THE GEOGRAPHY OF THE BEDFORD, ADELAIDE, FORT BEAUFORT, STOCKENSTRÖM AND VICTORIA EAST MAGISTERIAL DISTRICTS

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Thesis submitted for the Degree

of

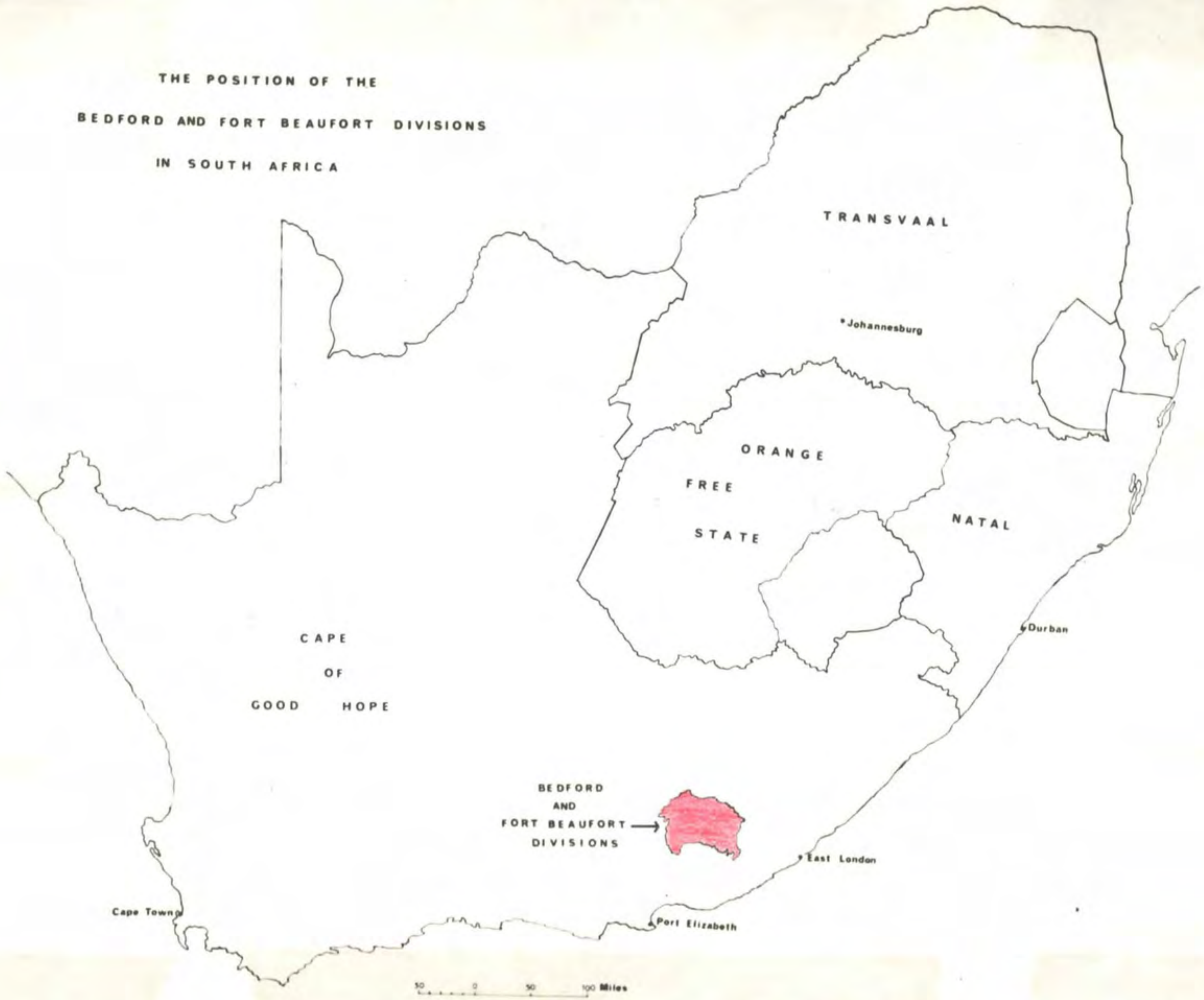
Master of Arts

Rhodes University

Grahamstown

1971

THE POSITION OF THE BEDFORD AND FORT BEAUFORT DIVISIONS IN SOUTH AFRICA



CONTENTS

LIST OF MAPS AND DIAGRAMS

An atlas of land use maps on a scale of 1:50,000
is bound in a separate volume.

PREFACE

This is a study of the physical landscape, climate, natural vegetation, historical geography and rural land use of the Bedford, Adelaide, Fort Beaufort, Stockenström and Victoria East magisterial districts. These five districts may be regarded as a natural region bounded by the crest of the Amatole-Winterberg range in the north and by the Great Fish River in the west. The southern boundary is a zone of semi-arid scrub bordering the Great Fish River valley. The Ciskei may be regarded as the eastern boundary of the region.

The natural vegetation of the area is of considerable interest owing to the great variations in altitude and climate. The region is a meeting ground of three distinct floras, viz. the Cape Flora, the Tropical African Flora and the Karroo Flora. The Cape Flora or macchia, characterised by such genera as _Erica_, _Cliffortia_, _Passerina_, _Gnidia_ and _Metalasia_, occurs here in relatively small patches in the cooler and wetter highlands. The diversified Tropical African Flora provides most of the components of forest, scrub, grassland and savannah. These formations occupy the greater part of the area under consideration. The Karroo Flora, characterised by dwarf shrubs and succulents, is dominant in the arid Great Fish River valley in the extreme west of the region, but mingles with the Tropical African Flora further east.

In his present short sketch of the natural vegetation the writer has attempted to depart from the traditional South African classifications of Acocks and others, which have resulted in the uniting of structurally unrelated vegetation types under one name. Instead an attempt has been made to classify each vegetation type according to the height, nature and density of the dominant stratum. As early as 1920, Sir Francis Younghusband declared that it was the duty of geographers to undertake the analytical study of beauty in scenery;[1] the writer has attempted to do this when describing the natural vegetation. Many of the plant species discussed are not of economic importance, but, as H.D. Thoreau wrote more than a century ago, "This curious world which we inhabit is more wonderful than it is convenient; more beautiful than it is useful; it is more to be admired than to be used."[2]

Historically this region is also of significance in that it formed part of the zone of conflict between the eastward moving White settlers and the westward moving Bantu settlers during the nineteenth century. The settlement pattern of the present reflects the manner in which the conflict was resolved. It is for this reason that the historical geography of the region forms an important part of this study.

Agriculture forms the basis of the economy of the five magisterial districts studied, and the writer has devoted several chapters to the various farming systems which are practised. An atlas of land use on the scale of 1:50,000 was also compiled from aerial photographs taken into the field. The atlas should be consulted when reading the chapters on agriculture and forestry.

This work was undertaken over a period of ten years, from 1961 to 1971, whilst the author was on the teaching staff of Rhodes University. The earlier chapters were completed before the introduction of the metric system in South Africa, consequently units of weights and measures are according to the Imperial system. Metrication of these chapters would have involved their retyping at considerable personal expense. For the sake of consistency later chapters were also written with weights and measures in the Imperial system. Another factor influencing the writer in favour of the

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[1] F. Younghusband, "Address at the Anniversary Meeting", Geographical Journal, Vol. LVI, 1920, pp. 1-13.

[2] H.D. Thoreau, "A Week on the Concord and Merrimack Rivers", Harrap, London, n.d., p.237.

Imperial system is that the 1:50,000 topographic maps on which the categories of land use have been superimposed are contoured only in feet. Furthermore, the only existing weather station in the region observing daily maximum and minimum temperatures is the privately owned station on the farm Surrey, Stockenström, where all meteorological instruments are graduated according to the Imperial system. Most readers of this work will readily be able to convert Imperial units to metric units. A simplified metric conversion table (Appendix A) has been provided for the convenience of any reader who wishes to refer to it.

ACKNOWLEDGEMENTS

It is impossible to produce a work of this nature without seeking the advice and assistance of many people and organisations. Space does not permit me to thank all of them, but in particular I should like to thank the following members of the staff of Rhodes University:

My supervisor, Professor V.S. Forbes, former professor of Geography, for his invaluable guidance throughout.

Professor J.V.L. Rennie, former professor of Geography, for constructive criticism of various chapters in this work.

Dr Amy F.M.G. JacotGuillarmod of the Botany Department for her valuable comments on the chapter on natural vegetation.

Mr J.P. Jessop of the Botany Department for assistance in the identification of various plant specimens.

The staff of the Cory Library for Historical Research, who on numerous occasions assisted in the location of historical documents.

I should also like to thank the following:

The Magistrate and Bantu Affairs Commissioner of Alice for making available to me statistical data concerning the Bantu reserves in the Victoria East and Fort Beaufort magisterial districts.

The Department of Forestry for unpublished statistical data.

The Geological Survey Office in Grahamstown for the loan of aerial photographs covering the whole region.

Numerous farmers, who with great goodwill provided much information concerning agricultural practice in the region.

My wife for her support, advice and encouragement throughout this investigation.

N.T. Childs.

Grahamstown,

August, 1971.

CHAPTER I

LOCATION AND PHYSIOGRAPHY

LOCATION

The area about to be described corresponds with five magisterial districts, viz. Bedford, Adelaide, Fort Beaufort, Stockenström and Victoria East, in the south-eastern part of the Cape Province, South Africa. Four of these districts, viz. Adelaide, Fort Beaufort, Stockenström and Victoria East, comprise the Fort Beaufort Divisional Council area, which is bordered on the west by the Bedford Divisional Council area, corresponding with the Bedford magisterial district. The total area of these five districts is approximately 2,781 square miles, the maximum dimensions being about 75 miles east-west and 55 miles north-south. The southern boundary of the region is from 29 to 57 miles inland from the coast between Port Elizabeth and East London, whereas the northernmost part of the region lies approximately 118 miles from the coast. The latitudinal range is from $32^{o}16'$ S. to $33^{o}10'$ S., and the longitudinal range is from $25^{o}43'$ E. to $27^{o}0'$ E.

Boundaries

In the west the boundary of the area is close to or along the Great Fish River. Here a zone of arid Karroid country forms a buffer of negative land between the grasslands of Bedford to the east and those of Somerset East to the west.

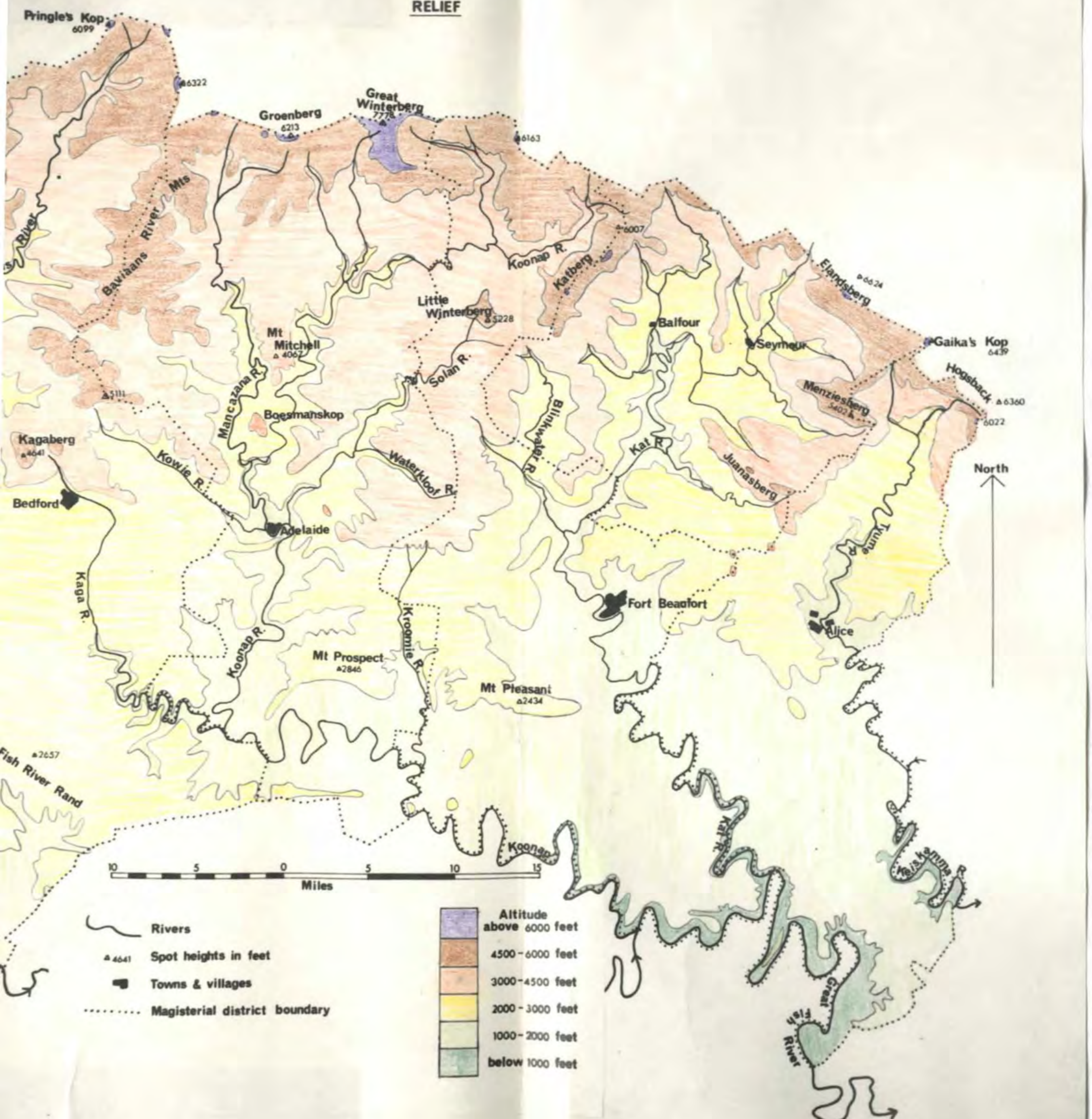
From the confluence of the Great and Little Fish Rivers the southern boundary runs in a north-easterly direction across a sparsely populated negative zone of arid Karroid country to the Koonap River. It then follows the Koonap to its junction with the Great Fish River, which forms the southern boundary as far as Committees Drift, in the extreme south-eastern corner of the area. The arid scrubland of the Koonap and Great Fish River valleys serves as a marked barrier zone separating the more densely populated grasslands of Fort Beaufort and Victoria East to the north from those of Albany to the south.

From Committees Drift the boundary runs north-eastwards along the road to Breakfastvlei, from where it continues to the Keiskamma River. Traced northwards the boundary follows the middle Keiskamma as far as the Tyume confluence, and then the lower Tyume River as far as its confluence with the Ncera stream, which forms the boundary for approximately four miles north of this point. It then leaves the Ncera to follow approximately the watershed between the Tyume and Keiskamma rivers, extending to within two miles of the summit of the Hogsback, in the Amatole-Winterberg range. This eastern boundary is not as "natural" as the others, for Acacia grassland and bushveld extends eastwards from Victoria East across Middledrift into the King William's Town district. Neither is there any topographical boundary in the east, for the lower Tyume and middle Keiskamma rivers are not deeply entrenched into the surrounding country. Although the eastern boundary of the area being studied is somewhat arbitrary, it corresponds with a change in economy for much of its length. Victoria East, with more than half of its area occupied by European farms, has an economy rather different from that of adjacent Middledrift district, which consists almost entirely of African reserves.

The northern boundary approximately follows the summit of the Amatole-Winterberg range, the steep slopes of which hamper north-south communications and form a marked natural boundary. Only five roads cross this range. Three of these have maximum elevations exceeding 5,450 feet. These are the road from Bedford to Spring Valley across the De Beer's Pass, the road from Adelaide to Spring Valley, and the road from Fort Beaufort to Queenstown across the Katberg Pass. The road northwards from Seymour over the Elandsberg has a maximum elevation exceeding 5,000 feet, and the road from Alice to Cathcart over the Hogsback has a maximum elevation exceeding 4,800 feet.

BEDFORD & FORT BEAUFORT DIVISIONAL COUNCIL AREAS

RELIEF



GREAT WINTERBERG

Mural jointing (both vertical and horizontal jointing) in the 400 ft. thick dolerite sheet capping the summit mesa of the Great Winterberg, elevation 7,700 feet.

The summit plateau of the Great Winterberg, looking south. The maximum elevation is 7,778 feet.

View from the Katberg Pass showing the insequent tributaries of the Wellesdale River, one of the headwaters of the Kat River. May 1960.

PHYSICAL FEATURES

The region is one of very diversified relief, ranging in altitude from 250 feet at Committees Drift in the extreme south-east to 7,778 feet on the summit of the Winterberg in the north. The Bedford and Fort Beaufort Divisional Council areas may be divided into two topographic sections stretching from east to west, viz. a belt of highlands in the north and a dissected peneplain elsewhere.

a) The Highlands

North of the railway line from Alice to Bedford is a belt of highland country with an east-west extent of approximately 75 miles and a maximum north-south extent of approximately 25 miles in the west. This belt commences at an altitude of about 2,000 feet at Alice and Fort Beaufort and about 2,500 feet at Bedford, and increases in altitude northwards. The entire northernmost part of the area exceeds 4,500 feet, with several sections exceeding 6,000 feet.

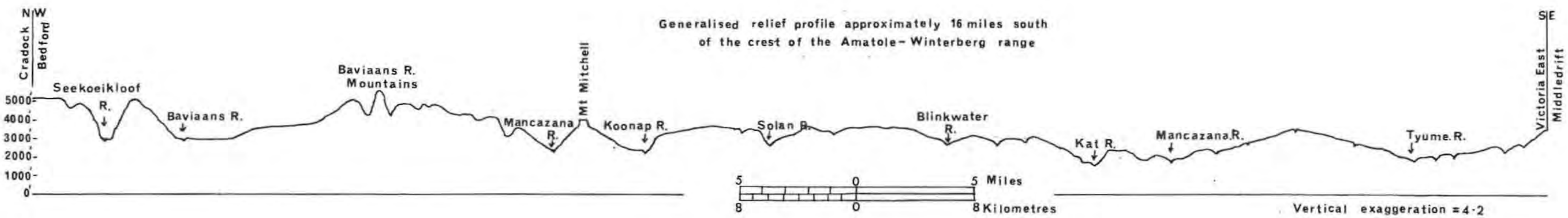
The highlands are considerably dissected by north-south valleys, on an average ten to fifteen miles apart, but sometimes considerably less than this. The lower parts of these valleys are below 2,000 feet in altitude. The Baviaans and Mancazana rivers penetrate some 20 miles northwards. The Waterkloof-Solan valley extends some 15 miles into the highlands, while the Koonap and Kat have cut embayments some 25 miles long. The Tyume is entrenched for about 16 miles within the highlands. The actual courses of these rivers, owing to widespread meandering, are considerably longer. Near their headwaters these rivers descend precipitously in spectacular gorges along relatively straight courses. Downstream their gradients become less irregular, and they follow highly meandering courses entrenched within the surrounding countryside.

These re-entrant valleys are separated from one another by spurs of highland which are being destroyed by the tributaries lateral to the main streams. The highest of these north-south spurs are in the Bedford district, where stream action is probably weakest owing to the rainfall being lower than that of the eastern part of the highlands. A belt of highland ranging from 6,000 feet in the north to 3,000 feet in the south separates the Baviaans River valley from the Great Fish River valley. Between the Baviaans River and the Mancazana River is the Baviaans River range, which exceeds 4,500 feet along most of the watershed. East of the Bedford district the interfluves are somewhat lower. Between the Mancazana and Koonap rivers is the Mynharts Kop-Mount Mitchell-Boesmanskop spur, the crest of which ranges from 4,250 feet in the north to 2,250 feet in the south. Separating the Koonap from the Waterkloof-Solan valley is the Little Winterberg-Bush Nek interfluve, with its crest ranging from over 5,000 feet to 3,000 feet. The Waterkloof-Solan valley is divided from the Kat River system by the Hermanuskop-Waterkloof spur, which exceeds 3,500 feet in altitude. The Kat and Tyume valleys are separated by very much more dissected country, their watershed ranging from over 5,000 feet to less than 2,500 feet. All the major highland rivers, with the exception of the Tyume, which flows into the Keiskamma, are tributaries of the Great Fish River.

The relief profile (page 6), parallel with the crest of the Amatole-Winterberg range and approximately 16 miles south of it, indicates the degree of dissection. It can be seen that the highland spurs tend to be lowest in the east.

Over much of the highlands there is a smoothing out of gradients into relatively level country at a height of 4,000 to 5,000 feet. This gently undulating surface can be discerned on the Kagaberg just north of Bedford, the Winterberg range, the fairly level country surrounding Gaikaskop and the three Hogsback ridges, and also in the area to the north and north-west of the Menziesberg.

Surmounting this surface, from which it is separated by scarps, is an even higher surface ranging from 5,500 to 6,500 feet.


Generalised relief profile approximately 16 miles south
of the crest of the Amatole-Winterberg range
NW
Cradock
Bedford
SE
Victoria East
Middledrift
5000'
4000'
3000'
2000'
1000'
0'
Seekoeikloof
R.
Baviaans R.
Baviaans R.
Mountains
Mancazana
R.
Mt Mitchell
Koonap R.
Solan R.
Blinkwater
R.
Kat R.
Mancazana R.
Tyume R.
5 0 5 Miles
8 0 8 Kilometres
Vertical exaggeration = 4·2

It occurs at the northern end of the Baviaans River Mountains, but the loftiest and largest area is the Great Winterberg plateau, which extends for some thirty miles in an east-west direction. It is surmounted by the Great Winterberg mesa (7,778 feet) on the border of the Adelaide and Tarkastad districts. Further east this apparently residual surface can be picked out on the crest of the Katberg (6,007 feet), the Elandsberg tableland (6,624 feet), the Gaikaskop monadnock (6,439 feet) and the three Hogsback ridges (6,360 feet). Although the Elandsberg overlooks Seymour, and the Hogsback is clearly visible from Alice, the actual crestlines of these eminences occur outside the boundary of our region. Lady Agnew believed that these summit areas were remnants of L.C. King's "Gondwana" cyclic landsurface, which was "bevelled by late Jurassic times, when the ancient continent of Gondwanaland was still of one piece, and stood at a height of about 2,000 feet above sea level." [1] In her paper on the Hogsback area she refers to these summit areas as the "Gondwana cyclic surface". However, L.C. King now regards the Gondwana surface as being confined to a much more limited area than previously supposed.[2] According to L.C. and L.A. King the early Tertiary or "African" surface in Natal slopes from sea level to 6,000 feet at the foot of the Drakensberg. The nearly 6,000 foot surface of the Transvaal highveld is also dated as early Tertiary or "African" in age.[3] The summit areas of the Amatole-Winterberg range are therefore more likely to be the remains of this "African" surface.

The 4,000 - 5,000 foot surface, which Agnew regarded as post-Gondwana,[4] is apparently post-African in age, for L.C. King

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[1] Swanzie Agnew, "The Landforms of the Hogsback Area in the Amatola Range", Fort Hare Papers, II (1958), p.2.

[2] L.C. King, "The Morphology of the Earth", Oliver and Boyd, 1962, p.57 and map opposite p.300.

[3] L.C. and L.A. King, "A Reappraisal of the Natal Monocline", S.A. Geographical Journal, Vol. XLI, 1959, p.24.

[4] Swanzie Agnew, p.2.

regards the area above 4,000 feet in the Eastern Cape Province as being a Quaternary surface.[1]

Much of these two high lying surfaces owes its preservation to the presence of numerous sills and dykes of resistant dolerite which give rise to impressive escarpments. The absence of the 4,000 - 5,000 foot surface on the eastern flanks of the Katberg can be attributed to the absence of major dolerite intrusions at this altitude in this area. Here the Kat River and its tributaries have been able to wear away the relatively weak Beaufort sedimentaries much faster than would have been the case with dolerite, thus allowing the deep valley to approach the 6,000 foot surface closely.

b) The Submontane Peneplain

South of the highlands lies the dissected surface of a peneplain, which slopes gently seawards from a height of approximately 2,500 feet in the west and 2,000 feet in the east. It reaches a minimum altitude of about 1,700 feet near Breakfastvlei in the south-east. Agnew refers to this surface as the "African master pediplain."[2] However, in the light of evidence supplied by L.C. and L.A. King this peneplain must be regarded as much younger than "African". L.C. King regards it, like the 4,000 foot surface, as being Quaternary in age, formed under scarp development and retreat upon the great arch of the Natal monocline.[3] During the Pliocene and Pleistocene periods the Karroo rocks of Natal were given an eastward tilt of from 5° to 45°. This mon-cline can be followed southwards to the mouth of the Umtata River in Pondoland.[4] South of the Umtata River du Toit presumes the folding to continue beneath the ocean off the Eastern Cape coast

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[1] L.C. King, "South African Scenery", Oliver & Boyd, 1963, p. 251.

[2] S. Agnew, "The Landforms of the Hogsback Area in the Amatola Range", Fort Hare Papers, II (1958), P. 2.

[3] L.C. King, p.251.

[4] A.L. du Toit, "Geology of South Africa", Oliver and Boyd, 1954, p.570.

eventually "to meet the prolongation of the Cape foldings in another 'syntaxis' corresponding to that of the Western Province." Oscillations of sea level corresponding with the monoclinal flexure would give rise to different base levels, each with its own cycle of erosion. The Kings refer to the "treppen" standing "around 2,000 and 4,000 feet" which "are specially prominent as in views from aircraft flying between Port Elizabeth and Durban." These surfaces "are separated from one another and from other surfaces by major scarps" which "are truly erosional scarps. As such their regularity implies that the treppen are cyclic within the Quaternary. The clear development of 2,000 and 4,000 feet stages could then perhaps be regarded as due to pauses in the general arching of the Quarternary monocline."[1]

The degree of dissection of the submontane peneplain is relatively great owing to the active headward erosion by streams emanating from the highlands. Near the highlands the irregularity of the surface is accentuated by the presence of dolerite intrusions. The peneplain surface is best developed along the interfluves separating the southward flowing streams. Between Alice and Breakfastvlei, on the interfluve separating the Kat and Keiskamma rivers, it has an average seaward slope of only 1 in 200 or 300, and in places is almost horizontal. Very gentle gradients occur in the Bedford district where an altitude of approximately 2,500 feet is maintained as far south as the Fish River Rand.

The sector of the submontane peneplain between the Koonap and Kat rivers is more irregular. Noteworthy eminences on this portion of the peneplain are Mount Prospect (maximum elevation 2,846 feet), 8 miles southeast of Adelaide, and Mount Pleasant (maximum elevation 2,434 feet), 8 miles southwest of Fort Beaufort. The Mount Prospect ridge is traversed by a dolerite dyke trending in a northwest-southeast direction. The width of the dolerite outcrop approximates only half a mile, whereas the ridge has an

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[1] L.C. and L.A. King, "A Reappraisal of the Natal Monocline", S.A.G.J., XLI, 1959, p. 25.

average width of some two miles. It thus appears that Mount Prospect is erosional rather than structural in origin and that peneplanation was incomplete at the time of uplift. Dolerite appears to be absent from Mount Pleasant, which has a crestline developed on relatively soft felspathic sandstones, suggesting that it too is an erosional rather than a structural feature. It appears that the two ridges are the remnants of a single ridge which has been breached by headward erosion of the Kroomie River.

In the south much of the submontane peneplain has been removed through widespread erosion by the Fish and Keiskamma rivers and their tributaries. A considerable part of this region is less than 1,000 feet in altitude, reaching a minimum of 250 feet at Committees Drift in the extreme south-east.

The Great Fish and the lower courses of its tributaries, together with the lower Tyume and the Keiskamma, follow tortuous meandering courses incised within their own flood-plains. Between the Koonap confluence and Committees the Great Fish River is confined to a gorge bordered by high cliffs. The most spectacular of these is Adam's Krantz, on the farms Bekker's Kraal and Nooitgedacht in the Victoria East district, which towers more than 1,000 feet above the river. Remains of rock cut terraces can be seen at various heights above the present level of the Great Fish River. They appear to be most common at 50 feet. Terraces of alluvium and consolidated river gravels are found at heights of up to 70 feet.

CHAPTER II

GEOLOGY

Apart from alluvial and other superficial deposits, the entire region is composed of sedimentary rocks of the Karroo System together with dolerite intrusions. As the area lies towards the south-east margin of the great Karroo basin of late Palaeozoic and Mesozoic age, and forms only a small part of it, the succession is confined to the Ecca and Beaufort Series. These late Palaeozoic and early Mesozoic rocks are correlated with the Permian and Lower Triassic of the Northern Hemisphere.[1]

ECCA SERIES

The Ecca Series, of Lower Permian age, occupy only 136 square miles, approximately 4.8% of the total area. They are chiefly in the extreme south of the Bedford district, where these rocks occupy an area of approximately 109 square miles from the latitude of Middleton southwards. Most of this area has not yet been mapped in detail by the Geological Survey, only a small section appearing on the Port Elizabeth Geological Sheet.[2] Approximately eight square miles of Ecca rocks crop out along the southern boundary of the Fort Beaufort district, just above and below the confluence of the Fish and Koonap rivers. In the Victoria East district the Ecca Series occupy 19 square miles of low-lying country in the extreme south. Both these areas are covered by Mountain's map,[3] from which most of the detail concerning the Ecca in these two districts has been obtained. Rocks of the Ecca Series are absent in the Adelaide and

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[1] A.L. du Toit, "The Geology of South Africa", Oliver and Boyd, 1954, p.292.

[2] A.W. Rogers, S.H. Haughton and E.H.L. Schwarz, Dept. of Mines and Industries Geological Survey, Cape Sheet 9, "Port Elizabeth", Govt. Printer, Pretoria, 1928.

[3] E.D. Mountain, Dept. of Mines Geological Survey, Sheet 136, "Grahamstown", Govt. Printer, Pretoria, 1946.

and Stockenström districts, which do not extend as far south a the other three districts.

A rough threefold division of the Ecca Series has been distinguished by both Haughton in the explanation of the Port Elizabeth sheet and by Mountain in the explanation of the Grahamstown sheet. The upper part of the lowest division, consisting of massive dark sandstones with subordinate shales, is present in the extreme south of the Bedford district. The middle division consists essentially of blue-black carbonaceous shales, and occurs in the Bedford district and the extreme south of the Victoria East district. On account of the non-resistant nature of the shales they give rise to flat low-lying country, particularly in the south-east.

The upper division occurs in the Bedford, Fort Beaufort and Victoria East districts. It consists predominantly of more resistant rocks such as massive sandstones and mudstones, forming more highly dissected country. There is an increasing development of deep bluish-green mudstones further up in the division in contrast to the olive-green dull mudstones commonly occurring at lower horizons. The uppermost part of the Ecca is also characterised by bluish-green quartzitic sandstone in thin bands.

In this area the boundary between the Ecca and Beaufort Series is difficult to delimit as no distinctive fossils have been discovered. Mountain states that "intensive search has led to the conclusion that the incoming of reddish and purplish mudstones and sandstones in appreciable quantities may satisfy the necessary requirements."[1]

The southernmost part of this area includes the northern margin of the Cape fold belt. The Ecca Series, together with the lowest horizons of the succeeding Beaufort Series, have been slightly involved in these Cape foldings, which have an east-west axis in this area. In general the dip is to the north, with minor anticlines and synclines.

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[1] E.D. Mountain, "Geology of an Area East of Grahamstown", Govt. Printer, Pretoria, 1946, p.19.

As can be expected, maximum dips are in the extreme south. In the southernmost part of the Bedford district the Lower Ecca has northward dips as steep as 60 degrees, and includes several steep-limbed anticlines and synclines, many of them asymmetric. This northward dip decreases to between 16° and 10° in the Upper Ecca around Middleton. At this locality a number of anticlines and synclines with dips of 15° or less have been observed. North of Middleton, where the Upper Ecca is succeeded by the Lower Beaufort, the northward dip becomes considerably less. In the latitude of Cookhouse, $32^{\circ}45'$ S., it appears to be less than 5° everywhere.

In the southernmost part of the Fort Beaufort district the upper division of the Ecca Series and the lowest horizons of the Beaufort Series are involved in a series of asymmetric folds with dips as steep as 30°. On the farm "Breede Drift" the northern limb of a syncline consists of Lower Beaufort beds dipping southwards at an angle of 30°. Approximately two miles to the north this gives way to a northerly dip of less than 5°. There is a succession of gently warped anticlines and synclines in the Lower Beaufort Series from here for 11 miles further north, to within 6 miles of Fort Beaufort. Dips become steeper at Tower Hill, some $5\frac{1}{4}$ miles south of Fort Beaufort, where the maximum angle of dip observed is approximately 32° along the southwestern limb of an anticline. The northeastern limb of this anticline has a maximum dip of 16°. At Fort Beaufort there is no evidence of folding, the rocks dipping to the north at an angle of less than 5 degrees.

Folding also occurs in southernmost Victoria East. On the farm "Double Drift" is a syncline with its southern limb, consisting of the uppermost Ecca, dipping northwards at an angle of 30°. The northern limb of this syncline, consisting of the lowermost horizons of the Lower Beaufort, dips southwards at 8°. A uniform northward dip of less than 5° commences within three miles north of the synclinal axis. On the farm "Groot Draai" both the uppermost Ecca and lowermost Beaufort dip northwards at angles of between 8 and 5 degrees. On the farm "Committees" black Ecca shales of the Middle Division dip south-westwards at an angle of 5° towards the Fish River. Less than three miles further north they dip north-westwards at 13°, indicating an asymmetric anticline. Further north, on the road to Breakfastvlei west of Bosch Plaats store, the Upper Ecca dips northwards at 15° steepening to 25° east of the store. This relatively steep dip towards the north continues for a few miles further north to include the lowermost horizons of the Beaufort Series. One mile north of Breakfastvlei, on the road to Alice, the northward dip in the Lower Beaufort is 15°. From here it flattens out to less than 5° at Lekfontein. Throughout the Bedford and Fort Beaufort Divisional Council area the northward dip in the Lower Beaufort is very gentle north of $32^{\circ}45'$ S. latitude. This marks the beginning of the enormous gently-flexed Karroo Basin.

BEAUFORT SERIES

According to the latest geological map of South Africa published by the Union Geological Survey,[1] approximately 95% of the Bedford and Fort Beaufort Divisional Council Area is occupied by rocks of the Beaufort Series together with dolerite intrusions. With the exception of the small area of Beaufort rocks appearing on the Grahamstown sheet, they have not been mapped in detail by the Geological Survey, and no large scale sheet maps have been produced. Professor E.D. Mountain has produced a map showing dolerite intrusions in the Hogsback vicinity, but does not indicate the various zones of the Beaufort Series present.

The Beaufort Series have been divided into three groups. These are the Lower Beaufort, which is correlated with the Upper Permian of Europe; the Middle Beaufort, correlated with the uppermost Upper Permian and the lowermost Lower Triassic; and the Upper Beaufort, which is correlated with the Lower Triassic.[2] These

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[1] Geological Map of the Union of South Africa, Govt. Printer, Pretoria, 1955.

[2] A.L. du Toit, "The Geology of South Africa", Oliver and Boyd, 1954, p. 292.

three groups are in turn divided into the following six palaeontological zones :-

Upper Beaufort	6	Cynognathus Zone
	5	Procolophon Zone
Middle Beaufort	4	Lystrosaurus Zone
Lower Beaufort	3	Cistecephalus Zone
	2	Endothiodon Zone
	1	Tapinocephalus Zone [1]

The most recent map showing the distribution of the various zones is that by F. von Huene.[2] A copy of part of it appears on page 16. Von Huene's map does not distinguish between the two zones of the Upper Beaufort. The summit of the Winterberg is shown to be occupied by the Molteno beds of the succeeding Stormberg Series, which appear to have a considerable east-west extent along the Winterberg plateau. However, the map in the latest edition of du Toit's "Geology of South Africa" does not indicate any Molteno beds as far south as this. Neither do they appear in this latitude on the latest geological map of South Africa published by the Geological Survey. There is certainly no palaeontological evidence for the occurrence of Molteno Beds in the vicininity of the Winterberg.

Lithologically the Middle Beaufort is distinguished from the Lower Beaufort by its horizons of coarse, very pale blue sandstones and bright red, maroon and purple mudstones and shales. These only become noticeable at a height of approximately 5,300 feet on the Katberg. As the northward dip is very slight, it appears that the sedimentary rocks of the entire post-Ecca area below 5,300 feet belong to the Lower Beaufort Series. This is in agreement with von Huene's map. According to du Toit the Middle Beaufort is "probably

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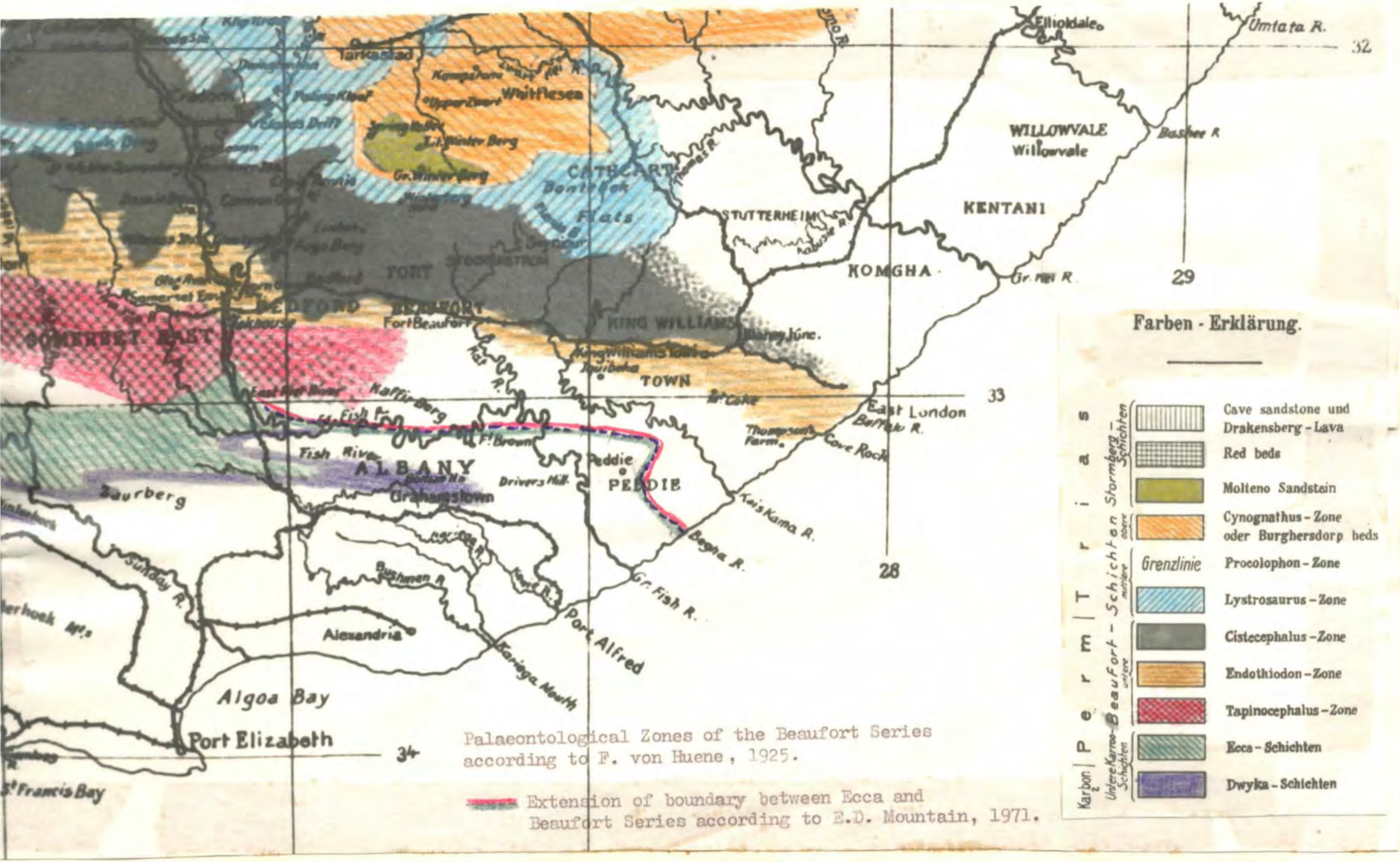
[1] A.L. du Toit, "The Geology of South Africa", Oliver and Boyd, 1954, p.292.

[2] F. von Huene, "Die südafrikanische Karroo-Formation als geologisches und faunistisches Lebensbild", Berlin, 1925.



Palaeontological Zones of the Beaufort Series according to F. von Huene, 1925.

Extension of boundary between Ecca and Beaufort Series according to E.D. Mountain, 1971.

Railway cutting between Deelkraal and Upsher sidings, Stockenström. Thickly bedded pale yellow felspathic sandstone of the Lower Beaufort Series overlain and underlain by thinly bedded grey-blue mudstone. The strata have a shallow dip towards the north (right).

Local unconformity in the Lower Beaufort Series, railway cutting between Deelkraal and Upsher sidings, Stockenström. The overlying layers of mudstone and sandstone can be seen to transgress the bedding planes of the underlying rocks. (See page 18.)

Dolerite dyke, near summit of the Katberg, looking west, February 1971. The photograph wastaken near the junction of the roads to Post Retief and Queenstown. At this point the dolerite intrusion is almost at right angles to the near horizontal sedimentary strata of the Beaufort Series, but it changes to a near horizontal sheet in a southerly direction, giving rise to the imposing cliffs on the south-eastern scarp of the Katberg.

The Elandsberg plateau under snow, August 1959, photographed from an elevation of 4,700 feet in north-eastern Stockenström. A capping sill of dolerite gives the fine free face. The maximum elevation of 6,624 feet, on the extreme right, is in the Cathcart district; the crag in the centre of the photograph, elevation 6,429 feet is in Stockenström. The 4,000 to 5,000 foot plateau in the foreground forms the watershed between the Elands and Tay Rivers, and is well grassed with <u>Themeda triandra</u> (rooigras or red grass).

over 1,000 feet thick about Rosmead" and "800 feet in the Transkei".[1] Including dolerite intrusions, the altitudinal range of the Middle Beaufort along the Amatole-Winterberg range must therefore approximate 1,000 feet. The Upper Beaufort can therefore occur only at altitudes exceeding approximately 6,300 feet. With the exception of the dolerite-capped summit of the Elandsberg, the only area exceeding this altitude is in the immediate vicinity of the Great Winterberg. Moreover, much of the area exceeding 6,300 feet is composed of dolerite, so that the Upper Beaufort group must occur in a very limited area only. Von Huene's map is thus incorrect in indicating Molteno Beds where they do not exist and in assigning too large an area to the Upper Beaufort group in the vicinity of the Winterberg.

The Lower Beaufort

More than 90% of the Bedford and Fort Beaufort Divisional Council Areas are occupied by the Lower Beaufort Series together with dolerite intrusions. The Lower Beaufort group consists of alternating shales, mudstones and sandstones which are seldom clearly laminated. The sandstones, pale-blue, grey or yellow in colour, tend to be massive and are usually felspathic. In some cases they weather spheroidally, and from a distance resemble mudstones. The hard, massive mudstones tend to be blue, pale-green or grey in colour, with conchoidal or splintery fracture, usually weathering spheroidally. Reddish or purplish mudstones are common at or near the base of the Series, where they are interbedded with greyish or greenish mudstones. The shales, blue or greeny-grey in colour, are rather sandy, and tend to be more clearly laminated than the mudstones. As a result of their splintery fracture they are reduced to a mass of irregular fragments when exposed to the elements. Intercalated with these rocks are relatively thin layers of sandy flagstones, yellow to grey-green in colour.

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[1] A.L. du Toit, "The Geology of South Africa", Oliver and Boyd, 1954, p. 294.

The strata are characterised by many local unconformities, often with a transverse length of only a few yards. Thus in road cuttings, cliffs and quarries layers of sandstone can be seen descending into a hollow in the underlying shales, rising again further on. Such transgressions of the bedding planes by shales and mudstones also occur. This indicates deposition in shallow pans or seasonal lakes, where recently deposited sediment was washed away by strong currents during flood periods. Such wash-outs also give rise to "tongues" and "lenses" of shale, or else erratic layers of "clay-pellet conglomerate", along or above the transgression.[1]

Zones of large, hard blue-black limestone concretions, in appearance like chert, occur in the shales and mudstones of the Lower Beaufort. Being more resistant, they remain behind as chocolate-coloured boulders up to a few feet in diameter after the surrounding rock has been weathered away.

The Middle Beaufort

Middle Beaufort rocks appear to occur in a very narrow zone exceeding 5,300 feet on the Amatole-Winterberg range. Du Toit sums this group up as follows: "Conspicuous are its horizons of bright red, maroon and purple mudstones alternating with bluish and greenish varieties and with pale bluish sandstones, capped by a very thick bed of bluish to yellow felspathic sandstone responsible for bold scarps and plateaux".[2]

The sequence of rocks at the base of the Middle Beaufort is clearly observed on the Katberg Pass along the road from Fort Beaufort to Queenstown. As this area apparently has not been previously described, it would be best to give a detailed description of the rock sequence. At a height of about 5,300 feet, where the road to Post Retief branches off from the main road, very

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[1] A.L. du Toit, "The Geology of South Africa", Oliver and Boyd, 1954, p.293.

[2] Ibid.

pale blue and lilac felspathic sandstones first appear.[1] They are in marked contrast with the yellow felspathic sandstones immediately below them. This probably could be the base of the Middle Beaufort. Further up the road leading to the Stockenström-Queenstown boundary thick layers of lilac sandstones alternate with thinner beds of white and yellowish sandstone. Intercalated with these sandstones are very thin bands of chocolate-red and maroon shales, which do not appear at lower levels. There is an interesting horizon of extremely pale blue sandstone containing numerous red clay pellets. Less than a mile from the grid on the Stockenström-Queenstown boundary, at a height of just over 5,500 feet, is a very narrow horizon of bright brick-red sandstone in marked contrast with any sandstones observed at lower levels. Beyond this the sequence is pale yellow sandstone followed by pale blue and lilac sandstone. The latter is intruded by a dolerite dyke stretching for 100 yards along the road. Beyond the dyke a zone of very fine-grained red micaceous shale stretches for over 30 yards. This is succeeded by a narrow dolerite dyke about 6 yards wide dipping southwards at approximately 30°. The invaded sediments dip northwards at angles of less than 5°. Beyond this dyke lilac sandstone stretches as far as the grid. This sandstone appears to be of considerable thickness as it continues along the hills on either side of the road. All the sandstones mentioned above are felspathic and rather coarse grained, in contrast with the finer grained sandstones prevalent in the Lower Beaufort.

DOLERITE

In the central and northern areas the Beaufort Series have been invaded by numerous dykes, sills and sheets of dolerite. According to du Toit "the precise inferior limit to the age of these rocks is unknown. From their intimate relationship to the Stormberg basalts they were apparently intruded at the end of the

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[1] This is less than two miles from the Stockenström-Queenstown boundary.

Jurassic Epoch."[1] With the exception of a long, linear outcrop near the southern boundary of the Bedford and Fort Beaufort Divisions, dolerite intrusions are absent south of a line passing from 2 miles south of Alice to about 11 miles south of Bedford and 8 miles south of Cookhouse.

Owing to its much greater resistance to erosion than the sedimentary rocks, dolerite gives rise to hills and mountains. The Amatole-Winterberg range, which constitutes the highest part of this area, is closely associated with dolerite intrusions, some of which are several hundreds of feet thick. The highest points almost invariably occur on dolerite. This basic crystalline rock, blue-black when fresh, frequently displays a columnar structure, as can be seen along the summits of the Hogsback, Katberg and Winterberg. As elsewhere in South Africa, it often has a strongly developed system of cross-jointing, which gives rise to a characteristic spheroidal weathering, so that the dolerite hills and mountains are characterised by huge domes and round boulders, generally rusty in colour. Dolerite has the merit of breaking down to form a black or dark brown clay soil which is far more fertile than that derived from the weathering of the adjacent sedimentary rocks. The majority of the larger sills and sheets are more or less parallel with the bedding planes of the invaded sedimentaries. However, Mountain has described how at the Hogsback an inverted cone of sedimentary rock about 1½ miles across is entirely surrounded by three dolerite sheets dipping centrally beneath the sedimentaries.[2]

A very narrow outcrop of dolerite occurs well to the south of the southern limit of frequent dolerite intrusions. This stretches for ninety miles from west of Cookhouse in the Somerset East district, through the Bedford, Adelaide, Fort Beaufort, Albany and Victoria East districts into the Peddie district, where it

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[1] A.L. du Toit, "The Geology of South Africa", Oliver and Boyd, 1954, p.370.

[2] E.D. Mountain, "The Hogsback Dolerite", S.A. Journal of Science, Vol. 52, 1956, pp. 163 - 165.

terminates six miles north-east of Peddie village.[1] The sheet crosses the highly meandering courses of the Koonap and Fish rivers five and six times respectively, and has been termed the "Fish River sheet" by Mountain. According to him the sheet is about 100 feet thick and dips northwards at about 25^{o}, whereas the invaded sediments are horizontal or inclined at a small angle to the south. The width of the outcrop does not exceed 100 yards, which is very slight compared with the intrusions further north. Mountain states that "within a few feet of the contact the invaded sediments adopt the attitude of the dyke", regardless of their general dip. "This is analogous to fault drag and, indeed, suggests that the dolerite may be intruded along a fault plane."[2]

SUPERFICIAL DEPOSITS

In general the rivers flow in incised channels, with the result that strips of alluvium are extremely narrow, often being confined to the slip-off slopes on the insides of meanders. Belts of alluvium are usually widest at stream confluences. The broadest and most extensive zone of alluvium occurs along the Great Fish River valley on the western boundary of the Bedford district, but it is seldom more than a few hundred yards wide. The alluvium usually occurs in terraces up to 50 feet or more above the present river beds.

Consolidated river gravels are sometimes encountered along the Great Fish River at a height of some 70 feet above the river bed. They consist of water-worn pebbles and boulders of various materials roughly held together by calcareous cement. Good examples can be seen at Committees just above the bridge on the left bank.

Whitish calcareous tufa is widespread in the low-lying Great Fish and lower Koonap valleys, particularly where the surface is

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[1] E.D. Mountain, "Geology of an Area East of Grahamstown", Govt. Printer, Pretoria, 1946, p.24.

[2] Ibid., p.25.

fairly flat. It forms a crust up to three feet thick resting directly on the underlying Karroo rocks, usually shales and mudstones, which are generally splintered and cracked, thus allowing the tufa to penetrate them. According to du Toit this surface limestone appears to have been "formed by the evaporation of ground water bringing to the surface carbonates derived from the underlying rocks."[1] Its occurrence is therefore due to the low rainfall of the area.

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[1] A.L. du Toit, "The Geology of South Africa", Oliver and Boyd, 1954, p.445.

CHAPTER III

CLIMATE[1]

The latitude of the Bedford and Fort Beaufort Divisions, approximately 32° to 33° South, places them well within the Warm Temperate Zone. Their interior position in the south-eastern Cape, approximately 30 to 120 miles from the coast, makes them a zone of transition between the relatively humid coastlands and the arid interior. The general increase in altitude, from less than 1,000 feet in the south to approximately 6,000 feet in the north has a profound effect on the climate, so that there tends to be a series of east-west trending climatic zones. As elsewhere in the south-eastern Cape, the two major air masses affecting this region are dry, adiabatically heated air descending from the interior, and cool moist air from the nearby ocean. Tropical maritime air masses from warmer water to the northeast occasionally invade the area, mainly during the summer months. The area is affected by the succession of eastward moving depressions and anti-cyclones which have their centres to the south of the continent. During midsummer the mid-latitude depressions usually pass too far south to affect the weather, and during midwinter they are often excluded by the prevailing high pressure over the interior. Consequently the passage of depressions over the Bedford and Fort Beaufort Divisions is most frequent in the spring and autumn, when, as can be expected, the weather is extremely variable.

CLIMATIC REGIONS

The entire region is characterised by a summer rainfall maximum; approximately two thirds of the precipitation occurs in

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[1] With the exception of climatic data for three stations, viz. Alice, Fort Hare and Surrey, all climatic data in this chapter have been obtained from the South African Weather Bureau publications, "Climate of South Africa", Vols. I & II, Govt. Printer, Pretoria, 1954, or else by correspondence with the Weather Bureau. The precipitation figures for Alice have been obtained from the Town Clerk's office. All meteorological data for Surrey and Fort Hare are from the author's personal records.

the summer half year, viz. October to March. With the exception of the extreme north-eastern portion of the highlands, March is everywhere the wettest month. Despite differences in rainfall totals, there is little difference in seasonal distribution from one part of the region to another. The percentage of precipitation received during the summer half year varies from a maximum of 71% at Hogsback in the north-eastern highlands to a minimum of 63% at Cheviot Fells in the north-western highlands. The percentages for Middleton, Bedford, Fort Beaufort and Lovedale are 65%, 69%, 68% and 67% respectively. These are for periods ranging from 79 to 66 years. Schumann and Hofmeyr have divided South Africa into rainfall districts, homogeneous in respect to "phase" and "relative amplitude."[1] The Bedford and Fort Beaufort Divisions occupy the less arid eastern portion of their "Rainfall District 12". No evaporation data exist for any stations in these Divisions. According to a generalised iso-evaporation map of South Africa, based on data from stations outside the area, the deduced evaporation rate from a free water surface ranges from over 55 inches per annum in the eastern part of Victoria East to approximately 65 inches in the extreme west of the Bedford district.[2] This map makes no allowance for the effect of varying altitude and the corresponding temperature changes which obviously must affect the evaporation rate to some extent. It would appear, however, that in the area lying south of a line running from Alice to Bedford the average rate of evaporation from a free water surface is more than double the average amount of precipitation received.

Using the Köppen System of climatic classification, the climate of the Bedford and Fort Beaufort Divisions may be divided into four types, viz. Cfa, Cfb, BSh and BSk.[3]

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[1] T.E.W. Schumann and W.L. Hofmeyr, "The Partition of a Region into Rainfall Districts", Quarterly Journal of the Royal Meteorological Society, London, Vol. LXIV, 1938, pp. 482-488.

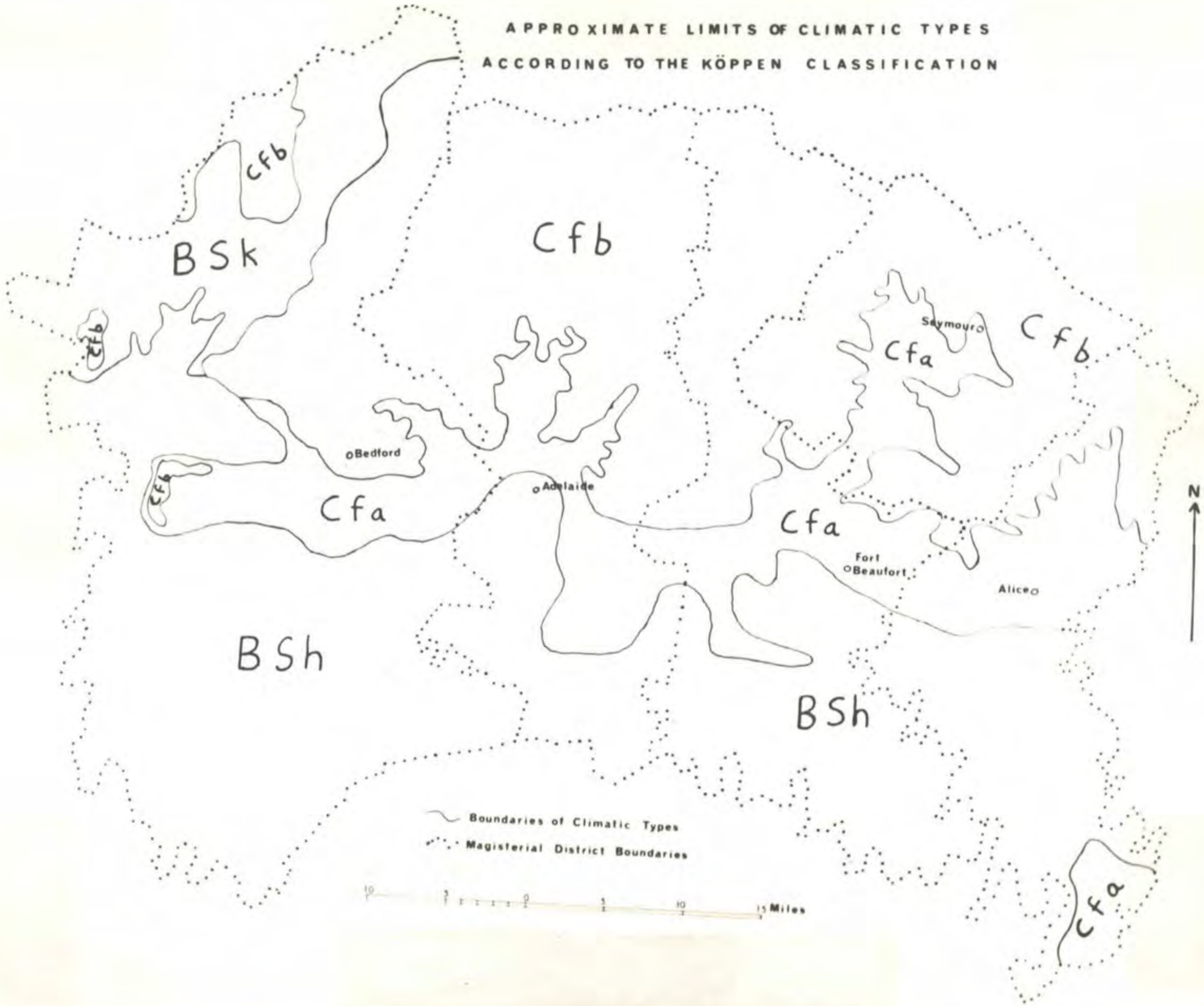
[2] Iso-Evap. Map of the Union of South Africa, Irrigation Dept., Govt. Printer, Pretoria, 1947.

[3] For elucidation of the Köppen System see London Essays in Geography, Longmans, Green, 1951, pp.116-118 and B. Haurwitz and J.M. Austin, Climatology, McGraw Hill, 1944, pp. 106-128.

Köppen's B or Dry Climates are distinguished from the C Climates, and also all other climatic groups, by an empirical aridity criterion based on potential evaporation and determined by the formula $R \leqq 0.44\ T - K$, where R is the mean annual precipitation in inches and T the mean annual temperature in degrees Fahrenheit. K is an empirical constant depending on the seasonal rainfall distribution. According to the Köppen System the entire area is one of all season precipitation, for the rainfall of the driest winter month is more than one tenth that of the wettest summer month, and the driest summer month receives more than one third of the rainfall of the wettest winter month. The value of K for this area is therefore 8.5. Within the Dry Climate group a distinction is made between BW (desert) and BS (steppe) climates, the boundary between the two corresponding with a mean annual rainfall of $\frac{0.44\ T - K}{2}$ inches. No part of this area has a rainfall low enough for the climate to be classified as BW. Köppen designates steppes and deserts as either hot (h) or cool (k), the boundary between the two corresponding with a mean annual temperature of 64.4°F. (18°C.). In the Bedford and Fort Beaufort Divisions the BSh or hot steppe climate is confined to the relatively low-lying southern portion of the region. (See map of Climatic Types on page 26). The BSk or cool steppe climate occurs in the north-western rainshadow areas where the altitude exceeds approximately 2,000 feet, viz. the Great Fish River valley from the vicinity of the Baviaans River confluence northwards and also the Baviaans River valley.

The remainder of this region is occupied by C Climates or Warm Temperate Rainy Climates. These are distinguished from other humid climates by their winter temperatures, which, according to Köppen, must average less than 64.4°F. (18°C.) but more than 26.6°F. (-3°C.).[1] The C Climates of the Bedford and Fort Beaufort Divisions may be regarded as Cf, i.e. wet at all seasons, as the driest summer month receives more than one third of the rainfall of the wettest winter month and the driest winter month receives more

[1] By this is meant the mean temperature of the coldest month.


APPROXIMATE LIMITS OF CLIMATIC TYPES
ACCORDING TO THE KÖPPEN CLASSIFICATION
Cfb
BSk
Cfb
Cfb
Cfa
Seymour
Cfb
Cfb
Bedford
Adelaide
Cfa
Cfa
Fort Beaufort
Alice
N
BSh
BSh
Cfa
Boundaries of Climatic Types
Magisterial District Boundaries
10 5 0 5 10 15 Miles

than one tenth of the rainfall of the wettest summer month.

In addition to his first order subdivisions based on the seasonal distribution of precipitation Köppen was responsible for compiling second order subdivisions based on temperature. For the C type there are two of these, designated by the symbols a and b, indicating long hot summers and long warm summers respectively. The boundary line between the two corresponds with the mean warmest month temperature of 71.6°F. (22°C.). In general open country exceeding approximately 2,000 feet in altitude may be regarded as experiencing the Cfb type of climate, whereas the warmer areas below this altitude experience the Cfa type. In the entrenched valleys, however, the boundary between the Cfa and Cfb types occurs at higher altitudes, at approximately 2,500 feet, this value being dependent on the width and depth of the valley concerned.

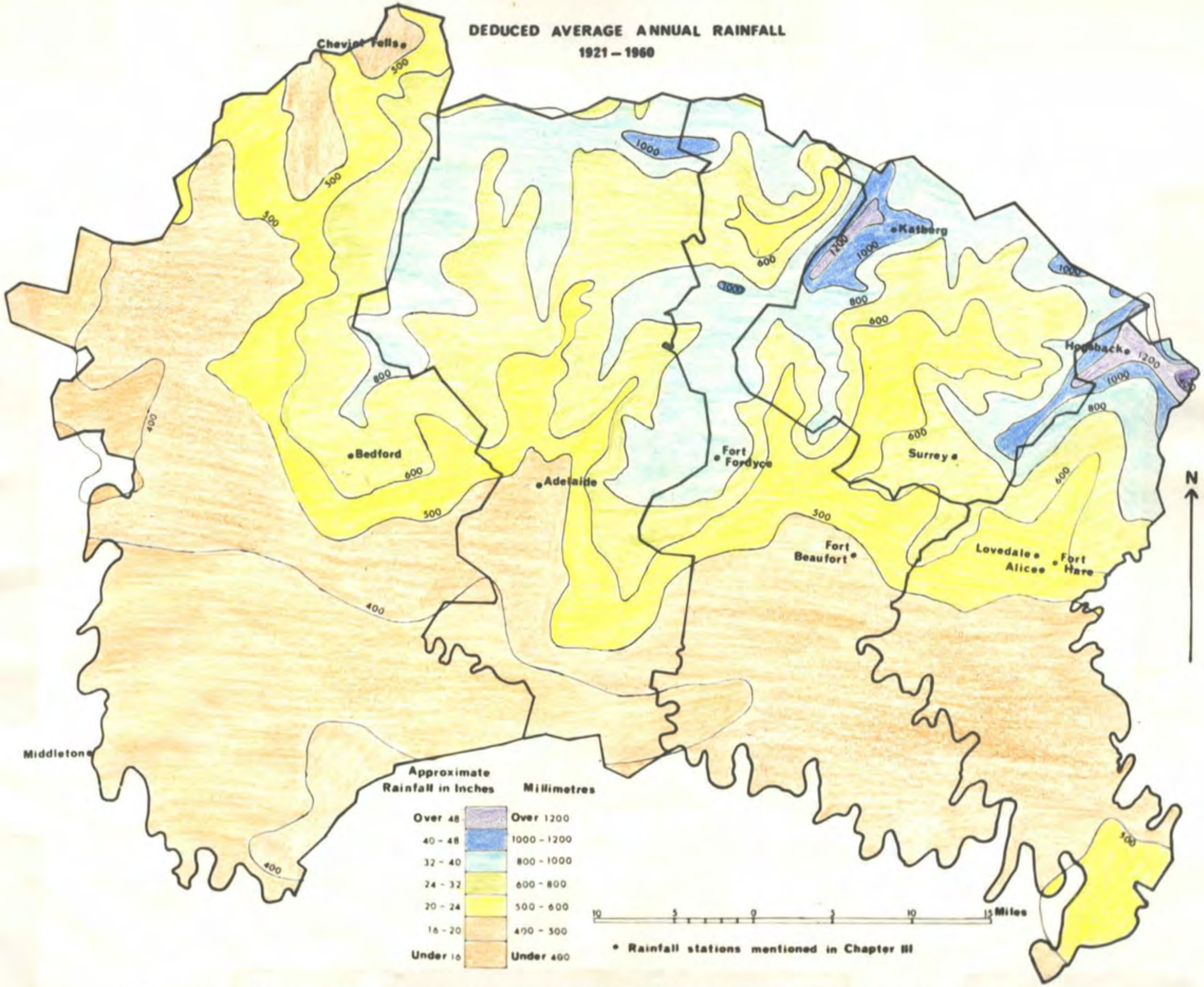
PRECIPITATION

The tables below give the average monthly and annual rainfall in inches for three stations in the most densely populated portion of the region, viz. Bedford (1881-1950), Fort Beaufort (1879-1950) and Lovedale (1881-1950), together with the extreme monthly totals up to 1950 for Bedford and up to 1955 for Fort Beaufort and Lovedale.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
Bedford													
Average	3.03	3.52	3.93	2.15	1.53	0.94	0.85	0.97	1.93	2.53	2.92	2.88	27.18
Abs.Max.	8.69	11.54	8.99	6.30	5.95	3.37	6.27	2.84	7.78	6.35	9.72	8.39	38.25
Abs.Min.	.45	.43	.55	.05	.00	.00	.00	.01	.00	.25	.15	.60	12.52
Fort Beaufort													
Average	2.08	2.60	2.92	1.74	1.19	0.64	0.68	0.72	1.52	1.98	2.12	2.10	20.29
Abs.Max.	5.15	8.60	5.90	5.64	4.64	3.09	5.44	6.24	7.70	9.90	6.85	5.64	35.54
Abs.Min.	.20	.09	.40	.03	.00	.00	.00	.00	.00	.00	.00	.00	7.36
Lovedale													
Average	2.48	2.60	3.05	1.81	1.46	0.87	0.91	0.87	1.57	2.01	2.52	2.48	22.63
Abs.Max.	6.25	6.58	6.65	6.15	5.99	7.17	7.06	3.82	7.60	7.69	8.30	6.46	38.06
Abs.Min.	.71	.35	.35	.00	.12	.00	.00	.00	.00	.39	.24	.19	8.92

From the above figures it can be seen that March is the wettest month at all three stations, while midwinter is the driest period.

DEDUCED AVERAGE ANNUAL RAINFALL
1921 – 1960



Isohyets compiled and drawn by the Hydrological Research Division, Department of Water Affairs, from data obtained from the Weather Bureau, Department of Transport, Pretoria.

At Lovedale the number of days per annum with 0.01 inch or more of rain averaged 102 over a twenty year period. The maximum was 122 and the minimum 72 days. During this period the monthly distribution of rainy ways was as follows:

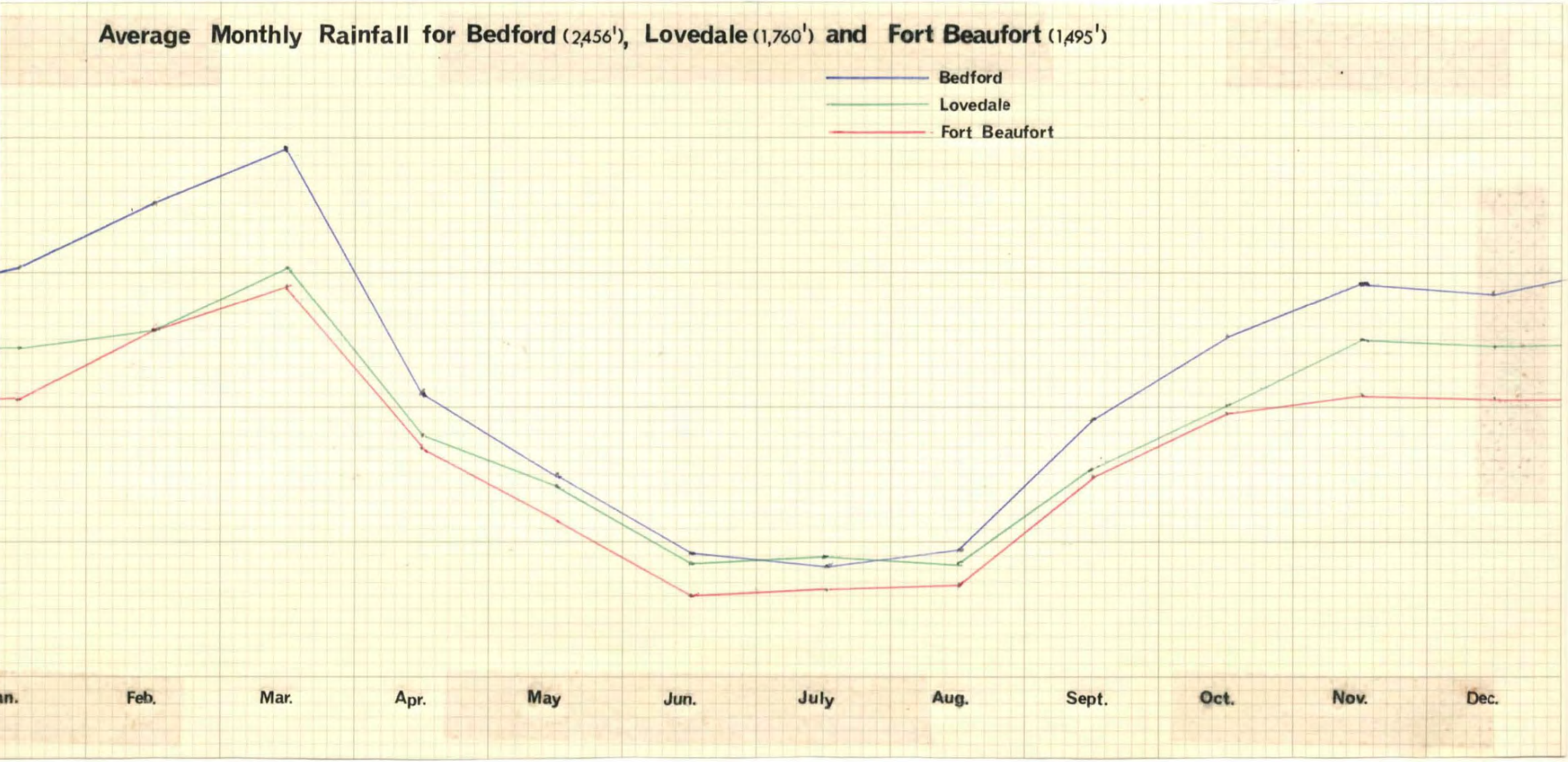
Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year.
9.7	10.5	11.4	8.1	6.5	4.5	5.9	4.9	8.0	10.4	11.8	10.3	102.

It can be seen that at Lovedale November and March have the maximum number of rainy days, with the minimum occurring in June. The number of rainy days decreases to approximately 80 per annum in the extreme west of the area. Somerset East, which lies beyond the western boundary, has 84 rainy days per annum, but in western regions away from the mountains the number must be considerably less than this.

The absolute maximum and minimum rainfall figures for Bedford, Fort Beaufort and Lovedale show that all three stations are susceptible to great departures from the mean in any particular month or year. The rainfall regime is erratic and unreliable, both in total amount and in periodicity. The conditions at Lovedale (average annual rainfall 22.63 inches) may be regarded as typical of the submontane and intermontane areas. The lowest average annual rainfall ever recorded at Lovedale (1881-1960) was 8.92" in 1927, followed by 9.84 inches in 1945. Rainfalls below 15 inches were recorded during three other years, viz. 11.39 inches in 1949, 13.90 inches in 1919 and 14.12 inches in 1904. This gives a rainfall of less than 15 inches on an average of one year in twenty. During the 80 year period from 1881 to 1960 the rainfall of Alice and Lovedale was below 20 inches during 20 years, i.e. an average of one in every four years. The maximum annual precipitation at Lovedale was 38.06 inches in 1886 followed by 36.36 inches in 1891, 36.16 inches in 1953, 32.45 inches in 1917 and 32.22 inches in 1950.

The period of greatest variability at Lovedale was that of 1945 to 1951, when the annual totals were as follows:

1945	9.84"	1949	11.39"
1946	21.98"	1950	32.22"
1947	17.46"	1951	15.09"
1948	21.39"		


Average Monthly Rainfall for Bedford (2,456'), Lovedale (1,760') and Fort Beaufort (1,495')
Bedford
Lovedale
Fort Beaufort
Jan.
Feb.
Mar.
Apr.
May
Jun.
July
Aug.
Sept.
Oct.
Nov.
Dec.

As a result of the lack of rainfall, both in total amount and regularity, African farmers of Victoria East harvested normal crops during only two of these seven years. Definite limits are set on agriculture when the variability is so great.

Effect of Relief on Precipitation

As the highlands are approached there is a progressive increase in precipitation, as can be seen from the following mean annual rainfall figures of adjacent mountain and valley stations. All the figures are for periods exceeding fifty years:

FortFordyce	(3,750 ft.)	35.82"	Adelaide (1,966 ft.)	18.57"
Katberg	(3,450 ft.)	41.34"	Fort Beaufort (1,495 ft.)	20.29"
Hogsback	(4,200 ft.)	49.91"	Lovedale (1,760 ft.)	22.63"

It is noticeable that the easternmost mountain areas are more humid than those to the west. There is a marked diminution of precipitation at the top of the escarpment, the rain shadow being indicated by forest giving way to open grassland. However, this may be due to greater exposure to wind, sun and frost. A large proportion of the precipitation in these east-west trending ranges is orographic, being caused by south-easterly and sometimes south-westerly winds ascending their southern flanks. Mist and drizzle, which is frequent in summer, is at a minimum in winter, when south-easterly winds are least frequent. At this time of the year south-westerly winds in the rear of depressions sometimes bring rain or snow to the escarpment. It is rare for snow to lie lower than 3,500 feet. However, old residents of this area have informed the writer that in one winter during the Anglo-Boer war snow fell on hills which are as low as 2,300 feet. Snow can be expected as early as April and as late as October on the highest areas. On rare occasions snow may fall in midsummer, but these light falls are very short-lived. A notable exception was the heavy snowfall of December, 1906. Old residents inform the writer than on Christmas Day of that year the Katberg was covered in snow down to a height of 5,000 feet or less. On December 7th and 8th, 1970, the writer observed snow at a similar altitude throughout the region.

The following table gives the mean monthly rainfall in inches for Hogsback Village (4,200 feet) over a 65 year period (1886 - 1950):

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.
Rainfall	6.30	6.08	6.11	3.61	2.42	1.63	1.55	1.85
% Excess over Lovedale	254	234	200	199	166	187	170	213

	Sep.	Oct.	Nov.	Dec.	Year
Rainfall	3.47	5.04	5.61	6.24	49.91
% Excess over Lovedale	221	251	223	252	220

It can be seen that the percentage excess over Lovedale is greatest during the spring and summer months, when orographic rain is more frequent. Moreover, the convectional thunderstorms of summer tend to travel along the highland escarpments.

The western highlands are very much drier than the eastern, as shown by the average rainfall figures in inches for Cheviot Fells (4,400 feet) for the period 1892 - 1959:

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
1.83	2.11	2.68	1.79	1.46	.83	.75	.71	1.29	1.51	1.87	1.81	18.64

The frequency of orographic rain makes the eastern highlands less susceptible to drought than the lowlands, e.g. the lowest annual rainfalls ever recorded at the previously mentioned highland stations are as follows:

Cheviot Fells	8.56 inches	(1949),	46% of	mean	annual
Fort Fordyce	12.98 "	(1899),	36% "	"	"
Katberg	23.94 "	(1945),	55% "	"	"
Hogsback	29.34 "	(1927),	59% "	"	"

These highlands are important as the sources of southward flowing streams, which supply both irrigation and domestic water to the relatively dry lowlands. Owing to their nearness to their head-waters and the irregular rainfall, these rivers, however, are characterised by small volume and erratic regime; perennial flow occurs along the upper courses of only two rivers, viz. the Kat and the Tyume. The Tyume is perennial as far as Alice, but during dry spells the Kat River ceases to flow some miles north of Fort Beaufort. Along the Koonap conditions are even worse, for while its water reaches Adelaide in most years, it has on occasions become stagnant throughout its entire course.

As the deeply entrenched Fish River valley is approached in the south and west of the area there is a progressive decrease in precipitation, although there is no change in seasonal distribution. As can be expected, rainfall is lowest in the extreme south-west, where there is a combination of low relief and increased distance from the sea.

Middleton (1,670 feet), just across the south-western border of the Bedford district, is the driest of all those stations for which long term precipitation data are available. The following table gives the mean monthly rainfall in inches for Middleton for the period 1878 - 1959 :

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
1.34	1.55	1.87	1.30	.91	.46	.47	.54	.96	1.26	1.32	1.31	13.29

During this period the wettest year was 1886 with 24.66 inches and the driest year was 1927 with only 4.73 inches.

Drought

Schumann has tabulated the frequency of droughts of different duration (in months) for each of the rainfall districts of the Union.[1] He assumes that a condition of drought is reached as soon as the moving twelve-monthly totals of precipitation fall to 75% of the annual average, and that this condition continues until the moving twelve-monthly totals have again risen to 75%. These moving monthly totals "serve in a way to depict the full course of the rainfall history and especially the cumulative effect of periods of abnormal precipitation." For district 12, the eastern part of which is occupied by the Bedford and Fort Beaufort Divisional Council areas, such drought occurred during 10.16% of the period covered by Schumann's data.

[1] "District Rainfall for the Union of South Africa", W.B. 6, Pretoria, 1949, p.50.

Schumann has constructed a second table giving the frequency and duration of the periods during which twelve-monthly totals were less than 60% of the mean annual rainfall. In rainfall district 12 such severe drought occurred during 1.59% of the period covered by the data.

Intensity of Rainfall

Another important factor is the intensity of rainfall as shown by the following figures for Lovedale. In 1947, a "dry" year, 8.58" of the total annual rainfall of 17.46" fell on 12 days. In 1944, a "normal" year, 11.06" of the total annual rainfall of 23.09" fell on 12 days. At this station falls exceeding 0.39 inches occur on an average of 16.3 days per annum.

Surrey Farm, less than 7 miles to the north-west of Lovedale, has a slightly higher average annual rainfall (23.9 inches) compared with 22.6 inches for Lovedale, but shows the same type of concentration.

Year	Number of days on which more than one inch of rain was recorded	Total rainfall recorded on those days	Total rainfall for year
1953	11 days	24.55 inches	40.79 inches
1954	3	3.93	24.27
1955	5	6.31	19.90
1956	7	10.74	26.33
1957	2	2.36	17.59
1958	3	4.12	23.62
1959	11	17.97	30.22
1960	1	1.06	19.07
1961	2	3.13	21.58
1962	4	6.70	19.72
1963	6	9.58	32.33
1964	7	12.26	26.28

As a result of the short, sharp showers of summer convectional storms a large percentage of the summer rainfall is wasted as runoff or else is evaporated before penetrating the soil to any depth.

Thunderstorms occurred on an average of 29.4 days per annum at Lovedale over a twenty year period. The maximum number of storms occurred in March (4.6 days), November (4.4 days) and February (4.4 days). During this period thunder was recorded on an average of only 0.1, 0.4 and 0.5 days during the months of June, July and August respectively. Although hail frequency is considerably less than over the high interior plateau, viz. 1.3 days per annum at Lovedale and 1.7 days per annum at Somerset East, it sometimes causes extensive damage to crops during the summer months.

Heavy falls of rain sometimes occur in winter, when eastward moving depressions traverse the area. Owing to the longer duration and more gentle nature of the winter rain compared with that of summer, far more water is caught by the vegetation and is absorbed by the soil, where it filters downwards to replenish underground water supplies. Springs and boreholes are always stronger during the summers following good winter rains, even if the summers happen to be dry. The evaporation rate is also much lower in winter, so that half an inch of winter rainfall may be more effective than an inch of summer rainfall. Unfortunately it is during the winter months that the variability is greatest. Thus at Alice and Surrey the July rainfall averaged 0.99 and 1.35 inches respectively during the period 1953 to 1959. This is approximately 9% above normal, yet in five of those seven years the rainfall was below normal, usually considerably so, as the following figures show:

July Rainfall in inches

	Alice	Surrey
1953	0.33	1.03
1954	1.44	1.73
1955	0.24	0.22
1956	0.15	0.13
1957	0.36	0.82
1958	0.06	0.21
1959	4.34	5.28
7 year average	0.99	1.35

The same tremendous deviations from the mean can be seen in the figures for the month of August.

August Rainfall in inches

	Alice	Surrey
1953	4.00	5.18
1954	0.41	0.47
1955	0.65	0.78
1956	0.86	0.80
1957	0.22	0.44
1958	0.76	0.99
1959	1.91	2.17
7 year average	1.26	1.55

Rainfall Variability

In South Africa the idea prevails amongst many farmers that the rainfall is less than it used to be. J.H. Wellington writes: "That there has been a decrease in rainfall effectiveness, due in part to bad methods of farming, is generally agreed, but the argument about the decrease in actual amount has been clouded by the fact that a station could generally be found in the locality concerned to justify both sides."[1]

We have information on the climate of the Eastern Cape from early travellers such as Lichtenstein, as well as missionaries who lived in the Tyume valley after 1820. Lichtenstein distinguishes between the winter rainfall of the Western Cape and the summer rainfall of the Eastern Cape.[2] He says "seldom a week passes in summer without at least two thunderstorms." All these storms come from the same quarter, the mountains to the north-west. He mentions the sharp lightning, tremendous claps of thunder and torrential rain, as well as the hot air accompanying a north wind "so that when under the

[1] J.H. Wellington, "Southern Africa", Vol. I, Cambridge University Press, 1955, p.269.

[2] H. Lichtenstein, "Travels in Southern Africa", Vol. I, van Riebeeck Society 10, Cape Town, 1928, pp. 349-352.

wind one seems as if by a large fire." The Eastern Cape appears to have been susceptible to droughts from early times, for Lichtenstein writes about the drought of 1804 and 1805 which "at least occasioned a great defalcation (sic) in the usual quantity of corn ... and the Koosas lost a great number of cattle for want of food for them."

More precise information on the climate of the last 70 to 80 years is contained in the temperature and rainfall records kept at a number of stations in the south-eastern Cape. T.E.W. Schumann and his weather bureau colleagues point out that "the rainfall at individual stations is extremely variable, and even neighbouring stations show such widely divergent tendencies over a long period that it is not only difficult, but also inadvisable and even misleading, to use separately the data of a few individual stations in order to make deductions about the rainfall over larger areas."[1] In their study the basic data of a number of representative stations in Schumann and Hofmeyr's districts of homogeneous "phase" and "relative amplitude" are combined in order to analyse the reliability. A total of nineteen stations in District 12 was used by Schumann to construct a smoothed percentage rainfall curve for the period 1878 to 1946. Eleven of the nineteen stations used for the construction of this curve are in the Bedford and Fort Beaufort Divisional Council area.[2]

From this curve, a copy of which appears on page 37, it can be seen that while the rainfall was considerably above normal from 1885 to 1895, it was below normal from 1897 to 1904, from 1923 to 1930, and from 1944 onwards. For the rest of the period it was approximately normal. The wet period from 1885 to 1895 stands out as an isolated phenomenon succeeding a much drier period. There is thus no evidence of a progressive decrease in precipitation.

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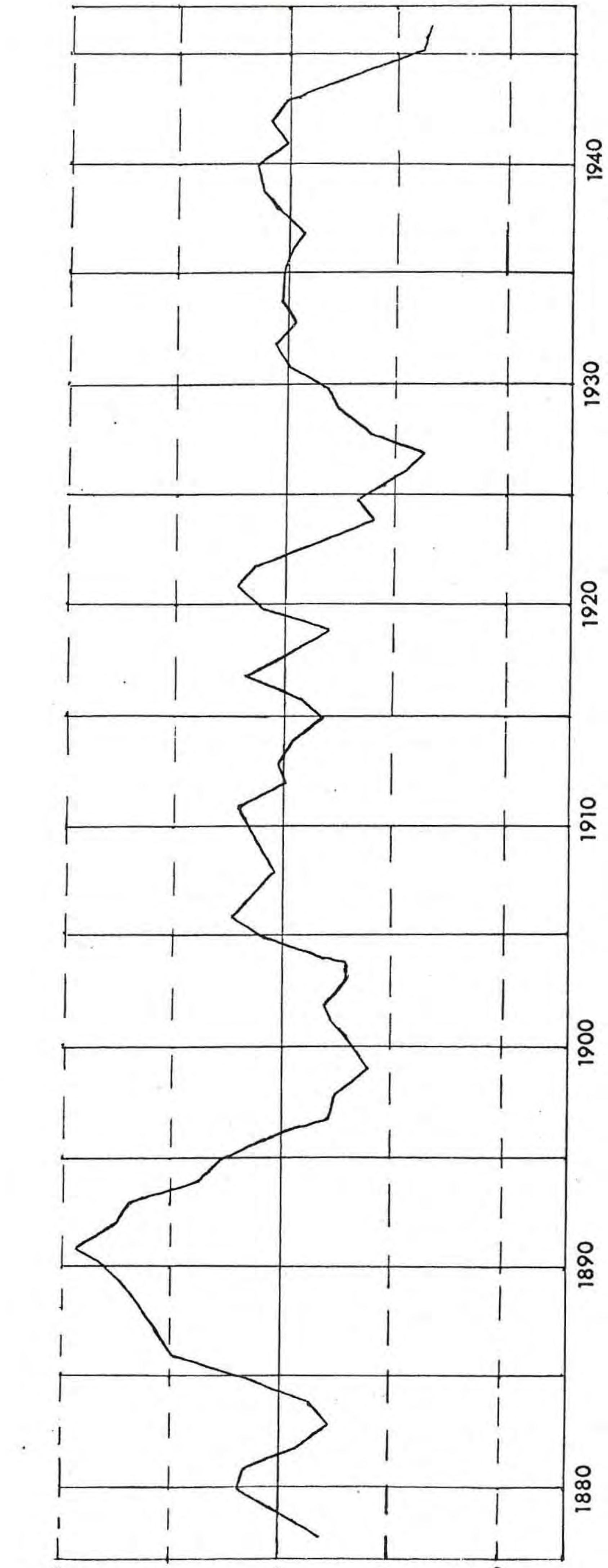
[1] District Rainfall for the Union of South Africa, W.B.6, Pretoria, 1949, p.1.

[2] Ibid., p.5.

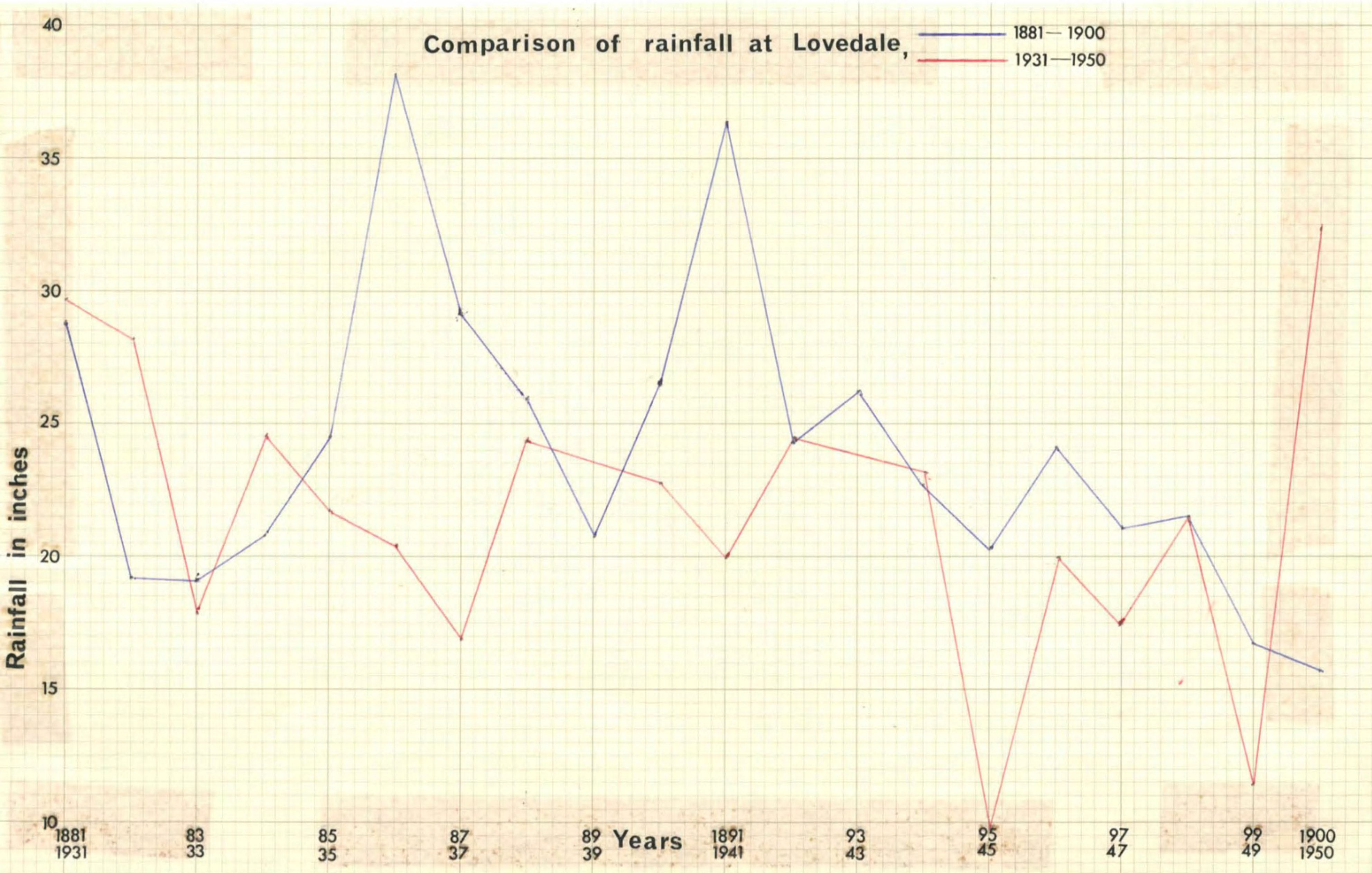


SMOOTHED PERCENTAGE RAINFALL CURVE
DISTRICT 12
(after T. E. W. Schumann)

Although it is inadvisable to use the data of individual stations, it is interesting to note that at Lovedale the rainfall averaged 23.9 inches during the period 1881 - 1900 compared with 21.8 inches during the period 1931 - 1950. The graph on page 39 clearly shows the higher rainfall of the earlier period. However, even in the so-called "wet cycle", great discrepancies can be seen between consecutive annual totals. The sequence of wet years may be regarded as a random phenomenon in what is normally an erratic rainfall regime. These wet years were also characterised by great variability from month to month, a condition typical of the present time. Thus in 1886, the wettest year ever recorded at Lovedale, there were pronounced dry spells, as the following figures show:

	Rainfall	Days
January	4.63 inches	10
February	6.36	10
March	2.08	11
April	3.02	11
May	0.60	4
June	0.08	1
July	7.06	8
August	0.26	5
September	0.93	6
October	4.76	6
November	1.95	8
December	6.33	12
TOTAL	38.06	92

Moreover, the total number of rainy days was almost 10% below the average of 102 in this year of maximum rainfall, indicating heavy showers with more runoff than normal. One cannot therefore avoid coming to the same conclusion as that reached by eminent South African writers, viz. that the apparent desiccation of this area, like that of other parts of the country, is due to overstocking and other bad farming practices, which have led to the destruction or deterioration of the natural vegetation cover.


