A STUDY OF PAST AND PRESENT USES OF THE RIVIERSONDEREND MOUNTAIN CATCHMENT AREA

by

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ABSTRACT

One of the problems in the planning and management of Mountain Catchment Areas, is the use of the Cape mountain fynbos for grazing by domestic animals. This land-use practice has a detrimental effect on the vegetation and soils and farmers must be persuaded to withdraw their stock from the mountainlands. In order to achieve this, catchment planners and managers need a thorough knowledge of the use of the mountains for grazing in the past as well as at present. To provide the necessary background information, a synthesis of information on the geology, climate and vegetation, as well as the history of settlement and land-use in the Riviersonderend mountains are discussed.

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CHAPTER ONE

INTRODUCTION

1.1 THE PROBLEM

During 1952 the Soil Conservation Board expressed concern over the condition of the principal catchment areas of South Africa. This led to the appointment of an Inter-Departmental Committee to investigate the problems relating to the conservation of these areas. This committee had to: classify the different catchment areas with reference to their importance as sources of water supplies; to investigate the problems regarding the conservation of the catchment areas and recommend how they should be overcome; to consider the adequacy of existing laws and recommend what further legislation may be required for the proper conservation of mountain catchment areas; to formulate a national policy regarding the conservation of mountain catchment areas. The report of this committee was published during 1961 and is commonly referred to as the Ross-report.

During 1970 the Mountain Catchment Areas Act No 63 was promulgated "to provide for the Conservation, use, management and control of land situated in mountain catchment areas..." The Directorate of Forestry is responsible for the planning and management of the different mountain catchment areas in South Africa. To plan and manage these areas, a thorough knowledge of such areas is necessary. As most of the mountain areas are under private ownership, many problems confront the planner. One such problem

is the use of the mountains for grazing and the effects this land-use practice has on the environment.

The Cape mountains with their fynbos vegetation have been used for grazing for a very long period. This practice has led to a deterioration of the vegetation and in extreme cases, to erosion. No records exist as to the extent to which the mountains have been used for grazing and how they were used in the past. Research has concentrated on the effects of fire on the vegetation but nobody has studied the consequences when grazing is combined with burning. Because of this shortcoming, the mountaint catchment planner does not have enough information available to persuade farmers to abandon the mountains as a place to graze their stock.

Section 4 of the Mountain Catchment Areas Act, No 63 of 1970, makes provision for farmers to claim compensation in cases where they suffer patrimonial loss due to limitations being placed on the purposes for which land may be used. To force farmers to withdraw their stock from the mountains, would result in claims for very large sums of money which the state would have to pay. To avoid this happening, the planner must offer the farmer an attratice alternative and convince him of the damage that burning and grazing does to the mountain vegetation. One compensating factor to the farmer who does not use his mountainland is that, according to section 5 of the Mountain Catchment Areas Act, he is exempt from any land tax. But as this tax is very low, the remission thereof is not enough to entice the farmer not to use his mountainland for grazing.

1.2 THE APPROACH

Because of the vastness of the Cape mountain system, it would be impossible for an individual to do a survey of the whole area. A fairly representative section of the

mountain+ where grazing and burning played an important role was sought so that information gathered there could serve as a basis for decision making in other catchment areas. The Riviersonderend mountains conformed to most of the requirements and were selected to serve as a study area.

Having gathered available information on the study area, it became clear that it would be necessary to undertake a thorough vegetational, geological and climatological study of the area to have some basis to work from. A thorough knowledge of the study area and its surroundings was also necessary. Further information required was a complete picture of land ownership patterns and of management systems used in the past and at present by the different farmers.

To get the relevant information, various methods were used. The ecological study was done by field survey and a study of all the available aerial photographs that cover the Riviersonderend mountains. A study of available literature was also carried out. Information about land ownership was obtained from searches in the deeds office, the different Divisional Councils and from personal visits to all the land owners. Information about land settlement patterns in the Overberg was obtained from the archives, the deeds office, books written by early travellers and a M A thesis by E J Prins. To be able to get as complete a picture as possible about land-use practices in the past as well as at present, and for possible future developments, a questionnaire survey was also done. Because of the size and comlexitiy of the questionnaire, it was completed during personal visits to each of the land owners. The

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+ In this study the common South African usage of 'mountain', (Afrikaans 'die berg') is used to refer to the short isolated range of mountains from Stormsvlei to Villiersdorp.

personal visits had the advantage that one could visit places of interest and actually see the effects the different management systems were having on the vegetation.

1.3 OBJECTIVES

1.3.1 Primary Objective

The primary objective of this study is to provide information necessary for a mountain catchment area planner to be able to influence farmers to withdraw stock from mountainlands.

1.3.2 Secondary Objective

In order to achieve the primary objective a synthesis of information on the geology, climate and vegetation of the area is required, as is knowledge of the history of settlement and land-use in the study area. Providing this background information is a secondary objective of this report.

CHAPTER TWO

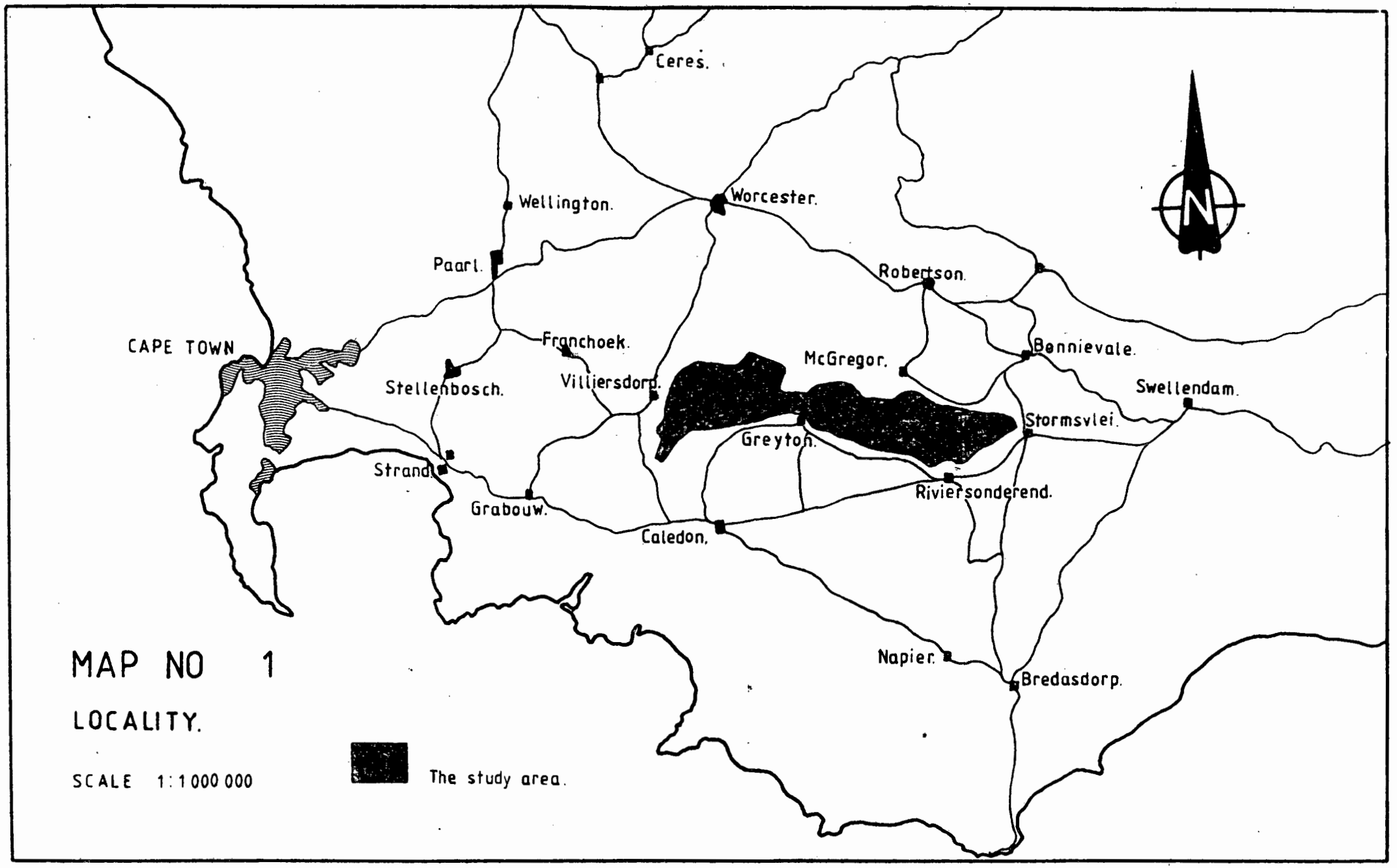
THE STUDY AREA

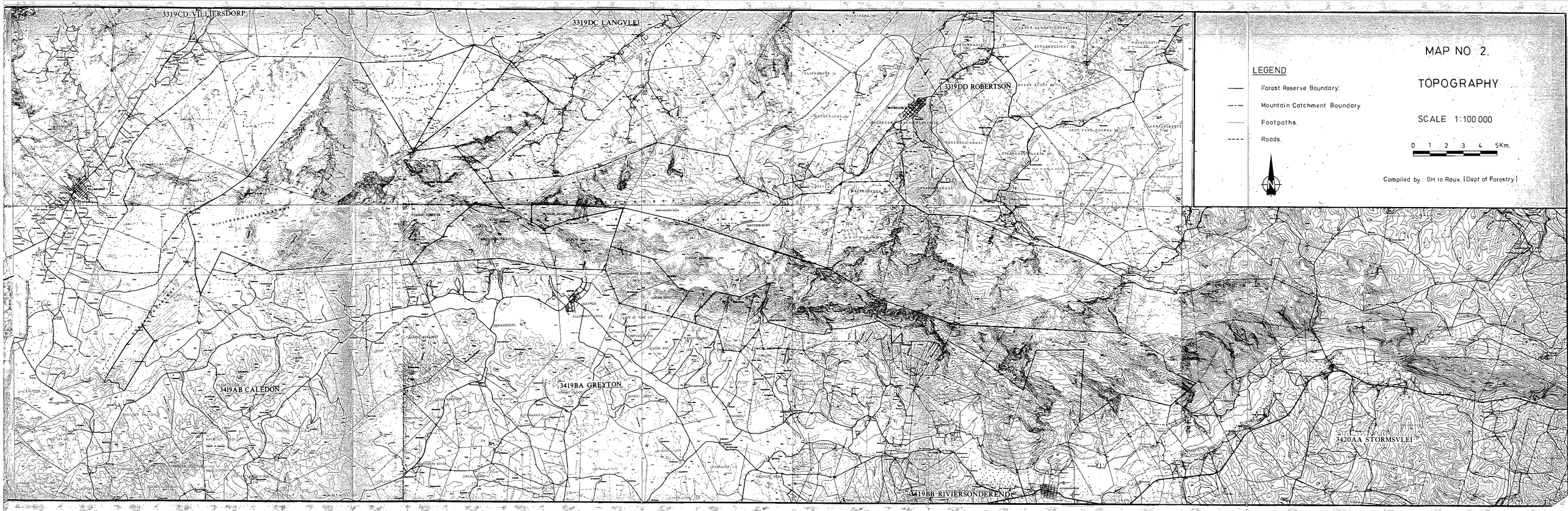
As little co-ordinated information about the Riviersonderend area is available it was necessary to undertake a synthesis of the geology, soils, climate and vegetation of the area to have a base to work from. Similarly, as a result of continuous burning and grazing in the past, a complete study of the nearly 70,000 ha of mountainland vegetation was necessary to see what effect this land-use practice had on certain vegetation types. This vegetation study was also useful for identifying all the old kraals that still occur in the mountains. As all stock was kept in kraals at night to protect them from predators, areas close to the kraals were most heavily grazed. A study of the species composition of the veld at some of these kraals is discussed.

2.1 LOCATION AND EXTENT

The Riviersonderend Mountain Catchement Area lies in the Southern Cape to the east of Cape Town, between latitudes 33° 55' and 34° 09' South and longitudes 19° 19' and 20° 05' East. The area stretches for a distance of about 75 km from Villiersdorp in the west to Stormsvlei in the east (Map 1.).

The Riviersonderend Mountains are partly state owned and for the rest consist of privately owned land which covers an area of 69 453 ha. The area is apportioned as follows:


Ceres.
Wellington.
Worcester.
Paarl.
Robertson.
CAPE TOWN
Franchoek.
Bonnievale.
McGregor.
Stellenbosch.
Villiersdorp.
Swellendam.
Stormsvlei.
Greyton.
Strand.
Riviersonderend.
Grabouw.
Caledon.
Napier.
Bredasdorp.
N
MAP NO 1
LOCALITY.
SCALE 1:1 000 000
The study area.


3319CD VILLIERSDORP
3319DC LANGVLEI
3319DD ROBERTSON
3419AB CALEDON
3419BA GREYTON
3419BB RIVIERSONDEREND
3420AA STORMSVLEI
MAP NO 2.
TOPOGRAPHY
LEGEND
Forest Reserve Boundary.
Mountain Catchment Boundary.
Footpaths.
Roads.
SCALE 1:100 000
0 1 2 3 4 5Km.
Compiled by : GH le Roux. [Dept of Forestry]

Private land	43 037 ha
State forest	23 871 ha
State land	2 545 ha
	69 453 ha

The catchment is covered by the following seven 1:50000 1/4° map sheets.

3319 CD	VILLIERSDORP
3319 DC	LANGVLEI
3319 DD	ROBERTSON
3419 AB	CALEDON
3419 BA	GREYTON
3419 BB	RIVIERSONDEREND
3420 AA	STORMSVLEI

2.2 PHYSICAL FEATURES

2.2.1 Geology

Geological surveys of the area in and around the Riviersonderend mountains started as early as 1896, but to date, only the western portion as far east as the area covered by the 1:50000 topographical maps 3319 CD Villiersdorp and 3419 AB Caledon, have been mapped. The only geological information freely available is that on geological map 3319 C Worcester/3419 A Caledon, on a scale of 1:125000. During and after World War II, students from the University of Stellenbosch working under Prof D L Scholz, studied the Pre Cape rocks found in the South West Cape. One of his students, Mr Hennie Beyers who still lives on part of the farm Ganskraal, studied and mapped the occurrence of a small area of Pre Cape rocks found at the foot of the mountain on the farm Ganskraal, and adjoining farms. No copies of his M.Sc thesis can be found and the only information available on this area, is that obtained from him in a personal interview on his farm.

The geological map (Map 3), produced in this report has been compiled by using information gathered from various sources, including aerial photographs. Only the western section of the map can be regarded as accurate, while the rest can only give approximate boundaries of geological types.

Except for a few isolated areas, the Riviersonderend mountain range is made up from rocks from the Cape System (Map 3). Two exceptions are the older Malmesbury shales with an intrusion of granite found between the towns of Greyton and Riviersonderend, and younger Karoo sediments at the town of Greyton.

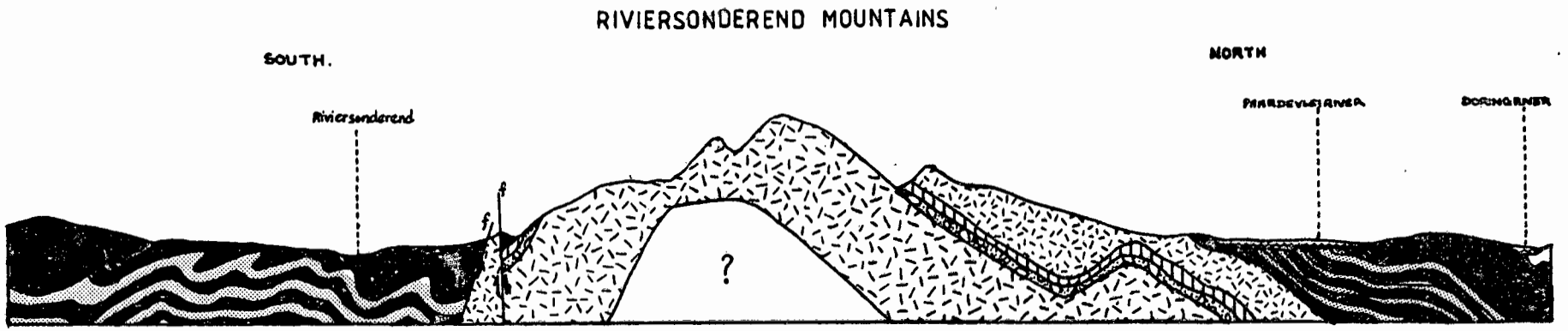
2.2.1.1 Malmesbury Formation

The Malmesbury shales form the base upon which the Cape System rests. A small section of these basal shales have been exposed on the historical farm Ganskraal and adjoining farms. The position of the shales has been mapped, but no description can yet be given as they still have to be studies in detail by geologists. The Malmesbury Beds, as found in the South-Western and Southern Cape, have been described by Du Toit (1954). The bedrock of the Malmesbury shales cannot be seen, as the region where the shale occurs is covered by Shaley red soils.

2.2.1.2 Intrusive Rocks

To the west of the exposed Malmesbury shales an intrusive body of granite can be seen. Mr Hennie Beyers who undertook an M Sc study on this occurrence of the Pre Cape rocks, used the presence of the intrusive granites in the numerous valleys along the mountain to infer the presence of the Malmesbury Shales in

FIGURE:2·1: GEOLOGICAL CROSS SECTION – RIVIERSONDEREND MOUNTAINS



Quartzite, sandstone & thin bands of shale and conglomerate. Sporadic basal conglomerate.

Quartzite, sandstone & thin bands of conglomerate.

Shale, frequently micaceous with thin bands of shale.

Tillite, grit & conglomerate.

Thick shale succession with numerous bands of white quartzite.

Shale, aranaceous shale.

Sandstone, argillaceous sandstone.

this area. According to Du Toit (1954) the intrusive granitic bodies nearly always caused considerable mineralogical changes in the surrounding strata with purely slaty beds being more affected than highly quartzitic ones. Because of the covering of the adjacent Malmesbury beds, it is not possible to determine the extent of the changes.

2.2.1.3 Cape System

The rocks and soils of the Riviersonderend Mountain Catchment, as well as most of the adjoining land are made up from sandstones, shales, and quartzites of Palaeozoic age which is known as the Cape System (Du Toit, 1954). The sediments that formed this system came almost exclusively from a northerly landmass between 440 and 300 million years ago (Truswell, 1977).

The Cape System is made up of three series which were identified by A G Bain (1945) with the exception that he limited the Witteberg Series to the Eastern Province (Du Toit, 1954). The three series from the oldest to the youngest are as follows:

(a) Table Mountain Series
(b) Bokkeveld Series
(c) Witteberg Series

(a) Table Mountain Series: This series covers most of the State land as well as the Mountain Catchment area. As can be seen in figure 2.1 the mountains consist almost completely of four of the six sub groups that make up the Table Mountain Series. Truswell (1977) gives six subdivisions of Table Mountain Sandstone as:

Nardouw Formation: Coarse-grained orthoquartzites with occasional pebbles and lenses. Usually felspathic towards the top.

Cedarberg Formation: Shale, siltstone, fine-grained sandstone.

Pakhuis Formation: Glacial mudstones and related rocks.

Peninsula Formation: Coarse-grained ortho-quartzites, with occasional pebbles and lenses, usually of vein quartz, quartzite and jasper.

Graafwater Formation: Purple, thinlybedded sandstone, siltstone and shale.

Piekenier Formation: Conglomerate and sandstone.

The latter two subdivisions cannot be identified in the Riviersonderend study area, and are accepted as not being present. (De Villiers, et al, 1964)

The lower sandstone (Peninsula Formation) and quartzites rest unconformably on the older Malmesbury shales (Du Toit, 1954). This change-over can be seen on a few farms to the west and near the town of Riviersonderend (Map 3). The lower 30 m of this subgroup varies from place to place and can either have intercalations of quartzite and purple shale or a conglomerate that is usually made up of small pebbles. After this the lower sandstone layer is thickly bedded and frequently crossbedded with occasional pebbly arenaceous beds. Another feature of this group is the shale partings, lenses and thin beds found throughout (De Villiers, 1964)

On top of the lower sandstone a thin layer of tillite (Pakhuis Formation) follows, which can be either pure unlayered rock, or conglomeritic beds. Where large flat areas of tillite occur weathering leaves a rock with pinnacles and holes. Folding due to the action of glaciers is also common where tillite is found (De Villiers, 1964).

Following on the narrow tillite layer, the upper shale band (Cedarberg Formation) is much wider and very distinct. On aerial photographs, and also in the veld, this layer can easily be separated from the other layers of the Table Mountain series by the absence of rocky outcrops and by its smooth appearance. The smoother appearance is caused by the faster weathering of the rock in comparison to the harder adjoining sandstone. A thickness of about 50 m can be taken as average throughout the area, the shale band disappearing in only a few areas.

The last layer to the Table Mountain Series, is the Upper Sandstone. This is very similar to the Lower Sandstone, except that there appears to be more shale present. The Upper Sandstone is also known as the Nardouw Formation as described by Truswell (1977). The rocks of this group tend to be red, and this can be seen in many places along the northern aspects of the mountain (De Villiers, et al, 1964).

The total thickness of the Table Mountain Series in the Riviersonderend has been measured as 1910 m, with the following thicknesses for the various subdivisions of the series (De Villiers, et al, 1964).

Upper sandstone and quartzite	670 m
Upper shale	50 m
Lower sandstone, quartzite and tillite	1190 m
	1910 m

(b) Bokkeveld Series: Lying on top of the Table Mountain Series, the Bokkeveld Series occurs right around the Mountain Catchment, and constitutes the low lying valley bottoms and the rolling hills of the Ruens. This series consists of four sandstone, and five shale zones, which are not easy to separate. On the geological map, (Map 3), the differentiation between the different zones, has only been entered as far east as the geological survey section has mapped it. The shale of this series is usually greenish or greyish at the surface, but a definite grey to black under the ground. The shale can be very fine grained, as in the black shale above the first sandstone zone, otherwise granular quartz can be seen. Along surface faults or joints manganese and iron has been leached out, to concentrate lower down in the fault or joint. The sandstone zones north of the mountain, from Stettyns mountains to Zandrivier in the Doringrivier Valley, are much browner and also finer than the sandstone of the Table Mountain Series, and also always mixed with varying quantities of clay. To the south of the mountain the sandstone is always rich in clay (De Villiers, et al, 1964).

Fossils have been found in this series just north of Villiersdorp on the farm Ratelfontein. Prints of Leptocoelia flabellites and Derbyina sp. have been identified. More discoveries will undoubtedly be made in the area between Ratelfontein and Zandrivier when a thorough search is made (De Villiers, et al, 1964).

The thickness for this series is 820 m as measured to the north of the Riviersonderend mountain.

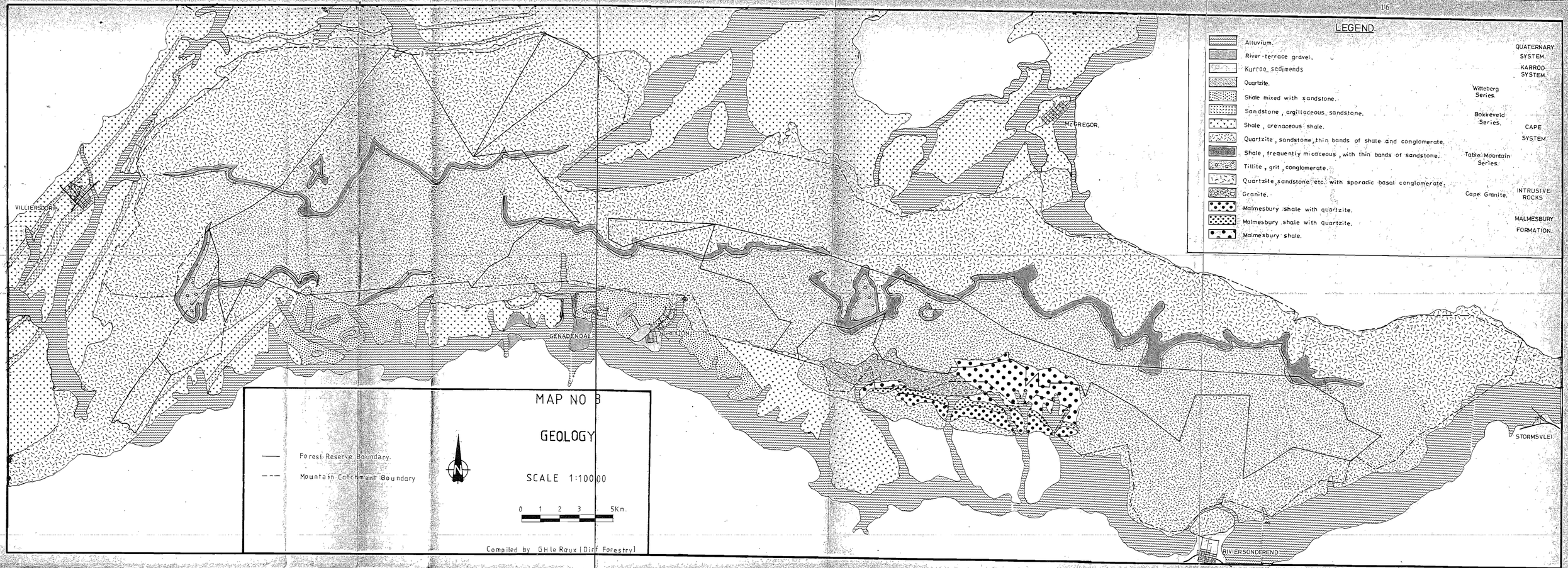
(c) Witteberg Series: The youngest of the three Cape System Series is the Witteberg Series that follows conformably on the Bokkeveld Series. This series has a thickness of 790 m and consists of quartzite and shale.

The lowest section of the Witteberg Series consists mostly of shale, although numerous thin bands of white quartzite and sandstone can be found at various levels. This section, known as the lower shale zone, is about 445 m thick. On top of the basal zone another succession of quartzite and shale zones follow. The first quartzite zone is very prominent and weathers red. Shale follows on this and these two zones are 180 m thick. The next quartzite zone, which is 70 m thick, is known as the "White Streak" and forms prominent white cliffs. On top of this white streak, follows another succession of shale, quartzite and shale which has a thickness of 100 m (De Villiers, et al, 1964).

The only fossil found in the Witteberg Series, in the vicinity of the Riviersonderend Mountains, is that near Genadendal, on the southern side of the range. Here Spirophyton has been found (De Villiers, et al, 1964).

