

RANGELAND MANAGEMENT



Photograph by Marina Coetzee

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TABLE OF CONTENTS

Acknowledgements	6
Preface	7
Foreword	9
Introduction	11
Chapter 1: The Ecology of Natural Grasslands	13
1. Plant succession	13
2. The role of competition in plant succession	13
Chapter 2: Growth of Plants	15
1. The development of a single grass plant	15
2. Photosynthesis	16
3. The growth cycle of an established perennial grass plant	16
3.1 Initial growth	16
3.2 Active growth period	16
3.3 Flowering/seed formation	16
3.4 Nutrient translocation period/storage of reserves	17
3.5 Dormant season	17
4. Growth of shrubs and bushes	17
5. Productivity and stability of plant communities	18
Chapter 3: Veld Types in the Farming Areas of Namibia	19
1. Deserts	20
2. Savanna	20
2.1 Semidesert and savanna transition	20
2.2 Mopane savanna	20
2.3 Mountain savanna and karstveld	21
2.4 Thornbush savanna	21
2.5 Highland savanna	21
2.6 Dwarf shrub savanna	21
2.7 Camel-thorn savanna (central Kalahari)	22
2.8 Mixed tree and shrub savanna (southern Kalahari)	22
3. Woodlands	22
3.1 Tree savanna and woodland (northern Kalahari)	22
Chapter 4: Grazing Management	23
1. Frequently used terminology	23
1.1 Continuous grazing	23
1.2 Rotational grazing	23
1.3 Zero grazing	23

1.4	Grazing capacity (carrying capacity)	23
1.5	Stocking rate	25
1.6	Grazing density	25
2.	Aims of grazing management and principles to be applied	25
2.1	Aims of grazing management	25
2.2	Principles of veld management	25
2.3	The grazing animal as utiliser of veld	27
2.4	Selective grazing	28
2.5	Physical veld management planning (land division)	29
3.	Different approaches to rangeland management	30
3.1	Rotational grazing	30
3.2	Slow (conventional) grazing systems	31
3.3	Non-selective, short-duration grazing systems	31
3.4	Controlled selective grazing	32
3.5	Continuous grazing systems	33

Chapter 5: Assessment of Veld Condition 34

1.	Setting the standards	34
2.	Desirable and less desirable plants	34
3.	The ecological status of grasses	35
4.	Factors affecting veld condition	35
4.1	Basal cover	35
4.2	Botanical composition	35
4.3	Growth vigour	35
4.4	Condition of topsoil	36
4.5	Damage due to insects and rodents	36
4.6	Procedures	36

Chapter 6: Evaluation of Carrying Capacity 39

1.	When to evaluate grazing capacity	39
2.	Methods	39
2.1	Computer simulation models	39
2.2	Estimation	39
2.3	Photo comparisons	39
2.4	Cutting of quadrates	39
3.	The cutting of quadrates	40
3.1	The method involves	40
3.2	Tools needed	40
3.3	The method consists of 4 steps	40
3.4	Example	41

Chapter 7: Regenerating Degraded Rangelands 43

1.	The impact of wrong rangeland management and methods to reclaim mismanaged rangeland	43
1.1	The impact of degenerated rangeland	43
1.2	Recovery/resting after rain	44
1.3	Priority treatment	44
1.4	Total withdrawal	44
1.5	Winter grazing only	44
1.6	Veld burning	44
1.7	Veld reclamation (radical veld improvement)	45

2.	Bush encroachment	45
2.1	Functions of bush in a natural environment	45
2.2	The nutritional value of bush	46
2.3	How much bush is too much bush?	46
2.4	Different approaches to prevent bush encroachment	47
2.5	Methods to treat bush encroachment	48
2.6	Aftercare	48
3.	Soil erosion and its treatment	49
3.1	Water erosion	49
3.2	Wind erosion	49
3.3	Prevention of soil erosion	50
3.4	Treatment of soil erosion	50

Chapter 8: Fodder Crops/Planted Pastures 51

1.	Incorporation of fodder crops/planted pastures in the production system	51
2.	Planted pastures	51
3.	Drought-resistant fodder crops	52
3.1	Oldman saltbush	52
3.2	Spineless prickly pear	52
3.3	Mexican agave	53
3.4	Pods	53
3.5	Makataan and tsamma	53
4.	Fodder crops	53

Chapter 9: Common Resource Management 54

References 55

List of Figures and Tables 56

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Preface

It is with great pleasure, gratitude and pride that the JPC presents this production manual.

After years of deliberations, careful planning, and a lot of dedication the NAMIBIA AGRICULTURAL UNION and the NAMIBIA NATIONAL FARMERS' UNION jointly embarked on the EMERGING COMMERCIAL FARMERS' SUPPORT PROGRAMME. This programme resulted from the realisation that the new group of emerging commercial farmers who, having been previously disadvantaged and mostly coming from the background of communal farming, were in dire need of basic (sophisticated) skills training to manage modern farming techniques. The planning phase entailed, amongst others, a need assessment way back in 2004/5, which clearly identified the areas of assistance required. After having analysed all the relevant data, the two unions set about structuring a two-year programme which would address the challenges faced by new farmers so that ultimately they would be able to deal with the daunting task of becoming successful commercial farmers. Besides a dedicated programme of lectures, training courses, study tours and mentoring, it was decided to also produce and publish a set of eight PRODUCTION MANUALS which would serve as valuable training guides with technical details, but would also be a source of reference for future everyday practical farming in Namibia.

It is with gratitude that we acknowledge the unrelenting support of many individuals, too numerous to name, and certain institutions which supported and still support the whole Emerging Commercial Farmers' Support Programme.

We sincerely hope that this initiative will make a lasting contribution to sustainable agricultural land utilisation and to the goals of land reform in Namibia.

On behalf of the JPC,

Raimar Von Hase
(President, Namibia Agricultural Union)

Pintile Davids
(President, Namibia National Farmers' Union)

Windhoek, December 2007

Foreword

Agriculture as the backbone of Namibia's economy has a major role to play in achieving Vision 2030. However, to be able to make a significant contribution towards the growth of the economy and thus wealth creation, agricultural production/output has to increase manifold. For the realisation of such an increase the following crucial issues have to be addressed. Subsistence farming should become commercialised, e.g. landownership in some form or other should be allocated to individuals, underutilised areas should be developed and put into production and the problem of bush encroachment should be addressed and solved at national level.

Food production at competitive and affordable prices for the consumer is the biggest challenge that farmers worldwide have to face. With input costs increasing at a higher rate than the increase in prices realised for produce from the farm, it is clear that productivity and the production capacity on farms have to improve continuously. This also applies to Namibia's agricultural sector.

Furthermore, if we want to participate in international trade with our export commodities, currently being beef, mutton, Karakul pelts and grapes, we have to be able to compete worldwide against all the countries exporting the same commodities. Apart from being price competitive we also have to be competitive in satisfying the needs of the sophisticated consumer in terms of quality, health issues, traceability, animal welfare and other ethical production norms, e.g. personnel management, conservation of biodiversity/ecology (fauna, flora and water resources), etc.

Agricultural production is no longer just a matter of producing whatever the farmer is able and willing to produce and then expecting to achieve good prices for the product.

Farmers have to become more involved in the value chain, and should become much more market orientated by being sensitive to the needs and preferences of the consumer whom they want to serve. In addition they have to adhere to international trading rules and regulations as prescribed by the World Trade Organisation (WTO), and also comply with the Sanitary and Phytosanitary (SPS) requirements of the various countries with which they want to trade. Norway, for instance, has zero tolerance for salmonella in beef/mutton, which is imported into that country, thus making it very difficult to serve this lucrative market.

*It is obvious that survival and growth in the agricultural sector can only be achieved if the farmer in future pays **greater attention** to the world around him, as has been the case in the past.*

Skills development and training of farmers and their employees are becoming imperative, and are of national interest.

Being a farmer and thus the owner of agricultural land in Namibia should be regarded as a privilege. Not every citizen in Namibia, as in countries all over the world, can own agricultural land. There is just not enough land available. Therefore every farmer has a responsibility to use his piece of land in a productive but also a sustainable way. Productive means exploiting the full production potential of the farm, furthermore contributing towards job creation in the primary and secondary sector, towards food production on national and international level and towards revenue for Government in terms of taxes paid. Sustainable means preserving and even improving the production potential, so that the generations to come can still make a living from that land. It should be the aim of every landowner to leave behind a farm that is in a better condition than the one he started off with, including production capacity, infrastructure and natural resources, e.g. underground water, fauna (game) and flora (plants).

Commercial farmers in general are often perceived as being wealthy, which, however, is not the case. Becoming a successful farmer in Namibia may take years and even generations, and requires love for and dedication towards farming, hard work, good management skills, financial discipline, persistency and a positive attitude.

Climate (rainfall) and other external unforeseen events can have a major influence on the progress made on the farm, and can ruin achievements made over years within a matter of time.

To get an indication of the current gross/net income on a cattle farm, the following indicators could serve as a guideline.

The average stocking rate on cattle farms in Namibia is ± 25 kg biomass (live mass) per ha. In old terms this meant ± 14 ha for every animal on the farm. In a cow/ox production system the production of beef (live mass) should be about 35 % of the stocking rate.

This means that if no herd building takes place, the farmer has $25 \text{ kg} \times 35 \% = 8,75$ kg live mass/ha available for sale every year.

At an average selling price (cows, oxen, heifers combined) of N\$9.00/kg live mass he/she would be able to generate a gross income of $\text{N}\$9.00 \times 8,75 \text{ kg} = \text{N}\$78.75/\text{ha}$ ($\pm \text{N}\$80.00$).

The operational costs will be at least around 50 % of the gross income, which leaves a net income of $\text{N}\$80.00 \times 50 \% = \text{N}\$40.00/\text{ha}$.

On a 5 000 ha cattle farm the gross income will thus be $\pm \text{N}\$400\,000.00$ and the net income, if operational expenditure is well managed, $\pm \text{N}\$200\,000.00$. This amount is available for interest and capital repayments (Agribank), new improvements/replacements on the farm and private expenditures.

These indicators clearly show that a 5 000 ha cattle farm will not enable a farmer to become wealthy overnight. To the contrary, for those farmers to survive they often either create additional income with employment elsewhere, or they venture into diversification on the farm e.g. guest farms, hunting, crops, hay, olive and charcoal production, etc.

It is advisable not to diversify as long as the main production line is not well managed and exploited to its full potential.

Although the commercial farmer functions in isolation on his property and to a great extent depends on himself concerning the day-to-day activities and progress on the farm, it is still important to establish and maintain good relationships with the neighbours. The control of stock theft and illegal hunting, predator control and the maintenance of border fences, etc. require good and open communication with, and trust in the neighbours.

In conclusion, farming should be a constant process of learning. Even farmers with formal agricultural qualifications still have to keep in touch with the latest developments concerning farming practices, market requirements, consumer preferences, etc. It is advisable to make use of every opportunity to improve their own knowledge and skills, to enable themselves to adjust and therefore survive and prosper in an ever-changing world. Farmers' days, study groups and established successful farmers can be a good source of knowledge and new ideas and are often a stimulation to creative thinking.

INTRODUCTION

Worldwide, increasing pressure is placed on the ever-decreasing agricultural land to produce more food for a growing world population, at the same time serving as a buffer against ecological catastrophes and still remaining a place for leisure and pleasure for urban populations. Namibia is no exception.

This places an enormous responsibility on the landowner or tenant to use the land under his control as productively as possible without exploitation. In a dry country like Namibia, this is extremely difficult, as mistakes which have led to veld deterioration and desertification may take generations to put right again. A livestock herd with poor productivity can be improved within a few years with visible success. Deteriorated rangeland, however, will take generations to recover.

It should be realised that extensive stock farming is totally dependent on rangeland. Without grazing and browse, no stock farming is possible in Namibia.

Whilst it is realised that rangeland management is a field where the last word has not been spoken yet, this manual aims to serve as a guideline for the farmer who wishes to be market orientated and to farm productively and sustainably on rangeland with the existing knowledge currently available.

In general, desertification has been identified as a major threat in Namibia as a whole. Indicators of desertification and land degradation are:

- lowering groundwater tables;
- soil erosion;
- loss of trees;
- decrease in preferred grasses and shrubs;
- bush encroachment;
- increase in soil salinity;
- decrease in soil fertility.

In connection with the above mentioned, this manual aims to address the following points, which are applicable to the rangeland farmer who produces livestock for the Namibian market:

- Stock management in such a way that preferred grasses and shrubs increase.
- Management which will improve total grass production on the veld.
- Ways to prevent and combat bush encroachment.
- Ways to combat soil erosion.

Successful attention to these issues should eventually lead to higher animal production with lower drought risk and would thus support the overall mission to produce meat for the market regularly on a long-term, sustainable basis.

Research is underway to establish a grazing index value for various common grasses and dwarf shrubs for shrubveld in southern Namibia. Factors like available forage cover and various nutritive values are included. If feasible, an evaluation of a few prominent species on a site should give an indication of the veld condition (and even carrying capacity) of these veld types.