Comparison of rainfall at Lovedale,
1881— 1900
1931—1950
Rainfall in inches
40
35
30
25
20
15
10
Years
1881 1931
83 33
85 35
87 37
89 39
1891 1941
93 43
95 45
97 47
99 49
1900 1950

Cloud

As may be expected from the summer rainfall maximum of this area, summer is much cloudier than winter. This is illustrated by the following figures for Lovedale:

	Cloud Amount 0 - 10		
	0800 hours (20 years)	1400 hours (12 years)	Mean
January	4.7	5.0	4.85
February	4.9	5.2	5.05
March	5.1	4.7	4.9
April	4.3	4.3	4.3
May	3.9	3.7	3.8
June	2.9	3.0	2.95
July	3.1	2.8	2.95
August	3.3	3.5	3.4
September	4.1	4.3	4.2
October	5.1	3.5	4.3
November	5.1	4.8	4.95
December	4.7	4.9	4.8
Year	4.3	4.1	4.2

TEMPERATURE

Temperature data are available for only five stations in the entire region. These are Lovedale, Fort Beaufort, Balfour (Wilsonia), Bedford and Surrey. Temperature records were kept at Lovedale from 1880 to 1955, when, unfortunately, the station was closed. At Bedford records were kept from 1892 to 1925, at Fort Beaufort from 1930 to 1958 and at Balfour from 1936 to 1952. At present the only station where regular temperature records are kept is that established by the author in December, 1952 at Surrey farm.

Mean temperatures for the warmest and coolest months at the five stations are as follows:

Lovedale	1,760 feet	73.4°F. (February)	54.9°F. (July)
Fort Beaufort	1,495 feet	72.1°F. (January & February)	54.0°F. (July)
Balfour	2,300 feet	72.0°F. (January)	52.0°F. (July)
Surrey	2,095 feet	71.1°F. (January	54.9°F. (June)
Bedford	2,456 feet	70.7°F. (January & February)	53.1°F. (July).

From the above data it can be seen that the climates of Lovedale, Fort Beaufort and Balfour belong to the Cfa group, whereas those of Surrey and Bedford fall just within the Cfb group. The greatest mean annual temperature range (20°F.) is at Balfour, which lies further inland than the other stations with the exception of Bedford, and has an unusually high summer temperature for its altitude owing to its being surrounded by high mountains on three sides. The smallest mean annual temperature range is that of Surrey, which is situated near the upper end of the northwest-southeast trending Mancazana valley.[1] During winter the station is susceptible to warm northwesterly berg winds which are funnelled along the valley, and during summer it regularly experiences cool southeasterly winds which blow down the valley. In the vicinity of Surrey much of the watershed between the Kat and Tyume river basins is less than 3,000 feet in altitude, so that maritime influences are not excluded to the same extent as in the intermontane valleys to the west. True comparisons between the various stations cannot be made, however, as they functioned over different periods.

Mean Temperatures in degrees Fahrenheit for Lovedale (1,760 feet)[2]

	Max.	Min.	Mean
January	86.9	59.5	73.2
February	86.4	60.4	73.4
March	82.9	58.3	70.7
April	78.4	52.3	65.3
May	73.6	46.2	59.9
June	69.8	41.2	55.6
July	68.7	40.8	54.9
August	72.5	43.2	57.7
September	75.5	47.3	61.3
October	78.1	51.3	64.6
November	81.1	55.0	68.2
December	84.4	57.4	70.9
	78.3	51.1	64.6

[1] Not to be confused with the Mancazana valley in the Adelaide district.

[2] For period 1931 - 1950.

From the temperature data for Lovedale, which may be regarded as typical of the relatively low-lying areas adjacent to the highlands, it can be seen that the summers are long and hot, four months having mean temperatures exceeding 70°F. March, which is supposed to be an autumn month, is almost as hot as December. There are only four months with a mean temperature of less than 60°F. The mean annual temperature of 64.6°F. may be regarded as decidedly warm. It is unfortunate that no data are available for the highlands or for the very low-lying areas. At Hogsback village (4,000 feet) the mean annual temperature should approximate 58°F., whereas in the lower parts of the Great Fish River valley it probably approaches 70°F.

Frost

Although the winters are mild and sunny, frost may be expected from May to September in the submontane region, and in deep upland valleys the period during which frost is possible is longer than this. At Lovedale temperatures below freezing point were recorded on an average of 5.7 days per annum over a twenty year period,[1] the monthly distribution being as follows:

May	0.2 days
June	1.3 "
July	3.2 "
August	0.9 "
September	0.1 "

Ground frost is observed on an average of about thirty mornings per annum.[2] Ground frost is defined as a grass temperature of 30.4°F. or below.[3] The Lovedale observations, however, are based merely on the visibility of frost on the ground, as the station was not equipped with a grass minimum thermometer. At Surrey the difference between

[1] 1931 - 1950.

[2] Lovedale Missionary Institution, Report for 1939, p. 72.

[3] "Observer's Handbook", Meteorological Office, H.M.S.O., London, 1952, p. 178.

grass and screen minimum temperatures was found to average approximately 4°F. on calm winter nights, although on one occasion it was as much as 10°F.

At Lovedale the mean absolute minimum temperatures over a thirty year period[1] were as follows:

January	49.1°F.	July	28.9°F.
February	49.5	August	31.5
March	46.6	September	35.2
April	40.3	October	39.4
May	34.3	November	43.9
June	31.3	December	46.4

Minimum temperatures as low as 25°F. have been recorded in June and July. It must be borne in mind, however, that the Lovedale weather station was situated on a hill slope 40 to 50 feet above the alluvial plain of the Tyume. Cold air from the surrounding uplands drains onto the flat alluvial land bordering the rivers to give minimum temperatures usually lower than those enumerated for Lovedale. The absolute minimum temperatures for Surrey, Balfour, Fort Beaufort and Bedford are 23°, 22.1°, 18° and 26.1°F. respectively. It would appear that low absolute minimum temperatures are experienced in the deep valleys north of Fort Beaufort, Adelaide and Bedford.

Winds

The mean annual wind frequency at Lovedale for the fifteen year period from 1940 to 1954 was as follows:

N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm
6	11	23	257	30	99	93	65	147

Wind directions were observed at 8.30 a.m. and 3 p.m. from 1940 - 1947 and at 8 a.m. and 2 p.m. from 1948 onwards.

South-easterly winds blew for 35% of the time during which observations were taken. They are most common in summer, particularly when the pressure gradient is slight and the sky is clear. During

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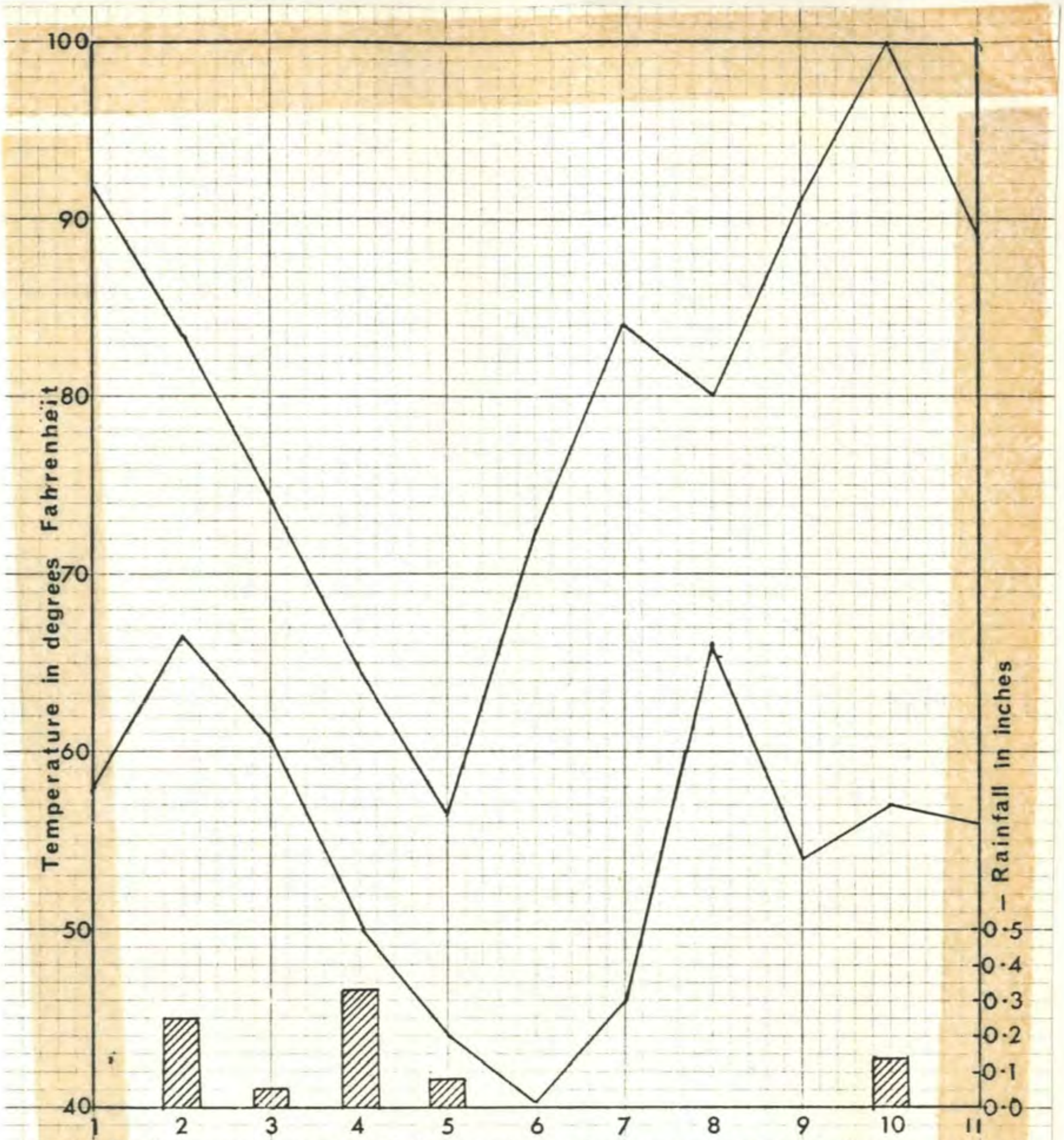
[1] 1921 - 1950.

the day the greater heating of the land causes the overlying air to ascend, and air from the sea moves in at right angles to the coast to take its place. This south-easter usually becomes noticeable in the early afternoon, and reaches its maximum velocity round about sunset. It is unusual for this wind to blow for more than two hours after sunset. When associated with a depression or coastal anticyclone this wind is not confined to any particular time of the day.

The south-easter can bring rain when general pressure and humidity conditions are favourable, but as a sea breeze it does not bring rain to the lowlands. Owing to cooling on ascent, the normal "sea breeze" south-easter often brings mist and drizzle to the highlands, particularly those eastern sectors which exceed 4,000 feet in altitude, with clear or partly cloudy skies over the lowlands. Only occasionally does it result in general overcast conditions. Although the sky may not be overcast, this influx of maritime air, which lowers the temperature and raises the relative humidity, serves as a reviver to vegetation which has been wilting in the hot noonday sun. Heavy dew often forms after the wind has dropped.

South-westerly winds accompany about half of the annual precipitation of the area, and are thus of considerable importance. They were recorded on 14% of the occasions when observations were taken at Lovedale. South-westerlies serve as the importers of polar air, resulting in a drop in temperature, often accompanied by rain. They may bring snow to the highlands, mainly in winter. During the warm season they often accompany eastward moving convectional thunderstorms with heavy rain. The graph overleaf shows maximum and minimum temperatures at Surrey for the first ten days of January. On the 2nd and 10th January warm south-westerly winds accompanied thunder showers, while on the 4th and 5th January cold south-westerlies brought polar maritime air accompanied by sharp showers alternating with bright spells.



Daily maximum & minimum temperatures at Surrey farm, 1st to 11th January 1960, showing invasion of polar air followed by berg wind conditions.

Throughout the year berg winds, generally from a north-westerly direction, can bring high temperatures and low humidities. The gradient necessary for their occurrence can be produced by the presence of either an anticyclone on the plateau, or a depression on the coast, or by a combination of the two. Since the plateau anticyclone is a winter phenomenon and coastal depressions are more frequent in winter, berg winds are more common during this season. When these winds blow in advance of the trough of a depression a distinct weather pattern is observed. The berg wind usually begins in the early morning, blowing from the north-west and backing to west-north-west or west as the barometer falls. The temperature increases as the wind approaches west. The wind remains steady for some time before backing suddenly to south-west as the trough of the depression passes. The temperature then falls rapidly, sometimes by as much as 30°F. in two or three hours.

Figure A (page 47) shows the barograph recordings at Fort Hare when the troughs of two coastal depressions traversed the area within 58 hours of each other. The first berg wind was succeeded by cold dry air from the south-west, the second berg wind was also succeeded by cold air from the south-west which apparently undercut a humid airstream, resulting in half an inch of rain at Fort Hare and snow on the mountains.

It is significant that precipitation is often associated with the passage of high pressure cells following in the rear of depressions along the coast. Figure B (page 48) shows how the rain commenced on August 5th when the trough of a depression passed over Fort Hare, bringing fresh cold south-westerly winds. 0.35 inch rain was recorded, while snow fell on the mountains. On August 7th moderate south-westerly winds and rain once more commenced when the pressure began to rise rapidly, but this time there had been no preceding drop in pressure. An amount of 0.4 inch of rain was recorded, followed by 0.04 inch on August 8th. It would appear that this rain was brought by a coastal anticyclone following the depression which traversed the area earlier in the week. The weather began to clear on August 9th, after the pressure had reached its maximum. Maximum temperatures (in degrees Fahrenheit) at the nearby farm of Surrey during this week were as follows:-

4th	84°
5th	50°
6th	59°
7th	64°
8th	48°
9th	55°
10th	69°

A number of conditions must be fulfilled for coastal highs to bring precipitation, and the amount of rain brought to the lowlands is usually not very large. Depressions, however, can bring exceptionally

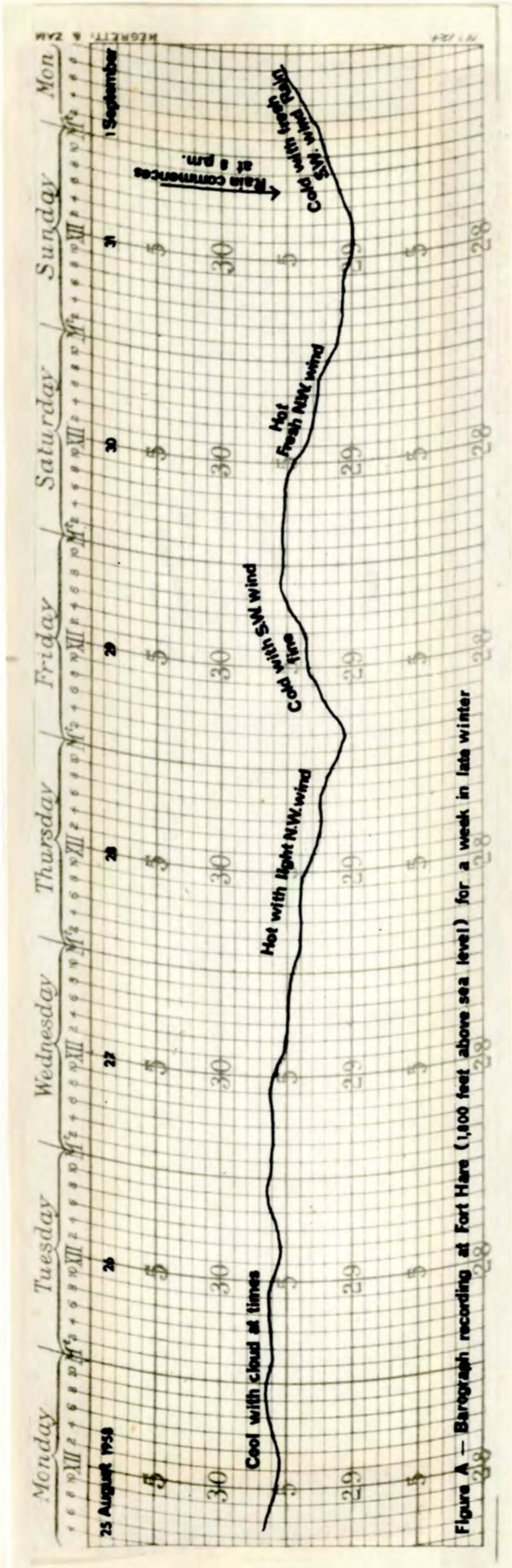


Figure A — Barograph recording at Fort Hare (1,800 feet above sea level) for a week in late winter heavy falls. This happened in July 1958, when south-westerly winds brought 3.20 inches of rain to Fort Hare and 4.56 inches to Surrey farm within a period of 52 hours.

Figure C (page 50) shows the pressure changes when persistent berg wind conditions gave way to a coastal high, which brought cold south-westerly winds and light rain. Maximum temperatures at Surrey during this week were as follows:

22nd September	78^{o}
23rd	83^{o}
24th	78^{o}
25th	84^{o}
26th	81^{o}
27th	56^{o}

These berg winds were of lower velocity and temperature than normal.

Figure D (page 51) shows the pressure changes and other weather phenomena when a berg wind gave way to a south-easterly air stream in spring. The maximum temperatures and rainfalls at Surrey were as follows:

October 14th	98^{o}F.	.08 inch
15th	78^{o}F.	.14 inch
16th	57^{o}F.	.30 inch
17th	61^{o}F.	.10 inch
18th	65^{o}F.	Nil

The above examples demonstrate how berg winds play an important part in the general pattern of weather in the south-eastern Cape. They are often gusty, with a velocity exceeding 20 m.p.h. Owing to their low humidity, high temperature and relatively high velocity, they accelerate evaporation considerably from the thin skeletal soils, with a very harmful effect on plant life. Owing to the frequency of berg winds the records of submontane weather stations all show abnormally high absolute maximum temperatures. At Lovedale the mean absolute maximum temperatures are as follows:

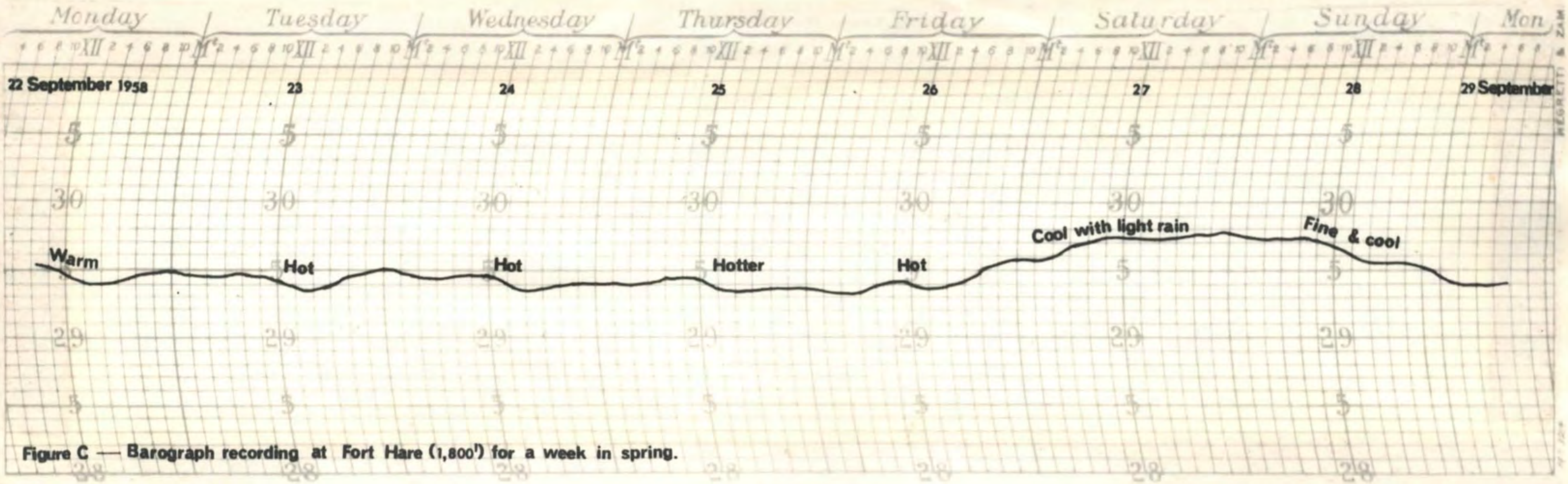


Figure C — Barograph recording at Fort Hare (1,800') for a week in spring.

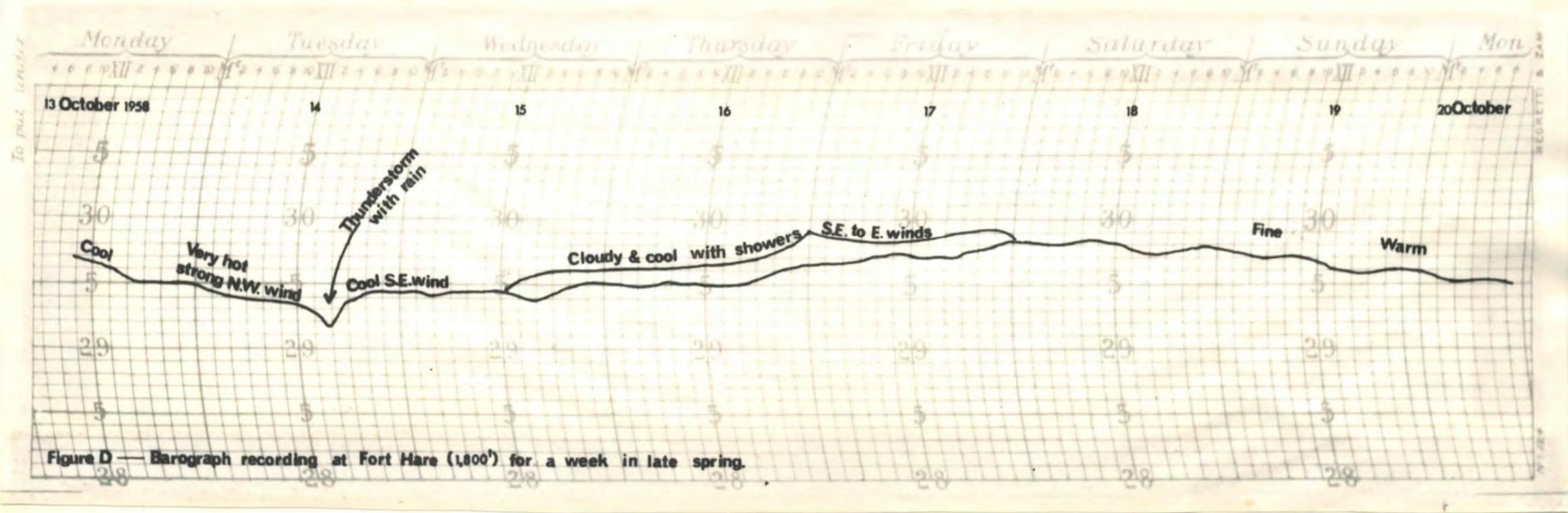


Figure D — Barograph recording at Fort Hare (1,800') for a week in late spring.

January	106.3°F.	July	82.9°F.
February	104	August	90.3
March	100.2	September	97
April	95	October	97.2
May	88.3	November	100.8
June	82	December	102.7

On 10th February 1945 a berg wind resulted in the highest temperature yet recorded at this station, viz. 114.4°F. At Lovedale temperatures of 100 degrees or more occur on an average of nine days per annum, the record being 23 days in 1931.[1] Conditions at Lovedale are typical of the submontane parts of the region, where the mean absolute maximum temperature exceeds 95°F. from September to March.

Despite all the disadvantages of berg winds they must be regarded as the heralds of precipitation. Such functions have already been referred to as far as winter and spring are concerned. In summer they can usher in tropical maritime air with very pronounced rainy spells. Thus on 27th December 1957 a berg wind brought a maximum temperature of 107.7°F. to Surrey farm, followed by cooler weather with rain on 20 of the 24 succeeding days. Berg winds which are not followed by rain can have a disastrous effect on dryland crops. This was the case at Surrey (2,095 feet) during January 1956, when the maximum temperature averaged 90.7°F., and the rainfall for the month was only 0.55 inches. During that month temperatures of 100°F. or more were recorded on eight days. Similar summer conditions have occurred on previous occasions, with even higher temperatures at lower altitudes. North-westerly winds blew for about 9% of the time during which observations were taken at Lovedale.

At Lovedale westerly winds are almost as frequent as south-westerlies. They are far more common in winter than in summer, usually bringing cool to cold, dry weather. However, berg winds sometimes blow from the west, in which case temperature conditions are very different to those of the normal westerly. In summer

[1] Lovedale Missionary Institution, Report for 1951, p. 71.

westerly winds sometimes accompany eastward moving thunderstorms.

Southerly winds blew for about 4% of the time during which observations were taken. They are usually cool and rainless. Easterly and north-easterly winds occur on even fewer occasions. Easterly winds are sometimes associated with cloud and rain as coastal anticyclones move north-eastwards, but often the synoptic situation is unfavourable for cloud or rain, and they are associated with fine weather. Northeast winds normally owe their origin to the semi-permanent South Indian Ocean anticyclone and are usually associated with fine, warm weather.

MONTHLY RAINFALL IN INCHES, 1953-1970, SURREY FARM
(ELEVATION 2,100 FEET), SOUTH-EASTERN STOCKENSTRÖM. (Extremes Are Underlined)

	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	Average	Median
January	2.40	2.04	1.82	0.55	1.21	4.19	2.41	3.13	1.61	0.95	5.16	1.11	1.20	2.89	2.66	0.15	0.45	1.85	1.99	1.84
February	4.25	1.98	3.99	2.03	3.48	1.59	1.35	1.42	1.23	4.18	1.62	5.40	0.58	3.02	1.02	0.49	6.12	3.91	2.65	2.01
March	1.59	5.35	1.40	5.19	3.29	2.40	3.07	2.21	5.07	4.41	6.81	3.43	0.87	1.21	3.67	1.78	3.13	0.76	3.09	3.10
April	2.23	2.04	1.60	0.76	1.37	1.79	3.34	1.38	1.45	1.51	4.06	1.14	2.44	1.08	3.35	2.83	1.62	0.63	1.92	1.61
May	0.63	3.02	0.74	1.80	0.72	1.41	2.78	0.86	3.04	0.61	1.31	0.33	1.91	1.31	3.46	0.92	0.57	1.08	1.47	1.20
June	0.78	1.24	1.80	0.04	0.56	0.38	Nil	0.51	0.87	0.50	0.42	3.21	2.28	0.24	1.00	1.29	0.96	2.34	1.02	0.83
July	1.03	1.73	0.22	0.13	0.82	0.21	5.28	0.62	0.33	0.13	3.32	0.35	0.96	0.04	2.01	0.38	1.21	0.45	1.07	0.54
August	5.18	0.47	0.78	0.80	0.44	0.99	2.17	1.08	1.77	0.44	0.37	1.78	0.55	2.02	0.53	1.45	0.70	11.25	1.82	0.90
September	4.42	1.39	1.46	3.31	0.72	1.90	1.71	2.39	0.41	0.23	0.39	2.12	1.31	2.07	0.53	4.73	0.36	0.57	1.67	1.43
October	8.40	1.62	2.47	1.94	1.10	1.63	0.87	1.23	1.09	2.63	3.00	2.17	5.92	0.73	0.58	1.62	2.23	1.66	2.27	1.65
November	4.74	2.52	3.09	5.91	1.34	1.76	2.45	1.68	3.78	1.55	2.45	2.12	4.09	4.03	1.65	1.46	3.25	0.85	2.71	2.45
December	5.14	0.87	0.53	3.87	2.54	5.37	4.79	2.56	0.93	2.58	3.42	3.12	0.48	0.81	0.87	0.83	0.21	7.13	2.56	2.55
YEAR	40.79	24.27	19.90	26.33	17.59	23.62	30.22	19.07	21.58	19.72	32.33	26.28	22.59	19.45	21.33	17.93	20.81	32.48	24.24	22.09

The church at Glen Lynden, built 1828.

The Presbyterian Church at Eildon, built 1958.

Both churches are constructed from local sand-stone, that at Glen Lynden from darker sandstone of the middle Lower Beaufort Series, that at Eildon from lighter sandstone of the upper portion of the Lower Beaufort Series.

Sweet Grassland, Kroomie. Brunsvigia gregaria, a common geophyte, is here seen in flower, April 1966.

Dwarf Karroid Shrub Steppe, July 1966, Great Fish River valley, south-western Bedford district. Notice the complete absence of grass. In the foreground is an open community of small-leaved xerophytic chamaephytes, mainly Pentzia incana, together with Aloe striata. On the horizon can be seen the taller Aloe ferox and microphanerophytic trees, the rounded crowns of which are probably the result of heavy browsing.

Karroid Acacia Savannah, Eildon Kloof, Baviaans River valley. Thomas Pringle writes that, in June 1820, "we were occupied two entire days in thus hewing our way through a rugged defile, now called Eildon-cleugh, scarcely three miles in extent."

Olea africana dominant on exfoliated dolerite, Eildon Kloof. The small tree in the foreground is Cussonia paniculata.

2nd February, 1968.

Encephalartos cycadifolius, unique to the Baviaans River valley and the adjoining mountains, can here be seen growing on bare, exfoliated dolerite in Eildon Kloof.

2nd February, 1968.

Looking north along a farm boundary in a small valley bordering the Mancazana River valley, Stockenström district, altitude 2,100 feet - 2,400 feet. Various stages in the reversed succession of Scrub Woodland can be seen. The climax stage of Scrub Woodland can be seen to the right of the fence on the mesocline. To the left overgrazing has resulted in the destruction of the woodland, which has been replaced by Acacia Savannah. Notice the large donga occupying the valley bottom. The xerocline in the foreground has degenerated even further. Here all grass has disappeared, leaving bare ground with an association of the Karroid shrublet, <u>Chrysocoma tenuifolia</u>.

January, 1965.

Pachypodium bispinosum, showing the large, underground, tuberous stem in which food and moisture is stored. A twelve inch ruler indicates the scale. P. bispinosum is abundant in the more arid portions of the Great Fish River valley.

Overgrazed Fish River Scrub, showing community of
Euphorbia bothae, Aloe speciosa and Portulacaria afra,
southern Fort Beaufort district, August 1965.

OVERGRAZED FISH RIVER SCRUB

Southern Fort Beaufort district

Aloe speciosa in flower, August 1965. Notice the complete absence of grass.

Euphorbia bothae in flower, Portulacaria afra in background, August 1965.

Scrub Woodland, Koonap River valley, north of Adelaide, Adelaide district. Aloe ferox, attaining a maximum height of more than 15 feet, dominates a rocky slope. In the immediate foreground is Asparagus plumosus, a relatively tall specimen occurring to the left of the man in the photograph.

April, 1960.

Scrub Woodland, looking east towards the Kat River from Tower Hill, five miles south of Fort Beaufort, July 1966. Arable land and citrus orchards occupy the alluvial land on the banks of the Kat River. In the foreground, across the road, is Euphorbia tetragona. Aloe pluridens, in fruit, is in the immediate right foreground.

Scrub Woodland looking west at Tower Hill, February 1971. Euphorbia tetragona is dominant in the left background, while the greener Portulacaria afra is dominant in the right foreground. Paradoxically no fence or change in soil type separates these strikingly different consociations. (A photograph taken in 1960 showed the same pattern.)

Euphorbia tetragona in Scrub Woodland on the upper margins of the Great Fish River valley, altitude approximately 1,200 feet, south-eastern Victoria East district. The scrub in the foreground consists mainly of Ptaeroxylon obliquum and Jatropha capensis.

April 1968.

Scrub Woodland, Mancazana River valley, north of Adelaide, Adelaide district. The dominant tree here is Olea africana together with Cassine crocea, and, in the foreground, young specimens of Acacia Karroo.

May, 1966.

Highland Karroid Grassland, northern Bedford. Looking ENE from Cheviot Fells, elevation 4,550 feet, towards De Beers Pass. Karroid shrubs, consisting mainly of <u>Chrysocoma tenuifolia</u>, are conspicuous in the foreground. The photographer was standing a few yards north of the northern boundary of the Karroid Acacia Savannah, which is very abrupt here. Only a few stunted specimens of <u>Acacia karroo</u> can be seen occupying the alluvial depression in the centre of the photograph. The summit of the hill in the left background exceeds 6,000 feet in altitude.

Highland Karroid Grassland. Looking east from Cheviot Fells, 2nd February, 1968. Virtually hoizontally bedded outcrops of felspathic sandstone of the upper Lower Beaufort Series are visible on the hillside.

Macchia dominated by Cliffortia paucistaminea, elevation approximately 5,200 feet, Katberg Pass, 9th February 1971. The shrub in the centre foreground is Protea lacticolor, approximately 8 feet tall.

Cliffortia paucistaminea invading sour grassveld, summit of Katberg Pass, elevation 5,400 to 5,650 feet, 9th February 1971. Note the dolerite dyke in the background.

By virtue of its size Erica caffra is the most conspicuous of the Ericaceae occurring in the Amatole-Winterberg highlands. The specimen illustrated above is approximately 12 feet tall.

Cape chestnut, Calodendron capense, in flower at Surrey farm, south-eastern Stockenström, December 1964.

Temperate Evergreen Forest on the southern slope of the Kagaberg, Bedford district. Acacia Savannah occupies the ecotone separating the forest from the grassland, the latter being mainly behind the photographer. The large tree with rounded crown next to the road is Olea africana.

2nd February, 1968.

Temperate Evergreen Forest on the south-western slopes of the Kagaberg, Bedford district, with Sour Grassland occupying the more exposed spurs. In the foreground is Acacia Savannah.

2nd February, 1968

Dolerite scree on the western slopes of the Great Winterberg dominated by Tetraria triangularis, individual specimens of which can be seen in the left foreground. Passerina sp. appears in the centre foreground.

17th March, 1968.

A closer view of the Tetraria triangularis association.

17th March, 1968.

Looking south-west towards Fenella Falls homestead from near the summit of the Great Winterberg. Passerina montana dominates the rocky spur in the centre of the picture. Amongst the large dolerite boulders in the foreground can be seen Restio sieberi var. schoenides and Chrysocoma tenuifolia, together with other karroid shrublets.

March, 1968.

A five foot tall specimen of Widdringtonia cupressoides growing on a dolerite dyke, elevation approximately 5,600 feet, at the foot of the Great Winterberg. This is one of the three species of conifer indigenous to the Amatole-Winterberg highlands.

The western slopes of the dolerite-capped Great Winterberg, maximum elevation 7,778 feet, showing sour grassland invaded by karroid shrubs. A plantation of exotic conifers, elevation 5,450 feet, can be seen in the valley on the extreme left of the photograph.

17th March, 1968.

Passerina montana and karroid shrubs dominate the slope in the foreground weathered from the Upper Beaufort Series, the felspathic sandstones of which form small scarps. The 300-400 foot high crags in the background are composed of dolerite.

17th March, 1968.

Katberg, elevation 5,350 feet, April 1971.

Domes of soil anchored by procumbent *Helichrysum argyrophyllum* are all that remains of the original soil cover. The purple and maroon mudstones of the Middle Beaufort Series are here exposed over wide areas as a result of sheet wash.

Helichrysum argyrophyllum with *Cliffortia paucistaminea* in the background, Katberg, April 1971.

THE DESTRUCTION OF SOUR GRASSLAND

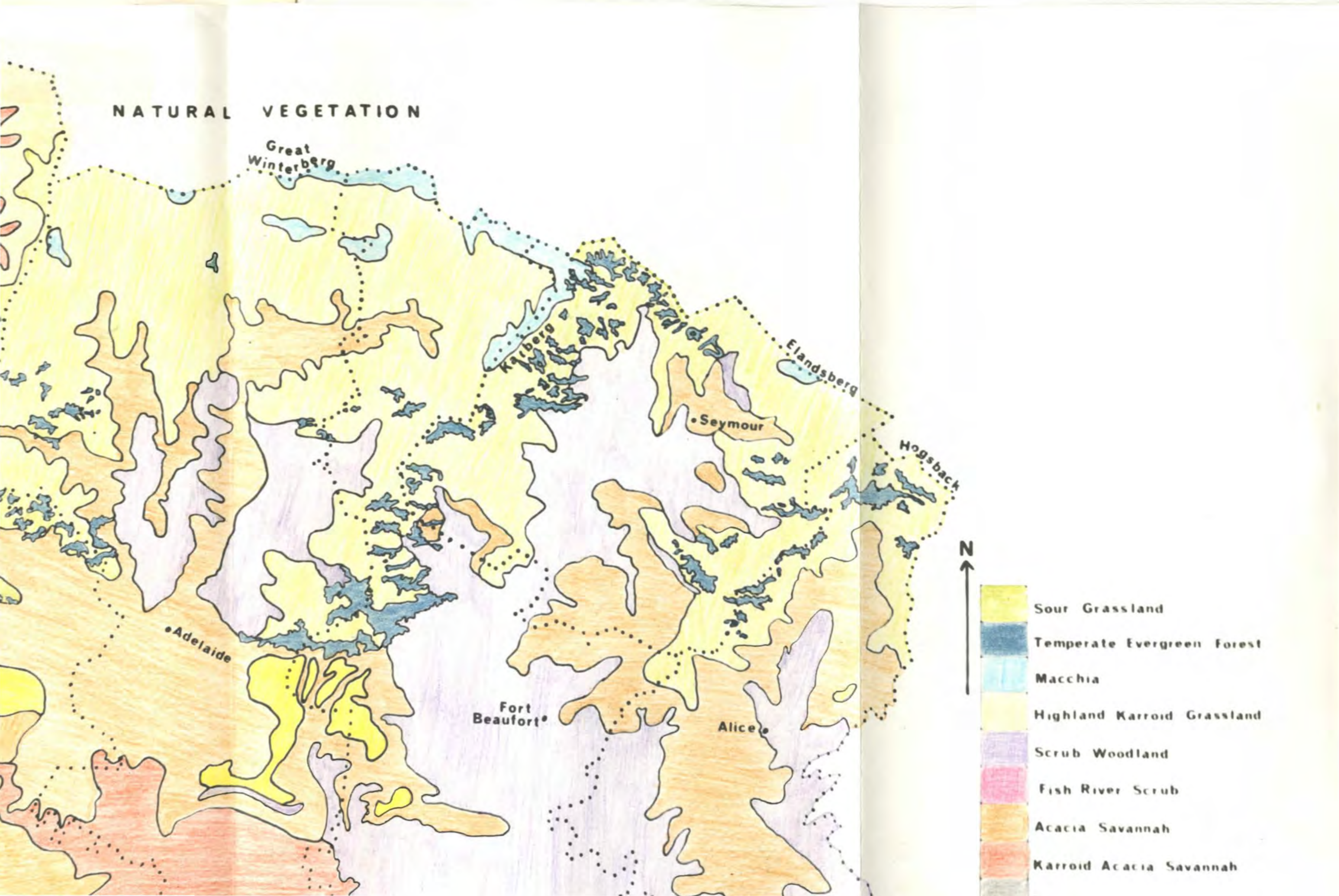
Katberg Pass, looking East

May 1960

The grassland above the road has been almost entirely replaced by Helichrysum argyrophyllum, although several individual specimens of exotic Acacia mearnsii may be seen, particularly in the vicinity of the abandoned quarry (top right). The depressions on the left and right centre are being invaded by Cliffortia paucistaminea, the olive-green colour of which is incorrectly depicted. In the foreground is a mixture of indigenous Temperate Evergreen Forest and the exotic Acacia mearnsii.

February 1971

The abandoned quarry has been re-opened and an access road constructed to it. Note the spread of Acacia mearnsii in the vicinity of the quarry. Cliffortia paucistaminea is depicted in a shade of olive green, in contrast with the silver colour of Helichrysum argyrophyllum. (Colours in this photograph are relatively accurate.)


NATURAL VEGETATION
Great Winterberg
Katberg
Elandsberg
Seymour
Hogsback
Adelaide
Fort Beaufort
Alice
N
Sour Grassland
Temperate Evergreen Forest
Macchia
Highland Karroid Grassland
Scrub Woodland
Fish River Scrub
Acacia Savannah
Karroid Acacia Savannah

CHAPTER IV

NATURAL VEGETATION

As the Bedford and Fort Beaufort Divisional Council areas are predominantly a region of rural settlement, with pastoral farming the chief activity, the natural vegetation influences the occupations of the people to a considerable extent. Griffith Taylor states that "of all the maps that the geographer can construct of a large extent of undeveloped country the Vegetation Map offers the best guide as to how the region may be exploited for man's benefit. The natural vegetation is Nature's response to many of the same controls as those which affect man's well-being." [1] Taylor was referring to undeveloped areas in Canada, but this statement applies equally well to the south-eastern Cape Province. Several vegetation maps of South Africa have been published, but the latest and most comprehensive is that by J.P.H. Acocks.[2] He recognises 6 major "veld types" in this region, viz. Dohne Sourveld, Karroid-Danthonia Mountain Veld, False Thornveld, Valley Bushveld, False Karroid Broken Veld and Eastern Province Grassveld. The last named type apparently no longer exists where indicated on his map, the grassland having been invaded by Karroid shrubs. In the memoir accompanying his map of "Veld Types of South Africa" Acocks has defined "veld type" as "a unit of vegetation whose range of variation is small enough to permit the whole of it to have the same farming potentialities." [3] This empiricism has led to the uniting of some structurally unrelated types under one name. For example, Acocks' so-called "Dohne Sourveld", which is indicated as occurring over a wide area in the Bedford and Fort

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[1] Griffith Taylor, "Canada", Methuen, London, 1950, p.103.

[2] J.P.H. Acocks, Map "Veld Types of South Africa", Govt. Printer, Pretoria, 1951.

[3] J.P.H. Acocks, "Veld Types of South Africa", Botanical Survey of S.A., Memoir No. 28, Govt. Printer, Pretoria, 1953, p.2.

Beaufort Divisions, includes no less than three widely differing vegetation types, viz. temperate evergreen forest, open sour grassland and macchia. Similarly, Acocks' "Valley Bushveld", the most extensive "veld type" of the Bedford and Fort Beaufort Divisions, includes evergreen woodland and dwarf succulent scrub. The present writer prefers to divide the region into vegetation types according to the species of plants present, their ecological relationships and their general effect on the appearance of the landscape in addition to the potential grazing value of each plant community as a whole. On this basis at least eleven vegetation types can be recognised within the Bedford and Fort Beaufort Divisions. These are:

1. Sour Grassland
2. Temperate Evergreen Forest
3. Macchia
4. Highland Karroid Grassland
5. Scrub Woodland
6. Fish River Scrub
7. Acacia Savannah
8. Karroid Acacia Savannah
9. Dwarf Karroid Shrub Steppe
10. Sweet Grassland
11. Lowland Karroid Tussock Grassland

The first three types occur in the cooler highlands and in their adjacent foothills wherever the mean annual precipitation exceeds approximately 26 inches. In the drier highlands of the west, where the mean annual precipitation is less than 26 inches and the altitude more than 4,000 feet, a type of karroid grassland, Type 4, occurs. Type 5, Scrub Woodland, is in general confined to valleys with an altitude of 2,500 to 1,100 feet, but may occur as high as 3,500 feet in sheltered localities, provided the mean annual rainfall is less than 26 inches. Type 6, Fish River Scrub, occupies the eastern part of the floor of the Great Fish River valley as well as the lower valley sides at elevations generally less than

1,100 feet. In this hot, low-lying area the meagre mean annual precipitation of 13 to 20 inches is rendered less effective by the high evaporation rate. Type 7 occurs where the average rainfall is 20 to 26 inches per annum, but is as low as 18 inches on exposed interfluves. It is best developed on the submontane peneplain and in the intermontane valleys of the Adelaide district, and never occurs higher than 3,500 feet. Type 8, Karroid Acacia Savannah, occupies the Baviaans River valley as well as portions of the valleys of the Great Fish, Koonap and Kaga rivers. Type 9, Dwarf Karroid Shrub Steppe, occupies the floor and lower slopes of the Great Fish River valley in the extreme west of the area as well as the lower Kaga and Koonap valleys. Over most of this area mean annual precipitation is less than 15 inches. Type 10, Sweet Grassland, occupies the submontane peneplain in the vicinity of Kroomie where the mean annual precipitation is less than 26 inches. Type 11, Lowland Karroid Tussock Grassland occurs south of Bedford on the relatively flat, only slightly dissected portions of the submontane peneplain where the annual precipitation averages from 15 to 26 inches and the altitude is approximately 2,000 feet.

1. SOUR GRASSLAND

Sour grassland occupies the major portion of the 6,000 and 4,500 foot plateau surfaces and their bounding scarps from Bedford eastwards. It also occurs on the foothills adjoining these highlands, provided the average annual rainfall exceeds approximately 26 inches. There is also an isolated patch of sour grassland south of Daggaboersnek, WNW of Bedford, where this precipitation requirement is fulfilled. Within the sour grassland are areas of forest, mainly on south facing scarps, as well as patches of macchia. This grassland is synonymous with Acocks' "Dohne Sourveld". [1] (In South Africa the terms "sourveld" and "sweetveld" are widely used to describe not the taste of the grass, but its

[1] J.P.H. Acocks, "Veld Types of South Africa", Botanical Survey of S.A.", Memoir No. 28, Govt. Printer, Pretoria, 1953, p.p. 121-124.

nutritive value.) The major difference between the two types is that sweetveld remains nutritious throughout the winter, whereas sourveld does not. In the Bedford and Fort Beaufort Divisions sweet grasses grow where the mean annual precipitation is less than approximately 26 inches, sour grasses where it exceeds this amount.

The dominant sourveld grasses tend to form dense tussocks of rather small size. These may be sufficiently close together to give the appearance of a uniform sward or, as is often the case at high altitudes, may be spaced out to present an uneven surface. Many other plants grow between the grasses, and, where the tussocks are widely spaced, the associated plants may be very abundant. These include numerous geophytes and small shrubs with woody bases. Of the last composites are particularly abundant. These are mainly of the genera Helichrysum and Senecio.

The most common species of sourveld grasses are Themeda triandra (rooigras or red grass), Heteropogon contortus (spear grass), Tristachya hispida (rooisaad or red seed), Eragrostis capensis and Sporobolus capensis. Above 5,000 feet Bromus speciosus (Brome grass) and Festuca species (Fescue grasses) are conspicuous, becoming dominant in places. In the vicinity of the Great Winterberg Danthonia disticha also becomes conspicuous, mainly above 5,000 feet.

All the grasses named, with the exception of Tristachya hispida, Bromus speciosus and the Festuca species, also occur in the sweetveld. Themeda triandra is the most widely distributed of the sourveld grasses and is recognised as the best pasture grass by the majority of South African farmers. Even where it forms a dense sward many other grass species grow in association with it. Indeed there are certain small areas which create the impression of a complete change in the composition of the species as the summer progresses. The shorter growing temperate Themeda commences growth earliest in the spring, and flowers before certain taller growing sub-tropical species,which may temporarily overshadow it in the late summer and early autumn. A fenced-off area near Healdtown, for example, appears as an almost pure stand of Themeda triandra in the early summer, but when viewed in autumn gives the impression of an almost pure stand of Hyparrhenia hirta. This tall grass, with culms normally exceeding three feet in height, may be as much as two feet taller than the Themeda. Hyparrhenia hirta is commonly known as thatch grass, owing to its use by the Bantu for roof thatching.

According to Story Themeda is naturally dominant in the lower parts of the sourveld, but in the higher parts it does not make up a stable community.[1] Story maintains that its dominance has been brought about by grazing animals. He does not explain why this most nutritious and palatable of all the sourveld grasses should be preserved in this manner. One can only presume that the grazing is moderate, sufficient to prevent taller growing coarse grasses from overshadowing and ousting the Themeda. Under heavy grazing pressure Themeda triandra disappears entirely. Where there is only a negligible amount of grazing in the cool upper regions of the sourveld, taller growing coarse grasses assume dominance. In the damper areas they are often associated with Pteridium aquilinum (Bracken Fern) and shrubs such as Leonotis leonurus (Minaret Flower or Wild Dagga). These are particularly common adjacent to the forest patches and probably represent a stage in the succession transitional to the invasion of grassland by forest. This does not mean that the climax is everywhere forest, for even in ungrazed areas, there is an abrupt cessation of indigenous forest at the upper ends of the south-facing scarps which bound the 4,500 to 5,000 foot surface. Beyond the scarp crests it would appear that the lower temperatures and strong winds prevent the growth of indigenous trees, except in sheltered ravines. The climax here would seem to be grass or macchia.

In the young stages the sourveld grasses contain high percentages of nutritive elements, but at maturity the proteins,

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[1] R. Story, "A Botanical Survey of the Keiskammahoek District", Botanical Survey of S.A., Memoir No. 27, Govt. Printer, Pretoria, 1952, p. 111.

carbohydrates and fats are largely used in the formation of seed. In the autumn most of the mineral salts return to the roots, while the remaining foodstuffs are enveloped in cellulose and lignin. All the grasses, even Themeda triandra, turn yellow and brown, becoming unpalatable and indigestible to animals. During the winter the areas where Themeda is dominant are readily discernible owing to the unique russet colour assumed by this particular grass. In the following spring new nutritious grass grows under the old dead grass. Farmers sometimes remove the old dead grass in advance in order to make the new grass available to livestock. In the past this was frequently done by burning round about August, a practice which has fortunately become far less common during recent years. When there is not sufficient moisture in the soil after burning great harm can be done to the nascent pasture, which may be frostbitten or dehydrated. Burning makes the bare veld liable to wind erosion, and the first good rains may bring about widespread sheet erosion.

Unfortunately in certain areas mismanagement has led to the eradication of many of the better species of sourveld grasses. On the Winterberg and upper Katberg trampling and selective grazing by livestock has led to the development of large tracts of almost pure stands of unpalatable, fibrous Elyonurus argenteus, locally known as "suurpol" (sour tussock), "koperdraad" (copper wire) or "wiregrass". This grass is widespread and common in the sourveld, but it is only where grazing is uncontrolled and heavy that it becomes dominant. Animals avoid Elyonurus argenteus wherever possible, except when it is forming new growth, as the mature grass has a very strong taste. If protected from heavy grazing the gradual accumulation of dead leaves smothers and eventually kills the plant, causing it to rot to ground level.

In certain areas on the upper slopes of the Katberg even the poorer grasses have entirely disappeared as a result of overstocking. Here large tracts of grassland have been replaced by the beautiful mountain everlasting, Helichrysum argyrophyllum. The frequent abrupt transitions from dense grassland on one side of a fence to a mass of silver and yellow Helichrysum on the other side clearly indicates that its dominance is not natural. The virtually continuous carpet of Helichrysum argyrophyllum serves to protect the soil from sheetwash as well as from gullying. Indeed, Schonland has described it as "a blessing in disguise",[1] for domestic animals will not eat the plant, even when deprived of all other food. A supporting view was given by Dr. A.F.M.G. Jacot Guillarmod of the Rhodes University Botany Department. In personal communication with the present writer she stated, "Helichrysum argyrophyllum is extremely useful in soil-binding and providing a protective cover in the shelter of which other plants, including grasses, can eventually grow, and also eventually smother, H. argyrophyllum. It is man's greed and folly that brings the conditions suitable for H.argyrophyllum and its necessary protective role." It is indeed fortunate that Helichrysum argyrophyllum colonises bare ground with such ease. It is essentially a highland plant; the writer has never seen it growing lower than approximately 3,000 feet in this area. It also appears to be absent from the highland areas to the west of the Katberg. Numerous other species of Helichrysum are present - the Rhodes University Botany Department has recorded more than twenty different species on the Hogsback - but never assume dominance.

In the high altitude areas overgrazing has also led to the overwhelming of the grassland by local remnants of the ancient sclerophyllous vegetation. On parts of the summit of the Katberg and its drier western slopes Cliffortia paucistaminea has virtually ousted the grasses. Cliffortia linearifolia appears to be invading lower altitudes. Another element of the macchia which appears to be invading the highland grasslands is Erica brownleeae. Whereas Cliffortia tends to occur mainly on steep slopes and Erica on fairly flat terrain, the two are often intimately mingled.

Overgrazing in the lower parts of the sourveld has led to an abundance of the yellow-flowering, shrubby Composite, Senecio

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[1] S. Schonland, "On the reclamation of ruined pasture on the Amatolas near Keiskama Hoek", Science Bulletin No. 55, 1927, p. 6. Dept. of Agriculture, Pretoria.

retrorsus. Numerous other species of Senecio occur, but are not dominant. No less than nineteen species of Senecio have been recorded on the Hogsback by the Rhodes University Botany Department. Indeed, the number of species other than grasses is comparatively large, yet individual plants of a species may be widely spaced. Monocotyledonous geophytes with water and food storage organs such as bulbs, corms, tubers and rhizomes are widespread, but are conspicuous for only brief periods when they produce showy flowers. The Iridaceae, most of which have a corm for a rootstock, include Dierama pendulum, with pink to mauve flowers, Gladiolus ecklonii, with pink to purple flowers, Hesperantha longituba, with mauvy-pink flowers, Moraea spathulata, the bright yellow flowers of which are said to be poisonous to livestock, Romulea spp., with white and yellow flowers, Tritonia securigera, with red flowers, Watsonia meriana, with pink flowers, and Schizostylis coccinea. The last mentioned is found growing in clumps on stream banks and other damp areas in the Hogsback. Although confined to such areas it is worthy of mention owing to its striking iridescent scarlet flowers. It is significant also in that it is one of the few Iridaceae which does not possess a corm. Geophytes belonging to the Liliaceae include Agapanthus africanus, with large blue or white inflorescences. Kniphofia spp., the red hot pokers, with large red, orange or yellow inflorescences, Eucomis undulata, a species belonging to a genus unique among South African genera of Liliaceae in that it has a coma above the yellow-green inflorescence, Tulbaghia alliacea, the "wild garlic", which has green flowers with conspicuous yellow-orange-brown coronas, and Ornithogalum subulatum, with white flowers. The best known species of this genus, O. thyrsoides, the chincherinchee, apparently does not occur in the sour grassland of the Bedford and Fort Beaufort Divisions.

Succulents are not numerous, but certain species are conspicuous over limited areas. On the Hogsback Aloe arborescens occurs as a tall nanophanerophyte or as a small microphanerophyte, usually on rock faces. On both the Hogsback and the Katberg Aloe saponaria is in places conspicuous on steep, rocky slopes. In these localities the Leptoaloe are represented by Aloe ecklonis, which usually grows on level grassland. Several species of Crassula occur, mainly from the Katberg eastwards. In the sour grassland of the Stockenström, Fort Beaufort and Victoria East districts is Crassula vaginata, a slender, fleshy perennial which is conspicuous in March and April when it bears large heads of yellow flowers. Crassula lineolata, a trailing, low, fleshy perennial, forms large patches in damp grassy flats within the same districts. It bears white flowers. Another straggling Crassula, C. ramuliflora, is frequent on rocky places near streams from the Katberg eastwards. It has attractive red flowers. Other members of the Crassulaceae include Crassula harveyi, C. sarcocaulis and C. setulosa.

The Flora of the Great Winterberg

In contrast with the Sour Grassland elsewhere, that of the Great Winterberg from 5,000 feet upwards has a large proportion of small-leaved shrubs, most of which have xeromorphic characteristics. The most common of these belong to the genera Aster, Chrysocoma, Helichrysum and Senecio of the Compositae family and to the genera Passerina and Gnidia of the Thymelaeaceae.

Chrysocoma tenuifolia is the most abundant of all the shrubs. It is dominant in patches on well-drained slopes from 5,000 feet to over 6,500 feet above sea level. Over much of the summit plateau of the Great Winterberg, which ranges in altitude from 7,400 feet to over 7,770 feet, Chrysocoma tenuifolia is dominant, in places excluding all other plants. It is not relished by stock, only being eaten in times of scarcity, and this is probably why it has ousted the grasses. Aster filifolius also occurs over a wide altitudinal range, but is dominant over only limited areas. Nowhere on the Great Winterberg is any species of Helichrysum dominant, but the yellow flowering H. trilineatum var. tomentosum is widespread. Several other species of Helichrysum, also with yellow flowers, are conspicuous. These include H. umbraculigerum and H. splendidum, the flowers of the last named species being particularly beautiful. All three species have their leaves covered with silvery down, those of H. trilineatum var. tomentosum being particularly tomentose. Of the Senecio spp. the feathery leaved S. tanacetoides is very common amongst dolerite boulders which compose the screes occupying ravines along the mountain side. The chamaephytic S. asperulus is common on soils derived from shales and mudstones of the Upper Beaufort Series. Other abundant Compositae are Gymnopentzia bifurcata and Cineraria aspera, which grow amongst the dolerite scree deposits occupying the ravines at over 6,000 feet. Lasiospermum bipinnatum, an aromatic Composite with deeply bipinnate leaves, is fairly abundant on soil weathered from shales on fairly steep slopes at approximately 6,000 feet. The presence of this weed species usually indicates overgrazing. Lotononis trisegmentata (Leguminosae), an attractive violet flowered shrub, occupies the same habitat. So also does the minute Sutera campanulata, (Scrophulariaceae), an annual seldom more than six inches tall. Geraniaceae are represented by the low-growing Pelargonium odoratissimum.

Growing on narrow dolerite dykes below 6,000 feet is Rhus rosmarinifolia (Anacardiaceae), a leptophyllous, xeromorphic species, in marked contrast with a broad-leaved species of Rhus, resembling R. pentheri, which grows in moister situations. Neither, however, exceeds five feet in height.

Very conspicuous on the Great Winterberg is the ericoid leaved Passerina montana (Thymelaeaceae), which assumes dominance over limited areas. Requiring soils of only moderate acidity, P. montana in the less humid Winterberg appears to be the equivalent in function and behaviour of the Cliffortia and Erica of the wetter Amatole mountains. Passerina montana occurs on the summits of the Katberg and Hogsback, but is not common in either locality. Another member of the Thymelaeaceae present on the Great Winterberg is Gnidia sericea.

Restio sieberi var. schoenoides is occasionally dominant in moist patches exceeding 6,000 feet. It is extremely abundant on the summit plateau, from 7,400 feet to 7,770 feet, where it is dominant over large areas.

Selaginaceae are well represented. Particularly abundant on soils weathered from the Upper Beaufort Series are Selago corymbosa, Walafrida densiflora and Hebenstreitia integrifolia.

The flora of the dolerite screes occupying the relatively sheltered and damper valleys on the mountain sides differs considerably from that of the adjacent slopes. Dominant throughout is Tetraria triangularis (Cyperaceae), locally known by the Xhosa name Rwashu. Woody nanophanerophytic shrubs are common on the scree, their basal portions being sheltered by the large dolerite boulders. Very abundant is Kiggelaria africana (Flacourtiaceae), the largest of all these shrubs, attaining a maximum height of six feet compared with over fifty feet for the same species on the milder Hogsback and Katberg. Buddleia salvifolia (Loganiaceae) occurs as a shrub less than five feet tall, although it too occurs as a tree on the Katberg and Hogsback. A broadleaved species of Rhus resembling R. pentheri is present together with Clutia katherinae (Euphorbiaceae), which bears attractive silvery leaves in elongated rosettes, and Heteromorpha trifoliata (Umbelliferae), which has very distinctive serrated leaves. All three species attain maximum heights of approximately four feet. Rubus pinnatus and R. rigidus (Rosaceae), commonly known as bramble, grow in the more sheltered parts of the scree, but are more abundant at the foot of the dolerite cliffs, which bound the summit plateau. These thorny shrubs are valued for their edible fruit, used for jam making. All the previously mentioned inhabitants of the screes also occur at the base of the dolerite cliffs, where Heteromorpha trifoliata is abundant. Smaller shrubs conspicuous on the screes are Muraltia alticola (Polygalaceae) and Thesium strictum (Santalaceae), together with very stunted Clematis brachiata (Ranunculaceae). The latter occurs as a climber amongst the nanophanerophytes. Its sweetly scented cream flowers are borne in profusion in autumn. The small rushlike Restio sieberi var. schoenoides is common, as also very stunted specimens of the mountain bamboo, Arundinaria tessellata (Gramineae), the long, green, papery leaves of which are arranged in tesselate fashion. On the Great Winterberg A. tessellata rarely exceeds two feet in height, although it may exceed 20 feet in other parts of South Africa.[1] Its low height in this area possibly could be the result of burning or of heavy grazing. The Liliaceae are represented by Kniphofia spp. (red hot poker), the attractive orange-red and yellow flowers of which are most conspicuous in late summer. Kniphofia occurs in clusters where the damp soil of the scree ravines is not too thickly covered with boulders, but also occurs in level grassland from 4,000 feet to over 7,700 feet.

Succulents are very poorly represented in the Sour Grassland of the Great Winterberg and its environs. Cotyledon orbiculata, tolerant of temperatures well below freezing point, is widespread, as are also small chamaephytic species of Crassula. Euphorbia pulvinata has been observed at elevations up to 6,000 feet. It forms a densely tufted, dome-like mass composed of many crowded branches, the whole plant from a distance resembling a moss-covered boulder. These pale green mounds, which may be as much as six feet in diameter, are attractive objects, in spite of their being armed with spines. In cultivation E. pulvinata has been known to withstand a temperature of only 12°F.[2]

Grazing pressure is obviously causing much of the Sour Grassland of the Great Winterberg and its environs to be replaced by Karroid Shrub or Dry Sclerophyllous Shrub communities. On certain steep slopes the parallel paths trodden by sheep grazing along the contour are only a few feet apart. Several Winterberg

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[1] D. Meredith, "The Grasses and Pastures of S.A.", Central News Agency, 1955, p.30.

[2] A. White, R.A. Dyer & B.L. Sloane, "The Succulent Euphorbieae"

farmers own sweetveld farms as well. These are used for winter grazing and the sourveld farms for summer grazing. The winter resting of the sourveld favours the growth of karroid shrubs and macchia, which require less warmth than grass in order to grow. Nevertheless much grass still remains, this being mainly of the species mentioned on page 59. As previously mentioned, selective grazing has led to the dominance of *Elyonurus argenteus* over fairly large tracts. A conspicuous grass growing on patches of soil in inaccessible dolerite crags on the summit plateau is *Pentaschistis sp. cf. P. tysonii*.[1] In March, 1968, the plateau was being grazed by large numbers of sheep owing to a drought which had prevailed over lower lying areas up to that time. Although the dark, dolerite-derived soil of the plateau was damp, the only grasses which had been able to produce seed were the inaccessible *Pentaschistis* sp. as well as a few tussocks of *Elyonurus argenteus*. Most of the latter had been subjected to heavy browsing despite its unpalatability.

2. TEMPERATE EVERGREEN FOREST

From Bedford eastwards patches and strips of Temperate Evergreen Forest occur. These are mainly on the slopes of the escarpment below 5,000 feet. In this zone of better air drainage winter frost is less severe than on the relatively level areas, and the lower amount of insolation on these south-facing slopes reduces the evaporation rate, making the precipitation more effective. The south and south-east facing slopes are also less affected by the desiccating Berg winds which normally blow from the north-west; the areas below and above the escarpment are normally subject to stronger winds. These conditions and the greater frequency of mist, particularly towards the east, favour the development of forest. From the Katberg eastwards the climax in the most favourable areas is high forest, whereas to the west the climax appears to be a

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[1] N.T. Childs, 47, 48, 49, in Rhodes University Herbarium.

relatively open type of dry forest, even in the most favourable areas. West of the Katberg burning and cutting has led to the removal of a much greater proportion of the forest, although it still remains on the southern slopes of the Kagaberg and the Kroomie mountains, as well as on portions of the southern and south-eastern slopes of the Little Winterberg. On the southern slopes of the Great Winterberg itself, which rises above the 4,500 to 5,000 foot surface, forest is entirely absent, not even occurring in sheltered ravines. It is doubtful whether forest was ever wide-spread on the slopes of the Great Winterberg, as the advantages of a moderate precipitation are more than offset by relatively low temperatures inimical to many of the subtropical species of tree which make up the so-called "Temperate" Forest. Relatively severe frost is experienced in the vicinity of the Great Winterberg during winter. At the summit, 7,778 feet above sea level, the mean July temperature probably averages approximately 35°F. and that of January approximately 55°F. The relatively high wind velocities experienced above approximately 5,000 feet would increase the effect of physiological drought, and favour grass rather than trees.

Relatively large areas of evergreen forest, with a dense undergrowth, including many climbers, remain on the south-eastern slopes of the Katberg and southern slopes of the Hogsback and Menziesberg. These moist forest areas, exceeding approximately 3,500 feet in altitude and with a mean annual rainfall which probably exceeds 35 inches, belong to Adamson's "Temperate Forest" type.[1] Story calls this "Moist Forest",[2] although in the region to which he refers (Keiskammahoek) the relative abundance of the various species appears to differ somewhat from that of the Hogsback and Katberg. The majority of the trees have small, elliptical, dark green, thick-cuticled leaves, which are highly

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[1] R.S. Adamson, "The Vegetation of South Africa", British Empire Vegetation Committee, London, 1938, pp. 101-102.

[2] R. Story, "A Botanical Survey of the Keiskammahoek District", Botanical Survey of South Africa, Memoir No. 27, Govt. Printer, Pretoria, 1952, p. 68.

glabrous on the upper surface. Adamson describes the community as "a complex stratified one" with "two layers of trees of which the upper is not continuous. This gives an irregular external view to the canopy which is very characteristic. There is very rarely any definite dominant species; several make up the canopy and share dominance."[1] The average height of the canopy is about 50 feet, but may be 70 feet or more where the tallest specimens of _Podocarpus falcatus_, _P. latifolius_ and _Olea capensis var. macrocarpa_ grow. These trees are commonly known as common yellowwood, real yellowwood and black ironwood respectively. Other common trees are _Halleria lucida_ (white olive), _Rhus legatii_ (red currant), _Rapanea melanophloeos_ (Cape beech), _Scolopia mundii_ (red pear), _Vepris undulata_ (white ironwood), _Pittosporum viridiflorum_ (bosbeukenhout), _Canthium inerme_ (turkey berry or bokdrol), _Curtisia dentata_ (assegaai), _Xymalos monospora_ (wild lemon) and _Kiggelaria africana_ (wild peach).[2] _Celtis africana_ (white stinkwood) also occurs, but unlike the other trees, is deciduous. Although not very abundant, _Calodendron capense_, the Cape chestnut, is very conspicuous when it bears masses of pink or lilac flowers in early summer. It is also deciduous. Even less abundant, but conspicuous, on account of its large-lobed leaves crowded at the ends of branches and also its finger-like inflorescences, is _Cussonia spicata_ (the cabbage tree or kiepersol). Under the forest canopy is a tall type of undergrowth consisting mainly of _Trichocladus ellipticus_, which is the commonest of all forest "trees". It frequently attains heights of 20 feet, but is relatively thin-stemmed in relation to its height. Often the stem is only about two inches thick, and is also very brittle, so that it is easily snapped by strong winds. The many broken _Trichocladus_ stems considerably hamper progress through the forest. Occasional specimens may, however, attain a

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[1] R.S. Adamson, "The Vegetation of South Africa", p. 102.

[2] For descriptions of many of these species see N. Pitman and E. Palmer, "Trees of South Africa", Balkema, Cape Town, 1961.

girth of more than 24 inches. Ferns are conspicuous amongst the shrubby undergrowth, where berry-bearing plants appear to predominate.

Most of the forest areas below 3,500 feet belong to what Story calls "Dry Forest".[1] It would appear that this more xeric forest has a mean annual rainfall of approximately 35 to 26 inches. Here Trichocladus still occurs, but Olea species are more common than at a higher altitude. The mosses, though widespread, appear in a rather dried out condition for most of the time. This drier type of forest is also characterised by pendant lichens, Usnea spp., which hang in festoons from the trees. The most common large plant is Grewia occidentalis (the kruisbessie), which can attain heights of up to 30 feet, but is usually much shorter. It is a climber supported by the larger trees, although it occurs as a shrub in the hotter and drier areas outside the forest. Another shrub which takes on the form of a scrambler in the dry forest is Azima tetracantha (the naaibos). The most common trees appear to be Celtis africana (white stinkwood), Dovyalis zeyheri (wild apricot), Olea capensis var. capensis (bastard black ironwood), Buddleia saligna and B. salvifolia (white olive), Calodendron capense (Cape chestnut), Cussonia spicata (cabbage tree), Olea africana (olive), Hippobromus pauciflorus (horse-wood) and Schotia afra (boerboon). Whereas the first three species are fairly abundant in the moister forest areas, the other species are abundant in the warm, dry Scrub Woodland. Indeed, this dry forest can be regarded as a transitional zone separating the Moist Forest from the Scrub Woodland. It reaches its lowest elevation in the moister ravines, where tongues of forest, separated by spurs of grassland, may reach lower than 2,500 feet on shady southern and south-eastern slopes. In such areas it may actually grade into Scrub Woodland. Where the land is relatively level and exposed there is usually a belt of sour grassland separating it from the Acacia Savannah or Scrub Woodland of lower altitudes.

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[1] R. Story, "A Botanical Survey of the Keiskammahoek District", Botanical Survey of S.A., Memoir No. 27, Govt. Printer, Pretoria, 1952, p. 63.

3. MACCHIA

Macchia is a type of vegetation usually associated with a Mediterranean type of climate. Indeed the name is derived from the native term for the sclerophyllous vegetation of Italy, although the French term maquis gained fame during the Second World War when it was applied to the French Resistance movement. In South Africa the term "fynbos" is used by farmers to describe the native vegetation, but since it is not widely known outside South Africa, the term "macchia" or "maquis" is preferable. It is an evergreen community made up predominantly of shrubs with small, hard, ericoid or cupressoid leaves, the exception, as far as South Africa is concerned, being the members of the Protea family. All, including the *Proteaceae*, have one or more of the following devices to reduce or to prevent transpiration: a thick leaf cuticle with a covering of either wax or hair, the rolling of the leaves with the stomata on the inner side, the sealing off of the stomata by exudations of resin or wax.[1] This sclerophyllous vegetation type occurs in all warm temperate regions in which most of the precipitation occurs during the winter months, and is best developed in the Mediterranean basin, Central and Southern California, Central Chile and the south-western Cape Province, and in Australia in a belt stretching for some 2,000 miles from Shark Bay in Western Australia as far as south-eastern South Australia and north-western Victoria.[2] Although widely differing genera and species make up the vegetation in these widely separated regions there are close structural and physiological similarities between them.

It is generally agreed that macchia is a more xerophytic type of vegetation than forest. It is probably for this reason that it occurs in humid regions which do not have a Mediterranean

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[1] A relatively detailed study of xerophytism as exhibited by the sclerophylls of the Amatole mountains appears in R. Story's "A Botanical Survey of the Keiskammahoek District", pp. 124-131.

[2] S.R. Eyre, "Vegetation and Soils", Arnold, London, 1963, pp. 126-128.

type of climate, but which experience the desiccating effects of strong winds or low temperatures. Macchia also appears to be tolerant of poor, acid soils, which may hamper the development of other plant communities. The arborescent ericaceous plants near the summits of Mounts Elgon, Kenya and Kilimanjaro are well known, as also the heaths of western and north-central Europe as well as the Falkland Islands, which are dominated by Ericaceae or ericoid-like shrubs. The heath vegetation of the central African mountains would be in response to the low temperatures and low precipitation experienced at very high altitudes; those of Europe and the Falklands would be in response mainly to the poor podzolic soil which has developed mainly on arenaceous formations. The presence of almost pure stands of macchia on the Amatole-Winterberg range is probably a response of the vegetation to a combination of environmental factors, particularly the podzolic soils and the desiccation caused by strong wind. In this area macchia is not found where the average precipitation is less than approximately 26 inches; in fact it becomes dominant only where the mean annual precipitation is approximately 30 inches or more. Its rainfall requirements thus more or less coincide with those of the sour grassland and temperate forest, but as far as soil moisture requirements are concerned, it is intermediate between the two. The macchia tends to occur as islands within the sour grassland, particularly on the mesoclines, where it is best developed in sheltered ravines and on seepage areas below rock faces, but it is also ecologically more successful than grass on almost all areas of excessively leached sandy soil. It is essentially acidophyllous, making few demands upon mineral nutrients in the soil and thus possessing foliage which is poor in mineral matter. The present writer found that on the Katberg the best stands of macchia occur on soils with pH values of between 4 and 5. According to Story there is strong evidence that macchia is the climax vegetation above the present timber-line and as far as the crests of the Amatole mountains.[1]

[1] R. Story, "A Botanical Survey of the Keiskammahoek District", Botanical Survey of S.A., Memoir No. 27, Govt. Printer, Pretoria, 1952, p. 89.

It is his contention that the macchia in these highlands is "an ancient and normal vegetation type."[1] This is borne out by the fact that a species of Erica, allied to Erica rupicola, only occurs on the mountains above Somerset East and Bedford.[2] Even stronger evidence is provided by the distribution of a very distinct species, Erica brownleeae which is limited to a 45 mile long highland belt between Katberg and Stutterheim.[3] It is unlikely that these highly localised plants could be the remains of a species which had invaded the area from another region, following which the parent community had become extinct.

The plants making up the local macchia community are mainly compact dark green, blue-green or grey-green shrubs seldom more than ten feet in height, profusely branched, generally with ericoid leaves, though the Proteaceae representatives are an important exception, the latter having broad leaves which are also thick-cuticled, with an outer covering of wax or hair. The macchia of the Amatole-Winterberg range from the Katberg eastwards is made up of three main communities, viz. the Cliffortia linearifolia, the Cliffortia paucistaminea and the Erica brownleeae communities. Other Ericaceae present include Blaeria revoluta, Erica alopecurus, E. caffra, E. caffrorum, E. leucopelta and E. longifolia, but they are not dominant in any particular area. Associated with the dominant Cliffortia and Erica brownleeae communities are other scattered sclerophylls, which include the following:

COMPOSITAE	Metalasia muricata, Arrowsmithia stypheloides, Stoebe sp., Relhania pungens.
MYRICACEAE	Myrica conifera, Myrica brevifolia.
RHAMNACEAE	Phylica sp.

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[1] R. Story, "A Botanical Survey of the Keiskammahoek District", Botanical Survey of S.A., Memoir No. 27, Govt. Printer, Pretoria, 1952, p.76.

[2] Ibid., p.75.

[3] Ibid., p.81.

On the slopes of the Great Winterberg the principal representatives of the macchia belong to the Thymelaeaceae family. These are Passerina montana and Gnidia sericea.

The members of the Protea family tend to occur in the form of open woodland or "bush clumps", always with a relatively localised distribution. They are rare west of the Katberg. Proteaceae are not always associated with other sclerophylls; often they are found growing in grassland. Studies of burntover macchia on the Juanasberg, in the Stockenström district, have convinced the writer that the proteas are more fire resistant than other species of the macchia flora, probably because they do not contain such inflammable resins. Where the proteas occur as scattered shrubs in open grassland they may be regarded as the remnant of a macchia physiognomically similar to macchia regions all over the world. Indeed, this "Protea Savannah" is nothing more than a fire climax.

The Proteaceae are represented by four species in the Amatole-Winterberg highlands. Three of these, viz. Protea lorifolia, P. lacticolor and P. multibracteata, may be regarded as small spreading trees or tall shrubs. The fourth species, Protea simplex, is a dwarf shrub less than three feet tall. Protea lorifolia and P. lacticolor have a wide distribution in the winter soil moisture maximum regions of the south-western and southern Cape Province, from where they have apparently spread into this summer soil moisture maximum region. Protea lorifolia apparently does not occur east of the Kagaberg, but P. lacticolor is widespread in the highlands, extending to the east of the Hogsback. Beard states its most easterly occurrence as being "in the Amatola and associated mountains."[1] The other two species are endemic to the wetter portions of the summer rainfall region of South Africa and reach their most westerly extent in this region.[2] The writer has

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[1] J.S. Beard, "The Protea Species of the Summer Rainfall Area of South Africa", Bothalia, Vol. VII, Pretoria, 1958, p.48.

[2] Ibid., p.41.

observed neither Protea multibracteata nor P. simplex west of the Katberg, although P. multibracteata is abundant and conspicuous from the Katberg eastwards. The ranges of these two species, one arborescent, the other dwarf, are more or less identical. The only difference in vegetational and floral characteristics is in size. Beard states that "It is suspected that P. multibracteata carries a gene for miniature habit which may be selected by veld burning, leading to the establishment of dwarf populations which are genetically incapable of assuming an arborescent habit even if protected against veld fires."[1]

As previously stated, the Amatole-Winterberg macchia from the Katberg eastwards consists of three dominant communities, viz. the Cliffortia linearifolia, the Cliffortia paucistaminea and the Erica brownleeae communities. The first community will be considered separately, but the remaining two are so inter-related that they will be treated in common. All three have in recent years been invading virtually pure stands of grassland.

The Cliffortia linearifolia community.

This is the shortest and most uniform of the three. Seldom more than four feet in height, these olive-green shrubs can form dense communities at altitudes below 4,000 feet, where the mean annual precipitation exceeds 30 inches. Above 4,000 feet Cliffortia linearifolia occurs only as widely spaced individuals, the lower temperatures possibly restricting its growth. It is most abundant in the east, becoming sparser westwards, where there is a progressive decrease in the area of humid land below 4,000 feet. Its westernmost limit appears to be the Kagaberg, north of Bedford, where a few scattered shrubs appear. Cliffortia linearifolia occurs naturally in sour grassland and it is the contention of Story that it tends to spread rapidly only when the grass cover is reduced as a result of

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[1] J.S. Beard, "The Protea Species of the Summer Rainfall Area of South Africa", Bothalia, Vol. III, Pretoria, 1958, p. 56.

heavy grazing.[1] Except for the young green shoots, Cliffortia linearifolia is avoided by livestock as long as there is sufficient grass to supply their needs - it is only consumed by animals when the grassland is unable to sustain them. By the time this stage is reached there are sufficient bare patches suitable for the germination of Cliffortia seed, and the shrub spreads rapidly. Moreover, the herbivores are unable to destroy the stout twigs of the adult plants. Burning will only eradicate the shrubs if they are close enough to produce a fierce blaze. Seed, however, germinates in great abundance in burnt areas, so that burning has to be repeated. Mechanical removal of the shrubs in the early stages of infestation is probably the best means of eradicating them from natural grassland. According to Story, "any system, or lack of system, which allows Cliffortia to spread will probably end in the establishment of some type of forest", for, in areas of uncontrolled Cliffortia linearifolia, numerous young forest trees appear.[2] However, it has not been established with certainty whether forest is the climax in all the treeless land within the Cliffortia linearifolia zone.

The Cliffortia paucistaminea and Erica brownleeae communities.

In contrast with Cliffortia linearifolia, C. paucistaminea is a dark green shrub attaining heights of up to six feet. Its crowded half-inch needle-like leaves resemble pine needles in shape and colour, whereas C. linearifolia is cupressoid, i.e. cypress-like, when considered from these two particular aspects. The western-most limit of C. paucistaminea appears to be the Kagaberg, north of Bedford, where the present writer has observed a few scattered shrubs. He has not observed this plant growing at an altitude of less than 4,000 feet, although it grows in profusion at heights of

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[1] R. Story, "A Botanical Survey of the Keiskammahoek District", Botanical Survey of S.A., Memoir No. 27, Government Printer, Pretoria, 1952, p. 78.

[2] Ibid., p. 80.

more than 5,000 feet on both the Katberg and Hogsback. It would appear that below 4,000 feet environmental conditions are unfavourable for C. paucistaminea. The altitudinal distribution of Erica brownleeae is rather similar to that of Cliffortia paucistaminea. The latter is, however, thicker on steep slopes and in hollows, whereas the more xerophytic Erica brownleeae tends to occupy the more exposed level surfaces as well as rocky ridge summits. Cliffortia paucistaminea is only reluctantly grazed by livestock, and Erica brownleeae is rarely eaten, if at all.

Both shrubs can be destroyed by burning, but germination from seeds occurs in the burnt areas, particularly where the growth has been sparse. The reason is probably that sparsely spaced macchia, when burnt, does not give off enough heat to destroy most of the seed. In dense macchia, apart from the fierce flames which envelop the shrubs themselves, there is a slower fire which, fed from the litter on the soil surface, continues smouldering for a long time after the blaze is over, thereby destroying the seeds more effectively.

It is important to realise, however, that both species spread naturally, whether in grazed or ungrazed grassland, as they appear to be better adapted to the rigorous highland climate. Indeed, Story has suggested that macchia is the climax above the treeline in all but the most exposed parts of the Keiskammahoek district,[1] and there is no reason for the adjoining Fort Beaufort and Victoria East districts to be any different. At first sight there appears to be a dilemma confronting farmers in the highlands, one of whether to check the spread of macchia by harmful artificial means such as firing or else to allow it to overwhelm the source of income, grass. Either choice is economically disastrous. There is, however, a third and not so obvious system - one of light grazing,

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[1] R. Story, "A Botanical Survey of the Keiskammahoek District", Botanical Survey of S.A., Memoir No. 27, 1952, p. 140.

allowing the macchia to spread slowly across the dense sward of grass. Individual shrubs can then be cleared mechanically before they have an opportunity to overwhelm the grassland. In this way the farmer's livelihood can be assured, at the same time allowing this unique and ancient flora to survive. Acocks refers to the fynbos of the Eastern Cape as "False Macchia",[1] but there is much evidence to support the theory that the macchia of the Amatole-Winterberg highlands is the ancient and normal vegetation type.

4. HIGHLAND KARROID GRASSLAND

This vegetation type is more or less synonymous with Acocks' Karroid-Danthonia Mountain Veld.[2] It is a scrubby type of grassland, occurring on either side of the Baviaans River valley in the northern portion of the Bedford district at an altitude of more than 4,000 feet. It has proved impossible to obtain long term precipitation data for this vegetation type as far as the Bedford district is concerned. The only long term data available are for Cheviot Fells, elevation 4,400 feet, which lies on the lower, and therefore drier, boundary. As seen in Chapter III, the mean annual rainfall at Cheviot Fells over a 68 year period was 18.64 inches. Spring Valley, in the Tarkastad district, elevation 4,649 feet, is well within the boundaries of the Highland Karroid Grassland, yet over a 37 year period recorded an average annual precipitation of only 14.41 inches. Temperature and exposure are therefore as important as precipitation in determining the lower boundary of this vegetation type. There is no upper limit, as the crests of the mountains are too low to bring about the necessary climatic changes. The other boundary appears to be closely related to precipitation. It would appear that wherever the mean annual precipitation approaches an average of 25 inches the Highland Karroid Grassland gives way to Sour Grassland. In the Bedford

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[1] J.P.H. Acocks, "Veld Types of S.A.", Pretoria, 1953, p. 154.

[2] Ibid., pp. 140-142.

district, this boundary runs along the summit of the Baviaans River Mountains, to the east of which the climate is wet enough to support Sour Grassland.

The dominant grass in the Highland Karroid Grassland is Danthonia disticha, but Acocks states that "although it may be the natural dominant on rocky sandstone parts, it is probable that in all dolerite parts, and all parts covered with soil, Themeda and Tetrachne are the natural dominants."[1] Acocks is obviously referring to Tetrachne dregei. Although Themeda triandra is fairly abundant in certain portions of this vegetation type, the present writer has neither encountered Tetrachne dregei, nor has he discovered any references to it as far as the Bedford district is concerned. It should be realised that Acocks' so-called Karroid-Danthonia Mountain Veld covers a wide area, extending as far north as the Steynsburg and Colesberg districts and as far west as Abderdeen. Indeed, a large number of plants listed by Acocks as being abundant in this vegetation type do not occur in the Bedford district at all.

In the highlands overlooking the Baviaans River valley Danthonia disticha is the undisputed dominant. When young it is a palatable and reasonably nutritious grass, despite the filiform, wiry appearance of the leaves. During maturity it becomes less palatable, but the seed-head itself remains palatable and nutritious, even when the leaves have dried out. Associated with the dominant Danthonia disticha there are numerous other grasses in the Highland Karroid Grassland of the Bedford district. These include Danthonia stricta, Themeda triandra, Festuca scabra, Eustachys paspaloides, Ehrharta calycina, Koeleria cristata, Bromus speciosus, Helictotrichon sp., Pentaschistis sp. and Melica decumbens. With the exception of the last named species all are of economic value, providing grazing of medium to good nutritional value. Melica decumbens, however, is said to have an intoxicating effect on stock, and for this reason

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[1] J.P.H. Acocks, "Veld Types of S.A.", Pretoria, 1953, p. 140.

is known by farmers as "Dronkgras."

Associated with the above mentioned grasses are a large number of shrubs. Very abundant, particularly at lower altitudes, is Diospyros austro-africana var. microphylla.[1] These sprawling shrubs, formerly named Royena hirsuta,[2] show evidence of heavy browsing by animals. The vernacular name, "kraaibos", applied to several species of Diospyros, was first recorded by Thunberg in 1772, and is derived from the fact that the fruits are considered of inferior quality, fit only for a crow.[3]

The ericoid-leaved, evergreen Passerina montana[4] is fairly common and is the most conspicuous element of macchia in the higher parts of this vegetation type, although there are several other Mediterranean type sclerophylls such as the cupressoid-leaved Elytropappus rhinocerotis (the renosterbos or rhinoceros bush), which, however, is not dominant anywhere in the Bedford district. The low growing, needle-leaved Composite, Relhania pungens, is another prominent member of the sclerophyllous community. Despite its small size, its bright green leaves are most conspicuous during the winter months as well as during the frequent summer droughts, when the grasses are in various shades of bistre. Another needle-leaved sclerophyll is Metalasia muricata which, like Relhania pungens, grows on sandy soils in exposed areas. Proteaceae are markedly absent, in contrast with the moister highlands to the east.

The karroid shrub, Chrysocoma tenuifolia is dominant in over-grazed areas, but occurs elsewhere with numerous other dwarf shrubby Composites such as Aster filifolius, Artemisia afra, Senecio asperulus, various other Senecio species, Helichrysum trilineatum,

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[1] Childs 2, Rhodes University Herbarium.

[2] Flora of Southern Africa, Vol. 26, Govt. Printer, Pretoria, 1963, pp. 64-66.

[3] C.A. Smith, "Common Names of South African Plants", Govt. Printer, Pretoria, 1966, p. 310.

[4] Childs 4, Rhodes University Herbarium.

Eriocephalus africanus and Dimorphotheca species. Many of these are aromatic, particularly the feathery leaved Artemisia afra, commonly known as wormwood and reputed to be of medicinal value. Selago corymbosa is widespread, but is most conspicuous where the grazing pressure has been fairly heavy.

A broad-leaved shrubby species of Rhus[1] is abundant at altitudes exceeding 5,200 feet. At this altitude, in the vicinity of De Beers Pass, the only shrub exceeding ten feet in height is Kiggelaria africana,[2] the wild peach. It is found growing at the base of cliffs of felspathic sandstone of the Upper Beaufort Series. Whereas Kiggelaria may reach a height of 50 feet in the Hogsback forests, it is almost invariably less than 15 feet tall in the northern Bedford district.

