60

IS THERE A FUTURE FOR LIVESTOCK FARMING IN SOUTHERN NAMIBIA'S COMMUNAL LANDS?

SASKIA MARIJKE KUIPER

A research paper submitted to the Department of Environmental and Geographical Science, University of Cape Town, in partial fulfillment of the requirements for the Master of Philosophy degree.

October, 2000

TABLE OF CONTENTS

....

LIST OF FIGURES, PHOTOGRAPHS AND TABLES

Acknowledgements

This study was made possible by financial support from the German Technical Co-operation, directed through the Namibian Programme to Combat Desertification project of the Ministry of Environment and Tourism, Government of Namibia. My supervisor, Mike Meadows is thanked for his guidance and support, as is Robert Kiunsi and Timm Hoffman for their help and comments regarding aerial photography and communal land management.

....

Paper to be submitted to: Desertification Control Bulletin

Contact Details:
Desertification Control Bulletin
UNEP
P.O. Box 30552
Nairobi, Kenya

Word Count: 4937

IS THERE A FUTURE FOR LIVESTOCK FARMING IN SOUTHERN NAMIBIA'S COMMUNAL LANDS?

SASKIA MARIJKE KUIPER and MIKE MEADOWS

Department of Environmental and Geographical Science,
University of Cape Town,
Rondebosch, 7700
Cape Town,
South Africa

Summary

The viability of livestock farming in southern Namibia's communal areas is investigated. Small stock farming is ubiquitous in this semi-arid region, and provides many people with their only source of wealth and income. However, it is thought that grazing by livestock negatively impacts on the vegetation resource. Using both interviews and interpretation of sequential aerial photographs, veld resilience and changes vegetation composition and cover were analysed. Results provide contrasting evidence. Veld resilience is illustrated by good plant regeneration after the 1999/2000 rainy season. This observation supports the disequilibrium theory, which hypothesises that, in semi-arid areas, productivity is primarily event driven and not influenced by grazing pressure. A number of other observations, however, dispute this paradigm. Results herein show that vegetation composition has changed in the communal lands from palatable perennials, to unpalatable annuals. In addition, localised areas of degradation are evident near homesteads, waterpoints, drainage channels and hills and slopes. Using sequential aerial photography, a comparison of veld which changed from commercial to communal tenure highlights changes in vegetation cover. Analysis of land units from when the farm was under commercial tenure (1970) to after it had been incorporated into Namaland (1998), indicates an increase in bare soil from 6.3-11%. This increase is attributed to increased pressure form livestock grazing. Although separating these anthropogenic factors from other, biophysical ones is difficult, appropriate management practices should slow

down the rate of degradation. Such initiatives include; a) a decrease in stock numbers and the elimination of freeloaders, such as feral horses, b) grazing co-operatives to allow both the veld to rest and facilitate free, unpredictable movement within the communal areas, and, c) alternative income generation, such as nature-based tourism.

Introduction

During the last three decades, land degradation in the world's arid and semi-arid countries has increased dramatically (UNCCD, 2000). Unfortunately, development initiatives aimed at slowing this rapid rate of degradation have generally been unsuccessful (Mills, 1995). One explanation for the lack of success may be an incomplete knowledge of the relevant factors (Mace, 1991). Although it is recognised that both anthropogenic and biophysical components combine in a complex interplay to influence the opportunities and constraints of the resource base, distinguishing between the two to identify one causal agent may be impossible. Even if this tangled web cannot be unravelled, an improved understanding of all the elements should assist decision-makers.

Inherent complexities are apparent in the communal farmlands of southern region of Namibia, where both stochastic and social factors severely limit land use opportunities. This area exhibits low, variable rainfall, and its inhabitants experience widespread poverty, relying on small stock farming as their main source of wealth and assets (Devereux and !Naruseb, 1994). Grazing management practices within the communal lands are minimal, and overstocking, over-concentration of stock, and continual grazing pressure are seen as negatively impacting on the vegetation resource (Steyn, pers. comm.; Lane and Moorehead, 1994; SARDEP, 1995). Development initiatives aimed at alleviating this pressure have not yet improved veld condition (Basson; Boois; Esterhuyse, pers. comm.). Exactly why there has been a lack of success may lie with how the problem is perceived; for example, is the degradation a livestock management problem, or is it a natural characteristic of a highly variable and event driven environment (Behnke and Scoones, 1993; Cowling, 2000; Fynn and O'Connor, 2000; Rohde, 1997; Sullivan, 1996; 1998)?

The disequilibrium theory argues against livestock management as the principle agent of degradation. Its advocates believe that in arid and semi-arid areas, highly erratic and unpredictable events such as rainfall drive the productivity of the system. The veld is seen to be resilient, even towards increased grazing pressure from growing numbers of livestock (Behnke and Scoones, 1993; Sullivan 1996; 1998; Ward *et al.*, 1998; Mace, 1991). Events such as droughts limit the ability of livestock numbers to increase beyond a threshold level where the animals would have a serious impact on resources (Mills, 1995; Sullivan, 1996; 1998). In practical terms, the disequilibrium theory suggests that, since herbivores have minimal impact on vegetation production, numbers of livestock should be allowed to fluctuate with resource availability. A 'variable tracking', or opportunistic, system of managing livestock numbers would therefore be more suitable (Sullivan, 1998).

There is, however, strong evidence opposing the disequilibrium theory, and substantiating equilibrium model (Campbell *et al.*, 2000; Cowling, 2000; Lykke, 2000; Fynn and O'Connor, 2000). Advocates of an equilibrium model believe that ecosystems function in a state of balance, with external disturbances, such as drought, affecting the system. The system, will, however, move towards balance after such a disturbance (Sullivan, 1998). Results from studies questioning disequilibrium theory suggest that although the veld may be resilient, livestock grazing can negatively impact on vegetation composition – increasing the number of annuals and unpalatable plant species. In addition, evidence promoting disequilibrium theory has been found to rely on generalisations, not quantitative, spatially specific data, and not all arid and semi-arid environments can be classified as disequilibrial. Therefore, according to this viewpoint, adopting a close tracked stocking system could lead to higher environmental degradation and lower economic returns (Campbell *et al.*, 2000; Fynn and O'Connor, 2000; Lykke, 2000).

This paper aims to investigate whether or not livestock negatively influence the vegetation base in southern Namibia's communal lands. In order to achieve this, both interviews and sequential aerial photographs were used. Interviews were conducted over a wider area with key stakeholders. The sequential photographs focussed on two farms, Nabaos and Gellap-Oost

(Figure 1). Ownership of Nabaos changed from commercial to communal tenure during the time period of the sequential photographs (1970 and 1998). Such a change in land tenure would be accompanied by different grazing management, the effects of which may be visible on the aerial photographs. Identification of these changes was made possible by comparing Nabaos farm with the neighbouring farm, Gellap-Oost. This farm remained under commercial tenure from 1970-1998. If there were no changes in vegetation cover at Gellap-Oost during the time period of the photographs, any changes seen in the Nabaos photographs would be a result of the change in land tenure and grazing management.

If, as expected, the vegetation base in the communal areas is being depleted over time due to grazing pressure, management initiatives should focus on alternative livelihood strategies, such as nature based tourism. However, if the evidence supports disequilibrium theory, and grazing does not seem to have a negative impact, alternative, appropriate, grazing management options should be encouraged.

Materials and Methods

Biophysical Description of the Study Area

Location

The study area is located in the southern region of Namibia, and comprises the Fish and Orange River catchment basins. Recently the subject of an intensive systematic analysis, this 100 000km^2 area includes the Karas and Hardap Regions, and part of the Khomas Region (see Figure 1) (Boonzaier *et al.*, 2000). The region represented on the aerial photographs, including Nabaos and Gellap-Oost farms, is approximately 15km northwest of Keetmanshoop (see Figure 1).

