Surviving pastoral decline: pastoral sedentarisation, natural resource management and livelihood diversification in Marsabit District, Northern Kenya Deel: "Vol. I"

Witsenburg, K.M.; Roba, A.W.

Citation for published version (APA):
Rangeland resources: the rangeland debate, livestock assets and shock effects

'Most disasters do not kill instantly. They wreak havoc by destroying livelihoods rather than lives. A graph for number of people affected – rather than killed – by disasters shows a totally different picture' (Cherpitel Didier, the Guardian, Environment 28th March 2001: 12).

The heavy dependence of livestock on the natural environment, especially on water and pasture, and the communal sharing of rangeland resources are the two distinguishing features1 of African pastoralism (Oba 1996; Scoones 1993; Salih et al. 2001, see Chapter 2). In the light of these features, rangeland degradation debates have for a long time formed the basis of development policies in the pastoral areas. However, independent of development interventions, the pastoral livestock economy repeatedly suffered from the effects of droughts and other predicaments that decimated the livestock assets (Amanor 1995; Oba 1997, 2001). The effects of drought on livestock and the way livestock are thought to impact on rangelands have direct consequences for the pastoral economy. Closely related public policy on the development of water facilities in the rangelands can limit or enable efficacy of range use. This chapter focuses on the rangeland-livestock debate and the effects of shock factors in the study area. This first part of the chapter is mainly concerned with livestock-rangeland interactions, while the second part focuses on the effects of adverse events on livestock and human welfare. In particular, the chapter gives an overview of the rangeland debate and dynamics in livestock numbers and highlights the effects of shock factors on livestock and human livelihood in the recent years.

It turns out that our understanding of rainfall variations over a long period of time is crucial for water resource and land use management in many areas (Verschuren et al. 2000: 410). Water is a critically important resource to the pastoral livestock economy in Africa. The use and supply of water in Africa’s drylands, through development of water infrastructure, has long been a topic of serious concern. This concern hinges on the problems of availability, accessibility, quality and quantity for human as well as animal populations. When it comes to water scarcity, Marsabit District is no exception. Being one of the driest districts in the

---

1 These characteristics differentiate the many pastoral production systems in sub-Saharan Africa from paddock, group ranching or use of fences under individualised land tenure systems (Ault & Rutman 1979; Helland 1980; Lancaster et al. 1987; Rutten 1992; Homewood 1995; Zaal 1998; Plateau 1996; Fratkin 2001).
country and receiving the lowest average amount of rainfall, the supply of water is very limited.

We discussed water development, accessibility and management in the district in Chapter 8. In the light of that chapter’s results, the next section revisits the rangeland degradation debate reviewed in Chapter 2. Subsequently, we relate livestock dynamics, rainfall and droughts with reference to Marsabit District. Here, we also supplement these relationships with a herder’s view and knowledge of the dynamics of rangeland conditions. In the subsequent sections, evidence of effects of recent drought (1996/97) and heavy rainfall (1997/98 El Niño rains) shocks on ecological systems and animal numbers and health are presented. These results are contrasted with those from the household survey data. The closely related effects of climatic stress on livestock-based livelihoods in the study area and specifically on child health are also considered. These results show that negative effects of external factors such as droughts have far-reaching consequences for livestock assets and hence for human survival in the rangelands (see opening remark above) and make it clear that droughts and the accumulative effects of adverse factors on livestock holdings can have severe financial implications. The chapter concludes with the salient observations concerning the main issues addressed in the chapter.

The rangelands degradation debate

Many of the arid and semi-arid environments are unsuitable for crop production and are mostly used for livestock keeping. It is acknowledged that pastoral herd movement is an important strategy for rangeland resource management, and many authors have considered the spatial distribution of livestock on the rangeland and the likely effects of livestock concentration for resource use. There are two premises that link livestock dynamics and rangeland degradation in the debate (Behnke, Scoones & Kerven 1993; Oba & Lusigi 1987; Oba 2001). First, the most popular view on livestock-environment interaction asserts that large herd sizes cause overgrazing. Here, the principal argument is that herders’ rearing of excess numbers of animals brings about a deterioration of the range and this, in turn, increases livestock mortality. Second, under variable and heterogeneous rangeland conditions in the arid areas, stochastic effects like those of drought occur independently of livestock numbers; in this case pre-drought herd size does not directly relate to the effects of drought on rangeland (Behnke et al. 1993; Scoones 1993; Oba et al. 2000). Thus, much of the rangeland degradation debate anchors on the negative interaction effects between livestock numbers and range units. There is only limited evidence that droughts and long-term rainfall patterns shape livestock populations in the arid and semi-arid areas. In a review of literature on changes in rangeland conditions, Jacobs & Coppock (1999: 3) argue that: ‘many rangeland sites in northern Kenya have been fundamentally altered by woody encroachment over the last 40 years’. In the next section we attempt to find a relationship between rainfall and livestock numbers in the district. However, we will first highlight how the rangeland debate influenced government policies towards pastoralism and livestock.

---

2 See Jacobs & Coppock (1999) for a review of range conditions in other arid and semi-arid areas in northern Kenya: Mandera, Wajir, Isiolo, Samburu and Baringo. In this chapter we mainly focus on Marsabit District.
The rangeland debate in policy reports and public policy

The government public policy towards pastoralism and livestock date back to the time of British colonial rule (see Dietz 1987; Rutten 1992; Nunow 2000). The African Land Development Board (ALDEV) was established in 1945 and continued to exist throughout 1946. A new policy shift was envisioned in Swynnerton’s Plan of 1954, which aimed to intensify the Development of African Agriculture in the Kenya colony. The plan also emphasised the need to de-stock pastoralists and introduce grazing controls (see MDARs 1950s, various years). The ALDEV was also integrated into the plan and the principal aim of the grazing control programme was in particular to limit livestock numbers to the capacity of the grazing units. The pastoral groups very much resented any restrictions on their movements in search of better grazing and water resources. Although the people agreed in principle that certain areas should be closed so that the grasses may reseed themselves, the grazing control and patrol programmes met with resistance from the local pastoral communities. The reasons were based on the consequences the control scheme had for livestock health and reproductive, and breeding potential. For example one of the colonial annual reports notes that:

‘Gabra complain that the policy of concentrating their livestock into small areas for security reasons has an adverse effect upon the waters and grazing areas, which adversely affects the health of the livestock and reduces breeding to a minimum’ (MDAR 1959: 16)

For pastoral herders, livestock access to environmental resources entails critical implications for human welfare, as well as major risks. This is true because a lack of livestock grazing or access to resources may at times translate into having to choose between livestock death by starvation and death by enemy action.

After Kenya’s independence in 1963, a number of ecological studies were initiated in Marsabit District to investigate the negative consequences of livestock numbers on range resources. The most extensive and foremost comprehensive ecological study was carried out by the UNESCO-IPAL project in the mid-1980s (Lusigi 1983; UNESCO various reports; Fratkin 1991; Schwartz et al. 1991). On the basis of the project’s outcome, the range conditions were, by and large, rated fair to poor. It transpired, however, that the results of the project were greatly influenced by the strong prior assumptions that livestock-induced rangeland degradation was an on-going process in Northern Kenya (Lamprey & Yusuf 1981) and that desertification was occurring. These processes were thought to be brought about through the misuse of the environment by the pastoral communities. It was also believed that degradation was caused by the irrational choice to keep large herds. On the whole, none of the reports really found scientific proof that this was the case. Moreover, the reports are quite contradictory (see Little 1999; Fratkin 1990) and give deceptive policy recommendations as regards the prospects and strategies for pastoral development. Consequently, the project’s findings have come under attack on the basis of lack of evidence that the pastoralists were causing desertification (O’Leary 1994; Lorot 2002) and also on the basis of the contradictions in the numerous project reports (Little 1999). Today, it is doubtful whether desertification is happening in that way and more emphasis is being placed on the unpredictability of climate and uncertain environmental conditions (Scoones 1993; Leach & Mearns 1996).

To date, there is some consensus that localised degradation is occurring around settled areas and permanent water points in the arid lowlands of Korr, Kargi, North Horr, among
others (O’Leary 1990; Oba 1996; Keya 1998; McPeak 1999). Thus, the poor range conditions around such sites are shaped considerably by human forces, including intensive grazing and households’ use of woody vegetation resources (Keya 1998) more than by highly variable climatic factors in the region. It is instructive to note, however, that the rangeland around settled areas also shows a lot of regeneration following site-specific ‘average or above-average’ rainfall and before the livestock grazes shortly after the rains (see Jacobs & Coppock 1999). Despite the fact that areas around settlements have witnessed denuded range units because of intensive grazing, there are tracts of rangelands in the area which are no-go areas because of a lack of security or because they lack water resources and thus remain underutilised. These points demonstrate the importance of varied factors that influence the intensity of use of the rangelands. The most substantive indication of range degradation occurs in the absence of (or reduction in) the mobility of herding households and part of the herds, which is partly a result of the misplaced pastoral settlement programmes of the earlier years (see Chapter 5). It is the disruption of the pastoral ways of life through policy or natural causes that causes environmental problems. Land deterioration is not caused by pastoralists’ irrational behaviour.

