THE DELIMITATION OF FAIRLY HOMOGENEOUS FARMING AREAS OF THE NORTHERN AND CENTRAL SUB-REGIONS OF S.W.A WITH THE PREVAILING PROBLEMS AND ENVISAGED DEVELOPMENT PROGRAMMES FOR THE VARIOUS BRANCHES OF AGRICULTURE

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CONTENTS

CHAPTER 1

INTRODUCTION

1.1 Optimal agricultural production depends on the optimal utilization and development of natural resources. To realize this ideal, the extent of insufficient knowledge in several areas, had to be determined. The most important are:

1. The delimitation of fairly homogeneous farming areas.
2. The gathering of more detailed climatological data.
3. Determination of the situation with respect to implementation of practices as far as cattle and karakul farming is concerned as well as the present production status.
4. The degree to which farms are already developed.
5. Determination of the most important problems in farming.

1.2 The objective is thus to identify problems in detail so that extension and research programs can be drawn up that are aimed at eliminating these problems and increase production.

A set of information like this will enable the Department to continuously evaluate the progress in agriculture and its activities.

1.3 PHYSICAL DATA ON WHITE FARMING AREAS IN SOUTH WEST AFRICA

The contents of this report is limited to the white farming community which owns 43,79 percent of the total surface area (82,31 million hectare) of South West Africa. The remaining 40,84 percent are inhabited by non-whites, while 15,37 percent are considered not to be suitable for farming.

Since the production potential is dependent on the natural resources, the white farming areas were divided into subregions according to their site morphology, soil pattern and macroclimate. Each of these subregions was thus identified as a reasonably homogeneous farming area (RHFA) in which little difference should exist with respect to production techniques and yield standards. Further refinement or division of these RHFA's is only necessary in areas with agronomic potential where climate, slope, soil characteristics and surface area will be criteria for delimitation of specific areas.

From the point of view of livestock farming, the division of potential in the areas seems to be sufficient. (See Map A, Appendix A). The real production potential of each of these RHFA's warrants future attention to aim at optimal production.

To start off, the area was divided into high, medium and low production potential areas. The total surface area as well as the number of farmers are indicated in Table 1.

TABLE 1. The total surface area and the number of farming units within the high, medium and low potential cattle and sheep farming areas of South West Africa.

	no. of farming units	total surface area (ha)
High potential beef producing area	1473	9 564 000
Medium potential beef producing area	433	3 100 000
Erosion areas (cattle farming)	135	480 000
TOTAL	2041	13 144 000
Mixed sheep/cattle farming area	480	4 837 000
High potential sheep farming area		8 100 500
Medium potential sheep farming area		7 340 000
Low potential sheep farming area		2 622 000
TOTAL	2606	18 062 500
TOTAL South West Africa	5127	36 043 500

If half of the total surface area of the mixed sheep/ cattle area were used for each of these farming sections, the total surface area

a) that can be used for sheep farming	20 481 000 ha
b) that can be used for cattle farming	15 562 500 ha

Extensive sheep farming for the production of pelts and meat and cattle farming for the production of beef, are the most important activities in agriculture. Dairy farming and agronomy play a minor role in the total soil utilization pattern. The various branches are discussed separately later.

CHAPTER 2

DELIMITATION OF FAIRLY HOMOGENEOUS FARMING AREAS

2.1 HIGH POTENTIAL CATTLE FARMING AREA

2.1.1 NORTHERN KALAHARI SANDVELD (A1)

2.1.1.1 ENVIRONMENTAL FACTORS

a) Climate

The average rainfall is ± 450 mm per annum. The south eastern area, especially east of the Omuramba Omatako, receives lower rainfall that varies between 400 and 420 mm per annum. In the northern and north western parts, the rainfall is higher than the average and in the region of 525 mm per annum.

The distribution of rainfall, expressed as percentage of the total annual average precipitation, is as follows:

September	0,4%
October	3,0%
November	9,0%
December	15,9%
January	22,1%
February	25,4%
March	16,9%
April	6,4%
May	0,8%

Rain therefore generally occurs from October to April with the largest precipitation during January, February and March.

Summers are very hot with winters that can be classified as mild with light frost now and then.

b) Soil Types

The largest part of the area consists of red Kalahari sand (dunes and plains) that varies in depth between 46 and 150 meter with a Karoo Basalt substrate. Hard soil with a limestone substrate occurs between the dunes. The sandy areas are acid to very acid and the pH varies between 5,5 and 4,5. A small part consists of shallow grey sand that is very acid and has a lower potential.

c) Topography

This area is situated between longitude 17^{o} to $19,3^{o}$ east and latitude $18,6^{o}$ to $19,8^{o}$ south.

This is an area with dense bush and few flat sandy areas, but consists mainly of high sand dunes with interdune valleys. The dunes are on average 15 meter high with some dunes as high as 24 meter. The width of the interdune valleys is between 600 and 1 200 meter.

Due to the nature of the topography and the soil type, erosion is no problem in this area.

d) Vegetation

Trees and shrubs

A dense stand of shrubs occurs especially on the dunes. Palatable shrubs that occur on the dunes are: Baphia obovata, Croton spp. Combretum apiculatum, Grewia spp. Mundulea sericea, Terminalia sericea and Lonchocarpus nelsii. In the interdune valleys several Acacia species occur. The interdune valleys can be severly encroached by bush due to overgrazing, so that they become virtually useless for cattle grazing.

In the northern and eastern parts, Gifblaar - Dichapetalum cymosum is widely spread. This plant usually occurs on the northfacing foot of the dunes in association with Combretum mechowianum, Burkea africana and Terminalia sericea.

Grass cover

The interdune valleys are characterized by good perennial grasses like Anthephora pubescens, Brachiaria nigropedata, Schmidtia pappophoroides, Panicum kalahariense and Digitaria setivalva.

The dunes on the other hand are characterized by less palatable grasses like Eragrostis pallens, Aristida meridionalis, Aristida stipitata and Eragrostis lehmanniana. A few Digitaria spp. Schmidtia spp., Eragrostis jeffreysii and Hyparrhenia dissoluta plants also occur.

e) Water sources

This subregion is entirely dependent on boreholes for its water supply. Boreholes generally are deep. The average depth is about 91 meter with an output of

around 5,6 m^3 per hour. There are on average 5 boreholes per farming unit; this means 1191 hectare for every borehole.

2.1.1.2 SOIL UTILIZATION PATTERN

a) Physical data

Planimetric surface area	924 000 ha
Total surface area of surveyed area	881 174 ha
Number of farms	188
Number of farming units	148
Average farm size	4 687 ha
Average size of farming unit	5 945 ha
Average number of camps / farming unit	20,2
Average camp size	290 ha

Camp sizes are spread as follows:

50 to 200 ha	38,3 % of total
201 to 300 ha	32,1 % of total
301 ha and larger	29,6 % of total

b) Cultivated fields

Cultivated fields represent only 1,4 % of the surface area per farming unit and the remainder, viz. 98,6 % consists of natural grazing.

Agronomy is practiced on a small scale but is widespread over the entire area. Crops like maize, peanuts, sunflower, sorghum, beans and other pasture crops are grown. The cultivation of Cenchrus ciliaris is gaining popularity in this area at present and 62% of the farmers in the area plan to grow this grass.

The existing cultivated lands are utilized as follows:

Maize	24,7 %
Peanuts	18,4 %
Cenchrus ciliaris	12,8 %
Sorghum	1,8 %
Sunflower	3,6 %
Pasture crops	1,8 %
Veld hay	26,1 %
Other crops	10,8 %

c) Cattle farming

Extensive cattle farming is the major activity. Small herds of boer goats and mutton sheep are kept. Upgraded boer goat studs are kept on a few farms.

d) Uneconomical units

In this area 10 uneconomical units (i.e. smaller than 2880 ha) are found.

2.1.1.3 HUMAN RESOURCES

a) Ethnic grouping

Number of German speaking farmers	12,8 %
Number of Afrikaans speaking farmers	87,2 %
Surface area in posession of German speaking farmers	16,1 %
Surface area in posession of Afrikaans speaking farmers	83,9 %

b) Education

Number of farmers with tertiary education	25 %
Number of farmers with Std. 6 or lower	41,7 %

c) Age

The percentages of farmers in the listed age groups are as follows:

20 to 30 years	3,4 %
31 to 40 years	13,4 %
41 to 50 years	36,1 %
51 to 60 years	28,6 %
61 to 70 years	16,8 %
71 years and older	1,7 %

2.1.1.4 PRESENT PRACTICES

Only practices on which information is available to date, are described here.

a) Veld Management

According to a survey done at 20 % of the farms, the following details were obtained:

Number of farmers that implement good pasture management practices	41 %
Number of farmers that implement fair pasture management practices	35 %
Number of farmers that implement poor pasture management practices	24 %

The majority of farmers in this subregion that have the poisonous plant Dichapetalum cymosum on their farm, follow a grazing system whereby they use non-infested camps (interdune valleys) during the danger months (from about August until sufficient green grazing and shrubs are available).

During the rainy season, the camps with dunes are grazed to allow effective utilization of the shrubs. The camps in the interdune valleys are saved for winter grazing.

This pattern is also followed on farms where Gifblaar does not occur.

b) Stocking rate

The average stocking rate is 1 LAU per 10,4 hectare while the recommended carrying capacity of the area is 1 LAU per 8 hectare.

c) Marketing pattern

Most of the farmers market their oxen at an early age. Percentages of farmers marketing oxen at the following ages, are:

8 months	12,9 %
12 months	6,5 %
18 months	12,9 %
24 months	25,8 %
30 months	16,1 %
36 months	9,7 %
42 months	9,7 %
48 months	6,5 %

This illustrates that 25,9 % of farmers market their oxen at an age of three years or older.

Most commonly, the age at marketing falls between two and two and a half years. The rounding off of oxen for the market by means of supplementary feeding, has taken root and already 28 % of farmers use this practice. It can be expected that this figure will vary over time, since fodder- and beef prices are determining factors.

d) Management practices

Number of cow herds per farming unit	2,4
Average size of herds (cows)	100
Total number of herds per unit	4
Average calving percentage	65,8 %
Percantage of farmers that isolate calves for 4 months	56,0 %
Number of farmers that have pregnancy tests done	3,1 %
Percentage of farmers whose livestock is identified	43,8 %
Percentage of farmers that supply supplementary feed (lick excluded)	0,0 %
Number of cows per bull	31
Number of farmers that implement a definite mating season (middle of December to middle of April) (of these, 37,9 % have their cows mated twice)	59,4 %

The animals are vaccinated against anthrax, quarter evil, botulism and brucellosis. Animals are dosed once during summer and again during winter. With a few exceptions, livestock is regularly de-horned and castrated.

2.1.2 PALM PLAINS (A2)

2.1.2.1 ENVIRONMENTAL FACTORS

a) Climate

The average rainfall for this area is 491 mm per annum. The south eastern parts, mainly the farms at the Omatako River receive less rain (420 mm p.a.). The distribution of rainfall is as follows:

September	0,5 % of total
October	4,4 % of total
November	10,3 % of total
December	14,2 % of total
January	18,5 % of total
February	25,0 % of total
March	20,7 % of total
April	5,4 % of total
May	1,0 % of total

The average number or rainy days, i.e. with a precipitation of 1 mm or more, is 53,1 with the maximum occuring in February. The number of rainy days during each month, follow the same pattern as the distribution of rainfall. Summers are very hot and temperatures of 40° C are often measured. Winters are cold and tem-

peratures as low as 4° C below freezing point have been measured. Usually frost can be expected at the beginning of May and again from the end of July until the middle of August. On farms along the Omuramba Omatako lower temperatures are generally experienced compared to the rest of the subregion.

b) Soil type

The soil varies from a broken sandy zone in the east to a gravelly, limestone area in the west. Flat ridges with surface alluvial limestone and limestone gravel alternate with somewhat lower lying areas where deeper brown-black to grey sandy loams occur. The soil has a phosphate deficiency, has a high calcium content and tends toward the alkaline. This is an area that consists mainly of shallow soils with limestone and dolomite substrata and sporadic occurences of igneous rock on the surface.

c) Topography

Location: between longitude 18° to 18,6° east and latitude 19,4° to 20,1° south.

The terrain is relatively flat with only a few solitary mountains in the central part. Towards the southeast, the shallow valley of the dry Omuramba, Omambonde and Omatako rivers, borders on the extensive sandveld.

Altitudes vary from 450 m in the western parts to 400 m in the east.

d) Vegetation

The sandy areas mainly support deciduous trees and shrubs like Terminalia sericea, Albizia anthelmintica, Lonchocarpus nelsii and a variety of Combretum and Grewia species. Other trees and shrubs are Peltophorum africanum, Combretum apiculatum, Terminalia prunioides and Olea africana. Hyphaene ventricosa occurs everywhere and is characteristic of this subregion. On the shallower lime soils Tarchonanthus camphoratus, Peltophorum africanum, Combretum imberbe and shrubs like Ziziphus mucronata, Catophractes alexandrii occur together with dwarf shrubs like Eriocephalus spp. and Leucosphaera bainesii. Where trampling of the veld occured in the past, encroachment by Acacia mellifera subsp. detinens is observed. Dichrostachys cinerea occurs mainly along the roads. Near vleys and brooks Acacia karroo and Ziziphus mucronata occur.

On harder soils Croton gratissimus can be found. In the vicinity of the Omatako River large trees of Acacia erioloba are present as well as a few Boscia albitrunca. In the sandy parts, small clumps of Acacia erubescens occur.

Grass cover

The grass cover is somewhere between a pioneer and subclimax stage. Annual Aristida spp. and Stipagrostis uniplumis are dominant.

Plant populations differ considerably in composition due to differences in soil. Trampled and selectively grazed veld is dominated by annual, inferior grasses, while the grass population of healthy pastures consists mainly of perennial species.

During the climax stage, species like Anthephora pubescens, Brachiaria nigropedata, Eragrostis superba, Panicum coloratum and Urochloa bolbodes should predominate. Schmidtia pappophoroides is considered to be an important indicator species.

Other species which were identified by Freyer and Kotze in 1963 at Uitkomst Research station, are: Heteropogon contortus, Hyparrhenia glauca, Cymbopogon plurinodis, Rhynchelytrum villosum, Andropogon gayanus, Elyonurus argenteus, Themeda triandra, Bothriochloa radicans, Enneapogon scoparius, Fingerhuthia africana, Aristida meridionalis, Eragrostis nindensis, Dichanthium papillosum, Pogonarthria squarrosa, Hyparrhenia hirta, Aristida stipitata, Eustachys paspaloides, Aristida effusa, Eragrostis porosa, Aristida hordeacea, Aristida rhiniochloa, Aristida scabrivalvis.

e) Water sources

This subregion is dependent on boreholes for its water supply. The average depth of boreholes is about 61 meter with an average output of 3,6 m^3. There are on average 5,4 boreholes per farming unit of 5096 ha. Each source therefore serves 944 ha.

A few nitrate poisonings have resulted in stock losses in the past; otherwise the water is of good quality.

2.1.2.2 SOIL UTILIZATION PATTERN

a) Physical Data

Planimetric surface area	238 000 ha
Total surface area of surveyed area	208 950 ha
Number of farms	53
Number of farming units	41
Average size of farms	3 942 ha
Average size of farming units	5 096 ha
Average number of camps per unit	19
Average camp size	268

The distribution of camps according to size is as follows:

50 to 200 ha	39,0 % of total
201 to 300 ha	23,8 % of total
301 ha and larger	37,2 % of total

All camps are provided with a permanent source of water.

b) Cultivated fields

On average 80 ha cultivated fields occurs per farming unit. The remainder consists of natural pastures. In general hardly any cash crops are cultivated. Most fields lie fallow or are partly used for the production of fodder, mainly hay.

c) Cattle farming

Farmers in this area concentrate on extensive cattle farming with the aim to produce beef. Very small numbers of boer goats and mutton sheep are kept for own use. One farmer supplies fresh milk to the Rietfontein Creamery, while a few farmers supply cream during the four months when pastures are green.

d) Uneconomical units

In this area only one uneconomical unit occurs.

2.1.2.3 HUMAN RESOURCES

a) Ethnic grouping

Afrikaans speaking farmers	37,5 %
German speaking farmers	62,5 %
Surface area in posession of German speaking farmers	66,2 %
Surface area in posession of Afrikaans speaking farmers	33,8 %

b) Age distribution

20 to 30 years	10,0 %
31 to 40 years	25,0 %
41 to 50 years	10,0 %
51 to 60 years	30,0 %
61 to 70 years	17,7 %
71 years and older	7,5 %

2.1.2.4 PRESENT PRACTICES

Available information about present practices are listed here.

a) Veld management

The survey revealed that 58 % of the farmers followed good, 9 % fair and 33 % poor pasture management systems.

b) Stocking rate

The average stocking rate is 1 L.A.U. per 10,2 ha. The recommended carrying capacity is 1 L.A.U. per 8 ha.

c) Marketing pattern

The majority of farmers market their cattle at an age of 18 months.

The distribution of age at marketing is as follows:

8 months	9,1 %
12 months	0,0 %
18 months	36,4 %
24 months	27,3 %
30 months	0,0 %
36 months	18,2 %
48 months	9,0 %

Thirty percent of farmers rounded off their oxen prior to marketing by supplementary feeding.

d) Herd management

Number of cow herds per farming unit	2
Average size of cow herd	100
Average total number of herds per farming unit	3,7

Number of camps available per herd	5,1
Average calving percentage	64,8 %
Farmers isolating calves for 4 months	41 %
Farmers that have pregnancy tests done	8 %
Farmers that have some form of identification for their cows	33 %
Farmers that supply supplementary feed (lick excluded)	25 %
Average number of cows per bull	36
Farmers that implement a definite mating season	58 %
Age of heifers at first mating:	
18 months to 2 years	66 %
2,5 years	9 %
3 years	25 %

Livestock is dosed twice a year, firstly three weeks after the first major rains and secondly three weeks after the onset of cold weather.

Calves are de-horned and castrated. Livestock is treated against ticks by manual spraying. Bulls are tested for vibriosis and trichomoniasis. Calf mortality is 3,5 %. Abortions amounted to 0,8 %. None of the farmers participate in the Postal Record System. Eighty percent of the farmers supply a good lick during summer, the rest supply a fair summer lick.

2.1.3 ONJENGA PLAINS (A3)

2.1.3.1 ENVIRONMENTAL FACTORS

a) Climate

The average annual rainfall is about 500 mm, with considerable variation between farms and years. The average monthly distribution, as a percentage of the total rainfall is as follows:

September	0,4 %
October	4,5 %
November	9,7 %
December	15,5 %
January	18,8 %
February	25,6 %
March	17,6 %
April	6,7 %
May	1,1 %

The average number of rainy days (1 mm and more) is 52,8 and shows the same pattern as the rainfall distribution from September to May.

Rainfall in the south-eastern parts is 420 mm p.a.. The dry Ondengaura River is more or less the border between higher and lower rainfall areas. The entire northern and central parts receive above average rainfall and averages of 660 mm p.a. occur.

Summers are very hot ($\pm$ 30^{o} C average maximum), while winters are cold with an average minimum temperature of 8^{o} C. Frost often occurs during June and July.

b) Soil types

This area shows varying soil types originating from the quartzites, conglomerates, schists and epidosites of the Nosib formation with isolated koppies of the above rock types. Soil depth also varies considerably from very shallow limestone and turf soils to deep red loam.

This pattern is found virtually throughout the entire area, although the northern parts tend toward shallower soils compared to the southern and central parts. Black turf is characteristic of the western parts, known as Aiams Plains.

c) Topography

The subregion can roughly be divided into two plains, viz. the Otjenga Plains (east) and the Aiams Plains (west) which are separated by a series of ridges. These ridges gradually level out towards the south. The south eastern corner is bordered by the Waterberg range and the north western border is formed by a range of ridges, koppies and mountains.

d) Vegetation

Giess (1970) describes this area as Mountain Savanna and Karstveld.

Trees and Shrubs

The largest tree species found here are Ficus sycomorus, Sclerocarya caffra, Kirkia acuminata, Albizia anthelmintica and Combretum imberbe. These species occur on the ridges and mountains. On the plains the following species predominate: Peltophorum

africanum, Acacia erioloba, Acacia karroo and a few Acacia tortilis. In the more sandy areas, Lonchocarpus nelsii and Terminalia sericea are found.

Large areas are encroached by shrubs like Acacia mellifera subsp. detinens, Acacia erubescens, Terminalia prunioides and Dichrostachys cinerea.

Grass cover

Dense stands, somewhere between pioneer and subclimax stages, are common. Annual Aristida species are common as well as species like Eragrostis porosa, Chloris virgata and Enneapogon cenchroides. Some parts have large amounts of Stipagrostis uniplumis followed by Schmidtia pappophoroides. This particularly applies to the more sandy areas where Eragrostis rigidior also occurs.

Certain areas in this subregion however support good perennial pastures and species like Anthephora pubescens, Cenchrus ciliaris, Urochloa bolbodes, Brachiaria nigropedata, Panicum coloratum, Heteropogon contortus and Fingerhuthia africana are common.

e) Sources of water

Water supply is virtually exclusively dependant on boreholes. The depth and output of borholes varies from farm to farm. The average depth is 61 meter and the output 7,1 m^3. Water quality varies from soft in the sandy areas to hard in the marble areas. Generally underground water is scarce in the eastern, southern and western parts but plentiful in the north. On average 5,7 boreholes occur per farming unit. This means 944 ha per borehole.

2.1.3.2 SOIL UTILIZATION PATTERN

a) Physical data

Planimetric surface area	674 000 ha
Total surface area of surveyed area	656 531 ha
Number of farms	189
Number of farming units	122
Average size of farm	3 474 ha
Average size of farming unit	5 381 ha
Average number of camps per farming unit	18,1
Average camp size	296 ha

The distribution of camp size is as follows (as a percentage of the total):

50 to 200 ha	40,6 %
201 to 300 ha	38,6 %
301 ha and larger	20,7 %

All camps are provided with permanent sources of water.

b) Cultivated fields

54 ha of cultivated fields exist per farming unit. Agronomy plays a minor role, even though it is practiced regularly on a few farms. Cultivation of maize is most important, although the largest percentage of fields is used for the production of hay. The survey revealed the following utilization pattern:

fallow	51,8 % of surface area
maize	38,4 % of surface area
hay crops	6,0 % of surface area
Cenchrus ciliaris	1,8 % of surface area
beans	1,2 % of surface area
sorghum	0,75 % of surface area

Farmers have shown considerable interest in cultivating Cenchrus ciliaris, and 68 % have indicated that they intend to cultivate this crop.

c) Cattle farming

Extensive cattle farming for the production of beef is the chief activity in this area. Small stock usually is kept only for personal use.

d) Uneconomical farming units

Only 4 uneconomical units occur in this subregion.

2.1.3.3 HUMAN RESOURCES

a) Ethnic grouping

Afrikaans speaking farmers	35,2 %
German speaking farmers	64,8 %
Surface area owned by Afrikaans speaking farmers	37,0 %
Surface area owned by German speaking farmers	63,0 %

b) Age distribution

Farmers are spread over the age groups as follows:

20 to 30 years	5,1 %
31 to 40 years	11,9 %
41 to 50 years	20,3 %
51 to 60 years	26,3 %
61 to 70 years	26,3 %
71 years and older	10,2 %

c) Communication channels

Initial contact can be made through the farmer's association. 51,2 % of the farmers are members of Organized Agriculture.

2.1.3.4 PRESENT PRACTICES

a) Veld management

In general, fairly good management practices are applied.

Farmers with good pasture management	60 %
Farmers with fair pasture management	20 %
Farmers with poor pasture management	20 %

b) Stocking rate

The present stocking rate is 11,2 ha per L.A.U.. If the size of cow herds is kept constant, this practice should contribute to the recovery of the veld.

c) Marketing pattern

According to this survey, 54,8 % of the farmers marketed their oxen at an age of two and a half years or younger. The distribution of ages at marketing is as follows:

8 - 10 months	12,9 % of farmers
12 months	3,2 % of farmers
18 months	16,1 % of farmers
24 months	12,9 % of farmers
30 months	9,7 % of farmers
36 months	38,7 % of farmers
48 months	6,5 % of farmers

29 % of the farmers use concentrated feed to round off oxen prior to marketing.

d) Herd management

Average number of cow herds per farming unit	2,6
Average size of cow herds	120
Average total number of herds per farming unit	4,7
Average number of camps available to herds	3,8
Average calving percentage	67,9 %
Farmers isolating calves for 4 months	45,2 %
Farmers that have pregnancy tests done	22,6 %
Farmers using some system of identification	61,3 %
Farmers supplying supplementary feed to cows (lick excluded)	0,0 %

The numbers of cows per bull are as follows:

less than 33	50 % of farmers
34 to 50	40 % of farmers
51 and more	10 % of farmers

Farmers following a definite mating season (December to March) 74,2 %
(Of these farmers, 22 % implement a mating season in spring as well)

Farmers leaving bulls with cows throughout the entire year 25,8 %

Age of heifers at first mating:

18 months	20,7 % of farmers
24 months	41,4 % of farmers
30 months	34,5 % of farmers
36 months	3,4 % of farmers

The average composition of herds in this area is as follows:

calves	25,2 %
oxen, 1-2 years	11,5 %
oxen, 2-3 years	6,6 %
oxen, above 3 years	0,7 %
heifers (young)	14,5 %
cows and heifers	39,9 %
bulls	1,5 %

Calf mortality per farming unit 5,9 %

Regular dosing and vaccination is done and calves are de-horned and castrated at a young age.

2.1.4 OTJIWARONGO THORNBUSH SAVANNA

2.1.4.1 ENVIRONMENTAL FACTORS

a) Climate

The average annual rainfall is 460 mm. The distribution of rainfall over the months is as follows (as a percentage of the total rainfall):

September	0,25 %
October	3,14 %
November	9,37 %

December	14,18 %
January	20,52 %
February	23,23 %
March	18,87 %
April	8,07 %
May	1,95 %

From this it is clear that January, February and March are the most important months for rainfall. The average number of rainy days (1 mm and more) is 48,6 per annum and during January to March, 56,8 % of the total number of rainy days occurs.

Summer temperatures in this area are high, while frost is occasionally experienced during May to September.

Average maximum temperature	29,4° C
Average minimum temperature	12,1° C
Absolute maximum temperature	39,4° C
Absolute minimum temperature	7,0° C

b) Soil types

The soil type varies from a sandy loam to a dark red loam. In the omurambas, heavy turf is found. The latter soil has great potential as far as grazing for cattle is concerned - quantitatively as well as qualitatively.

Where koppies and ridges are found (mainly in the southern parts), sandy soil predominates.

According to the geological map of S.W.A., this area consists mainly of dolomite, limestone, shale, tillite, quartzite and schist. A relatively small area (± 15 %) is composed of granite and gneiss.

Generally the soils here are deficient in phosphate, especially in the eastern parts around the Waterberg.

c) Topography

Location: Between longitude 16,1° to 17,3° east and latitude 19,8° to 21,0° south.

The largest part of this area is relatively flat, and provided sufficient basal cover is present, erosion should not be a problem. The area around the town of Otjiwarongo is hilly, but even here sufficient grass cover should prevent erosion.

Drainage is mainly towards the south-eastern parts towards the Omuramba Omatako, one of the major rivers in this area.

At the foot of the Waterberg as well as the Klein Waterberg, surface erosion and donga formation is a major problem. Erosion has progressed so far here, that an effective pasture management system alone cannot lead to recovery.

The most well known mountains in the subregion are the Paresis, Waterberg and Klein Waterberg mountains. Other mountains are found on the farms Janhelpman, Jägershof, Hoases, Good Hope, Ozondjacke Peak and

Hohenfels. Generally the mountainous terrain does not cause any problems. The various mountain slopes don't show differences in palatability of pastures.

The most important rivers are the Omuramba Omatako, Okahana, Waterberg, Ombatjipire and Erundu.

d) Vegetation

Trees and shrubs

A number of useful fodder plants occur. These shrubs are especially important during the dry periods of the year (early summer) when the pastures have a low nutrient level. The most common species are: Tarchonanthus camphoratus, Terminalia sericea, Lonchocarpus nelsii, Boscia albitrunca, Grewia spp. Combretum apiculatum and Leucosphaera bainesii.

The most valuable fodder shrubs are probably Tarchonanthus camphoratus and Leucosphaera bainesii. Due to careless grazing practices, these species have largely disappeared. These plants can be used as indicators to determine progress in pasture recovery.

In this area bush encroachment is a serious problem. Species responsible for this are Acacia mellifera subsp. detinens, Dichrostachys cinerea, Acacia nebrownii and Acacia tortilis. The first two are serious encroachers and cause large parts of farms to be underproductive or not productive at all. Encroachment was mainly caused by poor pasture management and overstocking. Acacia mellifera subsp. detinens tends to encroach on high potential soils. Dichrostachys cinerea and Acacia tortilis on the other hand tend to encroach wherever the soil has been disturbed.

It is estimated that about 25 % of an average farm has been seriously affected by bush encroachment so that grazing yield is reduced.

The most common poisonous plants occuring in this area, are Urginea sanguinea and Geigeria ornativa. Stock losses can be limited to a great extent by competent pasture management. Both these plants are responsible for sporadic stock losses only.

It seems that Crotalaria burkeana appears during good rainy seasons, when it is eaten by cattle with serious consequences.

Grass cover

A number of perennial, nutritious grasses occur in this area. The most important climax grasses are Antephora pubescens, Brachiaria nigropedata, Cenchrus ciliaris, Panicum maximum, Panicum coloratum, Urocholoa bolbodes, dichanthium papillosum, Heteropogon contortus, Cymbopogon spp. and Eragrostis superba. The nutrient levels of these species decrease considerably during the winter months and early summer.

Succession in most parts of this area is in the pioneer to subclimax stage. Other grasses found here are Eragrostis trichophora, Eragrostis rigidior, Chloris virgata, Eragrostis lehmanniana, Bothriochloa radicans, Stipagrostis uniplumis, Aristida congesta, Schmidtia pappophoroides, Eragrostis nindensis, Eragrostis porosa, Fingerhuthia africana, Cymbopogon excavatus and other Aristida species.

e) Sources of water

Boreholes are the major source of water. Unfortunately underground water can not always be found which means great financial expense to the farmer. The average depth of boreholes is estimated to be 90 to 105 meter. At present water from successful boreholes is distributed over the farm by means of pipelines to limit boreing costs. On average, 5,9 km pipeline is found per farm.

The output is estimated at 2 - 3 m^3 which is sufficient for teh watering of cattle. Irrigation from boreholes will not be feasible and will deplete natural resources.

Earth dams are not extensively used because of the unreliability of this source and the unsuitable terrain. Earth excavation dams are only build if no alternative source of water can be found, or to reinforce existing boreholes.

On a few farms livestock poisonings have occured due to nitrites in the water. At some boreholes a high level of flouride has been found. Continous analyses have shown a continuous increase in the flouride level. The extent of the problem is not known due to a lack of information. There probably are a lot more boreholes with water that is unfit for human and livestock consumption, but have never been analysed.

According to available information, the evaporation rate in this area is between 2800 and 3000 mm per annum.

2.1.4.2 SOIL UTILIZATION PATTERNS

a) Physical data

Planimetric surface area	743 000 ha
Total surface area of surveyed area	755 876 ha
Total surface area privately owned	738 211 ha
Surface area of planned farms	702 520 ha
Surface area of unplanned farms	35 691 ha
Number of unplanned units	7
Number of planned units	102
Average size of unplanned units	5 099 ha
Average size of planned units	6 887 ha
Average number of camps per farming unit	21,1
Average camp size per farming unit	326 ha
Distribution of camp size:	
200 ha and smaller	36,1 %
201 to 300 ha	24,1 %
301 ha and larger	39,8 %
Average number of watering points per unit	7,12
Average surface area per watering point	967 ha

All camps are provided with water.

b) Cultivated fields

According to Carstens ('n Ekonomiese ontleding van Boerdery in die Noordelike Vleisbeesstreke van Suidwes-Afrika, 1970), on average 38 ha of cultivated fields occurs per farming unit. Maize for personal use is the chief crop.

c) Cattle farming

Measured in L.A.U, cattle farming comprises 87,9 % of the total livestock. Extensive cattle farming for the production of beef is practiced.

2.1.4.3 HUMAN RESOURCES

a) Ethnic grouping

Afrikaans speaking farmers	51,13 %
German speaking farmers	46,59 %
English speaking farmers	2,27 %
Surface area owned by Afrikaans speaking farmers	45,79 %
Surface area owned by German speaking farmers	52,97 %
Surface area owned by English speaking farmers	1,23 %

b) Age distribution

Of the 72 owners, of which the age could be determined, the spread over age groups was as follows:

20 to 30 years	0,0 %
31 to 40 years	19,4 %
41 to 50 years	27,7 %
51 to 60 years	27,7 %
61 to 70 years	23,6 %
71 years and older	1,3 %

c) Communication pattern

The farmer's associations, which are part of Organized Agriculture, are the most important means of disseminating information. The Otjiwarongo farmer's association serves most of the district and consists of about

50 members of which ± 25 are active. Some of these members farm in bordering areas like Kalkfeld and Outjo. Outjo farmer's association serves the western parts of the subregion.

Furthermore, there are the Waterberg and Waterberg-South farmer's associations on the borders of this subregion with 14 and 35 members respectively. A number of farmers of this subregion are members of these associations.

The Otjiwarongo and Waterberg-South associations can be regarded as active while the Waterberg association is inactive.

There is one postal record study group with five members. During gatherings every two months, problems pertaining to farming are discussed.

d) Education

The real situation with respect to formal training is unknown. Informal training is given mainly during farmer's meetings. Knowledge was tested to evaluate progress. Results were promising and the Otjiwarongo farmer's association obtained an average of 62 %. It has to be stressed however, that only the more progressive farmers participate in these activities. There still exists a great need to disseminate information and knowledge.

e) Labour

Problems are availability of labourers, especially skilled, and rapid turn-over in the workforce.

f) Population density
Only 50 % of all farms is inhabited by whites.

2.1.4.4 PRESENT PRACTICES

a) Veld management
According to the survey, 18,18 % of the farmers implement a good pasture management system, 36,36 % a fair system and 45,45 a poor system.

The most common mistakes are too large herds and too long grazing periods in camps. Farmers classified as poor pasture managers, kept their stock in a camp for an average period of 69 days.

b) Stocking rate
At the time of this survey, the stocking rate was 1 L.A.U. per 14 ha. (It has to be said that at this time, farmers had sold large numbers of weaners because of above average prices and that the usual marketing season had already passed.)

c) Marketing pattern
Livestock is usually marketed directly from the veld. The average age of oxen is between two and a half and three years. Hardly any oxen are sold after the age of 3 years.

d) Herd management

Average number of herds per farming unit	2
Average size of cow herds	161
Average calving percentage	58 %

Farmers supplying supplementary feed (lick excluded)	0,0 %
Average cows per bull	25
Mating seasons:	
Farmers using one mating season (December to April)	63,3 %
Farmers using two mating seasons	18,2 %
Farmers without any mating seasons	18,2 %
Age of heifers at mating:	
2 1/4 years	81 % of farmers
3 years	19 % of farmers

Herd composition:	
Calves, younger than 1 year	22,7 %
Oxen, 1-2 years	13,7 %
Oxen, 2-3,5 years	5,4 %
Oxen, older than 3 years	1,4 %
Heifers, not mated	15,6 %
Heifers and cows, mated	39,9 %
Stud bulls	1,3 %

Animal health

Livestock diseases play a minor role in this area. The most important diseases that are combatted through vaccination are anthrax, botulism, quarter evil and contagious abortion.

Vibriosis and enzootic abortion has been reported during the past few years. Although the extent of these diseases is unknown, it does not mean that they pose important dangers to the fertility at the moment.

Accoriding to reports, calf mortality is 1,7 %, but estimated to actually be between 2 and 3 %.

Winter lick

The survey revealed that the following lick is supplied (number of farmers as a percentage of the total):

Good lick	45,45 %
Fair lick	36,36 %
Poor lick	18,18 %

Good lick had to satifsy following standards: sufficient phosphate, protein and energy content if ureum was used.

The licks classified as fair, usually did not contain sufficient (or no) protein but sufficient phosphate and energy.

Licks with an imbalance between the various components, were classified as poor.

Summer lick

Farmers supplying

Good lick	72,7 %
Poor lick	27,3 %

Good lick had to contain sufficient phosphate well balanced with the salt content. Poor lick usually had insufficient phosphate.

Performance Testing Scheme

In this subregion 17 farmers participate in the above scheme; 5 are stud breeders.

2.1.5 OSIRE SANDVELD

2.1.5.1 ENVIRONMENTAL FACTORS

a) Climate

The averages of the various weather stations show a rainfall of 395 mm per annum. The distribution of rainfall, as a percentage of the total, is as follows:

September	0,73 %
October	3,26 %
November	8,35 %
December	13,25 %
January	17,99 %
February	28,74 %
March	19,68 %
April	5,76 %
May	1,59 %

The average number of rainy days (1 mm or more) is 41,3 with a maximum during January to March.

An interesting occurence in this area is the so called Osire tongue. This is an area which receives considerably less rain than the immediate vicinity. According to observations, this "tongue" moves from east to west and then back over the years. At the same time it moves form north to south and back. During the drier years it extends northwards.

Summers are very hot while winters are very cold. Frost can be expected between the middle of May to September. During June and July frost occurs regularly, eSpecially in the lower-lying Omuramba Omatako.

b) Soil types

This area is also known as the Sandveld, which accurately describes the soil. In depressions heavier soil types are found (turf or limestone). According to the geological map of S.W.A., the northern half of the subregion consists of sandstone, skale and conglomerate (Stormberg series). The southern half consists of dolomite, marble, tillite, itabirite, quartzite and schist (Khomas and Hakos series).

The substrate is covered with a layer of sand which has been brought in by the wind from the pluvial period (Walter & Volk).

This soil is deficient in phosphates. According to Walter & Volk, potassium levels are also insufficient, but this will only affect cultivated crops. Generally the soil has a low humus content.

c) Topography

Location: between longitude 16,9° to 18,1° east and latitude 20,5° to 21,3° south.

This area is completely flat. No mountains occur with the result that there is no run-off. The Ohakaua and Obatjipire Rivers have their source in the Otjiwarongo area. Water drained by the Omuramba Omatako originates almost exclusively from the Etjo catchment area. Due to the sandy nature of the soil, most rainwater sinks in.

Where donga formation occurs, the problem can in most cases be rectified by good pasture management. Most of the smaller watercourses end in a series of pans.

These pans can pose problems in pasture management, since they supply surface water to livestock during the rainy season.

d) Vegetation

Trees and Shrubs

The most important palatable shrubs are Terminalia sericea, Boscia albitrunca, Tarchonanthus camphoratus, Grewia spp. and Lonchocarpus nelsii. The first two are the most important at the moment. It seems that Tarchonanthus camphoratus occured on a wider scale in the past, but disappeared due to careless grazing techniques. Terminalia sericea occurs mainly in the southern parts.

The most common encroaching species are Acacia mellifera subsp. detinens, Dichrostachys cinerea and Acacia tortilis. The first mainly encroaches on heavier soil types (sandy loam). Observations have shown that Acacia tortilis supresses growth of grass in its immediate vicinity, making these areas unproductive. It is estimated that about 20 % of the farms in this area are encroached by bush. Good veld management alone will not rectify this problem. Should it be possible to economically combat bush encroachment, the productivity of this area can be increased greatly.

The most common poisonous plants are Geigeria ornativa and Urginea sanguinea. Stock losses can however be minimized by the appropriate grazing practices.

Grass cover

The most important, nutritious perennial grasses that are part of the climax stage are: Anthephora pubescens, Brachiaria nigropedata, Cenchrus ciliars (pans and watercourses), Panicum maximum, Panicum coloratum, Urochloa bolbodes, Dichanthium papillosum (Omuramba Omatako), Heteropogon contortus, Cymbopogon sp., Schmidtia pappophoroides and Digitaria eriantha.

Succession generally is somewhere in a transitional stage with Stipagrostis uniplumis and Eragrostis rigidior as dominant species.

Eragrostis rigidior is a problem on many farms, since it displaces all other grasses to form homogeneous stands. This is a bottle neck at the moment that can be overcome only with great difficulty. This species is relatively hard and unpalatable.

Other species found are Aristida meridionalis, Eragrostis lehmanniana, Eragrostis porosa and various other Aristida species.

e) Sources of water

Boreholes represent the major source of water. Earth excavation dams are seldomly built, while larger earth dams cannot be built in this fairly level area.

In the parts north of the Omuramba Omatako, underground water is not as easily obtainable as in the southern parts. The depth of boreholes varies from 100 to 150 m with an average output of about 5 m^3.

In the western parts, bordering on the Otjiwarongo sub-region, obtaining water is an even greater problem.

Some water has a high level of flouride, making it unfit for human and livestock consumption. It seems that the water that is found, is relatively strong and can be spread by using pipelines.

South of the Omuramba Omatako, underground water occurs relatively close to the surface. The average borehole depth is 42 meter with an average output of 5,5 m^3 per hour.

Boreholes situated in a 1 ½km wide strip, along the southern banks of the Omatako, usually have brackish water unfit for consuption.

The evaporation rate is between 2900 and 3000 mm per annum.

2.1.5.2 SOIL UTILIZATION PATTERNS

a) Physical data

Planimetric surface area	671 000 ha
Total surface area of surveyed area	603 060 ha
Number of farming units	96
Number of planned units	91
	(582 370 ha)
Number of unplanned units	5
	(20 690 ha)
Average size of planned farming units	6 399 ha

Average size of unplanned farming units	4 138 ha
Average number of camps per farming unit	17,5
Distribution of camp sizes:	
200 ha and smaller	29,5 %
201 to 300 ha	30,9 %
300 ha and larger	39,6 %
Average camp size	365 ha
Average number of watering points per farming unit	6,9
Average surface area per watering point	927 ha
Number of uneconomical units	8

b) Cultivated fields

According to Carstens (1970), an average of 40 ha cultivated fields was found on farms. Maize for personal use is the main crop. Beans are planted as fodder crop and are well adapted to this area. The potential for agronomy should receive more attention.

c) Stock farming

Expressed as L.A.U., cattle represent 93,9 % of total livestock (Carstens, 1970). This subregion can therefore be considered to be a cattle farming area, although possibilities for agronomy exist. Small stock is kept mainly for personal use.

2.1.5.3 HUMAN RESOURCES

a) Ethnic grouping

Afrikaans speaking farmers	68,8 %
German speaking farmers	31,2 %

Surface area owned by Afrikaans speaking farmers	59,1 %
Surface area owned by German speaking farmers	40,9 %

b) Age distribution

Of the 84 owners of which the age could be determined, the distribution over age groups was as follows:

20 to 30 years	4,8 %
31 to 40 years	25,0 %
41 to 50 years	27,4 %
51 to 60 years	26,2 %
61 to 70 years	9,5 %
71 years and older	7,1 %

c) Communication pattern

Farmer's Associations:

This area is served by the Imkerhof, Waterberg, Waterberg-South and Osire famer's associations. The latter two can be considered to be active, making dissemination of information possible.

News media:

Most farmers receive the available newspapers like the "Allgemeine Zeitung" and "Die Suidwester". "S.W.A. Boer", published by S.W.A.A.U., is sent to farmers that are members of Organized Agriculture. The Extension Office publishes a quarterly newsletter in which items of agricultural interest appear. The reaction of farmers to this is generally good.

Knowledge:

75,2 % of the farmers are younger than 50 years, thus increasing their willingness to accept new practices.

Information on the formal training of farmers was not available.

Labour:
Problems are experienced with the availability of labourers, especially trained ones, and rapid turn-over of the workforce.

2.1.5.4 PRESENT PRACTICES

a) Veld management
According to the survey, 33 % of farmers implement a good, 16 % a fair and 50 % a poor pasture management system.

b) Stocking rates
The average stocking rate at the time of the survey was 1 L.A.U. per 14 ha. This low rate can be attributed to the increased sale of weaners due to exceptionally good prices in 1974. The survey was also done after the usual marketing season.

c) Herd management

Average number of breeding herds	
Average size of breeding herds	157
Average camp size for breeding herds	384 ha
Average calving percentage	61,6 %
Farmers supplying supplementary feed to cows (lick excluded)	0,0 %
Average number of cows per bull (range: 28 - 45 cows/bull)	36

Mating seasons:

Farmers implementing one mating season (December to April)	67 %
Farmers implementing two mating seasons (December to April and August to October)	33 %

Age of heifers at first mating:

±2 1/4 years — 83 % of farmers

(only one farmer had heifers mated at 18 months)

Animal health:

According to the state veterinarian, livestock diseases play a minor role if the necessary precautions are taken. The most important diseases that have to be prevented by vaccination are anthrax, botulism, quarter evil, contagious abortion and anaplasmosis. Observations seem to indicate that some farmers don't vaccinate regularly, since large stock losses due to anthrax and quarter evil occured in 1975.

The extent of vibriosis and enzootic abortion is unknown, which does not mean that they don't have an important influence on calving percentage.

Total calf mortality is 5 % while overall mortality is estimated at 2 - 3 %.

According to the survey, few abortions occured. This number may however be significant, since it is not always practically possible to spot these cases.

If the necessary precautions are taken, this area can be described as healthy.

Winter lick:
The same criteria with respect to good, fair and poor lick, mentioned under the Otjiwarongo subregion, were applied here.

About 50 % of farmers provide good lick and 50 % fair lick.

Summer lick:
Using the same criteria as for the Otjiwarongo subregion, the following results were obtained:

good lick	50 % of farmers
fair lick	16 % of farmers
poor lick	34 % of farmers

Performance Testing Scheme:
Only nine farmers in this area participate in this scheme, all of them being commercial breeders. They have joined only recently, so that only insufficient data are available.

Winter lick:
The same criteria with respect to good, fair and poor lick, mentioned under the Otjiwarongo subregion, were applied here.

About 50 % of farmers provide good lick and 50 % fair lick.

Summer lick:
Using the same criteria as for the Otjiwarongo subregion, the following results were obtained:

good lick	50 % of farmers
fair lick	16 % of farmers
poor lick	34 % of farmers

Performance Testing Scheme:
Only nine farmers in this area participate in this scheme, all of them being commercial breeders. They have joined only recently, so that only insufficient data are available.

2.1.6 OKAHANDJA THORNBUSH SAVANNA (A6)

2.1.6.1 ENVIRONMENTAL FACTORS

a) Climate
The average annual rainfall is 372 mm, distributed as follows:

September	0,6 %
October	2,9 %
November	5,2 %

December	12,6 %
January	21,9 %
February	23,4 %
March	22,4 %
April	8,2 %
May	1,9 %

The average number of rainy days (1 mm or more per day) of the various months, show the same pattern as the distribution of rainfall. During January to March the maximum number of rainy days occurs. The total number of rainy days per annum is 49 on average.

Temperatures during summer are high while winters are relatively short with frost occuring periodically. Average temperatures, measured at various weather stations, are as follows:

Average maximum temperature	29,4° C
Average minimum temperature	10,9° C
Absolute maximum temperature	42,6° C
Absolute minimum temperature	6,7° C

The annual evaporation rate is between 3000 and 3200 mm.

b) Soil type

According to the geological map of S.W.A., most parts of this area consist of limestone, dolomite, tillite, shale and quartzite.

Generally a deep sandy loam is found in this area. The soil is very fertile but has a phosphate deficiency which is reflected in livestock nutrition.

c) Topography

Location: between longitude 16,4° to 17,7° east and latitude 21,3° to 22,2° south.

Except for some isolated koppies in the western parts (± 15 % of the surface area), the area is flat to hilly. Because of this characteristic, erosion does not pose a problem as long as good basal cover is maintained.

d) Vegetation

Trees an shrubs

Several palatable shrubs occur in this area. The most important species are Tarchonanthus camphoratus, Boscia albitrunca, Leucosphaera bainesii, Justicia genistifolia. Combretum apiculatum is limited to the foot of the few ridges that do occur. Albizia anthelmintica is characteristic of this area and widespread.

Encroachment by Acacia mellifera subsp. detinens occurs. Competition for soil moisture by this bush, drastically reduces yield by grasses. In contrast with the northern subregions, Dichrostachys cinerea does not cause problems here.

Grass cover

Pastures on farms vary greatly, but are usually in a stage between pioneer and a transitional stage. In their undisturbed state, pastures consisted of dense stands of species like Anthephora pubescens, Brachiaria nigropedata, Urochloa bolbodes and Schmidtia pappophoroides.

At present Stipagrostis uniplumis is the most common perennial grass. On overgrazed veld, the basal cover is formed by annual Eragrostis and Aristida species, Eragrostis pallens and Eragrostis rigidior.

e) Sources of water

Boreholes are the major source of water. The depth of boreholes varies between 60 and 90 meter with an output of 2,5 m^3 and more. The quality of water is generally good.

Because of the topographical circumstances, few earth dams are found. Earth excavation dams are found more often than large earth dams. Where dams are built, the objective usually is to supplement ground water.

Generally underground water is obtained fairly easily.

2.1.6.2 SOIL UTILIZATION PATTERNS

a) Physical data

Planimetric surface area	573 000 ha
Total surface area of surveyed area	699 520 ha
Total number of farming units	122
Average surface area per unit	5 734 ha
Average number of camps per unit	18
Average camp size	318 ha
Distribution of camp size:	
smaller than 100 ha	13,9 %
100 to 200 ha	33,0 %
201 to 400 ha	37,8 %
400 ha and larger	15,3 %
All camps are provided with water.	
Average surface area per water point	1 039 ha

b) Cultivated fields

Agronomic activities occur sporadically. Old fields usually lie fallow and are used as occasional grazing camps.

c) Stock farming

Extensive cattle farming for the production of beef, is the main activity. Expressed as L.A.U., cattle farming is responsible for 95,8 %, sheep farming for 1,3 % and goat farming 2,9 % of total farming activities.

2.1.6.3 HUMAN RESOURCES

a) Age distribution

Farmers in the following age groups are:

35 years and younger	10,0 %
36 to 40 years	23,0 %
41 to 45 years	24,5 %
46 to 50 years	11,3 %
51 to 55 years	16,0 %
56 to 60 years	5,7 %
61 years and older	8,5 %

Researchers indicated that farmers younger than 30 years or older than 50 years, don't accept practices readily. Almost 58 % of these farmers fall into the age group 31 to 50 years. Extension work should therefore be very successful in this area.

b) Education and experience

Since the level of education is associated with rational thinking and insight, it is necessary to look at this community in that light.

Less than 9 years of education	36,75 %
10 years of education	23,5 %
11 to 12 years of education	32,5 %
More than 12 years of education	7,25 %

Education here includes any type of formal education. Average education is 10,3 years. These figures compare well with South African farmers, of which 34,7 % had an average of 11 to 12 years of education and 7,2 % had tertiary education.