(Figure 1 hereabouts)

Climate

Harsh climatic conditions are experienced in the arid/hyper-arid southern region, and droughts are a common occurrence. Most of the area is within the summer rainfall belt (October to April), although winter rainfall is experienced in the southwest. Rainfall throughout the entire region is erratic and highly variable, often occurring only as isolated thunderstorms (Heyns *et al.*, 1998). Figure 2 illustrates the seasonal rainfall in Keetmanshoop from 1970-2000

(Namibia Meteorological Service, 2000). The range of rainfall expected 90% of the time in this area is 46-291mm (Pallet, 1997). Long dry periods are interspersed by short, wet periods, such as during the 1974 and 2000 seasons. High evaporation rates exceed average rainfall by an order of 10-20 times (Directorate of Water Affairs, 1995). This is due to high daytime temperatures, and long hours of sunshine. In Keetmanshoop for example, mean monthly temperatures vary from between 3^0 C to 37^0 C (Namibia Meteorological Service, 2000).

(Figure 2 hereabouts)

Geology, topography and soils

Climatic conditions have influenced the geology, topography and soils of the study area. The area is geologically ancient, with many surface rock types, including sedimentary, volcanic and plutonic rocks (Federal Institute for Geosciences and Natural Resources of Germany and Geological Survey of Namibia, 1997). Topographically, the study area can be divided into three zones: a coastal plain (0-500m), western fragmented escarpment (1500-2200m), and an interior plateau (~1000m) (van der Merwe, 1983). The main soils in the study area are lithosols, with arenosols found in the extreme southwest (Barnard, 1998). Both soil types are typical of those found in arid areas. They tend to be shallow, coarse textured, have little horizon differentiation and contain minimal organic content.

Water resources

The majority of available water in the study area stems from groundwater reserves. The extent of these primary and secondary alluvial aquifers is, however, unknown (Desert Research Foundation of Namibia [DRFN] and Ministry of Water and Rural Development [MAWRD], 1999). The Directorate of Rural Water Supply provides water for human and livestock consumption in the communal areas, through approximately 900 waterpoints (DRFN and MAWRD, 1999). A Community Based Management of Rural Water Supply initiative began in 1997 and aims to fully decentralise power to the community level by 2007 (DRFN and MAWRD, 1999). Although this will bring many benefits to both the users and suppliers of rural water, it also increases further sedentarisation, and related degradation, around waterpoints (van der Merwe, 1999).

Vegetation

Vegetation is greatly restricted by the biophysical characteristics of the study region, and is highly dependent on rainfall, which is one of the area's driving forces behind plant growth and productivity (Strobach, pers. comm.). Three vegetation biomes occur in the study area; Succulent-Karoo, Nama-Karoo, and Savannah, with Nama-Karoo being the most widespread (Barnard, 1998). Although vegetation cover is scarce and productivity generally low, the 'sweetveld' grasses of the Nama-Karoo are palatable to livestock (Bester, pers. comm.; van Oudshoorn, 1999). Palatable species occurring in this area include various species of *Stipagrostis* and drought-resistant plants such as *Stipagrostis hirtigluma* and *Rhigozum trichotomum* (van Oudshoorn, 1999). Although these drought resistant plants are not normally utilised, they do provide fodder during dry periods. A number of annual grasses and pioneers, such as *Schmidtia kalihariensis*, *Tribulius terrestris*, and *Chrysocoma ciliata* are species indicative of disturbed veld. They are, however, also essential in replenishing degraded soils with the nutrients necessary for growth of climax vegetation (van Oudshoorn, 1999). These plants can also provide an essential fodder resource in the absence of other palatable species (Hoffman, pers. comm.).

Socio-Economic Description of the Study Area

Demographics and Economy

The southern region accounts for almost 5% of the national population (1.6 million), and has a very low population density - 0.73 people/km^2 (Barnard, 1998; Sustainable Animal and Range Development Programme [SARDEP], 1995). Economically, there are limited opportunities in the study area and poverty is widespread. There are high unemployment levels (41% and 28% for the Hardap and Karas Regions respectively), and the majority of labour is unskilled (Ministry of Labour and the National Planning Commission, 1998). Although livestock farming is ubiquitous throughout the southern region, it contributes little to the national GDP (Hansohm and Mupotola-Sibongo, 1998; Kroll and Kruger, 1998).

Land tenure

Historically, the Nama people practised a semi-nomadic, transhumance existence in southern Namibia, and moved their livestock according to fodder and water availability (Adams and Werner, 1990). The Nama's were however sedentarised by colonialists from 1883 through to independence in 1990. Three communal areas were formed in the study area to accommodate the Nama people: Namaland, Bondelswarts and Warmbad. In the 1960's, the Odendaal Commission set the majority (58%) of what is now Namaland aside for communal use. These 'Odendaal' farms retained much of the existing commercial infrastructure. The remainder of Namaland is open, with no boundary fences. Today, there is approximately 1 675 000 ha. of communal land and 3 000 communal farmers in the southern region (MAWRD, 1998; SARDEP, 1991). The communal areas are now home to the majority of Nama people, with Namaland being their cultural centre.

Livestock ownership and management

Livestock owned by communal farmers are mainly small stock, including goats and sheep (SARDEP, 1991). Dorper sheep are farmed more extensively than Karakul, especially since the 1982 karakul market crash. However, they have a greater 'ecological footprint' on the land than karakul. Although goats graze even more heavily than do dorpers and karakul, increasing numbers of donkeys and feral horses in the communal lands are thought to exert a greater impact on the grazing resource (Steyn, pers. comm.; Vlachos, 1995).

Communal farmers graze their stock near the homesteads, and make use of available water at waterpoints (SARDEP, 1995). There is little livestock management, and the veld is continuously grazed (Bester, pers. comm.). This is in contrast to management on commercial farms, where livestock are rotated within farm camps, allowing for resting periods of at least one year (Bester, pers. comm.).

Methodology

Information regarding resource use and management initiatives was collected during two field visits to the southern region of Namibia. These visits were conducted as part of the larger study by Boonzaier *et al.* (2000). During the field trips, informal interviews were conducted with key stakeholders, such as extension officers, farmers, and members of various non-governmental organisations and government departments. A literature search in Cape Town and Windhoek was also conducted. Although qualitative in nature, this multiple research approach allowed for a strategic level perspective of livestock farming.

Aerial photography has often been used to assess the influences of land use activities on natural systems (Knapp *et al.*, 1990; Lutchmiah, 1999; Paine, 1981; Watson, 1996). Sequential aerial photographs, although not always conclusive, can identify areas in which change has taken place (Paine, 1981). However, Jenks (1997) highlighted several negative aspects to this method. For example in arid areas, where vegetation cover is sparse, it is difficult to differentiate between various vegetation types. The photographs also often lack in temporal range; i.e. there are too long time periods between photographs, and there are often not enough 'time periods' to provide a reliable data source (Jenks, 1997).

Photographs were obtained from sections of two neighbouring farms, Gellap-Oost and Nabaos, and were taken during August 1970 and October 1998, during the region's dry season (1.3mm, and 0mm rain respectively) (Namibia Meteorological Service, 2000). Unfortunately, there are a number of limitation to using these photographs. The 1970 photographs are at a scale of 1:50 000, whereas the 1998 photographs are 1:80 000 - limiting the degree of accuracy in comparisons between the two. Only two photographs of a portion of each of the two farms were obtained, reducing the scope of the study area. As a result, more information is provided for Gellap-Oost than for Nabaos farm. Further ground truthing, a necessary tool to verify interpretation of aerial photographs, was not possible.