2.2.1.4 Karoo System

Only a small area of Karoo sediments has been identified in the vicinity of Greyton, but to date no studies as to its composition or origin have been done, and thus only the locality can be given.


LEGEND
Alluvium.
River-terrace gravel.
Karroo sediments
Quartzite.
Shale mixed with sandstone.
Sandstone, argillaceous sandstone.
Shale, arenaceous shale.
Quartzite, sandstone, thin bands of shale and conglomerate.
Shale, frequently micaceous, with thin bands of sandstone.
Tillite, grit, conglomerate.
Quartzite, sandstone etc. with sporadic basal conglomerate.
Granite.
Malmesbury shale with quartzite.
Malmesbury shale with quartzite.
Malmesbury shale.
QUATERNARY SYSTEM.
KARROO SYSTEM.
Witteberg Series.
Bokkeveld Series.
CAPE SYSTEM.
Table Mountain Series.
Cape Granite.
INTRUSIVE ROCKS
MALMESBURY FORMATION.
VILLIERSDORP
GENADENDAL
RIVIERSONDEREND
STORMSVLEI
MAP NO 8
GEOLOGY
Forest Reserve Boundary.
Mountain Catchment Boundary
SCALE 1:100 00
0 1 2 3 5Km.
Compiled by G.H.le Roux (Dirf. Forestry)

2.2.2 Geomorphology

The Riviersonderend mountains form part of the chain of folded mountains running parallel to the coast in an east-west direction, in the Southern Cape. This range joins the chain of mountains running in a south-north direction, at Villiersdorp.

The mountains were formed by upthrust and faulting along the southern side, which resulted in the high steep cliffs seen on the southern side. The northern slopes are much longer and more gentle as can be seen in fig 2.1. The higher rainfall on the southern side, results in higher erosion levels. In fig 2.1 it can be seen that the upper sandstone (Nardouw formation) only occurs on the northern slopes and has been eroded away on the southern side. The steep southern slope is most prominent between Genadendal and the town of Riviersonderend, with the mountain becoming lower to the west and east of these towns. The two highest peaks are also close to these towns, Jonas Kop (1646 m) to the north-east of Genadendal and Pilaarkop (1655 m) north-east of Riviersonderend.

The western end of the mountain, which is much lower than the rest, used to form a barrier to the Riviersonderend. This caused the formation of erosion platforms on both sides of the kloof through which the river today flows (De Villiers et al, 1964).

2.2.3 Soils

Weathering of the rocks of the Table Mountain Series, is a slow process because of its hardness. Where the slopes are steep, the high rainfall of the mountains results in the removal of the weathered products to the lower lying valleys where it accumulates. Somewhat deeper soils than on the steeper slopes can be found on the lower more gentle slopes. The high,

steep slopes are characterized by bare rock outcrops and very shallow lithosols. On the gentler slopes the soils are pale-coloured, shallow, sandy and usually of the Mispah and Houwhoek soil forms. Internal drainage in these soils are very good and resistance to normal water erosion is good. The poorly drained areas on these slopes have soils of the Cartref form. On the flatter areas soils accumulate and deep sands develop which is of the Fernwood form. Shallow peaty soils found at various places on the southern slopes, are of the Champagne form, which indicate localized seepage spots (Mac Vicar et al,1977)

Soils in the mountain show a great variety of series but all are sandy, highly leached, and acidic. No soil survey has yet been undertaken and, until such time, no correlation between soil type and vegetation can be given.

Soils from the Bokkeveld and Witteberg Series are heavy-textured with large fractions of fine sand and silt. They also have much higher nutrient levels.

2.2.4 Climate

The climate in the Riviersonderend catchment area varies from west to east, and also within a very short distance from south to north. This variation in climate is fully described by the South African Weather Bureau which has partitioned South Africa into fifteen climatic regions. Of these, three are found around the Riviersonderend Mountain Catchment Area. The mountain chain forms the boundary between the regions A and K which is south and north of it respectively. The third region, M, occurs at the western extremity in the vicinity of Villiersdorp. The main cause of the climatic variation over such short distances is the mountains running parallel to the coastline.

Rainfall is closely related to topography and this is why the southern side of the mountain has a much higher rainfall than the northern side, which is only a few kilometers away in some areas. The high mountain peaks block the cloudy coastal conditions from the interior, and the rainfall in region A (Coastal flats) is about double that of region K (Robertson Karoo). Comparing rainfall figures given by the Weather Bureau and those measured by farmers close to the mountain, a sharp increase in precipitation is encoutered as one approaches the mountain. In region A this increase is from an average of below 400 mm on the coastal flats to over 1000 mm at some places against the mountain. At Ganskraal an increase from 584,5 mm at the Riviersonderend to well over 1000 mm at the mountain has been recorded. Across the mountain in region K, the increase is from below 250 mm to about 500-600 mm in the mountains. Region M with its winter rainfall shows large variations of rainfall in the valleys where it varies between 500 mm and 800 mm. In the mountains surrounding the Villiersdorp valley the rainfall is much higher than in the rest of the Riviersonderend catchment area. The only recording station in these mountains is at Nuweberg with an annual average rainfall of 1542,6 mm. The rainfall pattern in these areas is shown by the number of rain days per month. In regions A and K these figures are the same throughout the year, with 8 - 12 days and 1 - 3 days per month respectively. Region M has different figures for winter and summer. In winter rain falls on 12 - 15 days per month with only 4 - 5 rainy days per month in summer.

In these regions thunderstorms occur more often in the drier inland areas of region K where between 10 and 20 storms a year are recorded. Sometimes about half the annual rainfall for an area can be

TABLE: 2.1 RAINFALL FIGURES : RIVIERSONDEREND M.C.A.

LAT.	LONG.	CODE	STATION	HEIGHT: m	YR.	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	ANNUAL	AVERAGE
34°02'	19°07'	6/182	Vygeboomsrivier	335	5	46,2	12,7	31,2	71,1	122,7	183,1	63,3	146,3	107,4	130,1	26,2	50,3	990,6	82,55
34°05'	19°07'	6/65	Nuweberg	792	34	35,0	37,7	48,1	110,2	215,0	246,9	248,0	235,0	161,6	98,6	67,4	39,1	1542,6	128,55
33°59'	19°18'	22/539	Villiersdorp	366	36	14,4	22,3	21,2	44,6	77,7	99,3	93,8	88,1	64,3	40,0	35,5	16,7	617,9	51,50
33°42'	19°27'	22/792	Brandvlei Dam	213	21	4,3	14,8	10,0	25,2	48,6	45,2	45,4	38,1	29,1	20,5	16,3	7,4	304,9	25,40
33°53'	19°27'	22/803	Doornrivier	296	33	6,1	10,4	8,8	17,7	31,8	25,8	33,1	30,5	19,3	15,4	12,9	6,0	217,8	18,15
34°13'	19°25'	6/733	Caledon TNK	244	83	21,6	22,7	33,8	45,5	63,8	68,1	65,7	64,9	53,0	47,2	33,2	22,6	542,1	45,18
34°02'	19°30'	6/872	Molen Rivier	549	10	20,1	18,0	26,2	29,5	38,3	37,6	44,5	52,1	46,7	25,7	49,0	22,6	410,3	34,19
34°02'	19°33'	7/62	Genadendal	290	27	37,1	37,3	56,6	56,1	54,4	61,2	64,3	65,0	69,6	60,5	58,7	32,8	653,6	54,46
33°57'	19°50'	23/597	McGregor	259	52	8,4	9,9	16,3	20,1	26,9	29,2	30,0	25,9	22,6	19,3	15,0	7,6	231,2	19,26
33°59'	19°51'	23/629	Rhebokskraal	274	31	7,8	14,4	10,6	21,8	37,7	32,8	39,5	29,3	22,7	20,3	16,2	7,5	260,6	21,71
34°00'	20°00'	23/900	Oudekraal	206	7	3,6	12,5	13,2	9,9	18,8	16,8	21,1	27,9	12,2	9,7	17,3	2,3	165,3	13,77
34°09'	19°54'	7/699	Blydskap	152	24	20,0	25,8	31,9	38,1	45,7	39,3	42,5	46,1	40,3	38,1	41,7	17,6	427,1	35,59
34°01'	20°26'	8/751	Swellendam Bos	122	31	68,1	74,8	88,1	62,5	57,6	42,1	52,6	69,4	80,2	91,5	86,9	56,9	830,7	69,22
34°02'	20°27'	8/782	Swellendam TNK	128	80	55,4	65,6	78,3	64,7	66,1	51,4	53,3	61,1	67,8	74,0	66,4	57,2	761,3	63,44
34°07'	20°13'	8/367	Kleinfontein	168	30	13,8	14,0	22,6	26,6	34,5	29,5	36,8	32,6	30,6	32,3	30,6	11,2	315,1	26,26
33°50'	19°54'	23/710	Robertson AGR	228	48	3,1	28,7	16,4	17,3	54,0	31,8	29,3	36,6	18,5	26,0	5,2	8,9	275,8	22,98
34°22'	19°52'	7/352	Karnmelksrivier	152	13	18,8	20,8	35,8	37,6	66,5	59,4	52,3	65,0	47,7	60,2	28,2	25,9	518,2	43,18
34°08'	19°49'	Private	Ganskraal	600	13	33,1	60,5	37,2	51,6	62,1	50,3	53,7	66,5	46,1	38,8	48,8	35,8	584,5	48,7
33°59'	19°35'	Private	Goodhope	380	25	14,6	20,7	11,6	28,2	68,4	58,2	73,9	98,7	40,1	37,6	32,2	14,5	498,7	40,4

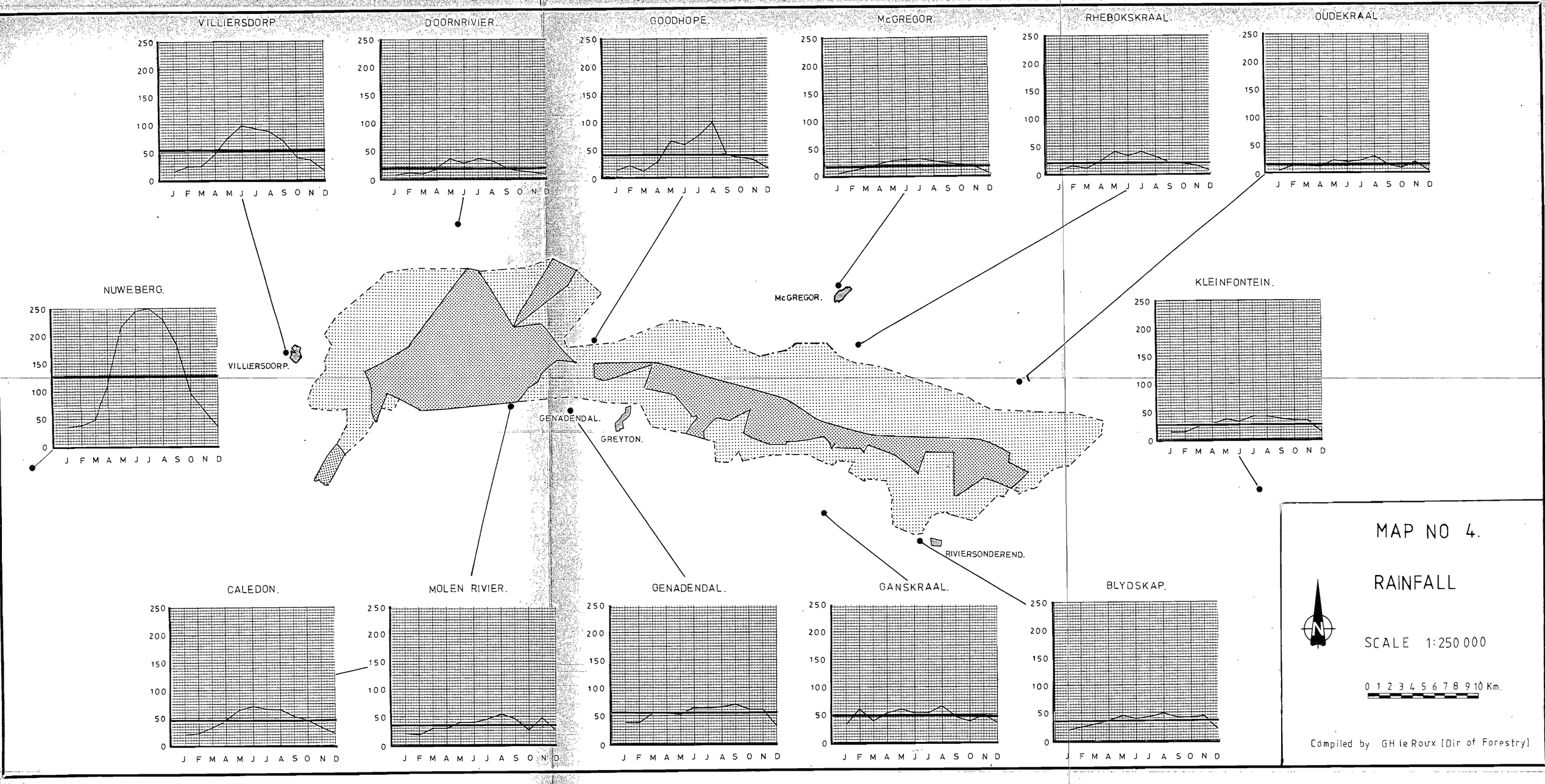
recorded during just one of these storms. Region A experiences about 10 thunderstorms a year and region M only 5. Snow falls on the higher mountain peaks between 2 and 5 times every winter and this has a pronounced influence on the underground water reserves. Hail in all three regions is an infrequent occurrence, and in region K, it is a distinct hazard to the fruit farmers.

TABLE 2.2: MAXIMUM AND MINIMUM TEMPERATURES IN THE THREE CLIMATIC REGIONS AROUND THE RIVIERSONDEREND MOUNTAINS

REGION	SUMMER (TEMP C)				WINTER (TEMP C)			
	Max	Extreme Measured	Min	Extreme Measured	Max	Extreme Measured	Min	Extreme Measured
A	26	42	15	4	19	32	7	-4
K	32	45	15	5	18	31	5	-3
M	28	43	15	4	17	30	6	-5

The weather stations in table 2.1 only measure rainfall and thus no detailed temperature figures for the study area exist. There are temperature figures for the different climatic regions which are given in table 2.2. These, however, are very general and local differences exist everywhere in the mountains. Temperatures on the southern side of the mountain are much lower than in region K during summer, due to the cooling effect of the winds from the sea. Region K is characterized by very large temperature fluctuations, both diurnal and seasonal. In this region changes of up to 28°C between day and night temperatures are not unusual. "Berg winds" cause temperature increases above 30°C mainly in late summer in the interior regions, this occur one to three times a month.

Frost in the low lying areas around the mountain is practically unknown except in region K where


VILLIERSDORP.
DOORNRIVIER.
GOODHOPE.
McGREGOR.
RHEBOKSKRAAL.
OUDEKRAAL.
NUWEBERG.
KLEINFONTEIN.
VILLIERSDORP.
McGREGOR.
GENADENDAL.
GREYTON.
RIVIERSONDEREND.
CALEDON.
MOLEN RIVIER.
GENADENDAL.
GANSKRAAL.
BLYDSKAP.
250
200
150
100
50
0
J F M A M J J A S O N D
MAP NO 4.
RAINFALL
SCALE 1:250 000
0 1 2 3 4 5 6 7 8 9 10 Km.
N
Compiled by GH le Roux [Dir of Forestry]

it is encountered from June to August. In the mountains it is more common during winter.

The coastal plains are covered in cloud for 50% of the year, whereas, just across the mountain, the skies are clear for at least 70% of the time. The mountain forms a clear boundary between these two regions as can be witnessed from high points on the mountain. On many occasions the southern half of the mountain is covered in cloud while the northern half experiences clear sunlight. In region M the skies are clear for 60 - 70% of the year.

2.3 BIOLOGICAL FEATURES

2.3.1 Vegetation

Using the Acocks (1975) classification of veld types in South Africa, four types can be distinguished in and around the Riviersonderend Mountain Catchment Area. They are Mountain Fynbos (Acocks type 69) which covers most of the catchment, Knysna Forest (Acocks type 4) found in the wet kloofs between Greyton and Riviersonderend, Karroid Broken Veld (Acocks type 26) intruding from the northern side into the catchment but found mostly on the plains adjoining the mountain, and Coastal Rhenosterbosveld (Acocks type 46) occurring on the north eastern side as well as on the southern side of the catchment, mostly on Bokkeveld and Witteberg shales.

Of the above four vegetation types only Coastal Rhenosterbosveld is not found in the mountains. The other three are shown on Map 5 which only includes the vegetation of the Mountain Catchment Area. Marloth (1908), Adamson (1938), Acocks (1975), Kruger (1976, 1979) and Taylor (1977, 1978) are only some of the many scientists who have described

the Cape vegetation. These descriptions are all in broad terms, while Mountain Fynbos with which we are dealing in the study area, is only a sub-category of fynbos. Taylor (1978) states that there are two major subdivisions, Mountain and Coastal Fynbos, both having typical fynbos families and physiognomy but differing in species composition. Acocks (1975) lists a third type of fynbos, called False Macchia. This is the fynbos found on the eastern mountain ranges which is a substitute vegetation for what earlier used to be either an unpalatable, wiry or "sour" grassveld or a "transitional forest climax". In contrast to Taylor and Acocks, Adamson (1938) included Rhenosterbosveld in his five fynbos types, which he called "Bush (Sclerophyll) Vegetation".

In his description of fynbos, Taylor (1978) closely followed the groupings first described by Adamson, only slightly altering the limits of rainfall and altitude as set by him. The first Adamson type called "Sclerophyll Bush", include both Mountain and coastal Fynbos. He limits it to areas with a rainfall of between 500 mm and 760 mm from sea level to an altitude of 900 m. The mountain section of this type corresponds closely to Taylor's proteoid zone. Taylor gave an altitude of up to 1000 m and rainfall of between 500 mm and 600 mm as the limits for this zone. "Wet Sclerophyll Bush", the second Adamson type, is the same as Taylor's Hygrophilous Fynbos. This is the vegetation of permanently wet or moist sites found along stream banks, seepage areas and moist flats. Adamson named his third type, "Mountain Sclerophyll Bush", which means everything growing above an altitude of 900 m where the rainfall is higher, it is colder and more mist occurs in summer. Taylor named this the "Ericoid - Restioid Zone". The "Dry Sclerophyll Bush" of Adamson represents all the fynbos in areas with a rainfall below 500 mm. Taylor called this Arid

Fynbos stating that there are many habitats bearing vegetation that could be described as dry, while in fynbos there is a separate and distinct type that should have a name other than dry. This type occurs as a narrow belt on the northern aspects of the mountains running from west to east along the coast.

For the purposes of this study it was necessary to further subdivide the broad classes defined by Adamson (1938) and Taylor (1978). This proved difficult because of the richness and distribution pattern of communities of the Cape Flora. It is estimated that there are about 8550 species of plants in the Cape (Goldblatt, 1978). Of this there are seven endemic families, 212 endemic genera and hundreds of endemic species present (Kruger 1976, Taylor 1978). To further complicate matters there are many factors other than climatic, affecting vegetation distribution in the mountains. They are: soil structure, soil depth, soil moisture, altitude, aspect and slope. These factors change over short distances and since many species have narrowly circumscribed habitat preferences, the composition of vegetation changes continuously. The boundaries between different communities are very gradual and this together with repeated patch burnings for grazing in the past, has led to a vegetation in different stages of regeneration which complicates community recognition (Taylor 1978).

The groups, as they are given below, have been chosen as the most practical from a management point of view, and also because they can be identified on aerial photographs. Further subdivision is still possible but then it becomes impossible to map on a 1:50000 scale, and the time needed to survey nearly 70 000 ha of mountainland will be a limiting factor. This is also the problem with the proposed system for the mapping of fynbos by Campbell, et al (1981) which comprises 33 classes.

2.3.1.1 Vegetation types

(a) Evergreen riparian forest: Forest communities, mostly small, occur in narrow, mountain kloofs. They are similar to Acocks type 4, Knysna Forest. In the Riviersonderend a few larger forests remain, of which Oubos, Olifantsbos, Appelbos and Coetzeebos on the southern slopes, are the best examples. These forests grow on Malmesbury shales and granitic soils. The rainfall in these areas is also the highest in the Riviersonderend Catchment Area. The canopies of these forests are closed and have a height of 10 - 15 m. The trees found in these forests include the following:

Ocotea bullata - Stinkwood
Curtisia dentata - Assegai
Kiggelaria africana - Wild Peach
Ilex mitis - Without
Podocarpus latifolius - Yellowwood
Apodytes dimidiata - White pear
Rapanea melanophleos - Boekenhout
Platylophus trifoliatus - White elder
Olea capensis - Ironwood
Diospyros whyteana - Bostolbos
Halleria lucida - Notsing
Grewia occidentalis - Assegai wood

Climbers like Rhoicissus capensis and ferns like Pteris dentata and Adiantum capillusvenerus are common inhabitants of these forests. The greatest danger to these forests are the regular fires in the fynbos which burn up to the edges of the forests, destroying all regenerating young trees.

A list of all the indigenous trees identified in a narrow kloof in the Greyton Nature Reserve can be seen in Appendix 1.

(b) Riparian shrub or bush: This is the vegetation of river and stream banks and does not include the vegetation of seepage areas. Proper riparian shrub is seldom seen in the Riviersonderend as the streams on the southern side are usually very short, fast flowing and infested with Acacia mearnsii. On the northern side of the mountain the streams flow in deep, rocky kloofs where very high temperatures are reached which is a limiting factor in the distribution of this type. Higher up in the mountain at the western end near Villiersdorp, the best examples of stream vegetation can be seen. The most prominent species in these streams are Leucadendron salicifolium, Brabeium stellatifolium and also Berzelia spp. The soils in and along these slow flowing streams are usually peaty.

(c) Tall closed shrub: This type is distinguised by dominant Protea spp growing to a height of 2 to 3 metres. The size of the area and the species of the communities is strictly governed by the site. For example, on warm talus slopes you will find mainly Protea nitida mixed with other species but on and close to shale bands, Protea repens is dominant. On the lower slopes of the cooler southern side, Protea neriifolia and Protea longifolia often occur in dense stands. In most cases, however, there is considerable overlapping and intermingling of the species. It is easy to identify this type in the field, as well as on aerial photographs.

(d) Tall open shrub: The same species as in the previous group are found here with the only exception being that the canopy is open to

sparse Protea laurifolia. This does not occur in the closed form. This type is mainly on the drier northern side of the mountain and is made up of tall scattered individual Protea spp., with a dense underlying growth of smaller shrubs, Leucadendrom salignum being the most common type.

(e) Medium shrub: This group comprises mostly the dominant Leucadendron salignum that can be identified from far away by its bright yellow colour which is prominent amongst greyish fynbos. Small communities of the shorter Protea spp also make up part of this type. On the southern side of the mountain, Cliffortia spp and also Erica spp occur in dense patches depending on the soil depth. The height of this group ranges from about 0,5 m to 1,5 m. Areas now mapped as medium veld will in time become either tall, open or closed shrub if given a chance to develop fully.

(f) Short shrub restio: This is the same as the ericoid-restioid zone of Taylor (1978). As the name implies this is a low growing vegetation made up of a variety of types. The most common plants in this group are from the Restionaceae family, which can be found on their own in very shallow ground, or mixed with Erica spp or low growing to creeping Protea spp. A host of other species can also be found, but they have all been mapped as low veld, will in time return to medium veld if the excessive burning for grazing, of the past, is stopped.

(g) Arid fynbos: Acocks (1975) divided his Karroid veld into three groups: a third of which can be found in the foothills of the northern

side of the Riviersonderend mountains. To draw the exact boundary between mountain fynbos and the karroid veld is very difficult and this can only be judged by the presence of species like Dodonaea viscosa var. angustifolia, Rhus lucida and also Elytropappus rhinocerotis. Another species found in the karroid veld that helps with the identification is Euphorbia spp. The area where species of both mountain fynbos and karroid veld occur has been mapped as Arid fynbos.

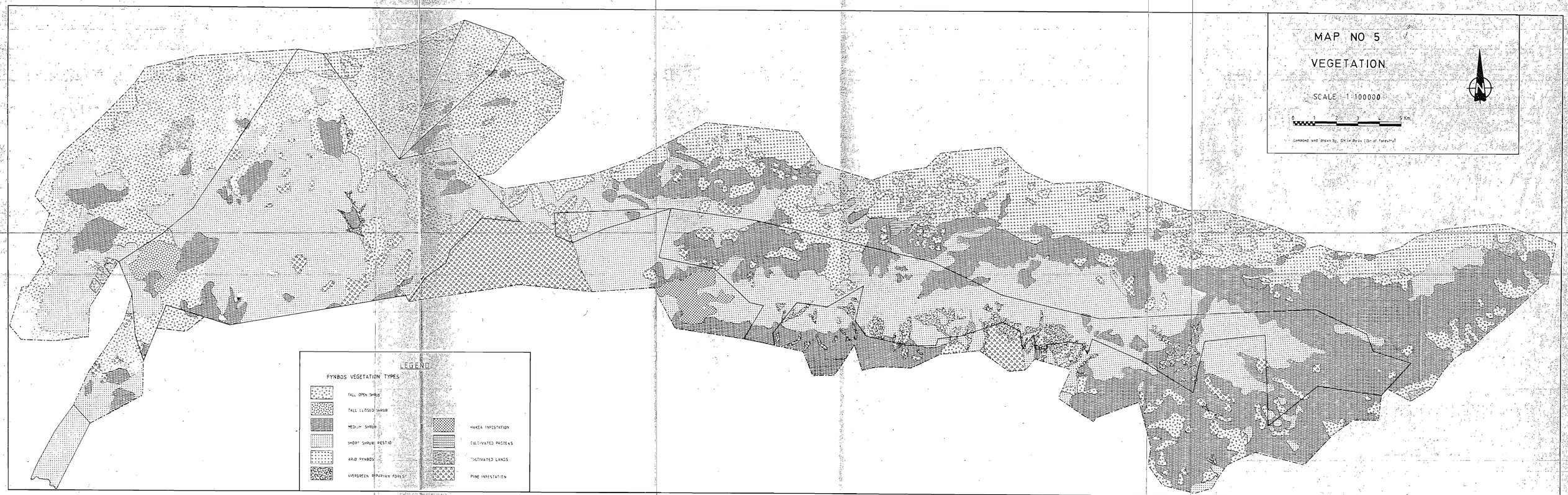
2.3.1.2 Major features of the flora

The major importance of the flora, besides its soil binding and covering value, lies in its complex variety of interesting and attractive species. There are a considerable number that are of commercial and aesthetic value, especially members of the Proteaceae and Ericaceae.

