



# Livestock market access and opportunities in Turkana, Kenya

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# 1 Introduction

## 1.1 Drylands

Characterized by low and erratic precipitation (resulting in low and unpredictable levels of crop and livestock production), drylands comprise more than 40% of the earth's land surface and supports almost 20% of the human population (Thomas et al. 2002). Drylands are divided into arid and semi-arid lands. Typically, arid areas are defined as those receiving <200 mm of winter or <400 mm of summer rainfall annually. Conversely, semi-arid areas are defined as those receiving 200–500 mm of winter rainfall or 400–600 mm of summer rainfall. However, the most notable feature of drylands is that mean annual precipitation is less than half of the potential evapotranspiration. In Africa, drylands (excluding deserts or hyper-arid lands) comprise more than 40% of the land surface (Anderson et al. 2004), contain approximately 40% of the population, and envelop most of the poorest countries in sub-Saharan Africa: 12 of the world's 20 most disadvantaged countries are in dryland Africa (Mortimore 1998). In Kenya, 11 districts are classified as arid, 19 as semi-arid and 6 as having high annual rainfall but with 'pockets' of arid and semi-arid conditions. The arid and semi-arid lands (ASALs) cover approximately 467,200 km<sup>2</sup>, which is 80% of the country's total landmass of 584 thousand km<sup>2</sup>. Annual rainfall is low, ranging from 150–450 mm, and is also highly variable in space and time, often occurring as high intensity storms (Watson et al. 2006).

### 1.1.1 Turkana

Turkana District, located in northwestern Kenya, has a population of between 450 thousand and 500 thousand people and a total land area of 68,032 km<sup>2</sup> (excluding the lake). Turkana shares international borders with Ethiopia to its northeast, Sudan to the northwest and Uganda to its west. Turkana District is the largest in the country. However, despite its size, it is the least developed district in the country (GOK 1998). This can be partly explained by the harsh climatic conditions inherent in the area. Turkana, which is situated in Kenya's ASALs, experiences low rainfall and high temperatures that hinder any significant agricultural development. Annual rainfall in the district has been estimated in the past at 300–400 mm, falling to 150 mm in the central zones. However, even these estimates could be on the high side. According to figures based on extensive research in the district, while some of the mountains at Turkana's eastern and southern extremes receive 300–400 mm of annual rainfall, the weighted average of rainfall for Turkana is only 202 mm. Indeed, some rangelands in the lowlands receive only 100 mm a year (e.g. Kalokol in 1994).

As one of the poorest districts in the country, inhabitants of Turkana have limited opportunities for education, health, water, investment and trade, institutional support or participation in decision-making forums.

## 1.2 Pastoralism in Turkana

### 1.2.1 Traditional pastoralism in Turkana

The nomadic pastoralist economy of Turkana, which has one of the highest numbers of livestock in the country, is based on goats, sheep, cattle and camels (ITDG 2005) in declining order of numerical importance. Pastoralists in the district rely heavily on extensive livestock production as their principal livelihood. The majority of their wealth is held in the form of livestock (Barrett 2001) and virtually all their cash earnings come from either sales of livestock or livestock products (Little 1992; Coppock 1994; Amanor 1995; Desta 1999; McPeak and Barrett 2001; Barrett and Luseno 2004). In addition to their economic value, livestock, particularly cattle and sheep, also have a significant cultural value (Hogg 2003). As droughts, or periods of unusually low rainfall, are part of the expected pattern of precipitation in Turkana, the traditional strategy of pastoralists is to move to areas with higher rainfall, where both grazing and browse can usually be found in the dry season, and then return to traditionally drier areas when the rains arrive and both pasture and browse is renewed. The survival of their herds depends on the pastoralists' willingness and capacity to move (Blench 2000). According to Blench (2000), approximately 70% of the human population inhabiting Turkana are nomadic or semi-nomadic. In Turkana, systems of natural resource management primarily evolved around the common tenancy of land, organized for the efficient utilization of available resources, primarily for livestock herding (USAID 2002). Boundaries between different clans in Turkana have never been static and rigid but are fluid. As a result, survival is dependent on a web of good relationships that provide for sharing and collaboration. Finely honed strategies of herd splitting, opportunism, defensive capability and raiding to enlarge one's herd all have relevance as adaptive strategies for survival. There is no formal insurance, but informal social insurance (i.e. livestock transfers between herders). However, while livestock transfers tend to be redistributive, poorer households are less well insured *ex post* by livestock transfers than are wealthier households (McPeak and Barrett 2001). Migration is always negotiated between groups (USAID 2002) and often extends to South Sudan, Ethiopia and eastern Uganda (ITDG 2005). Pastoralists have to balance their knowledge of pasture, rainfall, disease, political insecurity and national boundaries with access to markets and infrastructure. They prefer established migration routes and often develop long standing exchange arrangements with farmers to make use of crop residues or to bring trade goods (Blench 2000).

## 1.2.2 Challenges of contemporary pastoralism in Turkana

Whilst pastoralism, as the principal livelihood, has existed in Turkana for 9000 years (Blench 2000), a series of rapid and external developments in the 20th and 21st centuries have tended to severely compromise long-distance opportunistic movements of livestock (Blench 2000). One such development has been the establishment of national frontiers; the relatively uncontested migration between what are now Uganda, Sudan and Ethiopia no-longer exists. The establishment of national frontiers has been further compounded by a spate of severe droughts throughout the past 40 years. These droughts have placed significant pressure on the livelihoods of nomadic pastoralists in Turkana, causing catastrophic losses of livestock (capital and savings). Drought was identified as the principal constraint to livestock-based livelihoods in Turkana by the majority of livestock producers and livestock traders interviewed as part of this study.

Furthermore, the impact of drought is particularly acute for poorer members of communities with smaller livestock holdings and less developed social support networks. The consequence is that droughts, combined with restricted migration options, now cause significant humanitarian problems and localized degradation of natural resources, since large numbers of animals converge on certain pastures, especially around wells. This in turn is responsible for long-term impoverishment among pastoralists, since they must sell animals cheaply and cannot afford to re-buy them when the drought ends. At the same time, it places extra stress on already ineffectual veterinary services, since weakened animals are more susceptible to pathogens (Blench 2000).

Spatial marginalization of pastoralists is another major present-day concern. Pastoralists are continually being pushed further and further into increasingly inhospitable terrain, with greater risks of climatic uncertainty, as technical advances allow agriculture and agro-pastoralism to spread into new areas traditionally utilized by nomadic pastoralists (Blench 2000).