With the aid of a 1:50 000 topographical map, a Sokkisha mirror stereoscope fitted with x8 lenses was used to identify features on the aerial photographs. Firstly, the main terrain features; hills, slopes, and plains were recorded. Then, superimposed onto these, were areas with differences in tone (pale and dark) and differences in texture (rough and smooth). Light toned areas were termed by Watson as 'actively eroding or eroded surfaces' (Watson, 1996). Differences in texture can indicate the presence of trees (smooth) or shrubs (rough). Once these areas had been identified and recorded, they were transferred into 'land units'. Subsequently, a land cover map, incorporating the land units, was produced for both years (Figure 3a and b). Table 1 lists these land units and their characteristics.

(Table 1 hereabouts)

Results

Firstly, the findings from the interviews and field trip are presented, followed by an interpretation of the sequential aerial photographs.

No quantitative accounts were found recording levels of resource use and depletion, although the majority of those interviewed described instances of widespread resource degradation (e.g. Bester; de Lange; Esterhuyse; Neumann, pers. comm.). This is despite the apparent resilience of the veld. After the good 1999/2000 rainy season (268.3mm; Figure 2), regeneration of vegetation in commercial and communal lands was such that the vegetation boundaries between the two became 'blurred' (Steyn; de Lange, pers. comm.).

Although there is generally good regeneration, a difference in species composition was observed during the field trips. For example, as seen in Photo 1, the communal land to the left of the fence consists mainly of *suurgrass*, whereas the commercial land to the right exhibits cover of *Stipagrostis* grasses. This highlights the decrease in quality and quantity of palatable grasses, such as from the *Stipagrostis* species, in the communal lands during the last decade (Kohlman; Knouwds; Steyn; Bester; de Lange; Boois, pers. comm.). In addition, there has been an increase in less palatable species and annuals, such as *Chrysocoma ciliata*, *Schmidtia kalihariensis (suurgrass)* and *Rhigozum trichotomum* in communal areas (Esterhuyse; Knouwds; Steyn; Boois, pers. comm.). One extension officer even claimed the eradication of the highly palatable *Stipagrostis uniplumis* (silky bushman grass) from the communal lands (Steyn, pers. comm.). A loss of vegetation cover, and erosion is also observed in localised areas, such as surrounding homesteads and waterpoints (Photo 2).

(Photo 1 hereabouts)

(Photo 2 hereabouts)

Land units from two sets of sequential aerial photographs are compared. The first comparison made is that between the 1970 and 1998 photographs of Gellap-Oost. This farm has remained in commercial tenure from 1970 to present day. As grazing management on this farm has not altered, this comparison will highlight any biophysical impacts that may have influenced vegetation cover. The second comparison is that of the Nabaos photographs, also between the years 1970 and 1998. This farm's tenure changed from commercial to communal in the late 1970's, and as such, there has been changes in grazing management. If the comparison of the Gellap-Oost photographs indicate no differences, and rules out biophysical influences, any variation in vegetation cover at Nabaos can be attributed to changes in grazing management. Both comparisons are described in turn.

Figures 3a and b illustrate the three main terrain types; hills, slopes and plains, and the corresponding land units evident at Gellap-Oost and Nabaos from 1970-1998. Figures 4a and b graphically represent the proportion of land unit cover at Gellap-Oost (4a) and Nabaos (4b) during this time.

Gellap-Oost

(Figures 3a and b, Figure 4a hereabouts)

It is clear from Figures 3a and b that the main land unit in Gellap-Oost during both 1970 and 1998 is plains/grassland (unit 7). A number of other units occur in the plains/grassland, including bare soil and trees and shrubs.

Although no drainage lines are marked on figure 3a or b, most are lined with scattered trees and shrubs. The main drainage channel feeding into the Merensky Dam is surrounded by scattered trees and shrubs (unit 9), which are in turn surrounded by bare soil (unit 8). The next most abundant units are slope/bare soil (unit 3) and plains/grassland and bare soil (unit 8). The majority of slopes have little vegetation - 12.6/12.5% in contrast to slopes with trees and shrubs, 0.4% (unit 4), 4.9% (unit 5) and 0.35% (unit 6) (Figure 4a).

When comparing photographs from the two years (Figure 3a and b), there seem to be only minor changes in land unit coverage. There was a decrease in proportion of plains/grassland and bare soil from 1970-1998, and an increase in plains/scattered trees and shrubs. The small changes in coverage could be due to distortion errors when comparing information from the 1:80 000 map (1998) to the 1: 50 000 map (1970). Due to the small degree of changes, it is probable that little has changed in the land unit coverage in Nabaos.

Nabaos

(Figure 4b hereabouts)

As seen from Figures 3a and b, the Nabaos area captured in the photographs is more than half that of the Gellap-Oost area. Interpretation of the results must bear this discrepancy in mind. Only six of the 11 land units were represented in the Nabaos aerial photographs, and the most abundant was plains/grassland (unit 7). Plains/grassland and bare soil (unit 8), and hills/bare soil (unit 2) are the second and third most prevalent.

When comparing the two years, it is important to note the additional land units captured on the 1998 photographs, to north-east of the Nabaos farm buildings. These units are mainly plains/grassland and bare soil, and plains/scattered trees and shrubs. This area has not been included in the 1970 map, as the photographs did not extend to this area. It is thus excluded from the comparison. As with the Gellap-Oost photographs from 1970-1998, there were no major changes in the land units at Nabaos during the same period. The exception is that of plains/grassland and bare soil (unit 8), which almost doubled in size during the 28 year period (6.3-11%; Figure 4b).

Discussion

The objective of this paper was to investigate whether livestock in the communal areas of southern Namibia have a negative impact on the grazing resource. Both interviews with key stakeholders and analysis of sequential aerial photographs were conducted. Results from these investigations point to three main findings: 1) the veld is indeed relatively resilient; 2) there has been a change in vegetation composition and, 3) localised degradation is evident. Each of these observations is discussed in turn, with the limitations of the aerial photographs borne in mind.

That the veld in the communal areas is resilient is evident from the vegetation regeneration after the good 1999/2000 rainy season. De Lange's comment that 'there was not much difference between communal and commercial land' is a common sentiment amongst those interviewed (de Lange, pers. comm.).

As mentioned, commercial farms operate on a rotational grazing basis, and communal areas in the southern region typically have little grazing management practices. The continual grazing pressure on communal land is thought to be especially harmful to plant species after good rains, when there is an opportunity for some plants to complete their reproductive life cycle (Bester; Hoffman; Neumann, pers. comm.). With change in tenure, there would be a marked change in grazing management and a resultant change in vegetation cover (if grazing pressure was impacting on the vegetation base).

Analysis of the sequential aerial photographs indicates little major changes in proportion of land units in Gellap-Oost from 1970 to 1998. Any changes in the Nabaos land units can therefore be attributed to a change in grazing practice.

Figures 3a, b and 4a indicate a marked increase in bare soil from 1970-1998. This loss of vegetation cover and associated erosion is most probably due to increased grazing pressure on the land once the farm changed to communal tenure. This is despite the fact that the commercial farm infrastructure, such as boundary fences, remained on Nabaos. These can significantly help grazing management, although (as is often the case) if the fences fall into disrepair the benefits are lost (Fuller and Turner, 1996; Neumann, pers. comm.).

It is also possible that changes in vegetation cover occurred in the commercial farm, but were not captured on the photographs. Both aerial photographs were taken during the dry season, and any changes in vegetation due to grazing management may only have been evident during or after good rains. This emphasises the importance for both intra- and inter-seasonal monitoring. Jenks (1997) highlighted the inability of aerial photographs to detail vegetation composition differences, and it is possible that these may have been neglected in both interpretations of Gellap-Oost and Nabaos. Changes in vegetation composition may also have occurred outside the sample area, as suggested by Ward *et al.* (1995). They found that rangeland conditions could vary on a small spatial scale within farm boundaries. This is especially pertinent, as both farms were not completely captured in the photographs.