Experience in farming varies from 5 to 47 years. More than 58 % of farmers have more than 15 years of experience in farming. This may mean that strongly established opinions exist that cannot be changed easily.

Agricultural courses are not well attended. Farmer's days and short courses are not attended by 27,3 % of farmers, while 40,6 % attend irregularly and 32,1 % regularly (calculated on a yearly basis). It was found that 7,5 % of farmers don't read any agricultural magazines, 11,5 % read one magazine, 66 % read two magazines and 15 % three or more agricultural magazines.

2.1.6.4 PRESENT PRACTICES

The survey initially included a large part of the Gobabis district. Figures will therefore greatly correspond with those for the Gobabis Camelthorn Savanna.

a) Veld management

These data were collected only within this subregion.

Farmers implementing good pasture management	15,9 %
Farmers implementing fair pasture management	40,2 %
Farmers implementing poor pasture management	43,9 %
Average number of herds per unit	6,4
Average number of camps per herd	2,8

The attitude of farmers towards their pastures was tested and the following results obtained:

Farmers satisfied with their present method of pasture management	48,6 %
Farmers not satisfied with their present method of pasture management, but aim to improve it	51,4 %
Present producers that would caution future farmers to use good pasture management systems	97,7 %
Farmers that don't want to conserve their land for future generations	0,25 %
Farmers believing their veld can improve	74,5 %

Knowledge of farmers on grass species, their succession stages and physiology was tested. An average of 31,8 % was obtained.

b) Stocking rate

According to the producers, a stocking rate of 1 L.A.U. per 10,4 ha can be applied. Actual carrying capacity is 1 L.A.U. per 11,5 ha.

c) Marketing patterns

Ages of livestock at marketing against percentages of producers in this area:

Weaners	7,7 %
18 months	7,7 %
2,5 to 3 years	46,2 %
3 to 3,5 years	25,8 %
Older than 3,5 years	7,1 %
Speculation purposes	5,5 %

d) Herd management

Average calving percentage	65 %
Average number of cows per bull	34
Farmers having heifers mated at 2 years and older	76 %
Farmers having fertility of bulls tested	5 %
Farmers implementing a mating season of 4 months and less	55 %
Farmers implementing correct mating seasons	75,5 %

Other practices are reflected in the following:

Practice:	Percentage farmers positive	negative
Animal health		
Dosing of livestock	96	4
Dosing 2 - 3 times anually	57	43
Vaccination against quarter evil, botulism, anthrax	93	7
Vaccination against anaplasmosis	17	83
Licks		
Phosphate supplement	98	2
Nitrogen supplement (winter)	81	19

2.1.7 GOBABIS CAMELTHORN SAVANNA

2.1.7.1 ENVIRONMENTAL FACTORS

a) Climate

The average rainfall is about 410 mm per annum. In the western parts, rainfall is lower (364 mm p.a.) while the east receives 463 mm p.a. Rainfall gradually decreases from east (Botswana border) to west. The monthly distribution of rainfall (expressed as a percentage of the total rainfall) is as follows:

September	0,8 %
October	4,4 %
November	10,2 %
December	13,0 %
January	21,4 %
February	21,6 %
March	17,9 %
April	8,3 %
May	1,4 %

The average number of rainy days per annum is about 53. The maximum occurs from January to March. In the eastern parts, the average number of rainy days is 60,8 while in the west it is 46,5. According to available information, temperatures are as follows:

Average maximum temperature	28,0° C
Average minimum temperature	11,4° C
Absolute maximum temperature	40,5° C
Absolute minimum temperature	9,9° C

Summers are generally very hot, while frost occurs periodically during winter. The evaporation rate is about 3000 mm per annum.

b) Soil Types

In the north eastern parts (± 56000 ha) sand and gravel with high lime content occurs. These soils are more than 45 meter deep, forming sandy hillocks stretching from east to west. This alternates with parent rock of quartzite, conglomerate and skale. The sandy soil of this area is less fertile than the rest of this sub-region.

The area from point 18,13021,705 along the district boundary to 17,57021,885, along the western border of the subregion to point 17,92022,675 and from there in a north eastern direction to 18,64021,905 consists of dolomite, marble, tillite, itabirite, quartzite and schist parent rock. The surface layers consist of sandy loam.

With a few exceptions, the rest of the area consists of quartzite, conglomerate and skale. The soil is mainly sandy.

c) Topography

Location: between longitude 17,6° to 20,0° east and latitude 21,6° to 22,8° south.

The north eastern parts consist of sandy hillocks with sandy plains between them. The largest part of the rest of the subregion is flat with a few solitary koppies in the west. The soil type and topography do not allow erosion on a large scale.

The White Nossob River traverses the subregion, but its source and catchment area lie outside. The other important river is the Black Nossob.

d) Vegetation

Trees and Shrubs

According to Giess (1971), this area is described as Camelthorn Savanna. Acacia erioloba is therefore characteristic of this area, while Acacia tortilis occurs widespread. Because of the sandy soil, Terminalia sericea is also characteristic.

The most common shrubs are Grewia bicolor, Grewia flava, Phaeoptilum spinosum, Tagetes minuta and Tarchonanthus camphoratus.

Acacia mellifera subsp. detinens occurs as an encroaching species, but has not caused serious problems in this subregion yet.

Grass cover

In the climax stage, grasses like Anthephora pubescens, Brachiaria nigropedata, Digitaria setivalva, Digitaria eriantha and Schmidtia pappophoroides should be well represented. Annual species like Schmidtia kalahariensis, Aristida and Eragrostis species are most common.

The dominant perennial grasses at the moment are Stipagrostis uniplumis and Eragrostis rigidior.

In general, phosphates are lacking in the pastures, and during the winter months, the nitrogen requirements of livestock have to be supplemented. Because of the higher rainfall in the eastern parts, the nutritional value of the pastures is lower here than in the western parts.

e) Sources of water

Boreholes are the most important source of water. In the eastern parts of the subregion, the underground water level is deep. Water is extracted from as deep as 200 meter. Between the two Nossob rivers underground water is scarce and problems are experienced in obtaining water. Where possible, use is made of earth and earth excavation dams. For the remaining areas obtaining underground water is no problem and output is generally high.

Isolated cases occur where the nitrate content of the water exceeds the safe limits for animal use. According to a spokesman of the Department of Water Affairs, the nitrate levels are on the increase.

In this subregion extensive use is made of pipelines to spread water.

2.1.7.2 SOIL UTILIZATION PATTERN

a) Physical data

Planimetric surface area	1 521 000 ha
Total surface area of surveyed area	1 932 000 ha
Number of planned farms	364
Number of unplanned farms	24
Number of land owners	261
Average size of farms	4 979 ha
Average surface area per owner	7 402 ha
Average number of camps per farming unit	25,5
Average camp size per unit	290 ha

Distribution of camp sizes:

smaller than 100 ha	14 %
100 to 200 ha	33 %
201 to 400 ha	38 %
401 ha and larger	15 %

The physical development of farms, measured according to regional norms, is as follows:

developed 80 % and more	17,1 %
67 % to 79 %	24,7 %
50 % to 66 %	36,0 %
34 % to 49 %	18,6 %
33 % and less	3,6 %

Regional standards:

1:8 carrying capacity	160 ha
1:10 carrying capacity	175 ha

b) Livestock farming

Cattle farming for the production of beef, forms 96 % of the total stock. Sheep and goats constitute the rest. All meat is produced on natural grazing.

2.1.7.3 HUMAN RESOURCES

a) Age distribution

The distribution of farmers over the age groups is as follows:

Younger than 35 years	10,0 %
36 to 40 years	23,0 %
41 to 45 years	24,5 %
46 to 50 years	11,3 %

51 to 55 years	16,0 %
56 to 60 years	5,7 %
older than 60 years	8,5 %

b) Education

Average education is 10,3 years. Only 7,2 % of farmers had tertiary education, while 40 of farmers had more training than the average.

More than 58 % of farmers have more than 15 years of experience in farming. The number of farmers reading agricultural magazines is as follows:

No magazines	7,5 %
1 magazine	11,5 %
2 magazines	66,0 %
3 or more magazines	15,0 %

The attendance of agricultural training courses, is not very promising.

Farmers that (per annum):

attend no farmer's day or short course	46 %
attend only one farmer's day or course	32 %
attend more than one farmer's day or short course	22 %

Practice	Percentage farmers positive	negative
Licks		
Phosphate supplement	98	2
Nitrogen supplement (winter)	81	19

Practice	Percentage farmers positive	negative
Livestock improvement		
Possess a scale	25	75
Participate in Performance Testing Scheme	5	95
Identification system for livestock	30	70
General		
Castration before age of 3 months	55	45
De-horning before age of 3 months	80	20
Wean at or before age of 8 months	76	24
Keep adequate records	38	62

2.1.8 HIGHLAND SAVANNA (A8)

2.1.8.1 ENVIRONMENTAL FACTORS

a) Climate

The average rainfall for this area is about 400 mm per annum. The average annual rainfall in the western parts of the subregion is about 350 mm. The distribution of rainfall over the months varies little and is as follows:

September	0,5 %
October	3,1 %
November	7,3 %
December	11,7 %
January	21,9 %
February	22,2 %

March	21,2 %
April	8,6 %
May	2,4 %

The average number of rainy days (1 mm or more), reaches a maximum in the period from January to March, while the total number of rainy days for the subregion is on average 43,2 per annum.

Temperatures during summer are very high with relatively low humidity. The evaporation rate is between 3200 and 3400 mm per year. Winters are relatively short with mild temperatures while frost occurs periodically. The temperature seldomly falls below 5° C.

b) Soil Types

Soils generally are shallow, originating from quartzite, tillite, schist and dolomite partent rock. Loose rocks occur everywhere.

c) Topography

Location: between longitude 16,4° to 18° east and latitude 22° to 23° south. Altitude is about 1500 m above sea level.

The topography varies from hilly to mountainous. More or less half of the surface area has a slope of more than 10 %. This lends itself to erosion and care should be taken to maintain good basal cover.

The western parts constitute the catchment area of the Kuiseb River which has its mouth on the west coast. The eastern parts are the catchment areas for the Black and White Nossob Rivers.

d) Vegetation

This area is described by Giess (1971) as the Highland or Bergthorn Savanna.

Trees and Shrubs

The vegetation is characterized by Acacia hereroensis associated with Combretum apiculatum, Acacia reficiens, Acacia hebeclada subsp. hebeclada, Euclea undulata, Dombeya rotundifolia, Tarchonanthus camphoratus, Rhus marlothii and Rhus dinteri, Albizia anthelmintica and Ozoroa crassinervia. Along rivers and alluvial banks, Acaia erioloba, Rhus lancea, Ziziphus mucronata, Acacia karroo and sometimes Olea africana are found. Bush encroachment is not yet a problem in this area.

Grass cover

The undisturbed grass cover consisted of species like Anthephora pubescens, Brachiaria nigropedata, Cymbopogon spp., Heteropogon contortus, Hyparrhenia hirta, Digitaria dinteri, Sporobolus spp. and Eragrostis spp..

In large parts of the subregion, the above valuable species have largely disappeared and are replaced by species lower down in the succession. Stipagrostis uniplumis, a perennial grass predominates and is associated with Enneapogon cenchroides and Eragrostis prorosa.

Since the Khomashochland is hilly and a lot of loose rocks occur, grass tufts are protected. This has prevented to some extent that the more valuable grasses are grazed too severely causing their disappearance. The seeds of climax grasses are present virtually

everywhere. By means of the correct management practices, pastures should recover in a relatively short period.

Because of the topography of this subregion, area selection is a fairly prominent problem. Since the soil on top of hills usually is softer with less loose rocks, livestock grazes here first before utilizing the rocky slopes.

Most plants, i.e. grasses, shrubs and herbs, are utilized by livestock. The nutritional value of the veld remains high right through the year. With good pasture management paractices, livestock can be marketed straight from the veld throughout the year. Phosphate and protein deficiencies occur during winter, but can be effectively supplemented by means of licks.

e) Sources of water

Underground water in this subregion is scarce. Water that is found, generally is weak and often not perennial. The average depth of boreholes is about 82 meter with a range of 35 to 175 meter. The quality of water generally is good. Since the output of boreholes is insufficient, extensive use is made of dams which also supports boreholes. This has caused a more stable water supply through the year and almost doubled output. The character of the terrain is ideally suited for the construction of earth dams. Many farms or parts of farms are entirely dependant on earth dams for their water supply. Spreading of water from mentioned sources, occurs by means of pipelines, which means great financial expense because of the hilly terrain.

The construction of soil retaining dams in river beds has received a great deal of attention in the past decade. This is a good solution on farms where no underground water can be found. The deep layer of sand that is retained, eventually stores large amounts of water which can be utilized through a well in the dam.

Pools of water and waterholes in riverbeds play an important role only during the rainy season. Since the climate is dry with a high evaporation rate, this water disappears quickly. Utilizing these sources of water during the rainy season has a definite disadvantage. The surrounding pastures are always grazed during the early growint season which leads to the deterioration of the veld.

Boreholes, wells and earth dams fulfill about 90 % of the water requirements for farming pruposes. The rest is obtained from sand retaining dams, pools and water holes.

2.1.8.2 SOIL UTILIZATION PATTERN

a) Physical data

Planimetric surface area	1 327 000 ha
Total surface area of surveyed area	1 318 545 ha
Total number of farms	209
Total number of farming units	173
Number of planned farms	97 %
Average farm size	6 309 ha
Average size per farming unit	7 618 ha
Average number of camps per unit	15,6
Average camp size per unit	488 ha

b) Cultivated fields

No arable land occurs in this subregion.

c) Livestock farming

Extensive cattle farming for the production of beef constitutes 95 % of farming activities while sheep farming constitutes 3,4 % and goat farming 1,6 %.

About 60 % of farmers keep sheep, while 87 % have goats on their farm. Small stock is kept mainly for personal use.

d) Uneconomical units

Only six uneconomical farming units are found in this subregion.

2.1.8.3 HUMAN RESOURCES

a) Ethnic grouping

About 42 % of farmers are of German origin and own mainly the farms around Windhoek. The rest, i.e. 58 % are Afrikaans speaking farmers.

b) Age distribution

The average age of farmers in this area is 46,5 years, while 30 % are older than 50 years. 36 % of farmers fall into the age group 40 years and younger. This illustrates that farmers are relatively young. This should be advantageous from the angle of extension work.

c) Education

The average education period of farmers is 11,2 years. 30 % of farmers had tertiary education in an agricultural field. Only 6 % of farmers had less than 8 years of education i.e. Std. 6. These facts are important, since a good education broadens the farmer's vision and enables him to take rational decisions. These figures compare favourably with those of the R.S.A. where 34,7 % of farmers had and average of 11 to 12 years education and 7,2 % tertiary education.

The average period of farming experience is 20,8 years. This indicates that farmers should be familiar with the unpredictability of the climate and other problems of the area.

It should be kept in mind, that the farms around Windhoek have been inhabited since the turn of the century. With distance from Windhoek, the period of inhabitation decreases. The long periods of inhabitation together with the extensive experience has resulted in a slavish following of ancient practices. This is especially evident with the older farmers and sons that started farming directly after leaving school.

c) Communication pattern

On an organized level, four farmer's associations exist that meet regularly. These meetings present good opportunities to convey information and knowledge.

The usual agricultural magazines like "Landbou Weekblad", "Farmer's Weekly" and "S.W.A. Boer" together with newspapers like "Die Suidwester" and "Allgemeine Zeitung" are read by the majority of farmers.

2.1.8.4 PRESENT PRACTICES

a) Veld management

A survey revealed that 24 % of farmers use a fast rotating system with five or more camps per herd. 30 % of farmers use a two or three camp system and the rest does not follow any specific system.

A basic problem is that farmers keep too many herds for the number of available camps. An average of 15,6 camps per farming unit indicates that farms are not yet sufficiently developed. The average number of camps per herd is 2,4. This is about 40 % of the ideal number of camps per herd. In general, optimal utilization and veld improvement cannot be implemented. The shortage of permanent water is however a limiting factor in expansion of farms.

b) Stocking rate

The average stocking rate is 1 L.A.U. per 10,8 ha. The official carrying capacity, recommended by the Department of Agricultural Technical Services is 1 L.A.U. per 10 ha. Compared to the latter, only 18 % of farmers exceed the recommended carrying capacity.

c) Marketing Pattern

88 % of farmers market their oxen at an age of 2,5 to 3,5 years. According to available information, the present beef production is 5 kg per ha.

d) Herd management

Average number of cows per farming unit	246
Average calving percentage	68 %
Average number of cows per bull	30
Farmers with an identification system for livestock	45 %
Farmers using correct mating seasons	42 %

The average herd composition is as follows:
(percentage of total herd)

Bulls	1,1 %
Cows	34,6 %
Heifers, not mated	13,5 %
Calves	23,7 %
Oxen, 1-2 years	11,7 %
Oxen, 2-3 years	13,7 %
Oxen, older than 3 years	1,7 %
Average replacement of cow herd	20 %

Other practices employed by farmers:

Practice	Percentage farmers positive	negative
Participation in Performance Testing Scheme	15	85
Keep adequate records	39	61
De-horn calves	100	0
Vaccinate against quarter evil	78	22

2.1.9 S.W.A. MAIZE TRIANGLE

2.1.9.1 ENVIRONMENTAL FACTORS

a) Climate

The average rainfall is 550 mm per annum. Average rainfall figures of 600 to 700 mm per annum however occur in the mountainous areas. Distribution of rainfall is as follows:

September	0,3 %
October	4,0 %
November	10,0 %
December	16,3 %
January	20,8 %
February	23,7 %
March	17,2 %
April	6,9 %
May	1,2 %

Summers are very hot while winters are cold. Frost occurs seldomly. The average maximum winter temperature is 32^{o} C while the minimum temperaturE is 4^{o} C.

b) Soil Types

This area consists of prominent east-west orientated mountain ranges of dolomite with layers of limestone and skale. The valleys have deeper loams originating from the above rock formations.

Exceptions in the area are the fillite covered Otavi valley, the granite and Nosib formation valley from Sovis in the west via Nabis, Ghaub and Nosib to Reinhardsbrunn and the valley of Muldenquartzites in the Adelaide, Aden-Birkenhead area.

c) Topography

Location: between longitude 17,1° to 18,1° east and latitude 19,8° south.

This area is characterized by mountain ranges that stretch from east to west. Fertile valleys occur in between. In the western parts the famous Otjikoto and Guinas Lakes are found. Both were formed by the collapse of the dolomite roof of large underground caves. A similar but dry lake occurs ± 8 km north west of the Guinas Lake.

A minor tributary of the Omuramba Omatako runs through the Otjihaenena valley. It has its origin in the mountains and runs south easterly, crossing the farms Weiveld, Waldheim, Halberstadtfarm and others until it reaches the Omatako.

d) Vegetation

Trees and Shrubs

This subregion is densely vegetated and a large variety of tree, shrub and herb species occurs.

The most common trees are Kirkia acuminata, Acacia tortilis, Combretum imberbe, Sclerocarya caffra, Spirostachys africana and Ficus spp. Other, fairly common trees are Lonchocarpus spp., Albizia anthelmintica, Peltophorum africanum, Olea africana, Berchemia discolor, Dombeya rotundifolia, Terminalia prunioides, Acacia karroo, Lannea discolor, Ximenia spp. and Acacia erioloba.

The following shrubs should be mentioned: Catophractes alexandri, Commiphora spp., Combretum apiculatum, Rhus spp., Grewia spp., Acacia mellifera, Dichrostachys cinerea, Tarchonanthus camphoratus, Croton gratissimus, Ziziphus mucronata, Terminalia prunioides, Bauhinia macrantha and Mundulea sericea.

Giess (1970) describes this area as Mountain Savanna and Karstveld.

Grass cover

The grass cover in large areas of this subregion has been ruined and supports mainly annual Eragrostis and Aristida species. Some parts are severly encroached by Dichrostachys cinerea and support hardly any grass cover.

In less disturbed areas a large variety of perennial grasses occurs. The most well known species are Cymbopogon excavatus, Hyparrhenia hirta, Andropogon gayanus, Bothriochloa spp., Heteropogon contortus, Fingerhuthia africana, Anthephora pubescens, Panicum spp., Aristida meridionalis, Urochloa bolbodes, Brachiaria nigropedata and others. Especially in the mountainous areas, climax species are still abundant. Themeda triandra is found in isolated areas. Digitaria spp. are common.

e) Sources of water

Even though fountains are found on some farms, most are dependant on boreholes for a supply of water. Water is relatively abundant and the depth of boreholes is about 72 meter with an average output of about 5,7 m^3 per hour. The quality of water is good.

2.1.9.2 SOIL UTILIZATION PATTERN

a) Physical data

Planimetric surface area	609 000 ha
Total surface area of surveyed area	531 589 ha
Total number of farms	234
Total number of farming units	149
Average farm size	2 272 ha
Average size of farming units	3 568 ha
Average number of camps per farming unit	14,7
Average camp size per farming unit	243 ha
Distribution of camp sizes:	
50 to 200 ha	50 %
201 to 300 ha	25 %
301 ha and larger	25 %
Number of boreholes per farming unit	4,8
Average surface area per borehole	743 ha
All camps are provided with water	

b) Cultivated fields

There are on average 164 ha cultivated fields per farming unit. This represents 4,6 % of the total surface area. The following crops are cultivated (as percentages of total field surface area):

Maize	35,5 %
Sunflower	2,3 %
Sorghum	1,4 %
Kaffir Beans	0,9 %
Peanuts	1,8 %
Fodder crops and Cenchrus ciliaris	2,37 %
Used for grazing	28,9 %
Fallow	26,8 %

This subregion has potential for agronomy that should receive more attention.

c) Livestock farming

Although cattle farming represents the largest percentage of farming activities in this area, agronomy is practiced on a moderate scale (compared to the other subregions). Escalating production costs have however seriously hampered agronomic activities and large fields lie fallow.

Small flocks of small stock are kept mainly for personal use.

d) Uneconomical units

About 35 farming units smaller than 1000 ha are present in this area. These small pieces of land are characteristic of this area. The average farm size of 2272 ha indicates this.

2.1.9.3 HUMAN RESOURCES

a) Ethnic grouping

Afrikaans speaking farmers	45,8 %
German speaking farmers	48,5 %
Others	5,7 %
Surface area owned by Afrikaans speaking farmers	26,0 %
Surface area owned by German speaking farmers	67,6 %
Surface area owned by others	6,4 %

b) Age distribution

About 49,2 % of farmers in this area are 50 years of older. The distribution over age groups is as follows:

20 to 30 years	5,6 %
31 to 40 years	11,1 %
41 to 50 years	34,1 %
51 to 60 years	28,6 %
61 to 70 years	12,7 %
71 years and older	7,9 %

c) Communication pattern

The farmer's association can act as a good means of communication, since 41,6 % of the farmers are members.

2.1.9.4 PRESENT PRACTICES

a) Veld management

About 47 % of farmers use an effective pasture management system, 12,6 % a fair system and 40,6 % a poor system.

b) Stocking rate

The average stocking rate at present is 1 L.A.U. per 10,4 ha.

c) Marketing pattern

The distribution of livestock ages at marketing is as follows:

(percentages of farmers)

12 months	26,3 %
18 months	13,2 %
24 months	21,1 %
30 months	10,6 %

36 months	26,3 %
older than 36 months	2,5 %

d) Other management practices	
Average number of cow herds per unit	2,7
Average size of breeding herds	80
Average number of herds per unit (all stock)	4,6
Average calving percentage	65,3 %
Farmers isolating calves (4,7 months)	36,6 %
Farmers having pregnancy tests done	19,5 %
Farmers with an identification system for livestock	34,0 %
Farmers with:	
33 and less cows per bull	50,0 %
34 to 50 cows per bull	43,8 %
51 and more cows per bull	6,2 %
Farmers implementing a single mating season	24,3 %
Farmers implementing two mating seasons	24,3 %
Farmers implementing no definite mating season	51,4 %
Age distribution of heifers at first mating (% farmers):	
18 months	27,6 %
24 months	44,9 %
30 months	27,5 %
Producers supplying:	
good lick	46,9 %
fair lick	21,9 %
poor lick	31,8 %

Average number of dosings per unit	2
Calf mortality	4,5 %
Abortions	2,7 %
Average herd composition:	
Calves	27,7 %
Oxen, 1-2 years old	11,2 %
Oxen, 2-3 years old	4,2 %
Oxen, older than 3 years	0,4 %
Heifers, 1-2 years old	10,4 %
Cows and heifers, mated	44,6 %
Bulls	1,5 %

Cattle is vaccinated annualy against anthrax, quarter evil, botulism and contagious abortion.

Calves are castrated and dehorned at an early age.

2.1.10 SUMMERDOWN CAMELTHORN SAVANNA (A10 & A11)

2.1.10.1 ENVIRONMENTAL FACTORS

a) Climate

The average rainfall in this subregion varies between 400 and 450 mm per annum. The distribution of rainfall seems to be fairly reliable and good rains can be expected during December and January. The distribution of rainfall is as follows:

September	0,5 %
October	3,6 %
November	9,8 %
December	14,6 %

January	20,2 %
February	21,2 %
March	18,0 %
April	9,1 %
May	2,1 %

The fact that some farmers harvest maize during most years, is a good indication that this area experiences relatively few droughts.

Summer temperatures are high and an evaporation rate of 2800 to 3000 mm per year is experienced. During winter only slight frost occurs.

b) Soil types

The soil can generally be described as sandy loam of which the loam content varies. Dolomite, marble, tillite, itabirite, quartzite and schist are the parent rock. In some parts, especially west of Epukiro, white sand occurs where farmers experience difficulties in veld recovery.

c) Topography

Location: between longitude 17,5° to 19,4° east and latitude 21° to 22° south.

The average altitude is about 1500 m above sea level. The terrain consists of regularly hilly plains. Even though the Epukiro River and the Omuramba Eiseb originate in this area, erosion is not a problem. The nature of the soil and topography allow rain water to penetrate the soil.

d) Vegetation

Trees and shrubs:

According to Giess (1970) this area can be described as Camelthorn Savanna. Acacia erioloba therefore is typical of this area. Lonchocarpus nelsii and Boscia albitrunca are common, while Terminalia sericea is widespread, especially in the eastern half of the subregion; on some farms dense thickets of the latter are present in either its tree or shrubby form. Other important shrubs are Grewia bicolor, Tagetes minuta, Tarchonanthus camphoratus and Phaeoptilum spinosum. Terminalia sericea can be considered an encroaching species in this area.

Grass cover

In its undisturbed state, the grass cover was dominated by Urochloa bolbodes, Anthephora pubescens, Brachiaria nigropedata, Digitaria eriantha and other Digitaria species and Schmidtia pappophoroides. These grasses are largely replaced by more woody, hard grass species like Eragrostis rigidior. On sandy soils Eragrostis pallens and Aristida stipitata are the replacing species. These species form dense stands that are not utilized by livestock. These stands represent a bottle-neck in attempts to imporve veld conditions as it is a difficult stage to bridge. Most of the veld is in this stage of succession.

e) Sources of water

Boreholes are the most important source of water on most farms. Borehole depths vary bwetween 30 and 50 meter with good output. There are isolated farms with weak underground water; the problem is solved by making earth excavation dams.

2.1.10.2 SOIL UTILIZATION PATTERN

a) Physical data

Planimetric surface area	
i) Summerdown	1 422 000 ha
ii) Geelhoutsa	862 000 ha
Total surface area of surveyed area	858 000 ha
Total number of farms	178
Total number of owners	135
Unplanned farms	9 %
Average farm size	4 820 ha
Average size per farming unit	6 355 ha

The physical development of the farms, measured against the regional norms (1 : 8 carrying capacity - 160 ha on average) is as follows:
Of the planned farms, 75 % are already developed more than 70 %, while 15 % are developed less than 50 %. On none of the farms are all camps smaller than 200 ha, but on 36 % all camps are smaller than 400 ha.

Water supply
18 % of the units have 8 watering points or more
54 % of the units have 5 to 7 watering points
27 % of the units have 3 to 4 watering points
(Only watering points more than 1 km appart were considered to be separate watering points).

b) Cultivated fields
According to the survey, an average of 60 ha (0,9 % of the total surface area) of cultivated land exists per farming unit. According to the Hochfeld study group, agronomy amounts to 2 % of the total gross farming income. The most common crops are maize, beans and

peanuts. Crop rotation is practiced by using half of a field for the production of hay. Very little is however known about the agronomic practices in this area. Since this is one of the few regions suited for agronomy, more attention should be given to it.

c) Livestock farming

The major farming activity in this subregion is the production of red meat. Cattle farming amounts to 96,4 % of the gross income. Livestock ownership is on average 623 cattle, 25 sheep, 100 goats (calves, lams and kids included). Sheep is kept mainly for personal use while the income from boer goats amounts to about 1 % of the total gross income.

2.1.10.3 HUMAN RESOURCES

a) Ethnic grouping

Afrikaans speaking farmers	60 %
German speaking farmers	40 %

b) Education

Experience in farming varies from 3 to 50 years. More than 50 % of farmers have more than 16 years experience, while 45 % have between 6 and 15 years experience. The average period of formal schooling is about 11 years.

c) Age distribution

The farmers of this area are relatively young and extension work should have favourable effects. The average age is 45 years. According to the survey, 58 % of farmers fall into the age group 31 to 50 years, while 27 % are between 51 and 60 years old.

d) Communication

Farmer's associations are important communication media, since 86,5 % of the landowners are members. Generally these associations are active and prepared to act as training institutions. This is reflected by the fact that already three Master Farmers, four two-star farmers and three one-star farmers have been appointed within this subregion. This competition attracts great interest.

2.1.10.4 PRESENT PRACTICES

a) Veld management

Expressed as percentage of owners, the following results were obtained:

Good management system	27 %
Fair management system	41 %
Poor management system	18 %
No specific system	14 %

Keeping some veld in reserve for difficult times, is an important priority for these farmers. 41 % of farmers reserve more than half of their pastures, 31 % a quarter to a half, 18 % a quarter to a third of their farms.

b) Stocking rate

The average stocking rate is 1 L.A.U. per 9,9 ha. (6 S.A.U. = 1 L.A.U. and the total number, irrespective of age, is applicable)

Opinions regarding the carrying capacity of farms were obtained, and 27 % of the questioned farmers put it at 1 : 7, 54 % at 1 : 8 and 10 % at 1 : 10.

c) Marketing

Oxen are normally marketed at between two and three years of age. The total turnover in the herds is 25 %.

d) Other management practices

Average calving percentage	76,7 %
Average cows per bull	41,0 %
Average replacement percentage of cows	19,4 %
Farmers using a mating season	87 %
Farmers using a mating season of less than 4,5 months	68 %
Farmers that have heifers younger than 2 years, mated	49 %
Farmers testing fertility of bulls	23 %
Farmers with mating camps smaller than 200 ha	23 %
Farmers eliminating cows at an age of 9 years or younger	41 %
Farmers with an identification system for cows	36 %

Cattle improvement:

Few farmers participate in the Performance Testing Scheme and selection is generally done visually.

The average herd composition is as follows:

Bulls	0,8 %
Cows	33,8 %
Hiefers, older than 2 years	6,6 %
Calves	26,0 %
Heifers, 1-2 years old	12,8 %
Oxen, 1-2 years old	12,2 %
Oxen, 2-3 years old	6,4 %
Oxen, older than 3 years	1,3 %

Other management practices are:

Practice	Percentage farmers	
	positive	negative
Phosphate supplementing	98	2
Nitrogen supplementing (winter)	68	32
Production of own fodder	73	27
Castration before 2 months of age	63	37
Wean before or at 8 months of age	80	20
Adequate records	35	65
Dosing of livestock	82	18
Dosing 2 or 3 times annually	72	28

2.2 MEDIUM POTENTIAL CATTLE FARMING AREA

2.2.1 SHALLOW TURF SUBREGION (B1)

2.2.1.1 ENVIRONMENTAL FACTORS

a) Climate

Rainfall within this area is very variable. In the eastern parts, the average rainfall is about 500 mm per annum; it decreases to about 400 mm per annum in the western parts. Although some variation occurs in the distribution of rainfall throughout the year, the following figures are in practice reliable (percentage of total rainfall):

September	0,3 %
October	3,7 %
November	9,7 %
December	16,3 %
January	20,7 %
February	23,3 %
March	16,9 %
April	6,9 %
May	1,1 %

The average number of rainy days (1 mm or more) per year varies from 43 in the west to 63 in the east.

Temperature figures are as follows:

Average maximum temperature	29,1° C
Average minimum temperature	12,3° C
Absolute maximum temperature	38,3° C
Absolute minimum temperature	5,6° C

During winter only light frost occurs.

b) Soil types

This area is characterized by shallow turf soil with surface limestone outcrops. In the central-southern parts, deep turf soil is found especially in depressions. The western parts have an abundance of limestone rocks often in large patches.

During the dry months, road users are plagued by a grey white powder which becomes extremely smooth and slippery and almost impassable during the rainy season.

According to the geological map of South West Africa, dolomite, limestone, skale, tillite, ironore and quartzite are found in this area.

c) Topography

This subregion is densely vegetated and mostly flat with turf depressions. A few isolated dolomite ridges and koppies occur, mainly in the western half. In these latter parts low limestone ridges are common. The topographical character prevents erosion from becoming a serious problem.

d) Vegetation

Trees and Shrubs

As far as the higher strata of vegetation are concerned, two communities can be distinguished in this subregion. The parts east of longitude 17,5° east are characterized by the presence of Spirostachys africana. It is associated with Terminalia prunioides, Dichrostachys cinerea and Acacia mellifera subsp. detinens which also are the main encroaching species in the area.

Other prominent species of the area are Moringa ovalifolia, Berchemia discolor and Albizia anthelmintica. In the turf depressions, Combretum imberbe is associated with Dichrostachys cinerea and Acacia mellifera subsp. detinens.

West of longitude 17,5° east, the tree form of Colophospermum mopane is characteristic and the shrubby form occurs in increasing density towards the western border of the subregion. This part can be described as Mopane Savanna. The most important encroachers are Terminalia prunioides and Dichrostachys cinerea occuring in distressing densities. Acacia mellifera subsp. detinens occurs scattered in between. On the dolomite ridges, Kirkia acuminata is found commonly. These ridges also support some Moringa trees. Further towards the west, Sclerocarya caffra and Berchemia discolor are abundant, but their distribution does not include the western most third of the subregion.

Grass cover

Very large parts of the subregion support only annual Aristida and other species. Where veld is well managed, all the climax species occur. During the climax stage, Anthephora pubescens, Cenchrus ciliaris, Panicum maximum, Panicum coloratum, Brachiaria nigropedata, Urochloa bolbodes and Schmidtia pappophoroides should be dominant.

In turf vleys or pans, the following species occur: Bothriochloa radicans, Cymbopogon excavatus, Dichanthium papillosum, Andropogon gayanus and Hyparrhenia hirta.

e) Sources of water

There generally is no shortage in ungerground water in this area. On some farms in the western parts, water can be found only 10 meter below surface, but the average borehole depth is 40 meter. Output is about 11 m^3. Water quality is good throughout the area except for the high calcium content that is deposited in pipes eventually causing problems.

2.2.1.2 SOIL UTILIZATION PATTERN

a) Physical data

Planimetric surface area	1 546 000 ha
Total surface area of area surveyed	1 495 550 ha
Number of farms	387
Number of farming units	280
Average farm size	4 687 ha
Average size of farming unit	5 341 ha
Average number of camps per farming unit	16,6
Average camp size	322 ha
Size distribution of camps (percentage of total):	
200 ha and smaller	42,5 %
201 to 300 ha	22,4 %
301 ha and larger	35,1 %
Average number of boreholes per farming unit	5
Average surface area per borehole	1 090
Number of camps per borehole	3,4

b) Cultivated fields

The average size of fields is 40 ha per farming unit which is 0,75 % of the total surface area. Of existing fields, 39,3 % (surface area) lies fallow.

Agronomy plays a minor role. Existing fields are utilized as follows:

Maize	31,8 %
Sorghum	11,4 %
Hay crops	9,6 %
Cenchrus ciliaris	3,5 %
Sunflower	1,9 %
Beans	1,2 %
Other (pumpkin, watermelon etc.)	1,3 %

Of the questioned farmers, 49 % planned to plant Cenchrus ciliaris.

d) Uneconomical units

There are only 15 uneconomical units in the subregion. This is 5,3 % of the total number of farming units.

2.2.1.3 HUMAN RESOURCES

a) Ethnic grouping

German speaking farmers	20,7 %
Afrikaans speaking farmers	79,3 %
Surface area owned by German speaking farmers	17,8 %
Surface area owned by Afrikaans speaking farmers	82,2 %

b) Education

Farmers with:

Std. 10 and higher	23,8 %
Std. 7 to Std. 9	19,0 %
Std. 6 and lower	5,7 %

c) Age distribution

The distribution of farmers over the age groups is as follows:

20 to 30 years	7,8 %
31 to 40 years	18,4 %
41 to 50 years	27,9 %
51 to 60 years	25,7 %
61 to 70 years	15,1 %
71 years and older	5,0 %

2.2.1.4 PRESENT PRACTICES

a) Veld management

Figures obtained from a survey showed that 42,6 % of the producers implement a good pasture management system, 19,1 % a fair one and 38,3 % a poor one.

b) Stocking rate

An average stocking rate of 1 L.A.U. per 12,1 ha is presently implemented and seems realistic.

c) Marketing

The majority of the farmers market their oxen at an age of 2 years or younger. The percentage of farmers selling their oxen at the various ages, are as follows:

8 to 10 months	11,4 %
12 months	13,6 %
18 months	18,2 %
24 months	13,6 %
30 months	13,6 %
36 months	22,7 %
48 months	6,8 %

Only 15 % of the farmers provided supplementary feed to round off livestock before marketing. It seems that most farmers sell their stock privately.

d) Other management practices

Average number of cow herds per farming unit	2,3
Average herd size	109
Total number of herds per farming unit	4,3
Average calving percentage	57,3 %
Farmers isolating calves (4 months)	36,2 %
Calving percentage of farmers that don't isolate calves	55,8 %
Farmers that have pregnancy tests done	14,9 %
Farmers whose livestock is identified	25,5 %
Farmers supplying supplementary feed to cows (normal lick excluded)	12,8 %
Farmers with:	
33 cows per bull	53,2 %
34 to 50 cows per bull	36,1 %
51 and more cows per bull	10,6 %
Average number of cows per bull	33
Farmers implementing a definite mating season	51,0 %
Farmers implemening two mating seasons	2,2 %

Farmers having cows mated throughout the year	46,8 %
Average number of dosings per year	2

Farmers vaccinate against anthrax, quarter evil and botulism. Calves are castrated and dehorned at an early age.

2.2.2 WATERBERG SAND (B2)

2.2.2.1 ENVIRONMENTAL FACTORS

a) Climate

The average rainfall in this area is 410 mm per annum. The distribution of rainfall differs from that of the other subregions and is as follows (percentage of total average precipitation):

September	0,3 %
October	3,3 %
November	6,5 %
December	14,5 %
January	17,6 %
February	39,5 %
March	12,5 %
April	4,5 %
May	1,0 %

Temperatures vary greatly between the extremes. Summers are very hot with temperatures up to 40° C. Winters on the other hand are very cold. Temperatures

as low as 14° C below freezing point have been measured. Heavy frost occurs especially during June and July.

b) Soil types

The soil of the entire subregion consists of red, weathered Waterberg Sandstone. The geological map indicates the occurence of sandstone, skale and conglomerate. The soil is very deep and tends to be acidic. A typical soil analysis shows the following results (Farm Gemsbokpan no. 19):

pH	5,25
Resistance (ohm)	6025
Calcium (me/100g)	0,30
Magnesium (me/100g)	0,16
Potassium (me/100g)	0,07
Phosphor (ppm)	10,00
Aluminium (me/100g)	0,18
Texture	sand

The soil is deficient in phosphates, calcium and trace elements.

c) Topography

Location: between longitude 17° to 18° east and latitude 20° to 20,5° south.

This area is densely vegetated and fairly flat, except for the Waterberg that is situated in the south western corner of the subregion. The north facing slope of this mountain gradually merges into the plateau area, while the south facing slope descends steeply into the plains below. The average height of this mountain is 1500 meter.

On the south facing slope of the Waterberg, a number of dry rivers arise. They drain toward the Omuramba Omatako. Considerable soil erosion is present in this area.

The Ondengaura is another large river crossing two farms in the north eastern corner of the subregion. (The farms are Omambonde Ost and Omambonde Tal). On the latter farm the Ondengaura joins the Omuramba Omatako.

d) Vegetation

Trees and Shrubs

This subregion is very densely vegetated and many palatable shrubs are found. The most common trees are Terminalia sericea, Burkea africana and Lonchocarpus nelsii. Shrubs that occur commonly are Ozoroa insignis, Combretum zeyheri, Acacia erubescens, Acacia ataxacantha, Bauhinia macrantha, Tarchonanthus camphoratus, Grewia spp. and Ochna pulchra.

Grass cover

This sandstone area with its relatively acidic soils does not support many good palatable, perennial grasses. The grass cover consists mainly of species like Eragrostis pallens, Aristida meridionalis and Eragrostis rigidior, which are all hard and unpalatable.

If good pasture management practices are implemented, palatable Digitaria species as well as Anthephora pubescens can however occur here. Where the soil is somewhat loamy, Stipagrostis uniplumis and Schmidtia pappophoroides may occur.

e) Sources of water

The entire subregion is dependent on boreholes for its water supply. Boreholes are sometimes extremely deep (up to 300 m) but the average depth is about 132 m. Ouput is on average 4,8 m^3 per hour. Water generally is soft. Water is distributed by means of pipelines.

2.2.2.2 SOIL UTILIZATION PATTERN

a) Physical data

Planimetric surface area	350 000 ha
Total surface area of surveyed area	232 322 ha
Total number of farms	45
Total number of farming units	32
Average size of farms	5 163 ha
Average size of farming units	7 260 ha
Average number of camps per unit	26
The distribution of camp sizes (as percentage of total):	
50 to 200 ha	28,4 %
201 to 300 ha	41,1 %
301 ha and larger	30,5 %
Average camp size	279 ha
Average number of boreholes per unit	3,6
Average surface area per borehole	2 016 ha

All camps are provided with water

b) Cultivated fields

There are 30,5 ha of fields per farming unit (0,42 % of the total surface area of the unit). The following crops are cultivated:

Beans	31,1 % of field surface area
Maize	23,2 %
Hay crops and grass	8,2 %

Cenchrus ciliaris	3,6 %
Fallow	33,9 %

(meaning that on average 20,2 ha of the 30,5 ha are being cultivated.)

c) Livestock farming

The main farming activity is cattle farming for the production of beef. Small numbers of boer goats and sheep are kept for personal use. There are on average 175 S.A.U. per farming unit.

d) Uneconomical units

No uneconomical units occur in this subregion, although 8 famrs are smaller than 3000 ha. These farms represent 8,2 % of the total surface area of the subregion.

2.2.2.3 HUMAN RESOURCES

a) Ethnic grouping

Afrikaans speaking farmers	59,4 %
German speaking farmers	28,1 %
Others	12,5 %
Surface area owned by Afrikaans speaking farmers	70,2 %
Surface area owned by German speaking farmers	26,3 %
Surface area owned by others	3,5 %

b) Age distribution

The majority of farmers in this subregion is 51 years or older. The spread over the age groups is as follows:

20 to 30 years	3,7 %
31 to 40 years	3,7 %

41 to 50 years	29,6 %
51 to 60 years	40,7 %
60 to 70 years	22,2 %
71 years and older	0,0 %

c) Communication

About 44,8 % of the farmers are members of the farmer's association.

2.2.2.4 PRESENT PRACTICES

a) Veld management

About 46 % of the farmers implement a good pasture management system, 23 % a fair one and 31 % a poor one. A surprising fact was, that 50 % of the farmers keep a record of the grazing in their camps. It has not yet been evaluated, how effective these records are and how well farmers interpret their own records.

b) Stocking rate

The average stocking rate at present is 1 L.A.U. per 10,7 ha.

c) Marketing

The majority of farmers market their livestock at an age of 3 years. The age at marketing against the percentage of farmers is as follows:

8 months	0,0 %
12 months	7,7 %
18 months	0,0 %
24 months	23,1 %
30 months	7,7 %

36 months	53,8 %
48 months	7,7 %

d) Other management practices

Average number of cow herds per farming unit	2,7
Average herd size (cows)	97
Total number of herds per farming unit	4,6
Average calving percentage	70,7 %
Farmers having pregnancy tests done	15,4 %
Farmers isolating calves (5-4 months)	84,6 %
Farmers with identification system for livestock	46,2 %
Farmers that provide:	
good lick	42,9 %
fair lick	14,2 %
poor lick	42,9 %
Farmers implementing one mating season	23,1 %
Farmers implementing two mating seasons	30,7 %
Farmers leaving cows with bull all year	46,2 %

The number of cows per bull are spread as follows:

less than 33	30 % of farmers
34 to 50	40 % of farmers
51 and more	30 % of farmers

Farmers having heifers mated at:

2 years of age	66 %
2,5 years of age	34 %

The average herd composition is:

Calves, 1-2 years old	27,5 %
Oxen, 1-2 years old	12,4 %
Oxen, 3-4 years old	7,7 %
Oxen, older than 3 years	0,1 %

Heifers, 1-2 years old	12,4 %
Cows and heifers, mated	38,9 %
Bulls	0,9 %
Calf mortality	3,4 %
Abortions	1,4 %

Livestock is vaccinated annually against anthrax, quarter evil, botulism and brucellosis.
Dosing occurs twice annually (summer and winter).
Calves are dehorned and castrated at a relatively early age.

2.2.3 OTJIKONDO MOPANE SAVANNA (B3)

2.2.3.1 ENVIRONMENTAL FACTORS

a) Climate

The average annual rainfall for this subregion is 360 mm. There is some variation in rainfall within the subregion with a gradual decrease from east to west. The distribution of rainfall, as a percentage of the total, is as follows:

September	0,1 %
October	3,3 %
November	8,4 %
December	15,1 %
January	17,4 %
February	25,2 %
March	21,9 %
April	7,8 %
May	1,2 %

The total number of rainy days (1 mm or more) for the subregion is on average 37,2 per year.

Summers are very hot while winters are mild. During winter frost occurs only sporadically and usually is light.

Average maximum temperature	29,8° C
Average minimum temperature	12,4° C

b) Soil types

This subregion consists mainly of fertile, red loam. According to the geological map, granite and grit form the parent rock. The southern parts (about 20 % of the area) consist of a dolomitic mountain range. Here the parent rock is dolomite, limestone, skale, tillite, iron ore and quartzite. Between the mountains, small plains with sandy red loam are formed.

These soils are most notably deficient in phosphates. As far as other macro- and micro elements are concerdend, the situation is unknown, but in practice there seem to be no serious deficiencies.

c) Topography

Location: between longitude 15,2° to 16,1° east and latitude 19,7° to 20,3° south.

The southern parts (20 % of the total surface area) consist of a mountain range extending from east to west. Compared to other regions, this mountain range can be described as a ridge.

Although the whole area can be grazed by livestock, camps have to be planned with great care to avoid cutting off livestock crossings. This complicates the spreading of water by pipelines and the laying of underground pipelines. Steep slopes are found and water run-off can occur rapidly towards the Ugab River. Despite of this, soil erosion is no real problem at present. The rest of the subregion consists of plains with slight to no slopes. Erosion therefore poses no problem here at present. No significant rivers are found in the subregion. Drainage occurs mainly along watercourses like omurambas.

d) Vegetation

Trees and Shrubs

Giess (1970) describes this area as Mopane Savanna. The most important tree is Colophospermum mopane and in its shrubby form it is the most common shrub of the plains.

Combretum apiculatum appears prominently while Catophractes alexandri occurs on surface limestone. Phaeoptilum spinosum is less common. Grewia flava occurs singly over the entire area. Acacia mellifera subsp. detinens and Dichrostachys cinerea form dense thickets in some areas. Pechuel-Loeschea leubnitziae is prominent in some parts. Acacia reficiens occurs along rivers in its tree form.

In mountainous areas Kirkia acuminata is the most prominent tree while Terminalia prunioides is also common. Along watercourses and small rivers, Ziziphus mucronata and Combretum imberbe can be found. Other

species that occur commonly enough to be worth mentioning, are Moringa ovalifolia, Lonchocarpus nelsii, Acacia hebeclada and Acacia erubescens.

Monechma genistifolia and Leucosphaera bainesii are the most important fodder bushes.

Bush encroachment is not as severe as in large parts of northern S.W.A. On a few farms Urginea sanguinea occurs, causing isolated stock losses during the spring months.

Grass cover

Plant succession in most parts of this area is somewhere between pioneer and transition stages, but tending more towards pioneer stage. Aristida species, Schmidtia kalahariensis, Eragrostis porosa, Schizachyrium exile, Pogonarthria fleckii and Enneapogon cenchroides are the most common annual grass species.

Of the perennial grasses, Stipagrostis uniplumis occurs widespread but not in dense stands. The climas species like Cenchrus ciliaris, Schmidtia pappophoroides and especially Anthephora pubescens, occur only rarely.

Andropogon schinzii occurs sporadically in the plains but more often along water courses in the mountains. The mountainous areas are also characterized by denser stands of Stipagrostis hirtigluma compared to the plains. At present, Aristida meridionalis occurs widespread over the entire area.

The climax species for this subregion are Schmidtia pappophorides, Cenchrus ciliaris, Anthephora pubescens and Andropogon schinzii. In the mountains, these species, together with a dense stand of Stipagrostis uniplumis forms the climax stage.

e) Sources of water

Boreholes are the major source of water for livestock. The water table varies between 30 and 60 meter below surface. The quality of water varies from good to a little brackish. Considerable variation exists in borehole output.

In the mountainous parts, boreholes are much deeper and is water reached at between 90 and 150 meter. The quality and output of these boreholes is good. Earth and earth excavation dams do occur but are of minor importance.

Water from boreholes is distributed by means of pipelines.

2.2.3.2 SOIL UTILIZATION PATTERN

a) Physical data

Planimetric surface area	367 000 ha
Total surface area of surveyed area	367 116 ha
Total number of farms	67
Total number of farming units	55
Average farm size	5 479 ha
Average size of farming units	6 675 ha

The distribution of farming units by size are as follows (percentage of total number of farms in each category)

Size of farming unit (ha)	Frequency	% of total
500 - 2 000	1	1,8
2 001 - 3 000	4	7,3
3 001 - 5 000	25	45,5
5 001 - 7 500	18	32,7
7 501 - 10 000	5	9,1
10 001 - 15 000	0	0,0
15 001 - 20 000	0	0,0
20 001 and larger	2	3,6

Average number of camps per unit	17
Average camp size	393 ha
Distribution of camp sizes (percentage of total):	
50 to 200 ha	35,9 %
201 to 300 ha	22,1 %
301 ha and larger	42,0 %

Pasture management corridors were found only on one farm. All camps are provided with water.

b) Cultivated fields

Agronomy was practiced in the past. Old fields still exist today and are used only for grazing. The total surface area of old fields is 1300 ha; an average of 23,6 ha per farming unit.

c) Livestock farming

Cattle farming for the production of beef is the most important farming activity. Small stock is however gaining prominence.