Conditions in the N W section of the range are ideal for the cultivation of Proteas. An export industry built mostly on established indigenous stands exists. Some of the better known species include Protea magnifica, P. neriifolia, P. repens, P. laurifolia and P. cynaroides.

A few farmers have established Protea plantations, sometimes ploughing barely accessible level land at high altitudes. Farmers are also experimenting with in situ sowing methods.

The wide range of climatic conditions within a relatively small area, has resulted in this being a particularly rich floral paradise.


MAP NO 5
VEGETATION
SCALE 1:100000
0 1 2 3 4 5 Km
Compiled and drawn by GH le Roux (Dpt of Forestry)
N
LEGEND
FYNBOS VEGETATION TYPES
TALL OPEN SHRUB
TALL CLOSED SHRUB
MEDIUM SHRUB
SHORT SHRUB RESTIO
ARID FYNBOS
EVERGREEN RIPARIAN FORMS
HAKEA INFESTATION
CULTIVATED PROTEAS
CULTIVATED LANDS
PINE INFESTATION

2.3.1.3 Weeds and invasive species

Invasive weeds are today a widespread problem in fynbos. They are mainly shrubs and trees introduced from countries like Australia and South America. A complete list of all invasive species in the Riviersonderend mountains with their country of origin and growth habit is given in Appendix 3. These introduced species have spread, largely by natural means over the whole area covered by fynbos. Some of the species form extensive thickets and this is an important factor in causing the rarity and extinction of species in fynbos. Hall (1979) states, "... of 70 critically threatened or recently extinct taxa, 23% had been threatened by acacia invasion, 8% by pines and only 2% by hakeas." Relatively large areas of the Riviersonderend catchment area are affected by alien vegetation but an eradication programme has been started by the Directorate of Forestry.

(a) Pinus species: The southern and eastern aspects are the worst affected, plantations having been established in the moist foothills early last century. Pinus pinaster infestation can now be found in virtually every valley, the highest concentrations being in Genadendal and Boskloof. The infestation has now spread across the watershed line and scattered communities of pine can now be seen high up on the northern aspects. An indication of just how rapidly the Cluster Pine is capable of spreading can be seen by comparing photographs taken in 1938, 1949 and 1962. Even the area covered since 1962 is quite alarming.

The present eradication programme will have to be stepped up and systematically planned to control further infestation. In a pamphlet written by Hutchins (1900), called "The Cluster Pine at Genadendal", he describes the production of timber and the sylvan beauty of mountain slopes covered in pine, not being able to comprehend the problem it could actually cause 80 years later.

(b) Hakea: Hakea has also established itself throughout the area, but although widespread, most communities are small and can easily be found and brought under control. In the Boesmans-kloof Valley above Greyton however, the situation is far worse. Very dense Hakea gibbosa stands cover large areas and a very intensive operation will be required to clear the area. This dense stand of Hakea is shown on the vegetation map.

(c) Acacia species: Acacia saligna (Port Jackson) is found mostly in the south eastern section of the area. It occurs in small groups mainly in streams at low altitudes.
It would not at this stage appear to be a serious problem but should receive early attention.

Acacia mearnsii (Black Wattle) has established itself throughout the length of the Riviersonder-end River. In places it has penetrated the catch-ment area, but this spread has been restricted to valley floors, the worst affected being the Olifantskloof River. In isolated instances, stands of Black Wattle have been planted higher up in the mountain to make shade for livestock. The infestation here is not as serious as in other catchment areas in the country.

(d) Eucalyptus species: Isolated specimens can be found on the floor of valleys, obviously originating from farm homesteads which are always surrounded by gums planted for shade and wind protection. No large stands occur and no serious problem with this genus is expected.

2.3.1.4 The history of fire in the vegetation

Burning of vegetation in the Cape is something which has been recorded since the discovery of the southern point of Africa by Vasco da Gama in 1497. "Terra de Fume" is the name given by Da Gama to this part of the world because of the columns of smoke seen on the land from the sea (Brown, 1875). Brown thinks that the colonists adopted the practice of veld burning from the Hottentots who later were employed by them as herdsmen. Apart from man, natural causes are also responsible for fires and Wicht (1845) quotes authentic cases of fires caused by lightning and a falling rock in the Jonkershoek valley. Many instances of fires started by falling rocks during the earthquake of September 1969 have been recorded (Taylor, 1978).

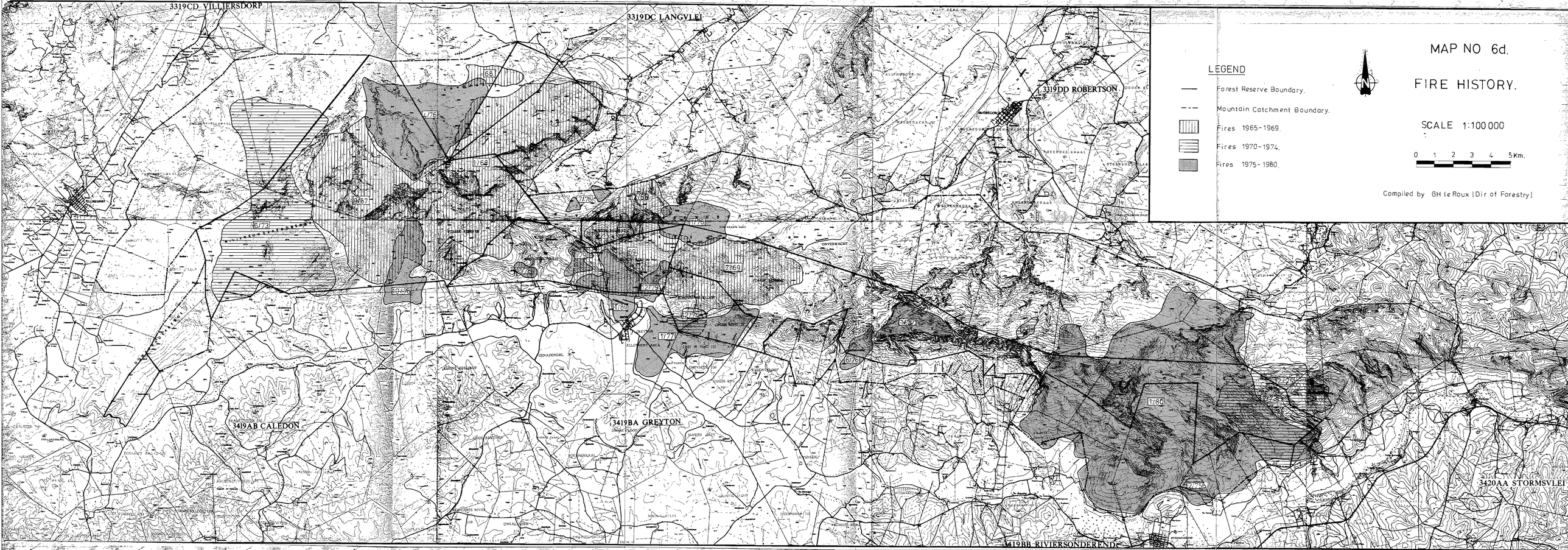
Concern about the effects of fires on natural veld has been shown from the earliest times and this can be seen in the stringent laws that were passed as early as 1687. Severe penalties for the contravention of this law were imposed, with a severe scourging for a first offence, and death, by hanging, for the second (Botha, 1924). This law was still in force in 1806 when the English took possession of the Cape. A further law, the Forest and Herbage Act of 1859, was passed to protect the forests from damage, and a fine not exceeding £100, or imprisonment not exceeding six months, or combined fine and imprisonment could be implemented in case of contravention of the act (Thompson, 1936).

Although the earlier travellers into the interior of the country all mentioned the use of fire by local inhabitants, no detailed description of how fire was used is available. Most cases mentioned were those of grassveld in the interior of the country being burnt, while no evidence that this same practice was used in the Southern Cape mountains could be found. Burning of the coastal plains did take place and fires must have spread from there into the mountains.

The first person to discuss the advantages and disadvantages of fire in vegetation was Brown (1875). He asserted that scientifically it is wrong to burn, and in his capacity as Colonial Botanist (1863-66) he secured the prohibition of burning in the Cape Colony, a common practice at that time. The complete protection of vegetation led to a build up of fuel levels, and ultimately to the big fire of February 1869, when an area 650 km long by 25 to 250 km wide was burnt along the Southern Cape coast. After this fire, Brown, who still regarded the practice of burning harmful, acknowledged the fact that it would be better to burn small areas at a time so as to prevent fires from spreading uncontrolled. The farmers followed this new viewpoint and started burning their veld so as to prevent the same catastrophy happening again. It was also about this time that pressure on the available land increased (see fig 3.3 and map 8) and farmers started moving towards the mountains to find extra grazing for the stock. Burning of the mountainland for grazing must have also started in earnest at this time because this would have been the only way in which stock could have been kept there.

No record of burning during this early period exists and one can only guess as to the extent that the mountain had been burnt and grazed. Mr Hennie Beyers during an interview, said that his father had told him that the farmers on the southern side of the Riviersonderend mountains only started burning the mountains towards the end of the nineteenth century. The first accurate record of burning in the Riviersonderend mountains is that obtained from aerial photographs taken during the years 1938, 1948 and 1962. From 1965 onwards the Directorate of Forestry has kept accurate records of every fire in the mountains. Maps have been prepared from these photographs and the records from forestry. These maps show all the patch burnt areas at the time that the photos had been taken and the extent of each fire from 1965 onwards (see maps 6a to 6d). The problem with the aerial photographs is that each of the flights only cover part of the mountains. As a result of this it was not possible to compare the total area burnt in the mountains during each of these time periods.

The information gained from studying the photos showed clearly that the vegetation consisted of a mosaic of different age classes. Very few large areas that must have burnt at the same time could be seen and these were mostly in the untraversable areas of the mountain. Map 6d clearly shows that after the patch burning system declined one got less fires but that each fire burnt much larger areas. Comparing the areas burnt during 1938, 1948 and 1962 there seem to be a decline in the total area burnt during each of these years. Farmers seemed to move out of the interior of the mountains to the more accessible areas along the fringes of the mountain.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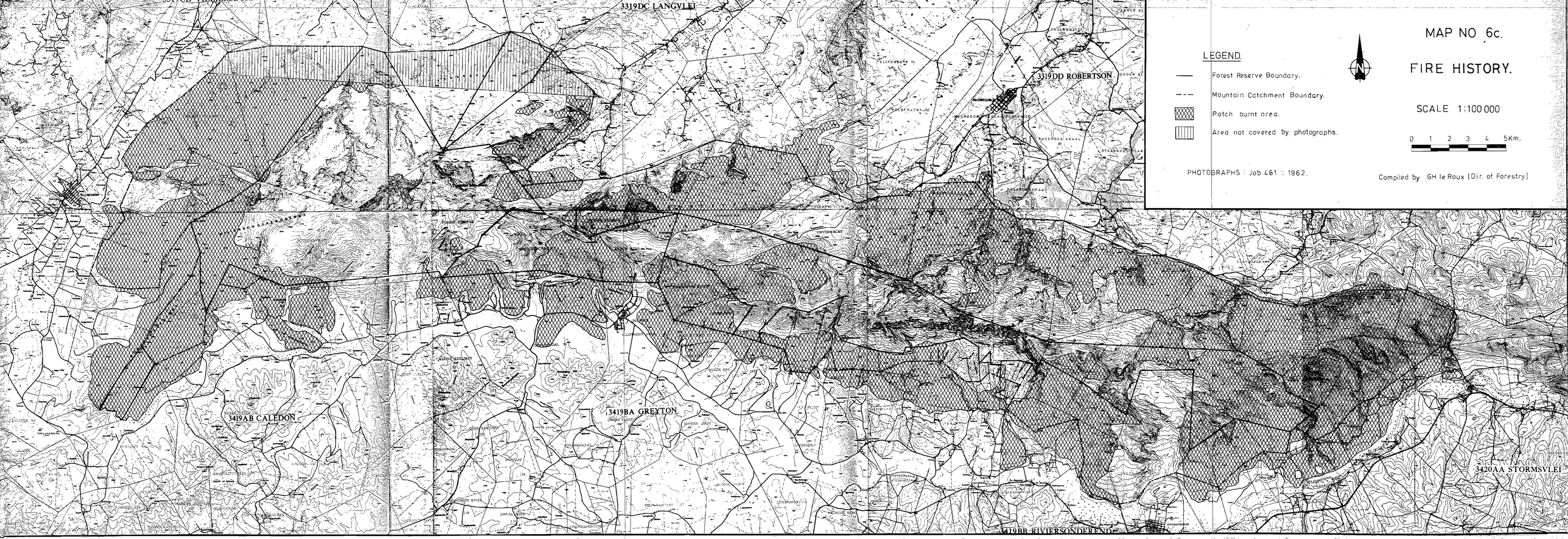
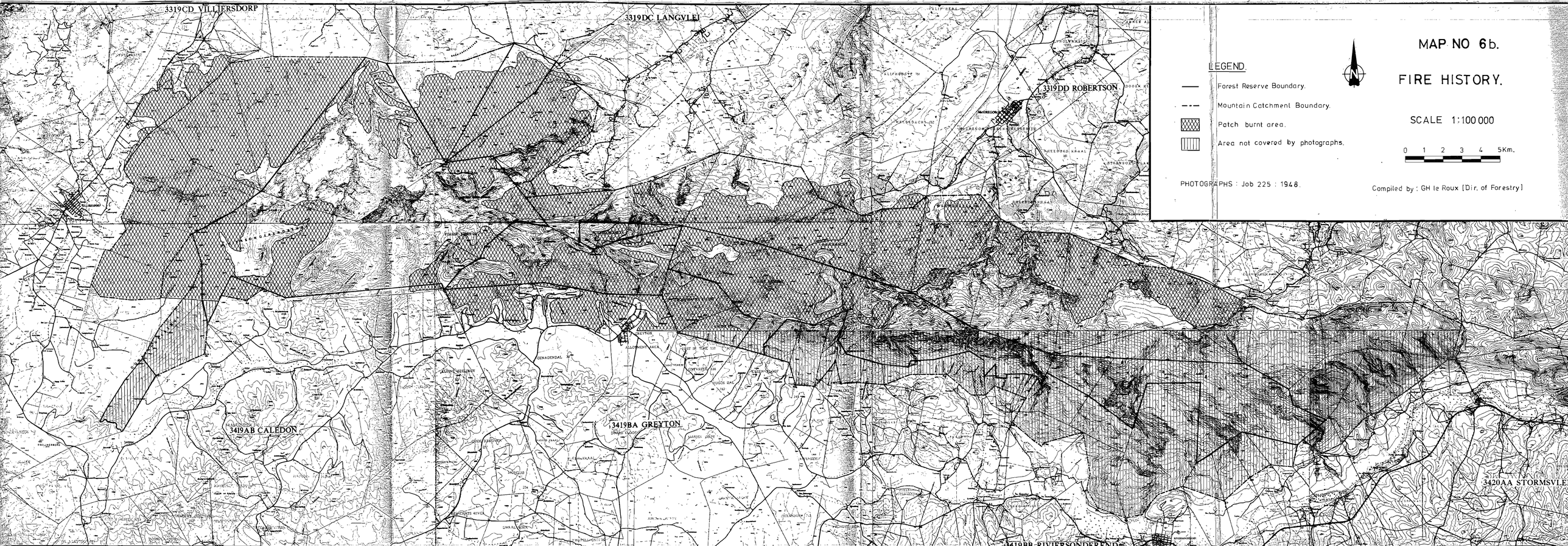
3319DC LANGVLEI
3319DD ROBERTSON
3419AB CALEDON
3419BA GREYTON
3419BB RIVIERSONDEREND
3420AA STORMSVLEI
LEGEND
Forest Reserve Boundary.
Mountain Catchment Boundary.
Fires 1965-1969.
Fires 1970-1974.
Fires 1975-1980.
MAP NO 6d.
FIRE HISTORY.
SCALE 1:100 000
0 1 2 3 4 5Km.
Compiled by GH le Roux [Dir of Forestry]


3319DC LANGVLEI
3319DD ROBERTSON
3419AB CALEDON
3419BA GREYTON
3420AA STORMSVLEI
3419BB RIVIERSONDEREND
MAP NO 6c.
FIRE HISTORY.
SCALE 1:100 000
0 1 2 3 4 5Km.
LEGEND
Forest Reserve Boundary.
Mountain Catchment Boundary.
Patch burnt area.
Area not covered by photographs.
PHOTOGRAPHS : Job 461 : 1962.
Compiled by GH le Roux [Dir. of Forestry]


3319CD VILLIERSDORP
3319DC LANGVLEI
3319DD ROBERTSON
3419AB CALEDON
3419BA GREYTON
3420AA STORMSVLEI
3419BB RIVIERSONDEREND
MAP NO 6b.
FIRE HISTORY.
SCALE 1:100 000
0 1 2 3 4 5Km.
LEGEND.
Forest Reserve Boundary.
Mountain Catchment Boundary.
Patch burnt area.
Area not covered by photographs.
PHOTOGRAPHS : Job 225 : 1948.
Compiled by : GH le Roux [Dir. of Forestry]

MAP NO 6a.

FIRE HISTORY.

SCALE 1:100 000

0 1 2 3 4 5Km.

LEGEND

- Forest Reserve Boundary
- Mountain Catchment Boundary.
- Patch burnt area.
- Area not covered by photographs.

PHOTOGRAPHS : Job 130 : 1938.

Compiled by GH le Roux [Dir. of Forestry]

2.3.1.5 The effect of fire and grazing on the vegetation.

Concern about the regular burning of fynbos veld has been expressed for many years. During 1924 a symposium was held to discuss the problem of veld burning and here Marloth (1924) expressed his concern about the shocking state of the Cape mountain vegetation. He said that before the White Colonists used the hills and mountain slopes for grazing, they were covered with thick evergreen shrub. At the time of the symposium the practice of burning and grazing of fynbos vegetation was at a high point and only young veld could be seen. During 1952 a fact-finding Inter-Departmental Committee was established to identify all water catchment areas in South Africa and investigate the management problems relating to these areas. This report was published during 1961 and is generally known as the Ross-report. In this report the committee again expressed their concern about the state of the vegetation in the catchment areas. It was only during the 1960's that experimental research on the effects of fire on fynbos vegetation and water supplies, really got underway.

Wicht (1945) was the first scientist to recognize the different ways in which fynbos plants can survive fire. He identified the following four ways: geophytes that regenerate from underground storage organs; sprouters that regrow from rootstocks; plants with thick bark that protect dormant stem-buds and woody shrubs that are killed and regenerate from seed.

Studies on the effect of fire on the vegetation have shown remarkable recovery rates of the vegetation

after fire. Kruger (1972) found that both canopy and basal cover recovered within 25 to 30 months to between 70 and 90 per cent of levels before the treatment. Sprouting species comprised 90 to 98 per cent of the basal cover and 80 to 95 per cent of the canopy cover. Van der Merwe (1966) found that 67 per cent of the species in Swartboskloof regenerated vegetatively with 33 per cent regenerating from seed. The most vulnerable plants in fynbos vegetation are those that regenerate from seed only. Taylor (1978) states that on average these plants need about five to six years to form viable seeds and recurring fires at shorter intervals will in time exterminate them. If the veld is used for grazing soon after the burn, this will increase the possibility of the extermination of such species. Animals grazing in this veld prefer the young seedlings as they are soft and more palatable then the older harder plants. In the vegetation survey in the Riviersonderend mountains it was noticeable that most seedlings in areas that had been burnt and used for grazing, had been grazed right down to the ground. This usually kills the seedling or retards the growth so much that these plants never reach a seed-forming stage before the next burn. The history of burning and grazing in the Riviersonderend mountains indicates that many areas had been continuously burnt for a century or more on a very short rotation. This must have led to the disappearance of many seedregenerating species. Martin (1966) identified two types of seed-regenerating species. The first regenerates from seed present in the soil while the other group regenerate entirely from light seed borne into the area. The first group are made up by plants such as Anthospermum aethiopicum and Selago corymbosa. In a plant survey done in a disturbed

section of fynbos in the Riviersonderend mountains, Anthospermum was also present. It is not certain whether this plant survived the heavy trampling, burning and grazing of the fynbos in that area or whether seed came into the area after grazing and burning had been discontinued there (see fig 2.2). The survival of the second group regenerating from seed from outside the area will depend on the availability of seed from areas that had not been regularly burnt. One of the main groups of plants found in this group is the Ericaceae which is increasing in dominance with the age of the community (Kruger, 1972; Martin, 1966).

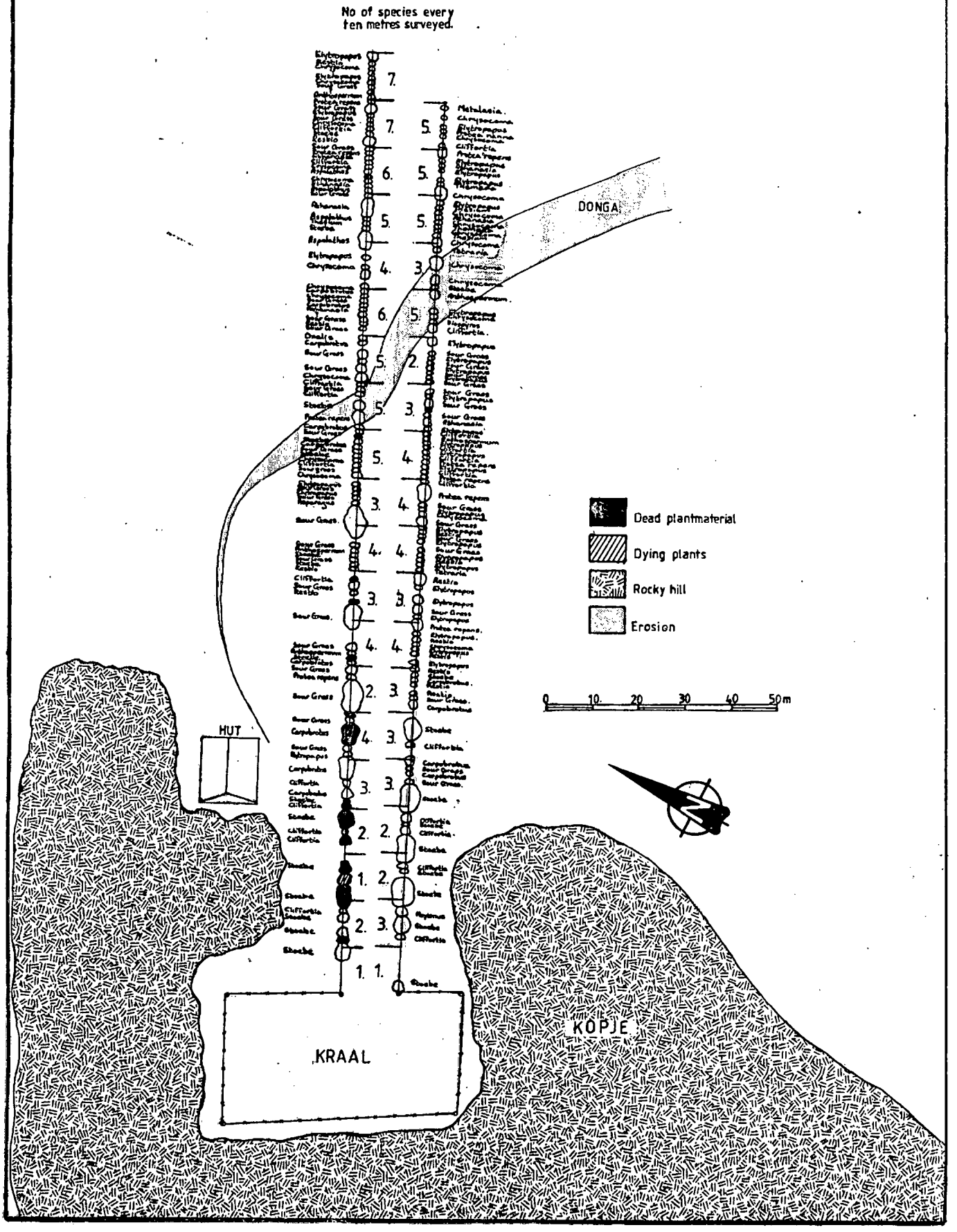
During the vegetation survey in the Riviersonderend mountains it became clear that vegetatively regenerating plants could also be damaged by repeated burning on a short rotation. One such example is that of Protea nitida which can survive extreme fires. This plant, has, however, been exterminated in some areas while struggling plants can still be seen on other slopes. Not one of the surviving plants had a flower head on them and it will take some time for these plants to re-establish themselves.

The continuous burning and grazing of the veld during the last century left no visual signs of deterioration of the vegetation. It is only in the vicinity of old kraals and overnight spots that one can see a dramatic change in the composition of the vegetation. Figure 2.2 shows the results of a survey in the Riviersonderend mountains. The survey was done by randomly choosing two lines in the direction from which the stock approached the kraal. A chain with a marker every 1 metre

was laid out over the vegetation and the plants that occurred at every marker were noted.
The results of the survey showed that there was a marked decline in species diversity close to the kraal which increased the further one moved away from the kraal. Also noticeable was the amount of dead plant material close to the kraal entrance. No seedlings were noticed between the dead plant material so that there was very little ground cover. This leads to excessive runoff from this area as well as from the bare soil in the kraal. Because the ground is sloping away from the kraal, a donga formed with a depth of 2 metres at a distance of about 130 metres from the kraal. This donga is shown on figure 2.2. Only pioneer plants such as Stoebe and Cliffortia grow in the disturbed area close to the kraal entrance. A bit further away patches of Carpobrotus edulis and clumps of sour grass (which could not be identified because of a lack of seeds) make their appearance. Species diversity increased from 1 species every 10 metres next to the kraal, to 7 species for every 10 metres surveyed 200 metres away.

Recovery of the fynbos in the area immediately next to the kraal seems to be very slow. Further away, Protea repens, which is the dominant plant in this specific area, has covered most of the area and the odd specimens have come as close as 70 metres to the kraal entrance. No kraals could be found which had been abandoned for a longer period than the one used in this study to be able to compare the recovery rate of fynbos. Even if older abandoned areas could be found, comparison would be very difficult because of the variability of the vegetation and terrain.