Increasing human and livestock populations (see below for a full discussion) also add to the risky nature of nomadic pastoralism in Turkana by increasing pressure on progressively scarce and fragile natural resources (Berger 2003). This was exacerbated in the 1980s by the introduction of trypanotolerant breeds, trypanocides, enhanced veterinary care and the elimination of tsetse habitat (Blench 2000). Because pastoralism is geared to the reproduction of the herd there is inevitably a surplus of animals, such as most males and those females whose reproductive span is over, which can be disposed of without affecting the reproductive capacity of the herd (Hogg 2003). One of the inevitable consequences of this is that, without intervening factors, livestock populations will eventually exceed the capacity of the range to support them (Hogg 2003).

Ultimately, political constraints to livestock migration, an increased lack of pasture and water due to severe droughts, encroachment onto traditional dry season pasture by agro-pastoralism, and growing human and livestock populations has led to increased competition and less co-operation between tribal clans within Turkana, and, between neighbouring tribes, in Pokot (Kenya), Uganda, Sudan and Ethiopia.

When livelihood strategies fail, conflict and livestock raiding becomes commonplace and violence extends from rural to urban areas (Berger 2003). After drought and livestock diseases, insecurity was mentioned as the third most important constraint to pastoralists' livelihoods; it was particularly emphasized around Lokichar, Turkana.

Climatic shocks in the past two decades have pushed an increasing number of pastoralists deeper into abject poverty, prompting huge flows of international humanitarian aid into the ASALs (McPeak and Barrett 2001). With the exception of one or two notable interventions, national governments, international agencies and NGOs have traditionally responded to the problems faced by pastoralists in Turkana by putting into place food relief mechanisms. According to Blench (2000), these interventions resulted in maintaining unsustainable levels of human and livestock populations in the district. Blench (2000) insists that there is considerable historical evidence that pastoralists who could not succeed in difficult climatic conditions, or who lost their herds through disease, would simply leave the agro-ecological zone and become settled farmers or traders. This is a brutal but effective mechanism of reducing pressure on resources. However, the provision of food aid has the effect of keeping in place populations who would otherwise move and initiate a new subsistence strategy (Blench 2000).

### 1.3 Interventions into livestock systems

Since 1960s, there have been various relatively uncoordinated livestock development initiatives in Turkana, with regular livestock marketing interventions being implemented since the 1970s (ITDG 2005). During this time, the Livestock Marketing Division (LMD) of the Ministry of Agriculture acted as the principal buyer of livestock; most of the livestock were sold in Uganda (Ajele 2005). Unfortunately, most commentators agree that the majority of donor-supported and GoK led technical-based interventions of the 1960s and 1970s including range rehabilitation, water development, destocking, veterinary programs and livestock marketing interventions failed (Sandford 1983). These were primarily targeted at subsistence pastoral production systems with the objective of increasing productivity and controlling environmental degradation (Mwangi and Dohrn 2006).

Similarly, the state-led institutional interventions of the 1980s that focused either on nationalizing and/or privatizing drylands resources have been consistently described by

scholars and practitioners as 'dismal failures'. Yet again, these were targeted primarily at pastoralists. The outcomes anticipated by these top-down interventions, often perceived as the silver bullets to solve all problems, were not realized: pastoralists continue to 'overstock' beyond what external experts considered the 'carrying capacities' of rangelands and they continued to pursue, albeit at increasingly smaller scales, extensive livestock systems, shifting herds between wet and dry season pastures (Mwangi and Dohrn 2006). Furthermore, they sustained institutions that supported their production systems, which hardly bore resemblance to the state or market dichotomies that were imposed upon them. The silver bullet of land tenure reform that was intended to set in motion livestock destocking, increased market off-take and rangeland conservation missed its target (Mwangi and Dohrn 2006). In the 1980s, the LMD stopped buying and private traders took over (Ajele 2005). During this period, the European Union (EU) sponsored the Turkana Rehabilitation Programme (TRP) to address forage resource improvements and stock production and marketing. TRP constructed six livestock development centres at Kakuma, Lokwamosing, Lorugum, Kaikor and Lodwar to facilitate disease control and training of pastoralists (Ajele 2005). In addition, sale yards were constructed by ARID Lands in Lodwar, Lorugum, Lokori, Kalemngorok, Kaaleng, Lokichoggio, Kakuma and Lokichar (Ajele 2005).

In the 1970s, the GoK, through the then Ministry of Livestock Development, supported the development and management of sale yards. Through this effort, livestock marketing gained prominence. NORAD, the Norwegian Government, continued in the same vein throughout the late 1980s. The most recent initiatives have emerged from ALRMP I and II, VSF Belgium (TLDP1), ITDG and other agencies. Unfortunately, many of their efforts have not been sustainable for a variety of reasons including weak grass-root institutional foundations (ITDG 2005).

The development and sustainability of livestock markets and marketing activities have been a major challenge in the district as a whole. Like other development and support areas where external agencies have been involved in the district, the level of enthusiasm from the local pastoral communities has been low; the communities have viewed livestock marketing support and penetration as an external agents' intervention rather than an opportunity to actively contribute towards a significant improvement and sustenance of their livelihoods (ITDG 2005).

Currently, the marketing of livestock remains a challenge in Turkana. The district has 12 livestock markets represented by sale yards. They include Lodwar, Katapakin (Kerio), Lomil, Kalimnyang, Namuripus, Kakuma, Lokichar, Lokori, Kaaleng, Lorugum, Kalemngorok and Lokichoggio. However, not all these are fully functional and active. Only 40% of these centres have designated market days (ITDG 2005).

## 1.4 Structure and purpose of this report

The purpose of this report is six fold. First, Section One begins by setting Turkana within the much broader context of Kenya's ASALs. It attempts to demonstrate that, while embodying relatively distinct characteristics, the District of Turkana has much in common with many other districts in northern Kenya and other countries in the Horn of Africa. The introduction goes on to characterize traditional nomadic pastoralism in Turkana and concludes with a section on the changing character of nomadic pastoralism in the contemporary period.

Section Two is dedicated to the characterization of people and livestock in Turkana. It begins by attempting to determine the human and livestock populations in Turkana; something that is severely hampered by a lack of hard contemporary census data. Indeed, a significant part of the research effort associated with the compilation of this report dealt with the estimation and spread of both human and livestock populations in Turkana and an estimation of livestock numbers per household. This is followed by a section that attempts to estimate the livestock carrying capacity of distinct bio-physical zones (rangeland units). It was deemed important by the research team to first determine the number of livestock and pastoralists in Turkana and, second, to determine the most likely location of livestock at a given time of year, by using estimates of livestock carrying capacities, in order to assess the strengths and weaknesses of the livestock marketing system in Turkana. This work was closely supported by a parallel study that attempts to estimate changes in livestock pasture and browse and herd species composition in response to a range of climate change scenarios. The final part of this section introduces the reader to traditional livestock marketing systems in Turkana. The livestock marketing systems were characterized through an extensive literature review and field research in Turkana during the first quarter of 2006.