The average composition of livestock farming is as follows:

Cattle	72,1 5 of total stock
Sheep	20,1 % of total stock
Goats	7,8 % of total stock

(All S.A.U.'s are converted to L.A.U.'s on a scale of 1 L.A.U. = 6 S.A.U.)

d) Uneconomical farming units

In this subregion, uneconomical units represent 54,6 % of the total. According to the latest knowledge, units smaller than 3000 ha are uneconomical.

2.2.3.3 HUMAN RESOURCES

a) Ethnic grouping

Farms owned by Afrikaans speaking farmers	60,7 %
Farms owned by German speaking farmers	34,3 %
Farms owned by English speaking farmers	4,9 %
Surface area owned by Afrikaans speaking farmers	71,2 %
Surface area owned by German speaking farmers	24,2 %
Surface area owned by English speaking farmers	4,6 %

b) Age distribution

Age group (years)	Farmers (%)	Average age (years)
20 - 24	2,6	22
25 - 29	2,6	29
30 - 34	7,8	33,2
35 - 39	7,8	36,2
40 - 44	13,1	42,1
45 - 49	23,6	46,4
50 - 54	10,5	52,2
55 - 59	7,8	57,1
60 - 64	13,1	62,0
65 - 69	5,2	66,0
70 - 74	0,0	-
75 - 79	2,6	78,0
80 - 84	2,6	85,0

The average age of the farmers is 50,8 years.

c) Education

9,5 % of these farmers had formal tertiary training in agriculture.

c) Communication pattern

The farmer's association is the most important institution when disseminating agricultural information. This organisation also organizes various gatherings in addition to the usual meetings. Good cooperation can be expected here.

Opportunities for the establishment of study groups exist. Farmers are prepared to cooperate and such study groups are founded as the need arises.

The most important formal and written news media received by farmers, are the Landbouweekblad, S.W.A. Boer and the two S.W.A. newspapers. The Allgemeine Zeitung is read mainly by German speaking farmers.

Every farmer in the area receives a quarterly newsletter containing topics of agricultural nature.

The labour force consists mainly of unskilled Ovambo, Kavango and Damara workers. Members of the first two groups usually work on a temporary basis on farms.

2.2.3.4 PRESENT PRACTICES

a) Veld management

Management of the natural pastures in this area is not yet as good as desired. According to the survey, farmers can be classified as follows:

Good pasture management system	25,0 %
Fair pasture management system	37,5 %
Poor pasture management system	37,5 %

b) Stocking rate

The present stocking rate of 1 L.A.U. per 11,3 ha at first seems satisfactory. If it is however kept in mind that 25 % of these farming units are presently participating in the Stock Reduction Scheme, the stocking rate on the remaining farms must be much higher.

Taking the irregularity of rainfall and the present veld conditions into consideration, if at all, veld improvement will be very slow.

c) Other management practices

Calving percentage and related practices	
Average calving percentage	55,3 %
Farmers using a definite mating season	50 %
Farmers not using a definite mating season	50 %
Where mating seasons are implemented, they are as follows:	
Single mating season, January to April	63 %
Doubble mating season, January to April and August to September	18 %
Single mating season, April to August	19 %
Average number of cows per bull	30,6
Farmers having:	
33 and less cows per bull	42,8 %
34 to 50 cows per bull	42,8 %
51 and more cows per bull	14,8 %
Farmers with herd replacement figures of:	
14 % and less	28,6 %
10 to 20 %	14,3 %
21 % and higher	57,1 %
Average replacement percentage	22,9 %
Farmers having heifers mated for the first time at an age of:	
1,5 - 2 years	85,7 %
2,5 to 3 years	14,3 %
3 years and older	0,0 %
Farmers having pregnancy tests done	12 %
Farmers requiring training in the performance of pregnancy tests	75 %
Farmers isolating calves	62,5 %

Average period that calves are isolated after birth	2 months
Farmers having switched camps during the mating season	50 %
Average calf mortality per farmer	3,0
Average number of known abortions by cows per farmer	0,8
Farmers using an identification system for livestock	20 %
Famers that could determine by means of their identification system, which cows had skipped calving during the past 5 years	27 %

Farming practices vs. physical development	
Average size of cow herds during mating season	141,0
Average number of cow herds during mating season	1,7

Pasture management:	
Farmers classified according to their pasture managment system:	
Good system	25,0 %
Fair system	37,3 %
Poor system	37,5 %

Nutrition:	
Farmers supplying:	
Good lick during winter	62,5 %
Fair lick during winter	37,5 %
No lick at all during winter	0,0 %
Good lick during summer	37,5 %
Fair lick during summer	50,0 %

Farmers supplying some form of supplementary feed to achieve a higher calving percentage (normal lick excluded)	0,0 %
Farmers that rounded off oxen prior to marketing	0,0 %
Farmers planning to cultivate Cenchrus ciliaris	87,5 %

Livestock numbers:
The average percentage herd composition is as follows:

Cows and heifers	46,6 %
Calves	25,7 %
Oxen, 1-2 years old	7,4 %
Oxen, 2-3,5 years old	4,5 %
Oxen, older than 3 years	3,6 %
Heifers, replacement	10,7 %
Bulls	1,5 %

2.2.4 KALKFELD THORNBUSH SAVANNA (B4)

2.2.4.1 ENVIRONMENTAL FACTORS

a) Climate
The average rainfall for the area is 367 mm per annum, dispersed over the year as follows:

September	0,2 %
October	3,6 %
November	7,8 %
December	12,1 %
January	20,0 %

February	25,7 %
March	20,0 %
April	8,5 %
May	2,0 %

The average number of rainy days (1 mm or more) per year are 44,4.

The possibility of long drought periods between rains is not excluded. Drought periods can however be more common between October and December. This is of course the case with most parts in western S.W.A.

Unfortunately no exact temperature data are available. The following are estimates:

Average maximum temperature	30° C
Average minimum temperature	12° C
Absolute maximum temperature	39° C
Absolute minimum temperature	12° C

Frost can be expected any time between the middle of May to September. During June and July frost occurs fairly regularly.

b) Soil types

In the northern parts red loam and sandy loam soils occur. Soils of the western parts are mixed, varying from red loam to gravelly, lime soils.

Omurambas with heavy turf soils are found mainly in the northern and eastern parts of the subregion.

According to the geological map of S.W.A., the soils in the area consist of dolomite, marble, tillite, itabirite, quartzite and schist (Khomas and Hakos Series). A small area around and west of Kalkfeld supports conglomerate, fillite, quartzite, dolomite and granite soils.

Surface limestone occurs in the southern parts (giving rise to the name Kalkfeld).

Since these soil types are leached to a greater extent, they are assumed to be alkaline. Phosphate deficiency occurs, but not on the same scale as in the other farming areas.

c) Topography

The area is situated between latitude 20,5° to 21° south and longitude 15,5° to 16,5° east. The northern parts are flat with limited run-off while the southern parts are hilly.

Drainage occurs towards the west with the main rivers being the Erundu and Kalkfeld Rivers.

A few smallish mountains and mountain ranges are found, but they do not have an adverse effect on farming.

Soil erosion, especially donga formation, occurs to some extent in the southern parts.

d) Vegetation

Trees and Shrubs

This area, compared to other subregions, has far less palatable shrubs, in species as well as numbers. The few species that do occur are Tarchonanthus camphorathus, Lonchocarpus nelsii, Boscia albitrunca, Combretum apiculatum and Grewia spp. The first species occurs mainly in depressions. Of the above shrubs, Grewia and Combretum apiculatum are most common.

Bush encroachment is a problem only in the northern parts. The southern parts can be described as a more open savanna. Overall, shrubs have not increased in such numbers that they constitute a problem to farmers.

The most important encroaching species are Acacia mellifera subsp. detinens, Dichrostachys cinerea and Acacia tortilis.

Grass cover

The most important climax grasses that can occur here are Anthephora pubescen, Cenchrus ciliaris, Panicum maximum, Panicum coloratum, Urochola bolbodes, Fingerhuthia africana, Schmidtia pappophoroides, Heteropogon contortus, Cymbopogon plurinodis and Stipagrostis uniplumis.

In general, the stage of succession of veld in this area is somwhere between pioneer and transitional. Annual Aristida and Eragrostis species predominate.

The present rare occurence of Stipagrostis uniplumis is also unsatisfactory. There is ample opportunity for veld improvement.

Poisonous plants:
Geigeria ornativa and Crotalaria burkeana are the most important poisonous plants. Stock losses due to these plants occur sporadically.

e) Sources of water
Boreholes are the major source of water. In the eastern and northern parts of the subregion, underground water is not always easily obtainable and extensive use is made of pipelines for the distribution of available water. The average depth of boreholes is 75 - 180 m. It is estimated that their output is 2 - 3 m^3.

In the western parts boreholes are shallower and their output generally is higher. Boreholes generally supply sufficient water for livestock.

From observations it is apparent that there are several boreholes with water unfit for human and livestock consumption. In most of these cases, flouride, nitrite, nitrate content and brackish water constitute the problems. The real extent of this problem is however unknown.

To some extent, earth dams and earth excavation dams are used for supplementary purposes.

The evaporation rate is 3000 - 3100 mm per annum.

2.2.4.2 SOIL UTILIZATION PATTERN

a) Physical data

Planimetric surface area	438 000 ha

Total surface area of surveyed area	329 250 ha
Surface area owned privately	289 929 ha
Surface area owned by companies	39 321 ha
Number of planned farming units	36
Number of unplanned farming units	8
Average size of planned farming units	7 872 ha
Average size of unplanned farming units	5 730 ha
Average number of camps per planned farming unit	20,8
Average camp size	378 ha

The distribution of camp sizes is as follows (percentage of total):

50 to 200 ha	31,3 %
201 to 300 ha	23,1 %
301 ha and larger	45,6 %

Average number of watering points per farming unit	7,8
Average surface area per watering point	10009 ha

b) Cultivated fields

Fields are virtually non-existent in this area and no agronomic activity is present.

c) Livestock farming

Extensive cattle farming is the major farming activity. Small stock is kept for personal use only.

d) Uneconomical farming units

There are only two uneconomical units in this sub-region.

2.2.4.3 HUMAN RESOURCES

a) Ethnic grouping

Afrikaans speaking farmers	34,1 %
German speaking farmers	63,3 %
English speaking farmers	2,3 %
Total surface area owned by Afrikaans speaking farmers	34,5 %
Total surface area owned by German speaking farmers	62,4 %
Total surface area owned by English speaking farmers	3,0 %

b) Age distribution

Among the 40 owners, whose age could be determined, the distribution in the categories was as follows:

20 to 30 years	2,5 %
31 to 40 years	17,5 %
41 to 50 years	22,5 %
51 to 60 years	17,5 %
61 to 70 years	22,5 %
71 years and older	17,5 %

c) Communication

Farmer's Associations:

The Kalkfeld farmer's association serves the largest part of this area. There are ± 34 members of which about 30 % are active. Some of these members are from the Etjo area.

The Kalkfeld farmer's association can be described as relatively active. It is attempted to present a lecture on agricultural aspects at every meeting. At present the committee consists of fairly young members;

the chairman is 32 years old and the secretary 38 years. Cooperation by this association can be described as good. The chairman also serves on the Soil Conservation Committee.

Postal Record study groups:
Interest in establishing such a study group in this area exists. Such a group will probably be founded early this year.

2.2.4.4 PRESENT PRACTICES

a) Veld management
In this area 17,5 % of the farmers implement a good pasture management system, 47,5 % a fair system and 35 % a poor one.

b) Stocking rate
From a survey it was established that the average stocking rate is 1 L.A.U. per 16,6 ha. This low stocking rate can be attributed to the sale of weaners because of exceptionally high prices during the previous year and to the poor rainy season of 1973.

c) Marketing
At marketing, oxen are between 2,5 and 3 years old. Livestock is normally sold straight from the veld.

d) Other management practices

Average number of breeding herds per farming unit	3,5
Average size of breeding herd	80
Average calving percentage	61,2 %

2.2.5 OSONA / WESTERN KHOMASHOCHLAND (B5)

2.2.5.1 ENVIRONMENTAL FACTORS

a) Climate

Annual rainfall varies from 200 mm in the western Khomashochland to about 350 mm near Okahandja. Rainfall is spread over the year as follows:

September	0,4 %
October	2,8 %
November	6,0 %
December	11,1 %
January	23,8 %
February	24,6 %
March	21,5 %
April	6,7 %
May	2,1 %

About 36 rainy days occur on average. Hot summers and mild winters are characteristic.

Along the Swakop River, heavy forst occurs often, while it is less frequent in the remaining parts of the subregion.

b) Soil types

The parts north of the Swakop River are characterized by generally shallow granite soils. South of said river, dolomite predominates.

c) Topography

This subregion is situated between longitude 16,2° to 16,9° east and latitude 21,8° to 22,4° south. Many ridges are found which are generally higher and more

closey spaced in the southern parts.

d) Vegetation

The farms along the road from Okahandja to Sneyriver Can be classified as being situated in the Thornbush Savanna or the Tree and Shrub Savanna. These farms along the Swakop River actually occur in the transitional zone between the Thornbush Savanna and the Highland Savanna.

The typical vegetation type is grassveld with trees and larger shrubs. Acacia species are dominant here. Bush encroachment by Acacia mellifera subsp. detinens occurs at some areas.

Tree stratum:

Acacia reficiens, A. mellifera subsp. detinens, A. hebeclada subsp. hebeclada, A. tortilis subsp. heteracantha, A. erubescens, A. erioloba mainly on river banks, A. albida in rivers, Albizia anthelmintica, Boscia albitrunca, Ziziphus mucronata and Combretum apiculatum sometimes on limestone and rocky ridges.

Shrub stratum:

Calicorema capitata, Catophractes alexandrii, Dichrostachys cinerea, Leucosphaera bainesii, Ehretia rigida, Mundulea sericea.

Herb stratum:

Aristida adscensionis (pioneer species), Schmidtia kalahariensis, Enneapogon cenchroides, Rhynchelytrum villosum, Eragrostis annulata, Pogonarthria fleckii,

Setaria appendiculata, Tragus berteronianus, Eragrostis rigidior, E. rotifer, Dactyloctenium aegyptium, Urochloa brachyura, Chloris virgata, Eragrostis echinochloidea, E. nindensis, Anthephora pubescens, Cenchrus ciliaris, Fingerhuthia africana, Stipagrostis uniplumis, S. hirtigluma, S. hochstetterana. The dominant grasses should be Anthephora pubescens, Stipagrostis uniplumis and Cenchrus ciliaris.

e) Sources of water

This subregion is dependant mainly on boreholes for its water supply. The depth of boreholes can be as much as 100 meter. Farms along the river make use of wells in the river. There are on average 6 boreholes per farming unit. Each borehole serves 1430 ha of land.

2.2.5.2 SOIL UTILIZATION PATTERN

a) Physical data

Planimetric surface area	206 700 ha
Total surface area of surveyed area	206 666 ha
Number of farms	24
Number of farming units	22
Average size of farms	8 611 ha
Average size of farming unit	9 393 ha
Average number of camps per farming unit	19,2
Average camp size	489 ha

The distribution of camps according to size is as follows:

up to 50 ha	7,0 %
51 to 200 ha	28,6 %

201 to 300 ha	24,0 %
301 to 400 ha	10,2 %
401 ha and larger	29,2 %

b) Cultivated fields

A few small fields are found along the river where cultivation of vegetables is the major activity. Irrigation from wells in the river is practiced here.

c) Livestock farming

Extensive cattle farming for the production of beef is the main activity. Some goats are kept for their meat.

d) Uneconomical units

In this subregion two uneconomical units are found (i.e. smaller than 4320 ha) and three units can only just be classified as economical. The remaining units are all considerably larger.

2.2.5.3 HUMAN RESOURCES

a) Ethnic grooуping

German speaking farmers	78,9 %
Afrikaans speaking farmers	21,1 %
Surface area owned by	
German speaking farmers	82,7 %
Surface area owned by	
Afrikaans speaking farmers	17,3 %

b) Education

No data are available.

2.2.5.4 PRESENT PRACTICES

a) Veld management

Farmers implementing :

good pasture management systems	10,5 %
fair pasture management systems	47,4 %
poor pasture management systems	42,1 %

b) Stocking rate

The average stocking rate is 1 L.A.U. per 12,9 ha, while the recommended carrying capacity is 1 L.A.U. per 12 ha.

c) Marketing pattern

The majority of farmers market their oxen at a mature age. The percentages of farmers marketing their livestock at the following ages, are:

younger than 18 months	0,0 %
18 months	6,25 %
30 - 36 months	68,75 %
36 - 42 months	18,75 %
older than 42 months	6,25 %
Speculation	0,0 %

Marketing usually is done directly from the veld.

d) Other management practices

Number of cow herds per farming unit	2,1
Average size of cow herds	100
Total number of herds per unit	6,15
Average calving percentage	68 %
Farmers having pregnancy tests done	10,5 %
Farmers whose livestock is identifiable	15,8 %
Number of cows per bull	40
Farmers supplying supplementary feed	

to cows (normal lick excluded)	0,0 %
Average number of cows per bull	35,4
Farmers implementing a definite mating season (December to May)	86,4 %
Farmers not implementing a definite mating season	13,6 %
Farmers having heifers mated for the first time at 2,25 years of age	100 %
Farmers supplying good winter lick	100 %
Farmers supplying good summer lick	100 %
Farmers participating in Performance Testing Scheme	31,8 %
Calf mortality	4 %
Total mortality	2-3 %

2.2.6 WESTERN HIGHLAND SAVANNA (B6)

2.2.6.1 ENVIRONMENTAL FACTORS

a) Rainfall

Annual rainfall varies between 250 and 300 mm.

The rest of the data are more or less identical to those given under 2.1.8 (Highland Savanna A8). This subregion was identified as a separate unit, because its production potential is lower than in the rest of the Highland. This subregion has a total surface area of 236 000 ha.

2.3 EROSION AREAS

2.3.1 ETJO CATCHMENT AREA (C)

2.3.2.2 ENVIRONMENTAL FACTORS

a) Climate

The average rainfall in this subregion is 446 mm per annum, which is comparable with that of the neighbouring Otjiwarongo Thornbush Savanna. The distribution of rainfall through the year is as follows:

September	0,1 %
October	3,5 %
November	8,1 %
December	12,3 %
January	19,5 %
February	28,5 %
March	18,8 %
April	6,9 %
May	1,9 %

The average total of rainy days (1 mm or more) is 44,6.

Almost half the annual rainfall is received during February and March. It is important that good basal cover is established after these rains to restrict run-off.

Rainfall varies considerably between years. It is estimated that it can vary from 60 % below to 80 % above average.

Unfortunately no temperature data are available; the following are estimates:

Average maximum temperature	30° C
Average minimum temperature	12° C
Absolute maximum temperature	39° C
Absolute minimum temperature	12° C

Maximum temperatures generally are experienced from October to December. Frost can be expected any time from the middle of May to September. During July frost occurs often.

b) Soil types

In general the soils of this area can be described as sandy loam or red loam. In the north western parts soils are more rocky (mainly quartz) while the south eastern parts have deeper soils (mainly sandy loam)

According to the geological map of S.W.A., the north western parts consist of granite, gneiss, dolomite, marble, tillite, itabirite, quartzite and schist. In the south eastern parts sandstone, skale and conglomerate are found.

Unfortunately no soil analysis is available. It can however be assumed that the granitic soils are alkaline. It can definitely be assumed that this subregion has a deficiency in phosphates in the soil.

c) Topography

The subregion is situated between latitude 20,5° to 21,5° south and longitude 16,5° to 17° east.

Altitude ranges from 1350 to 1700 meter above sea level.

The largest portion of this subregion can be regarded as hilly. In the north-western parts ridges and isolated mountains occur. The most important mountains are the Etjo and Omatako mountains.

This subregion represents the catchment areas for the following rivers: Omatako Omuramba (eastward flowing), Omaruru river (south westward flowing) and Erundu river (westward flowing).

Because of the hilly nature, water runs off easily if the soil is bare. Since this area probably was regarded as the prime cattle farming area in the past, overgrazing and poor pasture management over long periods, have caused that the natural plant cover has largely disappeared. All forms of soil erosion have therefore occured and constitute one of the major problems in this area. Erosion has progressed so far, that vley areas (with high production potential) are being destroyed by dongas.

Due to the rapid run-off and poor basal cover, soils have compacted and moisture only penetrates them during protracted, gentle rains. This is however a rare occurence, since rain usually is precipitated during thunderstorms.

Erosion has taken such serious proportions, that it can no longer be checked by means of good pasture management systems alone.

d) Vegetation

Trees and Shrubs

The most important fodder shrubs are the following: Tarchonanthus camphoratus, Boscia albitrunca, Lonchocarpus nelsii, Grewia spp., Combretum apiculatum, Terminalia sericea.

Fodder shrubs do not occur in the same quantities found in other areas. It is possible that they occured in greater numbers in the past.

The most important encroaching species are Acacia mellifera subsp. detinens and Dichrostachys cinerea. In the northern parts of the subregion, both cause problems, while the first species is more common in the southern parts.

Bush encroachment however is not such a serious problem in this area. If good basal cover can be restored, bush encroachment can be limited to some extent. The shrubs may even be of value at the present, since they bind the bare soil and prevent erosion. Estimates put the surface area affected by bush encroachment at 10 % of an average farm.

Crotalaria burkeana and Geigeria ornativa are the most important poisonous plants. Present indications are that they do not cause serious sotck losses. If sufficient grass is present, hardly any stock losses should occur.

Grass cover

The undisturbed grass cover consisted of species like Anthephora pubescens, Cenchrus ciliaris, Panicum maximum, Panicum coloratum, Urochloa bolbodes, Heteropogon contortus, Fingerhuthia africana, Cymbopogon plurinodis and Sporobolus rehmannii.

Because of the sweet nature of the veld, annual grasses are very palatable and have high nutritional value. Cattle will therefore flourish as long as some grass is available. It appears that the protein content of the grass in this region does not decrease as much during winter as in other areas.

Most parts of this subregion however are in a pioneer stage.

Since 1972 it was attempted by the Pasture Science Section to do annual (October) vegetation surveys. These surveys are done on farms surrounding the Etjo mountain.

To be able to make comparisons from year to year, surveys are always done in the same camps of the particular farms. Figures obtained are as follows:

Farm	Smalstreep			Ongangasemba			Etjo-Suid	
Year	1972	1973	1976	1972	1973	1976	1972	1973
% perennial grasses	0,10	0,10	0,85	0,05	0,20	0,90	0,20	0,15
% annual grasses	0,10	0,00	0,90	0,15	0,00	1,70	0,05	0,00
% other perennials	0,05	0,35	0,55	0,15	0,05	0,40	0,05	0,05
% other annuals	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Total cover	0,35	0,45	2,30	0,35	0,25	3,00	0,30	0,20

Farm	Omaha			Okonjati			Etjo-Nord	
Year	1972	1973	1976	1972	1973	1976	1972	197
% perennial grasses	0,05	0,00	0,00	0,10	0,50	1,95	0,05	0,05
% annual grasses	0,05	0,00	0,90	0,00	0,00	0,30	0,10	0,15
% other perennials	0,00	0,30	0,45	0,40	0,30	0,45	0,10	0,00
% other annuals	0,00	0,00	0,00	0,00	0,00	0,30	0,00	0,00
Total cover	0,10	0,30	1,35	0,50	0,80	3,00	0,25	0,20

These results were obtained in years that cannot be considered good rain years. This emphasizes the vulnerability of the veld during droughts. Secondly, this survey was done on farms that are most affected by soil erosion. Thirdly, this survey was done during October, which is generally regarded to be the beginning of a very difficult period of the year.

Since the area is more arid compared to the other subregions, small stock, mainly karakul sheep, is incorporated in farming activities. For every L.A.U. 1,63 S.A.U.'s are kept. It has to be mentioned, that sheep farming is more common in the southern parts where the subregion borders on the Omaruru district.

The average cover (after three years of good rains) on the Etjo farms, was 2,233 %. If the cover of perennial grasses only is calculated, figures are as follows:
Etjo - 0,88 % Nordland - 3,00 %

From this it is apparent, how sensitive these farms are to droughts. During October, perennial as well as annual grasses will be grazed down. If rains, usually thunder storms, occur at that stage, run-off will occur rapidly, especially on slopes.

A survey done on farm Nordland in 1974 (after a good rain year), showed the following % cover:

Perennial grasses	3,00 %
Annual grasses	0,05 %
Other perennials	0,45 %
Other annuals	0,00 %
	3,50 %

Even though farms are not completely comparable, this can be considered a standard.

e) Sources of water

Due to the presence of a watershed in this area, underground water is hard to find. Earth dams and earth excavation dams are therefore used extensively. Many of these dams are however not perennial, making efficient veld management difficult. If dams have water permanently, distribution of water from perennial dams by means of pipelines, bears great financial implications.

The average depth of boreholes is about 100 m with an output of 3,9 m^3. It therefore seems, that successful boreholes have good output. Chances are however great, that drilling will be unsuccessful.

So far, no problems have been experienced with any dissolved substances in the water.

2.3.1.2 SOIL UTILIZATION PATTERN

a) Physical data

Planimetric surface area	300 000 ha
Total surface area of surveyed area	301 083 ha
Surface area of farms privately owned	280 117 ha
Surface area of farms owned by companies	20 966 ha
Total surface area of planned farms	251 588 ha
Total surface area of unplanned farms	49 495 ha
Number of planned farming units	40
Number of unplanned farming units	8
Average size of planned units	6 290 ha

Average size of unplanned units		6 186 ha
Average size of all farming units		6 272 ha
Average number of camps per farming unit (planned)		14,5
Average camp size		434 ha
Distribution of camps according to size:		
200 ha and smaller	33,2 %	
201 to 300 ha	27,0 %	
301 ha and larger	39,8 %	
Average number of watering points per unit		7,55
Average surface area per watering point		833 ha

b) Cultivated fields

Agronomy is virtually absent in this area. The company "Nuwe Westelike Beleggings" has cleared about 800 ha of natural vegetation for the cultivation of "Cow Candy" and Babala.

c) Livestock farming

The Etjo area can be considered a pure cattle farming area. On a few farms, karakul sheep are kept. Extensive beef production therefore is the major farming activity. It has to be mentioned, that the production of these farms is at present low, due to the deterioration of veld and erosion.

d) Uneconomical farming units

If 3500 ha is considered to be still economical, four uneconomical units occur in this subregion. This represents 8,3 % of the total number of units.

2.3.1.3 HUMAN RESOURCES

a) Ethnic grouping

Afrikaans speaking farmers	56,0 %
German speaking farmers	44,0 %
Surface area owned by Afrikaans speaking farmers	52,6 %
Surface area owned by German speaking farmers	47,4 %

b) Age distribution

The 44 farmers, whose ages could be determined, are spread over the age groups as follows:

20 to 30 years	0,0 %
31 to 40 years	20,4 %
41 to 50 years	22,7 %
51 to 60 years	34,0 %
61 to 70 years	9,0 %
71 to 80 years	13,6 %

About 57 % of the farmers are thus in the age group that is considered to be less approachable from an extension work angle.

c) Knowledge and education

Details on formal education are not available. It can be assumed that knowledge of farming is based mainly on experience. Without actual testing, the level of this knowledge cannot be determined. Obviously, the younger farmers want to increase their knowledge on farming, which is also reflected in their attendance of courses. The largest percentage of farmers is above the age of

50 years, influencing their preparedness to accept new practices. Most of the unplanned farms belong to farmers of 60 years and older.

d) Communication pattern

This area does not have its own farmer's association. Farmers of the area are members of neighbouring farmer's associations like Kalkfeld and Otjiwarongo. This creates problems in dissemination of information at an organized level.

It is attempted to found a Postal Record study group, which may attract members from this region.

2.3.1.4 PRESENT PRACTICES

a) Veld management

The situation is well described by the following:

Veld management

	number of farmers good (15%)	number of farmers fair (44%)	number of farmers poor (41%)
Camps up to 200 ha large	7,66	6,82	2,12
Camps 201 to 300 ha	7,16	5,76	1,87
Camps larger than 300 ha	4,83	6,11	6,12
TOTAL	19,65	18,69	10,11
Grazing period (days)	7-14	21	59

b) Stocking rate

At the time of the survey, the average stocking rate was 1 L.A.U. per 18,7 ha. The drought of 1972/1973 most probably had an influence on this figure.

During a survey done in 1971, the average stocking rate was 1 L.A.U. per 13,7 ha. This illustrates that the farms are stocked relatively sparsely, since the veld cannot carry a heavier load.

c) Marketing

Livestock normally is marketed straight from the veld. Oxen are about three years old at marketing.

d) Other management practices

Calving percentage and related practices:

Average calving percentage	55 %
Average number of breeding herds	2
Average size of breeding herd	72
Average size of breeding camps	450 ha
Average number of cows per bull	39
Farmers implementing a definite mating season (November to May)	75,0 %
Farmers not implementing any mating season	25,0 %
Farmers supplying supplementary feed to increase calving percentage	0,0 %

Animal Nutrition:

Farmers supplying

good lick in winter	50,0 %
fair lick in winter	25,0 %
poor lick in winter	25,0 %
good lick in summer	75,0 %

fair lick in summer	0,0 %
poor lick in summer	25,0 %

Livestock improvement:
Only three farmers, of which two are stud breeders, participate in the Performance Testing Scheme.

Animal Health:
This subregion can generally be described as healthy as far as animal diseases are concerned. The most important diseases that are largely prevented by vaccination, are: anthrax, botulism, quarter evil, contagious abortion.

Botulism occurs fairly seldomly in this area and only a few farmers vaccinate against it as a preventative measure.

The extent of vibriosis and ezootic abortion is not known - it may however be responsible for the low calving percentage.

Calf mortality was 1,38 %, including all calves younger than one year.

Total mortality is estimated not to exceed 2-3 %. Predators contribute to stock losses.

Herd composition:
Average herd composition is as follows:

Calves, younger than 1 year	17,06 %
Oxen, 1-2 years old	25,21 %
Oxen, 2-3,5 years old	7,63 %
Oxen, older than 3,5 years	4,26 %

Heifers, not mated	14,40 %
Heifers and cows, mated	30,80 %
Bulls	0,61 %

2.3.2 OMARURU AND SLANG RIVER CATCHMENT AREAS (C)

2.3.2.1 ENVIRONMENTAL FACTORS

a) Climate

The average annual rainfall varies between 350 and 400 mm; 75 % occuring during January, February and March. The total annual precipitation is very erratic and varies from 130 % above average to 55 % below average.

Summers are very hot with temperatures as high as 40° C. Winters are mild with frost occuring only periodically.

b) Soil types

The parent rock in this area is mainly dolomite and quartzite and some granite. Limestone occurs rarely.

Generally the soil is slightly alkaline with pH values between 8,09 and 8,30.

c) Topography

Location: between longitude 16° to 16,5° east and latitude 21° to 21,6° south.

The terrain is fairly flat to hilly with isolated mountain ranges. This nature makes the area prone to erosion. The Omaruru and Khan rivers originate in this area. Drainage is towards the west.

d) Vegetation

According to the vegetation map of Giess (1970), this area is classified as Thornbush Savanna or Tree-and-Shrub Savanna. Typically the vegetation consists of grass veld with trees and larger shrubs.

Trees and Shrubs

The majority of trees in this subregion are acacias like Acacia reficiens, A. hebeclada and A. hereroensis. On the banks of rivers, large numbers of Acacia erioloba occur.

Encroachment by Acacia mellifera subsp. detinens occurs on a large scale and already causes problems.

Other trees and shrubs found in this area are Boscia albitrunca (usually on plains), Combretum apiculatum (dominant on limestone and rocky ridges), Tarchonanthus camphoratus and Catophractes alexandri.

Grass cover

The climax grasses for this area are Schmidtia pappophoroides, Cenchrus ciliaris, Panicum maximum, Panicum coloratum, Fingerhuthia africana, Anthephora pubescens and Eragrostis superba. These grass species unfortunately have disappeared to a large extent due to poor pasture management practices. For the same reason, Heteropogon and Cymbopogon species have become rare.

Grasses more common at present are Stipagrostis uniplumis, varying stands of Stipagrostis hirtigluma, Eragrostis annulata, Eragrostis echinochloidea, Eragrostis rotifer and Eragrostis porosa.

On sandy loam soils that have been trampled, Schmidtia kalahariensis predominates. Overgrazed areas are also being invaded by Aristida congesta.

If the natural pasture is in a fairly good condition, its nutritional value remains high throughout the year. The grazing is however deficient in phosphate all year round. If phosphates are supplemented together with protein, livestock can be marketed all year round.

e) Sources of water

The most important sources of water are boreholes and wells. The depth of boreholes varies from 20 to 100 meter, but underground water is obtained fairly easily. Dry boreholes or ones with insufficient output, are seldom. Wells are dug mainly along the Omaruru and Khan Rivers and their larger tributaries.

Sand retaining dams are also fairly common. Most of these have capacities lower than 20 000 m^3 and their water is not perennial. Many of these dams are built to reinforce boreholes. Earth dams with capacities larger than 20 000 m^3 are found only on a few farms. In most cases dams are used for domestic and gardening purposes.

Pipelines are widely used to distribute water from existing sources.

2.3.2.2 SOIL UTILIZATION PATTERN

a) Physical data

Planimetric surface area	180 000 ha
Total surface area of surveyed area	138 000 ha
Total number of farms	18
Total number of farming units	15
(One farm measuring 66 000 ha is owned by a company. This unit was not included in the calculation of averages, since it would distort the picture with regard to the other farming units)	
Average size of farms	4 235 ha
Average size of farming units	5 143 ha
Average number of camps per farming unit	21
Average camp size	245 ha
Number of units <u>not</u> implementing a system with at least 4 camps	4
All camps are provided with water	

b) Cultivated fields

Agronomy is not practiced in this subregion.

c) Livestock farming

Cattle farming for the production of beef is by far the most important farming activity in this subregion. On average, stock ownership is 310 cattle, 220 sheep and 45 goats. (Stock on Erindi Ranch excluded).

Only four of the 14 farming units generate considerable income from karakul farming, but cattle farming is still the major source of income. Most of the goats present on farms belong to the non-white labourers.

d) Uneconomical farming units

Only three of the farming units are smaller than 3000 ha and can be considered uneconomical measured against present standards.

2.3.2.3 HUMAN RESOURCES

a) Ethnic grouping

This area was already surveyed and inhabited by farmers before 1918 (i.e. during the German colonial era). Property therefore initially was exclusively owned by German farmers. With few exceptions, these farms still belong to the descendants of those German farmers.

Farming units owned by German speaking farmers	10
Farming units owned by Afrikaans speaking farmers	4
Farming units owned by companies	1

b) Age distribution

The average age of the farmers is 56 years. 60 % of farmers are older than 50 years, while only 22 % are younger than 40 years. This high age may influence the acceptance of new practices negatively.

c) Education

More than 50 % of the farmers had 12 to 13 years of schooling. Only two farmers attended school less than 10 years. One farmer had formal tertiary training in agriculture. This high level of education may diminish the negative effect of high age as describe in b).

2.3.2.4 PRESENT PRACTICES

a) Veld management

It was determined that 20 % of the farmers implemented a good pasture management system, 25 % use a two to four camp system and the rest do not implement any specific system.

The average number of herds during the growth season is 5, which means an average of 4 camps per herd. Almost 50 % of the farmers have less than 4 camps per herd during the growth period. There therefore still exists a shortage of physical facilities, which is reflected by the following as well:

Farmers that have:

0 to 3 camps	0 %
4 to 9 camps	35 %
10 to 14 camps	15 %
15 to 19 camps	12 %
20 to 24 camps	10 %
25 to 29 camps	13 %
more than 30 camps	15 %

b) Stocking rate

The average stocking rate is 1 L.A.U. per 14,5 ha (6 S.A.U. = 1 L.A.U., irrespective of age).

c) Marketing pattern

Three farmers speculate with livestock, while some market their oxen at an age of two to three years. Another group privately sells their livestock a an earlier age or markets it by public auction.

d) Other management practices

Mating:

Farmers having heifers mated for the first time at 18 to 22 months	20 %
Farmers having heifers mated for the first time at 27 months	80 %

Livestock improvement:

Almost 80 % of the farmers do not make use of an effective selection system. Selection is done purely visually without the use of any production records.

Elimination age:

Only 20 % of the farmers eliminate cows of 9 years or younger.

2.4 MIXED SHEEP AND CATTLE FARMING AREA (D1)

2.4.1 BIERMANSKOOL MOPANE SAVANNA

2.4.1.1 ENVIRONMENTAL FACTORS

a) Climate

The average annual rainfall varies between 350 mm in the eastern parts and 300 mm in the western parts. During October to December about 30 % of the total annual rainfall occurs. From January to April, rainfall is more regular and about 70 % of the total rainfall is received during this period. Considerable variation occurs between years.

Temperatures are as follows:

Average maximum temperature	29,8° C
Average minimum temperature	12,4° C
Absolute maximum temperature	39,6° C
Absolute minimum temperature	4,4° C

b) Soil types

The soils in the plains are mainly grey turf, but patches of heavier turf occur within this area. The turf soils are interspersed with broken surface limestone. This soil type generally is deep and fertile. The plains are scattered with ridges and mountains stretching from east to west. In the western parts, mountains and ridges are more prominent. The plains between then are smaller with red loamy soil.

The soils of this area are deficient mainly in phosphates.

c) Topography

Location: between longitude 14,8° to 15,9° east and latitude 19,2° to 19,8° south.

About 50 % of the surface area consists of mountains and ridges, the rest of plains. The ridges and mountains are orientated in a east to west direction. This facilitates the division of mountainous veld from flat veld by means of camps. There are no prominent rivers, drainage occurs entirely by means of omurambas and vleys.

Slopes are such, that erosion does occur but not to any serious extent. If adequate basal cover is maintained, erosion should be minimal.

Since even small watercourses are absent in the easten parts of the subregion, sand for building purposes is unobtainable. Farmers have to cart the latter from Outjo.

d) Vegetation

This subregion is described as Mopane Savanna (Giess, 1970).

Trees and shrubs

Colophospermum mopane in its tree form occurs far less in the plains compared to the Kamanjab, Otjikondo and Ugab areas. The shrubby form however occurs in large numbers. Towards the western parts of the area, this species is more dominant.

The most important species causing bush encroachment are Acacia mellifera subsp. detinens, Acacia nebrownii and Colophospermum mopane. Where limestone is present, Catophractes alexandri is typical. In the mountains, Kirkia acuminata is dominant while Moringa ovalifolia and Gnidia polycephala are also quite common. Combretum apiculatum occurs occasionally high up on the mountains or ridges, but forms denser stands at the foot.

Leucosphaera bainesii and Justicia genistifolia can be found in the plains, increasing in density form east to west.

Grass cover

The vegetation in this area is generally in a pioneer stage, especially in the plains where the soil suface has hardened. Characteristic of this successional stage are annual Aristida species, Enneapogon cenchroides, Eragrostis porosa and Chloris virgata.

Of the Aristida species, Aristida congesta is very common. Monelytrum luederitzianum occurs widespread on the grey turf soils. The perennial grass Eragrostis echinochloidea is more prominent on some farms, but is still considered to be a perennial pioneer species. Other perennial species that are not considered high up in the succession, like Bothriochloa radicans, Cymbopogon excavatus and Dichanthium papillosum occur mainly in and around the turf pans. Grasses like Fingerhuthia africana, Enneapogon scoparius and Triraphis ramosissima are found on the broken limestone soils, but are not yet common.

Cenchrus ciliaris, Schmidtia pappophoroides, Anthephora pubescens, Eragrostis superba, Eragrostis capensis and Panicum coloratum have been noticed, but are very scarce.

Fingerhuthia sesleriaeformis has been seen, but seems to be unpalatable. On the dolomite soils, the condition of the veld is generally better. Although Aristida species are most common, Triraphis ramosissima, Stipagrostis uniplumis, Enneapogon scoparius and Anthephora pubescens are more prominent.

Along watercourses, Andropogon schinzii is found. Danthoniopsis dinteri is also characteristic of this area.

In the climax stage, dense stands of the following grasses can be expected. In the Etosha Game Reserve, bordering on this subregion, where game populations are not very dense, this can actually be proven.
Plains, ridges and mountains:
Eragrostis superba, Eragrostis capensis, Panicum maximum (especially near vleys), Cenchrus ciliaris, Anthephora pubescens, Panicum coloratum, Triraphis ramosissima and Stipagrostis uniplumis.

e) Sources of water
This area is dependent mainly on boreholes for the supply of water. The groundwater level generally is deep, varying between 50 and 220 meter. On some farms, problems are experienced in finding underground water, but generally, underground water is sufficient and fairly easily obtained. The quality of water is good and the output of boreholes generally constant throughout the year. Earth and earth excavation dams do occur, but the farmers are not dependent on them.

2.4.1.2 SOIL UTILIZATION PATTERN

a) Physical data

Planimetric surface area	510 000 ha
Total surface area of area surveyed	437 130 ha
Number of farms	87
Number of farming units	82
Average size of farms	5 024 ha
Average size of farming units	5 331 ha

The distribution of farming units is as follows:

Surface area of unit (ha)	Frequency	% of total
500 - 2 000	0	0,0
2 001 - 1 000	6	7,3
3 001 - 5 000	11	13,4
5 001 - 7 500	56	68,3
7 501 - 10 000	3	3,7
10 001 - 15 000	3	3,7
15 001 - 20 000	3	3,7
20 001 +	0	0,0

Average number of camps per unit 21,3
Average size of camps 257 ha
The distribution of camp sizes is as follows:
50 to 200 ha 39,2 %
201 to 300 ha 38,6 %
301 ha and larger 22,2 %
All camps are provided with water.

b) Cultivated fields

Fields existing at present are usually old and with a few exceptions are used for grazing. The total surface area of old fields is about 550 ha.

c) Livestock farming

The composition of livestock farming in this area is as follows:

Cattle 48,3 % of total stock
Sheep (karakul) 46,6 % of total stock
Goats 5,1 % of total stock
(1 L.A.U. = 6 S.A.U.)

d) Uneconomical farming units

20,7 % of the units can be considered uneconomical.

2.4.1.3 HUMAN RESOURCES

a) Ethnic grouping

Farms owned by German speaking farmers	3,7 %
Farms owned by Afrikaans speaking farmers	96,3 %
Farms owned by English speaking farmers	0,0 %
Percentage of total surface area owned by German speaking farmers	4,4 %
Percentage of total surface area owned by Afrikaans speaking farmers	95,6 %

b) Education

7,3 % of the farmers had tertiary education in agriculture.

c) Age distribution

The spread of farmers over the age groups is as follows:

Age (years)	% Farmers
20 - 24	0,0
25 - 29	1,8
30 - 34	7,2
35 - 39	5,4
40 - 44	9,0
45 - 49	12,9

50 - 54	21,8
55 - 59	20,0
60 - 64	9,0
65 - 69	12,7
70 - 74	0,0
75 - 79	0,0
80 - 84	0,0

The average age of farmers in this area is 51,4 years.

d) Communication pattern
Two farmer's associations serve this area. Contact with the Biermanskool association can be improved. In the eastern part the Rooilyn association is fairly active and a good point of contact.

The most important news media are the "Landbouweekblad" and "S.W.A. Boer", as well as the two newspapers. Everyone receives a quarterly newsletter from the Soil Conservation Committee on agricultural matters.

2.4.1.4 PRESENT PRACTICES

a) Veld management
The farmers of the subregion were classified as follows:

Good pasture management system	22,2 %
Fair pasture management system	33,3 %
Poor pasture management system	44,4 %

b) Stocking rate

According to total S.A.U (A)	- 1,8 ha/S.A.U.
According to total S.A.U. x 0,8 (B)	- 2,2 ha/S.A.U.

Farmers implementing a stocking rate of:	
according to (A)	
1 - 1,9 ha/S.A.U.	20,0 %
2 - 2,9 ha/S.A.U.	70,0 %
3,0 ha/S.A.U.	10,0 %
according to (B)	
1 - 1,9 ha/S.A.U.	5,0 %
2 - 2,9 ha/S.A.U.	60,0 %
3,0 ha/S.A.U.	35,0 %

Cattle farming:	
Calving percentage and related practices:	
Average calving percentage	53,2 %
Farmers implementing a mating season	77,7 %
Farmers not implementing a mating season	22,3 %
Where mating seasons are implemeted, the periods are as follows:	
Single mating season (January to April)	63 %
Double mating season (August to Spetember)	18 %
Single mating season (April to August)	19 %
Average number of cows per bull	21,1
Farmers with 33 and less cows per bull	55,6 %
Farmers with 34 - 50 cows per bull	22,2 %
Farmers with 51 and more cows per bull	22,2 %
Farmers that have:	
replacement figures of 14 % and less	0,0 %
replacement figures of 15 - 20 %	0,0 %
replacement figures of 21 % and higher	100 %
Average replacement figure	29,6 %

Farmers having heifers mated for the first time at an age of:	
1,5 to 2 years	44,4 %
2 - 3 years	33,3 %
3 years +	22,2 %
Farmers having pregnancy tests done	0,0 %
Farmers wishing to receive training in doing pregnancy tests	55,6 %
Farmers isolating calves	77,8 %
Period that calves are isolated after birth	7 months
Farmers switching camps during mating season	55,6 %
Calf mortality per farmer (calves)	0,2
Abortions by cows per farmer	0,6
Farmers employing an identification system for livestock	11,1 %
Farmers that could determine by means of their system, which cows did not produce calves in the past 5 years	0,0 %
Farming practices vs. physical development:	
Physical development - see karakul survey	
Average size of cow herds during mating season	79,3
Average number of cow herds during mating season	1,9
Animal nutrition:	
Farmers supplying	
good lick in winter	44,4 %
fair lick in winter	55,6 %
no lick in winter	0,0 %

good lick in summer	11,1 %
fair lick in summer	77,8 %
Farmers supplying supplementary feed to increase calving percentage (normal lick excluded)	0,0 %
Farmers rounding off oxen prior to marketing	0,0 %
Farmers planning to plant Cenchrus ciliaris	88,8 %

Stock numbers:

Average composition of cattle herd:

Cows and heifers	43,5 %
Calves	23,1 %
Oxen, 1-2 years old	10,2 %
Oxen, 2-3,5 years old	8,2 %
Oxen, older than 3,5 years	0,0 %
Heifers, replacement	12,9 %
Bulls	2,1 %

Karakul farming:

Fertility and related practices:

Average lambing percentage 105 %

	% of farmers	Av. lambing %
no. of ewes per ram		
less than 34	40	124,0
34 to 40	35	111,2
41 +	25	85,8
implementing a mating season		
yes	50	104,7
no	50	107,6

Where mating seasons are implemented, it seems that these are not well planned.

Average number of camps per ewe flock during mating season:

6 or more	25 % of farmers
4 - 5	25 % of farmers
2 - 3	40 5 of farmers
1	10 % of farmers

Mating system implemented:

	% farmers	Av. lambing %
Rams mate only in the evenings and at night	15	103
Half of rams in, other half out	35	120,4
All rams with ewes at all times	50	105

Practices during mating:

use of a teaser	0,0
manual mating	0,0
usual herd mating	100

Farmers that have:

shepherds	35
no shepherds	65
both	0,0

Average amount of supplementary feed per ram per day 458 g

Supplementary feed consists of a good source of energy.

Farmers supplying supplementary feed:

100 - 249 g per day	30 %
250 - 499 g per day	25 %
500 g +	45 %

Herd management:

The average percentage livestock composition:

Cattle	48,3 %
Sheep	46,6 %
Goats	5,1 %

6 S.A.U. = 1 L.A.U. All cattle were converted to S.A.U. and expressed as % of total.

Percentage replacement in ewe flock:

Farmers that replace

0 - 9 %	30 %
10 - 14 %	40 %
15 % +	30 %
Average replacement percentage	12,8 %

Farmers with identification system for flocks	15 %
Farmers without identification system	85 %
Farmers that cannot determine which ewes skip lambing	70 %

Selection system implemeted:

Farmers that:

select according to a set standard	90 %
keep all female lambs until desired replacement % is reached	10 %
cull those with the best pelts for marketing	0 %
no system	0 %

Farmers keeping lambs during the following periods:	
throughout the year	20 %
January to April	30 %
May to June	5 %
July to August	5 %
October to December	35 %
January to March and June to July and October to December	5 %
June and again October	0 %
January/February and June/July	0 %
October to April	0 %

47,8 % of the farmers (of those that have ewes mated throughout the year) keep their lambs for replacement over a period of only 2 months.

Farmers sypplying supplementary feed to their weaners	35 %

67 % of the farmers that supply supplementary feed, also implement a mating season.

Amount of feed per day per lamb:

50 - 99 g
100 - 249 g
250 - 499 g
500 g +

Period that lambs received supplementary feed after being weaned:

1 month
2 months

3 months
4 months

Licks:
Farmers sypplying
good lick in winter 55 %
fair lick in witner 35 %
poor lick in winter 10 %
no lick at all in winter

Is the lick freely available to the animals?
yes 70 %
no 30 %

Animal health:
Number of occasions on which sheep were dipped during the past year:
twice 25 %
once 75 %
not at all

Sheep are dipped mainly during the periods from Fabruary to May and August to November.

Number of occasions on which sheep were dosed during the past year:
3 times or more 25 %
twice 60 %
once 15 %
never

Number of occasions during the past year on which suckling lambs were dosed:

3 times	5 %
twice	30 %
once	45 %
never	20 %

All farmers use the modern remedies available on the market.

Vaccination against bluetongue during the past year:

yes	30 %
no	70 %

Time of year vaccinated:

August/September
October/November
December/January
February/March

Vaccination against pulpy kidney during the past year:

yes	90 %
no	10 %

Vaccination against Pasteurellosis during the past year:

yes	20 %
no	80 %

Vaccination against Rift Valley Fever during the past year:

yes	10 %
no	90 %

Vaccination against Wesselsbron disease during the past year:

yes	0 %
no	100 %

Vaccination against anthrax during the past year:

yes	15 %
no	85 %

Rams vaccinated against contagious abortion:

yes	75 %
no	10 %
unknown	15 %

Ewes vaccinated against:

contagious abortion	20 %
enzootic abortion	0 %

Female lambs vaccinated during the past year against:

contagious abortion	40 %
enzootic abortion	0 %

Farmers that had rams examined for abnormalities of genitals during the past year:

yes	65 %
done personally	5 %
no	30 %

Farmers whose ewes were proven to have had abortions: 60 %

(Number of abortions per farm were few) Where abortions occured, fetuses were burned. According to this survey, not one of the farmers took samples to the veterinarian for examination.