FIG:2.2: SURVEY OF GRAZING IMPACT ON FYNBOS IN THE RIVIERSONDEREND MOUNTAIN CATCHMENT AREA.



CHAPTER THREE

HISTORICAL DEVELOPMENT OF THE SOUTHERN TIP OF AFRICA AND THE USE OF THE MOUNTAINS FOR AGRICULTURAL PURPOSES

The main aim in studying the historical development of the Cape and especially the Overberg area was to try and find evidence of the use of the Riviersonderend mountains for grazing, and if used, the methods employed. To accomplish this it was necessary to find and search through all the available literature, archival material and other sources that had any information that could be applicable to the problem of land use development in those areas.

3.1 THE INHABITANTS OF THE CAPE BEFORE THE ARRIVAL OF THE FIRST WHITE SETTLERS

As we now know there were two groups living at the Cape at the time of the arrival of Jan van Riebeeck in 1652. They were the Khoikhoi and San, or as they are otherwise known, the Hottentots and Bushmen. There is great controversy regarding the correct names to use and Elizabeth Prins in her thesis on the History of the Western Overberg gives a full discussion on this matter. For the purpose of my study I find the terminology used by Elphick (1977) the most suitable, and will henceforth use his subdivision of the two main groups and the names given to each.

Elphick gives the following definition of a Khoikhoi: "A Khoikhoi is any person accepted as a full (not a subordinate) member of a Khoikhoi community". He describes a Khoikhoi community as "one where a

dialect of the Khoikhoi language was spoken and where pastoralism was the preferred mode of economic life". This definition allows for the possibility that not all groups of Khoikhoi possessed livestock at all times, something that happened quite often in Khoikhoi society.

The Khoikhoi were a relatively homogenous group of people with the same language, except for dialects. Compared to this the "San" were linguistically very heterogenous. Elphick (1977) did not use the name "San" to describe all cattleless people as this leads to confusion in describing and understanding the historical settlement of the Cape by the different groups. He used the words "aborigines" for those inhabitants of any region of southern Africa before the arrival of the Khoikhoi and "hunter-gatherers" for all those people described as not keeping any cattle but living solely by hunting and gathering. This last group he simply named "hunters" and they include the strandlopers who were first seen by Vasco da Gama in 1497 and who met Van Riebeeck at the Cape in 1652.

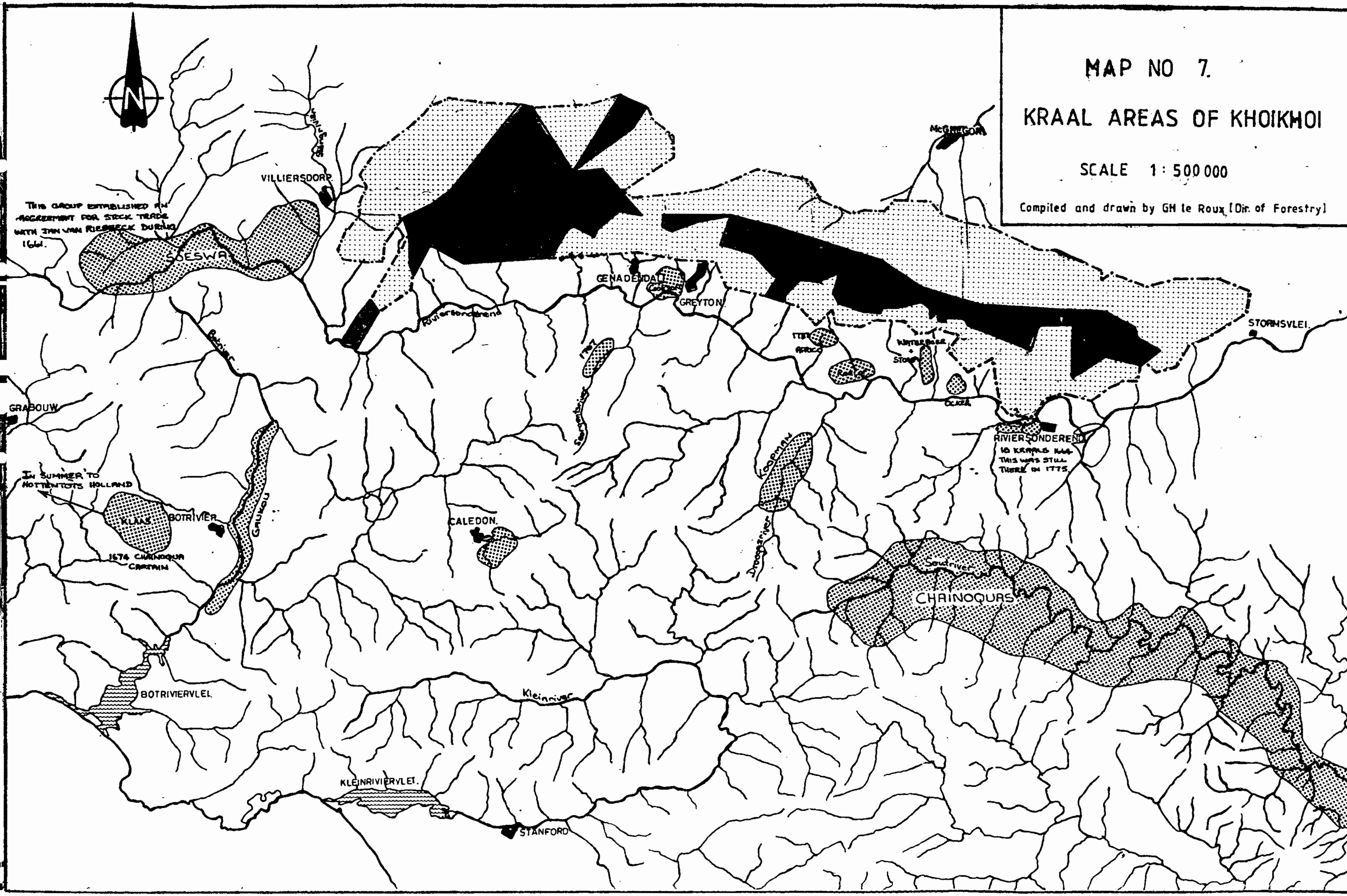
The first Europeans to make contact with the inhabitants at the southern tip of Africa were the Portuguese in 1488. During that year the Portuguese navigator, Bartholomeu Diaz, cruised down the west coast of Africa, he turned the ship eastwards and found no land so he suspected that he had rounded the tip of the continent. He then turned north and landed at Mossel Bay. Here he found many cows tended by their herdsmen who fled at the sight of the Portuguese. The next seafarer who followed Diaz was Vasco da Gama in 1497. He landed at St Helena Bay before he rounded the Cape and found no cattle but people who were probably hunters. It is reported that they lived on "sea wolves", whales, roots

and honey (Raven-Hart, 1967). The description of these people is very similar to accounts of the way of life of the strandlopers during the time of Van Riebeeck. The people that Diaz found here wore copper ornaments which indicates that they either had some sort of contact with Khoikhoi groups to the north or that they originated from the groups close to the Orange River. According to Elphick (1977) they were outcasts from local groups as well as defeated Khoikhoi who lost their cattle and homes and had to resort to hunting and gathering. When Diaz sailed from St Helena Bay he went to Mossel Bay where he also reported seeing Khoikhoi with their cattle (Raven-Hart, 1967). It was not until 1503 that the first meeting between the Portuguese and Khoikhoi took place at the Cape. During that year Antonio de Saldanha sailed into Table Bay. During their second visit to the shore the sailors were attacked by two hundred Khoikhoi. The attack gave them a reputation of ferocity and military prowess. In 1510 Francisco d' Almeida, on his way back from India, also found that the Khoikhoi caused trouble and he mounted an expedition into the interior of the country to teach them a lesson. They went to Khoikhoi kraals which they attacked and took Khoikhoi children as hostages. The Khoikhoi counter-attacked and killed d'Almeida and about fifty of his men. After that the Portuguese rarely called at the Cape and preferred Mozambique on their outward journey and St Helena Bay on their way home (Raven-Hart, 1967). From these accounts we know with certainty that the Khoikhoi were well settled at the southern tip of Africa by the beginning of the sixteenth century.

From reports written by the early explorers it is possible to reconstruct the distribution pattern of Khoikhoi groups that were living in the south-western Cape at that time. The two main groups of Khoikhoi living in the Overberg were the Hessequas and Chainoquas (Elphick, 1977).

No definite boundaries existed between adjoining groups as Hessequa kraals were often seen well into Chainogua territory. The same pattern was reported for groups living in other areas (Elphick, 1977). Map 7 shows the approximate areas that were occupied by the various groups at the time of the first expeditions into the interior. The positions shown were only occupied seasonally as most groups trekked during the dry summer months and only returned when the rainy season started again.

The main areas occupied by the Khoikhoi groups, as described by the various expedition reports, were along the bigger rivers and where good soils could be found, even today these areas still have the best pastures. It may also be assumed that expedition leaders would only mention the bigger kraals where they could barter stock from the Khoikhoi. From the reports it seems that there were four main concentration points where Khoikhoi kraals were found. According to Elphick (1977) and Prins (1979) the first group occupied the area between Grabouw and Botrivier and also occurred along the Botrivier itself. In this area Chainoquas and Hessequas could be found living side by side. A Chainoqua captain, Klaas, had his kraal in the higher lying Groenland area while Gaukau the Hessequa leader, lived along the Botrivier. The next group was under the leadership of Soeswa, the main Chainoqua leader, who died during 1663. They occupied the Villiersdorp valley along the upper reaches of the Riviersonderend. Soeswa visited Jan van Riebeeck during 1661 and established a stock trade agreement between the Chainoquas and the Dutch at the Cape (Mossop, 1927). It seems that a third group which occupied land between the Riviersonderend and the mountains occupied smaller kraals. The area occupied by them stretched from the present Genadendal to Riviersonderend. It is also in this area where reports of Khoikhoi kraals occur as late as 1803. The last main concentration of Khoikhoi kraals in the Overberg is that of a group of Chainoqua captains who occupied the land adjoining the Soutrivier (Godée Molsbergen, 1932).



MAP NO 7.
KRAAL AREAS OF KHOIKHOI
SCALE 1 : 500 000
Compiled and drawn by GH le Roux [Dir. of Forestry]
N
VILLIERSDORP
McGREGOR
GOESWA
GENADENDAL
GREYTON
STORMSVLEI
GRABOUW
RIVIERSONDEREND
CALEDON
BOTRIVIER
KLAAS
CHAINOQUAS
BOTRIVIERVLEI
KLEINRIVIERVLEI
STANFORD
Kleinrivier
1674 CHAINOQUA CAPTAIN
IN SUMMER TO HOTTENTOTS HOLLAND

3.1.1 The possible use of the mountains by the early inhabitants

The distribution of Khoikhoi as indicated on map 7 shows that only two of the four main groups lived close to the Riviersonderend mountains. The one being the group found between Genadendal and Riviersonderend and the other living in the Villiersdorp valley. The other two groups lived further away and would have had to cross the pastures of the Khoikhoi living close to the mountains to get into the mountains. It is doubtful whether the distant groups would have risked this, except during droughts when water and grazing became scarce. On map 2 we see that the topography on the southern side of the mountains next to where the Genadendal/Riviersonderend group lived, is such that one can enter the mountains in only a few places. Grazing would have taken place on the lower slopes, in the vicinity of the kraals of those groups living near to the mountain. The presence of aborigines, as well as defeated Khoikhoi, in the mountains would have served as a deterrent to sending cattle and sheep into the mountain.

The presence of aborigines in the mountains has been confirmed by the discovery of sites containing their paintings. Most of these sites have been discovered on the drier northern side of the mountain. Other sites deeper into the mountains and to the south indicate that the aborigines must have moved around a lot and that cattle would not have been safe if grazed deep into the mountain.

3.2 THE HISTORY OF SETTLEMENT AT THE CAPE

The Cape had been known to Europeans since its discovery by Bartholomeu Diaz in 1488. The Portuguese who monopolized the trade route to the East, seldom used Table Bay as a

port of call on either the outward or return journeys. It was not until 1611, after the Dutch and English traders had broken the Portuguese monopoly of trade in the East and a Dutch VOC captain discovered a new direct route to the Straits of Sunda that the Cape became an important port of call. By 1620, the Cape, which was situated about halfway on this new longer route, was used as a post office. All the seafaring nations had been thinking of establishing themselves at the Cape but nothing was done before 1652.

During March 1647 the Haarlem was shipwrecked in Table Bay and the survivors stayed there until March 1648. A report written by the commander of this group, Leendert Jansens and supported by Jan van Riebeeck, described the Cape as having fertile, well-watered soil, where a great variety of vegetables and fruit could be cultivated. They recommended that a garden be established there and that all VOC ships should make a compulsory stop at the refreshment station on their journey to and from Batavia (Thom, 1936; Wilson & Thompson, 1982). This report was accepted by the Directors of the VOC and during April 1652 Jan van Riebeeck landed at the Cape with the instructions to establish a refreshment station there. Development of the Cape refreshment station progressed well and after 10 months, when the fleet returned from Asia, Jan van Riebeeck was in a position to supply them with refreshments which included fresh meat obtained from cattle bartered from the Khoikhoi. It soon became apparent that to rely on the Khoikhoi for a regular supply of cattle would be impossible and a breeding programme was introduced. The soldiers lacked interest and this scheme was consequently not very successful. Wheat-growing in Table Valley was also unsuccessful because of the summer south-easters. The Company was not happy with the situation at the Cape because of the high cost of maintaining the station and of the rice imports from Batavia to feed the inhabitants at the refreshment station. Thus they had to

reconsider their attitude that there should be no expansion of the station. After several pleas by Van Riebeeck for colonization of other areas, to be able to produce wheat and other crops, the Company finally allowed him to give land along the Liesbeeck River to nine servants of the Company who completed their contracts. On 21 February 1657 the conditions under which the land had been granted were signed by the first freemen and expansion of agriculture at the Cape got underway. After this, Commissioner Rykloff van Goens encouraged as many free farmers as possible to settle at the Cape to reduce the number of salaried employees of the Company (Wilson & Thompson, 1982).

Expansion in those early years was slow and many farmers were disillusioned by the control of the Company and the difficulties of making a reasonable living from agriculture. The first move away from the Cape Peninsula came during 1679 when Simon van der Stel opened up the area around Stellenbosch and Hottentots Holland. At Stellenbosch wheat could be grown without the problem of the South-easter damaging the crop and during 1684 the first export of wheat from the Cape took place. Also at this time stock numbers at the Cape had increased to such a level that grazing was inadequate and concessions had to be given to farmers to use land further away. The first concessions given were to Henning Huising to graze his sheep in the vicinity of the Eerste Rivier and to Pieter Visagie and Jan Mostert to use the pastures to the east of the Tigerberg (Thom, 1936).

TABLE 3.1: Stock number in the Cape Colony from 1658 to 1780 (Thom, 1936).

YEAR	STOCK NUMBER
1658	350
1665	2500
1687	20142
1690	44741
1695	47447
1700	53971
1710	131630
1745	162305
1750	165534
1755	205263
1760	203635
1765	204429
1770	258250
1775	302965
1780	355659

During 1670 the Company increased the wheat price to 10 gulden per muid after realizing that the farmers would stop their wheat production if they did not increase the price. With the Cape now producing enough wheat for their own needs and also exporting wheat to Batavia, the Company saw this as an ideal situation to improve profits and decreased the price again to 8 1/2 gulden per muid. At this price only the established farmer could survive and all young and new farmers stopped developing new lands.

The government at the Cape threatened to repossess farms if they were not developed within six months. (The time period was later lengthened to three years). The farmers then started selling their land and to stop this, the Cape government established a 10% tax on land sold within three years after allocation and 5% if it were sold within 10 years. This tax had to be paid over and above the normal transfer fees payable upon the sale of land. Those farmers

who wanted to move to town after selling their farms had to pay a further 50 Riksdalers into the districts coffers before they were allowed to make the move (Van der Merwe, 1938).

The farmers were unhappy with this situation, and many saw pastoralism as the means to start farming and rid themselves of the control that the Company had over their lives. Reports of apparently unlimited grazing land in the interior of the country lured those farmers who wanted to get away.

Expansion into the interior of the country took place in three main directions: the first group moved to the north-west, while the second group crossed the Hottentots Holland Mountains and moved along the coast between the mountains and the sea. This second group split, with one section moving inland to the Graaff-Reinet area. The third group crossed the mountains to the border district in the Eastern Province (Botha, 1923).

3.2.1 The land tenure system

Before discussing the settlement of the Overberg area, it is necessary to describe the land tenure system used at the Cape during the early years of settlement. Three forms of land tenure were in use, namely, freehold, loan and quitrent. Under freehold the owners were given a title deed and they then became the full owners of that land.

Most of the farms granted in the area between Stellenbosch, Hottentots Holland and the Castle were granted in freehold. In loan tenure the land was issued on lease for a period of six months or a year. During 1703 the first lands for the grazing of stock without the payment of rent was granted. Such grazing licences were registered in the "Wildschutte Boeke" which were started in 1687 for the issuing of hunting licences. Some of these licences permitted the holder to grow

crops but others were purely for grazing. The permits specified the period during which grazing of a certain area could take place and also contained the condition that: should any other person be using the lands for grazing, he should not be interefered with. As most of these licences were issued for areas far away from the Cape, the persons mentioned that should not be intefered with, must have been Khoikhoi living in those areas. From 1714 rent had to be paid for each permit, the amount being 6 riksdalers in the beginning but this was soon increased to 24 riksdalers. The permission to graze in a certain area had to be renewed on its expiration. This system allowed farmers to move around when the grazing in one area was finished to find other suitable pastures. If he found such a piece of ground and it was not occupied by anyone else, all he had to do was apply for it to be registered in his name and pay his rent. Even though the farmers did not own the land and could not bequeath it to their families after their deaths, land was plentiful and it did not worry them. The third system of land tenure was introduced during 1732 and was known as Quitrent ownership. Under this system land was granted for fifteen years on payment of yearly rent. After this period the government could take back the land or renew the contract. In cases where the land was taken back, compensation was paid for the buildings and plantations at a valuation decided by the government. Not many farmers were interested in this form of land tenure as pastoralists would be bound to a single piece of land while somebody who wanted to plant crops had to spend money to improve the farm, not knowing whether he would keep it. This prompted the government to change the system so that the farmer would have more security. In 1743 they gave ownership over 60 morgen around the homestead while the rest of the farm was on loan against the payment of rent. In 1813 the system changed again. During that year Sir John Cradock, who was desirous of

abolishing the uncertain land tenure and replacing it with a more certain one, introduced the perpetual quitrent system. Under this system all holders of land on loan could apply for the land to be granted to them on perpetual quitrent. No farm was to be larger than 3000 morgan and had to be properly surveyed and diagrams prepared, these had to be registered in the Deeds Office. Annual rent had to be paid on the land, this varied according to the value of the farm. The maximum rent that could be asked was 250 riksdalers. In the case of subdivision of such land, the different owners still had to pay the same amount of rent as fixed on the original farm. The amount payable by each of the new owners could be decided amongst themselves (Botha, 1923; Thom, 1936; Van der Merwe, 1938).

3.2.2 Settlement of the Overberg

The Overberg is the area across the mountains from the Hottentots Holland. The name means over the mountains and was first used in 1708 on the grazing licence given to Ferdinand Appel (Prins, 1979). Until 1745, when Swellendam became a new district, the Overberg included all land as far as farmers had moved up the coast (Raper, 1972). In 1803 Dirk Gysbert van Reenen described the boundary of the Overberg as the Palmietrivier, Boontjieskraal, Zwartberg, Steenboksrivier, Quartelrivier, Potteberg and Zoutrivier (Van Reenen, 1937). During later years the local people also included the Villiersdorp valley as part of the Overberg, while others included the area between the Hottentots Holland mountains and the Breede River.

The first organized journey to the Overberg was undertaken on 6th June, 1657. This group, however, only reached the Hottentots Holland and turned back (Thom, 1952). During 1661 Sousoa, Chief of the Chainoquas, visited Van Riebeeck at the fort and started a trade in cattle, after which groups were sent inland to find the Khoikhoi and trade with

them. The first description of an expedition over the Hottentots Holland mountains is that of Corporal Jeronimus Croese who went to the kraals of the Obiquas and Hessequas living next to the River Zonder End during 1669 (Mossop, 1927). Regular expeditions then followed to this rich stock area. Isaq Schrijver visited the area during 1689 and gave a description of the grazing encountered. He mentions that the area around Houwhoek and right up to Boontjies Kraal at the Swarte River had been grazed bare. At the Swarte River his expedition found good grazing for cattle. At the Huis River (where Greyton is today) they found unusually fine pastures (Mossop, 1931). Towards the end of the seventeenth century, the Company had many cattle-stations in the Overberg where they kept animals which had been bartered from the Khoikhoi until they needed them at the Cape. Apart from the Company cattle-stations, W A van der Stel also had eight stock posts in this area on which he kept 2600 sheep. The burgers at Stellenbosch, who were against the farming ventures of the Van der Stels, claimed that W A van der Stel had 18 stock farms across the mountain and that he prevented the other farmers from using this area (Böeseken, 1964).

It was not until 1708 that the first grazing licence was given to a private farmer. At that stage Ferdinandes Appel had been grazing his stock over the mountain for a period of three years. The licence issued to him was for a period of six months and stated, "met denselvs vee, bestaande in runderen en schaapen,... to moogen gan leggen en wyden over de berg in Hottentots Holland booven aan de Bot Rievier" (Prins, 1979). On 1st March 1709 he got the right to use the grazing at the warm springs situated near the present Caledon. Appel stayed here until 1710 when he applied for land, which was duly granted, on 10th March 1710. This land was granted on condition that he did not barter cattle from the Hottentots (Botha, 1923). This was the

FIG 3.1: Occupation of farms under the loan farm and quitrent land tenure systems in the Overberg.

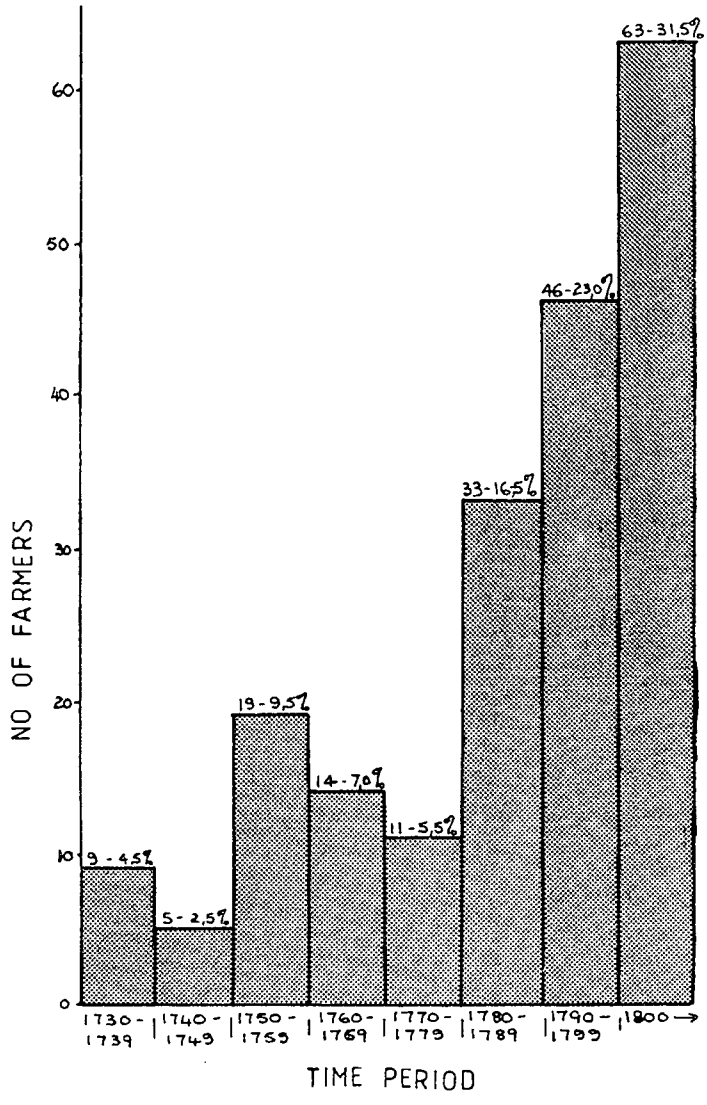


FIG 3.2: Occupation of farms next to the Riviersonderend mountains under the loan farm and quitrent land tenure systems