In more recent years, about 80 per cent of the rangeland in Marsabit District was noted as being in good condition and roughly 14 per cent of the rangelands in fair condition (Herlocker & Walther 1991). In addition, 4 per cent of the rangeland is in fair/good condition, while the settled areas around permanent water points are in poor condition and less than 1 per cent of the district’s range is in very poor condition (ibid.: 51). According to the MDAR (2000: 36), tree forage was stated as being in ‘fair’ condition, shrubs as being in poor condition and the condition of forbs and grass as being ‘very poor’, although the rangeland evidently appeared to be poor due to the drought of 2000. In 2001, the condition of the range was stated as having improved in comparison to the previous year, following relatively high rainfall. Thus, the condition of trees and shrubs improved to ‘good’ and that of grass to ‘fair’ relative to the previous year (MDAR 2001). It was also stated that the livestock recovered from the previous year’s drought stress and that their physical condition remained good for most of that year. Although the physical conditions of livestock often respond to the conditions of the range units, the manifestation of the range condition can be very deceptive at first sight – recall the beautiful title ‘The lie of the land’ (Leach & Mearns 1996). In our view the assumed rangeland degradation may, in general, represent a failure to make a distinction between landscape appearance between normal rainfall years, when the range improves, and drought years, when the condition of the range may appear severely deteriorated and irreversibly wasted.

Indications of rangeland deterioration, and thus the loss of important perennial grass and shrub forage, are assessed on the basis of changes in the (herbaceous) vegetation cover. In this context, the loss of top soils to erosion processes, the disappearance of certain perennial grasses, which are not replaced, and the emergence of annual grasses which are poor for dry-season feeding provide evidence of rangeland degradation (Livingstone 1991). These changes require year-by-year assessment and monitoring of the suspected on-going loss of vegetation cover and warrant focused attention. This is lacking today, apart from obvious observations about generalised damage of areas around settlement areas and permanent water holes. Moreover, the herding communities in the region perceive the rainfall pattern as cyclical, and
some cycles last 15 years, some 30 years and others recur even last 70 or 100 years (Robinson 1985). A similar pattern may be valid for dynamics in the vegetation cover.

The effects of El Niño rains and recent droughts on rangeland degradation, livestock dynamics, livelihoods and welfare in Marsabit District

The dynamics of the livestock population has been detailed in Chapter 4. There, livestock was treated as an important asset and in this section the main concern is about the debate on rainfall patterns and the role of livestock in altering the quality of the rangeland. This section mirrors the intricate interaction of the livestock populations and the livestock production system based on communal rangelands with the natural environment.

Chapter 4 detailed a decline in rainfall pattern during the last 80 or so years, at least on the mountain. This trend is not true for other stations in the northern Kenya region. Although this result is inconclusive, it is probable that changes in vegetation composition, or the replacement of grasses by woody plants (Livingstone 1991; Keya 1998) could result from the changes in the rainfall pattern (see Chapter 4). Thus the net effect on rangelands would be advantageous for browsers relative to the grazers (Keya 1998).

In Chapter 4 we revealed the changes in the livestock populations at district level (Figure 4.11). It has become apparent that there was a decline in the absolute number of livestock types with a varying degree. Relatively speaking, cattle sustained higher declines than both camels and small stock and, in turn, small stock numbers decreased more than those of camels between 1977 and 2001. In that chapter the focus was on assessing changes in the livestock population in the district over time and the net outcome was a decline in livestock wealth, especially in per capita terms. The evidently dynamic numbers of livestock in the aggregate livestock wealth in the district differ between the main livestock species; hence the species composition of herd is changing. This is reflected in Figure 16.1, where the total livestock wealth is measured in tropical livestock units (TLU) and the ratio of a specific species in the total herd is derived as a fraction of total TLU measure.

The changes in species composition of livestock matter because the heterogeneous composition of herds has direct implications for the demand for rangeland resources, and more particularly so for vegetation resources. Similarly, certain changes in environmental resources may occur to the detriment or to the benefit of browsers or grazers depending on the direction of the change. Figure 16.1 illustrates the species composition of the main livestock types in Marsabit District, and relates this to rainfall on Marsabit mountain.3

3 The reader is minded again that assessment of these changes is sensitive to initial and terminal years selected.

4 Rainfall on the mountain is used as a proxy for range conditions in the region. This measure might not do a good job in the light of highly spatial and temporal variations in rainfall amounts. However, Marsabit Mountain always receives higher rainfall amounts than any other site in the District. Thus, even if the rainfall here might exceed the range condition and the availability of resources, the overall trend might be a good approximation of the regional rainfall trend and a substitute for a lack of comprehensive rainfall data for other stations in the lowlands.
Figure 16.1
Rainfall pattern and changes in composition of livestock species, Marsabit District

![Graph showing rainfall pattern and changes in composition of livestock species.]

Sources: Authors' compilation from data from:
- Marsabit Meteorological Station;
- Range Management Handbook of Marsabit (Schwartz et al. 1991); and
- Marsabit District Annual Reports, various years.

Figure 16.1 shows the changes in the species composition of livestock in the district. The data available for years before 1976 are scant and these years show no trends for the animal types so we have omitted them, including 1976. It is clear that cattle always accounted for a higher percentage of the district's livestock populations, mostly followed by camels and finally small stocks owing to their low conversion factor to TLU measure. In decadal terms, cattle represented a higher percentage of the total livestock wealth in the 1970s (61 per cent) relative to being about 58 per cent and 49 per cent in the 1980s and in the 1990s until 2001, respectively. This shows a very clear decline in the cattle population with regard to the total livestock wealth of the district and corresponds with the higher proportional decline in absolute populations reported in Chapter 4.

Camels show less variation in the 1970s (a mean of about 25 per cent) and increased growth in the share of total herds in the 1980s (27 per cent on average) and a decline since 1992 (39 per cent), back to the level of the 1970s share in the total livestock population. The latter fall in the share of camels in the total livestock wealth was seemingly induced by the 1991/92 droughts in the district and this corresponds to a fall of about 21 per cent in camel population between 1991 and 1992/3 (mean camel number). Until 1993, small stock contributed about 15 per cent to the total herds and thereafter this proportion increased by almost 27 per cent of the total herds by 2001. By this time, the ratio of small stock in the entire livestock is high compared to camels. Thus, overall there was first an increased and later a decreased ratio of camels, a general decline in the ratio of cattle and an increased share of the small stock in the total TLU measure.

Note that 1976 is ignored for the reasons alluded to earlier in Chapter 4, namely poor livestock records prior to this year.
During the 1983/84 and 1991/92 droughts, the opposite was true for the share of cattle and camels in the total livestock populations. Apparently, the fraction of cattle decreased but that of camels increased around the 1983/84 droughts and the reverse changes occurred during the latter drought years. During the last two decades, there was a 9 per cent or so decrease in the ratio of cattle in the proportion of the entire district's herds, a decrease of about 2 per cent for camels and an increase of roughly 9 per cent for small stock between the 1980s and the 1990s until 2001. The contribution of cattle in the total herds decreased by about 7 per cent, that of small stock increased by about 10 per cent and that of camels decreased by 3 per cent between 1992 and 2001 compared to the previous decade. Thus, there was a greater decline in the proportion of core herds of cattle, a slight decline for camels and a more proportionate increase for small stock in the total livestock populations. From these results, the evidently continued decline in the ratio of cattle numbers, on average, differs from the aerial surveys of the Department of Remote Surveys and Resource Sensing (DRSRS) which observed there was no trend in cattle numbers between 1977 and 1994 (Peden 1984, 1987; Grunblatt et al. 1991; Jacobs & Coppock 1999). Neither did the surveys of this department report an increase in the number of small stock, sheep and goats (see Figure 4.11).

The role of droughts in directing livestock numbers is influential and needs some attention here. Camels were revealed as being least affected by droughts (Fratkin & Roth 1990; Fratkin 1997). The closely related effects of droughts have caused traditional cattle-keeping groups like the Boran and Samburu to diversify into camel herding following severe cattle losses. Camels are more resistant to disease and can withstand longer dry seasons or drought periods compared to cattle. However, the effect of multiple droughts indeed shows opposing effects on their proportion in the total livestock. The issues relating livestock numbers to rangelands indirectly via rainfall are complex to tackle (Jacobs & Coppock 1999). In the case of Marsabit, there are overall positive, significant relationships between aggregate livestock size (in TLU) and once-lagged annual rainfall, and between absolute cattle numbers and rainfall (0.39, p<0.016 and 0.38 p<0.019 respectively). Although the available data does not allow a further investigation, small stock and camel numbers show a negative correlation with twice and three times lagged annual rainfall, respectively, albeit insignificant (p>0.256 and p>0.231). Alternatively, on the basis of the recognition of the tendency of the arid areas to experience greater inter-annual variability in precipitation, we investigated the probable effect of the coefficient of variation in the annual rainfall on the dynamics in livestock populations. In this context, overall annual rainfall variations seem to explain only 5 per cent of the changes in the livestock numbers in TLU terms ($R^2 = 0.054$), but this is not significant. However, disaggregating the probable effect of annual rainfall on the livestock species reveals that the changes in rainfall might only explain 8.2 per cent of the changes in cattle numbers, 16.7 per cent of the changes in small stock numbers and less than 1 per cent of the changes in camel numbers, which is significant for small stock only ($t =2.15$, $p<0.05$). The changes in

---

6 Comparing mean annual rainfall stations in Northern Kenya in Chapter 4, stations like Wajir, Mandera and Garissa have mean annual rainfall comparable to those in the lowland sites in Marsabit. However, correlating lagged and year-to-year annual rainfalls for these stations with livestock numbers (in absolute and TLU terms) in Marsabit show no significant relationships.