After the relatively general introductory sections, Section Three focuses specifically on the problems associated with livestock marketing in Turkana, including the subsistence focus of pastoralists, weak market infrastructure, structural inefficiencies and high transaction costs, low and variable producer prices, and the lack of political capital amongst both livestock producers and livestock traders in Turkana. Section Four is dedicated to characterizing contemporary livestock marketing in Turkana. It begins by outlining a relational typology of livestock markets in Turkana and then goes on to characterize the main markets and local demand. However, the principal part of this section focuses on a detailed characterization of livestock flows, both within and outside the district. Section Five contains a range of options/recommendations that have the potential to increase the number of pastoralists profitably accessing livestock markets in Turkana. Some recommendations are simple, but costly to implement, others are complex and would require piloting before they were scaled up throughout the whole district. Section Six outlines pressing research needs required to

better understand livestock marketing issues in Turkana. This section stresses the need for quality research to underpin rational and sustainable interventions in livestock marketing in Turkana. It addresses the need to fill key knowledge gaps, namely the need for a better understanding of the impacts of recently introduced livestock markets (including the AMREF meat processing plant), the role of livestock disease management in profitable livestock markets, the potential role of women in livestock marketing, and the transitional process from subsistence to market-oriented livestock production and consumption.

## 2 People and livestock in Turkana

### 2.1 Estimating the human population

Much of the data available for Turkana is aggregated and/or has been extrapolated from censuses conducted many years ago. The last population census conducted in Turkana was in 1999, and gives populations by sublocation. According to the District Statistical Officer in Turkana, between censuses, figures are adjusted by 3.3% annually to reflect natural growth.

However, there are numerous population estimates available from a range of development-based organizations working in Turkana. While some only indicate small differences, others, such as an increase of 56 thousand inhabitants in Nadapal subdivision of Kakuma, ostensibly based on UNHCR estimates of the population in refugee camps, are significantly different. The research team decided to use available digital data for the 1999 census (total population 386,572) and increase it linearly by 3.3% per annum up to 2006, which equates to a total human population in Turkana of 469,713. The resulting figures were used to create the population density map by subdivision in ArcView, which is presented on page 11. Of the 74 thousand or so households, an estimated 64 thousand households own livestock (as will be explained in the next section).

It should be noted that, by extrapolating the 1999 data linearly to 2006, with a uniform population growth rate, the relative densities (that were valid in 1999) become even more pronounced. However, relative migration (internal displacements) and mortalities (due to shocks), which may be very different between subdivisions, are not reflected. Unfortunately, in the absence of a more recent census, an extrapolation of the 1999 census figures was deemed as the most sensible way to proceed. Only in the section about consumption demand for livestock do we acknowledge the increased population of Kakuma, due to the growth of the refugee camps.

Within Turkana District, there is a clear concentration of people around the main transport route. The main road entering Turkana from Kitale and West Pokot connects the principal towns of Lokichar, Lodwar, Kakuma and Lokichogio (which are also the 4 main livestock markets). Also, a higher concentration of people can be observed along the Turkwel River (coming from West Pokot, and crossing the main transport route at Lodwar, heading east into Lake Turkana). An important spill-over effect of the construction of a hydro-electric dam on the border between West Pokot and Turkana District is the regulation of water flow in the Turkwel River. This resulted in Turkwel River receiving a relatively constant flow of water (even in the dry season). Conversely, Kerio River, in the southeast of Turkana, is also a perennial river but is subject to significant fluctuations in water flows. Turkwel River cannot only supply livestock with drinking water, but also has more irrigation schemes that can



produce forage. Consequently, its river banks have a relatively high population density. There are also higher concentrations of people in Lokitaung Division and along the shore of Lake Turkana (Kachoda, Lowarenyak, and Kalokol). It must be noted that urban centres significantly skew subdivision population densities, notably, Lodwar, Kakuma, Lokichogio and Kalokol (on the Lake).

## 2.2 Estimating the livestock population

Based on an aerial count, the most recent livestock census in Turkana was conducted in 1998. Unfortunately, only the district aggregates of these livestock figures are available. These official livestock figures (Table 1) are adjusted yearly by the district livestock and veterinary officers based on expert knowledge of the area to reflect growth or mortalities. For instance, Table 1 demonstrates that, after the drought of 1999, sheep, goat and cattle numbers in Turkana were adjusted downwards by 25%, while camel numbers fell by only 5%. In subsequent years, the rains were perceived to have been reasonable to good and the herds recovered, until the present drought (2005–06). It can be expected that these figures will be adjusted downwards again. In the case of severe droughts, notably 1976, mortality rates in the district can be as high as 70%. After the 1991/92 drought it was reported that 30% of cattle and 25% of shoats died (AGSEC 2000). In a proportional pilling exercise conducted with a focus group of pastoralists in the Lougogo Adakar (near Lorugum), their perception of respective mortalities during the drought of 2004–05 was: Sheep 52%, goats 50%, donkeys 33%, and camels 14%. Whilst the drought of 2004–2005 has been acknowledged as severe, the research team believes that these estimates could have been exaggerated, as the respondents realized that we were on an evaluation mission that would inform the design of future interventions.

## 2.3 Estimating livestock ownership per household

Average herd size per 'livestock keeping' household in the district was estimated in the following manner. Estimates of the number of households in Turkana (73,762) were based on the 1999 census. As the estimation of livestock ownership in urban centres was problematic (as some households owned livestock and others did not), households from the five most populous towns (i.e. those with more than 1500 households) were arbitrarily omitted from the calculation (a total of 10,107 households). All the remaining households (63,655) were assumed to own livestock. This concurs with the estimated of 19,600 individual smallholders and 43,900 pastoralists, both in 1987, as enumerated in Table 5.1 (page 160) of the Rangeland Handbook.

