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Agro-ecology, land use and smallholder farming in the central Eastern Cape.

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Chapter 3: Agro-ecology, land use and smallholder farming in the central Eastern Cape

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2.1 Introduction

At a local level, farming and land-based livelihoods are linked to the particular natural resources that are available. The description and characterisation of these resources and their limitations provide the bio-physical context in which farming and land-based livelihoods need to be understood. This chapter starts with a description and characterisation of the agro-ecology of the central Eastern Cape, and proceeds with a generalised description of how these natural resources are used, with special emphasis on farming. This description follows the historical subdivision of the central Eastern Cape into the former Border and Ciskei regions, because important historical differences in terms of farm size and land use persist. The last part of the chapter presents a detailed description of natural resources, land use and farming in the historical Ciskei region, because both Guquka and Koloni form part of it.

2.2 Agro-ecological Regions

The central Eastern Cape covers an area of about 18 024 km^2, and incorporates two historical regions, namely the Border region covering 9 924 km^2 and the former Ciskei 8100 km^2. Roughly, it has the Kat and Lower Fish River as its western boundary and the Great Kei and Black Kei rivers as its eastern and northern boundary. In the south it borders the Indian Ocean.

The central Eastern Cape can be subdivided into five major land units. Four of these are encountered when travelling from the coast in a northern direction, namely the Coastal Belt, the Coastal Plateau, the Amatola and Winterberg Mountains, and the Midland Plateau. The valleys of the major river systems that cut through these four units make up the fifth unit.

The Coastal Belt

Stretching about 30 to 40 km inland, the Coastal Belt rises rapidly from sea level to an altitude of about 100 m, and thereafter gradually to an altitude of about 300 m at the boundary with the Coastal Plateau. Numerous steeply incised river valleys dissect it, causing intense relief at local level. Mean annual rainfall increases from 624 mm at Fish River Point in the southwest to about 850 mm in the northeast. The Coastal Belt receives most of its rain during summer, but the influence of cold fronts sweeping the southern edge of the continent, predominantly a winter phenomenon, causes approximately 40% of the rain to fall in winter. Moderated by the Indian Ocean, the climate is frost-free. Mean daily minimum temperature is between 17 and 18 ^oC in January and about 10 ^oC in July, but extreme minimum temperatures as low as 3 ^oC have been recorded (Marais, 1975). Land and sea breezes commonly occur, but they may be superseded by westerly winds, which are described as persistent, strong and disagreeable (Marais, 1975). The climate is suitable for year-round production of a range of crops,

including selected sub-tropical fruits, of which pineapples are the most important, economically.

Soils are generally shallow, and often prone to water logging, especially those situated on the level crests and valley bottoms. Cultivation occurs mainly on the valley slopes. Soils on valley slopes usually show evidence of leaching, and have an acid reaction. They appear to resist erosion, enabling their cultivation on gradients exceeding 20% without excessive loss of soil, at least during the initial years. The natural vegetation is dominated by Coastal Mixed Grassveld and Acacia Savanna, and the numerous steeply sloping river valleys are covered with Valley Bushveld. The use of natural vegetation mainly involves beef production. Around the city of East London dairy farming on planted pastures is common.

The Coastal Plateau

Geomorphologically, the Coastal Plateau is a continuation of the Coastal Belt, rising gradually from an altitude of 300 m in the south, and reaching an altitude ranging between 700 m and 900 m at the edge of the Amatola and Winterberg mountain ranges. Climatically, the plateau differs from the Coastal Belt. The influence of the Indian Ocean is less pronounced, making it hotter in summer and colder in winter. The proportion of rain falling in winter is typically between 20 and 30%. The rainfall pattern can be described as bimodal, because a mid-summer dry period separates the spring and the autumn peaks. Generally, the climate is dry in the west, where the mean annual rainfall is about 500 mm, and gets wetter towards the east, where the mean annual rainfall may reach about 750 mm. According to Marais (1975), mean annual rainfall on the coastal plateau may vary considerably over short distances. This appears largely due to differences in altitude and position in the local landscape. For this reason, local relief features need to be considered carefully when assessing rainfall of a particular site. Marais (1975) cites the example of King William's Town to demonstrate local variability in mean annual rainfall. The town, which is nestled in the valley of the Buffalo River, has a mean annual rainfall of 536 mm. At the country club, which is on the plateau overlooking the town and only 7 km from the centre, the mean annual rainfall is 618 mm.

On the Coastal Plateau, the mean daily maximum temperature is about 29 ^{o}C in January and 21 ^{o}C in July. Extreme maximum temperatures of 44 ^{o}C in January and 32 ^{o}C in July have been observed. These high temperatures are usually associated with the occurrence of "bergwinds". These strong, hot and desiccating winds can cause considerable damage to crops, both mechanically and by scorching the leaves (Marais, 1975). Frost occurs throughout, although the mean daily minimum temperature in July is about 5 ^{o}C. The frost period increases from about 30 days in the south to 60 days in the north. As a result, the plateau has two distinct growing seasons, namely a summer season during which crops sensitive to frost can be grown, and a winter season for frost-resistant crops. When grown under rainfed conditions both summer and winter crops have to rely on stored soil water during some part of their growing cycles. As a result, successful cropping relies heavily on the adequacy of the water holding capacity of the soils (Van Averbeke & Marais, 1991). In the dry parts the pH of the soils is close to neutral and in the wetter parts slightly or moderately acid. The low phosphorus content of soils is an important limitation to plant growth (Hensley & Laker, 1975). The general absence of deep and adequately drained soils causes the area of land suited to crop

production to be limited to about 10% of the total. Red soils of the Shortlands and Hutton form (Soil Classification Working Group, 1991) are the most productive (Van Averbeke & Marais, 1991). Derived from dolerite, they are usually deep, resistant to erosion (D'Huyvetter, 1985), and chemically fertile (Hensley & Laker, 1975). The natural vegetation is dominated by Acacia Savanna in the dry parts and Dohne Sourveld in wetter areas. Most of the land is best suited to extensive livestock production, involving a combination of goats and cattle on Acacia Savanna, and cattle or sheep on Dohne Sourveld.