Rangeland management in arid and semiarid Namibia in a nutshell

- Variation in rainfall in terms of geographic area, between seasons, and distribution within a season, has the single biggest impact on rangeland conditions and productivity. With the impact of climate change, extremes between low and high rainfall years will even increase, making it more and more difficult for livestock farmers to survive. Livestock farmers should understand the difference between ARIDITY and DROUGHT and be proactive rather than reactive.
- The biggest challenge for livestock farmers is to adjust livestock biomass (or numbers) to available fodder sources on a regular (at least an annual) basis. Several techniques for doing so exist or are in the process of being developed. In other words, prevent OVERSTOCKING.
- Short grazing periods (from a few days to a week) during the growing season, followed by resting periods for as long as possible (90 days and more) are the only way in which denuded veld can improve or productive land can be maintained. In other words, prevent OVERGRAZING.
- BUSH ENCROACHMENT has a tremendously negative impact on veld productivity and combating it should be part and parcel of every livestock farmer's long-term strategy. There are several methods for doing so.

CHAPTER 1

The Ecology of Natural Grasslands

The purpose of this chapter is to explain that:

- veld is not stable, but always in a state of change;
- various factors determine the direction of change and the optimum state which can be reached.

In order to understand the reaction of plant communities to various forms of treatment, it is necessary to understand some basic principles that govern their development. The progressive development of vegetation through a series of different plant communities is known as **plant succession**.

1. Plant succession

Primary succession describes the process of plant development on a bare area which has never supported any vegetation before. The first plants to populate such an area can withstand utmost extremes, e.g. virtually no soil depth and extreme climatic conditions (temperature, water runoff). These plants pave the way for other plants, which already need somewhat more favourable conditions. This process continues until a **climax** state of vegetation is obtained. This can be determined by climate (climatic climax), soil (edaphic climax) and fire or grazing climax, whatever might be the most limiting factor. In Namibia with its low and erratic rainfall, climate (rainfall) will be the most limiting factor, but all the other abovementioned factors (soil, fire, grazing) play a role as well.

Veld in healthy condition that is temporarily exposed to drought or fire (or even temporarily severe overgrazing) will immediately return to its former condition after favourable conditions for growth have been experienced.

Secondary succession occurs whenever a plant community has been disturbed and is no longer in equilibrium with its environment, although some plants have remained. Secondary succession (positive or negative) is in operation continuously as a reaction of different grazing treatments, climatic conditions (drought), fire, etc. Thus, veld condition is seldom stable, but always in a state of change in some direction. In areas where climate limitations prevent the vegetation from developing beyond the grassland stage, the climax is often the most productive community. In higher rainfall areas where the climax might be bushveld or forest, it might make sense to force the vegetation back to an ecologically lower status (grassland), to be more suited for certain farming practices (animal husbandry).

2. The role of competition in plant succession

Competition always arises where different individuals receive an insufficient quantity of limiting resources to fulfil their needs. In plant communities, these limiting factors are, amongst others, sunlight, moisture and nutrients. Different plant species have different abilities to withstand certain limiting factors. Depending on the intensity and the duration

CHAPTER 2

Growth of Plants

of the limitations, it is inevitable that the composition of a plant community will change for species that are more able to withstand the limitation. In practice, limited moisture for several years (drought) will be favourable for species which can withstand drought conditions (desert grasses), while species which are more suited for moist conditions, will relatively decrease. In the same way, some plant species are more tolerant to frequent defoliation (grazing) during the growing period than others. A grazing system with forced frequent grazing during the growing period will thus promote these species in a sward.

Favourable soil conditions (ability to store water and high nutrient status) can greatly compensate for low rainfall. This explains the presence of many highly sought-after grasses in the most arid parts of Namibia and their absence in higher rainfall areas with very sandy soils.

Climax grassland consists to a great extent of perennial grasses that will live for a few consecutive years and will give excellent long-term stability, but tend to get hard and woody over years. Farmers sometimes mismanage this veld and it develops back to a more pioneer type of grassland, which consists more of annual (very palatable) grasses, but needs to regrow from seed each year (“soetgrasse” – annual *Eragrostis* species). This might be an advantage as long as good rainy seasons (which promote germination and establishment of annual grasses) prevail, but can be fatal during less favourable rainy seasons. Due to differences in numerous factors like rainfall, soil type, slope, etc., it is not possible to supply a list of the most sought-after grasses and dwarf shrubs for all parts of Namibia. Undisturbed veld, (in many cases the road reserves) and the opinion of conservation-conscious fellow farmers should, however, give an indication of what the climax grasses for a specific area should be.

The purpose of this chapter is to make the reader understand that:

- grasses react differently to grazing and rest at different times of the year;
- it is important not to damage the lower growing zone (meristem) of grasses;
- reaction of bushes and shrubs are different from that of grasses;
- a mixed species composition has advantages.

1. The development of a single grass plant

If a grass seed germinates under favourable conditions, it basically consists of two growing zones (meristems), namely the stem apex and the root apex. The function of the first roots is only to support the newly developed plant and will die off as soon as a real root system has developed. Tiller buds, growing out laterally (sideways), will develop into lateral tillers. With perennial grasses, each lateral tiller will develop its own root system. This makes the grass perennial. An annual grass (also maize, wheat, etc.) does not develop lateral tillers with an own root system.

At an early stage, all cells of the developing grass plant grow simultaneously. Later, two definite growing zones (meristems) can be distinguished. One is at the base of the grass plant (where the leaf sheath transits into the root) (this growing zone elongates later when seed-bearing tillers are formed) whilst the other growing zone is where the leaf parts from the leaf sheath into the leaf blade. Each aboveground part of the grass plant thus has one growing zone which is rarely damaged by grazing, namely close to the soil surface. If, however, a growing zone is damaged, no growth will be possible from this growth zone any longer.

At some point of time, the growing zone at the base of the grass plant will stop forming new leaves, will elongate and form a flower. When and how fast this happens, will differ between grass species and according to circumstances (rainy season).

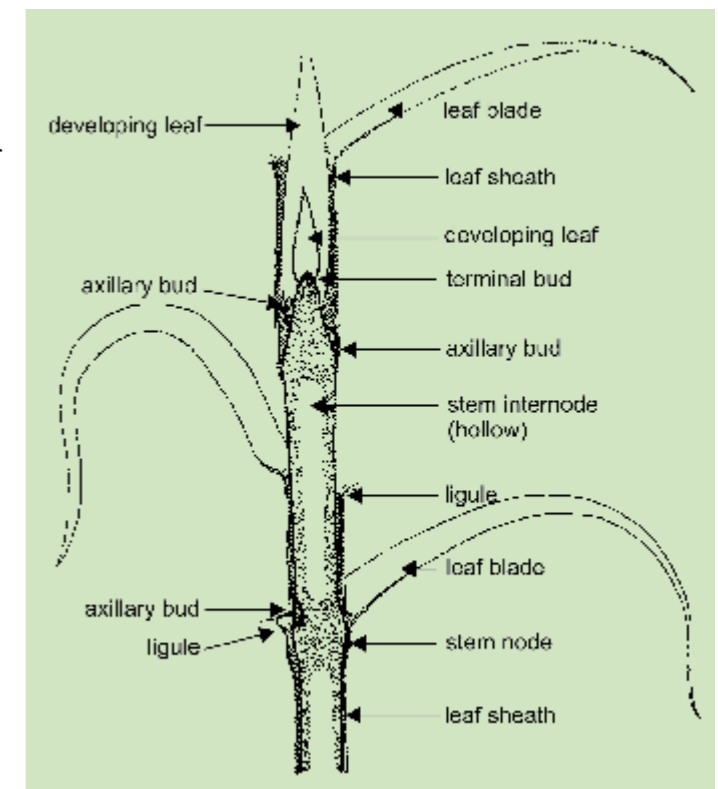


Figure 1: Vertical section through the growing shoot of a grass (© Roux, E. 1969)

2. Photosynthesis

A green leaf is able, through sunlight shining on it, to produce carbohydrates (sugars) and proteins from water and minerals, which are absorbed by the roots, and carbon dioxide, which occurs naturally in the air and enters the leaf through little “holes” at the bottom of the leaf.

3. The growth cycle of an established perennial grass plant

Figure 2 illustrates the growth cycle of a perennial grass plant.

Why is it necessary to understand the growth cycle?

The grass plant should be grazed (defoliated) and one must understand what happens when defoliation is applied at different stages.

3.1 Initial growth

When favourable circumstances arise (temperature and moisture), the established perennial grass plant starts producing leaf tillers. Growth is totally dependent on reserves (which are stored in the roots or lower parts of the tillers). Grazing will result in the grass plant producing new tillers from its reserves numerous times. This might lead to a complete depletion of reserves and the death of the grass plant (not only by grazing, because a long, early summer drought can have the same effect).

3.2 Active growth period

The grass plant is well equipped with green leaves and produces its own nutrients. Growth is fast. Grazing can have positive as well as negative effects. Grazing limits the photosynthetic surface and limits growth, but it also stimulates the grass plant to form new tillers. The most important point is not to damage the growth points (growing zones) with grazing.

3.3 Flowering/seed formation

Grazing of the growing zone at the point of a tiller that bears a flower will result in the forming of new tillers (only with grasses that form lateral tillers). This is positive, especially if a long growing season is to be expected. It is, however, also necessary to make provision for seed forming for forthcoming years.

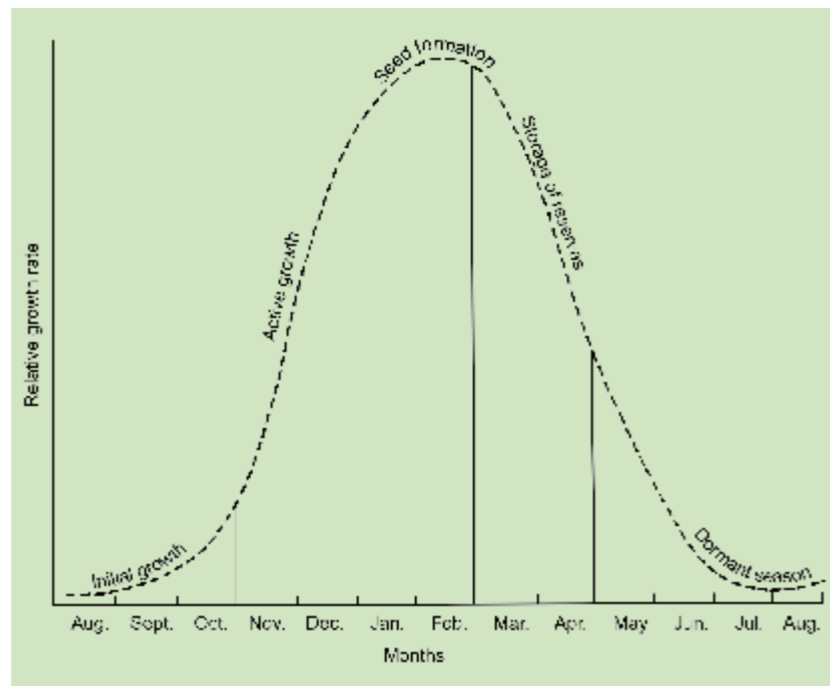


Figure 2: Growing cycle of a grass plant (© Du Toit, J.)

3.4 Nutrient translocation period/storage of reserves

After the active growth period, the grass plant moves nutrients formed by photosynthesis to the roots or lower parts of the tillers as reserve for regrowth the following year. Heavy grazing will result in poor regrowth in the next season. It is especially important to keep this in mind if the rainy season was favourable enough to facilitate the establishment of new plants from seeds.

3.5 Dormant season

This period starts with the first frost. Aboveground plant material dies to a great extent. Very little photosynthesis takes place and the grass plant survives on reserves. Grazing does not have any negative impact as long as the lower tiller parts (where the reserves are stored) are kept intact.

By rule of thumb, *overgrazing* happens when animals stay in a camp too long during times of rapid plant growth – or if they return too soon when growth is slow.

4. Growth of shrubs and bushes

Shrubs and bushes, through their pods, leaves and flowers, provide a substantial part of the diet of small stock and should be considered.

- Germination of savanna trees and bushes is generally poor and establishment of seedlings only happens in exceptionally good rainy seasons.
- The growing zone of most savanna trees, bushes and dwarf shrubs is situated at the tip of a shoot and in the axils of leaves. Growth from the normally dormant (resting) growing zone at the base of a stem only occurs when the upper growing zones are removed.
- The production of browse (bush feed) is much less than grazing with grasses, but is more readily available throughout the year and the nutritional value is higher if not overbrowsed.
- Browsing is necessary to stimulate growth, but should be moderate and preferably during the later growing season.
- Recovery after browsing is slower than after grazing with grasses. Moderate browsing followed by resting is necessary to maintain vigour.