**Table 1. Livestock Population in Turkana District (1993-2005) and growth rates (%) applied in livestock projections\***

Table 1b

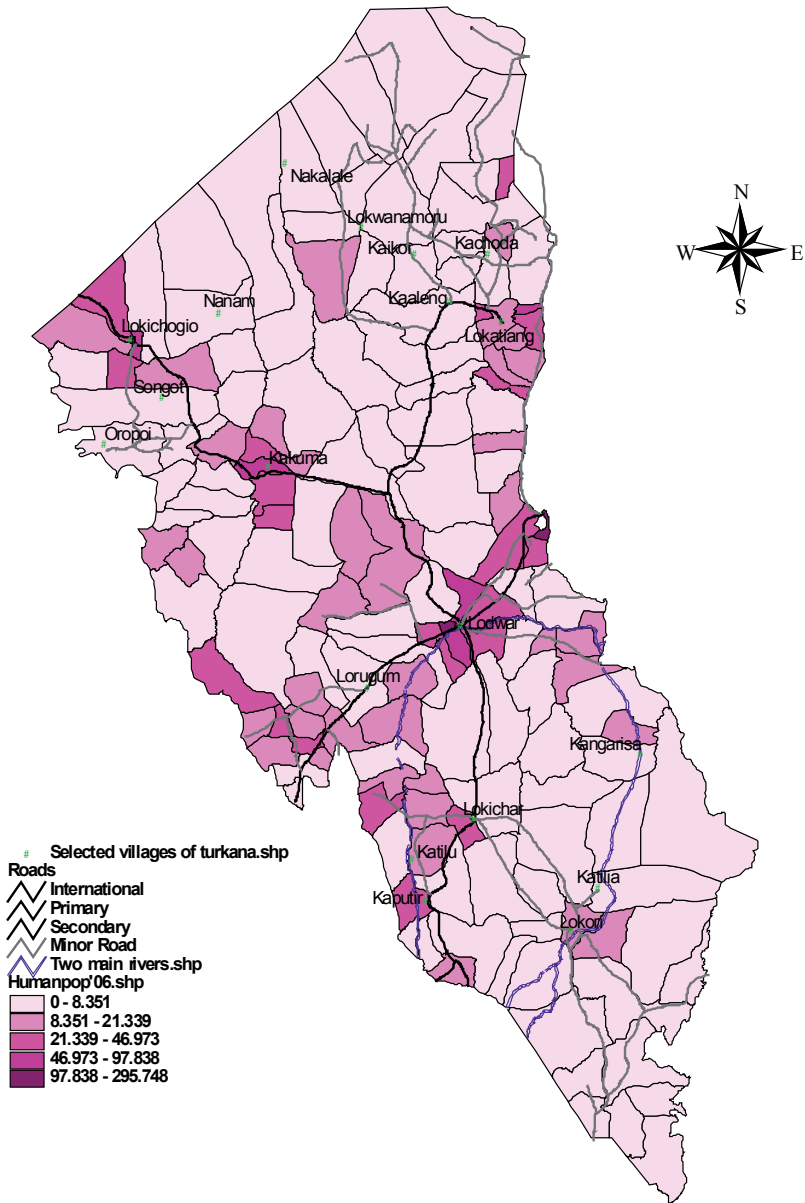
Quality of annual rains

Year	Shoats	Sheep	Goats	Cattle	Camels	Donkeys	Rains Seasons	Quality Judgment
1993	1,267,880	N/A	N/A	153,350	63,153			
1994	2,130,000	N/A	N/A	165,000	94,000			
1995	2,566,000	862,000	1,704,000	198,000	112,800			
1996	2,683,000	894,333	1,788,667	201,960	114,492			
1997	2,750,000	916,667	1,833,333	200,000	115,230			
1998	2,750,000	916,667	1,833,333	200,000	115,000			
1999	3,252,150	1,084,050	2,168,100	234,420	144,960			
2000	2,439,000	813,000	1,626,000	176,000	138,000	32,000	Long	poor?
2001	2,439,000	813,000	1,626,000	176,000	138,000	32,000	Short	?
2002	2,926,800	975,600	1,951,200	193,600	140,760	32,640	Short	good?
2003	2,926,800	975,600	1,951,200	193,600	140,760	32,640	Long	good?
2004	3,075,400	1,054,400	2,021,000	197,900	172,400	35,160	Short	too short?
2005	3,075,400	1,054,400	2,021,000	197,900	172,400	35,160	Long	mediocre?
							Short	failure

Section: 'Range Condition and Trend'

Source: MoL&DF, Turkana District, Annual Reports 1993-2005

\* The last livestock census was conducted in 1988 (based on an aerial count); since then the figures have been readjusted periodically, based on the perceptions of the District's Livestock Officers.



Map 1. Human population densities in Turkana District.

Spreading the 1999 livestock figures over these 'livestock keeping' households, the average number of livestock kept is: 4 cattle, 17 sheep, 34 goats and 2 camels, as presented in Table 2. This means that, on average, people keep twice as many cattle as camels (2:1); for every 1 head of cattle there are 13 shoats (1:13); and for every sheep there are 2 goats (1:2). When discussing this with the feedback forum in the validation workshop, they agreed more or less with regards to the sheep, goats and camels, but added that cattle are only found in a few areas (mainly in the north) where most owners have 'an average' amount of cattle and only a few individuals own very large herds of cattle.

**Table 2.** *Estimated livestock-herd per household*

	Cattle	Sheep	Goats	Camels
Livestock population 1999	234,420	1,084,050	2,168,100	144,960
Average household-herd	3.7	17.0	34.1	2.3
Number of pastoralist households estimated: 63,655				

For each of the households keeping livestock, shoats are more popular as they are cheaper to accumulate and keep; for every one head of cattle kept, there are about 15 shoats (ITDG 2005). This herd composition was broadly corroborated in the adakar Focus Group Discussions (FGDs) undertaken as part of this study. With the exception of the Kakongu Adakar (Kalemngorok), who identified cattle, the majority of pastoralists in adakar FGDs ranked goats as their principal livestock. Goats were perceived as being fast breeding and easy to sell and, unlike cattle, were appropriate for less affluent adakars. Elders from the smallest adakar represented in the Kerio adakar FGD stated that 'it's a question of what you can afford ... We have no cattle because we have not received any dowry for a long time: maybe God only gives you boys' (Kerio adakar 2006). Lastly, pastoralists from the Kanakurdio FDG indicated that they had kept cattle until the 1980s but had been forced to abandon them due to severe drought and had chosen to increase the number of more drought tolerant goats.

Assuming that most livestock is owned by pastoralists and that they are more or less uniform in wealth, we derived the average herd composition as presented in Table 3. Negligible differences in the average number of livestock per household were noted when using data from 1999 census compared to the 2005 adjusted livestock figures. Both suggested that an average herd would consist of approximately: 6% cattle, 30% sheep, 58% goats, 5% camels (and maybe 1% donkeys). Table 3 notes that several other sources suggest similar herd compositions. However, at this stage it must be noted that herd sizes and species composition vary by Division. As described later, due to differences in vegetation (forage biomass production), higher than average numbers of cattle are found in the north of the

district (Lokichoggio), while below average numbers of cattle are found further south (e.g. Lorugum).