Even on rocky areas succulents are not very numerous, but include Aloe broomii var. tarkaensis,[3] which occurs only in the northern part of Bedford district, Cotyledon species and several small species of Crassula, of which Crassula perforata is abundant. Many succulents cannot survive the low temperatures experienced at these altitudes, but it would appear that the above mentioned species contain certain compounds which prevent their protoplasm from freezing readily. Encephalartos cycadifolius[4] occurs in the Highland Karroid Grassland to the west and north-west of Eildon. Unlike most species of cycad, it can survive temperatures well below freezing without suffering defoliation.

5. SCRUB WOODLAND[5]

This type of vegetation consists mainly of gnarled evergreen trees smaller and more uniform in size than those of the Temperate

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[1] Childs 3, Rhodes University Herbarium.

[2] Childs 7, Rhodes University Herbarium.

[3] See page 107.

[4] See pages 107 - 108.

[5] For definitions of the terms scrub and woodland see L.D. Stamp, "A Glossary of Geographical Terms", Longmans, London, 1961. B.D. Jackson, "A Glossary of Botanic Terms", Duckworth, London, 1965.

Evergreen Forest together with a large variety of xerophytic shrubs and climbers. On more exposed sites, or where clearing has taken place, it resembles relatively open savannah. Scrub Woodland represents the reaction of the Evergreen Temperate Forest to the warmer and drier conditions prevailing in the valleys of the major rivers draining this area. It is synonymous with Acocks' "Valley Bushveld", in part.[1]

In general Scrub Woodland occurs in those parts of the valleys below 2,500 feet and above 1,000 feet in altitude. On sheltered slopes it is found as high as 3,500 feet, provided the average annual rainfall is less than 26 inches. At this altitude, as on the slopes of the Katberg, Scrub Woodland can be seen to grade into Temperate Forest. However, the annual rainfall is usually less than 26 inches, ranging from about 15 to about 23 inches over most of the Scrub Woodland. It occurs in the Mancazana, Koonap and Waterkloof-Solan valleys north of Adelaide, in the valleys of the Kat River and its tributaries, in the middle and lower Tyume valley and in the Keiskamma River valey. In the southern Fort Beaufort and Victoria East districts a narrow fringe of Scrub Woodland occurs on the less arid upper parts of the heights overlooking the very low lying, arid Great Fish River valley. There is also a somewhat broken strip of Scrub Woodland on the higher parts of the hills bordering the Great Fish River valley in the western part of the Bedford district, as well as on the lower slopes of the Kagaberg north of Bedford town.

The Scrub Woodland contains numerous attractive tree species. These include Boscia oleoides[2] (witgatboom), Euclea undúlata (gwarri), Ptaeroxylon obliquum (sneezewood), Cassine capensis (bastard saffron), Schotia afra (boerboon), Chaetacme aristata (bastard white pear),

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[1] J.P.H. Acocks, Botanical Survey of South Africa, Memoir No. 28, "Veld Types of South Africa", Govt. Printer, Pretoria, 1953, pp. 78-79.

[2] This is synonymous with Capparis oleoides.

Pappea capensis (wild plum), Olea africana (wild olive), Cussonia spicata (kiepersol or cabbage tree), Fagara capensis (knobwood or knobthorn), Scolopia zeyheri (thorn pear), Hippobromus pauciflorus (horsewood or baster perdepis), Harpephyllum caffrum (kaffir plum), Buddleia saligna and B. salvifolia (white olive).[1] Several of these species also occur in the lower portions of the Temperate Evergreen Forest, and all are evergreen. The only abundant deciduous tree is Acacia karroo (sweet thorn or mimosa), but it is usually far less numerous than Boscia oleoides, Euclea undulata, Ptaeroxylon obliquum and several other trees. The foliage of all the above-mentioned species provides good fodder for livestock. The great majority of the evergreen trees have rather glossy, tough, dark green leaves with thick cuticles and relatively few stomata on the upper surface, apparently to retard transpiration. In moist ravines, near the upper margin of the Scrub Woodland, is Calodendron capense. This deciduous tree, as mentioned earlier, is also a member of the Temperate Evergreen Forest. Its large open clusters of pink or lilac flowers are borne in early summer.

Each of the above-mentioned trees is of interest, the more notable examples, apart from Calodendron capense, being Ptaeroxylon obliquum, Cussonia spicata, Olea africana, Buddleia salvifolia, B. saligna and Schotia afra. Ptaeroxylon obliquum occurs as a small tree in the Scrub Woodland although it may attain a height of 40 feet in the Temperate Evergreen Forest. Ptaeroxylon obliquum is most conspicuous after the first heavy summer rain, when it bears large panicles of sweetly scented small yellow flowers. This tree, owing to the extremely durable nature of its wood, has been felled in large quantities for building purposes and for use as railway sleepers, telephone poles and fencing posts. It is therefore no longer as abundant as before. Cussonia spicata, which

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[1] For descriptions of many of these species see N. Pitman and E. Palmer, "Trees of South Africa", Balkema, Cape Town, 1961.

occurs in the Temperate Evergreen Forest, is conspicuous everywhere in Scrub Woodland, except in frosty areas, for exposed saplings will not survive screen temperatures of less than 30°F. Its soft and spongy wood is of little use for timber, and this is probably one of the reasons why this tree is still so abundant. The large palmately divided leaves present a very mesophytic appearance, yet, during severe droughts, when the foliage of several species of Scrub Woodland trees has a somewhat shrivelled appearance, that of Cussonia spicata remains green and luxuriant. This is probably because of the large fleshy roots, which retain water. According to Sim, "During times of scarcity the Natives dig out the large succulent roots of this tree and live more or less upon them. They have a slightly acidulous taste, and when freshly dug are cool and sappy, and about as easily chewed as a turnip."[1] Widespread in the Scrub Woodland, where it is often dominant, particularly where dolerite occurs, is Olea africana, a shapely rounded tree with foliage that glistens in the sun. In contrast with the dark green, thick cuticled, waxy upper leaf surface, the under surface of the leaf is covered with tiny silver to yellow-grey scales, presumably to retard transpiration. In full sunlight the masses of shimmering leaves give olive-clad hillsides the appearance of a Van Gogh painting. It is mainly the smallness of the flower and fruit which separates Olea africana from O. europoea, the cultivated olive of commerce. The latter has been successfully grafted onto the wild species. Impey states that in the main olive producing regions of the world the best crops are obtained where the lowest mean monthly temperatures are below 52°F. Above that the yields are less satisfactory and above 57°F. the trees produce no crop at all.[2] O. europoea trees planted on the

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[1] T.R. Sim, "The forests and forest flora of the colony of the Cape of Good Hope", Taylor & Henderson, Aberdeen, 1907, p.230.

[2] L.H. Impey, "The Olive Industry in South Africa", S.A.Geographical Journal, Vol. XLIV, 1962, p. 38.

farm, Surrey, in the Stockenström district, showed no sign of bearing any fruit twelve years after they had been planted in 1956. The mean July temperature at Surrey, altitude 2,100 feet, is approximately 55°F. Although outside the Scrub Woodland, the lowest mean monthly temperature of this station may be regarded as typical of this vegetation type. We can assume, therefore, that much of the Scrub Woodland area is too warm in midwinter for the commercial production of European olives. Buddleia salviifolia and B. saligna, both known commonly as white olive, also have leaves which are dark green above and white or yellowish-white below, but the white colour is due to minute stellate hairs on the under-surface of the leaves. Moreover both species of Buddleia bear small cream or white flowers in large clusters in contrast with the small green flowers of Olea africana which are borne singly and are therefore inconspicuous. It is often difficult to distinguish the two Buddleias, but the leaves of B. salviifolia are stipulate whereas those of B. saligna are exstipulate. The bark of the former is light green, whereas that of the latter is usually light brown. Schotia afra is a small, many branched tree which bears attractive bright red flowers in spring. The flowers develop pods which, when mature, are hard and brown and up to 3½ inches long, containing several tan coloured beans which are edible, hence the Afrikaans name boerboon, meaning farmer's bean. The tall Euphorbia tetragona and E. triangularis are very abundant on some hillsides. Exposed young plants are killed by air temperatures of less than 30°F., and for this reason they are not found in frosty valley bottoms. On some farms they are regarded as a pest, and are being eradicated en masse. Both species contain a pungent latex which produces intense inflammation if brought into contact with the mouth, eyes or an open wound. It has been used in the Eastern Cape for the manufacture of an inferior grade of rubber, as well as for gum for "chewing gum".[1]

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[1] A. White, R.A. Dyer, B.L. Sloane, "The Succulent Euphorbieae", Vol. II, Abbey Garden Press, Pasadena, 1941, p.895.

In the undisturbed Scrub Woodland there is a rather dense undergrowth which does not include many deciduous species. The great majority of the woody plants making up the undergrowth have leaves similar to those of the trees. The leaves are in general glossy, tough, dark green and thick-cuticled, with relatively few stomata on the upper surfaces. Many of the shrubs in the undergrowth are thorny. Spinescence is an advantage as a means of protection from herbivores. Some of the other shrubs in the undergrowth are probably protected by being unpalatable or toxic. In overgrazed areas plants with no protective devices tend to disappear, while the spiny, unpalatable or poisonous species tend to increase. The most common shrubs include Scutia myrtina (wag-'n-bietjie or katdoring), Azima tetracantha (beesting), Grewia robusta (crossberry or kruisbessie), Maytenus capitatus, Xeromphis rudis, Allophylus decipiens, Rhus refracta, Carissa bispinosa (num-num or lemoenbessie), Ehretia rigida (deurmekaarbos, kraalbos or Cape lilac), Brachylaena ilicifolia, Diospyros lycioides s.sp. lycioides (bloubessie or kraaibessie), Phyllanthus verrucosus. The common names of some of the shrubs are usually very apt. The Afrikaans names for Scutia myrtina, "wag-'n-bietjie", meaning "wait-a-while", refers to the difficulty experienced by humans in disengaging their clothing from its curved spines. It is also named "katdoring" (cat thorn), as its curved thorns resemble the claws of a cat. Azima tetracantha is named "bee sting" ("byangel" in Afrikaans) as a puncture from one of its spines causes great pain. Grewia robusta is known as the crossberry or kruisbessie because of its yellowish-orange four-lobed fruit which is eaten by the Bantu. This shrub is sometimes referred to as Assegaai Wood because it was used by the Xhosa for making spear handles. During the summer the violet-pink flowers of G. robusta considerably beautify the landscape. The most common Afrikaans name applied to Ehretia rigida, "deurmekaarbos" (untidy bush), is derived from the interlaced nature of the decurving branches which gives this tall shrub a somewhat unkempt and untidy appearance. The common English name, Cape Lilac, refers to the colour of its flowers which are produced in great abundance in early spring. A shrub not as abundant as those previously mentioned is Rhigozum obovatum (driedoring or Karroo gold). This is a compact shrub with small greyish green leaves, and therefore fairly inconspicuous. The young shoots are nibbled at constantly by herbivorous animals so that, in overgrazed areas, the plants grow extremely slowly, eventually reaching a maximum height of only about three feet. Marloth, referring to those of "the Karoo and karroid plains to the North", states that "They are merely an entangled mass of stumpy woody branchlets and now stand on the parched plain like worn-out brooms set up on end."[1] During spring Rhigozum obovatum bursts into bloom, when it brightens the countryside with magnificent masses of golden-yellow flowers which hide the shrub for several weeks, thereby transforming it into one of the most conspicuous shrubs of the Scrub Woodland. In protected areas this shrub can exceed seven feet in height.

Plumbago auriculata[2] is extremely abundant. Its soft, light green leaves are in contrast with the rather hard, waxy, dark green or glaucous-green leaves of most of the other woody shrubs. The masses of light sky-blue flowers borne by Plumbago beautify the Scrub Woodland during summer. The tall, succulent shrub, Portulacaria afra, (spekboom or elephants' food) is abundant in those drier parts of the Scrub Woodland where the absolute minimum temperature exceeds 30°F. It is a valuable fodder plant, its small obovate rounded succulent leaves being very palatable and nutritious; during droughts they supplement the water requirements of livestock. During midsummer Portulacaria afra brightens the landscape with dense masses of attractive small pink flowers.

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[1] R. Marloth, "The Flora of South Africa", Vol. III, Section 2, Darter Bros., Cape Town, 1932, p. 153.

[2] Plumbago auriculata Lam. is synonymous with Plumbago capensis Thunb.

Xerophytic climbers such as Cynanchum ellipticum, Sarcostemma viminale and Secamone frutescens, all belonging to the family Asclepiadaceae, are common. Cynanchum ellipticum in some instances may completely cover a tree with its dense mass of small leaves, thereby causing it to die from lack of sunlight. Sarcostemma viminale is aptly named melktou (Afrikaans for "milk rope") owing to the large amount of latex in its stem. Secamone frutescens is commonly known as bobejaantou or monkey rope. Common climbers belonging to the family Liliaceae are the feathery-leaved Asparagus plumosus and the broad-leaved Asparagus asparagoides. The former used to be popular for wreaths and bouquets; the latter, commonly known as breëblaarklimop, broad-leaved creeper or krulkransie, is widely cultivated in Europe, where it is known as Cape smilax.[1] A very abundant member of the undergrowth in areas where the absolute minimum temperature is above 29°F. is the climber Rhoicissus digitata, a member of the family Vitaceae. It is therefore related to the common grape, producing fruits which, when ripe, are not unlike grapes in appearance. These fruits are eaten by baboons, hence the Afrikaans name "bobbejaandruif" (baboon grape). The common English name is wild grape. Rhoicissus digitata has a large fleshy root-stock, usually completely buried in the soil, which enables its leaves to remain green and fresh in times of drought. A fairly abundant scandent member of the Geraniaceae is Pelargonium peltatum, known as the Ivy-leaved Geranium.

The white-flowering Sansevieria thyrsiflora, one of the few South African members of the family Agavaceae, is abundant, suckering freely wherever the undergrowth is not very dense. The very much larger Agave americana, commonly known as American aloe, century plant or garingboom, is a far less common alien which has been planted to form hedges around Bantu kraals or paddocks. Its freely suckering nature has caused it to spread. For this reason

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[1] C.A. Smith, "Common Names of South African Plants", Govt. Printer, Pretoria, 1966, p. 315.

some farmers have planted Agave americana in dongas to check soil erosion. Numerous in most open or rocky areas are various species of Cotyledon, Crassula and Kalanchoe, all members of the family Crassulaceae. Most of these have attractively shaped succulent leaves. Cotyledon orbiculata, C. ramosissima, C. velutina and C. coruscans have pink and orange tubular flowers. Those of Cotyledon teretifolia are yellow. A considerable amount of hybridisation between the various species of Cotyledon seems to have occurred. The most noteworthy of all the Crassula species growing in the Scrub Woodland is Crassula perfoliata, which bears beautiful bright red inflorescences during midsummer. Kalanchoe rotundifolia also has bright red flowers, but these are never as conspicuous. In the lower and drier portions of the Scrub Woodland, where it is transitional to the Fish River Scrub, the cycad, Encephalartos lehmannii, adds interest to this floristically rich community.

Succulent Asclepiadaceae also occur in the Scrub Woodland. The most common of all is Stapelia flavirostris. This chamaephyte bears flesh-coloured starfish-shaped flowers which have a carrion smell, thereby attracting flies and other insects as pollinating agents.

As stated in the introduction, Sir Francis Younghusband, in his presidential address to the Royal Geographical Society in 1920, declared that it is the duty of geographers to undertake the analytical study of beauty in scenery. Bearing this in mind, one cannot ignore the numerous aloes which considerably beautify the Scrub Woodland, particularly when in flower.[1] The tall, spiny Aloe ferox is abundant on hillsides. During June and July its bright orange-red flowers render it most conspicuous. In some localities the leaves are cut for the extraction of the juice which, owing to its laxative properties, is of importance to the

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[1] For descriptions of various Aloe spp., see G.W. Reynolds, "The Aloes of South Africa", Aloes of S.A. Book Fund, Johannesburg, 1950.

pharmacological trade. Some farmers erroneously believe that _Aloe ferox_, by virtue of its nutritional requirements, prevents grass from growing around it and so they destroy it systematically. Another arborescent aloe of less widespread occurrence is _Aloe pluridens_, with slender pale green leaves, gracefully recurved and bearing small soft pinkish-white teeth. It is less widely distributed than _A. ferox_ owing to its greater sensitivity to frost, exposed young plants being killed by temperatures of 29°F. The largest numbers occur in less frosty areas south of Bedford, Adelaide and Fort Beaufort. _Aloe pluridens_ usually flowers in May.

In contrast with the arborescent aloes which bear orange flowers are two varieties of the shrubby _Aloe tenuior_, seldom exceeding three feet in height, which bear yellow flowers. They have glaucous green serrated leaves. _Aloe tenuior, var. densiflora_, characterised by scandent stems, is particularly abundant in Victoria East, north-west, west and south-west of Breakfastvlei, but it is not found elsewhere in this area. The deciduous variety, _Aloe tenuior, var. decidua_, characterised by erect stems, is far more widespread, probably because it is more resistant to frost. It is fairly abundant in the Tyume valley both north and south of Alice, in the Kat River valley from Seymour to south of Fort Beaufort, in the Scrub Woodland north of Adelaide, and in the Great Fish River valley along the western borders of the Bedford district. The variety _decidua_ usually flowers in the summer months, while var. _densiflora_ usually flowers in May.

The more common grasses of the Scrub Woodland include _Panicum maximum_, _P. deustum_, _P. stapfianum_, _Sporobolus sp._, _Cynodon dactylon_, _Setaria neglecta_, _Heteropogon contortus_, _Themeda triandra_, _Eragrostis_ sp. and _Setaria chevalieri_. All remain highly nutritious throughout the year. Many farmers have engaged in extensive shrub and tree clearing to enable these grasses to spread, so that in many areas the Scrub Woodland resembles savannah country.

6. THE FISH RIVER SCRUB

The Scrub Woodland of the upper slopes bordering the Great Fish River valley becomes more open, scrubbier and thornier down the valley sides, with the proportion of succulents increasing as the altitude decreases. Every stage of transition can be traced from the Scrub Woodland climax of mesophanerophytic dry forest to the open nanophanerophytic succulent communities occupying the flat, dry valley floor. The Fish River Scrub, separated by Grisebach in 1872,[1] is recognised by Acocks as a subdivision of his "Valley Bushveld".[2] Dyer, in his study of the vegetation of Albany and Bathurst, refers to this type as "Karroid Scrub".[3] Martin and Noel, dealing with the same area, call it "Low Succulent Scrub".[4] The Fish River Scrub, whatever one may wish to call it, is distinguished from the adjoining Scrub Woodland by the great abundance of succulent forms. In the area under discussion it occurs along the southern boundary of the Fort Beaufort and Victoria East districts on the floor and lower slopes of the Great Fish River valley as well as in the lower Koonap River valley along the southern Fort Beaufort boundary at altitudes mainly below 1,100 feet in the west and below 800 feet in the east, reaching a minimum of about 250 feet in the south-east at Committees. From the Koonap confluence to two miles north of Committees the Great Fish River is confined to what may best be described as a gorge, so that the area of Fish River Scrub is very narrow. Upstream and downstream from these points the

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[1] A. Grisebach, "Die Vegetation der Erde nach ihrer klimatischen Anordnung", Vol. II, Wilhelm Engelmann, Leipzig, 1872, p.195.

[2] J.P.H. Acocks, Botanical Survey of S.A., Memoir No. 28, "Veld Types of South Africa", Govt. Printer, Pretoria, 1953, pp. 80-81.

[3] R.A. Dyer, Botanical Survey of S.A., Memoir No. 17, "The Vegetation of the Divisions of Albany and Bathurst", pp. 87-104.

[4] A.R.H. Martin and A.R.A. Noel, "The Flora of Albany & Bathurst", Rhodes University, Grahamstown, 1960, p. X.

area of succulent scrub is much broader. Because of the low altitude and interior position the average annual rainfall is low, approximating 18 to 14 inches. The value of the relatively low rainfall is considerably reduced by the high evaporation rate resulting from the high temperatures experienced at this low altitude. The Fish River Scrub may be regarded as Scrub Woodland, or in the extreme sense, as Temperate Forest, modified in response to arid conditions. Indeed, Sim has aptly described it as "the effect of a Karroo climate on a forest vegetation."[1] Certain Scrub Woodland trees such as Ptaeroxylon obliquum, Pappea capensis, Brachylaena ilicifolia, Boscia oleoides, Acacia karroo, Schotia afra and Cussonia spicata are numerous in the Fish River Scrub, where, however, they usually occur as nanophanerophytes or small mesophanerophytes. Frost is very light or else non-existent, thereby allowing many subtropical species to adapt themselves to the arid environment.

Portulacaria afra is the most abundant of all species. Although very common on the valley floor, it is even more abundant on the more densely covered valley sides. As previously stated, this succulent shrub, which is particularly conspicuous when its bright pink flowers adorn the countryside, is of great value as stock fodder. Also abundant is the pale-pink flowering Grewia robusta, a shrub which is less readily eaten by herbivores. Besides the previously mentioned Scrub Woodland trees which usually occur as nanophanerophytes, shrubs of general occurrence are Rhoicissus cirrhiflora, Asparagus striatus, A. racemosus, Maytenus capitatus, Azima tetracantha, Jatropha capensis, Phyllanthus verrucosus, Crassula argentea, Ehretia rigida, Rhigozum obovatum, Rhus refracta, Pelargonium peltatum, Cadaba juncea, Putterlickia pyracantha, Carissa haematocarpa and Lycium ferocissimum, as well as several other species of Lycium. The ground between the plants consists of bare rock or

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[1] T.R. Sim, "The Forests and Forest Flora of the Colony of the Cape of Good Hope", Taylor & Henderson, Aberdeen, 1907, p.6.

shallow soil with small nanophanerophytes and chamaephytes. Where soil occurs this sparse undergrowth is particularly rich in the small-leaved, herbaceous Crassula lycopodioides. Sansevieria thyrsiflora is also very abundant, as well as the succulent-leaved, slender-stemmed Crassula perforata which usually occurs semi-scandent amongst the shrubs. Crassula cultrata and Cotyledon species are fairly abundant. So also are succulent chamaephytes belonging to the Aizoaceae or Asclepiadaceae. Of the former Delosperma frutescens and Malephora spp. are frequent, but the genera Pharnaceum, Hypertilis, Galenia, Aizoon, Tetragonia, Aridaria, Bergeranthus, Drosanthemum, Eberlandtzia, Faucaria, Glottiphylum, Hereros, Lampranthus, Mestoklema, Psilocaulon, Ruschia, Sceletium and Trichodiadema are well represented. Grass is rarely conspicuous, but the most common grasses appear to be Panicum spp., Digitaria sp. and Sporobolus spp. Even Themeda triandra occurs in patches.

Aloe ferox is fairly widespread, but avoids steep slopes. Euphorbia bothae, which attains a maximum height of three to four feet, is dominant over a two mile square sector along the open valley floor south of the Great Fish River gorge in the Victoria East district as far as Committees Drift. This portion of the valley floor is very shaly, much of the original thin cover of soil having been removed by sheetwash. Similar conditions prevail over much larger areas in the adjacent Albany and Peddie districts, where Euphorbia bothae is also dominant. Another shrubby, spiny member of the genus Euphorbia present in this community is Euphorbia pentagona, which can attain heights of almost ten feet. It is the tallest of the succulent Euphorbieae with peduncular spines.[1] The somewhat smaller, but equally spiny, E. inconstantia is also abundant. Spineless, much branched, nanophanerophytic Euphorbieae, viz. E. mauritanica, E. burmanni and E. rhombifolia

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[1] A. White, R.A. Dyer, B.L. Sloane, "The Succulent Euphorbieae", Vol. II, Abbey Garden Press, Pasadena, 1941, p. 628.

are abundant in this community. All three species have small, rudimentary, deciduous leaves which are soon shed. Also abundant are the chaemaphytic E. inermis and E. squarrosa. All the above mentioned succulent Euphorbieae are laticiferous. They bear small yellow flowers which are crowded together, thereby rendering them conspicuous.

Aloe speciosa is conspicuous on the steep sides of the Great Fish River gorge from the Koonap confluence to two miles north of Committees. The rosettes of pink-edged leaves are almost invariably oblique or tilted sideways. The striking pose of this aloe adds to the weird and awe-inspiring appearance of the gorge region.

In 1872 Grisebach described the vegetation of the Great Fish River valley as "the wildest of bush thickets, mingled with so many succulents, that even in dry weather they cannot be destroyed by fire. Here the dense growth leaves no spaces between; by reason of the thorns and the tough nature of the twigs the bush is even more impenetrable than the primaeval forest of the tropics; it is the habitat only of the large pachyderms, along whose trails the thievish kaffir can creep lithely without the white man being able to follow him."[1] In its undamaged state the Fish River Scrub is still very much as Grisebach depicted it, but it has been considerably thinned by grazing and clearing over much of the area. The pachyderms are presumably elephants, which were numerous in the Fish River Scrub during the early part of the nineteenth century but no longer occur in the area.[2] The only wild elephants in the Eastern Cape at present occur in a similar vegetation type in the Addo Elephant National Park 60 to 70 miles southwest of the Great Fish - Koonap confluence.

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[1] A. Grisebach, "Die Vegetation der Erde nach ihrer klimatischen Anordnung", Vol. II, Wilhelm Engelmann, Leipzig, 1872, p.195.

[2] W.T. Black, "The Fish River Bush, South Africa, and its Wild Animals", Pentland, Edinburgh, 1901, p.23.

On the steep slopes forming the northern border of the Great Fish River valley the low succulent scrub is replaced by a much taller form in which microphanerophytic or even mesophanerophytic Euphorbieae, viz. Euphorbia tetragona, E. triangularis and E. curvirama are most conspicuous. Portulacaria afra is far more abundant than on the more subdued terrain. Aloe pluridens, which does not occur on the valley floor, is fairly common. The tree species previously mentioned occur here mainly as microphanerophytes. This is obviously a zone of transition between the Fish River Scrub and the Scrub Woodland. In this xerohylium Pelargonium peltatum and Sarcostemma viminale frequently occur as scramblers. The Cycadaceae are represented by Encephalartos lehmannii and E. horridus, which occur less frequently at lower altitudes. E. lehmannii has a thick trunk up to four feet tall and bears attractive bluish-green leaves about three feet long, each narrow leaflet tipped with a spine. E. horridus is stemless, but has similar sized silvery-blue leaves, the leaflets being forked and twisted in a regular fashion, each of the three tapering portions being tipped with a spine. This regimental uniformity of design renders an appearance less formidable than the name would imply. These two species of Encephalartos are the only Gymnosperms occurring in the Fish River Scrub and the adjoining Scrub Woodland.

A feature of the Fish River Scrub is the large number of plants which possess water and food storage organs, thereby enabling them to survive the long dry spells. Plants such as Portulacaria afra, Crassula species, Cotyledon spp., Aloe spp., and Kalanchoe rotundifolia, to mention but a few, store moisture in thick succulent leaves. The most common stem-succulents are the various species of Euphorbia. Sarcostemma viminale and the various species of Stapelia also use their stems for storing moisture and food. Jatropha capensis, Pachypodium bispinosum and P. succulentum store moisture and food in large submerged tuberous stems. It should be realised that, as far as many members of the

Fish River Scrub community are concerned, frost is a limiting factor. A large number of species, particularly succulents, are unable to survive more than a few degrees of frost. Only because of the mild winters, therefore, is it possible for such a rich flora to occur in such an arid region. The nature of the Great Fish River plant community supports Schimper's observations that the type of vegetation is determined by the moisture and the type of flora by the temperature.[1]

7. ACACIA SAVANNAH

A sixty-mile-long belt of Acacia karroo savannah, which Acocks designates "False Thornveld"[2] stretches from about ten miles west of Bedford to beyond the eastern boundary of the Victoria East district. It is essentially a xerophilous grassland containing numerous, generally stunted specimens of Acacia karroo which may however, attain heights of fifteen feet or more. This savannah zone is broken by strips of Scrub Woodland along the north-south trending Kat and Tyume valleys. It also contains pockets of Scrub Woodland along the Mancazana, Koonap and Waterkloof-Solan valleys which radiate northwards from Adelaide. As can be seen from the map, the major interruption of the Acacia karroo savannah is the relatively broad belt of Scrub Woodland along the Kat River valley. Just north of Fort Beaufort this belt is five miles wide. After becoming constricted in the vicinity of the town, mainly as a result of human interference, it broadens considerably towards the south. The zone of Scrub Woodland along the lower and middle Tyume valley is very narrow, giving way to Acacia Savannah in the upper Tyume.

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1 A.F.W. Schimper, "Plant Geography upon a Physiological Basis", Clarendon Press, Oxford, 1903, p. 160.

2 J.P.H. Acocks, Botanical Survey of South Africa, Memoir No. 28, "Veld Types of South Africa", Govt. Printer, Pretoria, 1953, pp. 74-75.

In general Acacia Savannah occupies undulating country along the foot of the mountains where the rainfall averages from 20 to 26 inches per annum. This belt has an east-west trend corresponding with the submontane peneplain. Tongues of Thornveld extend southwards along the interfluves separating the entrenched valleys. On these exposed interfluves, where temperatures are lower than in the adjacent valleys, Acacia Savannah occurs where the average rainfall is as low as 18 inches.

The grasses of the Thornveld range from slightly sour to considerably sweet. In contrast with the sourveld, the sweet grasses remain nutritious throughout the year, even when they are dry. They are thus subjected to considerable grazing pressure throughout the year and there has always been a tendency to overstock. Acocks calls this vegetation type "False Thornveld" and states that it "is to be visualised as having been originally either Eastern Province Grassveld (as parts are today) or scrub-forest marginal to the high forest of the mountains."[1] Today, presumably as a result of overstocking, it consists of relatively short grassland with numerous Acacia karroo trees. There is also a sprinkling of more attractive evergreen Scrub Woodland trees, such as Buddleia saligna, Olea africana, Ptaeroxylon obliquum, Boscia oleoides, Cussonia spicata, Cassine capensis, C. crocea, Schotia afra and Canthium inerme, together with shrubs such as Scutia myrtina, Azima tetracantha, Grewia robusta, Maytenus polyacantha, M. capitata, Xeromphis rudis, Allophylus decipiens, Rhus longispina, Brachylaena ilicifolia, Lasiocorys capensis and Phyllanthus verrucosus. The majority of the evergreen trees are tall and spreading, similar to those of the so-called "Dry Forest" previously described. The deciduous forest tree, Calodendron capense, is sometimes found in ravines and on dolerite slopes. Veld fires and chopping for timber and firewood have resulted in the destruction of many of the large

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[1] J.P.H. Acocks, Botanical Survey of S.A., Memoir No. 28, "Veld Types of South Africa", Govt. Printer, Pretoria, 1953, p. 74.

evergreen trees and shrubs. Those remaining generally bear evidence of heavy browsing. On certain farms, as well as in the Bantu reserves, fairly old shrubs occur in the form of densely matted low cones or domes, averaging three to four feet in height. This applies to certain tree species as well, Olea africana being the most common of the dwarf trees. Their great age is indicated by their gnarled and twisted woody stems. In most localities constant grazing by stock has prevented the growth of seedlings so that, with the exception of the quick growing, tough, thorny Acacia karroo, young trees are scarce. Within living memory large areas of open grassland have become crowded with Acacia karroo, which was originally confined to a narrow ecotone of grassy thorn and bush-clump veld marginal to the Scrub Woodland or else to the Temperate Forest. The prerequisite for the encroachment of Acacia karroo is bare patches between the grass tussocks. Where the grass sward is dense the thorn tree does not invade. In maturely dissected terrains studied by the present writer the reversed succession appears to be:

1) Scrub forest with a fair amount of grass on southern and south-eastern slopes, as well as on areas of dolerite-derived soils. Orchard savannah with a dense grass cover elsewhere. These are obviously the climax communities.

2) Overgrazing and trampling results in the shortening of the grass cover with bare patches developing, these being colonised by Acacia karroo. Large evergreen trees decrease in number.

3) Sheet erosion and enlargement of bare patches, with Acacia karroo colonising the short grassland as well. Evergreen trees and shrubs are now very widely spaced. Dwarf karroid shrubs, six inches to 24 inches tall, now become conspicuous.

4) Much bare ground with little grass. Acacia karroo and karroid shrubs dominant.

Definite evidence of much of this area formerly having been covered with scrub forest can be seen along the boundaries of certain farms adjoining the mountains. On occasions it is possible to see scrub forest with many tall trees on one side of the boundary fence give way on the other side to poor grassland with many patches of bare ground. The only microphanerophyte occurring in such poor grassland is usually Acacia karroo, while the karroid shrublet Chrysocoma tenuifolia is dominant on the bare patches. If the grazing pressure is relieved during stages 2 or 3, Acacia karroo can serve as a pioneer tree of the Dry Temperate Forest. Occasionally clumps of trees can be built up in the open around a nucleus of Scutia myrtina or Azima tetracantha, but the usual development of forest follows essentially the pattern described by Bews.[1] Scattered Acacia karroo in open grassland gives protection to seedling forest trees. Many of the seeds, of course, are deposited by birds perching on the branches of the Acacia trees. The seedlings grow up to form bush clumps, shading and killing the Acacia karroo in the process, and spreading outwards until they merge and form an unbroken community. Story remarks that "Without the Acacia the forest would probably spread more slowly than it does."[2] Under a single dying Acacia tree near the forest margin in the hills above Debe Nek, Story noted the seedlings of 38 species of trees and shrubs.[3] Acacia karroo, being a legume with well-developed root nodules, probably enriches the soil through the addition of nitrates, and, from this point of view, is useful. Marloth records its value as a fodder tree, the leaves, flowers and pods being edible.[4] Sim states that the bark is a good source of

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[1] J.W. Bews, "The plant succession in the thornveld", Report of the S.A. Association for the Advancement of Science, 1917, Cape Town, 1918, pp. 153-172.

[2] R. Story, Botanical Survey of South Africa, Memoir No. 27, "A Botanical Survey of the Keiskammahoek District", Govt. Printer, Pretoria, 1952, p. 65.

[3] Ibid.

[4] R. Marloth, "The Flora of South Africa", Vol. 2, Darter Bros., Cape Town, 1925, p. 53.

tannin, and was much used before the exotic Acacias were cultivated in South Africa.[1] The tree is extensively used by the Bantu for firewood. The branches are most effective in the construction of temporary fences for enclosing pasturage or cultivated lands, or for the construction of kraals. They are also useful for the construction of silt traps in the reclamation of eroded slopes or gullies, and any grass seed caught therein is shielded from excessive insolation, the thorns providing protection from herbivores. The gum exuded by Acacia karroo may be of economic value.

The climax grass in the Acacia Savannah is Themeda triandra (rooigras). It has, however, disappeared in many localities owing to overgrazing, selective grazing, indiscriminate burning and other forms of mismanagement. On scientifically managed farms such as Tukulu, near Alice, this grass is dominant on virtually all soil types.[2] Although Themeda triandra forms a dense sward when not misused, many other grasses grow in association with it. Under conditions of pasture mismanagement these other grass species tend to replace the Themeda. The first stage in the degeneration is marked by the dominance of the taller, more tufted Digitaria eriantha and Sporobolus fimbriatus, commonly known as finger grass and feather grass. Thus, in slightly mismanaged areas, Themeda triandra dominance is often confined to the more fertile dolerite and alluvial soils, with Digitaria and Sporobolus dominant elsewhere. Where overgrazing and erosion is even more severe, Aristida congesta and the very similar A. barbicollis, both known as steekgras, are often dominant. This is particularly the case in poor sandy or shaly localities, as Aristida species in general are able to withstand dry

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[1] T.R. Sim, "The forests and forest flora of the colony of the Cape of Good Hope", Taylor & Henderson, Aberdeen, 1907, p. 59.

[2] E.D. Matthews, "Tukulu", Lovedale Press, 1956, pp. 171, 130, 163 etc.

conditions to a remarkable degree.[1] It is for this reason that they are able to establish themselves on "tramped out" areas from which most of the soil has been removed by erosion. Both A. congesta and A. barbicollis are considered to be of little or no value as fodder plants. Also prominent on disturbed land, particularly on fallow fields, are Eleusine indica and Chloris virgata. However, both these grasses are superior to the above mentioned species of Aristida, for they provide relatively palatable and nutritious grazing. Around the homesteads on European farms animals are usually more concentrated than elsewhere and the soils consequently have a high nitrogen content. Here Cynodon dactylon, a nutritious and palatable grass locally known as Kweek, quick grass or quitch, is dominant. In many stands it is exclusive. The dominance of Cynodon dactylon is even more widespread in the Bantu reserves, where the grazing pressure is constantly high. This short grass appears to be nature's own remedy for overstocking, for it readily creeps by means of stolons and rhizomes to cover bare ground and thus saves it from erosion. W.W. Huffine states that in the United States, where it is known as "Bermuda", Cynodon dactylon has proved a useful pasture for beef cattle in areas with a growing season of 5½ to 6 months and with an annual rainfall of more than 30 inches, provided it is fertilized with nitrogen.[2] In the Acacia Savannah the mean annual precipitation is less than 26 inches, but the growing season is approximately 8 months. Although C. dactylon may remain dormant for long periods, it grows rapidly after good rains and is then eaten readily by livestock in preference to all other grasses, including Themeda triandra. In less mis-managed areas Panicum maximum, commonly known as buffalo grass, is abundant in the shade of trees. It grows rapidly and luxuriantly after rains, producing a large quantity of high quality fodder.

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[1] D. Meredith, "The Grasses and Pastures of South Africa", Central News Agency, 1955, p. 291.

[2] "Quickgrass as Cattle Pasture", Farmer's Weekly, June 12, 1963, p. 45.

Exomis microphylla var. axyrioides (dog bush), Lycium ferocissimum and Atriplex semibaccata, the latter introduced, are abundant on overgrazed areas around farmsteads. The first two shrubs usually inhabit the closely cropped Cynodon dactylon areas, the latter usually occurs on bare patches. The glaucous green, leathery leaved Exomis and the bright green leaved Atriplex are both grazed by herbivores, particularly sheep and goats. Lycium ferocissimum, the tallest of the three, is a rough shrub up to 3 feet high, with spiny and tough branches. It is of irregular growth, shedding its leaves during dry summer spells. Attractive mauve flowers are borne amongst the long spines; these later develop into small tomato-like fruits. The small, bright green leaves are nibbled by goats and sometimes by sheep, but the spines tend to act as a deterrent.

Fairly common in sectors of open grassland are Liliaceous plants belonging to the genera Bulbine and Albuca. Bulbine asphodeloides and B. frutescens are rendered conspicuous by their numerous small bright yellow flowers. The Amaryllis family is represented by Brunsvigia gregaria; in autumn the large bulbs bear striking single umbels of bright pink flowers.

Aloe ferox, briefly described on page 91, is fairly common on rocky hillslopes, particularly where dolerite occurs. This succulent member of the Liliaceae can attain the height of a tall microphanerophyte. In the wetter parts of the Acacia Savannah, mainly in Victoria East, is Aloe arborescens, a well branched microphanerophytic succulent shrub which also occurs in adjacent portions of the Sour Grassland. It is of economic value to the Bantu, who plant it in rows to form hedges separating fields and also to form enclosures for kraaling animals. During May the landscape is brightened by the rows of orange-flowering A.arborescens. Aloe saponaria, a spotted, acaulescent, freely suckering aloe, occurs in several localities within the Thornveld. It appears to be tolerant of a wide variety of climatic conditions, ranging from heights of 4,000 feet on the humid Katberg to only about 1,000 feet in the arid Great

Fish River valley. Because it suckers freely where there is any depth of soil, A. saponaria is useful in checking donga erosion.

Combretum caffrum (C. salicifolium), the bush-willow, is abundant on alluvial soil bordering stream banks in the Acacia Savannah as well as in the adjacent Scrub Woodland, but is rare in the Sour Grassland. It is a tall, graceful, deciduous tree with a crooked light coloured trunk and thick drooping foliage which is browsed by cattle during times of drought. The bright green leptophyllous leaves turn red before falling.

A rapid increase in the number of Acacia karroo trees is usually accompanied by an invasion of karroid shrubs. In the drier west and south-west of the Acacia Savannah these are mainly Pentzia incana, Asparagus striatus, Hermannia candicans, Aster sp. and Indigofera sp. Adjacent to the highlands, where the rainfall is higher, Chrysocoma tenuifolia, the bitter karroo bush, is the principal karroid invader, although Selago corymbosa, Walafrida geniculata, Aster filifolius, Aster muricatus and even Pentzia incana are conspicuous in patches.

Very abundant after rain during the winter half year is Nemesia floribunda, a small annual bearing numerous attractive white flowers streaked with purple and spotted with yellow.

8. KARROID ACACIA SAVANNAH

A rather unusual type of savannah occurs in the Bedford district, where it occupies the Baviaans River valley from south of Glen Lynden to as far north as Cheviot Fells. It also occupies portions of the Great Fish River valley, where it occurs discontinuously from the Bedford-Cradock border to the hills overlooking the Little Fish-Great Fish confluence in the south. Another tract of similar vegetation occurs in the Adelaide district, where it occupies the Koonap River valley from about seven miles south of Adelaide town to the vicinity of the Kroomie River confluence. It also occurs in the lower Kaga (Nyara) River valley. In this vegetation type microphanerophytes occur as loose clumps or single trees in a discontinuous stratum of small karroid shrubs interspersed with grass tussocks. The Karroid Acacia Savannah occupies rain shadow areas, the mean annual rainfall almost everywhere being less than 18 inches. It is probably the result of the thinning out of savannah trees, the destruction of much of the associated grassland and the invasion of karroid shrubs from the west. On Acocks' map of South Africa this vegetation type is indicated as being part of the False Karroid Broken Veld.[1]

The Baviaans River Scrub

This variety of the Karroid Acacia Savannah occurring in the Baviaans River valley and adjacent areas is characterised by an abundance of Acacia karroo, which is seldom close enough to form thickets. These trees are not very tall or well-branched, probably as a result of the low rainfall. Several evergreen savannah trees, rather stunted and usually with rounded crowns, also occur. Of these the most common is Euclea undulata (the gwarri), which is very conspicuous in places, but, unlike Acacia karroo, is seldom dominant. Boscia oleoides (the witgatboom) is also very common. There is a fair sprinkling of Pappea capensis (the wild plum) and Olea africana (the wild olive), the latter actually being dominant in parts of Eildon kloof. The leaves of all four species provide good fodder; their rounded crowns are probably the result of heavy browsing. With its upright, white trunk and ornamentally pruned dark green crown, Boscia oleoides gives a rather formal appearance to the landscape. As Thomas Pringle's "umbra-tree" it was one of the first trees to feature in South African poetry. In his poem, "The Emigrant's Cabin", Pringle writes:

"Where the young river, from its wild ravine,
Winds pleasantly through Eildon's pastures green,
With fair acacias waving on its banks
And willows[2] bending o'er in graceful ranks,
And the steep mountains rising close behind
To shield us from the Snowberg's wintry wind,
Appears my rustic cabin, thatched with reeds,

[1] J.P.H. Acocks, Map, "Veld Types of South Africa", Govt. Printer, Pretoria, 1951.

[2] Pringle presumably is referring to Rhus lancea.

Upon a knoll amid the grassy meads,
And close beside it looking o'er the lea
Our summer seat beneath an umbra-tree." [1]

"The tree", wrote Pringle in a footnote,[2] "to which I have given the above name is termed by the Dutch African Colonists the witte-gat boom (white-bark tree). It is an evergreen with a small leaf and a light coloured stem, rising generally to the height of 10 or 12 feet, and then spreading out into an umbrella-shaped top. One of these trees happened to grow close to the spot where I erected my bee-hive cabin and offered its shade very commodiously for a summer seat".

Almost invariably the space between the trees is much greater than the area occupied by their "crowns". In these intervening spaces there is a mixture of grass and karroid shrubs, but much bare ground can be seen. The most common karroid shrubs are Pentzia incana and Chrysocoma tenuifolia with Asparagus sp. and Aster filifolius conspicuous in places. The most common grass appears to be Eragrostis curvula, which is an excellent fodder grass. North of Eildon Setaria neglecta is abundant. Isolated patches of nutritious Themeda triandra occur throughout the Baviaans River valley, usually on dolerite derived soils. Aristida congesta with A. barbicollis is fairly abundant on rocky sandstone slopes. Sporobolus fimbriatus and Digitaria eriantha occur mainly in areas with a reasonable soil cover derived from argillaceous sedimentary rocks of the Beaufort Series. North of Eildon patches of Hyparrhenia hirta, the tall "thatch grass", are conspicuous after rainy seasons. This is of interest considering that in the standard work on South African grasses it is stated that this species is "rare in Karoo (sic) and Karroid Veld."[3] Around farmsteads in the northern portion of the Baviaans River valley Cynodon dactylon occurs, but it is not very extensive.

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[1] Thomas Pringle, "African Sketches", Edward Moxon, London, 1834, p.35.

[2] Ibid., p.314.

[3] D. Meredith, "The Grasses and Pastures of South Africa", Central News Agency, 1955, p. 510.

Abundant along the banks of the Baviaans River is Rhus lancea, the Karree, which, in times of drought, remains green and attractive, apparently deriving moisture from water contained within the deeply silted river bed. Its foliage is used as fodder in times of drought. Its small, round, yellowish to brown fruits are edible and useful as poultry food. The hard, durable, reddish-brown wood is used a great deal for fencing poles. On the crags overlooking the river are numerous examples of Buddleia lobulata, whose grey attenuated leaves are most distinctive. Cussonia spicata is conspicuous in the southern part of the valley, but further north its place is taken by the smaller and more glaucous Cussonia paniculata, which in places can be seen growing from crevices in sheets of dolerite. A species of Melianthus, a soft woody shrub less than three feet tall, is relatively abundant. It bears attractive red flowers, but the stems and leaves have an unpleasant odour.

Aloe ferox, occurs everywhere on rocky hillsides, and in the southern sector of the valley, Euphorbia mauritanica, E. rhombifolia and Aloe striata are conspicuous. Aloe striata is particularly abundant around Glen Lynden, where it can be seen growing on almost soilless dolerite sheets. Aloe saponaria grows in dense masses at Camerons Glen, some 29 miles by road from Bedford. Aloe broomii var. tarkaensis is abundant on rocky hillsides from Craig Rennie northwards. It occurs only in the northern Bedford district and in adjoining areas of the Tarkastad and Cradock districts. Reynolds records it as occurring in the latter two districts,[1] but not in Bedford district. This variety is very distinct, for its flowers are fully visible when open, unlike the typical Aloe broomii, the flowers of which cannot be seen on account of the large bracts, a feature not shared by any other South African aloe. Yet another species unique to the Baviaans River valley and the adjoining mountains is the very distinctive cycad, Encephalartos cycadifolius.

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[1] G.W. Reynolds, "The Aloes of South Africa", Aloes of S.A. Book Fund, Johannesburg, 1950, p. 165.

In Eildon kloof and Huntly Glen it can be seen growing on almost soilless dolerite. E. cycadifolius was first described in 1954 under the name of E. eximius Verdoorn,[1] but the reassessment of available data favours the application of the name E. cycadifolius (Jacq.) Lehm. to this species if the rules of botanical nomenclature are to be followed.[2] The valuable fodder succulent, Portulacaria afra, is conspicuous in Eildon gorge and around Lyndoch, five miles south of Camerons Glen, where winter frost is obviously less severe than in the rest of the Baviaans River valley. Crassula argentea is also abundant at Lyndoch.

Eildon "cleugh", about which Thomas Pringle wrote several poems,[3] is the most luxuriant sector of the Baviaans River valley. Here the river has cut a narrow gorge through a thick sheet of dolerite. During calm winter nights, when temperature inversions occur, the cold, heavy air draining southwards from the mountains to lower altitudes apparently dams up north of the winding gorge, through which air drainage is apparently difficult. Thus within the gorge and immediately to the south of it winter frosts are light. Trees flourish on the bare, exfoliated dolerite. In those parts where soil covers the rock the trees are close enough to form true woodland. Olea africana is abundant, but the tree species previously mentioned are all present, together with the frost-sensitive Schotia afra. Aloe pluridens, exposed young plants of which cannot survive temperatures of 29°F., occurs in association with Portulacaria afra.

According to Acocks' map, "False Karroid Broken Veld" occupies the Baviaans River valley. Thomas Pringle, however, encountered a rather similar type of vegetation more than 140 years

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[1] Bothalia, Vol. VI, Govt. Printer, Pretoria, 1954, pp. 426-428.

[2] R.A. Dyer, "New Species and Notes on Type Specimens of South African Encephalartos", Journal of South African Botany, Vol. 31, 1965, pp. 117-119.

[3] T. Pringle, "African Sketches", Edward Moxon, London, 1834.

ago. In his poem "Evening Rambles"[1] Pringle writes of

"Sterile mountains, rough and steep
That bound abrupt the valley deep,
Heaving to the clear blue sky
Their ribs of granite,[2] bare and dry,
And ridges, by the torrents worn,
Thinly streaked with scraggy thorn,[3]
Which fringes Nature's savage dress,
Yet scarce releaves her nakedness.
But where the Vale winds deep below,
The landscape hath a warmer glow:
There the spekboom spreads its bowers
Of light-green leaves and lilac flowers,
And the aloe rears her crimson crest,
Like stately queen for gala drest;
And the bright-blossomed bean-tree shakes
Its coral tufts above the brakes," .....

Pringle writes that "The spekboom, (Portulacaria Afra),[4] a favourite food of the elephant, is a succulent arboreus evergreen." In another footnote he writes that "Schotia Speciosa, the Hottentot bean tree, grows abundantly in some parts of the Glen Lynden valley."[5] He is, of course, referring to Schotia afra, the Karroo boerboon, which, when covered in red blossom during early spring, offers a most beautiful sight in Eildon kloof. The aloe referred to is most probably Aloe ferox, which is abundant throughout the valley.

Karroid Acacia Savannah very similar to that of the Baviaans River valley occurs in the remainder of the area occupied by this vegetation type. The area south of the latitude of Cookhouse, 32° 45' S., differs somewhat in that it is not subjected to severe frost. There is an abundance of more frost sensitive species such as those found in Eildon kloof and other less frosty portions of the Baviaans River valley. In the Adelaide district along the eastern margins of the Karroid Acacia Savannah adjacent to the Fish River Scrub

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[1] Thomas Pringle, "African Sketches", Edward Moxon, London, 1834, pp. 21 - 22.

[2] He is referring to the exfoliated dolerite domes, which superficially resemble granite.

[3] Acacia karroo.

[4] T. Pringle, "African Sketches", p. 509.

[5] Ibid.

and Scrub Woodland there is much Senecio pyramidatus and Euphorbia pentagona.

9. DWARF KARROID SHRUB STEPPE

This is an open community of small xerophytic shrubs developed under the semi-arid conditions which prevail in the lower parts of the Great Fish River valley in western Bedford. On Acocks' map of South Africa this vegetation type is also indicated as being part of the False Karroid Broken Veld.[1] Apparently he describes it as "false karroid" because the climate, while semi-arid, has a higher rainfall than the true Karroo, the average at Middleton being 13.29 inches for the period from 1878 to 1959; and also because this vegetation type contains elements of the Scrub Woodland, Fish River Scrub and the grasslands.

The vegetation consists mainly of small, perennial, woody shrublets, 6 inches to 24 inches tall, which form an open community, being spaced about a foot apart. Few of the shrubs are strongly succulent, but most are small-leaved. The root systems have a much wider spread than the twigs; the main roots penetrate to considerable depths. Some of the more prominent members of this community are Chrysocoma tenuifolia, Pentzia incana, P. globosa, P. virgata, P. globifera, Aster muricatus, A. barbata, Hermannia pallens, H. cf. linearifolia, Eriocephalus africanus, Sutera pinnatifida, Walafrida geniculata, Becium burchellianum, Lasiosiphon meissnerianus, Aptosium depressum, Blepharis capensis, Lycium ferocissimum and L. oxycladum. The ability of plants to survive desiccation is to a certain extent correlated with a general reduction in size, both in height and leaf surface. Nevertheless, it is surprising that the karroid shrubs, with no water storage organs, can survive conditions of extreme drought. M. Henrici found that the average daily summer transpiration rate of karroo bush

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[1] J.P.H. Acocks, Map, "Veld Types of South Africa", Govt. Printer, Pretoria, 1951.

leaves is very much lower than that of grasses, which can transpire six times as much in a semi-arid climate.[1] The lower rate of transpiration, their wide spacing and their deep root systems make the karroid shrubs more drought resisting than grasses. However, during droughts they become dry and brittle, often appearing dead, yet with the advent of good rains, they revive in an astonishingly short period and put forth new growth. The primary factor, therefore, in making these plants more drought resisting than grass is their capacity for enduring extreme desiccation without suffering permanent injury. Even when in a dry, brittle state the karroid shrublets are rather rich in proteins and mineral salts, and most species are readily eaten by livestock. For most of the time grass is virtually absent over much of this area, bare ground occurring between the shrubs. After good rains grasses spring up in patches between the shrublets. However, even when the grazed areas are grassless,dense stands of Eragrostis, Digitaria, Sporobolus and other genera can be seen in protected enclosures bordering the roads and railway lines, indicating that it is possible for grass to form a community where it is not heavily grazed.

With the exception of Aloe ferox, succulents are also small. These include Aloe striata, A. tenuior var. decidua, A. variegata, Pachypodium bispinosum, Sarcocaulon vanderietiae, Glottiphyllum grandiflorum, Psilocaulon articulatum, Euphorbia inconstantia, Astroloba sp. cf. A. deltoidea[2] and various Aizoaceae such as Drosanthemum obliquum, Ruschia spp., Delosperma spp. and Aridaria spp. There are various geophytic Liliaceae, e.g. Urginea altissima, Drimia anomala and Albuca sp. The alien composite, Verbesina encelioides, with showy yellow flowers, is abundant along the road sides.

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[1] M. Henrici, "Transpiration of Karoo Bushes", Bulletin of the Union of S.A., Department of Agricultural Science, No. 185, 1940, p. 23.

[2] The genus Astroloba, synonymous with Apicra, resembles Haworthia.

This vegetation type also contains scattered Scrub Woodland and Fish River Scrub trees such as Olea africana, Pappea capensis, Euclea undulata, Boscia oleoides and Ptaeroxylon obliquum. They are umbrella-like in appearance, the lower branches apparently having been destroyed by herbivores. In places trees are numerous enough to give the veld the appearance of open savannah when viewed from a distance. It is significant that the vast majority of trees are very old. It appears that most saplings are killed off by sheep, goats and other livestock. Rhus lancea is abundant along the banks of the Great Fish River.

The Karroid Shrub Steppe is the nearest approach in the Bedford and Fort Beaufort divisions to a true arid vegetation type. Nevertheless there is much justification for Acock's calling it "False Karroid". With suitable adaptations, J.F. Dobie's description of certain semi-arid sheep farming areas of the United States could apply to this region. Dobie writes "Coyotes are the arch-predators upon sheep. Sheep are the arch-predators upon the soil of arid and semi-arid ranges. .... Metaphorically, the sheep of the West eat up not only all animals that prey upon them - coyotes, wildcats and eagles especially - but badgers, skunks, foxes, ringtails and others. On some sheep ranges, wholesale poisoning and trapping have destroyed nearly all of them. The surface of the earth does not offer a more sterile-appearing sight than some of the dry-land pastures of America with nothing but sheep trails across their grassless grounds." [1]

10. SWEET GRASSLAND

Open, dry, low tussock grassland, the lowland equivalent of the Sour Grassland, occurs in a small area around Kroomie, on the western border of the Fort Beaufort district. This belt, corresponding with a relatively undissected portion of the submontane peneplain, is some eight miles wide in an east-west direction and has

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[1] J.F. Dobie, "The Voice of the Coyote", Little Brown & Co., Boston, 1949, pp. 43 - 44.

a maximum north-south extent also of eight miles. It includes relatively broad strips of Acacia Savannah along the north-south trending shallow valleys of the Kroomie River and its tributaries. This vegetation type is synonymous with Adamson's "Dry Grassland",[1] Story's "Sweetveld",[2] Acocks' "Eastern Province Grassveld"[3] and Martin and Noel's "Dry Low Tussock Grassland."[4] On Acocks' vegetation map Eastern Province Grassveld is indicated as occurring only in the southern portion of the Bedford district. However, it would appear that this type now occurs only in patches in this area owing to an invasion of Karroid shrubs.

Themeda triandra is dominant, but other abundant grasses include *Eragrostis* sp., *Digitaria eriantha*, *Microchloa caffra*, *Heteropogon contortus* and *Tragus koelerioides*. Small chamaephytic shrubs are regular components. These include *Hermannia candicans*, *H. flammea*, *Felicia muricata*, *Pelargonium* sp., *Barleria pungens* and *Blepharis integrifolia*. Liliaceous plants with underground storage organs are common in places. These include *Albuca*, *Drimia* and *Bulbine* spp.

11. LOWLAND KARROID TUSSOCK GRASSLAND

This occupies much of the submontane peneplain from Bedford southwards to the Albany border. It may be regarded as Sweet Grassland which has broken down under conditions of selective grazing to a community of *Digitaria* sp., *Eragrostis* sp., *Sporobolus* sp. and *Tragus koelerioides*, although *Themeda triandra* does occur and is dominant over

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[1] R.S. Adamson, "The Vegetation of South Africa", British Empire Vegetation Committee, London, 1938, pp. 166-167.

[2] R. Story, "A Botanical Survey of the Keiskammahoek District", Botanical Survey of S.A., Memoir No. 27, Govt. Printer, Pretoria, 1952, pp. 105-106.

[3] J.P.H. Acocks, "Veld Types of South Africa", Botanical Survey of S.A., Memoir No. 28, Govt. Printer, Pretoria, 1953, pp. 150-151.

[4] A.R.H. Martin and A.R.A. Noel, "The Flora of Albany and Bathurst", Rhodes University, Grahamstown, 1960, p. XV.

limited areas. The tussocks are not dense enough to exclude Karroid shrublets such as Nenax microphylla, Sutera pinnatifida, Nestlera humilis, Pentzia incana, P. virgata, P. globifera, Chrysocoma tenuifolia, Walafrida geniculata and Gamolepis trifurcata, which occupy from less than 25% to more than 50% of the area. In the shallow valleys of the submontane peneplain, Acacia karroo is fairly abundant. A few Scrub Woodland trees occur here too and, in some of the less shallow valleys, Aloe ferox is abundant.

CHAPTER V

SOILS

It is generally accepted that soils are the product of their environment, viz. the parent rock, the climate under which they weather, the slope, the vegetation covering, and also time. In the main, the soils of this region are young and unstable, i.e. they are essentially azonal. Over most of the five districts concerned, their development is accelerated by the relatively high temperatures, but they may be removed even more rapidly by vigorous erosion. Steep slopes prevail over much of the area, giving rise to sheetwash and thin skeletal soils, which are closely related to the parent rock. In the Amatole-Winterberg range the relatively high rainfall has leached out many of the minerals so that the soils may be classified as podzolic, characterised by a low pH value. In marked contrast are the deep alluvial soils of the relatively dry low-lying valleys of the south and south-west, which have a fairly high mineral content and thus a correspondingly high pH value. From the economic point of view the soils of the area may be divided into two groups, sourveld soils and sweetveld soils, the former acid, the latter relatively alkaline.

Sourveld Soils

The Sourveld soils are essentially podzolic, occurring in regions occupied by Sour Grassland, Temperate Evergreen Forest and Macchia, in the cooler highlands and their adjacent foothills, where the mean annual precipitation exceeds approximately 26 inches. True podzols consisting of (a) a surface layer of accumulated raw organic material, underlain by (b) a structureless grey or white layer of mineral soil, resting on (c) a brown or dark brown horizon underlain by (d) the parent material, do not occur in this region as far as the present writer is aware. The podzolic soils in this area are usually residual, having been derived mainly from sedimentary rocks of the Beaufort Series. These rocks have been intruded by dolerite, which covers extensive areas in some localities and in others small patches and narrow strips (vide pp. 19 - 21). The soils developed from dolerite may be regarded as intrazonal.

On the sedimentary rocks of the Beaufort Series the A_1 layer commonly consists of a brownish-grey, friable loam which is poor in humus on account of frequent veld burning in the past. The humus deficiency is more pronounced on steep slopes, where the surface flow of water is relatively rapid. The A_2 layer forms the lower portion of this zone of eluviation and is usually a light brown clay loam, which is well leached in the wetter areas. The usually high percentage of silica indicates an advanced stage of podzolisation. In general the B horizon, i.e. the zone of illuviation, consists of loose iron oxide concretions overlying a rather impervious yellowish-blue clay. In some places the shallow A horizon has disappeared, probably as a result of excessive spring burning followed by sheet erosion, resulting in the exposure of the easily erodable B horizon. Once this has occurred dongas can develop. The C horizon consists of partly decomposed shale, mudstone or sandstone, below which lies the unweathered parent rock, comprising the D horizon.

Where dolerite is the underlying rock the soil consists of a uniform black or dark brown clay for a considerable depth. There is no B horizon, the clay giving way to a yellowish-brown gritty loam which grades into partially decomposed dolerite. Owing to the high mineral content and basic nature of dolerite these soils are much superior to those derived from sedimentary rocks.

The sourveld soils are rather acid with pH ratios of approximately 4 to 6. The mean pH of soil samples collected from sedimentary rocks at altitudes exceeding 4,000 feet on the

Katberg was found to be 4.7, with pH ratios ranging from 3.8 to 5.3. The mean pH of dolerite soil samples was found to be 5.5, with pH ratios ranging from 4.7 to 6.2. The mean pH of all the soil samples collected at altitudes exceeding 4,000 feet on the Katberg was found to be 5.1. The mean pH of reddish loams developed on sedimentary rocks on the lower eastern slopes of the Great Winterberg was found to be 4.2. In the sourveld the pH ratios were found to vary tremendously over very short distances, whereas in the Karroid areas they remained fairly constant over large areas.

Transitional Soils

These soils occur in a region of topographic immaturity along the southern, dissected margins of the highlands, where the mean annual rainfall is approximately 25 inches, corresponding with a zone of transition between Sour Grassland and Acacia Savannah and between Temperate Evergreen Forest and Scrub Woodland. They also occur in portions of the Highland Karroid Grassland. Owing to the relatively steep slopes and the fact that the grass cover is not as dense as in the Sourveld, the surface flow of water is rapid after heavy rain, resulting in thin, skeletal soils. Even residual soils are partly derived from colluvial wash. In the soils derived from sedimentary rocks the A layer tends to be a grey sandy loam which is poor in humus because of the high surface flow and veld fires. The constant downward movement of soil water has led to a considerable amount of leaching which, however, is not as severe as in the Sourveld. The soils derived from the sedimentary rocks range from slightly acid in the wetter areas to near neutral in the drier areas. The mean pH of a number of samples of alluvium and soils derived from sedimentary rocks on the farm, Surrey, (mean annual rainfall 25 inches) was found to be 6.5. In general the B layer in the soils derived from the sedimentary rocks consists of a pale brown to red-brown compact clay, often containing white or cream pellets of calcium carbonate. Sheet erosion has resulted in its exposure. Once exposed, the B layer is liable to donga erosion. It is underlain by partly decomposed shale, mudstone or sandstone.

The dolerite soils are far superior to those derived from the sedimentary rocks. They contain far more available lime and magnesia, as well as a little soda, potash and phosphorus sufficient to supply the needs of plants. In general the soils derived from dolerite consist of a relatively uniform black or dark brown clay, but in warm, low-lying regions this clay is sometimes deep red in colour. Rounded "cores" of unaltered rock project through the soil with greater frequency than in the sourveld. As in the sourveld, the B layer is absent, the clay being underlain by a yellowish-brown sandy loam consisting of partially decomposed rock which is much more retentive of moisture than the C layer in the soils derived from sedimentary rocks. The position of a dolerite sheet or dyke along a hillside is frequently indicated by a belt of trees and shrubs in direct contrast to the barer slopes where the less water-retentive soils are derived from sandstones and shales. Small pockets of scrub forest within the Acacia Savannah are frequently associated with dolerite. The mean pH of dolerite soils collected on Surrey farm was found to be 6.2.

Sweetveld Soils

These slightly acid to alkaline soils occur in the Scrub Woodland, Fish River Scrub, Karroid Acacia Savannah, Dwarf Karroid Shrub Steppe, Sweet Grassland and Lowland Karroid Tussock Grassland, as well as in parts of the Acacia Savannah.

The soils of the Scrub Woodland, as well as those of the Sweet Grassland and the drier parts of the Acacia Savannah, are similar in structure to those of the previously mentioned zone, but tend to be less acid, with pH values of approximately 6.5 to 7.5. Reddish soils are more frequent, presumably because of the higher temperatures.

The soils of the Fish River Scrub are on the whole derived from the Ecca and lowermost Beaufort Series. They are very thin, drab and loamy with frequent occurrences of lime accretion. pH ratios range from about 7 to almost 8 in the driest parts. Strips of deep, fertile alluvium, often reddish in colour, occur on the banks of the Great Fish and Koonap rivers and also in the lower parts of some of the tributary ravines.

Typically drab, pale-brown, yellow-brown, grey-brown or brownish-red loamy soils characterise the areas of karroid vegetation. As a result of long dry spells chemical weathering of the rocks is very slow, and the soils are rather thin, with little distinction between the A and B horizons. Because of the sparse vegetation cover the surface flow of water is very rapid after summer thunderstorms, resulting in much soil being washed from the hillsides and bare rock being exposed in many localities. The absence of a continuous vegetation cover causes the soils to be low in humus and nitrogen. On the other hand leaching is very slight, and the soils have a large supply of soluble minerals. Lime accretion is very common, either in the form of pellets within the soil or collected deeper down as nodules and sheets. The soils are all alkaline. The mean pH of a number of soils collected in the Bedford sector of the Fish River valley was found to be 7.4.

Along the Great Fish River valley on the western border of the Bedford district is an extensive strip of deep, fertile, somewhat clayey alluvium, which provides excellent soil for growing crops under irrigation. Where the soils are clayey the abundance of calcium and other mineral salts prevents the soil particles from caking together. However, if the sodium content is increased as a result of using brack water for irrigation, the sodium salts hydrolise to form free sodium hydroxide, with the result that the colloidal clay particles cake together to make the soil impervious to water. The soil then becomes excessively alkaline and harmful to plant growth.

CHAPTER VI

THE HISTORICAL EVOLUTION OF SETTLEMENT

There can be little doubt that this area, like other parts of South Africa, was occupied by a succession of peoples in prehistoric times. Very early settlement is indicated by stone implements found in a number of localities between Bedford and Alice. For example, numerous artefacts have been found in an alluvial terrace about twenty feet above the present level of the Tyume River near the Alice weir; some of these implements, including well-formed handaxes, scrapers and arrowheads are on view in the museum of the University College of Fort Hare. Bushmen paintings occur in rock shelters in the mountains, particularly in the Katberg and Winterberg. Those on the farm Craig Rennie in the Baviaans River valley, although not very numerous or of outstanding quality, attracted the attention of the artist, Thomas Baines, who copied them when he visited the area in 1849.[1]

There was no written information about this area until the mid-eighteenth century. At that time the present Bedford and Fort Beaufort Divisions were outside the boundary of the Cape Colony and formed part of what was generally termed "Kafferland". In 1752, when permanent White settlement had progressed only as far eastwards as the vicinity of the Great Brak River,[2] the Dutch East India Company sponsored an expedition to the Eastern Cape under the leadership of Ensign Beutler. Forbes states that "This is remarkable as the first Government-sponsored expedition to pass near the sites of the present Port Elizabeth and East

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[1] T. Baines, "Journal of Residence in Africa", Vol. I, Van Riebeeck Society, Cape Town, 1961, p. 116 and plate opp. p. 96.

[2] V.S. Forbes, "The French Landing at Algoa Bay, 1752", Africana Notes and News, Vol. 16, Johannesburg, 1964-5, pp. 13 - 14.

London and to penetrate beyond the Kei River."[1] On its return journey, during August 1752, Beutler's party traversed the southern part of the present Victoria East, Fort Beaufort, Adelaide and Bedford districts.[2] Brief entries concerning the nature of the country traversed occur in the expedition's journal. Apart from a few Bushmen, it does not refer to any people occupying this area, probably owing to the drought prevailing at that time. According to the journal "no rain had fallen for several months, which could also be seen from the waterless rivers which we crossed day after day."[3]

During the eighteenth century the Bantu people were migrating southwards from their original home in tropical Africa. That they had reached the present Fort Beaufort and Adelaide districts by 1776 is indicated in the journal kept by Swellengrebel, who visited the area between present day Cookhouse and Kroomie in October of that year.[4] It is recorded in Swellengrebel's journal that at the Karoemo (Kroomie) River they "found a kraal of Caffers, the captain of which was called Jeramba."[5] Here they spent the night of 27th October, 1776. Forbes states that "In the course of this day a reprehensible incident occurred that might well have been attended by disastrous consequences. The colonists hunted down and forcibly detained a Kaffir youth, with what purpose and final outcome is not related. However, the incident nearly precipitated an attack upon the white visitors

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[1] V.S. Forbes, "Pioneer Travellers of South Africa", Balkema, Cape Town, 1965, p.4.

[2] Ibid., maps 1, 5 and 7.

[3] E.C. Godee Molsbergen, "Reizen in Zuid-Afrika in De Hollandse Tijd", Vol. III, Nijhoff, 's Gravenhage, 1922, p. 322.

[4] V.S. Forbes, "Pioneer Travellers of South Africa", p.71.

[5] E.C. Godee Molsbergen, "Reizen in Zuid-Afrika in De Hollandse Tijd", p. 11.

which was apparently only averted by the presentation of gifts to the Kaffirs. They continued, however, to show resentment and it was doubtlessly this attitude that led the colonists to wish to return westwards as soon as possible. A further cause of dissatisfaction was Swellengrebel's refusal to barter cattle from them, presumably because this traffic by private individuals was prohibited by the Company. For these reasons his desire to proceed further east could not be carried out."[1] The Kroomie River thus marked the eastern limit of Swellengrebel's expedition and he began his return journey to the Cape Colony on the following day.[2]

At the beginning of the nineteenth century the area bordering the Amatole highlands appears to have been fairly densely populated by Xhosa tribes under the chieftainship of Gaika. Theal states that in 1818 "Ngqika's residence was by the headwaters of the Chumie[3] in one of the most beautiful valleys of South Africa. Above his kraals rose the grand mountain range of the Amatolas, the highest dome of which is yet known by his name, while the hill sides and all the low lands along the margin of the river were one great corn-field."[4] In 1820 Gaika dwelt some ten miles north-northeast of Alice according to an indication given in June of that year by the Rev. J. Brownlee, then recently settled "on a little rivulet called by the Caffers Guallie[5] that runs into the main stream of the Chumie a little below Gaika's Kraal, from which place I am about two miles distant."[6]

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[1] V.S. Forbes, "Pioneer Travellers of South Africa", Balkema, Cape Town, 1965, p. 71.

[2] Ibid., Map 13.

[3] Tyume.

[4] G.M. Theal, "Compendium of S.A. History and Geography", Lovedale Press, 1876, p. 174.

[5] Gwali.

[6] G.M. Theal,"Records of the Cape Colony", Vol. XIII, 1902, p. 173.

Both the Europeans of the eastern districts of the Cape Colony and the Xhosa beyond the frontier were cattle farmers in search of grazing for their livestock. During the latter part of the eighteenth century and the early nineteenth century there was increasing friction between the eastward-moving Europeans and the Xhosa, who were endeavouring to move westward. De Kiewiet states that "In the writing of South African history it was long customary to believe that the chronic conflict of the Kafir frontier was the result of the spontaneous hostility of a savage and treacherous people to the presence of a superior race. Actually the conflict of black and white was fed more by their similarities than their differences. The opposing lines of settlement struggled for the control of the same natural resources of water, grass and soil."[1] This resulted in a series of frontier wars from 1779 to 1853, during which the present Bedford and Fort Beaufort Divisional Council areas were the scene of much of the conflict.

In 1778 the Dutch Governor Van Plettenberg decided that the best way to maintain peace was to keep the Dutch trekboers and Xhosa tribes apart, and declared the Great Fish River the boundary between the two groups. Transgression of the frontier by the Xhosa led to the first Kaffir war in 1779, followed by a second war in 1789. A third war occurred in the 1790's, followed by a fourth war from 1811 to 1812, by which time the control of the Cape had passed from the Dutch to the British. In 1819 Xhosas under the chieftainship of Ndlambe once more crossed the frontier. This resulted in a fifth Kaffir war during which Ndlambe and his people were driven back across the Great Fish River.[2] The Cape Governor, Lord Charles Somerset, decided to

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[1] C.W. De Kiewiet, "A History of South Africa", Oxford University Press, 1941, p. 48.

[2] For a brief discussion on the first five Kaffir wars see E.A. Walker, "A History of Southern Africa", Longmans, 1957, pp. 111 - 118 and pp. 153 - 155.

exclude the Xhosa from the dense, virtually impregnable scrub of the Great Fish River valley[1] which had been their stronghold for so long. The new policy involved the removal of the Xhosa from the Great Fish River valley and the establishment of the Keiskamma River as the western boundary of Kaffirland. The eastern boundary of the Cape Colony was still to be the Great Fish River, the country between these two rivers being designated neutral territory, in which neither black nor white should be permitted to reside. The new boundary of Kaffirland, to which Gaika agreed verbally, was the Keiskamma River as far north as the Tyume confluence, thence along the Tyume River until "a ridge of the Kat River hills" was reached and then along that ridge to the Winterberg mountain range "so that the waters that fall from that ridge into the Chumie shall belong to Gaika and those which fall into the Kat River shall appertain to the Colony."[2] It was after this war that Gaika was officially recognised as paramount chief of the Xhosa tribes living across the border. The area between the Great Fish and Keiskamma rivers, bounded by the Amatole-Winterberg range in the north, was known as the Neutral or Ceded Territory. It included the present divisions of Adelaide, Fort Beaufort, Stockenström and Victoria East, as well as most of the present Bedford district, except the Baviaans River valley and the region to the north-west of it. This latter area formed part of the sub-district of Cradock in the vast district of Graaff-Reinet, and was the home of a few Dutch pastoral farmers.

First British Settlers in the Area

In order to safeguard the frontier, Somerset decided to form a dense settlement of European farmers adjacent to it. Thus in 1820 some 5,000 settlers were brought out from Britain on a state-aided immigration scheme, most of them being located in the

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[1] See page 95.

[2] G.E. Cory, "The Rise of South Africa", Vol. I, Longmans, 1910, p. 398.

"Zuurveld" to the south and west of the lower Great Fish River in the present divisions of Albany and Bathurst.[1] A party of these settlers under the leadership of Thomas Pringle was allocated land in the Baviaans River valley in the present Bedford division, which at that time formed the easternmost part of the Graaff-Reinet division. According to Pringle, "The upper part of this glen could scarcely be said to have ever been permanently settled, but had been formerly occupied chiefly as grazing ground by a few Dutch-African boors, among the most rude and lawless of the whole colony. These men had been dispossessed, and some of them executed for high treason, about four years before, in consequence of their having taken a prominent part in an insurrection against the English government;[2] and a portion of the lands thus forfeited were now to be assigned as the location of our party."[3]

On 13th June 1820 the Pringle party, consisting of eight Pringles, 6 Rennies and 9 others, left Port Elizabeth in seven wagons.[4] Ten days later, on 23rd June, they reached the Baviaans River near its confluence with the Great Fish River.[5] The average distance covered each day was approximately fourteen miles. Early on 25th June the settlers entered the gorge where the Baviaans River leaves the highlands,[6] from whence followed a "toilsome march of five days up this African glen."[7] Pringle states that "In the upper part of the valley we were occupied two

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[1] G.E. Cory, "The Rise of South Africa", Vol. II, Longmans, 1913, pp. 10 - 76.

[2] Pringle is referring to the Slachter's Nek rebellion of 1815.

[3] Thomas Pringle, "Narrative of a Residence in South Africa", Edward Moxon, London, 1835, pp. 29 - 30.

[4] Ibid., p. 22.

[5] Ibid., p. 29.

[6] Ibid., p. 30.

[7] Ibid., p. 32.

entire days in thus hewing our way through a rugged defile, now called Eildon-cleugh, scarcely three miles in extent."[1] Near the northern end of the valley the Dutch field-cornet accompanying them indicated the land to be occupied by the party. Pringle states that this was "a beautiful vale, about six or seven miles in length, and varying from one to two in breadth. It appeared like a verdant basin, or cul de sac, surrounded on all sides by an amphitheatre of steep or sterile mountains, rising in the background into sharp cuneiform ridges of very considerable elevation; their summits being at this season covered with snow, and estimated to be about 5,000 feet above the level of the sea. The lower declivities were sprinkled over, though somewhat scantily, with grass and bushes. But the bottom of the valley, through which the infant river meandered, presented a warm, pleasant, and secluded aspect; spreading itself into verdant meadows, sheltered and embellished, without being encumbered, with groves of mimosa trees, among which we observed in the distance herds of wild animals - antelopes and quaggas - pasturing in undisturbed quietude."[2] Pringle comments on the presence of leopards as well as numerous jackals and hyaenas. He states that "we were visited several times during the winter and ensuing spring by lions, but without suffering any actual damage from them."[3] The spot chosen for the temporary settlement of the party was later named Clifton.[4] The name Glen Lynden, which originally had been given to the settlement, was subsequently extended by the Cape Colonial Government to include the entire Baviaans River valley and the field-cornetcy occupying this area.[5]

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[1] Thomas Pringle, "Narrative of a Residence in South Africa", Edward Moxon, London, 1835, p.32.

[2] Ibid., p. 33.

[3] Ibid., p. 40.

[4] Ibid., p. 35.

[5] Ibid.

By May 1823 the Pringle party had built two houses of raw brick or clay, two plastered wattle houses and thirteen reed cabins.[1] Approximately 62 acres were under cultivation and being irrigated. Gardens, orchards and vineyards occupied 6½ acres, wheat 46½ acres and barley and maize occupied 9 acres.[2] At that time the party possessed 170 cattle and 831 sheep and goats.[3] In 1826, as both the Dutch and Scottish settlers along the Baviaans River desired to have their own religious congregation, they petitioned the government for a minister and church buildings.[4] This resulted in the founding of the congregation of Glen Lynden in 1827.[5] The small massively-built stone church, which was completed in 1828, still stands. In May 1829 the first minister, the Rev. John Pears, arrived.[6] In that year, because there was then no organised Presbyterian Church in South Africa, the Glen Lynden church was handed over to the Dutch Reformed Church.[7] Both Scottish and Dutch farmers worshipped there, and the name Glen Lynden was eventually confined to the church and the farm on which it was situated. Pears served the Glen Lynden community for only one year.[8] From August 1830 until the arrival in the valley of the Rev. Alexander Welsh, in August 1833, the congregation was without a minister.[9] Under

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1 G.M. Theal, "Records of the Cape Colony", Vol.XVI, 1903, p.321.

2 Ibid.

3 Ibid.

4 S.F. Feneysey, "Die Nederduits-Gereformeerde Gemeente Glen Lynden", Nasionale Pers, Cape Town, 1930, p. 15.

5 Ibid.

6 Ibid., p.17.

7 W. de S. Hendrikz, "Adelaide, Almost a Century", Free Press Newspapers, Adelaide, 1958, p. 29.

8 S.F. Feneysey, "Die Nederduits-Gereformeerde Gemeente Glen Lynden", pp. 18 - 19.

9 Ibid., p. 25.

the Rev. Welsh the focal point of the community shifted from Glen Lynden to Koonap's Post (present day Adelaide) after a church had been completed there in 1840.[1]

In June, 1821, the Acting-Governor, Sir Rufane Donkin, had paid a visit to the Eastern Cape.[2] In answer to representations from the settlers, who found their orginal grants of land inadequate owing to the low rainfall, he extended the area allocated to the Pringle party in the Baviaans River valley. Subsequently Donkin granted them additional land in the Mancazana River valley in the present Adelaide district. "And thus", wrote Pringle, "instead of the 1100 acres, to which we would have been confined by a strict adherence to the Government scheme of settlement, and which would have been scarcely equal to one-fourth of a grazier-boor's farm, we at length succeeded in obtaining from the considerate liberality of the Colonial Government, the munificent allotment of not less than 20,000 acres.[3]

The Mancazana, owing to its higher rainfall, was well wooded and had a better grass cover than the Baviaans River valley. In his Narrative Thomas Pringle states that "In no other part of South Africa have I seen so many of the larger sorts of antelopes; and the elephant, the rhinoceros, and the buffalo were also to be found in the forests..."[4] He refers to the "strange wild cry" of the elephants "sounding like a trumpet among the moonlight (sic) mountains."[5] By the end of the nineteenth century all these animals, with the exception of certain species of antelope, had disappeared completely from the territory occupied by the Bedford and Fort Beaufort Divisions. Likewise, lions, leopards and hyaenas

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[1] S.F. Feneysey, "Die Nederduits-Gereformeerde Gemeente Glen Lynden", Nasionale Pers, Cape Town, 1930, p. 32.

[2] Thomas Pringle, "Narrative of a Residence in South Africa", Edward Moxon, London, 1835, p. 106.

[3] Ibid., p. 107.

[4] Ibid., p. 122.

[5] Ibid.

had become locally extinct. John Pringle, brother of Thomas Pringle, who had studied South African farming conditions at the Government farm at Somerset East, left the farm in 1828 to take up residence at "Glen Thorn" in the Mancazana valley. On leaving Somerset East Sir Andries Stockenström presented him with some merino rams which were the beginning of the present flock at Glen Thorn.[1] In 1840 a Presbyterian Church, still in use, was built at Glen Thorn by John Pringle from stone quarried on the farm. Thus the Pringle family played a prominent part in the development of both the Bedford and Adelaide districts, where some of their descendants are at present prosperous farmers.

Reference has already been made to the establishment of the Neutral Territory in 1819. Lord Charles Somerset planned to have the territory patrolled regularly to keep out both European and Xhosa. Moreover, to provide for the future safety of the frontier the Governor decided to establish military posts in the Neutral Territory. One of these, Fort Willshire, was situated in what is now the southern part of the Victoria East district. It was planned to build the fort on a slight rise within the Keiskamma valley, 215 feet above the river and less than a mile from it. When Acting Governor Sir Rufane Donkin visited the site in May, 1820, approximately a third of the work on the fort had been completed.[2] He then ordered the construction to be stopped, and had another commenced on fairly low-lying ground approximately 200 yards from the river, presumably to be closer to water. This second fort, often referred to as "Keiskamma Barracks", was in use by the end of 1821.[3] The ruins of both forts, as well as those of several small scattered

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[1] E., M.E. & J.A. Pringle, "Pringles of the Valleys", Adelaide, C.P., 1957, p. 108.

[2] G.E. Cory, "The Rise of South Africa", Vol. II, Longmans Green, 1913, p. 113.

[3] Una Long, "Notes on Fort Willshire", Africana Notes and News, Vol. 5, Johannesburg, 1948, p. 80.

buildings can still be seen on Fort Willshire farm.

Foundation of Fort Beaufort

Donkin had violated the Neutral Territory by establishing Fort Willshire. Although he had done this with the apparent permission of Gaika, the violation of the Neutral Territory set an example for Maqomo, a son of Gaika. Maqomo and his many followers formed kraals in the upper Kat River valley, not far from the present town of Fort Beaufort. Cattle raids by Maqomo on the Tyume mission station and on the farms of the European settlers in the Baviaans River valley proved successful. This encouraged the Xhosa in the southern part of the Neutral Territory to raid European farms in the Albany district. Recovery of the stolen cattle in the thick scrub woodland was exceedingly difficult. Consequently in 1822, in order to keep a check on the movements of Maqomo, Colonel Scott erected a blockhouse in relatively open level country where the Kat River emerges from its wooded highland embayment. Troops were stationed here. This blockhouse was named Fort Beaufort and was the beginning of the present town.[1] The fort was situated on an alluvial terrace bounded by an entrenched meander of the Kat River on three sides. The steep, high alluvial banks of the river are difficult to climb except at artificial cuttings. The fort was thus easy to defend in time of war, for troops could be concentrated on the eastern side of the settlement, where there was no river barrier, and at the cuttings elsewhere. In addition to its excellent site Fort Beaufort had a most strategic situation. Not only did it command the exit of the Kat River valley from the highlands, but also the relatively easy east-west route along the better watered portion of the submontane peneplain adjacent to the highlands. The Kat River provided the fort with an ample supply of water.

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[1] G.E. Cory, "The Rise of South Africa", Vol. II, Longmans Green, 1913, p. 147.

Trade

Trade between Europeans and the Xhosa had been declared illegal by several Cape Governors before the time of Somerset. On September 13th 1822 Lord Charles Somerset had issued a proclamation declaring trade illegal except at fairs which had received his sanction.[1] The possession by the Xhosa of valuable commodities such as ivory and cattle as well as the continued smuggling by the European colonists led to consultation with Gaika in 1823 with a view to the establishment of fairs in his territory.[2] Gaika agreed to such a scheme, and by a proclamation issued in July 1824 it was declared that barter was to be carried on only at Fort Willshire and only by persons who had obtained a special licence from the landdrost of Albany.[3] Trade by barter was to take place on Wednesdays, Thursdays and Fridays each week. No firearms, ammunition or alcoholic drink was to be supplied by the colonists. While the Xhosa were at first not allowed to barter with cattle, this was legalised from 17th November 1825 onwards, as so much illegal cattle bartering had been taking place.[4] The European colonists traded coloured beads, brass buttons, coils of brass wire, small mirrors, knives, scissors, agricultural implements, brightly coloured handkerchiefs, blankets, trousers and other items of clothing for ivory, hides, Acacia karroo gum and later cattle. Cory states that "Some idea of the trade in ivory which was carried on at Fort Wiltshire, (sic) and indirectly the slaughter of elephants which must have taken place, may be gained from the following returns of the Market Master. From

[1] G.M. Theal, "Records of the Cape Colony", Vol. XV, 1903, pp. 49 - 50.

[2] G.E. Cory, "The Rise of South Africa", Vol. II, 1913, p. 177.

[3] G.M. Theal, "Records of the Cape Colony", Vol. XVIII, 1903, pp. 179 - 181.

[4] G.M. Theal, "Records of the Cape Colony", Vol. XXIII, 1904, pp. 443 - 444.

August 18th, 1824, to January 11th, 1825, 38,424 lb of ivory were obtained in barter, and from January 12th, 1825 to March 12th, 1825, 12,017 - or in about seven months 50,441 lb. .... Besides this about 16,800 pounds of gum and 15,000 hides were also obtained."[1] In the meantime Europeans illegally entered "Kaffirland" to barter with the Xhosa. In 1830 they were first granted licences to penetrate "Kaffirland" and trade where they pleased.[2] The Fort Willshire fair then came to an end. In December 1836, Sir Benjamin D'Urban decided on the abandonment of Fort Willshire.[3]

Missionary Activity

During the nineteenth century British missionaries played an important part in the development of the area between the Great Fish and Keiskamma rivers. The Rev. Joseph Williams of the London Missionary Society, who built a house and school on the Kat River north of present day Fort Beaufort in 1816,[4] was probably the first missionary to settle in this territory. Williams, his wife and son appear to have been the first civilian European settlers east of the Baviaans River valley. He preached the gospel to large congregations of Xhosa and apparently was the first person to use the water of the Kat River for irrigation.[5] The first Kat River Mission came to an end in 1818 owing to the untimely death of its founder.[6]

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1 G.E. Cory, "The Rise of South Africa", Vol. II, Longmans Green, 1913, p. 179.

2 Ibid., p. 180.

3 Una Long, "Notes on Fort Willshire", Africana Notes and News, Vol. V, Johannesburg, 1948, p. 80.

4 J. Philip, "Researches in South Africa", James Duncan, London, 1828, pp. 166 - 167.

5 Ibid., p. 167.

6 Ibid., p. 181.

The Colonial Government forbade the London Missionary Society to send a successor to Williams,[1] and instead appointed the Rev. John Brownlee as its missionary agent in "Cafferland".[2] Brownlee in 1820 established a mission station on the Gwali River, a tributary of the Tyume, and attracted a number of Williams' Kat River followers.[3] In 1821 he was joined by the Rev. William Thomson, also a government employee, and the Rev. John Bennie of the Glasgow Missionary Society.[4] By March, 1822, there were between 50 and 60 African children attending Bennie's school at the "Chumie Mission".[5] At the end of 1823 a fourth missionary, the Rev. John Ross, also of the Glasgow Missionary Society, took up residence at Chumie.[6] Within a few days of his arrival the Mission press was set up and the printing of Xhosa reading sheets was commenced. In a letter to Dr. John Love, secretary of the Glasgow Missionary Society, Bennie prophetically stated that "Through your instrumentality a new era has commenced in the history of the Kaffer nation."[7]

In 1824 Ross and Bennie established a second mission station on the Ncera tributary of the Tyume, on what is now the farm "Napier Park".[8] This was called Lovedale after the Rev. John Love, secretary of the Glasgow Missionary Society. It was situated about four miles east of the present Lovedale and about 12 miles south-east of Chumie.

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[1] J. Philip, "Researches in South Africa", James Duncan, London, 1828, pp. 188.

[2] Ibid., pp. 188 - 189.

[3] R.W.H. Shepherd, "Lovedale", Lovedale Press, 1940, p. 22.

[4] Ibid., p. 32.