The Amatola and Winterberg Mountains

Running east to west, at a distance of about 70 km from the coast in the eastern part of the central Eastern Cape and about 120 km in the west, the Amatola and Winterberg mountain ranges occur. Rising sharply from the Coastal Plateau to an altitude varying between 1500 and 2000 m, the southern slopes of the mountain range appear as a dark-green forested belt. The sudden increase in altitude, causing orographic rain, explains why the southern slopes and mountain peaks enjoy a mean annual rainfall that is much higher than on the Coastal Plateau. As on the coastal plateau, mean annual rainfall varies considerably, depending on altitude and exposure. The high altitude causes the frequency of frost to be higher than on the Coastal Plateau and the growing season to be shorter. Overall, the climate in the mountains is cooler than on the Coastal Plateau, and misty conditions prevail during much of the year. Snow falls regularly during the winter, especially on the high peaks, but it hardly ever lasts longer than a few days. A large portion of the mountain range, which has a width of only about 10 to 15 km, is under mature Afromontane forest, pine plantation, or wattle. The rest supports Dohne sourveld, fynbos or scrub. Rock outcrop and stony soils are found on the steep slopes, but pockets of deep Clovelly and Hutton type soils occur on slopes that are gentler. Due to the high rainfall, leaching conditions prevail, explaining why most soils test acid throughout the profile. Soils on the southern foot slopes of the mountains are usually deep, lateritic, and often susceptible to erosion. The mountain range is the source and main catchment area of three important river systems, namely the Kat River, the Keiskamma and Tyume rivers, and the Buffalo River. In terms of land use, the mountain range is suited for forestry and the production of cattle, goats and sheep. Cultivation is very limited, although climatically the area lends itself well for a range of high-value niche crops, such as seed-potatoes, cherries and proteas. This potential remains largely untapped.

The Midland Plateau

The Midland Plateau is found in the rain shadow to the north of the Amatola and Winterberg mountain ranges. Situated at an elevation ranging between 900 and 1200 m, about 300 to 400 m higher than the northern parts of the Coastal Plateau, the Midland Plateau is characterised by many residual table-topped hills (inselbergs). Often these hills are capped by dolerite. Dolerite has a composition similar to basalt. About 100 million years ago, magma was injected into the existing sedimentary mother rock, giving rise to dolerite sills and dykes. Being more resistant to erosion than sedimentary rocks, dolerite dykes and sills protect underlying sedimentary rocks against being worn away, explaining the occurrence of the residual table-topped hills. The plateau forms part of the summer rainfall region, and receives about 600 mm annually. The climate is little influenced by the ocean and can best be described as continental (Marais, 1975). Thus, it is hotter in summer and colder in winter compared to the Coastal Belt and Coastal

Plateau. The mean daily maximum temperature is about 30 ^{o}C in January and the mean daily minimum just under 3 ^{o}C in July. Absolute maximum temperature in summer may go up to 40 ^{o}C, while minimum temperatures of –6 ^{o}C have been recorded during winter. On the plateau crests the dominant vegetation is Karroid Danthonia Mountain veld, whilst valleys are covered with Cymbopogon-Themeda veld, but this has been invaded by *Acacia karoo* and Karoo shrubs, a change apparently encouraged by soil erosion. The Midland Plateau was once renowned for its wool and wheat production, but this potential has been reduced by land degradation. The area is characterised by duplex soils. These soils show an abrupt increase in clay content at the transition between top and subsoil, and they are usually very susceptible to erosion when mismanaged.

The River Valleys

The valleys of the Kat, Fish, Tyumie, Keiskamma and Kei rivers form the fifth agro-ecological unit. They are drier than the surrounding landscape, and support an unique vegetation, referred to as the Valley Bushveld, consisting of scrub forest dominated by tree-Euphorbia. Soils on the valley slopes are usually shallow and rocky, but at the foot of the slopes and in the valley bottoms deep soils occur. Often, soils at the foot of the slopes show signs of water logging (pale grey), but those in the valley bottoms tend to be better drained. In most cases it is these valley-bottom soils that have been exploited for the development of irrigation schemes. These include Tyefu along the Fish River, Keiskamma and Zanyokwe in the valley of the Keiskamma River, Horseshoe along the Buffalo river north of King William's Town, Shiloh near Whitlesea on the Klipplaat River, Hertzog and Kat River citrus farms in the Kat River Valley, as well as several small projects along the Tyume River north of Alice.

2.3 Vegetation types

The five agro-ecological regions that make up the central Eastern Cape contain four of the major vegetation biomes of Low and Rebelo (1998). These, in turn, can be subdivided further into nine veld types according to Acocks' (1988) veld classification system (Beckerling et al., 1995). In Table 2.1 relationships among these three categorisations are summarised.

Table 2.1: Summary of agro-ecological regions, vegetation biomes and rangeland types in the central Eastern Cape Region

Agro-ecological zone	Vegetation Biome	Rangeland Type
Coastal Belt	Forest Biome	Coastal Forest & Thornveld Alexandria Forest
Coastal Plateau	Savanna Biome	Eastern Province Thornveld False Thornveld of the Eastern Cape
Valleys	Thicket Biome	Valley Bushveld
Mountains	Grassland Biome	Highland Sourveld & Dohne Sourveld Karroid *Merxmullera* Mountain Veld
Midland Plateau		Invasion of Grassveld by *Acacia karroo* Dry *Cymbopogon-Themeda* Veld

The vegetation biomes found in the region differ in their potential for livestock production because of their varying composition in terms of the proportion of grasses, bushes and trees they contain and the relative productivity of the various plant species for livestock production purposes. Particularly for grasses species composition is important and it forms the basis for a broad classification of grassland into sweetveld and sourveld. There are several important characteristics associated with these two categories of veld, but in simple terms sweetveld is veld which remains palatable and nutritious when mature, whereas sourveld provides palatable material only during the growing season (Tainton, 1999). Some broad indications of the composition and productive potential of each vegetation biome are provided below.

The Forest Biome

Of the two rangeland types that compose the Forest Biome, the Coastal Forest and Thornveld offers the greater potential for livestock production. Whereas the Alexandria Forest consists mainly of dense forest, the Coastal Forest and Thornveld is a mixture of forest interspersed with patches of open thornveld, which afford some limited opportunity for the grazing of livestock (Beckerling et al., 1995). The veld of both rangeland types can be described as sour to mixed depending on the rainfall aspect and soil type, which further limits the productivity of the available rangeland outside the growing season. Agriculture is predominantly crop-oriented although extensive livestock production is practised on those areas where thornveld and bush intrusion is less problematic or where this is actively controlled (Van Averbeke, 2000). Thus, the potential of the biome for livestock production is limited both spatially and temporally and can be described as fairly poor overall in comparison to some of the other biomes in the region.