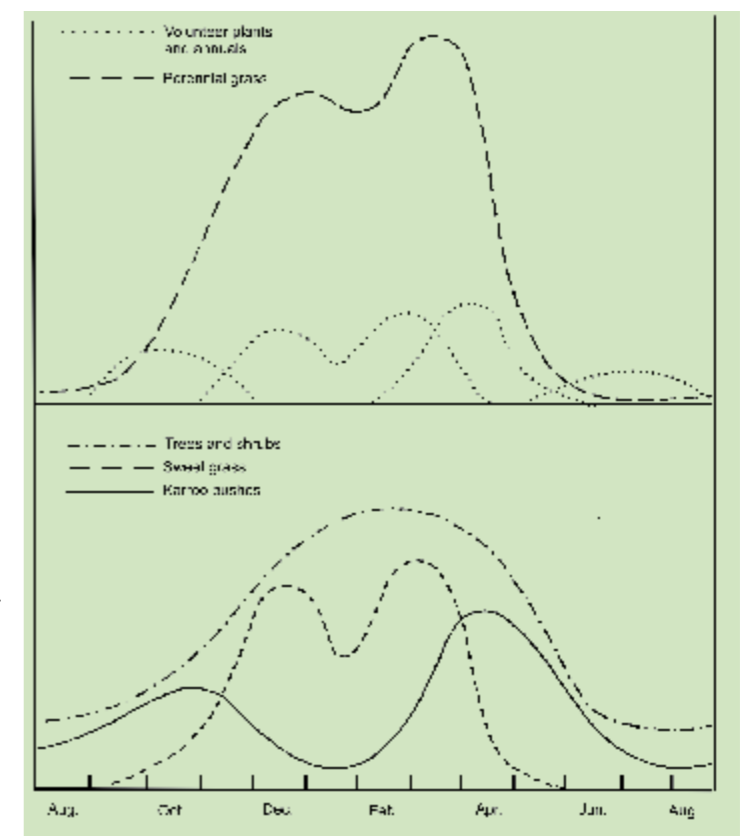


Figure 3: Typical growth cycles of some perennial and annual grasses as well as trees and shrubs (© Tainton, N.M. 1981)

5. Productivity and stability of plant communities

Productivity and stability in any grassland system (in fact in any agricultural system) are very important factors, but are unfortunately negatively related to each other. Stability in a natural ecosystem is reached by a big variety of different species which each handles different environmental changes, pests, etc. in different ways. This gives the system stability. Unfortunately, however, complex systems tend to be less productive. For this reason natural vegetation is often ploughed out and replaced by single species (crops, planted pasture, etc.). The aim of veld management, especially in areas with erratic rainfall, should thus be to maintain a mixed veld with a rich variety of plant species (climax condition).

CHAPTER 3

Veld Types in the Farming Areas of Namibia

After studying this chapter, the reader should realise that certain areas in Namibia are more suited for certain types of grazing/browsing animals.

In recent years, substantial effort has been put into compiling an agro-ecological zoning map of Namibia. An agro-ecological zone is considered to be a land entity that is sufficiently uniform in terms of climatic landform and soil features for broad planning objectives. By these criteria, 69 preliminary agro-ecological zones have been identified and described and an agricultural potential has been coupled to each one.

For grazing livestock, however, it might be adequate to look very briefly into a few veld types which exist within Namibia and which, on their own, give a good idea for which grazing animal they might be suited.

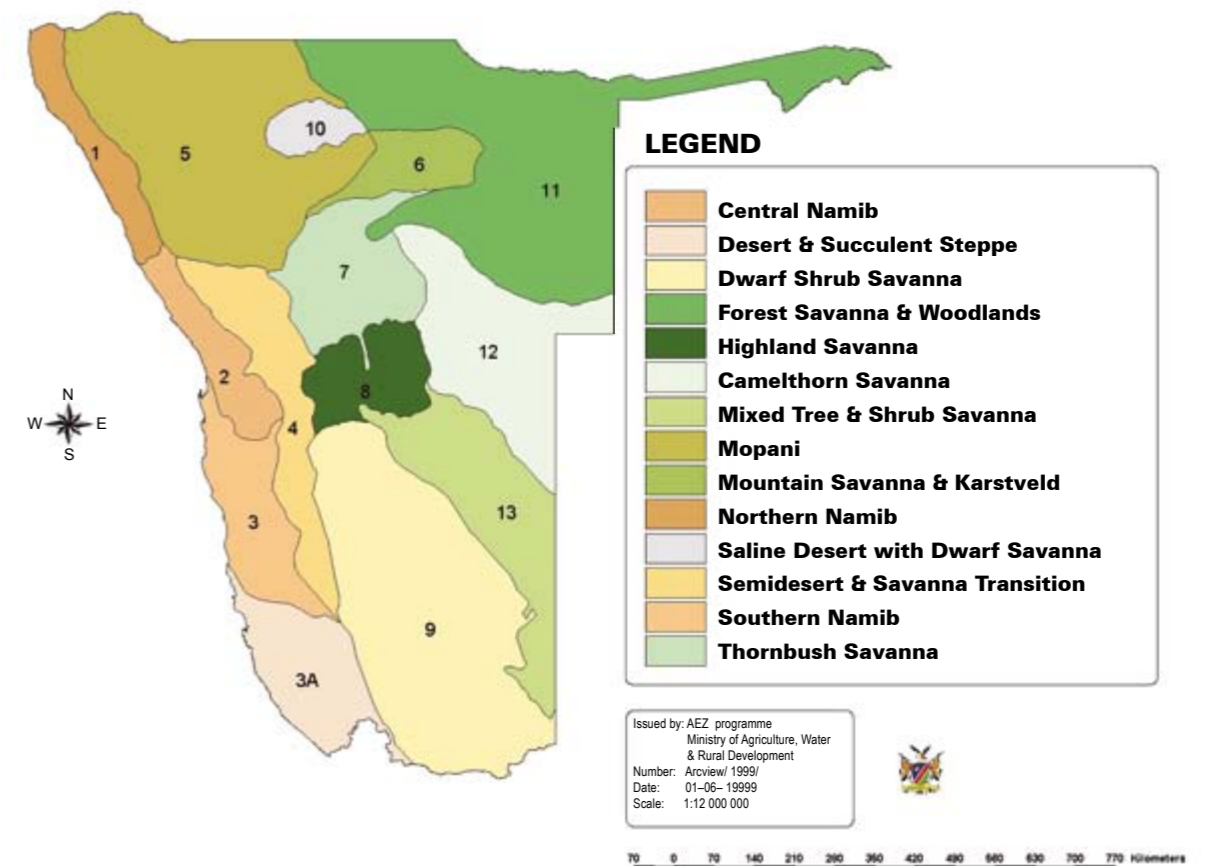


Figure 4: Vegetation map of Namibia (© Giess, W. 1971)

1. Deserts (see areas 1, 2, 3 and 3A on the map)

As the deserts fall outside the farming area of Namibia, they have been left out on purpose. High-quality grazing for sheep (and even cattle) is available in a few, very extraordinary rainy years.



Photograph by Tiaan van der Merwe

Central Namib before the rains



Photograph by Tiaan van der Merwe

Central Namib after the rains

2. Savanna

2.1 Semidesert and savanna transition (area 4 on map)

Parts of this veld type have a fair amount of dwarf shrub which is well suited for goat (and sheep) farming, whilst other parts tend to have a bush component, combined with mainly *Stipagrostis* grasses, suited for sheep. Generally, the rainfall is too low to support bulk feeders like cattle for several years.



Photograph by Ben Strohbach

2.2 Mopane savanna (area 5 on map)

The Mopane tree (or shrub) dominates this veld type. The grass cover varies substantially between soil types and rainfall, and so does the edible shrub component. The rainfall gradient is very steep. In the eastern parts, dry land crop farming is possible, in the intermediate zones cattle farming is possible and in the extreme western parts only sheep farming is possible. The shrub and bush component renders some areas suitable for goat farming.



Photograph by Ben Strohbach

2.3 Mountain savanna and karstveld (area 6 on map)

This veld type consists of a big component of browsable trees and shrubs with palatable, shadow-loving grasses underneath. It is mainly used for cattle farming. Dry-land crop production is possible where the soil permits it. The many browsable trees and bushes suggest that goat farming should be included.



Photograph by Ben Strohbach

2.4 Thornbush savanna (area 7 on map)

Bush encroachment, which creates a major concern in most parts of northern Namibia, is of particular importance in this area. However, if controlled, the area is very well suited for cattle farming. Many of the most valuable grass species to be found in Namibia should be present in climax veld in this area.



Photograph by Ben Strohbach



Photograph by Ben Strohbach

2.5 Highland savanna (area 8 on map)

The Khomas Hochland consists of this veld type. Again the most valuable climax grasses should be present and the area is very well suited for cattle farming.



Photograph by Willem Jankowitz

2.6 Dwarf shrub savanna (area 9 on map)

This veld type covers vast parts of the central south of Namibia. A big variety of dwarf shrubs supplemented by the more drought-resistant grasses, supply excellent browse for sheep and goat. Due to low and erratic rainfall, cattle farming is seldom feasible on the long term.

2.7 Camel-thorn savanna (central Kalahari) (area 12 on map)

The characteristic of this veld type is the open savanna with camel-thorn trees and grassland in between. A few shrubs are present, but the shrub/bush component is generally too little to support goats properly, especially in the dry months of the year. Cattle farming is the main enterprise due to the availability of bulk grazing (often of low quality).



Photograph by Marina Coetzee

2.8 Mixed tree and shrub savanna (southern Kalahari) (area 13 on map)

The dunes of the southern Kalahari make up this veld type. Shrubs are mainly limited to “streets” between dunes. Mixed cattle and sheep farming, with the emphasis on sheep, up to only sheep farming (more south) is practised.



Photograph by Ben Strohbach



Photograph by Ben Strohbach

3. Woodlands

3.1 Tree savanna and woodland (northern Kalahari) (area 11 on map)

The eastern parts of Oshanauna, Kavango and down to Waterberg form the habitat of the only fairly dense woodland of Namibia. Many different deciduous trees (losing their leaves in autumn) and bushes are present. Cattle farming is the main enterprise, but goats should be an alternative.

CHAPTER 4 Grazing Management

This chapter explains:

- generally used terminology in rangeland management;
- what is to be achieved by resting of veld;
- the grazing impact of various farm animals;
- the problem of various forms of selective grazing;
- why and where fences should be erected;
- the advantages and disadvantages of various grazing systems and why some are preferred to others.

In very broad terms, the objectives of grazing management are the following:

- Utilisation and conservation of natural grazing.
- Maximum animal production without negative impact on plant production.
- Considering the needs of the plant, the animal and the soil.

1. Frequently used terminology

In order to understand grazing management, some frequently used terms need to be explained.

1.1 Continuous grazing

This describes a management system where a certain area (camp) is grazed continuously for the full year.

1.2 Rotational grazing

This practice describes a system where more camps than groups of animals exist on a farm and camps are grazed in sequence, one after the other. In doing so, each camp receives a period of rest and a period of grazing. During the resting period, all animals must be removed from the specific camp. Animals are thus forced to utilise only a part of the whole farm for a certain period of time.

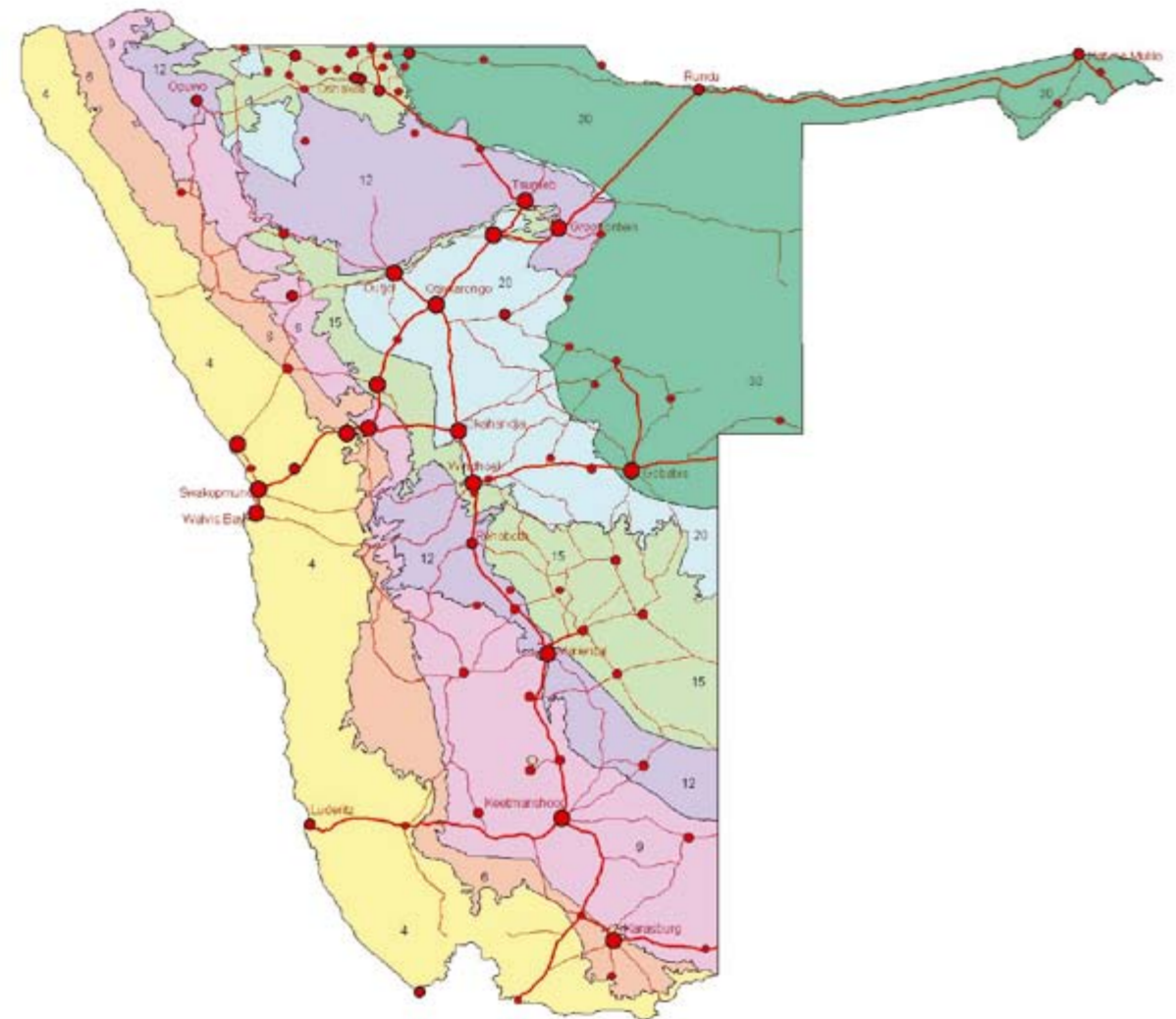
1.3 Zero grazing

With zero grazing no animals are ever permitted on the land, but the produced grazing is mown and offered to the animals at another place (e.g. feedlot). This practice is seldom applied in low rainfall areas like Namibia.