[5] Ibid., p. 56.

[6] Ibid., p. 62.

[7] Ibid., p. 63.

[8] Ibid., p. 69.

The District of Somerset

In 1825 Lord Charles Somerset established the new district of Somerset. To it he attached a portion of the Ceded Territory as far east as the Koonap River and "gave it the name of the East Riet River Field Cornetcy. It was the greater part of the present district of Bedford. The intention was to allot it to Dutch inhabitants who had deserved well of the country by their long services in the protection of the frontier. About 200 applications were made for portions of this district, and many seem to have helped themselves before matters were finally arranged."[1]

In the meantime, encouraged by Maqomo's occupation of the upper Kat River valley, chief Tyali and his followers settled in the Mancazana valley in the present Stockenström district, and chief Botman and his followers settled along the western Tyume valley.[2] Europeans also continued to breach the neutrality of the Ceded Territory, some settling in the vicinity of the Winterberg and others between the Koonap and Fish rivers. Maqomo and his people continued to steal cattle from neighbouring tribes and European colonists. Finally a burgher force drove Maqomo out of the Kat River valley in May, 1829.[3] He and his people then settled on a tributary of the Kubusi River in the present district of Stutterheim. The new Governor, Sir Lowry Cole, moved the colonial frontier eastwards to the Kat-Tyume watershed north-east of Fort Beaufort and a line drawn thence to the Kat River below Fort Beaufort, from where it followed the course of the Kat River to its junction with the Great Fish River.[4]

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1 G.E. Cory, "The Rise of South Africa", Vol. II, Longmans Green, 1913, p. 215.

2 Ibid., p. 343.

3 Ibid., p. 385.

4 E.A. Walker, "A History of Southern Africa", Longmans Green, 1957, p. 182.

The dwelling house, Sipton Manor, near Fort Beaufort.

DISTRICT ORDERS.

Fort Cox, 6th Sept. 1835.

1.—His Excellency the Governor and Commander in Chief having concluded a treaty of peace with the Kafir Chiefs, of the Gaika Tribe, lately at war, hostilities will cease throughout the prov nce of Queen Adelaide with this tribe.

WARD.

F. HAYWARD.

TO LET.

THE Dwelling House, situate in New street, lately occupied by Capt. Ross. For particulars apply to W. COCK.

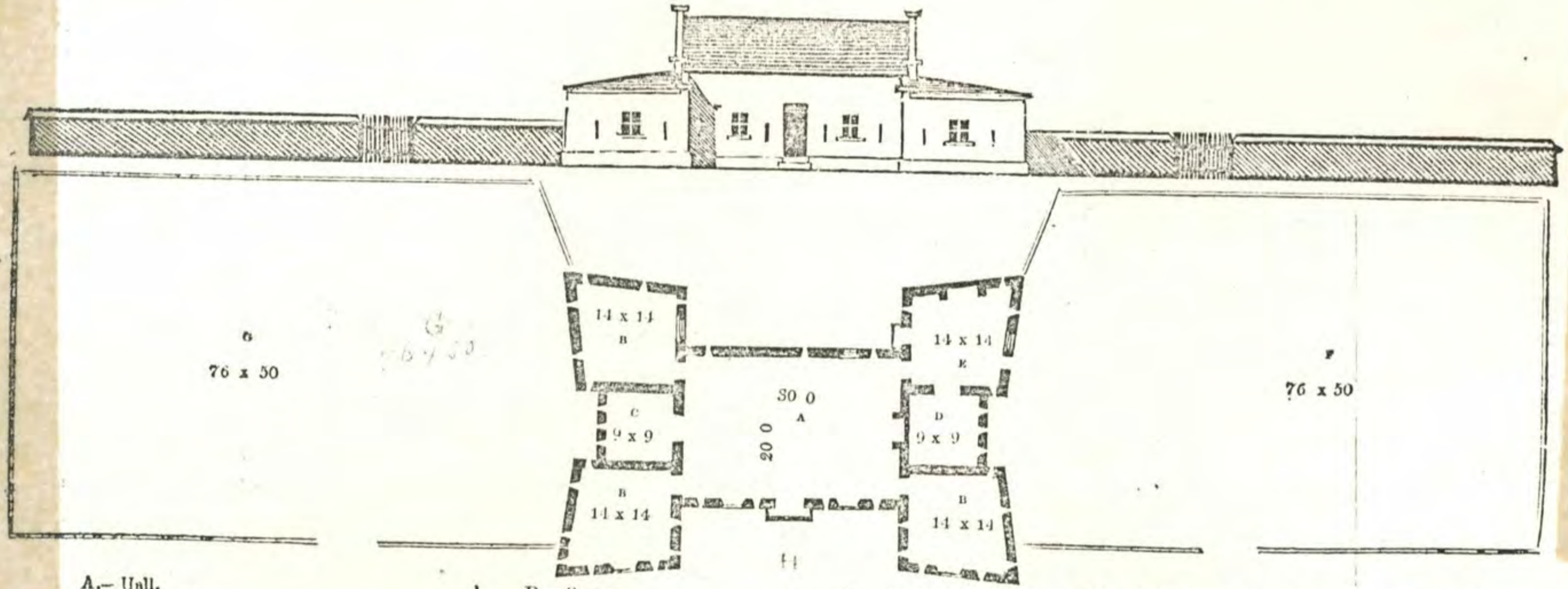
Mr. and Mrs. Saunders, and 4 children, and 4 passengers in the steerage.

SAILED FROM PORT ELIZABETH.

Sept. 2.—*Agrippina*, bark, to Mauritius.

VESSELS IN PORT ELIZABETH.

H. M. S. *Romney*, and *Joseph Maxwell*.
Brigs—*Atlantic*, *Sicilian*, and *Urania*.
Schooner—*Courier*.



A.— Hall.
B.—Bedrooms.
C.—Store.

D.—Pantry.
E.—Kitchen.

F.—Cattle Kraal
G.—Sheep, do.

Edited, Printed and Published by the Proprietor J. H. MEURANT, *High street, Graham's Town, Cape of Good Hope.*

The plan of the fortified farmhouse of Sephton Manor (now known as Sipton Manor), as published in the Graham's Town Journal, 10th September, 1835.

Coloured Settlers

Captain Andries Stockenström, the Commissioner-General in charge of the operations against Maqomo, in 1829 decided to settle Coloured people in the lands vacated by Maqomo. He also decided to settle English and Dutch farmers in the Upper Koonap as well as in the area between the Kat and Koonap rivers, stretching from the Kroomie range in the north to the Great Fish River in the south.[1] The Coloureds were of mixed ancestry, mainly Hottentot and European. By this time most of the true Hottentots had become extinct, but it was customary for Europeans to refer to the Coloureds as Hottentots, presumably as a mark of contempt. It was hoped that so-called "Hottentot" settlers in the Kat River valley would be useful in defending the Colony against Xhosa attacks. The majority of the more than 9,000 Coloureds[2] at present living in the Bedford and Fort Beaufort Divisions are descended from the people whom Stockenström settled in the upper Kat River valley. The first Coloured settlers took possession of their land in June 1829. Cory writes that "They consisted, for the most part, of the better class of people of Bethelsdorp and Theopolis together with some of the discharged soldiers of the Cape Hottentot Corps and others who had accumulated a little property in the service of the farmers. The principle of the organisation was that of the British settlement of Albany, namely, the formation of locations under 'heads of parties'. Each location was to be about 3,000 morgen (6,000 acres) in extent ... The allotments of individuals were to be laid out so as to constitute regular villages or hamlets and to be granted in freehold after they had been fenced in by hedges or other permanent enclosures, brought into cultivation and a decent cottage built thereon."[3]

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[1] "The Autobiography of the late Sir Andries Stockenstrom, Bart.", Vol. II, Juta, Cape Town, 1887, p. 359.

[2] 9,346 according to the 1960 Census.

[3] G.E. Cory, "The Rise of South Africa", Longmans Green, Vol. II, 1913, p. 386.

In December 1829 the Coloured population of the Kat River valley was 881. These people owned 369 horses, 2,614 cattle, 8,227 sheep and goats, 58 waggons and 22 ploughs.[1] The Coloureds grew crops under irrigation, the water from the Kat River being distributed to the arable lands by a system of furrows and aqueducts, which in 1824 totalled 24 miles in length.[2] The people were grouped under eighteen heads of parties in little villages a few miles apart. Most of these hamlets were named after people connected with the London Missionary Society. The village which formed the centre of mission work was named Philipton, after the Rev. John Philip, D.D., Superintendent of the Society's missions in South Africa.[3] The village of Balfour had originated as a mission station founded by the Revs. Ross and McDiarmid in 1828, and named after Dr. Robert Balfour, the first secretary of the Glasgow Missionary Society.[4]

In 1830 the Rev. James Read of Bethelsdorp settled amongst the Coloured settlers to keep them under the influence of the London Missionary Society. The Government was somewhat hostile towards this body, so in 1830 sent one of its agents, the Rev. W.R. Thomson, from the Tyume to the Kat River in an attempt to counteract its influence.[5] The Cape Government paid the Rev. Thomson a regular salary, and in 1834 built him a church which still stands at Balfour. However, the London Missionary Society established schools and churches from its private funds and was able to maintain its influence over the Coloureds.

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1 G.E. Cory, "The Rise of South Africa", Longmans Green, Vol. II, 1913, p. 387.

2 Ibid., p. 388.

3 R. Lovett, "The History of the London Missionary Society", Vol. I, Henry Frowde, London, 1899, pp. 541 and 566.

4 R.W. Shepherd, "Lovedale", Lovedale Press, 1940, p. 71.

5 Ibid., p. 74.

By 1833 the entire Kat River Settlement had been subdivided into 640 allotments capable of irrigation. The average size of each allotment was three morgen (six acres), the total area of irrigable land amounting to 3,840 acres. In that year the Coloured population was 2,114. The Coloureds owned 250 horses, 2,444 head of cattle and 4,996 sheep. The harvest for the year included 2,300 muids (6,900 bushels) of wheat and barley. Besides temporary cottages of wattle and daub, there were twelve "substantial stone houses" and thirteen orchards.[1] By 1844 the population had increased to 5,000.[2]

In 1832, owing to drought in the area beyond the Keiskamma, Colonel Somerset allowed Maqomo and some of his followers to cross the boundary to graze their cattle. However, when the drought ended Maqomo did not return to Kaffirland, but remained in the southern part of the present Victoria East division, his followers joining Tyali's people of the Mancazana in cattle raids on European farms. Towards the end of 1833 both groups were expelled.[3] This and other unrest led to the establishment in February, 1834, of Fort Adelaide, on the site of the present town of Adelaide.[4] Situated in open grassland at the confluence of the Koonap and Waterkloof rivers where they emerge from the highlands, Fort Adelaide commanded the exits of no less than three wooded highland embayments, viz. the Mancazana, Koonap and Waterkloof-Solan valleys. Like Fort Beaufort, it commanded the relatively easy east-west route along the northern margin of the submontane peneplain. In 1838 building was commenced of a Dutch Reformed church to serve the farmers living around Koonap Post,

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1 J. Rose-Innes, "Memorandum on the Kat River Settlement", Report from the Select Committee on the Kafir Tribes, London, 2 August 1851, pp. 402 - 403.

2 "The Autobiography of the late Sir Andries Stockenstrom, Bart.", Vol. II, Juta, Cape Town, 1887, p. 425.

3 G.E. Cory, "The Rise of South Africa", Longmans Green, Vol. II, 1913, p. 451.

4 Ibid., p. 455.

as Fort Adelaide was then commonly known.[1] This church, completed in 1840, was until 1859 served by the minister from Glen Lynden. However, during the period 1840 to 1859, 39 church council (kerkraad) meetings were held at Koonap Post compared with only 18 at Glen Lynden,[2] indicating that the former had become the focal point of the community. At a meeting of the church council in June 1849 it was decided to give the name Adelaide to the proposed village at Koonap Post.[3] Building plots were sold on a very small scale from then onwards.[4]

In 1834 the Xhosa once again invaded the Cape Colony, but by May 1835 they had been driven across the Kei River. The Cape Governor, Sir Benjamin D'Urban, then annexed the area stretching from the Keiskamma and Tyume eastwards to the Kei, and named it the Province of Queen Adelaide. This Province was abandoned in the following year. In order to keep a check on the movements of the Xhosa a number of new forts were established in 1835 and 1836. These included Fort Armstrong, on the upper Kat River, for the protection of the Coloured settlers; Post Retief, four miles to the north-west of the Katberg, for the protection of the European farmers of the Winterberg; and Fort Thomson, on the western outskirts of present day Alice, to protect the wagon fords across the river Tyume.[5]

Most of the farmhouses constructed at this time were fortified. A good example still standing is Sephton Manor (now known as Sipton Manor) some 6 miles west of Fort Beaufort. George Gilbert appears to have begun the construction of the farmstead soon after he had published the plan in the Graham's Town Journal of

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1 S.F. Feneysey, "Die Nederduits-Gereformeerde Gemeente Glen Lynden", Nasionale Pers, Cape Town, 1930, p. 32.

2 Ibid., p. 33.

3 Ibid.

4 Ibid.

5 G.E. Cory, "The Rise of South Africa", Vol. III, Longmans, 1919, pp. 187 - 190.

10th September, 1835. In spite of subsequent alterations the present plan and elevation closely resembles the original, the main difference being that the bedroom and kitchen walls are not splayed outwards as shown on the plan and that an entablature has been added to them. A corrugated iron verandah roof has also been erected over the recess surrounding the front door. (Most of the older farmhouses still in existence have had corrugated iron verandah roofs added, presumably to provide shade and protection from the weather. On clear summer days they actually make the house hotter than it would otherwise be.) The loopholes between the windows have been plastered over on the outside in recent years, but are preserved, complete with their wooden doors, on the inside. All the farm buildings are surrounded by an eight foot stone wall with loopholes placed at regular intervals. Between the barn and stables is a two storied lookout tower which is also loopholed at both levels, and is surmounted by a flat signal platform.

Despite the ravages of the Sixth Kaffir War, the Kat River Settlement favourably impressed several visitors. One such visitor was J. Rose-Innes, Superintendent-General of Education in the Cape Colony, who visited the Settlement for the first time in 1839. In his "Memorandum on the Kat River Settlement" Rose-Innes writes: "The impression then formed as I passed from the Chumie station to Balfour, the residence of my esteemed and respected friend, Mr. Thomson, are thus expressed in my private journal: 'August 5th, 1839. - I arrived at Balfour, from the Chumie, about three o'clock in the afternoon, passing through several of the Hottentot locations on my way. I was much struck with the simple, but neat, appearance of many of their cottages, surrounded with their gardens and cultivated fields. In no part of the Colony have I seen cultivation carried on to the same extent; every patch of ground capable of irrigation has been encircled by their watercourses. At present their crops, which are more extensive this year than at any former period, afford a most luxuriant prospect. I am sorry to say, however, that the rust has attacked their crops in many places, and that, in consequence, the grain crop will be, to a considerable extent, a failure. This is greatly to be lamented, as the poor people have suffered much from drought during the last two years; and the prospect they now have of surmounting their difficulties is, in a great measure, cut off. They are, however, by no means disheartened, as their crops of barley, oats, and Indian corn are rich beyond all former years. Really, at present, the Kat River is one of the most interesting sights in South Africa. Not an inch of ground is left unturned that can be brought within the reach of irrigation; whilst on the slope of many of the hills, fields have been prepared by the Fingoes, which are planted with Kafir corn.' " [1]

Lovedale

During the 1835 war the Lovedale mission station on the Ncera river, 4 miles east of the present village of Alice, was destroyed.[2] In 1836 the Presbyterian missionaries commenced to build a new Lovedale on the left bank of the Tyume, presumably on alluvial land immediately to the north of the present Fort Hare. Shepherd states that "The water supply provided by the Incehra stream was deficient and as a consequence the Bantu did not settle in large numbers in the vicinity."[3] However, "The new site possessed greater possibilities of irrigation and so was more likely to be attractive as a settlement to the Native people."[4] The safety offered by the proximity of Fort Thomson, which could be reached through a suitable ford, appears to have been an added incentive for moving the site.

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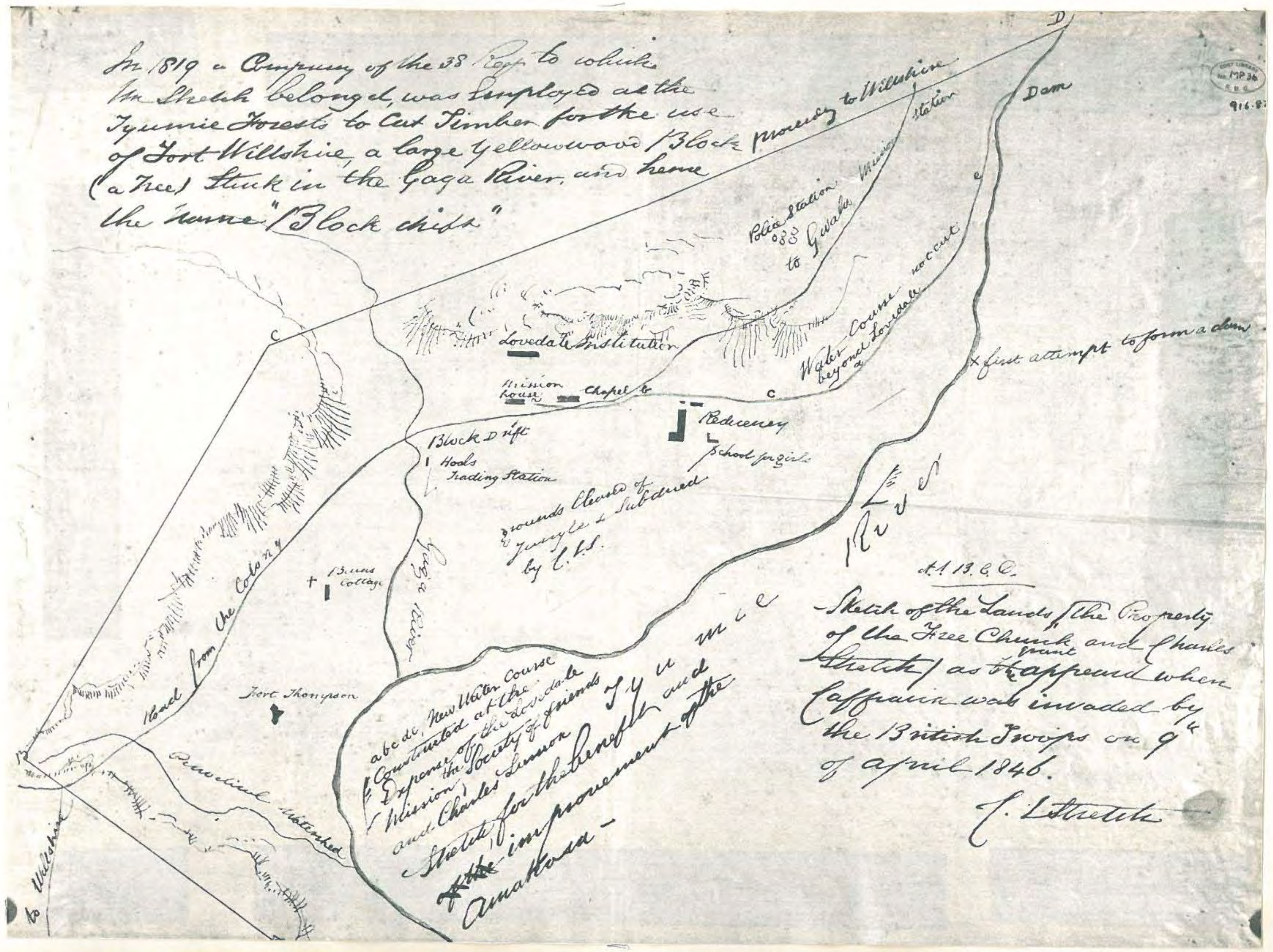
[1] J. Rose-Innes, "Memorandum on the Kat River Settlement", Report from the Select Committee on the Kafir Tribes, London, 2 August 1851, pp. 403 - 404.

[2] R.H.W. Shepherd, "Lovedale", Lovedale Press, 1940, p. 84.

[3] Ibid., p. 83.

[4] Ibid., p. 87.

Sketch map of
Lovedale
in 1846
by Captain C.L. Stretch.



Cory Library
for Historical Research,
MP 36.

Captain Stretch, the government commissioner to the Gaikas, had built a house on the right bank of the Tyume. "When the Commissioner saw the missionaries begin to build on the east bank of the Tyumie, he urged them to come over and build beside him on the west side. Bennie.... consented, and so the present site of Lovedale was chosen. In 1838 a small dwelling-house and church-school were built ..... It is recorded that by 3rd April of the following year, there were present at the school 132 pupils."[1] In the meantime the Glasgow Missionary Society had agreed to the building of a seminary for the training of preachers and teachers at Lovedale. In 1841 the magnificent stone seminary building, "a two-storied erection with basement",[2] was completed. Many Africans settled around the mission buildings to form a village. Forty acres of fertile alluvial land lying between the seminary buildings and the Tyume were obtained from chief Tyali. "Captain Stretch had begun to construct a furrow to irrigate the land which he held to the east of the seminary and an arrangement was made by which he would extend the furrow so as to take in also the land belonging to the village and seminary. It meant the cutting of a water-course or furrow from the River Tyumie two miles in length."[3] This furrow has since been extended to supply water to the town of Alice.

The Lovedale seminary was formally opened on 21st July, 1841.[4] This then was the beginning of the present Lovedale, which had developed into one of the largest South African boarding schools by the end of the nineteenth century. Captain Stretch's

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[1] R.H.W. Shepherd, "Lovedale", Lovedale Press, 1940, p. 88.

[2] Ibid., p. 90.

[3] Ibid., p. 91.

[4] Ibid., p. 95.

house, Domira, as well as the original mission buildings still stand.

Development of Fort Beaufort

In the meantime a small village was growing up around Fort Beaufort. Theal writes that "Most of the frontier villages had a similar origin. Round a fort as a nucleus gathered tradesmen and artizans, whose habitations were generally at first of a temporary nature. If the site proved to be a good one, the village gradually extended, in course of time the original wattle and daub huts gave way to stone or brick houses, churches were erected and municipal regulations introduced."[1] Reference has already been made to the strategic position of Fort Beaufort on open level country where the Kat River debouches from its wooded highland embayment. Its situation on an alluvial terrace bounded by an entrenched meander of the Kat River on three sides made the defence of Fort Beaufort easier than many of the other forts. Moreover, on the fourth side viz. the east, the steep banks of a tributary stream, the Brak River, also provided an obstacle to any intending attackers for part of the way. The deep alluvial soil could be irrigated by means of furrows from the Kat River. Moreover, the fort had relatively easy east-west communications along the sub-montane peneplain. It is not surprising therefore that Fort Beaufort attracted tradesmen and artisans. In 1835 Sir Benjamin D'Urban established a Matrimonial Court at the fort in order to spare people the tedious journey to Grahamstown.[2] Cory states that Fort Beaufort "had not, in 1837, got much beyond the actual fort - all of which has now disappeared - the commissariat buildings, officers' quarters and a few tradesmen's houses."[3] In June,

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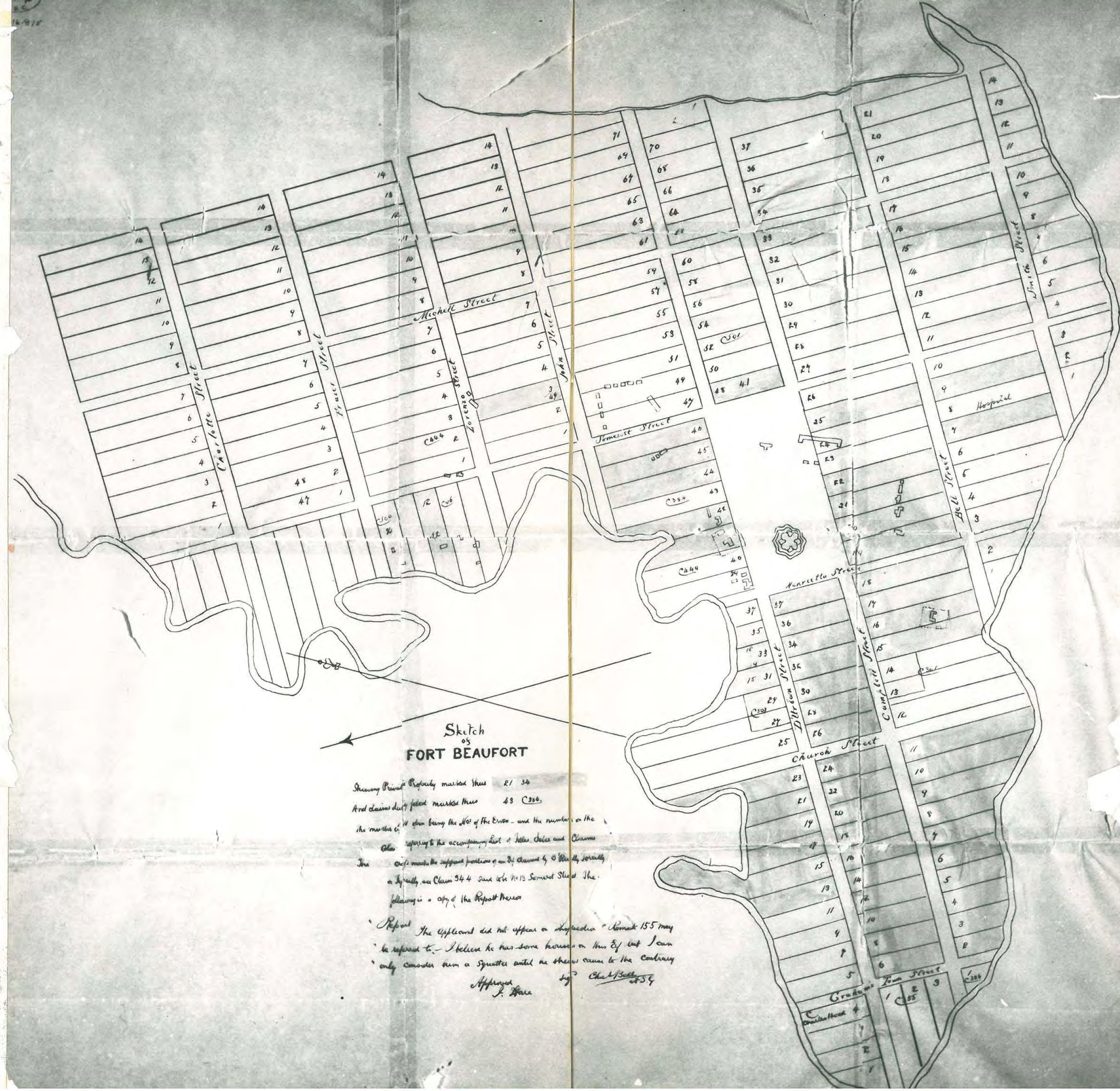
[1] G.M. Theal, "Compendium of South African History and Geography", Lovedale Press, 1876, p. 211.

[2] G.E. Cory, "The Rise of South Africa", Vol. III, Longmans, 1919, p. 202.

[3] Ibid., p. 425.


Sketch
of
FORT BEAUFORT
Shewing Private Property marked thus 21 34
And claims duly filed marked thus 43 C384.
the numbers on the numbers being the Nos of the Erven - and the numbers on the
referring to the accompanying List of Titles, Sales and Claims
a Squatter, see Claim 344 said to be No 13 Somerset Street The
following is a copy of the Report thereon
"Report The Applicant did not appear on Inspection " Remark 155 may
" be referred to. - I believe he has some houses on this Ef but I can
" only consider him a Squatter until he shews cause to the contrary
Approved
J. Hare
Sigd Chas Bell
Charlotte Street
Fraser Street
Mitchell Street
Lorenzo Street
John Street
Somerset Street
Smith Street
Bell Street
Hospital
Henrietta Street
Durban Street
Campbell Street
Church Street
Graham's Town Street

1837, Captain Armstrong, the resident J.P., instructed the Land Surveyor, Rex, to plan out a town. Although Cory does not say so, the problem must have been an extremely difficult one, for Rex commented that "if a Town is laid out there m(ust) be some regularity in the streets and th(at) we find is not to be done without making people pull down their houses."[1] The difficulty was apparently partly solved by introducing modifications in the town grid, but as can be seen in the plate opposite, it would have been necessary to demolish a number of houses. D'Urban and Campbell Streets, running roughly parallel with the north and south sectors of the Kat River meander, formed the main axis of the grid, as they still do. Halfway along the course of these streets an imposing town square was laid out. At present the centre of this is occupied by the Town Hall, the Municipal Market and Post Office, with lawns to the west and a park with tennis courts and bowling green to the east.

Despite the difficulties enumerated above, Charles Bell's "sketch" of 1845 shows that a most efficient town grid was established. At the time of the survey, plots were granted to people who had already built, and in 1843 eighty-four plots of land were sold. Cory states that "Some substantial buildings were commenced, including a church and school, and thus Fort Beaufort as a more purely civil, residential place became established."[2]

Road Building

After the 1835 war serious work was commenced on the construction of roads linking the frontier military posts with Grahamstown. In 1837 Andrew Geddes Bain commenced the supervision of the construction of the Queen's Road from Grahamstown through Fort Beaufort to the foot of the Katberg. Bond refers to it as

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[1] G.M. Theal, "History of South Africa", Vol. III, 1795-1834, Allen & Unwin, p. 372.

[2] G.E. Cory, "The Rise of South Africa", Vol. III, Longmans, 1919, p. 425.

"the first great South African highway ... Nothing to compare with these seventy miles of metalled highway, cut out of mountain-sides, raised on embankments over ravines, and carried by bridges across the rivers, had ever been seen in South Africa."[1] The construction of the road involved a drop of almost two thousand feet through thick scrub from Botha's Ridge near Grahamstown to the bottom of the Fish-Koonap valley. The section of road from Grahamstown to the Koonap River is in the present Albany division. A wooden bridge supported on massive stone pillars, "the biggest bridge South Africa had ever seen",[2] was built across the Fish River at Fort Brown (Albany) at a cost of £5,199 14s 11d.[3] No bridge was constructed across the Koonap River at the present Albany- Fort Beaufort boundary, but a pontoon was provided to carry traffic across the river, which could be forded for most of the time. From the Koonap River northwards the Queen's Road traversed the southern part of the present Fort Beaufort division. This section involved a climb of about 1,000 feet out of the valley onto the submontane peneplain. At Fort Beaufort the road was taken across the Kat River by means of a stone bridge which cost £2,000.[4] The foundation stone of this bridge was laid by Lady Napier, wife of the Governor, in November 1840. She named it the Victoria Bridge in the presence of a large crowd of soldiers and civilians. At this ceremony Major Selwyn pointed out that this was the first bridge of any permanent nature in the Frontier districts;[5] it is still in use. From Fort Beaufort the road continued up the Kat River valley to the forests at the foot of the Katberg.

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[1] J. Bond, "They were South Africans", Oxford University Press, 1956, p. 113.

[2] Ibid.

[3] G.E. Cory, "The Rise of South Africa", Vol. IV, Longmans, 1926, p. 244.

[4] Ibid.

[5] Ibid., p. 245.

While constructing the Queen's Road Bain enthusiastically collected fossil bones, and was rewarded by discovering the Dicynodont, completely new to science. In 1844 he despatched his collection of fossils, which included 19 Dicynodont skulls and the almost complete skeleton of a Pareiasaur, to the Geological Society of London. In his letter to the Society's Foreign Secretary, Sir Henry de la Beche, Bain gave a fairly detailed account of the topography and geology of those parts of the Eastern Cape which he had been able to visit.[1] This was the first geological description of a large tract of the Cape Colony. Bain stated that north of the Fish River "Continuing along the road to Fort Beaufort there is nothing but an alternation of Sandstones and disintegrating Slate, still conformable till we reach the signal Tower of Dan's Hoogte where the first vein or dyke of greenstone[2] appears, after which begins the country so rich in reptilean remains. It was here where I discovered the first head of that wonderful race of extinct animals, which I have called BIDENTALS from their having only two tusks in the upper jaw and no other teeth whatsoever! Of this race, or shall I say order, my collection will shew, I think, 19 skulls or portions thereof, all of different species and varying in size from a rat to a rhinoceros!"[3] The name Bidental was changed to Dicynodon by Professor Owen, the palaeontologist who described the new fossils.[4] At Blinkwater in the Kat River valley Bain discovered the more or less complete skeleton of a sixty-toothed Pareiasaur, which he named the "Blinkwater Monster".[5] He briefly describes this reptile in his letter. Bain's later geological map and his memoir "The Geology of South Africa" are well known.

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[1] Letter from A.G. Bain to Sir Henry de la Beche, "Journals of Andrew Geddes Bain", Van Riebeeck Society, Cape Town, 1949, pp. 219 - 233.

[2] Dolerite.

[3] "Journals of Andrew Geddes Bain", p. 224.

[4] Ibid., p. xxv.

[5] Ibid., p. 226.

Bain also supervised the building of the military highway from Grahamstown down the steep Pluto's Vale into the Fish River valley and then up its steep northern slopes to Breakfastvlei. This road, like the Queen's Road, is still in use. In 1845 Bain's work on the military roads in the Eastern Cape came to an end.[1] He thereafter undertook the building of roads elsewhere in the Cape Colony, as well as a considerable amount of geological work.

Bain resumed road building in the Eastern Cape in 1860[2] when he started the survey and construction of the Katberg Pass, which took the Queen's Road northwards across the Amatole-Winterberg escarpment to Queenstown.

Fort Hare and Alice

In 1846 the seventh Xhosa war commenced. In 1847, while this "War of the Axe" was still being waged, a large fort was built in Sandile's territory opposite Lovedale on the east bank of the Tyume, which could here be crossed through a suitable ford. According to Cory this military post, which was more of a large pallisaded village than a fort, was named Fort Hare, after Colonel Hare, the Lieutenant-Governor of the Eastern Province.[3] Fort Hare had a very strategic situation similar to that of Fort Beaufort. It commanded the exit of the fertile, well-watered upper Tyume valley from the highlands, as well as the relatively easy east-west route along the northern less arid margin of the submontane peneplain. The fort was well sited on open ground on a shaly hill some 80 feet above the alluvial terrace of the Tyume. This river provided an ample supply of water, which was pumped into large tanks inside the fort for the men and the horses. The roughly rectangular enclosure, some 600 yards long and some 260 yards wide, was defended by circular stone bastions with gun emplacements.

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1 "Journals of Andrew Geddes Bain", Van Riebeeck Society, Cape Town, 1949, p. xxvii.

2 Ibid., p. xxxvi.

3 G.E. Cory, "The Rise of South Africa", Vol. V, Longmans, 1930, p. 54.

Cory states that "Within this frail enclosure, there was accommodation for a battalion of 560 infantry and a squadron of 100 cavalry." The enclosure contained mess establishments, offices, storerooms, a hospital, stables, magazines and numerous huts for the men.[1]

Shortly after Fort Hare was established in 1847 the town of Alice was founded on the alluvial terrace 80 feet below the fort on the opposite bank of the Tyume. This terrace is approximately 20 feet above the overflow channel of the Tyume, which used to form a vlei on the western side of the present stock-fair grounds. The Xhosa name for Alice is "Edikeni", meaning a pond or vlei. Because of its excellent irrigation facilities the village attracted many pensioned British soldiers. Several shops, and later an inn, were established in Alice to serve the Fort Hare soldiery, and on 22nd March, 1852, the village was granted municipal government.[2] This was the first village in this area to acquire the status of municipality, the next being Fort Beaufort, which was granted municipal status on May 8th, 1855.[3]

Pollock states that "In 1856, the village of Alice appears to have covered much the same ground as now, the buildings being mainly wattle and daub huts of 2 - 3 rooms occupied by discharged soldiers... The Victoria Hotel serving both the soldiery and the waggon traffic to the interior was established next to the 'King' ford[4] across the river. A great event was the visit of Prince Alfred to the village in the 1860's; (sic) the Royal Hotel was named after this event."[5] (Prince Alfred actually visited Alice in 1860)

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[1] G.E. Cory, "The Rise of South Africa", Vol.V, Longmans, 1930, p.54.

[2] Proclamation, 22nd March 1852, Government Gazette No. 2417, 25th March 1852.

[3] Proclamation, 8th May 1855, Government Gazette No. 2611, 11th May 1855.

[4] King William's Town road.

[5] N.C. Pollock, "The Town of Alice, Cape Province", Geography, Vol. XXXIX, 1954, p. 178.

In December 1847, near the end of the War of the Axe, the Cape Governor, Sir Harry Smith, issued a proclamation announcing that the part of the Neutral Territory which had not yet been annexed to the colony, i.e. the territory bounded by the lower Kat and lower Great Fish rivers in the west and by the Tyume and Keiskamma rivers in the east, was to become part of the Cape Colony. This new division was named Victoria with Alice as its chief "town".[1] All Xhosa were removed from this area and loyal Fingoes[2] were settled in locations around Healdtown, in the Gaga River valley west of Alice and between the Kat River and the Grahamstown road south-west of Alice. The task of settling the Fingoes was entrusted to the Rev. Henry Calderwood, who was nominated Civil Commissioner for the new Victoria Division. The Africans were allocated individual holdings on which a quitrent of £1 per annum (reduced to ten shillings for the first year) was payable. It was argued that the quitrent was an inducement to industry and tended to tie the African down to his plot, thereby preventing vagrancy. The money collected from the locations was set aside for expenditure on them. The administration of the locations was in the hands of African headmen, under the direction of White superintendents, who corresponded with the Government through Mr. Calderwood in his

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[1] "Correspondence with the Governor of the Cape of Good Hope, relative to the state of the Kaffir Tribes", H.M.S.O., London, July 1848, p. 28.

[2] The Fingoes or Abambo were at one time a numerous and powerful Bantu tribe, living in Natal, and which included many clans, each ruled by a chief. They were defeated and diminished in number in fierce battles with other Bantu tribes, particularly the Zulu. The survivors became wanderers, known as Fingoes, seeking refuge with Xhosa-speaking tribes whose serfs they became and whose language they adopted. They were rescued from bondage in 1835 by Sir Benjamin D'Urban, acting on the advice of the Rev. John Ayliff, Wesleyan Missionary, who had been stationed amongst them at Butterworth, beyond the Great Kei River. The Governor not only gave them land within the Colony, mainly around Fort Peddie, but afforded them protection by receiving them as subjects of the British Crown. (See: J. Ayliff & J. Whiteside, "History of the Abambo generally known as Fingos", Butterworth, 1912, pp. 1 - 47.)

capacity of Civil Commissioner.[1] In the very first year 951 quitrents brought in a revenue of £475 10s 0d.[2] As this scheme proved such a success it was later adopted in other Ciskeian divisions as well as in the Transkeian Territories.

Europeans were allowed to buy farms in Victoria in 1848. "They averaged each about 1,000 acres in extent, and only realised the upset price of two shillings an acre."[3] Much of this cheap land was bought up by speculators, with the result that the European rural community remained small. In 1853 the residue of the unsold land was granted to settlers under military tenure.[4] Most of these settlers were of British stock.

On March 8th 1848 Fort Beaufort became a separate division. Until that time it had been part of the Division of Albany. A proclamation by the Governor, Sir Harry Smith, provided for the establishment of a Court of Resident Magistrate for "the district of Fort Beaufort, the boundaries of which shall be on the South, the Great Fish River, from its junction with the Kat River to its junction with the Koonap, thence the Koonap to its junction with the Kaga; on the West and North, the present boundaries of the Albany district; on the East, the Kat River from its junction with the Fish River to its confluence with a small river called the Umdala to the Tyumie Height, and thence the present boundary of the Albany district to Gaika's Kop."[5] In 1844 a Notice in the Government Gazette had stated that the Kat River Settlement north of

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[1] Government Notice, 9th February 1849, Government Gazette No. 2255, 15th February, 1849.

[2] Sir Harry Smith to Earl Grey, 24th May, 1849, "Correspondence relative to the state of the Kaffir Tribes", H.M.S.O., London, August 1850, p. 12.

[3] John Noble, "Descriptive Handbook of the Cape Colony", 1875, p. 197.

[4] G.M. Theal, "History of South Africa from 1795-1872", Vol. III, Allen & Unwin, 1919, p. 117.

[5] Proclamation, 8th March 1848, Government Gazette No. 2206, March 9th 1848.

Fort Beaufort village would henceforth be known as Stockenström in honour of its founder, Sir Andries Stockenström.[1] The proclamation of 8th March 1848 established the new district of Stockenström, consisting of the six field-cornetcies of the Kat River Settlement.[2] It was, however, still part of the Division of Fort Beaufort. Stockenström became a separate division less than ten years later.[3] The Governor's Proclamation of 8th March 1848 also established the Magisterial District of Fort Peddie, which comprised that portion of the Division of Victoria lying south of the main road running from Committees Drift on the Great Fish River to Committees Hill and a line from this hill to the Keiskamma River.[4] By 1848 there were therefore three divisions in the area covered by this thesis, viz. Somerset, Fort Beaufort and Victoria.

Four military villages were founded near Alice in 1848.[5] These were Ely, in the direction of Fort Beaufort, and Juanasberg, Woburn and Auckland in the Tyume valley north of Alice. Towards the end of 1850 the last of the wars directly affecting this area broke out. It was the longest and probably the most sanguinary of the Eastern Frontier wars. On Christmas Day, 1850, the newly founded military villages to the north of Alice were destroyed and many of their inhabitants massacred.[6] Fort Hare and Alice were attacked on January 21st, 1851, but the Xhosa were successfully repelled.[7]

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[1] C.G. Botha, "Place Names in the Cape Province", Juta, Cape Town, n.d., p. 161.

[2] Proclamation, 8th March 1848, Government Gazette No. 2206, March 9th 1848.

[3] "Cape of Good Hope Almanac and Annual Register", Van de Sandt, de Villiers, Cape Town, 1858 p. 179, and 1857 p. 210.

[4] Government Gazette No. 2206.

[5] G.E. Cory, "The Rise of South Africa", Vol. V, Longmans Green, 1930, p. 128.

[6] Ibid., pp. 311 - 314.

[7] Ibid., p. 337.

Stockenström

In the densely wooded ravines along the margins of the Kat River valley in the Stockenström district lived the wily Coloured leader Hermanus, who had repeatedly robbed European farmers in the open sourveld of the Winterberg and Upper Blinkwater. Dissatisfaction with their treatment by the Colonial authorities caused many Kat River Coloureds to join Hermanus. As soon as the news of the Xhosa military successes and the massacres of the military villages reached Hermanus, he was encouraged to seize the cattle of the Fort Beaufort Europeans and of the Healdtown Fingoes. Finally on January 7th, 1851, he attacked Fort Beaufort.[1] The Coloureds could only attempt to enter the town by means of the cuttings in the steep alluvial banks of the Kat River. Fierce fighting continued at these drifts for seven hours before the rebels were repelled, Hermanus being killed.[2]

Willem Uithaalder, a pensioner of the Cape Corps, succeeded Hermanus as leader of the rebels and captured Fort Armstrong, which was eventually recaptured by the British after a bloody battle in February, 1851.[3] This marked the end of the Coloured rebellion. The majority of the Coloured hamlets, together with their churches, mission and school buildings, were destroyed, although many of the Coloureds had remained loyal to the Cape Government.

It is not the geographer's task to pronounce judgement on the Kat River Coloureds, but no historian would be satisfied with any historical review which made no attempt to trace the causes of the rebellion. Macmillan states that "The outbreak was obviously a reckless and unconsidered protest against unsatisfactory conditions by people who had only too little to lose."[4] According to several

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1 G.E. Cory, "The Rise of South Africa", Vol. V, Longmans Green, 1930, p. 333.

2 Ibid.

3 Ibid., p. 353.

4 W.M. Macmillan, "The Cape Colour Question", Faber & Gwyer, London, 1927, p. 280.

responsible people of the time the grievances of the Coloureds were numerous and real. "My opinion", wrote James Rose-Innes, Superintendent General of Education, "is that the Kat River Settlement had not entirely recovered from the war of 1846-47 when that of 1850 commenced."[1] The Coloureds complained "that they had received not even thanks from Government after the last war, although they had served for more than 2 years, only receiving rations for themselves and families, without any pay."[2] Much evidence in favour of the Coloured people was furnished by the Rev. James Read, junior, but he would probably have been biased in favour of his flock.[3] Bias is not apparent in the evidence given by the Rev. Henry Renton before a committee of enquiry on 23rd and 24th July, 1851.[4] Renton had visited South Africa as Commissioner from the United Presbyterian Church of Scotland for the prime purpose of examining frontier mission stations amongst the Bantu, but in January, 1851, he visited the Kat River Settlement.[5] According to Renton the Coloureds "complained in connexion (sic) with that last war[6] that while they were doing duty as burghers they did not receive the same treatment as others who were serving in defence of the colony; that certain rations were witheld from them, such as coffee and soap, which diminished their comfort and their cleanliness, and made them feel they were treated as a degraded

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[1] J. Rose-Innes, "Memorandum on the Kat River Settlement", Report from the Select Committee on the Kafir Tribes, London, 2 August 1851, p. 406.

[2] James Read, Junior, "The Kat River Settlement in 1851", A.S. Robertson, Cape Town, 1851, p. 31.

[3] Ibid., 134 pp.

[4] Report from the Select Committee on the Kafir Tribes, London, 2 August 1851, pp. 376 - 439.

[5] Ibid., p. 376.

[6] 1846-47.

race."[1] Even for direct war losses there was little if any compensation,[2] although they were the only civilian group which had compulsory military service imposed on all the able bodied men.[3] According to Renton "The Kat River men were the first called out, and the last relieved."[4] They had thus little opportunity to tend their crops, maintain their homes or discipline their children. Although the rebellion cannot be condoned its motives are thus fairly clear.

For long the White settlers of the Eastern Cape had regarded the Coloureds as inferior and lazy, and this opinion was frequently expressed in the newspapers of the time, particularly "The Graham's Town Journal". There was also a tendency on the part of the colonists to criticise the missionaries for their role in championing the cause of the Coloureds. The opinions expressed by T.J. Biddulph, at one time Civil Superintendent of the Kat River Settlement, were typical of those held by the majority of White settlers. Biddulph, who was very unpopular with the Coloureds, wrote on 6th October, 1847, "Whatever might be the avowed motives of the founders of the Settlement ...... the whole affair from beginning to end has been nothing but the most transparent piece of humbug ever practised upon the public."[5] On 27th October, 1847, he summed up his sentiments as follows: "We have in this Settlement a large assemblage of able-bodied paupers, living partly on the credulity of the public, who absolutely refuse to enter into employment when it is offered at double the ordinary rate of wages."[6] The comment of "The Graham's

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[1] J. Rose-Innes, "Memorandum on the Kat River Settlement", Report from the Select Committee on the Kafir Tribes, London, 2 August 1851, p. 407.

[2] Ibid.

[3] Ibid., p. 413.

[4] Ibid.

[5] John Green, "The Kat River Settlement in 1851", Godlonton, White & Co., Grahamstown, 1853, p. 43.

[6] Ibid., p. 44.

Town Journal" of 15th March, 1851, suggested that the day of reckoning had arrived: "On the Eastern frontier a contest between stern justice and mistaken philanthropy has been raging, with more or less vehemence, for upwards of thirty years ..... unfortunately the case had to be referred to the Home government, and to the British people, who, influenced by the active exertions and pathetic appeals made by the representatives of certain powerful presumedly religious Associations, have hitherto given their voices against their fellow-countrymen, and, we trust, unwittingly, have assisted to their present affliction and prospective ruin.

"There has, however, not been at any time so important a crisis at hand as at present, and each party, finding that it bears very much the aspect of a death struggle, is preparing its weapons accordingly.......

"The voice of every Settler and Boer colonist must be loud in demanding that every Institution where a number of the colored (sic) classes are, or can be drawn together, shall be broken up, and restricted from re-assembling."[1]

These views were not disregarded by the Colonial Government. Writing to Sir John Pakington on November 29th, 1852, Governor Sir George Cathcart had expressed his plans for the Kat River Settlement: "I could mix the community with white settlers, who might improve, by their exertions and their example, a country which now resembles the garden of the sluggard, but which possesses agricultural capabilities of rare occurrence in this country."[2] The opportunity to put this into practice came in April, 1853, when the war finally came to an end. In May of that year a commission of three found that of the 509 erven (allotments) 160 belonged to rebels and 83 were vacant.[3] In accordance with the advice of this commission the

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1 "The Graham's Town Journal", Grahamstown, 15 March, 1851.

2 Correspondence of Lieut.-General Sir George Cathcart, John Murray, London, 1857, pp. 159 - 160.

3 Cape of Good Hope, Answer to an Address of the House of Assembly, 24th July, 1854, p. 3.

243 erven were confiscated. In November 1853 the commission published the names of 260 White farmers who had been recommended to it as fit and proper to receive allotments in the settlement,[1] and, according to the Deputy Surveyor-General, in April, 1854, "such portions as have been declared vacant .... have already been occupied by about 150 farmers, English and Dutch. Each farmer has an allotment of arable land, varying from 5 to 20 acres, with equal rights on surrounding blocks of common land."[2]

In that year work commenced on the re-survey of the whole Kat River Settlement so that title-deeds could be issued to all the erf-holders, both White and Coloured.[3] As a result of the re-survey the number of erven was reduced to 252.[4] Excluding the forest areas reserved for the Crown, the area of commonage amounted to 84 morgen (177 acres) per erf.[5] The Whites progressively enlarged their smallholdings with the passage of time. Often the Coloureds were deliberately lured into incurring debts and forced to sell their lands in order to pay them. At present the Coloured lands in Stockenström have dwindled to a few thousand acres, most of this being communal land owned mainly by the Congregational Church. Very few individual Coloured property holders remain. Many of the landless Coloureds have migrated to larger towns outside the Bedford and Fort Beaufort Divisions. Most of those remaining are employed as farm labourers and domestic servants. A considerable amount of miscegenation occurred during the nineteenth century, with the result that most of the Coloureds resemble Europeans

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[1] Government Notice No. 48, 10th November 1853, "The Graham's Town Journal", Grahamstown, November 12, 1853.

[2] Cape of Good Hope, Report by the Deputy Surveyor-General, 6th July, 1854, presented to Parliament, 24th July, 1854, p.3.

[3] Ibid.

[4] Cape of Good Hope, General Report presented to Parliament, G. 18-'59, 1859, p. 75.

[5] Ibid.

more than the original Hottentot people as far as physical characteristics are concerned.

While White settlers were establishing themselves in the Kat River Settlement the influence of the London Missionary Society was on the wane. During the mid-nineteenth century the Society had become more and more dependent on the Congregational Church for financial and other support, though it had formerly derived a considerable portion of its income from Episcopalian, Presbyterian and Methodist Churches. The growing concern of these denominations with mission work of their own not only led to a decline in financial support for the London Missionary Society but also to a decline in the total number of missionaries engaged in evangelical, educational and other work.[1] Thus, in 1867, the Society embarked on a new policy, viz. that of withdrawing from "Christian Churches already firmly established and surrounded by a nominally Christian population" in order to concentrate its men and resources in "heathen fields".[2] Philipton became independent of the London Missionary Society in 1871,[3] but has survived as a Congregational Church community. It remains the focal point of Coloured Congregational communities throughout the Stockenström district.

Before the outbreak of the War of the Axe a military post was established at the confluence of the Elands and Wellsdale tributaries of the Kat River near the foot of the Elandsberg. It was named Elands Post, and was built for the protection of the Upper Kat River valley, as it commanded the easiest route between the upper Tyumie and upper Kat via the Lushington valley. The abundant supply of irrigation water was one of the major factors leading to the establishment of a village an Elands Post in 1853.

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[1] R. Lovett, "The History of the London Missionary Society", Vol. II, Henry Frowde, London, 1899, pp. 688 - 689.

[2] Ibid., pp. 702 - 709.

[3] Ibid., Vol. I, p. 578.

It was named Seymour, after Colonel Seymour, military secretary of the Governor,[1] and became the seat of the magistrate of Stockenström. Its situation at the head of a deep embayment of the highlands, bounded by the steep slopes of the Elandsberg immediately to the north, caused Seymour to be bypassed by major roads. This resulted in the village missing much trade. As a marketing centre Seymour is limited to serving only its immediate surroundings, consequently its development has been extremely slow, and the population has been decreasing for the last forty years. Construction of a tarred road from Fort Beaufort to Queenstown via Seymour was commenced in 1969. When completed in 1972 it should enhance the importance of Seymour.

Fingo Locations

Further batches of loyal Fingoes were located at Healdtown at the close of the 1850-53 war by Sir George Cathcart. The Healdtown Location, the boundaries of which have remained virtually unchanged, stretched for approximately 9 miles along the Fort Beaufort-Stockenström boundary, from the Kat River in the west to the Victoria East boundary in the east. In 1853 several thousand Fingoes were settled west of Alice along the Gaga River valley and on the land to the north of the Alice-Fort Beaufort road. According to the report made in January 1855 by the Rev. H. Calderwood, "Special Commissioner, appointed to inquire into the present State of the Fingoe Locations in the Eastern Frontier", there were at that time 3,741 Fingoes in the Fort Beaufort division and 12,433 Fingoes in Victoria. The area of land occupied by their locations amounted to approximately 28 square miles in Fort Beaufort and 537 square miles in Victoria.[2] It should be borne in mind, however, that the present division of Peddie was at that time part of the division of Victoria. No separate population figures are given for the Victoria and Peddie districts, but some idea of the

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[1] G.E. Cory, "The Rise of South Africa", Vol. V, Longmans Green, 1930, p.490.

[2] "Further Papers Relative to the State of the Kaffer Tribes", H.M.S.O., London, July 1855, p. 42.

proportions of the Fingo population in the three districts of the two divisions can be obtained from the amount of hut tax paid by Fingoes in 1854. The amounts were as follows:-

Division of Fort Beaufort	£ 610 0s.
Division of Victoria -	
Fort Peddie district	£ 882. 0s.
Alice district	£ 385.10s. [1]

We can assume, therefore, that approximately one third of Victoria Division's Fingo population was at that time in the present Victoria East (i.e. Alice) district. The Bantu population of Fort Beaufort and Victoria East has remained overwhelmingly Fingo to the present day.

In 1855 the Healdtown Mission School was established by the Methodist Church after Governor Sir George Grey had offered generous grants to the Methodist missionaries for the purpose of educating the Fingoes.[2] The first mission station to occupy this site had been founded in 1844 by the Rev. Henry Calderwood, then a missionary of the London Missionary Society, who named it Birklands.[3] He was assisted by a Xhosa man in choosing a suitable site, viz. one with an abundant and perennial supply of water. After passing several springs the African at last reached one which met with his requirements, saying "This is the fountain. This does not die. It does not hear the rain".[4] This remark may still be applied to the steady flow of water which at Healdtown issues from the contact between a thick dolerite sill and overlying pervious sedimentaries of the Lower Beaufort Series. At the outbreak of the War of the Axe the Xhosa people who had settled at Birklands were

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[1] "Further Papers Relative to the State of the Kaffer Tribes", H.M.S.O., London, July 1855, p. 43.

[2] J. Rutherford, "Sir George Grey", Cassell, London, 1961, p. 319.

[3] H. Calderwood, "Caffres and Caffre Missions", James Nisbet, London, 1858, p. 90.

[4] Calderwood, loc. cit.

removed to Fort Beaufort and later, after the cessation of hostilities, their land was granted to a group of Fingoes who had been loyal to the Cape Government.[1] In 1853 the Rev. John Ayliff of the Methodist Church established the Healdtown Fingo Mission on the site of Birklands. The institution was named after James Heald, M.P., of Stockport, Cheshire. He was a prominent Methodist layman, very interested in missions, and was Treasurer of the Wesleyan Missionary Society from 1861 to 1874.[2] Heald and his sister contributed £1,750 towards the cost of its founding and maintenance.[3] The Mission School founded in 1855 was primarily for the purpose of providing industrial training;[4] this was followed in 1867 by the establishment of a Training Institution for teachers and theologians.[5] Over the years Healdtown became one of South Africa's leading Bantu educational centres. The Bantu Education Act of 1953 resulted in the transfer of the Institution's schools from the Methodist Church to the state and also in the limiting of enrolment to Xhosa-speaking students only.

The White Population

The distribution of the various races has remained more or less unchanged since 1853, the only exception being Stockenström, where there was a steady influx of White settlers during the latter half of the nineteenth century. By 1853 the White population of the present Bedford and Fort Beaufort divisions must have numbered well over a thousand, for in September of that year a "Return showing the Number of the Male Population between the Ages of 16

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[1] L.A. Hewson, "Healdtown", Thesis submitted for Ph.D. Degree, Rhodes University, 1959, p. 135.

[2] Ibid., p. 138.

[3] Address by L.A. Hewson, "The Eagle", Magazine of Healdtown Missionary Institution, 1955, pp. 16 and 18.

[4] L.A. Hewson, "Healdtown", p. 161.

[5] Ibid., pp. 240 - 241.

and 50 capable of bearing Arms in the several Divisions of the Cape of Good Hope"[1] included the following :-

	English	Dutch
Somerset East Division[2]		
Baviaans River Field Cornetcy	53	38
East Riet River Field Cornetcy	18	110
Fort Beaufort Division		
Koonap Field Cornetcy	42	43
Winterberg Field Cornetcy	34	17
Fort Beaufort Field Cornetcy	190	-
Kat River Settlement	"uncertain"	
Victoria Division[3]		
Alice Field Cornetcy	79	-
Total	416	208

The East Riet River Field Cornetcy was situated in the southern portion of the present Bedford district and in the present Adelaide district west of the Lower Koonap River. In both these areas the White population is predominantly Afrikaans-speaking, these people being descended mainly from the original "Dutch" settlers. Since 1853 the proportion of English-speaking Whites has increased in the area of the East Riet River Field Cornetcy, while the Afrikaans-speaking White population has increased greatly in the areas of the Fort Beaufort and Alice Field Cornetcies. Most of the Winterberg and Fort Beaufort Field Cornetcies, as well as a portion of the Koonap Field Cornetcy, are now included in the present Fort Beaufort district, where there is at present a small Afrikaans-speaking majority. A large proportion of the present Afrikaans population of Fort Beaufort is associated with the railways, the

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1 "Further Papers Relative to the State of the Kaffir Tribes", H.M.S.O., July 1855, pp. 18 - 23.

2 Excluding field cornetcies comprising the area west of the present Bedford Division.

3 Excluding the present Peddie Division.

non-white mental hospital and other Government-controlled organisations and institutions. The Afrikaans-speaking Whites of the district are concentrated mainly in the town of Fort Beaufort, and became important only in the twentieth century as a result of the Afrikanerisation of the civil service. The Alice Field Cornetcy consisted mainly of the present Victoria East district, where the White population is still predominantly English-speaking. Whereas in 1853 English-speaking Whites outnumbered Afrikaans-speaking (Dutch) Whites, the situation had been reversed by 1960, as the following figures[1] show:-

District	English-speaking	Afrikaans-speaking
Bedford	565	1,017
Adelaide	436	1,246
Fort Beaufort	884	984
Stockenström	312	677
Victoria East	775	394
TOTAL	2,972	4,318

In addition to the numbers enumerated above, there was in 1960 a total of 103 White people in the five districts whose home language was both English and Afrikaans.

Founding of Bedford

The origin of Bedford was somewhat different from that of the villages to the east. Had Sir Andries Stockenström not decided to sell the lower third of his well-watered 4,500 morgen farm, Maaström, at the foot of the Kagaberg, no township would have arisen there. In 1851 he returned from England to find that the dwelling on his farm had been burnt down by White farmers who disapproved of his philanthropic attitude towards the non-Whites, and consequently retired to Cape Town.[2] On 26th August, 1853, Stockenström

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[1] Population Census, 1960, Vol. 7, No. 1, pp. 120 -122.

[2] "The Autobiography of the late Sir Andries Stockenstrom, Bart.", Vol. II, Juta, Cape Town, 1887, pp. 302 - 312.

wrote a letter to R. Paver, his manager at Maaström, in which he intimated that he had decided to sell one third of the farm (3,300 acres) as a township site.[1] Approximately 500 morgen of land on the south-western bank of the Kaga stream was divided into plots, with more than 1,000 morgen serving as commonage to the proposed village. A portion of the advertisement inserted by the auctioneer, S.J. Meintjes, in certain colonial newspapers read as follows :-

"Sale of Erven of the Projected Town of Bedford, at the Kaga,

being part of the Maasstrom Estate

The undersigned has been favored (sic) with final instructions from Sir Andries Stockenstrom,[2] Bart., to sell by Public Auction, at Maasstrom (sic), on Wednesday, Thursday and Friday, The 18th, 19th and 20th January, between 350 & 400 Erven or Plots of Ground, of which 160 to 200 will be Water Erven.

The undersigned flatters himself that the position of Bedford is so well known, and the desirableness of a town in that neighborhood (sic) so universilly (sic) admitted, that anything he might bring forward cannot add, in any shape or way, to raise it in the estimation of the public; suffice it to say, that from the situation, the capabilities and fruitfulness of the soil, the healthiness of the climate, and the advantages granted by the seller, the

Town of Bedford

cannot fail to stand pre-eminent, and become one of the finest towns in the colony."[3]

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[1] Letter from Sir Andries Stockenström to R. Paver, August 26th, 1853, Cory Library for Historical Research, Grahamstown, MS. 7125.

[2] The umlaut is omitted from the o of "ström" in publications of that time, presumably because of printing difficulties.

[3] "The Cape Frontier Times", Grahamstown, January 3, 1854, also January 10, 1854 and January 17, 1854. See also "The Graham's Town Journal", January 14, 1854.

It is presumed that Sir Andries named the projected town in honour of his great English friend, the Duke of Bedford. The central square of the village was named Tavistock Square after the Duke of Bedford's estate in Britain. Although the Kaga River supplied very much less water than either the Koonap, Kat or Tyume, Maaström had the advantage of a higher rainfall than that of the settlements situated on the larger rivers to the east. Like Alice and Fort Beaufort, the projected town of Bedford would have the advantage of easy east-west communications along the less arid northern margin of the submontane peneplain. These factors, as well as the intensive advertising campaign in the newspapers, resulted in a large crowd of prospective buyers converging on Maaström for the opening of the sale on 18th January, 1854. On 20th January a correspondent of "The Cape Frontier Times" wrote "I am quite astonished at the result of the sale ..... when about 170 erven were sold" for "a clear £7,000".[1] In the same newspaper it is reported that "We learn from a gentleman who has just arrived from this place, that the sale of land on this splendid estate was going on in a very spirited manner. Several hundred persons were present. One water erf with an old ruined building sold for more than £200, the remaining water erven fetched from £70 to £100 each. The dry erven were bought for about £6 each. Many were bought for speculation."[2]

The building of houses appears to have commenced almost immediately after the sale, for a newspaper report in March, 1854, states that "the new town is in a very satisfactory state of progress, and bids fair to be a place of note hereafter."[3] In August, 1857, at the request of the local inhabitants, Governor Sir George Grey separated the Baviaans River and East Riet River

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[1] "The Cape Frontier Times", Grahamstown, January 24, 1854.

[2] Ibid.

[3] Ibid., March 21, 1854.

Field Cornetcies from the Division of Somerset East. These two field cornetcies were united into the new magisterial district and fiscal division of Bedford.[1] The establishment of a Court of Resident Magistrate in Bedford spared farmers living between the Great Fish and Koonap rivers from the long and tedious journey to the town of Somerset East for the transaction of official business.

A glowing report of the new town of Bedford appears in The Cape of Good Hope Almanac for 1858.[2] "This town; established by Sir A. Stockenstrom in January, 1854, has already attained to considerable importance. Beautifully situated at the foot of the magnificent Kaga Berg, the inhabitants seem to have fully appreciated the natural beauties of the place, by avoiding a fault which has been so often committed by the pioneers of a new location; no mean huts or hovels disgrace the proprietors, but many very elegant and substantial double-storied houses, well roofed with slate and iron, and with the lighter ornaments of verandah and balcony, give the place a highly civilized appearance. Trade is very brisk; considerable quantities of wool, skins, and hides find here a ready market, whilst the reputation of the magnificent mill is so great, that some thousands of muids of grain from the neighbourhood of the Orange River are converted into flour for the service of the Frontier, and a steam engine has already been ordered from England, to enable the enterprising proprietor of the works to fulfil the daily increasing demand for breadstuffs." In another paragraph it is stated that "A neat church has been erected, at a cost of £680, by voluntary contributions, and a salary of £250 per annum guaranteed to the Rev. E. Solomon, the resident minister, who has also established a flourishing Sunday school."

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[1] Proclamation, 13th August 1857, Government Gazette No. 2851, 14th August 1857.

[2] "The Cape of Good Hope Almanac and Annual Register for 1858", Van de Sandt, de Villiers, Cape Town, 1857, p. 191.

Development of Adelaide

Reference has already been made to the foundation of Fort Adelaide in 1834 and the building of a Dutch Reformed Church there between 1838 and 1840. The plan to lay out a town did not materialise until twenty years later. In February, 1859, the Rev. George Stegmann took charge of the Glen Lynden and Adelaide congregations.[1] When asking him to serve the Glen Lynden parish, the Church Council had promised a new church and parsonage at Adelaide.[2] Consequently the new minister took up residence at Adelaide instead of Glen Lynden. It would appear that the primary reason for the move was that there was a much larger Afrikaner (Dutch) community in this area. At that time Afrikaners made up an overwhelmingly large proportion of the White population in the East Riet River Field Cornetcy, to the west of the Koonap River; and in the Koonap Field Cornetcy, to the east of the river, they made up at least 50% of the White population. Moreover, in the Baviaans River Field Cornetcy, where Glen Lynden was situated, English-speaking Whites outnumbered the small "Dutch"-speaking population.[3] We can assume that, with the coming of the Rev. Stegmann, the small township of Adelaide at last began to develop, for plots on the left bank of the Koonap River were sold for a total amount of £11,488.[4] This was insufficient, however, to pay for the new church and parsonage, which cost £17,000 and £2,548 respectively.[5] The foundation stone for this expensive church was laid in 1859, and the impressive stone building was completed in 1862.[6] In the same year the Anglican Christ Church,

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[1] S.F. Feneysey, "Die Nederduits-Gereformeerde Gemeente Glen Lynden", Nasionale Pers, Cape Town, 1930, p. 37.

[2] Ibid.

[3] See population data on p. 164.

[4] S.F. Feneysey, p. 37.

[5] Ibid.

[6] Ibid.

still in use, was completed.[1] The "Union Presbyterian and Free Church" was also completed in 1862.[2] The latter two churches would have served English-speaking farmers living mainly in the Mancazana valley and in the area to the east of the Koonap, for the English-speaking population of the land to the west of the Koonap was extremely small.

Adelaide had the advantage of being sited on a relatively large alluvial terrace at the confluence of the Kowie, Waterkloof and Koonap rivers, which provided an ample supply of irrigation water. This was augmented by water from the Mancazana River, which joins the Koonap some four miles upstream from the town. Adelaide also had the advantage of being a route focus, as several highland embayments here converged upon the major east-west road along the submontane peneplain. Owing to a site and situation more favourable than that of Bedford, Adelaide developed at a faster rate, and by 1859 the village had three more houses than its older sister.[3] By 1861 there were between 100 and 200 completed houses in Adelaide,[4] and in November of that year municipal regulations were introduced.[5] Despite its rapid growth Adelaide did not become the seat of a Resident Magistrate, but remained part of the Fort Beaufort magisterial district, while the land immediately across the Koonap River was part of the Bedford district. It was only in 1906 that the separate magisterial district of Adelaide was created from parts of Bedford and Fort Beaufort.[6] A small portion of

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1 "Adelaide, A Hundred Years", Free Press Newspapers, Adelaide, 1961, p. 27.

2 Ibid., p. 43.

3 W. de S. Hendrikz, "Adelaide, Almost a Century", Free Press Newspapers, Adelaide, 1958, p. 47.

4 Ibid., p. 45.

5 Proclamation, 16th November 1861, Government Gazette No. 3307, 19th November 1861.

6 Proclamation, 30th September 1905, "Fort Beaufort Advocate", 20th October 1905.

Albany lying immediately south of the Koonap River was then also incorporated in Adelaide.

Victoria East

In January 1858 the "District of Fort Peddie" was completely separated from the Division of Victoria, and became known as the "Division of Peddie."[1] By this time it had become customary to refer to the Victoria district of the Eastern Cape as Victoria East in order to distinguish it from the district of Victoria West, which had been established in the Upper Karroo in 1855.[2] With the separation of Peddie in 1858 Victoria East attained more or less its present size and shape, but the whole of the Tyume valley east of the river remained part of the King William's Town district. Fort Hare, Mabandla's Location and certain European farms to the east of the Tyume were only added to Victoria East in 1891.[3] In that year the total area of the Bedford, Fort Beaufort, Stockenström and Victoria East districts for the first time almost corresponded with the area occupied by the five districts of the present time. It was only in 1906 that the area became delimited as at present.

FURTHER DEVELOPMENT AS REVEALED BY THE CENSUSES OF 1865 AND 1875

The Eighth Xhosa War, which ended in 1853, was the last war to affect this area directly, and marked the end of more than half a century of instability.

The first census of the Cape Colony took place in 1865. This revealed that the districts of Bedford, Fort Beaufort,

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[1] Government Notice No. 11, 6th January 1858, Government Gazette No. 2894, 12th January 1858.

[2] Proclamation, 15th November 1855, Government Gazette No. 2665, 16th November 1855.

[3] Proclamation, 4th November 1891, Government Gazette No. 7343, 6th November 1891

Stockenström and Victoria East had a total population of 35,630, of which 7,186 were White.[1] By 1875 the total population had increased to 38,517, of which 7,773 were White.[2] The 1865 census classified the population into four ethnic groups, Europeans, Hottentot, Kafir and Other; the latter presumably included Fingoes and the lighter skinned Coloureds. The distribution of these groups per district was as follows :-

District	European	Hottentot	Kafir	Other	Total
Bedford	1,952	1,060	3,842	1,496	8,350
Fort Beaufort	2,767	950	4,122	5,502	13,341
Stockenström	1,326	2,205	1,467	649	5,647
Victoria East	1,141	122	1,501	5,528	8,292
	7,186	4,337	10,932	13,175	35,630

The 1875 census gives a far clearer picture of the ethnic composition of the population, as the following table shows :-

	WHITE	AT PRESENT CLASSIFIED AS COLOURED			BANTU		
District	Euro-pean	Malay	Hottentot	Mixed & Other	Fingo	Kafir & Bet-shuana	Total Popul-ation
Bedford	2,134	Nil	1,277	519	864	3,974	8,768
Fort Beaufort	2,998	13	1,106	459	4,028	6,144	14,748
Stockenström	1,508	20	1,983	462	341	2,189	6,503
Victoria East	1,133	1	257	55	4,022	3,030	8,498
Total	7,773	34	4,623	1,495	9,255	15,337	38,517

[1] Census of the Colony of the Cape of Good Hope, G.20, 1866, p. 9.

[2] Results of a Census of the Colony of the Cape of Good Hope, 7th March, 1875, Part II, G.42-'76, pp. 20 - 22.

Stock Farming

The climate of most of this area had favoured the development of pastoralism rather than agriculture. The 1865 and 1875 censuses revealed that the Bedford, Fort Beaufort, Stockenström and Victoria East districts formed an important pastoral farming area in the Cape Colony.[1] In this region there were at that time more than 660,000 sheep, 160,000 goats and 45,000 cattle.

Sheep

In 1865 the total number of woolled sheep exceeded the 1960 total, as shown by the following table:-

Woolled Sheep

1865		1960	
Bedford	267,210	(Bedford	218,467
		(Adelaide	152,297
Fort Beaufort	209,765	(Fort Beaufort	98,179
Stockenström	82,134	Stockenström	68,735
Victoria East	98,707	Victoria East	22,100
Total	657,816	Total	559,778

In 1865 non-woolled sheep were very few, the total number in the four districts being only 3,711. These districts produced a considerable amount of wool, the 1865 production in lbs. being as follows :-

Bedford	637,728
Fort Beaufort	290,109
Stockenström	150,752
Victoria East	205,948
Total	1,284,537

This low average of just under 2 lbs. of wool per sheep indicates that they must have been of poor quality. By 1875 the total number

[1] 1865 and 1875 agricultural and livestock statistics obtained from Cape of Good Hope Blue Book, 1877, Saul Solomon, Cape Town, 1878, pp. Q8 and Q9 (Agriculture), R2 and R3 (Livestock). 1960 data obtained from Report on Agricultural and Pastoral Production 1959-60, No. 2, Agricultural Census No. 34, R.P. 18/1963, and Report on Agriculture and Pastoral Production 1959-60, No. 3, Agricultural Census No. 34, R.P. 10/1964.

of woolled sheep had decreased to 385,943, yet the wool production had increased to 1,465,483 lb. This gives an average of 3.8 lbs. of wool per sheep, which is still low when compared with 8.1 lbs. of wool per sheep in 1960. Non-woolled sheep remained insignificant, there being only 2,911 in the area in 1875, compared with a total of 12,706 in 1960.

Cattle

Whereas the number of sheep was nearly halved in the decade 1865 - 1875, the total number of cattle increased from 46,371 to 70,071. Nevertheless this was considerably less than the 1960 total of 94,392. The distribution of cattle in the four divisions in 1865 and 1875 was as follows :-

	1865		1875	
District	Draught Oxen	Other Cattle	Draught Oxen	Other Cattle
Bedford	5,222	11,356	7,693	10,822
Fort Beaufort	5,254	10,219	9,053	15,136
Stockenström	2,980	2,549	5,600	4,430
Victoria East	1,967	6,824	7,281	10,056
Total	15,423	30,948	29,627	40,444

The increase in the decade after 1865 was particularly marked as far as draught cattle are concerned. At this time oxen were an important means of transport, as there were no railways in the area and the motor car had not yet been invented. Ox-drawn wagons were the chief means of transporting heavy goods, and most of the ploughing was done by oxen. The importance of these animals declined after the arrival of the railways and even more so with the introduction of motor propelled vehicles. Most of the oxen in the area are now fattened and sold for beef.

Goats

In 1865 and 1875 the number of goats in each of the four divisions was as follows :-

	1865	1875
Bedford	6,035	13,457
Fort Beaufort	4,248	19,048

District	1865 Angora Goats	1865 Other Goats	1875 Angora Goats	1875 Other Goats
Bedford	10,769	50,044	61,632	17,518
Fort Beaufort	3,416	47,532	16,616	20,591
Stockenström	3,274	19,491	8,751	8,268
Victoria East	4,492	24,582	3,794	8,947
Total	21,951	141,649	90,793	55,324

The increase in the number of Angora goats during the decade before 1875 is noteworthy. The 1865 census reports give no mohair figures at all. In 1875 Bedford is reported as having produced 9,725 lbs. of mohair, no figures being given for the other districts. In 1953 there were 92,629 goats in this area compared with a total of 163,600 in 1865. By 1960 the total had risen to 118,931, the reduction in the number of Bantu owned goats being offset by an increase in the number of Angora goats in the Bedford district. During the latter part of the nineteenth century, when the land was unfenced, the large number of goats must have played a major role in the devastation of the natural vegetation which has occurred over so much of this area.

Horses

It is obvious that during the nineteenth century horses were most important for providing transport faster than that provided by oxen. The distribution of horses in 1865 and 1875 was as follows :-

	1865	1875
Bedford	3,092	2,171
Fort Beaufort	2,763	1,834
Stockenström	1,141	808
Victoria East	1,418	891
Total	8,414	5,704

In 1960, on the other hand, there were only 3,154 horses in the area. Horse drawn carts and carriages were used for the transport of passengers, mail and light goods. During this period it was customary for all hotels to supply hay and other fodder for animals. Barley and oats were important fodder crops for horses.

Crops

The returns of barley and oats in bushels[1] for the years preceding the 1865, 1875 and 1960 censuses were as follows :-

	BARLEY			OATS		
District	1865	1875	1960	1865	1875	1960
Bedford	1,071	2,216	363	577	1,195	10,860
Adelaide	-	-	162	-	-	10,100
Fort Beaufort	413	2,033	90	912	1,067	3,346
Stockenström	2,838	596	792	1,652	239	24,520
Victoria East	184	149	651	120	21	2,138
Total	4,506	4,994	2,058	3,261	2,522	50,964

The large percentage increase in the production of oats over the past century reflects its growing importance as a fodder crop for livestock of all types. In the past the production of oat hay was far more important than oat grain, as the following figures show :-

	Oat Hay (100 lbs.)	
	1865	1875
Bedford	6,035	13,457
Fort Beaufort	4,248	19,048
Stockenström	2,311	6,176
Victoria East	1,765	5,092
Total	14,359	43,773

Wheat was grown in far greater quantities than at present, although the yields were poor owing to the tendency for rust to develop during the warm spring months. During the nineteenth century it was customary, however, for food requirements to be

[1] 1 bushel of barley weighs approximately 50 lb. 1 bushel of oats weighs approximately 39 lb.

produced locally whenever possible. The wheat was also locally ground into flour, usually in water driven mills, the remains of which can be seen in several localities.

Maize and millet, however, were the leading cereal crop, as shown by the following figures (to the nearest bushel) :

	WHEAT		MAIZE and MILLET	
District	1865	1875	1865	1875
Bedford	8,691	23,307	21,738	67,754
Fort Beaufort	4,885	23,510	23,459	27,705
Stockenström	2,710	11,591	6,582	8,963
Victoria East	603	5,975	5,295	36,318
Total	16,889	64,383	57,074	140,740

The wheat crop for the year preceding the 1960 census[1] was the best for many years, owing to the good winter rains of 1959, yet it amounted to only half the 1864 harvest and less than one seventh of the 1874 harvest. Even the 1960 maize crop[2], produced during a normal summer, was very much less than the 1865 and 1875 crops. It would appear, therefore, that cereal production has declined over the past century.

Tobacco

On the other hand, tobacco production has expanded tremendously, as shown by the following figures :

District	1865	1875	1960
Bedford	3,075 lbs.	440 lbs.	Nil
Adelaide	-	-	Nil
Fort Beaufort	2,243	2,595	24,200 lbs.
Stockenström	8,584	46,823	564,800
Victoria East	600	190	17,000
Total	14,502	50,048	606,000

1 8,673 bushels or 520,400 lbs.

2 In 1960 the region produced 42,610 bushels of maize (2,386,400 lb.) and only 22,600 lb. of millet.

In 1875 Stockenström was the fifth leading tobacco producing district of the Cape Colony; in 1960 Stockenström ranked third in the Cape Province as a tobacco producing district, being surpassed only by the Oudtshoorn and Humansdorp districts.

The mean January and February temperature of the Kat River valley approximately equals the mean July temperature of the southern Connecticut River valley of the United States of America. It is not surprising therefore that the Connecticut seed-leaf variety of tobacco has always been popular in the Kat River valley. As early as 1877 the Cape Colonial Government Tobacco Expert was able to comment that "the Connecticut seed-leaf thrives well in the climate of Stockenstrom".[1]

Ostriches

Ostriches had occurred wild in the Eastern Cape before the advent of White settlers. In 1823 George Thompson encountered numerous wild ostriches in the upper portion of the Great Fish River valley,[2] but the first reference to ostriches in this area was made by the Swedish traveller, Andrew Sparrmann, who encountered breeding ostriches in December, 1772, on a journey from Quammedacka[3] to Agter Bruntjes Hoogte. Sparrmann describes how "we scared a male ostrich away from its nest, which was in the middle of the plains. This nest, however, consisted of nothing but the ground itself, on which the eggs lay scattered and loose. Hence it follows that the ostrich does not leave its eggs to be hatched by the sun, but likewise, at least in this part of Africa, sits upon them herself: we may also infer, that the male and the female sit upon them alternately. The Hottentots too assured me of this fact,

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[1] Cape of Good Hope, Report of the Government Tobacco Expert for 1877, G. 41 - '88, p. 4.

[2] G. Thompson, "Travels and Adventures in Southern Africa", Part I, Henry Colburn, London, 1827, p. 70.

[3] Commadagga, near the south-western border of the present Bedford Division.

which has hitherto been unknown to naturalists."[1]

At this time, according to Sparrman, ostrich feathers were used in Europe "chiefly for the purpose of adorning our heads", but in the Cape Colony "I did not see ostrich feathers made any other use of, than to brush away the flies." The eggs, however, were used for "pancakes and aumelets".[2] Although there were several large tame ostriches at the Governor's menagerie at the Cape,[3] tame ostriches were not popular in the farms as they "were so voracious as to swallow chickens whole, and trample hens to death, in order to tear them to pieces afterwards and eat them up. At a certain farm they were obliged to kill one of these ostriches, as he had got a habit of trampling sheep to death."[4] The wild birds were "chiefly to be found in such tracts of country as partook of the properties of the carrow,[5] and produced succulent plants." Sparrman saw but one ostrich in the entire "sour district."[6]

The Ostrich Boom

According to the 1875 census there were only 143 domesticated ostriches in the present Bedford and Fort Beaufort Divisional Council Areas, 130 of these being in Bedford and the remaining 13 in Fort Beaufort. In 1875, however, the average price per lb. of ostrich feathers exported from the Cape was £6.3s.0d. (R12-30)[7] which was the highest price since the early

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1 Andrew Sparrman, M.D., "A Voyage to the Cape of Good Hope, towards the Antarctic Polar Circle, and Round the World", Vol. II, Robinson, London, 1786, p. 120.

2 Ibid., p. 122.

3 Ibid., p. 124.

4 Ibid., p. 125.

5 Karroo.

6 He is presumably referring to the sour grassveld of the south-eastern Cape Province.

7 R. Wallace, "Farming Industries of Cape Colony", P.S. King, London, 1896, p. 233.

1860's. At this time ostrich feathers became very fashionable for the trimming of ladies' hats, mantles and dresses, and also began to play a major role in feminine coiffure. Consequently there was a rapid increase in the number of ostriches from the late 1880's onwards, as shown by the following figures[1] :-

	Bedford	Adelaide	Fort Beaufort	Stockenström	Victoria East	Total
1888	847	-	2,823	206	834	4,710
1890	4,226	-	2,192	341	748	7,507
1898	8,000	-	3,768	472	1,017	13,257
1911	14,074	5,904	6,083	3,377	5,212	34,650

Although wild ostriches had occurred mainly in karroid country, adult domesticated birds were well adapted to grazing on either grass, trees or shrubs, and thrived in all areas which were not too densely wooded. Their tolerance of a wide variety of grazing types, and their ability to survive severe droughts made them extremely popular with farmers. Sowings of lucerne along the major river valleys where irrigation water was available, ensured the necessary green-feed for chick rearing. Although ostrich feather prices declined steadily from 1880 onwards,[2] prices remained high enough to make the industry profitable. As in other sub-humid parts of South Africa, the ostrich brought prosperity to many farmers for the first time. The necessity of green feed being reserved for chicks and of the segregation of birds into breeding pairs resulted in the first appearance of fences on most farms; this in turn led to controlled grazing of other livestock. The ever increasing number of ostrich chicks led to a greater demand for lucerne, consequently more weirs and dams were

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[1] 1888 and 1890 data from "Statistical Register of the Colony of the Cape of Good Hope for the Year 1889", W.A. Richards, Cape Town, 1890, p. 329. 1898 data from Statistical Register for 1898, W.A. Richards, Cape Town, 1899, p. 354. 1911 data from Census of the Union of South Africa, 1911, Part IX, Livestock & Agriculture, pp. 1288 - 1290.

[2] R. Wallace, "Farming Industries of Cape Colony", P.S. King, London, 1896, p. 233.

constructed for the irrigation of this crop. These were of lasting value, for they could be used for other crops in the event of an ostrich feather slump, although farmers did not foresee this at the time. After the Anglo-Boer War feather prices began to rise again, and in 1910 the average price realised per lb. for export feathers in Port Elizabeth was £3.1s.3d. (R6-12½), the highest price since 1888.[1]

Prices remained high until 1913, resulting in a steady increase in the number of ostriches throughout South Africa. The big slump came in 1914, after the outbreak of the First World War, when ostrich feathers became virtually unsaleable.[2] In 1913 the average value of feathers exported from the Cape Colony was £2.17s.9d. (R5-77½) per lb., but in 1914 prices fell to an average of only 15s. (R1-50) per lb.[3] Immediately farmers set about reducing the number of birds, many being slaughtered to provide meat for farm labourers. Near the end of the war there was a rise in the price of ostrich feathers, the average market price per lb. in 1918 being 17s.8d. (R1-77). This rose to 23s.6d. (R2-35) in 1919 and 49s.6d. (R4-95) in 1920. After this prices began to decline again, sinking to twenty shillings (two rand) per lb. in 1923.[4] Prices continued to decline after 1923, during the 1930's the average price per lb. being less than 10s. (R1-00).[5]

The minor boom of 1920 did not reverse the steady decline in the number of ostriches. Not only were farmers fearful of a repetition of the 1914 slump, but also a large proportion of the

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[1] Union Castle Yearbook, 1938, p. 357.

[2] Ibid.

[3] Official Year Book of the Union, No. 6 - 1923, Pretoria, 1924, p. 509.

[4] Report on the Agricultural and Pastoral Production of the Union of South Africa, 1923 - 26, Agricultural Census No. 7, 1924, p. 106.

[5] D.J.v.Z. Smit, "Ostrich Farming in the Little Karoo", Department of Agricultural Technical Services, Bulletin No. 358, Pretoria, 1963, p. 7.

irrigated land previously devoted to lucerne was now being put under citrus.[1]

From 1913 to 1921 the number of ostriches in the Union of South Africa decreased by over 66 per cent.[2] The following figures clearly show that this area conformed to the trend of that time:

Number of Ostriches

	Adelaide	Bedford	Fort Beaufort	Stockenström	Victoria East	Total
1911	5,904	14,074	6,083	3,377	5,212	34,650
1918	2,369	5,158	1,686	1,589	1,993	12,795
1919	2,190	4,430	1,610	1,240	2,070	11,540
1920	1,420	3,350	1,230	1,390	1,790	9,180
1921	1,445	3,423	1,394	1,326	1,682	9,270
1922	1,207	3,440	1,140	1,454	1,604	8,845
1923	1,270	2,915	774	1,258	1,316	7,533
1924	888	2,437	695	1,048	1,210	6,278
1925	899	2,019	667	862	1,089	5,536
1926	661	1,568	395	734	935	4,293

The steady decline continued, as shown by later census statistics:

	Adelaide	Bedford	Fort Beaufort	Stockenström	Victoria East	Total
1937	217	306	162	218	141	1,044
1946	60	237	48	19	50	414
1960	38	77	12	201	30	358

Railway Development

In the decade after 1875 the area was first able to benefit from the construction of railways. In August, 1877, a 72 mile stretch of railway was opened from Port Elizabeth to Alicedale.[3]

[1] See Chapter XIII.

[2] Report on the Agricultural and Pastoral Production of the Union of South Africa, Agricultural Census No. 4, 1921, p. vi.

[3] "The General Directory and Guide-Book to the Cape of Good Hope and its Dependencies, Saul Solomon, Cape Town, 1880, p. 252.

The Great Fish River valley provided the easiest route from the coast to the interior plateau, thus it was chosen as the route for the railway from Port Elizabeth to the rapidly developing Kimberley diamond fields. By early 1880 the line had been extended to Middleton, on the south-western border of the Bedford district, 110 miles from Port Elizabeth.[1] Construction proceeded northwards along the western border of Bedford through Cookhouse towards Cradock. On 1st March, 1880, the line was extended to Cookhouse, 17½ miles north of Middleton.[2] On 31st May, 1881, the railway line was opened to traffic as far as Cradock, more than 180 miles from Port Elizabeth.[3] Although the line was confined to the right bank of the Great Fish River, the Cookhouse-Cradock section actually entered a portion of the Bedford Division in two sectors where the boundary line cut across the river. For this reason there were two railway sidings in the Bedford Division, viz. Thorngrove and Witmos. The town of Bedford was then only 25 miles from its nearest railway station, Cookhouse. The line from Port Elizabeth met that from Cape Town at De Aar on 31st March, 1884,[4] and on 28th November, 1885, the immediate goal of Kimberley was reached.[5] The proximity of the Port Elizabeth-Kimberley line provided a great impetus for agriculture in the Bedford Division, as there was a great demand for agricultural produce on the diamond fields. The discovery of gold on the Witwatersrand resulted in the extension of the Port Elizabeth line north-eastwards from

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1 "The General Directory and Guide-Book to the Cape of Good Hope and its Dependencies", Saul Solomon, Cape Town, 1880, p.252.

2 Cape of Good Hope, "Reports on the Construction and Progress, etc., of the several Railways of the Colony, for the year 1880", G.60, 1881, p. 4.

3 Ibid., 1881, G.29, 1882, p. 7.

4 J.R. Day, "Railways of Southern Africa", Arthur Barker, London, 1963, p. 25.

5 Ibid., p. 26.

Noupoort towards the Transvaal. This further increased railway traffic on the Bedford border.

In the 1870's work was in progress on a railway from the port of East London to the interior. In 1876 a branch line from Blaney, on the "East London and Queen's Town Railway", reached King William's Town. It was opened to passenger traffic on the 18th December of that year.[1] Alice was thus only about 40 miles from its nearest railway station. It was then customary to transport agricultural produce by ox-wagon to the railhead at King William's Town.