Recent studies on land degradation in semi-arid regions concluded that species composition changes in response to livestock grazing (Lykke, 2000; Fynn and O'Connor, 2000). Evidence collected during the interviews supports these findings, and suggests that plant species composition has altered in the communal areas. According to extension officers working in these areas, sweetveld seed banks have been depleted, with a concurrent increase in unpalatable species, such as *Schmidtia kalihariensis* (Steyn; de Lange, pers. comm.).

Localised land degradation at homesteads, waterpoints, hills, slopes and drainage channels is evident from both the aerial photographs and the interviews. The over-concentration of livestock around waterpoints and homesteads results from increased reliance on groundwater and increased sedentarisation (Adams and Werner, 1990). Drainage channels are focal points for livestock grazing and watering (when water is available), and erosion seen along these watercourses is more linear than that around waterpoints (see channel feeding into the Merensky Dam, Figures 3a and b). Concentration of livestock, including donkeys and feral horses, around these areas can lead to trampling, loss of soil permeability, loss of vegetation cover and increased erosion (Livingstone, 1991; Steyn, pers. comm.). The presence of these localised areas of erosion has also been noted in studies by Mills (1995) and Fynn and O'Connor (2000). They realised that some areas of the veld are more susceptible to erosion, and that erosion can occur at a small spatial scale.

The above results provide contrasting evidence. In the first case, there is evidence that the veld is generally resilient. In effect, this supports the disequilibrium theory that livestock do not have a negative impact on vegetation resources, and that rainfall is the main driving force behind plant productivity (Mills, 1995; Rohde, 1997; Sullivan 1996, 1998; Ward *et al.,* 1998; Watson, 1996). However, the limitations of interpreting the aerial photographs have been discussed, and it is possible that other vegetation cover and composition changes occurred, but were not captured by the photographs. In the second, contrasting, case, marked changes in bare soil cover, plant composition and areas of localised degradation are observed both be those interviewed, and from the aerial photographs. All are thought to be a direct result of livestock grazing and/or trampling (Boois; Steyn, pers. comm.; Lane and Moorehead, 1994). This supports instead an equilibrium model, insofar as livestock actions have a negative impact on the vegetation base (Lykke, 2000; Fynn and O'Connor, 2000; Mills, 1995).

These contrasting aspects can be drawn together by viewing the communal land in southern Namibia as relatively resilient, but nevertheless experiencing land degradation, both in the short term (localised degradation) and in the long term (plant composition changes) (Ward *et al.*, 1998). This degradation seems primarily due to livestock action. It is important, however, to recognise the difficulties in separating between anthropogenic and environmental causes of land degradation (Livingstone, 1991). It is also necessary to incorporate the inherent variability within such arid/semi-arid systems into any interpretations. Without long term social and environmental data, this is difficult.

What management practices should be recommended in such a dynamic and variable environment? Guidelines must be initiated to minimise the grazing impact of livestock. These include the following:

- Removal of excess donkeys and feral horses
- Decrease in livestock numbers
- Market incentives to promote fewer, better quality livestock
- Promotion of alternative livelihoods, such as nature based tourism
- Community management grazing schemes, such as herding co-operatives
- Grazing management at key areas susceptible to degradation
- Long-term monitoring of vegetation resource

The removal of 'freeloaders' from the grazing system is vital (Hoffman, pers. comm.). Although donkeys are utilised in the communal areas for transport, food and credit, they, and feral horses, exert the greatest grazing pressure on the land, and as such should be minimised (Esterhuyse, pers. comm.). Once this has been achieved, the destocking of livestock can progress.

A decrease in livestock numbers will reduce the grazing pressure on the land, increase the quality of livestock, and be economically profitable (Campbell *et al.*, 2000). Destocking is already being promoted in the communal areas of the study area (Steyn, pers. comm.). It is difficult to implement such a strategy, however, if livestock are the only asset of many of the communal farmers – the majority of which do not engage in formal markets (Devereux and !Naruseb, 1994). If destocking is to be successful therefore, it has to be implemented in conjunction with a number of other strategies. It has to aimed at a community level, where all members can benefit from the reduction in grazing pressure (Hoffman, pers. comm.). Marketing incentives should also be promoted which complement the increase in livestock quality. For those that do not engage in such markets (and for those that do), there should also be an emphasis on alternative income generation. This can include community based nature tourism, a land use that is gaining acceptance in the area and which offers huge potential with respect to economic, social and biophysical benefits (Ashley and Garland, 1994; National Development Plan, 1996).

The change in plant composition highlights the need for the veld to be rested at intervals, and not continuously grazed (Bester; Hoffman, pers. comm.). Although this would be difficult to implement, herding co-operatives where livestock are amalgamated and grazed in certain areas, would be one option. In this particular environment, it is important to retain the flexibility that is characteristic of the rainfall events – and this herding strategy would allow for unpredictable movements into various areas within the communal lands (Hoffman, pers. comm.; Sullivan, 1998). The upcoming Communal Land Bill proposes the formation of Land Boards, which may or may not facilitate such management (Boonzaier *et al.*, 2000). Grazing management around areas susceptible to degradation has already been implemented at waterpoints. The Community Based Management of Rural Water Supply initiative provides for

Water Point Committees to regulate the amount and frequency of livestock at the waterpoints (DRFN and MAWRD, 1999). Community members should however, also be made aware of the dangers of continual grazing at other key areas, such as hills, slopes, and along drainage lines (Fynn and O'Connor, 2000; Mills, 2000). In addition, an accurate assessment of vegetation composition and productivity over time is required before a clear understanding of the system dynamics can be reached. On-going monitoring and research of veld/livestock/rainfall interactions should provide this.

In conclusion, the evidence obtained suggests that the inherent resilience of the veld is being undermined by changes in plant species composition and localised areas of degradation. Destocking is recommended, but only if done in conjunction with alternative strategies, such as nature based tourism. Although livestock farming will never disappear from the communal lands, a move towards other livelihoods will benefit both the people and the veld.

Acknowledgements

This study was made possible by financial support from the German Technical Co-operation, directed through the Namibian Programme to Combat Desertification project of the Ministry of Environment and Tourism, Government of Namibia. My supervisor, Mike Meadows is thanked for his guidance and support, as is Robert Kiunsi and Timm Hoffman for their help and comments regarding aerial photography and communal land management.

References

Adams, F. and Werner, W. 1990. The land issue in Namibia: an enquiry, pp. 9-81, Namibia Institute for Social and Economic Research, University of Namibia, Windhoek.

Ashley, C. and Garland, E. 1994. Promoting community based tourism development – why, what and how? Directorate of Environmental Affairs, Research Discussion Paper: 4, pp. 1-34, Windhoek, Namibia.

Barnard, P. 1998. Biological diversity in Namibia: a country study, pp. 15-52, Namibia National Biodiversity Task Force, Directorate of Environmental Affairs, Windhoek, Namibia.

Behnke, R. and Scoones, I. 1993. Rethinking range ecology: implications for ranageland management in Africa. In: Behnke, R., Scoones, I. and Kerven, C. (Eds.), Range ecology at disequilibrium: new models of natural variability and pastoral adaptation in African savannahs, pp. 1-30, Overseas Development Institute, Russell Press Ltd. Nottingham.

Boonzaier, A., Edelstein, S., Fara, K., Kuiper, S., Spesier, A. and van der Merwe, S. 2000. Environmental situation analysis with regard to land degradation in the Orange and Fish catchment area, pp. 1-193, unpublished report, M.Phil. students, Environmental Evaluation Unit, University of Cape Town, South Africa.

Campbell, B., Doré, D., Luckert, M., Mukamuri, B. and Gambiza, J. 2000. Economic comparisons of livestock production in communal grazing lands in Zimbabwe. *Ecological Economics*, 33: 413-438.