**Table 3.** *Herd composition (%) according to different sources*

Source	Location	Cattle	Sheep	Goats	Camels	Donkeys
Official 2005 figures	Overall Turkana	6%	30%	58%	5%	1%
Official 1998 census	Overall Turkana	6.5%	30%	60%	3.8%	–
AGSEC 2004 <sup>1</sup>	Near Lokichoggio	18%	33%	39%	1%	9%
University of Nairobi <sup>2</sup> 2004	Near Lokichoggio	24%	25%	32%	14%	6%
ILRI 2006 <sup>3</sup>	Near Lorugum	–	25%	44%	18%	13%

1. AGSEC consultants report for AMREF (June 2000); Table 2.2 Herd Composition in Lokichoggio area of Turkana.

2. Consultancy report for Terra Nuova–AMREF, April 2004; Data from proportionate pilling at Aposta (near Lokichoggio) .

3. Data from this research, proportionate pilling in Lougogo Adakar.

As livestock population figures in Turkana are aggregated at a district level, official statistics did not inform us of where the livestock are. In order to understand local markets and make sense of livestock flows, some idea of how the livestock is divided within Turkana was required. In the next section, ‘carrying capacities’ are estimated in different rangeland units. In the contemporary period, the calculation of livestock carrying capacities in arid and semi-arid rangelands is a highly controversial undertaking (Behnke et al. 1993; Sneath 1993; Behnke and Kerven 1994; Niamir-Fuller 1995; Niamir-Fuller 1998; Niamir-Fuller 1999; Ho 2000; Fernandez-Gimenez 2002; Banks 2003). Hardin’s (1968) tragedy of the commons thesis now stands challenged. Indeed, a cross section of scholars have demonstrated that pastoral strategies of herd diversity, flexibility, mobility are rational and crucial for survival in erratic environments (Baxter and Hogg 1987; Ellis and Swift 1988; Westoby et al. 1989; McCabe 1990; Behnke and Kerven 1993; Scoones 1994; Niamir-Fuller 1998, 1999; Lamprey and Reid 2004). However, whilst we acknowledge the value of such observations, in the absence of hard evidence to the contrary, it is assumed that livestock is spread between areas according to relative livestock ‘carrying capacities’.

## 2.4 Livestock carrying capacity

To compute the livestock carrying capacities for Turkana, we drew extensively on the Range Management Handbook of Kenya (Vol. II, 9—published by GTZ/MALDM 1994). The handbook subdivided Turkana into 25 range units, which were defined as: ‘areas of reasonably uniform ecological potential for their use as rangelands, i.e. rangelands which are roughly similar with regard to altitude, precipitation, soils and vegetation.’ Hence, the range units boundaries were delineated on the basis of the major land form and primary vegetation types.

For each range unit, the handbook gives an inventory of land forms, vegetation types, water supply (distance to water), median rainfall, and estimated biomass production. Furthermore, recommended stocking rates (Ha/Tropical Livestock Units) were computed based on the following factors:

- Permanent Accessibility Factor (PAF) expresses the accessibility (rate) of land by livestock, to compute the accessible forage biomass;
- Permissible Off-Take (POT, % of forage biomass) to ensure that overgrazing, degradation of vegetation and long-term changes in the botanical composition of the pastures are avoided;
- Erosion Status Factor (ESF) an expression of the erosion status, by which the permissible off-take is adjusted;
- Range Condition Factor (RCF) an expression of average range condition, by which the estimated potential stocking rates are further adjusted.
- Accessible Forage Biomass is the total forage biomass produced multiplied by PAF;
- Utilizable (Permissible) Forage Biomass off-take is derived by adjusting the accessible forage biomass by the POT (when dealing with the shrub layer) and subsequently with POT and ESF (for the herb layer);
- 'Optimal number of grazing days', defined as the number of days per season when adequate quantities of forage with an adequate nutrient density are available to the animal, to cover their nutrient requirements for maintenance and production from the available pasture. This is different for each animal species as they have a different metabolism and also feed on different vegetation. For example, cattle feed exclusively on the herb layer, where quality deteriorates most rapidly after the end of the rainy season.
- Animal requirements, expressed as kg of dry matter forage per TLU per day. For the livestock to achieve a maintenance plus production level, they were: cattle 6.4 kg; sheep 7.9 kg; goats 7.3 kg; camels 7.3 kg.

For each livestock species, a maximum stocking densities (ha/TLU) was calculated with the information above. Roughly speaking, it can be summarized by the calculation:

$$\text{Forage need (kg/TLU)} \div \text{forage availability (kg/ha)} = \text{max stocking dens (TLU/ha)}$$

Forage need was calculated by multiplying animal requirements with the optimal number of grazing days, while forage availability was arrived at by multiplying the utilizable forage biomass by the Range Condition Factor (RCF). At this stage we highjacked the approach and went a few steps, and assumptions, further (see Annex 1). First the total land area of each range unit was divided by the maximum stocking densities (at maintenance + production level), to arrive at 'carrying capacity on accessible land during optimal grazing days' (in TLU). Note that the inaccessibility of some parts of each rangeland has already been accounted for in the calculation of the maximum stocking densities per ha. The resulting figures were converted using the handbooks definition of TLU: 250 kg of live weight, or 1.0 head of

cattle, 10 sheep, 11 goats or 0.7 camels. Next, we made a **drastic assumption**: that the same amount of forage biomass consumed during these optimal grazing days could be spread throughout the year. So we multiplied the respective livestock numbers with the number of ‘optimal grazing days’ and divided it by 365 days in a year, resulting in ‘year round carrying capacities’ per rangeland unit. The sum of all these carrying capacities, i.e. for the whole land area of Turkana, is given in Table 4.

**Table 4.** Non-additive ‘carrying capacities’ per species of livestock for Turkana

	Brief peak capacity		Year round capacity	
	(In TLU)	(No. of animals)	(In TLU)	(No. of animals)
Cattle	2,643,936	2,643,936	293,795	293,795
Sheep	1,381,176	13,811,756	237,475	2,374,749
Goats	871,666	9,588,328	227,569	2,503,255
Camels	752,557	526,790	228,003	159,602

It should be noted, however, that these stocking densities per species are *not* additive as the animals all compete for the total forage biomass produced on each rangeland. Moreover cattle and sheep use the herb layer competitively, while goats and camels compete for forage in the shrub layer.

We realize that due to the *drastic assumption* we made, these are most certainly over-estimates of the true carrying capacity of Turkana District. Moreover, we have included the vast area of Kibish in our calculations (see annex 1), which has inflated the overall capacity.

We now compare these carrying capacities with the official livestock figures (Table 1). While keeping in mind that these capacities are not additive, cattle and sheep both compete for herbs while goats and camels both compete for shrubs. Let us for simplicity's sake assume that they share the capacity equally. Working on this assumption, the collective rangelands could hold: 146,898 cattle; 1,187,375 sheep; 1,251,628 goats; and 79,801 camels. We can see in Table 1 that cattle have long since exceeded this amount (but they could have borrowed some herbs from the lower numbers of sheep) while camels only exceeded the 80 thousand mark in 1994. Goats and sheep, collectively referred to as shoats, reached their collective capacity (2.44 million) in the year 2000. The different species of livestock (Table 1) had reached their (individual) carrying capacities by 1995. Consequently, the sum of all livestock already grossly exceeded the overall carrying capacity by the end of the 1990s. Looking at the official livestock figures for 2005, even if we were to assume that no further ecological degradation has taken place since 1994 (when this rangeland data was brought together)—in other words, the carrying capacities have not gone down, and the livestock population has grown since then—we should conclude that Turkana today must be heavily overstocked.

