farmers should aim to buy and introduce a breeding herd

Utilization of the sable antelope

Trophy hunting is a selective form of utilization and the aim must be to limit the influence of hunting on the social behaviour.

The sale of live game will be the main income of the game farmer. During August and September, the veld condition is at a low level and could lead to failure of introduction operations. The most important factor is to introduce viable breeding herds.

Territories

The territories of these antelope are dependent on available area (size of the farm). The quality of the grazing also influences grazing areas and territories, it normally varies from 200-400 ha. The bulls have a territory of 25-40 ha.

Breeding

The cows reach sexual maturity at 2 years of age and usually calve for the first time at 3 years of age. The new born calf hides for about 2 weeks. The gestation period is 260 -280 days and calves are usually born from January to March reaching a peak in February. The ideal sex ratio is one bull to three cows with calves and juveniles.

SPECIFICALLY FOR TOOYSKRAAL

Species recommended: *Hippotragus niger niger*

Number recommended (founder group): at least 6 animals, 1 adult bull, and 5 cows and heifers.

Maximum number: 32 animals (2 groups)

Size of farm: 1085ha – adequate size for sable

Suitable habitat in areas: Around 80% of the farm consists of relatively open woodland with a good cover of medium to high climax grasses and adequate water. The farm is seen as highly suitable for sable antelope. Tree density in the central camp is too high and should be reduced before considering introducing sable antelope there for breeding purposes

Topography: Very suitable since only flat areas occur.

Carrying capacity: Current stocking rate below carrying capacity. Suitable.

Water: Very suitable – permanent stream and dam, with two artificially pumped waterholes.

Precipitation: Suitable – approximately 630mm per year.

Fencing: Well fenced with standard game fencing. Additional electrified fencing. Suitable for sable.

Suitability of grazing:

Grass height almost always between 50mm and 2000mm.

Grass cover: High

Grass species: Mostly dominated by medium to high climax grass species, suitable for the sable antelope

Woody plant cover: Mostly open woodland with small areas moderately encroached.

Conclusion: Habitat is highly suitable for sable antelope and it is recommended to introduce at least 6 animals as a free roaming starting population. Numbers of highly competitive species like impala should be kept in check. Perde camp is suitable but bush clearing should be done in the central camp before releasing sable antelope there.

GENERAL RECOMMENDATIONS

- The general management on the farm is good, with fence lines open and clean, roads well maintained and all facilities clean and neat.
- Veld condition is generally good and the farm is currently under stocked with bulk grazers. It is recommended to increase the number of zebra and to consider the introduction of buffalo.
- A burning program should be set up to remove dead grass material and to improve veld condition.
- Slashing should be done in the Old lands in order to reduce the amount of thatching grass and to encourage animals to use the area.
- The position of salt licks should be moved in order to avoid sweet veld areas (Brackish soil, Drainage line and Tamboti clumps) and to attract animals to the sour veld areas (*Terminalia* woodland and *Combretum* woodland)
- Invasion by the cactus pear or prickly pear *Opuntia ficus-indica*, and Queen of the night *Cereus jamacaru*, was observed, especially in the Brackish soil, and it is recommended to identify and mark the positions of all problem plants, and to implement a control program as soon as possible.
- A detailed bush control program (includes maps, costs, control methods, use of herbicides, schedule) is recommended. This should include the selective control of trees (especially *Terminalia sericea*) within the fenced off camp and in the Drainage line along the stream.
- A veld monitoring program should be set up in order to monitor any change in the vegetation.
- A record keeping program should be set up for game, including regular game counts and records of animals taken of through hunting or natural deaths should be kept.
- Blue wildebeest should be removed from camps where fighting is taking place through fences.

The cactus pear or prickly pear *Opuntia ficus-indica*, and Queen of the night *Cereus jamacaru*, invasive plants observed on Tooyskraal

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