Cowling, R. 2000. Challenges to the 'new' rangeland science. *TREE*, 15 (8), 303.

Devereux, S. and !Nuraseb, G. 1994. Water and sanitation in Namibia's southern communal areas: A knowledge, attitude and practices survey. Social Sciences Division, Multi-Disciplinary Research Centre, University of Namibia: Social Sciences Division Research Report, 8, pp. 7-10.

Desert Research Foundation of Namibia and Ministry of Agriculture, Water and Rural Development 1999. Managing water points and grazing areas in Namibia: Karas and Hardap Region, pp. 1-93, Desert Research Foundation, Windhoek, Namibia.

Directorate of Water Affairs 1995. General hydrological conditions and characteristics of surface water schemes in Namibia. Ministry of Agriculture, Water and Rural Development, Windhoek, Namibia.

Federal Institute for Geosciences and Natural Sciences of Germany and Geological Survey of Namibia 1997. Promising patterns: A new approach to the mineral potential of southern Namibia. Eberle, D. (Ed.), Windhoek, Namibia.

Fuller, B., and Turner, S. 1996. Resources access and rangeland management in three communal areas of Namibia, pp. 15-52, Social Sciences Division, Multi-Disciplinary Research Centre, University of Namibia: Social Sciences Division Research Report, 23.

Fynn, R. and O'Connor, T. 2000. Effect of stocking rate and rainfall on rangeland dynamics and cattle performance in a semi-arid savanna, South Africa. *Journal of Applied Ecology*, 37: 491-507.

Hansohm, D. and Mupotola-Sibongo, M. 1998 Overview of the Namibian economy. Namibian Economic Policy Research Unit, Windhoek, Namibia.

Heyns, P., Montgomery, S., Pallet, J., Seely, M. (Eds.) 1998. Namibia's water, A decision makers' guide, pp. 45-54, Desert Research Foundation of Namibia and the Directorate of Water Affairs, Windhoek, Namibia.

Jenks, C. 1997. Historical consideration of environmental dynamics in the identification of dryland degradation in northern Damaraland, pp. 22-69, unpublished M.Phil. Thesis, University of Cape Town.

Knapp, P. A., Warren, P. L. and Hutchinson, C. F. 1990. The use of large scale aerial photography to inventory and monitor arid rangeland vegetation. *Journal of Environmental Management*, 31: 29-38.

Kroll, T. and Kruger, A. S. 1998. Closing the gap: Bringing communal farmers and service institutions together for livestock and rangeland development. *Journal of Arid Environments*, 39: 315-323.

Lane, C. and Moorehead, R. 1994. Who should own the range? Thinking on pastoral resource tenure in dryland Africa, pp. 1-31, International Institute for Environment and Development.

Livingstone, I. 1991. Livestock management and 'overgrazing' among pastoralists. *Ambio*, 20 (2): 80-85.

Lutchmiah, J. 1999. Soil erosion in the central midlands of Kwazulu Natal: A comparative study. *South African Geographical Journal*, 81 (3): 143-147.

Lykke, A. 2000. Refining the ecological aspects of disequilibrium theories for Africa's pastoral drylands. *Desertification Control Bulletin*, 36: 23-33.

Mace, R. 1991. Overgrazing overstated. *Nature*, 349: 280-281.

Mills, A. 1995. The resilience of African arid/semi-arid rangelands to grazing pressure. Unpublished M.Phil. Dissertation, University of Cambridge, England.

Ministry of Agriculture, Water and Rural Development 1998. Survey 1998: communal farmers Hardap Region, Directorate Extension and Engineering Services Gibeon, Maltahöhe, Mariental Ministry of Agriculture, Water and Rural Development, Windhoek, Namibia.

Ministry of Labour and the National Planning Commission 1998. The Namibian labour force survey 1997: An interim Report of Analysis. Windhoek, Namibia.

National Development Plan 1996. National planning commission, Windhoek, Namibia.

Namibia Water Resources Management Review 2000. Strategic water resources assessment. Unpublished draft theme report.

Namibian Meteorological Service 2000. Unpublished data: rainfall and temperature Statistics, Mariental and Keetmanshoop.

Paine, D. 1981. Aerial photography and image interpretation for resource management. J. Wiley and Sons, New York, Chichester, Brisbane and Toronto.

Pallet, J. 1997. (Ed.) Sharing water in southern Africa, pp. 12-25, Desert Research Foundation of Namibia, Windhoek, Namibia.

Rohde, R. 1997. Nature, cattle thieves and various other midnight robbers: images of people, place and landscape in Damaraland, Namibia. Unpublished Ph.D., University of Edinburgh, Scotland.

Sullivan, S. 1996. Towards a non-equilibrium ecology: perspectives from an arid land. *Journal of Biogeography*, 23: 1-5.

Sullivan, S. 1998. People, plants and practice in drylands: socio-political and ecological dimensions of resource use by Damara farmers in northwest Namibia. Unpublished Ph.D. Thesis, University College, London, England.

Sustainable Animal and Range Development Program 1991. Environmental assessment study and identification of pilot areas for Hereroland and Namaland, pp. 18-38, Ministry of Agriculture, Water and Rural Development, Windhoek, Namibia.

Sustainable Animal and Range Development Program 1995. Information folder on southern communal areas in the Hardap and Karas Regions, pp. 1-21, Ministry of Agriculture, Water and Rural Development, Windhoek, Namibia.

UNCCD Glossary Sheet 2000. http://www.uncd.int/publicinfo/glossary.php.

van der Merwe, J (Ed.) 1983. National atlas of South West Africa, Windhoek, Namibia.

van der Merwe, B. (Ed.) 1999. IUCN water demand management country study: Namibia, pp. 2/11-2/13, Directorate of Resource Management, Department of Water Affairs, Ministry of Agriculture, Water and Rural Development and City Engineer, Water Services, Windhoek, Namibia.

van Oudshoorn, F. 1999. Guide to grasses of southern Africa, pp. 80-232, Briza, Pretoria.

Vlachos, J. 1995. Communal land tenure and land degradation: a minor field study of the Elim constituency, Omusati Region, Namibia. Unpublished Thesis, University of Lund, Scandanavia.

Ward, B., Ngairorue, B.T., Kathena, J., Samuels, R. and Ofran, Y. 1998. Land degradation is not a necessary outcome of communal pastoralism in arid Namibia. *Journal of Arid Environments*, 40: 357-371.

Watson, H. 1996. Short and long term influence on soil erosion of settlement by peasant farmers in Kwazulu Natal. *South African Geographical Journal*, 78 (1): 1-6.

Personal Communications

Basson, T. 2000. Personal Communication. Chief Executive Officer, Hardap Region, Namibia.

Bester, B. 2000. Personal Communication. Chief Pasture Scientist, Agricultural Research Division, Ministry of Agriculture, Water and Rural Development, Windhoek, Namibia.

Boois, S. 2000. Personal Communication. German Technical Co-operation and Sustainable Animal and Range Development Program Representative, Hardap Region, Namibia.

de Lange, D. 2000. Personal Communication. Chief Agricultural Extension Officer, Ministry of Agriculture, Water and Rural Development, Hardap Region, Namibia.

Esterhuyse, C. 2000. Personal Communication. Regional Head, Department of Rural Water Supply, Ministry of Agriculture, Water and Rural Development, Karas Region, Namibia.

Hoffman, T. 2000. Personal Communication. Researcher, National Botanical Research Institute, Kirstenbosch, Cape Town, South Africa.

Knouwds, H. 2000. Personal Communication. Chief Agricultural Extension Officer, Ministry of Agriculture, Water and Rural Development, Karas region, Namibia.