The King William's Town - Cookhouse rail link did not materialise until the beginning of the next century. In 1900 a contract was drawn up for the construction of "the line of Railway on a 3ft. 6 in. gauge from a point at or near Somerset East via Cookhouse, Bedford, Fort Beaufort and Alice to King William's Town, a length of about 142¼ miles."[2] The contractors undertook to construct the line at a cost of £4,500 per mile.[3] It was officially opened by the Governor of the Cape Colony, Major-General Edmund Smith-Brook, in October, 1904.[4] At last the towns of Bedford, Adelaide, Fort Beaufort and Alice had easy and quick access to the ports of East London and Port Elizabeth as well as the interior. Bedford was situated approximately equidistant by rail from Port Elizabeth and East London.[5] The East London route offered the advantage of being more direct and involving delays at only one

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[1] Cape of Good Hope, Report on Railways, 1877, Appendix I to the Votes and Proceedings of Parliament, G.32, 1878, p. 34.

[2] Cape of Good Hope, Annexures to the Votes and Proceedings of the House of Assembly, Vol. III, G.58, 1900, p. 16.

[3] Ibid., p. 2.

[4] "The Fort Beaufort Advocate", October 28, 1904.

[5] At present Bedford is 152 miles by rail from Port Elizabeth and 149 from East London, whereas Alice is 213 miles by rail from Port Elizabeth and only 88 miles from East London.

junction, viz. Blaney, whereas on the Port Elizabeth route delays tended to occur at both Cookhouse and Alicedale junctions. West of Eastpoort, between Bedford and Cookhouse, railway rates favoured Port Elizabeth, but east of this station they favoured East London.[1] It is not surprising therefore that most of the agricultural produce of the Bedford and Fort Beaufort Divisions should be exported through the latter port.

The development of the Kat River valley citrus industry following the ostrich slump[2] resulted in agitation by citrus farmers for the construction of a railway line to serve the main growing area north of Fort Beaufort. The South African Government eventually agreed to the construction of a narrow-gauge railway, despite the fact that the growers had asked for a broad gauge branch. Act No. 30 of 1922 provided for the equipment and building of a two foot gauge line from Fort Beaufort to Balfour, a distance of 24 miles 36 chains.[3] (80 chains equal one mile). Construction commenced in 1923, and, on 30th November, 1925, the railway was opened to traffic.[4] Meanwhile Act No. 33 of 1925 had authorised the construction of an additional 9 miles 43 chains from Balfour to Seymour.[5] Finally, on 19th November, 1926, the entire 34 miles of the new branch line was declared open for public traffic.[6]

Citrus was the raison d'etre of this narrow-gauge line. Highly seasonal, it proved to be a crop that was not without drawbacks. During the period October to April three trains per

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1 S.A. Railways & Harbours, Report on the Commission on the Trade Prospects of Port Elizabeth Harbour, 1925, U.G. 13-'26, 1926, Map No. 6332.

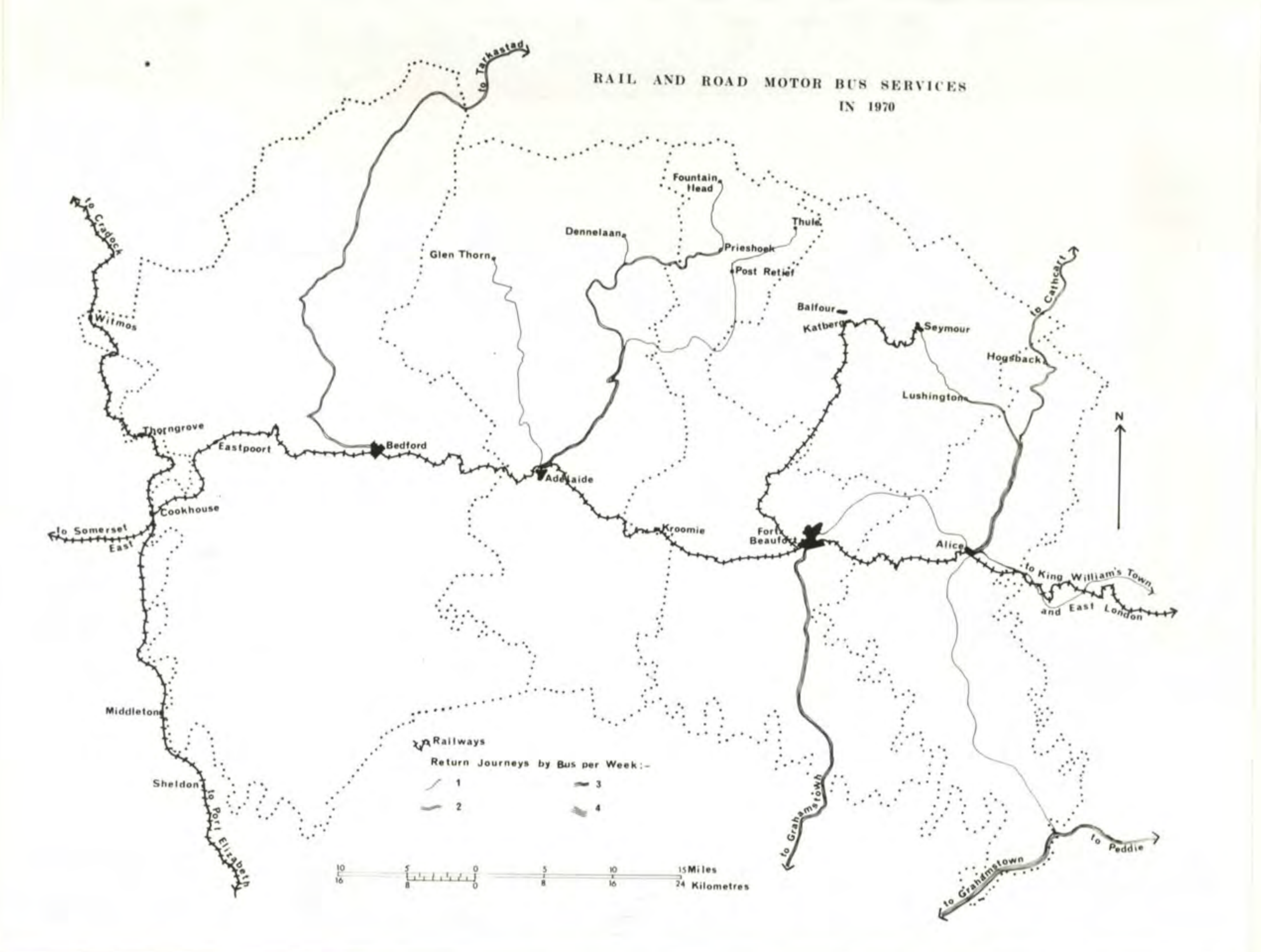
2 See Chapter XIII.

3 Union of South Africa, Report of the Railways & Harbours Board for the Year ended 31st December, 1925, U.G. 29-26, 1926, p. 16.

4 Ibid.

5 Union of South Africa, Report of the Railways & Harbours Board for the Year ended 31st December, 1926, U.G. 20-27, 1927, p. 18.

6 Ibid.


RAIL AND ROAD MOTOR BUS SERVICES
IN 1970
to Tarkastad
to Cradock
Wilmos
Thorngrove
Eastpoort
Bedford
Glen Thorn
Dennelaan
Fountain Head
Thule
Prieshoek
Post Retief
Balfour
Katberg
Seymour
to Cathcart
Hogsback
Lushington
Adelaide
Cookhouse
to Somerset East
Kroomie
Fort Beaufort
Alice
to King William's Town and East London
Middleton
Sheldon
to Port Elizabeth
to Grahamstown
to Peddie
Railways
Return Journeys by Bus per Week:-
1
2
3
4
N
Miles
Kilometres

week moved all the goods offered for transport, and for this purpose two locomotives were sufficient. During the winter half year, however, the line was strained to capacity, particularly during the Navel Orange picking season, which lasts from May to July. During this period it was necessary to operate several trains per day, thus an extra engine had to be borrowed from one of the other narrow gauge lines, either from the Port Elizabeth - Avontuur railway or from one of the Natal narrow-gauge lines.[1]

Citrus production in the Kat River valley quadrupled during the period 1927-1938. In 1938 the narrow gauge line transported 295,752 cases, compared with 75,756 in 1927,[2] and the two foot gauge had increasing difficulty in coping with the demands made on it. Whereas in the early days all the fruit was off-loaded at Fort Beaufort for grading and packing, increasing quantities were being graded and packed at sidings, calling for direct loading onto a standard 3 ft. 6in. gauge line. After more than a decade of use the rolling stock and track were beginning to require major overhauls. For these reasons it was decided to convert the Fort Beaufort - Seymour branch line to standard 3ft. 6in. gauge.

Preliminary work on the widening of the line commenced in February, 1939,[3] but by the end of the year only 8 miles 70 chains had been relaid.[4] The task was completed in 1940 at an estimated cost of £51,198, approximately £1,500 per mile.[5] This was slightly less than half the cost per mile of the original construction. The Fort Beaufort - Balfour narrow-gauge line had

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1 S.M. Moir, "Twenty-Four Inches Apart", Oakwood Press, 1963, p. 160.

2 Information obtained from System Manager's Office, East London.

3 "The Fort Beaufort Advocate", March 2, 1939.

4 Union of South Africa, Report of the Railways & Harbours Board for the Year ended 31st December, 1939, U.G. 24-'40, 1940, p. 33.

5 Ibid., for the year ended 31st December, 1940, U.G.24-'41, 1941, p.21.

been constructed at an estimated cost of £84,466, i.e. approximately £3,450 per mile,[1] and the Balfour-Seymour extension had originally cost an estimated £37,104, i.e. approximately £3,900 per mile.[2]

Economic Development from 1890

Since 1890 outstanding development has taken place in the field of dairying in the Bedford and Fort Beaufort Divisions. The Bedford district pioneered the large-scale commercial butter manufacturing industry in South Africa. Until the first creameries had been started in that district, no organised commercial development of butter making had been attempted, for the industry had been undertaken privately at individual farmsteads. The first butter factory in Southern Africa was established at Daggaboersnek, some 17 miles north-west of Bedford town, in September, 1890.[3] The founder was a Londoner surnamed Wilkie.[4] The creamery was situated some seven miles from the Witmos railway station, from where the butter could be railed to markets as far afield as Cape Town. By April, 1891, more than 300 lbs. of butter was being forwarded weekly to Cape Town.[5] It apparently reached Cape Town in good condition, despite the fact that refrigerated trucks had not yet been introduced to South Africa. The butter was packed in pound parcels, each wrapped in linen soaked in a saline solution, which were packed in large boxes lined with wet blankets and covered with wet sacking. This method was so efficaceous that a receiver in Cape Town remarked "During the

1 S.A. Railways & Harbours, Estimates of Expenditure on Capital and Betterment Works for the Financial Year ending 31st March, 1926, U.G. 10-1925, p. 2.

2 S.A. Railways & Harbours, Estimates of the Additional Expenditure on Capital and Betterment Works during the Year ending 31st March, 1927, U.G. 8-1927, p. 2.

3 C.W. Abbott, "The History of Buttermaking in South Africa", Bulletin No.300, Department of Agriculture, Pretoria, 1949, pp. 22 and 25.

4 The Bedford Enterprise, Bedford, 22 June, 1892.

5 Ibid., 8 April, 1891.

very hot weather, a box which had just come 700 miles by rail was opened. The cotton blanket in which the pounds of butter were wrapped was moderately damp and quite cold; the butter itself quite firm and could not possibly have been in better condition. The butter was from the Daggaboer's Nek Creamery and of most excellent quality and I learnt that some months the consignees get nearly a ton and a half from that establishment."[1]

The significance of this portion of the Eastern Cape in the pioneering of South Africa's dairying industry is indicated by the fact that the second creamery to be established in the entire subcontinent was opened on the farm Avondale, also in the Bedford district, in 1893.[2] Like the Daggaboer dairy, this building was a stone structure, and still stands. It was erected by a Mr. Webber, who was also the founder of the creamery.[3] The Avondale creamery had the disadvantage of being situated further from the railway than the Daggaboer creamery, the butter having to be transported a distance of 24 miles to Cookhouse, which was the nearest railway station. This disadvantage was partly offset by its situation in a region of higher rainfall and better grazing, more suited to dairy cattle.

By 1896 the large scale commercial manufacturing of butter had spread eastwards to Cottesbrook, a farm situated near Kroomie, in the Fort Beaufort district, as well as farther afield to other centres in the Cape Colony. The year 1896 marked the introduction of refrigeration to South African creameries, and once again Bedford and Fort Beaufort were in the forefront. Of the three creameries which invested in refrigeration plants in that year, two were in the Bedford and Fort Beaufort districts, one being the Bedford

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1 Cape of Good Hope, Department of Agriculture, Agricultural Journal, Vol. VI, No. 3, 1893, p. 49.

2 C.W. Abbott, "The History of Buttermaking in S.A.", p. 31.

3 R.D. Shone, "Historic Butter Factory Still Stands", The Farmer's Weekly, Vol. LXXIV, Bloemfontein, 29 October, 1947, p. 111.

Creamery[1] and the other the Cottesbrook Creamery.[2] The third was the Bowker's Park Creamery, near Queenstown.[3]

A temporary setback occurred in 1897 as a result of the Rinderpest epidemic, which considerably decreased the number of cattle. All the creameries of the Cape Colony had to suspend operation.[4] Towards the end of the year the disease was checked and good rains fell, so that most of the factories could be re-opened. By this time cheese was also being commercially produced in certain parts of the Cape Colony, for the Government Agricultural assistant at Grahamstown reported that the "good prices" for cheese, 1/- per lb., were expected to stimulate farmers into greater production of dairy produce.[5]

The 1911 census revealed that this region produced fairly large quantities of butter, but that the cheese industry was at this stage insignificant. The amount of butter and cheese produced from 1st May 1910 to 30th April 1911 was as follows :-

	Butter	Cheese
Adelaide	199,712 lbs.	10 lbs.
Bedford	251,441 "	-
Fort Beaufort	102,675 "	50 lbs.
Stockenström	9,993 "	20 "
Victoria East	74,948 "	-
Total	638,769 lbs.	80 lbs.[6]

It is interesting to note that, during that year, the total butter production for the entire Cape Province was 4,954,476 lbs. compared

[1] It is assumed that this creamery was in Bedford town, for, according to R.D. Shone, the Avondale Creamery did not install refrigeration plant.

[2] Cape of Good Hope, Department of Agriculture, "Report of the Agricultural Assistants at Grahamstown and Stellenbosch for the year 1896", G.26, 1897, pp. 11 - 12.

[3] Ibid.

[4] Ibid., for the year 1897, G.34, 1898, p. 18.

[5] Ibid., p. 19.

[6] Census of the Union of South Africa 1911, Part IX, Livestock and Agriculture, pp. 1289 - 1293.

with a total cheese production of 414,301 lbs.[1] In the Bedford and Fort Beaufort Divisions the small amount of cheese obviously was all made on a very small number of private farms, and would not have been sufficient to satisfy even local requirements. The first local cheese factory was established at Avondale during the First World War, when the creamery was converted to a cheese factory, Cheddar cheese being made.[2] All the local creameries appear to have closed down by 1924, when the Cookhouse creamery started operating as a butter factory.[3]

The First World War, together with the ostrich slump, provided a tremendous stimulus to production, and, by 1916, the Union of South Africa was in a position to export butter in significant quantities for the first time.[4]

A great increase in the production of fresh milk for human consumption took place after the First World War. This may be attributed to the greatly improved means of transport and to the demand created by the expanding population of the larger towns of the Eastern Cape. From 1911 to 1937 fresh milk production increased threefold in Bedford, more than twentyfold in Adelaide, approximately twelvefold in Fort Beaufort and almost fourfold in Victoria East. Only Stockenström showed a slight decline, probably caused by the replacement of irrigated pasture in the Kat River valley by citrus orchards, which yielded a higher income per unit area of irrigable land. The rapid development of the citrus industry during this period is discussed in Chapter XIII. The following figures give some indication of the increasing importance

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[1] Census of the Union of South Africa 1911, Part IX, Livestock and Agriculture, pp. 1289 - 1293.

[2] R.D. Shone, "Historic Butter Factory Still Stands", The Farmer's Weekly, Vol. LXXIV, Bloemfontein, 29th October 1947, p.111.

[3] By correspondence with the Manager, Cookhouse Creamery, 2nd October, 1965.

[4] Union Office of Census & Statistics, Official Yearbook of the Union, No. 6 - 1923, Pretoria, 1924, pp. 500 - 501.

of fresh milk production in the Bedford and Fort Beaufort divisions during this period:-

	Milk Sold, in gallons	
	Year ending 30th April 1911[1]	Year ending 31st August 1937[2]
Adelaide	7,963	178,196
Bedford	9,497	29,665
Fort Beaufort	11,539	148,126
Stockenström	6,198	5,124
Victoria East	108,786	397,573
Total	143,983	758,684

The closing down of the local creameries and the opening of cheese factories at Kroomie and Breakfast Vlei in the 1930's by the Fort Montgomery Cheese Factory (Pty.) Ltd. resulted in fresh milk production becoming more important than cream production. In the year ending on 30th April, 1911, 514,674 lbs. of cream were produced. This would have equalled approximately 234,000 lbs. of butterfat if it is assumed that 1 lb. of cream equals 0.455 lbs. of butterfat.[3] In the year ending on 31st August, 1937, the area produced a total of 244,665 lbs. of butterfat.

	Cream Sold		
	1911[4]	1911 Approximate equivalent in	1937[5]
	lbs. of cream	lbs. of butterfat	lbs. of butterfat
Adelaide	202,577	92,190	43,024
Bedford	126,097	57,370	47,398
Fort Beaufort	117,659	53,560	36,617
Stockenström	25,519	11,610	31,434
Victoria East	42,822	19,480	86,192
Total	514,674	234,210	244,665

1 Census of the Union of South Africa 1911, Part IX, Livestock & Agriculture, pp. 1289 - 1293.

2 Union of South Africa, Agricultural Census No.17, 1936-7, U.G. 18/1939, pp. 69 - 71.

3 At the Grahamstown Butter & Ice Factory, 1 lb. of cream yields an average of approximately 0.455 lbs. of butterfat. However, the ratio varies considerably, depending on the breed of cow, the condition of the cow, the quality of fodder available, daily air temperature and the efficiency with which the cream is separated from the milk.

4 Census of the Union of South Africa 1911, Part IX, Livestock & Agriculture, pp. 1289 - 1293.

5 Union of South Africa, Agricultural Census No.17, 1936-7, U.G. 18/1939, pp. 69 - 70.

As can be seen from these figures, the decrease in Adelaide, Bedford and Fort Beaufort was offset by an increase in Stockenström and Victoria East. The sharp rise in cream production in Victoria East had been caused largely by the opening of a butter factory in King William's Town by Bowker's Park Co-operative Creamery Ltd. in 1933.[1] The rise in Stockenström probably can be attributed to the opening of the Seymour - Fort Beaufort railway line in 1926. The tri-weekly rail service would have been more favourable for the transport of cream than milk, a commodity which undergoes rapid deterioration.

The more than fivefold increase in fresh milk production from 1911 to 1937 is all the more remarkable when it is considered that the 1927 drought was, in some parts of the region, the worst of the century. This drought not only resulted in a decline in milk production per cow, but caused the death of a large number of livestock. The following figures give some indication of the severe stock losses resulting from the 1927 drought :-

Livestock Died from Disease, Drought and Exposure
from 1st September, 1926 to 31st August, 1928.[2]

	CATTLE		SHEEP and GOATS	
	Number died	% of 1926 Total	Number died	% of 1926 total
Adelaide	9,021	38	33,782	16
Bedford	8,129	42	46,857	15
Fort Beaufort	10,891	49	19,756	15
Stockenström	8,242	52	32,002	27
Victoria East	10,848	48	22,699	39
Total	47,131	46	155,096	19

During the period 1st September, 1927 to 31st August, 1928 37,377 cattle and 113,431 sheep died from disease, drought and exposure in this area.

1 By correspondence with the General Manager, Bowker's Park Co-operative Creamery, Ltd., 4th October, 1965.

2 Compiled from Report of the Agricultural & Pastoral Production of the Union of South Africa, 1926-27, Agricultural Census, No.10, U.G. 37-28, pp. 66-67. Report for 1927-28, Agricultural Census, No.11, U.G. 41-29, pp. 71-72. The data exclude animals killed by vermin or missing.

Despite further severe droughts in 1945 and 1949 the dairying industry has continued to expand. Although the 1945 drought was as severe as that of 1927, it did not result in such heavy livestock losses, owing to the more scientific farming methods of the time. This is shown by the table below. Data are unavailable for the census year prior to September, 1945, as the Union Office of Census and Statistics was obliged through war conditions to abandon the annual Agricultural Census during the years 1940 to 1945.

Stock Losses through Drought (excluding losses due to disease, exposure or vermin)
1st September, 1945 to 31st August, 1946[1]

	Cattle	Sheep and goats
Adelaide	4,014	10,560
Bedford	2,924	23,366
Fort Beaufort	5,320	3,886
Stockenström	4,591	2,790
Victoria East	7,302	10,815
Total	24,151	51,417

At present there is only one cheese factory in the region, this being centrally situated at Kroomie, near the Adelaide-Fort Beaufort boundary. (See map, p. 253.) Although there are no longer any creameries in the Bedford and Fort Beaufort divisions, the cream is, however, sent to the Bowker's Park Co-operative Creamery at King William's Town and to the Cookhouse Creamery.

Electricity

No discussion of the economic development of the area would be complete without reference to the development and distribution of electrical power, which, of course, is of the greatest importance not only in the development of industry, but also in the operation

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1 Report on Agricultural & Pastoral Production, 1945-46, Agricultural Census No. 20, U.G. 77/48.

of certain farm machinery, such as water pumps and cream separators. The availability of electricity for domestic consumption has played a major role in making life in the small towns more comfortable and convenient.

The first local town to generate electric power was Alice, where a power station was opened in 1921. In 1925 Bedford inaugurated its own electricity supply, followed by Fort Beaufort and Adelaide in 1927.[1] All four power stations were coal burning. The vast majority of farms remained without electricity; only a few installed paraffin or petrol driven generators, which were not able to generate a high voltage. It was not until the 1950's that certain farms were able to benefit from power station generated electricity. In 1951 the power stations at Alice, Fort Beaufort and Adelaide were taken over by the Electricity Supply Commission (Escom) and linked by power line with the large thermal power stations at King William's Town and East London.[2] Farms adjacent to the line were able to receive power from it. The Adelaide and Fort Beaufort power stations were closed down, but the Alice power station remained in operation as a booster station until the mid 1950's when it too ceased to generate electricity. At about the same time, in 1955, the Escom power line was extended to Bedford, where the local power station was also closed down.[3] The entire Alice-Bedford sector was therefore supplied with electricity generated by the King William's Town and East London power stations.

In the late 1950's the Escom power line was extended northwards up the Kat River valley from Fort Beaufort to Seymour, which it reached in 1960. This extension has been very beneficial to farms in the valley, for electricity is now used on a large scale for the pumping of irrigation water from the Kat River.

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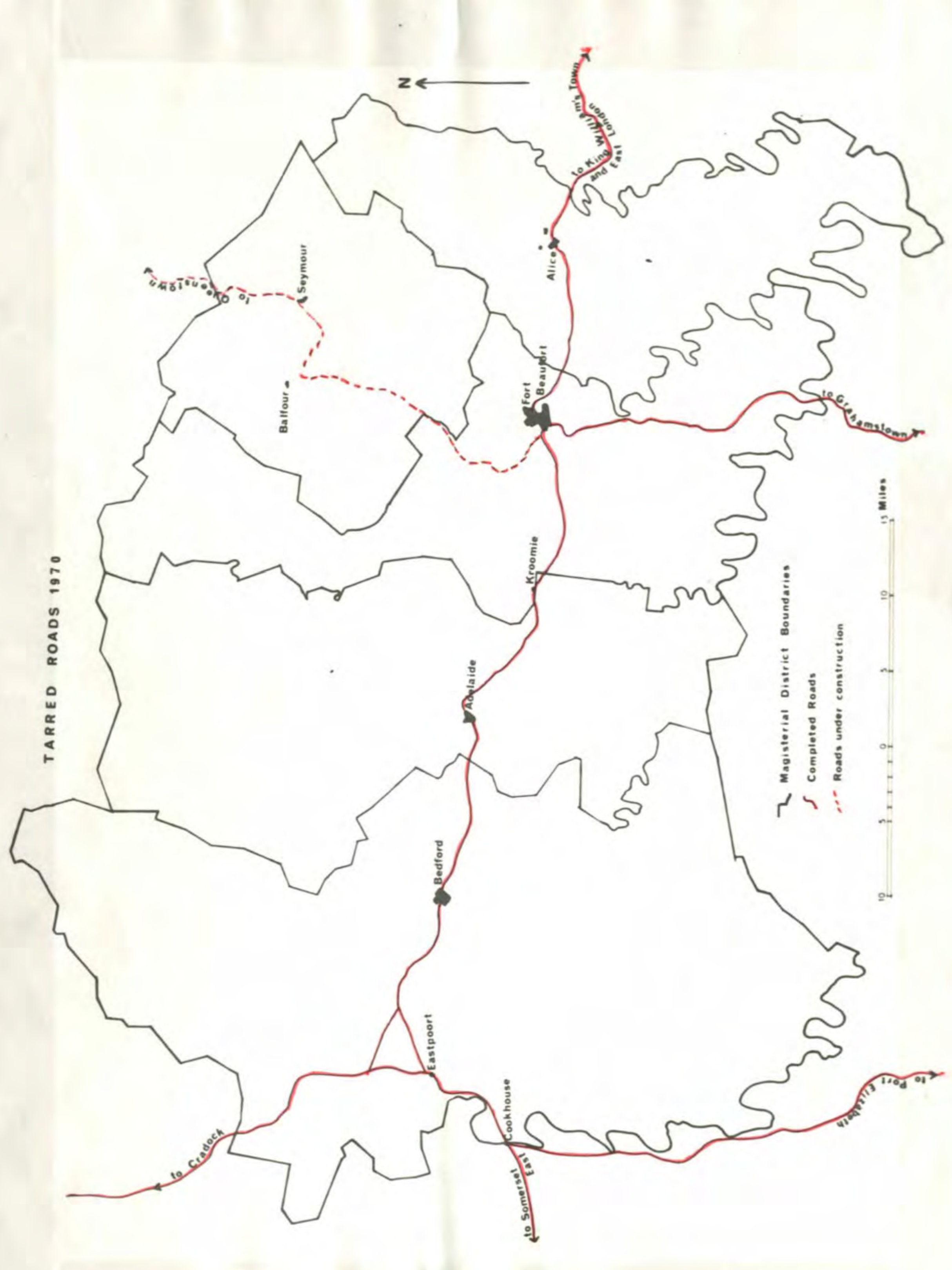
[1] Information obtained from Town Clerks of respective towns.

[2] Ibid.

[3] Ibid.


TARRED ROADS 1970
N
to King William's Town and East London
Alice
to Queenstown
Seymour
Balfour
Fort Beaufort
to Grahamstown
Kroomie
Adelaide
Bedford
Eastpoort
Cookhouse
to Cradock
to Somerset East
to Port Elizabeth
Magisterial District Boundaries
Completed Roads
Roads under construction
10 5 0 5 10 15 Miles

Road Improvement

The first permanent surfacing of roads outside the four principal towns occurred in the mid 1950's. Until then the only roads with tarmac or concrete surface were those in the towns of Bedford, Adelaide, Fort Beaufort and Alice. During this period, however, work commenced on the permanent surfacing of the dusty and badly corrugated road which ran from Somerset East through the above mentioned towns to King William's Town. The first section of tarred road to be completed was the 35 mile long sector between Alice and King William's Town, which was formally opened on 20th March, 1964.[1] This sector alone cost R1,000,000 (£500,000).[2] Later in the year the 37 mile sector between Alice and Adelaide was completed. The 14 mile sector between Bedford and Adelaide was completed in 1965, thereby completing a 123 mile long tarred highway from Bedford to the coast at East London. This road, eliminating numerous dangerous curves and level-crossings, should play a major role in the development of the Bedford and Fort Beaufort Divisions. An eleven mile long tarred extension from Bedford to Eastpoort, opened in 1966,[3] gives the region ready access to the National road from Port Elizabeth to Johannesburg.

In 1962 a 28 mile long tarred road was completed from Grahamstown to the Koonap Bridge on the Albany - Fort Beaufort Divisional boundary. This had involved the reconstruction of the Albany portion of the Queen's Road, which had remained virtually unchanged since it had been constructed by Andrew Geddes Bain some 120 years earlier. In June 1965 work commenced on the reconstruction and tarring of the 24 mile long portion of the Queen's Road between the Koonap River and Fort Beaufort. The new road actually criss-crosses the old Queen's Road, but follows more or less the same line, merely straightening out the curves, so that

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1 Eastern Province Herald, Port Elizabeth, 21st March, 1964.

2 Ibid.

3 Eastern Province Herald, 1st February, 1966.

the original 24 miles is shortened to $21\frac{1}{2}$ miles. In May 1965 the cost of constructing this sector was estimated at R1,494,637 (£747,318.10s.).[1] It was completed in September 1967, thus providing a 48 mile long direct tarred road link between Fort Beaufort and Grahamstown. It is planned eventually to tar the entire road between Fort Beaufort and Queenstown; part of this road has already been completed to the north of the Katberg. The completion of a tarred road from Grahamstown to Queenstown via the Katberg should greatly enhance the importance of Fort Beaufort, which will then lie at the intersection of a major north-south highway with a major east-west highway.

The most recent event to affect the economy of the Fort Beaufort Division is the construction of a large dam across the Kat River a few miles downstream from Seymour. Excavations for the dam wall were commenced in April 1964. The wall itself, scheduled for completion at the end of 1969, will be 1,400 feet long and rise 180 feet above the bed of the river. The resulting 500 acre dam will hold approximately 10,000 morgen feet of water, thereby stabilising the flow of the Kat River and providing an assured supply of irrigation water for the citrus orchards downstream.[2] The dam will also provide Fort Beaufort with sufficient water for any possible industrial development in the future. Whether the village of Seymour will be able to shake off its lethargy and take advantage of its new situation on the shores of a $2\frac{1}{2}$ mile long lake, remains to be seen. Certainly this stretch of water with its magnificent mountain backdrop should offer superb conditions for yachting, boating, water ski-ing and fishing.

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[1] The Alice Times, Alice, 21st May, 1965.

[2] Personal communication from E.F. Muller, Resident Engineer, 23rd May, 1969.

Social and Cultural Development

Considering the relatively sparse population of the area during the latter half of the nineteenth century, it was remarkably advanced for that time. The first local newspaper to appear was "The Fort Beaufort Advocate", which has appeared weekly since its establishment in 1859. "The Alice Times", founded in 1874, still continues to appear as a weekly newspaper. The other weekly published in the area, "The Adelaide Free Press", was first published in 1904. In 1951 it amalgamated with "The Bedford Enterprise", which had been founded in 1885. A feature of recent years has been the increasing sales of East London and Port Elizabeth daily newspapers.

The Victoria East district has played a major role in the development of medical services for Bantu people in rural areas. In 1880 Dr Jane Waterston opened a Medical Department at the Lovedale Missionary Institution for the treatment of Bantu patients,[1] and within five months her patients numbered 817.[2] Eighteen years later the Victoria Hospital was opened at Lovedale. Shepherd states that, "Until the Victoria Hospital was opened in 1898 there was no properly equipped mission hospital in the whole of Southern Africa, and little or no systematic training was being given to the Bantu in the laws of health."[3] In 1929 the Victoria Hospital became a Class I Training School for Bantu nurses.[4] This hospital has become a focal point for the Bantu people not only of Victoria East but also of the adjacent districts. Some idea of its importance can be gained from the fact that in 1955, the last year of the independent Lovedale Missionary Institution, the Victoria Hospital dealt with 2,121 in-patients and 31,994 out-patients.[5] The daily

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1 R.H.W. Shepherd, "Lovedale", Lovedale Press, 1940, p. 817.

2 Ibid.

3 Ibid., pp. 346 - 347.

4 Ibid., p. 514.

5 Lovedale Missionary Institution, Report for 1955, Lovedale Press, 1956, p. 52.

average of the former was 141, and that of the latter was 102, excluding Sundays.[1] An additional 131 patients were treated in the adjacent Macvicar Tuberculosis Hospital,[2] where the daily average was 74 patients.[3] A total of 227 patients in the Victoria Hospital also suffered from tuberculosis.[4] It is significant that various forms of tuberculosis accounted for 20% of the deaths in the Victoria Hospital, the next largest number of deaths being those resulting from gastro-enteritis and colitis (15%, excluding newborn babies).[5] These high percentages reflect the poor and unhygienic living conditions of many of the Bantu.

The first hospital for Europeans was founded in 1912, when the Cottage Hospital was opened in Fort Beaufort.[6] This was not the first hospital in Fort Beaufort, for, in 1893, the Tower Hospital for Non-White mental patients had been founded on the outskirts of the town.[7] At the end of 1962 there were no less than 2,265 patients in the Tower Hospital,[8] making it the largest Non-White mental institution in South Africa. The patients comprised 1,869 Bantu, 374 Coloured and 22 Asiatic.[9] The importance of this hospital in the development of Fort Beaufort cannot be ignored.

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1 Lovedale Missionary Institution, Report for 1955, Lovedale Press, 1956, p. 52.

2 Ibid., p. 61.

3 Ibid., p. 52.

4 Ibid., p. 53.

5 Ibid., pp. 53 - 56.

6 Information obtained from Fort Beaufort Museum.

7 Ibid.

8 Annual Report of the Commission for Mental Health, Year Ended 31st December, 1962, R.P. 29/1964, p. 11.

9 Ibid.

Small hospitals, mainly or entirely for Europeans, also exist in Bedford, Adelaide and Alice. The foundation stone of the Bedford Cottage Hospital was laid in 1920, that of the Victoria Memorial Hospital, Alice, shortly afterwards. A hospital was opened in Adelaide in 1958. In 1958 a very much larger hospital was opened in Fort Beaufort to replace the old Cottage Hospital, which had provided beds for 24 White and 24 Non-White patients.[1] The new Fort Beaufort hospital, like the old, is the largest hospital for Whites in the Bedford and Fort Beaufort Divisions.

Alice became the cultural centre for all educated Non-Whites of Southern Africa as a result of the founding of the University College of Fort Hare in 1916. The College, then known as the South African Native College, was declared open on 8th February, 1916, by General Louis Botha, Prime Minister of South Africa, who reminded his audience that Europeans and Natives had united to raise funds to build a monument "on the place where the great struggle between white and black was settled in blood and tears."[2] The College was multiracial from the outset. In 1916 there were 20 students, two of them White.[3] By 1959 the number of students had increased to 489, the ethnic composition being most revealing. At that time there were 188 Xhosa-speaking students (including Fingo and Pondo) as well as 41 Zulu, 9 Swazi, 26 Sotho, 24 Tswana, 100 Indian, 70 Coloured and 31 students of other ethnic groups.[4] At first the South African Native College was one of the constituent colleges of the University of South Africa, but in 1951 it became affiliated to neighbouring Rhodes University, Grahamstown,[5] and a year later the College's name was changed to the

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[1] H.T. Matthews, "A Guide & History of Fort Beaufort", Fort Beaufort, the author, 1958, p. 3.

[2] A Short Pictorial History of the University College of Fort Hare, Lovedale Press, 1961, p. 4.

[3] Ibid., p. 5.

[4] Ibid., p. 48.

[5] Ibid., p. 8.

University College of Fort Hare.[1] The affiliation with Rhodes University was terminated at the end of 1959 by legislation which removed the control of the College from an independent Council to the Department of Bantu Education.[2] The University College of Fort Hare now serves only Xhosa-speaking students, which numbered more than 500 in 1969.[3] In terms of a Government Notice of April 30th, 1969, full university status was granted to Fort Hare with effect from January, 1970.[4]

The educational role of the old Fort Hare has now been assumed partly by the adjacent Federal Theological Seminary of Southern Africa which was officially opened on 26th September, 1963.[5] The Seminary is situated on the slopes of Sandile's Kop, overlooking Fort Hare. The first classes, with an enrolment of 87 students, commenced in March, 1963.[6] The institution provides training for non-European clergy of all races, the participating religious bodies being The Bantu Presbyterian Church of South Africa, The Church of the Province of South Africa (i.e. Anglican Communion), The Congregational Union of South Africa, The London Missionary Society and Church Council, The Methodist Church of South Africa as well as The United Church Board for World Ministries.[7] The contribution of the missionaries is thus as great today as when they were the first White settlers in the Kat and Tyume valleys. The influence of the British churches is

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1 Rhodes University Calendar, Grahamstown, 1963, p. 11.

2 A Short Pictorial History of the University College of Fort Hare, Lovedale Press, 1961, p. 43.

3 Personal communication from Registrar, U.C.F.H., 29th May, 1969.

4 Ibid.

5 Eastern Province Herald, Port Elizabeth, 27th September, 1963.

6 The Magazine of the Federal Theological Seminary of Africa, No. 1, September, 1963, pp. 3 and 38.

7 Ibid., p. 39.

clearly discernible in the social and cultural life of many of the Bantu people of the Victoria East and Fort Beaufort districts.

Conclusion

The White population of the Bedford and Fort Beaufort divisions, as elsewhere in South Africa, is a minority group. In one respect in particular the area represents a microcosm of South African social and cultural life, for the English-speaking element amounts to approximately 40% of the total White population. As in the rest of South Africa,[1] their role in the economic development of the area has been out of all proportion to their numbers for, until fairly recently, the Afrikaner played but a minor role in the economy of the Bedford and Fort Beaufort divisions. Although the economic superiority of the British South African is waning, it should be realised that their contact with the Western World is closer than that of any other long-established White group in South Africa; thus the major role of British South Africans, particularly where they come into contact with large numbers of Afrikaners, as is the case in the Bedford and Fort Beaufort divisions, may be to interpret the trends of the outside world and adapt them for acceptance in South Africa.

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[1] N.T. Childs, "British in South Africa", Standard Encyclopaedia of Southern Africa, Vol. 2, Nasou Ltd., Cape Town, 1970, pp. 507-515.

CHAPTER VII

CHARACTERISTICS OF THE POPULATION

The historical evolution of the settlement pattern was described in chapter VI. The third census of the Cape Colony, taken on 5th April, 1891, revealed that the Bedford, Fort Beaufort, Stockenström and Victoria East districts had a total population of 43,008 of which 8,338 were White.[1] At this time the present district of Adelaide was still part of the Bedford and Fort Beaufort districts.[2] As in the census of 1875,[3] the population was divided into six ethnic groups, their distribution per district being as follows:

CENSUS, 1891

	WHITE	AT PRESENT CLASSIFIED AS COLOURED			BANTU		
District	Europ-ean	Malay	Hotten-tot	Mixed & Other	Fingo	Kafir & Bet-shuana	Total Population
Bedford	2,301	4	801	1,197	1,083	6,296	11,682
Fort Beaufort	3,135	-	744	709	3,105	6,982	14,675
Stockenström	1,660	-	1,196	1,255	431	3,234	7,776
Victoria East	1,242	-	183	233	3,762	3,455	8,875
Total	8,338	4	2,924	3,394	8,381	19,967	43,008

Victoria East, approximately one third of which consisted of densely populated Bantu reserves, had the highest population density, viz. 26.9 per square mile. Stockenström, a relatively well-watered district with a large number of small-holdings, had

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[1] Census of the Colony of the Cape of Good Hope, 1891, G. 6 - '92, pp. 18 - 19.

[2] See p. 169.

[3] See p. 171.

the next highest density - 24.8 per square mile. Fort Beaufort had an average of 17.1 people per square mile, while Bedford, owing to its large proportion of semi-arid land and the absence of Bantu reserves, had a density of only 9.5 people per square mile.

During the following 45 years there was a steady increase in the total population of the area, although the proportion of Europeans decreased from 19.4% to 14.0%. According to the census taken on 5th May, 1936, the total population of the five districts was 67,463 including 9,473 Europeans. By this stage the population was separated into four ethnic groups for census purposes. As can be seen from the table below, Victoria East still was the most densely populated of the five districts, the density being 43.4 per square mile. The decrease in density towards the west continued to be pronounced, Bedford having only 11.1 people per square mile.

CENSUS, 1936[1]

District	European	Coloured	Asiatic	Bantu	Total	Density per square mile
Bedford	2,037	1,797	1	7,305	11,140	11.1
Adelaide	2,022	1,460	4	6,455	9,941	16.3
Fort Beaufort	2,190	1,717	43	13,424	17,374	33.7
Stockenström	1,945	1,861	17	8,540	12,363	39.4
Victoria East	1,279	673	26	14,667	16,645	43.4
Total	9,473	7,508	91	50,391	67,463	24.3

From 1936 to 1951 the total population of the region continued to increase, although this period marked the beginning of the decrease of the number of Europeans (Whites). In 1951 there were actually fewer Europeans in the region than in 1891.

[1] Union of South Africa, Sixth Census, Vol. I, Population, U.G. No. 21, '38.

The decrease of the White population, as can be seen from the tables, was most marked in Stockenström, where there was an exodus of Whites from their smallholdings to the cities, mainly Port Elizabeth and East London. It was only in Victoria East that the White population showed a slight increase.

CENSUS, 1951[1]

District	White	Coloured	Asiatic	Bantu	Total	Density per sq.mile
Bedford	1,787	2,377	8	7,963	12,135	12.1
Adelaide	1,774	1,170	13	7,616	10,573	17.7
Fort Beaufort	1,979	2,005	29	14,910	18,923	38.2
Stockenström	1,351	1,859	32	8,128	11,370	36.2
Victoria East	1,370	715	22	17,089	19,196	52.0
TOTAL	8,261	8,126	104	55,706	72,197	25.9

Between 1951 and 1960 the White population continued to decrease, although there was a big increase in the number of Bantu and Coloureds. As can be seen in the table below, the decrease of the White population was still greatest in Stockenström.

CENSUS, 1960[2]

District	White	Coloured	Asiatic	Bantu	Total	Density per sq.mile
Bedford	1,610	2,573	5	10,351	14,539	14.4
Adelaide	1,713	1,744	21	9,268	12,746	21.4
Fort Beaufort	1,911	2,307	24	18,508	22,750	46.0
Stockenström	999	2,234	19	9,734	12,986	41.3
Victoria East	1,209	508	67	20,734	22,518	61.9
TOTAL	7,442	9,366	136	68,595	85,539	30.8

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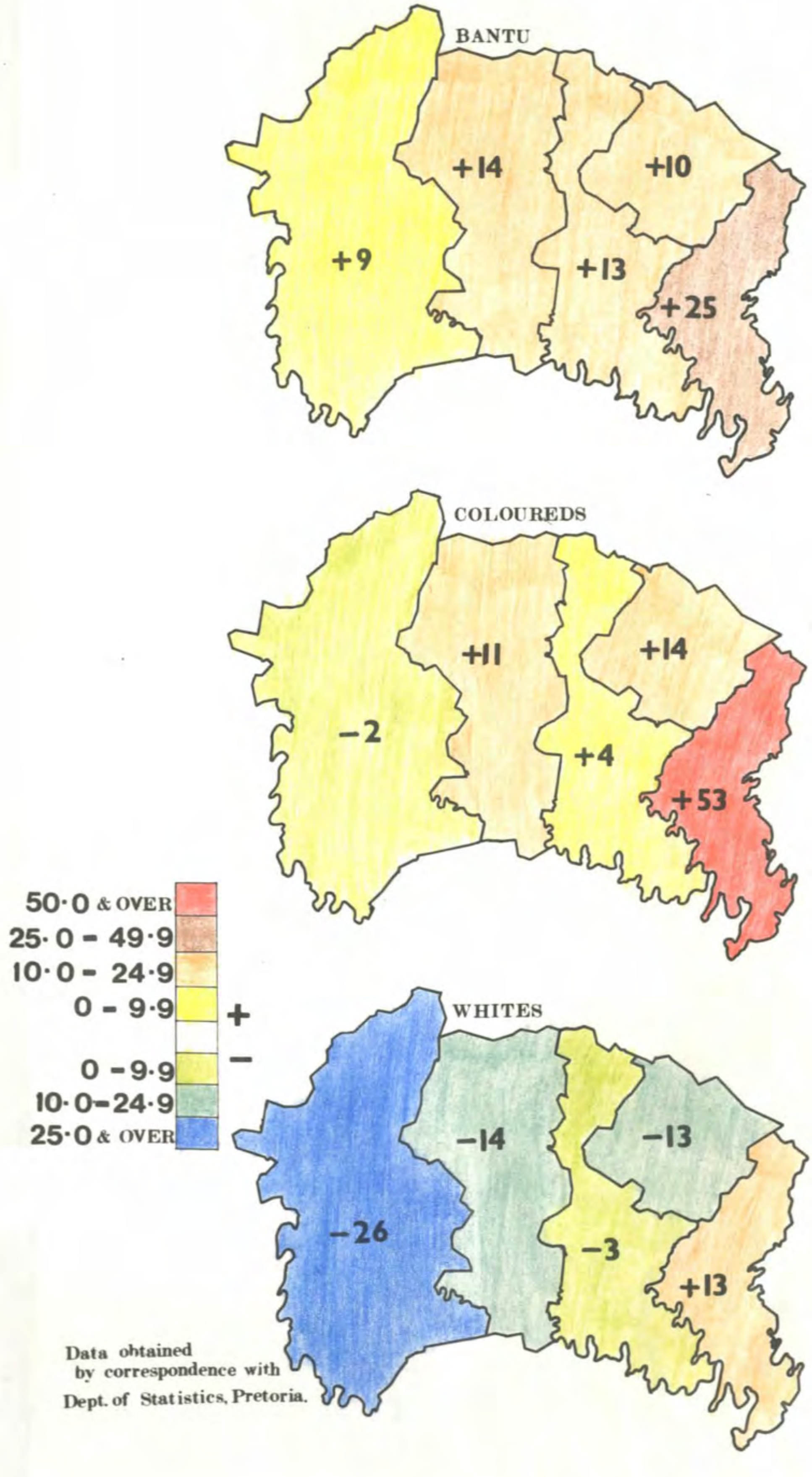
1 Population Census, Vol. I, Population, R.P. No. 62/1963.

2 Ibid.

PERCENTAGE INCREASE /DECREASE
IN POPULATION (1960 - 1970)



It was during this period that the number of Coloureds in the five districts exceeded the number of Whites for the first time. In 1960 Whites made up only 8.7% of the total population of the area, compared with 19.4% in 1891. No less than 62 of the 67 Asiatics of Victoria East were resident at Fort Hare, of whom 60 were students and two were lecturers.

An attempt was made to obtain population data per ward or census district, in order to obtain a more accurate picture of the variations in population density from one part of a magisterial district to another. However, the South African Director of Statistics informed the present writer that he could not furnish information on these bases. Some idea of the local variations in population density can be obtained from a study of aerial photographs of the region taken during the period 1963 to 1968. The large agglomerations of fairly closely spaced huts and houses in the Bantu reserves of Victoria East and Fort Beaufort indicate population densities in these areas which are well above the average for the districts as a whole. Aerial photographs also give some indication of the distribution of the rural White population in the White-owned areas. Here the farm houses are more closely spaced on the western side of the Tyume River in Victoria East, along the Kat River and its major tributaries from Fort Beaufort northwards, along the valleys radiating from Adelaide into the highlands and along the Great Fish River in Western Bedford.

The majority of the population in all five magisterial districts is rural. Even Fort Beaufort town, which is the largest of the region's five towns, contains less than 43% of the Fort Beaufort district's population. In 1960[1] the populations of the towns and villages of the five magisterial districts was as follows :-

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[1] Population Census, Vol. I, Population, R.P. No. 62/1963.

District	Town or Village	White	Coloured	Asiatic	Bantu	Total
Adelaide	Adelaide	1,329	861	21	3,362	5,573
Bedford	Bedford	808	859	5	2,292	3,964
Fort Beaufort	Fort Beaufort	1,494	1,685	24	6,547	9,750
Stockenström	Seymour	126	252	-	694	1,072
Victoria East	Alice	748	309	5	2,489	3,551
"	Fort Hare	65	78	62	465	670
"	Hogsback	129	24	-	263	416

All the above "urban" settlements, with the exception of Fort Hare and Hogsback, are municipalities. Fort Hare, across the Tyume River from Alice, was classified as semi-urban, and Hogsback, administered by a Village Management Board, was classified as a village. In the 1960 Census Blinkwater (population 1,259, including 39 Whites), in the Kat River valley in the district of Fort Beaufort, was classified as an urban area becaue it is administered by a Village Management Board, but the population is too dispersed for the community to be regarded as a village. On the other hand, the rural settlements of Balfour (population 300, including 70 Whites) and Hertzog (population 336, including 32 Whites) in the Stockenström district, although without Village Management Board status and classified as rural communities for Census purposes, are sufficiently nucleated to be regarded as villages.

Occupations of the People

The 1960 Census showed that the majority of economically active people in the region was employed in agriculture.[1] The second largest number was engaged in services. As can be seen from the table on the following page this applied to all three

[1] This category includes self-employed farmers.

OCCUPATIONS OF THE PEOPLE[1]

	Agri-culture	Manu-facturing	Construction	Electricity	Commerce: Wholesale & Retail Trade	Commerce: Motor Trade	Commerce: Other	Transport	Services	Unemployed & Unspecified	Not economic-ally active
WHITES											
Adelaide	146	18	18	1	94	27	20	63	129	5	1,192
Bedford	232	10	49	-	49	17	12	32	107	13	1,089
Fort Beaufort	115	17	60	5	127	26	18	42	316	19	1,170
Stockenström	186	5	18	3	27	11	4	18	49	7	670
Victoria East	91	15	14	1	76	13	13	32	181	11	754
TOTAL	770	65	159	10	373	94	67	187	782	55	4,875
COLOUREDS											
Adelaide	170	33	66	7	22	6	-	5	135	69	1,232
Bedford	351	7	87	-	11	11	2	26	176	103	1,799
Fort Beaufort	71	10	71	6	33	8	1	16	194	568	1,327
Stockenström	228	13	49	-	17	2	1	5	107	95	1,720
Victoria East	25	11	37	1	7	1	1	2	66	41	316
TOTAL	845	74	310	14	90	28	5	54	678	876	6,394
BANTU											
Adelaide	1,173	22	110	1	73	22	3	25	805	259	6,775
Bedford	1,432	7	163	2	42	13	3	25	824	330	7,508
Fort Beaufort	1,643	64	250	13	97	20	6	58	1,267	2,465	12,617
Stockenström	1,783	69	35	73	14	7	2	13	391	237	7,105
Victoria East	2,063	88	81	6	56	10	5	30	1,283	666	16,426
TOTAL	8,094	250	639	95	282	72	19	151	4,570	3,957	50,431

1 Population Census, 1960, Vol. 7, No. 2, Government Printer, Pretoria. D 7, pp. 52-54, 156-158, 243-244, 330-332.

major ethnic groups. Asiatics are omitted from this table as only 15 of this group were employed in a specific type of economic activity. 12 of these were employed in the wholesale and retail trade, 2 in manufacturing and 1 in construction. A fairly large proportion of economically active Whites was engaged in commerce; indeed in the Fort Beaufort and Victoria East districts more Whites were employed in commerce than in agriculture, an indication of the importance of the towns of Fort Beaufort and Alice as wholesale and retail trade centres for the adjacent relatively densely populated rural areas.

Masculinity of the Population

A remarkable feature of the area's population was the low degree of masculinity revealed in the 1960 census returns. The masculinity of a population is defined as the number of males per 100 females. The average for the White population of all South Africa in 1960 was 99.3 and that of the Non-White population was 101.5.[1] The masculinity of the three main population groups of the five districts is shown by the following table:

MASCULINITY OF THE POPULATION, 1960.

District	Whites	Coloureds	Bantu
Bedford	85.1	98.5	88.7
Adelaide	91.8	97.1	81.8
Fort Beaufort	95.6	99.3	86.3
Stockenström	107.6	93.4	85.5
Victoria East	91.3	127.7[2]	84.7

With the exception of Stockenström, the ratio of males to females amongst the White population was below the national average. This

[1] Population Census, Vol. I, Population, R.P. No. 62/1963, p.4.

[2] The high masculinity of the small Coloured population of Victoria East can be attributed in part to the presence of Coloured students, mainly males, at the University College of Fort Hare, which at this time admitted members of this ethnic group.

high degree of femininity was even more marked amongst the Bantu population of the region, a large number of Bantu males at any given time being temporarily absent as migrant labourers in the cities. Amongst the White families engaged in agriculture there is a tendency for only one adult son to remain on each farm, whilst the other sons obtain employment in the larger urban centres outside the Bedford and Fort Beaufort Divisional Council areas.

CHAPTER VIII

CATEGORIES OF LAND USE

A study of the land use of the five magisterial districts comprising the Bedford and Fort Beaufort divisions was made in 1969. The results of the field survey, initially plotted on aerial photographs, are shown on the coloured land use maps in the accompanying atlas. It will be noticed that these are South African topographic sheets of the 1:50,000 Series on which most of the land use categories have been superimposed by means of different colours. The classification and colours used are an attempt to show as clearly as possible the main categories of land use in the five districts. Where possible the writer has endeavoured to use classifications and colours suggested by the World Land Use Survey Commission of the International Geographical Union,[1] although, for reasons given later, it was found necessary to make several departures from this scheme. The categories employed are as follows:

1. Veld used for grazing

Veld used for grazing, i.e. unimproved grazing land, is the largest single category of land use in the Bedford and Fort Beaufort divisions, covering over 90% of the total area. This land is occupied mainly by indigenous vegetation, although the characteristics of the vegetation have often been modified by grazing or, occasionally, by the introduction of non-indigenous plants. According to the recommendations of the International Geographical Union, unimproved grazing land should be depicted in orange or yellow, depending on whether it is used or not. Because of the large area occupied by this category it was decided not to indicate it by any colour, leaving it unshaded instead. As can be seen in Chapter IX, as well as in later chapters, livestock farming

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[1] S. Van Valkenburg, "The World Land Use Survey", Economic Geography, Vol. 26, 1950, pp. 1-5.

forms the basis of the economy of the region. It is the veld which is the major source of food for the domesticated herbivores. Indeed, veld used for grazing, as so aptly described by C. Board in his study of the nearby East London and King William's Town districts, may be seen "in the Land Use Map as a backcloth on which are superimposed man-made variations in the patterns of nature, and what is left of the indigenous forest."[1] It was also decided not to regard unused grazing land as a separate category. The region has been occupied for many centuries by pastoralists,[2] and the enclosure of farms commenced only in the late nineteenth century; there is thus probably no veld which has not been grazed during the last century. In several parts of the region small areas have been fenced off to prevent their being grazed by domestic livestock. However, such areas are very small and certainly are "used" by indigenous wild animals such as the smaller antelope, springhares and hares, so that they closely resemble adjacent areas which have been lightly grazed by domestic livestock.

2. Arable Land

Arable land is indicated by means of chestnut brown on the land use maps of the Bedford and Fort Beaufort divisions. This category includes all areas under field crops, such as cereals, vegetables, pulses and tobacco, as well as hay and fodder crops, such as cowpeas, lupins, teff and other grasses, but excluding lucerne. The latter crop, because of its relatively large acreage and its semi-perennial nature, has been mapped as a separate category. This again is a divergence from the World Land Use classification, which includes lucerne, fodder grass and clover under the category of croplands, i.e. arable land.[3]

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[1] C. Board, "The Border Region", Oxford University Press, Cape Town, 1962, p. 153.

[2] See pp. 120-124.

[3] S. Van Valkenburg, "The World Land Use Survey", Economic Geography, Vol. 26, 1950, pp. 3-4.

It is well known that horticulture was suggested as a separate category by the Commission appointed by the International Geographical Union to study the possibility of a World Land Use Survey.[1] In the Bedford and Fort Beaufort divisions there are several areas where vegetables and other market-garden crops are grown in rotation with field crops, and such areas have been mapped as arable land. Areas devoted exclusively to horticulture are generally too small to be shown on a scale of 1:50,000. The number of gardens large enough to be indicated on the land use maps is so small that a separate category was considered unnecessary and they have also been mapped as arable land.

3. Lucerne

This category is indicated on the land use maps of the Bedford and Fort Beaufort divisions by a shade of light green. Lucerne in this region usually fulfils the function of improved semi-permanent pasture, and that is why this shade of green, used in the World Land Use Survey for improved permanent pasture, was chosen. Improved permanent pasture, of the type so well understood in countries like Great Britain and New Zealand, is here of very limited occurrence owing to the unreliable rainfall and the high cost of irrigation. In this region it usually involves grasses such as Kikuyu, timothy or cocksfoot. Land occupied by these has been mapped either as arable land or as abandoned land. Kikuyu, the most common of the exotic grasses, is often self-established on abandoned arable land, in most cases indicating a deterioration rather than an improvement of the land originally used for crops.

4. Orchards

This category, indicated in deep purple on the land use maps, consists mainly of citrus orchards. Board, writing of the nearby King William's Town and East London magisterial districts, states that "Citrus trees in production give a very much higher return

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[1] Ibid., p. 3.

per acre than any other type of land use."[1] This statement also appears to apply to the five districts of the Bedford and Fort Beaufort divisions. Also included in the category "orchards" are deciduous tree fruits, as well as the limited areas occupied by vineyards and subtropical tree fruits, the latter consisting almost entirely of avocado pears. The purple shade used for orchards is much darker and more readily distinguishable than that proposed for "Tree and Other Perennial Crops" by the World Land Use Survey Commission.[2]

5. Temperate Evergreen Forest

The two main types of indigenous forest and woodland occurring within the region have been described in Chapter IV. The Temperate Evergreen Forest, described on pages 68 to 71, is indicated by means of a dark green colour, which, according to the World Land Use Survey indicates "forests where the crowns of the trees are touching."[3] This definition applies well, as the Temperate Evergreen Forest of the Bedford and Fort Beaufort divisions is essentially a closed community dominated by mesophytic trees, usually of mesophanerophytic life form, producing an interlacing canopy. The Temperate Evergreen Forest is of little commercial value, as much of it is relatively impenetrable to both man and domesticated animals. Before the establishment of plantations of exotic trees the Temperate Evergreen Forest was exploited for firewood as well as for timber for building, fencing and railway construction. Today these forests are worth more than ever before. They are essentially areas of outstanding beauty and of great biological interest; their aesthetic value transcends all economic values. The more open Scrub Woodland, most of which is used for grazing, is not indicated on the land use maps.

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[1] C. Board, "The Border Region", Oxford University Press, Cape Town, 1962, p. 166.

[2] S. Van Valkenburg, "The World Land Use Survey", Economic Geography, Vol. 26, p. 3.

[3] Ibid., p. 4.

6. Plantations

This category applies to aggregations of exotic species of trees, mainly *Pinus* and *Eucalyptus* spp., most of which have been planted in the region. On the aerial photographs used for mapping in the field these plantations were usually distinguishable from the adjacent indigenous forest by their regular layout. On the land use maps plantations have been indicated by means of a medium shade of green.

7. Built-up Areas

On the 1:50,000 map it was not possible to do more than indicate by means of one colour, red, the areas covered by towns and villages. The only urban settlements of any size are the four White towns of Bedford, Adelaide, Fort Beaufort and Alice with their adjacent Bantu and Coloured Townships. Part of the small town of Seymour can also be regarded as built-up. Away from these towns dwellings are usually too scattered for areas to be classified as urban, although in the Bantu reserves of the Fort Beaufort and Victoria East districts some "locations" are relatively built-up. The criteria used for mapping rural Bantu settlements as urban areas were somewhat subjective. Generally, aggregations of more than 40 houses, with a minimum density of 4 houses per acre, were regarded as built-up areas, provided approximately 50% of the houses were rectangular buildings of a sufficiently large size to be subdivided into more than one room. In most of the locations the traditional type of Bantu dwelling, a circular one-roomed hut, is outnumbered by the rectangular European style dwelling.

8. Open Water

Open water is indicated in light blue. The only relatively large body of open water is the $2\frac{1}{2}$ mile long Kat River Dam near Seymour.[1] There are numerous small farm dams and weirs used for irrigation purposes and to supply drinking water mainly for livestock,

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[1] See p. 197.

but in some cases for humans as well. Some of these dams are large enough to be indicated on the land use maps. Also indicated are the small reservoirs used for the purpose of supplying water to the urban communities of Bedford, Adelaide, Fort Beaufort and Alice.

9. Abandoned Land

Abandoned land, a category not recognised by the World Land Use Survey, is indicated in yellow on the land use maps of the Bedford and Fort Beaufort divisions. This is land which is not yet covered by natural vegetation but is no longer under cultivation. The most extensive area in this category is in western Bedford, along the Great Fish River valley, in the vicinity of Cookhouse, Long Hope and Middleton. Certain fields in this sector have become encrusted with alkali, preventing their cultivation as well as the return of the natural vegetation. Other fields have been abandoned recently owing to the scarcity of irrigation water, or else as a result of the land being purchased by the State and being deprived of irrigation rights in order to reduce the demand for irrigation water. (See pp. 350-351.) Such fields are in the process of being colonised by the woody shrubs, Lyceum ferocissimum and Asparagus plumosus, together with occasional young Acacia karroo trees. In less arid sweetveld areas further east Acacia karroo is more frequently encountered on abandoned land.

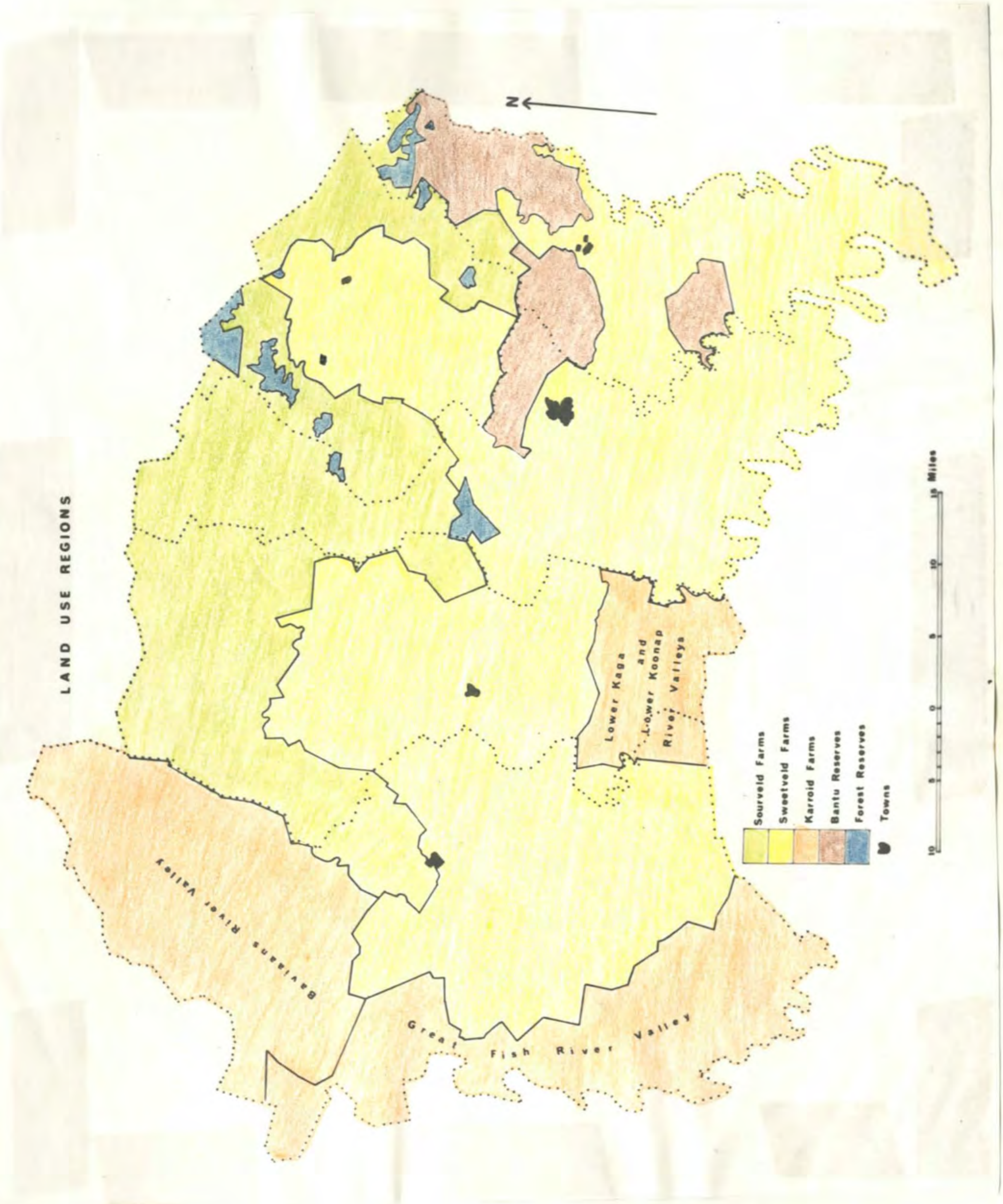
Land Use Regions

On the basis of physical landscape, climate, vegetation, the frequency of the different land use categories, and the different patterns of the evolution of human settlement, an attempt has been made to divide the Bedford and Fort Beaufort divisions into different land use regions. (See map, p.217A.) As in all such attempts, a balance must be struck between the strength of impact of the physical and human factors on the region and its inhabitants. In this predominantly agricultural region, where physical contrasts are often startlingly sharp, the physical factors must play a prominent, and usually dominant, role. Human factors, however, have in parts of the region moulded areas of similar physical background into dissimilar demographic, cultural and economic patterns. This is well illustrated where White-owned farmland adjoins Bantu-owned farmland.

The component land use regions are:

1. Forests and Plantations.
2. The Sourveld Farms.
3. The Sweetveld Farms.
4. Bantu Reserves.
5. The Karroid Farms.
6. The Towns.

Many individual farm units include two or more land use regions. Therefore, before discussing these regions in turn, there follows a chapter dealing with general aspects of agriculture on White-owned land in the Bedford and Fort Beaufort divisions. The Bantu reserves, although including both sour and sweet grassveld, show a relatively homogeneous land use pattern characterised by a high proportion of arable land and the almost total absence of forests and plantations. From the cultural and economic point of view they may be regarded as a single land use region.


LAND USE REGIONS
N
Lower Kaga and Lower Koonap River Valleys
Baviaans River Valley
Great Fish River Valley
Sourveld Farms
Sweetveld Farms
Karroid Farms
Bantu Reserves
Forest Reserves
Towns
10 5 0 5 10 15 Miles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CHAPTER IX

A GENERAL SURVEY OF AGRICULTURE ON WHITE-OWNED LAND WITHIN THE BEDFORD AND FORT BEAUFORT DIVISIONS

The total area of White-owned land, including State-owned plantations, in the Bedford and Fort Beaufort divisions comprises approximately 95% of the regional area. In 1961 there were 675 White-owned holdings or farm units in the Bedford and Fort Beaufort divisions.[1] The distribution of farms and farm areas per magisterial district was as follows:

	Number of farm units	Total area of farms (morgen)	Mean farm area (morgen)
Bedford	159	303,155	1,905
Adelaide	111	172,161	1,564
Fort Beaufort	109	122,868	1,128
Stockenström	210	79,755	380
Victoria East	86	70,537	820
Total	675	748,476	1,108

Paradoxically Stockenström, the smallest district, has the largest number of farms. This is the result of the taking over by Whites of the Kat River Settlement smallholdings from 1853 onwards.[2] Victoria East has the smallest number of farms. This is because 30% of the district's area was occupied by Bantu Reserves in 1961[3]

[1] Information obtained by correspondence with Bureau of Census & Statistics, Pretoria. According to the 1960-61 Census of Agriculture questionnaires, from which these statistics were extracted, "a holding or farm unit means any land on which livestock, including poultry, rabbits and bees, are kept, or crops or fruit or flowers are grown... and consists of one or more separate farms or pieces of land which are situated in the same magisterial district, and which are operated by the holder or farmer as a single unit."

[2] See p. 158.

[3] The area of Bantu territory has increased slightly since then. For a discussion of agriculture in the Bantu reserves see Chapter XV.

AREAS IN MORGEN UNDER CULTIVATION ON WHITE-OWNED LAND

1st SEPTEMBER, 1960, TO 31st AUGUST, 1961

	Bedford	Adelaide	Fort Beaufort	Stockenström	Victoria East	Total
Wheat	124	103	21	186	12	446
Oats	1,089	757	560	2,122	461	4,989
Barley	57	22	35	37	17	168
Maize	203	213	153	839	232	1,640
Kaffir corn	-	-	-	6	1	7
Legumes	23	33	29	109	14	208
Tuber crops	13	1	26	39	16	95
Tobacco	-	-	29	503	5	537
Lucerne	2,013	1,130	557	611	340	4,651
Cash crops, vegetables & flowers	5	5	6	8	9	33
Other crops, excluding tree crops	13	112	50	34	12	221
Citrus	19	135	400	415	442	1,411
Deciduous fruit, including vineyards	45	15	5	16	10	91
Subtropical fruit	-	-	5	-	1	6
Timber and wattle plantations	8	64	25	47	75	219
TOTAL	3,612	2,590	1,901	4,972	1,647	14,722

and also because a large part of the district had by that time been bought up by speculators. As can be seen from the figures given on page 218, the mean farm unit size for the five districts combined was 1,108 morgen in 1961. The districts with the largest farms are Bedford and Adelaide, which have been settled by Whites for a longer period than the rest of the region. These districts also have the highest proportion of semi-arid land. Only in Fort Beaufort does the mean farm size approximately correspond with that of the whole region. Victoria East and Stockenström, the last of the five districts to be settled by Whites, have mean farm areas which are below average. The majority of farms in Victoria East average approximately 330 morgen, which was the standard Government grant during the period of settlement; the average of 820 morgen can be attributed to a few speculators who have bought up farms in the Scrub Woodland area of southern Victoria East for the purpose of cattle ranching. In this district one farmer actually owns more than twenty farms which are, however, operated as a single unit.

Crops

Only a small percentage of White-owned farmland in each district is under cultivation, the areas in 1961 being 3,612 morgen (1.2%) in Bedford, 2,590 morgen (1.5%) in Adelaide, 1,901 morgen (1.5%) in Fort Beaufort, 4,972 morgen (6.2%) in Stockenström and 1,647 morgen (2.3%) in Victoria East. If the plantations on State-owned land are included, the percentage of "cultivated" land in Fort Beaufort, Stockenström and Victoria East is higher. The areas of all cultivated White-owned land are therefore as follows:

Bedford	3,612 morgen, 1.2%
Adelaide	2,590 morgen, 1.5%
Fort Beaufort	2,502 morgen, 2.0%
Stockenström	5,678 morgen, 6.8%
Victoria East	2,298 morgen, 3.2%

From the table on page 219 it can be seen that oats was the chief crop for the whole region in 1961, occupying a total of 4,989 morgen (33.9% of all cultivated farmland). Normally it is grown as a winter fodder crop in the sourveld as well as in the sweetveld. It is usually irrigated in the sweetveld, but on many sourveld farms it can be grown successfully without irrigation. Oats takes second place after lucerne in the drier districts of Adelaide and Bedford. Lucerne, also a fodder crop, occupied the second largest area of cropland in the region, viz. 4,651 morgen (31.6% of all cultivated farmland). It is essentially a summer crop, grown almost invariably under irrigation, mainly in sweetveld regions. The third crop, as far as acreage is concerned, is maize, which in 1961 occupied an area of 1,640 morgen (11.1% of the cultivated farmland). On the sourveld farms it is usually grown without the aid of irrigation, but on the drier sweetveld farms the converse holds true. Citrus orchards occupied the fourth largest area of cultivated land, viz. 1,411 morgen (9.6%). Citrus is grown under irrigation, mainly in the Koonap, Kat and Tyume river valleys. Only 219 morgen of privately owned farmland was under "timber and wattle plantations" compared with 1,957 morgen of State-owned plantations. If the latter were to be included, plantations would rank third in importance as far as area is concerned. It is rather doubtful, however, whether they should be regarded as cultivated land. The timber plantations, consisting mainly of conifers, are grown without the aid of irrigation in the relatively wet sourveld regions.

<u>Livestock</u>

The economy of the region is essentially based on livestock. On 30th June, 1961, the number of cattle, sheep and goats owned by Whites in each district was as follows:

District	Cattle	Merino Sheep	Other Sheep	Angora Goats	Other Goats
Bedford	13,388	198,168	6,862	49,548	3,150
Adelaide	14,784	138,575	6,684	23,624	3,676
Fort Beaufort	13,087	94,083	3,134	12,192	1,025
Stockenström	13,670	51,399	7,562	2,283	1,874
Victoria East	13,985	3,382	2,666	1,992	1,134
TOTAL	68,914	485,607	26,908	89,639	10,859

At that time the number of livestock owned by Non-White employees on White-owned farms in the region was as follows:

District	Cattle	Sheep	Goats
Bedford	2,919	3	3,415
Adelaide	3,256	-	1,819
Fort Beaufort	3,321	-	414
Stockenström	1,590	197	718
Victoria East	1,511	10	215
TOTAL	12,597	210	6,581

Cattle

The table on the following page shows that cross bred cattle outnumber any individual White-owned breed. The Bureau of Census and Statistics was unable to provide information concerning the breeding strains used, but on ninety farms investigated by the present writer the Africander-Shorthorn cross was most frequent. On these farms the Africander strain occurred in 72% of all cross bred cattle, followed by Shorthorns 61%, Friesland 28%, Aberdeen Angus 17%, Hereford 11%, Jersey 5% and Ayrshire 5%. Pure bred Shorthorns were almost as numerous as cross breds, with Frieslands ranking a close third, followed by Africanders in fourth position and Jerseys in fifth position.

The Shorthorn is thus the most important cattle breed in the area from the point of view of the most common strain per mean cattle unit. It is a paradox that this breed, which originated in the relatively cool, moist Tees valley of the counties of Durham

MOST COMMON BREEDS OF WHITE-OWNED CATTLE EXCEEDING TWO YEARS IN AGE,

BUT EXCLUDING BULLS AND OXEN, 1961

	Bedford	Adelaide	Fort Beaufort	Stockenström	Victoria East	Total
Cross Bred	838	1,105	1,125	1,876	2,083	7,027
Shorthorns	1,514	1,668	2,052	537	1,013	6,784
Frieslands	2,120	1,594	742	672	1,326	6,454
Africanders	862	1,186	373	1,171	709	4,301
Jersey	479	563	194	805	92	2,133
Hereford	124	413	141	96	52	826
Ayrshire	43	33	11	15	380	482
Aberdeen-Angus	30	85	236	101	Nil	452

and Yorkshire in north-eastern England,[1] should prove the most suitable breed for the relatively warm and dry Bedford and Fort Beaufort divisions of the south-eastern Cape, where it thrives on the indigenous grasses and scrub. Shorthorns are, however, tolerant of a wide range of climates, and are of economic importance not only on the relatively mild pampas of Argentina and Uruguay but also on the harsh prairies of North America and the semi-arid grasslands of the Australian interior.[2] The first Shorthorns were imported into South Africa from Great Britain during the latter part of 1850 and the beginning of the next decade.[3] Amongst the earliest importers were the King and Trollip families of Bedford,[4] who developed the breed for both beef and dairying purposes. The thickset dual-purpose Shorthorn cow, developed in Bedford, is a good milker but has a high ratio of meat to bone, so that the male progeny, on reaching maturity, can command high prices as beef cattle. When her own milking life has passed its prime, the cow is still endowed with an excellent beef carcass which commands high prices. On many farms the Shorthorn has been successfully crossed with the indigenous Africander; the resulting progeny possess the heavy, high quality beef of the Shorthorn as well as the hardiness of the Africander.

In the Bedford and Fort Beaufort divisions the Friesland breed is almost as numerous as the Shorthorns. The reasons for the Friesland's popularity are not far to seek, for, from the milk production point of view, it has proved to be the leading dairy breed of the world. It is not nearly as hardy to drought as the Shorthorn. In fact the mortality rate amongst Frieslands grazed entirely on veld is very high during droughts. Neither is the

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1 A. Fraser, "Beef Cattle Husbandry", Crosby Lockwood, London, 1959, p. 43.

2 Ibid., pp. 55 - 56.

3 N. Eliovson & B. Eliovson, "South African Stockbreeder & Farmer", Seal Publishing Co., Johannesburg, 1956, p. 368.

4 Ibid.

Friesland able to do anything more than survive on the mineral and protein deficient grasses of the sourveld during the winter months. The Friesland over most of the Bedford and Fort Beaufort divisions thus needs to have its diet supplemented by feeding off artificial pastures, but the fact that it leads all dairy breeds in milk production makes this an economic proposition. The Friesland's size has an added advantage in that it carries, on an average, a greater weight of beef than any other dairy breed. The aim in breeding has always been to sacrifice beef on those parts of the body where it is likely to reduce the milk yield and at the same time to encourage flesh on those parts of the animal that do not affect milk production.[1] The efficiency of this breeding achievement can best be gauged from the fact that, although the Friesland has such excellent dairying qualities, its bull calves can be steered to advantage, and cows, when dry, can be fattened to fetch good prices from the butcher.

The Africander is the third most numerous of the pure breeds reared in the Bedford and Fort Beaufort divisions and, as previously mentioned, it is the most important strain in cross bred stock. Bred by the early Dutch settlers from Hottentot cattle, the Africander possesses the hardiness of the native stock together with superior characteristics developed by careful selection. Its ability to subsist on poor grazing as well as its greater resistance to tick-borne diseases outweigh its most obvious defect, viz. a low milk yield. During the nineteenth century the primary use of the Africander was that of a draught animal, but in modern times the breed has been improved for beef purposes.

The 1961 Agricultural Census showed that Jersey cattle were half as numerous as Africanders. The qualities which have made the Jersey breed popular with farmers include adaptability to a variety of climates and reproduction at an early age, combined with

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[1] N. Eliovson & B. Eliovson, "South African Stockbreeder & Farmer", Seal Publishing Co., Johannesburg, 1956, p. 358.

longevity, a persistently high milk yield and, above all else, the high butterfat content of the milk. The milk yield of the Jersey is slightly lower than that of the larger Friesland, but, on the other hand, the Jersey outstrips all other major dairy breeds by an ample margin in amount of milk produced per 1,000 lb. liveweight.[1] Its unsuitability for beef purposes is a major factor limiting its popularity in the Bedford and Fort Beaufort divisions.

The relatively small number of Hereford cattle in the region are reared mainly for beef purposes, and the even smaller number of Ayrshires serve essentially as dairy cattle. The Aberdeen-Angus is slowly gaining importance as a beef breed and, on some farms, it has been crossed very successfully with the Africander. Under ranching conditions Africander cows can be mated with Aberdeen-Angus bulls in order to obtain hardy, heavy, high quality, early maturing beef animals.

Although the cattle numbers in each of the five magisterial districts were approximately equal in 1961, the milk production varied considerably from one district to another, as shown by the table below:

FRESH MILK PRODUCTION DURING THE TWELVE MONTHS ENDED 30th JUNE, 1961.

District		Quantity in Gallons
Bedford		275,820
Adelaide		114,617
Fort Beaufort		117,566
Stockenström		42,365
Victoria East		64,141
	TOTAL	614,509

The figures above exclude milk sold to creameries and cheese factories, for which statistics were unobtainable.

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[1] Ibid., 365.

Sheep

As can be seen from the table on page 222, more than 94% of the White-owned sheep in the region in 1961 were merinos. The merino was introduced into South Africa in 1789[1] and has proved to be admirably suited to most of the country. Primarily a woolled sheep, it is regarded as a dual purpose breed in this region, as in the rest of South Africa. In the Bedford and Fort Beaufort divisions there has been a steady improvement in the annual yield of wool per sheep, so that in 1960 it was 8.1 lbs. compared with just under 2 lbs. in 1865.[2] If the number of lambs too young for shearing be excluded the yield of wool per sheep would be very much higher than 8 lbs. During the period 1st September, 1959, to 31st August, 1960, 4,388,687 lbs. of wool were obtained from the 430,964 White-owned adult woolled sheep in the region,[3] giving a yield of just over 10 lbs. per sheep. Merino sheep are more numerous in the more arid western magisterial districts of Bedford and Adelaide.

Goats

Angora goats, kept mainly for mohair, are also most numerous in the Bedford and Adelaide districts. The total number of Angoras for the whole region is approximately one fifth that of merino sheep. In the 1959-1960 season all the region's mohair was produced on White-owned farms. During the period 1st September, 1959, to 31st August, 1960, the mohair production[4] per magisterial district was as follows:

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1 J.H. Wellington, "Southern Africa", Vol. II, Cambridge University Press, 1955, p. 69.

2 See p. 172.

3 Agricultural Census No. 34, RP/10/1964, Pretoria, pp. 14,15,50,51.

4 Agricultural Census No. 34, RP/10/1964, Pretoria, pp. 50-51.

District	Mohair in lbs.
Bedford	377,039
Adelaide	155,708
Fort Beaufort	87,792
Stockenström	11,792
Victoria East	4,713
TOTAL	637,044

Other goats, mainly of the boer goat type, are kept mainly for sale for meat to the Bantu. These goats are also a source of milk for Bantu employees on the White-owned farms. In 1961 there were 10,859 White-owned goats of this type in the region, compared with 89,639 Angora goats. It is interesting to note that in the Bantu reserves, which occupy only 5% of the regional area, there were in 1960 a total of 12,611 boer goats and 1,247 Angoras. The harmful effects of boer goats on the grazing and natural vegetation are discussed in the chapter on Bantu Reserves.

Equines[1]

In 1960 there were 1,762 White-owned and 1,392 Bantu-owned horses in the five magisterial districts, including the Bantu reserves. More than half of the White-owned horses were in the Bedford district, where they are used mainly by wealthy farmers for recreational purposes. On the other hand, horses are important as a means of transport for the rural Bantu. In 1960 more than 40% of the Bantu-owned horses were in Victoria East, mainly in the reserves, which comprise approximately 30% of the area of this magisterial district. Donkeys and, less frequently, mules are chiefly employed as draught animals. In 1960 there were 845 White-owned donkeys and 756 Bantu-owned donkeys in the region, including the reserves, as well as 151 White-owned mules and 2 Bantu-owned mules.

[1] Agricultural Census No. 34, RP.10/1964, Pretoria, pp. 34-35.

Livestock Diseases

Livestock farming in the Bedford and Fort Beaufort divisions is to a certain extent handicapped by protozoan diseases transmitted by ticks, the most common of these diseases being redwater and gall sickness, which are carried mainly by the blue tick, Boophilus decoloratus, and heartwater, which is carried by the bont tick, Amblyomma hebraeum. Both cattle and sheep can suffer from heartwater and gall sickness, whereas redwater occurs among cattle. These diseases are prevalent in the warmer, relatively lowlying areas occupied by Acacia Savannah, Scrub Woodland and Fish River Scrub. They can, however, be controlled by regular and systematic dipping, while stock can now be immunised against redwater and gall sickness by inoculation. Cattle reared from birth in tick infested regions apparently develop a natural resistance to redwater, but not to gall sickness, for which they have to be inoculated during the first few months of their lifespan. Sheep are also susceptible to pulpy kidney and blue-tongue, against which there are effective vaccines now in use. It is customary for farmers to inoculate their sheep against pulpy kidney biennially, usually in April and in September. Sheep are inoculated against blue-tongue annually, usually from September to December, so that immunisation can take effect before the outbreak of the disease, which is prevalent from January to March.

During summer the eggs of internal parasites such as tapeworm, wireworm and nodular worm are plentiful amongst the grasses of the Sourveld, although they also occur in drier regions which are well-grassed. In these areas it is necessary to dose sheep in order to eliminate the parasites. Over much of the region blowfly strike is a serious problem, as far as woolled sheep are concerned, during warm, humid weather following good summer rains. The sheep blowflies present in the region are Lucilia sericata, L. cuprina, Chrysomyia chloropyga and C. albiceps, although the latter is a relatively scarce species.

CHAPTER X

FORESTS AND PLANTATIONS

The 1969 land use survey revealed that indigenous forest of the temperate evergreen type occupies 2.4% of the total area of the Bedford and Fort Beaufort divisions. This compares very favourably with the percentage for the whole of South Africa; according to an estimate of the Department of Forestry "indigenous high forest... excluding savannah and bushveld" covers only 0.2% of the total area of the four provinces.[1]

The areas occupied by Temperate Evergreen Forest in the five magisterial districts are as follows:

District	Area		Percentage of Total Area
	Square Kilometres	Square Miles	
Bedford	41.25	15.93	1.6
Adelaide	21.25	8.21	1.4
Fort Beaufort	36.25	14.0	2.8
Stockenström	53.5	20.65	6.6
Victoria East	20.25	7.82	2.1
	172.5	66.61	2.4

It will be seen on the vegetation map as well as on the land use maps that Temperate Evergreen Forest occurs only in the relatively well-watered northern highland half of the region. In fact it does not occur south of the railway line passing through Bedford, Adelaide, Fort Beaufort and Alice. As described on page 68, the indigenous forest occurs mainly on the relatively sheltered south and south-east scarps bounding the plateau areas of the highlands. It is best developed in the ravines where soil depth and moisture is greatest and where exposure to wind and insolation is least. The Temperate Evergreen Forest usually

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[1] Dept. of Forestry, Investigation of the Forest & Timber Industry of South Africa, Govt. Printer, Pretoria, 1964, p. 3.

occurs in regions of good air drainage, as temperatures of only a few degrees below freezing are inimical to many of the subtropical species which make up this so-called "temperate" community. The land use maps also show that the major plantations of exotics occur adjacent to areas of indigenous forest. Whereas Temperate Evergreen Forest may occur in localities with a mean annual rainfall as low as 26 inches, the major plantation areas, viz. those of the Hogsback in northern Victoria East, the Katberg in western Stockenström and Fort Fordyce in north-western Fort Beaufort, occupy areas where the mean annual rainfall apparently exceeds 32 inches. The following data give some indication of the rainfall of the plantation areas:

Station	Altitude	Mean Annual Precipitation
Hogsback (65 years)	4,200 ft.	49.91 inches
Katberg Forest Station (68 years)	3,450 ft.	41.34 inches
Buxton Forest Station (38 years)	2,999 ft.	33.67 inches
Fort Fordyce (52 years)	3,750 ft.	35.82 inches[1]

The exotics, however, appear to be less sensitive to frost and to wind, thriving not only on sheltered slopes but also on exposed plateau areas and spurs.

As mentioned on page 214, the indigenous forests are at present of little commercial value. This has not always been the case, for, in the days before plantations of exotics had been established, these forests were the source of firewood and timber. The Podocarpus spp. in particular were ruthlessly felled to provide timber for beams, ceilings, floors, doors, furniture and wagon-building. With the commencement of railway construction they were also used for sleepers. Reckless felling of trees resulted in much dry wood remaining in the forests, thus favouring the entry of fires from the adjacent grasslands. In his report for 1884 the Conservator of Forests in British Kaffraria gave some indication of

[1] See p.30 for effect of relief on precipitation.

the extent to which the forests of the Katberg had been exploited:

> "How a fine forest estate may be frittered away, and, as a whole, lost to the country, there is the sad history of the Katberg forest to tell. Plundered at first by wood-stealers, overworked and unsystematically worked by Government, for the sake of a few hundred pounds above the cost of management, thrice swept by fire; a few blackened and charred limb [sic] standing in a tangle of thorns, now show where the forest once stood, a forest then the pride of the Province, and about which people who have not visited the locality for some years still speak with admiration." [1]

He stated furthermore that "Localities such as these show little sign of natural reproduction."[2] The failure of devastated forest to regenerate, as well as the slow growth of saplings in un-devastated areas, paradoxically resulted in the preservation of what remained of the Temperate Evergreen Forest. The inability of the indigenous forest to furnish the timber needs of the Cape Colony resulted in the introduction of fast-growing exotics in the early 1880's. The first exotic plantation in the region was established on the Katberg in the vicinity of the present Katberg Forest Station, in north-western Stockenström, in 1882.[3] The first plantation on the Hogsback, in northern Victoria East, was set out in 1888.[4] The Buxton plantation, in western Stockenström, was begun in 1889, and those at neighbouring Jury's Hoek were begun in 1903.[5] Planting of exotic trees at Fort Fordyce, some ten miles north-west of Fort Beaufort town, commenced in 1893.[6] The establishment of plantations by the Cape Colonial Government considerably relieved the pressure on the indigenous forests in various parts of the Colony, and helped meet the heavy demand for timber in South Africa. As far as the Bedford and Fort Beaufort divisions

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1 J.C. Brown, "Management of Crown Forests at the Cape of Good Hope", Oliver & Boyd, Edinburgh, 1887, p. 286.

2 Ibid.

3 Annual Report of the Dept. of Forestry for the year ended 31st March, 1964, Govt. Printer, Pretoria, R.P. 34/1966, p. 27.

4 Ibid.

5 "Fort Beaufort Advocate & Adelaide Opinion", 2nd Aug. 1907.

6 Ibid.

are concerned, the area occupied by Temperate Evergreen Forest apparently has not decreased much since the turn of the century. As this forest type was described in Chapter IV, pp. 68 to 71, the remainder of this chapter will be devoted to the plantations of exotic trees.