Other management practices:

	% farmers
What happens to the old ewes on the farm?	
marketed	20 %
left to die	70 %
sell privately	10 %
How were rams obtained?	
all bought	70 %
bred on farm	15 %
some bought, some bred on farm	15 %
Farmers keeping ewes in spare camps during mating season	85 %

Physical development of farms:	
Average size of farming unit	5 502 ha
Average number of camps per unit:	
larger than 100 ha	18,35
smaller than 100 ha	3,0
total	21,3
Average camp size	257 ha
Production:	
Number of pelts per 100 ha	37,8

2.4.2 KAMANJAB MOPANE SAVANNA (D2)

2.4.2.1 ENVIRONMENTAL FACTORS

a) Climate

The average annual rainfall is 324 mm. From October to December, the distribution of rainfall is poor, but from January to April a more constant pattern is formed. During the latter period on average 73 % of the total precipitation occurs.

During summer the days are hot, while the nights are cooler than further inland. Winters are mild with sporadic occurences of frost.

Average maximum temperature	29,9° C
Average minimum temperature	12,4° C

b) Soil types

In the southern two-thirds of the subregion, plains with mainly red, sandy, deep loams occur. The ridges and koppies consist of granite and weathered granite. In the northern third of the subregion, heavier red, deep loam is found.

As far as could be established, the soils are deficient in phosphates. From analyses of liver samples, it seems that this area is also deficient in copper, but not to a serious degree. In general, the soil can be described as very fertile.

According to the geological map of S.W.A., the soils are mainly granite and gneiss.

c) Topography

Location: between longitude 14,5° to 15,3° east and latitude 19,3° to 20,2° south.

Granite ridges are present in the entire area and are separated by small to large, vast plains. Isolated granite koppies occur on the plains. Vleys can be found mainly in the northern third of the subregion.

The irregular pattern of ridges and plains as well as the significant difference in palatability of pastures in the vleys, plains and ridges, makes effective pasture management very complicated.

The most significant rivers are the Huab and Katemba Rivers with numerous tributaries. Due to the nature of the terrain, run-off is very rapid and erosion may be a problem. If good basal cover is maintained, erosion should be minimal.

d) Vegetation

Trees and shrubs

In the plains Colophospermum mopane is the most dominant tree and in its shrubby form the most common shrub. On heavier soils, Acacia mellifera subsp. detinens is found as an encroaching species. Bush encroachment is however not a serious problem in this area yet. Areas along rivers and roads are infested with Pechuel-Loeschea leubnitziae. In the granitic soils, Combretum apiculatum is the most common tree. On limestone, Catophractes alexandri is prominent. This subregion is not rich in fodder shrubs. The northern parts support some Leucosphaera bainesii and Justicia genistifolia.

Grass cover

Where the vegetation is in the pioneer stage, Schmidtia kalahariensis predominates on sandy loams. On heavier or granitic soils, annual Aristida species take over.

In general, the vegetation of this subregion is in a transitional stage with Stipagrostis uniplumis widespread. Though few in number, some of the climax species do occur. Stipagrostis species are succeded by Schmidtia pappophoroides and on heavier loam soils Anthephora pubescens, Panicum coloratum, Urochloa bolbodes and Cenchrus ciliaris are found.

In addition to Panicum maximum, Eragrostis superba and Cymbopogon excavatus, the same grass species as above occur in the vleys. Panicum maximum also tends to grow on river banks and in watercourses. On the ridges, Stipagrostis uniplumis, Triraphis ramosissima and Anthephora pubescens are the most common perennial species.

Depending on the soil type, the climax community can consist mainly of the following:

Sandy loam	Stipagrostis uniplumis
	Schmidtia pappophoroides
Heavy, red loam	Anthephora pubescens
	Panicum coloratum
	Urochloa bolbodes
	Cenchrus ciliaris
Vleys	Anthephora pubescens
	Panicum coloratum
	Urochloa bolbodes
	Panicum maximum
	Eragrostis superba

Ridges — Anthephora pubescens
Triraphis ramosissima

e) Sources of water

Farmers generally depend on boreholes to supply water for their livestock. The output of boreholes varies considerably, but strong boreholes are seldom. Because of the broken substrate, earth excavation dams are often used to reinforce boreholes with low output. In some instances, parts of farms are completely dependant on earth dams. Extensive use is made of pipelines to distribute the water.

In general water tends to be somewhat brackish. In some areas the water quality is very poor causing rapid corrosion of sheetmetal reservoirs. These cases are however rare.

The underground water table is between 33 and 50 meter deep.

Analyses of water have been done in the past.

2.4.2.2 SOIL UTILIZATION PATTERN

a) Physical data

Planimetric surface area	473 000 ha
Total surface area of surveyed area	459 200 ha
Number of farms	87
Number of farming units	79
Average size of farms	5 278 ha
Average size of farming units	5 812 ha

Size of farming unit (ha)	Frequency	% of total
500 - 2 000	2	2,5
2 001 - 3 000	2	2,5
3 001 - 5 000	25	31,6
5 001 - 7 500	42	53,2
7 501 - 10 000	5	6,3
10 001 - 15 000	2	2,5
15 001 - 20 000	0	0,0
20 001 +	1	1,3

Average number of camps per farming unit 42,1

Average camp size 224 ha

All camps are provided with permanent water.

Distribution of camp sizes:

50 - 200 ha	36,8 % of total
201 - 300 ha	25,4 % of total
301 ha +	37,7 % of total

b) Cultivated fields

Agronomy was practised on a very small scale in the past. At present small fields still exist but are not used for crop cultivation any longer. The entire surface area is utilized for grazing.

c) Livestock farming

Livestock farming in this area is composed of the following:

Cattle	45,5 % of total stock
Karakul sheep	45,3 % of total stock
Goats	9,2 % of total stock

(All L.A.U. were converted to S.A.U. for this calculation on the basis of 1 L.A.U. = 6 S.A.U.)

d) Uneconomical farming units

If 5000 ha is taken to be the minimum size that can be farmed economically, 36 % of the units in this sub-region are uneconomical.

2.4.2.3 HUMAN RESOURCES

a) Ethnic grouping

Farms owned by German speaking farmers	25 %
Farms owned by Afrikaans speaking farmers	75 %
Surface area owned by German speaking farmers	29,6 %
Surface area owned by Afrikaans speaking farmers	70,4 %

b) Age distribution

Age group (years)	% of farmers	Average age (years)
20 - 24	1,8	21,0
25 - 29	3,7	27,1
30 - 34	5,5	32,0
35 - 39	5,5	36,0
40 - 44	22,2	42,3
45 - 49	7,4	47,2
50 - 54	9,2	52,0
55 - 59	18,5	57,0
60 - 64	9,2	61,0
65 - 69	9,2	67,2
70 - 74	7,4	72,0
75 - 79	0,0	-
80 - 84	0,0	-

The average age of the farmers in this subregion is 50,5 years.

c) Communication pattern

At an organized level, the farmer's association is the best point of contact with farmers. In this subregion there is one farmer's association at present, that is very active and well organized. Almost all farmers are members, while quite a number of their wives are members as well.

The postal record study group has been in existence for two years. This group consists of six members.

The most important news media are the "Landbouweekblad", the "S.W.A. Boer", the two S.W.A. newspapers and an agricultural newsletter.

Although only 2 farmers had formal tertiary training in agriculture, the farmers of this area are generally progressive and prepared to train themselves by means of the informal media.

2.4.2.4 PRESENT PRACTICES

a) Veld management

Classification of farmers according to their pasture management systems:

Good	26,5 % of farmers
Fair	40,8 % of farmers
Poor	32,7 5 of farmers

The corresponding lambing percentage is as follows:

Good system	120,4 %
Fair system	118,7 %
Poor system	92,3 %

b) Stocking rate

According to total number of S.A.U. (A)	2,2 ha/S.A.U.
According to total number of S.A.U. x 0,8 (B)	2,7 ha/S.A.U.

Percentage of farmers implementing a stocking rate of:

According to (A)	
1 - 1,9 ha/S.A.U.	42,2 %
2 - 2,9 ha/S.A.U.	47,4 %
3 ha/S.A.U. +	10,5 %
According to (B)	
1 - 1,9 ha/S.A.U.	21,0 %
2 - 2,9 ha/S.A.U.	42,2 %
3 ha/S.A.U. +	36,8 %

c) Cattle farming practices

Calving percentage and related practices:

Average calving percentage	66,5 %
Farmers implementing a definite mating season	55,6 %
Farmers not implementing a definite mating season	44,4 %

Where mating seasons are implemeted, the periods are as follows:

Single mating season	
January to April	63 % of farmers
Double mating season	

January to April and August to September	18 % of farmers
Single mating season April to August	19 % of farmers
Average number of cows per bull	37,3
Farmers with:	
33 and less cows per bull	33,3 %
34 - 50 cows per bull	22,2 %
51 and more cows per bull	44,4 %
Farmers with a replacement figure of:	
14 % and less	22,2 %
15 - 20 %	11,1 %
21 % and higher	66,7 %
Average replacement percentage	29,3 %
Farmers having heifers mated for the first time at:	
1,5 to 2 years of age	100 %
2,5 to 3 years of age	0 %
older than 3 years	0 %
Farmers having pregnancy tests done	0 %
Farmers that want to receive training in performing pregnancy tests	
Farmers that isolate calves	77,8 %
Period that calves are isolated after birth	3 months
Farmers that switch between camps during mating season	78,8 %
Calf mortality per farmer	5 %
Abortions	1,4 %

Farmers that implement an identification system for livestock	22,2 %
Farmers that could determine by means of that system, which cows skipped calving in the past 5 years	0,0%

Farming practices vs. Physical development:
For physical development see survey for karakul

Average size of cow herds during mating season	68,1
Average number of cow herds during mating season	2,6

Pasture management:

Farmers employing a	
good system	33,3 %
fair system	33,3 %
poor system	33,3 %

Animal nutrition:

Farmers supplying	
good lick in winter	77,8 %
fair lick in winter	22,2 %
poor lick in winter	0,0 %
good lick in summer	22,2 %
fair lick in summer	44,4 %

Farmers supplying some form of supplementary feed to cows to improve calving percentage (normal lick excluded)	0,0 %
Farmers that rounded off oxen prior to marketing	0,0 %

Farmers intending to plant *Cenchrus ciliaris*	100 %

Average herd composition:	
Cows and heifers	40,4 %
Calves	26,8 %
Oxen, 1-2 years old	7,5 %
Oxen, 2-3,5 years old	12,4 %
Oxen, older than 3,5 years	0,0 %
Heifers (replacement)	11,8 %
Bulls	1,1 %

d) Karakul farming practices

Fertility and related practices:

Average lambing percentage 109,8 %

No. ewes/ram	% farmers	Av. lambing %
33 and less	42,1	106,6
34 - 40	31,6	106,0
41 and more	26,3	111,0

Implementation of mating seasons:

	% farmers	Av. lambing %
yes	47,4	99,2
no	52,6	115,1

Where mating seasons are implemented, it is clear that they are generally not well planned.

Average number of flocks during mating season	5,7

Number of camps available for ewe flocks during mating season	% farmers
6 or more	36,8
4 - 5	21,1
2 - 3	42,1
1	0,0

Mating system implemented:

	% farmers	Av. lambing %
Rams mate only in evenings or at night	10,5	108
Half of rams in, half of rams out	10,5	114
All rams with ewes	79,0	106,6

Practices during mating:

Use of teasers	0,0
Manual mating	0,0
Normal flock mating	100
with shepherds	57,9
without shepherds	31,6
both	10,5
remove tails	5
don't remove tails	95
supply supplementary feed to rams	100
don't supply supplementary feed to rams	0
Average amount per day	557 g

Supplementary feed consists of a good source of energy.

Farmers supply supplementary feed in the following categories:

None	10,5 %
100 - 249 g/day	0,0 %
250 - 499 g/day	21,1 %
500 g/day +	68,4 %

Herd management:

Average composition of livestock herds:

Cattle	45,5 % of total
Sheep	45,3 % of total
Goats	0,2 % of total

6 sheep = 1 L.A.U. All cattle was converted to S.A.U.'s and percentages of total calculated.

Replacement percentage in ewe flocks:

0 - 10 % replacement	42,1 % of farmers
10 - 14 % replacement	26,3 % of farmers
15 % + replacement	31,6 % of farmers
Average replacement percentage	11,3 %

	% farmers
Identification system for livestock:	
yes	5,3
no	94,7
Farmers that cannot determine which ewes skip lambing	78,9

Selection system:	
Selection according to a set standard	73,7
Keep first female lambs until desired replacement percentage is reached	21,1
Cull best pelts for marketing	0,0
No specific system	5,2

Farmers keeping lambs during the following periods:	
All year round	26,3
January to April	26,3
May to June	0,0
July to August	0,0
October to December	26,3
January to March and June to July and October to December	5,3
June and October	0,0
January/February and June/July/August October to April	15,8

47,8 % of the farmers (that have ewes mated throughout the year) only use a period of 2 months to keep replacement lambs.

Farmers supplying supplementary feed to weaners	26,3 %

67 % of farmers that supply supplementary feed, also implement mating seasons.

Supplementary feed per day:

50 - 99 g

100 - 249 g

250 - 499 g

500g +

Period after weaning during which lambs receive supplementary feed:

1 month

2 months

3 months

4 months

	% farmers
Licks:	
Farmers supplying	
good lick in winter	63,2
fair lick in winter	26,3
poor lick in winter	10,5
none	-
Does livestock have free access to lick?	
yes	89,5
no	10,5
Animal health:	
Number of occasions on which sheep were dipped in previous year	
twice	47,4
once	36,8
never	15,8

Animals are dipped mainly in the periods from February to May and August to November.

Number of occasions on which sheep were dosed in previous year	
3 times or more	21,0
twice	58,0
once	21,0
never	-
Number of occasions on which suckling lambs were dosed in previous year	
3 times	10,5
twice	36,8
once	26,3
never	26,3

All farmers make use of the modern remedies available on the market.

Vaccination against bluetongue:	
yes	52,6
no	47,4
Time of year vaccinated:	
August/September	
October/November	
December/January	
February/March	
Vaccination against pulpy kidney:	
yes	79
no	21
Vaccination against Pasteurellosis:	
yes	32
no	68

Vaccination against Rift Valley Fever:	
yes	21
no	79
Vaccination against Wesselsborn disease:	
yes	0
no	100
Vaccination against anthrax:	
yes	0
no	100
Rams vaccinated against contagious abortion:	
yes	84
no	5
unknown	11
Ewes vaccinated against contagious abortion:	
yes	58
Ewes vaccinated against enzootic abortion:	
yes	5,3
Female lambs vaccinated against contagious abortion during the past year:	
yes	32
Female lambs vaccinated against enzootic abortion during the previous year:	
yes	0
Farmers having rams examined for abnormalities in genitals:	
yes	32
done personally	47
no	21

Famers whose ewes were proven
to have had abortions: 84

(Number of abortions per farm were minimal.) Where abortions occured, the fetuses were burned. The survey showed that none of the farmers took samples to the veterinarian for examination.

Other farming practices:
What happens to the old ewes on farms?

marketed	5 % of farmers
left to die	90 % of farmers
sold privately	5 % of farmers

How were rams obtained?

all bought	47
bred on farm	11
some bought, some bred	42

Farmers keeping ewes in spare camps
during mating season: 84

Physical development of farms:

Average size of farming unit 5397 ha

Average number of camps per farming unit:

larger than 100 ha	17,2
Smaller than 100 ha	6,8
Total	24,1

Production:
Number of pelts produced per 100 ha 33,5

2.3.4 OMARURU ESCARPMENT SUBREGION (D3)

2.4.3.1 ENVIRONMENTAL FACTORS

a) Climate

The average annual rainfall varies from 250 mm in the western parts to 300 mm in the eastern parts of the subregion. The average distribution of rain through the year is as follows:

September	0,1 %
October	2,1 %
November	7,2 %
December	12,2 %
January	19,5 %
February	27,5 %
March	20,6 %
April	9,0 %
May	1,4 %

Summers are very hot and temperatures up to 40° C have been measured. Winters are relatively short (June to beginning of August) and mild. Frost occurs only periodically during a few nights of the year.

b) Soil types

A variety of soil types originating from a number of parent rock types, change in rapid succession in this subregion. The most common rock formations and soil types are granite and granitic products of ultra-metamorphosis (Salem granite), dolomite, limestone and quartzite or conglomerates of these rocks. Basalt and andesite are restricted to the Erongo mountains.

c) Topography

Location: between longitude 15,4° to 16,1° east and latitude 20,8° to 22,1° south.

The terrain is flat to hilly with some smaller mountain ranges and isolated koppies. These koppies occur sporadically and culminate in the southern parts in the Erongo mountains. Most farms in the Erongo mountains are typically mountainous with valleys, gorges and steep slopes which often are difficult or impossible to use for grazing.

The entire subregion is drained by the Omaruru and Khan rivers and their tributaries.

d) Vegetation

Giess (1971) describes this area as Semi Desert and Savanna Transition zone. The vegetation particularly of the western parts is typical of the semi desert areas in South West Africa.

Trees and shrubs

Euphorbia querichiana, a shrub that can also grow into a tree of five meters in height, is characteristic for this area.

Conditions here are optimal for Cyphostemma species with their succulent stems.

As rainfall increases, the density of trees and shrubs also increases. The most common shrubs are Acacia senegal var. rostrata, Acacia mellifera subsp. detinens and Acacia reficiens. The most important palatable shrubs found in the entire subregion, are Boscia al-

bitrunca, Tarchonanthus camphoratus and Catohpractes alexandri. In areas with higher rainfall, Combretum apiculatum often dominates on limestone and rocky ridges. The most important trees, mainly along rivers, are Acacia erioloba and Acacia tortilis.

Grass cover

In parts with an average annual rainfall of 250 mm or less, Stipagrostis uniplumis, Stipagrostis hochstetterana and Stipagrostis obtusa are the most common species with high nutritional value.

Grasses like Cenchrus ciliaris and Panicum maximum occur only along rivers and watercourses, while Anthephora pubescens is restricted to mountains and ridges. As rainfall increases in a northerly and easterly direction, the latter species, together with Schmidtia pappophoroides, Cymbopogon and Heteropogon species and Fingerhuthia africana represent the climax stage.

e) Sources of water

Boreholes and wells are the most important sources of water in this subregion. Underground water is difficult to find in the southern and western parts; dry boreholes are a common sight. The depth of boreholes varies from about 30 m to 100 m.

Wells are restricted to the banks of the Omaruru and Khan rivers and their larger tributaries. Dams are not common and are only used to reinforce boreholes; they cannot be considered permanent sources of water.

Pipelines are commonly used to distribute water from existing sources.

2.4.3.2 SOIL UTILIZATION PATTERN

a) Physical data

Planimetric surface area	522 000 ha
Total surface area of surveyed area	520 000 ha
Number of farms	95
Number of farming units	77
Average farm size	5 473 ha
Average size of farming units	6 753 ha

The distribution of farming units according to size is as follows (percentage of total number of farming units):

3 000 ha and smaller	5,2 %
3 001 to 4 000 ha	5,2 %
4 001 to 5 000 ha	16,9 %
5 001 to 6 000 ha	36,4 %
6 001 to 7 000 ha	11,7 %
7 001 to 9 999 ha	6,5 %
9 001 to 11 000 ha	11,7 %
11 001 to 15 000 ha	5,2 %
15 000 ha and larger	1,3 %
Average number of camps per farming unit	19
Average camp size	355 ha

The distribution of camp sizes is as follows:

250 ha and smaller	20,0 %
250 to 399 ha	33,3 %
400 to 599 ha	33,3 %
600 to 799 ha	10,0 %
800 ha and larger	3,3 %

All camps are provided with water.

Number of farming units with jackal-proof fencing 5

b) Cultivated fields

Agronomy is not practiced in this subregion.

c) Livestock farming

Due to the nature of the natural vegetation of this subregion, optimal soil utilization can only be achieved if cattle as well as sheep are kept. On farms with sufficient shrubs, additional income can be generated from goat farming.

The ratio of cattle to sheep varies from farm to farm and is determined by a variety of factors, the personal preference of the farmer being the most important. Other factors determining the cattle : sheep ratio, are topography, condition and nature of the natural pastures, availability of reasonable camps and the presence of predators.

Since some shrubs that are not browsed by cattle or sheep, are utilized by goats, goat farming can generate additional income. The number of goats in this area is however very low; most of the goats are the property of non-white labourers.

According to a survey, the average livestock ownership per farmer in this area is 337 cattle, 1104 sheep and 169 goats (calves, lambs and kids included). The

average cattle : sheep : goat ratio therefore is 1 : 3,3 : 0,51. The large stock : small stock ratio varied from 1 : 550 to large stock only.

It is estimated, that 25 % of the farmers are exclusively or chiefly cattle farmers, 25 % are exclusively or chiefly small stock farmers. The remaining 50 % of the farmers generate considerable income from both. Only 8% of the farmers generated significant income from goats.

d) Uneconomical farming units

For this area, with a carrying capacity of 2,5 ha / S.A.U. (or 15 ha / L.A.U.), ± 3000 ha can be considered an uneconomical farming unit. Some units with a surface area between 3000 and 4000 ha can also be classified as uneconomical.

Of the eight farming units smaller than 4000 ha, three belong to part-time farmers. One unit belongs to a farmer owning another unit of 5000 ha. Only four units smaller than 4000 ha belong to full-time, bona-fide farmers with no other property. Uneconomical units therefore are not a significant problem in this subregion.

2.4.3.3 HUMAN RESOURCES

a) Ethnic grouping

Afrikaans speaking farmers	50 %
German speaking farmers	50 %

b) Education

Despite the relative high average age of the farmers, their average level of education compares favourably with that of other farming communities.

Farmers in this region on average had 11 successful years of schooling. Only 20 % of farmers had less than 10 years and 12 % less than 8 years of school education. The high level of education may diminish the negative effect of high age on acceptance of new practices.

c) Age distribution

The percentage of farmers in the following age groups:

30 years and younger	0,0 %
31 to 40 years	21,0 %
41 to 50 years	24,0 %
51 to 60 years	24,0 %
61 to 70 years	21,0 %
71 years and older	9,0 %

The average age of the farmers is 52,6 years. It should be noted that 54 % of the farmers are older than 50 years, while 78 % are older than 40 years.

2.4.3.4 PRESENT PRACTICES

a) Veld management

It was found that 20 % of the farmers use a fast rotating system, while 25 % manage their pastures with a two to four camp system.

Due to the absence of the necessary physical facilities, most farmers are not able to implement a refined, fast rotating system. In many cases, farmers make new camps with the aim of creating more herds. The problem regarding physical facilities, is reflected in the following:

Farmers with	
0 - 3 camps	0,0 %
4 - 9 camps	13,3 %
10 - 14 camps	46,7 %
15 - 19 camps	3,3 %
20 - 24 camps	10,0 %
25 - 29 camps	6,7 %
30 camps and more	19,9 %

This shows that 60 % of farmers have less than 15 camps. Taking the needs of individual herds into consideration, this means that these farmers cannot implement a four camp system for all their herds.

b) Stocking rate

The average stocking rate in this subregion is 1 L.A.U. per 12,3 ha or 1 S.A.U. per 2,0 ha (lambs and calves taken as full units). The recommended carrying capacity for this area is 1 L.A.U. per 15 ha or 1 S.A.U. per 2,5 ha.

c) Other cattle farming practices

Average calving percentage	66 %
Average number of cows per bull	30
Farmers that do not implement a definite mating season	45 %
Farmers keeping records	20 %
Farmers eliminating cows of 12 years	

or older	25 %
The average herd composition is as follows (as a percentage of the total):	
Bulls	1,2 %
Cows	35,0 %
Heifers, not mated	11,0 %
Calves, up to 11 months	23,1 %
Oxen, 12 - 24 months	11,6 %
Oxen, 25 - 36 months	14,2 %
Oxen, older than 3 years	3,9 %

The average cattle:sheep:goat ratio is 1 : 3,3 : 0,5.

Cattle farmers	25 %
Sheep farmers	25 %
Both	50 %

d) Sheep farming practices

Average number of ewes per ram	35,7
Farmers not implementing a definite mating season (On 60 % of the farms, the main mating season occurs too late.)	30,0 %
Farmers supplying stimulating feed	15,0 %
A large percentage of farmers have their ewes mated for the first time at an age of 10 to 12 months.	
The average replacement figure is adequate.	
Farmers implementing an efficient method of selection (keep records)	36 %
Farmers implementing a fair method of selection (use ear marks of different colours)	48 %

The average composition of karakul flocks is as follows:

	Number	Number as S.A.U.	% of flock (S.A.U.)
Rams	17	17,0	1,7
Productive ewes	583	583,0	59,2
Female lambs	112	112,0	11,4
Lambs, birth to weaning	103	41,2	4,2
Lambs, weaning to 12 mths.	96	38,4	3,9
Young ewes, not mated	88	88,0	8,9
Redundant ewes and wethers	105	105,0	10,7

2.4.4 UGAB MOPANE SAVANNA (D4)

2.4.4.1 ENVIRONMENTAL FACTORS

a) Climate

The average annual rainfall is about 320 mm. This figure should be representative for the subregion, since there is no significant deviation in practice. What is however important is the large variation in rainfall between years. From October to December only 21 % of the total precipitation occurs, the rest during January to April.

Average maximum temperature	29,8° C
Average minimum temperature	12,4° C
Absolute maximum temperature	39,6° C
Absolute minimum temperature	4,4° C

Winters generally are mild and frost occurs only sporadically.

b) Soil types

There is considerable variation in this subregion as far as soil types are concerned.

On top of the terraces, shallow soils with surface limestone and grey turf are found. A few dolomite ridges occur. The valleys below the terraces on both banks of the Ugab River, consist of deep, grey turf. Surface limestone occurs throughout the area. Mica, weathered sandstone and dolomite also occur.

c) Topography

Location: between longitude 15,1° to 16,1° east and latitude 20,1° to 20,5° south.

This subregion is characterized by a plateau in the north that is about one to two farms wide and extends aobut 80 km westwards from the eastern border. (This plateau covers about 16 % of the subregion). The terraces with perpendicular cliffs of 30 meter height or more, divide the plateau and the Ugab valley. This valley extends westwards from the estern border over the entire subregion and represents 22 % of the total surface area. Towards the south, the valley borders on a dolomitic mountain range. The non-perennial Ugab River crosses this valley. The Erundu River is the largest tributary to the Ugab, other tributaries vary in size. (The Ugab River has its source in the western part of the Otavi district and flows toward the Atlantic Ocean).

In the western third of the subregion, dolomitic ridges and mountians are more prominent, but large plains still occur. The rest of the area, the southern third, is mainly hilly.

The entire subregion is characterized by steep slopes and therefore vulnerable to erosion. On the farms Rondehoek, Bosryk, Rustig and Elberret erosion is severe and dongas are already present.

c) Vegetation

Trees and Shrubs

Colophospermum mopane in its tree and shrub form is dominant over the entire subregion, especially in its shrub form it often forms dense stands. On top of the terraces, Terminalia prunioides, Dichrostachys cinerea, Combretum apiculatum predominate. Acacia reficiens and Catophractes alexandri are fairly common.

In the valley Acacia reficiens is most common, forming thickets on quartzite soils. Acacia mellifera subsp. detinens is less common. On calcareous soils, Grewia flava and Catophractes alexandri are found. Along the rivers, Combretum imberbe grows with Acacia albida in the river bed. Especially in quartzite soils in the southern parts, Acacia reficiens forms dense thickets. This bush encroachment together with the shallow soils, complicates recovery of the veld. Quartzite soils are however only found in a relatively small part of the subregion. Colophospermum mopane and Acacia reficiens can be considered to be the most significant encroaching species. osphaera bainesii and Justicia genistifolia are the most important fodder shrubs.

Grass cover

The most common pioneer grasses are Eragrostis porosa, Enneapogon cenchroides, Enneapogon brachystachyus, annual Stipagrostis and Aristida species. On farms participating in the Stock Reduction Scheme or of conservation conscious farmers, Stipagrostis uniplumis occurs in fair amounts. Stipagrostis hochstetterana also occurs widespread but rarely. Generally, this area is in a pioneer stage.

Where surface limestone occurs, Triraphis ramosissima and Fingerhuthia africana can be found, especially in the areas above the terraces. The first grass species is the more common one. Above the terraces and in the dolomitic ridges, Anthephora pubescens is found in small numbers. Another rare grass seen in this area is Setaria appendiculata.

Cenchrus ciliaris occurs over the entire area, but not prominently. On the banks of the Ugab River, Panicum maximum occurs in fairly dense stands. The climax stage of succession in this area should consist of species like Anthephora pubescens, Triraphis ramosissima, Setaria appendiculata, Cenchrus ciliaris, Stipagrostis uniplumis.

In a survey to determine basal rooted cover, the following results were obtained:

Perennial grasses	0,25 %
Other perennials	0,05 %
Annual grasses	0,00 %
Other annuals	0,00 %

This survey was done on a farm in the Ugab valley and is based on one camp only.

e) Sources of water

Boreholes are the major source of water for livestock. In addition, a number of fountains occur, but their output generally is low and many cease flowing late in the year. The two fountains on Tsumamas and Naachaams with an output of 70 m^3 per hour are exceptions. The output of boreholes varies a lot from low to high. The underground water level varies between 25 and 80 m. There are small areas where underground water is difficult to find and obtain; where water is found, it often is unfit even for livestock use. This is the situation mainly in the south easten part of the valley. Fortunately the farms with these problems have one to three successful boreholes. Pipelines are commonly used to distribute water.

Earth dams do not play an important role in water supply and only few occur.

2.4.4.2 SOIL UTILIZATION PATTERN

a) Physical data

Planimetric surface area	466 000 ha
Total surface area of surveyed area	318 000 ha
Number of farms	75
Number of farming units	72
Average farm size	4 241 ha
Average size of farming units	4 418 ha

The distribution of farming units according to size is:

Size (ha)	Frequency	% of total farm units
500 - 2 000	3	4,3
2 000 - 3 000	10	13,9
3 001 - 5 000	15	20,8
5 001 - 7 500	36	50,0
7 501 - 10 000	4	5,5
10 001 - 15 000	4	5,5
15 001 - 20 000	0	0,0
20 001 plus	0	0,0

Average number of camps per farming unit 26,6
Average camp size 231 ha
(These figures were obtained from a survey where the average size per farming unit was 6144 ha).

All camps are provided with water. Pasture management corridors do not occur.

Number of camps:
smaller than 100 ha 16,5 %
larger than 100 ha 83,5 %

b) Cultivated fields
In the past, there was some optimism towards cultivation of cash crops and mainly maize was planted on some farms. This practice has ceased. The total surface area of old fields is estimated at 300 ha.

c) Livestock farming
The composition of livestock in the subregion is as follows:
Cattle 17,0 % of total stock

Sheep	73,5 % of total stock
Goats	9,5 % of total stock

(1 L.A.U. = 6 S.A.U.)

Karakul farming for the production of pelts, is the most important activity.

d) Uneconomical units

At least 18,2 % of the farming units can be described as uneconomical.

2.4.4.3 HUMAN RESOURCES

a) Ethnic grouping

Farms owned by	
German speaking farmers	12,0 %
Farms owned by	
Afrikaans speaking farmers	88,0 %
Total surface area owned by	
German speaking farmers	14,0 %
Total surface area owned by	
Afrikaans speaking farmers	86 %

b) Education

Only 4,2 % of the farmers had formal tertiary training in agriculture.

c) Age distribution

The percentage of farmers in the following age groups:

20 - 24 years	0,0 %
25 - 29 years	5,3 %
30 - 34 years	1,8 %
35 - 39 years	8,7 %

40 - 44 years	19,2 %
45 - 49 years	12,2 %
50 - 54 years	21,0 %
55 - 59 years	12,9 %
60 - 64 years	7,0 %
65 - 69 years	5,3 %
70 - 74 years	5,3 %
75 - 79 years	0,0 %
80 - 84 years	1,8 %

The average age of the farmers in this subregion is 49,8 years.

d) Communication pattern

The active farmer's association of this area serves as a good contact point to disseminate information. This association meets regularly and an annual farmer's day is organized where competitions are held.

The most important news media received by farmers in this area are "Landbouweekblad", "Die Suidwester", "Die Suidwes-Afrikaner" and to a lesser extent "Allgemeine Zeitung". Newsletters with agricultural content are issued quarterly by the Soil Conservation Committee to every farmer.

2.4.4.4 PRESENT PRACTICES

Since karakul farming is the main activity in this area, only practices pertaining to karakul farming are mentioned here.

40 - 44 years	19,2 %
45 - 49 years	12,2 %
50 - 54 years	21,0 %
55 - 59 years	12,9 %
60 - 64 years	7,0 %
65 - 69 years	5,3 %
70 - 74 years	5,3 %
75 - 79 years	0,0 %
80 - 84 years	1,8 %

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d) Communication pattern

The active farmer's association of this area serves as a good contact point to disseminate information. This association meets regularly and an annual farmer's day is organized where competitions are held.

The most important news media received by farmers in this area are "Landbouweekblad", "Die Suidwester", "Die Suidwes-Afrikaner" and to a lesser extent "Allgemeine Zeitung". Newsletters with agricultural content are issued quarterly by the Soil Conservation Committee to every farmer.

2.4.4.4 PRESENT PRACTICES

Since karakul farming is the main activity in this area, only practices pertaining to karakul farming are mentioned here.

Fertility and related practices:

Average lambing percentage 119 %

No. of ewes/ram	% farmers	Av. lambing %
33 and less	50	132,4
34 to 40	40	103,5
41 and more	10	94,0

Implementation of a mating season:		
yes	70	123,0
no	30	103,3

Where mating seasons are implemented, it seems that they are not well planned.

Average number of camps available to ewe flock during mating season:

6 or more	20
4 to 5	30
2 to 3	50
1	0

Average number of flocks during mating season 4,7

Mating system used:		
Rams mate only in evenings and at night	0	-
Half of rams in, half out	50	120
All rams with ewes at all times	50	118

Farmers using:	
Teasers	0
Manual mating	0
Normal flock mating	100
Farmers:	
with shepherds	30
without shepherds	50
both	20
Farmers:	
removing tails	
not removing tails	

Animal nutrition:

Average amount of supplementary feed per day 846 g

Supplementary feed consists of a good source of energy. Farmers supplied feed to rams in the following categories:

None	0 %
100 - 249 g/day	10 %
250-499 g/day	10 %
500 g/day +	80 %

Average stocking rate:

According to total number of S.A.U.'s (A)	2,4 ha/S.A.U.
According to total number of S.A.U. x 0,8 (B)	3,1 ha/S.A.U.

Farmers implementing a stocking rate of:

According to (A):	
1 - 1,9 ha/S.A.U.	20 %
2 - 2,9 ha.S.A.U.	40 %
3 ha/S.A.U. +	40 %

According to (B):

1 - 1,9 ha/S.A.U.	0 %
2 - 2,9 ha/S.A.U.	40 %
3 ha/S.A.U. +	60 %

Production:

Number of pelts per 100 ha	26,8

Herd management:

Average percentage composition of livestock per farm:

Cattle	17,0 %
Sheep	73,5 %
Goats	9,5 %

6 S.A.U.'s = 1 L.A.U. All cattle was converted to S.A.U. and the percentage of the total calculated.

Replacement percentage in ewe flocks:

Farmers replacing	
0 - 9 %	40 %
10 - 14 %	20 %
15 - 20 %	40 %
Average replacement percentage	14,4 %

Farmers with identification system for livestock:	
Yes	10 %
No	90 %

Farmers than cannot determine by means of their system, which ewes have skipped lambing	60 %

Selection system:

Farmers that implement:	
Selection by some set standard	70 %

Keep first female lambs up to desired replacement percentage	20 %
Cull best pelts for market	10 %
No particular system	0 %

Farmers keeping lambs during the following periods:

Throughout the year	30 %
January to April	20 %
May to June	10 %
July to August	10 %
October to December	0 %
January to March and June to July and October to December	10 %
June and October	10 %
January/February and June/July/August and October to April	0 %

47,8 % of farmers that have ewes mated throughout the year, keep lambs for replacement over a period of only two months.

Farmers supplying supplementary feed to weaners	30 %

67 % of the farmers that supply feed, also implement a definite mating season.

Licks:

Farmers supplying good lick in winter	60 %
fair lick in winter	30 %
poor lick in winter	10 %
no lick at all	0 %

Animal health:

Farmers that dipped sheep during the past year:

twice	20 %
once	50 %
never	30 %

Sheep are dipped mainly during the periods Fabruary to May and August to November.

Farmers that dosed their sheep during the past year:

three or more times	20 %
twice	80 %
once	-
never	-

Farmers that dosed their suckling lambs during the past year:

three times	0 %
twice	30 %
once	50 %
never	20 %

All farmers use modern remedies available on the market.

Vaccination against bluetongue:

yes	50 %
no	50 %

Vaccination during August/September, October/November, December/January and February/March.

Vaccination against pulpy kidney:

yes	100 %
no	0 %

Vaccination against Pasteurellosis:	
yes	40 %
no	60 %
Vaccination against Rift Valley Fever:	
yes	70 %
no	30 %
Vaccination against Wesselsbron disease:	
yes	0 %
no	100 %
Vaccination against anthrax:	
yes	0 %
no	100 %
Rams vaccinated against contagious abortion:	
yes	70 %
no	20 %
unknown	10 %
Ewes vaccinated against contagious abortion:	
yes	30 %
Ewes vaccinated against enzootic abortion:	
yes	0 %
Female lambs vaccinated against contagious abortion:	
yes	50 %
Female lambs vaccinated against enzootic abortion:	
yes	0 %
Farmers having rams examined for abnormalities of genitals:	
yes	50 %
personally done	20 %
no	30 %

Farmers where known cases of abortion occured: 70 %

(The number of abortions per farm are minimal. Where abortions occured, lambs were burned. Not one of the farmers took samples to the veterinarian for examination).

Other management practices:

What happens to old ewes ?

market	10 % of farmers
leave to die	80 % of farmers
sell privately	10 % of farmers

How were rams obtained?

all bought	40 % of farmers
bred	10 % of farmers
both	50 % of farmers

Farmers keeping ewes in spare camp during mating season: 100 %

Physical development of farms:

Average size of farming unit	6144 ha
Average number of camps per unit:	
larger than 100 ha	22,2
smaller than 100 ha	4,4
total	26,6
Average camp size	231 ha

Pasture management:

Farmers were classified in the following categories:

good pasture management system	21 %
fair system	34 %
poor system	45 %

2.4.5 CENTRAL WESTERN THORNBUSH SAVANNA (D5)

2.4.5.1 ENVIRONMENTAL FACTORS

a) Climate

The entire subregion is situated in a summer rainfall zone. There is considerable variation in total precipitation in the area generally with an increase towards the east.

The longterm average annual rainfall figures for towns in this subregion are:

Omaruru	297 mm
Wilhelmstal	352 mm
Okahandja	371 mm

Rainfall varies considerably between years. During the period 1 July 1962 to 30 June 1972, 144 % to 23 % of the average rainfall occured.

The most important months as far as rain is concerned are January to March; 76,6 % of the total occurs then.

The distribution of rainfall, as a percentage of the total annual average, is as follows:

May to September	1,9 %
October to December	16,6 %
January	24,9 %
February	20,3 %
March	27,4 %
April	8,9 %

Summers in this area are hot with mild winters. Severe frost sometimes occurs in the low-lying parts like for instance the river banks. Slight frost occurs during a few nights each winter.

b) Soil types

The main type of parentrock in this subregion is granite (Salem granite) and products of granite. Dolomite (of the Khomas Series) and other formations like quartzite and schist occur in the area but are not restricted to certain locations.

The depth of topsoils varies from very shallow on hills and ridges to fairly deep in valleys and plains. Along banks of large rivers, deep alluvial soils are found.

The nature of the parent rock and the semi-arid climate, causes the soils to be strongly alkaline and rich in mineral nutrients.

c) Topography

Location: between latitude 21,3° to 22,4° south and longitude 15,9° to 16,9° east.

The topography of the terrain varies considerably from mainly flat to mainly hilly. On most farms the terrain varies from plains to hilly areas to ridges. No significant mountains occur in this subregion and the total surface area of farms can usually be utilized for grazing.

A small area in the northwestern part is drained by the Omaruru River and its tributaries. The central parts are drained by the Khan River and its tributaries, while the southern and extreme eastern parts are drained by tributaries of the Swakopriver.

Due to the nature of the topography, run-off water can cause severe erosion, especially if basal vegetation cover is in a poor condition.

d) Vegetation

The vegetation of this subregion is described by Giess(1971) as Thornbush Savanna or Tree and Shrub Savanna. Vegetation in this area varies, but typically consists of grassveld with trees and larger shrubs in dense or sparse groups of differing size. Large parts of this subregion are dominated by Acacia species and bush encroachment by Acacia mellifera subsp. detinens causes problems over large areas. Other typical species are Acacia reficiens, Acacia hebeclada, Acacia fleckii, Acacia erubescens (in the western regions). Acacia erioloba occurs mainly on the banks of large rivers. Boscia albitrunca usually occurs on plains where it can be quite common. On sandy soil, Lonchocarpus nelsii may be found toghether with Acacia fleckii. Combretum apiculatum is restricted to ridges and hills while Ziziphus mucronata is widespread in the subregion.

Where natural pastures are in good condition, the following perennial grasses predominate: Cenchrus ciliaris, Eragrostis superba, Schmidtia pappophoroides, Cymbopogon plurinodis and Brachiaria nigropedata in plains with farily deep sandy loam soils.

counter these defficiencies can maintain good condition in their livestock so that it can be marketed directly off the veld throughout the year.

e) Sources of water

This subregion depends entirely on underground sources for its water supply. Boreholes are most important on all farms in supplying water, while wells, mainly on banks of the larger rivers, contribute significantly to water supply on only a few farms. The level of the water table varies considerably in this area. Boreholes deeper than 100 m are seldom, the average depth being between 30 and 60 meter.

Sand retaining dams and earth excavation dams are common, but hardly ever have a capacity exceeding 20 000 m^3 and are not perennial. Plastic pipelines are used to distribute water to watering points.

2.5.4.2 SOIL UTILIZATION PATTERN

a) Physical data

The total surface area of the subregion is 482 000 ha (to the nearest 1000 ha). There are 91 surveyed farms in the area, constituting 78 farming units of which:

73 have only 1 owner
2 have 2 owners
1 has 4 owners
1 is owned by a municipality
1 is owned by a missionary company

The average size of surveyed farms is 5296 ha, while the average size of farming units is 6179 ha. The distribution of farming units according to size is as follows:

	Frequency	% of total
smaller than 2 000 ha	7	8,97
2 000 - 2 999 ha	9	11,54
3 000 - 3 999 ha	8	10,26
4 000 - 4 999 ha	13	16,67
5 000 - 6 999 ha	22	28,20
7 000 - 8 999 ha	7	8,97
9 000 - 10 999 ha	4	15,30
larger than 11 000 ha	8	10,26
TOTAL	78	100,0

Six of the seven farms smaller than 2 000 ha belong to non-bona fide farmers while four of the eight units larger than 11 000 ha are owned by more than one individual.

Measured against the present price/cost structure, units smaller than 3 000 ha must be considered uneconomical. 20,51 % of the total number of farming units in this subregion therefore are uneconomical - quite a significant figure. On units of 3 000 - 4 000 ha, an above average level of management has to be applied to make these units economical.

The average number of camps in this area is 17,9. This makes the average camp size 345,2 ha. (Survey done in 1974: 37 farming units = 47,4 % sample size).

The distribution of camp sizes in 1974 was as follows:

Size	% units
smaller than 100 ha	4,54
100 - 199 ha	13,64
200 - 299 ha	9,09
300 - 399 ha	18,18
400 - 599 ha	31,82
600 - 799 ha	13,64
larger than 800 ha	9,09

Optimal utilization of grazing will be hampered in this subregion, since 23 % of farmers have an average camp size of 600 ha or more and almost 55 % of the farmers have camps on average larger than 400 ha.

b) Cultivated fields

Agronomy and cultivation of pastures are not generally practised in this area because of the low rainfall. No significant income is generated by agronomic activities.

c) Livestock farming

Extensive cattle farming for the production of beef is the major farming activity in this subregion. Karakul farming is restricted to the western parts, but even there it plays a minor role.

Goats generate mentionable income only on a few farms. Most goats in this area are the property of non-white labourers.

The average livestock ratio on famrs in this subregion is:

1,00 cattle : 0,43 sheep : 0,18 goats

The average number of livestock per farming unit were found to be :
475 cattle + 206 sheep + 86 goats.

Karakul farming is an important activity on 30 % of farms, but cattle farming still is the main source of income.

2.4.5.3 HUMAN RESOURCES

a) Ethnic grouping
Since this subregion was one of the first regions in South West Africa where white farmers settled and all farms here had been surveyed and issued during the German colonial era i.e. before 1918, the original owners were predominantly of German origin. Even though a number of farms have been sold to Afrikaans speaking farmers in the meantime, the majority is still in posession of German speaking farmers.

At present the following ethnic distribution is found:

German speaking farmers	64 %
Afrikaans speaking farmers	32 %
Others, including companies	4 %

b) Education
The average level of education of farmers in this subregion compares favourably with that of farming communities elsewhere in S.A. and S.W.A.

The percentage distribution of successful education of farmers in this subregion is as follows:

less than 8 years of schooling	18,4 %
8 to 10 years of schooling	37,8 %
11 to 13 years of schooling	43,8 %

(13 years of schooling = "Abitur", the highest level according to the German system)

tertiary training, not agricultural	6 %
tertiary training, agricultural	12 %
Average number of years of schooling	10,6 years

c) Age distribution

The average age of farmers in this subregion is 55 years with the following distribution:

20 to 30 years	4,2 %
31 to 40 years	16,7 %
41 to 50 years	25,0 %
51 to 60 years	22,5 %
61 to 70 years	23,3 %
71 years and older	8,3 %

The average age of these farmers seems to be higher than that of farmers elsewhere in S.W.A. or S.A. Furthermore it should be significant that more than 50 % of the farmers in this area are older than 50 years.

Since it has been proven that with increase in age, the resistance to accept new practices also increases, this may be a negative factor in this subregion.

2.4.5.4 PRESENT PRACTICES

a) Veld management

A survey done in 1974 gave the following results:
(n = 37 = 47,4 % sample)

i) Number of camps

The average number of camps per farming unit was 17,9 with the following distribution:

	% farmers
0 - 3 camps	0,00
4 - 9 camps	13,51
10 - 14 camps	24,32
15 - 19 camps	27,03
20 - 24 camps	21,62
25 - 29 camps	8,11
30 or more camps	5,41

ii) Camp size

The average size of camps was 345,2 ha with the following distribution:

Average camp size	% of total units
smaller than 100 ha	5,41
100 - 199 ha	13,51
200 - 299 ha	10,81
300 - 399 ha	18,92
400 - 599 ha	29,73
600 - 799 ha	13,51
larger than 800 ha	8,11

iii) Camps per herd

The average number of camps per herd in the rainy season was 3,9 with the following distribution:

	% farmers
less than 3 camps / herd	48,65
4 - 5 camps / herd	29,73
6 - 7 camps / herd	13,51
8 and more camps / herd	8,11

Some of the factors hampering optimal veld utilization in this area are:
A large percentage of farmers have a shortage of camps which therefore complicates the implementation of sophisticated pasture management techniques. (Almost 38 % of the farmers have less than 15 camps on their farms, while antoher 27 % have less than 20 camps).

The average camp size is too large on many farms which does not allow optimal utilization of grazing. (The average camp size on 22 % of farms was 600 ha or larger while another 30 % of farmers have camps between 400 and 599 ha in size).

A large percentage of farmers have too many herds or too few camps to follow a 4-camp system in the rainy season. (alomost 50 % of farmers have less than 4 camps per herd during the rainy season).

It has furthermore been established that:
Only about 25 % of farmers in this subregion implement a definite and effective grazing system. 60 % of farmers implement some system but do not purposefully apply it. The pasture management systems of almost half of the farmers in this area must be described as poor. About 15 % of the farmers in this area do not implement any system.

b) Stocking rate
The average stocking rate in this area during 1974 was as follows:
475 cattle + 206 sheep + 86 goats on 6179,5 ha = 7,7 cattle + 3,3 sheep + 1,4 goats on 100 ha.

Given that 1 L.A.U. = 6 S.A.U.:
number of cattle x 1,0 = number of L.A.U.
number of sheep x 0,8 = number of S.A.U.
number of goats x 1,0 = number of S.A.U.
the following stocking rate can be calculated:
7,7 L.A.U. + 3,04 S.A.U. on 100 ha or 8,21 S.A.U. on 100 ha or 12,18 ha per L.A.U. or 2,03 ha per S.A.U.

The official carrying capacity varies from 12 ha per L.A.U. to 15 ha per L.A.U. in the southwestern parts. Compared to these figures, it seems that the actual stocking rate generally is not exceeded.

Pasture management has to be improved however to maintain these stocking rates without adverse effect on the natural pastures.

c) Marketing pattern
The majority of farmers in this area market livestock directly from the veld without supplying any significant supplementary feed. The practice of rounding off of oxen prior to marketing, has never been accepted in this area. The price of cereal products makes the rounding off of cattle an expensive practice and can only be successfully implemented if distances to abbatoirs are short and if the farming practice is large enough.

A few farmers from time to time use supplementary feed to round off cattle for early marketing. This practice is only applied to some of their cattle to be marketed. Reliable figures are not available. Available information however seems to indicate that:

i) about 10 % of all marketable cattle is marketed at an age of 18 months or younger. These young animals usually have received some form of supplementary feeding. The majority of animals in this group however are heifers and young oxen that are marketed alive on public auctions.

ii) The marketing of cattle in the age group 1,5 to 2 years, contributes only minimally to the total income of farmers. Whether these animals are sold for slaughtering or live at auctions, depends on the condition of the veld at that particular time. During poor rain years, the percentage of cattle slaughtered is higher than in good rain years. It seems that the percentage of cattle of this age group that is marketed, varies from year to year between 15 and 30 % of the total number of animals marketed. During continuous dry years, this figure will be even higher than 30 %

iii) The marketing of livestock in the age group of 2 to 3 years generates the major income for farmers in this region. Where the condition of pastures is good, where good lick is provided and the quality of cattle is good, animals of this age group can be marketed directly off the veld in reasonable condition.

It can be assumed that cattle of this age group that is marketed, contributes about 50 % to the total income of farmers in this area.

iv) The marketing of cattle at an age above 3 years is luckily a decreasing practice. Cows that are too old or are eliminated because of poor breeding performance will of course always be part of this group of animals to be marketed.