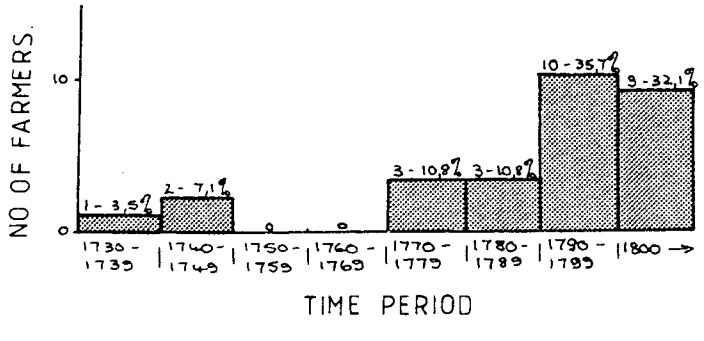
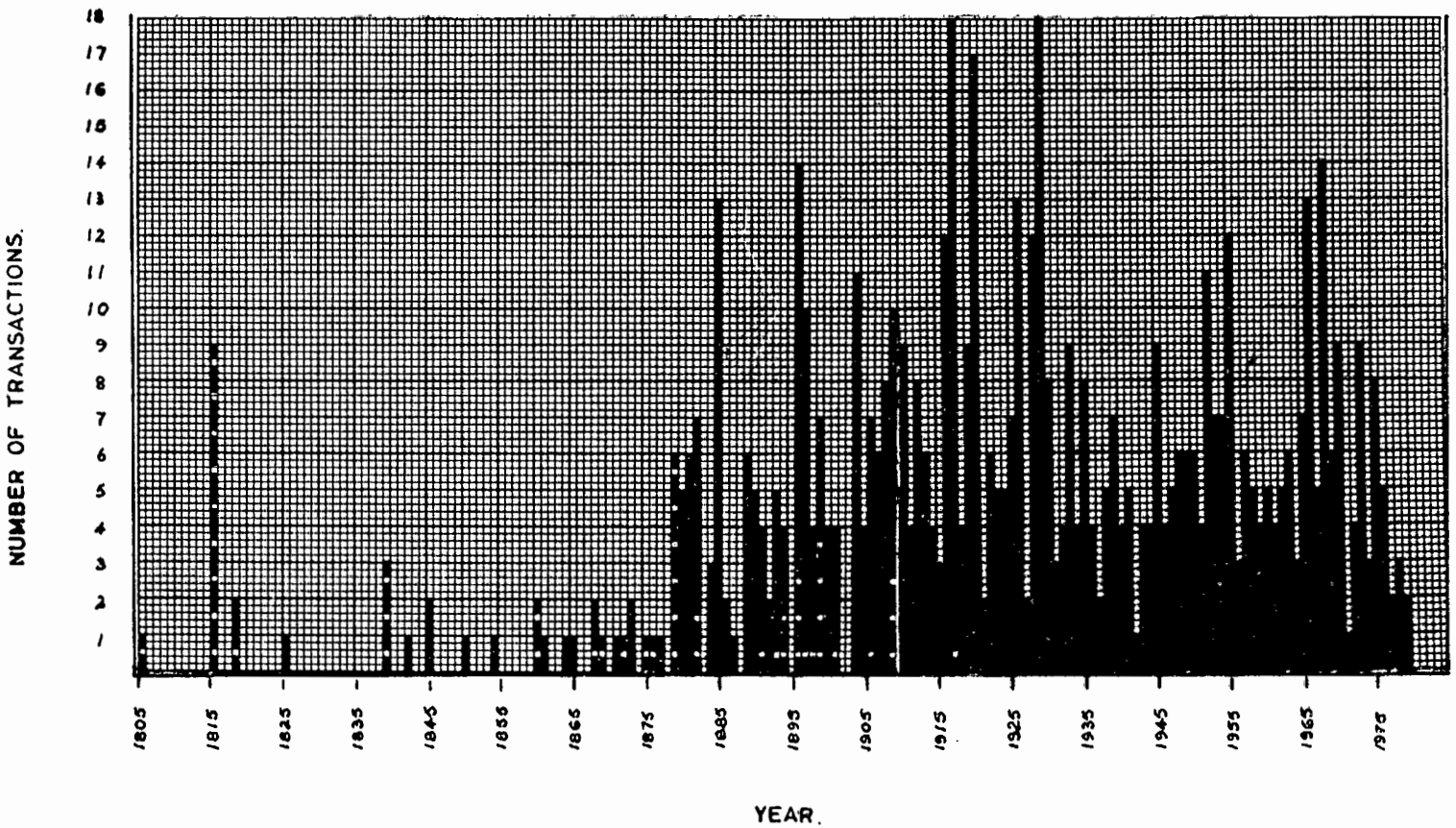
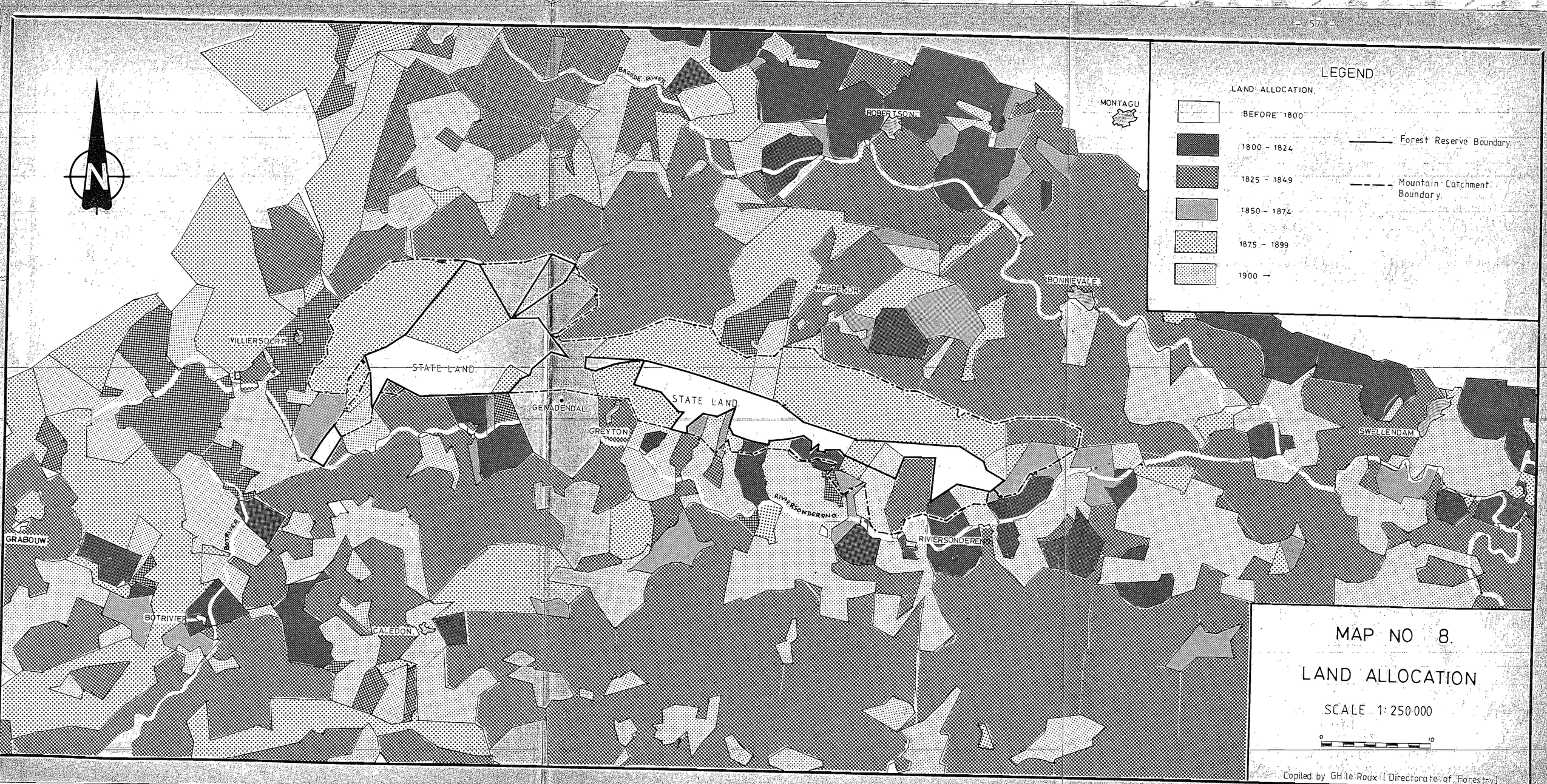


FIG: 3·3 : LAND ALLOCATIONS AND TRANSACTIONS SINCE THE START OF QUITRENT OWNERSHIP.





Copied by GH le Roux [Directorate of Forestry]

first land owned by an individual to the east of the Hottentots Holland mountains.

Movement into the area after the first allocation of land was slow and in the area next to the mountains, only three farms were allocated during 1714/15. They were Granzkraal to Isaak Scheeperd on 27th July 1715 (present farm no 166, Caledon), De Zeekoe Jacht to Jacobus van der Heiden on 28th July 1715 (present farm no 133, Caledon) and Stetteyn to Jan Cloetas and Jan Jurgen on 26th September 1714 (present farm no 532, Worcester). Most farmers who had stock in the area, were further away from the mountains as most of the best grazing land situated between the Riviersonderend and mountains, was in the possession of the Company. It was not until the period 1730 to 1739 that more allocations of land under the loan system were made. Both the loan and quitrent farm system were conducive to a very open settlement pattern as the farmers chose what they considered to be the best land and settled there. Farms were thus separated by large tracts of inferior land that remained unclaimed until people were forced onto it because of the lack of other suitable ground. Until such time as this land was claimed by newcomers to the area, it had been used by the older established farmers as unofficial grazing land. This practice led to overstocking problems when the adjoining land became occupied. Figures 3.1 and 3.2 show the settlement trends in the Overberg under the old loan and quitrent farm system. Under these systems farmers applied for the land and it was registered for the purposes of payment of tax. No diagrams for most of these farms were ever drawn so that there are no records of exactly which areas were occupied under these land tenure systems. Nevertheless, few farm names changed and it was possible to trace much of the earlier settlement. Using the registers of loan farms, all the farms situated close to the mountains that could have had an influence on the use of the mountains for grazing were extracted from the deeds register and dates of first allocation noted (see

Appendix 5). In figure 3.2 it can be seen that it was only after 1770 that the land close to the mountains was occupied by farmers. Before this time only Company stock-posts and Hottentot kraals occurred here (see map 7). In the rest of the Overberg it was also only after 1780 that there was an increase in the demand for land (see figure 3.1).

With the introduction of the perpetual quitrent system proper records of all farms were kept in the Deeds Office. From this, it was possible to draw a map of land allocation under this system, giving some idea of land settlement patterns in the Overberg. Map 8 shows that most of the mountain area was only allocated during the period 1875 to 1899. It should, however, be noted that some farmers who were actually living in the area may not have applied for such land to be granted to him under perpetual quitrent at the time that the system was introduced. We are, however, only concerned with the situation in and around the Riviersonderend mountains. From Appendix 5 and figure 3.2 it is possible to determine that less than one third of the present farms in this area were allocated before 1800. Figure 3.3, showing land transactions of all the farms that fall partly or fully within the Riviersonderend Mountain Catchment Area, indicates that demand for this land only increased from about 1880, when a sudden increase in land transactions occurred.

3.2.3 The use of the Riviersonderend mountains after settlement of the area by whites

The early use of the area by whites was for extraction of timber from the numerous forests that occur in the area between the present towns of Greyton and Riviersonderend. Sparrman wrote in his journal that because of the distance to the Cape the Company could not make a profit from selling crops grown in this area but that they did get an income

from timber cut in Oliphants bos. A party of wood cutters under a corporal stayed at the Company post at the present Tygerhoek. A Hottentot kraal was also situated on the banks of the river and the Hottentots working for the whites received mainly cattle as payment for their services (Molsbergen, 1932). The next to mention the use of the forests for timber exploitation, was Henri Lichtenstein who wrote that the British gave the Brethren who were in charge of the mission station at Genadendal permission to cut down as much timber as they needed to build their buildings (Lichtenstein, 1928).

From as early as 1660 the good pastures between the river and the mountains from the present Greyton to Ganskraal were used by the Company to rest and gather the cattle bartered from the Khoikhoi living in the Overberg. The main stockposts were at the farms Langverwacht, then known as De Ziekenhuijs, Zoetemelksvlei en Ganzekraal. From accounts of the early travellers it seems that this area had an abundance of grass and that the cattle had no need to go into the mountains. In a personal interview with Mr Hennie Beyers on his farm Ganskraal, he said that his father had told him that there was so much grass, and that it was standing so high, that only the backs of the cattle were visible. According to him this was still the case during 1860, but after that the veld deteriorated because of continuous burning and grazing by too many cattle. Lichtenstein (1928) wrote that during his travels he noticed that the farmers to the east of Riviersonderend, where it is much drier, were forced to use the mountains for grazing. In this area the mountains are much more accessible and not as high as in the central part of the range. Most of the stock kept in the area close to the mountain were probably cattle as the long grass was not suitable for sheep and sheep would prefer areas where slaty shrubs grow (Van Reenen, 1937). From this is seems that sheep were

only kept on the drier farms further away from the mountains. One area that would have been intensively used for grazing from very early on is the land around the mission station at Genadendal. This station was established during 1737 and at the end of the eighteenth century had a population of just over 1000 inhabitants (Van Reenen, 1937; Lichtenstein, 1928).

The area between the Riviersonderend and the mountains was also important as far as the defence of the Cape was concerned. Both the Dutch and later the British used this area to store equipment and food in case they had to withdraw from the Cape. Buildings were erected at Soetemelksvlei for this purpose (Prins, 1979). A warning system which consisted of a series of canons spaced so that the one could be seen by the two on both sides of it, was introduced. One such post was on the mountain slopes above the farm Oubos, just to the west of Riviersonderend.

The early travellers into the area gave very general descriptions of what they saw and not much information of early farming methods could be gained from their journals. One can only make deductions as to the extent to which land was used for different farming ventures. Land settlement patterns indicate that pressure on the mountainland only started towards the last quarter of the nineteenth century. Exactly how the land was used in those early days is not certain, but information gathered in the questionnaire survey seems to indicate that there was not much change in methods used in the mountains since the last century. Chapter 4 gives a complete description of land use in the Riviersonderend Mountain Catchment Area.

CHAPTER FOUR

PRESENT USE OF THE MOUNTAINS AND SURROUNDING AREAS FOR GRAZING

QUESTIONNAIRE SURVEY

In chapter 3 land use before and after the arrival of the first whites was discussed. Land use practices for many years remained the same and it was not until mechanization was introduced that an intensification in cultivation practices took place. With new farming methods being developed by scientific research, and the dramatic increase in land prices and production costs in the last few years, farmers have been forced to make drastic changes to their farming methods to be able to survive. One of the changes in farming methods evident in the Cape mountains during the past decade is a tendency to make less use of the mountains for grazing. To find the reasons for this, a questionnaire study was used to get a complete picture of land ownership and land use in and around the Riviersonderend mountains. The questionnaire was filled in during a personal visit to each of the land owners and any additional information gained about past and present land use not covered in the questionnaire, was also noted.

4.1 RESULTS OF THE QUESTIONNAIRE SURVEY

4.1.1 Land ownership

	YES	NO
1. Do you own any other farming land, inside or outside of the mountain catchment areas?	☐	☐

2. Which other farms do you own? (Where are they situated?)

.....

.....

.....

In the Riviersonderend mountains there are 56 landowners other than the state. Of these, 17 own farms other than those falling inside the catchment boundary and it is on these that their main farming activitites take place. Thirty-eight of the other landowners have part of their farms falling inside the catchment boundary with only one owner who owns no other land than that falling inside the catchment area. This owner lives in Cape Town and does not utilize his land at all. See map 9 for the locality of farms and appendix 4 for farm names.

4.1.2 Present land use

	YES	NO
3. Do you utilize your mountainland at all?	☐	☐

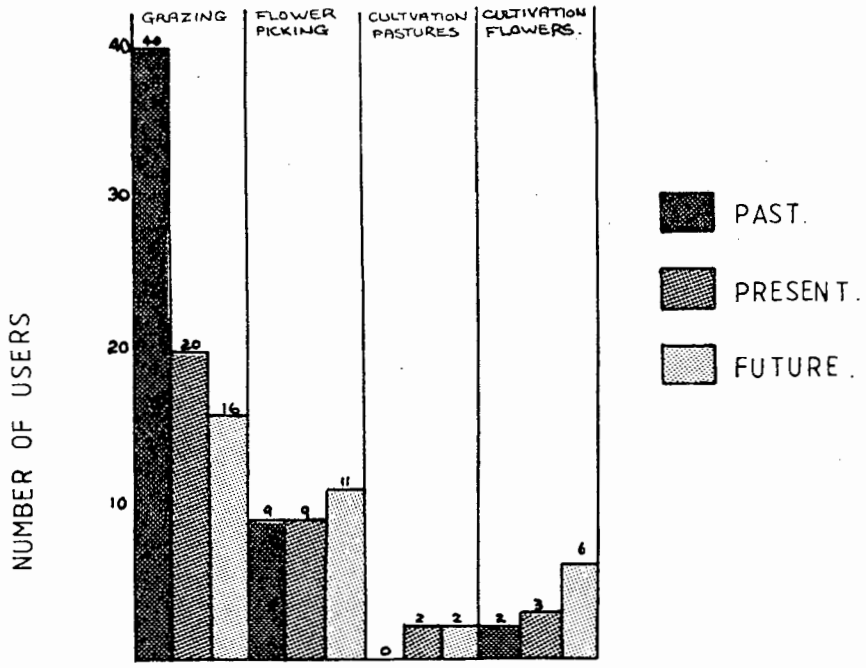
4. What do you use your mountainland for at present? (Area involved to the nearest ha?)

a)	Grazing	..... ha
b)	Flower picking	..... ha
c)	Cultivation (pastures)	..... ha
d)	Other (specify)	..... Ha

At present 25 of the 56 landowners use their mountainland in one way or another. Not one of the landowners using the mountain could give an estimate of the total area that they were utilizing. Those using the mountain for grazing send their stock into the mountain without knowing exactly where they graze.

The flower pickers concentrating on the larger Protea spp., need veld older than 10 years. If they concentrate on picking sewejaartjies, Helichrysum spp., veld up to the age of about 4 years is needed. Thus, areas that they can utilize will depend on the burning patterns on their farms. Not even the owners who cultivate mountainland for protea growing could estimate the area of their cultivated land.

FIG 4.1: Comparison of the number of farmers using their mountainland for different activities in the past, at present and possible future users. The number of "past users" are only for those present owners of land who used their land for such activities prior to 1980.



4.1.3 Past land use

		YES	NO
5.	Have you ever used your mountainland in the past?	☐	☐
6.	What did you use it for? (Area involved to the nearest ha)		
	a) Grazing	.....	Ha
	b) Flower picking	.....	Ha
	c) Cultivation	.....	Ha
	d) Other	.....	Ha

Of the 56 landowners in the Riviersonderend mountains 40 used their land for farming purposes before 1980. Figure 4.1 gives an indication of what they used their land for. All of those who used their land had stock in their mountain veld while 9 of them combined grazing with flower picking. Two of the farmers cultivated land

in the mountains for flower production but they also picked flowers in the natural veld.

7. For how long did you continue with this farming activity?

a)	Grazing	From	To ....
b)	Flower picking	From	To ....
c)	Cultivation (pastures)	From	To ....
d)	Other	From	To ....

Most of the owners (40 of the 56 private landowners) used their land for grazing from the time of purchase until the late 1970's. With the introduction of the Mountain catchment areas act No 63 of 1970, the practice of extensive grazing diminished when the Directorate of Forestry started managing the land according to the block burning system. The biggest single factor having an effect on the withdrawal of sheep and cattle from the mountains was the introduction of cultivated pastures, dryland as well as areas under irrigation. This is mainly the case on the southern side of the mountain. On the northern side which is much drier, grazing of most of the area stopped from about 1965 as flower picking for export then became more popular. Because older veld is needed for flower production, most of the farmers were too scared to burn for grazing in case they also destroyed older veld.

The earliest account of grazing in the Riviersonderend mountains is that at Paul's Gat situated to the north-east of Villiersdorp. Burning and grazing started here during 1893 when the farm was originally allocated. Burning and grazing in other areas could have started earlier, but no record of such activities exists.

The cultivation of pastures is a new method being tried in the mountains and only started at the time of the survey. Farmers owning mountainland have, however, been planting pastures on their lower lying land since 1973, which is

the earliest date known for pastures in this area.

	YES	NO
8. Did the previous owner also use the land in the same way?	☐	☐

Very few of the present owners could supply any information about the activities of previous owners. As many of the previous owners are either deceased or not residing in the area anymore, the only information about past land use came from present owners. Fortunately, Mr Hennie Beyers of the farm Ganskraal who did his M Sc study on a particular section of the mountain and who still shows a lively interest in the history of the area, could supply some information about past land use. According to him it was not until about 1880 that the mountains became important as a place to graze cattle and sheep because of the predators that roamed there. The lower slopes had been used from an earlier date as these used to be well grassed with Themeda triandra. Information gathered from some of the other older inhabitants indicates that patch burning and grazing were common practices in earlier times.

4.1.4 Future land use

	YES	NO
9. Do you plan to use any of mountainland in the future?	☐	☐

10. What do you plan to use it for) (Area involved to the nearest Ha)

a) Grazing ..... Ha
b) Flower picking ..... Ha
c) Cultivation (pastures) ..... Ha
d) Other ..... Ha

Of the 56 landowners, 26 plan to use their mountainland in future. Of these, 16 want to use it for grazing, while 11 show an interest in flower picking. There are two farmers who will carry on with cultivated pastures in the mountains to provide extra grazing. Of the 11 flower pickers, 6 intend planting protea seedlings between the fynbos to simplify their management.

No other farmers plan to establish cultivated pastures in the mountains and would rather increase the areas of pastures on their lower lying land.

4.1.5 Land value

11. What do you consider a realistic price for the mountainland you own? (To the nearest R/ha or morgan) R..... per ha/morgan

12. If you buy more mountainland, what would you be prepared to pay per ha or morgan? R..... per ha/morgan

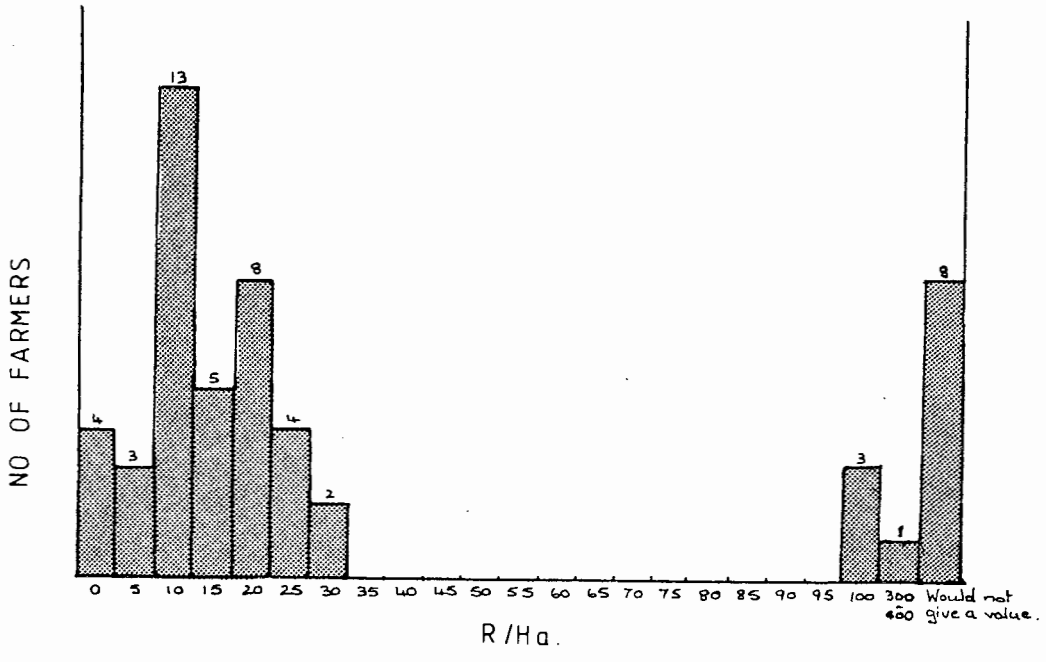


FIG 4.2: An estimate of the value of mountainland in the Riviersonderend mountains by 51 landowners

Two distinct groups of farmers can be identified in terms of their judgement of the value of mountainland. One group only occasionally uses the mountains for grazing, or not at all. This group consists of 39 farmers and they give land values from R1,00/ha to R30,00/ha. Most of these people feel that the value of their properties stems from the water that flows across it and on which their whole farming enterprise depends, and that it is meaningless to place a value on the land as such.

The other group consists of farmers that use their land for flower picking and intensive grazing. These farmers place a much higher value on their land as flower picking is a profitable business. The price they put on their land correlates with the intensity of flower picking. Most of the farmers who have other farming incomes give a figure of R100,00 or more. One farmer on the northern side of the mountain who farms exclusively with flowers estimated a figure of between R300,00 and R400,00 per ha as the value of his land.

The value given by farmers are very subjective and cannot be taken as the true value of the land. An interesting comparison is that of the values given by two neighbouring farmers at the eastern extremity of the mountains. Both these farmers have the same type of sheep, namely Dorpers; one also has much better land than the other. The farmer with the better grazing land also has a large area under dryland pastures high up in the mountains. This farmer placed a value of R20,00/ha on his land, while the other gave a figure of R100,00/ha. So it is obvious that it is very difficult to get an accurate estimate of the value of the land for agricultural purposes. The only way to get such a figure would be to make a study of records kept by farmers, if such records exist. (Not one of the farmers in the Riviersonderend mountains was able to give a breakdown

of costs and income related to use of the mountains).

13. What do you feel is the present value (R per ha or morgan) of agricultural land in your region? (Describe the boundaries of the region)

R.....
per ha/morgan

.....

.....

The most valuable land in the Riviersonderend mountains occurs along the southern side of the mountain from just east of Greyton to the town of Riviersonderend. The next best farms can be found from Villiersdorp to Greyton with the farms along the streams on the northern side of the mountain comparing very favourably. The rest of the area is either too dry or the soils are too sandy.

Most farmers did not even want to give an estimate of the value of land as very few had bought land in the past few years. The other problem with estimating land values is that land prices are made up of two values: the farming value plus the market value. The first indicating the return a farmer can expect from his farming activities; the second, a value dependent on the demand for land as an investment. There are also many other factors influencing land prices, e g the soil types and the availability of water for irrigation. Estimated land values for irrigation as well as drylands are shown in figures 4.3 and 4.4. Land values have changed so much lately that these values will be out of date as they represent the values at the time of the survey, which was done during 1981.

IRRIGATED LAND

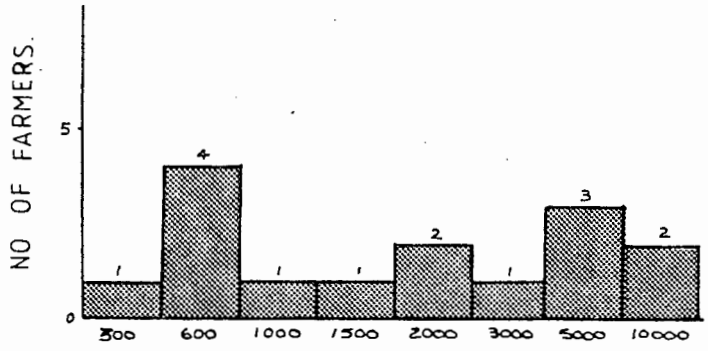


FIG 4.3: Estimated land values in Rand per hectare for land under irrigation

DRYLAND

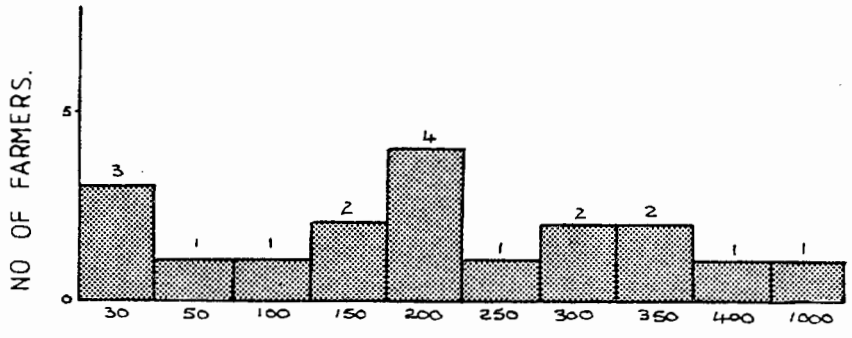


FIG 4:4 Estimated land values in Rand per hectare for dryland sowing.