The Savanna Biome

In the central Eastern Cape, the vegetation of the Savanna Biome consists of thornveld, dominated by *Acacia karroo*, with a dense grassveld layer of variable nature. In some areas this is grassveld is sourish to mixed but is predominantly sweet in classification. This, combined with the generally flat topography makes it suited to livestock production for both grazers and browsers throughout the year in most areas of its occurrence and the biome with probably the greatest production potential in the region. According to Barnes (1982), where tree and shrub density is low, or where such conditions may be easily achieved through selective clearing, high levels of production can be achieved using cattle alone or with goats in a secondary role. However, it is important that management strategies are employed to try and ensure that the herbaceous layer is not overused during drought years and that the cost of maintaining open savanna is not excessive. In more dense shrub savanna the goat is the obvious choice as the main producer and its use in the dry thornveld of the Eastern Cape has been demonstrated by Aucamp (1976). Again, however, realising this productivity is largely dependent on the utilisation of appropriate management strategies.

Sweetveld in summer rainfall areas such as the central Eastern Cape is prone to damage by heavy grazing (i.e. has fairly low resistance to grazing-induced change) but has the capacity to recover rapidly in terms of both composition and density (i.e. has a fairly high level of inherent resilience) (Tainton, 1999). This has important implications for management. Strategies should generally focus on allowing livestock numbers to track climatic variability but ensuring that they are appropriately distributed in space and time to allow for range recovery. In areas of very extensive animal production on communal rangeland this can effectively be achieved through active herding to different areas. However, in a communal area such as the former Ciskei where range area is comparatively limited this is not possible.

Rather, rotational grazing of livestock to facilitate optimal range recovery is only possible through some system of paddocking as introduced to the former Ciskei under betterment. However, given the enormous demands on grazing resources in communal areas, few communities are able to perpetuate previous rotational grazing practices. Where management systems have disintegrated rangeland productivity will inevitably be compromised although the implications of this for communal livestock production are debateable (see below).

The Thicket Biome

In the former Ciskei the Thicket Biome is constituted entirely by the valley bushveld associated with the valleys of the Keiskamma, Tyume, Bira, Kat and Great Fish Rivers and is the most extensive veld type in the region. The vegetation tends to be scrubby and consists of a combination of thicket and *Acacia karroo* thornveld or *Euphorbia* forest with limited grassveld. The veld type is very sweet and therefore very sensitive to both overgrazing and overbrowsing (Beckerling et al., 1995). Such sensitivity severely limits the livestock production potential of the biome as the vegetation can only support limited numbers of animals under very extensive stocking strategies. Goats have been advocated as the main producers in this environment with cattle in a secondary role utilising the relatively small proportion of grass in the vegetation (Aucamp, 1976). However, in light of its inherent sensitivity, it can be concluded that this biome is generally poorly suited to the demands of livestock production at either a communal or commercial level and consequently considerable areas of it are now under management for wildlife conservation.

The Grassland Biome

Locally, the four veld types that constitute the Grassland Biome differ considerably in their productivity and therefore in the way in which they can be used for livestock production. The Highland Sourveld and Dohne Sourveld is associated with mountainous regions and as its name implies is dominated by dense and inherently sour grassveld. In contrast to the sweetveld described above, this type of rangeland is characterised by being resistant. It is capable of tolerating quite high levels of grazing pressure without producing any noticeable shift in species composition although this does lower productivity (Tainton, 1999). It is productive during the spring and early summer, although this rapidly declines during the autumn and remains low throughout the winter. This means that without supplementary feeding livestock productivity drops off markedly at this time and animals may even die. Thus, even communal areas many livestock owners producing on this sourveld have to be prepared to grow forage crops or buy in supplementary feed to maintain their animals.

The other three veld types in this biome are essentially mixed or sweet in nature and tend to be quite sensitive to degradation. Livestock production, whilst possible for a larger proportion of the year than in the sour, mountainous areas cannot be undertaken under the same high stocking rates and necessitates a more conservative approach.

Overall the potential of the biome for livestock production can be considered as reasonable, being better than that of the forest and thicket biomes although not as high as the savanna biome.

2.4 General Land Use

Land in the central Eastern Cape is used mainly for livestock production. In 1989, 98 % of the region's land area was used for agriculture. Eighty-six percent of the agricultural land was covered by natural pasture (Antrobus, Fraser, Levin & Lloyd, 1994). Other important land uses were planted or natural forest and cultivated land. In 1995, the region's natural pasture supported approximately 341,000 cattle, 667,000 sheep, and 306,000 goats (Department of Agriculture, 1995). On average, the stocking rate was 3.25 ha per large stock unit (LSU) in the Border region and 2.90 ha per LSU in the Ciskei region. If one considers that six small stock units (sheep and goats) are equivalent to one LSU, the dominance of cattle in the region's livestock production system is clearly evident. In 1995, the overall LSU ratio of goats:sheep:cattle was approximately 1:2:7 in the central Eastern Cape. The Border and Ciskei regions differed mainly in terms of the importance of goats in the livestock mix. In the Border region, where the ratio was 1:6:15, goats were fairly rare, but they were a lot more prominent in the Ciskei districts where the ratio was 1:1:4. Since 1994, when foreign tourists started to return to South Africa, several cattle farms in the Border region have been converted wholly of partly into game farms.

Overall, the agro-ecology of the central Eastern Cape favours mixed farming dominated by livestock production in which most of the fodder is supplied by the natural range. This was also how the land was used during pre-colonial times as discussed in the first chapter of this book.

Land use in the Border and Ciskei regions differ to an extent. In the Border region, where farm units are large, much of the arable land supports livestock production, being planted to fodder crops, such as silage maize and lucerne, or to cultivated pasture grasses. Along the coast, climatic conditions encourage use of arable land for pineapple production, but during the past two decades the centre of pineapple production has shifted from East London to Bathurst, a small town situated west of the Fish River. Vegetable production in open fields, and increasingly in tunnels, is important around East London, especially northeast of the city. Ciskei was one of the areas set aside by the Land Act of 1913 for occupation by black people, and in 1981 it became one of four independent South African homelands, before being re-incorporated into South Africa in 1994. Due to its political history, farming in Ciskei developed differently from that in the Border region. One of the most striking differences is that farm units in Ciskei tend to be small compared to those in the Border region. Whilst a typical smallholding in Ciskei covers about 12 ha, a farm unit in the Border region is about 500 ha in size. Another difference is that much of the land in Ciskei is held by means of communal tenure, whilst farms in the Border region are in private hands. As in the Border region, most land in the Ciskei region is under natural veld. The natural range is also primarily used for livestock production, but also provides homesteads with wood and herbs for various uses. On their fields, which typically range from one to three ha in size, smallholders in the Ciskei region produce mainly food crops, particularly maize. Homestead gardens are planted to a wide range of crops and vegetables. Since both Guquka and Koloni are settlements that were once part of Ciskei, the rest of this chapter deals specifically with agriculture as it is practised in this region.