A significant number of farmers, about 30 - 35 %, market the majority of oxen and eliminated heifers at an age of 3 years or above. This practice cannot be recommended.

d) Herd management

The basic requirements for good herd management are:

i) Effective selection in breeding herds. This includes the elimination of cows with poor reproductive characteristics and the effective selection of heifers as replacements.

ii) To implement effective selection, an effective identification system and applicable records on individuals in the breeding herd have to be available.

iii) The age at which heifers are mated for the first time, should not be too high. Ideally, heifers should be mated at 18 months of age.

iv) The implementation of correct mating seasons. In this area a double mating season can be recommended, viz. from February to April and July to August.

v) Sufficient bulls should be kept. Depending on several factors, between 3 and 4 % of the breeding herd should consist of bulls.

vi) Cows should be eliminated from the breeding herd at an age of 8 to 9 years. This will diminish the negative effect of reduced reproductive capacity and make use of the genetic advantage of shorter generation intervals.

If present practices are measured against the above norms the following categories can be established:

Practice	% farmers		
	good	fair	poor
i) selection of cows	22	53	25
ii) identification of cows	28	44	28
iii) mating age of heifers	22	33	45
iv) implementation of recommended mating seasons	25	40	35
v) % of bulls	56	28	26
vi age of cows at elimination	32	30	38

Generally, the basic and essential herd management practices in this subregion can be much improved on.

As far as karakul management practices are concerned, the following requirements can be recommended for this area:

i) Effective selection in breeding herds.

ii) An organized identification system for individuals as well as effective record keeping are a prerequisite for good selection.

ii) The age of young ewes at first mating, has to be controlled. Where good grazing is available and where other management practices are of a high standard, ewes should be mated at an age of not more than 12 - 13 months.

To decrease this age, good results were obtained on research stations and on progressive farms, by supplying supplementary feed to lambs before and after weaning, and weaning lambs at an early age. Where this practice is implemented wisely, it can be profitable even though extra expenses are incurred.

iv) Mating seasons have to be implemented sensibly. Mating seasons will not increase lambing percentage, but are necessary for organized and planned managment.

The following mating seasons can be recommeded for karakul sheep in this subregion:
A main mating season from about the middle of November to the middle of February, or the beginning of November ot the end of January.

An additional mating season of about six weeks from the middle of June to the end of July.

To obtain sufficient successfull matings during the first weeks of the main mating season, the ewes will have to be supplied with stimulating feed. Under natural conditions, the first matings will only occur after the first significant rains were received, i.e. in January or February.

The main lambing season will then be from June to July. Since environmental conditions late in winter are unfavourable for the raising of lambs, ewes that gave birth in June to August, will under natural circumstances only be receptive again in the following rainy season.

v) Two to three rams to every 100 receptive ewes are necessary to maintain satisfactory lambing percentages. Where camps are relatively small and other management practices are of a high standard, 2 % rams per breeding flock can be sufficient. More rams should be kept if farming is more extenstive.

vi) Ewes should be eliminated from breeding flocks at a maximum age of 8 years. This will decrease the effect of decreased reproductive capacity with increased age and makes use of the advantage of shorter generation intervals.

Practice	% farmers good	fair	poor
i) Effective selection of breeding flock	22	50	28

ii)	Effective identification and good records on breeding flock	24	60	16
iii)	Age at first mating	20	45	35
iv)	Implementation of recommended mating seasons	35	40	25
v)	Ram/ewe ratio	45	30	25
vi)	Age of ewes at elimination	15	40	45

Mating age: up to 12 months = good
13 - 15 months = fair
16 months and older = poor

Mating seasons: as recommended = good
unfavourable = fair
throughout year = poor

Ram/ewe ratio: more than 2,5 % = good
2 - 2,5 % = fair
less than 2 % = poor

Elimination age: up to 8 years = good
9 - 10 years = fair
11 years to death = poor

2.4.6 SPATZENFLED CAMELTHORN SAVANNA (D6)

2.4.6.1 ENVIRONMENTAL FACTORS

a) Climate

The average annual rainfall varies from 250 mm to 350 mm. Distribution of rainfall through the year is as follows:

September	1,1 %
October	3,1 %
November	7,7 %
December	11,6 %
January	17,9 %
February	24,1 %
March	22,5 %
April	8,8 %
May	1,7 %

Summers are generally very hot with an evaporation rate of 3100 to 3500 mm. Frost occurs almost every year during winter.

b) Soil types

The soil consists mainly of shallow sand or loam with limestone substrate. Along the Nossob Rivers the soil consists mainly of granite and limestone.

c) Topography

Location: between latitude 22,8° to 23,2° south and longitude 17,5° to 20° east.

The altitude is 1500 meter above sea level.

The terrain is flat to slightly hilly and soil erosion by water run-off is limited.

d) Vegetation

Trees and Shrubs

This area can be described as an open savanna with scattered occurences of Acacia erioloba. Where the natural balance has been disturbed, Acacia mellifera subsp. detinens occurs.

The most important shrubs in this area are Grewia flava, Catophractes alexandri, Acacia karroo and Acacia haematoxylon.

Grass cover

At present Stipagrostis uniplumis is the dominat grass species, but Digitaria eriantha, Anthephora pubescens, Brachiaria nigropedata, Schmidtia pappophoroides and Cenchrus ciliaris should be the dominant climax species. Stipagrostis obtusa and a variety of Aristida species are also found.

The pastures are palatable and have high nutritional value.

e) Sources of water

Boreholes are the major source of water in this sub-region. They are perennial. The water of some boreholes has a high nitrate content. During 1973/74, a good rainy season, some boreholes became unfit for human and livestock use and caused some livestock losses.

2.4.6.2 SOIL UTILIZATION PATTERN

a) Physical data

Planimetric surface area	871 000 ha
Total surface area of surveyed area	564 000 ha
Number of farms	
(5 are unplanned)	117
Number of farming units	103
Average size of farms	4 820 ha
Average size of farming units	5 475 ha

b) Cultivated fields

The soil and climate are not suitable for agronomic activities.

c) Livestock farming

The most important activities are cattle and sheep farming. The ratio between cattle and sheep varies from farm to farm and can be one third cattle with two thirds sheep to two thiRds cattle and one third sheep.

The higher the rainfall in the subregion, the more cattle is kept. Karakul sheep are the most important breed, but recently Droper sheep have been introduced.

2.4.6.3 HUMAN RESOURCES

a) Education

The educational situation is as follows:

	% farmers
less than 9 years of education	36,7
10 years of education	23,5
11 to 12 years of education	32,5

more than 12 years of education	7,3

The average education lasted 10,3 years.

Experience in farming varies form 5 to 47 years. More than 58 % of the farmers have more than 15 years of experience. The possibility therefore exitsts that dated, established opinions and practices will be difficult to change.

b) Age distribution

The percentage of farmers in the following age groups are:

35 years and younger	10,5 %
36 to 40 years	23,5 %
41 to 45 years	24,5 %
46 to 50 years	11,3 %
51 to 55 years	16,0 %
56 to 60 years	5,7 %
61 years and older	8,5 %

c) Extent of reading and course attendance

The extent of reading done by the farmers, indicates how eager they are to obtain new knowledge. The percentage of farmers reading agricultural magazines is as follows:

none	7,5 %
1	11,5 %
2	66,0 %
3 and more	15,0 %

Agricultural training courses are poorly attended. 46 % of the farmers did not attend any farmer's day or short course, 32 % only once and 22 % more than once.

2.4.6.4 PRESENT PRACTICES

The present practices of farmers in this area don't differ significantly from those of farmers in the neighbouring sheep and cattle farming areas. Data from these regions therefore are also applicable here.

It has been found, that during good rainy seasons, farmers acquire young oxen that are marketed at a later stage. Should the successive rainy season be poor, these oxen can easily be sold.

2.4.7 **FHFA D7**

Description: Mixed Tree and Shrub Savanna
Carrying capacity: 2 - 2,5 ha/S.A.U. or 16 - 22 kg/ha

2.4.7.1. ENVIRONMENTAL FACTORS

a) Climate
The average rainfall in the subregion varies between 200 and 250 mm per annum with the highest rainfall in the northern parts of the subregion. Rainfall occurs in isolated showers from October onwards, but the major rainfall period is from February to April. The number of rainy days per year is about 25 - 30. Temperatures vary from less than 0^{o} C to above 40^{o} C within a year.

b) Soil types
The entire subregion consists of Kalahari sand with isolated lime pans. Most of the parent rock is skale, sandstone and mudstone of the Prince Albert formation. Stretches of dolorite are also found. Soil fertility is generally good.

LEGEND:

A	-	HIGH POTENTIAL CATTLE FARMING AREA
B	-	MEDIUM POTENTIAL CATTLE FARMING AREA
C	-	ETJO CATCHMENT AREA
D	-	MIXED AREA
E	-	HIGH POTENTIAL SHEEP FARMING AREA
F	-	MEDIUM POTENTIAL SHEEP FARMING AREA
G	-	LOW POTENTIAL SHEEP FARMING AREA

A1	-	NORTHERN KALAHARI SANDVELD
A2	-	PALM PLAINS
A3	-	OTJENGA PLAINS
A4	-	OTJIWARONGO THORNBUSH SAVANNA
A5	-	OSIRE SANDVELD
A6	-	OKAHANDJA THORNBUSH SAVANNA
A7	-	GOBABIS CAMELTHORN SAVANNA
A8	-	HIGHLAND SAVANNA
A9	-	S.W.A. MAIZE TRIANGLE
A10	-	GOBABIS YELLOW-WOOD SANDVELD
B1	-	SHALLOW TURF

B2	-	WATERBERG SANDVELD
B3	-	OTJIKONDO MOPANE SAVANNA
B4	-	KALKFELD THORNBUSH SAVANNA
B5	-	OSONA
B6	-	WESTERN HIGHLAND SAVANNA
C	-	ETJO CATCHMENT AREA
D1	-	BIERMANSKOOL MOPANE SAVANNA
D2	-	KAMANJAB MOPANE SAVANNA
D3	-	OMARURU TRANSITION ZONE
D4	-	UGAB MOPANE SAVANNA
D5	-	CENTRAL WESTERN THORNBUSH SAVANNA
D6	-	SPATZENFELD CAMELTHORN SAVANNA

COMPLIED BY: DEPARTMENT OF AGRICULTURAL TECHNICAL SERVICES

c) Topography

The subregion is situated between latitude 23,7° to 24,75° south and longitude 18,8° to 20° east. The terrain is dominated by dunes and interdune valleys orientated in a NW-SE direction. Towards the west, the Nossob River constitutes the border. Soil erosion by water is not significant, but from August to October, erosion by wind causes considerable damage to pastures.

d) Vegetation

This subregion is described as Mixed Tree and Shrub Savanna of the southern Kalahari. Acacia haematoxylon, mainly in its shrubby form, is characteristic. On harder soil in the interdune valleys, mainly Rhigozum trichotomum is found. Other trees and shrubs in the area are: Acacia mellifera subsp. detinens, A. reficiens, A. hebeclada, Boscia albitrunca, B. foetida, Grewia flava, G. deserticola, Rhus tenuinervis.

Perennial grasses in undisturbed veld are: Asthenatherum glaucum, Eragrostis lehmanniana, Stipagrostis uniplumis and S. ciliata. Disturbed veld is dominated by Schmidtia kalahariensis. On dune crests, dense stands of Stipagrostis amabilis often occur. Along the Nossob River Prosopis trees are common.

e) Sources of water

Boreholes are the most important source of water. The underground water level is not excepitonally deep. Boreholes are on average 100 m deep in the area. The Nossob River does not play any significant role in the water supply of the area. No specific problems are experienced as far as water quality is concerned. The entire subregion falls within the controlled subartesian water area.

2.4.7.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Surface area of surveyed farms	689 901 ha
2. Total surface area of surveyed area	689 901 ha
3. Total number of surveyed farms	135
4. Number of farming units	86
5. Average farm size	5 110 ha
6. Average size of farming units	8 022 ha
7. Average number of camps per farming unit	34
8. Distribution of camp sizes:	
50 - 200 ha	30 %
201 - 300 ha	60 %
301 ha and larger	10 %
9. Average camp size	220 ha
10. Average number of boreholes per farming unit	4
11. Average surface area per borehole	2 005 ha
12. All camps are provided with water	

b) Livestock farming

Extensive meat and pelt production is practised. Pelt production constitutes about 30 % of small stock farming. Cattle farming makes up about 20 % of farming activities. The remainder consists of Dorper and Boer goat farming.

c) Uneconomical farming units

10 = 11,6 %

2.4.7.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	84
Number of German speaking farmers	1
Number of other farmers	1

b) Age distribution

20 - 30 years	2
31 - 40 years	27
41 - 50 years	30
51 - 60 years	14
61 - 70 years	9
71 years and older	4

c) Communication

The area is served by three farmer's associations. One T.V. club exists.

2.4.7.4 PRESENT PRACTICES

a) Veld management

In general, these farmers are familiar with the basic principles of veld management but they are not always implemented. No good scientific records are kept.

b) Stocking rate

In general, most farms are overstocked. The condition of the veld also indicates this.

c) Marketing

Small stock to be slaughtered for meat, is marketed at an age of 5-6 months at auctions and at the controlled markets. Cattle is marketed at the controlled markets at an age of $\pm$ 2 years with a carcass mass of $\pm$ 250 kg. Marketing of pelts occurs 3 times annually at the pelt auctions.

d) Other management practices

1. Reproduction

1.1 Average number of herds per farming unit	5
1.2 Average size of herds	300
1.3 Average size of herds at mating	300

1.4 Mating seasons:

Small stock farmers producing mutton - from one mating season to mating throughout the year

Karakul farmers - 3 mating seasons per year

1.5 Average lambing percentage 130 %

1.6 Average weaning percentage 120 %

1.7 Average marketing percentage 120 %

2. Flock composition

2.1 Karakul: 3 % rams
75 % ewes
15 % replacement

2.2 Dorper: 4 - 6 % rams
60 % ewes
15 % replacement

2.3 Boer goats: 3 % rams
50 % ewes
15 % replacement

3. Animal nutrition

Because of the nature of the veld, supplementation by means of lick is an integral part of animal nutrition.

4. Animal health

An intensive vaccination and dosing programme is implemented. A key-dosing once a year with a broad spectrum agent, and depending on rainfall, a further 3 dosings in between, with a single spectrum agent, are administered. Stock is regularly treated against external parasites.

2.5 HIGH POTENTIAL SMALL STOCK FARMING AREA

2.6.1 FHFA E1

Description: Mixed Tree and Shrub Savanna
Carrying capacity: 2 ha/S.A.U. or 20 - 22 kg/ha to
2,5 ha/S.A.U. or 16-18 kg/ha.

2.5.1.1 ENVIRONMENTAL FACTORS

a) Climate

The average rainfall of this area is 200 - 250 mm per annum. Rainfall is spread fairly uniformly over the entire area. The number of rainy days varies from 28 to 30 per year. Temperatures are between 0° C in winter and 40° C in summer. Frost occurs fairly seldomly.

b) Soil types

The parent rock in the western parts of the subregion consists of stretches of riolite and in the eastern parts of skale, mudstone and sandstone of the Prince Albert formation. A very large part of the subregion consists of sand dunes and calcareous interdune valleys. The dunes are not as high as those in the Kalahari. Charactersitic of this area is the transition zone from sandy parts to the harder, limestone areas.

c) Topography

The subregion is situated between latitude 23,4° to 24° south and longitude 17,5° to 18,8° east. Sanddunes and calcareous interdune valleys are typical of this area.

The Olifants River crosses the eastern part of the subregion. The interdune valleys towards the western parts of the subregion tend to be broader, giving the area a more open appearance.

d) Vegetation

Characteristic of this area is the coincidence of three vegetation types:

1. Dwarf shrub Savanna - the grass cover of this area consists of a large diversity of grass species that vary according to the soil types. Stipagrostis species are typical for large parts of the area. Trees like Acacia erioloba occur along rivers. In certain areas Boscia albitrunca, B. foetida and Acacia nebrownii are characteristic.

2. Highland Savanna - the extremities of this vegetation type are represented in this subregion. In undisturbed veld climax species like Anthephora pubescens, Brachiaria nigropedata and Digitaria eriantha can be found. these good pasture grasses are decreasing because of poor pasture management practices. Characteristic trees include Combretum apiculatum, Acacia hereroensis.

3. Mixed Tree and Shrub Savanna - the subregion is classified as this vegetation type. Acacia haematoxylon is typical, usually in its shrubby form. On harder soils in interdune valleys, Rhigozum trichotomum is common.

Other trees and shrubs that are found in the area are: Acacia erioloba, A. mellifera subsp. detinens, A. reficiens, A. hebeclada, Boscia albitrunca, B. foetida, Grewia flava, G. deserticola, Rhus tenuinervis.

Perennial grasses occuring in undisturbed veld are Asthenatherum glaucum, Eragrostis lehmanniana, Stipagrostis uniplumis and S. ciliata. Disturbed veld is dominated by Schmidtia kalahariensis. On the crests of dunes, Stipagrostis amabilis may form dense stands thus acting as sand binder. Along the Nossob River, Prosopis trees are especially prominent.

e) Sources of water

Boreholes are the major source of water. The quality of water generally is good. In the extreme western parts, problems are experienced with very high nitrate levels in the water. This water is virtually unfit for animal consumption.

2.5.1.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Surface area of surveyed farms	503 782 ha
2. Total surface area of surveyed area	503 782 ha
3. Total number of surveyed farms	97
4. Number of farming units	72
5. Average farm size	5 194 ha
6. Average size of farming units	6 997 ha
7. Average number of camps per farming unit	30
8. Distribution of camp sizes:	
50 - 200 ha	10 %
201 - 300 ha	75 %
301 ha and larger	15 %
9. Average camp size	235 ha
10. Average number of boreholes per farming unit	6
11. Average surface area per borehole	1 166 ha
12. All camps are provided with water	

b) Cultivated fields

None

c) Livestock farming

The main activity is centered around extensive meat and pelt production. Pelt production has to a large extent been replaced by meat production. Meat produced mainly originates from Dorper sheep, Boer goats and cattle.

d) Uneconomical farming units

The number of farms that can support less than 2000 S.A.U.'s is 13. This is 18 % of the total.

2.5.1.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	62
Number of German speaking farmers	7
Number of other farmers	3

b) Age distribution

20 - 30 years	2
31 - 40 years	22
41 - 50 years	37
51 - 60 years	7
61 - 70 years	3
71 years and older	0

c) Communication

Two farmer's associations are active in the area.

2.5.1.4 PRESENT PRACTICES

a) Veld management

The farmers in this area are farily up-to-date with basic principles of good veld management. Most farmers know their pastures, but unfortunately, very few implement their knowledge in practice. Scientific records on pastures are usually not kept.

b) Stocking rate

Stocking rates are slightly high.

c) Marketing

Small stock is marketed at an age of ± 6-8 months, resulting in carcasses with a mass of ± 20 kg. Stock is generally marketed at controlled markets in the R.S.A. or on local auctions. Pelts are sold on pelt auctions.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	5
1.2 Average size of flocks	350
1.3 Average size of flocks at mating	350
1.4 Mating seasons:	
2-3 seasons are implemented by most farmers	
1.5 Average lambing percentage	130 %
1.6 Average weaning percentage	120 %
1.7 Average marketing percentage	120 %

2. Flock composition

2.1 Karakul:	3 %	rams
	75 %	ewes
	15 %	replacement
2.2 Dorper:	6 %	rams
	60 %	ewes
	15 %	replacement

2.3 Boer goats: 3 % rams
50 % ewes
15 % replacement

3. Animal nutrition

Most farmers supply a good lick during winter. Sufficient hay is generally available, but because of its lower palatability, lick has to be provided as well.

4. Animal health

Most farmers implement a good vaccination and dosing programme. They vaccinate against botulism, pulpy kidney and pasteurellosis. Three broad spectrum dosings are administered per year.

2.5.2 FHFA E2

Description: Interdune valley Kalahari
Carrying capacity: 3 ha/S.A.U. or 13 - 15 kg/ha to
4 ha/S.A.U. or 9 - 11 kg/ha

2.5.2.1 ENVIRONMENTAL FACTORS

a) Climate

Rainfall in this subregion varies from 150 mm per annum in the southern parts to 230 mm per annum in the northern parts. The rainy season starts in October with isolated showers. Rainfall then increases to a climax in February and March. The average number of effective rainy days is between 15 and 25 per year of which 80 % occur in the latter period. Summers are long with high average day temperatures of 36^{o} C. Winters are mild to cold with light frost.

b) Soil types

The substrate in this area consists of limestone covered with fine red dune sand. Absorbing capacity of the soil is very high, but does not bind well. Fertility is good.

c) Topography

The subregion is located between longitude 24^{o} to $27,3^{o}$ east and latitude 19^{o} to 20^{o} south. Kalahari dunes with wide interdune valleys are the most prominent topographical feature of this area. The altitude of the area is about 1300 m above sea level. The north-eastern border is formed by the Nossob River. The dunes are low to medium high with calcareous interdune valleys. The area east of the Olifants River is characterized by prominent dunes and wide interdune valleys. West of the Olifants river, the terrain changes into a transitional zone with a mixture of dunes and limestone plains.

d) Vegetation

This subregion is also situated in the Mixed Tree and Shrub Savanna. Grass is the main source of fodder for livestock. The most important grasses are: Asthenatherum glaucum, Eragrostis lehmanniana, Stipagrostis uniplumis, S. ciliata, Schmidtia kalahariensis, Stipagrostis amabilis.

The most common trees and shurbs are: Acacia erioloba, A. mellifera subsp. detinens, A. hebeclada, Rhigozum trichotomum, Acacia haematoxylon, Catophractes alexandri.

e) Sources of water

This area is dependent on borholes for the supply of water. With the exception of five farms, the entire area is included in the controlled artesian water area.

South of the road between Gochas and Wandervogel, water quality is poor and farmers have to rely on pipelines and earth excavation dams.

The rest of the subregion includes the Stampriet artesian water area and subartesian boreholes. Extraction of water is monitored by the Department of Water Affairs by means of a permit system. The quality of this water is good.

2.5.2.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Surface area of surveyed farms	1 995 756 ha
2. Total surface area of surveyed area	1 995 756 ha
3. Total number of surveyed farms	345
4. Number of farming units	213
5. Average farm size	5 785 ha
6. Average size of farming units	9 370 ha
7. Average number of camps per farming unit	28
8. Distribution of camp sizes:	
50 - 200 ha	14 %
201 - 300 ha	72 %
301 ha and larger	14 %
9. Average camp size	350 ha
10. Average number of boreholes per farming unit	5
11. Average surface area per borehole	1 987 ha
12. All camps are provided with water	

b) Cultivated fields

On about 11 farming units in the vicinity of Stampriet, crops are culitvated for commercial purposes on a total surface area of about 200 ha. A number of irrigation schemes are present along the Auob River where mainly fodder is produced.

c) Livestock farming

Small stock farming is the major farming activity and contributes about 85 % to the total livestock present. The remaining 15 % consists of cattle. Production of meat and pelts are the main industries.

d) Uneconomical farming units

The number of farms that can support less than 2000 S.A.U.'s is 42. This is 20 % of the total.

2.5.2.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	203
Number of German speaking farmers	6
Number of other farmers	0

b) Age distribution

20 - 30 years	3
31 - 40 years	52
41 - 50 years	70
51 - 60 years	35
61 - 70 years	35
71 years and older	14

c) Communication

Three farmer's associations are active in the area.

2.5.2.4 PRESENT PRACTICES

a) Veld management

The farmers in this subregion are up-to-date with the basic principles of good veld management. Most farmers know their pastures, but unfortunately only a few implement their knowledge effectively. Scientific records on pastures are generally not kept.

b) Stocking rate

Stocking rates are slightly high.

c) Marketing

Mutton sheep are marketed at an age of 6 - 8 months with the resulting carcass mass of ± 20 kg. Marketing points are mainly the controlled markets in the R.S.A. or local auctions. Pelts are sold at pelt auctions.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	5
1.2 Average size of flocks	±350
1.3 Average size of flocks at mating	±350
1.4 Mating seasons:	
2-3 seasons are implemented by most farmers	
1.5 Average lambing percentage	130 %
1.6 Average weaning percentage	120 %
1.7 Average marketing percentage	120 %

2. Flock composition

2.1 Karakul:	3 %	rams
	75 %	ewes
	15 %	replacement
2.2 Dorper:	6 %	rams
	60 %	ewes
	15 %	replacement

2.3 Boer goats: 3 % rams
50 % ewes
15 % replacement

3. Animal nutrition
Most farmers provide good lick during winter. Sufficient hay is usually available, but because of its low palatability, lick has to be provided as well.

4. Animal health
Most farmers implement a good vaccination and dosing programme. They vaccinate against botulism, pulpy kidney and pasteurellosis. Three broad spectrum dosings are administered per year.

2.5.3 FHFA E3

Description: Dwarf shrub Savanna
Carrying capacity: 3 ha/S.A.U. or 13-15 kg/ha

2.5.3.1 ENVIRONMENTAL FACTORS

a) Climate
The rainfall in the subregion varies between 150 and 180 mm per annum. Considerable variation in temperatures is experienced with measurements between 0^{o} C and 40^{o} C. The number of rainy days is between 25 and 30 per year.

b) Soil types
The parent rock of this subregion consists of skale, mudstone and sandstone. There is a very distinct transition between the more sandy dune area and harder limestone areas. The soil consists typically of limestone gravel.

c) Topography

This subregion consists of a small area, about 2 farms wide, extending south-eastwards from Mariental. North-west of Stampriet a few more farms are included in this FHFA. The terrain is typically level with few sandy hillocks.

d) Vegetation

The entire subregion is typical of the Dwarf shrub Savanna. The grass cover consists of a large diversity of species, depending on the soil type. Stipagrostis ciliata and S. obutsa are characteristic for large parts. Trees like Acacia erioloba occur along rivers while Boscia albitrunca, B. foetida and Acacia nebrownii are common in some parts. Small, palatable shrubs like Leucosphaera bainesii and Petalidium species occur.

e) Sources of water

Boreholes are the major source of water. No serious problems are experienced with the quality of water. In the vicinity of Stampriet, artesian and subartesian water is common. Extraction of water in this area is also controlled by the Department of Water Affairs.

2.5.3.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Surface area of surveyed farms	297 117 ha
2. Total surface area of surveyed area	297 117 ha
3. Total number of surveyed farms	56
4. Number of farming units	41
5. Average farm size	5 306 ha
6. Average size of farming units	7 247 ha
7. Average number of camps per farming unit	27

8. Distribution of camp sizes:	
50 - 200 ha	10 %
201 - 300 ha	70 %
301 ha and larger	20 %
9. Average camp size	250 ha
10. Average number of boreholes per farming unit	6
11. Average surface area per borehole	1 207 ha
12. All camps are provided with water	

b) Cultivated fields

On about 3 farming units, commercial crop cultivation is practised on a total of about 80 ha. Production of fodder occurs to a limited extent on some farms.

c) Livestock farming

About 95 % of total livestock numbers consists of small stock, the remaining 5 % is made up of cattle. Production of meat and pelts are the main activities.

d) Uneconomical farming units

12 = 29 %

2.5.3.3 HUMAN RESOURCES

a) Ethnic grouping	
Number of Afrikaans speaking farmers	37
Number of German speaking farmers	1
Number of other farmers	3
b) Age distribution	
20 - 30 years	0
31 - 40 years	10
41 - 50 years	10
51 - 60 years	8
61 - 70 years	3
71 years and older	0

c) Communication

One farmer's association is active in the area.

2.5.3.4 PRESENT PRACTICES

a) Veld management

With the exception of a few farmers, the basic principles of good veld management are applied. 20 % of the farmers keep good pasture records.

b) Stocking rate

With a few exceptions, stocking rates are normal.

c) Marketing

Pelts are marketed three times per year at auctions. Mutton sheep are marketed at an age of ±6 months at the controlled markets in the R.S.A. and at local acutions.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	5
1.2 Average size of flocks	300
1.3 Average size of flocks at mating	300
1.4 Mating seasons:	
on average 2-3 mating seasons are implemented	
1.5 Average lambing percentage	130 %
1.6 Average weaning percentage	120 %
1.7 Average marketing percentage	120 %

2. Flock composition

2.1 Karakul:	3 % rams
	75 % ewes
	15 % replacement
2.2 Dorper:	4 - 6 % rams
	60 % ewes2
	15 % replacement

2.3 Boer goats: 2 % rams
50 % ewes
15 % replacement

3. Animal nutrition
Since sufficient small, palatalbe shrubs are present in the veld, providing lick is not absolutely necessary, but is nevertheless supplied where it seems necessary.

4. Animal health
Most farmers implement good vaccination and dosing programmes. Stock is treated against external parasites.

2.5.4 FHFA E4

Description: Dwarf shrub Savanna
Carrying capacity: 4 ha/S.A.U. or 9 - 11 kg/ha

2.5.4.1 ENVIRONMENTAL FACTORS

a) Climate
Rainfall in the subregion varies from 100 to 180 mm per annum. The occurence of rain in patches is typical, with the result that some parts are often skipped during some years. Considerable variation in temperature occurs; measurements of 0^{o} C to 40^{o} C are recorded within a year.

b) Soil types
The parent rock of the subregion consists of skale, mudstone and standstone of the Prince Albert formation. Soils are generally calcareous with sporadic occurences of sandy soil.

c) Topography

The subregion is a vast plain. The north-western border near Mariental and the border north of Namaland are formed by the so called Kalk- or Weissrand. The entire western border is formed by Namaland.

d) Vegetation

The entire subregion is contained within the Dwarf Shrub Savanna zone. The grass cover consists of a wide variety of species depending on the soil type. Stipagrostis ciliata, S. obtusa and S. uniplumis are characteristic for large parts.

Trees like Acacia erioloba occur along rivers, while Boscia albitrunca, B. foetida and Acacia nebrownii are common in some areas.

2.5.4.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Surface area of surveyed farms	342 746 ha
2. Total surface area of surveyed area	342 746 ha
3. Total number of surveyed farms	66
4. Number of farming units	41
5. Average farm size	5 193 ha
6. Average size of farming units	8 360 ha
7. Average number of camps per farming unit	26
8. Distribution of camp sizes:	
50 - 200 ha	5 %
201 - 300 ha	65 %
301 ha and larger	30 %
9. Average camp size	300 ha
10. Average number of boreholes per farming unit	4
11. Average surface area per borehole	2 090 ha
12. All camps are provided with water	

b) Livestock farming

Small stock farming is virtually the only farming activity. Mutton and pelt production are the main industries.

c) Uneconomical farming units

12 = 29 %

2.5.4.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	41
Number of German speaking farmers	0
Number of other farmers	0

b) Age distribution

20 - 30 years	0
31 - 40 years	10
41 - 50 years	15
51 - 60 years	14
61 - 70 years	2
71 years and older	0

c) Communication

One farmer's association is active in the area.

2.5.4.4 PRESENT PRACTICES

a) Veld management

Most farmers possess the basic knowledge about good pasture management systems, but only a few implement it in practice. The latter also keep good records.

b) Stocking rate

Stocking rates implemented can generally be described as conservative.

c) Marketing

Lambs are marketed at an age of 4-6_months when their carcasses have a mass of ± 20 kg. Pelts are marketed three times annually at the pelt auctions.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	5
1.2 Average size of flocks	300
1.3 Average size of flocks at mating	300
1.4 Mating seasons:	
on average 2-3 mating seasons are implemented	
1.5 Average lambing percentage	130 %
1.6 Average weaning percentage	120 %
1.7 Average marketing percentage	120 %

2. Flock composition

2.1 Karakul:	3 %	rams
	75 %	ewes
	15 %	replacement
2.2 Dorper:	4 %	rams
	60 %	ewes
	15 %	replacement
2.3 Boer goats:	2 %	rams
	50 %	ewes
	15 %	replacement

3. Animal nutrition

Since sufficient palatable shrubs are present in the veld, supplementation by means of lick occurs seldomly.

4. Animal health

A regular vaccination and dosing programme is implemented. Two key dosings with a broad spectrum agent are administered per year.

2.5.5 FHFA E5

Description: Mixed Tree and Shrub Savanna
Carrying capacity: 3 ha/S.A.U. or 13 - 15 kg/ha

2.5.5.1 ENVIRONMENTAL FACTORS

a) Climate

The average annual rainfall of the subregion is about 150 mm. Cool winters and very hot summers with extreme temperatures, are typical of this area. The number of rainy days varies between 20 and 30 per year.

b) Soil types

Skale, mudstone and sandstone of the Prince Albert formation form the parent rock of this subregion. A few parts have stretches of dolorite parent rock. Top soils are pure sand in the entire region.

c) Topography

The eastern border is the international border with the R.S.A. Low to medium-high sand dunes with calcareous interdune valleys are found. The dunes are typical of the Kalahari and orientated in a NW-SE direction.

d) Vegetation

The subregion is described as Mixed Tree and Shrub Savanna of the southern Kalahari. Acacia haematoxylon is typical, especially in its shrubby form. On the harder soils of the interdune valleys, Rhigozum trichotomum is common.

Other trees and shrubs in this subregion are: Acacia erioloba, A. mellifera subsp. detinens, A. reficiens, A. hebeclada, Boscia albitrunca, B. foetida, Grewia flava, G. deserticola and Rhus tenuinervis.

Perennial grasses occuring in undisturbed veld are Asthenatherum glaucum, Eragrostis lehmanniana, Stipagrostis uniplumis and S. ciliata. Disturbed veld is dominated by Schmidtia kalahariensis. On dune crests, dense stands of Stipagrostis amabilis may be found, acting as sand binder. Along the Nossob River, Prosopis trees are common.

e) Sources of water

Boreholes are the only source of water and are controlled by the permit system of the Department of Water Affairs. Serious problems w.r.t. water quality are experienced in 50 % of this subregion. Here water is even unfit for livestock consumption. In general, boreholes are very deep, varying from 250 to 300 meter.

2.5.5.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Surface area of surveyed farms	666 836 ha
2. Total surface area of surveyed area	666 836 ha
3. Total number of surveyed farms	104
4. Number of farming units	69
5. Average farm size	6 657 ha

6. Average size of farming units	9 737 ha
7. Average number of camps per farming unit	31
8. Distribution of camp sizes:	
50 - 200 ha	10 %
201 - 300 ha	60 %
301 ha and larger	30 %
9. Average camp size	541 ha
10. Average number of boreholes per farming unit	5
11. Average surface area per borehole	2 160 ha
12. All camps are provided with water	

b) Livestock farming

Small stock farming predominates, but some cattle is also kept. Mutton and pelt production are the main activities. The official carrying capacity is about 3 ha/S.A.U..

c) Uneconomical farming units

1 = 1,2 %

2.5.5.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	68
Number of German speaking farmers	0
Number of other farmers	1

b) Age distribution

20 - 30 years	0
31 - 40 years	21
41 - 50 years	25
51 - 60 years	14
61 - 70 years	9
71 years and older	0

c) Communication

Two farmer's associations are present in the subregion.

2.5.5.4 PRESENT PRACTICES

a) Veld management

All farmers have the knowledge to implement a basic veld management programme. In practice however, this is not the case. Scientific records on pastures are not kept by most farmers.

b) Stocking rate

Stocking rates are generally too high.

c) Marketing

Mutton sheep are marketed at an age_of 4-5 months with a carcass mass of ± 18 kg. Marketing points are the controlled markets or local auctions. Pelts are offered for sale three times annually on the pelt auctions.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	5
1.2 Average size of flocks	350
1.3 Average size of flocks at mating	350

1.4 Mating seasons:

2 - 3 mating seasons are implemented by Karakul farmers, while Dorper sheep are mated throughout the year.

1.5 Average lambing percentage	130 %
1.6 Average weaning percentage	120 %
1.7 Average marketing percentage	120 %

2. Flock composition

2.1 Karakul:	3 %	rams
	75 %	ewes
	15 %	replacement
2.2 Dorper:	4 %	rams
	60 %	ewes
	15 %	replacement
2.3 Boer goats:	2 %	rams
	50 %	ewes
	15 %	replacement

3. Animal nutrition

Supplementation by means of lick is fair.

4. Animal health

An intensive vaccination and dosing programme is implemented. Three key dosings with a broad spectrum agent are administered annually.

2.5.6 **FHFA E6**

Description: Knobbly-dune Kalahari

Carrying capacity: 4 ha/S.A.U. or 9 - 11 kg/ha

2.5.6.1 ENVIRONMENTAL FACTORS

a) Climate

The average annual rainfall in the southern parts is 160 mm and in the northern parts 200 mm. Isolated thunder showers occur from November onwards, increasing to a climax in February and March. The number of effective rainy days per year lies between 10 and 20, 80 % of which occur in February and March. Summers are

long and very hot with average day temperatures between 35° C and 37° C. Winters are short and mild with few occurences of frost.

b) Soil types

Limestone formations form the substrate and are covered with fine, red dune sand. This sand has a high absorbtion capacity but does not bind well.

c) Topography

The subregion is located between longitude 26° to 27° east and latitude 19° to 20° south. Continuous, high, red Kalahari dunes with narrow, sandy interdune valleys are characteristic of this area. The altitude is 1350 m above sea level.

d) Vegetation

This subregion is a Mixed Tree and Shrub Savanna with grass making up the main pasture component and trees and shrubs being merely supplementary. The most important perennial grasses that occur in undisturbed veld are: Aristida meridionalis, Eragrostis lehmanniana, Stipagrostis uniplumis, S. ciliata, Asthenatherum glaucum, Stipagrostis amabilis.

The most common trees and shrubs are: Acacia erioloba, Catophractes alexandri, Rhigozum trichotomum, Acanthosicyos naudinianus.

e) Sources of water

This area is dependent on boreholes, but since the water often is not fit for human and animal consumption, extensive use is made of pipelines and earth excavation dams.

2.5.6.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Surface area of surveyed farms	365 447 ha
2. Total surface area of surveyed area	365 447 ha
3. Total number of surveyed farms	43
4. Number of farming units	28
5. Average farm size	8 616 ha
6. Average size of farming units	13 051 ha
7. Average number of camps per farming unit	29
8. Distribution of camp sizes:	
50 - 200 ha	4,2 %
201 - 300 ha	65,5 %
301 ha and larger	30,3 %
9. Average camp size	477 ha
10. Average number of boreholes per farming unit	7,5
11. Average surface area per borehole	1 740 ha
12. All camps are provided with water	

b) Livestock farming

Two game farms and one wool producer occur in the sub-region. The remaining farmers produce mutton and pelts.

c) Uneconomical farming units

1 = 3,6 %

2.5.6.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	26
Number of German speaking farmers	2
Number of other farmers	0

b) Age distribution

20 - 30 years	0
31 - 40 years	13
41 - 50 years	10
51 - 60 years	5
61 - 70 years	0
71 years and older	0

c) Communication

No active farmer's association serves this area. An active "Polocross" club exists in the area.

2.5.6.4 PRESENT PRACTICES

a) Veld management

Farmer's knowledge about veld management is fair and some keep good pasture records.

b) Stocking rate

Stocking rates are generally a little too high.

c) Marketing

Pelts are offered for sale 3 times annually on the pelt auctions. Mutton sheep are marketed at an age of 4-6 months at the controlled markets or at local auctions.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	5
1.2 Average size of flocks	350
1.3 Average size of flocks at mating	350
1.4 Mating seasons:	
2 mating seasons are implemented	
1.5 Average lambing percentage	110 %
1.6 Average weaning percentage	95 %
1.7 Average marketing percentage	95 %

2. Flock composition

2.1 Karakul:	3 %	rams
	75 %	ewes
	15 %	replacement
2.2 Dorper:	4 %	rams
	60 %	ewes
	15 %	replacement
2.3 Boer goats:	2 %	rams
	50 %	ewes
	15 %	replacement

3. Animal nutrition

In the sandy parts, a source of energy is supplemented. In the limestone areas, little supplementary feeding is provided since sufficient nutrients are provided by the shrubs present.

4. Animal health

A regular vaccination and dosing programme is implemented.

2.5.7 **FHFA E7**

Description: Dwarf shrub Savanna
Carrying capacity: 4 ha/S.A.U. or 9-11 kg/ha

2.5.7.1 ENVIRONMENTAL FACTORS

a) Climate

The average annual rainfall is ± 150 mm. Rain occurs mainly in thunder storms during summer; winterrain occurs seldomly.

Distribution of rainfall:

January	10,82
February	23,26
March	27,50
April	7,48
May	4,42
June	3,43
July	1,52
August	1,08
September	1,53
October	2,98
November	10,19

Rain occurs mainly from November to April with highest precipitation during February and March. Summers are very hot but winters are cold with frost occuring regularly.

b) Soil types

Sweet, sandy, loam soils that sometimes merge into limestone, occur. The slopes have a slatey character and alternate with Torra veld which has far poorer soil than the mountains.

c) Topography

Location: between longitude 18,4° to 19,3° east to latitude 17° to 28° south.

Almost the entire subregion is mountainous with deep gorges and is known as the Great Karasberg. The highest peak is 2202 m above sea level. West of the great Karasberg, plains with isolated koppies occur.

d) Vegetation

Trees and shrubs:

Trees occur sparsely in this subregion and are usually confined to the gorges and rivers. The following trees occur: Acacia erioloba, A. hebeclada, A. karroo, A. mellifera, Prosopis.

Shrubs:

Catophractes alexandri, Rhigozum trichotomum. Salsola and Pentzia species are also important components of the vegetation.

Pioneer grasses:

Aristida adscensionis, A. congesta, A. engleri, Enneapogon desvauxii, E. cenchroides, E. scaber.

Subclimax grasses:

Eragrostis lehmanniana, E. nindensis, E. porosa, Triraphis ramosissima.

Climax grasses:

Anthephora ramosa, Setaria appendiculata, Cenchrus ciliaris, Digitaria eriantha, Fingerhuthia africana, Panicum arbusculum, P. maximum, Stipagrostis ciliata, S. obtusa, S. uniplumis.

e) Sources of water

This area is mainly dependent on boreholes that usually are situated in the gorges. Earth excavation dams are used on plateaus where there are no boreholes nearby. Boreholes are 30 to 120 m deep and the quality of water is fair.

2.5.7.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Surface area of surveyed farms	759 835 ha
2. Total number of surveyed farms	132
3. Number of farming units	90
4. Average farm size	5 756 ha
5. Average size of farming units	8 442 ha
6. Average number of camps per farming unit	23
7. Distribution of camp sizes:	
50 - 200 ha	35 %
201 - 300 ha	22 %
301 ha and larger	43 %
8. Average camp size	380 ha
9. Average number of boreholes per farming unit	6
10. Average surface area per borehole	1 160 ha
11. All camps are provided with water	

b) Cultivated fields

None

c) Livestock farming

Meat and pelt production are the major farming activities in this area.

d) Uneconomical farming units

21 = 23 %

2.5.7.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	88
Number of German speaking farmers	1
Number of other farmers	1

b) Age distribution

20 - 30 years	5
31 - 40 years	15
41 - 50 years	30
51 - 60 years	30
61 - 70 years	10
71 years and older	0

c) Communication

One farmer's association is active in the area.

2.5.7.4 PRESENT PRACTICES

a) Veld management

In general farmers are aware of the principles of good veld management, but most don't implement them.

b) Stocking rate

Stocking rates are somewhat high.

c) Marketing

Mutton sheep are marketed at an age of 4-6 months at the controlled markets as well as on auctions. Pelts are marketed three times annually on the pelt auctions.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	5
1.2 Average size of flocks	±350
1.3 Average size of flocks at mating	±350
1.4 Mating seasons: from one mating season to mating throughout the year are implemented.	
1.5 Average lambing percentage	130 %
1.6 Average weaning percentage	100 %
1.7 Average marketing percentage	95 %

2. Flock composition

2.1 Karakul:	3	% rams
	75	% ewes
	15	% replacement
2.2 Dorper:	4	% rams
	60	% ewes
	15	% replacement
2.3 Boer goats:	2	% rams
	50	% ewes
	15	% replacement

3. Animal nutrition

Supplementary feeding is provided seldomly.

4. Animal health

One to two key dosings with a broad specturm agent are administered annually. Livestock is vaccinated against pasteurellosis and pulpy kidney.

2.5.8 **FHFA E8**

Description: Dwarf Shrub Savanna
Carrying capacity: 4 ha/S.A.U. or 9-11 kg/ha

2.5.8.1 ENVIRONMENTAL FACTORS

a) Climate

The average annual rainfall for this subregion is between 150 mm and 200 mm (175mm). The northern parts, bordering on the Maltahöhe district and more eastwards towards Namaland (Berseba) received more regular follow-up rains than the western and southern parts. One could describe this area as a 3,5 ha/S.A.U. area within a 4 ha/S.A.U. area. The southern half of the

area is drier because of lower, total precipitation as well as the lower frequency of follow-up rains. The rainy days are on average 10-20 per year. Rain generally occurs from October to April with the highest precipitation during February and March (60-70 %).

Summers are very hot (average temperature 36,4° C, absolute maximum 41° C), while winters are mild (daily average minimum temperature 5,1° C, absolute minimum -4,0° C). Slight frost occurs occasionally. Evaporation rates of 3400 - 3500 mm per year are experienced.

b) Soil types

The area consists of black Nama sandstone (Nama skale). The plateau is partly covered with sand and sandy dry rivers occur. These hard soils are alkaline with a pH of 7 or higher. The plateau is covered with round, loose rocks.

c) Topography

This area is situated between longitude 17°15′ to 17°30′ east and latitude 25°45′ to 26°30′ south. The terrain consists of a plateau, covered in round rocks with high ridges, deep dry river beds and gorges, but can generally be traversed by car. The altitude of the subregion is on average 1250 m above sea level. Due to the nature of the soil type and topography, erosion is not a problem in this area. The Swartrant mountain range levels off towards the east and west.

d) Vegetation

The subregion is a typical Dwarf Shrub Savanna. Valuable grasses like Stipagrostis uniplumis, S. ciliata, Setaria appendiculata, Anthephora ramosa occur widespread toghether with Catophractes alexandri and Eriocephalus species. Less desireable species like Aristida congesta, A. effusa and Triraphis ramosissima

also occur widespread. Rhigozum trichotomum causes problems in some areas while Petalidium species occur in undesireable densities in the southern parts of the subregion.

e) Sources of water

This area has mainly deep boreholes in the dry river beds. The water is fit for human and livestock consumption. A few earth dams and earth excavation dams are found here. The distribution of boreholes over a farm is a problem, resulting in the extensive use of pipelines to supply the necessary watering points.

2.5.8.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Surface area of surveyed farms	815 918 ha
2. Total number of surveyed farms	104
3. Number of farming units	88
4. Average farm size	7 721 ha
5. Average size of farming units	9 118 ha
6. Average number of camps per farming unit	22
7. Distribution of camp sizes:	
50 - 200 ha	45 %
201 - 300 ha	32 %
301 ha and larger	23 %
8. Average camp size	373 ha
9. Average number of boreholes per farming unit	4
10. Average surface area per borehole	2 177 ha
11. All camps are provided with water	

b) Cultivated fields

None

c) Livestock farming

Extensive small stock farm8ing is practised. Dorper, Karakul, Lettelle and Merino sheep as well as Boer goats and a few cattle are kept.

d) Uneconomical farming units

22 = 25 %

2.5.8.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	68
Number of German speaking farmers	20
Number of other farmers	0

b) Age distribution

20 - 30 years	1
31 - 40 years	16
41 - 50 years	41
51 - 60 years	21
61 - 70 years	9
71 years and older	0

c) Communication

Two of the neighbouring farme's associations are active in the subregion.

2.5.8.4 PRESENT PRACTICES

a) Veld management

Fairly good knowledge on veld management exists among farmers and is also implemented. No records are kept.

b) Stocking rate

Stocking rates are somewhat high.

c) Marketing

Mutton sheep are marketed at an age of 5-6 months at the controlled markets. Pelts are offered for sale three times annually at the overseas pelt auctions.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	5
1.2 Average size of flocks	300
1.3 Average size of flocks at mating	300
1.4 Mating seasons: One to three mating seasons per year are implemented	
1.5 Average lambing percentage	120 %
1.6 Average weaning percentage	90 %
1.7 Average marketing percentage	90 %

2. Flock composition

2.1 Karakul:	3 %	rams
	75 %	ewes
	15 %	replacement
2.2 Dorper:	4 %	rams
	60 %	ewes
	15 %	replacement
2.3 Boer goats:	2 %	rams
	50 %	ewes
	15 %	replacement

3. Animal nutrition

Provision of lick is a common practice in this area.

4. Animal health

Two key dosings with a broad spectrum agent are administered annually. Stock is vaccinated against pulpy kidney and botulism.

2.6 MEDIUM POTENTIAL SMALL STOCK FARMING AREA

2.6.1 FHFA F1

Description: Dwarf Shrub Savanna
Carrying capacity: 5 ha/S.A.U. or 8-9 kg/ha

2.6.1.1 ENVIRONMENTAL FACTORS

a) Climate

The rainfall of the subregion varies between 100 mm and 180 mm per annum, with the highest precipitation occuring in the northern parts of the area. Temperatures over a year vary between 0^{o} C and 40^{o} C.

b) Soil types

Various types of parent rock occur in the subregion: red skale and sandstone of the Gross Aub formation, red sandstone and skale of the Nababis formation, red and grey sandstone and skale of the Breckhorn formation, red sandstone and skale of the Stockdale formation. The top soil is rocky and partly forms the so called Torra veld.

c) Topography

The subregion is delimited by the Rehoboth (north), Maltahöhe (west) and Namaland (south) district borders and the national road north of Mariental forms the eastern border. Vast open plains as well as deep gorges and rivers occur. Important rivers in the area are the Fish, Lewer, Auros, Kalf, Packriem and Tsub Rivers.

d) Vegetation

This subregion falls entirely within the Dwarf Shrub Savanna zone, but because of the lower rainfall, relatively poorer soil and poorer grazing practices, the southern parts of the subregion support considerably less dense vegetation than the northern parts. Grasses that occur are Stipagrostis uniplumis, S. anomala and S. ciliata. Trees and shrubs are Acacia nebrownii, Catophractes alexandri and Albizia anthelmintica.

e) Sources of water

The subregion falls outside the controlled water area and boreholes are the most common source of water. In the southern parts of the subregion various stong fountains occur.

2.6.1.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Surface area of surveyed farms	562 009 ha
2. Total number of surveyed farms	59
3. Number of farming units	45
4. Average farm size	9 526 ha
5. Average size of farming units	12 489 ha
6. Average number of camps per farming unit	40
7. Distribution of camp sizes:	
50 - 200 ha	5 %
201 - 300 ha	80 %
301 ha and larger	15 %
8. Average camp size	275 ha
9. Average number of boreholes per farming unit	4
10. Average surface area per borehole	3 122 ha
11. All camps are provided with water	

b) Cultivated fields

None

c) Livestock farming

The official carrying capacity is 5 ha/S.A.U. Small stock farming for the production of meat and pelts is the main activity.

d) Uneconomical farming units

5 = 11 %

2.6.1.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	38
Number of German speaking farmers	7
Number of other farmers	0

b) Age distribution

20 - 30 years	0
31 - 40 years	2
41 - 50 years	20
51 - 60 years	20
61 - 70 years	2
71 years and older	0

c) Communication

There are two farmer's associations in the area.