1.4 Grazing capacity (carrying capacity)

By this term, the productivity of a grazing area is described in terms of the amount of kilogram live animal mass (biomass), which a certain area can support for a lengthy period

of time, (normally one year). Maps for the long-term grazing capacity for Namibia have been compiled. Grazing capacity is expressed as hectares needed to support one large stock unit or one small stock unit for the period of one year under **normal circumstances**.




NAMIBIA Carrying Capacity
(Provisional Update - May 2003)

Carrying Capacity		
kg/ha	ha/LSU	ha/SSU
4	-	14
6	-	9
9	-	6
12	30	4.5
15	24	2.5
20	18	-
30	12	-

● Municipality
 ● Town
 ● Village

Main Road
 Trunk Road



Issued by : Agro-Ecological Zoning Programme
 Ministry of Agriculture, Water & Rural Development
 Number : ArcView/2003/010
 Date : 8 May 2003
 Source : Subdivision Pasture Science
 Directorate of Agricultural Research & Training
 Ministry of Agriculture, Water & Rural Development
 Projection: Geographic

100 0 100 200 300 400 Kilometers

Although a large stock unit (LSU) is clearly defined (one LSU is the equivalent of an ox with a mass of 450 kg and a growth of 500 g/day) and other animals (game, small stock) are defined in relation to an LSU in terms of their nutritional needs [6 small stock units (SSUs) are more or less one LSU], it was found appropriate to express grazing capacity as kilogram live mass which an area can support for one year (thus kg/ha/year). This formula caters better for larger and smaller animals by simply weighing (or estimating the weight) of the animals over a year.

1.5 Stocking rate

Stocking rate is the area that a farmer allocates for each LSU/SSU (or kg live mass) for a year. The stocking rate should be in harmony with and should continuously be adapted to the carrying capacity.

1.6 Grazing density

This term describes the amount of LSU/SSU (or kg live mass) on a given piece of land (camp) at any given point of time. It is expressed as LSU/SSU per ha (or kg/ha) and shows the concentration of animals in a camp.

2. Aims of grazing management and principles to be applied

2.1 Aims of grazing management

The first aim of grazing management and grazing systems is to obtain maximum animal production in the long term. This aim can be subdivided in various smaller aims:

- A high production of fodder (grazing) on the veld.
- The production of a high quality fodder (nutritional value and palatability).
- Constant supply throughout the year and for the future. Provision should be made for drought situations.
- Effective utilisation of the available veld by the grazing animal. This includes utilisation by the best-suited type of animal (cattle, sheep or goat) and having high quality, productive animals of the best-suited type.

Secondly, grazing management should be aimed at maximum protection of the fertile topsoil. This can be achieved by aiming for a dense population of perennial grasses, combined with dwarf shrubs and bushes where possible.

Thirdly, it should be aimed, within the limitations that soil conservation imposes, at making animal farming economically worthwhile. The total aim should thus be a method that enables the farmer to utilise the veld, generate an income and improve veld condition at the same time. Most of the time, however, a compromise between these three components is needed.

2.2 Principles of veld management

Grazing management in low rainfall areas like Namibia basically cuts down to the principle of alternative utilisation (grazing) and rest of veld.

Figure 5: Carrying Capacity Map of Namibia

Effective utilisation of veld

Due to the complexity of this subject, it will be discussed under various headings hereafter. In short, utilisation should be aimed at maximum animal production (without veld deterioration). To achieve this, attention has to be given to the grazing habits of various farm animals, selective grazing and physical veld management planning.

By rule of thumb, a rest period of six weeks with a grazing period of one to two weeks during the growing season is adequate for most parts of Namibia. In the dormant season, a grazing period of two weeks to one month should do no harm to veld and should keep animals happy.

Effective rest of veld

- Veld is rested to obtain maximum production and vigour of the grazing plants (grasses and shrubs). As has been illustrated under the topic “growth of plants”, veld is rested for:
 - seed production;
 - seedling establishment;
 - development of tillers;
 - accumulation of leaf material;
 - plant vigour;
 - accumulation of reserves.
- Rest can be used as a tool to influence the balance between grass, dwarf shrub and bush component.
- The time when the veld has to be rested to obtain the abovementioned effects has been discussed.
- The duration of a rest period is greatly influenced by the veld type, veld condition, climate (rainfall) and aim of the rest period. Generally, any improvement of veld condition will need a longer rest period. Also, lower and more erratic rainfall asks for longer rest periods.
- The sequence of rest is, again, determined by the aim. For example, rest for seed production will benefit from rest for seedling establishment and rest (or light grazing) to give the young plants a fair chance to obtain vigour.

Short grazing periods combined with long rest periods are prerequisites for improving rangeland productivity and condition.

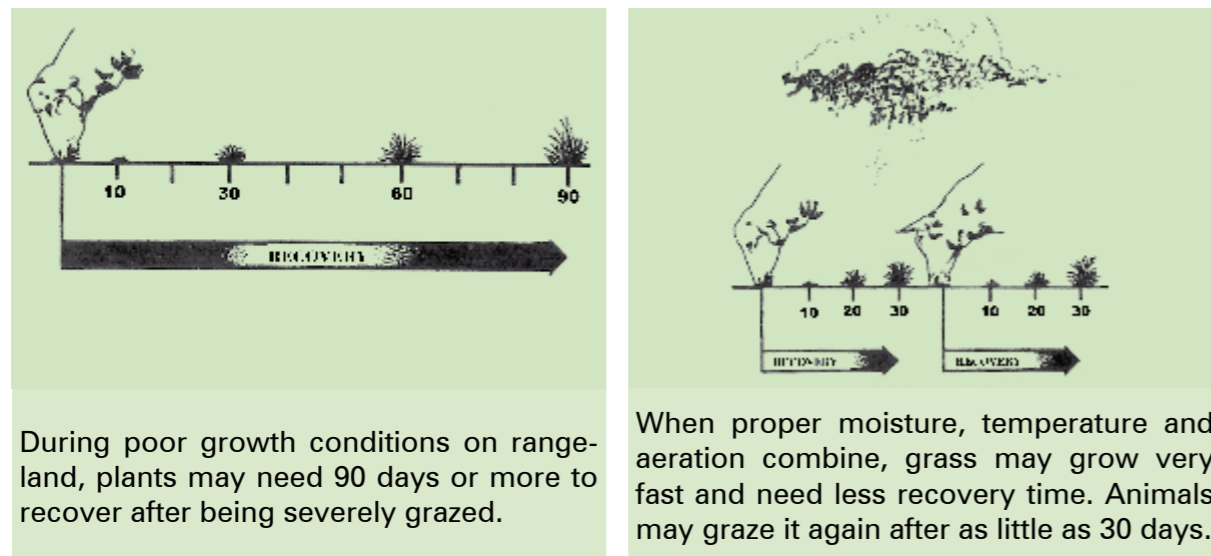


Figure 6: Different recovery times as needed by the grass plant during different seasons (© Savory, A. 1988)

2.3 The grazing animal as utiliser of veld

• Veld type

In the discussion of veld types of Namibia, it has already been mentioned that cattle are better suited for pure grass veld, while goats need a fair dwarf shrub or palatable bush component to thrive.

• Topography

Highly productive animals (dairy cows) and heavy animals are normally less suited for very mountainous terrain.

• Grazing habits

Big differences occur between cattle, sheep and goats concerning the selective grazing habit, the preferred plant component (shrub or grass) and the grazing height. This should be considered when making a choice.

Cattle: Cattle are primarily grazers, while well-adapted cattle also use a fair amount of browse. They are not very selective grazers, but rather bulk feeders. The grazing range is between 8 cm and 60 cm. This causes cattle to be less severe grazers than most other animals, but cattle are also the least adaptive concerning their grazing habits.

Sheep: Sheep are very selective grazers and prefer a grazing range of between 2 cm and 30 cm. They are good browsers and, if permitted, will use grass in summer and shrubs in winter. Sheep tend to feed from bottom to top (in contrast to cattle and goats which feed from top to bottom). They are regarded as severe grazers because they graze selectively and very low.

Some sheep breeds (Karakul and Damara) tend to flock whilst others graze individually. This has different effects on the veld and should be considered in grazing management decisions. In mountainous terrain, some sheep breeds prefer grazing on foot slopes, while others prefer crests and middle slopes. Good use can be made of this phenomenon to optimise production by combining various breeds.

Goats: Goats are primarily browsers, but use herbs and grass as well. The preferred grazing range is between 10 cm and 150 cm. Goats are regarded as less selective grazers because they select such a wide spectrum and because they tend to graze from top to bottom. Under wrong management, however, they tend to be extremely severe grazers due to their very adaptable grazing habits.

Horses, donkeys and mules:

These animals are mainly grazers, but browse as well. Due to their preferred grazing range of between 2 cm and 20 cm, they are regarded as very severe grazers which can do great harm to the veld.

Combinations of various types of animals: Very few veld types are suited for one type of animal only. Combinations are thus possible and even recommendable as various types of animals can complement each other's grazing habits. To find the right combination will need expert advice and some trial and error. It is important, however, to graze the various animals simultaneously in the same camp.

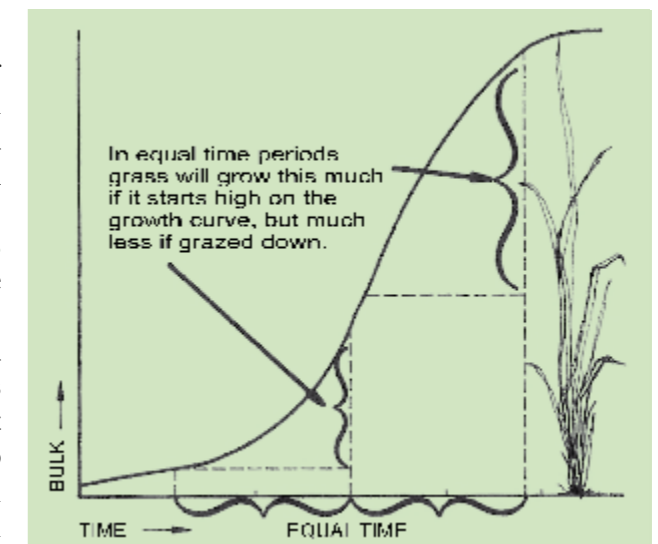


Figure 7: The effect of foliage availability for photosynthesis by the grass plant on recovery time after grazing (© Savory, A. 1988)

2.4 Selective grazing

Selective grazing, just as overgrazing, is an important reason for veld deterioration, but is in most cases less obvious and thus less easily observed. The term selective grazing describes the habit of animals to select certain plant species, plant parts and parts of camps above others. The result is that these parts or species are grazed and trampled more severely than others.

- **Plant part selection**
Animals prefer young, juicy tillers and leaves to old, lignified (woody) plant parts. Flowers and flower buds of shrubs are much sought after by sheep and goats.
- **Selection of plants of the same species**
This is normally observed in very homogeneous (only one type of grass) stands of grass where certain plants are selected due to differences in soil, genetic differences or treatment differences (previous grazing, fire).
- **Species selection**
This is the most common form of selective grazing and the most difficult to combat. Certain plant species are more acceptable to the grazing animal than others. This leads to unequal defoliation (with all the disadvantages and advantages thereof) of different species in the same sward.
- **Area selection**
This occurs when different veld types (plain and mountain) occur in the same camp. It will occur in any camp where differences in palatability (in many cases as a result of differences in soil type) occur.
- **Seasonal selection**
This type of selection is mainly observed in dwarf shrub veld where sheep tend to concentrate on grass in summer and shrubs in winter.
- **Interspaced overgrazing**
A large bush component can limit access to certain areas which again leads to overutilisation of spaces between bushes which are accessible. Vice versa, a bush-cleared part within one camp will lead to overgrazing of only that part of the camp.