Kohlman, J. 2000. Personal Communication. German Technical Co-operation and Sustainable Animal and Range Development Program Coordinator, Windhoek, Namibia.

Neumann, N. 2000. Personal Communication. Co-ordinator, Sustainable Animal and Range Development Program, Windhoek, Namibia.

Steyn, K. 2000. Personal Communication. Agricultural Extension Officer, Ministry of Agriculture, Water and Rural Development, Karas region, Namibia.

Strohbach, B. 2000. Personal Communication. Researcher, National Botanical Research Institute, Windhoek, Namibia.

Figure 1: Study area

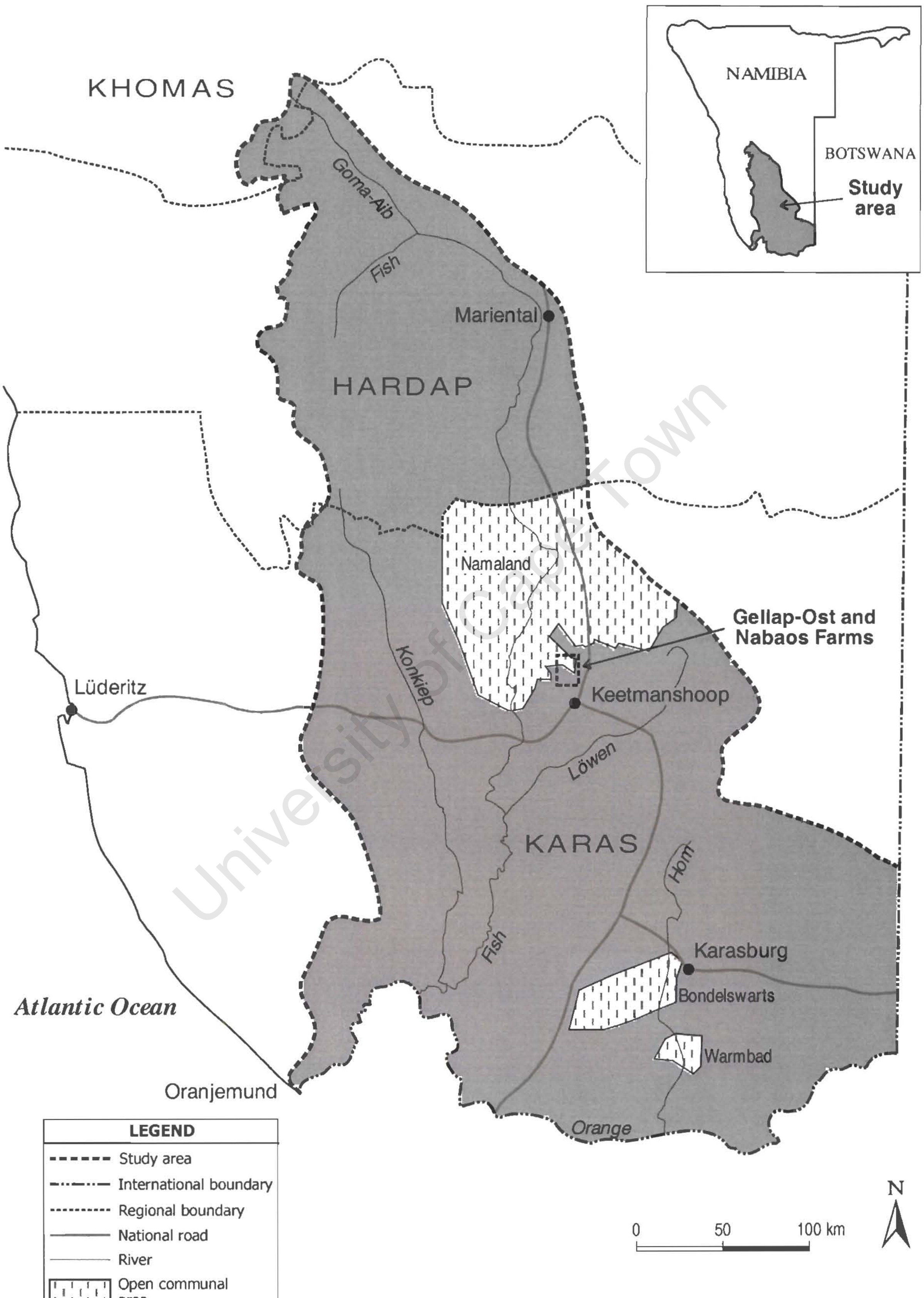


Figure 2: Seasonal rainfall in Keetmanshoop: 1970/1971 – 1999/2000

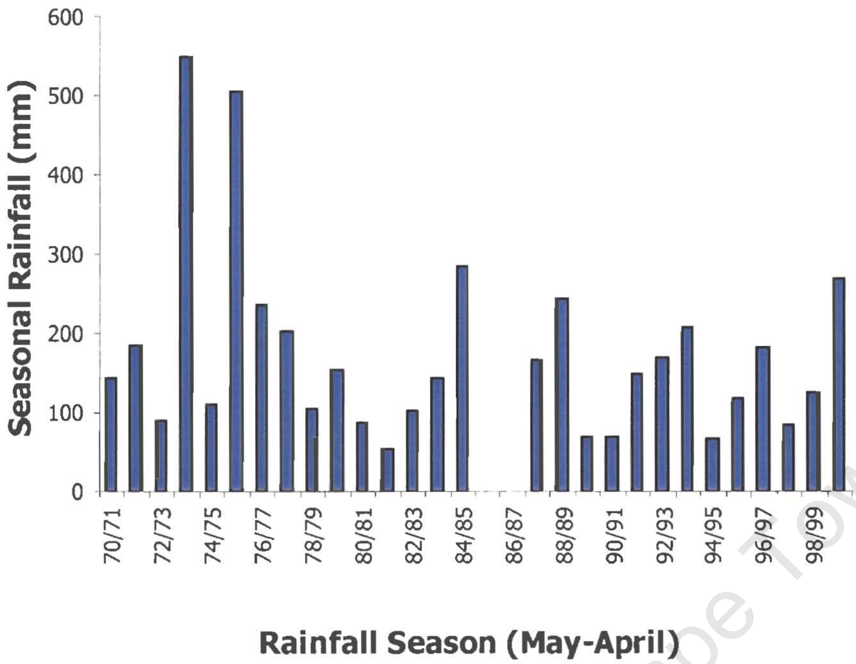


Table 1: Interpretation of aerial photography characteristics of Gellap-Oost and Nabaos farms

TERRAIN TYPE	AERIAL PHOTOGRAPH CHARACTERISTIC	LAND UNIT
Hills	Hill with *pale*	Hill with bare soil
	Hill with *dispersed rough*	Hill with scattered shrubs
Slopes	Slope with *pale*	Slope with bare soil
	Slope with *rough*	Slope with shrubs
	Slope with *smooth* and *rough*	Slope with trees and shrubs
	Slope with *dispersed smooth* and *rough*	Slope with scattered trees and shrubs
Plains	Plains with *dark*	Plains with grassland
	Plains with *dark* and *pale*	Plains with grassland and bare soil
	Plains with *smooth* and *rough*	Plains with trees and shrubs
	Plains with *dispersed smooth* and *rough*	Plains with scattered trees and shrubs
	Plains with *dispersed rough*	Plains with scattered shrubs

Photo 1: Differences in vegetation composition between communal and commercial land. Photo: Saskia Kuiper