2.6.1.4 PRESENT PRACTICES

a) Veld management

Good pasture management practices are fairly well known in this area and are also implemented. Pasture records are not kept regularly.

b) Stocking rate

In general conservative stocking rates are implemented and very little veld deterioration can be noticed.

c) Marketing

Pelts are marketed three times annually at pelt auctions. Mutton sheep are marketed at 5-6 months of age at the controlled markets or at local auctions.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	5-6
1.2 Average size of flocks	350
1.3 Average size of flocks at mating	350
1.4 Mating seasons: Two to three mating seasons per year are implemented	
1.5 Average lambing percentage	120 %
1.6 Average weaning percentage	110 %
1.7 Average marketing percentage	100 %

2. Flock composition

2.1 Karakul:	3 % rams
	75 % ewes
	15 % replacement
2.2 Dorper:	4 % rams
	60 % ewes
	15 % replacement
2.3 Boer goats:	2 % rams
	50 % ewes
	15 % replacement

3. Animal nutrition

Lick is not normally provided because of sufficient shrubs in the veld.

4. Animal health

A good vaccination and dosing programme is implemented. Two key dosings with a broad spectrum agent are administered annually.

2.6.2 FHFA F2

Description: Limestone - Dwarf Shrub Savanna
Carrying capacity: 5 ha/S.A.U. or 8-9 kg/ha

2.6.2.1 ENVIRONMENTAL FACTORS

a) Climate

The annual rainfall in this area varies from 180 mm to 200 mm. Light, isolated showers occur in October and precipitation reaches a climax in February and March. The number of effective rainy days varies from 15 to 23 per year, of which 80 % occur in the period from February to March. Summers are very hot with an average maximum temperature of 36° C. Winters are mild and light frost occurs occasionally.

b) Soil types

This area consists mainly of hard limestone formations with occasional stretches of red sand.

c) Topography

The subregion is situated between longitude 26° to 27°30′ east and latitude 18° to 19° south. The level plains of hard limestone formations are typical of this area. The altitude is 1300 m above sea level.

d) Vegetation

The subregion is classified as Dwarf Shrub Savanna. Grasses, trees and palatable shrubs occur.

Most important grasses:
Stipagrostis uniplumis, S. anomala, Cenchrus ciliaris.

Most important trees and shrubs:
Acacia erioloba, A. nebrownii, Rhigozum trichotomum, Catophractes alexandri.

e) Sources of water

The subregion is dependent on boreholes for its water supply. The quality of the water is good and water is fairly easily obtainable.

2.6.2.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Surface area of surveyed farms	378 631 ha
2. Total number of surveyed farms	72
3. Number of farming units	41
4. Average farm size	5 259 ha
5. Average size of farming units	9 235 ha
6. Average number of camps per farming unit	26
7. Distribution of camp sizes:	
50 - 200 ha	24 %
201 - 300 ha	26 %
301 ha and larger	50 %
8. Average camp size	343 ha
9. Average number of boreholes per farming unit	8
10. Average surface area per borehole	1 110 ha
11. All camps are provided with water	

b) Livestock farming

Dorper, Boer goats, Angora, Karakul and game are kept.

c) Uneconomical farming units

5 = 12 %

2.6.2.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	41
Number of German speaking farmers	0
Number of other farmers	0

b) Age distribution

20 - 30 years	1
31 - 40 years	1
41 - 50 years	27
51 - 60 years	7
61 - 70 years	7
71 years and older	0

c) Communication

One active farmer's association exists in the area.

2.6.2.4 PRESENT PRACTICES

a) Veld management

Most farmers' knowledge on principles of pasture management is good and also implemented by them. Scientific pasture records are however not kept.

b) Stocking rate

Stocking rates are a little high.

c) Marketing

Mutton sheep are marketed at an age of ± 5 months at the controlled markets or local auctions. Pelts are sold three times annually at the pelt auctions. Mohair is sold at Port Elizabeth at public auctions. Game is captured by night and sold by harvesting teams.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	5
1.2 Average size of flocks	350
1.3 Average size of flocks at mating	350
1.4 Mating seasons: Two to three mating seasons per year are implemented	
1.5 Average lambing percentage	130 %
1.6 Average weaning percentage	120 %
1.7 Average marketing percentage	100 %

2. Flock composition

2.1 Karakul:	3 % rams
	75 % ewes
	15 % replacement
2.2 Dorper:	4 % rams
	60 % ewes
	15 % replacement
2.3 Boer goats:	2 % rams
	50 % ewes
	15 % replacement
2.4 Angora goats:	2-3 % rams
	60 % ewes
	20 % kapaters
	15 % replacement

3. Animal nutrition

Because of sufficient shrubs in the veld, lick is not generally supplied.

4. Animal health

A definite vaccination and dosing programme is implemented. Two key-dosings with a broad spectrum agent are administered annually.

2.6.3 FHFA F3

Description: Plains with hills and inselbergs
Carrying capacity: 5 ha/S.A.U. or 8-9 kg/ha

2.6.3.1 ENVIRONMENTAL FACTORS

a) Climate

Annual rainfall varies from 150 mm in the southern parts to 180 mm in the northren parts. Isolated, light showers occur already in November, but most rains, to a total of 10 - 20 days, occur during the monts of February and March. Summers are very hot with day temperatures around 37° C. Winters are mild with occasional frost.

b) Soil types

The soil in this subregion is characterized by pale brown to grey Nama sandstone and large areas of Torra veld. The fertility of these soils is very low.

c) Topography

This subregion is the largest FHFA in the district. The terrain consists of plains with hills and inselbergs that are pale grey and consist of sandstone. The subregion is situated between latitude 18° to 19°20′ south and longitude 26° to 27° east. The altitude is 1400 m above sea level.

d) Vegetation

Because of the poor soils, vegetation in this area is rather sparse. Grasses are the main component of pastures, while trees and shrubs occur in rivers.

Grass species:
Stipagrostis uniplumis, S. obtusa, Eragrostis nindensis, Asthenatherum glaucum, Stipagrostis anomala.

Trees and shrubs:
Acacia nebrownii, A. erioloba, A. mellifera, Catophractes alexandri, Rhigozum trichotomum.

e) Sources of water

Boreholes are the main source of water in this area. Water quality is good and underground water fairly well spread.

2.6.3.2 SOIL UTILIZATION PATTERN

a) Physical data	
1. Surface area of surveyed farms	833 068 ha
2. Total number of surveyed farms	118
3. Number of farming units	76
4. Average farm size	7 059 ha
5. Average size of farming units	10 961 ha
6. Average number of camps per farming unit	25
7. Distribution of camp sizes:	
50 - 200 ha	20 %
201 - 300 ha	19 %
301 ha and larger	61 %
8. Average camp size	466 ha
9. Average number of boreholes per farming unit	7
10. Average surface area per borehole	1 493 ha
11. All camps are provided with water	

b) Cultivated fields

None

c) Livestock farming

Dorper and Karakul sheep, Boer goats and game are kept.

d) Uneconomical farming units

15 = 19,7 %

2.6.3.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	75
Number of German speaking farmers	0
Number of other farmers	1

b) Age distribution

20 - 30 years	2
31 - 40 years	10
41 - 50 years	50
51 - 60 years	12
61 - 70 years	2
71 years and older	0

c) Communication

One farmer's association exists in the area.2

2.6.3.4 PRESENT PRACTICES

a) Veld management

It seems that there is a general lack of knowledge w.r.t. basic veld management. No records what so ever are kept.

b) Stocking rate

Stocking rates are slightly high.

c) Marketing

Mutton sheep are marketed at 6-8 months of age at the controlled markets and local auctions. Pelts are offered for sale three times annually at the pelt auctions.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	5
1.2 Average size of flocks	350
1.3 Average size of flocks at mating	350
1.4 Mating seasons: From one season to mating throughout the year occurs	
1.5 Average lambing percentage	130 %
1.6 Average weaning percentage	100 %
1.7 Average marketing percentage	90 %

2. Flock composition

2.1 Karakul:	3 % rams
	75 % ewes
	15 % replacement
2.2 Dorper:	4 % rams
	60 % ewes
	15 % replacement
2.3 Boer goats:	2 % rams
	50 % ewes
	15 % replacement

3. Animal nutrition

Lick is provided regularly late in the year.

4. Animal health

Once a year livestock is dosed with a broad spectrum agent. Animals are regularly vaccinated against pulpy kidney.

2.6.4 FHFA F4

Description:

Carrying capacity: 5 ha/S.A.U. or 8-9 kg/ha

2.6.4.1 ENVIRONMENTAL FACTORS

a) Climate

The rainfall varies between 150 and 170 mm per annum. Rain generally occurs between October and April. The largest percentage of rainy days (10-20 days) occurs during the months of February and March. Summers are very hot with an average maximum temperature between 36^{o} c and 38^{o} C. Frost regularly occurs in winter.

b) Soil types

This subregion supports three types, viz. Kalahari sand and dunes, Nama sandstone plains and high granite mountains.

c) Topography

The subregion is situated between longitude 19^{o} to 20^{o} east and latitude $26,8^{o}$ to 28^{o} south.

The area consists of Kalahari sand dunes, hard plains and high granite mountains. The altitude is about 1600 m above sea level.

b) Vegetation

Grass cover:

Asthenatherum glaucum, Anthephora ramosa, Digitaria eriantha, Eragrostis lehmanniana, E. nindensis, Stipagrostis amabilis, S. ciliata, S. obtusa, S. uniplumis, Schmidtia kalahariensis, Aristida stipitata.

Trees and shrubs:

Acacia erioloba, A. hebeclada, A. nebrownii, A. mellifera, Boscia foetida, Catophractes alexandri, Rhigozum trichotomum, Salsola sp.

e) Sources of water

The subregion's water is supplied mainly by boreholes and earth excavation dams. The quality of water varies from very good to extremely brackish and bitter.

2.6.4.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Surface area of surveyed farms	1 129 306 ha
2. Total number of surveyed farms	138
3. Number of farming units	88
4. Average farm size	8 156 ha
5. Average size of farming units	12 661 ha
6. Average number of camps per farming unit	28
7. Distribution of camp sizes:	
50 - 200 ha	25 %
201 - 300 ha	25 %
301 ha and larger	50 %
8. Average camp size	444 ha
9. Average number of boreholes per farming unit	9
10. Average surface area per borehole	1 406 ha
11. All camps are provided with water	

b) Cultivated fields

None

c) Livestock farming

Pelt and meat production with Karakul, Dorper, Boer goats, cattle and game are practised.

d) Uneconomical farming units

21 = 24 %

2.6.4.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	87
Number of German speaking farmers	1
Number of other farmers	0

b) Age distribution

20 - 30 years	0
31 - 40 years	11
41 - 50 years	38
51 - 60 years	24
61 - 70 years	10
71 years and older	5

c) Communication

One farmer's association is active in the area.

2.6.4.4 PRESENT PRACTICES

a) Veld management

Farmers are fairly knowledgeable about basic pasture management, but records are not kept.

b) Stocking rate

Generally, stocking rates are conservative.

c) Marketing

Mutton sheep are marketed at an age of 4-6 months at the controlled markets and local auctions. Pelts are marketed three times annually at the pelt auctions.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	5
1.2 Average size of flocks	350
1.3 Average size of flocks at mating	350
1.4 Mating seasons: Two to three mating seasons per year	
1.5 Average lambing percentage	130 %
1.6 Average weaning percentage	110 %
1.7 Average marketing percentage	100 %

2. Flock composition

2.1 Karakul:	3 % rams
	75 % ewes
	15 % replacement
2.2 Dorper:	4 % rams
	60 % ewes
	15 % replacement
2.3 Boer goats:	2 % rams
	50 % ewes
	15 % replacement

3. Animal nutrition

Lick is provided late in the year.

4. Animal health

One to two broad spectrum dosings are administered per year. Livestock is vaccinated against pulpy kidney and botulism.

FHFA F5 - See FHFA G2

2.6.5 FHFA F6

Description: Klein Karasberge and Slopes
Carrying capacity: 5 ha/S.A.U. or 8-9 kg/ha

2.6.5.1 ENVIRONMENTAL FACTORS

a) Climate

The annual average rainfall of the subregion varies from 100 mm in the southern parts to 130 mm in the northern parts. Light, isolated showers occur from October onwards, with the highest precipitation in February and March. The number of effective rainy days is 10 - 15 per year, of which 80 % occur during the latter two months. Summers are very hot with the daily maximum temperature of 37° C to 40° C. Winters are mild to very cold, especially in the mountainous parts where temperatures below freezing point are recorded.

b) Soil types

There are two main soil types in the subregion, one of granitic origin (in the mountainous areas) and a sandstone-skale type on the lower slopes. The soil of the latter is much poorer than that in the mountainous areas.

c) Topography

The subregion is situated between longitude 26°50′ to 27°20′ east and latitude 17°30′ to 18°20′ south. The terrain consists of a high mountain range with deep gorges while the Apron veld is hilly with isolated koppies. The altitude is 2000 m above sea level.

d) Vegetation

Grasses are the main component of the pastures. Trees occur sparsely along rivers and in gorges.

Most important grass species:
Aristida engleri, A. congesta, Eragrostis lehmanniana, E. nindensis, Stipagrostis uniplumis, S. obtusa, Cenchrus ciliaris.

Important trees and shrubs:
Acacia nebrownii, A. erioloba, A. hebeclada, A. mellifera, Catophractes alexandri, Rhigozum trichotomum.

e) Sources of water

Farmers in this area depend on boreholes for their water supply. Boreholes are generally situated along gorges or rivers. Earth excavation dams are made at suitable sites so that certain parts can be utilized during the rainy season.

2.6.5.2 SOIL UTILIZATION PATTERN

a) Physical data	
1. Surface area of surveyed farms	425 981 ha
2. Total number of surveyed farms	77
3. Number of farming units	41
4. Average farm size	6 349 ha
5. Average size of farming units	10 389 ha
6. Average number of camps per farming unit	25
7. Distribution of camp sizes:	
50 - 200 ha	22 %
201 - 300 ha	21 %
301 ha and larger	57 %
8. Average camp size	524 ha
9. Average number of boreholes per farming unit	6,8

10. Average surface area per borehole 1 510 ha
11. Not all camps are provided with water

b) Livestock farming
Meat and pelt production are common.

c) Uneconomical farming units
15 = 36,6 %

2.6.5.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	41
Number of German speaking farmers	0
Number of other farmers	0

b) Age distribution

20 - 30 years	0
31 - 40 years	3
41 - 50 years	4
51 - 60 years	27
61 - 70 years	6
71 years and older	1

c) Communication
One farmer's association is active in the area.

2.6.5.4 PRESENT PRACTICES

a) Veld management
Farmers in this area are fairly up-to-date on general pasture management practices. Grazing records are however insufficient.

b) Stocking rate

Generally, stocking rates are average.

c) Marketing

Mutton sheep are marketed at an age of 4-6 months at the controlled markets in the R.S.A. or at local auctions. Pelts are pesently marketed three times annually at auctions in Frankfurt.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	5
1.2 Average size of flocks	350
1.3 Average size of flocks at mating	350
1.4 Mating seasons:	
From three mating seasons to mating throughout the year occurs.	
1.5 Average lambing percentage	120 %
1.6 Average weaning percentage	100 %
1.7 Average marketing percentage	90 %

2. Flock composition

2.1 Karakul:	3 %	rams
	75 %	ewes
	15 %	replacement
2.2 Dorper:	4 %	rams
	60 %	ewes
	15 %	replacement
2.3 Boer goats:	2 %	rams
	50 %	ewes
	15 %	replacement

3. Animal nutrition

Because of the large number of shrubs in the natural pastures, supplementation with lick is minimal.

4. Animal health

Dosing is done in exceptional cases, while vaccinations against mainly pulpy kidney are administered.

2.6.6 FHFA F7

Description: Kuibis Rooirante - Semi-desert and Savanna Transition zone

Carrying capacity: 5 ha/S.A.U. or 8-9 kg/ha

2.6.6.1 ENVIRONMENTAL FACTORS

a) Climate

The average annual rainfall of this subregion is 100-200 mm (150mm). Follow-up rains are less frequent than at the Swartrant, but light winter rains and heavy dew precipitation result in adapted vegetation (shrubs) that is in various stages of production irrespective of seasonal changes.

Rains may occur from October onwards, but maximal precipitation occurs in February and March (70-80 %). Winter rains occur during June, July and August. The subregion is a 1 ha : 5 S.A.U. region. The average number of rainy days per year is 10-20. Summer are very hot (average: 31,5° C; absolute maximum 40,5° C), while winters are mild (daily average 6° C; absolute minimum -4,2° C) with light frost. An evaporation rate of 3000 - 3200 mm per annum is experienced.

b) Soil types

The soil type is sandstone; poorer soils in the plains are calcareous.

c) Topography

This subregion is situated between longitude 16°30′ to 16°45′ east and latitude 26°45′ to 27°05′ south. Deep gorges and sandy rivers arise on the 1300 m high highland and flow east-, west- and southwards. Due to the nature of the topography and soil, erosion is a problem in this area.

d) Vegetation

Trees and shrubs:

This subregion falls into the Semi-desert and Savanna Transition zone. Single Acacia species occur in the gorges and rivers of the Rooirante.

Palatable trees and shrubs: Acacia erioloba, Boscia foetida, Catophractes alexandri, Calicorema capitata, Parkinsonia africana, Petalidium linifolium, Rhigozum trichotmum, Justicia spp., Leucosphaera bainesii, Monechma spp., Salsola tuberculata, S. nilotica.

Grasses:

The Stipagrostis species are the most common. The following species occur:

Aristida adscensionis, A. congesta, A. engleri var. engleri, Asthenatherum glaucum, Brachiaria glomerata, Cenchrus ciliaris, Cymbopogon pospischilii, Danthoniopsis ramosa, Digitaria eriantha, Enneapogon desvauxii, E. scaber, Eragrostis nindensis, E. scopelophila, Fingerhuthia africana, Panicum arbusculum, Setaria verticillata, Stipagrostis anomala, S. ciliata, S. namaquensis, S. obtusa, S. uniplumis, Triraphis purpurea, T. ramosissima.

e) Sources of water

The subregion has a few cases where the availability of water is a problem, but generally underground water is sufficient for farming needs. The water is fit for human and livestock consumption.

2.6.6.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Surface area of surveyed farms	211 049 ha
2. Total number of surveyed farms	21
3. Number of farming units	19
4. Average farm size	10 049 ha
5. Average size of farming units	11 107 ha
6. Average number of camps per farming unit	14
7. Distribution of camp sizes:	
50 - 200 ha	14 %
201 - 300 ha	28 %
301 ha and larger	58 %
8. Average camp size	788 ha
9. Average number of boreholes per farming unit	5
10. Average surface area per borehole	2 398 ha
11. All camps are provided with water	

b) Livestock farming

Extensive small stock farming is practised. Droper and Karakul sheep, Boer goats and a few cattle are kept on these farms.

c) Uneconomical farming units

7 = 37 %

2.6.6.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	18
Number of German speaking farmers	1
Number of other farmers	0

b) Age distribution

20 - 30 years	0
31 - 40 years	1
41 - 50 years	4
51 - 60 years	10
61 - 70 years	2
71 years and older	2

c) Communication

The farmer's association of neighbouring Bethanie is active in the area.

2.6.6.4 PRESENT PRACTICES

a) Veld management

The farmers possess the basic knowledge of pasture management and implement it. No records are kept.

b) Stocking rate

Stocking rates are relatively conservative.

c) Marketing

Pelts are marketed three times annually at the overseas pelt auctions. Mutton is marketed at the controlled markets, via speculators and at local auctions.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	3
1.2 Average size of flocks	400
1.3 Average size of flocks at mating	400
1.4 Mating seasons:	
One to two mating seasons per year are implemented	
1.5 Average lambing percentage	120 %
1.6 Average weaning percentage	100 %
1.7 Average marketing percentage	90 %

2. Flock composition

2.1 Karakul:	3	% rams
	75	% ewes
	15	% replacement
2.2 Dorper:	4	% rams
	60	% ewes
	15	% replacement
2.3 Boer goats:	2	% rams
	50	% ewes
	15	% replacement

3. Animal nutrition

Fair lick is provided.

4. Animal health

One dosing per year with a broad spectrum agent is administered. Livestock is vaccinated against botulism.

2.6.7 **FHFA F8**

Description: Semi-desert and Savanna Transition zone
Carrying capacity: 5 ha/S.A.U. or 8-9 kg/ha

2.6.7.1 ENVIRONMENTAL FACTORS

a) Climate

This subregion receives an annual rainfall of 100 to 150 mm. Rain occurs mainly in thunder showers from October to April. 70-80 % of the total precipitation occurs during February and March. The evaporation rate is between 3400 and 3500 mm per year. The average temperature during summer is 32,5° C and during winter 4,5° C.

b) Soil types

Soils in this subregion are a mixture of alluvium, sand, gravel and calcrete.

c) Topography

The terrain has high mountains in the northern parts, vast plains in the western parts and plateaus in the south. The area inbetween is hilly.

d) Vegetation

This is a semi-desert area.

Grasses:

Stipagrostis ciliata, S. anomala, S. hirtigluma, S. obtusa, Triraphis ramosissima.

Trees and shrubs:

Zygophyllum spp., Acacia erioloba, Boscia foetida, Rhigozum trichotomum.

e) Sources of water

Water is mainly supplied from boreholes. Except for high nitrate levels of the water of boreholes in the north-eastern parts, water is generally suited for human and livestock consumption.

2.6.7.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Surface area of surveyed farms	707 417 ha
2. Total number of surveyed farms	70
3. Number of farming units	58
4. Average farm size	10 237 ha
5. Average size of farming units	12 501 ha
6. Average number of camps per farming unit	25

7. Distribution of camp sizes:	
50 - 200 ha	16 %
201 - 300 ha	32 %
301 ha and larger	52 %
8. Average camp size	444 ha
9. Average number of boreholes per farming unit	7
10. Average surface area per borehole	1 572 ha
11. All camps are provided with water	

b) Livestock farming

Extensive farming is practised in this area. Karakul sheep are kept for pelt production, Dorper sheep and Boer goats for meat production and Lettelle sheep for their wool.

c) Uneconomical farming units

9 = 15,5 %

2.6.7.3 HUMAN RESOURCES

a) Ethnic grouping	
Number of Afrikaans speaking farmers	48
Number of German speaking farmers	8
Number of other farmers	2
b) Age distribution	
20 - 30 years	1
31 - 40 years	13
41 - 50 years	19
51 - 60 years	16
61 - 70 years	6
71 years and older	3

c) Communication

Two neighbouring farmer's associations are active in the subregion.

2.6.7.4 PRESENT PRACTICES

a) Veld management

In general, farmers of this area are fairly knowledgeable w.r.t. basic veld management practices and also implement their knowledge. Only a few farmers in the area don't keep records.

b) Stocking rate

Stocking rates are a little high.

c) Marketing

Mutton sheep is marketed mainly at the controlled markets and at local auctions. Pelts are marketed three times annually at pelt auctions.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	6
1.2 Average size of flocks	300
1.3 Average size of flocks at mating	300
1.4 Mating seasons:	
One to two mating seasons per year are implemented	
1.5 Average lambing percentage	120 %
1.6 Average weaning percentage	90 %
1.7 Average marketing percentage	80 %

2. Flock composition

2.1 Karakul:	3 % rams
	75 % ewes
	15 % replacement

2.2 Dorper: 4 % rams
60 % ewes
15 % replacement

2.3 Boer goats: 2 % rams
50 % ewes
15 % replacement

3. Animal nutrition
Because of the ample supply of shrubs in the veld, lick is seldomly provided.

4. Animal health
Two dosings per year are given. Livestock is vaccinated against botulism and pulpy kidney.

2.6.8 FHFA F9

Description: Semi-desert and Savanna Transition zone
Carrying capacity: 5 ha/S.A.U. or 8-9 kg/ha

2.6.8.1 ENVIRONMENTAL FACTORS

a) Climate
Rainfall of 150 - 200 mm per annum is received, mainly as thunder showers. On average 21 rainy days occur per year. The evaporation rate is between 3400 and 3600 mm per annum.

b) Soil types

Soils in this subregion have a loamy character with an abundance of green and red skale - the so called blue and red Torra. In the northern parts of the subregion, calcrete occurs while large areas in the west consist of black limestone.

c) Topography

The north-western parts are bordered on by the black limestone, sandstone and skale Zaris mountains as well as the high, rugged Naukluft mountains consisting of dolomite, quartzite, black limestone and skale. The eastern parts border on the Swartrant, while the central parts are flat and hard. Four rivers, viz. Fish, Usib, Zebra and Haruchas Rivers have their origins in this subregion.

d) Vegetation

This subregion includes two vegetation types viz. the Semi-desert and Savanna Transition zone and the Dwarf shrub Savanna. The area bordering on the Naukluft mountains supports ample shrubbery with species like Leucosphaera bainesii and Eriocephalus spp. Unfortunately thickets of Acacia nebrownii and Rhigozum trichotomum are also found. Stipagrostis uniplumis is dominant with climax species restricted to mountain slopes and rivers. Several Salsola species and Catophractes alexandri are widespread over the entire subregion.

e) Sources of water

Water supply is dependent mainly on boreholes with a few water-retaining depressions or earth excavation dams found in the area. A few boreholes in the central and southern parts have water with very high levels of

sulphate and total dissolved solids. These areas are however very localized. Nitrate and flouride levels are within limits.

2.6.8.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Surface area of surveyed farms	518 878 ha
2. Total number of surveyed farms	52
3. Number of farming units	40
4. Average farm size	9 978 ha
5. Average size of farming units	12 971 ha
6. Average number of camps per farming unit	24
7. Distribution of camp sizes:	
50 - 200 ha	17 %
201 - 300 ha	58 %
301 ha and larger	25 %
8. Average camp size	415 ha
9. Average number of boreholes per farming unit	7
10. Average surface area per borehole	1 425 ha
11. All camps are provided with water	

b) Livestock farming

The main farming activities involve Karakul sheep, Dorper sheep and Boer goats. Cattle and game are secondary industries on some farms.

c) Uneconomical farming units

3 = 7,5 %

2.6.8.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	28
Number of German speaking farmers	12
Number of other farmers	0

b) Age distribution

20 - 30 years	0
31 - 40 years	0
41 - 50 years	21
51 - 60 years	16
61 - 70 years	3
71 years and older	0

c) Communication

One of the neighouring farmer's associations is active in this subregion.

2.6.8.4 PRESENT PRACTICES

a) Veld management

Farmers of the area are very knowledgeable as far as pasture managment is concerned and they also implement this knowledge. Records on pasture management are however not kept conscientiously.

b) Stocking rate

A very conservative stocking rate is implemented.

c) Marketing

Mutton sheep is marketed at an age of 5-7 months at the controlled markets or local auctions. Pelts are sold three times annually at the overseas pelt auctions. Game is captured at night by harvesting teams.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	5
1.2 Average size of flocks	350

1.3 Average size of flocks at mating 350

1.4 Mating seasons:

From one to three seasons per year are implemented

1.5 Average lambing percentage 120 %

1.6 Average weaning percentage 110 %

1.7 Average marketing percentage 100 %

2. Flock composition

2.1 Karakul: 3 % rams
75 % ewes
15 % replacement

2.2 Dorper: 4 % rams
60 % ewes
15 % replacement

2.3 Boer goats: 2 % rams
50 % ewes
15 % replacement

3. Animal nutrition

Due to the abundance of shrubs, lick is provided only in exceptional cases. Droughts occur periodically and livestock numbers are adjusted accordingly.

4. Animal health

Dosing is done seldomly, but regular vaccination against especially pulpy kidney occurs. Livestock are treated regularly against external parasites.

2.6.9 FHFA G2 (includes FHFA F5)

Description: Dwarf shrub Savanna
Carrying capacity: 6 ha/S.A.U. or 6,5 - 7 kg/ha

2.6.9.1 ENVIRONMENTAL FACTORS

a) Climate
The average annual rainfall is ± 75-100 mm. Rain occurs in thunder showers during summer and autumn. Winterrain sometimes occurs. Summer temperatures are high, while frost occurs in winter.

b) Soil types
The subregion consists mainly of sandy loam, resulting in Sweetveld. In the north-westen parts, soils are harder while the north-eastern parts have a slatey character.

c) Topography
The terrain is hilly with ridges. Erosion does not pose a problem.

d) Vegetation
Trees and shrubs that occur:
Acacia erioloba, A. mellifera, Phaeoptilum spinosum, Rhigozum trichotomum, Eriocephalus ambiguus, Salsola spp..

Grasses:
In pioneer and trampled veld, various Aristida species occur. Subclimax and climax grasses are: Stipagrostis uniplumis, S. ciliata, S. obtusa.

e) Sources of water

Boreholes are the major source of water. They are fairly perennial.

2.6.9.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Surface area of surveyed farms		1 131 133 ha
2. Total number of surveyed farms		117
3. Number of farming units		89
4. Average size of farms		9 667 ha
5. Average size of farming units		12 709 ha
6. Average number of camps per farming unit		21
7. Distribution of camp sizes:		
50 - 200 ha	3 =	14 %
201 - 300 ha	4 =	19 %
301 ha and larger	14 =	67 %
8. Average camp size		595 ha
9. Average number of boreholes per farming unit		6
10. Average surface area per borehole		2 118 ha
11. All camps are provided with water		

b) Livestock farming

Karakul and Dorper sheep and Boer goats are kept for the production of pelts and meat.

c) Uneconomical farming units

33 = 37 %

2.6.9.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	89
Number of German speaking farmers	0
Number of others	0

b) Age distribution

20 - 30 years	1
31 - 40 years	11
41 - 50 years	50
51 - 60 years	19
61 - 70 years	7
71 years and older	1

c) Communication

One farmer's association exists in the subregion, while three associations of neighbouring areas are active in the subregion as well.

2.6.9.4 PRESENT PRACTICES

a) Veld management

A broad general knowledge about the basic principles of pasture management exists, but is not widely implemented. Few farmers keep records.

b) Stocking rate

A fairly conservative stocking rate is implemented.

c) Marketing

Mutton sheep are marketed at ± 6 months of age at the controlled markets or the well-known auction at Karasburg. Pelts are auctioned three times annually at the overseas pelt auctions.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	5
1.2 Average flock size	350
1.3 Average size of flock at mating	350
1.4 Mating seasons: From one season to mating throughout the year is implemented.	
1.5 Average lambing percentage	120 %
1.6 Average weaning percentage	100 %
1.7 Average marketing percentage	80-90 %

2. Flock composition

2.1 Karakul:	3 % rams
	75 % ewes
	15 % replacement
2.2 Dorper:	4 % rams
	60 % ewes
	15 % replacement
2.3 Boer goats:	2 % rams
	50 % ewes
	15 % replacement

3. Animal nutrition

Because of the composition of the veld, supplementation by means of lick is necessary.

4. Animal health
Regular dosings and vaccinations against botulism are performed.

2.6.10 **FHFA G3**

Description: Dwarf shrub Savanna
Carrying capacity: 6 ha/S.A.U. or 6,5 - 7 kg/ha

2.6.10.1 ENVIRONMENTAL FACTORS

a) Climate
The average annual rainfall in this subregion varies from 50 mm in the southern parts to 100 mm in the northern parts. Light thunder showers occur from November onwards with the maximum precipitation during February and March. The average number of effective rainy days varies from 10 to 20 per year, of which the largest percentage occurs during February and March. Summers are long and very hot with average maximum temperatures of 35-40^{o} C. Winters are mild to cold in the southern mountainous regions. Evaporation rates of 3200 - 5400 mm per year are experienced.

b) Soil types
These soils are poor with low production capacity and consist of sandstone and Nama sandstone. Inselbergs of black granite occur in the subregion.

c) Topography

This subregion is situated between longitude $16^{o}45'$ to $17^{o}45'$ east and latitude $26^{o}45'$ to $27^{o}05'$ south. Level black limestone plains with ridges and hills occur. Sanddunes form on the western side of these ridges, especially on the eastern parts of the lower Swartrant plateau (west of the Fish River). The average altitude in the subregion is 1050 m above sea level. Erosion by wind is a problem in this area. The subregion can be divided into an eastern and a western part.

d) Vegetation

Grasses are the main component of pastures with trees and shrubs playing a supplementary role. Trees occur sparsely and mainly along rivers.

Grasses:

Stipagrostis uniplumis, Eragrostis nindensis, Stipagrostis obtusa.

Trees and shrubs:

Acacia karroo, Boscia foetida, Acacia mellifera, Catophractes alexandri, Rhigozum trichotomum.

e) Sources of water

Boreholes are the main source of water. Water quality is good and boreholes are fairly well to poorly spread on farms.

2.6.10.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Surface area of surveyed farms		279 191 ha
2. Total number of surveyed farms		31
3. Number of farming units		26
4. Average size of farms		8 541 ha
5. Average size of farming units		10 739 ha
6. Average number of camps per farming unit		18
7. Distribution of camp sizes:		
50 - 200 ha	3 =	17 %
201 - 300 ha	3 =	17 %
301 ha and larger	12 =	66 %
8. Average camp size		753 ha
9. Average number of boreholes per farming unit		6
10. Average surface area per borehole		2 133 ha
11. All camps are provided with water		

b) Livestock farming

Extensive small stock farming is practised. Mainly Karakul sheep and Boer goats are kept, while Dorper sheep are kept occasionally but not with great success.

c) Uneconomical farming units

8 = 30,7 %

2.6.10.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	24
Number of German speaking farmers	2
Number of others	0

b) Age distribution

20 - 30 years	0
31 - 40 years	2
41 - 50 years	6
51 - 60 years	8
61 - 70 years	4
71 years and older	6

c) Communication

One farmer's association is active in the subregion.

2.6.10.4 PRESENT PRACTICES

a) Veld management

Farmers in this subregion are not familiar with basic veld management principles and therefore implement poor systems. No records are kept.

b) Stocking rate

A conservative stocking rate is implemented.

c) Marketing

Mutton sheep are marketed at auctions or are sold privately. Pelts are marketed three times annually at the overseas pelt auctions.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	3
1.2 Average flock size	500
1.3 Average size of flock at mating	500

1.4 Mating seasons:

One to two seasons per year are implemented

1.5 Average lambing percentage	120 %
1.6 Average weaning percentage	100 %
1.7 Average marketing percentage	90 %

2. Flock composition

2.1 Karakul:	3 %	rams
	75 %	ewes
	15 %	replacement
2.2 Dorper:	4 %	rams
	60 %	ewes
	15 %	replacement
2.3 Boer goats:	2 %	rams
	50 %	ewes
	15 %	replacement

3. Animal nutrition
Hardly any lick is provided.

4. Animal health
Livestock is not dosed.

2.6.11 FHFA G5

Description: Dwarf shrub Savanna
Carrying capacity: 6-7 ha/S.A.U. or 6,5-7kg/ha

2.6.11.1 ENVIRONMENTAL FACTORS

a) Climate
The average annual rainfall of the subregion is 100-200 mm. Rain may occur as early as October, but the main rains occur during February and March. Because of air

currents (westerly winds), the Konkiep valley is more arid than the surrounding areas. The average number of rainy days per annum is 10-20. summers are very hot (average temperature 36,4° C, absolute maximum 41,3° C) while winters are mild (daily average of coldest month 5,1° C, absolute minimum -4,0° C) with light frost occasionally. The evaporation rate is 3400-3500 mm per year.

b) Soil types

The sandstone soil originates from the geological Damara series - Nama sandstone/skale.

c) Topography

The Konkiep valley is situated between the Rooirante (west) and the Swartrant (east) i.e. between longitude 16°45′ to 17°15′ east and latitude 25°30′ to 26°45′ south. The easten border is formed by the red sandstone and skale Swartrant. The northern parts are flat and hard, while the southern parts are characterized by a rolling landscape with a few high granite koppies on the low, black limestone-sandstone Duwisib plateau range. The average altitude of the Konkiep valley is 1100 m above sea level.

d) Vegetation

According to the vegetation map of S.W.A., this subregion lies within the Dwarf shrub Savanna zone. The northern parts are characterized by a wide variety of Salsola spp. that occur together with Xerocladia viridiramis. Acacia nebrownii and Rhigozum trichotomum have encroached relatively large parts in the area. Eragrostins rotifer occurs near open water, while Stipagrostis uniplumis and S. ciliata are less abun-

dant. Catophractes alexandri occurs localized. On the south-western black limestone and sandstone soils, Stipagrostis anomala is widespread. Climax species like Anthephora pubescens, Setaria appendiculata and Digitaria eriantha are less abundant.

e) Sources of water

Boreholes are the main source of water with earth excavation dams being supplementary. In the subregion there are a few areas where the nitrate and sulphate levels are above the desired limit for animal and therfore human use too. These areas are however very localized. Levels of flouride and total dissolved solids are within limits and generally water quality is good. Boreholes are not deep and readily available.

2.6.11.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Surface area of surveyed farms		363 910 ha
2. Total number of surveyed farms		38
3. Number of farming units		30
4. Average size of farms		9 553 ha
5. Average size of farming units		12 143 ha
6. Average number of camps per farming unit		24
7. Distribution of camp sizes:		
50 - 200 ha	2 =	8 %
201 - 300 ha	12 =	50 %
301 ha and larger	10 =	42 %
8. Average camp size		437 ha
9. Average number of boreholes per farming unit		7
10. Average surface area per borehole		1 683 ha
11. All camps are provided with water		

b) Livestock farming

Extensive small stock farming is practised. Dorper sheep, Kakarul sheep, Boer goats and some cattle are found. Townlands comprise 40 514 ha. No cultivated fields are present.

c) Uneconomical farming units

7 = 23 %

2.6.10.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	26
Number of German speaking farmers	4
Number of others	0

b) Age distribution

20 - 30 years	0
31 - 40 years	1
41 - 50 years	17
51 - 60 years	9
61 - 70 years	2
71 years and older	1

c) Communication

Two farmer's associations are active in the subregion.

2.6.10.4 PRESENT PRACTICES

a) Veld management

Most farmers know the basic principles of pasture management and implement them in practice. No records are kept.

b) Stocking rate

A fairly conservative stocking rate is maintained.

c) Marketing

Meat is marketed at the controlled markets, auctions and through private sales. Pelts are sold three times annually at the overseas pelt auctions.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	5
1.2 Average flock size	350
1.3 Average size of flock at mating	350
1.4 Mating seasons:	
Two to three seasons per year are implemented	
1.5 Average lambing percentage	120 %
1.6 Average weaning percentage	90 %
1.7 Average marketing percentage	90 %

2. Flock composition

2.1 Karakul:	3 % rams
	75 % ewes
	15 % replacement
2.2 Dorper:	4 % rams
	60 % ewes
	15 % replacement
2.3 Boer goats:	2 % rams
	50 % ewes
	15 % replacement
2.4 Lettelle:	3 % rams
	60 % ewes
	15 % replacement

3. Animal nutrition
Fair lick is supplied.

4. Animal health
At least one dosing per year and vaccinations against pulpy kidney and botulism are administered.

2.6.12 FHFA G6

Description: Semi-desert and Savanna Transition zone
Carrying capacity: 7 ha/S.A.U. or 5 kg/ha

2.6.12.1 ENVIRONMENTAL FACTORS

a) Climate
The annual rainfall is between 100 and 150 mm in this subregion. Rains occur as thunder showers. The evaporation rate is unknown. Almost 15 rainy days occur per year. Temperatures during summer are high (35 - 40^{o} C).

b) Soil types
Soils in this subregion are composed of alluvium, sand, gravel and calcrete.

c) Topography
The north-western border of the subregion is formed by the high Nubib granite range. The black limestone - sandstone-skale Zaris mountians form the north-eastern border. The Duwisib plateau, consisting of granite

koppies, red quartzite, skale and basalt, forms the southern border. The subregion therefore is mountainous with grassy valleys.

d) Vegetation

The area is described as Semi-desert and Savanna Transition zone. A larger diversity of plant species compared to FHFA H5 is present here. Small shrubs are well represented. The northern parts of the subregion show signs of encroachment by Rhigozum trichotomum. Along the Zaris River, Acacia erioloba and Stipagrostis namaquensis are found. Stipagrostis ciliata is dominant in the grassy plains, while Setaria, Panicum and Anthephora species are less abundant and occur on the mountain slopes.

e) Sources of water

A few boreholes in the southern parts of the subregion have water where flouride levels exceed the limit of 2,0 p.p.m. (for human consumption). Apparently there are some boreholes in that area with flouride levels of 6 p.p.m., making their water unfit even for livestock consumption. Levels of sulphate, nitrate and total dissolved solids are within limits. Water supply is dependent mainly on boreholes, but a few, minor fountains do occur in the subregion. Boreholes generally are not very deep.

2.6.12.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Surface area of surveyed farms	188 620 ha
2. Total number of surveyed farms	23

3. Number of farming units		20
4. Average size of farms		8 200 ha
5. Average size of farming units		9 431 ha
6. Average number of camps per farming unit		21
7. Distribution of camp sizes:		
50 - 200 ha	6 =	28 %
201 - 300 ha	9 =	44 %
301 ha and larger	6 =	28 %
8. Average camp size		350 ha
9. Average number of boreholes per farming unit		6
10. Average surface area per borehole		1 366 ha
11. All camps are provided with water		

b) Livestock farming

Farming with Karakul and Dorper sheep are the main industries in this subregion. Goat farming is not common, while cattle is kept mainly for speculation purposes.

c) Uneconomical farming units

2 = 10 %

2.6.12.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	19
Number of German speaking farmers	1
Number of others	0

b) Age distribution

20 - 30 years	0
31 - 40 years	3
41 - 50 years	8

51 - 60 years	7
61 - 70 years	2
71 years and older	0

c) Communication

One extremely active farmer's association exists in the subregion.

2.6.12.4 PRESENT PRACTICES

a) Veld management

Good knowledge w.r.t. pasture management exists, but only a few farmers implement their knowledge. Scientific pasture records are not kept.

b) Stocking rate

A conservative stocking rate is maintained.

c) Marketing

Mutton sheep are mainly sold privately and occasionally at auctions in Maltahöhe. Pelts are offered for sale three times annually at overseas pelt auctions.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	5
1.2 Average flock size	350
1.3 Average size of flock at mating	350
1.4 Mating seasons: One to three seasons per year are implemented	
1.5 Average lambing percentage	130 %
1.6 Average weaning percentage	120 %
1.7 Average marketing percentage	100 %

2. Flock composition

2.1 Karakul:	3	% rams
	75	% ewes
	15	% replacement
2.2 Dorper:	4	% rams
	60	% ewes
	15	% replacement
2.3 Boer goats:	2	% rams
	50	% ewes
	15	% replacement

3. Animal nutrition

Supplementation by means of lick occurs readily.

4. Animal health

One to two dosings per year and regular vaccinations against pulpy kidney and botulism are administered.

2.7 LOW POTENTIAL SMALL STOCK FARMING AREA

2.7.1 FHFA G1

Description: Dwarf shrub Savanna
Carrying capacity: 8 ha/S.A.U. or 3-4 kg/ha

2.7.1.1 ENVIRONMENTAL FACTORS

a) Climate
The rainfall for the subregion is about 150 mm per annum. The number of rainy days is 10-15 per year. Temperatures vay between 0 and 40° C. Frost occurs seldomly.

b) Soil types
The main types of parent rock in the subregion are tillite, skale, sandstone and limestone of the Dwyka formation. Characteristic of the area are the stony surface and shallow soils. Towards both banks of the Fish River, red skale and sandstone are typical. Level patches of heavy, compacted, level clay are found east of the Fish River.

c) Topography
The subregion is a narrow strip to both sides of the national road to Keetmanshoop. The western border is the Fish River and the eastern border the so called Kalk- or Weissrante. The area is outstretched with typical, compacted, level areas where pastures are very poor.

d) Vegetation

The subregion is situated within the Dwarf shrub Savanna zone. Grass species are mainly Stipagrostis spp.. Along the Fish River a typical riverine forest with Acacia erioloba, Tamarix usneoides and other trees occurs. Salsola spp. are typical of the area, while some parts are encroached by Tetragonia reduplicata.

e) Sources of water

Boreholes are the major source of water, while some strong fountains also occur. Problems are experienced with water quality east of the Fish River up to the limestone plateau - especially high concentrations of NaCl occur. The pools of water in the Fish River are important for watering of livestock.

2.7.1.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Surface area of surveyed farms	52 111 ha
2. Total number of surveyed farms	7
3. Number of farming units	5
4. Average size of farms	7 4444 ha
5. Average size of farming units	10 422 ha
6. Average number of camps per farming unit	28
7. Distribution of camp sizes:	
50 - 200 ha	2 %
201 - 300 ha	22 %
301 ha and larger	76 %
8. Average camp size	372 ha
9. Average number of boreholes per farming unit	4
10. Average surface area per borehole	2 605 ha
11. All camps are provided with water	

b) Cultivated fields

None

c) Livestock farming

Mixed small stock farming aimed at meat and pelt production are the main activities. The official carrying capacity for the subregion is 5 ha/S.A.U., but a stocking rate of 10 ha/S.A.U. is still too high.

d) Uneconomical farming units

5 = 100 %

2.7.1.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	4
Number of German speaking farmers	1
Number of others	0

b) Age distribution

20 - 30 years	0
31 - 40 years	0
41 - 50 years	2
51 - 60 years	1
61 - 70 years	2
71 years and older	0

c) Communication

None

2.7.1.4 PRESENT PRACTICES

a) Veld management

The (few) farmers in this subregion have the necessary basic knowledge of pasture management. The knowledge is partly implemented. No records are however kept.

b) Stocking rate

A very conservative stocking rate is implemented.

c) Marketing

Mutton sheep are sold at a relatively late age of ± 10 months, mainly at local auctions or privately. Pelts are marketed three times annually at the overseas pelt auctions.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	4
1.2 Average flock size	450
1.3 Average size of flock at mating	450
1.4 Mating seasons: From one to three mating seasons per year are implemented	
1.5 Average lambing percentage	100 %
1.6 Average weaning percentage	90 %
1.7 Average marketing percentage	75 %

2. Flock composition

2.1 Karakul:	3 % rams
	75 % ewes
	15 % replacement
2.2 Dorper:	4 % rams
	60 % ewes
	15 % replacement

2.3 Boer goats: 2 % rams
50 % ewes
15 % replacement

3. Animal nutrition
Because of the abundance of Salsola spp. in the veld, lick is not provided.

4. Animal health
Stock is merely treated against external parasites.

2.7.2 FHFA G4

Description: Desert and Succulent Steppe
Carrying capacity: 8-10 ha/S.A.U. or 3-4 kg/ha

2.7.2.1 ENVIRONMENTAL FACTORS

a) Climate
The average annual rainfall of this subregion is between 50 and 100 mm (75 mm). This area receives mainly winter rains and heavy dew. The vegetation of this area is adapted to complete its life-cycle within a relatively short period. Rain occurs in February and March as well as in June, July and August. The subregion falls within the 8-10 ha : 1 S.A.U. area. The average number of rainy days per year is 10-20. Summers are hot (31-33^{o} C average temperature; absolute maximum 40,6^{o} C) and winters are mild (average tempera-

ture 5-8° C; absolute minimum -4,0° C) with light frost. Evaporation rates are between 2600 and 3000 mm per year.

b) Soil types

The subregion consists of Karoo sandstone and calcrete. Inbetween (Aus) Sinclair intrusions of the Mocolium formations are found. Towards the east, the border is formed by the Kuibis - Rooirante (Damara - Nama sandstone/skale). Towards the west, the arid Namib Desert is situated.

c) Topography

The subregion is situated between the Namib (west) and the Rooirante (east). The location is between longitude 15°45′ to 16°45′ east and latitude 25°45′ to 27°20′ south. The sand and quartzite gravel plains are on average 1000 m above sea level.

d) Vegetation

Trees and Shrubs:

The subregion is classified as a Desert and Succulent Steppe (Winterrainfall area). Scarce vegetation is typical of the area. The following palatable trees and shrubs occur: Acacia erioloba, Calicorema capitata, Parkinsonia africana, Rhigozum trichotomum, Salsola tuberculata, S. nilotica.

Grasses:

Stipagrostis species are the most abundant grasses. The following grasses are found in the subregion: Aristida adscensionis, Asthenatherum glaucum, Enneapogon

cenchroides, E. desvauxii, E. scaber, Eragrostis nindensis, Schmidtia kalahariensis, Stipagrostis anomala, S. ciliata, S. obtusa, S. uniplumis.

e) Sources of water

Problems in obtaining water are experienced especially in the area north of Aus. Most available water is fit for human and livestock consumption.

2.7.2.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Surface area of surveyed farms		474 060 ha
2. Total number of surveyed farms		29
3. Number of farming units		23
4. Average size of farms		16 346 ha
5. Average size of farming units		20 611 ha
6. Average number of camps per farming unit		17
7. Distribution of camp sizes:		
50 - 200 ha	2 =	12 %
201 - 300 ha	5 =	29 %
301 ha and larger	10 =	59 %
8. Average camp size		1 228 ha
9. Average number of boreholes per farming unit		5
10. Average surface area per borehole		4 052 ha
11. All camps are provided with water		

b) Livestock farming

Extensive, mixed small stock farming is practised. Mainly Karakul sheep and Boer goats are kept, but the number of Dorper sheep is increasing.

c) Uneconomical farming units

7 = 30 %

2.7.2.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	17
Number of German speaking farmers	6
Number of others	0

b) Age distribution

20 - 30 years	0
31 - 40 years	2
41 - 50 years	7
51 - 60 years	9
61 - 70 years	1
71 years and older	4

c) Communication

The Aus farmer's association is active in this area.

2.7.2.4 PRESENT PRACTICES

a) Veld management

The basic principles of veld management are known, but because of the low rainfall in the area, veld management is guided by conditions of the veld.

b) Stocking rate

A conservative stocking rate is maintained.

c) Marketing

Pelts are marketed three times annually at the overseas pelt auctions. Mutton sheep are sold at auctions.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	3
1.2 Average flock size	500
1.3 Average size of flock at mating	500
1.4 Mating seasons:	
On average two seasons per year are implemented	
1.5 Average lambing percentage	100 %
1.6 Average weaning percentage	90 %
1.7 Average marketing percentage	80 %

2. Flock composition

2.1 Karakul:	3 %	rams
	75 %	ewes
	15 %	replacement
2.2 Boer goats:	2 %	rams
	50 %	ewes
	15 %	replacement

3. Animal nutrition

No lick is provided.

4. Animal health

Livestock is not dosed and vaccinations are an exception.