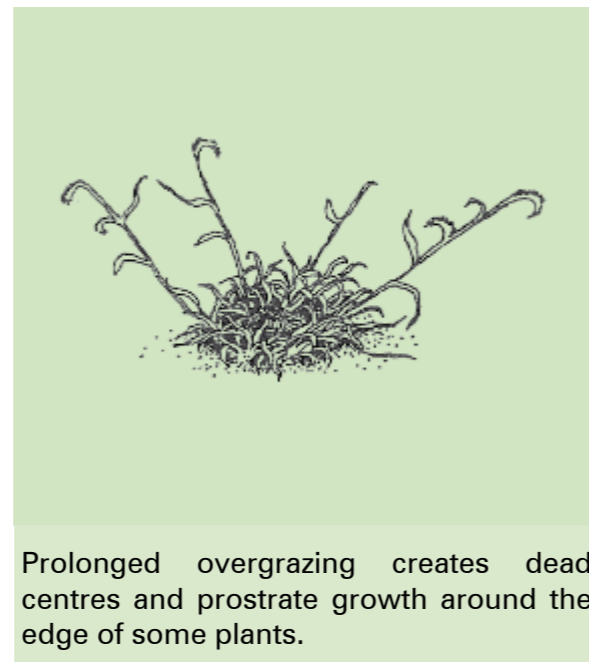
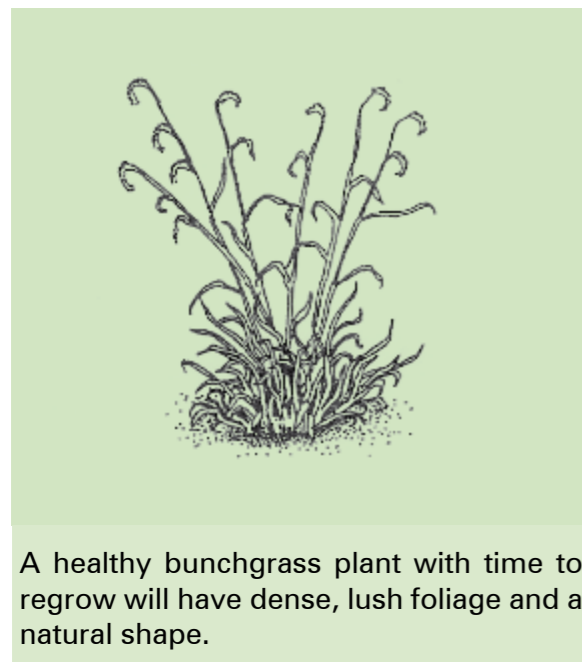


Figure 8: The effect of prolonged overgrazing on the recovery ability of the individual grass plant (© Savory, A. 1988)

2.5 Physical veld management planning (land division)

In order to arrive at the aim of grazing management, namely to use and conserve natural grazing to gain maximum advantage for the grazing animal, the plant and the soil, and considering the grazing habits of various farm animals, it is inevitable that limitations be put on time and space where these animals are allowed to graze. This is done by erecting fences to create numerous camps for one single herd of animals. This physical form of planning should be a combined effort of the extension officer and the farmer. In order to decide where exactly a fence should be erected, the following sequence from a rangeland management point of view, is followed:

- a) Separate cultivated lands from natural veld and camp out eroded parts of land.
- b) Separate various veld types from each other as far as possible.
- c) Within these veld types, further subdivide according to: topography, plant species composition, and soil type.
- d) Further subdivide according to veld condition.
- e) For management purposes, more or less equal camp sizes and convenience regarding the movement of animals from one camp to another should be considered.

It will be obvious that, in many cases, it will be practically impossible to arrive at all of the above mentioned points, and compromises will have to be made.

Rather include a small piece of less sought-after veld in a camp with generally more preferred veld than the other way round. A small piece of preferred veld will be destroyed before the animals will move to the less sought-after, bigger part of available grazing. Positioning a water point in a less sought-after part of a camp can force animals to come there and utilise this part at least to a certain extent.

The number of camps needed for one herd of animals remains an ongoing debate. The following advantages of many camps per herd should be considered:

- shorter grazing periods and longer rest periods will be possible;
- fewer footpaths and less trampling around water points will occur;
- selective grazing can be controlled more effectively;
- more flexibility and stability of the whole farming operation can be achieved;
- animal management for purposes like stock inspection, etc. is easier.

A system of many camps, however, also has some disadvantages:

- erection costs are high;
- maintenance costs are high;
- a higher level of management is needed;
- if mismanaged, veld deterioration will occur much earlier than with a few large camps.

Water supply should, ideally, be in the middle of each camp to avoid daily animal movement to the same corner of a camp. In most cases this is not financially viable.

Long, narrow camps should be avoided if possible, especially if the water point cannot be placed in the middle of the camp. Over utilisation close to the water point and under utilisation in the far-away corners will be the obvious result.

The supply of shelter and shade might be necessary in areas where no natural shade and shelter are present. The disadvantage, again, is the concentration of animals around these structures.

3. Different approaches to rangeland management

A grazing system should be seen as a tool used to achieve the aim of maximum animal production in the long term to the advantage of the farmer, and to protect and improve veld and soil conditions at the same time.

3.1 Rotational grazing

Only a part of the whole grazing area is available for the grazing animals whilst other parts are left ungrazed at **any given time**. The same camp will thus be alternatively grazed and withdrawn from grazing.

Advantages

- Rest can be applied to the grass sward and browse for various reasons as described earlier.
- Selective grazing can be limited, which gives way to more effective use, fewer bare patches and a better botanical composition.
- Overgrazing close to the water point and footpath forming occur less often than with permanent grazing.
- Provision for drought by total withdrawal of camps from any grazing is possible.
- Priority treatment to some areas is possible.
- More flexibility and stability can be incorporated into the whole farming operation.
- Production per hectare tends to be higher, although production per animal tends to be lower.

The more camps there are available per herd, the more advantages can be achieved. If the number of camps on a farm is limited, herds should be consolidated to enable proper rotational grazing.

Disadvantages

- Capital layout to erect and maintain the fences is high.
- Production per animal is lower.
- Intensive management is needed.
- Wrong decisions taken can have disastrous results.

Depending on the number of camps available per herd and the speed of rotation between the camps, a distinction can be made between slow and fast rotational grazing systems.

From the above-mentioned it is obvious that any rotational grazing system aims to rest a camp as long as possible and graze it for as short as possible during the growing season. Thus, the number of camps available and the number of herds that have to be run separately determine the rotational grazing system. All the abovementioned factors also emphasise the importance of limiting the number of herds in the rainy season to have the maximum amount of rest for camps during this season.

Any grazing system should be flexible (this is easier if many camps are available per herd). A rest period of six weeks is of no use whatsoever if no rain fell to promote growth, but might be long enough if optimal growth conditions were to be experienced.

Any rotational grazing system should be flexible according to the situation of the year and the condition of the veld.

3.2 Slow (conventional) grazing systems

All these grazing systems have a few camps (2, 3 or 4) per herd. Rotation normally happens on a seasonal basis. Attention is given not to graze the same camp in two consecutive years in the same season. The follow-up of two negative grazing seasons (i.e. seed forming and seedling establishment) should be avoided. The length of the grazing period is normally coupled to the speed of growth which takes place during this season. Two examples (of many possibilities) are given (three camps, A, B and C, in three consecutive years).

Table 1: System developed for primarily dwarf shrub veld in drier parts of the country

Months grazed												
Year	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.
1	A	A	A	B	B	B	C	C	C	A	A	A
2	B	B	B	C	C	C	A	A	A	B	B	B
3	C	C	C	A	A	A	B	B	B	C	C	C

Table 2: System for grass veld

Months grazed												
Year	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.
1	A	A	B	B	B	C	C	C	A	A	B	B
2	C	C	A	A	A	B	B	B	C	C	A	A
3	B	B	C	C	C	A	A	A	B	B	C	C

Please note that the abovementioned system for grass veld is adapted to the production potential of veld in various seasons. Each camp has a rest for virtually a whole growing season every third year, followed with rest periods in late and early summer.

3.3 Non-selective, short-duration grazing systems

For all fast (multicamp) grazing systems, five or more camps per herd are available.

The non-selective short-duration grazing systems are based on a few basic principles:

- Grazing period as short as possible – maximum 14 days (the reason being the re-fooliation of new growth of leaves).
- Minimum rest period of six weeks, preferably longer.
- A minimum of twelve camps per herd is recommended. This gives a grazing period of two weeks and a rest period of five months.
- The grazing density should be so high that more or less all species (palatable and less palatable) will be defoliated. Plant species selection should be eliminated by this approach as far as possible.

The main problem with the non-selective grazing approach is that it is virtually impossible to eliminate selective grazing. In an attempt to have animals graze as non-selectively as possible, virtually all grazable material in a camp is removed, with negative results on animal performance and plant regrowth, especially with erratic rainfall. A possible solution is a shorter grazing period and a longer rest period, which can only be achieved with more camps. This, however, will lead to over-capitalisation in terms of fences and water supply.

3.4 Controlled selective grazing

The underlying principles of this grazing system are the following:

- Grazing period as short as possible, especially during the growing season – during the active growing season not longer than fourteen days (rather three to five days), but longer in the dormant season.
- The duration of the rest period depends on the length of the grazing period, the growing season and the climatic conditions – preferably not shorter than six weeks.
- Grazing may be selective, but as soon as the most palatable species are defoliated more or less 60 %, animals should be withdrawn and moved to the next camp
- A minimum of six camps per herd is recommended. With eight camps per herd, two camps can rest for a full growing period each year.
- The underlying principle of controlled selective grazing is that palatable plants are not defoliated more than 60 %. Damage to growing zones and removal of photosynthetic surface is thus limited and growth vigour is stimulated. Less palatable plants are not defoliated and should eventually lose vigour and die.

Although the controlled selective grazing system will apply a lower stocking rate to achieve the goals, animal performance is higher than with non-selective grazing. Lower stocking rates will also reduce the immediate risk of drought as soon as a less favourable rainy season is experienced.

In practice it might be difficult to compare short-duration (non-selective) grazing with controlled selective grazing, but the physiological principles which are applied with controlled selective grazing are sound and the principle of lower drought risk should always be considered in low rainfall areas like Namibia.

Six camps **per herd** with a moderate stocking rate should be the aim to be achieved by farmers in most parts of the country.

Table 3: Comparison between non-selective grazing and controlled selective grazing

GRAZING APPROACH		
	NON-SELECTIVE GRAZING (NSG)	CONTROLLED SELECTIVE GRAZING (CSG)
CRITERIA		
Rate of defoliation	90 % and more	maximum 60 %
Manner of defoliation	non-selective	selective
Period of occupation	maximum 2 weeks	3 days to 30 days
Period of rest	6 weeks and longer	6 weeks and longer
Number of camps	12 and more	6 and more
ANIMAL PRODUCTION ASPECTS		
Stocking rate	higher than with CSG	lower than with NSG
Production per hectare	higher than with CSG	lower than with NSG
Production per animal	lower than with CSG	higher than with NSG
Reproduction percentage	lower than with CSG	higher than with NSG
Weaning mass	lower than with CSG	higher than with NSG
Ready for slaughter	later than with CSG	earlier than with NSG
Turnover	bigger than with CSG	faster than with NSG

3.5 Continuous grazing systems

The whole grazing area is available to the grazing animals for the whole grazable period (a year).

Advantages of this system

- They are cheap in terms of physical structures (fences and water points) that need to be erected.
- Management is easy.
- In cases where the stocking rate is low, the animal performance is usually high.

Disadvantages of this system

- Selective grazing takes place with overutilisation of the most palatable plant species.
- As a result of species selection, the botanical composition of the sward deteriorates.
- As a result of area selection, bare patches will develop which are favourable for erosion.
- Overgrazing next to the water point and footpath forming are severe.
- Build-up of reserves for times of drought is difficult.
- Animal production per hectare is usually low.
- With a low stocking rate, this system usually leads to slow veld deterioration.

Whatever the system, the more camps are available, the more (longer) rest can be allowed to those camps not being grazed at any given point of time.

CHAPTER 5

Assessment of Veld Condition

After studying this chapter, the reader should:

- be able to distinguish between veld in a good and a poor condition;
- know what factors have an effect on veld condition and why;
- realise the importance of entering the veld on foot, away from the water point and looking on the ground at what happens.

Veld condition describes the state of health of a particular sample of veld. It is meaningful only if related in some way to some known standard. The criteria commonly used to judge veld condition have an ecological basis namely the long-term stability of a plant community and its ability to protect the soil from unacceptable rates of soil loss.