Photo 2: Localised degradation surrounding a waterpoint. Photo: Saskia Kuiper

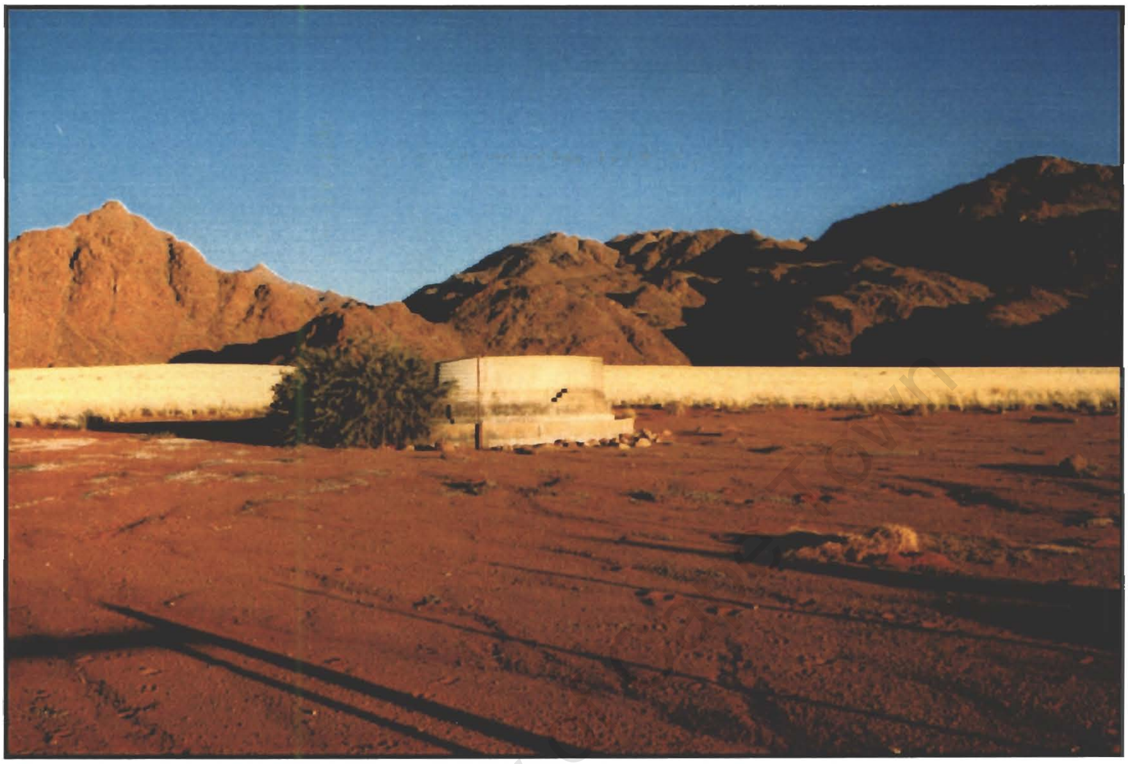


Figure 3a: Land cover map of Gellap-Oost and Nabaos in 1970

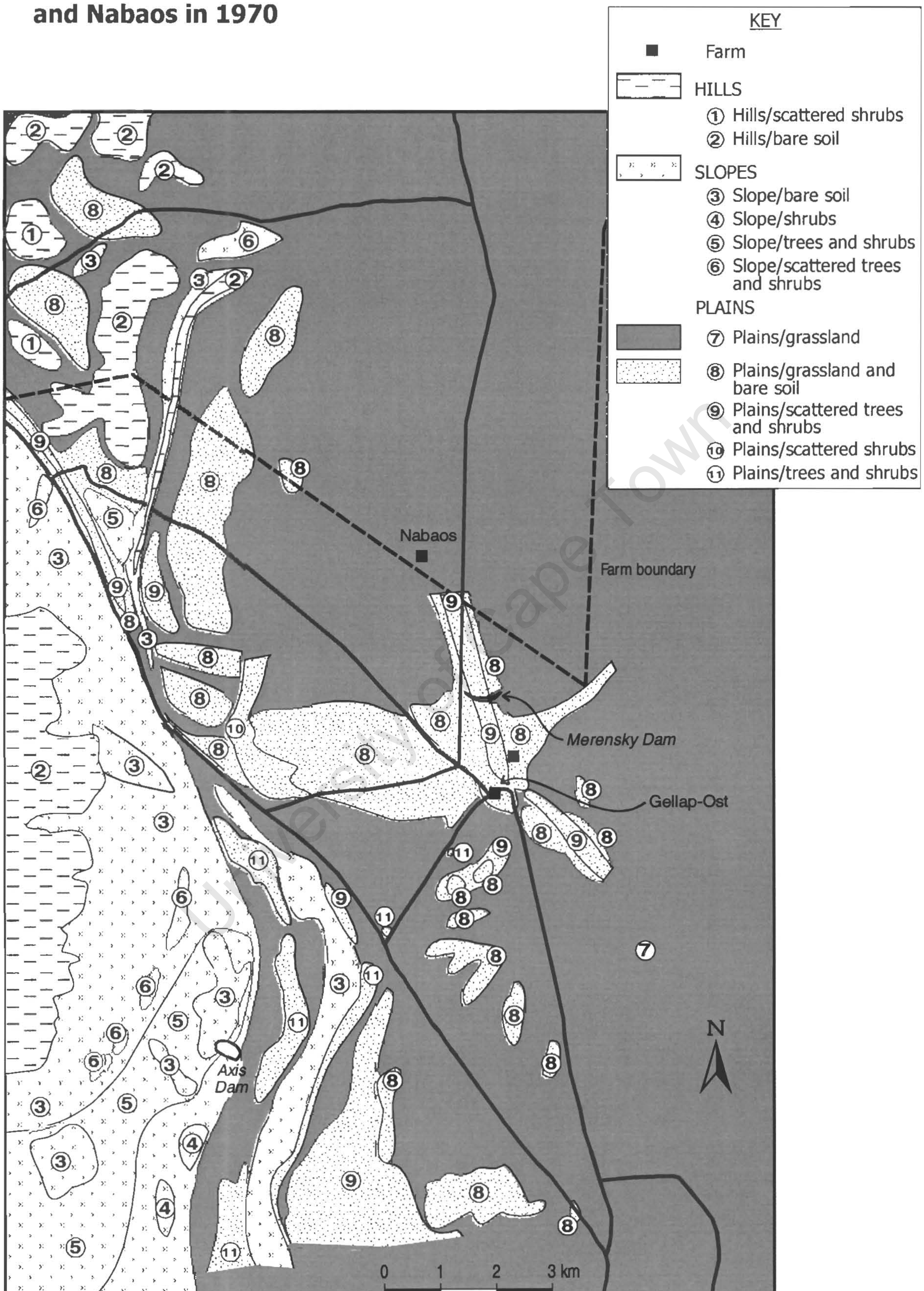


Figure 3b: Land cover map of Gellap-Oost and Nabaos in 1998

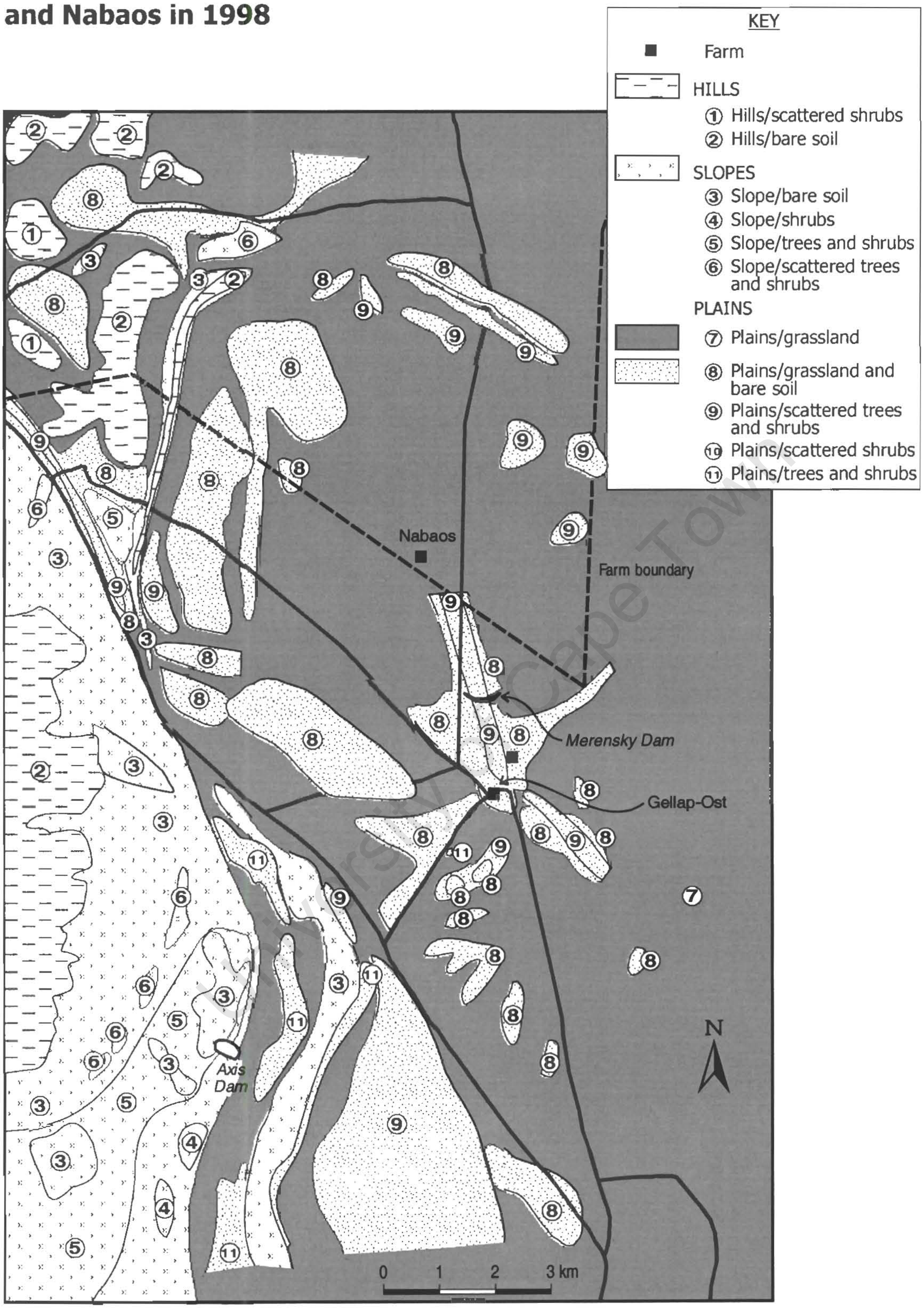
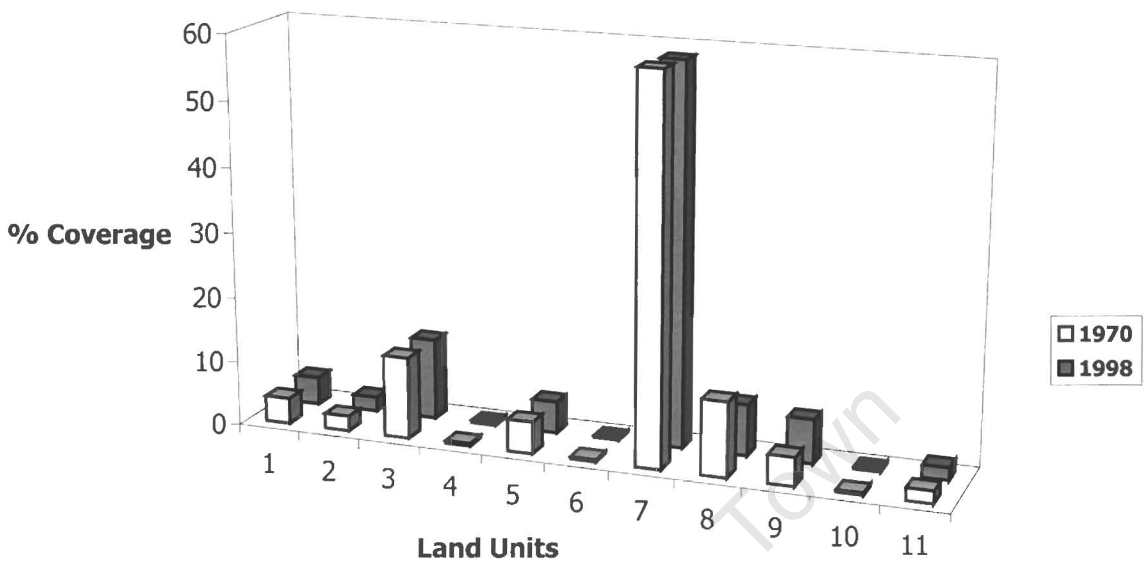