7 The average annual rainfall and standard deviation used here are 776.33 mm and 340.64 mm, respectively, for the period between 1977 and 2001.
annual rainfall, other factors being constant, might also have delayed the influence on livestock trends. Thus a one-year lag period reveals that the variations in the annual precipitation might account for 11.8 per cent of the changes in the livestock population in TLU terms, but this is not significant. Again, for the specific livestock species the coefficient of variation in the annual rainfall might explain 16.1 per cent of the changes in the cattle numbers, while this amounts to 17.0 per cent for small stock and 2.7 per cent for the camels. The corresponding t-statistics are 2.1 (p<0.05) for cattle and small stock, and 0.806 for camels (p>0.429), which are significant for cattle and small stocks. These results reveal a better positive lagged effect of the coefficient of variations in the annual rainfall on livestock numbers, as opposed to the relationship between the total annual rainfall and livestock numbers. The result suggests that camels are less vulnerable to stress weather conditions and are only slightly affected by the cumulative rainfall pattern.

The findings confirm that livestock dynamics and rainfall are not directly coupled. The result supports the view of herd movements taking place in order to exploit spatially distributed rainfall and heterogeneous range units (Benhke 1993; Scoones 1993; Oba 1996). These results, although inconclusive, further support the view of non-equilibrium perspectives for the arid- and semi-arid environments and their production system (Ellis & Swift 1988; Behnke 1993; Behnke et al. 1993). The results seem to highlight the importance of adaptive herd mobility and flexible land tenure and access rights to the rangeland resource, while still recognising the role density-dependent grazing pressure plays with regard to sustainable rangeland management (Bruce & Mearns 2001). Moreover, rainfall alone may not play a decisive role in explaining the environment-livestock outcome. Besides rainfall and droughts, there are also other important factors such as disease epidemics, livestock losses to cross-border raids and cross-border livestock movements, which are not normally reflected in the official reports (MDAR 2000), but which certainly affect livestock dynamics. In addition, the prevalence of diseases, prolonged and recurrent droughts and, at times, torrential rains can have a negative influence, individually or jointly, on rangeland conditions and thus livestock populations. Also, changes in livestock could be due to increased ‘normal’ livestock sales, independent of drought-induced disposal to salvage (or recover) current meat and animal protein. It is also probable that the various stress factors have different effects on the livestock types and these effects may not relate in any systematic manner. In other words, these variables (i.e. droughts, prevalence of diseases and heavy rains) may not be linearly related. A specific shock factor may inflict dramatic effects that crosscut district and national levels, with major setbacks on usually drought-prone pastoral districts. Chapter 4 revealed that the livestock population has not substantially grown even in absolute numbers. However, it could be true that one concern about the livestock use of range resources relates to the reduced territory of land space currently available for herd mobility, relative to the past.

To date, there is no consensus about the relationship between livestock populations and the worsening of the ecological units. However, besides being an unresolved question, the livestock-induced deterioration debate has greatly influenced popular programmes and

---

8 This bears out the point that herbage production is relatively more variable compared to annual rainfall (see De Leeuw & Tothill 1993: 144). Thus, annual rainfall alone may be a weak predictor of herbage yields and stocking densities.
development policies in the rangelands (Livingstone 1991; Morton & Meadow 2000; Oba et al. 2000). The effect of such policies has been a neglect of the pastoral system of production.

At national level, the performance of the livestock sector has been adversely aggravated by low priority and budgetary allocation. Independent of these, the situation of the pastoral economy has further been worsened by a series of recent droughts and other shock factors that are associated with large livestock asset losses, as well as the recent years of economic downturn of the Kenyan economy. The latter case has been considered earlier in Chapter 10, while the consequences of the recent droughts and El Niño rains on the range conditions, livestock assets and livestock-based livelihoods, including human health in relation to food deprivation, are examined in the following sections.

The households' herd holdings reveal a wide heterogeneity and wealth differentiation across agro-ecological zones and between classes of livestock species. In general, low herd sizes or a lack of herds affect a broad spectrum of values that pastoral families attach to animals and may also undercut the human sense of well-being. The economic significance of livestock for human welfare and the effect of herds on rangelands feature prominently in livestock production literature, but cultural values seldom receive attention. While acknowledging the critical value of livestock in human welfare, ideals of cultural values assigned to animals differ between groups and influence rights, decisions and control over animals and access to animal products. To illustrate this, the Rendille and Gabra are mainly camel herders and the Samburu and Boran are cattle keepers (Spencer 1976; Robinson 1985; Fratkin 1991; Tablino 1999). They each consider these animals their prime herd and the way they deal with animals is governed by a wide range of beliefs which play a crucial role in traditional sacrifices, rituals and ceremonies.

In this regard, customs and local preferences are observed to influence acceptance of the food types, especially meat (Dhanda et al. 1999) that people consume. Social values, rather than economic returns per se, shape how people regard certain animals over others. It is on this basis that animals are accorded different values and held in high or low esteem. The ownership of large livestock herds gives individuals a prestigious social status. Although livestock social values are at time at disparity with ecological sustainability of the range (Githinji & Perrings 1996), recent findings indicate that the district's herd population is well below ecological carrying capacity and rangelands are generally not overstocked (McPeak 1999, 2000). The problem of declining herd populations in the rangelands in the face of a growing demand for food from animal sources seemingly has little to do with ecological stress due to large herd numbers. Alternatively, this may be due to other factors such as rainfall variability and changes in the migration patterns and herd movement routes over time and space in order to optimise the use of patchy rangeland resources. Other factors, such as the insecurity that directly influences herders' mobility decisions and thus herd movement, may play an important role in affecting the quality of rangelands. This observation does not seem to support the equilibrium system view, based on the carrying capacity model. In northern regions, where climatic variability, dynamics in range productivity and livestock numbers are all normal phenomena, these variables are not necessarily linearly related and

---

9 We are aware of rules that certain household members eat meat from specific animal body parts (e.g. meat for elders, boys and girls) and rules governing the sharing of food gifts with neighbours in the study area.
directly influence each other. Even so, we found that during the last three decades there has been a greater risk of adverse precipitation compared to the previous five decades (see Chapter 4). Given that the availability of range resources is principally dependent on rainfall amounts, this observation has consequences for range resources, herd movement and herd dynamics. The argument of heterogeneous rangeland units and related resources favours flexible herd-movement strategies based on temporally shifting productivity of rangeland. The recognition of these attributes has implications for policies pursued with regard to the development of rangelands and the people and livestock that heavily depend on them.

**Oscillations and cycles of above-normal rainfall and severe droughts**

The concept of rangeland degradation is based on changes in plant composition. It centres around a strong understanding of plant composition and dynamic changes in plant species, both in types of species and the sequence of vegetation changes from tree vegetation to shrubs to grassland. It also places a sort of hierarchy on the successive replacement of useful shrubs, dwarf plants and grass species by inferior biomass that is often unpalatable to animals. In the light of a lack of full information, the use of a precautionary principle would be crucial before serious changes in plant composition occur and subsequent colonisation of invasion plant species takes place prior to the irreversible loss of important plant species of specific range units. One important concern about the rangeland degradation debate is based on the powerful influence the debate has had on the pastoral development programmes, which have been largely negative.

Climatic variability is the norm in the arid region (see Chapter 4) and years of average rain pose no concern. The years of heavy or extremely little rain do, however, cause special concern for livestock and humans. For example, heavy rains are almost always accompanied by disease epidemics and other whims of nature. The severe drought years (or abnormally long periods of no rains) are associated with reduced pasture and long distances trekking to water sources and livestock concentrations around these as well as with famine. Recurrent droughts are an obvious impediment to herd growth and pose a serious threat to the livestock economy. Several seasons of rainfall failure are also characterised by conditions of livestock starvation (increased livestock mortality). Drawing inferences, such reasons justify attempts by herders to foretell or vainly predict such events (see Box 16.1) and this has relevance for the rangeland debate.

Herder communities use the seven-day week and seven-year cycles to reconstruct a calendar of events that return with varying durations (Robinson 1985; Oba 1997b; Tablino 1999). This system of calculating time occupies a central position in the herders’ perception of climatic variations, their influences and the signs that predict such changes. The signs of rain and drought would be diagrammatically opposed. In this regard, the role of oral historians and cosmic experts is crucial, and their knowledge is used to escape areas of adverse predicted conditions wherever feasible. These signs are observed through animal feeding behaviour in relation to the productive and basic nutritional attributes of rangelands. The limited availability of desirable rangeland qualities, as observed through animal behaviour, is

---

10 The different groups have different names for adverse events like drought and famine. For example, drought is called *Irai* in Rendille and *Bonn* in Gabra and famine is referred to as *Holl* in Rendille, *Oola* in Boran and Gabra. These concepts are always expressed with reference to the amount of rain.
used to foretell uncertain adverse future events (see Box 16.1). Such signs are also ‘read’ from
the reproduction of certain animals such as an unusually large number of twins.\(^\text{11}\)