1. Setting the standards

The standard to which veld condition in a certain veld type is compared, is the so-called bench mark site. Its selection is subjective and should reflect the **potential** of the veld type. In low rainfall areas, like most parts of Namibia, the climatic climax veld will show on the bench mark site. It must be stressed that the plant composition of the bench mark site will always be in a state of change as a reaction to preceding rainy seasons.

Veld condition is normally assessed on the basis of a few factors, namely:

- basal cover (plant cover of the soil on **ground level**)
- botanical composition
- growth vigour
- condition of topsoil
- damage due to insects and rodents

2. Desirable and less desirable plants

Desirable veld plants have the following properties:

nutritional properties

- high production
- high nutritional value
- tastiness
- palatability
- no poisonous components
- tolerance to insects, frost and defoliation

conservation properties

- fast recovering after defoliation
- easy establishment

- good ground cover
- well-expanded soil system
- resistance to trampling
- resistance to fire

3. The ecological status of grasses

Grasses can be classified into various groups according to their reaction to grazing.

- **Decreasers (highly desirable species)**

These species are dominant in conserved veld, but tend to decline when veld deteriorates.

- **Increaser I species**

These species are not abundant in veld with a good condition, but tend to increase when veld is underutilised. In low rainfall areas no increaser I species are present.

- **Increaser II species**

These species increase when veld is overutilised. Sub-divisions can be made:

Increaser IIa species are still desirable in a sward, but tend to increase with slight overgrazing.

Increaser IIb species are also desirable, but tend to increase under moderate overgrazing conditions.

Increaser IIc species take over in a sward under conditions of severe overgrazing. These species are always a sign of overgrazing and are not present in poor rainy seasons.

- **Invaders**

These species are not naturally part of a certain veld type and invade from outside.

It is obvious that specialist knowledge is required to classify species into these categories. Extension officers and conservation-conscious fellow farmers should be able to supply this expertise.

4. Factors affecting veld condition

4.1 Basal cover

This term describes the veld density on ground level. A higher basal cover reduces runoff of water which, in return, results in a better stability of the soil and higher carrying capacity, especially when the basal cover consists of perennial grasses. Judgement of basal cover should be made in consideration of the potential of the area in terms of rainfall and soil.

4.2 Botanical composition

This is judged in terms of the abundance of various plant species within the different groups of ecological status in comparison to the potential of the area. Bush encroachment should be considered under this heading as well and, considering the impact of bush on grass production, should be rated as important. Veld consisting of one single grass species will be less favoured, as species variety gives stability under various changing environmental conditions.

4.3 Growth vigour

This shows the health status of plants and is an indicator of tendencies. First signs of veld condition improvement can be seen in more vigorous growth of decreaser species. The

influence of climate is, however, important under low rainfall conditions and knowledge of the life cycle of various grass species is necessary. Growth vigour is a less accurate indicator of veld condition than basal cover and species composition.

4.4 Condition of topsoil

Criteria like soil fertility, water infiltration, runoff and soil erosion (wind and water) are considered. A poor condition of the topsoil normally indicates severe veld deterioration and may necessitate drastic veld reinforcement actions.

4.5 Damage due to insects and rodents

Termites and mice can cause considerable damage, but the occurrence is normally bound to a certain rainy season. It should, however, be considered.

4.6 Procedures

Various procedures can be followed. While some only concentrate on key grasses and shrubs, others take the whole sward into consideration. Eventually, however, some sort of checklist is compiled to come up with an answer. Consideration should be given to the following:

- Make sure the site is representative of the whole area (camp) under view (thus no camp corners, not close to the water, etc.).
- Include all the important plant structures (creepers, grasses, shrubs, bushes, etc.).
- Evaluation should be in relation to the potential of the area or veld type.
- A point evaluation (shoe point, rope, etc.) is time-consuming, but accurate in terms of botanical composition and basal cover.

A point evaluation is done by means of a long rope or chain with marks at regular distances (e.g. every 2 metres). The rope is laid down on the ground in a straight line and at each mark the nearest plant is recorded. [By differentiating between strikes (the mark is exactly on the rooted part of a plant) and nearest plants, calculations of basal cover can be made.] Now the rope is pulled forward until the end reaches the point of the front part of the previous recording and again the plants nearest to the marks are recorded. This procedure is followed throughout the camp. In the same way a mark on one shoe point can be used. With each step taken with this foot, the nearest plant is recorded.

In short, the following main questions need to be answered when assessing veld condition:

Prime factors

- What is the plant density on ground level?
- Are many decreaser species present?
- Are increaser IIb species fairly abundant?
- Are few increaser IIc species present?
- Is there little bush encroachment?

Secondary factors

- Do the decreaseers show vigour of growth?
- Does the increaser IIb show vigour of growth?
- Are there enough young plants of decreaser and increaser IIb species?
- Are few young plants of increaser IIc species present?
- Is there no monostand of a single grass species?

Table 4: Example of a veld evaluation check list (Fourie, 1976)

VELD EVALUATION CHECK LIST	
Farm	District
Camp no.	Evaluator
Sample site no.	Date
Score: very poor = 0, poor = 1, fair = 2, good = 3, excellent = 4	
score x weight = total	
1. DENSITY OF SWARD x 1 =
a. Are patches of bare ground present?	No Yes
b. Is the soil adequately covered, in other words, is the distance between tufts small enough for the area?	Yes No
c. Is the grass cover stable, consisting of perennial grasses?	Yes No
2. BOTANICAL COMPOSITION x 1 =
a. Are abundant perennial, tasty, high-productive grass species present (decreaser species)?	Yes No
b. Is a fair number of grass and shrub species present which are desirable according to their perennial habit, taste and productivity (increaser IIa species)?	Yes No
c. Is the number of unwanted species too high?	
i. too many increaser IIb and IIc species and annuals?	No Yes
ii. too many untasty species?	No Yes
iii. too many woody species (bush encroachment)?	No Yes
iv. too many poisonous plants?	No Yes
v. too little variety in species composition (monostands)?	No Yes
Density of sward x botanical composition x 4 = x x 4 =
3. VIGOUR OF GROWTH x 2 =
a. Are tufts or parts of tufts of the following dead?	
i. perennial, tasty and productive grass species	No Yes
ii. less wanted species	Yes No
b. i. Are abundant young plants of perennial, tasty and productive species present?	Yes No
ii. Are there few young plants of the less wanted species?	Yes No
c. i. Do the perennial, tasty and productive species show adequate new growth of tillers and leaves?	Yes No
ii. Do the less wanted species show little new growth?	Yes No
4. CONDITION OF SOIL SURFACE x 3 =
a. Are there signs of soil losses (water erosion, wind erosion, plants on pedestals, etc.)?	No Yes
b. Are there signs of sheet erosion or dune formation?	No Yes
c. Is there enough organic material on the soil surface?	Yes No
5. DAMAGE BY INSECTS AND RODENTS x 1 =
Are there signs of insect and/or rodent damage?	No Yes
TOTAL POINTS:	
Condition score: very poor poor fair good excellent	
Points: 0-20 21-40 41-60 61-80 81-96	
Tendency of veld (in comparison with previous evaluations) deteriorated/improved/stable <input type="checkbox"/>	

Table 5: Point evaluation of veld condition

	Plant species	Strikes	Total	Nearest plant	Total	Grand total
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
Total points						

$$1. \text{ Absolute percentage basal cover} = \frac{\text{strikes of species} \times 100}{\text{total points}}$$

Plant species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Percentage																

$$2. \text{ Relative percentage basal cover} = \frac{\text{absolute \% basal cover of species} \times 100}{\text{total \% basal cover}}$$

Plant species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Percentage																

$$3. \text{ Percentage nearest plant (\% frequency)} = \frac{\text{strikes} + \text{nearest plant of species} \times 100}{\text{total points}}$$

Plant species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Percentage																

CHAPTER 6

Evaluation of Carrying Capacity

The aim of this chapter is:

- to make the reader aware that budgeting has to be done to match the available grazing with the number of animals to be fed;
- to offer a method which can be used to determine the amount of grazing available.

Grazing capacity (or carrying capacity) has been described as the area needed to support a certain number of animals for a lengthy period of time (normally one year) without negative effects to the veld. It is thus to a great extent dependent on the amount of grazable plant material available and is greatly influenced by many factors, especially rainfall (and soil).

1. When to evaluate grazing capacity

At the end of a rainy season most fodder has already been produced that could be used for the dry season ahead. This is critical for any farmer to get an idea on how much fodder is available for how many livestock for how long.

2. Methods

2.1 Computer simulation models

These models are fairly accurate for making harvest predictions for agronomy (one specific crop plant with harvest potential for a certain soil type which has been mapped), but are unsatisfactory under veld conditions.

2.2 Estimation

The most commonly used method. Farmers with experience usually estimate their farms' grazing capacity fairly accurately. In many instances, however, farmers knowingly overestimate because they hope for relief from early rain, etc.

2.3 Photo comparisons

Various researchers are developing such a (fairly easy) method. Photos will be bound to a certain area and veld types and regular calibration of the photos will be necessary.

2.4 Cutting of quadrates

This method involves the cutting of an amount of grass, weighing the grass and calculating the number of animals that can be supported. This method is cumbersome, but the only accurate method to date and the only method to calibrate the other abovementioned methods.

This method is suited primarily for grass veld. No suitable method with reasonable accuracy (other than judging and experience) is available for dwarf shrub veld at this point of time.

3. The cutting of quadrates

3.1 The method involves:

- cutting the grass;
- drying the grass;
- weighing the dried grass;
- doing calculations.

3.2 Tools needed

- Some knowledge of grasses.
- A quadrate (square or circle exactly 1 m²).
- A sickle or sheep clippers.
- Fodder bags.

3.3 The method consists of 4 steps

Step 1

- Pick a representative camp on the farm or at a post.
- Determine the surface area of the camp (hectares).
- Determine a representative route (normally diagonally) through the camp.
- On this route, cut 40 quadrates at even intervals (e.g. if the route is 2 000 m, cut every 50 m).

Step 2

- Cut all palatable, perennial grasses on ground level.
- Species can be cut individually for future comparison.
- Cut all annual grasses on ground level.
- Leave the three awn grasses (*steekgrasse*).

Step 3

- Dry the grass in a windy place for two to three weeks.
- Weigh the grass.

Step 4

Calculation – certain assumptions are made:

- dry-matter intake of an animal is 3 % of body weight per day;
- 50 % of the available grass material is grazable (this figure might be adapted with reasons, e.g. *Stipagrostis uniplumis* (*blinkhaarboesmangras*, silky bushman grass) on sandy soil might only be 30 % grazable);
- sometimes a factor for losses by termites, wind, etc. is subtracted.

The formula for calculating the available grass yield (A) and carrying capacity (B):

$$A. \text{ available grass yield (kg/ha)} = \frac{\text{weighed grass in bags}}{40 \text{ square metres}} \times \frac{10\,000 \text{ m}^2/\text{ha}}{1}$$

B. calculated carrying capacity (kg live body weight/ha)

$$= \frac{50 \% \text{ of available grass yield}}{3 \% \text{ intake} \times 365 \text{ days per 1 kg animal}}$$

$$= \frac{\text{available grass yield}}{21,9}$$

An estimate of how many kilogram live body weight per hectare can be stocked is thus available. If an average body weight of the animals to be stocked is available, a total number of animals that can be kept can be calculated.

Thus

Calculated carrying capacity (kg live weight/ha) x farm size
 = kg live mass for the farm per year
 ÷ average animal mass
 = number of animals that can be kept for one year.

3.4 Example

Mass (in gram) dried perennial grasses in bags (40 quadrates):	1 250 g
Mass (in gram) dried annual grasses in bags (40 quadrates):	950 g
TOTAL:	2 200 g

$$\frac{2\,200 \text{ g}}{40 \text{ quadrates}} \times \frac{10\,000 \text{ m}^2 \text{ per hectare}}{1} = 550\,000 \text{ g}$$

= 550 kg dry plant material per hectare

$$\frac{550 \text{ kg}}{21,9} = 25,1 \text{ kg biomass/hectare}$$

Assume a herd of 50 animals with an average body weight of 400 kg throughout the year

= 50 animals x 400 kg = 20 000 kg live body weight

are kept in a camp of 200 hectares with the calculated carrying capacity of 25,1 kg/ha

= 200 ha x 25,1 kg/ha = 5 020 kg live body weight can be stocked for a period of one year.

Thus: $\frac{5\,020 \text{ kg carrying capacity available for 1 year}}{20\,000 \text{ kg total live body weight of herd}}$

= 0,251 years

0,251 years x 365 days/year = 91,61 days

The assumed herd of 50 cattle can graze in the assumed 200 ha camp for 91,61 days in that specific year.