In March, 1964, the total area in morgen of State-owned plantations per magisterial district was as follows:[1]

Fort Beaufort	Stockenström	Victoria East	Total
600.9	704.9	650.4	1,956.2

There are no State-owned plantations in Bedford or Adelaide. The area under privately owned plantations is small. In 1961 it amounted to a total of only 219 morgen for the five districts. (See page 219). The 1969 land use survey showed that the area under plantations, both private and State, in the five districts is approximately as follows:

	Areas	
District	Square Kilometres	Square Miles
Bedford	0.25	0.1
Adelaide	1.25	0.5
Fort Beaufort	3.0	1.2
Stockenström	13.5	5.2
Victoria East	7.25	2.8
	25.25	9.8

The State-owned plantations are all situated in State Forest Reserves, formerly known as Crown Forests. These include several categories of land use, as the following table shows:

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[1] By correspondence with Secretary for Forestry, Pretoria.

Classification	Area in morgen per Magisterial District			Total
	Fort Beaufort	Stockenström	Victoria East	
Plantations	604.5	658.6	692.8	1,955.9
Indigenous Forests	2,107.0	1,605.0	1,139.0	4,851.0
Unplanted, suitable for afforestation	123.2	533.8	187.5	844.5
Unplanted, unsuitable or unavailable for afforestation	917.3	1,017.0	206.0	2,140.3
	3,752.0	3,814.4	2,225.3	9,791.7

The information in the above table was obtained by correspondence with the Secretary for Forestry, and reflects conditions as at 31st March, 1964.

During the year ended 31st March, 1966, the area of State Forest Reserve in Stockenström was increased by 1,323 morgen[1] as a result of the purchase of the farm Pleasant View at the head of Readsdale. This is an area mainly of sour grassland, with macchia in the higher areas and forest in the ravines. It was purchased primarily for the protection of the catchment area of the Wellsdale River, which is one of the main sources of water for the Kat River Dam.

In all three districts the felling of indigenous trees in the State Forest Reserves is prohibited. The species used for afforestation in South Africa belong almost entirely to three exotic genera, viz. Pinus, Eucalyptus and Acacia. The pines were introduced from various Northern Hemisphere countries, whereas the eucalypts and acacias are indigenous to Australia. The area occupied by each species[2] in the State-owned plantations as at 31st March, 1964, was as follows:

[1] Annual Report of the Dept. of Forestry for the Year ended 31st March, 1966, R.P. 44/67, pp. 9-10.

[2] By correspondence with Secretary of Forestry, Pretoria.

Species	Area in morgen per Magisterial District			Total
	Fort Beaufort	Stockenström	Victoria East	
CONIFEROUS spp.				
Pinus radiata	245.8	166.0	435.0	846.8
P. canariensis	54.0	51.4	23.1	128.5
P. roxburghii	23.7	5.7	55.1	84.5
P. taeda	2.4	44.4	53.8	100.6
P. patula	142.8	35.5	23.4	201.7
Other pines	63.1	145.0	21.8	229.9
Other conifers	12.0	28.6	10.9	51.5
Total Conifers	543.8	476.6	623.1	1,643.5
BROADLEAF spp.				
Eucalyptus grandis	6.2	13.6	-	19.8
E. cladocalyx	8.8	35.3	-	44.1
Other eucalypts	12.1	72.7	4.1	88.9
Poplars	-	3.9	2.1	6.0
Wattles	1.6	23.7	37.5	62.8
Other hardwoods	32.0	32.8	23.0	87.8
Total Hardwoods	60.7	182.0	66.7	309.4
Aboreta	-	-	3.0	3.0
Total all species	604.5	658.6	692.8	1,955.9

During the year ended 31st March, 1964, there was a sharp reduction in the plantation area of Stockenström owing to the destruction by fire of 400 morgen of pine trees in the late winter of 1963.[1]

From the table above it can be seen that Pinus radiata accounts for more than 50% of the area occupied by conifers. This species, synonymous with P. insignis, is often referred to as the Monterey pine, after the Monterey peninsula in central California, which is its natural habitat. Although endemic to only a few square miles of California, it has proved remarkably successful as an exotic not

[1] Annual Report of the Dept. of Forestry for the Year ended 31st March, 1964, R.P. 34/66, p. 11.

only in South Africa but also in New Zealand, south-western and south-eastern Australia, central Chile and the less arid portions of Spain. P. radiata is one of the fastest growing exotics planted in South Africa, and is capable of a mean annual increment exceeding 500 cubic feet per acre.[1] On first quality sites the trees are usually ready for felling at the age of 30 years, but take as long as 50 years to reach maturity on third quality sites.[2] P. radiata produces a strong timber suitable for constructional purposes. It is also the principal species grown in privately-owned plantations, if the self-propagating Acacia mearnsii is excluded.

Pinus patula occupies less than one quarter of the area covered by P. radiata. It is a native of east-central Mexico, where it occurs in the tierra fria at altitudes of 6,000 to 9,000 feet. The main reason for the popularity of P. patula is its remarkably rapid rate of growth, the mean annual increment also exceeding 500 cubic feet per acre.[3] It also takes from 30 to 50 years for these trees to reach maturity, depending on the quality of the site. The height-growth rate of P. patula, however, is not as rapid as that of P. insignis. It produces a strong, hard timber suitable for constructional purposes. After a severe hailstorm the bruised bark of both P. patula and P. insignis is liable to be attacked by the fungus Diplodia pinea, which causes die-back of the branches and tops, often with fatal results for the trees. This is a major disadvantage of both species. However, during the last decade no outbreaks of Diplodia pinea have occurred in the State-owned plantations of Fort Beaufort, Stockenström and Victoria East, as hailstorms of only light to moderate intensity occurred during this period.

Pinus canariensis, from the Canary Islands, is the third most numerous of the pine species grown in the plantations of the region.

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[1] M. Grut, "Forestry and Forest Industry in South Africa", Balkema, Cape Town, 1965, p. 25.

[2] Ibid., p. 40.

[3] Ibid., p. 24.

Capable of a mean annual increment of up to approximately 250 cubic feet per acre,[1] it is regarded as a relatively slow growing species in South Africa. The mature trees are ready for felling at the age of 40, 50 or 60 years depending on whether the quality of the site is first, second or third class. P. canariensis produces a very good pole for telephone and power lines and is almost exclusively used for this purpose, although its wood, which is harder, heavier and stronger than that of any other pine grown in South Africa, is also used for flooring and other purposes where strength is required.

Pinus taeda, the loblolly pine, a native of the south-eastern United States, is the fourth most numerous of the pine species grown in the State-owned plantations of Fort Beaufort, Stockenström and Victoria East. Under favourable conditions it is a fast growing tree capable of a mean annual increment of about 500 cubic feet per acre, but its timber has the reputation of being somewhat brittle.

Pinus roxburghii, synonymous with P. longifolia, is indigenous to the Himalayan region of northern India. It is commonly known as the Chir pine.[2] Although not one of the fastest-growing pines, it has the advantage of being more drought resistant than most species. A major defect of P. roxburghii is that a large proportion of the trees is marred by spiral grain which makes the timber almost useless.[3] For this reason the area under P. roxburghii in South Africa has declined in recent years.

Although the above mentioned coniferous species take from 30 to 40 years to reach maturity, even on the most favourable sites, a certain amount of revenue can be derived from the several prunings and thinnings which occur during the life of a plantation. The thinning prescriptions for the various species previously enumerated

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[1] Ibid., p. 22.

[2] W.E. Hiley, "Conifers : South African Methods of Cultivation", Faber & Faber, London, 1959, p. 59.

[3] Ibid.

are as follows:

Thinning Prescriptions and Rotations for State Saw-Timber Plantations[1]

Species	Site quality I		Site quality II		Site quality III	
	Age, Years	Stems per acre after thinning	Age, Years	Stems per acre after thinning	Age, Years	Stems per acre after thinning
P. radiata	10	330	6	210	6	300
	15	220	18	150	14	150
	20	150	23	120	20	100
	25	120	40	0	50	0
	30	0				
P. patula	8	300	6	300	6	300
	12	200	14	200	14	150
	18	130	20	130	20	100
	30	0	25	100	50	0
			40	0		
P. taeda	13	200	15	200	15	150
P. roxburghii	9	260-280	8	260-280	7	260-280
P. canariensis	20	100-110	18	100-110	20	70 - 80

The sale of timber from the various thinnings accounts for about one-fifth of the value of the final felling.

As can be seen from the table on page 235, most of the introduced hardwoods are the Australian eucalypts and wattles. A small amount of constructional timber is obtained from the eucalypts. The wattles consist mainly of Acacia mearnsii, synonymous with A. mollissima. It is commonly known as black wattle. This native of south-eastern Australia and Tasmania was originally grown for its tannin-rich bark, but at present, as far as the Fort Beaufort division is concerned, its heavy reddish brown wood is used mainly for fuel. In parts of northern Victoria East and Stockenström it is self-propagating and is regarded by some farmers as a pest because it eliminates natural pasture. A relatively small area on the

[1] De Villiers, P.C. et al., 1961. "The silviculture and management of exotic conifer plantations in South Africa." Forestry in S.A., No. 1.

Katberg is occupied by A. melanoxylon, the blackwood. Also a native of south-eastern Australia and Tasmania, A. melanoxylon is far more sensitive to drought and frost than A. mearnsii. Its major advantage is that it is one of the few exotics which yields a good furniture and flooring wood.[1]

The importance of the genus Pinus in the State-owned plantations is indicated in the table on page 235. The main reason for the popularity of pines is that their timber has a greater number of uses than that of the eucalypts and the wattles. Softwood timber, such as that yielded by the pines, is easier to saw than the hardwoods; it is also more stable and less liable to crack than the wood of most of the eucalypts. Another reason for the popularity of pines is that they are on the whole less demanding than the broadleaved species as regards soil, and less sensitive to drought and frost. Compared with eucalypts and wattles, pines are at a disadvantage in one respect. In the plantations of the Fort Beaufort division, considerable numbers of pine trees up to five or six years old are killed by rodents, which gnaw off the bark of the stem near ground level and sometimes up to a height of five feet. Wattles and eucalypts apparently are not affected. The worst offender in this respect is the vlei rat (Otomys irroratus), which is most common in dense vegetation in moist places.[2] Consumption of bark commences about March or April and ends when green grass appears in spring. Hoeing between the trees destroys the rats' cover and considerably lessens the amount of damage. In recent years poisoned maize meal has been used to kill the rodents.

Fire is, however, the greatest enemy of the plantations, especially of pines, which are highly inflammable. In a few hours the work of years may be completely destroyed with consequent loss of time and money. The last major plantation fire in the region

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[1] M. Grut, "Forestry & Forest Industry in South Africa", Balkema, Cape Town, 1965, p. 19.

[2] N.L. King, "Tree-planting in South Africa", Journal of the South African Forestry Association, No. 21, 1951, p. 23.

occurred in 1963. (See p. 235).

The basic principle of sound plantation management is the establishment of a sustained annual yield. The plantations of the Fort Beaufort division are organised on the basis that the quantity of wood felled each year should not exceed the annual increment. Thus if a ten morgen stand of Pinus radiata is ready for felling at the age of thirty years, there should be 29 other stands of equal area ranging consecutively in age from one to twenty-nine years. Clearly ten morgen will become due for felling and planting each year. In actual practice the system is not so simple. In crops which take 30 years or more to reach the requisite size for clear felling complications are introduced by variations in soil depth and fertility, and consequent differences in the rate of growth. Although a sustained annual yield can only be adhered to approximately, it is necessary, not only for the continuity of the plantations but also in the interests of the sawmilling industry.

There are two sawmills in the region, both privately owned. One is at Fort Fordyce and the other at Jury's Hoek, approximately 1½ miles west of the Katberg Forest Station. The State Forest Stations at Fort Fordyce, Buxton, Katberg and Hogsback sell droppers and poles to private individuals for fencing purposes, these having been obtained as a result of the thinning of trees. As far as droppers are concerned, the smallest saleable diameter is approximately three inches. Twigs and crooked branches from pruned or felled trees are also sold for firewood. After the felling of mature trees, the logs are sawn up in lengths of anything from 6 to 20 feet and sold to the privately owned sawmills. The Fort Fordyce sawmill processes most of the timber of the Fort Beaufort district. That at Jury's Hoek purchases most of the timber of the Katberg plantations, although at times it also receives timber from the Hogsback. The privately owned sawmill on the Hogsback was destroyed by fire several years ago and has not been rebuilt. Most of the Hogsback timber is sent to the sawmill at Kubusi in the Stutterheim district. The Fort Fordyce and Jury's Hoek sawmills sell the processed timber not only to builders' merchants in the Bedford and Fort Beaufort divisions but also to merchants in centres such as Grahamstown and Port Elizabeth.

In 1964 the area of exotic plantations in South Africa was estimated to cover a total of 1,416,000 morgen compared with a national total of 300,000 morgen of "indigenous high forest".[1] The 1969 land use survey of the Bedford and Fort Beaufort divisions revealed that only 2,960 morgen of the region was occupied by plantations, but that more than 20,110 morgen was occupied by temperate evergreen forest. The Bedford and Fort Beaufort divisions, although containing only approximately 0.2% of South Africa's plantations, thus contain approximately 6.7% of South Africa's indigenous forest. The region thus compares unfavourably with the whole of South Africa as far as exotic plantations are concerned, although it has a relatively high percentage of land covered by indigenous forest.

There is very little unplanted land suitable for afforestation by exotics left in the State Forest Reserves, although there are relatively large areas of privately owned sour grassland in Stockenström, northern Fort Beaufort and northern Adelaide suitable for afforestation. The area under plantations on these farms is not likely to increase very much. As stated on page 238, the fast growing, self-propagating Acacia mearnsii has been encroaching on grazing land in the eastern part of the sourveld, and is regarded as a weed by many farmers. Owing to the long period which elapses between the planting of trees and their felling for timber, only a few farmers have deliberately established plantations of non-spreading exotics. It is interesting to compare the annual return per acre for sheep farming in the sourveld with that from silviculture. Assuming an average carrying capacity of 1½ adult sheep per acre (3 sheep per morgen) for the sourveld regions and an annual

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[1] Dept. of Forestry, Investigation of the Forest & Timber Industry of South Africa, Govt. Printer, Pretoria, 1964, p. 3.

return of approximately 8 lbs of wool per sheep at an average price of only 40 cents per lb., a farmer would earn approximately R4-80 per acre per annum for wool alone. Also assuming that each ewe produced one lamb per annum and that older ewes were sold for mutton at a price of R6-00 each in order to keep stock numbers constant, there would be a further income of R9-00 per acre from sheep farming. The total income from one acre would thus be approximately R13-80 per annum or R552 over a period of 40 years. It should also be realised that only a very small proportion of sourveld farms in the region would have first class timber sites, i.e. south and south-east slopes with relatively deep soils, and that most of the sour grassland would therefore be classified as second or third class terrain from the point of view of afforestation. Grut in 1965 calculated the estimated yields for fast growing conifers such as <u>Pinus radiata</u> and <u>P. patula</u> on a second quality site over a 40 year rotation period as follows:[1]

Estimated Yield with a Rotation of 40 Years

Age (years)	No. of trees felled	Volume produced (cu.ft.)	Mean value per cu.ft. (cents)	Total value (Rands)
6	230	320	1.9	6.08
12	100	615	3.7	22.75
18	70	952	5.2	49.50
23	30	570	6.3	35.91
40	100	5,358	11.7	626.89
TOTAL	530	7,815		741.13

From the table above it can be seen that a farmer would earn only R114-24 from one acre over a period of 23 years, with no income at all for the succeeding 16 years. The final felling at 40 years would bring the total up to R741-13. Whereas sheep farming can bring in a steady income of over R13 per acre per annum, the farmer would

[1] M. Grut, "Forestry & Forest Industry in South Africa", Balkema, Cape Town, 1965, p. 107.

have to wait 40 years before earning a bigger income from forestry. Furthermore, over the long years of waiting for a return on his tree crop the farmer is constantly confronted with the danger of grass fires running out of control and invading the highly inflammable plantations. As stated in Chapter XI, it is customary for most sourveld farmers of the region to burn their grass at intervals. Insurance premiums quoted by a major insurance company in the early 1960's ranged from 20 cents per acre for a one year old stand of conifers to R5 per acre on a 20 year old stand.[1] The average premium per annum over a period of 20 years would work out at R1-92c per acre. The Department of Forestry does not insure its plantations against fire, as they are distributed over a large area of South Africa, so that the risk is well distributed. Thus the State could never be in the predicament of an individual silviculturist, viz. that of finding his major source of income destroyed. For the foreseeable future most of the region's plantations of exotics will be State-owned, and the area devoted to silviculture is likely to remain relatively static.

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[1] Ibid., pp. 33-34.

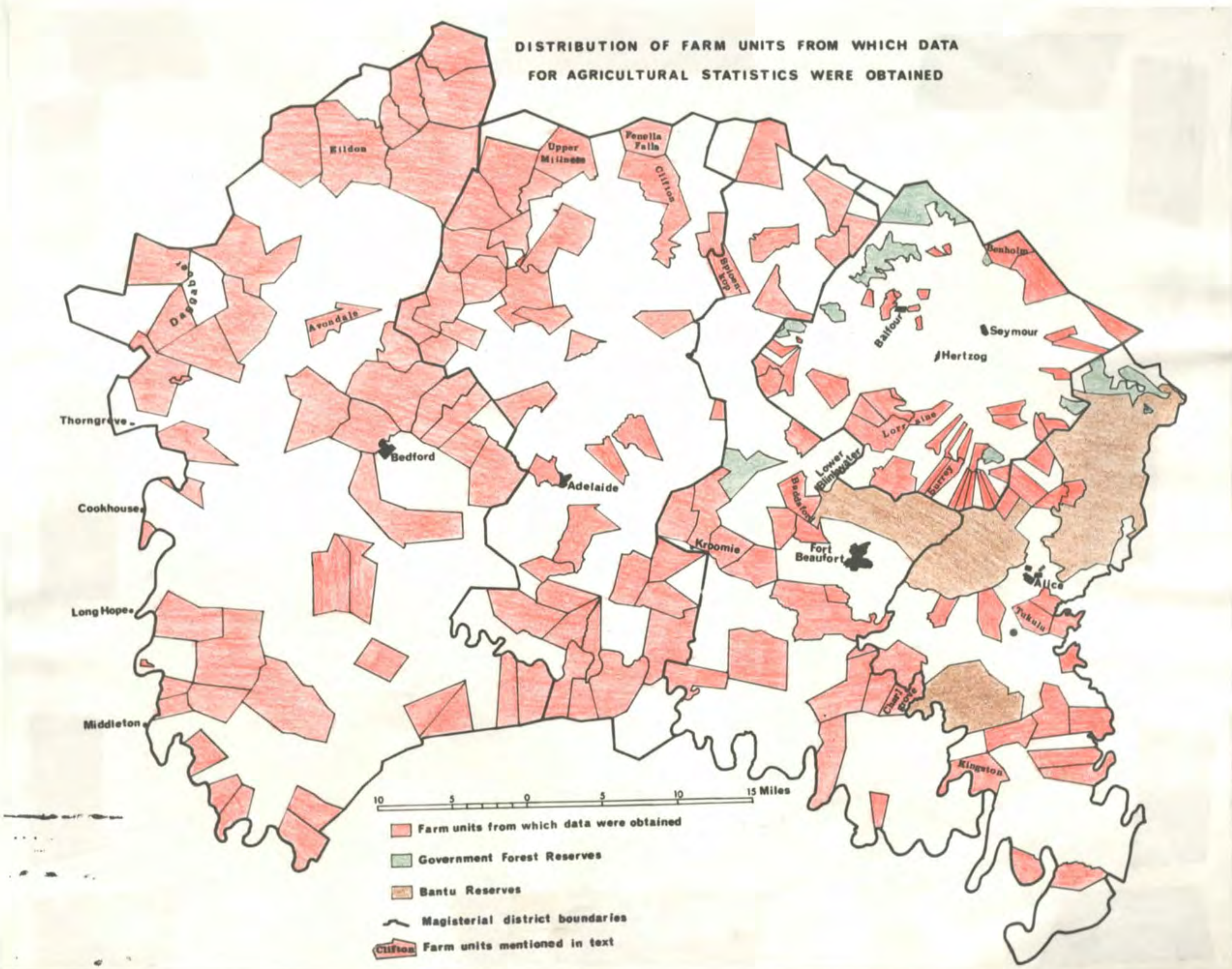
CHAPTER XI

THE SOURVELD FARMS

Methods of obtaining data

The statistics published for each magisterial district in the annual Agricultural Census reports of the Republic of South Africa are not of great value for the study of agriculture in regions of great diversity of relief and climate, such as the five magisterial districts of the Bedford and Fort Beaufort divisions. The Secretary for Statistics was requested to allow the writer access to Agricultural Census returns filled in by individual farmers so that a description could be given of agricultural practices in the various land use regions. The Secretary replied, however, that he was precluded by the provisions of the Statistics Act of 1957 from allowing anyone access to Agricultural Census questionnaires for the purpose of extracting information therefrom.

For the purpose of investigating agriculture in the region a short, bilingual questionnaire concerning livestock, crops and farming practices was therefore compiled. Farmers were required to give only single word or phrase answers, or else merely to delete statements which were inapplicable to their farms. In May, 1970, these questionnaires, with stamped, addressed envelopes for reply, were despatched to 200 White farmers throughout the Bedford and Fort Beaufort divisions. The writer attempted to sample farms evenly distributed throughout the region, but this goal could not be achieved, as the initial response from some sectors was poor or non-existent. By initial response the writer means a reply received within four weeks of the despatch of a questionnaire. In order to improve the percentage of replies received, a further 30 questionnaires were despatched in June, mainly to farmers with whom the writer was personally acquainted. This would no longer give an even spread of the farms sampled, but it greatly improved the response rate. One of the prerequisites for a successful initial response appears to have been personal acquaintance. Thus in south-eastern Stockenström, where the writer is well-known amongst the farming community, the initial response was 90%. The owners of large, prosperous farms often showed a better response than less wealthy farmers; for example, there was an excellent initial response (100%) from north-western Adelaide as well as southern Adelaide (80%), where the farms are large and the farmers relatively wealthy. The response from the large, prosperous Kagaberg and Kowie valley farms of Bedford was also excellent. In contrast, the initial response from central and north-western Stockenström, which has a high percentage of small-holdings, and where the writer is not well-known, was zero. It was necessary to interview farmers personally in central and north-western Stockenström, but in other regions of poor response handwritten appeals for replies raised the response rate. Uneven distribution of farms from which replies were received was not always the result of unco-operativeness by farmers. When interviewing farmers in Stockenström it was found that several farms had recently been sold or else the owners had abandoned them to seek employment in cities. When visiting a high rainfall, 184 morgen farm in Upper Maasdorp, where there is an abundant supply of irrigation water, even in the driest periods, a Bantu labourer informed the writer that the farmer now works in Port Elizabeth, visiting his property only occasionally. The owner of a high rainfall small farm at the foot of the Katberg had abandoned it to seek employment in East London. The owner of a 110 morgen high rainfall farm in Readsdale, which has an abundant supply of irrigation water from the Wellsdale River, even during severe droughts, finds it more remunerative to operate a garage in nearby Seymour to which village he daily commutes. As farming was not his main source of income he had felt it unnecessary to answer the questionnaire. An even spread of sampled farms in Stockenström was also hampered by the fact that relatively large


DISTRIBUTION OF FARM UNITS FROM WHICH DATA
FOR AGRICULTURAL STATISTICS WERE OBTAINED
Eildon
Upper Millness
Fenella Falls
Clifton
Benholm
Seymour
Hertzog
Balfour
Avondale
Thorngrove
Bedford
Adelaide
Cookhouse
Long Hope
Middleton
Lorraine
Lower Blinkwater
Surrey
Kroomie
Fort Beaufort
Alice
Kingston
10 5 0 5 10 15 Miles
Farm units from which data were obtained
Government Forest Reserves
Bantu Reserves
Magisterial district boundaries
Clifton Farm units mentioned in text

areas at Philipton and Hertzog are owned by the Congregational Church and are collectively farmed by Coloured peasant occupants. Further irregularities in the distribution of sampled farms were produced by the presence of State Forest Reserves or Bantu Reserves in the Stockenström, Fort Beaufort and Victoria East districts.

By the 15th of August, 1970, a total of 157 replies had been received to the 230 questionnaires despatched. In some cases two or more farms owned by one farmer, even when not adjoining each other were operated as a single unit, and considered as one farm by the farmer. According to the Agricultural Census definition of a holding (see footnote 1, page 218) the farms making up a farm unit must all be in the same magisterial district, those parts of a unit in another district being considered as separate farms. On this basis the 157 replies actually covered 169 holdings. The distribution of replies and holdings per magisterial district was as follows:

District	Number of farmers replying in 1970	Number of holdings in 1964 according to Census definition[1]	No. of holdings for which data was obtained in 1970	Percentage of 1964 holdings
Bedford	45	129	47	36.4
Adelaide	38	110	38	34.5
Fort Beaufort	20	97	25	25.8
Stockenström	35	201	38	18.5
Victoria East	19	65	21	32.3
	157	602	169	28.1

From 1961 to 1964 the number of holdings decreased from 675 to 602. (See page 218.) Should this trend have continued at the same rate, the number of holdings in 1970 must be very much less.

[1] Agricultural Census No. 38. The Secretary for Statistics on 21st July, 1970, informed the writer that he was unable to furnish more recent data.

The Sourveld Farms

It was decided that all farms of which more than 50% of the unforested area consists of Sour Grassland and/or Macchia should be classified as sourveld. These vegetation types and the climatic conditions suitable for their development have been described in Chapter IV. Many of the sourveld farms include sectors of Temperate Evergreen Forest, which, however, does not cover more than 50% of any farm from which a reply was received. According to this definition a total of 49 sourveld farms was sampled. Their distribution is as follows:

District	Number of farm units
Bedford	5
Adelaide	15
Fort Beaufort	6
Stockenström	20
Victoria East	3
	49

Where a farm unit is located in more than one district it is classified as belonging to the district in which the owner's homestead is situated.

The mean area of the sampled farms is 1,483 morgen. The largest sourveld farm unit sampled, approximately two-thirds of it in northern Adelaide and one-third in northern Fort Beaufort, is 5,000 morgen in area. The smallest of the sampled farms, in the upper Blinkwater basin of western Stockenström, is 22 morgen. More than half the sourveld farms sampled are below the average area of 1,483 morgen, the median farm size being 1,205 morgen. The top quartile of the farms exceed 2,200 morgen and average 3,298 morgen. Eight of the twelve farms in the top quartile of twelve are in Adelaide, two in Bedford, one in Fort Beaufort and one in Stockenström. The four largest sourveld farms are between 4,000 and 5,000 morgen, and are all situated in Adelaide. The bottom quartile of farms are less than 408 morgen and average 252 morgen. Eleven of these are in Stockenström and one in Adelaide.

Livestock

The 1969 land use survey revealed that almost all the farmland of the sourveld, as in the rest of the Bedford and Fort Beaufort divisions, consists of unimproved grazing and, by implication, pastoral farming is the dominant activity. The 1970 questionnaires revealed that cattle are reared on all the sourveld farms sampled, sheep on 44 of the 49 farms and goats on 28 of the 49 farms. The average sourveld farm of 1,483 morgen has 198.4 cattle, 1,484.6 sheep and 158.4 goats, of which 140.1 are Angoras and 18.3 Boer goats. Farmers were not required to enumerate horses, donkeys and mules as they make up such a small percentage of the livestock. (See page 228.) As pigs are even fewer in number than equines, they were also not listed on the questionnaires. The Agricultural Extension Officers in Fort Beaufort and Adelaide consider that six small stock are equivalent to one cattle unit. In terms of cattle units the average sourveld farm has a total of 472.2 cattle units, consisting of 198.4 cattle, 247.4 sheep and 26.4 goats. This gives an average of 3.1 morgen per cattle unit, which corresponds very closely with the rate of 3 morgen per cattle unit recommended by the Kat River and Koonap River Soil Conservation Committees for the sourveld regions of the Bedford and Fort Beaufort divisions.

A marked contrast was observed between the stocking pattern of the top quartile of sourveld farms and that of the bottom quartile. In 1970 cattle were reared on all twelve of the top quartile farms, sheep also on twelve, goats on seven, six of these seven having Angora goats only, the seventh both Angora and Boer goats. The twelve farms of the top quartile, which average 3,298 morgen, each carry an average of 340.0 cattle, 2,849.8 sheep and 262.5 goats. In terms of cattle units this amounts to 340.0 cattle, 475.0 sheep and 21.9 goats, a total of 836.9 cattle units per farm. Farms of the top quartile thus have an average of 3.9 morgen per cattle unit, which is a favourable ratio. In 1970 cattle were also reared on all twelve of the bottom quartile farms, but sheep on only eight of the farms and goats on three of the farms, two of these having both Angora and Boer goats and one having Angoras only. The twelve farms of the bottom quartile, which have an average area of only 252 morgen, each carry an average of 63.0 cattle, 485.1 sheep and 18.8 goats. In terms of cattle units this amounts to 63.0 cattle, 80.8 sheep and 6.3 goats per farm, the total being 150.1 units per farm. The bottom quartile farms thus have an average of 1.7 morgen per cattle unit, indicating a high degree of overstocking, for, as previously stated, the recommended rate is 3.0 morgen per large stock unit.

Cattle

On the 49 sourveld farms investigated White-owned cattle are kept on all but one of the farms. The only farm without White-owned cattle has cattle belonging to Bantu employees. Bantu and Coloured servants rear cattle on 43 of the 49 farms investigated. On the sourveld farms 14.6% of the cattle are owned by non-White servants and consist almost entirely of cross breds. The remaining 85.4% of cattle are White-owned. Of the White-owned cattle 63.9% are cross breds. This is in marked contrast with the sweet grassveld regions where pure bred cattle are in the majority. Cross bred cattle appear to be more suited to the major geographical limitation of the sourveld, i.e. poor winter grazing as a result of the relatively cold winters and the shallow, acid, infertile soil. In 1970 White-owned cross bred cattle were kept on 33 of the 49 farms. Twenty-one farmers stated the strains of cattle used in cross breeding. Most of these crosses are for the purpose of good quality beef. The Africander strain occurred on 15 farms, the Shorthorn on 13, Hereford on 8, Aberdeen Angus on 2 and Simmental on 2. Swiss, Drakensbergers, Frieslands and Jerseys are used for cross breeding on one farm each. The most common cross is the direct Africander-Shorthorn cross, which occurs on seven farms. This cross possesses the heavy, high quality beef of the Shorthorn as well as the hardiness of the Africander. On two other farms the Africander-Shorthorn cross has been crossed once again with the Hereford. Direct Hereford-Africander crosses occur on 3 farms, Hereford-Shorthorn crosses on one farm and Hereford-Simmental crosses on one farm. The excellent beef qualities of the Hereford and its tolerance to extremes of temperature are well known. Pure bred cattle comprise only 36.1% of the White-owned cattle on the 49 sourveld farms investigated in 1970. They are reared on 30 of the 49 farms. The Shorthorn is the most numerous of the pure breeds reared in the sourveld of the Bedford and Fort Beaufort divisions, accounting for 31.4% of the pure bred livestock, and occurring on 8 of the farms investigated. The relative importance of the Shorthorn amongst the pure breeds is indicated in the table below:

Breed	Number of farms where occurring	Percentage of Pure Bred Cattle
Shorthorn	8	31.4
Friesland	11	16.5
Brown Swiss	3	11.3
Hereford	3	10.4
Drakensberger	1	8.7
Guernsey	3	5.3
Jersey	4	4.2
Red Poll	1	4.2
Africander	2	3.3
Aberdeen Angus	1	2.3
All other breeds	4	2.4

The merits of some of these breeds are discussed on pages 222-226.

The importance of beef cattle in the sourveld is indicated by the fact that 21 of the 48 White farmers who reared cattle stated that they were mainly for beef, whereas only 5 farmers stated that they were mainly for dairy produce. A total of 22 farmers stated that they kept cattle both for beef and dairy produce. Beef cattle from the sourveld are marketed locally in the towns of Bedford, Adelaide, Fort Beaufort and Alice as well as in the cities of Port Elizabeth and East London.

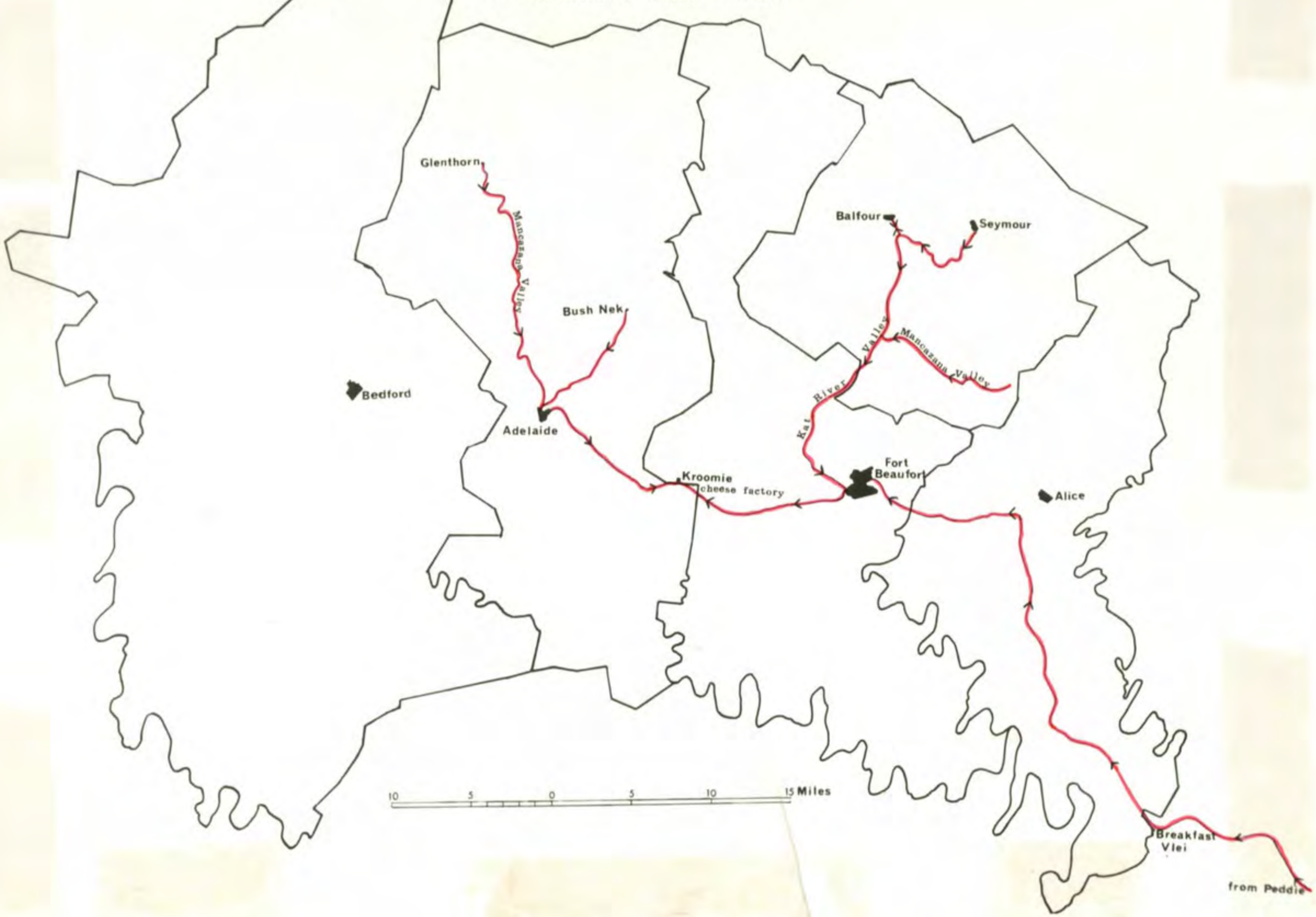
Dairy produce was sold by 32 of the 48 farmers. Cream only was sold by 21 of these farmers, milk only by 6 and both milk and cream by 5 farmers. Many of the sourveld farms are situated in relatively remote areas, thus the transport of fresh milk to market is often a major problem. The production of cream is favoured owing to its better keeping qualities. All eleven farmers selling fresh milk (6 in Stockenström, 5 in Adelaide) sell it to the Kroomie cheese factory and are on or near routes traversed daily by the factory's lorries. (See map, p. 253). All sourveld farms selling cream are situated on or near routes traversed weekly or bi-weekly by buses of the Road Transport Service of the South African Railways (see map on page 185), although some of the Stockenström farms are situated fairly close to a railway line. From Adelaide westwards most of the farmers sell their cream to the Cookhouse Creamery. East of Adelaide most of the cream is sent to Bowker's Park Creamery, King William's Town. One farm in the extreme north of the Adelaide district sells its cream to Bowker's Park Creamery, Queenstown. The analysis of sourveld cream markets per district is as follows:

	Number of sourveld farms marketing cream at		
District	Cookhouse	King William's Town	Queenstown
Bedford	1	-	-
Adelaide	4	2	1
Fort Beaufort	1	4	-
Stockenström	2	8	-
Victoria East	-	3	-
TOTAL	8	17	1

Sheep

As previously stated, sheep are reared on 44 of the 49 sourveld farms investigated. Merinos are reared on 42 of the farms and comprise 98.1% of the total number of sheep. Cross bred sheep are reared on 9 farms and account for 1.8% of the sheep population. One farm has a small flock of Corriedales which account for the

ROUTES OF LORRIES TRANSPORTING MILK
TO THE KROOMIE CHEESE FACTORY



OAT FIELDS IN THE SOURVELD

Oat field, elevation 3,050-3,250 feet, Upper Blinkwater basin, western Stockenström, May 1969. In autumn the newly germinated green oats contrasts markedly with the russet coloured Themeda triandra grass. In the background Temperate Evergreen Forest occupies the south-east facing scarp, maximum elevation approximately 4,000 feet. Grassland in the foreground is being invaded by Senecio retrorsus.

Contoured oat fields, elevation 3,400-3,600 feet. Ox Kraal, in the vicinity of the Great Winterberg, northern Adelaide district, July 1969. Small plantations of Populus deltoides var. missouriensis can be seen on the left.

remaining 0.1%. The importance of the merino is well known, and has been referred to briefly on page 227.

Goats

Goats are reared on 28 of the 49 sourveld farms investigated. 88.4% of the goats are Angoras, which are reared on 22 farms, mainly for mohair. Boer goats make up the remaining 11.6% and are reared on 11 farms, mainly to provide meat for the non-White labourers, although some are sold to butchers. There is a tendency for Angora goats to be kept on the larger farms. 44.9% of the Angoras are reared on the twelve largest sourveld farms, which have only 7.8% of the Boer goats. The twelve smallest sourveld farms investigated have only 1.7% of the Angora goats but 11.7% of the Boer goats.

Livestock Migration

It is obvious that in a region which consists mainly of unimproved grazing animal husbandry will be dependent largely on the natural vegetation. As described on pages 60 to 61, pasturage in the sourveld is excellent in spring and summer but deteriorates rapidly in autumn. Owing to the poor quality of the winter grazing, it is still customary for some farmers to move all or some of their livestock to nearby sweetveld areas, where, in contrast with the sourveld, the dry grass remains palatable and relatively nutritious throughout the winter months. A total of 17 of the 49 sourveld farmers who answered the questionnaire on agriculture indicated that they sent some of their livestock to the sweetveld during the winter. Several of those who indicated that they did not send any of their livestock to the sweetveld gave as their reason that their farms had both sour and sweet winter grazing. It is customary for owners of such farms to move their cattle from the sour grassveld camps to the sweet grassveld camps during the winter months. A total of 25 of the 49 sourveld farmers answered in the affirmative to the question "Do you own another farm?" Most of the additional farms consist mainly of sweetveld. Of the 17 farmers who stated that they send livestock to the sweetveld for the winter months, 16 also owned one or more sweetveld farms. Often the livestock is moved over long distances. Every autumn sheep from a 2,400 morgen sourveld farm in north-western Adelaide are sent 40 miles on foot to a 1,760 morgen Acacia Savannah farm in southern Adelaide, whence they return the following spring. Steers are also sent to this sweetveld farm for winter fattening before being sold. The owner of a 2,200 morgen sourveld farm in Upper Blinkwater, western Stockenström, annually sends 2,400 of his 3,000 merino ewes to his 2,600 morgen Karroid Acacia Savannah farm 40 miles away in southern Adelaide before the April-May lambing season commences. When the lambs are four to five months old the flock returns to the sourveld. The owner of a 332 morgen sourveld farm in eastern Stockenström every autumn sends part of his Merino sheep flock as well as all weaned steers to a 700 morgen Scrub Woodland farm some 34 miles distant in southern Victoria East. The shortest distance over which livestock is annually moved from a sourveld farm to a sweetveld farm is three miles.

Veld Burning

Reference was made on page 61 to the custom of removing the old unpalatable sourveld grasses by late winter or spring burning in order to make the new nutritious spring growth available to livestock. Twenty-eight of the 49 sourveld farmers answered in the affirmative to the question "Do you ever burn your veld?" When asked to state how often, the replies from 26 of the farmers ranged from "Once every ten years" to "Once every two years", the mean being once every 4.4 years. Two farmers did not state the frequency of their veld burning. One of these replied "We hope to avoid this with stock management", the other replied "Very occasionally and only for undesirable encroachment". Some of the harmful effects of veld burning have already been discussed and it is thus not necessary to repeat them. The wealthy owner of a large sourveld farm in Upper Blinkwater, Stockenström, informed the writer that the best way of removing the old grass is to spray it with molasses in autumn, thereby rendering it palatable to the livestock who graze it throughout the winter. In this way the new growth of spring is immediately made available to the animals. The livestock on this farm have their molasses and grass diet supplemented with silage and are also periodically put to graze on green oats.

Crops

During the May-July 1970 survey farmers were asked to state the approximate areas occupied by various crops during a "normal" year, as the rainfall for the twelve month period from July 1st 1969 to June 30th 1970 was below normal at all stations investigated in the region. At the farm, Surrey, in south-eastern Stockenström, where rainfall has been accurately recorded for the past eighteen years, only 78.3% of the mean annual precipitation was received during the twelve months following July 1st 1969. During this period the rainfall at Surrey had been above average in only four months, viz. July 1969, November 1969, February 1970 and June 1970. The October 1969 precipitation had approximated the average, but that of the other seven months had been below average, often considerably so.

The 1970 survey showed that cultivation takes place on 47 of the 49 sourveld farms investigated. The average sourveld farm has only 3.1% of the land under crops, partly because the rugged terrain and the thinness of the soil away from the river valleys seriously restricts the amount of arable land available. On many farms shortage of irrigation water is another limiting factor. Irrigation is practised on 43 of the 49 farms. Of the 46.7 morgen under cultivation on the average sourveld farm 22.9 morgen (49.0%) is irrigated. This is in marked contrast with the sweet grassveld farms, where more than 90% of the cropland is irrigated. Owing to the poorness of the natural grazing during winter, most of the crops grown in the sourveld are for winter fodder purposes. The area occupied by the principal crops on the 49 farms investigated is as follows:

Crop	Number of farms where growing	Percentage of total cultivated land [1]
Oats	39	44.4
Lucerne	33	24.7
Maize	20	12.7
Sown grasses	15	11.5
Barley	10	3.8
Citrus	4	1.5
Tobacco	7	1.2
Wheat	5	1.2

Other crops such as deciduous fruit (mainly apples and peaches), sorghum, potatoes, peas, beans and cabbages each occupy less than 1% of the cropland.

The winter cereals, oats, barley and wheat, occupy 49.4% of the cultivated land. Less than 30% of this portion (49.4%) is put under summer crops such as maize, sorghum and tobacco. Most of the land occupied by winter cereals lies fallow during midsummer. Over much of the sourveld, however, winter cereals are sown as early as March and remain on the land until as late as November or December, which means that the fallow period is confined only to a a short period of from two to three months, after which winter cereals are again sown. During any particular winter, however, it is customary for farmers to fallow approximately one third of the land occupied by cereals during the previous season.

The relative areas occupied by the various crops on the largest sourveld farms differ somewhat from those on the smallest sourveld farms investigated, as is shown below:

[1] Total percentage exceeds 100 owing to rotation of summer-grown maize and sorghum with other cereals, grown in winter.

Top Quartile of Twelve Farms

Crop	Number of farms where growing	Percentage of total cultivated land
Oats	8	40.3
Lucerne	9	31.5
Maize	2	4.1
Sown grasses	4	12.9
Barley	4	7.3
Citrus	Nil	Nil
Tobacco	1	3.5
Wheat	2	1.9

Bottom Quartile of Twelve Farms

Crop	Number of farms where growing	Percentage of total cultivated land
Oats	8	48.6
Lucerne	7	13.7
Maize	7	26.8
Sown grasses	2	13.4
Barley	3	2.3
Citrus	Nil	Nil
Tobacco	5	3.6
Wheat	Nil	Nil

Lucerne is more important than maize on the largest sourveld farms, whereas the converse holds true for the smallest sourveld farms. Lucerne is sensitive to acid soil. Most of the small sourveld farms do not include sweet grassveld sectors with relatively alkaline soil suitable for lucerne, whereas the large farms often do. Moreover, the largest farms are usually owned by wealthier farmers who can more readily afford the application of fertilisers to counteract the acidity of the soil where it is too high for lucerne. Another major difference between the top and bottom quartiles of the sourveld farms investigated is the percentage of farmland under cultivation. On the twelve largest farms it is only 2.2% whereas on the twelve smallest farms it is 10.1%. The relatively high percentage of cropland on the smaller farms increases the carrying capacity of the natural grassland which, as stated on page 250, is in the main overstocked.

Differences between the largest and smallest sourveld farms also occur as far as the percentage of cropland under irrigation is concerned. On the top quartile of farms 73.8% of the cropland is irrigated, compared with 42.5% on the bottom quartile. Much of the cropland on the largest sourveld farms occurs on alluvial soils in deeply entrenched rain-shadow valleys, such as the upper Mancazana and upper Koonap River valleys in the northern Adelaide and Fort Beaufort districts, where irrigation is not merely beneficial but essential. By virtue of their small size most of the farms of the bottom quartile have relatively homogeneous rainfall conditions. Moreover, they occupy positions either with south-eastern aspect or on plateaus so that rain-shadow conditions in their lowest portions are not pronounced and irrigation is thus not so essential. Irrigation is often costly, which means that the owner of a large farm usually is better able to afford it than the owner of a small farm.

Winter Cereals

The table on page 257 shows that oats occupies the largest area (44.4%) of cropland in the sourveld. Two species of oats, viz. Avena sativa and A. byzantina are grown in the region, the former being more common. During the winter months, when the natural grassland is poor in mineral salts and proteins, oats is a nutritious green fodder crop, the best time of grazing being during the tillering stage. Most of the oats, like the other winter cereals, is usually grown without irrigation. The oats is usually sown during the period March to May, i.e. in the autumn. The best green fodder return is obtained from oats sown early in the autumn as the tillering period is thus prolonged. If there are good spring rains livestock can be turned out to graze on the natural pasture and the oats they would otherwise have eaten can be harvested as a grain crop by the farmer. Grain harvesting usually takes place from October to early December. Only the grain of Avena byzantina (Algerian oats) is sold for human consumption; that of A. sativa is usually used for seed purposes or else as concentrated animal fodder.

The other winter cereals grown in the sourveld are barley and wheat, but, as can be seen on the table on page 257, they occupy only 3.8% and 1.2% of the cropland respectively. Like oats, they are grown mainly for green fodder. Barley, a species-complex of the genus Hordeum, is less tolerant of acid soils than is oats. Moreover, in early summer it is more readily damaged by hot humid weather which favours the development of black rust, Puccinia graminis. Both two-row and six-row types of barley are grown in the region. Farmers gave various reasons for preferring oats to barley as a winter fodder crop. In addition to emphasising its tolerance to acid soils, many farmers stated that they preferred oats as it stays green for a longer period than barley. Others stated that green oats is more nutritious than green barley, although this has not been proved scientifically. It has been proved, however, that oat grain is a better balanced food than any other cereal,[1] and for this reason livestock are often allowed to graze oats when it has reached the grain forming stage. Oat straw is also the best of all the cereal straws.[2] It is softer than wheat or barley straw, contains less silica and is more digestible.[3] Oat hay and oat straw from the previous season are often fed to livestock during the following autumn before the next green crop of oats is tall enough to be grazed. It has already been shown that wheat, a complex combination of the several uncertain species comprising the genus Triticum, is of minor importance in the sourveld. As winter green feed it is not as nutritious or palatable as

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[1] J.C.B. Ellis, "The Feeding of Farm Livestock", Crosby Lockwood, London, 1954, p. 121.

[2] Ibid., p. 96.

[3] Ibid.,

oats or barley. It is seriously affected by poor rainfall in August and September, whereas oats and barley withstand drought better and usually recover very well. As the wheat is so heavily grazed during the winter months only a small grain crop is obtained, provided it has not been ruined by the various fungoid diseases to which it is susceptible. The grain is not sold for flour but kept as seed for the following season. Most farmers do not favour wheat hay owing to its fibrous nature and its relatively low nutritional value.

Lucerne

Lucerne (Medicago sativa) occupies the second largest area (24.7%) of cropland in the sourveld of the Bedford and Fort Beaufort divisions. Its merits lie in its high protein content, its high yield per morgen and its perennial nature. When used in crop rotation it enriches the soil with nitrates. Lucerne thrives in dry regions where irrigation water is available, but is sensitive to acid soil. For this reason it is grown mainly on those sourveld farms which include sectors of relatively alkaline soil in their lower reaches. Indeed, most of the lucerne of the so-called sourveld farms is grown in the northern Adelaide and Fort Beaufort districts, where the upper Mancazana and upper Koonap have cut deep embayments into the highlands, with consequent rain-shadow conditions and relatively alkaline soils. Virtually all the lucerne in these rain-shadow areas, where the mean annual precipitation is approximately 22 to 26 inches per annum, is grown under irrigation. As lucerne does not do well on acid soils it is of minor importance on most farms which consist entirely of sourveld. Although it can be grown under dryland or semi-dryland conditions on such farms, successful yields can only be obtained after heavy fertilisation of the soil together with applications of lime to counteract the acidity. Another problem confronting the growing of lucerne in the wetter regions is the tendency for grass to invade and replace the crop. In such areas a field of lucerne is usually replaced by grass after three to five years. Rust and mildew also at times affect lucerne in the wetter parts of the sourveld. Most of the lucerne grown on sourveld farms is mown and made into hay for winter feeding. On some farms it is mixed with maize or sorghum and converted into silage. Very little silage is made entirely from lucerne, and in such cases from 3 to 5% molasses (60 to 100 lbs per ton) is added to provide the sugar necessary for fermentation.

Maize

Maize (Zea mays) occupies the third largest area of cultivated land (12.7%) in the sourveld. Most of the maize is grown as livestock fodder.[1] The leaves and stalks are either converted into silage for winter feeding or allowed to dry on the land, where they are grazed by livestock in early winter. Grain yields are not very good as most of the sourveld experiences the Cfb type of climate. (See page 27.) It is common knowledge that the best maize grain yields are produced in areas experiencing hot summers. It is well-known that maize does 80% of its growing by night; thus another inhibiting factor is the relatively low minimum temperatures experienced in the sourveld of the Bedford and Fort Beaufort divisions, which ranges in altitude from approximately 2,500 feet to 7,700 feet. Large portions of the sourveld experience minimum temperatures lower than would be expected for their altitude owing to temperature inversions resulting from air drainage from the Amatole-Winterberg range. Some of the maize is grown for grain to feed farm workers, who receive a "ration" of maize at regular intervals.

Sown Grasses

By sown grasses is meant those grasses which were not originally developed by man for the purpose of supplying himself with food, thus the cereals, which also belong to the grass family (Gramineae), are excluded from this category. The principal grasses sown in the sourveld for the sole purpose of supplying fodder for livestock are Italian rye grass, cocksfoot, timothy and

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[1] It is usually not irrigated, as it is mainly grown on the higher rainfall farms.

teff, although Yorkshire fog is also grown on one of the farms investigated. On several farms kikuyu grass has also been planted as a fodder crop, and, although this grass is not sown, it has been grouped with the sown grasses. Crops belonging to the category "Sown Grasses" occupy 11.5% of the cropland on the 49 sourveld farms investigated.

The sown grass occupying the largest area in the sourveld is Italian rye grass, Lolium multiflorum. It is a vigorous annual, green, palatable and nutritious in winter, and sometimes may last into a second season. Farmers who grow this crop find it one of the most nutritious of all pasture grasses, but it requires fairly high soil fertility and soil moisture in winter. The largest area occupied by sown grasses is on the farm Upper Millness, in northern Adelaide, which is owned by Warren W. Pearson. On this farm approximately 100 morgen is under Italian rye grass, which is periodically grazed by some 5,000 sheep from April to October, giving a carrying capacity of approximately 50 sheep per morgen. The sheep are put to graze on Italian rye grass for two days every three weeks during the winter months. Its high protein and mineral content enable the sheep to maintain condition on the poor natural winter grazing for the succeeding nineteen days. After each period of heavy grazing approximately three inches of irrigation water is applied to the rye grass. At present (1970) W.W. Pearson is constructing a 200 million gallon dam on one of the tributaries of the Mancazana River, which should enable him to increase the area under Lolium multiflorum.

Cocksfoot, Dactylis glomerata, is a relatively nutritious, palatable, tall, winter-green grass which is grown mainly without irrigation on a few high altitude, high rainfall farms adjacent to the Great Winterberg, where the soils remain relatively moist throughout the winter. It is grazed by livestock during winter, but also mown during summer and made into hay for winter feeding.

Timothy, Phleum pratense, is grown for hay in the vicinity of the Great Winterberg, mainly because of its resistance to low temperatures. It is not used as a pasture grass, however, since it will not stand close grazing or trampling. Because of its high moisture requirements it is grown under irrigation.

Yorkshire fog, Holcus lanatus, also a relatively nutritious winter grass, is resistant to temperatures well below freezing point. Its water requirements are, however, high. To the writer's knowledge it is grown on only one farm in the region, Fenella Falls, which is also the highest farm in the region.

Teff, Eragrostis tef, is grown on several farms. This frost-sensitive annual is a summer crop which provides one or two mowings of hay for winter. Its relatively high water requirements, approximately 25 inches from October to April, necessitate irrigation on the drier sourveld farms.

Kikuyu, Pennisetum clandestinum, is a hardy perennial occurring on a few farms, where it is regarded as a nutritious, palatable fodder grass. It is used mainly for summer and autumn grazing. In the Bedford and Fort Beaufort divisions kikuyu is seldom used for hay or silage.

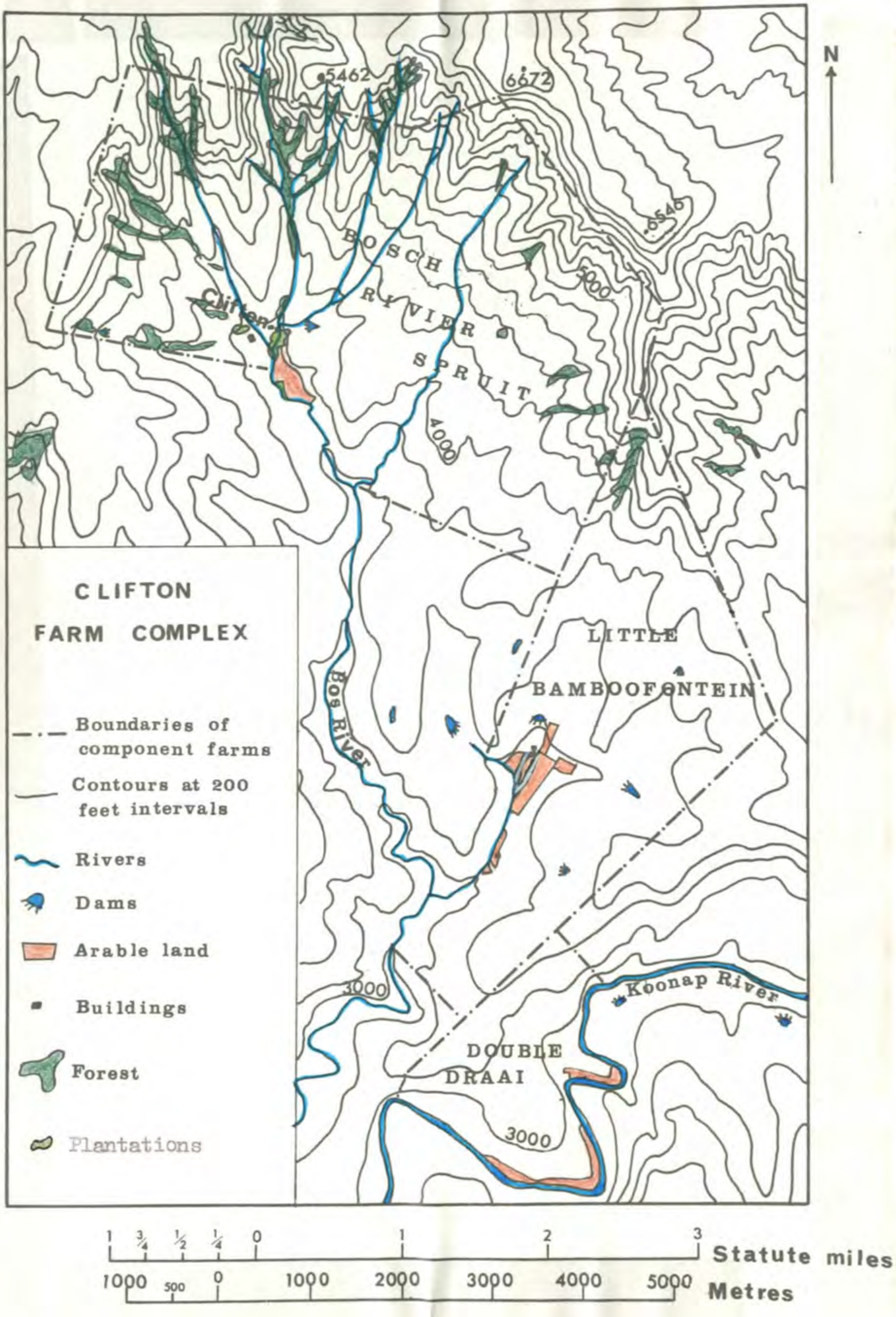
Citrus and Tobacco

Citrus and tobacco are the only other crops which occupy more than 1% of the cultivated land on the sourveld farms investigated. The Cfb climate (see page 27) experienced over most of the sourveld is not favourable for either of these crops. They are thus grown only on those sourveld farms where there is an area of sweetveld suitable for their cultivation. (See Chapters XII and XIII for climatic requirements of tobacco and citrus.) Citrus accounts for 1.5% of the cropland on the 49 sourveld farms investigated. It is a commercial crop on four farms, two of which are in Victoria East, one in Fort Beaufort and one in Bedford. Tobacco occupies 1.2% of the cropland on the 49 sourveld farms investigated. It is grown on seven of these farms, all of which are in Stockenström, where there is a strong tradition of tobacco growing.

The Clifton Farm Complex

An example of a large, well-run sourveld farm complex is Clifton, in the northern Adelaide district. The farm unit, 3,306 morgen in area, consists of the original farm, Bosch Rivier Spruit together with two adjoining farms, Little Bamboesfontein and Double Draai. The owner is Errol Knott Moorcroft, B.A.Hons. (Rhodes), B.Litt. (Oxon.). E.K. Moorcroft, although only thirty years old in 1970, is the great-grandson of an 1820 British settler, his great-grandfather having emigrated to South Africa at the age of one in 1820. The Bosch Rivier Spruit farm came into the possession of the Moorcroft family in 1865 when the present owner's grandfather, S.S. Moorcroft, purchased it. The present farm unit ranges in altitude from approximately 2,850 feet to 6,400 feet.

The Clifton homestead is situated on Bosch Rivier Spruit, which is the largest of the three farms comprising the Clifton farm unit. Bosch Rivier Spruit, which is 1,634 morgen in area, ranges in altitude from 3,550 feet to 6,400 feet. It is almost entirely situated on or below an amphitheatre-like scarp which separates the Winterberg plateau from the Koonap River valley. No less than four perennial streams flow down the scarp and unite to form the Bos River, which is a tributary of the Koonap. No long term precipitation data are available for Bosch Rivier Spruit, but the present owner estimates that the mean annual precipitation ranges from approximately 26 inches at the Clifton homestead, elevation 3,800 feet, to more than 40 inches in the highest areas. Much of the midwinter precipitation in the higher areas occurs in the form of snow. At the Clifton homestead snow lies for at least one day per annum. Although Bosch Rivier Spruit consists almost entirely of sour grassland, there are narrow strips of Temperate Evergreen Forest occupying some of the deep ravines, mainly on the wetter south facing and east facing scarps of the amphitheatre. The farm derives its name from the presence of these forests.


CLIFTON
FARM COMPLEX
Boundaries of component farms
Contours at 200 feet intervals
Rivers
Dams
Arable land
Buildings
Forest
Plantations
N
5462
6672
6546
5000
4000
3000
3000
3000
BOSCH RIVIER SPRUIT
Clifton
LITTLE BAMBOOFONTEIN
Bos River
Koonap River
DOUBLE DRAAI
1 3/4 1/2 1/4 0 1 2 3 Statute miles
1000 500 0 1000 2000 3000 4000 5000 Metres

Farm boundary on a steep south-east facing slope, elevation approximately 5,300 feet to 5,600 feet, in the vicinity of Post Retief, northern Fort Beaufort district, April 1962. The land to the right of the fence consists of a community of the large tussocky sedge, Tetraria triangularis, and grass, mainly Elyonurus argenteus. The terminal stage of succession is represented to the left of the fence by a consociation of Cliffortia paucistaminea. This consociation was later destroyed by burning, and the succession reverted to a subclimax community of Tetraria triangularis and grass.

The Maasdorp valley, $1\frac{1}{2}$ miles north of Balfour, Stockenström, April 1966. This is a region of small holdings where oats, maize and tobacco are the principal crops. The Katberg can be seen in the right background.

To the south-east of the Bosch Rivier Spruit is Little Bamboesfontein, the two farms having a common boundary for approximately 1.4 miles. The farm Little Bamboesfontein ranges in altitude from 5,525 feet in the north to 3,000 feet in the south and occupies an area of 1,261 morgen. The natural vegetation consists mainly of sour grassland, but there is a small area of sweet grassland occupying the lowest portion of the farm, i.e. the area below approximately 3,400 feet. There is only one small strip of Temperate Evergreen Forest occurring for less than a mile along one of the ravines. The mountain bamboo, <u>Arundinaria tessellata</u>, forms thickets in the higher portions of moist, sheltered ravines on both Bosch Rivier Spruit as well as Little Bamboesfontein, the latter farm having been named after it. In contrast with other farms in the region, <u>Arundinaria tessellata</u> attains heights exceeding ten feet. (See page 67.)

The third farm of the Clifton complex is Double Draai, which has a common boundary with Little Bamboesfontein for approximately 0.94 miles in the north. Its southern boundary is the Koonap River, the farm having derived its name from two fairly prominent meanders on the river. Double Draai ranges in altitude from approximately 3,450 feet on its northernmost boundary to approximately 2,850 feet in the extreme south-west, the area being 411 morgen. Almost all of the farm is occupied by the Acacia Savannah vegetation type and is sweet grassland.

In addition to the three farms comprising the 3,300 morgen Clifton complex, E.K. Moorcroft in partnership with his brother, S.L. Moorcroft, ownsthe farm Spioen Kop, 1,600 morgen in area, which is situated twelve miles from Clifton homestead in the northern Fort Beaufort district. The northern boundary of Spioen Kop is the Koonap River, from which it extends southwards to near the summit of the Little Winterberg. The farm ranges in altitude from approximately 3,000 feet in the north-east to 5,169 feet in the south-west. The northern portion consists of Acacia Savannah, whereas the remainder consists of Sour Grassland.

During the summer months some 2,000 Merino sheep, 500 Shorthorn cattle and 340 Angora goats are grazed on the three farms of the Clifton unit. There are also 40 cattle owned by Bantu employees. During the winter months, when the sour grasses are low in nutritional value, some 500 sheep in lamb as well as 100 cows are moved to the farm Spioenkop in order to graze on the nutritious dry sweetveld grasses of the Acacia Savannah which occupies the Koonap River valley. The sweetveld on Spioen Kop is normally not grazed by domestic livestock during the summer. The sweetveld camps on the Little Bamboesfontein and Double Draai components of the Clifton complex are also rested during summer, so that they can provide nutritious grazing for a portion of the livestock remaining on Clifton during these seasons. More than 50% of the Clifton livestock remains, however, on sour grassveld for the winter half year. The protein and mineral salt deficiencies in the sour grasses are counteracted by allowing the livestock to feed from troughs containing protein and mineral-rich licks. Several troughs containing licks are placed in each 200 to 300 morgen camp. E.K. Moorcroft maintains that his livestock are able to maintain their condition and, in some cases, even improve it if their diet of dry, sour grass is supplemented with licks. When the writer visited Clifton at the end of June, 1969, all the livestock appeared to be in excellent condition. Each camp is also provided with several watering places. These are mainly earth dams, but in some camps there are concrete dams into which water is pumped from the Bos River.

The only crop grown on Clifton is oats, which is used mainly as green feed to supplement the diet of livestock during winter. During autumn, winter and spring it occupies approximately 60 morgen of land on the Clifton complex as well as 6 morgen on Spioen Kop, all being under irrigation. Only 13 morgen of land on Bosch Rivier Spruit is under cultivation. The oat fields occupy the deep, relatively fertile, dolerite-derived alluvium south of the Clifton homestead on the banks of the Bos River, which also provides the necessary irrigation water. On Little Bamboesfontein there is approximately 27 morgen of arable land of similar soil, irrigation water being provided by a tributary of the Bos River. On Double Draai some 20 morgen of alluvium bordering the Koonap River is also put under oats. The oats is sown in March, and cows with calf as well as some of the ewes with young lambs graze on it at intervals from May until September. The oats grows rapidly in October and is harvested in November, mainly for hay, although a small portion of the harvested oats is threshed to provide seed for sowing during the following autumn. The oat hay is used as fodder for cows with young calves during the following winter. All the arable land lies fallow during the three midsummer months of December, January and February.

The ewes on Clifton are mated to lamb in autumn as the autumn rainfall is more reliable than the spring rainfall, resulting in better quality grazing. Autumn lambs are also less susceptible to infection by internal parasites which are prevalent in spring. The sheep are shorn annually, in October or November, when the danger of severe cold snaps is over. E.K. Moorcroft states that each adult sheep yields approximately ten to twelve pounds of wool. The Angora goats are also shorn in spring. The Shorthorn cattle on Clifton are reared entirely for beef purposes, being marketed in Adelaide and in Port Elizabeth.

Livestock diseases are not a serious problem on Clifton. The sheep are periodically immunised against pulpy kidney, blue-tongue and gall sickness. (See page 229.) The cattle are also inoculated against gall sickness. The latter disease is, however, rare in livestock which are entirely grazed on the Clifton complex.

Approximately 180 morgen of steep terrain in the north-east of Clifton is fenced off for permanent protection from grazing by livestock. Here Passerina montana (See page 65) and Helichrysum spp., mainly H. splendidum, are dominant. This area is never burnt deliberately, and it would appear that this plant association, i.e. a macchia community, is the natural climax for ungrazed high

altitude portions of the farm. In the moist, sheltered ravines the tall shrub Leucosidea sericea (ouhout) is becoming dominant and appears to be the pioneer species in the establishment of Temperate Evergreen Forest. Associated with L. sericea are Buddleia salvifolia, Arundinaria tessellata, Rubus pinnatus and R. rigidus.
Mr. Moorcroft states that on one occasion this area was swept by fire. This was in "the late nineteen fifties" when a fire, started on the adjacent farm, Fenella Falls, swept out of control as a result of a strong berg wind which carried it south-eastwards into Clifton. On this occasion grazing areas were also destroyed as well as some two thousand sneezewood fencing poles and "many sheep".

On the remainder of Clifton, Tetraria triangularis (Cyperaceae), locally known by the Xhosa name, Rwashu, is dominant above approximately 4,800 feet. Livestock will eat it only when it is young and tender. Rwashu appears to be a sub-climax, and if all fire, natural or deliberate, were to be eliminated, the climax would be macchia. The Rwashu sub-climax can, however, be reduced to a grassland association dominated by Themeda triandra as a result of burning and cattle grazing. It is for this reason that veld burning takes place in the higher reaches of Clifton approximately once in a decade. Once a grassland community has been established in the high altitude portions of the farm sheep can be introduced successfully. The ecological processes operative can be summarised by the following formula: $(R + F + C) - C = G$, i.e. Rwashu plus fire plus cattle, followed by a removal of the cattle, results in grassland. If sheep (S) are used instead of cattle, the ecological process may be expressed as follows: $R + F + S = K$, where K represents Karroo.

Let us examine the processes summarised by the first formula. Once the Rwashu is burnt in early spring, cattle are grazed on its tender new shoots. At this stage the grass is too short to be eaten by cattle. As soon as the grass is long enough to be eaten by cattle they are removed. The Rwashu grows very slowly as a result of its growing points having been nipped off, whereas the grass now grows rapidly as a result of the rapidly increasing temperatures and length of day. During the following spring the grass continues to spread by self seeding, so that after two consecutive summers of protection from grazing, a grassland community replaces the original Tetraria triangularis community. If sheep are introduced to Rwashu-dominant areas after burning they ignore the less palatable Rwashu and concentrate on the young grass which, unlike cattle, they are able to eat when in a very short state. The ground between the burnt Tetraria tussocks becomes bare and is colonised by woody shrublets, mainly the karroid shrub Chrysocoma tenuifolia, together with Selago corymbosa, Senecio retrorsus and various Helichrysum spp. Tetraria triangularis also increases in area as sheep will not eat it when slightly long. Indeed, on a nearby farm where sheep are grazed after burning, this mixed Rwashu-shrub community is dominant over large areas.

Most of the patches of indigenous forest which occur on the Bosch Rivier Spruit and Little Bamboesfontein farms of the Clifton complex are not grazed by livestock. The larger portions are fenced in to protect them from browsing. Sponge areas adjacent to streams are also protected in this manner. The forest community on Clifton is not as rich in species as that making up the Temperate Evergreen Forest further east. (See pp. 68 - 71.)
The principal species on Clifton appear to be: Olea africana, Halleria lucida, Buddleia salvifolia, B. auriculata, Kiggelaria africana, Leucosidea sericea, Ptaeroxylon obliquum, Podocarpus latifolius, P. latifolius and Scolopia zeyheri.
Grazed areas below 4,200 feet are being rapidly colonised by Leucosidea sericea, a member of the family Rosaceae, which occurs only as isolated specimens in highland areas to the east of the Great Winterberg. This tall shrub or small tree appears to be the pioneer of forest in sheltered ravines above 4,200 feet as well as in more exposed areas below this altitude. On Clifton L. sericea is felled at regular intervals to prevent it from ousting the grassland. On the more heavily grazed farms, Ox Kraal and Waai Kraal,

lying immediately south of Bosch Rivier Spruit, L. sericea shows no sign of spreading.

A major problem on Clifton is the destruction of grassland by harvester termites, Trinervitermes havilandi, which cut grass into short lengths and carry it into their mound-like nests. Termitaria, some of which attain heights of more than three feet, are abundant in the lower portions of the sour grassveld areas of the Clifton complex, and even more so on the adjacent farms Ox Kraal and Waai Kraal, which are more heavily grazed than Clifton. In June 1969 the termitaria had been broken open on these farms in an attempt to get the termites killed by the relatively severe frost which is regularly experienced at this season. An indication of the amount of damage done by termites is given by an officer of the Grootfontein Agricultural College who, on one occasion, removed from one broken termitarium of average size a total of 10 lbs. of dry grass.[1] According to this officer, sheep can be kept alive during droughts on two pounds of dried grass per day.[2] In 73 such ant-heaps there may consequently be stored enough grass to keep alive one sheep for one year.

Assistance in the control of termites on Clifton is provided by the aardwolf, Proteles cristatus. This hyaena-like animal lives mainly on insects and consumes large quantities of termites. Unlike the Hyaena, the aardwolf has weak jaws with enamelless molars which cannot bite together, although it does possess canine teeth, which are probably used in self defence. Because of its basic diet of insects the aardwolf is often first on the scene when an animal dies, snuffling around the carcase for termites and other "undertaker" insects. Many farmers, seeing the aardwolf in this compromising position, conclude that it must have been the aardwolf which killed the animal, and shoot it in the traditional manner. The stomach of a dead aardwolf, however, is usually found to be filled mainly with termites, but also contains locusts and beetles,

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1 "Eradicating Ant-Heaps", Farmer's Weekly, August 7, 1968, p. 37.
2 Ibid.

and, sometimes, birds' eggs or carrion. It is for this reason that aardwolfs are protected on Clifton. On two occasions E.K. Moorcroft has seen aardwolfs consuming the carcasses of newly born lambs. He cannot, however, prove whether they had killed the lambs or were merely acting as scavengers. The antbear or aardvark (Orycteropus afer), a stocky and powerful pig-like animal with a long tubular snout, long ears and thick tapering tail, is also protected on Clifton owing to its diet of termites and ants. One disadvantage is that it burrows under fences, allowing the entry of jackals from neighbouring farms.

The black-backed jackal, Thos mesomelas,[1] formerly caused considerable losses amongst the sheep on Clifton, but, after more than a century of relentless hunting and trapping, this predator has been virtually exterminated. All the camps on Clifton are fenced with jackal-proof wire mesh to prevent the entry of jackals. They do, however, occasionally gain entrance by burrowing under the fences or by utilising pre-existing antbear holes.

It is the policy to protect all indigenous antelope on the Clifton estate, where grey duiker (Silvicapra grimmia), steenbok (Raphicerus campestris), klipspringer (Oreotragus oreotragus), grey rhebuck (Pelea capreolus) and mountain reedbuck (Redunca fulvorufula) appear to be fairly numerous.

Although parts of the farm are suitable for afforestation by exotic trees, timber production is negligible. The only exotic of economic importance in the sourveld of the northern Adelaide district is Populus deltoides var. missouriensis, which is locally referred to as the match poplar. There are approximately 8 morgen of this poplar on the Clifton complex; one plantation of 5½ morgen is on Bosch Rivier Spruit, the other of some 2½ morgen is on Little Bamboesfontein. Populus deltoides var. missouriensis requires deep, moist soil and both plantations are situated on alluvium flanking the Bos River and one of its tributaries. The trees are periodically felled and sold for the manufacture of matches, regeneration being rapid.

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[1] Synonymous with Canis mesomelas.

Clifton is typical of the large, prosperous sourveld farms of the northern Adelaide and Fort Beaufort districts. Its economy is based almost entirely on the sale of wool, mohair and beef cattle. Because of its large size Clifton may be regarded as atypical of the sourveld region as a whole, but its significance lies in the judicious grazing management system practised on the farm, which enables the natural vegetation to be utilised at almost full potential without any deterioration in its condition and without the occurrence of soil erosion.

CHAPTER XII

THE SWEETVELD FARMS

In the Bedford and Fort Beaufort divisions sweet grasses usually grow where the mean annual precipitation is approximately less than 26 inches. (See pp. 58-59). These grasses are dominant in the Acacia Savannah, Sweet Grassland and Lowland Karroid Tussock Grassland vegetation types as well as over much of the Scrub Woodland, where extensive clearing of scrub has occurred. (See p. 91.) It was decided that all farms of which more than 50% consists of the above mentioned vegetation types should be classified as sweet grassveld. The Fish River Scrub is poor in grasses, but, because of its nutritious succulent grazing, (see p. 93) it is usually regarded by farmers as sweetveld. In the Bedford and Fort Beaufort divisions the Fish River Scrub occurs on farms which consist predominantly of Scrub Woodland; on no farm in the region does it occupy more than 50% of the area. It was decided not to include Highland Karroid Grassland (see pp. 79-82) in the sweetveld, as it occurs only in the higher portions of the predominantly karroid farms of the Baviaans River valley.

According to the definition above, a total of 71 sweet grassveld farms was sampled. Their distribution is as follows:

District	Number of farm units
Bedford	11
Adelaide	15
Fort Beaufort	14
Stockenström	15
Victoria East	16
	71

The mean area of the 71 sweetveld farms sampled is 1,455 morgen, which is 28 morgen less than the mean area of the 49 sourveld farms sampled. The largest of the sampled sweetveld farms is 4,662 morgen in area and is situated in the Fort Beaufort magisterial district. The smallest of the sampled farms, only 13½ morgen in area, is an irrigation holding on the outskirts of Alice in Victoria East. More than half the sweet grassveld farms sampled are below the average of 1,455 morgen, the median farm size being 1,121 morgen. The top quartile of 17 farms exceeds 2,000 morgen and averages 3,147 morgen. Six of these are in Bedford, two in Adelaide, five in Fort Beaufort, three in Stockenström and one in Victoria East. The four largest sweetveld farms are between 4,089 and 4,662 morgen in area. The bottom quartile of farms is less than 600 morgen and averages 254 morgen. Ten of these are in Stockenström, three in Fort Beaufort, two in Adelaide and two in Victoria East.

Livestock

The 1970 questionnaires revealed that cattle are reared on all of the 71 sweetveld farms sampled, sheep on 42 farms and goats on 36 farms. Angora goats are reared on 21 farms and Boer goats are also reared on 21 farms. The average sweetveld farm of 1,455 morgen has 178.2 cattle, 727.8 sheep and 174.0 goats, of which 142.9 are Angoras and 31.0 are Boer goats. This is equivalent to a total of 328.5 cattle units (see p. 249) per farm, giving an average of 4.6 morgen per large stock unit. The Agricultural Extension officers in Fort Beaufort and Adelaide recommend from 4 to 6 morgen per cattle unit in the northern submontane peneplain portion of the sweetveld which is bisected by the road from Bedford to Alice. The Extension Officer at Adelaide states that this strip of sweet grassveld, where *Themeda triandra* and *Setaria neglecta* are dominant, "is generally regarded as of the best grazing in the country."[1] The recommended rate

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[1] From correspondence with A.E. du Plessis, Senior Technical Officer, Dept. of Agricultural Technical Services, Adelaide.

of stocking in the rugged intermontane valleys north of the peneplain is 6 morgen per cattle unit. In the sweet grassveld and Scrub Woodland in the extreme south of the Bedford and Fort Beaufort divisions there should be a minimum of 8 to 9 morgen per large stock unit. In terms of cattle units the average sweetveld farm has 178.2 cattle, 121.3 sheep and 29.0 goats. Farms of the top quartile have 4.6 morgen per cattle unit, whereas those of the bottom quartile have only 3.3 morgen per cattle unit. The most favourable stocking rate is on the median 50% of farms, where there is a ratio of 5.3 morgen per large stock unit.

In 1970 cattle were reared on all of the top quartile of 17 farms, sheep on 14 of these farms and goats on 11 farms. All 11 of these farms have Angoras, but only four carry Boer goats. The average top quartile farm, which is 3,147.0 morgen in area, carries 331.2 cattle, 1,769.9 sheep (295.0 cattle units) and 377.5 goats (62.9 cattle units). 91.1% of the goats on the top quartile farms are Angoras. The bottom quartile of 17 farms, which have an average area of only 253.8 morgen, each carry an average of 44.9 cattle, 157.1 sheep (26.2 cattle units) and 31.9 goats (5.3 cattle units). Cattle are reared on all the bottom quartile farms, but sheep on only seven and goats on only eight of these farms. All the goats on the bottom quartile farms are Boer goats.

<u>Cattle</u>

White-owned cattle are kept on all but three of the 71 sweetveld farms investigated. The three farms without White-owned cattle have cattle belonging to Bantu servants. Bantu and Coloured employees rear cattle on 54 of the 71 farms investigated. Non-White servants own 10.9% of the cattle, which consist almost entirely of cross breds. The remaining 89.1% of the cattle are White-owned. Of the White-owned cattle 71.0% are pure bred. This is in marked contrast with the sourveld, where cross breds are in the majority. In 1970 pure bred cattle were kept by Whites on 56 of the 71 sweetveld farms investigated, but White-owned cross bred cattle were kept on only 28 farms. The Shorthorn is the most numerous of the pure breeds reared in the sweetveld of the Bedford and Fort Beaufort divisions, accounting for 47.2% of the pure bred cattle, and occurring on 19 of the farms investigated. Frieslands, although less numerous, occur on more farms. They comprise 34.2% of the pure bred cattle and occur on 29 farms. The relative importance of the various White-owned breeds is indicated in the table below:

Breed	Number of farms where occurring	Percentage of Pure Bred Cattle	Percentage of All Cattle
Shorthorn	19	47.2	33.5
Friesland	29	34.2	24.3
Africander	6	9.0	6.4
Hereford	5	6.5	4.6
Bonsmara	1	1.9	1.3
Jersey	4	0.6	0.4
Aberdeen Angus	1	0.6	0.4

Of the 68 White farmers in the sweetveld who rear cattle, 16 stated that they are kept mainly for beef, 12 that they are mainly for dairy produce and 40 that they are for both beef and dairying. The suitability of the Shorthorn and Friesland breeds both for beef and dairying was discussed on pages 222-225.

Beef cattle from the sweetveld, like those of the sourveld, are marketed locally in the towns of Bedford, Adelaide, Fort Beaufort and Alice, as well as in the cities of Port Elizabeth and East London. Dairy produce is sold by 53 of the 68 farmers. Cream only is sold by 27 of these farmers, milk only by 16, and both milk and cream by 10 farmers. Transport of fresh milk and cream is less of a problem than in the sourveld as many farms in the northern portion of the sweetveld are situated on or near the west-east railway line and tarred road from Cookhouse to King

William's Town. This area is also served by lorries which daily collect milk for the cheese factory at Kroomie. (See map on page 253.)

A total of 21 farmers sell milk to the Kroomie cheese factory. One of these farmers is in Bedford, six in Adelaide, four in Fort Beaufort, eight in Stockenström and two in Victoria East. A total of five farmers sell milk for domestic consumption in nearby towns. One of these is in Bedford, one in Adelaide, two in Fort Beaufort and one in Victoria East.

From Adelaide eastwards most of the farmers sell their cream to Bowker's Park Creamery, King William's Town. The analysis of sweetveld cream markets per district is as follows:

	Number of sweetveld farms marketing cream at	
District	Cookhouse	King William's Town
Bedford	3	2
Adelaide	1	5
Fort Beaufort	1	6
Stockenström	-	6
Victoria East	-	13
Total	5	32

Sheep

As previously stated, sheep are reared on 42 of the 71 sweetveld farms investigated. Merinos are reared on 33 of the farms and comprise 93.0% of the total number of sheep. Cross breds are reared on 13 farms and account for 5.9% of the sheep population. Three farms have Dorpers, which account for the remaining 1.1%. The Dorper is a hardy, mutton beeed which thrives in the semi-arid and arid areas of South Africa. The three farms on which Dorpers are reared are situated in the relatively arid Scrub Woodland of southern Fort Beaufort and Victoria East. The importance of the merino has been discussed briefly on page 227.

Many farms in the Scrub Woodland sectors of the sweetveld do not rear sheep owing to the prevalence of black-backed jackals, Canis mesomelas.[1] On 14th October, 1966, a Hound Training Station was officially opened at Adelaide.[2] The station was originally conceived primarily for the advanced training of hounds in the hunting of jackals in the Adelaide and Fort Beaufort magisterial districts, but its present function is one of predator control throughout the Eastern Cape. During the 1968-69 season 40 trained jackal-hunting hounds were sold to the public, but the demand still exceeds the supply.[3] The Adelaide Hound Training Centre also makes coyote getters (traps baited with cyanide) available to farmers. Unfortunately coyote getters do not result in the death of black-backed jackals only. Thus during the 1968-69 season coyote getters purchased from the Adelaide centre not only killed 33 black-backed jackals but also 32 harmless silver jackals (Vulpes chama), 11 mongoose, 8 genets, 18 meercats, one aardwolf, one crow, one ground hornbill and one wild cat, as well as twelve dogs.[4] It is obvious, therefore, that hounds rather than poison must be used in the control of the black-backed jackal if the present ecological balance is to be maintained.

Goats

Angoras account for 82.2% of the goats on the sweetveld farms investigated, the remaining 17.8% consisting of Boer goats. Most of the Angoras are kept on the large farms; 92.8% of the Angoras are reared on 11 farms in the top quartile of 17. As shown on page 277, Angoras do not occur on the bottom quartile farms.

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[1] Synonymous with Thos mesomelas.

[2] Dept. of Nature Conservation, Annual Report No. 23, 1966, p.105.

[3] Ibid., No. 25, 1969, p.144.

[4] Ibid., p.146.

Kudu

No discussion of livestock farming in the sweetveld would be complete without reference to the kudu, Tragelaphus strepsiceros. This large antelope, approximately five feet tall, is abundant in the Scrub Woodland and Fish River Scrub. The Fort Beaufort Divisional Council recently estimated that there are approximately six thousand kudu in the division, which includes the magisterial districts of Adelaide, Fort Beaufort, Stockenström and Victoria East.[1] No data are available for the Bedford Divisional Council area. It is the policy of the divisional councils to protect kudu, which can be shot only by permit. In 1966 the Fort Beaufort Divisional Council considered 124 applications to shoot 734 kudu and granted permission to shoot 536.[2]

On some Scrub Woodland and Fish River Scrub farms the number of kudu approximately equals the number of cattle. An example of such a farm is Kingston, in southern Victoria East, which is owned by E.G. Cockroft. Kingston, a 1,600 morgen farm, ranges in altitude from a maximum of 1,790 feet on the submontane peneplain to a minimum of less than 600 feet in the Great Fish River valley approximately one mile below the confluence of the Fish and the Kat. These two rivers form the western and southern boundaries of the farm. (See map, page 246.) Only a small portion of the farm, viz. the area above 1,600 feet, consists of Acacia Savannah. The area below this altitude consists of Scrub Woodland or Fish River Scrub, the former occurring above approximately 900 feet, the latter below this altitude.

Kingston is well-known for its pedigree Africander and Dairy Shorthorn cattle, which total 165 in number. No sheep or goats are kept on the farm. No crops are grown on Kingston, the indigenous vegetation being the sole source of livestock fodder.

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1 "Eastern Province Herald", 3 May, 1966.

2 Ibid.

The owner estimates that there are approximately 150 kudu on Kingston, and that these animals consume almost 50% of the farm's grazing. Although it is the policy of the owner to practise rotational grazing, kudu regularly jump fences of paddocks which are meant to be rested. These antelope inflict most damage in the lower portions of Kingston where they favour the dominant Portulacaria afra, this highly nutritious shrub (see pp. 88 and 93) being the major source of cattle fodder. In the higher parts of Kingston, where Portulacaria is less common, the kudu are non-selective browsers of leaves, twigs and pods of a great variety of trees and shrubs, and the competition with cattle is less severe. Grass is relatively abundant in the highest parts of Kingston, but the kudu apparently do not consume much of it.

Livestock Migration

On pages 254-255 reference was made to the winter migration of livestock from the sourveld to the sweetveld owing to the poor quality of the sourveld grasses during the winter months. In contrast with the sourveld, the sweetveld grasses remain nutritious throughout the year, even when they are dry. They are thus often subjected to continuous heavy grazing which can lead to serious deterioration of the natural veld. (See pp. 99, 101.) Most farmers practise systems of rotational grazing which provide for the exclusion of livestock from a portion of the farm for all or part of the summer growing season. Some farmers rest their grazing by sending livestock to the sourveld during the summer months. A total of 18 of the 71 sweetveld farmers who answered the questionnaire on agriculture indicated that they sent some of their livestock to the sourveld during the summer. Several of those who indicated that they did not send any livestock to the sourveld gave as their reason that their farms had both sweet and sour summer grazing, the livestock being grazed on the former during the winter and on the latter for part of the summer.

No less than 50 of the 71 sweetveld farmers answered in the affirmative to the question "Do you own another farm?". 44 farmers have their additional farms, totalling 70 in number, detached from the home farm; the distances of these farms from the homestead on the main farm range from one mile to 270 miles. Most of the additional farms are in the Bedford and Fort Beaufort divisions, but six farmers own sourveld in the Cathcart district. Two Victoria East farmers own land in the adjacent Peddie district. Three farmers in Fort Beaufort and Victoria East own additional farms in adjacent Albany. The only other district in which the local sweetveld farmers own land is Hanover, the farm in this district being situated 270 miles from the home farm in Stockenström.[1] A total of 16 of the 18 farmers who stated that they send livestock to the sourveld for the summer months also own one or more sourveld farms. All the sweetveld farmers answered in the negative to the question "Do you ever burn your veld?". This is in marked contrast with the sourveld, where more than half the farmers practise veld burning.

Crops

The 1970 survey showed that cultivation takes place on 56 of the 71 sweetveld farms investigated. The average sweetveld farm has only 2.9% of the land under crops. All but four of the crop-growing farms practise irrigation; the four farms which do not practise irrigation are relatively high rainfall farms situated near or on the boundary zone separating sweetveld from sourveld. Of the 41.6 morgen under cultivation on the average sweetveld farm 37.7 morgen (90.5%) is irrigated. This is in marked contrast with the sourveld farms, where less than 50% of the cropland is irrigated. The area occupied by the principal crops on the 71 sweetveld farms investigated is as follows:

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[1] If the farm in the Hanover district, acquired by inheritance, were to be excluded, the greatest distance of any additional farm from the home farm is 58 miles.