Land values depend on the degree of development of each farm and the type of crops that can be produced. The most expensive land is that on which fruit orchards have been established. The estimate for this land is anything up to R10 000 per hectare depending on the age of the trees. Land on which vegetables can be grown also varies in price according to soil type and the availability of water and can be anything up to R5 000 per hectare. The value of irrigated pastures is given as anything up to R1 000 per hectare, depending on the type of pasture that can be established.

The value of drylands on which wheat and dryland pastures can be established depends more on the rainfall than soil type. Estimates range from R30 per hectare to R400 per hectare, with one estimate of R1 000 per hectare which is unrealistic for this type of land. At the time of the study the cost of establishing a dryland pasture came to about R120 per hectare so that a price of between R200 to R400 per hectare for established pastures would seem reasonable.

4.1.6 Grazing

	YES	NO
17. Do you have any stock on your farm(s)?	☐	☐
18. Do you utilize your mountainland for grazing purposes?	☐	☐

Of the 56 landowners that own mountainland, 45 keep stock on their farms. Of these, 20 make use of their mountainland for grazing. Some of those who do not use the mountains make use of the natural veld along the foothills of the mountain during the dry summer months.

19. How many animals do you have?
(To the nearest 10)

a) Cattle .....
b) Sheep .....
c) Goats .....
d) Other .....

20. What type of animals do you keep?

a) Cattle .....
.....
b) Sheep .....
.....
c) Goats .....
.....
d) Others .....
.....

TABLE 4.1: Total number of animals kept on the farms lying in and adjoining the Riviersonderend mountain catchment area.

CATTLE	SOUTH			NORTH			TOTAL
	TOTAL	% South	% Catchment	TOTAL	% North	% Catchment	
Milk	498	44	32	344	83	22	842
Beef	585	51	38	-	-	-	585
Milk x Beef	59	5	4	68	17	4	127
TOTAL	1142		73	412		27	1554
SHEEP							
Merino	9310	60	46	663	15	3	9973
Mutton Merino	3120	20	16	300	7	1	3420
Dohne Merino	560	4	3	410	9	2	970
Dormer	1100	7	5	50	1	1	1150
Dorper	1134	7	6	2150	49	11	3284
Crosses	392	2	2	848	19	4	1240
TOTAL	15616		78	4421		22	20037
GOATS	-		-	740	100	100	740

From table 4.1 it is clear that the southern side of the mountain has a much higher potential for stock farming than the northern side. It is only in dairy farming where use is made of irrigated pastures that the north comes close to the south as far as stock numbers go. The harshness of grazing conditions on the northern side of the mountain is further shown by the fact that farmers there keep the hardier breeds of sheep that can cope with these dry conditions. Dorpers and crossbreds make up 67% of the sheep on that side, compared to only 9% on the southern side. It is also only on the northern side that goats are found.

21. Do you apply different grazing systems for cattle, sheep and goats?

	YES	NO
a) In the mountains	...	...
b) On other farming land	...	...

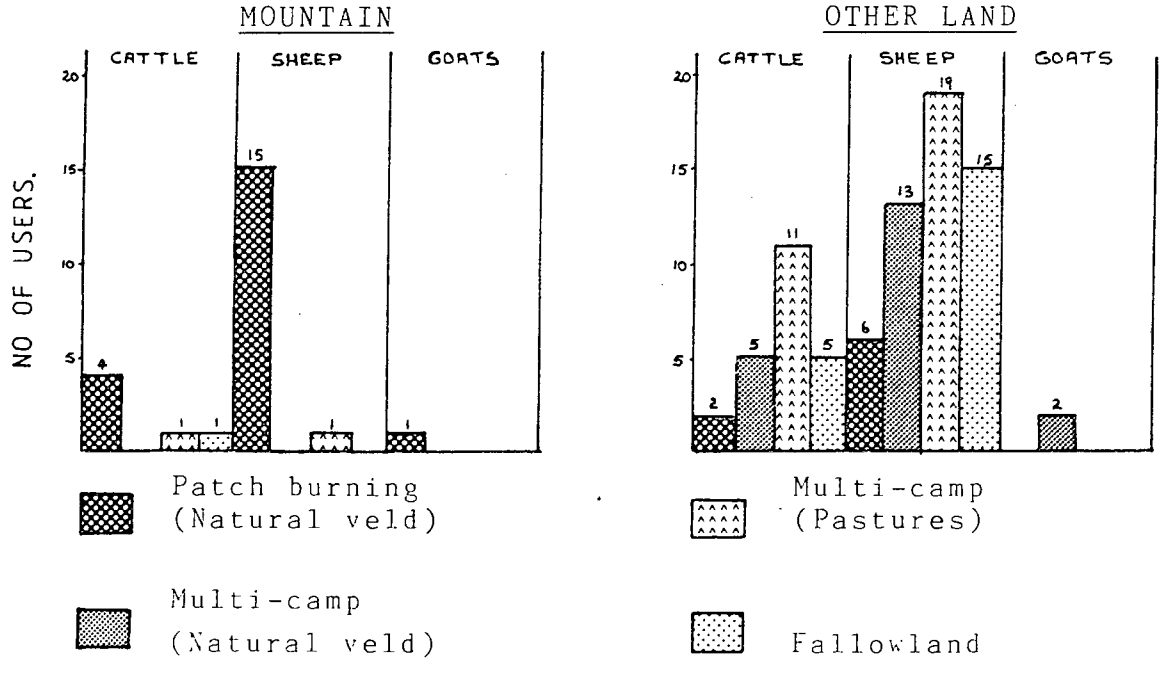
Only two farmers use cultivated pastures in the mountains. The other users of the mountain all use the patch burning system as shown in figure 4.5

22. What systems do you use for

(i) Mountainland
(ii) Other farming land?

	Cattle		Sheep		Goats	
	i	ii	i	ii	i	ii
(a) Patch burning (Natural veld)						
(b) Multi-camp (Natural veld)						
(c) Multi-camp (Pastures)						
(d) Fallowland						
(e) Other						

FIG 4.5: The different grazing systems used in the mountains and on the adjoining land and the number of users of each system.

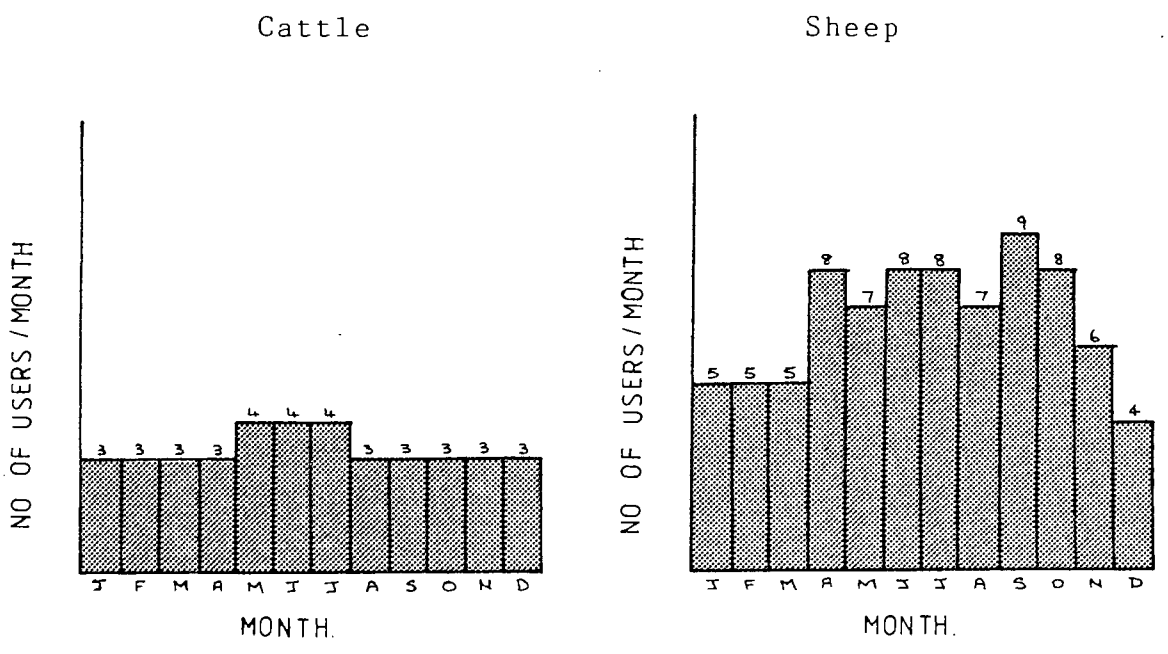


23. When do you use each of the different systems) (Give the starting and withdrawal months)

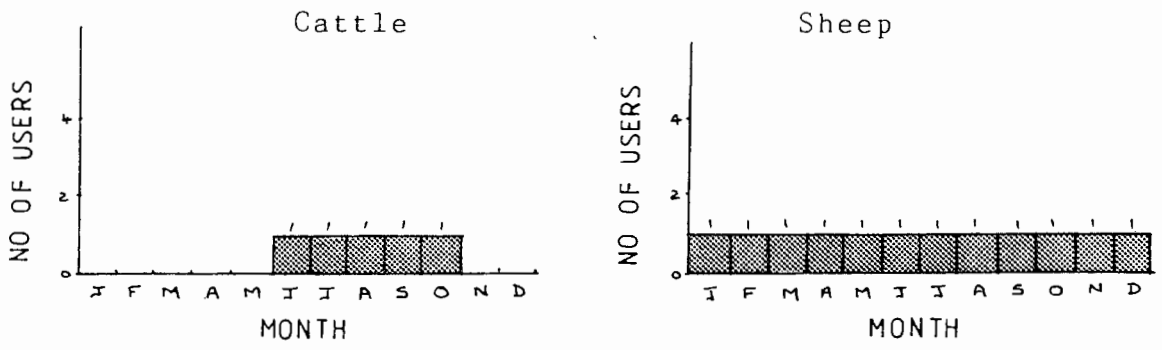
		Cattle	Sheep	Goats
(a) Patch burning (Natural veld)	From			
	To			
(b) Multi-camp (Natural veld)	From			
	To			
(c) Multi-camp (Pastures)	From			
	To			
(d) Fallowland	From			
	To			
(e) Other	From			
	To			

FIG 4.6: The time of the year that the different grazing systems are used in the mountain and the number of users each month.

PATCH BURNING AND GRAZING



MULTI-CAMP (PASTURES)



FALLOWLAND

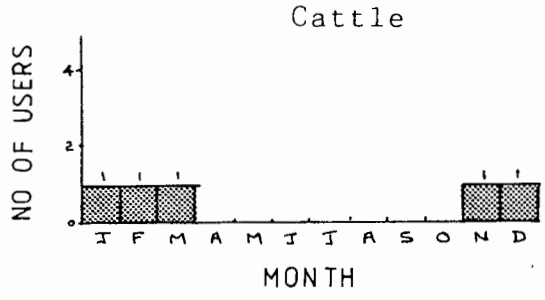
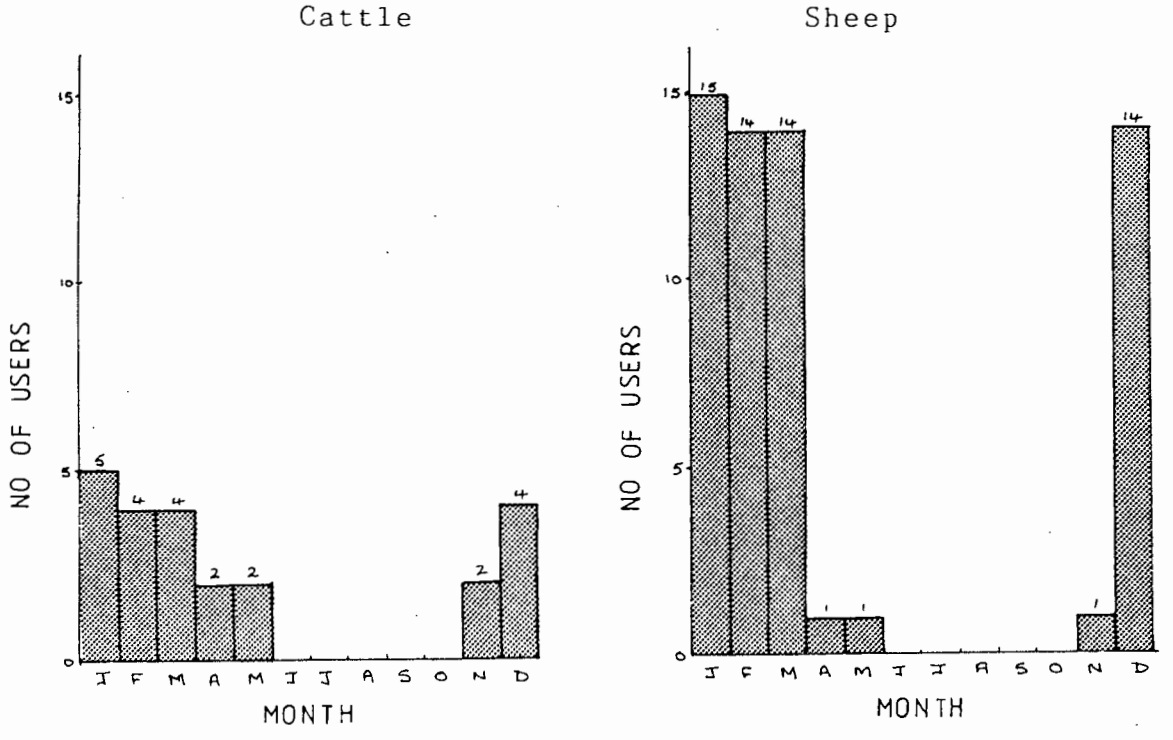


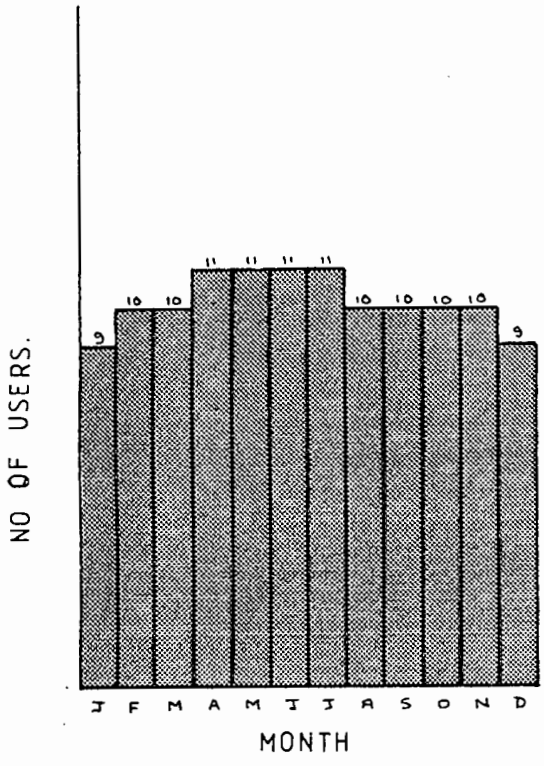
FIG 4.7: The times of the year that the different grazing systems are used on the land adjoining the mountain and the number of users of each system.

GRAZING OF FALLOWLAND

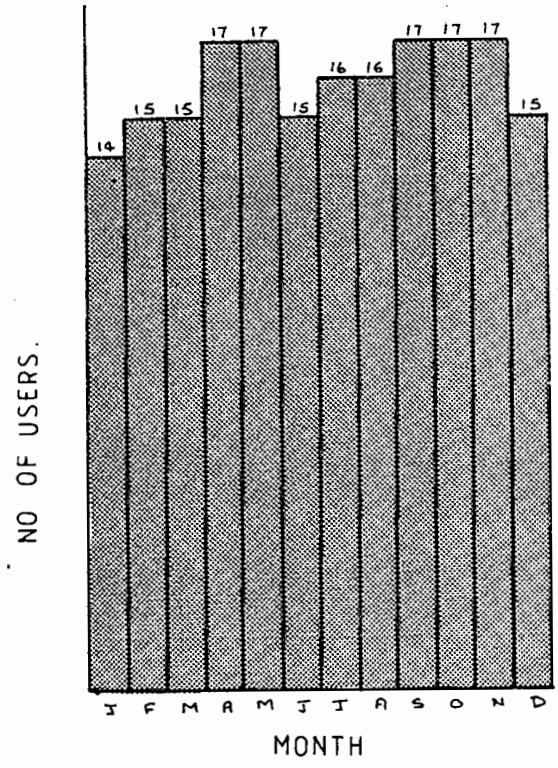


GRAZING OF CULTIVATED PASTURES

Cattle

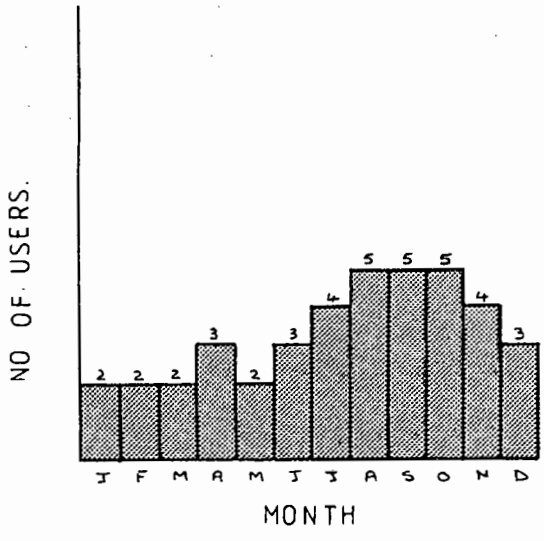


Sheep

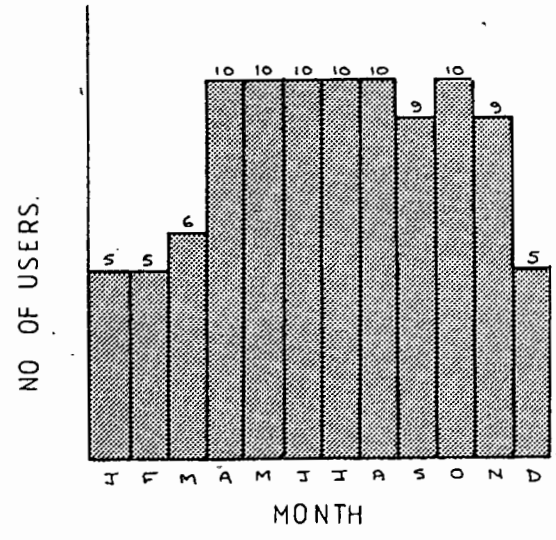


MULTI-CAMP SYSTEM IN NATURAL VELD

Cattle

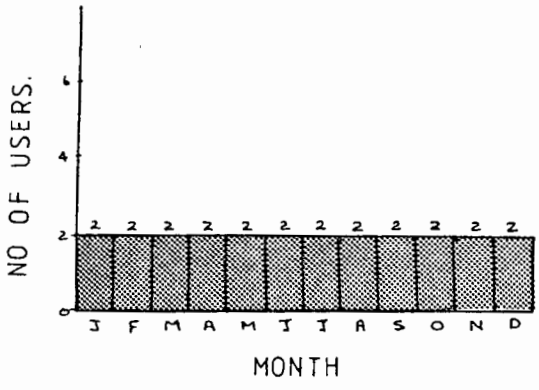


Sheep

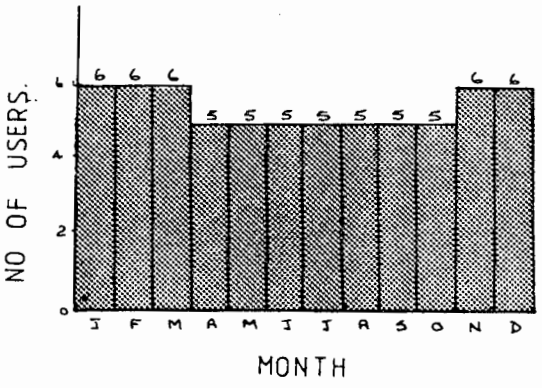


PATCH BURNING AND GRAZING OF NATURAL VELD

Cattle



Sheep



24. Have any of the above systems ever failed?

		YES	NO
(a)	Patch burning (Natural veld)	...	...
(b)	Multi-camp (natural veld)	...	...
(c)	Multi-camp (Pastures)	...	...
(d)	Fallowland	...	...
(e)	Other	...	...

25. Why did the system that you used, fail? (Describe briefly)

Patch burning: This was the main grazing system used in the past. The decrease in the number of users of this system does not indicate a failure of the system, but happened because of the introduction of the Mountain Catchment Areas Act No 63 of 1970, as well as the better control exercised by the Directorate of Forestry. Farmers are now held responsible for fires that originate on their properties and spread to neighbouring properties. Due to this, farmers have become hesitant to burn their land because of the danger of runaway fires.

Multi-camp (Natural veld): This system is not used in the mountains because of the cost involved in erecting fences. Away from the mountain most farms have internal camp fences but no specific grazing systems.

Multi-camp (Pastures); Problems with this system do arise in times of drought if dryland pastures are used. In the case of irrigated pastures this is not a problem because the mountain streams have never failed and there is always enough water for irrigation. Because of the introduction of pastures the carrying capacity of farms increased from one small stock unit (SSU) per 8 ha in the mountains to about 5 SSU per ha on dryland pastures. This leads to a situation where overstocking occurs in times of drought. As droughts along the southern side of the mountain are rare and of short duration, this problem can be overcome by extra feeding.

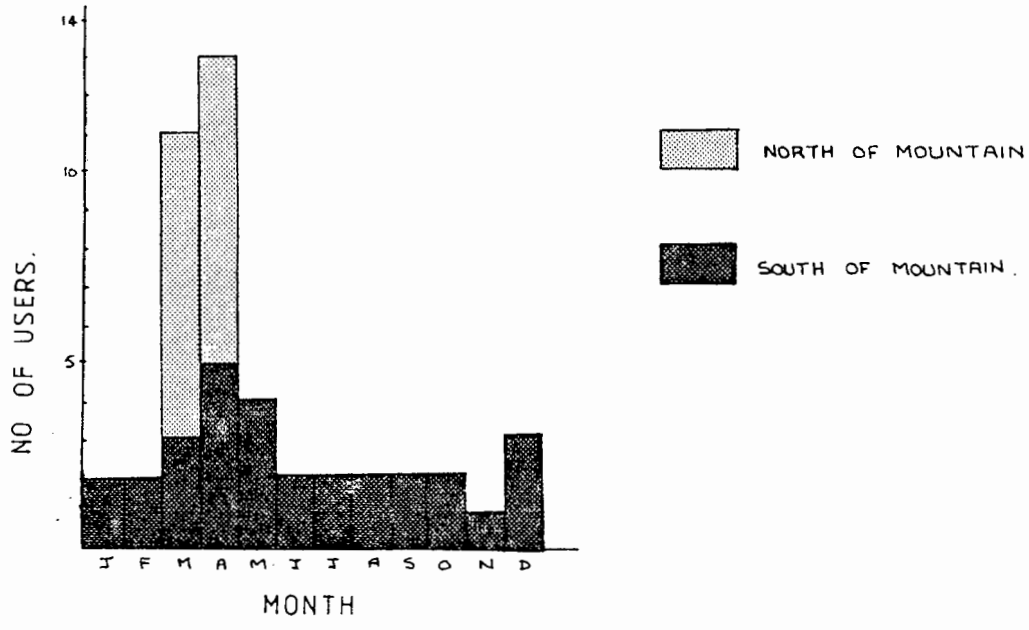
Fallowland: This system has been used for a long time in the study area. Farmers used to combine fallowland grazing with patch burning in the mountains. In figure 4.7 it can be seen that fallowlands can only be used from after harvesting of the wheat or oat crops in November to about March. The sheep and cattle are then moved to cultivated pastures, either dryland or irrigated, or to the mountains.

4.1.7 Burning of the veld

	Month of burn
26. If you burn your natural veld, when do you burn?	.....

On the southern side of the mountains farmers burn throughout the year with a few more burning during the months March, April and May. The farmers who burn on the northern side of the mountain only do so during March and April.

FIG 4.8: Months of burning on the southern and northern side of the Riviersonderend mountains.



27. Why do you burn your veld?
(Describe briefly)

.....
.....
.....

All of those burning their veld do it to encourage regrowth of bushes and grass. One other reason given was to get rid of ticks.

28. If you do not burn your veld, why not?

.....
.....
.....

Two main groups can be identified:
The first group, made up by 35,7% of the landowners, does not use their mountainland and prefers that forestry manages it according to the block burning system. The other group is represented by farmers who want to burn.

As there is a possibility of a court case if the fire they started runs away, they do not use the patch burning system anymore. This second group is represented by 28,6% of the landowners.

29. How often do you burn the same area?

..... Years

Burning cycles used by those farmers who still burn their own veld vary from 3 to 12 years. Eleven of the 19 users of the patch burning system use burning cycles while the other 8 only burn when they need extra grazing. The cycles used on the northern side of the mountain are longer than on the southern side because of the slower recovery of the veld.

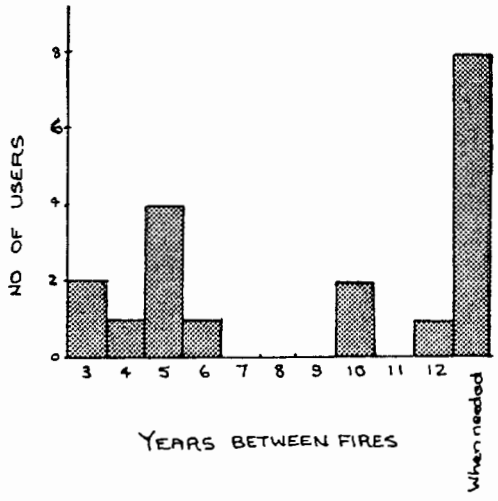


FIG 4.9: Burning cycles used by private landowners in the Riviersonderend mountains.

30. How big an area do you burn at one time?

..... ha

Of the 19 farmers who burn their veld, 6 try to burn a specific area with every burn. The area that they

burn at any one time depends on the total area available to them. In most cases between a quarter and half of the total available area gets burnt in one burn. The other 13 farmers set the veld alight after rains and let it burn until it stops on its own. This is usually against younger veld. The farmers using this system burn on short rotations which can even be shorter than 3 years in some instances.