Table 6: Example of a grazing register

Camp number:	A	Area:	63 ha	Budgeting period:	01/06/2007 to 31/05/2008		
CLIPPED GRASS PRODUCTION							
a)	Grazable perennial grasses	1 000 kg/ha	Calculated grazing capacity	57 kg/ha			
b)	Annual grasses	248,3 kg/ha	Available grazing days:	38			
Date in	Date out	Period of occupation (days)	Number of animals	Total mass in kg	Average mass in kg	Grazing capacity utilised in kg/ha	Grazing capacity available in kg/ha
01/06/2007	14/06/2007	14	69	34 776	504	21,17	35,83
01/08/2007	14/08/2007	14	69	34 776	504	21,17	14,66
01/10/2007	14/10/2007	10	69	34 776	504	15,12	-0,46
TOTAL GRAZING DAYS							38

CHAPTER 7 Regenerating Degraded Rangelands

This chapter should offer advice on:

- management practices to be followed to try to improve veld condition;
- radical methods that might improve veld condition;
- why and when bush should be regarded as a problem;
- methods to treat bush encroachment;
- the prevention and treatment of soil erosion.

1. The impact of wrong rangeland management and methods to reclaim mismanaged rangeland

1.1 The impact of degenerated rangeland

Throughout the manual, emphasis has been put on the importance of maintaining and promoting veld consisting largely of perennial grasses. There are good reasons for doing so, especially in low rainfall areas like most parts of Namibia.

- Perennial grasses produce more aboveground dry matter (leaves and tillers) than annuals with the same amount of water (rainfall).
- Perennial grasses in a healthy state still produce some amount of aboveground dry matter in a poor rainy season where annual grasses will not go much further than germination.
- The fair amount of aboveground dry matter of perennial grasses gives fair protection against wind erosion, while annuals tend to be blown away.
- The well-developed root system of perennial grasses gives protection against water runoff and thus limits loss of topsoil.
- Perennial grass swards in a healthy state can, in a way, limit the establishment of bush seedlings.

It is thus obvious that any effort that promotes perennial (climax) grasses will largely contribute to a higher production and a more stable farming operation through years of good and poor rainy seasons. Unfortunately many rangelands are in a state of despair and methods to reclaim this land should be implemented. It must, however, be stressed that the success of any effort to regenerate degraded rangeland is most dependent on good rainy seasons.

Do not expect perennial grasses to establish within patches of annual grass. Reclamation with perennial grasses will take place from the sides of a patch of annual grasses. The patch will grow smaller with time and with good treatment and rain.

Single grass plants seldom multiply within a sward of different grass species. Changes normally take place in association with well-established swards.

1.2 Recovery/resting after rain

The withdrawal of animals after rain gives young grasses and seedlings the opportunity to produce abundant green leaf matter and form a stronger plant. Abundant, undisturbed green leaf matter also facilitates better use of the available soil moisture. The period of withdrawal will depend on the follow-up rains, but should be at least six weeks. This practice is, in any case, one of the principles on which any rotational grazing system is based.

1.3 Priority treatment

Within any flexible rotational grazing system, preference treatment to certain camps is possible. Such a camp can:

- receive additional or longer resting periods;
- be grazed for a shorter period of time;
- be grazed with a lower grazing density (fewer animals);
- be grazed with only cattle/goats on certain veld types;
- be grazed only during the dormant growing season.

1.4 Total withdrawal

Total withdrawal from grazing can be considered under circumstances of severe water or wind erosion. This gives the grass the opportunity to go through the whole production cycle unhindered. As a result of the positive impact of light grazing (stimulation), total withdrawal should not be applied for longer than a few (maximum of five) years.

1.5 Winter grazing only

The advantages of grazing a grass sward only in the dormant season and leaving the whole growing season undisturbed have been discussed in length. This practice is especially favourable for areas where water runoff is a problem, but where a fair potential for grass production exists.

1.6 Veld burning

Veld burning is sometimes considered as a veld regeneration method, mainly with the following aims:

- to get rid of overgrown, dead grass material;
- to combat bush encroachment and to get rid of dead wood that limits access to the veld;
- to force the grass sward to produce green plant material out of season (with disastrous effects on growth reserves);
- to combat parasites (not very effective).

It must be stressed that under sweetveld conditions (which prevail in most parts of Namibia), the negative effects of burning outscore the positive effects by far. Any burning programme should be very well planned (in cooperation with extension officers) and be preceded and followed by rest periods.

1.7 Veld reclamation (radical veld improvement)

Veld reclamation as such is not a method of regeneration of veld and is normally used in combination with some of the abovementioned practices and with each other. Practices involve:

- combating bush encroachment and eradication of unwanted plant species;
- oversowing with selected species;
- bush packing;
- loosening and fertilisation of soil;
- building of gabions.

All practices are applied with varying success rates in Namibia. Oversowing seems to be only successful with a certain amount of soil and seed preparation and only in higher rainfall areas (or in extraordinarily good rainy seasons further south and west). Also consider that grasses prefer to establish in associations (thus in close proximity to one another). Single plants will probably germinate and grow for a few (better) years after sowing, but will disappear again in less favourable years.

Bush packing is an easy and fairly successful method, especially where cases of water of wind erosion exist. The wind or water deposits soil and seed in the bushes and the bushes protect the young grass plants against grazing until they are decomposed.

The loosening and fertilisation of soil can be successful in areas where capped soils exist. It should, however, be done only with expert advice as it might have totally unwanted results like the explosion of unwanted woody species (e.g. *sekelbos*, sickle bush).

The building of gabions (structures of wire mesh and rock) to reclaim areas of donga erosion is effective but expensive, and should be planned in cooperation with the extension officers.

2. Bush encroachment

Bush encroachment is the single most limiting factor on increased animal production in especially the northern parts of Namibia. The enormous loss of soil moisture is the main problem of bush encroachment. Soil moisture that should be available for grass growth is extracted by bush. It must be stressed, however, right at the beginning, that bush has advantages as well. The problem is that there is too much bush rather than the individual bush itself.

2.1 Functions of bush in a natural environment

- **Impact on soil temperature**
The shade of bushes reduces the soil temperature and creates a more favourable condition for germination of highly desirable grass species.
- **Impact on soil fertility**
Virtually all of our invader bush species are legumes. Nitrogen, which is important for plant growth, is bound by legumes and made available to grass by shed leaves and pods which decompose in the topsoil. The deeper-rooted bushes supply minerals in the same way to the grass sward.
- **Biodiversity**
Some highly desirable grass species grow only in close proximity to bushes.

Thorn bushes also serve as protection for young trees and other bushes until they are well established (e.g. witgat/shepherd's tree).

- **Impact on animals**
Some game species are browsers. Others need bush as protection and resting place while some species prefer open areas.

Bush as such is thus not a problem, but too much bush can be a problem indeed.

2.2 The nutritional value of bush

Dwarf shrubs, especially in the south of the country, form a very important part of small stock diet and are, from a nutritional point of view, comparable with lucerne. An additional advantage is that they keep their nutritional value in times when grasses tend to be less nutritious.

Trees and shrubs are fairly high in digestible protein and phosphate, but have defence mechanisms like tannin and thorns, outgrow the browsing height of animals and have very small leaves. Only shed leaves, flowers and pods are thus available, and these in fairly small quantities. Trees and shrubs therefore do not contribute much to the farm animals' daily dietary needs.

2.3 How much bush is too much bush?

It has been mentioned that bush, however important it may be, is the main competitor for the soil moisture needed by grass. A balance between bush and grass seems to be the solution. It has been calculated that the total number of bush units (one bush of 1,5 m height = one bush unit) should not exceed more than double the amount of the long-term rainfall (in mm) per year. (A bush of 4,5 m height is reckoned as three bush units for this calculation, etc.) The following should be considered:

- Bush eradication should aim to take out only the amount of bush that is in excess.
- Bush eradication should be aimed at those species that are of little value and in excess.
- The figure of rainfall (in mm) $\times 2$ = optimum number of bushes of 1,5 m height is based on total ecological findings. From a farmer's (particularly a cattle farmer's) point of view regarding production, it will be much lower.



Bush density reflecting 200 bush units/ha



600 bush units/ha

(All six photographs by Johan van Eck)



1 000 bush units/ha



1 500 bush units/ha



3 000 bush units/ha



12 000 bush units/ha

2.4 Different approaches to prevent bush encroachment

Considering the abovementioned, it is obvious that many parts of Namibia have a serious problem with bush encroachment. The question is what can be done to prevent further bush encroachment (or reinfestation of cleared areas) and what to do with infested areas.

- Good grazing management remains one of very few tools to prevent bush encroachment to a certain extent. A conservative stocking rate and an effective grazing management system ensure a stable, perennial grass sward that will prevent establishment of bush seedlings to some extent.
- Regular veld fires can be used to cut back bushes and damage seedlings. It must be remembered that rest before and after burning is essential:
 - to get enough heat; and
 - to give grasses a chance to recover.

It is doubtful whether this can be achieved within a farming operation that has to care for itself financially.

- Goats and browsing types of game can be incorporated in the farming operation. This has to be done with care, especially when incorporating goats. Goats tend to adapt their grazing/browsing habits and have even been observed to trigger bush encroachment by the spreading of seeds through their dung. At Omatjenne Research

Station it has been found that if bush encroachment is to be counteracted with goats, stocking rates must be so high that all valuable fodder shrubs are seriously damaged (almost extinct) before invader bush is controlled.

- Combat bush encroachment in good time (combating bush encroachment is expensive, but remember that it gets more expensive the more bush there is to combat). Furthermore, the increase in production (up to 200 %) by eradicating bush must be considered.

2.5 Methods to treat bush encroachment

• Mechanical

Bush can be removed by the use of heavy machines (bulldozers). This, however, involves soil disturbance, which can result in the explosion of new bushes. It is thus only recommended if the cleared areas are to be used for some sort of cultivation (crops or planted pastures) afterwards.

• Fire

As mentioned before, fire should be seen as a preventative method (and an aftercare treatment) rather than a treatment of bush encroachment. Apart from a pruning effect (top kill), fire does very little to established bushes. Rest before and after fire as described above makes fire an expensive way of bush treatment for the farmer with little real gain in terms of killed bushes.

• Hand chopping

This method is effective if the correct height of chopping is adhered to. Furthermore, the chopped wood can be bundled and sold or burnt for charcoal. This method can thus be self-financing. It is very labour-intensive and aftercare, as with any other method, is important.

• Stem burning

In times of drought or during the rainy season, smouldering fires of branches or dung can be lighted around the stems of bushes. The method is effective if the bark is burnt to such a degree that it peels off. Again the method is labour-intensive and actually more suited for larger bushes.

• Chemical treatment

Various chemicals are available and can be divided into root-absorbent and leaf-absorbent chemicals. Normally the root-absorbent chemicals are preferred as this application is easier. A liquid or grain is placed in the drip zone of the bush, infiltrates to the roots with rain and is absorbed. Leaf-absorbent chemicals are sprayed onto the leaves of the bush. Application in daytime is important to ensure that absorption takes place, but reaction to treatment is very fast. Leaf-absorbent chemicals are often used to treat bushes where root-absorbent chemicals are not registered. Application of especially root-absorbent chemicals is by hand (for less dense stands). This method can then be applied selectively, thus only bushes that should be taken out are treated. For very dense stands, aerial application (by aeroplane) is possible, but the great disadvantage is the non-selectiveness of the treatment.

2.6 Aftercare

It must be stressed that combating bush encroachment is not a once-off action. Aftercare by means of veld management, combined with chemical treatment, burning or hand chopping will be necessary. The rewards of bush eradication are, however, much higher production and better stability in the form of increased grass production, even in poor rainy years, as bush is not in competition with grass for limited soil moisture any longer.

3. Soil erosion and its treatment

Soil erosion is a natural process and an integral part of landscape forming. Many natural phenomena like steep slopes and certain soil properties contribute to increased erosion potential by water and wind. On the other hand, perennial grass coverage is the best antipode against erosion, and the land-user as the manager of veld condition on his land, can be held directly responsible for the erosion which takes place.

3.1 Water erosion

Water erosion starts as splash erosion, where the falling raindrops move the soil particles. This impact also results in some sealing of the topsoil for water infiltration. The result is increased runoff of water, saturated with soil particles. The end result may be donga (gully) erosion or sheet erosion where masses of soil (the most valuable topsoil) are washed away and deposited elsewhere (in dams, etc.) where it is of little or no value.