2.5 Livestock production on smallholdings

Livestock numbers

It is difficult to find recent data on livestock numbers in the communal areas of the central Eastern Cape Province. Since 1994, data tend to be dealt with at a provincial level. An overview of cattle numbers in former Ciskei is presented in Table 2.2.

Table 2.2: Cattle numbers in the former Ciskei.

Year	1977-78[1]	1981-82[1]	1983-84[1]	1984-85[1]	1990[2]	1995[3]
No. of animals	190,000	150,000	75,000	83,180	162,000	161,929

1 Hundleby et al. (1986).
2 Fraser (1992)
3 Van Averbeke et al. (2000).

It is clear from the data in Table 2.2 that there was a crash in animal numbers during the early 1980s. In 1984, the number of cattle had been reduced to half of what it was in 1978. This decline was precipitated by droughts, particularly that of 1982-83. By 1985 there was evidence of a recovery in cattle numbers, and continued through to 1990, remaining virtually unchanged in by 1995. Similar cycles of large drops in cattle numbers and subsequent recovery of the herds to their original populations were described by Beinart (1992) in the former homeland of Transkei. This lends support to the theory that in spite of short-term fluctuations, cattle numbers have remained relatively constant over the long term in the communal areas of South Africa (Tapson, 1993). It also suggests that in spite of changing times the desire to own cattle remains largely undiminished among people living in these areas.

An overview of small stock numbers in the former Ciskei are presented in Table 2.3.

Table 2.3: Sheep and goat numbers in the former Ciskei.

Year	1972[1]	1979-80[2]	1984-85[3]	1990[2]	1995[4]
Sheep	478,000	249,719	224,920	289,454	239,972
Goats	220,000	226,509	274,490	281,135	249,991

1 Brown et al. (1975)
2 Fraser (1992)
3 Hundleby et al. (1986).
4 Van Averbeke et al. (2000)

As with cattle, sheep numbers in the former Ciskei declined sharply between the early 1970s and the mid 1980s to less than half their former numbers. It is likely that this can again be attributed to the severe drought episode of the early 1980s. However, numbers showed little or no recovery in the decade after 1985, suggesting that the decline was part of a long-term trend. The reasons for this decline are investigated in more detail later on, and also in Chapter 5. Goat numbers in the Ciskei apparently remained fairly constant throughout the 1970s, 80s and 90s. This is consistent with their general hardiness.

Distribution of livestock ownership

There is an overwhelming body of evidence to suggest that while many people in communal areas continue to own stock, the average number of animals held by individuals is small and the majority of animals are owned by a relatively small number of people (Ainslie, 2002;

Kepe; 2002; Vetter, 2003). Bembridge (1979) provided an indication of herd size in the former Ciskei (Table 2.4).

Table 2.4: Distribution of cattle herd size in the Ciskei (after Bembridge, 1979).

Number of animals	1-4	5-8	9-12	13-16	16+
% of owners	47.5	28.5	13	6	5

Table 2.4 shows that three decades ago nearly half of all owners had very small cattle herds consisting of 4 or fewer animals. This skewed distribution of livestock ownership was confirmed in recent work by Ainslie (2002), in the Peddie Magisterial District of the former Ciskei. He found that 53 % of cattle owners held l6 animals or less, and only one in five held 13 or more cattle. Bembridge (1979) judged that a homestead needed a herd of at least 9 cattle to meet its various subsistence needs. By this measure only 24% of owners in the Ciskei had a cattle herd that was large enough. Tapson and Rose (1984), working in Kwa-Zulu, argued that considerably larger minimum herd size of 18 animals was required by Zulu households to effectively fulfil all the livelihood functions required of cattle (milk, draught, sale, slaughter) and allow the herd to perpetuate itself. Only about 5% of Ciskeian cattle owners were able to meet this requirement in 1979, and judging from the herd size information supplied by Ainslie (2002), this proportion is unlikely to have changed greatly. Consequently, regardless of the benchmark of minimum effective herd size the implication is that cattle production alone is capable of providing an effective livelihood strategy for a handful of owners in the region only.

Comparable data for small stock are more difficult to find. Steyn (1982) recorded a mean flock size of 18 animals for sheep and 10 for goats, among owners in the Amatola basin in the Ciskei. However, means do not convey the spread of the size of small stock holdings that exists among individual owners. Vetter (2003) showed that while the vast majority of owners in Herschel held relatively few sheep, one individual held nearly 1000 animals, and three more held more than 100 animals each. Not only did these large holdings dramatically skew the mean flock size in the area (mean =129, median = 36), but they also underlined the very uneven nature of livestock holdings, particularly of small stock. Just over 20% of the owners interviewed held 80% of sheep, and the data for goats were even more extreme, with 60% of goats being held by just 10% of owners. For cattle, distribution was far more even, with some 80% of animals being held by about 50% of owners. However, the apparently egalitarian distribution of cattle among livestock owners disguised a serious gender bias, which also applied to small stock. Across all livestock types, females consistently had far smaller holdings than men. Male livestock owners had median holdings of cattle (9), sheep (45) and goats (27), while for females the median was 5.5 for cattle, 9 for sheep and 8 for goats. Moreover, the bias in cattle ownership is probably greater in reality than such figures suggest. Ainslie (2002) has pointed out that even where females are nominally identified as the ‘owners’ of cattle, they are often widows who are only holding the animals to allow them be passed on to the oldest son. Responsibility for the maintenance of these animals and decisions over sales and marketing will invariably rest with male kin. This is consistent with local tradition, which views on ownership and husbandry of sheep, goats and especially cattle as a male domain (Coertze, 1986). Thus, few if any females can be said to ‘own’ cattle. The implications of this are debateable. While, responsibility for livestock primarily rests with males, there is much to suggest that the benefits from them (livestock products, money from sales) accrue to the household rather than to the male owner. In this respect ‘ownership’ can

be considered to be more a reflection of traditional gender roles than a claim over the resultant benefits.