31. How long after the burn do you send the animals onto the veld?

..... Months

Only one farmer let his veld rest for at least one year after burning it. Four other farmers give their veld at least one grazing season while the rest send their stock onto the veld after the first rains when the grasses start sprouting. Most farmers believe that the veld is only useful for grazing for a period of one year after burning it. Others use their veld for up to five years after burning it. The difference in time that the veld can be used, depends on the type of sheep grazing there.

32. Why do you choose this particular time period?

.....

.....

.....

Most farmers feel that the short time period between burning and grazing is necessary to make maximum use of the young sprouting grasses and shrubs. Those that give the veld at least one growing season feel that the worst climatic conditions encountered in the mountains occur during the months June, July and August. They thus wait until spring before they utilize their veld. Only one farmer sees the value in giving the veld a full year's rest before grazing it. He feels

that most grasses and shrubs should be given a chance to seed before they are utilized.

33. How many animals do you send onto the burnt veld per ha?

(a) Cattle ..... ha
(b) Sheep ..... ha
(c) Goats ..... ha
(d) Other ..... ha

Not one of the farmers who use their mountainland for grazing restrict stock numbers to a certain level when utilizing burnt veld in the mountain. As most of them use their mountainland to rest their other pastures during the growing season in spring, the number of stock sent into the mountain depends on the condition of the pastures at that time.

34. For how long do you keep the animals in this veld?

..... months

The farmers keep their stock in the mountains from 2 to 6 months. This varies from year to year depending on the rainfall and the condition of the grazing.

35. What plants do animals prefer to graze on

(i) the burnt veld
(ii) unburnt veld?

Not one of the farmers know what plant species their stock utilize when grazing in mountain fynbos. They could only guess that Themeda triandra, a sweet grass that grows on the southern side of the mountain, gets grazed by the stock. From observations in the veld it is clear that sheep very seldom move out of the burnt areas into older fynbos. Cattle on the other hand walk long distances and will graze in both young and old fynbos. Different breeds of sheep also utilize

different plant species. The Dorpers can graze much harder plant material than Merino's but prefer to stay in the freshly burnt veld if available.

4.1.8 Fencing of mountainland

		YES	NO
36.	Do you have any fenced camps in the mountains?	☐	☐
37.	If yes, how many?		
38.	What is the average size of camps? ..... ha		
39.	On what basis do you decide where the boundaries of camps should be?		

.....

.....

.....

.....

Only one of the farmers using his mountainland for grazing uses a camp system in the mountains. Another farmer has dryland lucerne on the lower slopes of the mountain which is fenced off but has gates in the fences giving access to the mountain veld. Many of the other farms have fences between the lower lying farmland and the mountain to stop their animals wandering off into the mountains.

The farmer actively managing his mountainland has 5 camps; each camp is ± 200 hectares in extent. The camp boundaries have been placed so as to have camps of roughly equal size and so that water could be provided for each camp.

The cost involved in making internal camps is one of the reasons why no other farmers follow this system. The topography of some farms is such that it would be very difficult to divide the area into camps. The

farmers also feel that sheep seldom move out of the freshly burnt veld into older fynbos and that the edge of the burnt veld can be seen as a natural fence. Most farmers feel that if they have to erect fences to be able to make use of the mountain for grazing, the cost involved will force them to reduce their stock numbers and abandon the mountain as a place to graze stock.

4.1.9 Cultivated pastures

40. Do you use cultivated pastures? YES ☐ NO ☐

TABLE 4.2: Number of farmers on the two sides of the mountain who make use of cultivated pastures.

	South 29 Farmers	North 27 Farmers	TOTAL 56 Farmers
Number of farmers with established pastures, dryland and irrigated	11 (38%)	6 (22,2%)	17 (30,3%)
Number of farmers in the process of establishing pastures	5 (17,2%)	3 (11,1%)	8 (14,3%)
Number of farmers with no pastures	13 (44,8%)	18(66,7%)	31 (55,4%)

41. Describe how you establish your pastures.

.....

.....

.....

Most of the farmers establishing pastures do it in a scientific way. They use private consultants who advise them on the best mixtures of seed to use as well as the best fertilization program for their particular soils.

The secret of the successful establishment of pastures lies in the proper preparation of the seedbed. Most of the seeds are very fine, thus seedbeds should also be well-prepared to allow proper contact between the seed and the soil. This ensures a high germination percentage of the seeds and an even plant cover. Many methods of land preparation exist but should not differ greatly from the following: Most farmers loosen the soil about six months before planting and apply anything from 2 to 6 tons of lime to increase the soil pH. Before sowing, the soil is again loosened, by ripping, after which it is ploughed. The soil is then harrowed after which the seeds are sown. Most farmers hook a roller behind the sowing machine to press the soil down to ensure close contact between the seed and the soil.

42. What plant species do you use in your pastures?

species	Advantages of species
.....	.....
.....	.....
.....	.....
.....	.....

No two farmers use the same mixture of species in their pastures. A mixture of lucerne, grasses, medics and subterranean clovers are used in most pastures. Medics flower towards the end of winter and produce an abundance of seed which is picked up by the sheep on the lands during summer when most of the plant material has dried up. These seeds have a very high nutritional value. The subterranean clovers, as well as the grasses, do well during the wet winter months while lucerne only starts to grow well during spring when temperatures increase. On the northern side of the mountain lucerne is only planted when irrigation

is possible because the rainfall is too low to grow it under dryland conditions.

43. If you fertilize your pastures, what types do you use, and how much?

Type	Quantity
.....	..... Kg/ha
.....	..... Kg/ha
.....	..... Kg/ha
.....	..... Kg/ha

44. Do you give any top-dressing?

Type	When	Quantity
.....	.....	..... Kg/ha
.....	.....	..... Kg/ha
.....	.....	..... Kg/ha

45. Do you treat the soil for trace element deficiencies?

When	How often	Quantity
.....	.....	..... Kg/ha
.....	.....	..... Kg/ha
.....	.....	..... Kg/ha

As a result of the low pH of the soils in and around the mountains, agricultural lime has to be added to increase the pH level to about 6,5 which is acceptable to most of the pasture plants. Mountain soils need about 4 to 6 tons of lime per hectare while 2 to 3 tons per hectare is enough for the lower lying areas. The lime gets worked into the soil about 6 months before planting. About one month before planting the ground gets prepared for planting

and some farmers add superphosphate at a rate of about 200 kg per hectare. Most farmers however, add between 150 to 250 kg superphosphate only at the time of planting. Most farmers give their pastures a top-dressing at some time or another but no fixed routine exists. Some farmers give a yearly top-dressing while others only do so once or twice during the lifetime of their pastures which can be anything from four to ten years. Superphosphate, at a rate ranging from 150 to 400 kg per hectare, seems to be the most popular fertilizer as a top-dressing. Very few farmers treat their soil for trace element deficiencies. Those that do so, treat for Copper, Zinc and Manganese deficiencies. Treatments vary from a yearly treatment to a four yearly treatment. Zinc is added at levels from 250 g per hectare every year to 3 kg per hectare every four years. Copper is added at 7 kg per hectare every four years while manganese is added yearly at 2,5 kg per hectare.

46. Do you irrigate your pastures? YES ☐ NO ☐

47. If irrigating, how much water do you use?

species	Quantity
.....	..... ℓ/ha
.....	..... ℓ/ha
.....	..... ℓ/ha

48. What irrigation system do you use?

(a) Pumping
  (i) Diesel .....
  (ii) Electrical .....
(b) Gravity flow .....

49. Where do you get your water from?

	Quantity
(a) Dams	.....
(b) Streams	.....
(c) Bore holes	.....
(d) Other	.....

	YES	NO
50. Do you have any extra water available to start cultivated pastures?	☐	☐

Of the 56 landowners 25 (44,6%) have cultivated pastures. Only 3 (5,3%) farmers irrigate all their pastures while another 12 (21,4%) irrigate some of their pastures. Another 10 (17,8%) farmers have only dryland pastures. Most of the other landowners who have no pastures at all, either own land on the northern side of the mountain where it is too dry for dryland pastures, or only own land in the mountain. Only ten farmers have extra water to start cultivated pastures.

Most farmers only irrigate their pastures during summer and dry spells in winter. The quantity of water used for their pastures varies from 25 mm to 50 mm per irrigation. Most of the farmers only irrigate once a week during summer while others only irrigate when they see that the pastures look dry. The three farmers who only use irrigated pastures irrigate according to a set program and use much more water. The farmer with the most intensive system is Mr Joubert of the farm Uitvlugt (See farm no 59/5 on map a) who runs over 2000 ewes and some cattle on his irrigated pastures. His annual water use amounts to over 25 million litres of water per hectare. He uses the same amount of water on all his different types of pastures. He irrigates once a week during the months October to November and March to May, and twice a week from December to February. Other farmers who do not use irrigated pastures as intensively as Mr Joubert use anything from 2 to 10 million litres of water per hectare per year.

Most of the farmers who pump water also use gravity flow from dams or streams on some of their lands. Those that irrigate from the Riviersonderend use electrical pumps because diesel has become too expensive. Only two farmers still use diesel because they do not have electricity on their farms. Of the 56 landowners 8 have built large dams

higher up on the mountain slopes while another 14 take water from weirs built in the mountain streams. Only 2 farmers irrigate their pastures from boreholes while one other uses sewage water.

4.1.10 Supplementary feeding

51. Do you give any supplementary feeds?

	Always	Sometimes	Never
(a) Mountainland			
(b) Cultivated pastures			

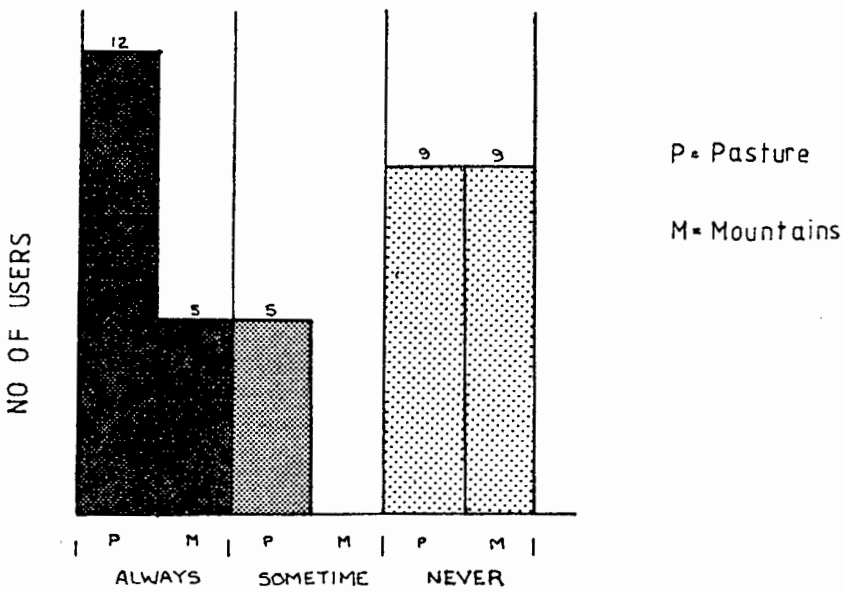


FIG 4.10: Number of farmers giving supplementary feeds in the mountains and on cultivated pastures

Only twenty five per cent of the farmers who use their mountainland for grazing give supplementary feeds to the animals while they utilize the mountain veld. This is very low compared to the sixty eight per cent of farmers giving extra feeds to animals grazing on cultivated pastures. Because of the low nutritional value of the mountain veld, it would be expected that more farmers would feed their animals while they use the mountain. Most of the farmers who still use the mountain do not use scientific

farming methods and do not know what the productivity of their stock is like. The farmers who use cultivated pastures see their animals often and aim for the highest possible production levels. Four of the five farmers who give supplementary feeds to their animals when grazing in the mountain, only use the mountain to rest their pastures. These farmers also provide supplementary feeds for their animals when they graze on cultivated pastures.

52. When to you feed your animals?

(a) Mountainland .....
(b) Cultivated pastures .....

53. What do you feed your animals?

(a) Mountainland .....
(b) Cultivated pastures .....

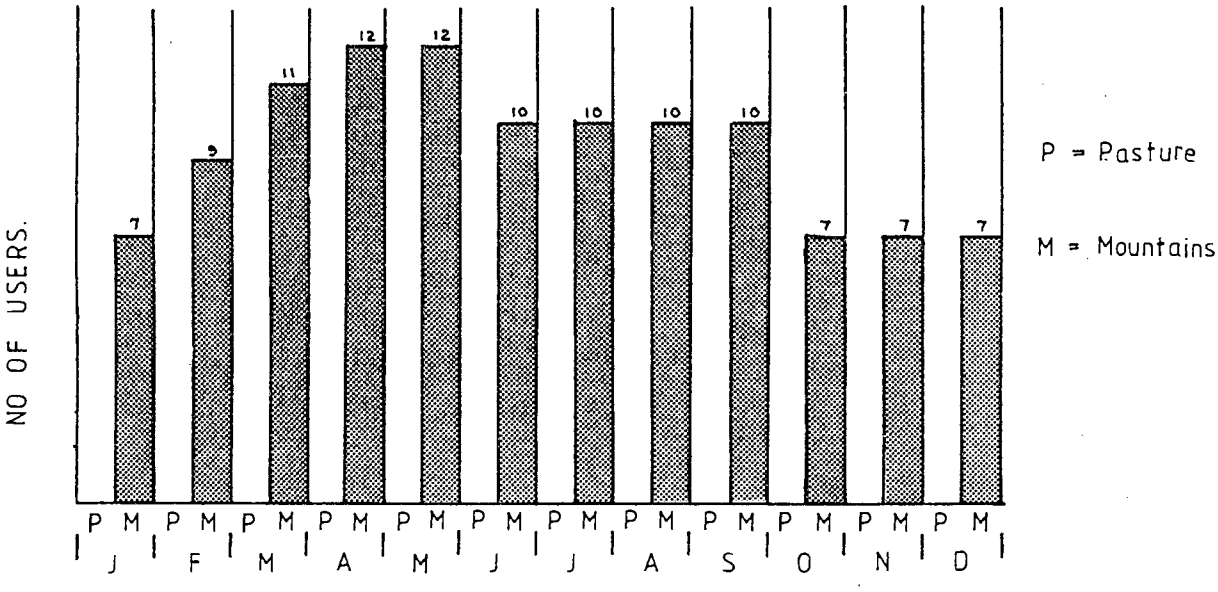


FIG 4.11: Time of the year when farmers supply supplementary feeds for their animals.

Most farmers only supply supplementary feeds for their animals during a certain part of the year. No clear pattern could be identified and each farmer had his own reasons for using a specific system. In figure 4.11 the increase in farmers feeding their animals during the months February to May can be ascribed to the deterioration in the quality of the pastures during late summer. From

May to September some farmers give their stock extra roughage in the form of hay or straw or a mixture of the two. This is necessary because the pastures become very soft and juicy during the wet winter months. Cattle need more roughage than sheep and it is mainly dairy and cattle farmers who provide roughage.

54. How much to you feed your animals?

Type		
(a)	Mountainland	kg/anml/day
(b)	Cultivated pastures	kg/anml/day

Only those farmers who keep records of the development of their stock could provide accurate records of the amounts of fodder given to their animals. Most of the other farmers give fodder when available and the quantities always vary. Most cattle farmers provide between one and two kilograms of fodder daily, depending on the length of time that they spend on the cultivated pastures each day. Sheep get anything from 25 grams of high energy licks to 50 grams of roughage mixed with Rumevite per day.

	Always	Sometimes	Never
55. Do you produce your own fodder?	☐	☐	☐

56. If not, where do you buy your fodder?

.....

.....

57. Why do you only sometimes produce your own fodder?

.....

.....

58. If never, why don't you produce your own fodder?

.....

.....

Of the farmers who provide supplementary feeds thirteen produce their own fodder while another two sometimes do so. Only three farmers buy all their fodder. Some farmers who produce their own fodder also buy high energy licks which they mix with the fodder they produce. Most of the farmers on the southern side of the mountain grow grain during winter and thus have ample roughage for their stock after harvest time. The farmers on the northern side of the mountain cannot produce grain because of the low rainfall and if they want to feed their animals they have to buy in hay. The two farmers who only sometimes buy fodder also farm on the northern side of the mountain. They can produce fodder in the better years as they farm in an area which gets a bit more rain than the rest of the farms on that side of the mountain.

59. Do you supply salt as licks? YES ☐ NO ☐

Only eleven farmers give salt to their animals in one form or another. The farmers who use the mountainveld feel that it is essential and leave blocks of rock-salt in the veld close to the water. Other farmers add salt to their fodder mixture.

60. Do you supply trace elements in any form?

Type	How much	How given
.....	.....	.....
.....	.....	.....

Eight farmers on the southern side of the mountain give trace elements in the form of Rumevite blocks which they leave in the veld. Three other farmers prepare their own mixtures which they put out as required by the animals.

61. When do you give these licks?

Type	When	Quantity
(a) Mountainland	.....	.....
(b) Cultivated pastures	.....	.....

Most of the farmers who give licks do so for the whole year. The quantity varies continually and the stock determines how many are put out. When a block is finished the farmer puts out more. The same holds for the mixtures that the farmers prepare themselves as these go into self feeders which get filled when empty.

62. If not, why don't you give licks?

.....

.....

The farmers who do not supply licks and only use cultivated pastures, feel that the pastures contain all the essential elements and that it is a waste to give extra licks. The other group of farmers who use the natural veld and who do not give licks, acknowledge the necessity of extra licks. Most of them however feel that the cost involved is too high. Others still farm as their fathers did and do not believe in the new scientific farming methods.

4.1.11 Animal diseases

63. What diseases do cattle get in this area?
64. What diseases do sheep get in this area?
65. What diseases do goats get in this area?

Two sheep diseases occur in all areas around the mountain. They are pulpy kidney and blue tongue. Pulpy kidney is most common during the changes in season from winter to summer and summer to winter when veld conditions also change. Blue tongue is most prevalent during late summer when the first dew is encountered. This disease is more common on the wetter southern side of the mountain and to the west on the northern side. Both diseases can be constrained by vaccination. Endoparasites are also a major problem, especially on the pastures on the southern side of the mountain. To keep contamination of animals

DISEASES:

63. What diseases do cattle get in this area?

Disease	When most susceptible	Preventative action	Treatment - when and how often

64. What diseases do sheep get in this area?

Disease	When most susceptible	Preventative action	Treatment - when and how often

65. What diseases do goats get in this area?

Disease	When most susceptible	Preventative action	Treatment - when and how often

to a minimum where they graze on pastures, camps should not be grazed again for at least a month after removal of stock from such a camp. Dosing of animals should be done on a regular basis in the south but less frequently in the north. Another problem on the southern side of the mountain, not mentioned in the north, is enzootic abortion. This can be controlled by vaccination. Only one sheep disease is encountered on the northern side of the mountain which does not occur in the south. This is paralysis caused by the karoo paralysis tick. The poison in this tick is activated by extreme cold weather and most farmers dip just before the first frost in April or May. The severity of this problem differs between farms and some farmers have to dip a second and others a third time towards the end of winter.

Cattle on the northern side of the mountain also have the problem of paralysis by the paralysis tick. The cure is the same and all animals must be dipped. Dairy cattle which graze on irrigated pastures on the northern side also have a problem with endoparasites but not as severely as on the southern side of the mountain. Two other diseases pertaining to cattle on the southern side of the mountain and not found to the north, are Bovine piroplasmosis and Gall sickness. Both these occur just before winter from February to May. Piroplasmosis can again be a problem from September, in areas heavily infested by ticks. The cure for this disease is vaccination of the animals.

The only disease encountered by goats is paralysis by means of the paralysis tick. All the animals are dipped once before winter and again after two months.

66. Where do you dip your animals?

(a) Mountainland .....

(b) Cultivated pastures .....

Only a few farmers have constructed dips. The others all use hand pumps or sprays driven by means of a pump connected to their tractors. One farmer owns a portable dip which he transports around between his various farms.

		YES	NO
67.	Do you have any stock losses due to illnesses?	☐	☐
68.	What percentage do you lose annually?	☐	☐

	Diseases	Losses
(a)	Cattle	.....%
(b)	Sheep	.....%
(c)	Goats	.....%
(d)	Other	.....%

Although stock losses due to illness do occur on most farms, figures are very low and seem to be within normal levels. Percentage losses vary from below one per cent to five per cent. Cattle losses very seldom occur and it is mostly young calves that die of piroplasmosis before they can build up a resistance to the disease.

4.1.12 Management practices

		YES	NO
69.	Do you keep a special herdsman?		
	(a) Mountainland	☐	☐
	(b) Cultivated pastures	☐	☐

Ten farmers employ special herdsmen whose sole task is to tend their stock while grazing on cultivated pastures. Only one other farmer uses a fulltime herdsman during lambing season. Not one of the farmers employ herdsmen to look after their stock while grazing in the mountain veld. The reason they give for this is that they cannot find any labourers willing to live in the mountain during

the time that the stock spend there. Some farmers also give this as one of the reasons why they do not use the mountains for grazing anymore.

	YES	NO
70. Do you provide special drinking points?		
(a) Mountainland	☐	☐
(b) Cultivated pastures	☐	☐

Only the two farmers who manage their mountain veld in the north-eastern extremity of the mountain, provide special drinking points in the grazing areas. All the others who utilize the mountain let their animals drink from the nearest stream. This is one of the problems in using the mountain for grazing as the animals create paths to these streams, which in time erode as they are mostly on steep slopes.

All the farmers who use cultivated pastures provide special drinking troughs because they use a camp system and not all camps have streams flowing through them. These farmers also feel that they prefer drinking troughs as they can be cleaned regularly which cuts down on the parasite problem.

	YES	NO
71. Do you provide special feeding points?		
(a) Mountainland	☐	☐
(b) Cultivated pastures	☐	☐

The farmers who provide supplementary feeds to their animals when grazing on cultivated pastures, all use self feeders because they do not have to be filled daily. Due to the problem of getting into the mountain to put out the supplementary feeds, the farmers leave it close to roads and paths on the lower slopes. Except

if they have access roads far into the mountains, they always use the same location which leads to trampling and overgrazing problems in that vicinity. Two of the farmers who provide extra feed in the mountain use drums to hold the food but the rest place the food on the ground or on flat rocky areas.

	YES	NO
72. Do you provide shelter against heat and cold?		
a) Mountainland	☐	☐
b) Cultivated pastures	☐	☐

73. If yes, describe briefly

.....

.....

In the past farmers had kraals in the mountain and a herdsman who looked after the sheep and cattle. Every night he brought them back to the kraal. The reason for this was more to protect them from predators than to provide shelter against the elements. These kraals are not used anymore, mainly because the farmers cannot find herdsmen prepared to live out in the mountain. Only farmers who farm with Dorpers use the mountain for long periods at a time as this breed is more hardy than Merino's.

Next to most lands with cultivated pastures occasional Eucalyptus trees can be seen. These provide shade which the sheep utilize during the heat of the day. Most of the farmers who use cultivated pastures farm with Merino sheep. All agree that it is important to provide shade in all the camps to protect the sheeps' wool. A few have already started planting more trees while others intend putting up shelters in the camps. One of the farmers provides shelters in the camps where he keeps his ewes when they are with the rams. He also provides asbestos domes in small camps

where the ewes with lambs are kept.

74. Do you have any stock losses due to predators?

	How many	To what	How often
(a) Mountainland	.....	.....	.....
(b) Cultivated pastures	.....	.....	.....

Fairly accurate records of predator action have been obtained from the Provincial Problem Animal Control Unit stationed at Vrolikheid between McGregor and Bonnievale. This together with the data collected from the farmers gives a good idea of the movements of predators in and around the mountain. From the data it can be seen that certain areas are much more prone to predator attack than others. Closer inspection of these areas shows that they provide good hiding places for predators which makes their control much more difficult. In the mountains it is only the leopard that causes any damage and then not on a regular basis. From sightings and leopard kills, it is safe to assume that the Riviersonderend mountains are only a thorougfare for leopards travelling from the Langeberge to the Hawequas mountains and back. One place where leopards may stay permanently is the Olifantsbos area to the northwest of Riviersonderend. It is only in this area where regular leopard attacks take place. The farmer who uses this area for grazing keeps up to 500 hamels there on a regular basis and loses between three and four per cent of his stock annually to leopards. No accounts of leopards moving out of the mountains onto adjoining farms could be found.

Various animals attack sheep on the farmland adjoining the mountain. In table 4.3 statistics for 1978 and 1979 are shown. This is for the Riviersonderend area but does not include all killings. Most farmers never report all the deaths of their stock and hunt the predators themselves. Figures gathered

from the farmers indicate the same pattern.

TABLE 4.3: Stock losses reported to the Provincial Predator Control Unit during 1978/1979 and the number of predators killed.

Predator	Stock losses		Predators killed	
	1978	1979	1978	1979
Leopard	?	6	0	0
Lynx	42	18	8	9
Honey-badger	1	3	0	0
Siver jackal	7	9	7	6
Dogs	157	61	15	10

Lynx only seem to be a problem on the northern and south-eastern sections of the mountain. They never enter the mountain to kill sheep and all the deaths of sheep noted occured in the karoo veld adjoining the mountain. Further away from the mountain and only on the northern side the Black-backed jackal also causes a lot of damage. One farmer on the southern side of the mountain who has pastures next to the Riviersonder-end lost 80 lambs to water mongoose in one breeding season. Dogs seem to be the biggest problem on intensive pastures and if the unreported figures of sheep lost are added to that of the Provincial Unit, then it nearly doubles those given in table 4.3

75. Do you provide shelter at night against predators?

Type of shelter

(a) Mountainland .....

(b) Cultivated pastures .....

Not one of the farmers who keep sheep in the mountain for any length of time provide protection against predators. In the past the herdsmen who stayed in the mountains with

the sheep, were responsible for bringing them back to kraals at night and protecting them from predators. The farmers who still use the foothills of the mountain all bring their animals to kraals closer to the farmhouse at night.

76. What control measures to you take against predators?

Predator	Control
.....	.....
.....	.....

The farmers in the Riviersonderend mountains have three options open to them to combat predators on their farms. They can either use the Provincial Problem Animal Control Unit situated at Vrolikheid or the Divisional Council hunting unit which has two hunters, the one at Doorn Rivier and the other near Bot Rivier. The third option is to hunt the problem animals themselves. Methods used by the farmers themselves are: shooting of stray dogs, putting out baited cages for leopard and lynx and setting of spring-traps.