FHFA H1 see FHFA H2

2.7.3 FHFA H2 (includes FHFA H1)

Description: Dwarf shrub Savanna
Carrying capacity: 8 ha/S.A.U. or 4 kg/ha

2.7.3.1 ENVIRONMENTAL FACTORS

a) Climate

The average annual rainfall is 50-75 mm. This is chiefly a summer rainfall area, but winter rains occur occasionally. Summers are extremely hot and temperatures of 43° C are recorded. The average day temperature in summer is 37° C. Winters are mild but frost occurs sometimes. Average winter temperature: 6,5° C.

b) Soil types

The western parts consist mainly of clay soils, while the area bordering on the Fish River shows slate and sandstone. The south-eastern parts have mainly sandy loam soil.

c) Topography

The subregion is situated between longitude 16°45′ to 17°30′ east and latitude 27°10′ to 28°50′ south. The Fish River traverses the area. In the southern parts, the Huns mountains are situated and the subregion extends up to the highwater mark of the Orange River. Deep gorges occur along the Fish River, making that area very inaccesible. Isolated koppies occur further south, making that area more wavy.

d) Vegetation

Trees and shrubs:

Acacia erioloba, Catophractes alexandri, Salsola spp., Rhigozum trichotomum.

Grasses:

Stipagrostis uniplumis, S. ciliata, S. obtusa, S. namaquensis, S. anomala.

e) Sources of water

Boreholes are the main source of water. Water quality is fair. Water is scacer, the farther away one moves from the Fish River.

2.7.3.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Surface area of surveyed farms		1 097 660 ha
2. Total number of surveyed farms		96
3. Number of farming units		79
4. Average size of farms		10 215 ha
5. Average size of farming units		13 417 ha
6. Average number of camps per farming unit		15
7. Distribution of camp sizes:		
50 - 200 ha	1 =	6 %
201 - 300 ha	3 =	20 %
301 ha and larger	11 =	74 %
8. Average camp size		1 079 ha
9. Average number of boreholes per farming unit		5
10. Average surface area per borehole		2 898 ha
11. All camps are provided with water		

b) Livestock farming

Extensive small stock farming with Karakul sheep and Boer goats is paractised. Cross-bred muttoh sheep are also found.

c) Uneconomical farming units

45 = 57,7 %

2.7.3.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	78
Number of German speaking farmers	0
Number of others	1

b) Age distribution

20 - 30 years	0
31 - 40 years	13
41 - 50 years	27
51 - 60 years	23
61 - 70 years	13
71 years and older	3

c) Communication

Three farmer's associations are active in this area.

2.7.3.4 PRESENT PRACTICES

a) Veld management

Farmers in the area have limited knowledge of the basic principles of veld management. No records are kept.

b) Stocking rate

A conservative stocking rate is maintained.

c) Marketing

Pelts are marketed three times annually at the overseas pelt auctions. Meat is marketed mainly by private sale or on auctions.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	3
1.2 Average flock size	500
1.3 Average size of flock at mating	500
1.4 Mating seasons:	
Karakul sheep: 2 seasons per year	
Meat producing small stock: all year round	
1.5 Average lambing percentage	110 %
1.6 Average weaning percentage	95 %
1.7 Average marketing percentage	90 %

2. Flock composition

2.1 Karakul:	3 % rams
	75 % ewes
	15 % replacement
2.2 Dorper:	4 % rams
	60 % ewes
	15 % replacement
2.3 Boer goats:	2 % rams
	50 % ewes
	15 % replacement

3. Animal nutrition

No lick is provided.

4. Animal health
Dosings and vaccinations are administered only in exceptional cases.

2.7.4 FHFA H3

Description: Dwarf shrub Savanna
Carrying capacity: 10 ha/S.A.U. or 3 kg/ha

2.7.4.1 ENVIRONMENTAL FACTORS

a) Climate
Rainfall is generally very low, ±25-50 mm per annum. Rains occur during summer and occasionally in winter. Summers are hot and winters cold with frost, except along the Orange River where frost occurs seldomly.

b) Soil types
With the exception of the hard soils of the northern and north-eastern parts, the subregion has sandy loam soils resulting in Sweetveld. Along the lower Orange River and at Noordoewer, fairly deep clay-loam soils are present that are very fertile.

c) Topography
Along the Fish River and the Orange River, the terrain is very mountainous. The remainder of the subregion has many ridges. In the mountainous areas, erosion is a problem because of the steep slopes.

d) Vegetation

Trees and shrubs:

Few large trees and shrubs occur in the area. Of the smaller shrubs, Salsola and Pentzia spp. are the most common.

Grass cover:

Stipagrostis ciliata, S. obtusa, S. uniplumis.

e) Sources of water

Boreholes are the main source of water, byt water is scarce. Water for irrigation purposes is pujped from the Orange River or forced into canals from where it is used.

2.7.4.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Planimetric surface area	652 915 ha
High risk livestock farming area	
2. Total number of surveyed farms	49
3. Number of farming units	47
4. Average size of farms	13 325 ha
5. Average size of farming units (farming units used exclusively for irrigation, are excluded from the above)	13 891 ha
6. Farming units on which mixed livestock farming is practised together with irrigation as main industry	9
7. Farming units where only irrigation occurs:	
- where water is pumped from the river	6
- Noordoewer and lower Orange	28
8. Surface area under irrigarion	1 250 ha

b) Cultivated fields

At present 1 250 ha are used for irrigation. The following crops are cultivated: lucern, cotton, vegetables like tomatoes, peas, oranges (20 ha), grapes (28 ha).

Irrigation by means of pumping water from the river seems to be less successful than irrigation from the canal system, which is very successful. Products are marketed directly in the R.S.A.

c) Livestock farming

Mainly Karakul farming is practised; it may be supplemented with Boer goat farming.

c) Uneconomical farming units

Livestock farming: 35 = 100 %

Livestock farming in this area carries a high risk. Despite the official carrying capacity of 3 kg/ha, the area cannot support this. The remainder of the subregion is taken up by the irrigation farms along the Orange River.

2.7.4.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	46
Number of German speaking farmers	0
Number of others	3

b) Age distribution

20 - 30 years	0
31 - 40 years	16
41 - 50 years	19

51 - 60 years	14
61 - 70 years	2
71 years and older	0

c) Communication

The Noordoewer farmer's association serves this area.

2.7.4.4 PRESENT PRACTICES

a) Veld management

None.

b) Stocking rate

Very low stocking rates are maintained.

c) Marketing

Meat is sold only privately.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	1
1.2 Average flock size	500
1.3 Average size of flock at mating	500
1.4 Mating seasons: Mating occurs throughout the year	
1.5 Average lambing percentage	90 %
1.6 Average weaning percentage	80 %
1.7 Average marketing percentage	60 %

2. Flock composition

2.1 Karakul:	3 % rams
	75 % ewes
	15 % replacement

2.2 Boer goats: 2 % rams
50 % ewes
15 % replacement

3. Animal nutrition
No supplementation occurs.

4. Animal health
No programmes are followed.

2.8 UNSTABLE SMALL STOCK FARMING AREA

2.8.1 **FHFA H4**

Description: Desert and Succulent Steppe
Carrying capacity: 10 ha/S.A.U. or 3 kg/ha

2.8.1.1 ENVIRONMENTAL FACTORS

a) Climate
The average annual rainfall of the subregion is 50-75 mm. Rains occur during June, July and August. The average number of rainy days is almost 10 per year. Summers are fairly hot with an average temperature of 31° C; absolute maximum 41° C. Winters are mild with the average day temperature of 8,5° C, absolute minimum

-2,0° C. Long periods occur that feel cold because of the cold southerly winds and rains in winter. The evaporation rate is 3000 - 3200 mm per annum.

b) Soil types

The subregion consists of Karoo sandstone and calcrete with some Nama sandstone of the Damara series. Soils consist of sandstone of the poorly developed, shallow calcareous soils.

c) Topography

The subregion is situated between the Namib desert (longitude 16°15′ east), the Kuibis-Rooirante and Huns mountains (longitude 17°00′ east) and latitude 27°15′ to 28°06′ south. The altitude of the sand and quatz gravel plains is on average 900 m above sea level.

d) Vegetation

The area is classified as a Desert and Succulent Steppe (Winterrainfall area). Scarce vegetation is typical of the area. Poisonous plants occur in the mountains and ridges around Rosh Pinah.

Palatable trees and shrubs:

Calicorema capitata, Parkinsonia africana, Rhigozum trichotomum, Salsola tuberculata, S. nilotica and some winter annuals.

Grasses:

Aristida adscensionis, A. congesta, A. engleri var. engleri, A. engleri var. ramosissima, Brachiaria glomerata, Enneapogon cenchroides, E. desvauxii, E.

scaber, Eragrostis nindensis, Schmidtia kalahariensis, Stipagrostis anomala, S. hritigluma subsp. patula, S. ciliata, S. namaquensis, S. obtusa, S. uniplumis.

e) Sources of water

As would be expected in a desert area, the subregion has little water. Stock watering points are in dry river beds where water can be found. Water is generally fit for human and livestock consumption.

2.8.1.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Surface area of surveyed farms	380 288 ha
2. Total number of surveyed farms	21
3. Number of farming units	18
4. Average size of farms	18 108 ha
5. Average size of farming units	21 127 ha
6. Average number of camps per farming unit	4
7. Distribution of camp sizes:	
50 - 200 ha	25 %
201 - 300 ha	25 %
301 ha and larger	50 %
8. Average camp size	5 511 ha
9. Average number of boreholes per farming unit	3
10. Average surface area per borehole	6 446 ha
11. All camps are provided with water	

b) Livestock farming

Extensive small stock farming is practised. Dorper sheep, Karakul sheep, Boer goats and small herds of cattle are kept.

c) Uneconomical farming units

10 = 44 %

Rosh Pinah townlands are just outside of this sub-region. No cultivated fields exist.

2.8.1.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	18
Number of German speaking farmers	0
Number of others	0

b) Age distribution

20 - 30 years	1
31 - 40 years	1
41 - 50 years	0
51 - 60 years	15
61 - 70 years	0
71 years and older	1

c) Communication

The Aus farmer's association is active in this area.

2.8.1.4 PRESENT PRACTICES

a) Veld management

Farmers have little knowledge about veld management systems, but old farmers handle the area in accordance with the high risk factor. No records are kept.

b) Stocking rate

A conservative stocking rate is maintained.

c) Marketing

Pelts are marketed three times annually at the overseas pelt auctions.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	2
1.2 Average flock size	500 - 600
1.3 Average size of flock at mating	500 - 600
1.4 Mating seasons:	
One to two seasons per year are implemented	
1.5 Average lambing percentage	100 %
1.6 Average weaning percentage	90 %
1.7 Average marketing percentage	80 %

2. Flock composition

2.1 Karakul:	3 % rams
	75 % ewes
	15 % replacement
2.2 Boer goats:	2 % rams
	50 % ewes
	15 % replacement

3. Animal nutrition

No lick is provided.

4. Animal health

Livestock is not dosed and vaccinations against botulism are administered occasionally.

2.8.2 FHFA H5

Description: Semi-desert and Savanna Transition zone
Carrying capacity: 10 ha/S.A.U. or 3 kg/ha

2.8.2.1 ENVIRONMENTAL FACTORS

a) Climate

The extreme western parts of the subregion receive 50-100 mm rain per annum. The remaining area receives about 100 mm per year. Precipitation occurs mainly as thunder showers. The average summer temperture is 38° C and winters are cold. Evaporation rate: 3400 - 3600 mm per annum. Rainy days: almost 15 per year.

b) Soil types

The extreme western parts of the subregion consist of Namib sand. The soils more inland towards the Nubib mountains, are a mixture of alluvium, sand, gravel and calcrete.

c) Topography

Isolated, single granite and basalt koppies are typical. Basalt koppies occur more towards the northern parts of the subregion. The rugged Nubib mountains form the eastern border. Inbetween the typical pro-Namib plains give the terrain a low, rolling character.

d) Vegetation

According to the vegetation map of Namibia, the area is a Semi-desert and Savanna Transition zone. Dominant grass species are Stipagrostis ciliata, S. obtusa and S. uniplumis which also are the climax species for this

area. Less abundant species are Enneapogon desvauxii and Eragrostis nindensis. Few trees occur in the area, all of which are Acacia erioloba.

e) Sources of water

About 7 farms, spread from north to south over the sub-region, do not have sufficient water. Water sources in the south contain 2,1-5 p.p.m. of flouride, making the water suitable for livestock use but not for human consumption (recommended limit = 2,0 p.p.m.). Levels of nitrate, sulphate and total dissolved solids are within limits.

2.8.2.2 SOIL UTILIZATION PATTERN

a) Physical data

1. Surface area of surveyed farms		531 651 ha
2. Total number of surveyed farms		46
3. Number of farming units		31
4. Average size of farms		11 557,6 ha
5. Average size of farming units		17 150 ha
6. Average number of camps per farming unit		28
7. Distribution of camp sizes:		
50 - 200 ha	4 =	14 %
201 - 300 ha	4 =	14 %
301 ha and larger	20 =	72 %
8. Average camp size		450 ha
9. Average number of boreholes per farming unit		4
10. Average surface area per borehole		2 889 ha
11. All camps are provided with water		

b) Cultivated fields

None

c) Livestock farming

The following small stock is kept for farming - Karakul, Dorper, Boer goats. Small numbers of cattle are present, while about 120 960 ha is owned by farmers intending to generate income from game farming.

c) Uneconomical farming units

3 = 10 %

2.8.2.3 HUMAN RESOURCES

a) Ethnic grouping

Number of Afrikaans speaking farmers	30
Number of German speaking farmers	1
Number of others	0

b) Age distribution

20 - 30 years	0
31 - 40 years	9
41 - 50 years	11
51 - 60 years	9
61 - 70 years	2
71 years and older	0

c) Communication

One fairly inactive farmer's association exists in the area, while a large group of farmers are members of an active, neighbouring farmer's association.

2.8.2.4 PRESENT PRACTICES

a) Veld management

No systems are implemented.

b) Stocking rate

Stocking rates are low.

c) Marketing

Stock is sold mainly privately at an age of ±12-15 months. Pelts are sold three times annually at overseas pelt auctions.

d) Other management practices

1. Reproduction

1.1 Average number of flocks per farming unit	3
1.2 Average flock size	±500
1.3 Average size of flock at mating	±500
1.4 Mating seasons:	
Two to three seasons per year are implemented	
1.5 Average lambing percentage	120 %
1.6 Average weaning percentage	100 %
1.7 Average marketing percentage	90 %

2. Flock composition

2.1 Karakul:	3 %	rams
	75 %	ewes
	15 %	replacement
2.2 Droper:	4 %	rams
	60 %	ewes
	15 %	replacement
2.3 Boer goats:	2 %	rams
	50 %	ewes
	15 %	replacement

3. Animal nutrition

Because of the composition of the veld, supplementary lick is provided late in the year.

4. Animal health

Few, if any dosings are administered. Sporadic vaccinations against pulpy kidney and botulism are administered.

CHAPTER 3

PRODUCTION SYSTEMS AND PROBLEMS

3.1 KARAKUL FARMING

Measured against the three basic principles of optimal soil utilization, karakul farming is the most suitable production system in the southern parts of South West Africa, which includes more than half the white farming areas. In this area, farming is extremely extensive and is often described in the literature as desert-like. Nonetheless, karakul are doing very well in this region.

Exact figures on the number of karakul sheep cannot be obtained, but 3,1 million seems a reasonably accurate estimate. In addition, 1 million of other sheep races are found in this area, mostly Black-headed Persians, Afrikaner, Van Rooy and Dorper.

Should a surface area of 5 million hectare be utilized by non-karakul sheep, about 15 481 000 hectare are available for karakul pelt production.

The total pelt production of South West Africa is indicated in Table 2. (<u>These figures must be used only for Departmental reasons and be considerd confidential</u>).

TABLE 2: Total karakul pelt production in South West Africa, 1973 to 1978.

Year	Karakul pelts produced		
	Total pelts produced	% white farmers	% non-white farmers
1973	3 261 239	88,0	12,0
1974	2 647 563	86,5	13,5
1975	2 774 287	86,6	13,4
1976	2 436 960	85,8	14,2
1977	2 680 474	84,7	15,3
1978	2 709 552	85,2	14,8

Source: Karakul Board of South West Africa, 1979.

It is estimated that during the past six years 23 % good quality pelts, 57 % average quality pelts and 20 % poor quality pelts were produced.

Taking above statistics into consideration, an average of 17,497 pelts per 100 ha were produced in the sheep farming area. (This is an average figure for the high, medium and low potential areas).

Karakul farming makes an important contribution to the total gross farming income in South West Africa. It varied between 27% and 35 % since 1973. The gross value of karakul pelts and wool is listed in Table 3.

TABLE 3 : Income from karakul pelts and wool, 1973-1978

Year	Total income frrm pelts R	Total income from wool R	TOTAL R
1973	30 036 011	1 741 000	31 777 011
1974	24 701 762	2 172 000	26 873 762
1975	33 014 015	1 857 000	34 871 015
1976	43 426 627	2 857 000	46 283 627
1977	37 204 979	3 596 000	40 800 979
1978	34 086 164	3 677 000	37 763 164

The total of ± 5 million kg karakul wool produced in South West Africa, represents about 65 % of the total production of South West Africa and the Republic of South Africa together. Since 1972/1973 the price of karakul wool increased from about 42,39c per kg to 73,77 c per kg in 1977/1978. The average price of karakul pelts on the other hand was as follows:

1973	R 9,21
1974	R 9,33
1975	R 11,90
1976	R 17,82
1977	R 13,88
1978	R 12,58

The production cost during 1978 makes up about 50 % of the average pelt price. This does not include interest on capital.

3.1.1 Problems experienced in karakul farming

The problems are approached from three angles viz. research, marketing and production.

3.1.1.1 Research

There is a shortage in specialized professional knowledge and broad background knowledge as far as all aspects of the industry, from the raw pelts to the finished product, are concerned.

Breeding:

a) The switching from curly tipe pelts to water silk type pelts was accompanied by such undesirable characteristics like thick hair, lower quality, metallic shine etc. These divergent pelt types took on larger proportions in time and the poor wearability of SWAKARA garments can be directly ascribed to these characteristics.

b) From a breeding point of view, this is an alarming situation, since particularly these longitudinally wrinkled, feathery or ribbed types (that comprised about 20 % of the market) appear to be the best on a photo. They are therefore usually given high marks and enjoy the highest demand on ram auctions. This undesirable genetic influence is increasingly spread in the karakul industry.

c) There exists a large number of characteristics for which selection has to be done. Most of the characteristics are not measureable and have low hereditary value. On top of this they still are subject to mutual interaction. No knowledge exists on how these factors influence the morphology and histology of the final product, and further research is needed.

d) There are no research facilities where this important and fundamental histological and morphological work can be done.

The problem is compounded by the lack of professional manpower to handle this and and other aspects of research.

e) The karakul industry is genetically vulnerable mainly because of the large influence of a few established studs and a low diversity as far as pelt types and colours are concerned.

f) The fact that the price of pelts is influenced up to twice as much by pattern than quality, has aggravated the quality problem in the industry. This problem is mainly the fault of the buyer, since farmers produce the pelts for which they can obtain the highest prices at auctions. This situation will definitely not motivate farmers to pay more attention to quality. The reputation of SWAKARA can therefore suffer.

3.1.1.2 Market Research

a) Market research with respect to karakul products, has been neglected in the past. More should be done about problems concerning the market, preferences of the consumer and extension of the market.

b) Existing information from research that has already been done, should be processed in such a way that it becomes available to all interested parties. This can only benefit all interested parties in the karakul industry.

c) Better marketing opportunities for old karakul ewes should be investigated. At present, many farmers let their ewes lamb until they die naturally. On the one hand, this is done, because farmers believe they get more money for the pelts of the lanbs than for the old ewe. On the other hand, the market for these animals is very limited.

This leads to an increased average flock age with the resulting decrease in flock vitality and lambing percentage, inhibition of genetic progress and even the over-utilization of pastures.

d) Although several attempts have been made to utilize the lamb carcasses more effectively to the benefit of the farmer, no practical solution has yet been found. Research in this direction is necessary and must be aimed at the practial processing of lamb carcasses on individual farms. A huge amount of nutrients (protein) is lost, while the world is threatened with a protein shortage.

e) The 20 % of poor quality pelts that are marketed, can only be detrimental to the industry. This is especially applicable to the breeding and process-

ing of pelts. Effective methods to prevent these pelts from reaching the SWAKARA market, have to be devised.

3.1.1.3 Extension work and training

a) The present implementation of all practices, measured against existing standards, desparately needs improvement. This means that a lack of knowledge on the implementation of practices (i.e. existing scientific knowledge) exists with a large percentage of farmers. The lack of correct implementation can also be attributed to a number of socio-economic factors. In the latter field a huge lack of knowledge exists.

b) Existing research results cannot be properly conveyed to the farmer. One of the most important causes, is a lack of professional extension officers. In the entire southern subregion, only one departmental extension officer is presently employed. This is utterly unsatisfactory.

c) The karakul industry is specialized and experts are not trained for this specific field at formal training centers. Experts in the field therefore receive in-service training, with the result that they are scarce and becoming even scacer. At present the coordination and relations between departmental, cooperative and private institutions is ineffective.

A proper and extensive organisation for the industry has to be established with a common, programmed plan of action, resulting in the maximal utilization of knowledge on the various sectors of the industry.

d) A few of the more important problems in the industry were established and are listed in order of importance from an extension point of view:

1. Negative perception of farmers with regard to their own efficiency, leading to a lack of aspirations.
2. Injudicious aquisition or selection of breeding stock.
3. Low fertility (lambing percentage) in karakul sheep.
4. Inefficient financial management of farming practice.
5. Poor pasture managment.
6. Lack of strategic supplementary feeding during certain times of the year.

The opinion exists that the inherent breeding capacity of the ewes is not the largest obstacle, but that environmental influences like poor veld and veld management as wel as supplementary feeding are the major reasons why the full breeding potential of animals is not realized.

Point 1. mentioned above, is interesting from an extension point of view and emphasizes the basic concept that any change in the industry can only be accomplished if there is a wish or aspiration from the farmer to improve practice(s).

3.1.1.4 Labour

a) Especially in the areas that are suited for sheep farming but are not provided with jackal-proof fencing, labour is a big problem. Farmers are unable to obtain labourers that are willing to look after their flocks in the veld. As a result, many farmers have switched to cattle farming, which is not in harmony with the environment.

b) Unskilled and untrained labour still is one of the biggest problems. More formal training on farms in flock management will be necessary in future.

3.2 CATTLE FARMING (BEEF)

3.2.1 The report of the Committee of Inquiry into the marketing sheme for cattle and meat in South West Africa (May 1978) deals in detail with the present cattle population, production and marketing of cattle. A few current aspects are summarized and some deductions made.

a) Production of beef contributes the largest amount to the gross value of agricultural products in South West Africa. Since 1960 the income from this farming activity varied between 48 % and 58 % of the total agricultural income (Table 4).

TABLE 4: Contributions of the various animal products to the total gross value (G.V.) of agricultural production in South West Africa 1955 - 1977.

Year	G.V. [1] of agricultural production ,000R	G.V. of beef ,000R	% of total	G.V of sheep goats, pigs ,000R	% of total	G.V. of karakul pelts ,000R	% of total
1955	31836	10799	34	3462	11	10011	31
1960	34516	17665	51	2560	7	8478	25
1965	49441	25246	51	3150	6	13844	28
1970	65618	33185	51	4822	7	20989	32
1971	79181	42197	53	5778	7	24346	31
1972	102753	56145	55	7023	7	32475	32
1973	106873	61570	58	8023	8	29341	27
1974	88602	44700	50	9793	11	24531	28
1975	111872	54676	49	11747	11	3352	30
1976	136330	63484	47	11937	9	46378	34
1977	129563	62592	48	13916	11	37055	29
% Increase 1955-1977	370	480		302		270	

1 Estimated values

2 Gross value

Source: Report by the Committee of Inquiry into the marketing scheme for cattle and meat for South West Africa/ Namibia 1979.

b) Although the income from beef production increased by 48 % since 1955, the increase in beef produced, was only 7,34 % since 1958.

If it is however kept in mind, that the number of cattle owned by white farmers in 1958 was 2430500, compared to 1543000 in 1977 (i.e. a decrease of 36,5 %), this is an exceptional achievement by the farmers. This is furthermore reflected in the average carcass mass of 212,4 kg at an average age of 6,18 years in 1958 compared to 216,1 kg at an average age of 4,74 years in 1977.

c) The local consumption of beef has increased by 39,78 % from 1958 to 1977.

d) Although about 42 % of cattle is owned by non-whites (1977), they only contributed 11,8 % to the total number of carcasses marketed. If the 12 % to 15 % contribution to the total beef production by non-white farmers is taken into consideration together with the fact that they own about 48,3 % of the total farming area, the large potential of this area for increased beef production, can be realized.

e) Because of the extensive nature of cattle farming in South West Africa, lower grades of beef are usually produced. Since 1974 to 1977 good rainfall was experienced. During these years the average number of good grades was 14,62 %, average grades 59,95 % and poor grades 25,43 % of the total.

f) South West Africa at present depends on export to South Africa and foreign countries for 90 % of its total production. Maitland is the most important market and about 90 % of the cattle slaughtered there, are from South West Africa. 83,6 % of all cattle that is imported is marketed at Maitland. The Republic of South Africa is the most important market and during the past 23 years 80 % of South West Africa's production was marketed there.

g) The present production in South West Africa, as far as quality and seasons of marketing of various grades are concerned, complements shortages in South Africa without negative effects on South African producers.

h) The Republic of South Africa was dependent on imports for 25 % of its beef consumption. Production from South West Africa was responsible for 15,5 % of the total meat supply in the Republic of South Africa since 1967.

i) Given that 15562 million hectare are utilized for the production of beef and the meat production of 1974 to 1977 is taken into account, the average meat production in South West Africa is 4,665 kg per ha.

j) The southern districts (Bethanie, Mariental, Aranos, Keetmanshoop, Luderitz, Maltahöhe and Warmbad) contribute about 10 % to the total meat production in South West Africa. Of this, 62 % is produced in the Aranos and Mariental regions.

3.2.2 Problems in cattle farming

a) Marketing problems

The largest, single problem at present is the imbalance in numbers of cattle reaching the market by means of permits.

The "Verslag van die Komitee van Ondersoek na 'n Bemarkingskema vir Vee en Vleis vir Suidwes-Afrika/Namibië is cited here: "About 90 % of the cattle slaughtered at Maitland are from South West Africa and more than 50% of them are marketed directly from this region (S.W.A.) while the rest are marketed via feeding-paddocks in the vicinity of Cape Town." Present information indicates that the figure for direct marketing this year (1979) was 60 %. This means that about 95 % of the farmers are dependant on 60 % of the export potential to Cape Town.

b) Production costs

According to postal records of the Division Agricultural Economics and Marketing, the production cost (weighted average of 75 farmers) is R2,60 per ha. The interest on capital is not included in this calculation. The average gross farming income per ha is R4,26 (1977/1978).

c) The natural condition of pastures varies from pioneer to transitional stages. This increases the vulnerability of farming activities during poor or below average rain years. Large variation in rainfall between years is characteristic for South West Africa. This leads to variation in the

yield of pastures, since there is a general lack of rapidly producing grass species on farms. The buffer effect of perennial grasses, exists only to a limited extend. Nutritional problems are therefore primarily quantitative. This is applicable to a greater extent to the northern than the central parts of the area.

Secondly, a qualitative problem is experienced. Many of the nutritious, perennial grasses are replaced by inferior perennial or annual grasses.

This loss in nutritional value thus has to be supplemented with feed. The result is, that most of the supplementary feed is absorbed for bodily maintenance instead of contributing to increased production.

Recommendations

i) The present subsidy system must be retained in an independent South West Africa and the subsidy tariffs have to be adjusted to prevailing costs.

This wil stimulate further development of farms. It has been proven on several farms, that a six-camp system gives good results as far as veld improvement is concerned.

It is recommended, that six camps per herd is accepted as a standard. The total number of camps per farm must be determined according to carrying capacites, viz:

Carrying capacity		Average camp size
8 ha/cattle	-	130 ha
10 ha/cattle	-	140 ha
12 ha/cattle	-	150 ha
15 ha/cattle	-	180 ha
3 ha/sheep	-	200 ha
4 ha/sheep	-	220 ha
5 ha/sheep	-	240 ha
6 ha/sheep	-	260 ha
less	-	300 ha

ii) Pasture management corridors between watering points should be subsidised. a large number of camps on a farm are of little use, if effective rotational grazing is not implemented. These corridors will facilitate faster and more effective moving of cattle between camps, which is a good point in motivating farmers to implement rotational grazing.

iii) Continuous extension work should be done to decrease the number of farmers that implement a poor pasture management system.

d) Bush encroachment

The extent of bush encroachment by especially Acacia mellifera subsp. detinens and Dichrostachys cinerea is taking on serious proportions. It is generally accepted, that about 8 million hectare in South West Africa are affected, 4 million thereof severely.

The dense stands of bush, cause enormous decrease in the mass yielded by natural pastures. Research on aerial spraying of bush in South West Africa, indicates that pasture yield can be increased 100 to 200 % within two years after treatment. Where Hyvar X was used, increase in yield was 100 to 400 %.

Hypothetically, this means the following. If control of bush encroachment results in an increase of 500 kg in grazing per ha, theoretically between 800 000 and one million more cattle (or a 50 % increase) can be kept in in South West Africa. If the present stock numbers are kept constant, an increase in nutritional value and stability of the veld can be achieved.

Because of competition by the encroaching species, veld recovery is very difficult. This means that there is no qualitative improvement in pastures. Taking the basic requirements into consideration, little improvement can be expected through pasture management alone in severly affected areas. It therefore is extremely important, that effective and economical methods of control are found, even though the present treatments already showed positive results.

A lack of knowledge still exists as far as the following are concerned: effective period of treatment, period and rate of re-encroachment and how it can be prevented, increase in beef production and how long it can be maintained.

Recommendations

i) Future research should be aimed at establishing the effective duration of treatment with the tested chemicals, i.e. the period that bush is absent or/and at what rate re-encroachment occurs. If re-encroachment occurs, which alternative methods that are practically and economically viable, can be used to control bush.

ii) The present cost of ± R25 per ha makes it virtually impossible for farmers to use Tordon 225 against bush encroachment. It is recommended that the chemical is placed under government control in an independent South West Africa. The government therefore imports the chemical and supplies it to the farmer without making any profit. The elimination of a middleman and customs fees, can already mean considerable savings (about R4 to R6 per ha).

iii) The supply of the chemical to the farmer has to be controled. It has to be well planned, taking marketing possibilities into account, so that a drastic increase in production does not result in marketing problems. Certain minimum requirements, e.g. the degree of development of the farm and the percentage of the surface area that may be treated annually, have to be laid down and must be complied with before Tordon will be supplied.

iv) The possibility to subsidise this project for individual farmers, has to be investigated, since it requires considerable capital.

e) Nutritional deficiencies

It is well known that a deficiency of phosphate occurs in the area. During winter, the protein content of the pastures decreases drastically and has to be supplemented. As far as the other nutrients of pastures are concerned, little information is available at present. Research on the following should be priorities:

The nutrient content of grasses and palatable bushes should be determined to be able to pinpoint deficiencies in various areas. This, together with liver sample analyses, should give a good indication of possible deficiencies that could hamper production.

In general, soil analyses have only been done sporadically. More information in this field should become available.

f) Drought restistant fodder crops

Since drought has such a prominent influence on agriculture in South West Afica, cultivation of drought resistant crops should be more acceptable to farmers. At present no drought resistant crops are cultivated by farmers.

g) Pasture management

The present condition and nutritional status of the natural pastures, is largely the result of injudicious pasture management in the past. According to information in 1970, only 10 % of farmers implemented effective pasture management systems. Since then, this situation has improved somewhat, and at present 30,6 % of farmers implement good pasture management systems,

35,6 % fair ones and 33,7 % poor ones. This means that 69,3 % of the farmers still do not have effective systems. Factors hampering good pasture management are:

i) Number of herds

One of the largest problems at present is the practice of having too many herds for too few camps. Often the physical facilities have not been developed yet so that a minimum of 6 camps per herd are not available. With these standards in mind, the number of herds per farm should not exceed 5 - i.e. 30 camps per average farming unit. At present most farmers keep six and more herds, which means about 3 camps per herd.

ii) Grazing periods

Grazing periods per camp are generally too long.

iii) Knowledge

Knowledge on ecological and physiological principles of pasture management is limited. Better insight will mean that farmers can make better decisions.

iv) Record keeping

Record keeping with respect to pasture managment has until now not been implemented. It can be a very important aid in pasture management.

v) Stocking rate

Although a small percentage of farmers exceed the presently recommended carrying capacity, it is doubted if the natural pastures are inherently able to support the present capacity. Especially

on severely encroached farms, veld recovery can occur only very slowly under the present stocking rate.

vi) Yield of natural pastures

Knowledge on the yield of grasses on different soil types is limited. A rule of thumb is usually applied when determining the carrying capacity of a farm, without taking the production potential of different soil types into consideration.

h) Herd management

Only the most important shortcomings in general management are mentioned here.

i) Calving percentage

The average calving percentage for the area at the time of the survey was 65 %. If it is kept in mind, that good rainy years preceded this survey, the figure is disappointing.

Factors hampering the calving percentage, are the following:

The condition of the veld and thus its nutritional value, is the single most important contributing factor to the low calving percentage.

Only 58,8 % of the farmers implement correct mating seasons.

About 50 % of farmers have to few bulls for their cows.

Only 39,8 % of farmers have an identification system for their cows. The elimination of cows with low fertility, cannot be implemented effectively.

About 50 % of farmers do not provide good lick during winter. This together with the low nutritional value of the veld can cause cows to loose excessive weight after calving with the result that they will not be receptive during the next mating season. Good lick should buffer the weight loss.

Virtually no attention is given to the fertility of bulls.

The existence of enzootic abortion and vibriosis is unknown. Very little is done to prevent these diseases.

First mating of heifers occurs too late in many cases, i.e. at an age of 2,5 to 3 years. Lower fertility of herds can thus be expected.

ii) Other management practices

The most important problems identified through this survey, are:

a) Record keeping

Only a few farmers participate in the Performance Testing Scheme. At present, mainly phenotypical selection is implemented, based on vision and memory. The lack of effective identification sys-

tems and production records, means that selection is very ineffective and genetic progress is hampered.

The resistance to record keeping is also found on economical level. An extremely low percentage of farmers participates in a formal economical record system (± 2 %). The rest keep records mainly for taxation, where no standards of efficiency are involved.

Record keeping in general is a serious problem that needs urgent attention.

b) The production policy on farms is easily changed. When there is a demand for weaners with the resulting high prices, farmers switch to producing weaners. The resulting high percentage of cows in the herds, causes instability because of erratic rainfall. Once the herd has been adjusted to production of weaners, prices decrease and the herd has to be re-adjusted. The effect of this constant changing on genetic progress is obvious. Most commercial farmers implement cross-breeding. There are few effective cross-breeding programs and it usually occurs randomly.

3.2.3 The Performance Testing Scheme should be a priority for extension work. Participation can be encouraged by placing a premium on products marketed by participating farmers. Participation will have a considerable effect on implementation of practices as well as the income of the farmer and in the end the country. The in-

creased income from the cattle industry should by far exceed any premiums payable to participating farmers and contribute to a healthy cattle farming industry.

3.3 DAIRY FARMING

A complete investigation into the dairy industry was launched by a Commission of Inquiry. Here the discussion centers around extension work.

Production of milk in South West Africa occurs under circumstances varying from intensive to extensive systems where cows are milked directly off the veld. As a result, production is subject to seasonal fluctuations leading to overproduction during the green season and shortages during the dry season. This obviously leads to instability in the dairy industry.

The industry is geared mainly toward the supply of fresh and industrial milk. At present there are 55 fresh milk producers which are registered with the Board. They can be divided into three categories:

1. Producers supplying milk to the controled areas of Windhoek, Otjiwarongo, Grootfontein and Gobabis. At present 28 farmers supply this need.
2. Producers supplying areas not controlled, including the towns of Outjo, Tsumeb, Walvis Bay and Keetmanshoop. On 31 March 1979 there were 5 producers in this group.
3. Producers supplying milk to the remaining 17 smaller towns. On 31 March 1979, there were 22 of them.

The industrial milk producers can be divided into two groups:

1. Those supplying milk to the cheese factory at Outjo. Their numbers vary between 40 and 50 (1976/1977 and 1977/1978).
2. Producers supplying cream to the butter factories at Rietfontein and Gobabis. The number of producers involved here, cannot be determined, since their numbers vary with variation in rainfall (availability of pastures) and changes in their economical situation.

3.3.1 Production and Consumption

a) Fresh milk

The total production of fresh milk during the 1977/1978 season for the controled and not-controled areas was 10 913 500 liter of which 6 510 000 liter were destined for the controled areas. The total volume was absorbed locally without any surplus. During the peak production period (green season), part of the production had to be channeled to the factories, while shortages during the dry periods had to be supplemented with imports from the Republic of South Africa. 615 630 liter of milk were imported to supply the needs of the controled areas - mainly Windhoek. This means that about 95 % of the total consumption during this year was produced locally. It has to be kept in mind, that this figure is related to the good rainy season.

b) By-products of fresh milk

The most important by-products are fruit yoghurt, drinking yoghurt, cultured milk and cottage cheese. The total production was 804 000 liter (1977/1978).

Better facilities would enbale higher production if the demand should exist. Production of these by-products depends on the green season; during the dry season South West Africa is wholely dependant on imports of these products.

Walvis Bay produced 10 000 liter cultured milk during 1977/1978. All these products were marketed within S.W.A.

c) Cheese

According to the Dairy Board, 95 ton (86 363 kg) of cheese was produced during 1977/1978. This satisfied about 18 % of the local demand. The total amount of cheese that had to be imported was 394 585 kg.

d) Butter

Figures obtained from the Dairy Board show a production of 194 ton (176 363 kg) butter during 1977/1978. This represents 14 % of the total consumption in South West Africa. The remaining 1 111 131 kg of butter were imported from the Republic of South Africa.

3.3.2 Distribution of fresh milk products

According to the quota allocated by the Dairy Board since 15 December 1978, the Gobabis producers are responsible for 87,4 % of the total milk supply for Windhoek, while the quota for the North and the so called Kanneblok are 9,2 and 3,4 % respectively. Calculated on the basis of number of farmers, Gobabis contributes 68 %, The North 24 % and the Kanneblok 8 %.

Except for a concentration of producers north east of Gobabis, the rest is spread over South West Africa.

3.3.3 Problems in dairy farming

A complete study was done to determine the problems experienced with the implementation of practices under fresh milk producers. It becomes clear, that generalizations cannot be made on many aspects, since specific problems occur in specific production areas. The extension program therefore has to be adjusted to emphasize certain aspects in some areas and other aspects in others.

A detailed, written report exists on the specific problems in each production area on which extenstion work can be based. For this reason, no further details will be given in this report.

3.4 AGRONOMY

3.4.1 It is estimated that about 100 000 ha cultivated fields exist, 60 00 of which are situated in areas that do indeed have agronomic potential. It is doubted, if 20 000 ha are presently utilized for cash crop cultivation.

Since the 1950's the cultivation of crops has shown a steady decline. At present the contribution of agronomy to the total gross value of agricultural products is probably less than 5 %. The reasons lie with various factors like climatological circumstances, soil aspects and the economic viability of the in-

dustry. Although a report was compiled on the agronomic potential of South West Africa by a team of experts during November 1978, the three factors are discussed again.

a) Climate

Hig temperatures with the resulting high evaporation rates, are a limiting factor in agronomy. Soil moisture levels are affected adversely by these factors.

As was discussed in the introductory part of this report, considerable variation in rainfall between as well as within years occurs. There is no clear rainfall pattern and proper planning is extremely difficult.

b) Soil

At present one would really take a chance to predict the agronomic potential of the available soil. The lack of knowledge in this field is a big problem. It is questionable, whether farmers are utilizing the best soil for fields, or whether better soil is avialable but is used for natural grazing at the moment. It is generally known, that the choice of soil is extremely important especially in marginal areas like South West Africa because of the relatively low average rainfall. Soil tilling practices aimed at conservation of soil moisture, will depend greatly on the soil type. To be able to implement the correct practices to conserve soil moisture, soil analyses have to be done properly and should be a priority. Until such time that these analyses have been done, no production techniques and

standards should be established for farmers. Only once soils have been analyzed, a fair judgement can be passed on the agronomic potential of certain areas.

Available information on agronomic performance in South West Africa are limited and in most cases incomplete. It is just as dangerous to make proper deductions from these data. For reasons unknown, large variation occurs in the yields obtained by farmers, even during the same season. Soil types and production techniques can play major roles. The latest survey (1977/1978 season - good rainy year) indicates that 30 % of farmers in the central part of South West Africa harvested more than 25 bags (70 kg) per hectare while 35 % of farmers got less than 15 bags per hectare. The range was between 9,7 to 32,0 bags per ha with an average of 18,2 bags/ha.

Although detailed economic studies have not yet been done, it seems that the break-even point is a harvest of about 18 bags per ha (70 kg).

From information supplied by Agricultural Economics and Marketing, the following production figures were obtained:

Maize (which reached the market):

1974	40 000 bags
1975	27 000 bags
1976	45 000 bags
1977	12 000 bags
1978	21 000 bags

It is estimated that the actual production (i.e. that which reaches the market and that which is kept for private use) is in fact double the amount mentioned above. The surface area under cultivation could not be established with certainty.

During 1977/1978 about 780 000 (70 kg) bags or 60 000 ton of maize was imported into South West Africa.

Sunflower:
It is estimated that about 2 000 ton of sunflower seeds were produced compared to the estimated demand of 12 000 to 15 000 ton per annum. (The import of cooking oil amounts to about three-quarters of a million to one million liter with and additional 190 ton of fats).

Wheat
During 1976 and 1977 12 500 and 18 000 bags were produced respectively (at Hardap and Stampriet). The required import of wheat products is 16 000 ton per year of which 11 000 ton are used by bakeries and 5 000 ton are distributed by retailers.

Peanuts
The production of this crop in 1978 was 500 ton.

Hay production
Hay production at present is between 300 000 and 400 000 bales which generally is of poor quality. The demand for good quality hay is about 80 000 bales. Under normal circumstances, hay is the only commodity where a surplus is produced. Only good quality hay can be competitively sold on the local market.

3.4.2 Problems in agronomy

a) Erratic rainfall will probably cause considerable variation in production between years. This wil have an important effect on the establishment of a stable infrastructure and market for agronomic products. The economic viability of this industry is also influenced by this erratic nature.

b) There is a lack of sufficient supportive services, especially in the fields of extension, training, soil analysis, seed supply and specialized mechanical services. The problem has to be viewed against the high-risk nature of the industry in South West Africa. This warrants the question: What should be first - the chicken or the egg ? There first has to be sufficient agronomic production before the corresponding supportive services can be expected.

c) A severe shortage of professionals in this field exists. The necessasry advice on implementation of practices cannot be given. It therefore is necessary that all expertise in the private and public sector is harnessed and properly coordinated and planned to serve farmers.

d) Besides the erratic rainfall conditions, the question arises, if the risk-factor is not increased by implementing insufficiently tested practices. Are existing fields situated on the soils with the best agronomic potential? There is a general lack of knowledge which caused farmers to abandon the

industry. Firstly, proper soil surveys have to be made and production technique standards have to be established.

e) Where new fields have to be made e.g. because of existing soil potential, the cost of clearing is extremely high. This questions the economic justification of new fields, especially since the best soils are severly affected by bush encroachment.

f) At present there still is a lack of knowledge as far as the break-even point for various crops in South West Africa is concerned. Postal record information from South Africa is practically the only guideline and still has to be adjusted. Economic standards for each production technique are very important and must be a priority.

Farmers must be encouraged to join the postal record system as soon as possible, so that local economical information can be obtained.

g) A severe problem in the north is the infestation of fields by Rottboellia exaltata. Research on the control of this grass is urgently needed.

h) Information must be obtained or research done to establish the correct cultivars of especially sunflowers and maize. Compaction of soil and preservation of soil moisture must also be priorities.

j) Remarks:

i) Where credit is given to farmers, it should be with the condition that the properly adapted cultivars are bought and must be limited to marketable products. If these conditions cannot be met, loans should be refused.

ii) The available extension officers must give agronomy higher priority by allowing more time for the collection of data which can be used to stimulate the industry if justified.

iii) Guidelines for the standardization of mechanization in agronomy must be drawn up. Problems often occur when suppliers cannot or don't want to service the products they sold. The producers should be protected against such behaviour.

CHAPTER 4

GENERAL PROBLEMS

4.1 Coordination

A general need exists for more efficient coordination between related departments, cooperations and other institutions e.g. the Karakul Board, Meat Board, Organized Agriculture etc. Coordination is especially important as far as future planning, establishment of needs and exchange of information are concerned.

Because of the existing shortage of manpower, mainly professionals, any duplication of work, for instance research, must be prevented. The establishment of a national research programme that stipulates research priorities, should be a priority. The various institutions, whose functions have to be clearly delimited, can work in parallel on projects that should be complementing each other. The aim is not, that one institution dictates to another, but that they should cooperate and plan projects together for the sake of national interest. Expertise can be maximally utilized and coordinated in this way.

Recommendation

A permanent coordinating structure in agriculture is recommended with the following as guideline:

National Agriculutral
Planning and Coordinating
Committee

Agronomy Industry Committee	Meat Producers Industry Committee	Karakul Industry Committee	Dairy Industry Committee

The National Planning Committee can consist of representatives from related departments and institutions like marketing boards, cooperations etc. The committees for the various industries can probably consist of representatives from the departments, cooperations, SWAAU, farmers and private sector involved.

The committee for each industry can determine its needs and within the broad, national guidelines, properly plan its actions. Effective inter-action will lead to balanced agricultural development.

4.2
The economic position of especially cattle farmers, is reason for great concern. This is one of the main reasons for the large number of uninhabited farms in the northern regions.

The committee of inquiry that was established, will pay some attention to this problem. It is however recommended, that the standard for an economical unit is reconsidered. The total economic situation must be aimed at average managerial ability.

Attention must be given to the economic position of the farmers that still inhabit their farms.

4.3

The Etjo Erosion area also seriously requires further attention. These farmers are economically not in a position to help themselves. At this stage, it is difficult to recommend a solution to the problem. The danger exists, that the deterioration of veld will spread to adjacent areas.

4.4

As could be expected, the average age of farmers generally is high (48,50 years). Only 25,5 % of farmers are younger than 40 years. This tendency is alarming and can be one of the factors contributing to the low level of efficiency in the farming industry. Young farmers experience great difficulty in entering the industry because of the massive capital involved.

4.5

The present financing system is not adapted to livestock farming. Income from livestock farming, especially cattle farming, does not realize as fast as income from agronomy. This matter has to be discussed with agricultural financing institutions, so that certain facets of the financing policy can be adapted to local conditions.

CHAPTER 5

EMPLOYMENT OPPORTUNITIES IN THE AGRICULTURAL SECTOR

All figures are taken from the 1974 census. During that year, a total of 22 981 non-whites were employed full-time in the agricultural sector. This means an average of 4,4 labourers per farmer. In addition, jobs were available for 16 524 casual labourers, giving a total of 39 415. This means that the agricultural sector employs not more than 19 % of the total non-white, male labour force. In addition to these employees, another 55 627 persons reside on farms (families etc.). It seems that 13 % of the total non-white population makes a livelihood on farms of white farmers. It is doubted, if the employment potential can be increased in the short term. The opposite is probably true, since the present economic situation forces farmers to restrict their expenses to absolute necessities, which may lead to a reduction of employment opportunities.

CHAPTER 6

CLIMATOLOGICAL DATA

6.1 Rainfall

South West Africa is well known for its erratic rainfall and the large variation in rainfall between years. The distribution of rainfall within seasons is not reliable. The average rainfall figures given for the various regions therefore cannot be acceptet without some reservations. As far as agricultural planning is concerned, the irregular rainfall pattern must be a primary consideration.

Rainfall figures obtained over 60 years, indicate that in the south, 60,3 % of the years received less than the average annual rainfall. The corresponding figures for the central parts (74 years) and the northern parts (61 years) are 62,9 % and 56,8 % respectively.

Despite the fact that the distribution of effective rainfall within a season greatly affects the specific rain year, it was attempted by means of the total annual precipitation to predict the number of drought years in South West Africa. For this purpose, precipitation of 85 % or more of the average is considered a normal year; 70 - 84 % as slight drought, 55 - 69 % as severe drought and less than 54 % as as disasterous drought.

Table 6 shows the results of this analysis.

TABLE 6: The expected number of drought years for the various districts in South West Africa.

Area/ Town	Period (years)	Percentage years with precipitation of 85 % +	70-84 % (slight drought)	55-69 % (severe drought)	54 % less disastrous drought)
Outjo	73	64,4	11,0	8,2	16,4
Otjiwarongo	59	59,3	17,0	17,0	6,7
Grootfontein	61	63,9	16,4	8,2	11,5
Tsumeb	64	64,1	18,7	12,5	4,7
Average	64,3	63,0	15,5	11,4	10,1
Omaruru	73	54,8	13,7	9,6	21,9
Okahandja	73	54,8	13,7	19,2	12,3
Windhoek	76	60,5	10,5	22,4	6,6
Gobabis	75	65,3	12,0	13,3	9,4
Average	74,2	58,8	12,5	16,1	12,6
Keetmanshoop	70	50,0	15,7	10,0	24,3
Mariental	44	52,2	6,8	20,5	20,5
Karasburg	57	49,1	12,3	14,0	24,6
Average	57	50,3	12,3	14,0	23,4

According to this, it can therefore be expected that 37 % of the years in the norhtern parts of South West Africa, 41 % in the central parts and 50 % in the southern parts will ex-

perience some or other degree of drought if the veld is in good condition. At present a larger percentage of South West Africa is vulnerable because of the poor condition of veld on a large percentage of farms. It can be assumed that any rainfall less than the annual average means a drought for these farmers which means that the chances are increased to about 60 %.

It is noteworthy that the southern parts of South West Africa are expected to be more prone to drought.

As was mentioned before, the distribution of effective showers of rain can create problems. Early October/November rains often are not followed by effective rain. On the other hand, effective rain often only occurs in January or February. Good rain may occur within a very short period, but if it is not followed by later rains, grass production is severly hampered.

On Table 7 and Fig. 1 the average monthly distribution of rain in the North, South and Central parts is indicated. Maps B, C and D of Appendix A further explain the rainfall situation.

It is evident that the northern, central and southern parts respectively receive 66 %, 63 % and 66% of the total annual average rainfall in the period January, February and March. For the northern and central parts, February receives the maximum average rainfall, while the same occurs during March in the southern parts.

The frequency and occurence of hail is low and seldomly causes problems.

6.2 Temperature

South West Africa is subject to large temperature variation. In the southern parts the average summer temperature varies from 33,5° C to 35° C, while the corresponding figures for the northern parts are 30,8° C to 31,8° C. Around Windhoek summers are milder with an average temperature of 29,3° C (the figure for Gobabis is higher viz. 31,6° C). The average monthly temperatures for various towns in South West Africa are listed in Table 3, Appendix A. Steep increases in temperature are often experienced and temperatures of 43° C have been recorded. Even though this is an extreme, temperatures of 36 to 40° C are not uncommon. (See Fig. 2 for the average daily temperature during the various months).