Theft has increasingly come to impact on livestock ownership in communal areas of Eastern Cape. Although, the scale of the problem varies regionally, where it is severe it is a disincentive to livestock ownership. Little published information appears to be available for the former Ciskei, but case material presented in Chapter 5 for sheep theft illustrates the problem. In the former Transkei stealing of livestock appears to be quite severe. For example in the Madlangala area of Maluti district, theft was largely responsible for a drop in cattle numbers from 1,300 animals in 1997 to just 500 animals in 1999 (Ntshona and Turner, 2002). Similarly, Kepe (2002) reported widespread cattle theft in Lusikisiki district. This is particularly associated with the winter months, when cattle are often allowed to roam unsupervised on the arable fields. The authorities are finding it difficult to deal with the problem due lack of resources and the involvement of well-organised gangs. This has prompted the establishment of vigilante groups, who are often indiscriminate in how and from whom they 'reclaim' cattle, a response that has accentuated the problem (Kepe, 2002).

Livestock breeds

Cattle currently held in communal areas of central Eastern Cape Province are a mixture of African, European and prototype Afrikaner breeds (Hundleby et al., 1986). The main African breed is the Nguni, which is descended from the original Sanga cattle brought from central and Eastern Africa by the ancestors of the Nguni people (Coertze, 1986). Several European cattle breeds are present with dairy breeds, such as Jersey, Gurnsey and Ayrshire, and Brown Swiss being particularly common. Cross-breeding between European and indigenous Nguni stock has taken place since contact between the settlers and the Xhosa was first made in the early part of the 19th century. The result is that many of the animals in communal areas are of mixed breed (Hundleby et al., 1986). Much of the interbreeding that has taken place can also be attributed to cattle improvement schemes, which were a feature of the agricultural policy of the former Ciskei. Here the emphasis was on introduction of improved breeds of European origin, such as the Brown Swiss. This inevitably resulted in cross-breeding with indigenous breeds in the communal environment. In the case of the Brown Swiss this also had the unfortunate outcome of crossbred offspring being treated with disfavour by their owners, as they tend to be grey in colour, which in Xhosa custom associates them with the river spirits who are feared (Hundleby et al., 1986). More recent cattle improvement programmes have been more sympathetic to such considerations and have tended to work with indigenous Nguni breeds, particularly the related Nkone breed (Masika and Magadlela, 2001).

Similarly, the lack of control over mating has resulted in the majority of small stock being of mixed breed. Sheep tend to be a mixture of merino and local Döhne merino breeds (Vetter, 2003). Goats tend to be mostly of boer stock with some also mixed with indigenous breeds from other parts of Africa (Mafu and Masika, 2002).

Livestock productivity and its important constraints

The productivity of livestock in communal areas of the central Eastern Cape is relatively low when assessed from a commercial perspective. One measure of this is the level of off-take of animals for slaughter and sale as a percentage of the total herd size. Brown et al. (1975) estimated an on off-take of 7% of the cattle herd held by farmers in the communal areas of Ciskei, wheras herd off-take on local commercial farms was about 20%. Data on any sort for

small stock, and more recent figures for cattle, are difficult to find, but Vetter (2003) reported mean off-take levels of 6.4% for cattle, 18.1% for sheep and 8.8% for goats in the Herschel district of the former Transkei. These data refer only to 'useful' off-take from the herd in form of sales or slaughter, and do not take into account changes in herd size due to mortality or theft (see below). Cattle off-take in Herschel was remarkably similar to the estimate arrived at by Brown et al., (1975) for the Ciskei, suggesting that off take has remained consistently low. It is difficult to assess how representative the Herschel data for sheep and goat turnover is for the current situation in the central Eastern Cape region. Certainly, the figure for sheep appears high, and Vetter (2003) explicitly points out that the mean off-take value was affected by a few owners with very large flocks producing at a commercial level. Unfortunately comparative data for median values were not available. Nevertheless, the general picture in the communal livestock production systems of the region is one of relatively low levels of animal performance.

Cultural factors aside, from a production perspective two main factors appear to mitigate against levels of animal performance being improved in communal systems, i.e. low reproductive rate and high levels of mortality. Successful production of offspring among livestock in communal herds is low when compared to commercial animals, although most information in support of this contention is historical. Using the results of several studies, Bembridge (1979) concluded that the weaning rates among communal livestock during the 1970s were very low compared to commercial animals (Table 2.5).

Table 2.5: Weaning rates (%) among livestock in communal areas during 1970s compared with commercial systems (Bembridge, 1979)

	Livestock type		
Production system	Cattle	Sheep	Goats
Communal system	32-40	45-60	70
Commercial system	78	90	-

Brown et al. (1975) attributed the low rate of reproductive success to several factors. The main reason he cited was the poor quality of the available forage on the communal rangelands, which he attributed to overgrazing. Too many animals for the forage that is available results in low levels of animal performance, with females experiencing difficulties in conception and embryo development as well as poor levels of milk production once offspring are born. Milk production may also be affected by milking of lactating females (particularly cows) for home consumption. This reduces the amount of milk available for the calves, reducing their rate of growth (Brown, 1975). However, the low reproductive success of livestock in communal areas can only be perceived as a generalised picture. Spatially and temporally, forage quality and quantity vary enormously and animal performance, including reproduction tends to track this variability. Thus, in a good year animal numbers can increase rapidly, particularly following a period of drought when competition for forage resources is diminished (Behnke and Scoones, 1993).

Another characteristic of communal livestock production that contributes to low breeding success is the lack of control over mating. Since communal rangelands contain animals belonging to a multitude of owners, females in season will mate with whichever male is available at the time. This may result not only in less productive offspring, but also in inbreeding. For many livestock species, problems of lack of conception and inbreeding are

often exacerbated by the low number of male animals available to service females in oestrus. For example, with cattle it is not uncommon that in a village there may be only one or two bulls available to mate with all the cows (Vetter, 2003), but this appears less problematic for other species. For example for goats Mafu and Masika (2002) reported that buck to doe ratios fell within the recommended 1:30-40 ratio at the villages of Sheshegu and Ncera.

There is little doubt that high rate of offspring mortality is one of the major obstacles to reproductive success in communal areas. Many offspring die during birth due to the general lack of veterinary support, particularly the birth is difficult. The magnitude and severity of the problem is apparent from both historical and contemporary data. Bembridge (1979) estimated the mean calf mortality in the Ciskei of 20%. Vetter (2003) reported similarly high levels of offspring mortality among lambs (18.1%) and goat kids (27.9%).