**Box 16.1**
Signs used by herders to foretell crises

<table>
<thead>
<tr>
<th>Animal behaviour and cosmic signs of adverse events</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I. Signs of rain</strong></td>
</tr>
<tr>
<td>The following animal behaviour is an indication that rain is imminent:</td>
</tr>
<tr>
<td>1. When the faeces of a thirsty animal are too watery and green, and the animal have no diarrhoea.</td>
</tr>
<tr>
<td>2. When the hooves of a he-goat (keleh) stops its crackling sound.</td>
</tr>
<tr>
<td>3. When an animal stands as if it is feeling cold, while it really feels hot.</td>
</tr>
<tr>
<td>4. Greening of acacia tree before the start of the rain.</td>
</tr>
<tr>
<td><strong>II. Sign of forthcoming droughts</strong></td>
</tr>
<tr>
<td>The following animal behaviour is an indication that a drought is imminent:</td>
</tr>
<tr>
<td>1. When animals defecate or pass urine while in a resting position.</td>
</tr>
<tr>
<td>2. When mature and currently fat goats (keleh) or sheep (worab) feed while kneeling or crawling.</td>
</tr>
<tr>
<td>3. When kids/lambs become greedy or look for their mother in order to suckle even at night.</td>
</tr>
<tr>
<td>4. When a male camel bull (orr) becomes docile during it’s mating season.</td>
</tr>
<tr>
<td>5. When there is plenty of pasture but animals rush over them without browsing or grazing.</td>
</tr>
<tr>
<td>6. When animals move out of the kraal or boma at night to look for grass or move in the boma restlessly.</td>
</tr>
<tr>
<td>7. When animals of the Rendille’s Galoro clan and small stock among the Gabra give birth to excessive numbers of twins.</td>
</tr>
<tr>
<td><strong>III. Astrological weather signs/conditions that tell sign of drought</strong></td>
</tr>
<tr>
<td>1. When the sun at the time of setting is completely red and round.</td>
</tr>
<tr>
<td>2. When wind velocity is high and wind is strong.</td>
</tr>
<tr>
<td>3. When the cloud moves in the opposite direction to the sun.</td>
</tr>
<tr>
<td>4. When there is sufficient cloud cover but only very little rain falls at the ‘normal’ time of the rainy season.</td>
</tr>
<tr>
<td>5. When the new moon slants towards the north.</td>
</tr>
</tbody>
</table>

*Source: Authors’ field notes, 1998 and 2000.*

The herders’ perception about future climatic conditions is shaped by recurrent uncertainty
that they usually face and their predictions are aimed at minimising vulnerability to climatic
changes. Such predictions are forged even though future climatic events might sharply differ
from past trends on which future predictions are based. The focus is on the uncertainty of
average rainfall, below-average rainfall, excessive rainfall and droughts. None of these can be
predicted with any certainty and expected negative influences may turn out to be positive.
Precision aside, climatic variability is real, and wide variations exert profound impacts on the
rangeland condition and impart important influences on the pastoral welfare.

\(^\text{11}\) We visited our Manyatta (Ola) around Bubisa in June 1998 and at that time unusually large number of goats
gave birth to twins. We were informed, after inquiring, that this was a sign of terrible drought ahead (Arbe
Wario: pers. comm. 1998). This actually turned out to be true. However, this was an interesting coincidence,
although people’s *ex ante* measures in response to the sign remained vague.
Information gaps and the need to incorporate the herders' view in the rangeland debate

The pastoralists potentially have a good understanding of the environment that may be useful in linking range condition and livestock. The temporarily dynamic concepts\textsuperscript{12} like finna, koshe and orromo (in Borana) (Oba 1985; Kassam 1986) may be crucial in relating condition and the productivity of range units. These notions embrace both positive and negative aspects and their influence is synonymous with boom and bust periods of rangeland production. In relation to the range, finna covers a complex set of meanings and comes close to nutrition inherent in nature, derived from pasture by animals. The livestock depend on the natural environment for various needs and this, in turn, is acquired by humans for sustenance, nourishment and to realise well-being. The term orromo refers to a sign of calmness or restless animal behaviour in the kraal that indicates the presence or absence of quality feed. Koshe is used to portray the nutritional value or enrichment of the feed to animals that is obtained by humans through animal produce (\textit{e.g.} milk). This term differs from the extent of pasture abundance and centres on the availability of quality pasture and sufficient browse for livestock species. These attributes are not necessarily present together. According to this way of thinking, more emphasis is placed on nutrition from range units, species richness and quality via natural browsing and grazing. These qualities enable herd growth, sufficient subsistence production and better animal conditions and the absence of diseases. The recognition of these concepts demands intimate knowledge of range conditions, water holes, an assessment of grazing and browse quality and diversity and the spatial distribution of good quality rangelands. Interestingly, similarly to the unpredictability and spatial variability in the arid ecology, the productivity of rangelands varies in time and between localities according to fluctuations in rainfall and variations in soil types. These fluctuations highlight the mixture of vegetation and pasture that grows in response to the spatial distribution of rain. These views add new elements to the complexity of heterogeneous range units in arid lands (Chapter 2).

The rainfall input is critical, sequentially, in improving range condition, animal health and providing sufficient products for human sustenance. The oral historians of the pastoral groups studied have a rich knowledge of the repetition of certain short and long-term cycles of good, above-average and excessive rainfall years, or drought (Sobania 1979; O’Leary 1985; Robinson 1985; Tablino 1999). Another important aspect is that the herders’ in-depth understanding of range dynamics, their ancient ways of predicting the recurrence of shock events and of forecasting\textsuperscript{13} rainfall concur with the unresolved rangelands degradation debate in which this knowledge is currently neglected and therefore under-utilised. To bridge the information gap between science and practice will definitely take time. Presumably, the differences may not be a flaw in one of these views, but emphasise the need for a long period of empirical data collection to verify this mismatch and contribute towards informed development policies for arid lands.

\textsuperscript{12} These views are based on our detailed interview with a Gabra elder (Ramat Kushi, pers. comm. 1997).

\textsuperscript{13} The role of oral historians who can relate the recurrence of past cyclical events is significant (see Robinson 1985 for an excellent account on this). These people relate past years of good rains, droughts, raids, disease epemics etc. Using such knowledge communities by extension predict range conditions, and map out strategies to use range resources (see Chapter 3). Such events are usually given specific names.
Another gap in knowledge refers to the interaction between factors such as soil fertility, herbivore composition and types, and fires, which could be an important determinant of range conditions and livestock populations over time (see also Chapter 9). Today, adverse effects of these factors occur around permanently settled areas and vast tracts of rangelands are not used most part of the year. In addition, the rangelands are characterised by patchiness and heterogeneity of the range units and the associated wide and wild dispersal of seed. There is a need to understand the duration of seed storage in the soil before irreversible loss and the disappearance of the seed bank owing to dry out and seed rot in the soils occur. For example, what are the seed’s minimum rainfall or water requirements for germination, re-generation or growth for different plant species? It is important to know this at least for dominant dwarf shrubs and grass types important for animal species. It is probable that the composition of in-situ species composition, changes in the plant composition of range units over time and the indications of the aggregate biomass constitute the natural order of range units, rather than degraded conditions. We need a better understanding of the natural variation and rhythm of plant species and composition at a specific range unit level independent of livestock impacts or human activities. Still, crucial information on the time before the seed bank completely dies in the soil, or the minimum amounts of rain that permit germination of different type of seeds is lacking at present. These issues require a critical re-examination and are crucial for the discussion of rangeland degradation and the on-going process that might lead to desertification. Future empirical work in this direction would greatly benefit rangeland development policies and human welfare of the majority of the pastoral groups in the region.

This review of the rangeland degradation debate and herders’ understanding of rangeland conditions presented here does not constitute a wholesale challenge to the huge quantity of literature on rangeland degradation and its contribution to science. Even so, there is no comprehensive, long-term study to date that offers insights into the rangeland deterioration debate in an effort to capture certain cyclical patterns in the study area. The changes in plant biomass and composition should be linked to temporal, spatial and seasonal variations in range conditions, rainfall amounts, livestock dynamics, animal feeding behaviour, critical seeds’ moisture requirements and seed dispersal among other crucial factors. Such information is needed in order to contribute to the on-going rangeland debate and informed policy decisions. In this respect, the information gathering on the early warning signs by the United States Agency for International Development (USAID), in collaboration with the Arid Lands Project, provides promising datasets for future policy. These datasets need to incorporate herder’s indicators of separate range units so as to generate rich, long-term data to come to a better understanding of livestock-rangelands interactions. The rich knowledge pool that complements insights from various viewpoints is needed to contribute to informed decisions on livestock and rangeland links and improve livelihoods in the arid areas in the distant future. In this regard, the participation of the communities in the collection and dissemination of the early warning information is important.

Meanwhile, the collective consequences of variable shock factors in the short run play a decisive role in shaping the environment and destroying rural livelihoods in the arid areas. The effects of recent vulnerability-inducing shock factors in the study area are discussed below.
Effects of El Niño rains on ecological systems in Marsabit District

The effects of stochastic shocks on the natural environment are difficult to understand and their synergies difficult to discern. Neither are these factors a recent phenomenon. That being the case, the occurrences of shock-inducing events are uncertain and their effects can only be assessed *ex post.* The effects of external shocks on the ecological system are pertinent for their feedback responses on the natural environment, their consequences for human welfare and their impacts on the livestock economy on shared rangelands. A large part of our argument here is rather a review and counter intuitive. It draws heavily on the general information of the agro-ecological zones and their support of production potentials in the region and evidence from the households’ responses. Herd populations in the district are heavily dependent on the condition of the rangelands. Therefore, poor plant biomass production and the poor state of the forage might explain the casual links between high livestock losses and the changes in environmental conditions.

The physical characteristics of different ecological units respond differently to various sudden or gradual shock factors. The three study sites of Marsabit Mountain, Korr and Maikona have different physical characteristics and ecological conditions14 (see Chapter 4) and thus differentiated ecological and economic productivity potentials. As regards the effects of El Niño rains in the district, one of the important indices of assessing shock effects across ecological zones is to compare the physical conditions of livestock and the state of environmental parameters such as water availability, condition of the pasture, regeneration and the recovery of the environment (Table 16.1).