## Comparing carrying capacities per hectare

Notwithstanding all the caveats in our approach to obtain carrying capacities in the previous section, even if the absolute figures would not make sense, we can now at least compare the theoretical carrying capacity of the 26 areas of Turkana (25 original rangeland units + Kibish which we have added). As the range units' capacities largely depend on their size, in order to compare between their biological features (vegetation and rainfall) we first computed the average 'carrying capacity per ha' for each range unit (Annex 2a). To ease the comparison we then converted these into percentages—relative to their overall sum. [Note that the overall sum of individual capacities per ha has no significance whatsoever.]

Our calculations demonstrate that the north has a higher livestock carrying capacity than the Centre and south, particularly with respect to cattle and sheep. This is also true for some ranges of hills along the western and southern borders in contrast to the eastern side on the shores of Lake Turkana. This can be explained by differences in the vegetation and higher rainfall patterns.

In the north and northwest, the rangelands best suited for cattle and sheep (in order of importance) are: Songot-Mogila; Kibish; northern Lotikipi Plain and Oropoi. Songot-Mogila, Oropoi and Kibish may also hold an equally high amount of goats and camels. Further south in the district, our theoretical model suggests that the Silalei and Tiat mountains and Naroo have relatively high carrying capacities for all livestock species, while Suguta Valley is relatively well suited for cattle and sheep. In the west of Turkana, the (Lodwar-) Lorugum Area is suggested to have a high carrying capacity for cattle and sheep, while Lorengippi has a higher carrying capacity for goats and camels.

### 2.4.1 Projected livestock populations per rangeland unit

The next, and more reasonable assumption we made, is that Turkana's livestock is effectively spread according to the relative carrying capacities of the rangelands. The only 'but' to this assumption is that because of insecurity and raids, some pastoralists are displaced and so are the livestock they travel with. If they moved into already overstocked areas, this would have reduced the growth rate (or increased mortality) of their herds. Hence these should ideally be reflected in the overall livestock figures.

Assuming that our assumption is reasonable, we finally multiplied those 'relative carrying capacities' (%) with the official livestock population figures to obtain a projection of where the livestock might be today (see annex 2b). The resulting projected livestock numbers per rangeland unit are presented in Map 2.

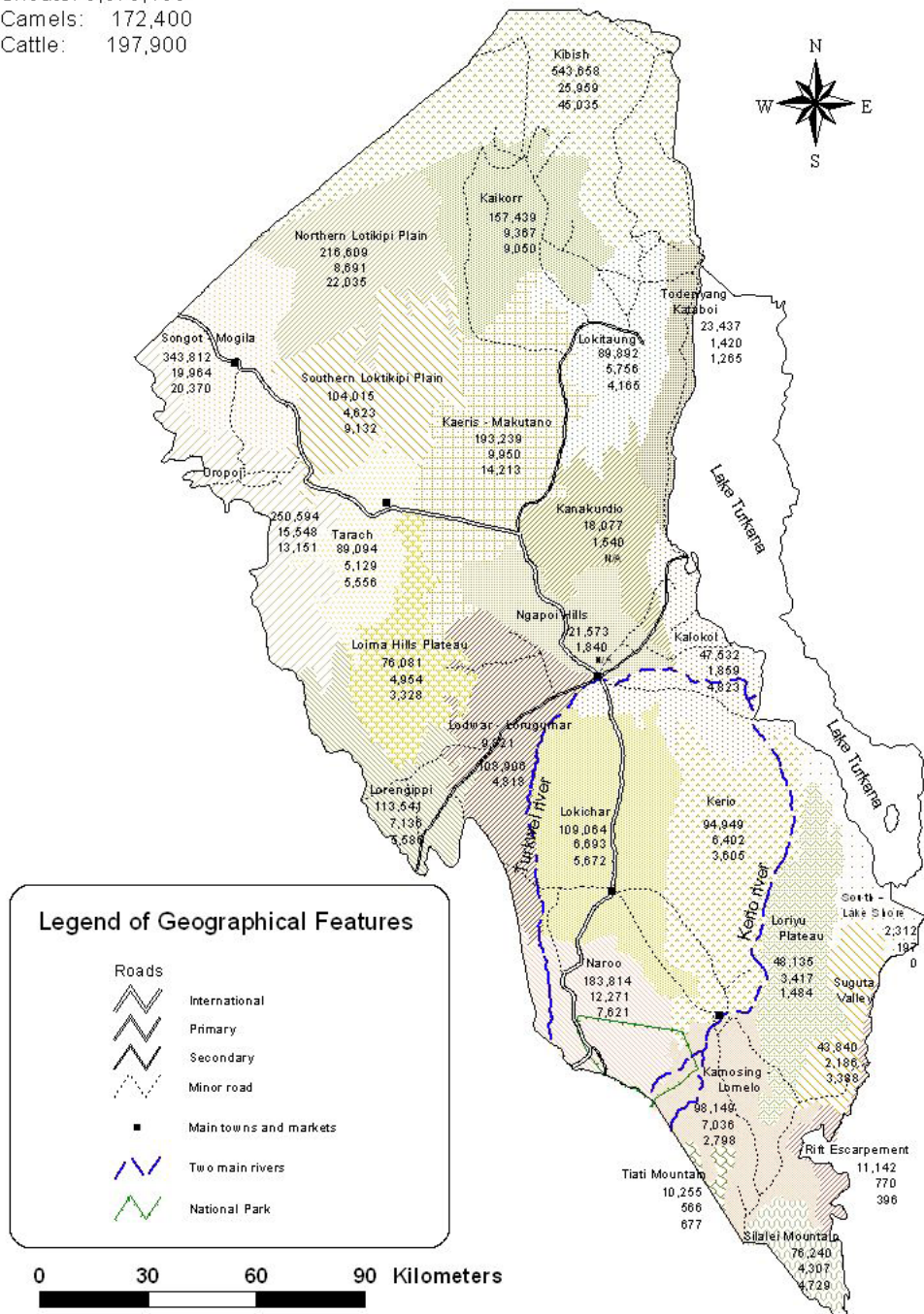


Livestock spread according to estimated carrying capacities, totals equal the official MoLD&F (2005) livestock figures:

Shoats: 3,075,400

Camels: 172,400

Cattle: 197,900



Map 2. Projected shoats, camels and cattle per rangeland unit of Turkana District.