Crop	Number of farms where growing	Percentage of total cultivated land
Lucerne	44	37.5
Citrus	29	28.4
Oats	36	17.2
Maize	17	5.1
Sown grasses	13	3.5
Barley	10	1.8
Tobacco	4	1.3

Other crops such as sorghum, potatoes, peas, beans, cabbages, pumpkins, cotton and avocado pears each occupy less than 1% of the cropland.

The relative areas occupied by the various crops on the largest sweetveld farms differ somewhat from those on the smallest sweetveld farms investigated, as is shown below:

Top Quartile of Seventeen Farms

Crop	Number of farms where growing	Percentage of total cultivated land
Lucerne	14	56.7
Citrus	9	27.4
Oats	8	14.6
Maize	4	6.2
Sown grasses	4	5.5
Tobacco	Nil	Nil
Barley	4	2.1

Bottom Quartile of Seventeen Farms

Crop	Number of farms where growing	Percentage of total cultivated land
Lucerne	9	36.6
Citrus	5	32.3
Oats	11	19.6
Maize	6	6.1

Crop	Number of farms where growing	Percentage of total cultivated land
Sown grasses	5	4.3
Tobacco	3	5.5
Barley	Nil	Nil

The tables above show that lucerne occupies a much greater proportion of arable land on the larger farms than on the smaller ones. They also show that most of the tobacco is grown on the smaller farms.

Lucerne

The tables above show that lucerne (Medicago sativa) occupies the largest area (37.5%) of the cropland on the sweetveld farms investigated. The soils of the sweetveld are relatively alkaline and thus favourable for the cultivation of this crop, the merits of which are discussed on pages 261-262. All the lucerne in the sweetveld is irrigated, as its water requirement in this region, which is the thermal homoclime of the south coastal interior of California, is approximately 37 inches per annum.[1] As in the sourveld, most of the lucerne is mown and made into hay for winter feeding, although a certain proportion is used as green feed during summer, particularly when the natural grazing is poor as a result of drought. To produce good quality hay the lucerne is first mown when about ten per cent of the plants are in flower. This usually occurs in October. In the sweetveld lucerne which receives adequate irrigation and is not grazed yields about five mowings of hay per season, compared with only two to three mowings in the sourveld. A yield of approximately two tons per morgen is regarded as a good average for the sweetveld, yields in the sourveld being slightly less. Care is taken that the last mowing should not be later than early April. This ensures that the lucerne can "grow out" to a

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[1] O.W. Israelson & V.E. Hansen, "Irrigation Principles and Practices", Wiley, New York, 1962, p. 261.

height of approximately four inches before the advent of the first frost. In this manner the root system can be maintained through the winter. The average life of a lucerne field in the sweetveld is between five and seven years.

Citrus

Citrus occupies the second largest area of cultivated land (28.4%) on the sweetveld farms investigated. It is grown under irrigation in the major river valleys, particularly those of the Kat and Tyume (see p. 305 .) Citriculture in the Bedford and Fort Beaufort divisions is discussed in detail in Chapter XIII.

Oats

Oats (Avena sativa and A. byzantina), which is the leading crop of the sourveld, is the third most important crop of the sweetveld, where it occupies 17.2% of the cultivated land. The merits and cultivation of this crop, with particular reference to the sourveld, are discussed on pages 259-260. Although the sweetveld grasses remain relatively nutritious throughout the winter, dairy cows and ewes with young lambs require supplementary feed if they are to maintain good milk production. During the winter months oats is a nutritious green fodder crop, and has the added advantage of requiring only a small amount of irrigation water. Normally good oat crops are obtained if the normal rainfall is supplemented by approximately one inch of irrigation water per month from May to September. On some of the higher rainfall farms of the sweetveld oats is grown without irrigation, although growth is slow during months of subnormal rainfall, and the crop may even die.

Maize

Maize (Zea mays) is the fourth most important crop of the sweetveld, where it occupies 5.1% of the cultivated land on the farms investigated. Although temperature conditions in the sweetveld are more favourable for maize than in the sourveld (see page 262), it occupies a much smaller percentage of cropland in the former region than in the latter, as lucerne provides a better yield of livestock fodder. Only a small proportion of the maize is grown for grain to feed farm workers. In contrast with the sourveld farms, the maize on the sweetveld farms is irrigated, which also adds to the cost of production.

Sown grasses

Sown grasses are also far less important on the sweetveld farms than on the sourveld farms. They occupy only 3.5% of the cropland on the 71 sweetveld farms investigated. There is no great need for artificial pastures, as the natural sweetveld remains relatively palatable and nutritious throughout the year. It is likely to produce as good grazing as any artificial pasture after the first year following its establishment except under conditions of high soil moisture and soil fertility.

The two most important "sown" grasses in the sweetveld are Rhodes grass and Napier grass. Rhodes grass, *Chloris gayana*, which probably originated in Rhodesia,[1] is used as a pasture and hay grass on several sweetveld farms, where the warm to hot summer temperatures and relatively alkaline soils favour its growth. During a summer experiencing average rainfall conditions it can produce a good crop after only two or three irrigations of some two inches each.

Pennisetum purpureum, commonly known as Napier, Uganda or elephant grass, is a very tall bunch grass introduced from tropical Africa.[2] Culms are usually 6 to 12 feet tall, but may attain 25 feet. This is in marked contrast with Rhodes grass, which averages only one foot in height. Napier grass is usually grown for silage or for green feeding, but is sometimes used as

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[1] D. Meredith, "The Grasses and Pastures of South Africa", C.N.A., 1955, p. 197.

[2] *Ibid.*, pp. 443-444.

wind breaks for newly established citrus orchards. It is usually cut for fodder when it is three to four feet tall, so that more than one cutting may be obtained during a season. Farmers maintain that Napier grass requires approximately 3 inches of water per summer month, so irrigation is necessary. It does not usually set seed in South Africa and is thus propagated by means of roots.[1]

In the sweetveld sown grasses are sometimes used to produce a good grass cover on abandoned arable land rather than to produce high quality pastures. Local indigenous grasses, of which there are seed supplies available, give good results for such purposes. Cynodon dactylon (see page 102) is a valuable coloniser and soil stabiliser on old lands. On some farms Themeda triandra, Digitaria spp. and Sporobolus fimbriatus have been sown on tramped out land, resulting in the restoration of the damaged natural grazing.

Barley

Barley, Hordeum sp., which does well on relatively alkaline soils, paradoxically is not widely grown in the sweetveld, where it occupies only 1.8% of the cultivated land on the 71 farms investigated. Many sweetveld farmers, like those of the sourveld, stated that they preferred to grow oats instead of barley, as the former is more nutritious. (See p. 260.)

Tobacco

It is significant that tobacco is grown on only seven of the 157 farms investigated in the Bedford and Fort Beaufort divisions, all seven tobacco growing farms being situated in Stockenström. It is grown mainly on small holdings, so does not feature prominently in the survey of the 71 sweetveld farms, only three of which are less than 100 morgen in area. Tobacco is

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[1] Ibid., p. 663.

as well as from boreholes. Normally sprinkler irrigation is practised once per month, depending on the prevailing weather. Thus in December, 1969, the rainfall at Charlgrove was only 0.21

grown on only four of the sweetveld farms investigated, and occupies 1.3% of the cropland. In the Kat River valley kromneksiekte, Lethun Australiense, attacks tobacco during the early summer;[1] thus the crop is only transplanted during December. Early autumn frost shortens the growing season even further so that only a locally developed, quick maturing variety is successful. This is known as "Kat River Special" and is apparently developed from the Connecticut seed-leaf type. (See p. 177.) Almost all the tobacco in Stockenström is grown at elevations from 1,700 to 2,800 feet, where the mean January and February temperatures apparently exceed 70°F. At Balfour, elevation 2,300 feet, the mean January temperature is 72.0°F. (See page 41.) The greater part of the tobacco crop is grown in the vicinity of Balfour and Hertzog, where the Kat River and its tributaries provide the necessary irrigation water and where summer temperatures are unusually high for this altitude owing to the narrowness of the entrenched valleys.

Other crops

No other individual crop on the 71 sweetveld farms investigated occupies more than 1% of all the arable land. However, on one farm, Baddaford, five miles north of Fort Beaufort in the Kat River valley, avocado pears are relatively important. On this farm, where most of the arable land is devoted to citrus, avocados occupy approximately five morgen. The winter climatic conditions at Baddaford, which enable Mexican type avocados to be cultivated, are discussed on pages 319-320.

On the farm Charlgrove, 8½ miles south-southeast of Fort Beaufort, also in the Kat River valley, where citrus is also the leading crop, cotton occupies approximately six morgen of arable

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1 A.D.P. Botha, H.G. Snyman, C.J. Steenkamp & A.L. Prinsloo, " 'n Ondersoek van die Gronde in die Tabakproduserende Gebied van die Katriviervallei", Dept. of Agricultural Technical Services, Pretoria, 1966, p. 3.

land. The cotton fields are situated on alluvial land bordering the Kat River valley at an altitude of approximately 1,050 feet. The cotton is sown in early November and harvested in April and early May. The owner of Charlgrove, E.M. de Villiers, states that the water requirements of his cotton crop are approximately four inches per month. As the mean annual rainfall for each month of the growing season at Charlgrove is approximately two inches, the deficit has to be made up by irrigation, the water being obtained from earth dams filled from a weir on the Kat River, as well as from boreholes. Normally sprinkler irrigation is practised once per month, depending on the prevailing weather. Thus in December, 1969, the rainfall at Charlgrove was only 0.21 inch and a full four inch irrigation was applied. In February, 1970, no irrigation was necessary as the rainfall was 3.65 inches. The owner states that the cost of a four inch irrigation is approximately one rand per morgen.

Once the first buds appear, some six weeks after germination, the cotton has to be sprayed regularly because of infestations of bollworm. Both the American bollworm, Heliothis armigera, and the red bollworm, Diparopsis castanea, occur on Charlgrove. These bollworms should not be confused with the notorious North American cotton boll weevil, Anthonomus grandis, which fortunately does not occur in South Africa.[1] The Heliothis armigera caterpillar hollows out the young fruit of the cotton plant, causing it to drop off. On larger cotton bolls the caterpillar makes a large hole and eats into the fibre which then ferments and rots. The caterpillars migrate from one boll to another, destroying many in turn. H. armigera has for many years caused minor losses in the citrus orchards on Charlgrove, as it attacks the small oranges soon after they have set in spring. The larva of Diparopsis castanea, the red bollworm, spends its life cycle in a single boll,

[1] B. Smit, "Insects in Southern Africa", Oxford University Press, Cape Town, 1964, p. 223.

consuming both fibre and seed. In the Eastern Cape the red bollworm is not known to feed on anything but cotton,[1] and, as there are no other cotton fields in the Kat River valley, it was probably introduced to Charlgrove in the cotton seed. In order to control the bollworm the cotton is sprayed with insecticide weekly from January to April. The six morgen is sprayed in approximately nine hours. The yield of cotton in 1970 averaged approximately 5,000 lbs per morgen, giving a gross income of approximately R350 per morgen, as the unginned cotton realised 7 cents per lb. when marketed in East London. The farmer maintains that this results in a good profit, as the cost of spraying is approximately R31 per morgen during one season.

Irrigation in the Sweetveld

It has already been shown that cropping under dryland conditions is virtually impossible in the sweetveld, owing to the relatively low and erratic rainfall. For fodder farmers must therefore rely primarily on veld conservation, together with hay and silage produced from crops grown under irrigation. Irrigation is practised on virtually all the sweetveld farms bordering on the major rivers of the region, viz. the Kaga, Mancazana, Koonap, Waterkloof, Kat and Tyume Rivers. There is a great need for conservation dams on these rivers in order to increase the area of arable land, which at present comprises only 2.9% of the area of the 71 sweetveld farms investigated. The first large dam in the region was completed at the end of 1969. This is on the upper Kat River, the dam wall having been constructed where the river passes through a dolerite gorge some 2½ miles south of Seymour. The Kat River Dam was officially opened on 20th March, 1970.[2] The cost of the 180 foot high, 1,540 foot long dam wall was R3.51 million, but an additional 490,000 Rands had to be spent in resiting sectors of roads,

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[1] Ibid.

[2] "Eastern Province Herald", Port Elizabeth, 21 March, 1970.

railway, telephone line, power line and even the Seymour cemetery which would be inundated by the waters of the new dam.[1] Of this amount R470,000 was spent on the deviation of the Alice-Seymour road, including the construction of three bridge spans across the drowned Elands River valley.[2] The full capacity of the Kat River Dam is 10,000 morgen feet. It will provide the equivalent of 21 inches of irrigation water per annum for 1,700 morgen of land in the Kat River valley as well as a regular daily supply of half a million gallons of domestic and industrial water for the town of Fort Beaufort, approximately 24 miles south of the dam.[3] It was expected that it would take two years for the new dam to fill, but this period proved to be much shorter. The water content rose from 1½% on the morning of August 25th, 1970, to 67% on the morning of August 29th as a result of four days of continuous rain in the catchment area.[4] At Surrey farm, seven miles south of the dam wall, the precipitation over this period totalled 11.17 inches, but the rainfall over most of the catchment area must have been higher. The Kat River Dam receives the waters of the Wellesdale, Eyre, Elands and Lushington Rivers, all of which unite within a distance of three miles to form the Kat River. The catchment area of the dam is approximately 95 square miles. The dam overflowed for the first time on December 8th, 1970, after three days of heavy rain and snow in the catchment area.

There are several sites in the Fort Beaufort division which are suitable for the construction of dams with far greater catchment areas than that of the newly completed Kat River Dam. A dam constructed where the Kat River passes through a dolerite gorge

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[1] "The Mercury", King William's Town, 25 March, 1970.

[2] Ibid.

[3] "Eastern Province Herald", Port Elizabeth, 21 March, 1970.

[4] Personal communication from Resident Engineer, 21 September, 1970.

south of its confluence with the Blinkwater River would give a catchment area more than three times as great as that of the present Kat River Dam, but it would result in the inundation of the present railway line as well as the new tarred road which was under construction in 1970. A less serious problem presented by the construction of a dam at this site would be the inundation of the small settlement of Blinkwater, where the only substantial buildings are a shop-cum-hotel and a Roman Catholic Church together with its manse and school for Coloured children. An ideal dam site occurs on the Koonap River at Foxwood, some two miles north of Adelaide and approximately one mile south of its junction with the Mancazana River. The construction of a dam at this site, which would have a catchment area of more than 300 square miles, has already been agreed to by the Department of Water Affairs,[1] although no construction work had been undertaken by 1970.

The greater part of the Bedford and Fort Beaufort divisions is underlain by sedimentary rocks of the Beaufort Series, which have a relatively high content of mineral salts. The pH value of the river water, much of which is derived from seepage, is thus fairly high. It was possible to obtain pH values and mineral salt contents only for some of the headwaters of the Kat River. The data in the table on page 294 were obtained from water sampled in the Kat River catchment area in January, 1963, a month when the rainfall in Stockenström was well above average, following normal rainfall in December. It will be noticed that the percentage of soluble salts is far too low to cause the accumulation of harmful alkali in the soil.

[1] "Die Oosterlig", Port Elizabeth, 21 August, 1962.

ANALYSES OF IRRIGATION WATER FROM UPPER KAT RIVER CATCHMENT AREA[1]

Parts per million

River and place of sampling	Na (Sodium)	Ca (Calcium)	Mg (Magnesium)	CO_3	HCO_3	Residual Na_2CO_3	Cl (Chlorine)	Total soluble salts	pH
Balfour River, Balfour	15.6	1.4	3.0	0	40.8	27.6	10.7	150	7.4
Philipton Creek, Philipton	17.0	3.0	3.0	0	45.9	24.0	14.2	110	7.3
Balfour River, N. of Balfour	34.7	11.4	10.0	7.5	96.9	38.9	32.0	198	8.3
Wellesdale River, Readsdale	14.3	3.2	2.9	0	40.8	19.7	24.9	96	8.1

[1] Data obtained from Department of Water Affairs, Seymour.

Tukulu, a sweetveld farm with no irrigation

A well run sweetveld farm where irrigated crops play a major role in the farm economy is discussed in the following chapter. Owing to the high nutritional value of sweetveld grasses it is possible to farm succesfully without any crops being cultivated. An example of a prosperous sweetveld farm, where no crops are grown at all, is Tukulu, owned by Edgar D. Matthews. This farm, 940 morgen in area, is situated from $1\frac{1}{4}$ miles to $3\frac{1}{2}$ miles south and south-east of Alice, in Victoria East. The altitude of Tukulu ranges from 2,118 feet to slightly less than 1,600 feet. There are no perennial streams on the farm. The largest stream is the 2.3 mile long Tukulu River, which has its source on the farm and is a tributary of the Tyume River, which it joins approximately 1.2 miles to the east of the farm's eastern boundary. No precipitation data are available for Tukulu, but the owner estimates that the mean annual rainfall is approximately 20 to 22 inches per annum, as the mean annual rainfall at Lovedale, elevation 1,780 feet, situated 4 miles north of the Tukulu homestead, was 22.63 inches per annum over the period 1881-1950 (see page 27.) In the 1927 drought the destruction of grasses was severe. It was after this drought that Matthews abandoned the system of random grazing in favour of a rotational grazing system. Until 1927 the vegetation of most of the farm, i.e. the area above approximately 1,850 feet, consisted of thinly grassed, overgrazed Acacia Savannah. By the mid nineteen thirties all Acacia karroo trees had been eliminated from the Acacia Savannah area, which now consists of treeless, tall, dense grassland as a result of carefully controlled, rotational grazing. The remainder of Tukulu originally consisted of dense Scrub Woodland from which much of the grass had been eliminated by overgrazing. Since the severe drought of 1927, however, E.D. Matthews has undertaken the eradication of scrub, allowing only a few tree species such as

Cussonia spicata, Olea africana and Schotia afra to remain. Scrub clearance and rotational grazing has resulted in the transformation of the Scrub Woodland to a region of tall grassland with scattered trees.[1]

Tukulu is today renowned for the quality of its pastures. The farm is divided into 22 paddocks, giving an average of 42.7 morgen per paddock. Matthews maintains that paddocks of between 40 and 50 morgen are the most convenient size for grazing control. At Tukulu a three yearly grazing rotation is practised, i.e. each paddock is allowed to rest completely for twelve months once every three years. During this period the paddock gates are locked and no livestock are allowed to enter. Approximately fifteen paddocks are grazed during the course of one year, but it is customary to rest half of these during the summer months, so that during any given summer only one third of the farm is grazed by livestock.

There are altogether 35 earth dams on Tukulu. Matthews attaches great importance to providing a central drinking point in each paddock. This saves the livestock from making long journeys to and from water every day, as the paths they wear can readily develop into dongas, especially if they happen to be on a steep slope. Paddocks on rugged terrain usually have two drinking points, but one drinking point is found to be adequate where the terrain is level or gently undulating.

Tukulu is well-known for its pedigree herd of Shorthorn cattle which have gained prizes at agricultural shows in Johannesburg, Bloemfontein and other South African cities. The farm carries 160 dairy Shorthorn cows. Cream is sent daily by rail to Bowker's Park Creamery in King William's Town. There are also approximately 160 Shorthorn steers which are sold for beef in East London. Heifers and young bulls are marketed as

[1] The reclamation of Tukulu is narrated by E.D. Matthews in his book "Tukulu, The Rebirth of a South African Farm", 178 pp., Lovedale Press, 1956.

breeding stock in all four provinces of South Africa. Owing to the high quality of the grazing, slaughter stock are ready for market at three years of age, whereas twelve or eighteen months longer are required for slaughter cattle to be marketable if reared on inferior grazing. The grazing system on Tukulu has resulted in the doubling of the carrying capacity since 1927. Matthews estimates that at present it is one head of large stock per three morgen. The only other livestock reared on Tukulu are Boer goats, some thirty of these animals being kept in order to prevent the encroachment of scrub.

As a result of the rotational system of grazing there is a continuous grass cover in all the paddocks of Tukulu. Matthews estimates that, despite the spell of subnormal rainfall experienced from 1966 to 1969, approximately 80% of the grass cover consists of Themeda triandra (rooigras). This percentage rises to approximately 90% after a rest period. The good cover of rooigras enables the cattle on Tukulu to maintain excellent condition even during severe droughts. The severest droughts since 1927 in the Alice area occurred in 1945 and 1949 (see page 28), but in these years the cattle were able to maintain condition without any artificial feeding. On Tukulu E.D. Matthews has clearly demonstrated that the major asset of the sweetveld is its grass, which enables livestock production to reach its maximum potential.

CHAPTER XIII

CITRUS FARMING

In the previous chapter it was shown that citrus occupies the second largest area of cropland in the sweet grassveld. It is generally agreed by citriculturalists of the Bedford and Fort Beaufort divisions that at least 35 inches of water, applied at regular intervals throughout the year, is necessary for the production of profitable citrus crops. The sectors receiving more than 35 inches of rain per annum are in the highlands, which do not have sufficiently warm summers for the production of oranges with a high sugar content. Moreover, even these areas are not free from long dry spells. Most of the highlands have the additional disadvantage of experiencing winter frosts which are severe enough to damage the citrus fruit or even the trees themselves. Almost all the orchards are located in the warm Scrub Woodland regions, where the average annual rainfall is less than 26 inches, and are therefore dependent on irrigation.

Brief Historical Review

Citrus trees were growing in the Eastern Cape before the arrival of the British settlers in 1820, for Webber records that in that year certain of these immigrants were arrested for stealing fruit from orange trees growing at Lombard's Post, near Grahamstown.[1] In 1823 George Thompson described the "fine orange trees" which were cultivated in the garden of the Government-owned Somerset Farm,[2] which is now the site of the town of Somerset East, some 14 miles from the western border of the Bedford district. As white settlement expanded eastwards from the Karroo and northwards from Albany,

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[1] L.D. Batchelor and H.J. Webber, "The Citrus Industry", Vol. I, University of California Press, 1943, p. 47.

[2] G. Thompson, "Travels and Adventures in Southern Africa", Part I, Henry Colburn, London, 1827, p. 55.

the settlers would have taken orange seeds with them. Thus the first citrus trees in this area were seedlings planted by the early White settlers in small orchards primarily for household use. Throughout the nineteenth century citrus in the region between Bedford and Alice was of little commercial value. Occasionally, towards the turn of the century, loose oranges were transported in wagons to be sold in the villages and also in the adjacent towns such as Somerset East and King William's Town.[1]

The first large scale planting of citrus in the region occurred on Llewellyn Roberts' farm, Baddaford, in the Kat River valley, in 1903.[2] Before purchasing Baddaford, Roberts farmed with sheep, cattle and ostriches at Cottesbrook, four miles south-southeast of Kroomie railway station. At this time, circa 1890, the farmers along the submontane peneplain and its valleys were losing stock in great numbers from tick borne diseases. Llewellyn Roberts invited C.P. Lounsbury, an American entomologist, to live at Cottesbrook in order to investigate the tick problem <u>in situ</u>. Lounsbury, impressed by the young and rapidly growing citrus industry of California and Florida, encouraged Roberts to plant citrus. In 1895 a small orchard of Navel oranges was planted at Cottesbrook as an experiment, but the venture was not a success owing to the scarcity of irrigation water. At times the fruit also suffered frost damage.

Roberts, who was determined to make citrus pay, sought a farm with an abundant water supply and which was free from severe frost. When travelling up the Kat River valley one winter he had noticed that there was no sign of frost damage to the indigenous vegetation of the farm Baddaford, approximately five miles north of Fort Beaufort. Baddaford had a furrow of water running through it from the then perennial Kat River to the mill on the farm Mill Bank.

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[1] Information obtained from author's father, born 1893, and from author's grandfather, born 1871, both living in 1970.

[2] Information concerning Baddaford has been obtained from Baddaford farm diaries and from Mrs. Llewellyn Roberts, Snr.

Forbes Ainslie, owner of both farms, eventually agreed to sell Baddaford to Llewellyn Roberts, who was to have half the water rights.

In 1903 the first orange orchard was planted at Baddaford, where some of the original trees are at present still bearing paying crops. These trees, of the Washington Navel type, were bought from H.G. Flanagan, of Prospect, Komgha. The Washington Navel originated at Bahia, Brazil, apparently as a bud sport. When introduced into the U.S.A. in 1873 it was named the "Bahia Navel" orange.[1] As it was distributed by the United States Department of Agriculture from Washington, American farmers referred to it as the Washington Navel, and the name "Bahia" became obsolete.[2] Budded Bahia Navel orange trees had been introduced to South Africa as early as circa 1850 by Joachim Brehm of Uitenhage. In 1854 scions of these trees, grafted by W. Tuck of Grahamstown, were distributed to various parts of the Cape Colony.[3] Flanagan's trees at Komgha were probably descendants of this original introduction, for there appears to have been no further importation until 1905.[4] As many trees in the first Baddaford orchard were off-type, Bahia Navels were introduced to Baddaford direct from Brazil in 1905. Other orchards were later planted at Baddaford by Llewellyn Roberts and his son, Daniel, the new trees being budded from the best of the original Komgha and Brazilian trees on rough lemon stock.

Although deciduous fruit had been exported from Cape Town since 1896, it was only ten years later that the first South African citrus fruit made its appearance in London. This was at the Colonial Fruit Show organised by the Royal Horticultural Society.[5]

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[1] H.J. Webber, "A Comparative Study of the Citrus Industry of South Africa", Dept. of Agriculture, Bulletin No. 6, Pretoria, 1925, p. 15.

[2] Ibid.

[3] Ibid.

[4] Ibid.

[5] Winston Allwright, "South African Co-operative Citrus Exchange Ltd.", Pretoria, 1959, p. 3.

Citrus fruit from eleven British colonies and dependencies, including the Cape Colony, Natal and the Transvaal, was exhibited at this show, where a gold medal was awarded to the Transvaal Government for its exhibit.[1] The success of the Transvaal exhibits at the show demonstrated the ability of South Africa to export citrus fruit to London. In 1907 3,000 cases of South African oranges reached Covent Garden Market.[2] This shipment included several cases of Washington Navels from Baddaford. The oranges were packed in the "Florida" case of approximately 90 lbs. net weight, ten lbs. heavier than the "California" pack used at present. From 1907 onwards Baddaford regularly exported oranges to the United Kingdom. The Kat River valley is thus one of the oldest citrus exporting areas in South Africa.

A few years after the first orchards had been established at Baddaford, Robert Hockly laid out citrus orchards on the farm Gonzana, which was later sold to Murray McGregor. Until the ostrich slump of 1914 most of the irrigated alluvial land along the Kat River and its tributaries was used for the production of lucerne for the feeding of ostriches. As described on page 180, many farmers suffered heavy losses in the ostrich slump and sought some other means of income. In 1916 George White planted his first orange trees on the farm Lorraine. Other farmers followed suit, and by 1920 citrus orchards were established or were being established along the entire section of the Kat River valley from Balfour to several miles south of Fort Beaufort.

After the decease of Llewellyn Roberts in 1916 his son Daniel, in conjunction with the farm manager, Colin Story, developed what became known as the "Baddaford Navel", budded on to rough lemon root stock from only the healthiest and most vigorous trees. The fruit of such trees was examined carefully for flavour, skin colour and skin texture, and the juice tested for sugar content, solids and acids over a period of three years before any decision was made

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[1] R.A. Davis, "Fruit Growing in South Africa", C.N.A., 1928, p. 442.

[2] W. Allwright, loc.cit.

on whether they were good enough for budding. In this way first-grade scions were made available to many other Kat River orchards.

As a result of the rapid expansion of the citrus industry, the Kat River Co-operative Citrus Company Ltd. was established in 1922. Its objects were to market the members' fruit efficiently, both in South Africa and overseas, to secure shipping space for the export fruit, to obtain members' packing material requirements, to assist in the control of insect pests, and also to obtain loans from the Land Bank to finance packing and export costs. Transport proved a difficulty, the citrus having to be transported mostly by ox-wagon to the nearest railway station at Fort Beaufort. In 1926, however, a narrow gauge railway line was completed from Fort Beaufort to Seymour,[1] thereby reducing the average distance between farms and the railway from fifteen to two miles. In the same year the Kat River Co-operative established a packhouse at Fort Beaufort and started exporting the famous "Kat Brand" orange to the United Kingdom. Until then the citrus had been sorted and packed privately on individual farms, with no uniform standards of size or quality. In 1926 the average yield per acre of Navel oranges in the Kat River valley was more than 310 cases, the highest in the country.[2]

The first commercial orchards had been established in the Koonap River valley during the First World War. The success of the Kat River Co-operative led to the establishment in 1925 of the Koonap River Citrus Co-operative Company Ltd., which officially opened a packing shed in Adelaide in 1930.[3] Both the Kat and Koonap Co-operatives were foundation members of the South African Co-operative Citrus Exchange on its establishment in 1926.[4] The foremost aim of the Exchange was to dispose of members' fruit in

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[1] See page 184.

[2] "An Enquiry into the Factors of Production in the Citrus Industry of S.A.", Dept. of Agriculture, Bulletin No. 62, 1926, p. 12.

[3] Data obtained from minutes etc. of Koonap Co-operative.

[4] W. Allwright, "S.A. Co-operative Citrus Exchange Ltd.", Pretoria, 1959, pp. 51-52.

the most profitable manner.

Despite the world economic depression, which reached its nadir in 1931, the export of South African citrus fruit continued to expand, leading to the planting of more citrus trees in this area as well as in the rest of South Africa.[1] This was largely due to Government export subsidies totalling £1,074,044 during the period 1931-37.[2] At the height of the depression, in 1931, a record number of 1,786,993 cases of citrus was exported.[3] The total value of this fruit was £856,777,[4] to which the Government added a subsidy of £163,022. South African growers received from the Union Government a subsidy of two shillings per case during 1931, 1932, 1933 and 1934; one shilling and four pence during 1935 and eight pence per case during 1936.[5]

A temporary setback was suffered by the Kat River Co-operative in 1934, when Baddaford seceded and re-established its own packhouse. Although citriculture had developed rapidly in the Tyume River valley, no co-operative was formed by the growers, who continued to pack their crops privately, leaving only the marketing of export fruit in the hands of the Citrus Exchange. By 1936 no less than 1,512 morgen of land in the present Bedford and Fort Beaufort divisions was under citrus, the distribution being as follows: Stockenström 763 morgen, Fort Beaufort 297, Victoria East 282 and Adelaide 170. These four districts had more than 210,000 orange trees in bearing, 123,858 of these being in Stockenström, 16,564 in Fort Beaufort, 40,361 in Victoria East and 30,165 in Adelaide. In Fort Beaufort the number of young trees which had not yet reached the bearing stage almost equalled those in bearing.[6]

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[1] Ibid.

[2] Union Year Book, 1938, p. 786.

[3] Ibid., 1933-34, p. 441.

[4] Ibid., 1933-34, p. 437.

[5] S.D. Neumark, "The Citrus Industry of South Africa", Witwatersrand University Press, Johannesburg, 1938, p. 115.

[6] Compiled from the Union Agricultural Census, 1935-36.

Increasingly heavy citrus traffic on the Seymour-Fort Beaufort railway line led to its conversion to broad gauge in 1940. (See page 186). Up to that year there had been a steady increase in citrus production in all the major citrus producing areas of South Africa. The outbreak of the Second World War, and the resulting shortage of shipping for commercial purposes, led to a sharp drop in the amount of citrus exported. By 1944 the South African citrus export total was less than one quarter of that of 1939 and a little more than half that of 1931.[1] The majority of growers, who were faced with the problem of disposing of their fruit locally, stopped planting new trees and did away with many of the older orchards, using the land for the growth of fodder crops. It was only in 1950 that production returned to its prewar level. Unfortunately no figures are available for the Kat and Koonap Co-operatives over this period, but it can be assumed that production trends were in agreement with South Africa as a whole. The manager of the packing shed in Adelaide has kindly made available the production figures of the Koonap Co-operatives over the period 1949-1962. These figures, giving the number of cases exported overseas as well as pockets sold locally are listed below.

KOONAP RIVER CO-OPERATIVE CITRUS PRODUCTION[2]

Year	Cases	Pockets
1949	7,600	12,400
1950	6,600	8,600
1951	15,300	23,600
1952	5,000	12,500
1953	8,400	27,600
1954	11,500	26,500
1955	14,600	16,200
1956	15,800	17,200
1957	23,300	31,800

[1] Union Official Year Books, 1933-34, p. 441; 1940, p. 759; 1946-47, Chapter XIX, p. 71.

[2] To nearest hundred.

Year	Cases	Pockets
1958	19,500	13,400
1959	22,600	14,300
1960	29,900	32,500
1961	28,600	31,400
1962	35,000	30,000

It can be seen that over this period the amount of oranges exported increased nearly five-fold. The decreases in 1950, 1952 and 1958 were due to the droughts of the preceding years. The 1952 and 1958 yields were further reduced by severe frost before the harvesting of the navel crop had been completed.

Citrus Production

The citrus growing areas are all located on land bordering the major rivers, where irrigation water is available. The greatest concentration of citrus is found in the Kat River valley, particularly north of Fort Beaufort. Some idea of the relative importance of the various valleys can be obtained from the following figures, which give the total orange crop, expressed in cases,[1] sold by each valley during the 1960 season.

CASES OF CITRUS SOLD, 1960[2]

	Navels	Valencias	Seedlings & Others	Total
Kat	248,355	17,074	48	265,477
Tyume	74,756	29,594	202	104,552
Koonap	23,734	2,636	Nil	26,370
Waterkloof	13,599	2,081	Nil	15,680
Kowie	2,655	Nil	Nil	2,655
Mancazana	303	Nil	Nil	303
Keiskamma (part of)	6,386	1,285	Nil	7,671
Part of Great Fish	1,851	3,376	Nil	5,227
Total	371,639	56,046	250	427,935
S.A. Total	4,303,325	7,203,643	737,173	12,244,141

[1] Pockets converted to cases on basis of 2.33 pockets per case.

[2] Totals for the various valleys compiled from figures of individual farmers' sales made available by Citrus Exchange Field Officer, Grahamstown.

In 1960 the region produced 8.64% of South Africa's total Navel orange export crop and only 0.78% of the country's total Valencia export crop. The region accounted for 3.5% of South Africa's total orange export. Other citrus fruit plays a very subordinate role. Thus in 1960 the region produced the equivalent of only 4,100 cases of grapefruit and 594 cases of lemons.

The citrus is either marketed in pockets for consumption in South Africa or in cases for export overseas. The average packed weight of a case is 80 lbs., of which approximately 70 lbs. is actual fruit. The average weight of a pocket of citrus is 30 lbs., although this weight varies somewhat with the moisture content of the fruit. As can be seen from the figures listed above, the Kat and Tyume valleys are by far the most important orange growing areas. Approximately two thirds of the Navel oranges in both valleys are grown for export and the remainder for local consumption. The proportion of Valencias grown for export, approximately three quarters in both valleys, is slightly higher owing to the popularity of these medium-sized oranges on the British market. In 1960 the number of cases and pockets of Navels and Valencias marketed by farmers of the Kat and Tyume valleys was as follows:

	NAVELS		VALENCIAS		TOTAL ALL VARIETIES	
	Cases	Pockets	Cases	Pockets	Cases	Pockets
Kat River	164,926	194,389	12,166	11,435	177,140	205,824
Tyume	47,322	63,922	22,329	16,927	69,753	81,082

The total for the Kat River valley includes 40 cases of seedling oranges and 8 cases of other oranges, while that for the Tyume River valley includes 36 cases of seedlings, 66 cases of other oranges, 39 pockets of seedlings and 194 pockets of other oranges.

In 1960 a total of 1,554 morgen of land was occupied by citrus, representing an increase of only 42 morgen since 1936. The distribution of orchards was as follows: Stockenström 520 morgen, Victoria East 509 morgen, Fort Beaufort 374, Adelaide 143 and Bedford 8 morgen. Over the 24 year period the decline in the area of citrus orchards in Stockenström had been balanced by an increase in the area under citrus in Victoria East, Fort Beaufort and Adelaide. The increase was most marked in Victoria East, where the citrus acreage almost doubled during this period.[1] Since 1960 the area under citrus appears to have declined slightly, for, when using the 1963 and 1964 aerial photographs for land use mapping of the Kat and Tyume River valleys in 1969, it was apparent that several citrus orchards had been uprooted. The area of new orchards was very small and did not compensate for the area of land where citrus had been replaced by other crops.

Citrus Varieties

Because of its excellent eating quality and its large size, the Washington Navel orange is much in demand by consumers in South Africa. Nevertheless, as far as the whole of South Africa is concerned, Navels take second place to the Valencias. Growers prefer the latter for their high yield, vigorous growth and mid-winter swelling of the fruit, when insect pests are at a minimum. In this area, where severe midwinter frosts occur over much of the valley bottoms, Washington Navels predominate. These oranges ripen in autumn, and the peak picking period occurs in late May and early June, before the advent of damaging frost. The fruit of the Valencia is in a vulnerable, green, immature state during midwinter, attaining maturity from August to September. For this reason Valencias are confined to those areas which are not subjected to severe temperature inversions.

Effect of Temperature

All the orchards are situated in areas where the mean midsummer (December, January, February) temperature exceeds 70°F. The mean daily maximum temperature in January and February is in the vicinity of 86°F., which is ideal for the development of oranges with a high sugar content.

According to Webber, an average daily temperature of approximately 55°F. is the lowest temperature at which growth can occur

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[1] Agricultural Census No. 34, R.P.18/1963, pp. 63-64.

in citrus trees.[1] He tabulates average monthly and annual indices of heat units available to Californian citrus, based on the sum of the day degrees exceeding 55^{o}F., and points out that the Washington Navel orange reaches its "highest perfection and success" in areas with total indices during the growing season (from March to November in California) of 3,000 to 3,500 day degrees. Coupled with this, it is desirable that there be a total winter index of -500 to -700^{o} to ensure continuous dormancy, so that the trees are less likely to experience severe frost injury.[2]

Average Monthly Indices of Heat (Degrees Fahrenheit) available for Citrus at Lovedale and Fort Beaufort during Period 1931-1950

	Lovedale	Fort Beaufort
January	564.2	530.1
February	515.2	478.8
March	486.7	452.6
April	309.0	303.0
May	151.9	108.5
June	18.0	-9.0
July	-3.1	-31.0
August	83.7	74.4
September	189.0	153.0
October	297.6	269.7
November	396.0	375.0
December	492.9	480.5

The above table has been calculated in the same way as that compiled by Webber for Californian citrus growing areas. It can be seen that Lovedale and Fort Beaufort, situated in the Tyume and Kat River citrus growing areas, have optimum heat conditions for Washington Navel oranges during the growing season, September to May.

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[1] H.J. Webber, "Influence of Environment on Citrus", California Citrograph, Vol. 23, No. 3, Los Angeles, 1938, p. 108.

[2] Ibid.

For this period the average total available heat at Lovedale is 3,402.5°F., while that at Fort Beaufort is 3,151.2°F. These figures closely correspond with those calculated by Webber for the optimum Washington Navel growing areas of Southern California.[1] The indices for the three midwinter months at Lovedale and Fort Beaufort, 98.6° and 34.4° respectively, are too high to ensure continued dormancy of the trees, with the result that they can be injured more easily by excessively low temperatures than trees growing in areas with colder winters.

The most satisfactory growing season index for lemon trees is approximately 2,700°F., which means that these valleys are less satisfactory for lemon production. The greater sensitivity of lemons to frost is an additional factor precluding large scale cultivation.

Berg Winds

Excessive temperatures and low humidities associated with berg winds are capable of affecting fruit yields. These winds, which are most frequent during the critical blossoming and fruit setting period, August to November, can affect the pollination of the blossoms, since the low humidity dries out the secretions of the stigma and prevents its fertilisation. The vast majority of flowers, however, are unaffected. The young fruit, particularly that of Navel oranges, is far more sensitive to hot dry conditions. The heavy drop of young fruit occurring immediately after flowering is normal to all varieties of citrus, as the trees always form more flowers than can mature into fruit. With Navel oranges this drop does not occur only after flowering in September, but continues until midsummer. Wager divides the dropped fruit into two categories. Those with diameters less than 0.4 inch, which fall with their pedicels attached, are termed shed fruits; those with diameters

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[1] Ibid.

exceeding 0.4 inch, which dehisce above the calyx and drop without the pedicels, are termed dropped fruits.[1] Wager regards the shedding of fruit less than 0.4 inch in diameter as normal, but the dropping of larger fruit, from 0.4 inch to 1.5 inch in diameter, as abnormal.

Farmers in the Kat River valley maintain that approximately 90% of the Navel oranges are shed, mainly in September and October, before they attain diameters of approximately half an inch, regardless of whether hot dry winds occur or not. This shedding has the advantage of thinning the crop so that the remaining oranges can develop into a good marketable size. It is the dropping of the larger fruit, particularly in the months of November and December, which results in economic loss to the farmer. Local farmers estimate that up to 50% of their crop can be lost as a result of this drop, which can sometimes occur as late as early February.

From 1935 to 1937 V.A. Wager investigated the drop problem in Washington Navel oranges exceeding 0.4 inch in diameter. The severity of the drop on the three Kat River farms investigated ranged from 24% to 50%, the highest and lowest percentages occurring on the same trees on one particular farm.[2] Control trees treated with fertilizer suffered drop as severely as untreated trees. It was also discovered that the presence of fungi had no bearing on the cause of dropping. Wager discovered that the drop invariably follows three to eight days after hot dry winds, with a temperature over 80°F. and a relative humidity of less than 15%.[3] Drop was found to be as severe amongst fruit completely shaded on the inside of trees as on the exposed outside, indicating that the cause is the low relative humidity rather than the high temperature. Whereas

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[1] V.A. Wager, "Alternaria Citri and the November-Drop Problem of Washington Navel Oranges in the Kat River Valley", Dept. of Agriculture and Forestry, Science Bulletin No. 193, Pretoria, 1939, p. 5.

[2] Ibid., pp. 5 - 6.

[3] Ibid., p. 17.

saturation of the soil with irrigation water reduces the percentage of drop, it does not prevent it. It would appear that during hot dry weather the trees are unable to take up moisture sufficiently fast to replace that lost by transpiration from the foliage, and consequently draw moisture from the young setting fruit, eventually causing it to drop. Unfortunately berg winds are all too frequent during the spring and early summer months. Wager suggests that, apart from frequent irrigations, the severity of the drop may be reduced by the planting of windbreaks, and also tall dense cover crops, the latter serving to increase the relative humidity of the overlying air.

Frost

Frost, which can cause severe damage to citrus in this area, occurs in many orchards with sufficient frequency and severity to justify its being regarded as a major disadvantage. The majority of the orchards are located along the bottoms of deep valleys entrenched within the highlands or that portion of the submontane peneplain immediately adjacent. On clear, calm winter nights the ground surface of the highland slopes and also of the submontane interfluves often becomes chilled below freezing point by radiation, thereby chilling the air in contact with it. This air, which during the day is cooler than that of the entrenched valleys, is cooled to such an extent that it becomes denser than the air at the same level in the free atmosphere. It thus moves down the mountain and hill slopes into the valleys to displace the lighter, warmer air. Such temperature inversions are severest where the Quaternary valleys have cut embayments within the highland masses. This is because these valleys are close to the source of the coldest air, and also because their narrow winding nature retards air drainage. Southwards the valleys become broader and shallower, thereby allowing swift dispersal of cold air from the upper reaches.

Frost is severest in the Koonap and Kat valley systems north of Adelaide and Fort Beaufort. The absolute minimum temperature at Fort Beaufort over a twenty year period, 18°F., is comparable with those experienced in the citrus growing area of central Florida, U.S.A., and the San Bernardino valley, near Los Angeles, California.[1] The Tyume citrus growing areas are subject to less severe temperature inversions owing to the broader nature of the valley. The Absolute minimum temperature recorded at Lovedale over a twenty year period, 25°F., equals that of San Diego, Southern California, over a forty year period.[2]

All severe frosts and a large proportion of the lighter frosts follow the passage of a cold front and the subsequent influx of polar maritime air. Cold south-westerly to southerly winds, often accompanied by cloud and less often by rain, usually penetrate the area on the western sides of coastal depressions or the eastern sides of coastal anti-cyclones. Severe frosts occur after the cessation of the wind when the sky has cleared, provided there has not been heavy rain. After heavy rain, when the ground remains wet for several days, the dew point is very high, and the latent heat given off by the condensing moisture checks the rate of cooling. Freezing of the abundant ground moisture also aids in checking the rate of fall in temperature, so that damaging frost does not occur. If the influx of polar air is accompanied by light rain, as is more often the case, conditions are more favourable for damaging frost. By the second night after the rain the surface of the ground usually has dried out considerably, the dew point is likely to be lower, and loss of heat from the cold ground surface will be very great. Before the third night the day temperature usually has risen high enough to make the night frost less severe. Should a strong anticyclone arrive immediately behind a depression, it is possible for the worst frost to occur on the third night. Such conditions occurred in June 1962, when exceptionally severe

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[1] "Climate and Man", U.S. Department of Agriculture, Washington, D.C., 1941, pp. 786, 809, 810.

[2] Ibid., p. 786.

frost was experienced in the Koonap, Kat and Tyume valley systems. Unfortunately no regular daily recordings are available for any of the major citrus growing valleys, but the temperature and rainfall figures for Surrey farm, 7 miles from the Kat-Mancazana junction and 420 feet above it, illustrate these conditions.

WEATHER RECORDINGS AT SURREY FOR PART OF JUNE, 1962

Temperatures in Degrees Fahrenheit, Rainfall in Inches

Date	Min.	Max.	Rainfall	Wind Direction (2 p.m.)
11	37	76		Light northerly.
12	56*	72	0.17	Change to moderate south-westerly from north-westerly.
13	37*	57		Fresh south-westerly.
14	28	53		Light WSW.
15	23	64		Calm.
16	26	75		Light westerly.
17	36*	63		Light south-westerly.

* Indicates overcast night

Cold air associated with a well developed depression invaded the Eastern Cape on the afternoon of 12th June. By the afternoon of 13th June the centre of the depression was east of Durban, and for the next twenty-four hours it remained more or less stationary. Thus, on the afternoon of 14th June, immediately preceding the worst frost, the pressure was still low along the Natal coast when a fairly strong high reached the South Cape coast. This resulted in a further influx of very dry polar air during the afternoon and early evening, followed by calm cloudless weather as the coastal high encroached upon the south-eastern Cape hinterland, resulting in unusually severe frost.[1]

In marked contrast with the dry cold snap of June, 1962, was the humid one of July, 1963. During this period, as the recordings for Surrey show, daily maximum temperatures were several degrees

[1] Daily Weather Bulletin for the Month : June 1962, Weather Bureau, Pretoria, 1962.

lower, but minimum temperatures were very much higher, owing to the wet nature of the ground.

WEATHER RECORDINGS AT SURREY FOR PART OF JULY, 1963

Temperatures in Degrees Fahrenheit, Rainfall in Inches

Date	Min.	Max.	Rainfall
6	33	70	
7	34	71	
8	35	70	
9	36	67	0.79
10	45	48	1.75
11	43	49	0.27
12	42	54	0.01
13	39	60	
14	32	68	
15	36	68	

It can be seen that the highest minimum as well as the lowest maximum temperature occurred on the day of maximum precipitation. As in the preceding example, the lowest minimum temperature was recorded on the third morning following effective rainfall.

It is common knowledge that the various types of citrus vary widely with respect to the degree of low temperature they can withstand. Moreover, the freezing point of the fruit varies according to its stage of development. In experimental work done by the United States Weather Bureau the freezing point of ripe Washington Navel oranges varied from 27 to 28°F., that for half ripe from 28 to 29°F., and that for green from 28.5 to 29.5°F.[1] The fruit itself must reach these temperatures before freezing commences. Wright and Taylor found the mean freezing point of ripe Washington Navels to vary from 28.3 to 28.68°F., the mean being 28.42°F., whereas that of ripe Valencia oranges was somewhat lower.[2] The

[1] F.D. Young, "Frost & the Prevention of Frost Damage", U.S. Dept. of Agriculture, Farmers' Bulletin, No. 1588, Washington, D.C., 1929, p. 52.

[2] R.C. Wright and G.F. Taylor, "The Freezing Temperatures of Some Fruits, Vegetables and Cut Flowers", U.S. Dept. of Agriculture, Farmers' Bulletin No. 1133, Washington, D.C., 1929, p. 4.

freezing point of ripe Valencias was found to range from 26.9 to 27.6°F., the mean being 27.01°F. Ripe Valencias were found to have the lowest freezing point of all orange varieties investigated. According to Parker, the blossoms and young fruits of all citrus varieties are very sensitive to cold, and exposure for short intervals to temperatures of 30 to 31°F. may kill them.[1]

It is obvious that the larger the fruit, the longer it takes to reach the temperature of the surrounding air. The thick, pithy rind of the ripe orange is a poor conductor of heat, and, because of the protection it provides, the temperature of the interior of the fruit is usually several degrees higher than that of the surrounding air.[2] A temperature of 26°F. persisting for several hours usually results in the freezing of the fruit. The writer has observed that in the Mancazana valley of the Stockenström district oranges are not damaged until the air temperature has reached approximately 25°F., i.e. about three degrees below the freezing point of the juice. At this temperature only the outer fruits are liable to be damaged. According to Young, the inner fruits, which are sheltered by foliage, are up to three degrees warmer than the outer ones.[3] The first formation of ice crystals in an undercooled fruit is accompanied by a rise of the juice temperature to approximately its freezing point. Young found that oranges, usually when not coated with frost, i.e. when the humidity is very low, are often cooled several degrees below their freezing point without the formation of ice and the consequent irreparable damage to the cell walls. Neither does a rise in temperature to freezing point on the following morning cause any damage.[4]

The length of time during which the temperature remains at a given value will also determine the amount of damage suffered by

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[1] E.R. Parker in Batchelor & Webber, "The Citrus Industry", Vol. II, University of California Press, 1948, p. 225.

[2] F.D. Young, "Frost and the Prevention of Frost Damage", p. 51.

[3] Ibid.

[4] Ibid., p. 52.

the fruit and trees. Whereas a temperature of 24°F., after a rapid drop in temperature, can leave the entire orange crop undamaged, a temperature of 26°F., after a very slow drop in temperature, can destroy the whole crop. As far as damage to the tree itself is concerned, general observation indicates that this first occurs at temperatures of approximately 24 to 25°F., which result in the killing of the outermost leaves and young shoots.

The weather preceding the frost has a considerable affect on the amount of damage. If temperatures have been high and soil moisture abundant, the trees will be in a succulent growing condition, and low temperatures will cause the maximum amount of damage. If the trees are actively growing almost total defoliation can occur at 20°F., but if they are dormant they can endure temperatures as low as 16°F. with only about 10% defoliation.[1]

Over a 23 year period (1942 - 1964) severe frost damage occurred in the main citrus belt of the Kat River valley during three winters, viz. those of 1952, 1958 and 1962. On each of these occasions the observed or inferred minimum temperature at Fort Beaufort was 25°F. or less, as can be seen in the table below, which gives annual absolute minimum temperatures for four stations in or near citrus growing valleys. The severe frost experienced at the end of June 1964 did not cause much damage, as it occurred after an unusually cool, wet period, when the trees were dormant. The fruit which had not been harvested by this time was largely unharmed, probably because of the latent heat liberated by the freezing of the heavy dew on the damp ground. Although the absolute minimum temperature recorded in Fort Beaufort in 1954 was less than 25°F., the damage to citrus was slight, as this cold snap occurred at the end of July, by which time the entire Navel orange crop had been harvested.

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[1] Ibid., p. 55.

ABSOLUTE MINIMUM TEMPERATURES, DEGREES FAHRENHEIT, 1942-1964

	Lovedale	Fort Beaufort	Balfour (Wilsonia)	Surrey
	1,760 ft.	1,495 ft.	2,300 ft.	2,095 ft.
1942	28.0	27.0	24.2	
1943	27.0	27.0	23.0	
1944	31.0	No data	No data	
1945	29.0	29.2	22.0	
1946	28.0	29.5	23.4	
1947	29.0	28.8	25.0	
1948	29.0	27.3	24.0	
1949	29.0	28.0	No data	
1950	28.0	27.0	23.0	
1951	28.0	27.5	22.5	
1952	26.0	25.0	20.0	
				Station opened
1953	28.4	26.6	Station closed	29.0
1954	26.6	24.5		26.5
1955	Station closed	27.9		26.5
1956		27.3		28.5
1957		29.0		30.0
1958		23.4		24.5
1959		Station closed		29.5
1960				29.0
1961				29.0
1962				23.0
1963				30.0
1964				25.0

Balfour, at the northern end of the Kat River citrus belt, experiences more severe frost than Fort Beaufort. From 1942 to 1952 the absolute minimum temperature at Balfour was from 3 to 7 degrees lower than at Fort Beaufort. The 1952, 1958 and 1962 freezes resulted in a considerable amount of economic loss, as they occurred in June, before harvesting had been completed.

Some of the effects of the more recent of these freezes were observed by the writer in the Kat River valley. Temperature data could be obtained for only one farm, which happens to be situated between Balfour and Tidbury's Toll. On this particular farm[1] a minimum temperature of 14°F. was observed 6 feet above ground level in the lowest part of a sloping orchard on the morning of 15th June, 1962. The minimum temperature was not observed on the 14th or 16th June, when the frost was less severe. In this orchard all young trees up to three feet in height were completely killed and approximately three quarters of the adult trees were completely defoliated; only those in the highest parts retained some leaves. Frost damage to trees was not as severe in other orchards which are of slightly higher elevation. Fortunately part of the orange crop already had been harvested, but the unharvested part was completely lost. In 1962 this farm produced approximately 2,500 cases of Washington Navel oranges, whereas the normal production is approximately 6,000 cases.

No attempt is made to combat frost damage in any of the citrus growing valleys. By the observation of the maximum temperature and the relative humidity of the air on any particular day it should be possible for farmers to estimate the ensuing minimum temperature with reasonable accuracy. Those in the severest temperature inversion pockets would then be prepared for combating damaging frost on the few nights when it does occur. In California and Florida oil burning heaters have proved successful in saving entire citrus crops when those in adjacent unheated orchards have been completely destroyed. There is no reason therefore why those Kat and Koonap farmers who suffer damage most frequently should not invest in a sufficient number of oil burning heaters for the protection of their citrus crops. The added expense of orchard heating should not make production costs excessively high owing to the small number of nights on which it would

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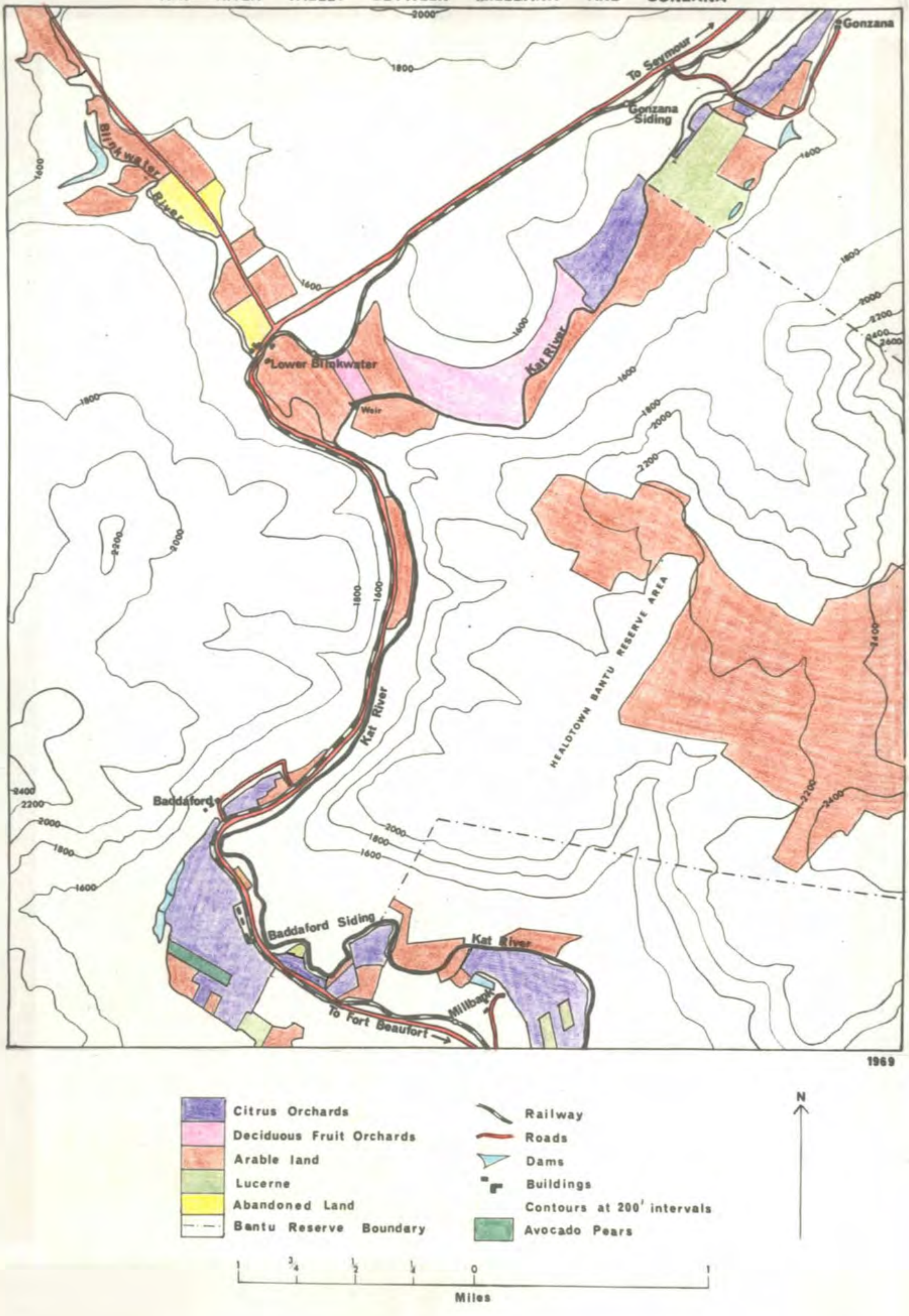
[1] The owner does not want the name of the farm disclosed for fear that the market value may be affected.

be necessary to light the heaters. Moreover, the exceptionally low wages paid to the Bantu and Coloured farm workers should more than compensate for the additional expense involved in heating.

During the 1962 freeze, frost damage was severest between Balfour and Tidbury's Toll. It would appear that the main area of damaging frost occupies that part of the Kat valley floor exceeding 1600 feet in altitude, for at Baddaford, where the orchards are from 1450 to 1500 feet, citrus fruit is unharmed. No temperature data are available for Baddaford, but one of the owners states that "I would guess that temperatures in the main block of citrus have never fallen below two degrees of frost ... Even soft weeds like Stremonium species (Stinkblaar) are virtually unaffected when other farms have had freezes."[1] The reason for this peculiar distribution of severe frost lies in the shape of the Kat River valley. South of Tidbury's Toll the valley narrows considerably where the Kat River passes through a sill of resistant dolerite. Air drainage is obviously very difficult along this narrow winding sector, and when temperature inversions occur, the cold air appears to dam up behind the defile. Between this gorge and Lower Blinkwater the valley is fairly wide, assisting in the dispersal of any cold air draining down the Blinkwater valley as well as any which may have filtered through the defile upstream. Shortly after being joined by the Blinkwater River, the Kat enters an even narrower two mile long curved gorge cut through a second sill of dolerite, which acts as a most effective barrier to cold air draining southwards. Consequently the valley bottom for a few miles to the south is free from severe frost. At Baddaford there is thus the paradox of land adjoining a southern slope being warmer than that on the northern side. It is for this reason that Baddaford produces nearly half of the Kat River valley's total Valencia export crop (46.9% in 1960). Despite these favourable factors, Navels still predominate over Valencias. Baddaford is the only

[1] From correspondence with Llewellyn Roberts, 23/10/1962.

KAT RIVER VALLEY BETWEEN MILLBANK AND GONZANA



3 lemon exporting farm in the Bedford and Fort Beaufort divisions and is also one of the few farms which export grapefruit. Even avocado pears can be profitably produced at Baddaford, where there is an orchard of 600 Mexican type avocado trees, which are readily distinguishable from other varieties by the characteristic aniseed smell of the leaves when crushed. They are also the hardiest of the avocado varieties; mature trees can tolerate a temperature of 24°F. The fruit is more vulnerable to frost, but fortunately ripens in late summer and autumn. It seldom exceeds 8 ounces in weight, but is palatable, although the oil content of the pericarp appears to be higher than that of other avocado varieties.

Soils and Fertilisers

Most of the citrus orchards are situated on fairly deep alluvial soils, varying from light sandy loams, mainly derived from sedimentary rocks of the Beaufort Series, to fairly heavy black loams mainly derived from dolerite. pH values vary from a little less than 7.0 to 8.5. The high pH ratio is due partly to the relative high percentage of Sodium, Magnesium, Calcium and other salts in the irrigation water,[1] particularly during dry spells, when the rivers derive most of their water from seepage. It would appear that the soils in general are deficient in nitrogen and the trace elements, manganese sulphate and copper sulphate. At Baddaford nitrogen, potassium and phosphorus are applied to the orchard soils every year. In addition the trees are annually sprayed with zinc sulphate and biennially with sulphates of manganese and copper, which they require as trace elements. Magnesium is seldom applied to the soil owing to the relatively high magnesium content of the irrigation water. Llewellyn Roberts, Jnr., states that "As we have no leaf analysis service we don't really know if the above chemicals are deficient, but apply them any way as various 'experts' tell us they are necessary."[2] On

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1 See p.

2 From correspondence with Llewellyn Roberts, 23/10/1962.

4 most farms, however, kraal manure is the only fertiliser used.

It has been found that nitrogen is the most important plant food lacking in the soils of this region. Animals are kept on all the citrus farms, and their manure has proved a satisfactory source of nitrogen, in contrast with certain acid soil areas of the Transvaal and south-western Cape, where the application of kraal manure has not always given satisfactory results. Nitrogen is seldom applied in the inorganic form, for its excessive application could result in the soils becoming too alkaline, thereby damaging the trees. Lombard observes that leaf analysis clearly indicates that during the period September to November citrus trees draw heavily on their reserves of nitrogen, "and it is during this period that a good supply of available nitrogen must continually be present in the soil if good tree condition and a good set of fruit is to be assured."[1] He recommends that the application of nitrogenous fertiliser be made sufficiently early to become available and be absorbed by the trees by the time blossoming commences. On most farms in the region kraal manure is broadcast and disced in before fruit picking commences in May. This gives the trees sufficient time to absorb the extra nitrogen before blossoming. The amount of manure applied varies from farm to farm, but the average is approximately 50 lbs. per tree. Some farmers also apply compost to increase the organic matter in the soil. Only a few farmers spray their trees with sulphates of manganese, copper and zinc in order to combat deficiencies of these trace elements in the soil.

Irrigation

The vast majority of orchards derive their irrigation water from the rivers. On the Kat, Tyume and Koonap there are many weirs, which hold the water back for pumping or for leading by gravity flow along furrows. It is conveyed either directly to the orchards

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[1] C.A. Lombard, "The Fertiliser Requirements of Citrus Trees", The Citrus Grower, No. 166, Pretoria, 1947.

5 or else to storage dams, from where it can be utilised as required, regardless of the amount of water in the river.

Although sprinkler irrigation is gaining in importance, the majority of orchards are irrigated by the basin system. Low earth banks, from 6 to 12 inches in height, are thrown up around each tree. Water flowing along a furrow is turned successively into each basin to give each tree the equivalent of about 4 inches of rain. When the water flows in faster than it is absorbed, the tree is assumed to have had this amount. This arbitrary method is obviously unreliable because of the varying rate of inflow of water and dryness of soil encountered, but in practice the farmers gauge sufficiently accurately to obtain the desired results.

On level land, where the trees are sufficiently widely spaced to permit mechanical cultivation, the basins are usually temporary structures which can be broken down when weeds are disced in. The tractors are usually fitted with scrapers in front in order to push down the basin banks when discing the orchard. On terraced land, or where the trees are planted rather closely, large scale mechanisation is impossible. The building of basin banks on such land is a tedious time consuming hand operation, consequently basins are retained as permanent features. In such orchards the cultivation consists of hand-hoeing where the terraces are very narrow or the trees closely planted. Where the terraces are wider, horse or ox-drawn toothed harrows are used without causing much disturbance of the basin banks, and thereby minimising the costly spade work involved in their construction.

The amount of water to be applied when irrigating citrus trees varies on individual farms according to local climatic factors, the age of the trees and the depth and type of soil. In all the major valleys the orchards are normally irrigated from four to five times per annum, thereby providing the trees with an extra rainfall equivalent of 16 to 20 inches, and giving mean annual orchard water averages of 35 to 45 inches. According to Lombard, the soil moisture condition should be as near optimum as

Citrus orchards and lucerne fields, Kat River valley in the vicinity of Amherst, August 1971. Note the poplar windbreaks.

possible from August to December, during the critical blossoming and fruit setting period.[1] Moreover, the trees should not be allowed to suffer from a lack of moisture during the hottest summer months of January and February, when the quality of the fruit can be adversely affected.[2] Most farmers in the submontane valleys plan their irrigations so that three of these fall during the blossoming and fruit setting period, one during midsummer and the fifth in autumn, before the fruit begins to ripen. The months of greatest irrigation frequency are August, October, December, February and April, but obviously the times are adjusted to suit the rainfall conditions of each year. Irrigation is rarely practised in March, the wettest month, or in midwinter, between the period of fruit ripening and the next blossoming period. To conserve moisture and plant food the orchards are kept clear of weeds by persistent cultivation of the ground, either by mechanical discing or hoeing. Cultivation is practised several days after irrigation, when the soil has dried sufficiently.

The basin system of irrigation can lead to widespread brown-rot gummosis infection, i.e. rotting of the basal trunk and crown roots of citrus trees by any species of Phytophthora. According to Fawcett and Klotz,[3] the rough lemon rootstock is least resistant to brown-rot gummosis, whereas the sour orange rootstock is most resistant. In this area, despite the extensive use of rough lemon stock, losses due to rotting are very slight. The trees are planted with the topmost roots at ground level, and, as the slightly sandy topsoil dries out very quickly, the saturated conditions necessary for the establishment of Phytophthora do not persist long enough.

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[1] C.A. Lombard, "Irrigation Practices in the Eastern Cape Coastal Area", The Citrus Grower, No. 156, Pretoria, 1947.

[2] Ibid.

[3] Fawcett and Klotz in Batchelor & Webber, "The Citrus Industry", Vol. II, University of California Press, 1948, p. 556.

The Citrus Farms

In 1960 a total of 82 farms or holdings in the Bedford and Fort Beaufort divisions produced citrus for marketing through the Citrus Exchange. 51 of these were located along the Kat River and its tributaries, 10 in the Tyume River valley, 12 in the Koonap River valley, including two erven within the municipal area of Adelaide, 3 in the Waterkloof, 2 in the Mancazana, 2 in the Kowie, one in that part of the Keiskamma River valley situated in Victoria East, and one in that part of the Great Fish River valley situated in the Fort Beaufort district. Several other farms produced small amounts of citrus for local requirements. The mean production of citrus per farm in each of the valleys was as follows: Kat River 5,205 cases,[1] Tyume 10,455 cases, Koonap 2,198, Waterkloof 5,227, Kowie 1,328, Mancazana 152, Keiskamma 7,671, Great Fish 5,227.

As part of the farming study carried out in 1970 a total of 35 citrus producing farms, situated in all five magisterial districts, was investigated. The mean area of these farms was found to be 1,546 morgen, of which 74.4 morgen (4.8%) was cultivated. 67.7 morgen (91%) of the cultivated land was irrigated. The area under citrus averaged 25.3 morgen per farm, i.e. 34% of the cultivated land.

On only one farm was more than half the total area cultivated. This was a 475 morgen farm in the Upper Tyume valley, of which 250 morgen was under cultivation, all of it irrigated. This farm had the largest area under citrus, viz. 155 morgen. Ten years before, in 1960, it was the leading producer of both Washington Navel and Valencia oranges in the entire region, a position which it apparently maintained in 1970. The production in 1960 was 29,583 cases and 22,834 pockets of Washington Navels as well as 15,436 cases and 8,886 pockets of Valencia oranges. This farm in 1960 produced 62.5% of the Tyume valley's export Navel orange crop and 69.1% of the export Valencia crop.

[1] Pockets converted to cases on basis of 2.33 pockets per case.

3 On the 35 citrus producing farms investigated in 1970, the average number of livestock per farm was 195 cattle, 700 sheep, 224 Angora goats and 35 Boer goats. Cattle were kept on every farm. Only 5 of the 35 farms had less than 50 cattle, but 18 farms had less than 200 sheep, 15 of these with no sheep at all. Sheep are absent from many of these farms as jackals are numerous in the denser sectors of Scrub Woodland. In these sectors losses amongst sheep not kraaled nightly are rather high. Angora goats were reared on 16 of the farms, Boer goats on 10 farms. Thus it can be seen that the character of farming in the citrus producing valleys is essentially that of mixed farming, with pastoralism more important than agriculture. A detailed study of a leading citrus farm in the Kat River valley illustrates this very well.

In 1961 a visit was paid to the property of the brothers Donald L. and Clive L. White, situated in the vicinity of the junction of the Kat and Mancazana Rivers in the Stockenström district. The two brothers owned 4,473 morgen of farm land, of which 2,786 is a block of essentially sweetveld situated in the Kat River valley. Lorraine, Jelliman's Kloof, Tidbury's Toll, Killarney and Vaalkop are the chief farms in this block, ranging in altitude from 1,650 to 3,200 feet. In addition they owned 1,687 morgen of sourveld, 1,359 morgen of which makes up the farm Benholm, at a height of 3,000 to 5,400 feet in the Elandsberg. The brothers are the sons of the late George White who, after the Anglo-Boer War of 1899-1902, farmed with ostriches on the farm Hounslow in the Albany division. In 1910 he purchased Lorraine, the first of his several farms in the Kat River valley, with the intention of growing lucerne for ostriches. A record of his Kat River farming ventures has been kept in the Lorraine farm diaries. In conjunction with his brother Alfred, George White was successful at the 1911 shows in Port Elizabeth, winning 45 first and second prizes and three gold medals for ostriches and feathers. Two of his breeding birds, "Skopper" and "Ounceman", became famous, and even today their descendants are in strong demand at Oudtshoorn.

9 George White was affected seriously by the ostrich slump in 1914, and concentrated more and more on his property on the Kat River, where he planted his first orange trees in 1916. While these trees, numbering three thousand, were still in the non-bearing stage he reared pigs, and had at one time approximately four thousand of these animals at Lorraine. In 1917 George White sold Hounslow and moved to Lorraine, where he systematically switched to citrus farming. Owing to the long term nature of citrus he continued to farm with ostriches, as he believed that the feather trade would revive. Ostriches are still bred at Lorraine by his sons, who have been very successful in showing these birds at the Port Elizabeth and Oudtshoorn shows. After the First World War George White decided to breed heavy horses as well, and imported Percheron mares and stallions from Great Britain for this purpose. He gained many successes with his heavy horses at agricultural shows, but later stopped breeding them owing to the increasing use of the tractor for agricultural purposes. At present Lorraine, Jelliman's Kloof and their satellite farms are important for the breeding of mutton sheep from imported English breeds such as the Southdown, South Devon and Romney Marsh. The farms are equally important for beef and dairy cattle.

George White was chairman of the Kat River Citrus Co-operative from 1923 to 1934. His son, Donald, who now lives in the main Lorraine homestead, became chairman in 1947 and still occupied this position in 1970. George White was also one of the foundation members of the Cape Eastern Meat Export Company, which was formed for the purpose of exporting mutton when prices were extremely low during the world economic depression. After the Second World War the company ceased exporting owing to the increased demand of meat in South Africa, and became known as the Cape Eastern Meat Co-operative, now concerned with disposing of members' livestock at controlled centres and through regular auctions held in all the smaller centres of the Eastern Cape. George White relinquished active farming in 1953, his sons Clive and Donald taking over the estate. In 1961 Clive White, who lives at the Jelliman's Kloof homestead, was chairman of the South African Meat Producers Central Co-operative as well as chairman of the Cape Eastern Meat Co-operative, positions which he still occupied in 1970. A third brother, Stanley White, is farming independently at Amherst, to the north of the block owned by the other two brothers.

The rainfall over the lowland block of 2,786 morgen probably averages less than 25 inches per annum everywhere, reaching a minimum in the valley bottom. The average annual rainfall at the main Lorraine homstead for 26 years from 1930 to 1960 is 20.23 inches.[1] No temperature data are available, but owing to the narrow entrenched nature of the valley, the summer maxima in the lowest parts are probably higher than those of Fort Beaufort and the winter minima probably lower. The vegetation is essentially Scrub Woodland, grading into Acacia Savannah at 1,900 to 2,000 feet. On those sectors of the estate below 1,800 feet the Scrub Woodland is considerably modified as a result of the low winter minimum temperatures, and frost sensitive components such as _Portulacaria afra_ and _Cussonia spicata_ are absent. The presence of either of these plants may be taken as an indication of whether the land at that level is suitable for the commercial production of Valencia oranges. Exposed saplings of _Cussonia spicata_ and even fully grown _Portulacaria afra_ are invariably killed by a minimum temperature of 28°F., at which temperature immature Valencia oranges are injured. The most common trees in the lower part of the estate are _Olea africana_ and _Acacia karroo_, both frost hardy. The less hardy _Euphorbia tetragona_ is conspicuous on steep slopes at some height above the valley floor. It is most abundant on the very steep north facing slopes to the south of the main Lorraine homestead. This tree is regarded as a pest, and steps are being taken to eradicate it. As a result of careful veld management and the eradication of undesirable scrub, the veld is very well grassed.

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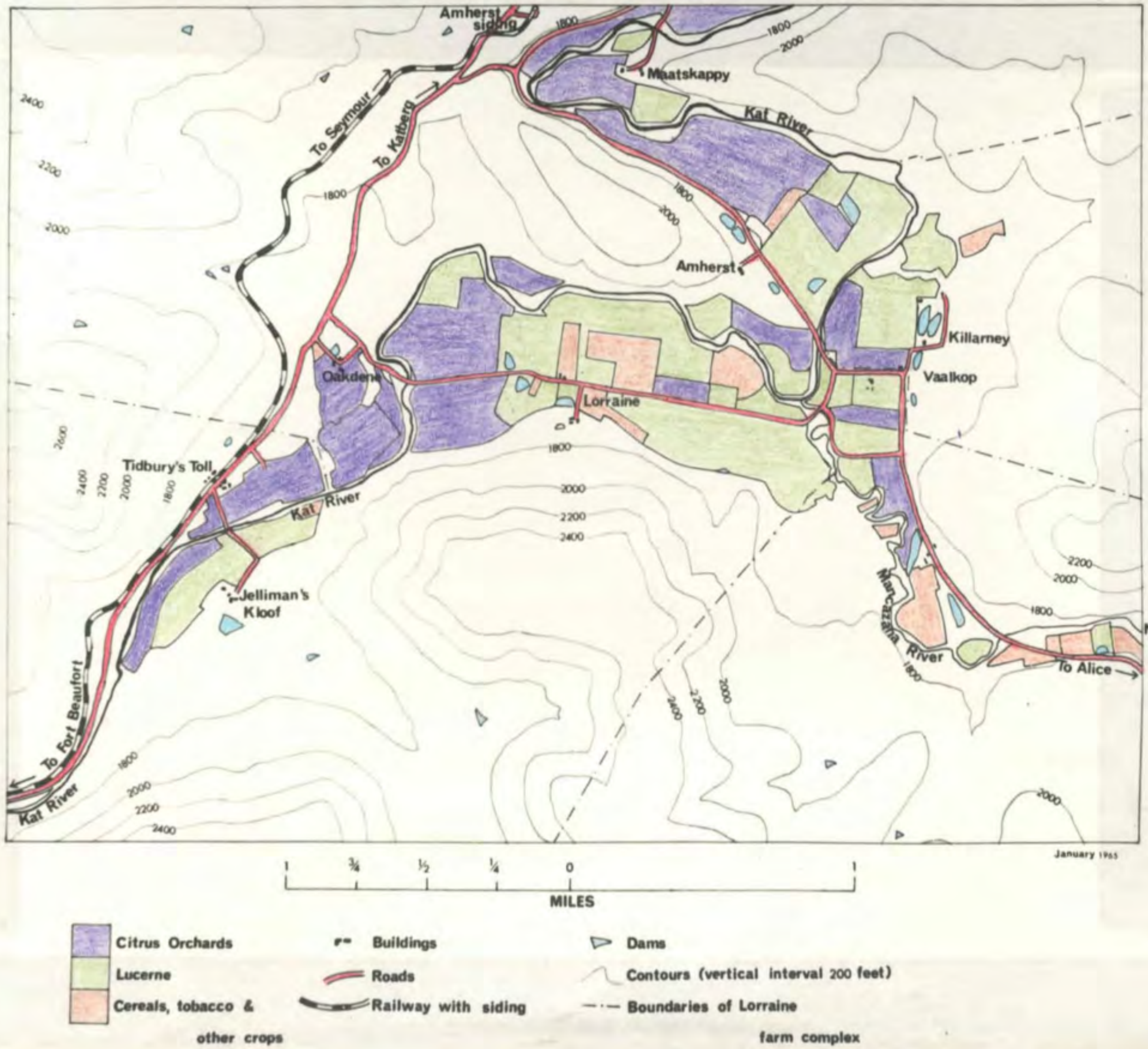
[1] Complete recordings not available for period 1938-1942.

Sporobolus, *Digitaria* and *Panicum* spp. are the most common grasses in the lower lying parts, where *Setaria* spp. are also conspicuous. *Themeda triandra* is the dominant grass only in areas exceeding approximately 2,000 feet.

All the cropland is situated between 1,650 and 1,730 feet, i.e. on the deep alluvium occupying the very lowest parts of the block of farms. No crops are grown without irrigation. A total of 282 morgen was under cultivation in the winter of 1961. Of this amount 118 morgen was devoted to citrus, and the balance to fodder crops for livestock, 42 morgen of this being under oats and 122 morgen under lucerne. During summer the oats is replaced by maize and a small amount of sorghum. After the maize and sorghum cobs have been harvested for the purpose of feeding the Bantu workers, the stalks and foliage are used for making silage. No significant changes in the areas under the various crops were noted in January, 1965, when the writer mapped the land use of the Kat River valley in the vicinity of Lorraine. (See p. 329.) The land use of the Lorraine area was mapped a second time in October, 1969, as part of the land use survey of the Bedford and Fort Beaufort divisions. Once again the same pattern was observed.

In 1960 there were more than 20,000 citrus trees growing on the 118 morgen of irrigated land, giving a mean density of approximately 170 trees per morgen. All are Washington Navels as the orchards are too frosty for any other types. In that year these trees, including those in the non-bearing stage, yielded the equivalent of 31,264 cases of oranges, giving a yield of a little more than 1½ cases per tree. Donald White states that the average yield for mature trees in full production is approximately 2½ to 3 cases. The orchards are situated on level or slightly sloping alluvial terraces bordering the Kat River, and range in altitude from 1,650 to 1,730 feet. To the west of the main Lorraine homestead a curved depression, from 10 to 20 feet deep, traverses the orchards. This abandoned meander of the Kat River is a severe frost pocket, and

KAT RIVER VALLEY IN THE VICINITY OF LORRAINE



trees growing there suffer severe frost damage every few years.

Annual production figures for the 11 year period from 1950 to 1960 give an indication of the effect on the harvest of weather as well as other factors:-

1950 - 4,652 cases, an unusually low yield owing to the 1949 drought, when the total rainfall for the year was only 8.19 inches, there was a shortage of irrigation water, and hot dry winds were frequent during the spring.

1951 - 21,170 cases, a good harvest owing to the high rainfall (36.07 inches) and mild temperatures of 1950.

1952 - 9,166 cases. This severe reduction was partly due to persistent hot, dry winds in November 1951, when an unusually large proportion of the setting fruit was dropped. This calamity was followed by "one of the frostiest seasons on record", when a lot of fruit was damaged. In June 1952 practically all the fruit in the abandoned meander was destroyed and the trees completely defoliated.

1953 - 13,467 cases. This was a very poor season owing to heavy hail in January, which knocked off the fruit or else bruised it. Packing of Outspan brand oranges for export was impossible as a result of the hail damage.[1]

1954 - 19,229 cases. A record fruit crop was expected owing to the unusually high rainfall (31.87 inches) and mild temperatures of 1953. This did not occur, however, as there was a severe bollworm infestation in October 1953, and only DDT was available for dusting. This was followed by what Donald White terms "the heaviest red scale infestation in the history of Lorraine". Spraying of the trees with parathion was hampered by frequent showers in March and April. The scale was killed too late, and consequently the fruit was badly stained.

1955 - 18,380 cases. No comments on the weather or citrus pests appear in the Lorraine farm diary. Orange picking commenced

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[1] For hail frequency in this region see p. 34.

on 3rd May, the earliest start on record, and was completed by 7th July.

1956 - 18,343 cases. Despite the fact that an ever increasing number of young trees was coming into bearing, production failed to expand. The exceptionally hot dry summer preceding the harvest resulted in a lot of fruit drop and fruit burn.

1957 - 32,831 cases, the highest production ever attained. The exceptionally wet, mild spring of 1956, like that of 1953, reduced fruit drop to a minimum. Further good rains in February and March favoured vigorous fruit development, and the pests of the 1953-54 season did not recur. The exceptionally mild winter resulted in no frost damage at all.

1958 - 23,375 cases, a mediocre season owing to severe fruit drop during the hot, dry spring of 1957. Severe frost on 21st June (23.4^{o}F. at Fort Beaufort and 24.5^{o}F. at Surrey) destroyed much of the crop which had not yet been harvested.

1959 - 27,888 cases. The production still below the potential, this time largely the result of hail in January. There was a bad scale infestation in the late summer, and the trees had to be fumigated with cyanide.

1960 - 31,264 cases. A severe hail storm on 13th March resulted in a fair amount of loss and prevented the season from being a record one.

It can thus be seen that, although frost is a major climatic hazard, losses due to hot dry winds, sunburn and hail can also be considerable. All the fruit is usually off the trees before mid-July in order to escape as much frost damage as possible. During exceptionally hot weather in midsummer, unshaded oranges on the north-western sides of trees can become sunburnt, resulting in the skin splitting later in the year. Such fruit is sold locally at a reduced rate by the Kat River Co-operative.

The Lorraine-Jelliman's Kloof-Tidbury's Toll orchards are too frosty for the establishment of nurseries, thus the White brothers obtain their young trees from Baddaford. Like all the Baddaford Navels, they are grafted on rough lemon stock. The young trees are planted in two sets of rows which intersect each other at right angles, one set of rows being twelve feet apart, the other twenty-four feet. This spacing allows for mechanical cultivation on all sides. The extra wide lane is to allow tractor drawn trailers to pass through the orchards during the picking season. After five years the tree tops start meeting along the twelve foot lanes, but never do so along the 24 foot lanes. For the first three years the trunks of the young trees are covered in straw. Although this protects the tender trunks from sunburn, its main function is to protect the trees from frost during the winter and to stop the rough lemon stock from shooting during the summer. The trees usually start bearing in their third year, although a little fruit is obtained sometimes from two year olds. The crop increases annually, usually reaching its maximum in the twelfth year. The full yield can be maintained for more than thirty years. At Lorraine many of the trees planted in 1916 are still yielding from 3½ to 4 cases each per annum. There appears to be no definite age at which a decline in yield occurs, the age varying from tree to tree. Every year the White brothers order approximately 100 trees from Baddaford for the replacement of declining trees. This gives a very low annual replacement rate of 0.05%.

The orchard soils are reasonably fertile sandy loams with a mean pH of 7.4. The trees are each given approximately 100 lbs. of kraal manure as fertiliser every alternate year. It is broadcast in the orchards and disced in. This usually occurs in March and April, thereby giving the orange trees sufficient time to absorb the nitrogen and other mineral salts before blossoming in late September. In addition the trees are annually sprayed, in September and October, with manganese and zinc sulphate in order to combat any deficiencies of these trace elements, should they occur. Solid artificial fertilisers, such as calcium phosphate, sodium nitrate, etc. used to be applied regularly until 1939. In the late 1930s the value of the artificial solid fertilisers applied to the citrus trees averaged more than R3,600 per annum. Because these mineral salts were unobtainable during the war years, this practice was discontinued. As there was no consequent loss in yield, it was not resumed when artificial fertilisers once more became available during the post war years.

The citrus orchards are irrigated by gravity flow from weirs in the Kat River, as well as by pumping. No large conservation dams have been constructed for irrigation purposes, as they would occupy too large a proportion of the valuable alluvial land. The orchards are bordered by steep hills, composed of pervious Beaufort shale and sandstone, which do not offer suitable dam sites. The existing earth dams do not take up a very great area and are relatively shallow. They are mainly for the regulation of the flow irrigation water and the watering of livestock. It is fortunate that citrus farming has been possible without large conservation dams owing to the almost perennial nature of the Kat River. During the driest years it has always been possible to irrigate the orchards, on a reduced scale, from water holes in the river. The proposed construction of a series of conservation dams on the Kat River and its tributaries should ensure permanent flow of the river and make more water available for irrigation. The first of these dams, on the upper Kat River, near Seymour, was completed at the end of 1969. (See page 292.)

All the irrigation in the Lorraine-Tidbury's Toll-Jelliman's Kloof orchards is by means of the basin system. Apart from those on some narrow terraces, the basins are permanent. Normally there are about five irrigations during the course of the year, but the time and frequency depends on the distribution and amount of rainfall. The citrus trees are always irrigated before blossoming commences in September. It takes 17 days to irrigate all the orchards, and this usually starts in the first week of August. Discing follows irrigation when the ground is sufficiently dry. Every five years deep subsoil ploughing is carried out to a depth of 24 inches in order to prevent the soil becoming too hard and compact. This prunes the surface roots, but does not harm the trees in any way.

The three major insect pests on the block of farms are boll worm, infestations of which occurred in 1953 and 1960, red scale and fruit fly. Serious losses, however, seldom occur as a result of insect infestation. The fruit is sprayed for fruit fly at fortnightly intervals from February until picking time. Fumigation for scale occurs in January and July.

Orange picking usually occurs from the second week in May to the first week in July. Most of the pickers are Coloured and Bantu women and older children, who individually average from 40 to 50 lug boxes of 50 to 56 lbs. per day. The pickers use clippers to prevent the trees from being damaged. They are paid one cent per box, which is the common wage throughout the valley. The lug boxes are loaded by Coloured and Bantu men on to lorries for transport to the railway siding at Tidbury's Toll. No orchard is more than two miles from this siding. From here the fruit proceeds by rail to Fort Beaufort, some 15 miles away, for sorting and packing in the Katco packing shed. Occasionally the oranges are taken by road if there is a shortage of railway trucks.

On the 2,786 morgen owned by Donald and Clive White in the Kat valley there were approximately 700 cattle and 2,000 sheep in June 1961. The Whites have been cross-breeding sheep for many years, and have found that the best strain for fat lamb production is a South Down-South Devon cross with a small infusion of Romney Marsh blood. There were approximately 1,500 of these cross-breds in mid 1961, and also about 500 pure bred Merino sheep, reared for both mutton and wool. During dry spells, when the natural grazing is in poor condition, the sheep are grazed on oats or lucerne. The average weight of three month old cross-bred lambs, many still suckling, is between 65 and 70 lbs. These heavily built lambs give a surprisingly long wool staple of nearly two inches when shorn before being sent to the abbatoirs. The White brothers, like most farmers in the area, prefer to mate their sheep to lamb in the autumn, when parasitic diseases are less prevalent, but those ewes which do not conceive are mated to lamb in the spring. The mortality rate amongst even the spring lambs is so low that for every 100 ewes well over 100 progeny annually reach the slaughtering stage.

The White brothers graze approximately 700 cattle on their lowland farms. In 1961 a total of 60 of these were Frieslands, which are kept for dairying purposes. Milk production is not seriously affected by the frequent droughts, as the natural grazing is supplemented by feeding on lucerne and silage. The milk is collected daily by a lorry which conveys milk from the Mancazana and Central Kat valleys to a cheese factory situated at Kroomie, midway between Fort Beaufort and Adelaide. On the estate in mid 1961 there were 240 pure bred Africander cattle as well as 400 Africander-Shorthorn cross-breds. These cattle, which graze on the indigenous vegetation all the year round, are sold for beef. They are able to stand up well to the long dry spells and are also very resistant to heat. The Bantu and Coloured labourers are not allowed to keep any livestock of their own. No goats are kept owing to the damage they inflict. The White brothers endeavour to market their cattle and sheep as young as possible, which means that their turnover is quick. They feel that the higher prices on young stock is an adequate inducement to market early.

Rough, indigenous grazing occupies all but the 282 morgen of irrigated land in the lowland block. The approximately 2,500 morgen of sweetveld grazing is divided into 26 very large paddocks, locally termed "camps". All are well supplied with drinking water, so that adequate grazing rotation can be practised. The stock water supply is provided by means of earth dams or boreholes on all the farms except Tidbury's Toll. Here the terrain is either too steep or the soil and bedrock too pervious for dam construction, and boring has proved unsuccessful. Electric pumps[1] are used to raise

[1] For source of electricity supply see p. 194.

water from the Kat River into drinking troughs, the highest of which is situated more than 700 feet above river level !