One of the causes of the high mortality rates among livestock is the incidence of diseases amongst both offspring and adult animals. Among cattle, the most important diseases are gall sickness (anaplasmosis) and redwater (both tick borne), foot rot and brucellosis (spontaneous abortion of offspring). Infections are also problematic, and among cattle they often are the result of poor veterinary practices by unqualified people. One of the most common causes of infection among young male cattle is unhygienic castration (ukuthena in Xhosa), which often involves blunt knives and misguided treatment of the resulting wound using soil, ash or dung (Kepe, 2002).

Sheep are particularly vulnerable to disease when young if not properly cared for. Diseases include diarrhoea (particularly among lambs), sheep scab, blue tongue, and pulp kidney (Ntshona and Turner, 2002). For many sheep owners in communal areas disease takes a heavy toll on their flocks leading to the common perception that sheep are difficult animals to maintain. This, combined with difficulties in marketing wool, may to some extent explain the downturn in sheep numbers in the Ciskei during the past few decades (Table 2.3). Goats, in comparison, have a reputation for being more hardy and self-reliant. Research conducted by ARDRI in the villages of Ncera and Sheshegu in the central Eastern Cape region, suggests that the most commonly reported diseases among goats are gall sickness and heartwater (cowdriosis), which are tick-borne diseases; lameness due to foot rot and tick bites between the hooves, and scab caused by itch mites (Mafu and Masika, 2002). Goat owners in these villages treated their goats using both conventional and traditional methods, in different combinations. The combination of herbal and conventional remedies was based on the belief that mixing the two types of remedies gave better results than sole use of either (Mafu and Masika, 2002).

Among African livestock farmers in central Eastern Cape the use of herbal remedies in the treatment of livestock ailments remains common and such remedies are locally perceived to be particularly effective against gall sickness, babesiosis and heartwater (Mululuma and Masika, 2000). Reliance on such traditional techniques is prompted to a large extent by the lack of extension services and veterinary support in many communal areas and by the prohibitive cost of conventional livestock medicines. Nevertheless, this ethno-veterinary knowledge is only retained by a few older individuals and is not being embraced by the younger generation (Mululuma and Masika, 2000). Among households who do not employ herbal remedies, outlay on medicines and vaccines can be very significant, running into thousands of Rand per annum (Ntshona and Turner, 2002; Vetter, 2003).

Any attempt to explain the relatively poor levels of productivity of communal livestock herds from a commercial perspective must give adequate recognition to the objectives of the communal farmer. Certainly, the offtake values presented above for cattle, sheep and goats corroborate to a large extent the different uses these livestock have. The relatively low turnover rates among cattle and goats reflect their primary importance for investment and ceremony respectively. In contrast the high turnover of sheep seems to reflect their widespread use as animals of slaughter and sale for short-term economic gain, although some individuals do tend to continue to maintain large flocks primarily for wool (Vetter, 2003). Thus, despite unfavourable levels of performance in comparison with commercial systems, from a livelihood perspective the value of livestock to owners in communal areas cannot be under-estimated.

Rangeland management

Grazing of rangeland for livestock production in communal areas of Eastern Cape is currently subject to varying levels of management control. This is largely dependent on the original history of management imposition by the state and subsequent social, and to some extent ecological, change (Bennett, 2002).

The imposition of state control over grazing management was achieved through the widespread application of betterment planning (see chapter 1). The betterment system was widely implemented in the former Ciskei, such that by 1973/74, some 79% of the region had been planned and of this almost 87% was under some form of rangeland (veld) management (Trollope and Coetzee, 1975). An important feature of rangeland management, introduced with betterment, was the rotational grazing of range camps. This generally took the form of the one-herd-four-camp system, whereby one grazing camp was rested for the entire year and the remaining three were grazed on a rotational basis (Trollope and Coetzee, 1975). This resting system was perpetuated under state control in the Ciskei until the mid-1970s, when the South African Bantu Trust, responsible for its enforcement, was dissolved and control devolved to individual communities (Forbes and Trollope, 1991).

It appears that very few communities in communal areas of Eastern Cape now perpetuate any of the rotational grazing practices associated with betterment. Vetter (2003) relates that in Herschel district, efforts to maintain the system slowly collapsed, such that by the mid-1990s even the most rudimentary attempts at grazing management had disappeared. Nevertheless, in some administrative areas of Herschel, such as Bensonvale and Tugela, local committees were still adhering to a limited form of control over grazing through rotational resting of the old grazing camps to ensure adequate winter forage, but their efforts were severely compromised by inadequate fencing, shortage of grazing elsewhere and lack of political authority. The situation is similar in the former Ciskei. Cousins (1996), has documented conflicts over grazing rights among several of the villages in Sheshegu and Tyefu locations. On this basis he suggests these areas have little if any control over grazing management. Furthermore, it would appear that this scenario is not restricted only to rural villages but is also typical of the informal settlements associated with many of the towns in the region. Higginbottom (1995) documented the degeneration of previously regulated grazing systems associated with municipal commonage into open-access in the town of Peddie in the former Ciskei. Thus, the general situation with regard to management of rangeland grazing in the region seems to be one in which previously enforced common property systems have disintegrated into ‘open-access’ systems of the type associated with the ‘tragedy of the commons’ scenario described by Hardin (1968).

One fodder-control strategy, which does seem to have been perpetuated with slightly more success, concerns the use of the arable land allocations as an additional forage reserve during the dry season. Once crops have been harvested at the end of the growing season, the crop stubble is left on the fields to function as a forage reserve, and this is augmented by grass that has been conserved on uncultivated fields (ARDRI, 1996; Vetter, 2003). These reserves seem to be particularly important for cattle and in some cases individual farmers will actually remove the crop residues from their fields and feed them to their own cattle separately, to ensure they get maximum benefit from them (Vetter, 2003). Indeed, the high value attached to cattle is also expressed in the willingness of owners to buy supplementary feed for them when natural forage is scarce (Vetter, 2003). This also extends to sheep, where there appears to be a general recognition among smallholders of the need for additional feed inputs, particularly when they are lambs. Vetter (2003) found that in addition to buying supplementary feed, nearly 40% of sheep owners planted feed crops (wheat or oats) for their animals. Thus, for cattle and sheep at least, farmers in communal areas appear acutely aware of the benefits of supplementary feeding. However, the extent to which this is practised appears to be determined primarily by household income (Ntshona and Turner, 2002).