## 2.5 Characterizing traditional livestock use/marketing systems in Turkana

In general, pastoralists in Turkana are predominantly subsistence based and rarely sell their livestock. The primary aim of most pastoralists is to enlarge their herd size. Keeping a large herd is not merely a question of status, but is associated with the need to accumulate livestock assets to act as a dowry or as a drought coping strategy (maintaining sufficient breeding stock to rebuild their herd). Fundamentally, it is also associated with a lack of better alternative investment opportunities. Hence, although from an 'economic' point of view it would seem rational for them to sell their livestock before an anticipated drought, when they would fetch a higher price for reasonably healthy livestock, this does not happen in practice. In general, pastoralists do not often slaughter livestock. We were informed in FGDs and by key informants that some would only slaughter a shoat (sheep or goat) once or twice a year. The demand for meat principally arises in the major towns; it is here that the livestock sold by pastoralists in need of cash finds its way. Only a very small portion of the livestock trade in Turkana is exported outside the district. Livestock has been identified as a key household asset in low-income, high-risk production settings, where they are used to buffer consumption against income shocks (Binswanger and Rosenzweig 1986; Bromley and Chavas 1989; Dercon 1998; Fafchamps 1998; Fafchamps et al. 1998; Kinsey et al. 1998). These 'buffer stock' models hypothesize that livestock purchased as a store of wealth in unexpectedly high income years are sold to buffer consumption in unexpectedly low income years (McPeak 2004).

When pastoralists sell their animals it is mainly to meet urgent household needs (ITDG 2005). Usually, urgent needs equate to food (maize and maize flour), tobacco, bread, medical or school fees, and shoes and clothing. Most of these cash needs can be covered with the sale of a few goats (or sheep) (ITDG 2005). For example, pastoralists from an adakar near Lokichar only sell goats in the dry season. Two are sold for the first two months; one goat is sold in the third month (all goats so far are used to buy maize and maize flour) and one goat in the fourth month. One goat is also slaughtered for home consumption in the fourth month. Only when they are really hungry, and haven't eaten meat for a long time, will they slaughter a camel.

Larger stock, and particularly cattle, are hardly ever sold/marketed, as the pastoralists love them very much and only sell them in case of an extreme need for more cash. Camels are also an important source of milk, and breeding camels are very expensive to buy and have a high cultural value (ITDG 2005); hence a pastoralist would avoid selling female camels at any cost. Sheep are occasionally used for home slaughter (mutton is considered a delicacy), used as a 'treatment' for some human ailments, used for some traditional rituals or given

as gifts. In addition, a small number of pastoralists use livestock markets for self-restocking (McPeak and Barrett 2001). According to Barrett et al. (2004), the strongest correlate of livestock marketing is herd size, suggesting that preserving or restoring the viability of large herds is the single most important factor in stimulating livestock marketing expansion (Barrett et al. 2004).

The principal mode of exchange is barter, particularly in the northeast of the district (ITDG 2005). In our interview with the DLPO, he stated that ‘Somalis informed pastoralists in Kaleng etc. that, while they may receive cash, they can’t buy food and tobacco from Lodwar LMA traders’. The Somalis bring key goods that are demanded by pastoralists and barter them (at extortionate rates) for goats and cattle. When Somalis buy goats etc. in the north of Turkana they move them directly to Nairobi’. As the pastoralists are not well informed about the market value of their livestock, they are easily exploited. Some shop owners also fulfil the role of itinerant traders, offering barter or cash interchangeably. Traders are involved in barter trade and operate retail shops from which they exchange foodstuffs and tobacco for small stock. However, these traders are generally blamed for exploiting the pastoralists as the ‘exchange rates’ are generally low and highly skewed. These traders are in touch with secondary and primary market traders (ITDG 2005). It is apparent that where barter trade is predominant in the area, the exchange of stock is done with food such as maize and/or maize meal. The exchange rate is to the disadvantage of the pastoralists. In the drought cycle and in particular during emergency situations, the exchange rate for a grade one goat is equivalent to KES 400–600 (ITDG 2005).

Itinerant interior traders also operate in the secondary markets (ITDG 2005). Whoever buys livestock from the interior needs to trek them to the nearest market. In doing so, they incur the risk of losses due to theft or disease. Some pastoralists choose to bring their own livestock to the nearest market, particularly if the market is nearby. Although they may be aware of better livestock prices at the market, they are often prevented from achieving these prices by the machinations of trader cartels. Traders await them on the trekking route before reaching, or on arrival at, the market and badger livestock owners into selling the livestock to them before reaching the market. Failure of the pastoralist to sell stimulates the ‘cartel trader’ to spread the word at the local market that this individual livestock owner is hard to deal with and should better be left alone. We failed to verify whether this is a real threat, or just intimidation that sufficiently impresses the pastoralists (personal communications).

There are four principal parallel livestock marketing systems operating in Turkana, namely:

1. Mobile/itinerant traders that venture into the interior and barter with pastoralists for small numbers of livestock. Itinerant traders trek their livestock to either secondary or primary markets, where they are re-sold to local butchers or larger traders who then

resell outside the district (ITDG 2005). Many itinerant traders buy livestock (mainly shoats) and combine them with their own stock for between 2 and 12 months before selling them in primary markets such as Kakuma, Lokichogio and/or Lodwar. Stock is kept to gain weight and/or to sell when market prices are good (ITDG 2005). Through FGD data, it was possible to capture a diversity of insights into itinerant trade in Turkana. First, our studies suggested that itinerant trade is still an important mode of livestock marketing. However, none of the adakars that took part in our FGDs indicated that sales to itinerant traders were their principal mode of marketing livestock. Most adakar-level responses suggested that while livestock were sold to itinerant traders, livestock were also taken to secondary and primary markets. However, it must be noted that the areas visited by the research team were located in Central and southern Divisions of Turkana and had been subjected to several years of market development initiatives. Furthermore, for reasons of security and constrained vehicular access, the research team did not interview adakars more than 20 km off secondary roads; responses from adakars deep in the interior may well have painted a very different picture. The principal explanation for limited livestock sales to itinerant traders was that sellers were aware of the market prices in secondary and primary markets and wouldn't sell their goats for less. Pastoralists perceive itinerant traders to be exploitative (University of Nairobi 2004). Responses from pastoralists from Kerio suggested that the local market was the principal mode of livestock sales. Kaaleng and Kalemnarok adakars, where no one sold to itinerant traders, were notable exceptions. In the case of Kaaleng, the lack of sales to itinerant traders was explained by the fact that itinerant traders did not venture to Kaaleng. In the case of Kalemnarok, pastoralists explained that all their livestock sales occurred in the local markets. Ironically, LMA members from Kalemnarok expressed that livestock traders' sourced livestock deep in the interior on foot, bringing beads etc., with which to barter. In general, livestock traders suggested that they rarely ventured into the interior to buy goats, as most sellers bring their goats to the market.