<p>| Table 16.1 |
| Condition of environmental variables during El Niño rains at selected locations, 1998 |</p>
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Manyatta Jillo</th>
<th>Dirib G.</th>
<th>Karare</th>
<th>Maikona</th>
<th>Korr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water availability</td>
<td>Fair</td>
<td>Fair</td>
<td>Fair</td>
<td>Very good</td>
<td>Very good</td>
</tr>
<tr>
<td>Environmental recovery</td>
<td>Fair</td>
<td>Fair</td>
<td>Fair</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Pasture availability condition</td>
<td>Good</td>
<td>Fair</td>
<td>Good</td>
<td>Very good</td>
<td>Fair</td>
</tr>
</tbody>
</table>

Notes:

a. Range regeneration rate and soil erosion indices were assessed as high and fair, respectively, across all the sites.
b. The assessment of the parameters during the El Niño rains was made with reference to their ‘normal’ conditions during a year of average rains.


Table 16.1 represents the state of the main environmental variables as assessed during the El Niño period (1998). Manyatta, Dirib and Karare are on the mountain and Maikona and Korr are in the lowlands (MoALD&M, GTZ & ALRMP 1998). Dirib Gombo, which is on the eastern side of the mountain, has ‘fair’ conditions. Manyatta Jillo, in the north-north east and Karare on the south-western side of the mountain had identical parameters of ‘fair’ water availability and environmental recovery and ‘good’ pasture availability. The availability of water on the mountain, which was rated ‘fair’, was blamed on the adverse destruction of man-made water sources (e.g. dams and pans) by heavy rains and siltation from severe erosion. However, water was available from flowing river basins (*laggas*) and naturally occurring

---

14 The source used here provides effects on more ecological units in the district but only a few have been selected for illustration purposes.
perennial surface water sources of pools and depressions in the earth surface. The condition of environmental parameters is similar within the ecological zones of the lowlands and on the mountain. The environmental recovery rates were assessed as ‘fair’ for the mountain and ‘good’ for the lowland sites. The spatial location of the study sites and the intensity of the rains caused differentiated effects on crop production and livestock populations on the mountain. On the one hand, water availability and pasture availability conditions seem to account for differential impacts of the El Niño phenomenon on livestock across the ecological zones. On the other hand, differences in adverse impacts of the rains within an ecological zone, for example in the lowland sites, could have emerged owing to differences in conditions and availability of pasture.

Livestock herds in many dry lands in Africa are substantially dependent on the natural environment, especially for water and pasture. The differentiated ecological unit responses to El Niño rains in turn affected the physical conditions of livestock differently and this appears to be different across sites and various species of livestock. Table 16.2 summarises evidence of the physical conditions of livestock and the prevalence of diseases as a result of drought and rain effects on livestock populations.

### Table 16.2
Livestock body condition during El Niño rains, 1998

<table>
<thead>
<tr>
<th>Animal type</th>
<th>Manyatta Jillo</th>
<th>Dirib</th>
<th>Karare</th>
<th>Maikona</th>
<th>Korr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Very good</td>
<td>Very good</td>
</tr>
<tr>
<td>Small stock</td>
<td>Poor</td>
<td>Poor</td>
<td>Poor</td>
<td>Very poor</td>
<td>Very poor</td>
</tr>
<tr>
<td>Camels</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>Good</td>
<td>Poor</td>
</tr>
<tr>
<td>Donkeys</td>
<td>Fair</td>
<td>Fair</td>
<td>Fair</td>
<td>Good</td>
<td>Good</td>
</tr>
</tbody>
</table>


As this table shows, there are no differences in the physical conditions of cattle and small stock within a given ecological zone. However, the table shows differences in the physical conditions of cattle and small stock between the zones. The table also shows differences in the physical conditions of camels within the lowlands. Generally, the physical condition of the livestock was poor as a result of diseases and other stress factors associated with the effects of El Niño rains. The heavy rains had a positive effect on cattle health, but a negative effect on the body condition of small stock and a ‘fair’ effect on donkeys on the mountain. The El Niño rains had positive effects on the physical conditions of cattle and donkeys, but negative effects on small stock in the lowlands. These effects were positive for camels in Maikona, but negative for camels in Korr as judged by their physical conditions. The differences in the physical conditions of livestock can be traced to the heterogeneous ecology of the lowlands across the study sites. These include physical characteristics and its constituents and the ability of a specific ecological unit to withstand unusually high rainfall intensities. This assertion assumes a uniform rain distribution across ecological zones and heterogeneity in environmental parameters. These negative effects need not necessarily be the same across various sites. The differences in the physical conditions of animals were conditional on combinations of negative effects (Table 16.3).
Table 16.3

<table>
<thead>
<tr>
<th>Site</th>
<th>Cattle</th>
<th>Small stock</th>
<th>Camels</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. On the mountain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M. Jillo</td>
<td>Abortion, non-specific disease</td>
<td>Foot rot diseases, abortion and</td>
<td></td>
</tr>
<tr>
<td>Drrib G.</td>
<td>Abortion and diarrhoea</td>
<td>Foot rot diseases, diarrhoea and</td>
<td></td>
</tr>
<tr>
<td>Karare</td>
<td>Abortion and diarrhoea</td>
<td>Foot rot diseases, diarrhoea and</td>
<td></td>
</tr>
<tr>
<td>b. In the lowlands</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maikona</td>
<td>Abortion</td>
<td>Pneumonia, foot rot diseases,</td>
<td>Pneumonia, abortion and</td>
</tr>
<tr>
<td>Korr</td>
<td>Abortion</td>
<td>Abortion, foot rot diseases and</td>
<td>diarrhoea</td>
</tr>
</tbody>
</table>

---

Note:
- Double dash (--) denotes no cases of diseases were reported.

The heavy rains not only improved environmental conditions in terms of highly enhanced productivity of plant biomass for livestock species but also led to the emergence of plant seeds and micro-organisms and improved their survival. These manifested themselves through the prevalence of pathogens and incidence of diseases among humans and livestock. Table 16.3 reflects the causes of animal mortalities and prevalent livestock diseases for selected sample villages, on the basis of the various range units discussed in the above tables.

Abortion, diarrhoea and pneumonia are mirrored as the most common causes of livestock mortality across the sites. However, some causes of animal death vary between livestock species and also differ often in a specific time of incidence of herd mortalities. For example:

1. While high mortality among cattle is caused by abortion, high mortalities among small stock are caused by diarrhoea, foot rot disease and pneumonia.
2. According to the herders, pneumonia often causes high mortality incidences when the ‘first-rain’ showers are associated with strong and severe cold winds and animals are seemingly in weak physical condition from the previous dry season or drought. Thus the prevalence of pneumonia among animals is normally high at the onset of the rainy season.
3. It is probable that foot rot disease and diarrhoea are common to all animal types and they arise out of excessively wet soils and the ‘extremely watery’ state of the pasture. The

---

Foot-and-mouth is a highly contagious viral disease that affects cloven-hoofed animals: cattle, sheep and goats. The disease is rampant in the district. Its symptoms include fluid blisters that appear in and around the mouth, nose, teats and feet of the animals (Carassava et al. 2001: 22). Loss of appetite and a sudden drop in milk yields among lactating herds are also indications of the disease. The recurrence of the disease in the region can be traced to the ability of the virus to persist in certain meats, bone marrow, viscera and non-pasteurised livestock products (ibid.). However, since movement of infected animals can spread the disease among separate herds, the imposition of a quarantine that restricts livestock movements is commonly used as a control measure in Kenya (Chabari & Njiri 1991; Mboog 1997). In addition, imposing quarantine acts as a tariff on the livestock marketing. This raises livestock and meat prices as a result of reduced supplies and undermines the ability of the pastoral households to meet their market-based needs. Other control measures, once the disease strikes, include quarterly or bi-annual revaccination and the destruction (including mass slaughters) of all animals that are (suspected of being) infected. The former has
prevalence of these two effects could be traced to widespread flooding of most low plains, which is also supported by thriving disease-causing organisms and the availability of succulent (moist and tender) foliage materials during extended rains seasons.

4. Moreover, haemorrhagic septicaemia and trypanosomiasis are limited to camels and reported in the lowlands only. Trypanosomiasis is due to increases in biting flies.

The information in the table does not allow us to determine the severity of each disease with regard to different animal species. However, estimates of livestock dynamics at household and district levels show that rain had more severe mortality effects on small stock than on cattle and camels and also more on cattle than on camels.

The effect of droughts and El Niño rains on livestock and livelihoods in Marsabit District

Since livestock herds substantially depend on the natural environment, rainfall is a critical factor in shaping the interdependence between rangeland resources, livestock and livelihoods. The effects of shock events such as multiple droughts and occasional heavy rains on environmental resources like water and livestock are far-reaching. However, the net outcome of such adverse factors depends on how their impact on the various resources is distributed across households and ecological zones (see penultimate section).

In this section we aim to link livestock dynamics to droughts and El Niño rains. We thereby build on the results regarding the implications of rainfall amounts below water requirements for crops presented in Chapter 4 and particularly the findings about droughts. As regards the latter, we pointed to a series of droughts experienced in the northern Kenya region, which made it clear that there were more frequent droughts during the last 30 years, with the more severe droughts occurring in the last decade. During the last 20 years, Marsabit District and Kenya experienced severe droughts in 1983/84, 1991/92, 1996/97 and 1999/2001 (UNEP-GoK 2000; Aklilu & Wekesa 2002), with equally devastating effects on the livestock population and livelihoods. The devastating impact of the sudden heavy 1997/98 El Niño rains added to the effects of droughts.

According to Mbogoh (1997), cattle losses in the arid areas of Kenya amounted to about 33 and 38 per cent respectively and about 28 per cent for small stock during both the 1984 and 1992 droughts. The region also suffered about 13 per cent of camel losses in the 1984 drought and about 8 per cent during the 1992 drought.