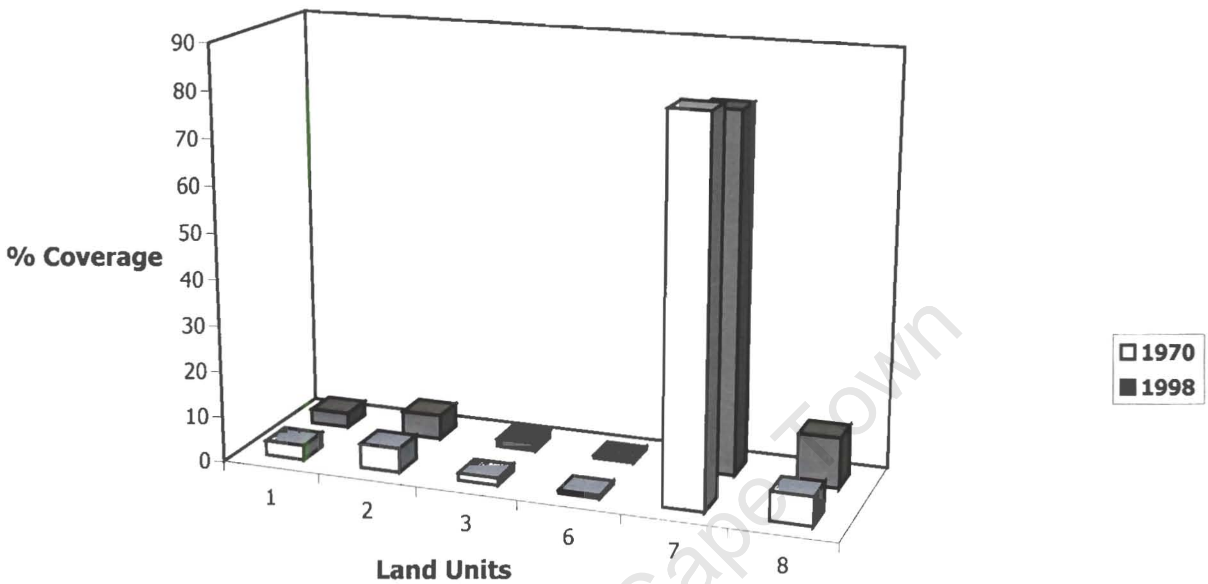


Figure 4a: Proportion of land unit cover at Gellap-Oost farm from 1970-1998



	1	2	3	4	5	6	7	8	9	10	11
□ 1970	4	2.3	12.6	0.4	4.9	0.35	58.8	11.5	4.4	0.37	1.9
■ 1998	4.3	2.2	12.5	0.4	4.9	0.35	58.3	7.9	6.8	0.37	1.9

Figure 4b: Proportion of land unit cover at Nabaos farm from 1970-1998



	1	2	3	6	7	8
1970	3.2	5.3	1.6	0.7	82	6.3
1998	3.2	5.3	1.6	0.7	78	11