4.1.13 Marketing

77. Where do you market your animals?

.....

.....

Ten farmers send animals to the Maitland Abattoir. Of these, four send all their animals to the controlled market while the six others only send lambs to the market. Hamels and old ewes are sold at the local auctions. Two of the biggest sheep farmers use all their animals for own consumption. They are the Donkerhoek prison and a fruit grower, Mr Beukes, who slaughters his animals for his staff. All the other farmers send all the animals that they sell to their local auctions. The farmers on the southern side of the mountain go to the

Caledon, Rietpoel and Jongensklip auctions while those on the northern side go to the Worcester auction.

78. What transport do you use to market your animals?

.....

.....

Only two farmers use hired transport while the rest all use their own trucks. Five owners take stock direct to the Maitland market with their own trucks, with one farmer renting a truck to take his animals. The other four farmers who send stock to Maitland use the train and take the animals to their nearest station with their own transport. Nearly all the other farmers take their animals to local auctions with their own transport. Only one farmer rents trucks to take his animals to his local auction.

79. What is your estimated cost of transportation?

Small animal unit	R	/SAU
Large animal unit	R	/LAU

Transportation costs for 1980, when the survey was done, worked out to an average of forty cents per kilometer. Most of the farmers use the same size trucks and thus costs will not vary much. Since 1980 there has been an annual rise of about twenty per cent in costs. With this in mind, the cost per kilometer will now be close to eighty cents. These figures include the driver's salary. The bigger stock farmers altered their trucks to be able to load double layers of sheep which cuts their costs per small stock unit by half. With the different loading methods used, capacity of the trucks vary from forty to about one hundred small stock units. Very few farmers transport large stock units. Most farmers who do, use their bakkies for this purpose. The other farmers use trucks which

can transport from eight to about fifteen large stock units depending on the age and type of animals transported. Most of the farmers could not even give an estimate of what it cost them to transport their stock to the markets or whether they used the most economical methods or not.

80. Do you sell wool? YES ☐ NO ☐

Seventeen of the landowners who farm with stock keep wool producing sheep and sell wool. The other farmers all keep Dorper sheep and although they do get some wool it has not been taken as wool production.

	Max	Min
81. What is your average wool production per sheep?	.....kg	.....kg
82. What price does your wool fetch?	R.....kg	R.....kg

Wool production of Merino sheep on cultivated pastures varies from about 6 kilograms to a maximum of 8 kilograms. For other merino breeds this figure ranges from 4 to 6,5 kilograms per sheep. The farmers who use the mountain for grazing have a much lower wool production and this varies from 2,5 to 5 kilograms per sheep. An interesting comparison between sheep grazing on cultivated pastures and another group who only use the mountain for grazing, is that from Mr Van Deventer of the farm Vooruitzicht. He keeps all his ewes on cultivated pastures while a group of 500 hamels are kept in the mountains. The hamels get maize as a supplementary feed once a week. Under normal circumstances fully grown hamels will produce more wool than ewes who have to rear lambs. The wool records of Mr Van Deventer show that the hamels from the mountain produce on average 5,9 kilograms of wool compared to 8,2 kilograms for the ewes. This should not be so because both the hamels and the ewes come from the same breeding stock. The most likely reason for this difference

is the inferior feeding of the hamels grazing on the mountain fynbos.

The nutritional value of the pastures compared to the mountainveld is reflected in the average price that each farmer receives for his wool. Prices recorded in this survey varied from R1,50/kg for sheep grazing only on mountain fynbos to R1,80/kg for sheep on dryland pastures. In the case of Mr Van Deventer it was impossible to compare between the prices fetched for wool from sheep grazing in the mountain and those who feed on cultivated pastures because all the wool is baled together. According to Mr Van Deventer the wool of the sheep in the mountain is much shorter and also discoloured which reduces the price.

83. What percentage of your farming activities does your stock production form? .....%

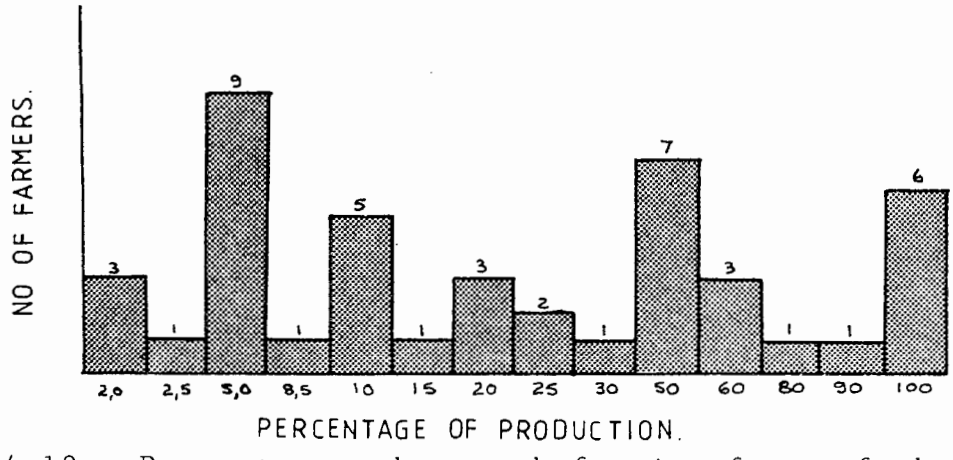


FIG 4.12: Percentages that stock farming forms of the total farming activities of farmers in the Rivierson-derend Mountain Catchment Area.

Stock production on the northern side of the mountain is not very important with only two farmers fully dependent on that farming activity. On average stock production only forms about 5 per cent of the turnover of farmers on that side of the mountain. On the southern side stock is much more important and percentages vary from 2 per cent to 100 per cent.

CHAPTER FIVE

CONCLUSIONS

5.1 CONCLUSIONS

Land settlement patterns in the Overberg indicate that the mountainland has only been used for intensive grazing during the last century. Isolated patches, especially the eastern and western extremities have been burned and grazed for much longer. It is possible that these areas could have been utilized by the Khoikhoi before the arrival of the first whites. After the whites started using the mountains for grazing, towards the end of the nineteenth century, burning and grazing were practiced on a large scale. A study of aerial photographs taken during 1938, 1948 and 1962 indicate that there was a gradual withdrawal from the central parts of the mountain to the more accessible areas on the mountain slopes. It was not before the early seventies, after the introduction of the Mountain Catchment Areas Act and the introduction of cultivated pastures, that most farmers withdrew their sheep from the mountains.

The system of patch burning and grazing used by the pioneer farmers in the Overberg had a definite detrimental effect on the composition of the fynbos vegetation. The exact effect will never be known as many plant species have been destroyed in the process. Indicator plants of disturbed fynbos are the excessive occurrence of Cliffortia, Stoebe and Elytropappus. Erosion in the form of sheet erosion, step erosion and dongas is also common in areas that have been intensively used by large numbers of domestic animals.

Studies of the nutritive value of the various fynbos types as well as Rhenosterbosveld indicates that it is not of much value to domestic animals. Serious shortages of various elements occur in these veld types. This study in the Riviersonderend mountains indicated that to get any production from stock kept in the mountains, large amounts of supplementary fodder had to be given on a regular basis. This study in the Riviersonderend mountains has clearly shown that a viable alternative to using mountainland for grazing exists. The development of cultivated pastures, both under dryland conditions as well as under irrigation, has revolutionized farming practices in the southern and western Cape. Pastures such as lucerne and clovers have improved soil fertility and increased nitrogen levels. As a result wheat production levels have increased enabling farmers to put smaller areas under wheat annually. Production costs of wheat have come down drastically while the farmer at the same time increases his income from his stock because of the increased carrying capacity of the pastures on his farm.

Farmers who own farms which fall partly inside the Mountain Catchment Area and who had been using the mountainland for grazing in the past, found that by planting cultivated pastures they increased the number of animals that they could keep. By not using the mountains they also had less management problems. The farms situated next to the mountains are the best for planting cultivated pastures because of the higher and more consistent rainfall. On the northern side of the mountain rainfall is the limiting factor when it comes to the planting of pastures. In isolated areas the rainfall is high enough for cultivated pastures but in other places irrigated pastures are the only solution.

Most farmers who keep stock on the northern side of the mountains only do so for their own use. In a few isolated cases where it is possible to grow cultivated pastures, farmers also keep stock for production. Dairy farming seems to be the only viable branch of stock farming on the northern side of the mountain, except if enough water and land are available to produce pastures for sheep.

Although this study will give the catchment planner and manager more information to be able to try and influence the farmer to stop using the mountains for grazing, more detailed studies of the economic aspects of using the mountainland for grazing will be necessary. Not one of the farmers who use the mountainland for grazing could give a breakdown of costs and income related to the use of the mountains for this purpose. As the production levels of stock using the mountains are low and the cost of giving supplementary feeds on a regular basis, is high, stock production in the mountains does not appear to be profitable and should be discourages so as to encourage conservation of natural flora and optimum water yields for use on the lowlands adjoining the mountains.

APPENDIX 1: LIST OF INDIGENOUS TREES FOUND IN NOUPOORTKLOOF IN THE GREYTON NATURE RESERVE

18	Podocarpus latifolius - Real Yellowwood
20	Widdringtonia nodiflora - Mountain Cypress
72	Brabeium stellatifolium - Wild Almond
86	Protea arborea - Waboom
94.2	Protea repens - Sugarbush
140	Cunonia capensis - Rooiels
141	Platylophus trifoliatus -Witels
221	Virgilia oroboides - Keurboom
225	Podalyria calyptrata - Waterkeurtjie
225.4	Psoralea pinnata - Fonteinbos
394	Rhus tomentosa - Taaibos
397	Ilex mitis - Cape Holly
398	Maytenus acuminata - Silky Bark
399	Maytenus heterophylla - Pendoring
400	Maytenus oleoides - Rock Candlewood
414	Cassine peragua - Bastard Saffron
418	Hartogia schinoides - Spoonwood
422	Apodytes dimidiata - White Pear
494	Kiggelaria africana - Wild Peach
573	Olinia ventosa - Hard Pear
570	Curtisia dentata - Assegai
572	Erica caffra - Water Heath
578	Myrsine melanophloeos - Cape Beech
603.1	Diospyros glabra - Bloubessie
611	Diospyros whyteana - Forest Monkey Plum
617	Olea africana - Wild Olive
618	Olea capensis ssp. capensis - Black Ironwood
670	Halleria lucida - Tree fuchsia
708	Canthium ventosum - Turkey Berry
729	Brachyleana neriifolia - Waterwitels

APPENDIX 2: LIST OF RARE AND ENDANGERED PLANTS IN THE RIVIERSONDEREND MOUNTAINS

REF NO	SPECIES	FLOWERING TIME	DEFINITION	MAP REF
1.	Elegia stokoei	7 7-8 8	Vulnerable	3319 C.D.
2.	Carpococe heteromorpha	4 7-9 11	Undefined	3319 C.D.
3.	Erica hibbertia	0 9-11-0	Undefined	3319 C.D.
4.	Ixia patens var linearifolia	0 9-9 0	Undefined	3319 C.D.
5.	Paranomus adiantifolius	9 9-10-11	Rare	3319 C.D.
6.	Sorocephalus alopecuris	0 9-10 11	Rare	3319 C.D. 3419 A.B.
7.	Corycium venosum	0 10-11 0	Uncertain	3319 C.D.
8.	Roella bryoides	0 11-12 0	Uncertain	3319 C.D.
9	Osteospernum aciphyllum	9 11-12-1	Rare	3319 C.D.
10	Disa charpentierana	0 11-11-0	Uncertain	3319 C.D.
11	Paranomus capitatus	11 11-12 1	Rare	3319 C.D. 3319 C.D. 3319 D.C.
12	Erica rufescens	0 1-4 0	Uncertain	3319 D.C. 3419 B.A. 3419 B.A. 3419 B.A. 3419 B.A.
13	Passerina burchellii	0 1-2 0	Rare	3319 D.C. 3319 D.C.
14	Agathosma leptospermoides	10 2-4 4	Uncertain	3319 D.C.
15	Lightfootii effusa	0 4-4 0	Uncertain	3319 D.C.
16	Leucadendron burchellii	8 8-8 0	Undefined	3319 D.C. 3319 D.C.
17	Leucadendron nervosum	6 9-9 10	Rare	3319 D.C. 3319 D.C. 3319 D.C. 3319 D.C.

NO	SPECIES	FLOWERING TIME	DEFINITION	MAP REF
18	Heliophila tricuspidata	0 10-12 0	Rare	3319 D.C. 3419 B.A. 3419 B.A.
19	Phylica lugens	0 10-2 0	Uncertain	3319 D.C. 3319 D.C.
20	Diosma thyrsophora	10 10-2 3	Uncertain	3319 D.C. 3419 B.A.
21	Aristea recisa	11 12-1 1	Uncertain	3319 D.C. 3319 D.C.
22	Anisodontea gracilis	0 1-1 0	Uncertain	3319 D.D.
23	Ruschia leipoldtii	8 8-10 10	Endangered	3319 D.D.
24	Aspalathus burchelliana	0 9-1 0	Uncertain	3319 D.D.
25	Grisebachia niveni	0 1-12 0	Uncertain	3419 A.B.
26	Phylica burchellii	0 3-3 0	Uncertain	3419 A.B.
27	Gladiolus subcaeruleus		Uncertain	3419 A.B. 3419 B.A. 3419 B.B.
28	Hypodiscus paludosus	8 8-9 9	Endangered	3419 A.B.
29	Erica xanthina	9 10-11 11	Uncertain	3419 A.B. 3419 B.A. 3419 B.A. 3419 B.A. 3419 B.B.
30	Cliffortia crenulata	0 10-10 0	Uncertain	3419 A.B.
31	Staavia trichotoma	0 1-12 0	Extinct	3419 B
32	Gladiolus stokoei	3 3-4 4	Rare	3419 B 3419 B.A. 3419 B.A. 3419 B.A. 3419 B.B. 3419 B.B.

NO	SPECIES	FLOWERING TIME	DEFINITION	MAP REF
33	Wahlenbergia serpentina	0 11-11 0	Uncertain	3419 B
34	Thamnea depressa	0 1-2 0	Extinct	3419 B.A.
35	Erica alfredii	1 1-4 6	Rare	3419 B.A. 3419 B.B. 3419 B.B. 3419 B.B.
36	Erica insolitanthera	0 1-2 0	Rare	3419 B.A. 3419 B.A. 3419 B.A.
37	Endonema lateriflora	0 1-4 0	Rare	3419 B.A. 3419 B.A. 3419 B.A.
38	Endonema retzioides	2 2-6 11	Rare	3419 B.A. 3419 B.A. 3419 B.A. 3419 B.B. 3419 B.B.
39	Agathosma leptospermoides	10 2-4 4	Uncertain	3419 B.A.
40	Nerine pudica	4 4-5 5	Rare	3419 B.A.
41	Phylica apiculata	0 4-8 0	Uncertain	3419 B.A.
42	Anaxeton brevipes	8 9-10 10	Rare	3419 B.A. 3419 B.B.
43	Erica cryptanthera	9 9-10 11	Uncertain	3419 B.A. 3419 B.B.
44	Erica parvulisepala	0 9-9 0	Rare	3419 B.A. 3419 B.B
45	Erica galgebergensis	0 10-11 0	Rare	3419 B.A.
46	Disa micropetala	0 10-11 12	Rare	3419 B.A.
47	Monadenia pygmaea	9 10-11 11	Uncertain	3419 B.A.

NO	SPECIES	FLOWERING TIME	DEFINITION	MAP REF
48	Muraltia pottebergensis	10 10-12 1	Uncertain	3419 B.A. 3419 B.B.
49	Gryptadenia laxa	10 10-11 12	Uncertain	3419 B.A. 3419 B.A. 3419 B.B. 3419 B.B.
50	Anthansia harmeri	10 11-12 1	Uncertain	3419 B.A.
51	Erica diotaeflora	0 11-1 0	Uncertain	3419 B.A. 3419 B.A.
52	Ortho penthea minor	0 11-12 0	Rare	3419 B.A.
53	Muraltia concava	0 11-11 0	Undefine	3419 B.A.
54	Cliffortia intermedia	8 11-12 12	Uncertain	3419 B.A.
55	Erica kraussiana	0 12-12 0	Uncertain	3419 B.A.
56	Erica trichophylla	0 12-12 0	Uncertain	3419 B.A.
57	Sorocephalus crassifolius	0 12-1 0	Vulnerable	3419 A.B. 3419 A.B.
58	Arctotis dregei	0 1-12 0	Uncertain	3419 B.B.
59	Felecia annectens	0 1-12 0	Extinct	3419 B.B.
60	Gladiolus emiliae	2 2-3 4	Endangered	3419 B.B.
61	Nivenia dispar	0 3-3 0	Uncertain	3419 B.B.
62	Erica praenitens	0 4-4 0	Uncertain	3419 B.B.
63	Anaxeton hirsutum	4 6-10 11	Rare	3419 B.B.
64	Staavia zeyheri	6 7-10 10	Endangered	3419 B.B.
65	Babiana foliosa	0 8-6 0	Uncertain	3419 B.B.
66	Sorocephalus pinifolius	6 8-9 10	Rare	3419 B.B.
67	Geissorhiza pappei	7 9-9 12	Uncertain	3419 B.B.
68	Watsonia caledonica	0 9-9 0	Uncertain	3419 B.B.
69	Spatalla propinqua	6 9-12 3	Extinct	3419 B.B.

NO	SPECIES	FLOWERING TIME	DEFINITION	MAP REF
70	Adenandra gracilis	0 9-10 0	Extinct	3419 B.B.
71	Gibbaeum esterhuyseniae	0 10-11 0	Extinct	3419 B.B. 3420 A.A.
72	Orthopentha bodkini	10 10-11 12	Rare	3419 B.B.
73	Cliffortia monophylla	9 10-1 2	Uncertain	3419 B.B.
74	Lonchostoma esterhuyseniae	0 11-11 0	Undefined	3419 B.B.
75	Helichrysum manopappum	0 11-11 0	Uncertain	3419 B.B.
76	Venidium angustifolium	10 11-2 4	Uncertain	3419 B.B.
77	Labostemon gracilis	0 9-10 0	Uncertain	3420 A.A.
78	Diosma eckloniana	0 9-9 0	Uncertain	3420 A.A.
79	Ixia bellendonii	0 10-10 0	Uncertain	3319 C.D.

APPENDIX 3: LIST OF INVADER SPECIES IN THE RIVIERSONDEREND MOUNTAIN CATCHMENT AREA

SPECIES	COMMON NAME	COUNTRY OF ORIGIN
Acacia longifolia	long leaved wattle	Australia
Acacia cyclops	rooikrans	Australia
Acacia melanoxylon	blackwood	Australia
Acacia mearnsii	black wattle	Australia
Acacia saligna	port jackson willow	Australia
Pinus pinaster	cluster pine	Mediterranean
Pinus radiata	monterey pine	North America
Pinus halepensis	Jerusalem pine	
Eucalyptus spp	-	Australia
Leptospermum laevigatum	Australian myrtle	Australia
Hakea sericea	silky hakea	Australia
Hakea suaveolens	sweet hakea	Australia
Hakea gibbosa	rock hakea	Australia
Opuntia imbricata	imbricate cactus	North America
Opuntis ficus-indica	prickly pear	Mexico
Sesbania punicea	sesbania	South America

APPENDIX 4: NUMERICAL LIST OF PRIVATE PROPERTIES IN THE RIVIERSONDEREND MOUNTAIN CATCHMENT AREA

FARM NAME & NUMBER		DEED NUMBER	CATCHMENT AREA (Ha)	SONE NO
25	Wagenboom Kloof	1838	860	1
25/3	Wolfkop	1838	197	1
25/4	Waboomskloof B	19077	275	1
26	Silverstreams	17835	962	1
32	Lang Gezocht	13284	1921	5
33	Kanon Berg	Val 10/3	1160	5
37/1	Groenberg	14039	348	5
38	Boschmans Kloof	Val 10/4	758	5
59/5	Uitvlugt	27998	71	2(b)
59/8	Elandskloof	34489	86	2(b)
64	Donkerhoek	14993	580	2(a)
64/1	Donkerhoek	25713	131	
65	Boschkloof	15258	393	1
66	Baviaansberg	15409	281	1
67	Oude Baviaanskloof	15258	723	1
137	Just in Time	23598	131	5
144/3	Lismore (Ptn.)	26857	83	6
144/5	Lismore (Ptn.)	3655	23	6
144/6	Stylbergen (Ptn.)	3655	101	6
145	The Oaks	2122	317	6
145/1	The Oaks (Ptn.)	32035	167	6
147	Poortjie	18808	112	6
150/1	Helderfontein	34966	50	6
150/2	Soetfontein	28123	66	6
150/3	Good Hope	40124	92	6
154	Soetmelksvlei		74	6
154/1	Brandenberg		68	6
155/1	Leeuwkraal	20699	100	6
169	Slang Riviers Bosch	8625	65	6
170/1	Kortgeschiet	21414	33	6
171	Oude Bosch	5573	83	6
172	Brood Kamer	20577	34	6
173	Groot Hendriks Bosch	20577	45	6
174	Piet Moolmans Bosch	20577	87	6

FARM NAME & NUMBER		DEED NUMBER	CATCHMENT AREA (ha)	SONE NO
175	Vooruitzigt (Shakespeare)	3608	458	6
176/1			488	6
179/1	Helderfontein	3085	119	6
181	Bokke Rivier (Ptn.)	17595	188	6
182/2	Noordhoek	25556	376	6
182/4	Twistwyk (Ptn.)	25556	203	6
218	Bok River	8626	70	6
360	Krom Rivier	28072	183	6
741	Ganskraal	8628	338	6
754	Die Plaas	38585	248	6
231/3	Brakke Fontein (Ptn.)	24260	617	5
232	Sandfontein	39052	314	5
232/1	Sandfontein (Ptn.)	24013	372	5
232/2	Sandfontein	24013	118	
232/4	Vlak Berg	24260	264	5
232/5	Donkerkloof	24013	3	5
233	Bergfontein	24013	353	5
234	-	724013	519	5
234/1	-	24013	269	5
235	Grootkloof	2583	367	5
239	Boschheuwel	21109	161	5
400	-	29242	53	5
400/1	Meulkloof	9959	158	5
402	Willowdale	39426	305	6
405	Loch Lotus	12632	279	6
407	Morning Star	25813	239	6
408	De Poort	2456	278	6

MATROOSBERG DIVISIONAL COUNCIL

FARM NAME & NUMBER		DEED NUMBER	CATCHMENT AREA (Ha)	ZONE NO
584	Wilde Paarde Kraal	14248	1078	1
585	Pauls Gat	18418	1784	1
585/1	-		1290	1
587	Wilde Paarde Berg	21225	1744	3

WYNLAND DIVISIONAL COUNCIL

146	Omklaar	20472	1895	4
154	Riet Valley	4591	945	5
174	Zaturdags Voetpad	24018	988	5
175	Dassies Berg	29895	407	5
177	Roep My Niet	19885	379	5
177/1	Roep my Niet		448	
180	Middeberg	10390	1120	5
181	Groot Toren	41558	2910	5
182	Hoeksberg	11431	1682	5
183	Weltevreden	12944	3028	5
184	Onverwagt	16790	76	5
184/1	Onverwagt	16790	1373	5
184/4	Onverwagt (part)	6377	211	5
186/1	Rooi Krantz Berg	21116	1597	5
186/2	Koeniesrivier	8708	544	5
187	Boschkloof	3256	1287	5
189	De Hoek	3256	195	5
196/1	De Hoek (part)		263	5
147/7	**Poesje**nelsrivier		184	5
147/4	Zevenfontein		31	5
196	De Hoek		298	4 + 5
148/2	De Fontein (part)		44	4


3319CD VILLIERSDORP
3319DC LANGVLEI
3319DD ROBERTSON
3419AB CALEDON
3419BA GREYTON
3419BB RIVIERSONDEREND
3420AA STORMSVLEI
MAP NO 9
LAND OWNERSHIP
SCALE 1:100 000
0 1 2 3 4 5Km
LEGEND
Forest Reserve Boundary.
Mountain Catchment Boundary.
State Land.
Private Land.
00/0
Farm Numbers.
Compiled by GH le Roux [Dir of Forestry]

APPENDIX 5: OCCUPATION OF LOAN FARMS

List of farms in the Overberg that could have had an influence on the use of the mountains for grazing and the years first allocated (Prins, 1979).

1.	Aan de Mond van de Sergeantsrivier	Sept 1793	Jan Morel
2.	Aan de Waterval	23.2.1745	J C Schabord
3.	Appelskraal	25.11.1785	Gerrit Beukes
4.	Bosjemanskloof	26.3.1772	Lucas Marthinus Marais
5.	Bosjemanskloof in Berg	16.1.1783	Jan Roux
6.	Bosjemansrivier	5.9.1781	Coenraad Groenewald
7.	Brandenburg	4.6.1804	Michiel Otto
8.	Bruyneklips Cloof	1804	Hermanus Gerhardus Pieterse
9.	Donkerhoek	1770	Jan Bernard Hofman
10.	Drooge Boom	1803	Johannes Hermanus Redelinghuys
11.	Elze Cloof	11.1.1792	H Lodewyk Bletterman
12.	Ezeljagt	1798	Widow - Willem Morkel
13.	Ganzekraal	1714	Isaak Scheepers
14.	Hartebeeskraal	8.1.1792	Arend van Wielligh
15.	Koningsriviershoek	1806	Jonathan Groenewald
16.	Krommerivierspoort	3.12.1804	Marthinus Coertze
17.	Kuyersrivier	17.2.1749	Pieter Rossouw
18.	Matjiesgat	22.1.1790	Christoffel Groenewald
19.	Poejenelsrivier	1796	Widow - Matthys van As
20.	Poort van Slangerivier	1800	Hendrik Wessels
21.	Ratelfontein	1771	Jacob van der Merwe
22.	Rietvallei	1806	Barend Gildenhuys

23.	Takkapsvalley	1801	Josua Pieter Cilliers
24.	Tygerhoek	?	Nicolas Colyn
25.	Weltevreden	27.12.1791	Marthinus Theunissen
26.	Wolvenkloof	8.5.1793	Eduard Wium
27.	Zeekoejaght	3.5.1739	Pieter du Plessis
28.	Ziekenhuys	1793	Marthinus Theunissen

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