For more than thirty years the White brothers have been planting Agave americana, locally referred to as American aloe or garingboom, and feeding it to their livestock. They plant about 5,000 young Agaves per annum. In addition to its use as fodder the Agave, owing to its readiness to sucker, can be grown in hedge form to serve as boundaries between the irrigated grazing paddocks. When grown on the contour, Agave hedges serve as effective silt traps, thereby preventing soil erosion. The establishment of an Agave hedge simply involves the setting of two year old plants in furrows at intervals of four to six feet. These xerophytic plants require no irrigation or any other attention. The leaves may be used as fodder when the plants are ten to twelve years old.

The leaves, some of which weigh more than one hundred pounds, are levered out from the centre of the plant by means of a crowbar, so that as much of the fleshy basal part as possible can be used. The fibrous margins are cut away before the leaves are put through a chaff cutter which cuts them up into approximately one inch slices. The juice contains an extremely pungent acid which has a burning taste and produces a rash on contact with the human skin. It is less pungent if the leaves are allowed to lie for a day after cutting. Stock readily eat Agave once they have become accustomed to it. It is rendered more palatable when mixed with lucerne hay, bran or maize meal. On the White brothers' estate Agave leaves are always supplemented with lucerne hay, as it alone cannot provide an adequate maintenance ration. Sheep are never given more than 14 lbs. of Agave per day. When planted in rows nine to fifteen feet apart a yield of 120 tons of Agave leaves per morgen may be expected, even on rather poor, thin soils.

Stud ostrich farming still plays a considerable role in the economy of the Lorraine farming complex. In 1961 there were 74 adult birds on the estate, all of stud stock. 41 of these were cocks, and 32 hens. The birds are grazed on lucerne for most of the time. In July they are put out in pairs in small individual 3 to 4 acre paddocks of rough pasture for mating and breeding. Their grazing is supplemented with lupins, dried maize, lucerne meal and Agave leaves. The hens lay approximately 16 eggs in well camouflaged nests. These, once detected, are covered with V-shaped shelters in order to protect the birds over the incubation period. Usually the hens have completed their laying by August, after which incubation commences. Both male and female take turns at nesting, the black feathered male sitting by night, the dun coloured female by day. This lasts for 42 days, most of the chicks hatching in September and October. The newly hatched chicks are labelled with rings to indicate their parentage. The majority of the adults are then deprived of their offspring in order to get them off brood and back to good condition. The tamest ostrich pairs are selected for bringing up batches of approximately fifty chicks in order to ensure that they become tame before they are sold. The young chicks eat the mother's soft dung for the first few days. Those chicks hatched in incubators are fed on fresh cow dung diluted with water. During the first few months of their lives the young ostriches are rather delicate, and a small number of deaths annually occur as a result of accidental wetting by rain or breaking of legs. The chicks are put into sheds overnight should there be any indication of rain. Internal parasites are, however, the major problem. These are kept under control by regular dosing with a mixture of Cooper's dip and sugar!

The chicks are sold before they are three months old in order to reduce transport costs. Occasionally a few chicks are retained at Lorraine to keep up the breeding flock. Buyers, most of whom are from the Oudtshoorn district, select the chicks on the basis of the parents' feathers, which are displayed in catalogues despatched by the White brothers. Some buyers, however, prefer to inspect both the parents and offspring before making purchases.

The feathers of the adult ostriches are clipped annually in June, the first crop being ready at the age of approximately 21 months. They are sorted separately for each bird into three classes, viz. wings, tails and blacks, the latter only from cocks. The quill bases are not removed until November, by which time they have dried, thereby rendering the process painless. If dead quill bases are not removed they interfere with the growth of new feathers. The feather yield of a good cock is approximately 14 ozs., whereas that from a good hen is approximately 10 ozs. The average price obtained by the White brothers for cocks' wing plumes at sales in Oudtshoorn in 1960 was approximately R10 per lb., that for good short feathers approximately R4-50c. and for tail feathers approximately R2-00.[1] These prices are naturally low when compared with those of the boom years immediately preceding the First World War.

The White brothers also conserve game, and their estate abounds with indigenous antelope such as bushbuck (<u>Tragelaphus scriptus</u>) and grey duiker (<u>Sylvicapra grimmia</u>). Other South African antelope, now extinct in this area, have been introduced to the Lorraine farming complex. These include rhebuck (<u>Pelea capreolus</u>), blesbuck (<u>Damaliscus dorcas phillipsi</u>) and springbuck (<u>Antidorcas marsupialis</u>).

It will be recalled that the White brothers also own 1,687 morgen of highland sourveld in the Elandsberg. 1,359 morgen of this make up the farm Benholm, ranging from 3,000 to 5,400 feet in altitude, and situated 23 miles from Lorraine. A European manager is in charge of this high rainfall farm which is divided into 14 "camps", each supplied with water from perennial mountain springs. Cattle and sheep are sent from the lowland farms for summer grazing at Benholm. As stated in previous chapters, such migration of livestock between lowland sweetveld and highland sourveld is practised by many farmers in the area. During the winter Benholm is devoid of livestock, except for several hundred sheep grazing mainly on 60 morgen of oats. The oats, which is sown in the late

[1] The average 1968 price for cocks' wing plumes was R54 per lb.

summer, grows well without irrigation. When the White brothers first acquired Benholm in the 1950's it was badly infested with Helichrysum argyrophyllum, Cliffortia paucistaminea and Elyonurus argenteus owing to heavy overgrazing. Most of the Cliffortia has been chopped out and is now under control. As a result of careful management Helichrysum is gradually being ousted by grass and Elyonurus is giving way to more palatable species of grass. Spring burning occurs every few years, as the White brothers believe that this eliminates undesirable plants and gives the grass a better chance of spreading.

Although the White brothers' estate is one of the largest and richest of all the citrus producing farms investigated, the diversity of the farming operations may be regarded as typical.

Future Development

For the last thirty years the area occupied by citrus orchards has remained virtually static in all the major river valleys, with the exception of the Tyume. As stated in the previous chapter, it is planned to build storage dams on all the major rivers. In addition to the 10,000 morgen-feet capacity dam on the Upper Kat, which was completed at the end of 1969,[1] three similar dams are projected for the remainder of the Kat River system. The Koonap River Water Conservation Committee has accepted the offer of the Department of Irrigation to construct a storage dam on the Koonap River at Foxwood, two miles north of Adelaide, just below its junction with the Mancazana. There is also the possibility of a large dam being constructed on the Upper Tyume.[2]

The Kat River valley north of Fort Beaufort is the most intensively cultivated of all the sectors, with most of the alluvial land already under irrigation. As the flow of the river becomes more regular, new orchards will probably be established on the lower

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1 See p. 291.

2 A.H. Jonker, M.P., reported in "Die Oosterlig", Port Elizabeth, 21st August 1962.

parts of pediments bordering the alluvial terraces. These pediments have the disadvantage of rather shallow colluvial soils, with the subsoil completely absent, and will thus have to be irrigated fairly frequently. When the greater amounts of irrigation water become available development will almost certainly be very great along the Koonap and Kat valleys south of Adelaide and Fort Beaufort, where much fertile alluvial land is at present uncultivated. Increases in citrus production in the Tyume valley, which in places has deep residual soils, will probably be less spectacular, for the eastern side of the valley is occupied by Bantu reserves, and at present the Xhosa do not have the capital or skill necessary for successful commercial citriculture. The implementation of the Orange River Project should also make more alluvial land along the Great Fish River available for irrigation. The areas south of Adelaide, Fort Beaufort and Alice are very suitable for the production of Valencia oranges, as they do not experience severe frost, and it would be advantageous to grow more of these in order to keep the packing sheds operating over a longer period. Moreover, Valencia orange trees do not suffer fruit drop to the same severe extent as Washington Navels.

CHAPTER XIV

THE KARROID FARMS

The karroid farms are those where the natural vegetation consists mainly of Karroid Acacia Savannah, Dwarf Karroid Shrub Steppe or Highland Karroid Grassland. According to the above definition a total of 36 karroid farms was sampled.[1] Of these 28 are situated in the Bedford district and 8 in Adelaide. The mean area of the 36 karroid farm units sampled is 2,904.4 morgen, which is more than double the mean area of either the average sour grassveld or the average sweet grassveld farm unit sampled. The largest karroid farm unit sampled, 8,292 morgen in area, occupies part of the Baviaans River valley in northern Bedford. The smallest karroid farm sampled is a 90 morgen irrigation holding situated in the Great Fish River valley in western Bedford.

The karroid farming region has been divided into three sub-regions, viz. the Baviaans River valley, the Great Fish River valley and the lower Kaga and Koonap River valleys.

The Baviaans River Valley

The Baviaans River valley differs from the other karroid sub-regions in several respects. One of the major differences is that it is richer in grass. Although the lower portions of all the farms consist of Karroid Acacia Savannah (see pp. 104-110), the higher portions of all but one of the farms sampled, i.e. the areas above approximately 4,000 feet, consist mainly of Highland Karroid Grassland (see pp. 79-82), which is relatively rich in grass. Although part of the Daggaboersnek area occurs outside the catchment area of the Baviaans River, it was decided to include it with the Baviaans River valley rather than with the

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[1] Questionnaires were completed by 37 farmers owning predominantly karroid farms, but one return had to be discarded as it was inadequately completed.

Great Fish River valley, because its natural vegetation and land use has more in common with the former than with the latter. On four of the twelve Baviaans River valley farms sampled Highland Karroid Grassland comprises more than 50% of the area. The remaining eight farms consist mainly of Karroid Acacia Savannah.

A second factor differentiating the Baviaans River valley from the other karroid regions is that much of it is subject to relatively severe winter frost as a result of air drainage from the surrounding high mountains. As shown on the map on page 26, most of the Baviaans River valley experiences the BSk type of climate of the Köppen System, although the higher portions belong to the Cfb type. This is in contrast with the other karroid sub-regions which experience the BSh type of climate.

Thirdly, the Baviaans River seldom flows and is thus a poor source of irrigation water. From this point of view the Great Fish River and the Kaga and Koonap Rivers are superior.

The Baviaans River valley farms are the largest farms in the Bedford and Fort Beaufort divisions. As shown in Chapter VI, pages 124 to 128, this area was one of the first portions of the present Bedford and Fort Beaufort divisions to be settled by Whites, and the original grants of land were large. The mean area of the twelve farm units sampled is 4,174 morgen, which is almost three times the mean area of either the sour grassveld or sweet grassveld farms sampled. The median lies between 3,179 and 3,679 morgen. The largest Baviaans River valley farm unit, 8,292 morgen in area, is larger than any other farm sampled in the Bedford and Fort Beaufort divisions. The smallest farm sampled in the Baviaans River valley is 1,500 morgen. Only two of the sampled farms in the sub-region are less than 2,000 morgen in area, and two exceed 7,700 morgen in area.

<u>Livestock</u>

The 1970 questionnaires revealed that both cattle and sheep are reared on all twelve of the Baviaans River valley farms sampled, but that goats are reared on only seven farms. Of the latter, five rear Angora goats only, and two rear both Angora and Boer goats. The average Baviaans River farm carries 200.0 cattle, 1,966.2 sheep and 867.4 goats. In terms of large stock units the average farm has 200.0 cattle, 327.7 sheep and 144.6 goats, a total of 672.3 units, which amounts to 6.2 morgen per large stock unit. Sheep and goats thus account for 70.3% of the large stock units, which is in marked contrast with the sweet grassveld, where cattle account for the majority of large stock units.

Cattle

White-owned cattle are kept on all twelve of the Baviaans River valley farms sampled. Bantu employees rear cattle on ten of these farms. They own 23.8% of the cattle, the remaining 76.2% being White-owned. Of the White-owned cattle 50.4% are pure bred. This is in contrast with the sweet grassveld, where 71% of the cattle are pure bred. The relative importance of the various White-owned cattle breeds is indicated in the table below:

Breed	Number of farms where occurring	Percentage of cattle
Africander	1	20.6
Galloway	1	8.2
Shorthorn	2	7.1
Jersey	4	6.3
Hereford	1	4.8
Brown Swiss	1	2.7
Friesland	1	0.7
Shorthorn-Africander-Hereford cross	1	16.4
Shorthorn-Hereford cross	1	8.5
Shorthorn-Africander cross	1	2.7
Galloway-Drakensberger cross	1	12.3
Africander-Brahman cross	1	3.3
Cross bred (strains not stated)	2	6.4

The table above shows that most of the cross bred cattle in the Baviaans River valley are derived from straight crosses between pure bred cattle. Hybrid vigour produced by crossbreeding ensures greater adaptability to the rigorous environment, resistance to disease, greater size, increased growth rate and increased milk production. A local farmer informed the writer that "hybridisation usually produces offspring one tenth to one fifth above either parent in carcass weight. The greater the diversity between the parents and the more pure the two parents the better will be the hybrid progeny."

Eight farmers stated that their cattle are reared mainly for beef, and three that they are for both beef and dairying. On only one farm are cattle kept mainly for ~~of~~ dairying purposes. This is Avondale, a farm consisting mainly of ~~for~~ Highland Karroid Grassland, where South Africa's second creamery was established in 1893. (See page 188.) The milk from Avondale is now marketed in Cookhouse. A portion of the Avondale Brown Swiss herd is, however, sold for beef.

Beef cattle from the Baviaans River valley are marketed mainly in Bedford and in Port Elizabeth. Five farmers stated that their cattle are mainly marketed at the local stock fairs in Bedford, six farmers stated that their cattle are marketed both in Bedford and in Port Elizabeth. Only one farmer stated that his cattle are marketed mainly in Port Elizabeth.

A total of seven Baviaans River valley farms sell dairy produce. As previously stated, the farm Avondale markets fresh milk in Cookhouse. Five farms sell cream to the Cookhouse creamery and one farm, in the north of the Baviaans River valley, markets its cream in Queenstown.

<u>Sheep</u>

As previously stated, sheep are reared on all twelve of the Baviaans River valley farms investigated. Merinos comprise 95.0% of the total and are reared on eleven of the farms.

Dorpers and Corriedales are each reared on one farm and each accounts for 0.8% of the sheep. Crossbreds (strains not stated) are reared on two farms, accounting for 3.3% of the sheep in the sub-region.

Goats

Angora goats account for 98.6% of the goats on the sampled farms of the Baviaans River valley. As previously stated, goats are reared on seven farms, five of these having Angoras only and two both Angora and Boer goats.

Livestock Migration

The grasses in the higher parts of the Highland Karroid Grassland on the mountains bordering the Baviaans River valley tend to be slightly sour. There is a tendency for farmers to graze their livestock in the higher camps for part of the summer and to move them to the lower lying areas of sweet grass and karroid shrubs for the winter months.

Crops

The 1970 survey showed that cultivation takes place on eleven of the twelve Baviaans River valley farms investigated. Approximately 0.6% of the farm land is under cultivation. Only one crop growing farmer in the region does not practise irrigation. This is on a farm consisting almost entirely of Highland Karroid Grassland, where the rainfall is apparently higher than on most of the other farms. Of the 2.71 morgen under cultivation on the average Baviaans River valley farm, 2.43 morgen (89.8%) is irrigated. The area occupied by the principal crops in the sub-region is as follows:

Crop	Number of farms where growing	Percentage of total cultivated land
Lucerne	8	52.3
Oats	9	33.2
Sown grasses	1	6.2
Maize	2	2.8
Match poplars	1	2.2
Barley	2	1.8
Wheat	2	1.6

Oats is more important in the Baviaans River valley than in the other karroid sub-regions as it requires less irrigation water than lucerne. (See Chapter XII, page 286.) From Eildon northwards oats is the principal crop.

The Karroid Sector of the Great Fish River Valley

This sub-region consists of the Great Fish River valley in western Bedford and excludes those karroid areas in the major tributary valleys, viz. the Baviaans, Kaga and Koonap valleys. This sub-region forms part of the what W.C. Els terms "The Great Fish River Irrigation Area", the land use of which he has discussed in detail.[1] The natural vegetation in the Great Fish River valley sub-region consists mainly of Karroid Acacia Savannah and Dwarf Karroid Shrub Steppe (see pp. 110-112), although, in the vicinity of Cookhouse, where the mean annual precipitation is higher, there is a strip of Scrub Woodland on the scarp bounding the eastern side of the valley. The mean annual precipitation at Cookhouse (for the period 1902-1960) is 16.13 inches, compared with only 13.29 inches at Middleton, fifteen miles to the south. (See page 32.) Almost the whole sub-region experiences the BSh type of climate.

The mean area of the fourteen Great Fish River karroid farms sampled is 2,451.1 morgen. The largest of these farms is

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[1] W.C. Els, "Die Evolusie van Grondgebruik in die Groot-Visriviervallei", unpublished thesis, D.Litt. et Phil., University of South Africa, 1965.

6,364 morgen, the smallest, an irrigation holding on the Great Fish River, is only 90 morgen. Five of the sampled farms, all with relatively large tracts of irrigated land, are less than a thousand morgen in area, but five of the farms are larger than three thousand morgen. The median size lies between 2,725 and 1,680 morgen.

Livestock

The questionnaires distributed in 1970 revealed that livestock are reared on all fourteen of the Great Fish River karroid farms sampled. Cattle are reared on 13 farms, sheep also on 13 farms, but goats on only eight of the farms. The average Fish River farm carries 38.0 cattle, 911.6 sheep and 525.6 goats. In terms of large stock units this is the equivalent of 38.0 cattle, 151.9 sheep and 87.6 goats. There is an average of 277.5 large stock units per farm, which amounts to an average of 10.5 morgen per large stock unit.

Cattle

Cattle are of minor importance on the majority of farms investigated, accounting for only 13.7% of the large stock units in the sub-region. White-owned cattle are kept on thirteen of the farms sampled, and comprise 96.2% of the cattle in the sub-region. Cattle belonging to non-White servants make up the remaining 3.8% and are kept on three farms. The relative importance of the various White-owned breeds is indicated in the table below:

Breed	Number of farms where occurring	Percentage of Cattle
Friesland	7	57.0
Jersey	3	8.8
Shorthorn	1	1.6
Dexter	1	1.0
Friesland-Shorthorn-Africander cross	1	29.3
Cross bred (strain not stated)	1	2.0

Four of the farmers stated that their cattle are reared mainly for dairying, and four that they are for both beef and dairying. One farmer rears cattle mainly for beef. Three farmers keep small herds of cattle entirely for domestic milk consumption. Six of the farmers market dairy produce in Cookhouse, four of these cream only, one milk only and one both milk and cream. One farmer, near Thorngrove railway station, sends fresh milk daily to Cradock. One farmer, near Harefield railway siding, midway between Long Hope and Middleton, markets fresh milk daily in Port Elizabeth.

Sheep

The economy of the karroid sector of the Great Fish River valley is at present based largely on the rearing of sheep and goats. Sheep account for 54.7% of the large stock units in the sub-region. Merinos are reared on eleven of the thirteen sheep rearing farms sampled and comprise 92.6% of the total number of sheep. Dorpers are reared on four farms, accounting for 6.9% of the sheep. The remaining 0.5% of the sheep are cross bred, these being reared on only one of the farms sampled.

Goats

Goats account for 31.6% of the large stock units on the fourteen sampled farms of the Great Fish River karroid sub-region. All eight of the goat rearing farms keep Angoras, which comprise 95.8% of the goats in the region. Four of these farms have Boer goats, which make up the remaining 4.2%.

Crops

The 1970 survey showed that cultivation takes place on thirteen of the fourteen Fish River farms sampled. Approximately 1.5% of the land on these farms is under cultivation compared with only 0.6% on the Baviaans River valley farms sampled. However, the percentage of land under cultivation on the average Great Fish River valley farm is only half that of the average sweet grassveld farm. More than 99% of the cropland in the Great Fish River valley is irrigated. Owing to the low and erratic rainfall combined with relatively high summer temperatures, the growing of crops without irrigation is virtually impossible. The area occupied by the principal crops on the fourteen Great Fish River valley farms sampled is as follows:

Crop	Number of farms where growing	Percentage of total cultivated land
Lucerne	12	70.0
Oats	8	16.9
Barley	3	8.0
Sown grasses	2	2.9
Wheat	2	2.0
Maize (for silage)	1	2.0

The merits of these crops have been discussed in previous chapters. Lucerne is by far the most important crop of the sub-region. It thrives on the relatively alkaline soils provided that sufficient irrigation water is available. The mean pH of a variety of soils collected in the Bedford sector of the Great Fish River valley was found to be 7.4. (See page 119.) As mentioned in Chapter XII, the water requirements of lucerne in this region is approximately 37 inches per annum. Wheat or barley is sometimes sown as a cover crop with lucerne in late summer. These cereals grow faster than the lucerne, protecting it from wind and sun, as well as shading out weeds. If the lucerne plants are established by May, the roots develop well during the winter, thus accelerating spring growth. The cover crop cereals are mown for hay before the grain ripens, leaving an established lucerne field.

Although no farmers who completed questionnaires enumerated any fruit crops, the writer, when land use mapping in 1969, observed five small apricot orchards totalling approximately 33 morgen in area, between 1.5 and 2.5 miles west of Thorngrove railway station. Els states that the Great Fish River valley between Cookhouse and Middleton was in 1940 the world's second leading apricot producing region,[1] yet in the Bedford sector of the valley south of Thorngrove all apricot orchards had disappeared by 1969. According to Els, the shortage of irrigation water has been a major factor in the decline of the apricot industry of the central Great Fish River valley.[2]

Irrigation

A major problem confronting crop growing in the Great Fish River valley is the shortage of irrigation water. The Fish River valley region of Bedford is at present dependent mainly on water from the Commando Drift and Lake Arthur dams on the Tarka River, this tributary of the Fish having its headwaters in a relatively low rainfall area north of the Great Winterberg range. The Tarka River flows only sporadically and the heavily silted dams dry up at times.[3] Owing to the shortage of irrigation water, cultivation had to be discontinued from the mid 1950's onwards on much fertile alluvial land bordering the Great Fish River. This resulted in the economic ruination of many farmers, particularly those who worked relatively small holdings where irrigated crops were the mainstay of the farming economy.

Owing to the severe financial straits to which many farmers in the Great Fish River Irrigation District[4] were subjected, an investigation of farming practises and economic conditions was undertaken in 1960 by the Division of Economics and Marketing

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1 W.C. Els, "Die Evolusie van Grondgebruik in die Groot-Visriviervallei", unpublished thesis, D.Litt. et Phil., University of South Africa, 1965, p. 205.

2 Ibid., p. 206.

3 Ibid., pp. 247-256.

4 This district stretches from the vicinity of the Grass Ridge Dam, some thirty miles north of Cradock, to the vicinity of Sheldon, some eight miles south of Middleton.

under the supervision of J. le R. Retief.[1] The aim of this survey was to determine what means the State could employ to alleviate the pressure on irrigation water as well as to assist those farmers who were in financial difficulties.[2] The unpublished Retief Report revealed that 70% of the farmers with less than 300 morgen of grazing per farm were in financial difficulties. According to the Retief Report, a minimum of 300 morgen of grazing is necessary for an irrigation holding in the Great Fish River Irrigation District to be economically viable.[3] It is significant that the minimum depends not on the area of irrigable land, which often could not be irrigated, but on the area of natural grazing. By 1965 approximately 30% of the irrigable land in the Great Fish River Irrigation District had been purchased by the State and deprived of irrigation rights.[4] In this manner more irrigation water was made available to the remaining farmers. The large areas of abandoned cropland can be seen on the 1969 land use maps of the Bedford portion of the region. It is expected that water from the Orange River will reach the Great Fish River in 1973,[5] when the abandoned cropland should be brought back into production. Most of the small farms which have been able to survive are those with strong boreholes.

A Fish River small holding

An example of a small holding which has continued to be economically viable, and actually presents an air of prosperity, is a ninety morgen farm situated midway between Long Hope and

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[1] W.C. Els, "Die Evolusie van Grondgebruik in die Groot-Visriviervallei", unpublished thesis, D.Litt. et Phil., University of South Africa, 1965, p. 340.

[2] Ibid.

[3] Ibid., p. 345.

[4] Ibid.

[5] "Eastern Province Herald", Port Elizabeth, October 21, 1970.

Middleton railway stations on the eastern side of the Great Fish River. No less than 89 morgen of the farm is under cultivation, the remaining morgen being occupied by the homestead, barns and workers' dwellings. The farm is fortunate in having a good supply of underground water, the single borehole yielding approximately 6,000 gallons per hour. During the long periods when irrigation water from the Great Fish River has been unavailable the borehole has been in constant use. Owing to the high mineral content of the water, over-irrigation has to be practised to prevent the harmful accumulation of mineral salts in the soil.

In June, 1970, of the 89 morgen under cultivation, 54 morgen was occupied by lucerne, 30 morgen by oats and 5 morgen by Rhodes grass. The oat fields lie fallow during the hot months of January and February, when extra irrigation water is required for the lucerne. A total of approximately 75 Friesland cattle and 100 Merino sheep are kept on this farm. The farmer's major source of income is from fresh milk which is sent by train daily from Harefield railway siding to a dairy in Port Elizabeth, 112 miles away. The Friesland steers and old cows are sold for beef in Port Elizabeth.

The Karroid Region of the Lower Kaga and Koonap River Valleys

This land use sub-region occurs mainly in southern Adelaide, but includes the extreme south-eastern portion of Bedford. The natural vegetation consists mainly of Karroid Acacia Savannah. This is the most favourable of all the karroid regions owing to the relatively abundant supply of irrigation water provided by the Koonap River. The mean area of the ten farms sampled is 2,015.7 morgen, the largest farm being 4,651 morgen and the smallest 806 morgen. The median size lies between 1,761 and 1,693 morgen.

Livestock

The questionnaires of the year 1970 revealed that cattle, sheep and goats are reared on all ten of the sampled farms. The average Lower Kaga and Koonap karroid farm has 78.5 cattle, 968.0 sheep and 452.6 goats. This is equivalent to an average of 315.2 large stock units, consisting of 78.5 cattle, 161.3 sheep and 75.4 goats. There is an average of 6.4 morgen per large stock unit, which is much less than that of the other karroid regions.

Cattle

White-owned cattle are kept on nine of the ten Lower Kaga and Koonap karroid farms investigated, accounting for 80.4% of all the cattle. Non-White employees own the remaining 19.6% ~~and~~ which are reared on seven farms. The relative importance of the various White-owned breeds is indicated in the table below:

Breed	Number of farms where occurring	Percentage of cattle
Jersey	3	38.5
Friesland	6	28.2
Africander	1	7.4
Simmental-Africander-Hereford cross	1	15.8
Africander-Hereford cross	1	8.7
Jersey-Friesland cross	1	1.3

Three of the nine White farmers rearing cattle in the sub-region stated that they are mainly for dairying, two that they are mainly for beef and four that they are dual purpose. Nevertheless, all nine farmers sell dairy produce. Six of these sell cream only, one milk only and one both milk and cream. Paradoxically all the cream from the sub-region is marketed in King William's Town, although the Cookhouse creamery is nearer. The reason for this is that lorries from Bowker's Park Creamery, King William's Town, traverse the area thrice weekly to collect cream. One farmer sells fresh milk to the Kroomie cheese factory and another sells it to a dairy in Adelaide town, which is approximately ten miles north of the farm concerned. Three of the farmers market their cattle mainly in Adelaide, five mainly in Port Elizabeth and one farmer sells cattle in Adelaide, Port Elizabeth and East London.

Sheep

Merinos are reared on all ten of the sampled farms in the Lower Kaga and Koonap karroid sub-region, accounting for 91.9% of all the sheep. Cross breds are kept on three farms and account for 5.3% of the total number of sheep. Dorpers are also reared on three farms, accounting for the remaining 2.8% of the sheep.

Goats

Angora goats are kept on all the sampled farms, accounting for 88.5% of the total number of goats. The remainder consists of Boer goats, which are reared on four of the ten sampled farms.

Crops

The area under crops in the Lower Kaga and Koonap karroid sub-region is greater than that in the other karroid sectors of the Bedford and Fort Beaufort divisions. This is mainly due to the more reliable flow of the Koonap River, which is the major source of irrigation water. The 1970 survey showed that 1.8% of the farmland in the sub-region is under cultivation, of which 94.5% is irrigated. Crops are grown on eight of the ten farms sampled; all the crop growing farms practise irrigation. The area occupied by the principal crops is as follows:

Crop	Number of farms where growing	Percentage of total cultivated land
Lucerne	8	57.1
Oats	5	26.2
Sorghum (for silage)	1	5.5

Crop	Number of farms where growing	Percentage of total cultivated land
Maize (for silage)	2	4.1
Citrus	2	2.5
Barley	1	1.4

Spineless Cactus

A spineless variety of the prickly pear, *Opuntia megacantha*, is of growing importance as livestock fodder in the karroid regions of the Bedford and Fort Beaufort divisions, where it is grown on several farms. During the first three decades of this century the common spiny type of *Opuntia megacantha*, together with other thorny species of *Opuntia*, became a pest in the drier parts of the Cape Province, owing to their encroachment on grazing land. The sharp thorns on these *Opuntia* species rendered them inedible by livestock. A species of cochineal insect, *Dactylopius opuntiae*, introduced to South Africa in 1937,[1] not only led to the destruction of the common prickly pear and the other harmful species, but also destroyed the spineless cactus which had been cultivated on a large scale in karroid areas as a stock feed. Now, however, new varieties of spineless cactus, known as Monterey, Robusta and Chico, all of which are not attacked by cochineal, have been developed. The merit of spineless cactus is that it provides nutritious, succulent fodder and can be grown without irrigation where the mean annual rainfall is as low as ten inches.[2]

The spineless cactus is propagated vegetatively, the leaves being planted in holes dug in the natural veld. Leaves are obtainable from the Department of Agricultural Technical Services experimental stations at Grootfontein and Carnarvon at a cost of one cent each.[3] As it is desirable to have some 2,500 plants per

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1 B. Smit, "Insects in Southern Africa", Oxford University Press, Cape Town, 1964, p. 162.

2 *Scientific Progress*, Vol. 3, No. 2, 1970, p.3.

3 Ibid.

morgen, the cost of the leaves amounts to R25 per morgen. It is estimated that the total cost of establishment, including labour and the railage of leaves, is approximately R55 per morgen.[1] One morgen of established spineless cactus can provide sufficient leaves for the planting of a further forty morgen.[2] As cattle, sheep and goats are such destructive feeders, they are not allowed to graze the spineless cactus. The leaves usually are cut up by Bantu and Coloured employees, and then transported to feeding points.

At present most of the spineless cactus in the Bedford and Fort Beaufort divisions occurs in the southern Baviaans River valley and in the Great Fish River valley between Cookhouse and Middleton, where it occupies relatively small areas, the largest planting on any farm covering approximately six morgen.

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[1] Ibid.

[2] Ibid.

CHAPTER XV

THE BANTU RESERVES

The Bantu reserves in this area are confined to the Victoria East and Fort Beaufort magisterial districts, where they occupied a total area of 144.1 square miles (43,572 morgen) in 1970. This total includes 719 morgen of land privately owned by Bantu in Victoria East, viz. the farm Nightingale and several small holdings. In 1970 the reserves occupied 121.8 square miles in Victoria East (approximately 33% of the total area of this district) and 22.3 square miles in Fort Beaufort (approximately 4½% of the total district area).[1]

The Bantu reserves of South Africa have been defined by legislation. The Natives Land Act of 1913 prescribed the Bantu reserves and forbade Bantu and Whites alike from acquiring land in each others areas.[2] In order to relieve the population and grazing pressure in the reserves, the Native Trust and Land Act was passed by the South African parliament in 1936. This act provided for the "release" or exemption of certain White-owned land from the limiting provisions of the Natives Land Act of 1913. It also provided for the creation of a Native Trust to operate funds allocated by the Government for the purchase of land in the various released areas of South Africa on behalf of the Bantu people.[3] In terms of the Act of 1936 the White owned farm land occupying the Tyume valley of northern Victoria East became a released area.

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[1] All data concerning land areas, livestock and population in the Bantu reserves of Victoria East and Fort Beaufort obtained from the records of the Magistrate and Bantu Commissioner, Alice, unless otherwise stated.

[2] E.A. Walker, "A History of Southern Africa", Longmans, 1957, p.549.

[3] "Acquisition of Land by the South African Native Trust and the Consolidation of the Bantu Homelands", Bantu, Pretoria, Vol. 8, 1961, pp.357-358.

Between 1936 and 1970 the trust purchased 5,643 morgen of White owned land in Victoria East for the Bantu. Of this area 3,028 morgen was purchased in the decade from 1961 to 1970.

In Victoria East and Fort Beaufort the reserves may be divided into two areas. The northern area of 117 square miles, by far the most important, stretches in a crescent from the Hogsback in the north-east to the Kat River in the west. This crescent is broken in the centre by the town of Alice, and its commonage together with land owned by the Lovedale missionary institution, the University of Fort Hare and the Federal Theological Seminary of Southern Africa. (See map, page 359.) Most of this area occupies maturely dissected country to the north of the submontane peneplain. The altitudinal range is considerable, varying from 6,044 feet in the extreme north-east of Victoria East to less than 1,500 feet along the Kat River in the Fort Beaufort district. With such variation in altitude great variation in the mean annual rainfall is to be expected. It ranges from an average of over 56 inches[1] in north-eastern Victoria East to only 20 inches in the Kat River valley in the extreme west of the Healdtown location. (See Rainfall Map, page 27A.)

The Sheshegu Fingo Location, some 27 square miles in area, is situated south-west of Alice, forming a southern sector somewhat isolated from the other reserves. Its altitude ranges from just under 800 feet along the Kat River in the extreme south-west to over 1,900 feet in the extreme east, where the location includes a portion of the Kat-Keiskamma watershed. The average annual rainfall of Sheshegu apparently is everywhere less than 20 inches. No precipitation data are available for Sheshegu, but at the homestead of the adjacent White-owned farm, Kingston, elevation 1,700 feet, the mean annual rainfall for the period 1931 to 1960

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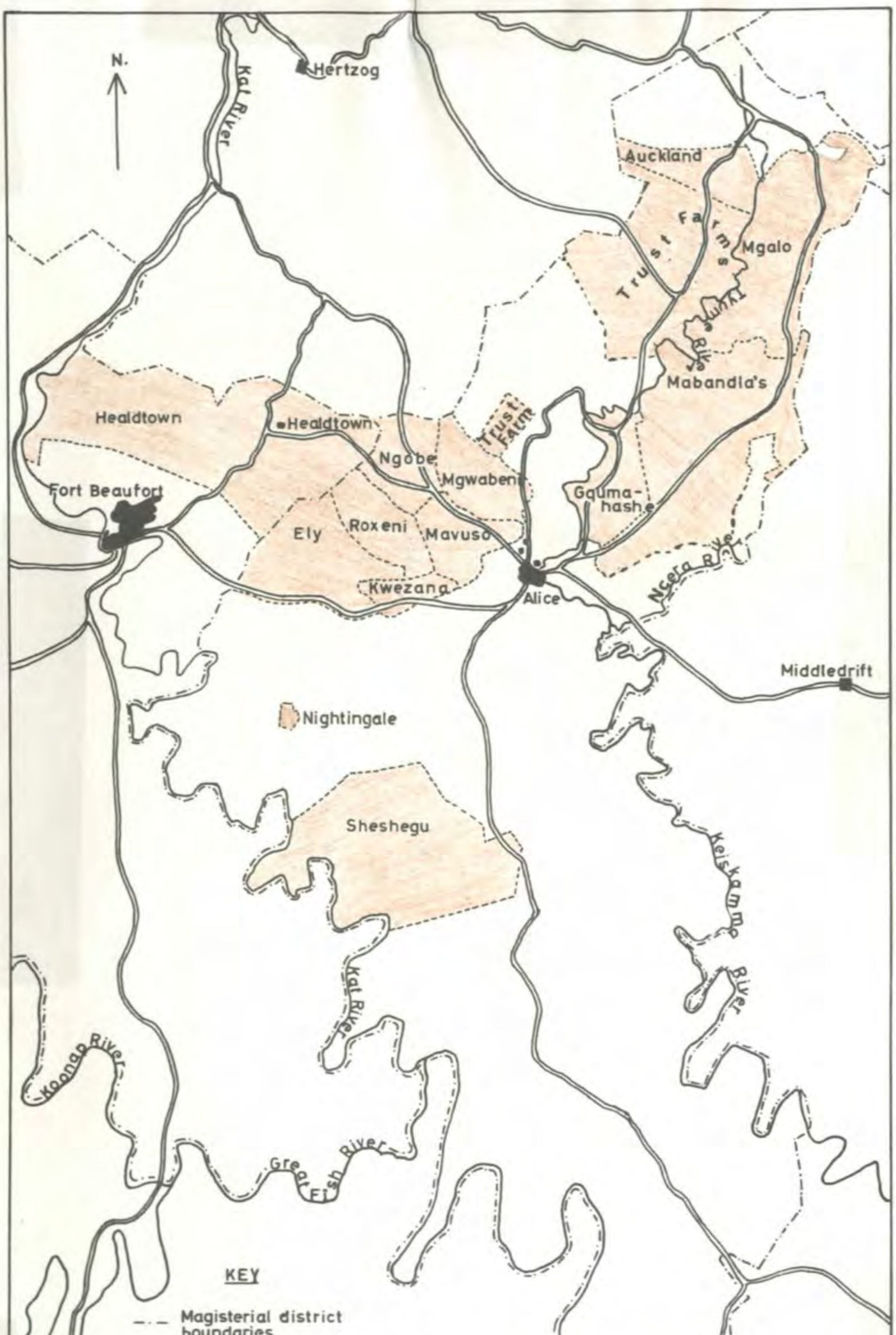
[1] This is a deduced value.



— NATIVE RESERVES OF THE FORT BEAUFORT AND VICTORIA EAST DISTRICTS —
1970

was 19.12 inches. Sheshegu is without doubt the most arid of all the Bantu locations in the Victoria East and Fort Beaufort magisterial districts.

Population Distribution

In May 1970 the total population of the Bantu reserves in Victoria East and Fort Beaufort was 24,677, representing a density of 174.1 persons per square mile (67.2 per square kilometre). The population of the Bantu reserves in the two districts has increased by 58.3% since 1951, when it was only 15,588.

The populations and densities of the various locations in 1970 was as follows:

		Density	
Location	Population	Per Square Mile	Per Square Kilometre
Auckland	813	189.5	73.2
Mgalo	2,588	216.5	83.6
Mabandla	4,391	219.8	84.9
Gqumahashe	2,048	312.5	120.6
Mgwabeni	1,164	255.6	98.7
Ngobe	628	171.9	66.3
Mavuso	2,654	362.5	139.9
Roxeni	498	116.9	45.1
Kwezana	350	174.4	67.3
Ely	1,117	122.9	47.4
Sheshegu	1,438	53.2	20.5
Trust Farms	23	1.2	0.5
Healdtown	6,965	311.7	120.3
Total	24,677	174.1	67.2

It is interesting to note that the population density of all the Bantu reserves in Fort Beaufort and Victoria East exceeds that of the relatively rich English agricultural county of Hereford, which in 1967 had a density of 168.6 persons per square mile (65.1 per square kilometre.)[1] In Mavuso, Gqumahashe and Healdtown, which adjoin the towns of Alice and Fort Beaufort, where a small proportion of the inhabitants are employed, the population density is greater than that of the intensively cultivated English county of Norfolk. In 1967 the population density of Norfolk, including the city of Norwich, was 296.9 per square mile (114.6 per square kilometre).[2]

Masculinity of the Population

The masculinity of the population is defined as the number of males per hundred females.[3] The table below shows that in all the reserves there is an abnormally large preponderance of females. This is an indication of the inability of the reserves to provide adequate employment for the population, either in agriculture or in industry. A large proportion of the male population must perforce seek employment outside the reserves.

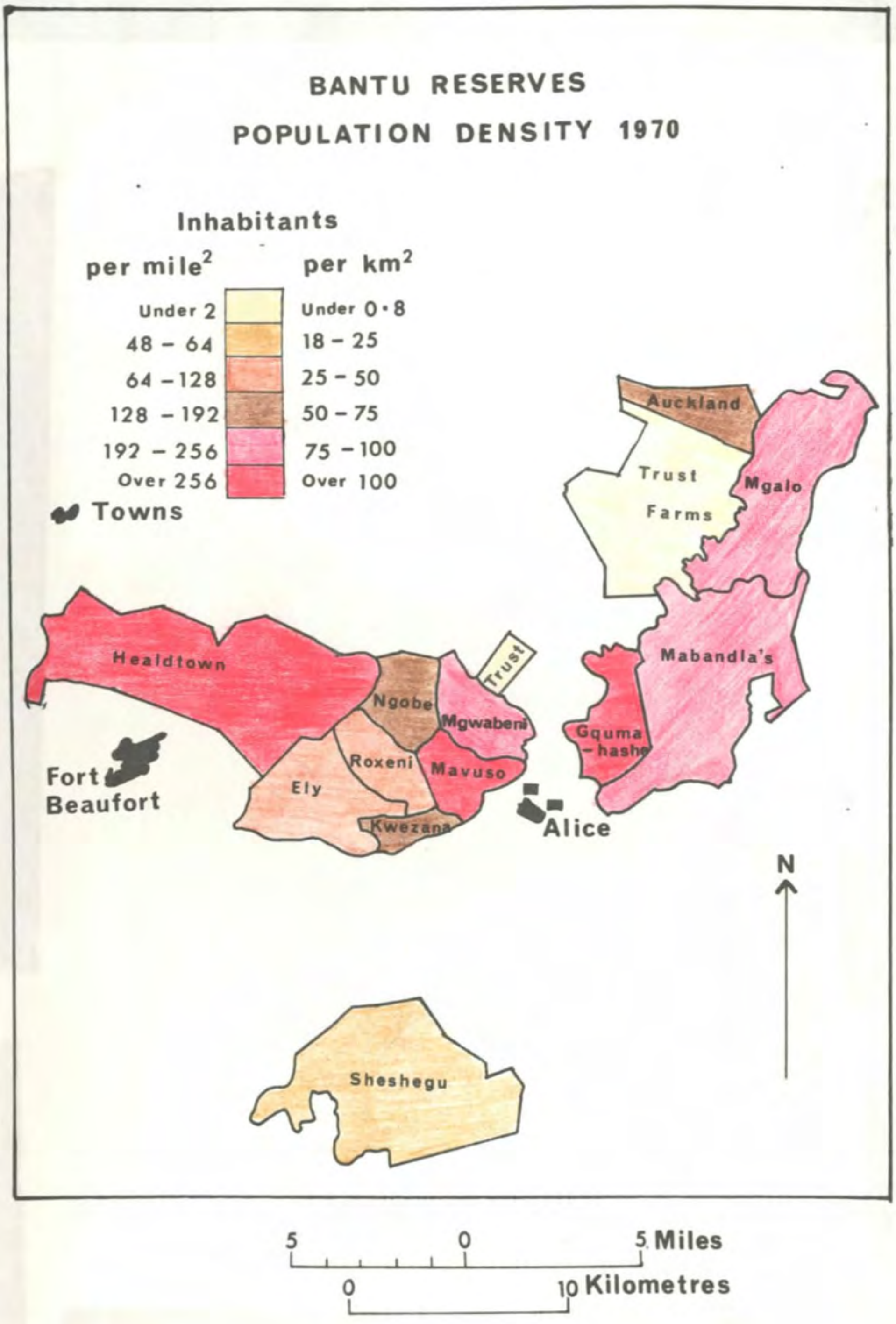
Masculinity of Bantu population in Victoria East and Fort Beaufort reserves, 1970

Auckland	76.0
Mgalo	75.6
Mabandla	78.2
Gqumahashe	79.6
Mgwabeni	87.4
Ngobe	85.8
Mavuso	81.0
Roxeni	82.4
Kwezana	77.7
Ely	86.5
Sheshegu	83.2
Trust Farms	64.3
Healdtown	87.2

[1] See "Area & Population of English Counties", Whitaker's Almanack, London, 1971, p.631.

[2] Ibid.

[3] See page 209.


BANTU RESERVES
POPULATION DENSITY 1970
Inhabitants
per mile²
per km²
Under 2
Under 0·8
48 - 64
18 - 25
64 - 128
25 - 50
128 - 192
50 - 75
192 - 256
75 - 100
Over 256
Over 100
Towns
Auckland
Trust
Farms
Mgalo
Mabandla's
Healdtown
Trust
Ngobe
Mgwabeni
Gquma - hashe
Roxeni
Mavuso
Ely
Kwezana
Fort Beaufort
Alice
N
Sheshegu
5
0
5 Miles
0
10 Kilometres

If the Trust Farms with their 23 inhabitants are excluded, the lowest masculinity is in the two northernmost reserves, Auckland and Mgalo, where it is 76.0 and 75.6 respectively. Masculinity is highest in the locations of Mgwabeni and Healdtown, where it is 87.4 and 87.2 respectively.

Agricultural Practice

Until the mid-nineteenth century the Xhosa-speaking tribes in the Victoria East and Fort Beaufort districts were semi-nomadic pastoralists. On the whole, the cultivation of crops was less important than the rearing of cattle. As early as 1803 Lichtenstein observed that "When the supply of grass fails, either from drought or long continuance, the whole kraal is broken up and the inhabitants remove to another spot."[1] Similarly shifting cultivation, as practised over much of present day tropical Africa, used to be the prevailing method of agriculture; when the land became exhausted after a number of years it was abandoned and the tribe moved to a fresh patch of land. This system was possible with a small population and plenty of land, but obviously cannot be carried out by a large population limited to a small area. After 1853, when the land available to them was limited to the reserves,[2] the Bantu tribes in this area were no longer free to move as they pleased. Since then the population has been increasing steadily, making it impossible to practise shifting cultivation. Unfortunately the same lack of regard for the soil characteristic of shifting cultivation continues in the reserves, where the same land has to be farmed continuously. Some fields have been poorly cultivated almost without rest for the last hundred years, resulting in the exhaustion of the soil and extremely low crop yields. Sheet erosion has removed the topsoil from many fields on hill slopes, which are frequently gashed by dongas.

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[1] H. Lichtenstein, "Travels in Southern Africa", Van Riebeeck Society, Cape Town, 1928, Vol. I, p. 330.

[2] See Chapter VI.

The condition of some fields is so poor that, unless drastic remedial action is undertaken, all the remaining soil will be eroded away within a few years, leaving nothing but barren rock.

In the drier parts of the reserves removal of the binding vegetation cover by uninterrupted, intensive grazing and the cutting of trees for firewood has left the bare, sunbaked soil exposed to the intense summer downpours of rain. With little vegetation to check the speed of the running water and few plant roots to bind the soil together, each heavy thunderstorm strips away a certain amount of soil. The brown floodwaters of the rivers after summer thunderstorms indicate the rapid erosion of the hillsides, many of which have been reduced to stony wastes.

The Department of Bantu Administration and Development has made great efforts to improve farming methods in the reserves by education and demonstration. In 1946, after the crippling drought of the previous year, the people of Mgalo, Mabandla's Location, Mgwabeni, Ngobe and Mavuso requested the Native Affairs Department to undertake rehabilitation of their lands, and these Locations were then gazetted as "Betterment Areas".

Livestock

In the Bantu reserves pastoralism is far more important than arable farming. Barrow in 1806 referred to the suitability of the Tyume valley for cattle rearing and Lichtenstein found that "as the Koossas live almost entirely on the produce of their cattle, the attending upon them is the principal business of every householder."[1] The present day situation is not very different. The majority of the Bantu peasantry regard livestock as their only form of investment, and cattle are still used in the custom of "lobola", which involves the giving of cattle to the bride's father on marriage. Among the majority of the peasanty the concern with livestock is more with quantity than with quality.

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[1] H. Lichtenstein, "Travels in Southern Africa", Van Riebeeck Society, Cape Town, 1928, Vol. I, p. 330.

According to the 1970 census there were 6,114 cattle, 12,690 sheep, 5,082 goats and 1,944 pigs in the Bantu reserves of Victoria East, compared with 5,353 cattle, 31,097 sheep, 20,593 goats and 1,237 pigs in 1951. In 1970 there were 891 cattle, 4,203 sheep, 3,102 goats and 486 pigs in the Healdtown Location, which is the only Bantu reserve in the Fort Beaufort magisterial district. In 1951 there were 1,194 cattle, 4,724 sheep, 5,443 goats and 605 pigs in the Healdtown Location. A marked feature of recent years has been the reduction in the number of sheep and goats which in 1970 accounted for 36.1% of the large stock units[1] in the reserves of the two districts. (As mentioned in previous chapters, six small stock units are regarded as being equivalent to one large stock unit.) Because they are very close grazers, sheep and goats can feed on grass which is far too short for cattle; they are therefore hardier to drought, but more harmful to the pasture. They are able to nibble grass right down to ground level and, in a dry spell, they will dig out the roots with their sharp hooves. Cattle cannot graze on very short grass, and many have died during droughts when the large number of sheep and goats have kept the grass too short. Prior to the implementation of Government controlled stock reduction schemes small stock were increasing at a much greater rate than cattle, particularly after droughts. The following statistics concerning Bantu owned livestock in Victoria East illustrate this tendency.

Year	Cattle	Sheep	Goats	Lovedale Rainfall (Average 22.63 inches)
1945	8,229	20,305	13,189	9.84 inches
1946	4,519	20,813	13,371	21.98 "
1947	5,574	28,594	19,226	17.46 "

As a result of the 1945 drought almost half of the Bantu owned cattle died, while the number of sheep and goats remained constant.

[1] Excluding equines.

During the period immediately following the drought there was a big increase in the number of small stock. From June 1946 to June 1947 the number of sheep increased by 37% and the number of goats increased by 44%. The enlightenment of the peasantry by Agricultural Officers and the completion of various Government betterment schemes has resulted in a progressive decrease in the number of small stock since 1951. Over the twenty year period from 1951 to 1970 the number of sheep in the Bantu reserves of Victoria East decreased by 59.2% and the number of goats decreased by 75.3%, while the number of cattle increased by 14.2%.

In May, 1970, the distribution of livestock in the various locations of Victoria East and Fort Beaufort was as follows:

Location	Area in morgen	Cattle	Sheep	Goats	Pigs
Auckland	1,297	527	590	102	87
Mgalo	3,614	1,084	1,133	383	198
Mabandla's	6,040	1,557	1,880	Nil	303
Gqumahashe	1,982	467	1,105	532	120
Mgwabeni	1,377	663	1,257	549	113
Ngobe	1,105		1,187	327	98
Mavuso	2,214	376	1,701	213	139
Roxeni	1,288	366	1,248	986	84
Kwezana	607		492	266	66
Ely	2,749		805	451	284
Sheshegu	8,180	309	1,292	1,273	386
Trust Farms	5,643	765	Nil	Nil	66
Healdtown	6,757	891	4,203	3,102	486
Total	42,853	7,005	16,893	8,184	2,430

The table below indicates the number of morgen per large stock unit, the veld type and approximate average annual rainfall of each location :

Location	Morgen per large stock unit (Equines excluded)	Veld Type	Approximate average annual rainfall in inches	
			Driest part	Wettest part
Auckland	1.97	Sourveld	40	48
Mgalo	2.64	Mainly sourveld	24	56
Mabandla's	3.18	Mainly sourveld	22	32
Gqumahashe	2.61	Sweetveld	22	24
Mgwabeni, Ngobe	1.98	Both sweetveld and sourveld	22	30
Mavuso	3.08	Sweetveld	22	24
Roxeni, Kwezana, Ely	4.05	Mainly sweetveld	20	30
Sheshegu	10.21	Sweetveld	16	20
Trust Farms	7.27	Mainly sourveld	24	48
Healdtown	3.09	Mainly sweetveld	20	26

The recommended rate of stocking for White-owned sourveld farms is three morgen per large stock unit (see page 249), while that for White-owned farms in the optimum region of the sweetveld, mean annual rainfall approximately 20 - 26 inches, is from four to six morgen (see page 276). With the exception of Sheshegu, all the sweetveld locations may be regarded as experiencing optimum conditions. Sheshegu lies in the Scrub Woodland vegetation belt of southern Victoria East, and here there should be a minimum of eight to nine morgen per large stock unit (see page 277).

The most heavily stocked location is Auckland, immediately south of Hogsback, where there is only 1.97 morgen per cattle unit, which is considerably less than the recommended rate of 3 morgen per large stock unit on White-owned sourveld farms. It should be realised, however, that the average annual rainfall of Auckland is high, even by sourveld standards. Mgwabeni and Ngobe are almost as heavily stocked as Auckland, although the average annual rainfall is much lower. Although Government sponsored stock reduction schemes were introduced in these two locations in 1961, the number of livestock has not yet been reduced to the desired level. The most overstocked location consisting entirely of sweetveld is Gqumahashe, 1½ to 6 miles north-east of Alice, where there are only 2.61 morgen per cattle unit.

The least heavily stocked and the driest of all the locations is Sheshegu, where there is an average of 10.21 morgen per large stock unit. This would appear to be a favourable ratio. Years of continuous grazing, however, have seriously impaired the carrying capacity of the veld, and much of Sheshegu has been reduced to bare ground covered with either unpalatable *Chrysocoma tenuifolia* in the less arid sector occupying the Kat-Keiskamma watershed or with inedible *Euphorbia bothae* in the drier Kat River valley sector.

The livestock density of the Trust farms is in marked contrast with that of the locations. Although the Trust farms consist almost entirely of relatively high rainfall sourveld, a ratio of 7.27 morgen per large stock unit was maintained in May, 1970. At that time the farms had only 23 inhabitants, but it is planned to populate them eventually with Bantu repatriated from urban areas outside the region. In May 1970 approximately half of the Trust farmland was ungrazed, the remaining area being used to accommodate surplus livestock from adjacent locations.

Crops

The land use survey conducted by the writer in 1969 revealed that 21.2% of the Bantu reserves in Victoria East and Fort Beaufort consisted of cropland. Although the proportion of land devoted to crops in the reserves is approximately ten times as great as the proportion of arable land on White-owned farms in the Bedford and Fort Beaufort divisions, the production of crops in the reserves is much less important than pastoral farming. Crop yields in the reserves are low and variable owing to poor farming methods, the erratic rainfall and the almost complete absence of irrigation. In the sweetveld areas, which receive average rainfalls below 26 inches per annum, crops in many years prove a total failure. When the writer conducted the land use survey in the spring and early summer of 1969 a large proportion of the arable land (63.7%) was found to be fallow owing to the prevailing drought.

The agricultural officer attached to the Department of Bantu Affairs in Alice states that the average annual maize yield for the reserves is only 2 to 2½ bags (of 200 lb.) per morgen. In 1963 a Bantu farmer actually obtained 26 bags of maize from one morgen of land on a high rainfall Trust farm in the upper Tyume valley. This was due to the judicious application of manure and other fertiliser combined with a good summer rainfall. On the Trust farms, Auckland, Mgalo, Mabandla's Location and Gqumahashe there are extensive areas of arable land flanking the perennial Tyume River. These fields are not irrigated, but if irrigation were to be practised, there is no reason why yields of over 20 bags per morgen should not prove to be the average rather than the exception.

Good rains in the spring and early summer of 1970 prompted the writer to conduct a second survey of arable land in the Bantu reserves of Victoria East and Fort Beaufort. This survey, undertaken in late December, 1970, and early January, 1971, showed that 55.9% of the arable land was under crops, compared with 36.3% in the previous year. The arable land not under crops was either fallow or under ley. The percentage area of the various crops grown at this time was as follows:

Maize	88.4
Sorghum	5.7
Citrus and deciduous fruit (on recently purchased Trust farms)	0.8
Lucerne (on recently purchased Trust farms)	0.4
Beans, peas, pumpkins and all other crops	4.7

The women appear to be anxious to grow vegetables and to try new crops. This is especially so in the Betterment areas, where the Government has put down boreholes and constructed dams providing sufficient water for the irrigation of small gardens. This is done by means of tins and buckets of water laboriously carried by the women on their heads. The women and the youths are responsible for much of the arable farming, as many of the men are not willing to till the land or else seek work away from the reserves. The youths are responsible for much of the ploughing as well as herding the livestock, while the women take care of the hoeing of the fields and the reaping of the crops.

Apart from the watering of small gardens from tins and buckets, no irrigation is practised. Thus drought at times causes low crop yields or even total failures. This is shown by the maize yields for the years immediately preceding and following the worst droughts over the ninety year period from 1880 to 1970.[1]

Census, Year ending August	Yield of maize in 200 lb. bags		Lovedale rainfall for calendar year (Average 22.63 inches)
	Victoria East reserves	Healdtown	
1926	1,603	822	21.41
1927	1,442	400	8.92
1928	161	Nil	21.28
1929	1,100	Nil	21.13
1930	6,874	1,500	23.27
1945	no returns available		9.84
1946	606	157	21.98
1947	2,575	100	17.46
1948	7,506	150	21.39
1949	1,200	Nil	11.39
1950	7,391	300	32.22

[1] Data concerning maize yields obtained from Agricultural Census reports of the Union of South Africa, precipitation data obtained from annual reports of the Lovedale Missionary Institution.

The arable lands are usually owned under individual tenure, whereas the livestock is grazed on communal pastoral land. The fields are usually on colluvial soils on the lower slopes of valleys and on alluvial soils in valley bottoms. Steep dolerite hillsides are in many places cultivated because dolerite soils are more water retentive. Such areas, however, are frequently boulder strewn with cores of unweathered dolerite projecting through the soil, making ploughing difficult. Owing to their clayey nature and the steep gradients, doleritic soils are readily eroded by heavy rains. This is especially the case where the lands have not been contour-ploughed. For many years, however, agricultural officers have been encouraging the peasants to plough hillsides along the contours, with intervening contour banks and grass strips, and many farmers have become "contour conscious". In the hilly country of Ely and upper Kwezana the arable lands on thin soils derived from the Lower Beaufort shales and sandstones have become so badly eroded that they have had to be abandoned, and the abandonment of badly eroded fields is also encountered in other locations.

It is unfortunate that irrigation is virtually non-existent in the reserves. The present situation is not very different to that of more than a hundred years ago, when Andrew Geddes Bain tried to initiate chiefs Soga and Tyali into the mysteries of irrigation farming. In the journal which he kept at Fort Thomson (present day Alice) Bain made the following entry for 23rd June, 1836: "In the course of the evening Makomo told me that he had received assistance from Colonel Smith in having the waters of the Kiese taken out for the purpose of irrigation. This is one of the most important steps that could be taken for giving him an interest in the soil, and the only one likely to change the habits of a savage race, leading them imperceptibly from a pastoral to an agricultural life. They had seen my dam and water course which astonished them, and on Tyali's expressing a great inclination to have the waters of the Chumie taken out at his kraal, I offered to examine it and level it for him and give him every assistance in my power."[1] Tyali also asked Bain to make provision for training some of his oxen for ploughing. However, when the British abandoned the Province of Queen Adelaide shortly afterwards, Tyali gave up his plans for irrigating his land with the reply: "Tyali has altered his mind since he got his land back again. Tyali is a Kafir, a son of Gachabie, and he is not going to spoil his oxen with ploughing while he has plenty of wives to till the ground for him."[2] The conservatism that has been the hallmark of Bantu agriculture is gradually disappearing, however, underthe guidance of the Department of Bantu Administration and Development, and the Government sponsored betterment schemes are at last bringing about an agricultural revolution.

Betterment

By 1970 betterment schemes had been completed at Mabandla's Location, Mgwabeni, Ngobe and Auckland, while rehabilitation work was being carried out in all the other locations with the exception of Sheshegu. Once a location has unconditionally opted for betterment an ad hoc committee is appointed. This consists of the principal agricultural officer of the Ciskei, the senior agricultural officer of the area, and the agricultural personnel of the district concerned with the local magistrate as chairman. Two members of the community concerned act as observers, but they are not members of the committee.

It is the duty of the agricultural officers to gather statistics concerning the betterment unit. The age, sex and number of the population is enumerated, and the number, type and ownership of stock are established. The householders are differentiated into hereditary plot-holders and those without title to land, the latter known as "squatters". Thereafter attention and planning schemes are

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1 "Journals of Andrew Geddes Bain", Van Riebeeck Society, Cape Town, 1949, p. 178.

2 Letter from A.G. Bain to the Graham's Town Journal, July 3rd, 1847.

directed to the land itself. Careful examination is made of slope, aspect, soil and veld types before the degree of land exhaustion and the necessary remedial work is determined.

Betterment involves the fencing of the land into camps, so that grazing can be rotated, thereby enabling the veld to be periodically rested and restored. Arable lands are fenced off from the grazing lands, in order to eliminate constant herding of livestock, which leads to much destruction of pasture by trampling. Betterment also involves the sinking of boreholes and the construction of dams to provide water at central spots in every camp, thereby reducing destruction of pasture and the formation by trampling of donga-conducive footpaths by animals having to walk long distances in order to obtain water. Diversion banks are built to lead water into dams, and contour banks are constructed on the hillsides to check the downward rush of floodwater during storms, thereby allowing it to soak into the ground, instead of washing it away. Strips of grass are fenced in for permanent resting to ensure a supply of grass seed which can be blown by the wind on to bare patches of ground. Permanently rested grass strips also create sponge zones which can absorb the rush of water caused by heavy rain. In all the betterment areas the number of livestock is reduced to suit the carrying capacity of the land, which depends on the rainfall and the quality of the soil. Once betterment work has commenced in a location the community is given five years in which to dispose of surplus livestock. The ratio of sheep to cattle depends on what type of animal the area is best suited to.

Huts and houses which are in unsuitable positions are re-sited. The policy is on the whole one of concentrating the scattered houses into nucleated villages. Title-holders who have to move their houses receive compensation. Those who are not title-holders who are required to move receive no compensation for the expenses incurred. These "squatters" are settled in separate villages, which, because of non-availability of land, are often sited in juxtaposition to the villages of title-holders. The "squatters" are not allowed to cultivate arable land or own stock in the location. The title-holder villages are set out in rectangular pattern, with garden plots attached to each house. There is usually one village to every three or four grazing camps, or multiples of these. Concentration of the houses into villages has certain advantages. Firstly it eliminates numerous footpaths and roads leading to scattered kraals, and thus removes a major cause of dongas. Secondly, only one borehole or dam is required to supply water to the whole community. Thirdly, the village is centrally placed with respect to several grazing camps, thus stock moving to and from the village does less damage to the veld. (Sheep have to be kraaled every night owing to marauding jackals.) One in every three or four grazing camps around each village is rested for a complete growing season. Lastly it is claimed that administration and control of the population is made easier, as the village contains no more residential sites than the number of title-holders. This provides a check on the infiltration of squatters to the village.

In the betterment areas there has also been a considerable amount of re-siting of the arable lands. The original lay-out of the arable lands in the locations was in many instances done with no regard for sound agricultural principles. In Mabandla's Location 15% of the arable land was found to be too poor for cultivation and approximately 10% of the remainder was found to be too steep to cultivate without serious loss of soil. These fields therefore had to be abandoned. In the Mabandla, Mgwabeni, Auckland and Ngobe Locations new arable lands to replace impoverished, eroded or over-steep fields have been established on virgin veld.

The first reserve in which betterment was undertaken was Mabandla's location, where work commenced in 1948. This location, 5176 ha 6,040 morgen in extent, lies to the north-east of Alice. The rainfall varies from approximately 22 inches (559 mm) per annum in the southern and western sweetveld to over 32 inches (800 mm) in the north-eastern sourveld.

The total population in the 1951 census was 2,587 Blacks Bantu and 4 whites Europeans, the latter being the family of a store keeper. (In 1970 the Black Bantu population was 4,391.) In 1948 Mabandla's location had 3,239 cattle units (6 small stock being equal to one cattle unit). As the number of livestock was far too great, 54 cattle and 4,337 small stock were slaughtered or sold. It was planned to reduce the number of stock to 1,200 large stock units by 1953. By this time, however, the grazing land had improved to such an extent that it was decided to allow a maximum number of 1,500 large stock units. The location was divided into twenty-one camps. During this five year period no less than R93,498 was spent on improving the location, although free labour was provided by the inhabitants. The expenditure may be summarised as follows:

Fencing	93 km 58 miles	R 15,480
Boreholes	6	4,320
Piping	44 m 143 feet	300
Compensation for hut removals		10,000
Diversion Banks	28,800 yards	5,760
Contour Banks	367,250 yards	36,724
Grass Strips	328,890 yards	914
Dams	15	20,000
	TOTAL	R 93,498

Rehabilitation of this reserve involved the enormous expenditure of an average of R18,000 per annum over the five year period. The total cost averaged approximately 13-26 R15-48c. per ha. morgen. The agricultural officer of the Department of Bantu Affairs stationed in Alice estimates that the eventual earnings at Mabandla's will be in excess of 13 R15 per ha morgen per annum, which in the long run offsets the expense incurred.

In the Victoria East district the desired economic unit for each family qualified to hold land in a betterment location is approximately 12 cattle units, or 60 small stock,[1] plus five or six morgen of arable land. The economic unit is assessed on the basis of the allocated land and stock bringing in R150 per annum under the existing system of poor subsistence agriculture. The standard laid down in arriving at this figure of R150 is that one cattle unit will bring in at least R6 per annum and one 1 ha ~~acre~~ of arable land yield at least four bags of maize per annum. This estimated income from the land is not wholly a cash income, but includes the value of produce consumed by the family. It is maintained by the Department of Bantu Administration and Development that this income could be doubled when farming methods improve and the land is properly stabilised.

Owing to the high population density it has been found impossible to provide each family with an economic unit. If this were done only about 20% of the present population could remain in the locations. The only solution to the problem is for the surplus population to be absorbed by industry and to be urbanised. At present the number of cattle units which each family is allowed to own is obtained by dividing the total number of families into the total number of cattle units permissible in the location. The amount of arable land owned by each family has remained the same as that set out in the original deed of occupancy given to each title-holder. In Mabandla's location it varies from 1,9 ~~2.2~~ to 4.6 ~~5.4~~ ha ~~morgen~~ per family.

After betterment has been established, the landowner may, if he wishes, sell his land to another title-holder; but thereafter he loses his right to reside in the village and must leave. Land may be privately leased to another title-holder, and the title-holder may leave the village for urban work while yet retaining his right to his plot, even though it is cultivated by another. A man

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[1] In order to discourage the keeping of sheep and goats five, not six, small stock are regarded by the Department of Bantu Administration and Development as being equivalent to one large stock unit.

may increase his single economic unit to two, with an equal increase in the number of stock allowed. Thus it is possible for a householder with two economic units to control ~~twelve~~ 10 ha morgen of arable land and 24 cattle or 120 sheep, or a ratio of both.

Not more than two-thirds of the arable land owned by each title-holder can be in production in any year. The remainder has to be left fallow or put under suitable ley. There is in addition to this the residential plot with vegetable garden in the village itself. Although one third of the arable land is under compulsory fallow or ley, there is no compulsion for any man to cultivate the remaining two-thirds of his land, which may revert to fallow for any length of time.

The Department of Bantu Administration and Development offers to market any surplus livestock which may accrue, if the owners are in favour. In one particular case this was done through the Meat Control Board after the animals had been fattened on vacant Trust Farm land. Average prices of R92 per head of cattle were obtained without any middle-man expenses being incurred. However, the onus usually lies on the owner to obtain surplus grazing for fattening slaughter stock.

In 1970 there were four Government-paid Bantu demonstrators in Victoria East. One supervises the work on the Trust Farms, and the others are stationed at Mabandla's location, Mgwabeni and Auckland. Each demonstrator possesses the minimum qualification of a two year agricultural diploma course. The demonstrator supervises the rotation of grazing and crops as well as the culling of excess livestock. They assist the peasant farmers in the marketing of livestock and produce, sheep shearing, dipping and other activities. The Betterment Committee makes periodic reassessments of the grazing capacity of the various camps, and if grazing has improved sufficiently, the maximum number of livestock permitted is increased.

The Department of Bantu Administration and Development has established seven dairies for the separating of milk. Three of these are on the Trust Farms, two in Mabandla's location, one in Mgwabeni and one in Auckland. All the equipment, such as separators and cream cans, has been loaned by the Department. There is also a privately-owned dairy in Auckland. Many farmers take milk to the communal dairies. Each farmer's milk contribution is weighed separately and the weight is recorded before separating. The cream is railed to Bowker's Park Creamery in King William's Town, the skimmed milk being retained by the farmers for home consumption. Each dairy receives a single monthly cheque from the creamery in payment for the cream, and the pro rata share for each farmer is worked out by the local officials according to the weight of milk supplied. Payment of the individual farmers is in the hands of the agricultural demonstrators.

Wool marketing can be done privately or communally. The White and Bantu personnel of the Department of Bantu Administration and Development render assistance with wool sorting in the Victoria East locations when they are requested to do so. The wool used to be poorly sorted and commanded low prices. However, prices have improved considerably since the farmers have received instruction in wool sorting. Transport of the wool to the Alice railway station is usually in the hands of private enterprise.

The Department of Bantu Administration and Development claims that with the recent introduction of the economic unit, for the first time in the history of South African Bantu land policy, some headway is being made in establishing a true peasantry, permanently resident on the land and freed from the necessity - if willing to work the land properly - of migrant labour. Betterment definitely is increasing the productivity of Bantu agriculture and has also initiated the African to a co-operative system of marketing.

Before criticism is levelled at certain aspects it must be remembered that betterment is asked for by the community, and is usually not requested until the position of the village is so desperate and the pressure on its land so great that help from the Government is the only way out. Opposition to Betterment comes from two quarters - from the non title-holders who lose the right to own stock on the land of their choice, and from the resourceful man who has increased his number of stock above that of any other man in the community. It would appear sociologically unsound to bring together landless persons made dissatisfied by the dispossession of all the privileges they may have acquired by long residence in the old village. These people in the squatter villages may own no stock, and the men must perforce leave the village to seek work elsewhere. This leaves an unstable community of women and children who have not even the discipline of caring for land or stock.

It has already been pointed out that it is virtually impossible to provide each title-holder with an economic unit. Moreover, the rights and privileges which go with the title deed can be handed on to only one member of a plot holding family. This means that in each succeeding generation there will be an increase in the number of landless people, and, unless adequate opportunities are offered for the absorption of this surplus population, there will be a steadily growing body of opposition and agitation.

Finally, in a society which allows Whites to acquire as much land as they desire, it is surely unwise to restrict one man to two economic units which he can acquire only with difficulty. This placing of a low ceiling for land on the Bantu section of the community is a source of resentment and ground for political dissatisfaction.

CHAPTER XVI

FUTURE DEVELOPMENT

The census of May, 1970, revealed that the total population of the Bedford, Adelaide, Fort Beaufort, Stockenström and Victoria East magisterial districts was 96,332,[1] compared with a total of 35,630 in 1865, when the first census was taken. (See pp. 170-171.) This represents a 170.4 per cent increase over the 105 year period. The White population in 1970 was, however, only 6,748 compared with 7,186 in 1865 and 9,473 in 1936. (See Chapter VII.) The loss of White population in the Bedford and Fort Beaufort divisions is significant. On the whole the Whites form the high income-generating group in South Africa and a decrease in the numbers of this group in any region of the country is usually an indication of economic stagnation, if not decline.

The economy of the Bedford and Fort Beaufort divisions is based on agriculture. Much will depend on the planning and future development of agriculture if the decline in the total White population is to be halted and the ever increasing Coloured and Bantu populations are to improve their standards of living. The development of the tourist trade and of industry is also desirable. The purpose of this chapter is to summarise some of the possible means of raising the productivity of the region.

1. AGRICULTURAL DEVELOPMENT

Water Control

At present only a small proportion of the total farming area is under cultivation and much of it is marginal owing to the unreliable rainfall and the scarcity of irrigation water. State assisted irrigation schemes can play a major role in providing reliable water supplies for immediate needs as well as making it possible to bring

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[1] Data obtained by correspondence with Dept. of Statistics, Pretoria.

new land under cultivation. There should be a marked increase in yields and in total production in the western Bedford district after 1973, when water from the Orange River is scheduled to reach the Great Fish River. The recently completed Kat River Dam will provide a more reliable supply of irrigation water for the existing arable land in the Kat River valley, but will not necessarily result in an increase in the area under cultivation. (See page 292.) There are several sites in the Fort Beaufort division which are suitable for the construction of much larger dams, the existence of which should considerably augment the area of arable land. (See pp. 292-293.)

Better Agricultural Practice

Development of the region is also dependent on better agricultural practice. As a result of the implementation of Government sponsored betterment schemes there is cause for optimism in preventing further deterioration of the arable land and pasturage in the Bantu reserves. Whites, however, own almost 95% of the land in the Bedford and Fort Beaufort divisions, of which area only about 2% is cultivated. The natural vegetation of the region is its major resource, yet on the White-owned farms misuse of the natural grazing owing to lack of veld management or incorrect veld management is still widespread. Many White farmers do not practise rotational grazing and this has lowered the carrying capacity of the land. To enable the farms to carry more livestock more fences must be erected in order to divide the land into smaller paddocks. Careful rotational movement of livestock will eliminate uncontrolled grazing and thus enable farmers to derive maximum benefit from pastures. The quality of livestock could also be improved, particularly on the smaller White-owned farms and in the Bantu reserves, where both cattle and sheep are usually of low standard.

Diversification of the Rural Economy

Extensive rearing of sheep for wool plays an important part in the economy of much of the region, which has a high ratio of sheep to cattle. Only in the sweet grassveld regions do cattle account for the majority of livestock units. During recent years the price of wool has been falling while production costs have been rising steadily. During the 1970-1971 season, for example, the average price per kilogramme of wool sold in South Africa dropped by over 28 per cent compared with that of the previous season.[1] The resulting drop in income of many farmers is probably one of the factors causing the exodus of Whites from the region. This can be combated by wool farmers changing the emphasis of their farming to the rearing of sheep for mutton, and cattle for beef and milk.

At present most of the small area of arable land on the White-owned farms is devoted to the growing of fodder crops for livestock. Citrus is the only cash crop occupying a relatively large proportion of the arable land. There is a definite need for farmers to grow more cash crops. The suitability of tobacco, cotton, avocado pears, deciduous fruit and vegetables has been proved by some farmers. Tobacco has been grown successfully in Stockenström for more than a century (see pp. 176-177, 288-289), but occupies only a minute proportion of the arable land in the district. Cotton is grown profitably on a farm in the lower Kat River valley (see pp. 289-291), and climatic conditions have proved suitable for the cultivation of avocado pears in that sector of the valley lying some five miles to the north of Fort Beaufort (see p.320). Deciduous fruit crops such as apples, pears and plums have proved a success in small orchards on the Hogsback and in the vicinity of the Katberg and the Great Winterberg, where mean midwinter temperatures are sufficiently low to prevent delayed foliation. It would appear that the area under these crops could be increased considerably. There is no reason why the apricot industry should not be revived in the Great Fish River valley on the borders of Bedford and Somerset East once irrigation

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[1] The Standard Bank Review, Johannesburg, August 1971, p. 8.

water is available from the Orange River. (See pp. 349 - 350.) At present the area occupied by vegetable crops is very small, but the climate and soils of the region are so diverse that a great variety of vegetables can be grown. Market gardening is suited to the aptitudes of the Bantu peasantry; it demands a great deal of labour in a region in which peasant labour remains abundant.

Education

Ultimately the development of this area lies in the hands of the farmers themselves. Farmers tend to be conservative and do not readily discard long-tried practice. A difficult task lies in persuading them that new ideas are worthy of adoption. The success of new methods must be proven, and demonstration has been the chief method relied upon by the South African Department of Agricultural Technical Services, which has two extension officers stationed in the region. One officer in Adelaide serves the Koonap Soil Conservation District, which consists of the magisterial district of Adelaide, the magisterial district of Bedford (excluding irrigation farms in the Great Fish River valley) and the Post Retief area of northern Fort Beaufort. The other officer, stationed in Fort Beaufort, serves the Kat River Soil Conservation District, which consists of the remainder of the Fort Beaufort magisterial district together with Stockenström and Victoria East. The agricultural high school for Whites, scheduled for opening at Fort Beaufort in 1972, will provide much needed training in modern agricultural techniques.

The guidance and assistance offered by the Department of Bantu Administration and Development in the field of agriculture in the Bantu reserves has been discussed in Chapter XV. Bantu agricultural officers in the area have the advantage of being in close contact with the Department of Agriculture of the University of Fort Hare.

2. THE TOURIST TRADE

The Bedford and Fort Beaufort divisions are of considerable interest both from the historic and scenic point of view. At present the tourist trade relies mainly on the attraction to visitors of the forested Katberg and Hogsback ranges. Some indication of the tourist traffic in these areas can be obtained from the fact that Hogsback village (White population 129 in 1960) has three hotels. There is one hotel and several holiday resorts at the foot of the Katberg escarpment. Poor gravel roads, which are only means of reaching the Hogsback and Katberg, are a deterrent to many prospective visitors. The tarring of the roads to these resorts would increase the tourist traffic considerably. Unfortunately the tarred road from Fort Beaufort to Queenstown, scheduled for completion in 1973, will bypass the existing resorts at the Katberg.

At present there are no publicity associations in the Bedford and Fort Beaufort divisions. Their establishment would result in the advertising of the region's various amenities and thus encourage visitors.

3. DEVELOPMENT OF SECONDARY INDUSTRY

The four main towns of the region, Bedford, Adelaide, Fort Beaufort and Alice, function mainly as service centres for the farming community. They are ranked by Davies and Cook as Order 6 towns, i.e. Minor Country Towns, in the South African urban hierarchy. The remaining town, Seymour, is classified as a Local Service Centre (Order 7).[1]

Secondary industry is almost non-existent in the Bedford and Fort Beaufort divisions. Not only is there a small market for manufactured goods, but the easy means of communication between the towns

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[1] R.J. Davies & G.P. Cook, "Reappraisal of the South African Urban Hierarchy", S.A. Geographical Journal, Vol. 50, 1968, pp. 116 - 121.

of the region and established industrial areas such as Port Elizabeth and East London has served as a deterrent to industrialisation. (See maps, pp. 185, 195.) Local requirements of manufactured goods can be obtained easily from Port Elizabeth or East London, so that the incentive to establish industries has been lacking.

The 1960 census showed that manufacturing industries employed only 389 people in the Bedford and Fort Beaufort divisions. (See page 208.) Of this number 65 were White, 74 Coloured and 250 Bantu. Most of the workers are employed in service industries for local requirements only. Thus the two largest towns, Fort Beaufort and Adelaide, each have a bakery and a mineral water factory, and the region's three local newspapers are all printed in Adelaide. Other service industries include plumbing, shoe repairing and tailoring. Non service industries, consisting of the relatively simple processing of local primary products, are cheese making and sawmilling. The region has one cheese factory at Kroomie, and two sawmills, one at the Katberg and the other at Fort Fordyce, on Kroomie Mountain. Box shooks are manufactured in Alice. The only noteworthy industries which do not fall into the above categories are the manufacture of proprietary medicines at Adelaide and the printing and bookbinding industry at Lovedale, near Alice. The traditional "Cape Dutch" medicines manufactured in Adelaide are known in Afrikaans as "Boere rate" and are marketed throughout South Africa. The Lovedale Press is probably the most important industrial establishment in the Bedford and Fort Beaufort divisions. In 1970 this concern produced more than 600,000 bound books in eight Bantu languages as well as in English and Afrikaans. The market extends over the whole of Southern Africa, including Zambia.[1] Other light industries commanding wide markets are required if the region is to develop.

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[1] Personal communication with R. White, General Manager, Lovedale Press, 22/2/1971.

The towns of Alice and Fort Beaufort, which adjoin Bantu reserves, have been granted concessions in terms of the South African Government's border industries policy.[1] Both towns have set land aside for industrial development, but as yet no industrialists have shown any interest. The choice of suitable types of industry is a matter to which considerable attention should be devoted, for the development of light industry in the region will help alleviate the problem of economic imbalance produced by an increasing low income population group and a decreasing high income group.

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[1] For a discussion of the border industry policy see R.T. Bell, "Government Policy and Industrial Location in South Africa", unpublished Ph.D. thesis, Rhodes University, 1968, pp.355-367.

APPENDIX A

CONVERSION TABLE, IMPERIAL TO METRIC UNITS

Note : The sign ≑ stands for "equals approximately".

LENGTH

1 inch	=	2.54 centimetres = 25.4 millimetres
1 foot	=	0.3048 metre = 30.48 centimetres
1 yard	=	0.914 metre
1 mile	=	1.609 kilometre
5 miles	≑	8 kilometres
10 miles	≑	16 kilometres

To find the approximate equivalent in metres of a value expressed in feet, multiply by 0.3. Thus 50 feet ≑ 15 metres, 100 feet ≑ 30 metres.

AREA

1 square inch	=	6.452 square centimetres
1 square foot	=	0.093 square metre
1 square yard	=	0.836 square metre
1 acre	=	0.472 morgen = 0.405 hectare
1 morgen	=	2.117 acres = 0.857 hectare
1 square mile	=	2.58999 square kilometres

VOLUME AND CAPACITY

1 cubic inch	=	16.4 cubic centimetres
1 cubic foot	=	0.0283 cubic metre
1 cubic yard	=	0.76 cubic metres
1 pint	=	0.568 litre
1 British gallon	=	4.546 litres
1 British bushel	=	0.364 hectolitre = 36.37 litres

MASS

1 ounce	= 28.350 grammes
1 pound (lb.)	= 453.6 grammes = 0.454 kilogrammes.

TEMPERATURE

To convert Degrees Fahrenheit to Degrees Celsius (Centigrade): subtract 32, multiply by 5, and divide by 9, i.e.

$$^{o}C = \frac{5}{9}\ (^{o}F-32).$$

Comparative Temperature Readings

°F	°C
14	-10
23	- 5
32	0
41	5
50	10
59	15
68	20
77	25
86	30
95	35
104	40
113	45

APPENDIX B

CONVERSION OF BRITISH STERLING TO SOUTH AFRICAN DECIMAL CURRENCY

In 1825 British Imperial coinage was introduced as the medium of exchange in the Cape Colony. The monetary units in use were pounds (£), shillings (s.) and pence (d.), there being 12 pence to one shilling and 20 shillings to one pound. The British sterling system continued in use until 14th February, 1961, when a decimal currency system of rands (R) and cents (c) was introduced in South Africa. One rand equalled ten shillings and one shilling equalled ten cents. Financial statistics for the pre-1961 period have been converted to the decimal system on this basis.

The devaluation of the British pound sterling by approximately 14% on 18th November, 1967, has not altered the conversion rate of pre-decimal South African currency.

Bedford Adelaide Fort Beaufort Alice with Lovedale and Fort Hare

APPENDIX D

COMMERCIAL, SERVICE AND INDUSTRIAL ESTABLISHMENTS IN THE FOUR MAJOR TOWNS OF THE BEDFORD AND FORT BEAUFORT DIVISIONS, 1970

	Bedford	Adelaide	Fort Beaufort	Alice with Lovedale and Fort Hare
COMMERCIAL AND FINANCIAL				
Licensed Hotel (with offsales)	1	2	3	2
Bottle Store	-	1	-	2
General Store	6	9	13	6
Department Store	-	-	-	1
Furnishers	-	1	2	1
Ladies' Clothing	1	1	1	1
Gents' Outfitter	-	1	-	-
Fancy Goods Shop	-	-	-	1
Shoe Store	-	1	1	-
Shoe Repairs	1	-	1	-
Dry Cleaner	-	-	1	-
Gentlemen's Hairdresser	-	1	1	-
Ladies' Hairdresser	1	1	1	-
Butcher	2	2	2	3
Cafe, Restaurant	2	2	3	1
Green Grocer, Fruiterer, Fishmonger	-	-	3	2
Cinema	-	1	1	1
Chemist	1	1	1	1
Herbalist	-	-	1	-
Jeweller and Watchmaker	1	-	-	-
Electrical Supplies and Radio	-	-	2	1
Bookshop & Newsagent	-	-	-	2
Bank Branch	2	3	2	2

NGOBE'S LOCATION, NORTH-WESTERN VICTORIA EAST

MAY 1962

On the left is a traditional circular Xhosa hut with mud walls and thatch roof. The hedge of Aloe arborescens, in flower on the right, forms a kraal for the protection of livestock from predators overnight. Closely cropped Cynodon dactylon appears in the foreground.

Hedge of Aloe arborescens.

APPENDIX C

RHODES UNIVERSITY, GEOGRAPHY DEPARTMENT

ENQUIRY INTO FARMING IN THE BEDFORD, ADELAIDE, FORT BEAUFORT, STOCKENSTRÖM AND VICTORIA EAST DISTRICTS.

STRICTLY CONFIDENTIAL

I shall not disclose the names of farms or farmers to anyone. The data will be used to obtain average figures for different veld types within the area.

N. T. Childs

N.T. CHILDS
Lecturer,
Department of Geography.

(Where alternatives are given, please delete what is inapplicable)

1. Name of farm . . . . Owner. . . . .

2. Area of farm . . . . morgen.

3. Magisterial district . . . .

4. The veld is sour grassland / sweet grassland / Karroo bush / mixed Karroo and grass / succulent scrub.

   If all types are present, state where different types occur. (e.g. sour grassveld on hills, sweet grassveld in valleys) . . . .

   . . . .

5. Breeds of sheep kept, together with total numbers of each breed (e.g. 450 Merino, 200 cross bred). . . . .

   . . . .

6. Is there a registered stud flock of sheep? Yes / No.

7. Number of angora goats . . . . Number of other goats . . . . . .

8. Breeds of cattle owned by farmer, together with numbers (e.g. 20 Friesland, 40 Africander, 60 cross bred) . . . .

   . . . .

9. Total number of native-owned cattle . . . .

10. Is your herd (or part of your herd) a pedigree herd? Yes / No.

11. Do you sell mostly milk, mostly cream, both milk and cream, or neither?

    . . . .

12. Cattle kept for dairying / beef / both.

13. Where are your cattle marketed?. . . . .

14. Where is the milk and/or cream marketed?. . . . .

15. Approximate areas under crops in a normal year (Please give areas in morgen).

    Barley .... Oats.............. Wheat.......Lucerne. . . . . .

    Maize................ Sown grasses.............. Tobacco...............

    Citrus................ Other crops (please state)....................

    Total area under crops................. Total area irrigated.............

RHODES UNIVERSITEIT, DEPARTEMENT AARDRYKSKUNDE

NAVRAAG MET BETREKKING TOT BOERDERY IN DIE BEDFORD, ADELAIDE, FORT BEAUFORT, STOCKENSTRÖM & VICTORIA-OOS DISTRIKTE.

STRENG VERTROULIK

Die inhoud van hierdie ~~vraagskrif~~ vraelys sal aan geen ander persoon bekendgemaak word nie. Die inligting sal gebruik word om gemiddelde syfers vir die verskillende veldtipes te verkry.

N. T. Childs
N.T. CHILDS
Lektor,
Departement Aardrykskunde.

Waar alternatiewe aangegee word skrap uit a.s.b. die wat nie van toepassing is.

1. Naam van plaas .... Eienaar ....
2. Oppervlakte van plaas .... morg.
3. Landdrosdistrik..
4. Die veld is suur grasveld / soet grasveld / karoobossies / karoo en gras gemeng / sappige bos (spekboom ens.)[X]
5. Skaaprasse wat aangehou word, met getalle van elke ras.
(b.v. 450 Merino, 200 baster) ....
....
6. Is daar 'n geregistreerde stoet skape ? Ja / Nee.
7. Getal sybokke (angora bokke) .... Getal ander bokke ....
8. Beesrasse deur boer aangehou, met getalle (b.v. 20 Fries, 60 Afrikaner-Korthoring Kruis.) ....
....
9. Aantal naturellebeeste ....
10. Is u kudde (of deel van u kudde) rasag ? Ja / Nee.
11. Verkoop u meestal melk, meestal room, albei melk en room of geen ?
....
12. Beeste aangehou vir suiwelprodukte / vleis / albei.
13. Waar bemark u u beeste ? ....
....
14. Waar word die melk / room bemark ?
15. Gemiddelde besaaide oppervlakte in 'n normale jaar (Gee a.s.b. oppervlaktes in morge.)

Gars .... Hawer .... Koring .... Mielies ....
Tabak .... Lusern .... Gesaaide grasse .... Sitrus ......

Ander oeste (Meld a.s.b.) ....
Totale oppervlakte gesaaides ....
Totale besproeide oppervlakte ....

[X] As verskeie veldtipes voorkom, meld waar. (b.v. suurveld op heuweltoppe,

	Bedford	Adelaide	Fort Beaufort	Alice with Lovedale and Fort Hare
TRANSPORT AND STORAGE				
Railway Station	1	1	1	1
Cartage Contractor	3	1	2	1
Taxi for Whites	1	1	1	1
Taxi for Non-Whites	1	1	2	3
Petroleum Bulk Storage	-	1	2	-
CULTURAL AND EDUCATIONAL				
Weekly Newspaper	-	1	1	1
Public Library for Whites	1	1	1	1
White Primary School	2	1	1	1
White Secondary School	1	2	-	1
White High School	1	1	1	-
Coloured Primary School	1	1	1	1
Bantu Primary School	1	1	1	2
Bantu Secondary School	-	-	1	1
Bantu High School	-	-	-	1
Bantu Teachers' Training College	-	-	-	1
Bantu University	-	-	-	1
SOCIAL[1]				
General Hospital, all races	1	1	1	-
General Hospital, non-Whites only	-	-	-	1
General Hospital, Whites only	-	-	-	1
Mental Hospital, non-Whites only	-	-	1	-

[1] Excluding churches.

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