According to a survey report (MoALD&M, GTZ & ALRMP 1998; see also Table 16.4), Marsabit District again suffered substantial livestock losses due to the 1996/97 droughts and subsequent 1997/98 El Niño rains. Table 16.4 reveals the changes in livestock numbers and shock-induced mortality differentiated for livestock species, with cattle, small stock and camels in that order of decreasing effects. The drought decimated the sheep population by about 32 per cent, the goat population by 24 per cent and the cattle population by 20 per cent. Relatively speaking, the 1996/97 droughts had a more severe impact on small stock compared to cattle and camel populations, while camels – which suffered a loss of about 4 per cent –

considerable financial implications for a developing country like Kenya and the latter has profound adverse consequences for herders' life given that there is no system of formal insurance.

At the macro-economic level, droughts have substantial potential impacts on the economic sector. During the 1999/2000 drought, Kenya’s GDP growth rate declined by 0.7 per cent, inflation rose by roughly 2 per cent and the foreign exchange rate of the Kenya shilling against the US dollar plunged to an all-time low rate of Ksh. 79 (UNEP-GoK 2000: 14).
were least affected by the drought. Hence, camels reveal a greater stability and adaptation to the dynamic arid and semi-arid environments.

During the 1997/98 El Niño rains, however, cattle (6 per cent) were least affected compared to camels (20 per cent) and small stock (about 50 per cent). Indeed, small stock was again most affected by the rains with mortality recorded at about 48 per cent compared to the pre-rains numbers for sheep and 51 per cent for goats. As can also be seen from Table 16.4, the El Niño rains caused less mortality among cattle herds relative to the preceding drought, at a margin of almost 6 per cent. The district's livestock losses to drought and El Niño rains are equivalent to 16 per cent and 21 per cent of the livestock assets measured in TLU, correspondingly. In monetary terms, these losses translate into Ksh. 88.7 million and 362.3 million worth of animals for the district as a whole, on the basis of the animal market prices on the mountain which applied at the time (see also section on financial implications of droughts and El Niño rains).

The heavy 1997/98 El Niño rains followed the 1996/97 droughts quickly and they jointly had very similar negative effects on livestock numbers, although the effects were more or less mirrored. Whereas the drought effects manifested themselves as a scarcity of pasture and increasing distances to watering holes, the El Niño rains resulted in excessive floods, destruction of infrastructure facilities, outbreak of diseases and water logging of soils. It is, however, not easy to disentangle the effects from each other. The effect of El Niño rains may have been more severely felt because of poor physical conditions of animals owing to the prior 1996/97 droughts in the region. The high livestock mortalities observed, in relation to other herd dynamic parameters of the study sites, can largely be attributed to the effect of a sudden rain shock on the natural environment. These, in turn, account for most of the wide variations in households' herd size and differentiated wealth (see Chapter 7).

### Table 16.4
Livestock losses (%) due to drought and El Niño rains in the district, 1996/97 and 1997/98

<table>
<thead>
<tr>
<th>Animal type</th>
<th>1996/97</th>
<th>1997/98</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-drought</td>
<td>Post-drought</td>
</tr>
<tr>
<td>Cattle</td>
<td>224,500</td>
<td>179,300</td>
</tr>
<tr>
<td>Sheep</td>
<td>409,000</td>
<td>278,950</td>
</tr>
<tr>
<td>Goats</td>
<td>554,000</td>
<td>421,390</td>
</tr>
<tr>
<td>Camels</td>
<td>130,000</td>
<td>124,950</td>
</tr>
<tr>
<td>Weighted TLU</td>
<td>409,450</td>
<td>345,484</td>
</tr>
</tbody>
</table>

**Notes:**
- a. Livestock population estimates are all in absolute numbers and livestock losses in percentages.
- b. Weighted livestock loss measure derived using TLU index


---

17 The authors recorded the animal prices and used average prices of Ksh. 6,065 for cattle and Ksh. 790 for small stock. While the cattle and small stock prices are the September ones in order to reflect the weak physical condition of the animals, hardly any camels were sold but here we use Ksh. 8,000 based on a few cases observed on the market.

18 The arid areas of Kenya experienced two severe prior droughts in 1984 and 1992. The effects of these two events were also shown to be devastating on the livestock population (see Mbogoh 1997: 15)
The 1997/98 rains were soon succeeded by new years of droughts. The effects of the recent dramatic drought crisis were a result of two consecutive years (i.e. 1996/97 and 2000/01) of poor rains and the near total hold off of the April rains in 2000 (UN-OCHA 2001: 1). The consequences of the droughts were particularly severe in the pastoral and agro-pastoral areas in the Horn of Africa countries. In this connection, an estimated 35 per cent of the cattle, 43 per cent of small stock and 18 per cent of the camels were lost during the 1999-2001 droughts in the Northern Kenya rangelands alone (Aklilu & Wekesa 2002: 12). It was further estimated that the impact of these droughts amounted to about Ksh. 6 billion (roughly US$ 77 million) worth of livestock at national level (ibid.). This shows that these droughts had more of an impact (Ksh. 6 billion versus Ksh. 88.7 million) on the livestock numbers relative to both the previous 1996/97 droughts and the El Niño rains. The severity of the recent droughts surpassed those of the previous ones in that they affected those areas and regions where droughts are characteristically uncommon phenomena, such as the Central Province (UNEP-GoK 2000: 12-13). Country-wide, an estimated 5 million people relied on relief food, and electricity and water rationing was imposed.

That brings us to the effects of rangeland degradation and livestock losses on pastoralists' livelihoods. Pastoralists rely heavily on livestock assets for a variety of needs such as food, cash, various social obligations and security. Consequently, livestock losses due to catastrophic factors have enormous implications for the survival and broader human livelihoods of pastoral communities. The effects of the 1996/97 and later droughts and 1997/98 El Niño rains on the study region and communities were more pronounced than those of the 1983/84 and perhaps those of the 1991/1992 droughts, which affected Kenya as whole. As a result, the adverse El Niño rains and subsequent droughts received more international attention and were the focus of humanitarian interventions (UN-OCHA 2001).

**Results of the household survey regarding livestock losses**

Figures on regional and national livestock losses mask the differential impacts of shock events at household level. Fortunately, data from sample households at about the time of these shocks is available for comparison with the district level data presented above. Our own household survey results reveal a different pattern of drought and El Niño rain effects on livestock herds from the ones reported above. These differences are apparent across the sample sites on the mountain and in the lowlands, and between the main livestock species. With reference to the 1996/97 droughts, household cattle size decreased by almost 18 per cent on the mountain, but increased by about 8 per cent and 9 per cent, respectively, at the lowland sites in Maikona and Korr. The change in small stock population at the household level is similar: a decrease of almost 10 per cent on the mountain, and an increase of nearly 14 per cent in Maikona and 6.1 per cent in Korr. Camels are less important holdings on the mountain compared to the lowland sites. The households in the lowlands show a sustained increase in

---

19 It should be noted that the arid areas of Kenya that Mbogoh refers to cover a much larger area than Marsabit District. Thus, in this conclusion we primarily reflect on livestock losses within the study region.

20 These results are obtained from herd variables like births, sales, slaughter, purchases, deaths and animal exchanges, which are compared with deaths (i.e. mortality) and herd sizes (see Chapter 7).

camel sizes in both Korr and Maikona of about 9 per cent and 5 per cent respectively. On the whole, the livestock wealth (excluding camels) decreased by about 17 per cent on the mountain, and increased by about 12 per cent in Maikona and 7 per cent in Korr in TLU terms, largely due to the impact of the drought.  

Turning to the El Niño effects, both small stock and cattle numbers reduced by about 22 per cent on the mountain. Despite the heavy livestock losses reported during the El Niño rains, cattle and small stock increased by 21 per cent and 5 per cent in Maikona respectively at household level. In Korr, the cattle numbers declined by about 10 per cent and small stock increased by 6.1 per cent following the El Niño rains. Following the El Niño rains, the camel numbers dropped by about 21 per cent in Maikona, but increased by almost 4 per cent in Korr. Again, overall cattle and small stock numbers decreased by about 22 per cent on the mountain and about 7 per cent in Korr, but increased by about 10 per cent in Maikona after the El Niño rains in TLU terms. Including camels, the aggregate livestock wealth dropped by 1 per cent in Korr and increased by almost 30 per cent in Maikona in the post-El-Niño rains period.

The above results reveal that the sample population on the mountain experienced more shock effects among small stock and cattle compared to the sample population in the lowland sites. In Maikona, the effects of El Niño rains were more positive on camels than on cattle and small stock, while these effects in Korr were more severe on cattle, but positive for small stock and camels. The camel population was least affected by the two shocks in Korr compared to cattle and small stock. Furthermore, the cattle and small stock assets on the mountain were most affected by the variable factors relative to the lowland sites. Based on the herd dynamics as derived from the household survey, the joint impact of the drought and the rains shows proportionally higher cattle and small stock losses in the lowlands compared to camel losses. In monetary terms, our own estimates determined a mortality value of almost Ksh. 1.9 million after the drought and Ksh. 2.2 million after the post-El Niño rains. The mortality value at the lowland sites remains lower than on the mountain, at Ksh. 0.5 million and Ksh. 0.8 million during the droughts and El Niño rains respectively. In both cases, the value of livestock mortality was higher during the El Niño times compared to the drought time.

Since then, the herd numbers have generally declined on the mountain. By August 2000, the cattle holding was 7.3 per cent below the (August) 1998 herd size and small stock almost at par, at 2.1 per cent above the 1998 level on the mountain. Thus, in general, cattle and small stock wealth on the mountain was 6.4 per cent below the 1998 (August) level.