Winters generally are mild. Frost occurs sporadically in the northern parts, while the frequency is considerably higher in the central and southern parts as indicated in Table 8. Table 9 lists the average distribution of frost in the northern parts.

Since frost is more significant in the northern parts, the average distribution of frost is given only for the northern weather stations in Appendix A, Table 3.

Table 8: Occurence of frost in South West Africa

	A	B	C	D	E	N	Nr	100Nr/N	F	10/C
Windhoek	5/7	24/7	19	24/5	8/9	44	24	55	1,3	7
Tsumeb	26/6	8/7	12	4/6	28/7	40	7	17	0,3	3
Rundu	23/6	6/7	13	11/6	28/7	12	5	42	-	-
Gobabis	3/6	24/8	82	22/4	19/9	32	32	100	19,2	23
Keetmanshoop	30/6	29/7	29	25/5	9/9	24	20	83	3,2	11
Warmbad	12/6	28/7	46	1/5	4/9	14	12	86	-	-

A = Average starting date
B = Average last date
C = Average period of frost (days)
D = Earliest occurence (date)
E = Latest occurence (date)
N = Number of years in sample
Nr = Number of years in which frost occured
F = Average number of frost days annually

Table 9: Average distribution of frost in northern weather stations South West Africa

Town	Years		Average number of days							
			Mar	Apr	May	Jun	Jul	Aug	Sep	Oc
Outjo	21	0^{o} C	-	-	-	0,6	0,6	0,3	0,1	-
		5^{o} C	-	-	-	11,7	10,6	5,6	1,5	-
Grootfontein	7	0^{o} C	-	-	-	1,7	2,4	1,1	0,1	-
		5^{o} C	-	-	6,5	15,9	17,3	6,5	1,1	-
Otjiwarongo	18	0^{o} C	-	-	0,4	1,2	1,6	0,3	-	-
		5^{o} C	-	-	4,9	11,5	10,9	5,4	1,1	-
Tsumeb	55	0^{o} C			-	0,2	0,2	0	-	
		5^{o} C			1,3	4,6	3,9	14	-	

6.3 Evaporation

The high evaporation rate experienced, stresses the importance moisture conservation in this country. Fig. 3 illustrates t drastic difference between the northern and southern parts, p ticularly during summer.

CHAPTER 7

DEVELOPMENT PROGRAMME

7.1 Personnel

In several fields a need exists for the creation of new post This wil obviously influence the budget to a great exten Should this become necessary and once funds are available f this purpose, a proper proposal and motivation will be drawn u

The most urgent need is the establishment of an own Soil Cons vation Division in South West Africa. For this division, a Ch Technician and two Clerical Assistants are necessary.

7.2 Professional and technical posts

Development programmes for the most important agricultural i dustries in South West Africa are enclosed. They contain schematic representation of the activities and a description each activity. See Appendix B.

The broad objectives of the Department are as follows:

1. The collection of natural-physical data to facilitate the di sion of the Region into fairly homogeneous farming areas; process all information and produce a detailed description homogeneous areas.

2. To satisfy the basic principles of optimal resource utilizati a study has to be done for each of the agricultural industri (Meat Production, Pelt Production, Dairy industry and Agrono to:
   i) determine the extent of present production and economic situation;
   ii) determine the practices presently implemented.

Appendix B

Schematic representation

SHEEP FARMING INDUSTRY

1. Climatological data

1.1 Obtain all data w.r.t average rainfall, distribution and eff tiveness of precipitation for sheep farming area.

1.2 Compile temperature chart.

1.3 Collect data on relative humidity and evaporation.

2. Delimit fairly homogeneous farming areas (FHFA) within the sh farming areas

2.1 Divide area according to differences in topography, climate soil type.

2.2 Decide if subdivision into smaller resource units is necessary

3. Compile vegetation map

3.1 Climax and economically important grasses have to be clear highlighted for each FHFA. Which species have to be promoted.

3.2 Indicate typical trees, shrubs and herbs for each FHFA. Jud the shrubs present by the same standards applicable in the cat farming areas.

3.3 Indicate dominant encroaching species and also those that m cause problems in future.

3.4 Determine the extent of bush encroachment and its effect on gr production and the resulting influence on pelt and mutton prod tion within each FHFA.

4. Yield standards

4.1 Pelt production: number of pelts/100 ha.

4.2 Quality of pelts and mutton. Determine a realistic relations between good and poor quality to aim at.

4.3 Number of ha/S.A.U. (define S.A.U. and standardize).

4.4 Economical standard (break-even point and minimum profit mar for a decent standard of living) R/ha or Net faming income and/or Net farming income/S.A.U.

4.5 Live mass/age in case of mutton sheep.

For all yield standards and standards for production techniqu the following background information has to be supplied:

a) Resource unit
b) Soil pattern
c) Effective depth of soil
d) Appropriate meteriological data
e) Desired cover and compostion of vegetation

5. Standards for production techniques

For each FHFA, standards have to be set and their economical fluence on profitability of the farm must seriously be taken i consideration.

5.1 Determine adapted sheep races.

5.2 Flock management

a) Number of ewes per ram
b) Mating seasons
c) Size of flocks during mating
d) Age at first mating
e) Supplementary feeding of rams
   i) amount of P/ram/day (determine P - source)
   ii) amount of energy/ram/day (determine energy source)
   iii) amount of protein/ram/day (determine suitable source
   iv) any other necessary treatment
f) Supplementary feeding of ewes
   Determine the amount of phosphate, energy and protein p day for:
   i) ewes not lactating
   ii) pregnant ewes
   iii) lactating ewes
   iv) post partum period
g) Weaning age
h) Surface area of veld allocated to each ewe

i) Veneral diseases (preventative measures)
j) Selection for fertility
k) Replacement percentage
l) Record keeping (production and economical)
m) Rounding off (mutton sheep)
n) Growth after weaning
o) Flock compostition and ratio of sheep to other farming a tivities
p) Marketing
q) Breeding policy
r) Animal health
    i) external parasites
    ii) internal parasites
    iii) diseases - occurence and prevention

5.3 Pasture management (natural fodder)
a) Number of available grazing days / ha
b) Physical-biological priciples like:
    i) division into veld types
    ii) grazing and resting periods within growing season
    iii) choice of key species as indicators for time withdrawal of flocks from camp
    iv) principle of resting periods within the differe seasons e.g. spring, autumn etc.
c) Number of camps per flock
d) Number of flocks per farming unit
e) Relative stocking rate
    i) pregnant females
    ii) weaners (calves)
    iii) non-lactating sheep
f) Cultivated pastures
    i) as initial aid to veld recovery
    ii) increased production
    iii) economical standards for cultivation
    iv) areas where it could be recommended

v) choice of crop species

g) Veld recovery and improvement

i) choice of grazing species

ii) method of establishment

5.4 Economical farming units

6. Present production and production systems

Determine for each resource unit:

6.1 Surface area presently utilized for that specific purpose.

6.2 Number of farmers in the industry.

6.3 Total production for S.W.A.

6.4 Meat produced/ha and number of pelts produced/100 ha.

7. Present economic situation

7.1 Present production costs/pelt or kg of mutton.

7.2 Net farming income and gross farming income/ha.

7.3 Interest incurred on total capital investment.

7.4 Gross farming income and net farming income/L.A.U.

7.5 Present earnings for S.W.A.

7.6 Number of farmers showing a profit.

7.7 Agricultural-economic value of property.

7.8 Present number of uneconomical farming units.

8. Present situation w.r.t. acceptance of practices

Determine these w.r.t. the production technique standards est lished.

9. Psycho-sociological situation

See Agronomy programme.

10. Analysis of natural-physical data to identify problems for wh there are no solutions at present

11. Determine the level of production to be aimed at, taking the f lowing into consideration:

11.1 Present production and human resources.

11.2 Theoretical production potential (based on economical factors) yield standards.

11.3 Local consumption, export potential and population growth.

11.4 Influence of other agricultural activities on the total prod tion - the area put aside.

11.5 Scientific development in other directions.

12. Determine the influence of the industry on the job market.

13. Determine the problems in in industry w.r.t.:

13.1 Implementation of practices.

13.2 Psycho-sociological problems.

13.3 Natural-physical problems.

schematic representation fo meat production programme

BEEF PRODUCTION PROGRAMME

1. Climatological data

1.1 Obtain from agronomic information.

1.2 Decide whether more detailed information than in 1.1 is need for the rest of the cattle farming area (i.e. where no agron is pratised),

2. Divide beef production areas into farily homogeneous areas

2.1 Divide area according to differences in topography, climate soil patterns.

2.2 Decide if subdivision into smaller resource units is necessa (re-group into ecotopes).

3. Compile vegetation map

3.1 Climax grasses for each fairly homogeneous area must be e phasized.

3.2 Indicate typical trees, shrubs and herbs for each veld type homogeneous area.

3.3 Decide on a scale by which the degree of bush encroachment can measured.

3.4 Indicate dominant encroaching species.

3.5 Determine the extent of affected areas and its influence on gr production and therefore beef production (for each homogeneo area).

4. Yield standards

Determine for each individual resource unit:

4.1 Beef production kg/100 ha/year

4.2 Quality of beef (relate to marketing problems that may arise).

4.3 Number of ha/L.A.U. (define L.A.U. and standardize). Total gestible fibre / ha?

4.4 Economic standards (break-even point).

4.5 Living mass/age

For all yield standards and production techniques, the follow information has to be supplied:

a) resource unit
b) soil pattern (form and series)
c) effective depth of soil
d) applicable meteriological data
e) desired cover and composition of vegetation
f) slope

5. Standards for production techniques

All production techniques compiled, should be throroughly inv tigated as far as the price of the product vs. price of t production item is concerned. Separate standards for ea resource unit.

5.1 Adapted cattle races

5.2 Fertility

a) number of cows per bull
b) mating seasons
c) herd size during mating
d) age at first mating
e) supplementary feeding of bulls
    i) amount of P/bull/day (g)
    ii) amount of energy/bull/day
    iii) amount of protein/bull/day
f) supplementary feeding of females
    i) non-lactating animals
    ii) pregnant animals
    iii) lactating animals
    iv) post partum period
g) weaning age
h) surface area of grazing allocated to female animals
i) veneral diseases (preventative measures)
j) selection for fertility
k) replacement percentage

l) record keeping (production and economic)
m) rounding off prior to marketing
n) growth after weaning
o) herd composition
p) marketing system
q) breeding policy
r) animal health
    i) external parasites
    ii) internal parasites
    iii) diseases

5.3 Pasture management (natural fodder)

a) number of grazing days / ha available
b) physical-biological principles like:
division into veld types
grazing and resting periods within growing season
choice of indicator plants to judge time of withdrawal of h from camp
principle of resting period within different seasons e.g. spring, autumn etc.
c) number of camps/herd
d) number of herds/farming unit
e) relative stocking rate
    i) pregnant females
    ii) weaners
    iii) 1-2 year old animals
    iv) 2-3 year old animals
f) cultivated pastures
    i) initially as an aid to veld recovery
    ii) increased production
    iii) economic standards for cultivation
    iv) choice of crop
    v) areas for which practice can be recommended

g) veld recovery and improvement

i) choice of pasture crop species

ii) method of establishment

5.4 Economic farming unit

6. Present production and production systems

Within each homogeneous area:

6.1 Surface area presently utilized for the specific purpose.

6.2 Number of farmers in the industry.

6.3 Total production in S.W.A.

6.4 Beef produced / ha.

7. Present economic situation

7.1 Present production cost (break-even point per kg of meat).

7.2 Net farming income and gross farming income per ha.

7.3 Interest incurred on capital investment.

7.4 Gross farming income and net farming income / L.A.U.

7.5 Present earnings for S.W.A.

7.6 Number of farmers showing a profit.

7.7 Agricultural-economical value of property.

7.8 Present number of uneconomical units.

8. Present practices

Determine level of acceptance, measured against standards f yield and production techniques.

9. Psycho-social situation

See programme for agronomy.

10. Analysis of natural-physical data to determine problems for wh solutions have not yet been found.

11. Level of production aimed at

11.1 Compare present production with theoretical production.

11.2 Decide on extent of production, taking local consumption, exp potential and population growth into consideration.

11.3 Influence of other industries on total production e.g. how c production be increased, possible future marketing problems l competitive grades, meat etc.

11.4 Influence of research results on production e.g. clearing of b vs. production.

11.5 Influence of industry on job market, other industries and n tional economy.

12. Production systems

Decide on production system that is suited for the specif resource unit.

13. Problems

Must be aimed at:

13.1 Implementation of practices

13.2 Psycho-sociological problems

13.3 Natural-physical problems

PROGRAMME FOR AGRONOMY

1. Climatological/ meteriological data

Complement climate map with:

1.1 More information about rainfall (distribution, effective rainf etc.)

1.2 Temperature

1.3 Wind movement

1.4 Disadvantageous elements like frost, hail, evaporation, humid and photoperiod.

These data should be available for each of the identifi resource units.

2. Method of data storage

3. Soil Science programme

3.1 Determine priorities for areas.

3.2 Use alternative soil classification if present fields show p resluts, i.e. investigate if better soil is available on farm.

3.3 Determine

a) nutrient relations

b) water relations

c) aeration

d) sensitivity towards erosion

4. Vegetation map

4.1 Place special emphasis on climax grasses that should occur.

4.2 Typical trees, shrubs and herbs for veld type.

4.3 Decide on scale by which degree and extent of bush encroachm can be measured.

a) indicate dominant encroaching species

b) determine influence of bush encorachment on grass product in each area.

5. Yield standards

Determine for each crop within the different resource units:

5.1 Production per ha (kg/ha).

5.2 Quality of product

5.3 Economic standard (minimum production/ha)

5.4 Cultivar

6. Standards for production techniques

6.1 Basic soil preparation (soil moisture preservation)

6.2 Seed bed preparation (depth of tilling, choice of implement time etc.).

6.3 Method of planting

a) type of planting implement
b) depth
c) spacing (between and within rows)
d) kg of seed/ha.

6.4 Fertilizer

a) type
b) total amount/ha
c) number of applications
d) time of application
e) method of application
f) depth to which applied

6.5 Weed control

a) mechanical
   i) type of implement
   ii) times of weeding (growth stage)
b) chemical
   i) type of chemical
   ii) time of application (growth stage)
   iii) method of application

6.6 Any other chemical treatments that may be necessary e.g. ripen of crop.

6.7 Disease and pest control
Treatment and method for each disease (potential and existi diseases)

6.8 Harvesting methods

6.9 Crop rotation system

6.10 Cultivar

6.11 Minimum soil and climate requirements from a global point view.
For each yield standard, the following information has to be s plied:

a) resource unit
b) soil form and series
c) effective depth of soil
d) applicable meteriological data
e) slope

Possible sources of information for yield standards:

a) results of departmental, cooperative or private research
b) records from best farmers
c) other methods like:
   i) information from study groups
   ii) surveys
   iii) group discussions
d) calculation by mathematical formulae in which applicable vironmental factors are quantified.

7. Present production and extent
Determine for each crop in every resource unit:

7.1 Present production in S.W.A.

7.2 Present production / ha.

8. Present production systems

8.1 Surface area presently utilized for each crop

8.2 Number of farmers cultivating each crop.

9. Present economical situation

9.1 Determine present production costs

9.2 Investment in property and implements

9.3 Effectivity of investment.

9.4 Interest incurred on investment.

9.5 Economic feasibility (plus/minus) under present circumstances.

9.6 For which crops is import more economical than local productio

10. Present situation w.r.t. acceptance of practices

10.1 Implements presently used - the capacity of implements vs. s face area to be tilled.

10.2 Soil moisture preservation techniques implemented.

10.3 Methods of seed bed preparation

10.4 Planting methods

10.5 Fertilizing methods

10.6 Methods of weed control

10.7 Disease and pest control

10.8 Harvesting method

10.9 Marketing method

10.10 Recording of meteriological data

10.11 Implementation of rotational systems

10.12 Record keeping

a) production

b) economical

11. Psycho-sociological situation

11.1 Background

a) age

b) education

c) ethnic origin

d) experience

11.2 Economic resources

a) extent of industry

b) income from industry

c) efficiency of production

d) economic viability

e) keeping of records

11.3 Communication

a) personal contact with extension workers

b) contact with news media

c) extent of reading done

d) attendance of group activities e.g. demonstrations, farme days.

e) discussion/reference groups

11.4 Social-welfare factors

a) standard of living

b) involvement in social groups

c) formal leadership structure

d) informal leadership structure

11.5 Personality factors

a) progressiveness

b) aspirations

c) rational thinking

d) opinions

e) knowledge

f) traditionalism

g) managerial ability

11.6 Determine borders of socio-economic community and their relati ship to resource units.

12. <u>Analysis of natural-physical data to identify problems for wh there are at present no solutions.</u>

13. <u>Level of production aimed at</u>

13.1 Compare present production with theoretical production

13.2 Decide on production / ha aimed at, taking present local consu tion, export possibilities and population growth into conside tion.

13.3 Decide on extent of production i.e. how many farmers and cu tivated surface area is aimed at. (Keep in mind that in addit to production by white farmers, other areas e.g. Kavango wi also contribute to the total demand/ export).

13.4 Quality of product aimed at.

13.5 Influence of industry on total job market, other industries national economy.

14. Production systems

Determine production system(s) suitable for each resource unit

15. Present problems

Must be aimed at:

15.1 Implementation of practices

15.2 Psycho-sociological problems

15.3 Natural-physical constraints

Fig. 1: Average monthly precipitation for the northern, central and southern parts of S.W.A. (mm).

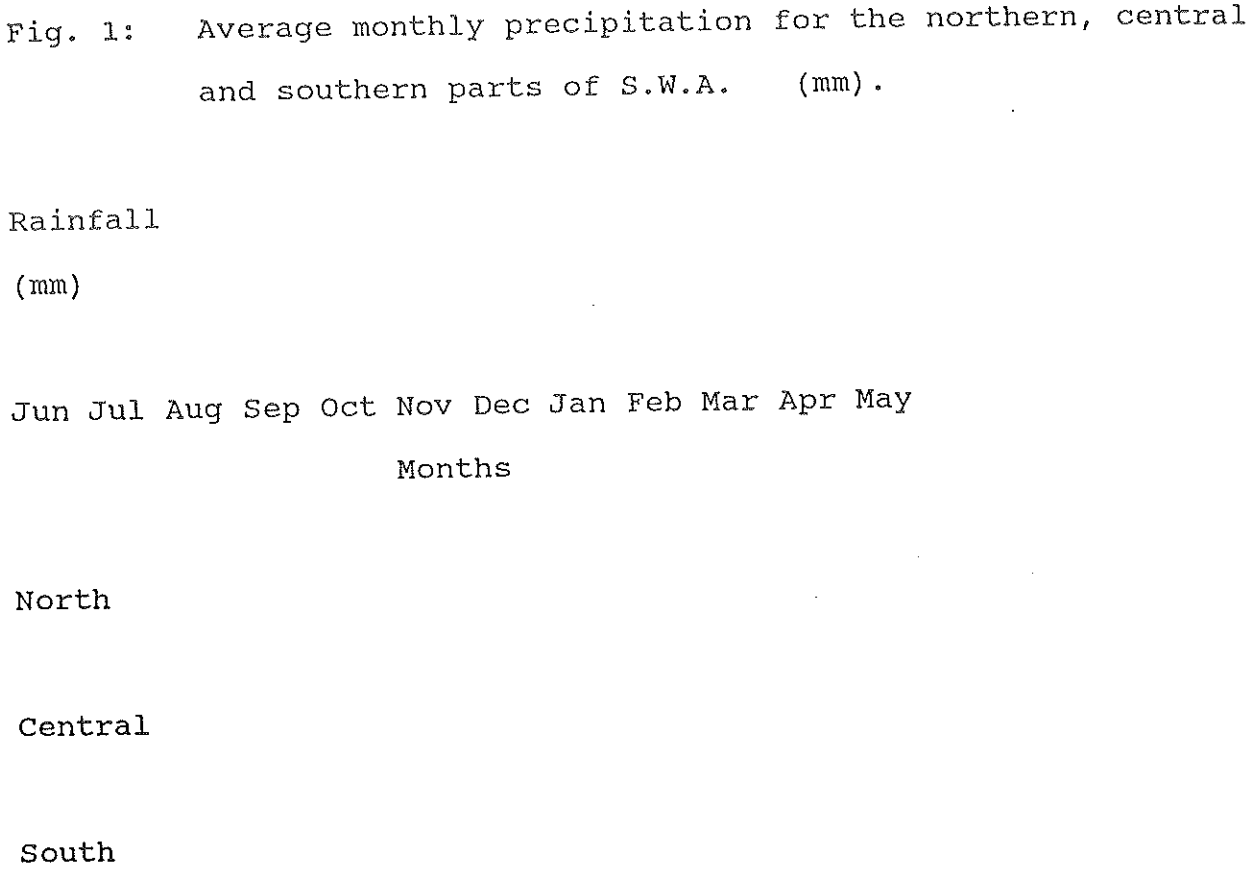


Fig 2.: Average daily maximum temperature (^{o}C) and average daily minimum temperature (^{o}C) during the months of the year.

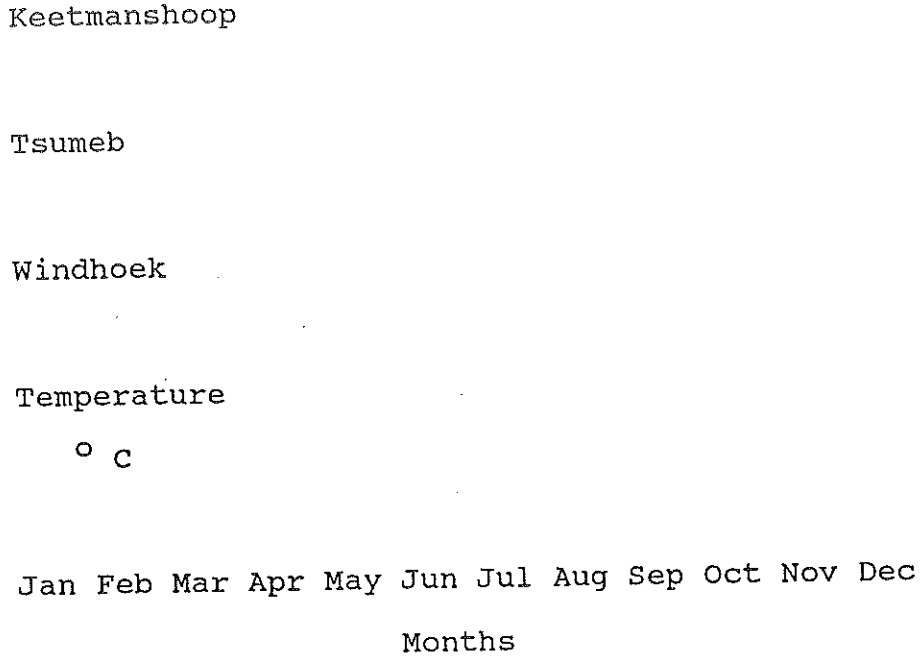
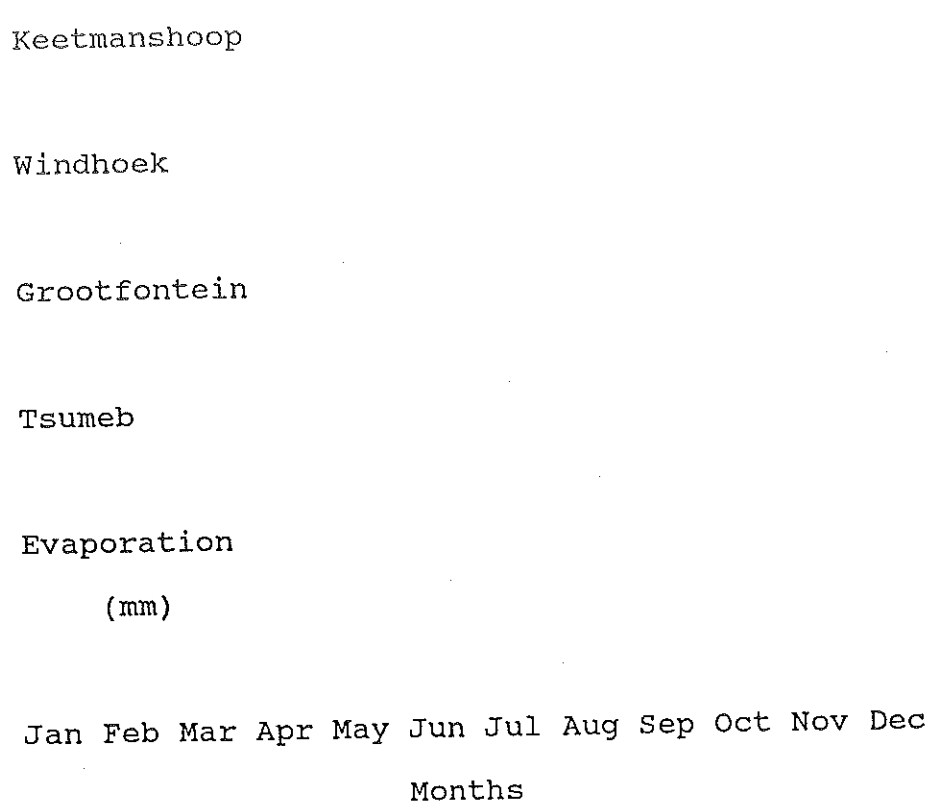


Fig. 3: Average monthly evaporation (mm) at various towns in S.W.A.



Map B: Standard deviation of annual rainfall as percentage from the average annual rainfall.

Source: Weather Bureau

Map C: Reliability of annual rainfall

Source: Weather Bureau

$B = (1 - vg/200)^2$

Map D: Average deviation as percentage of the average annual rainfall.

Source: Weather Bureau

Map E: SOUTH WEST AFRICA: Non-White farming areas

Scale 1 : 3 000 000

PHASE 2

ANALYSE RAINFALL DATA AND PRODUCE MAP

DIVIDE AREA INTO FHFA ACCORDING TO TOPOGRAPH SOIL PATTERN, MACRO-CLIMATE

DETERMINE YIELD STANDARDS (KG MEAT/HA, PELTS/100 HA)

DETERMINE PRODUCTIO STANDARDS

DETERMINE LOCAL DEM AND EXPORT POTENTIA

DETERMINE ECONOMIC BREAK-EVEN POINT

DECIDE ON METHOD OF DATA STORAGE

DETERMINE PRESENT PRODUCTION, EXPORTS (QUALITY AND COLOUR) OF PELTS AND AMOUNT

DETERM REGARD

ANALYZE SOIL UTI

ANALYZE SITUATI

DETERMINE PRESENT SOIL UTILIZATION, PRODUCTION, ACCEPTANCE OF PRACTICES, ECONOMIC AND PSYCHO-SOCIOLOGICAL SITUATIONS

ANALY SOCIOLO

DELIMIT AREAS WHERE OTHER INDUSTRIES CAN BE INCORPORATED

DETE SH

INTERPRET NATURAL-PHYSICAL DATA AGAINST PRESENT PRODUCTION AND YIELD STANDARDS

CALCULATE THEORETICAL PRODUCTION POTENTIA

DELIMIT PROBLEM AREAS WITH RESPECT TO PLANT PRODUCTION OR EROSION

T

PHASES 1, 3 & 4 THE SAME AS FOR AGRONOMY PROGRAMME

PHASE 2:

ANALYZE OTHER NATURAL AND SOIL DATA FROM AGRONOMY PROGRAMME FROM A PASTURE SCIENCE POINT ANGLE

DIVI
FARMING AR
SOIL PATTE

ANALYZE RAINFALL DATA

PRODUCE RAINFA
(FROM AGRONOMY PROGRAMME

DECIDE ON METHOD OF DATA STORAGE

DETERMINE YIELD STANDARDS

DETERMINE STANDAR

DETERMINE LOCAL DEMAND/ CONSUMPTION OF BEEF

DETERMI
AND POSSIB

ECONOMIC STUDY TO DETERMINE BREAK-EVEN POINT

ANALYZE PRESENT SOIL UTILIZATION

DETERMINE PRESENT SOIL UTILIZATION, PRODUCTION, ECONOMIC SITUATION, ACCEPTANCE OF PRACTICES AND PSYCHO-SOCIOLOGICAL SITUATION

ANALYZE E
SITUAT

ANA
A

ANALYZE PSYCHO-SOCIOLOGICAL SITUA

DELIMIT AREAS ACCORDING TO PLANT PRODUCTION AND EROSION PROBLEMS

DETERMIN

INTERPRET NATURAL-PHYSICAL DATA WITH RESPECT TO PRESENT PRODUCTION AND YIELD STANDARDS

DELIMIT AREAS WITH POTENTIAL FOR INTENSIFICATION

D
IN

DETERMINE THEORETICAL YIELD A) NATURAL B) NA

PHASES 1, 3 & 4 AS FOR AGRONOMY PROGRAMME

PHASE 2

ECONOMIC STUDY:
BREAK-EVEN POINT

INFLUENCE OF IND

DECIDE ON
METHOD OF
DATA STORAGE

DETERMINE YIELD
STANDARDS

DETERMIN
PRODUCTION

DETERMINE DEMAND
A) FRESH MILK
B) CHEESE
C) BUTTER

DETERMINE PRESEN
AND IMPORTS OF A), B) &

ANALYZE PRESE
SOIL UTILIZAT

DETERMINE PRESENT
SOIL UTILIZATION,
PRODUCTION, ECONOMIC
SITUATION, ACCEPTANCE
OF PRACTICES AND
PSYCHO-SOCIOLOGICAL
SITUATION

AN
SITU

ANALY

PRACT

ANALYZE PSYCH
SOCIOLOGICAL

INTERPRET NATUAL-
PHYSICAL DATA WITH
RESPECT TO PRESENT
PRODUCTION AND YIELD
STANDARDS

DETERMINE THE INFLUENCE OF OTHER
INDUSTRIES ON PRODUCTION AND
PRODUCTION AREAS

PHASES 1, 3 & 4 AS FOR AGRONOMY PROGRAMME

PHASE 1

DETERMINE EXTENT OF STATUTORY
ADMINISTRATIVE AND OTHER AD HO
SERVICES TO BE RENDERED

DETERMINE BROAD
OBJECTIVES AND
PRIORITIES

DECIDE ON
FIELD OF
INVESTI-
GATION

CREATE NETWORK
PROGRAMME W.R.T.
DETERMINATION OF
POTENTIAL AND
SITUATIONS AND
PERSONNEL NEEDS

ESTIMAT
TECHN
DETERMINA
SITUATIONS

DETERMINE WHICH OTHER
INSTITUTIONS ARE NEEDED
OR CAN BE INVOLVED

DECIDE ON LEVEL OF
INVESTIGATION
RECONSIDER BROAD
OBJECTIVES
INVESTIGATE AREA
W.R.T. AVAILABLE
MANPOWER

DECIDE ON PERSON
RESPONSIBLE FOR
INVESTIGATION

DELEGATE SEQ
TASKS AND SE

PHASE 2

COLLECTION OF LONG-TERM METERIO-LOGICAL DATA

ANALYZE RAINFALL DATA

OBTAIN GEOLOGICAL MAP

OBTAIN TOPOGRAPHICAL MAP

COMPILE AIR CURRENT MAP

ANALYZE TEMPERATURE DATA

DECIDE ON METHOD OF DATA STORAGE

TRAINING OF PERSONNEL FOR CLASSIFICATION OF SOILS

EXECUTE PROGRAM

COMPILE VEGETATION MAP

DETERMINE STANDARDS FOR PRODUCTION TECHNIQUES

DETERMINE YIEL FOR APPROPRIAT

ECONOMIC STUDY - BREAK-EVEN POINT

DETERMINE ECONO OF EACH CROP (PO CONTRIBUTION TO NATIONAL

DETERMINE LOCAL CONSUMPTION/ DEMAND

DETERMINE EXPORT SURPLUSSE ANNUAL SURPLUSSES IN THE

ANALYZE SOIL UTILIZATION PATTERN AND PRODUCTION

DETERMINE PRESENT SOIL UTILIZATION, PRODUCTION, ECONOMIC SITUATION, ACCEPTANCE OF PRACTICES AND PSYCHO-SOCIOLOGICAL SITUATION

ANALYZE DEGRE ACCEPTANCE OF PRACTIC

ANALYZE ECONOMIC

ANALYZE PSYCHO-S

PHASE 2 continued

RECONSIDER PRODUCTION STANDARDS IF NECESSARY

COMPILE SOIL UTILIZATION MAP AND DELIMIT RESOURCE UNITS

DETERMINE THEORETICAL LEVEL OF PRODUCTION

COMPA PRODUCT PRESENT PRODUCT IN PRACTICE AND RE UTILIZA AIMED AT

DETERMINE TOPOGRAPHICAL TYPES, PEDOSYSTEMS, LAND TYPES, RESOURCE UNITS AND ECOTYPES

PHASE 4

FIND SOLUTIONS FOR PROBLEMS NOT RELATED TO IMPLEMENTATION OF PRACTICES

COMPILE NETWORK PROGRAMME FOR COMMUNICATION

IDENTIFY PROBLEMS AND DETERMINE PRIORITIES WITHIN EACH HOMOGENEOUS AREA

DETERMINE OBJECTIV

EXECUTE PROGRAMME

EVALUATE RE W.R.T. ACCEPTANCE OF PRACTICE

DETERMINE WHO WILL HAVE WHAT FUNCTION

EVALUATE CO PROGRAMME

2.4.6.4 PRESENT PRACTICES

The present practices of farmers in this area don't differ significantly from those of farmers in the neighbouring sheep and cattle farming areas. Data from these regions therefore are also applicable here.

It has been found, that during good rainy seasons, farmers acquire young oxen that are marketed at a later stage. Should the successive rainy season be poor, these oxen can easily be sold.

Table 1: Average monthly precipitation as a percentage of the total rainfall and average number of rainy days (1 mm and more) per month at various weather stations in S.W.A.

Station	Years		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average	
Karasburg	40-42	mm	12,0	25,8	30,5	8,3	4,7	3,8	1,7	1,2	1,7	3,3	6,6	11,3	110,9
		days	1,6	2,7	3,6	1,4	1,1	0,6	0,6	0,3	0,3	0,7	1,2	1,4	15,5
		%	10,82	23,26	27,50	7,48	4,24	3,43	1,53	1,08	1,53	2,98	5,95	10,19	100,0
Keetmans-hoop	43-53	mm	20,10	28,40	38,6	18,1	3,7	1,4	1,1	0,4	2,4	4,7	10,2	12,4	141,5
		days	3,4	4,3	5,1	2,0	1,1	0,5	0,4	0,3	0,4	0,9	1,9	2,7	23,0
		%	14,2	20,07	27,28	12,79	2,62	0,99	0,78	0,28	1,7	3,32	7,21	8,76	100,0
Mariental	29-38	mm	31,3	51,3	44,9	14,1	3,3	2,8	1,0	0,2	1,5	5,5	12,7	16,7	185,3
		days	3,7	5,1	5,7	2,2	0,5	0,4	0,2	0,1	0,2	1,0	1,7	2,3	23,2
		%	16,83	27,69	24,23	7,61	1,78	1,51	0,54	0,11	0,81	2,97	6,85	9,01	100,0
Maltahöhe	56-59	mm	29,3	40,5	44,3	16,4	2,7	1,1	0,4	0,1	1,4	3,3	8,4	14,1	162,0
		days	3,9	5,4	5,3	2,2	0,5	0,4	0,2	0,1	0,2	1,0	1,7	2,3	23,2
		%	18,09	24,99	27,35	10,12	1,67	0,68	0,25	0,06	0,86	2,04	5,19	8,70	100,0
Omaruru	41-44	mm	58,2	81,9	61,4	26,8	4,2	0,5	0,1	0,0	0,4	6,2	21,6	36,4	297,7
		days	6,0	7,4	6,2	3,1	0,7	0,1	0,1	0,0	0,2	1,1	2,8	4,4	32,1
		%	19,5	27,5	20,6	9,0	1,4	0,0	0,0	0,0	0,0	2,1	7,3	12,2	100,0
Windhoek	69-70	mm	76,7	75,8	80,6	40,0	6,8	1,1	1,1	0,9	2,0	10,9	25,6	45,8	367,3
		days	10,4	10,3	10,4	5,1	1,7	0,3	0,2	0,2	0,8	2,9	5,0	7,5	54,8
		%	20,9	20,6	21,9	10,9	1,9	0,0	0,0	0,0	0,5	3,0	7,0	12,5	100,0
Okahandja	64-66	mm	81,4	87,1	83,5	31,3	7,2	0,8	0,7	0,9	2,1	10,7	19,4	46,8	371,9
		days	9,1	9,8	9,5	4,5	1,3	0,2	0,1	0,2	0,6	2,6	4,3	6,8	49,0
		%	21,9	23,4	22,5	8,4	1,9	0,0	0,0	0,0	0,6	2,9	5,2	12,6	100,0
Hochfeld	22-23	mm	98,1	72,2	85,5	25,9	8,2	0,6	0,1	0,1	3,1	14,9	42,2	71,2	422,1
		days	8,5	6,7	6,7	3,0	1,2	0,1	0,1	0,1	0,3	1,9	4,7	7,0	40,0
		%	23,2	17,1	20,3	6,1	1,9	0,0	0,0	0,0	0,7	3,5	10,0	16,9	100,0
Steinhausen	28-34	mm	90,7	85,5	81,7	28,4	6,9	1,0	0,2	0,6	1,4	14,5	36,1	58,9	405,9
		days	8,6	7,4	6,3	3,1	0,9	0,3	0,1	0,1	0,5	2,4	4,3	6,4	40,4
		%	22,3	21,1	20,1	7,0	1,7	0,0	0,0	0,0	0,0	3,6	8,9	14,5	100,0
Gobabis	60-62	mm	82,3	81,5	69,6	29,9	6,4	1,7	0,5	0,9	3,9	15,0	31,0	41,5	364,2
		days	8,6	8,3	8,2	4,3	1,3	0,2	0,1	0,2	1,0	3,4	4,6	6,4	46,5
		%	22,6	22,4	19,0	8,2	1,8	0,5	0,0	0,0	1,1	4,1	8,5	11,4	100,0
Tsumeb	49-50	mm	117,3	129,6	81,2	40,3	6,7	0,5	0,2	0,0	1,8	19,0	54,5	87,1	538,2
		days	14,5	13,9	11,5	6,0	1,5	0,1	0,1	0,0	0,7	5,1	8,6	12,7	74,7
		%	21,0	24,1	15,1	7,5	1,2	0,1	0,0	0,0	0,3	3,5	10,1	16,2	100,0

		mm	126,6	134,6	95,2	40,5	7,1	0,9	0,0	0,5	2,8	19,4	60,1	101,9	588,8
Goub	51-57	days	11,8	12,5	10,7	5,1	1,2	0,1	0,0	0,1	0,5	3,7	7,9	11,1	64,7
		%	21,5	22,9	16,2	6,9	1,2	0,0	0,0	0,0	0,0	3,3	10,2	17,3	100,0
		mm	116,2	124,6	100,5	37,2	6,6	0,1	0,1	0,1	1,5	18,3	56,2	81,7	534,1
Grootfontein	43-44	days	11,0	10,6	9,3	3,7	1,1	0,1	0,1	0,1	0,4	3,3	6,8	8,6	55,1
		%	21,4	22,9	18,5	6,8	1,2	0,0	0,0	0,0	0,0	3,4	10,3	15,0	100,0
		mm	114,6	131,2	98,3	36,0	6,5	0,1	0,0	0,1	1,2	24,7	54,3	84,0	551,0
Rietfontein	43-48	days	10,7	10,3	8,4	3,9	0,9	0,1	0,0	0,1	0,5	3,6	6,2	9,2	53,9
		%	20,8	23,8	17,8	6,5	1,2	0,0	0,0	0,0	0,0	4,5	9,9	15,2	100,0
		mm	88,3	109,9	80,2	36,1	5,2	1,2	0,1	0,0	2,5	14,6	33,9	78,7	450,7
Otjiwarongo	43-48	days	8,3	9,5	8,0	4,1	1,2	0,1	0,1	0,0	0,5	2,7	4,4	7,2	46,1
		%	19,6	24,4	17,8	8,0	1,1	0,0	0,0	0,0	0,6	3,2	7,5	17,5	100,0

TABLE 2: Average monthly evaporation (mm)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Keetmanshoop	454,2	359,8	314,3	235,7	205,9	182,4	204,9	248,9	303,1	382,8	442,0	480,0	3814,0
Mariental	437,1	335,2	294,6	232,7	187,4	153,1	165,2	210,6	287,6	363,7	395,4	452,2	3514,8
Windhoek	329,6	271,8	244,7	224,4	214,7	185,1	206,8	260,9	329,7	385,8	355,2	380,2	3388,9
Gobabis	328,9	275,8	236,3	190,3	171,1	153,6	168,9	219,8	291,9	340,3	326,9	361,4	3065,2
Outjo	298,8	234,0	20,94	189,5	178,8	156,7	167,6	207,6	273,1	349,5	298,8	332,3	2696,1
Tsumeb	216,7	173,7	154,7	123,1	106,4	91,9	114,0	165,1	230,9	284,1	229,8	248,3	2138,7
Grootfontein	265,1	214,6	189,6	164,1	181,3	158,4	177,4	239,5	321,5	327,6	344,0	351,6	2934,7

Table 3: Temperatures at the various weather stations in South West Africa (°C)

Town		Average daily max.	Average daily min.	Average of max. and min.	Highest max.	Lowest min.	Lowest max.	Highest min.	Average temp. 14h°°	Average temp. 18h°°		
Tsumeb	Years	37	37	37	35	35	35	35	28	28		
	Month											
	J	31,2	18,7	24,9	39,6	9,6	20,2	26,3	21,4	29,3		
	F	30,2	18,1	24,2	38,0	9,9	18,9	23,9	20,4	28,8		
	M	29,4	17,2	23,3	37,9	6,6	18,9	23,5	19,4	27,5		
	A	28,6	15,1	21,9	35,5	6,5	17,5	21,6	17,8	27,3		
	M	26,5	11,0	18,7	34,5	1,1	15,5	19,1	14,2	25,6		
	J	24,2	8,5	16,3	32,0	-3,0	16,5	15,9	11,0	23,1		
	J	24,5	8,2	16,3	30,8	-3,9	15,4	16,2	10,4	23,0		
	A	27,4	10,8	19,1	33,5	1,7	18,0	22,0	14,0	26,2		
	S	31,5	15,5	23,5	37,8	2,8	16,7	28,4	19,5	29,9		
	O	33,2	18,9	26,1	39,1	7,8	18,4	26,3	22,8	32,2		
	N	32,4	18,7	25,5	39,5	11,5	19,6	25,6	22,4	30,0		
	D	31,8	18,8	25,3	39,6	7,8	21,0	25,7	22,2	30,7		
Windhoek	Years	30	30	30	30	30	30	30	9	9		
	J	29,7	17,1	23,4	35,9	9,5	19,6	25,0	20,5	28,2		
	F	28,5	16,4	22,5	34,6	6,8	15,7	22,9	19,2	27,0		
	M	26,9	15,3	21,1	43,2	3,7	16,5	22,7	17,5	25,8		
	A	25,3	12,9	19,0	30,5	2,4	13,1	19,1	15,6	24,7		
	M	22,2	9,1	15,7	31,8	-1,6	10,7	16,8	11,0	21,7		
	J	19,9	6,5	13,2	26,1	-2,5	11,8	15,1	8,3	19,4		
	J	19,1	6,0	12,9	24,9	-2,6	8,7	12,1	7,5	19,4		
	A	23,0	8,5	15,8	29,5	-3,9	8,0	15,5	11,0	22,7		
	S	25,3	11,4	18,6	32,7	-0,5	13,8	20,9	15,0	25,8		
	O	28,9	14,7	18,6	34,1	1,6	14,8	21,6	19,0	28,2		
	N	29,0	15,3	22,2	35,5	0,4	18,1	23,2	20,3	28,1		
	D	30,2	16,7	23,1	36,1	3,3	17,7	24,0	21,0	28,6		
Gobabis	Years	30	30	30	30	30	30	30	11	9		
	J	32,0	17,0	24,5	39,0	8,9	20,8	24,9	21,9	30,4		
	F	30,7	16,4	23,6	37,3	7,4	21,5	23,0	20,4	30,3		
	M	29,0	14,8	21,9	36,0	5,1	18,0	23,0	17,8	27,7		
	A	27,3	11,3	19,3	33,7	-0,5	11,0	25,3	15,5	26,0		
	M	24,6	6,2	15,4	31,0	-6,0	14,5	19,7	10,2	23,2		
	J	22,2	3,0	12,6	28,0	-9,2	12,4	13,5	6,7	20,9		
	J	22,2	2,2	12,2	28,0	-9,6	10,1	12,4	5,6	20,3		
	A	25,0	4,9	15,0	33,2	-8,5	9,5	16,6	9,4	21,4		
	S	28,8	8,8	18,8	35,5	-5,6	14,5	20,6	14,3	27,3		
	O	31,2	13,2	22,2	35,8	0,9	16,9	22,4	19,1	29,9		
	N	31,6	14,8	23,2	37,9	3,1	18,9	22,4	21,3	30,1		
	D	32,6	16,7	24,6	38,0	8,3	22,2	26,0	22,4	31,1		

Outjo	Years	15	15	15					15	15
	J	32,5	17,1	24,8	37,3	9,7	20,3	23,8	19,8	30,8
	F	30,5	16,6	23,6	36,9	8,7	21,0	22,2	18,5	28,9
	M	30,1	16,7	23,4	35,7	9,4	19,2	22,5	18,3	28,7
	A	29,1	14,2	21,7	34,4	5,6	19,9	21,8	15,8	28,1
	M	27,0	9,2	18,1	32,3	0,0	18,5	19,2	11,0	26,3
	J	24,6	6,1	15,3	30,8	-2,8	15,8	15,2	7,6	23,7
	J	24,9	5,7	15,3	29,0	-3,9	16,7	14,8	7,2	24,0
	A	27,7	7,5	17,6	33,1	-1,8	16,2	16,3	9,4	26,9
	S	31,4	11,1	21,3	36,3	-0,6	22,2	20,6	14,4	30,6
	O	32,8	14,0	23,4	38,7	3,5	21,7	21,2	18,6	31,8
	N	32,8	16,1	24,4	39,6	5,6	22,5	25,2	20,7	31,5
	D	33,2	16,5	24,9	38,3	7,8	22,0	24,3	20,5	31,8
Keetmanshoop	Years	17	17	17	17	17	17	17	17	17
	J	35,0	18,3	26,6	41,7	7,5	15,4	27,2	22,0	33,1
	F	34,6	18,7	26,5	41,5	8,5	21,5	28,7	21,9	32,3
	M	32,2	16,9	24,6	39,7	7,0	19,7	25,0	19,3	29,7
	A	29,2	13,8	21,5	37,3	3,7	16,0	22,5	16,1	26,8
	M	24,9	9,6	17,3	39,4	-1,4	10,7	19,7	11,7	23,1
	J	21,9	6,6	14,2	31,5	-2,4	11,2	15,0	9,1	20,7
	J	21,2	5,5	13,4	30,7	-3,5	9,0	15,3	6,5	18,9
	A	24,4	7,4	15,9	34,0	-2,2	9,7	19,0	9,1	22,2
	S	26,6	9,6	18,1	36,1	-0,5	7,0	20,6	12,9	24,8
	O	30,7	12,9	21,8	38,7	3,0	16,2	23,8	17,3	28,7
	N	32,8	15,2	24,0	40,6	4,7	12,6	26,7	19,7	30,2
	D	34,6	17,3	25,9	42,2	2,6	21,2	28,1	21,1	32,2
Warmbad	Years	12	12	12	12	12	12	12		
	J	36,1	17,9	27,0	42,0	8,0	24,1	30,0	-	-
	F	36,0	17,7	26,8	43,0	6,5	22,6	25,5	-	-
	M	34,6	15,5	25,1	39,5	8,0	22,1	26,0	-	-
	A	31,3	11,7	21,8	37,2	1,5	15,5	23,0	-	-
	M	25,5	6,9	16,5	34,4	-4,0	8,3	17,2	-	-
	J	22,9	3,5	13,8	30,0	-3,0	10,0	17,5	-	-
	J	21,7	3,3	12,9	30,0	-4,0	9,2	19,0	-	-
	A	24,6	4,3	14,8	34,8	-4,0	12,0	16,1	-	-
	S	28,4	6,3	17,7	36,5	-1,0	12,0	22,0	-	-
	O	32,1	10,8	21,6	39,6	3,0	14,2	24,0	-	-
	N	34,2	13,6	24,4	41,5	5,0	13,0	26,8	-	-
	D	36,9	17,3	27,3	42,0	5,0	25,5	26,0	-	-

Grootfontein	Years	8	8	8	8	8	8	8	8	8
	J	30,0	17,8	23,9	38,3	14,5	20,8	23,1	20,8	21,1
	F	28,9	16,9	23,0	35,2	11,1	20,7	21,3	19,5	27,1
	M	28,0	15,6	21,8	34,8	5,9	18,3	19,8	18,1	26,5
	A	27,4	13,2	20,3	34,8	5,6	17,1	19,5	15,5	25,7
	M	25,4	7,5	16,5	29,5	-1,7	22,8	12,0	10,6	24,3
	J	23,1	4,4	13,8	27,8	-4,8	15,0	13,0	6,9	22,1
	J	23,6	4,0	13,8	29,5	-3,4	17,2	14,0	6,3	22,4
	A	26,8	5,7	16,8	33,4	-6,0	17,0	15,1	10,5	25,6
	S	30,5	10,9	20,7	34,9	-0,4	19,2	18,3	16,2	29,1
	O	31,9	15,9	23,9	36,8	5,4	20,5	22,9	20,9	30,5
	N	31,4	16,8	24,1	36,2	7,6	18,9	22,0	21,9	29,6
	D	31,9	17,4	24,7	37,0	10,5	24,2	23,3	21,9	30,1

Otjiwarongo	Years	15	15	15					15	15
	J	31,6	16,4	24,0					20,3	29,8
	F	29,9	15,9	22,9					18,7	28,1
	M	29,5	15,5	22,5					18,0	27,6
	A	28,3	12,8	20,6					15,5	26,9
	M	26,4	8,3	17,9					10,9	25,3
	J	23,7	5,1	14,4					7,5	22,5
	J	23,9	5,3	14,6					7,7	22,8
	A	26,9	7,4	17,1					10,4	25,7
	S	30,8	11,7	21,3					16,1	29,6
	O	32,5	14,5	23,5					20,2	30,9
	N	32,2	15,4	23,8					21,6	30,4
	D	32,5	15,9	24,2					21,3	30,8