Rangeland quality in communal areas

Given that many of the communal grazing systems in the central Eastern Cape appear to have degenerated into 'open-access', with little effort to control grazing management, it is important to consider the possible effects of this on rangeland quality. Historically, there were repeated claims from state officials and pasture scientists that rangeland in the Ciskei region was degraded and incapable of supporting the high levels of grazing it was subject to. However, such claims tended to be largely speculative and highly subjective, involving little or no empirical support. Trollope and Coetzee (1975), contended that "…malpractices such as overstocking and poor pasture management have led to the destruction of the vegetative cover in large areas of the Ciskei." They go on to argue that the implementation of betterment grazing management systems "…has caused a significant improvement in the condition of the veld in the Ciskei, particularly in the mixed and sourveld areas." However, the few data that are included seem to support the opposite conclusion. Data is presented from a botanical survey of a severely overstocked area of sweetveld, at Cildara location in Middledrift district, from which the authors conclude that desirable grass species such as *Themeda triandra, Digitaria eriantha* and *Sporobolus fimbriatus* had survived in significant quantities. These findings could not easily be reconciled with the general consensus of opinion at the time that overstocking by commercial standards resulted in range degradation.

More recently, attempts have been made to conduct objective measurements of rangeland condition in communal areas. Goqwana (1998) conducted an assessment of veld condition at four villages in Middledrift district in the former Ciskei. He employed the key species approach for veld condition assessment developed by researchers at Fort Hare University (Scogings et al., 1994; Beckerling et al., 1995). Veld condition scores were in the region of 60-80% for all villages, and on this basis he concluded that the overall condition of the grass sward could be described as good to excellent in all cases, even by commercial farming standards. Furthermore, the botanical composition of the sward was also good, being quite varied and dominated by desirable species such as *Themeda triandra*, *Digitaria eriantha* and *Heteropogon contortus*. This was despite the fact that stocking rates at all the villages were at least three times higher than recommended for the area, and two of the villages practised no form of grazing management and were grazed at an 'open-access' level.

In contrast Vetter (2003), working in communal villages in Herschel district found that the level of range degradation was considerably higher than in comparable commercial farms and that the proportion of valuable grazing species such as *Themeda triandra* in the sward was considerably reduced. This area is largely sourveld and high grazing pressure seemed to have overcome the inherent ability of the sward to resist change and resulted in a fundamental change in species composition and greatly lowered associated productivity that is largely irreversible.

The available evidence indicates that the relationship between animal numbers and rangeland condition is not as clear as pasture scientists previously believed. Rather, it appears that whilst some communal areas of rangeland in the Eastern Cape have undergone considerable and irreversible degradation in response to intensive grazing pressure there are also others that have supported high livestock populations over long periods without experiencing irreversible degradation.

2.6 Smallholder crop production

In the first chapter of this book it was pointed out that the pre-colonial South-Nguni farming system had two principal components. The primary activity conducted by men was cattle farming, with milk as the main consumption product. Grain crops (sorghum and later maize) and vegetables (cucurbits mainly) were grown by women in gardens. While home gardening maintained its importance in the local farming system, crop production on a field scale came to the fore after the introduction of labour-saving technology, first the metal hoe and later on animal-drawn equipment.

In the former Ciskei region production of crops is subject to several limitations. The most important are water deficits in all areas except the Amatola and Winterberg mountain ranges (Marais, 1975), and limited availability of land capable of supporting cultivation (Hensley & Laker, 1975). In 1989, 8.2 % of the Ciskei region was cultivated (Antrobus et al., 1994), but a considerable proportion of that land was of poor quality. Good arable land is restricted by slope and soil depth, and usually occurs in isolated pockets of limited extent. Low soil fertility and soil acidity in areas where mean annual rainfall exceeds 600 mm are also factors limiting crop growth and yield.

Water deficits

During the 1980s the potential for rainfed cropping of important soil-slope-climate combinations, called ecotopes, found on the Coastal Plateau was evaluated empirically (Van Averbeke and Marais, 1991). This evaluation was conducted along similar lines as the Benchmark Soils Project (Beinroth et al., 1980). It was apparent from the evaluation of the water regimes of the major land types in Ciskei by Marais (1975) that the degree of water sufficiency was the key factor limiting rainfed crop production. An evaluation of 113 field experiments conducted over a period of five years on 16 ecotopes showed rainfall and effective rooting depth of soils to be important determinants of crop yield. Under similar climatic conditions, deep soils produced higher yields than shallow soils, because they stored more water than shallow soils, enabling the crop to subsist for longer on stored water when there was no rain.

Based on their experimental results Van Averbeke & Marais (1991) concluded that relatively risk-free maize production on the Coastal Plateau required three conditions to be met. These were (1) land with a slope not exceeding 6 %, (2) a soil with an effective rooting depth of at least 900 mm, and (3) an expected rainfall of at least 290 mm during the growing period of the crop. In Figure 2.1, the Ciskei region has been subdivided into three zones based on the rainfall expected at the 75% level of probability for the period October to February inclusive (Austin, 1989; Van Averbeke, 1989). This period represents the growing period of a long-season maize cultivar that was planted early. The high rainfall zone, where at least 300 mm of rain can be expected during this period, is limited to the Amatola and Winterberg mountain ranges and the adjacent fringe of the Coastal Plateau. Here, maize production is largely free of risk as long as the crop is planted in soils with a rooting depth of 900 mm or more. A moderately dry zone with an expected rainfall ranging between 200 and 300 mm is found along the coast, and on parts of the Coastal and Midland Plateaus that neighbour the mountains. In this zone selecting soils with adequate storage capacity and effective conservation of water during the fallow are critical factors for success in dryland maize production. The dry zone, where the expected rainfall during the growing season is less than 200 mm, is extremely marginal for dryland maize. This zone covers large parts of the Coastal and Midland plateaus. To harvest at least one ton of maize grain per ha in seven to eight seasons out of every ten, selection of suitable soils and effective soil water conservation during the fallow season are even more critical than in the moderately dry zone. In addition, planting density should be reduced from about 20 to 30 thousand plants per ha to 10 thousand plants per ha, to increase the amount of stored soil water per plant (Van Averbeke, 1989).