The occurrence of adverse factors such as droughts and excessive rains matter because of the ex post consequences they bear on the natural environment and people's livelihoods. The principle effect of droughts is large livestock losses (high herd mortality) and subsequent destitution of many pastoral families at the end of such forces. The cyclical nature of stochastic shock factors, the uncertainty of their occurrence and the inability of the people to predict them always depress herd population and often leave the pastoral households worse-

---

22 These increases are about 27 per cent for Maikona and 7 per cent for Korr, including camels.
23 The prices used here were based on the livestock prices for Marsabit market: Ksh. 6,065 for cattle and Ksh. 790 for small stock during September 1997 and Ksh. 6,300 for cattle and Ksh. 1,233 for small stock in May 1998. A constant camel price of Ksh. 8,000 was used for the lowland sites.
The effects of droughts and El Niño rains on the reproductive capacity of herds
In addition to herd mortality, herd fecundity is another key parameter that determines the
dynamics of livestock populations under external shocks, but which is often overlooked. This view recognises that livestock population dynamics is in part an outcome of specific
traits or characteristics endogenous to an individual animal, mainly females. The adverse
factors indirectly impact on livestock through the availability of environmental resources and
thus question the effects of stress factors on livestock biology. In other words, we consider the
impairments that external shocks bear on the intrinsic livestock characteristics that determine
the reproductive potential of female herds. The livestock biology literature offers evidence
that droughts affect animal energy expenditure in general, the level of energy intake and the
reproductive potential of female mammals through ovulation rates, as well as oestrous cycle
behaviour under stress conditions (Khokhlova et al. 2000). The first two of these conditions
directly influence one another and are often jointly the effect of droughts on the range
conditions where livestock depend directly on the natural environmental resources. The
evidence shows that energy intake and animal reproductive performance correlate strongly
poor nutrition lowers oestrous cycles in cows by about 32 per cent. Therefore, we can state
that the severity of drought effects on livestock, and in particular on female animals, stems
from the reduced caloric intakes, and these in turn have an adverse effect on a key process
that determines female potential reproduction – the oestrous cycles (ibid.: 257). The female
herd-specific endogenous factors are ultimately the driving force in herd dynamics and female
reproduction potentials among pastoralists in sub-Saharan Africa in general, and the African
dryland in particular. It is our presumption that frequent droughts undermine the female
intrinsic reproductive potential. It is possible that the decline in the livestock populations,
despite development of water resources, could be due to effects of stress factors on the
reproductive potential of female herds.

The effects of droughts on child’s health and human survival
The effects of droughts also indirectly spill over into the area of human health. The most
chilling effect of droughts and other related factors emerge from effects on human food
deprivation in general and child malnutrition in particular. A series of nutritional surveys
confirm the negative effects of droughts and El Niño rains on human well-being in the arid
areas and some other districts in Kenya. According to UNICEF, malnutrition in the ASAL
districts was between 25 and 30 per cent of the population during the 2000 drought (cited in
UNEP-GoK 2000). A supplementary feeding programme carried out in Marsabit district
revealed monthly prevalence of malnutrition to be about 16 per cent and severe malnutrition
to be 2 per cent (based on Mid Upper Arm Circumference (MUAC) measurements) between
April and November 1997 (Brown & Carbonell 1998). Based on UN-World Health

---

24 We would like to thank Allan Degen at Ben-Gurion University of the Negev, Israel most sincerely for bringing this point to our attention. However, much of the insight that might be developed from this concern is beyond our expertise.
Organisation (WHO) guidelines, a nutritional survey reported an average critical malnutrition level of 25 per cent in seven out of eight trading centres sampled in the lowlands (Owuor 2000), including Maikon with a malnutrition rate\(^{25}\) of about 22 per cent of the children below the age of 5 years. Similarly in the district, moderate and acute malnutrition rates of about 35 and 7 per cent of the children between 6 months and 5 years of age were reported for Loiyangalani in 2000 (MEDAIR 2001a). In North Horr, a nutritional survey revealed a moderate malnutrition rate of about 44 per cent and a severe malnutrition rate of 6.3 per cent in 2000 (MEDAIR 2001b). These rates were relatively lower in Laisamis Division at about 20 and 3 per cent respectively (OCHA-Kenya 2001: 4). The situation on the mountain is quite similar, although lower when compared to other areas in the district. The moderate and severe malnutrition rates for Gadamoji and Central Divisions of the mountain were 10 and 21 per cent and less than one and about 3 per cent respectively \(\text{(ibid.): 4}\). These surveys consistently show the severity of drought effects on the households and in particular on children's health. Furthermore, the consequences of droughts for the human deprivation of food and health are directly linked to the livestock-based pastoral economy.

**The financial implications of droughts**

A common feature of all these effects is the high costs of shock-inducing factors on crop production, losses of livestock assets and child health. Not only are the costs of droughts high, but the emergency responses aimed at mitigating drought effects are even higher. In addition to this, at the Horn of Africa regional level the recent dramatic drought crisis captured wider humanitarian attention than ever before. During the 2000 drought for example, more than 1.3 million metric tonnes of food aid were distributed, together with water, health and livestock interventions reaching millions of people in countries in the Horn of Africa region (UN-OCHA 2001: 1). It was estimated that over 4 million people were severely affected by the drought in Kenya alone, with estimated food requirements of about 40,000 metric tonnes \(\text{(ibid.): 3}\). The total drought-related financial requirements were estimated at over US$ 353 million for the Horn of Africa region as a whole. Of these, emergency food aid accounted for 72 per cent, livestock sector 5.4 per cent and pastoral support constituted less than 1 per cent. Of the total drought-related regional financial requirements, Kenya's share of the total requirements was about 36 per cent (roughly US$ 127 million). Emergency food aid and support for the livestock sector accounted for about 70 per cent and 9 per cent respectively while no pastoral support services were provided. Following the recent 1999-2001 droughts, some estimates show that more than US$ 931,000 were disbursed to mitigate the effects of droughts and to support the livestock sector in Marsabit District alone, with a total value of US$ 6 million of emergency interventions in Kenya as whole (Aklilu & Wekesa 2002).

This evidence does not include the asset losses due to various shock factors. In other words, aggregate asset losses at district or regional level may disguise substantial distributional shock experiences suffered by specific households. The current study seeks to fill in some of this gap and this has already been demonstrated in Chapter 7. All these issues regarding effects of droughts and other adverse factors on livestock, human health and their financial implications indicate an area of future concern. There is a serious need to shift

\(^{25}\) According to WHO cut-off guidelines, a less than 5 per cent nutritional status is considered acceptable and more than 15 per cent prevalence using z-scores in populations is regarded as critical (see Owuor 2000: VII).
development policies away from the negative rangeland discussion to find ways to enable pastoralists to acquire improved access to resources and to cope more effectively with the adverse factors in their environment.

**Accumulative effects of stress factors on livestock holdings**

In Chapter 7 we investigated households’ herd holdings and also gave an indication of the temporal changes in livestock assets. The overall decline in the average livestock holdings seems to point towards weak livestock assets at regional level and, in particular, an increase in the number of livestock-poor households. In addition, the fall in livestock assets per household or per capita seems to have a negative effect on the livestock-sharing mechanisms of insurance arrangements among the study groups, as we have highlighted in Chapter 11. In this subsection we give a further indication of the average livestock changes on the basis of household survey information in the region available to us (Table 16.5). The fact that the data used is based on household surveys might shed some light on temporal changes in the livestock assets. In the lowlands, the 1998 survey results refer to the “mobile” households and the 2000 survey to the households settled around permanent water sources. The differences in the sample sizes between the surveys perhaps warrant some caution, and this should be examined in greater detail bearing in mind the general trend in livestock numbers discussed in Chapter 7. In order to be able to detect trends over a longer period of time, we also use data from the survey carried out by O’Leary (cited in Lusigi 1983: 366).

As can be seen from Table 16.5, the average cattle and small stock sizes on the mountain were lower in the 1998 survey compared to both the 1996/97 and the 2000 surveys. This low herd size could be due to the joint effects on the livestock of the 1996/97 droughts and the heavy El Niño rains in the area that preceded our 1998 survey. The El Niño rains less affected cattle compared to the small stock and camels in the region (see Table 16.4) and this may have enabled better recovery of the average cattle sizes in the 2000. The average small stock size was lower in 2000 compared to 1996/97 and this may be attributed to the substantial losses of small stock due to torrential El Niño rains. Apparently, there is a tendency towards a growing share of households without animals over time, both for cattle and small stock. Therefore, what becomes clear from the surveys on the mountain is the dynamics in the average household herd sizes and the proportion of households without animals. In relative terms, the fall in average herd sizes and the rise in the proportions of households with no animals seem to change rapidly in the case of small stock when compared to cattle. The temporal changes in the cattle and small stock holdings reveal a growing disparity in asset holdings and thus greater inequality in herd sizes. The poorer 10 and 20 per cent of the households own just 5 per cent of the cattle and small stock on the mountain and these groups even seem to be worse off as regards small stock holdings compared to cattle. On the contrary, the top 20 per cent of households show a tendency to hold higher proportions of the cattle (about 60 per cent) and small stock (more than 75 per cent) wealth over time. The top 10 per cent of households appear to control higher ratios of small stock holdings (from about

---

Previous studies in the study area speak of ‘rural households’ when ‘mobile households’ are meant, while they refer to ‘settled’ or ‘town’ households when they mean the households around permanent water sources. We adapted these descriptions to the terminology adopted throughout this book, in order to analyse household herd wealth changes and inequality in livestock holdings over time.
40 in 1996/97 to 63 per cent in 1998 and 2000) over time, although these changes are inconsistent, particularly for cattle.