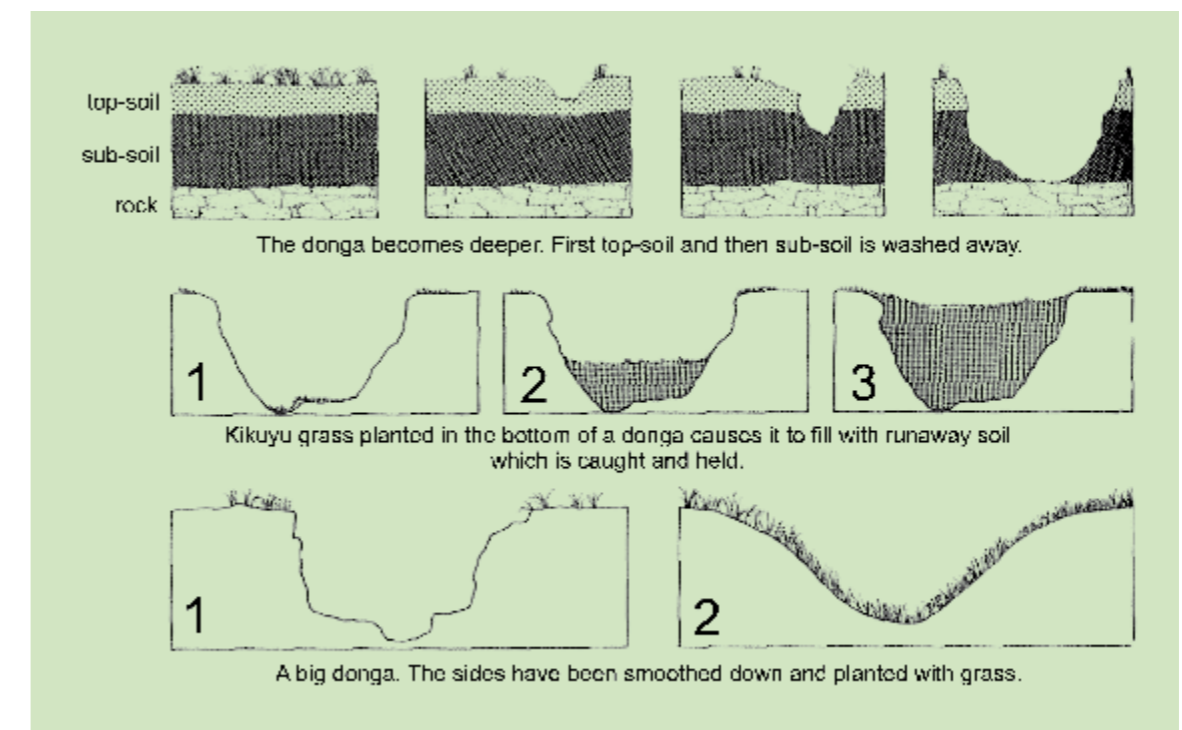


Figure 9: Donga formation cure (© Roux, E. 1969)

3.2 Wind erosion

With wind erosion, which is more common on sandy soils with little plant cover, soil particles are moved from only a few millimetres up to hundreds of kilometres (when soil particles are taken up in suspension in the air). Again, the most valuable topsoil is affected most.

3.3 Prevention of soil erosion

It is obvious from the elaborations above that a healthy, perennial grass cover is the most valuable preventative measure against water and wind erosion. No splash erosion will occur if a grass tiller catches the falling raindrops before they fall on the ground

or run down the tiller. Furthermore, a strong root system of grasses will bind the soil particles and limit the speed of runoff water. Less runoff will take place as more time for infiltration is available and the runoff that takes place, takes very little sediment with it. Concerning wind erosion, a healthy grass sward will avoid high wind speed on the soil surface. No soil particles can thus be picked up and transported.

To be fair it must be mentioned that drought situations will create bare ground, which is susceptible to water and wind erosion and cannot be avoided. As has been mentioned before, however, a healthy perennial grass sward is less prone to effects of drought than an annual grass sward. Any effort to try and limit water runoff should always start as far up in the catchment area as possible and then move down the watercourse. This makes sense as some small efforts in an area where runoff is still limited can result in more infiltration and thus less runoff further downstream. Major efforts and structuring to control runoff downstream will be needed to have any effect whatsoever.

3.4 Treatment of soil erosion

Any programme to treat soil erosion should start with efforts to reclaim bare ground and get grass established there. (This applies to cases of wind and water erosion.) It would be advisable to seek expert advice to avoid costly experiments. Some soils might profit by some sort of mechanical input (ripping or ploughing, possibly with sowing), while other soils might have a chemical reason for being bare. Here it might be necessary to treat the soil with suitable fertilisers (gypsum, organic polymers) before any establishment of grass cover will be possible.

Many possibilities exist to facilitate grass establishment on bare ground. The method of bush packing has been discussed. Rock structures can have the same effect. Ripping or ploughing and seeding of grasses in the area might be possible. On more or less level ground, the “happloeg” which makes rows of little dams, works well to reduce runoff and promote infiltration. The rehabilitation of dongas (gullies) will be a much more expensive undertaking. Some sort of structure will have to be erected to limit the speed of runoff and help the deposition of sediment. Upstream, a few rocks or bushes in the watercourse might be the solution. Downstream proper structures of mesh and rock, poles, tyres, etc. will be needed. These structures will have to be properly planned and constructed to achieve their aim. Again, professional advice would be good. To conclude, the key to all soil erosion treatment lies in proper rangeland management. Without this, the most expensive efforts to combat erosion will probably result in a failure.

CHAPTER 8 Fodder Crops/Planted Pastures

The purpose of this chapter is to make the reader aware of:

- where fodder crops and planted pastures can fit into a stock farming operation;
- some possibilities that might exist regarding pastures and fodder crops.

Although most parts of Namibia are not suited for fodder production or planted pastures due to insufficient rainfall, underground water or quality, some possibilities do exist.

1. Incorporation of fodder crops/planted pastures in the production system

If the cultivation of land for the use of fodder crops or the establishment of planted pastures is considered it must be decided beforehand where this fodder should fit into the production system. This will in a way also determine the kind of crop or pasture that needs to be planted.

In Namibia, fodder crops and pastures are mainly planted for the following reasons:

- **Fodder availability for periods of drought**
It must be stressed that drought in Namibia is never predictable in terms of when it will occur and the duration thereof. From this point of view, it is doubtful (especially for cattle) whether a build-up of hay would serve its purpose. As a fodder bank for drought it can be considered to bale grass (some veld grass hay is also very valuable) or produce silage or haylage (hay that has been silaged).
- **Quality hay or fodder for times when the veld is not able to supply quality grazing**
This would be mainly for highly productive animals (lambing ewes, calving cows) or for finishing slaughter animals for an off-season market. Many possibilities exist. Quality hay, silage or haylage may be a consideration, but the grazing of (planted winter) pastures is another possibility.
- **Veld management**
It has been stressed already that rest of veld in the growing season is advantageous. With highly productive planted pastures (summer grasses) available, it is possible to withdraw animals from natural veld in the growing season and keep them on pastures.
- **Supplementary feeding**
Cash crops like maize and legumes like cowpeas can be planted, harvested and mixed into supplementary feeds for cattle and small stock in the winter season.

2. Planted pastures

Dry-land planted pastures in Namibia will, due to the summer rainfall nature of the area, be summer grasses. It is generally accepted that at least 400 mm to 500 mm of rain annually is

needed for planted pastures, and under these conditions only very few suitable grasses exist, e.g. **perennials**:

- blue buffalo grass (*bloubuffelgras*);
- wool grass (*borseltjiegras*);
- finger grass (*smuts vingergras*);

and **annuals**:

- *columbusgras*;
- sorghums (e.g. cow candy).

Under irrigation the possibilities are much larger and planning should include aspects such as time available, planned use (grazed or zero grazed), purpose (some planted pastures include estrogens and are not suited for breeding animals), etc.

Naturally, with all cultivation many aspects of climate, soil, parasites, etc. should be considered beforehand. Expert advice and specific literature should be consulted.

3. Drought-resistant fodder crops

It is possible to grow some kinds of crops with fairly little water and even with water with a high salt content. This practice was fairly common in the past, but is not practised anymore. The most important decision to make is to plan the integration of these crops into the production system. Most commonly these crops are used to provide fodder in times of drought, but careful calculations have to be made beforehand regarding how many animals can be supported for how long. Drought in Namibia is generally not a question of a few weeks without rain, but normally a case of one or more years with very little rain. Fodder crops can be helpful to keep animals in a fair condition for a period of time until the opportunity arises to sell rather than to feed animals (especially cattle) until enough grazing is available on the veld again.

3.1 Oldman saltbush

Saltbush is normally established in seed trays and only planted when about 30 cm to 45 cm high (six months of age). Some irrigation will be necessary in the beginning and to obtain higher production. Utilisation can take place one year after planting. Sheep can browse saltbush, but it is recommended to cut and feed the bushes to cattle, as cattle tend to be very destructive when browsing saltbush.

Saltbush is frost-resistant and can be established on deep soils and even brackish soils.

3.2 Spineless prickly pear

Be sure to establish only spineless prickly pear as other prickly pears can be invasive and some have been declared problem plants.

Establishment is easy. Blades are planted and will form roots within weeks in fairly favourable conditions. Again, some irrigation during establishment and for higher production is advisable.

Prickly pear is very juicy and less saline and is preferred to saltbush by animals. Some cutting might be necessary to make prickly pear available to sheep and, again, feeding is preferred to grazing to protect the established plants.

Prickly pear is fairly sensitive to frost.

3.3 Mexican agave

Establishment is done by planting tubers that appear around old plants. Agave is often planted to combat erosion, but also serves as good drought fodder.

Leaves are chopped off close to the stem, the thorny tip and the thorny sides are removed and the rest of the leaf is chopped into blocks before giving it to the animals. Plants must be four to five years of age before leaves can be harvested as fodder.

3.4 Pods

Pods of various **acacia** species (especially camel-thorn) and **prosopis** (mesquite) are good sources of protein and energy in a ration. An animal nutritionist should be consulted on how to fit these components into a feed.

Camel-thorn pods contain prussic acid (especially when green) and may cause poisoning if fed in high concentrations.

Camel-thorn pods have to be milled. The seeds have to be broken to be of real value to the animal.

Prosopis pods should be stored for one year and be milled before feeding to avoid infestation of veld by prosopis through the dung of the animals.

3.5 Makataan and tsamma

Both makataan (a type of watermelon) and the indigenous tsamma grow with fairly little water in sandy, less fertile soils in a warm and dry climate. Both supply fair amounts of juicy fodder and can be incorporated in a feeding programme during dry periods of the year. As they can only be stored for a limited period of time (three to four months after harvest) they are less suited as a drought fodder, but may make a contribution as a juicy fodder during a part of the dry time of the year.

Never intend to bridge a drought by purchasing fodder for your animals. This is financial suicide. Rather sell your animals early, while the price is still reasonable.

*Remember one thing:
Drought means financial loss, but the first loss is the smallest loss!*

4. Fodder crops

Obviously, any grain (maize, sorghum, wheat, etc.) can be used as fodder crop. If produced on the farm, it is mostly used as a whole plant rather than as a grain and then as hay, haylage or silage. Legumes like lucerne and cowpeas are also suitable for Namibian conditions. The way to incorporate these fodders into a feeding programme should be discussed with an animal nutritionist beforehand. Some grains need to be milled beforehand to be of value, whilst too much of some may cause dietary disorders.

The whole field of fodder crops and planted pastures must be regarded as a specialised field on its own. Sound advice should be asked before engaging in such an operation.

CHAPTER 9

Common Resource Management

This chapter offers a suggestion on how rangeland management can be applied around a communal water point.

This chapter very briefly looks into the possibilities of sound rangeland management of a communal piece of land or a single water point shared by several users. Naturally, the most obvious solution is to allocate a certain area to each member of the community to keep his stock. This, however, will result in many small pieces that are permanently grazed. Even if animal numbers are fairly low, this will result in veld deterioration, as only the most palatable grasses will be selected by the animals and will therefore not withstand this permanent defoliation.

The following is suggested:

- The people involved must agree to cooperate and certain common goals/objectives have to be identified (quality of life, production goals, croplands of individuals, predators, etc.).
- Special thought should go into the size of the livestock herds, which will have to be maintained. The amount of grazing available on the long term and the conservation goals will be of crucial importance. The number of herds to be kept will give an indication of the number of “camps” or grazing cells needed.
- Herds should be limited as far as possible. Cattle and small stock can be kept together without problems.
- The final plan will involve herding rather than fencing. It is of utmost importance that some sort of demarcation of “camps” be made (stone piles, flags, marked trees, etc.) and that the herd stays within the boundaries of the “camp” for the prescribed time before moving to a next camp.
- Short barriers near the water point will help to funnel the herds as they approach. This will result in the concentration of animals only in their “camp” close to the water and will prevent milling around the water for 360 days a year. These short barriers can be wire fences, bush fences, etc. and need only reach 100 to 300 metres from the water point.



Figure 10: Possibilities of communal rangeland management systems (© Savoury, A. 1988)

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List of Figures

Figure 1: Vertical section through the growing shoot of a grass	15
Figure 2: Growing cycle of a grass plant	16
Figure 3: Typical growth cycles of some perennial and annual grasses as well as trees and scrubs	17
Figure 4: Vegetation map of Namibia	19
Figure 5: Carrying capacity map of Namibia	24
Figure 6: Different recovery times as needed by the grass plant during different seasons ..	26
Figure 7: The effect of foliage availability for photosynthesis by the grass plant on recovery time after grazing	27
Figure 8: The effect of prolonged overgrazing on the recovery ability of the individual grass plant	28
Figure 9: Donga formation cure	49
Figure 10: Possibilities of communal rangeland management systems	54

List of Tables

Table 1: System developed for primarily dwarf scrub veld in drier parts of the country ...	31
Table 2: System for grass veld	31
Table 3: Comparison between non-selective grazing and controlled selective grazing ...	32
Table 4: Example of a veld evaluation check list	37
Table 5: Point evaluation of veld condition	38
Table 6: Example of a grazing register	42