Low soil fertility

Low soil fertility is the other important factor limiting crop production in Ciskei (Hensley and Laker, 1975). Generally, cultivated soils are low in organic matter and plant available phosphorus, and many test acid (Mandiringana et al., 2001). Garden soils tend to have a higher fertility status than field soils. Similar differences in fertility between garden and field soils were reported in Transkei (Mkile, 2001) and KwaZulu-Natal (Roberts, Adey & Manson, 2003). Evidence from Transkei suggests that differences in soil fertility between field and garden soils are mainly due to differences in nutrient supply, primarily in the form of kraal manure, with gardens receiving larger and more regular applications than fields (Mkile et al., 2001).

When water and nutrients are in short supply, controlling weeds is critical in crop production. In dryland maize a strong linear relationship between biomass of weeds and reduction in grain yield has been demonstrated (Marais, 1985). In a maize crop weeds need to be controlled effectively during the interval of 30 to 60 days after planting to avoid a major reduction in grain yield. Per day up to 2 % of the grain yield may be sacrificed as a result of not controlling weeds during this interval of the growing season. On most smallholdings weeds are controlled by hand hoeing. Often only one or two people take care of the weeding of a field and it may take them several weeks to complete the task. Marais (1985) identified two important limitations associated with the control of weeds in smallholder maize production namely delayed commencement, usually 40 days after planting, and the protracted period over which weeding occurred. He estimated that the combination of these two limitations was responsible for an average reduction in grain yield of 44 %,

Field cropping
In smallholder farming in the Eastern Cape, including the Ciskei region, the main field crop is maize, but often maize is intercropped with other food crops (Steyn, 1988 and Silwana, 2000). In the Eastern Cape maize is usually intercropped with varying combinations of dry beans, pumpkins and bitter watermelons. In humid parts of the Province, such as the coastal zone of Transkei, dry beans and pumpkins feature prominently in the mix (Silwana, 2000 and Mkile, 2001). In the dry areas of the Ciskei region bitter watermelons are common. Intercropping maize with cucurbits, such as pumpkins and bitter watermelons helps to control weeds (Wahua, 1985 and Silwana, 2001). The prominence of cucurbits in such arrangements suggests an attempt by farmers to reduce the drudgery of controlling weeds by hand, but they do not necessarily select a particular intercrop mixture with that specific purpose in mind. In personal contacts they usually refer to homestead traditions that evolved over time as the main explanation for their specific intercropping practice.

Home gardening
Earlier it was indicated that cropping on a field scale has declined to very low levels in the former Ciskei. At present, most rural households in the region limit production of crops to home gardens. These may range in size from 100 m^2 to 10 000 m^2. In settlements where betterment was implemented, which applies to at least 79 % of Ciskei (Coetzee & Trollope, 1975), home gardens are situated within the confines of the residential sites. Since residential sites in Ciskei tend to be relatively small, home gardens rarely exceed 1 000 m^2. In the Transkei region withdrawal from crop production on a field scale has also been reported (McAllister, 2001 and Andrew and Fox, 2003), but here home gardens tend to be larger than in the Ciskei region (Mkile, 2001).

In both regions home garden production has been subject to intensification. In Transkei this has taken various forms including scale enlargement, intercropping and higher levels of nutrient additions in the form of animal manures (Andrew & Fox, 2003; Mkile, 2001). In Ciskei, where water is usually the most limiting factor, smallholders often improve soil water availability in their gardens. Where water for irrigation is available, crops are occasionally irrigated, especially at planting or when a lack of rain threatens survival of the growing plants (Monde, 2000). Where water is not available, a few innovative gardeners have adopted and modified water harvesting and conservation technologies. One technology involves the diversion of water running off roads using cement-lined micro-dams. Water in these micro-dams is used to irrigate garden crops using hosepipes. Another is the use of organic mulches to reduce surface evaporation. Expansion of home gardens has been achieved in part by taking vacant residential plots into production or by excising small parcels of land from the rangeland neighbouring the homestead.

2.7 Summary and conclusions

Agro-ecologically, the central Eastern Cape is diverse. Mean annual rainfall varies from 450 mm to 1700 mm, and altitude ranges from sea level to about 2200 m. Temperature regimes also differ, from moderate subtropical near the coast to highveld conditions with cold winters and hot summers in the north. The diversity in physical attributes of the land is reflected in the vegetation cover. Yet, in spite of the considerable agro-ecological variety of the region, land use is fairly uniform throughout, consisting of mixed farming with emphasis on livestock (beef) production. Generally, land available for cultivation is limited in extent for

reasons of water deficit, steep relief and poor soil quality. On many commercial farms arable land is used to grow fodder crops in support of the livestock enterprise. On smallholdings it is used to produce grain crops for human consumption, primarily maize. Land use around East London, the main urban centre in the region, differs from that in the other parts. Here arable land is used for the production of dairy, vegetables and pineapples. The valleys of major rivers, where cultivated land is often used for citrus, are the other important exception.

Smallholder farming in the region occurs primarily in the communal areas of the former Ciskei. Smallholder livestock production generally involves mixed holdings of cattle, sheep and goats in varying proportions dependent largely on the local vegetation biome. Livestock numbers are constrained only by the productivity of the natural rangeland rather than by adherence to recommended stocking rates. Overall numbers are high and ownership continues to be widespread. However, individual holdings are generally limited and certainly too small to allow most owners a livelihood based purely on their stock. Rather, livestock are farmed at a subsistence level and fulfil a number of important livelihood roles. Consequently, levels of animal offtake tend to be low compared to commercial herds. The management activities of smallholder livestock farmers also tend to be more limited, despite facing the same agro-ecological constraints as commercial farmers. Seasonal herding is practised where appropriate but management practices such as rotational grazing, introduced under betterment planning, have been largely abandoned. Fodder control tends to be limited to the use of the arable land allocations as a winter forage reserve and the purchase of supplementary feed where this can be afforded. Given these low levels of management, smallholder livestock production in central Eastern Cape remains closely tied to local levels of rangeland productivity, and thus shows considerable variation between areas and both within (seasonal) and between years.

Crop production is subject to several environmental limitations. Water deficit is the key limiting factor, followed by low soil fertility. Sustainable production of maize, the principal crop in the region, depends on local conditions of soil and rainfall and on the application of management practices that reduce the effect of the prevailing limiting factors. These practices include soil water conservation, the application of fertilizers and effective control of weeds. For various reasons, many contemporary rural homesteads do not produce crops on a field scale. Instead they focus of crop production in home gardens. Compared to fields, home gardens are cropped more intensively, receiving more nutrients and water. These interventions address the key limitations experienced in local plant production, enabling higher productivity than is generally being achieved when producing on a field scale.

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