The households in the lowlands consistently show increases in average household herd sizes for camels, cattle and small stock through time, in absolute numbers.\(^{27}\) The outcomes of the surveys also reveal declines in the percentages of the households that owned no animals, except for camels during 1983 and 1998, with a slight increase in the proportion of households with no camels. Despite the indications of the increase in the livestock herd sizes, the share of the total herds owned by the households in the lower wealth classes (the bottom 20 per cent) fell for all the animal types in the rural household samples. The households in the lower wealth classes owned less than 10 per cent of the livestock assets. In addition, the share of households in the upper wealth classes as regards livestock assets reveals a decline between the survey periods. This suggests that the increases in the livestock assets of rural households in the lowlands may have accrued largely to households in the middle livestock wealth classes and this result is true for all the main livestock species.

<table>
<thead>
<tr>
<th>Table 16.5</th>
<th>Temporal changes in the average herd sizes and households herd disparity, per site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>Approx. % of the households (%)</td>
</tr>
<tr>
<td>Sites</td>
<td>mean (n)</td>
</tr>
<tr>
<td>a. Marsabit mountain</td>
<td></td>
</tr>
<tr>
<td>Cattle in 1996/97</td>
<td>9.1 (200)</td>
</tr>
<tr>
<td>Cattle in 1998</td>
<td>8.8 (215)</td>
</tr>
<tr>
<td>Cattle in 2000</td>
<td>9.8 (203)</td>
</tr>
<tr>
<td>Small stock in 1996/97</td>
<td>10.4 (199)</td>
</tr>
<tr>
<td>Small stock in 1998</td>
<td>6.8 (215)</td>
</tr>
<tr>
<td>Small stock in 2000</td>
<td>8.3 (203)</td>
</tr>
<tr>
<td>b. Lowlands</td>
<td></td>
</tr>
<tr>
<td>I. Mobile households</td>
<td></td>
</tr>
<tr>
<td>Camels in 1983</td>
<td>4.0 (48)</td>
</tr>
<tr>
<td>Camels in 1998</td>
<td>12.3 (77)</td>
</tr>
<tr>
<td>Cattle in 1983</td>
<td>3.9 (49)</td>
</tr>
<tr>
<td>Cattle in 1998</td>
<td>5.5 (77)</td>
</tr>
<tr>
<td>Small stock in 1983</td>
<td>41.9 (36)</td>
</tr>
<tr>
<td>Small stock in 1998</td>
<td>79.4 (77)</td>
</tr>
<tr>
<td>II. Settled households</td>
<td></td>
</tr>
<tr>
<td>Camels in 1983</td>
<td>4.2 (46)</td>
</tr>
<tr>
<td>Camels in 2000</td>
<td>4.0 (94)</td>
</tr>
<tr>
<td>Cattle in 1983</td>
<td>4.1 (47)</td>
</tr>
<tr>
<td>Cattle in 2000</td>
<td>6.0 (94)</td>
</tr>
<tr>
<td>Small stock in 1983</td>
<td>29.6 (51)</td>
</tr>
<tr>
<td>Small stock in 2000</td>
<td>52.0 (94)</td>
</tr>
</tbody>
</table>

Sources:


\(^{27}\) Of course one needs to adjust livestock holding for human population in order to gain better insight. Since these increases are not in per capita terms, the growth in absolute livestock numbers is more than offset by the growth in human population. This explains why this result seems to contradict all our previous statements on declining livestock trends over time.
As regards the settled households, the average cattle and small stock herd sizes showed upward trends over time\(^{28}\), which again holds true for only average livestock holding in absolute numbers. This increase does not, however, apply to the average camel herd sizes which underwent a slight fall. Contrary to the average herd size holdings, the ratios of the households with no camels fell, while it increased for the households without cattle and small stock for the samples of settled households in the lowlands. The households in the lower wealth classes (the bottom 20 per cent) hardly possessed 2 per cent of the livestock assets and this share is only marginally higher for small stock in 2000. The shares of the camels held by the top 20 per cent wealth classes increased between the survey periods. This latter increase, combined with the lower average camel holdings and increase in the ratio of the households without camels reveal a growing inequality in camel holdings over time. The share of the small stock held by the top 10 per cent of the households show a slight increase, while the proportion of the small stock and cattle wealth controlled by households in this wealth class shows a decline. On the whole, livestock inequality among the sample households in the lowlands seems to have declined between the surveys.

The sample households on the mountain and in the lowlands show differences in average herd sizes and changes in the livestock asset holdings between the surveys. It is clear that few households in the lowlands own cattle compared to households on the mountain. The higher averages of small stock holdings also confirm the upward share of small stock in the district’s total livestock wealth (see Figure 16.1). Thus, the households’ accumulation of small stock might be because of frequent droughts that enable relatively fast reproduction and rebuilding of small stock herds, but perhaps block households’ accumulation of the camels and cattle. This is reflected in particular in the share of the households in the lower (i.e. herd-poor) and the upper classes of livestock wealth. The general impression across the sample sites is a decline in livestock assets, and this indicates that the cattle and small gains by the settled households seem to smoothen out in the overall herd wealth in per capita terms. The result also shows long-term growth in livestock inequalities across the sites and does not indicate a systematic direction of change in livestock wealth between the sampled groups and across the sites. This result might highlights dynamics in livestock holding between groups, sites and perhaps between households.

The overall trend would be a decline in livestock wealth in TLU per capita. The changes in the household herd sizes could be a by-product of a number of stress factors such as droughts, diseases and the recent El Niño rains. In our view, the recurrent droughts might have had the strongest impact on the livestock numbers over time in the study area. The evidence of the growing proportions of herd-poor households is consistent with the negative adverse effect of various stress factors on the livestock assets and the decline in the economy of pastoral

\(^{28}\) Again, this result does not contradict our earlier findings of declining livestock holdings. This trend is apparent mainly for small stock, while the overall trend is one of declining livestock holdings. This would possibly be true for two reasons: (i) only a few households in the lowlands own cattle and small stock holding has little influence on livestock wealth because of the low TLU conversion factor assigned to them; and (ii) these increases are in absolute figures and not in per capita measures. Our data reveals an increased proportion of small stock and decreased proportions for cattle and camels in the total livestock wealth in the district (see Figure 16.1), while overall per capita livestock wealth declined. Indeed, in Chapter 7 we showed that the per capita livestock wealth is well below the subsistence level.
households. These results generally correspond to the fall in per capita livestock assets over time, but the changes do not support a systematic decline in the households’ livestock holdings in absolute numbers for the mobile or settled households through time. The growing proportion of herd-poor households and the concentration of a large share of livestock wealth in the hands of the few herdsmen provide sufficient evidence of the long-term increase in livestock inequality among the studied households.

The apparent herd size inequalities have consequences for intervention policies and local resource-sharing mechanisms. One primary focus is on why people diversify their herd tenure and this provides motivation for pastoral households to participate in herd-sharing arrangements that we discussed in detail in Chapter 11. Taken together, the generally downward trends in the livestock holdings and the persistent growth in livestock inequality might have undermined the traditional herd-sharing mechanisms of risk insurance as practised by the communities studied. Of particular interest to us, the latter note strongly supports our earlier remark that a general declining trend in the household’s livestock assets might be the primary cause of limited inter-household herd-sharing and low household diversification of herd tenure, to the detriment of herd-poor households. This seems to emphasise the greater need for external support with a view to helping out the herd-poor households. In sum, the differential livestock losses across households and locations, the growing proportions of herd-poor households over time and the emerging herd inequality (concentration of herds in the hands of a few households) all have direct implications for development policies oriented towards the pastoral economy.

Conclusions

Many of the arid and semi-arid environments are not suitable for crop production and are primarily suitable for livestock keeping. The state of the natural ecology is important because of feedback responses it is likely to have on human welfare. It is for this reason that pasture and water resources on the communal rangelands have been the focus of this study.

The rangeland degradation debate frequently assumed negative impacts of excessive herds on the natural ecology. In this context, we did not find any significant negative relationship between rangeland conditions, proxied by rainfall, and livestock numbers in the region, although this result needs further confirmation. Even so, the rangeland debate has had a profound, albeit negative, influence on development policies and intervention efforts related to the pastoral livestock sub-sector, perhaps inadvertently. The outcome of such policies has been a neglect of the livestock sector — both in terms of budgetary allocation and the sector’s attraction of development funds (see Chapter 1). From the early 1990s onwards, the pastoral economy suffered a series of droughts and other adverse crises that caused their livestock assets to dwindle considerably below basic sufficiency level. The evidence from effects of recent droughts and El Niño rains confirms a decrease in livestock assets in the district. The effects of variable shocks on livestock, and thus a decline in livestock at district and household level over time, are widely distributed across ecological units of the district. The district and household level results show different patterns, however. The results reveal differential impacts of shocks on livestock assets that need to be borne in mind when dealing
with changes at regional level. Today, an average household in the region is much poorer in terms of per capita livestock wealth than ever before. This provides evidence of collectively shared long-term negative herd losses by pastoral households. Still, the subsistence economy is in a continual downward spiral deep into livestock poverty and thus the lack of an important livelihood capital. Another important aspect is that such stress accumulatively renders livestock-based structures of social security and mutual trusts ineffective. The most chilling outcome of the decline in livestock assets has to do with serious consequences for human livelihoods, especially on the mental development of children (Bwibo & Neumann 1999). This remark emphasises the need to focus on livestock asset poverty in order to improve human survival and human well-being rather than implementing *ex post* emergency relief food responses following local production failures. On this note there is an urgent call for long-term development initiatives, the improved allocation of public resources and a more sympathetic support of the international community for the livestock-based pastoral economy.