2. Direct sales to butchers and shop/kiosk owners who deal with a range of consumer goods. In this marketing mode, pastoralists deliver their livestock directly to butchers and shops in exchange for cash or barter goods. Butchers tend to be the main local buyers of livestock (mainly shoats). In Lodwar alone, there are more than 10 butchers, each handling at least a single shoat carcass/day. In Kakuma, 5 butchers were identified (ITDG 2005) (and a multitude of 'butchers' in the refugee camps). In Lokichogio, there are 8 butchers (ITDG 2005). However, according to ITDG (2005), pastoralists risk disease and theft when using this mode of marketing. There is also a significant amount of informal livestock sales undertaken within the settlements. Unfortunately, the focus of this study did not allow for a detailed examination of this mode of marketing.

3. Middle-level traders purchase livestock from pastoralists at secondary markets, and occasionally venture into the interior (ITDG 2005), and deliver them to primary markets. LMA traders from Lokichar indicated that they ventured as far as Lokori market (68 km), either trekking with the goats or using mechanized transportation. Trekking was the principal means of reaching Lokori. Middle-level traders also act as brokers between sellers at the primary markets and out of district buyers. These traders including butchers account for more than 80% of players in livestock trade. Nearly all these traders are members of livestock traders' groups in their respective areas (ITDG 2005). Livestock transactions tend to be negotiated on a face-to-face basis at designated sale yards. It is deemed to be the preferred mode of marketing by pastoralists (University of Nairobi 2004). However, few of the middle-level traders have the financial and knowledge capacity to access and function in terminal markets.
4. Out of district traders, mainly of Somali and Borana origin, visit the principal markets of Lodwar, Lorugum, Lokichar, Kerio and Kakuma and purchase trailer-loads of livestock for the Nairobi market (ITDG 2005). This is a cash-based mode of marketing.

## 3 Problems associated with livestock marketing in Turkana

### 3.1 Subsistence orientation of pastoralists

The pastoralist way of life is based on socio-cultural norms and practices and not the rationality of market-based capitalism; there was little or no cash in traditionally pastoralist societies. Strong cultural ties bind pastoralists to their extended families and their livestock. As Hogg (2003) suggests, 'it is a peculiar characteristic of pastoral capital that it can reproduce itself without intervention of any market mechanism'. When internal and external forces (such as conflict and drought) threaten their livelihoods, they draw upon their significant social capital, and an intimate knowledge of their livestock and environment, to redress or at least reduce these threats.

While markets for livestock, based on elaborate networks of traders and middlemen, have long been a feature of African pastoral systems, including those of northern Kenya, (Kerven 1992), exchange of livestock for goods has traditionally been undertaken on a barter basis. Indeed, members of the Kerio LMA suggested that pastoralists had only been exposed to the cash economy for the last 10 years or so. Whilst the bartering of livestock for maize and other staple grains, blankets and other key goods and services still exist in the contemporary period, the cash economy is slowly beginning to establish itself. Livestock, particularly goats are sold so that the vendor may pay school, hospital fees etc. However, while the growing presence of the market is acknowledged, there is substantial disagreement between researchers and development practitioners as to the extent which market relations have penetrated the pastoralist livestock economy in Turkana and other districts in northern Kenya. Markets for livestock exert considerable influence over pastoralist livelihoods by establishing the value of their assets and by affecting herd management decisions (Barrett 2001). However, in a later paper, Barrett et al. (2003) suggested that the literature on east Africa reveals consistently low marketed off-take rates, 1.5 and 3.5% of beginning period cattle stocks among Borana pastoralists since 1980, with off-take rates less than mortality rates every single year (Desta 1999). Similar off-take rates have been observed in the Chamus and Gabra (Little 1992; McPeak and Barrett 2001). However, it is acknowledged that off-take rates vary significantly between districts. For example, Mwangi (2005) suggest off-take rates are as low as 5.7% in Turkana, compared to 14.6% in neighbouring Marsabit.

Of the livestock offered for sale in Turkana, sheep and goats are the most important species, most being consumed within the district (Mwangi 2005). There is also a noticeable gender imbalance in the livestock offered for sale. As reported by Coppock (1994) and Desta (1999), female animals constitute less than 33% of the livestock sold; this is corroborated by Barrett (2001) who suggest that females comprise only 20–30% of animals sold in any species or market (McPeak and Barrett, (2001). Accordingly, this reflects pastoralists' preference to

retain females of breeding and milking age and to sell males when there is a need (Coppock 1994; Desta 1999). Another important point to note is that the lack of market-orientation of pastoralists in Turkana often leads to exploitative terms of trade (whether bartering or exchanging for cash) when they do sell their livestock (Mwangi 2005).

One of the key arguments put forward to explain the lack of market integration is that of absence of other, more attractive, investment opportunities (Barrett et al. 2004). Even if pastoralists are persuaded to sell livestock and bank the cash received from sales, they watch their savings being slowly eroded by exorbitant banking fees. However, in studies conducted by Barrett et al. (2004), households that held bank accounts were actually slightly less likely to sell animals than those without bank accounts. According to Barrett et al. (2004), this reinforces the hypothesis that livestock sales are largely in response to immediate cash needs, which bank account holders can meet through financial savings rather than liquidation of livestock (Barrett et al. 2004). Formal banking institutions in Turkana are few and very far apart, although there have been some recent attempts at introducing micro-financial institutions and mobile banks into rangeland communities. Banking seems more accessible or attractive to wealthier pastoralists (McPeak and Barrett 2001). In addition, due to the altruistic tendencies of the Turkana, those families accumulating surplus capital are continually beset by claims from family and friends, something the Turkana find difficult to ignore. Lastly, even if non-livestock based enterprises are present, they themselves are usually very risky investments.

Another key argument forwarded is that, while high losses can occur due to drought and other natural and man-made calamities, maintaining a large herd remains the best investment available in the ASAL today (Hogg 2003). The strategy of herd stabilization and accumulation was reiterated in adakar-level FGDs. This sentiment is admirably summed up in a quote from an adakar close to Lokichar, 'nobody can or wants to 'finish' his farm: nobody can sell all his animals'. In addition, even in the grip of drought, most pastoralists interviewed revealed that they held onto their livestock as they expected that the rains would eventually come (Gebru and McPeak 2004). While the tendency of pastoral households to accumulate livestock has been attributed to cultural factors (Herskovits 1926) or common property tenure arrangements (Jarvis 1980), there is growing awareness that herd accumulation is a rational self-insurance strategy to follow in an uncertain production environment (Sandford 1983; McPeak and Barrett 2001; McPeak 2003). Assuming that periodic herd die-offs are inevitable in this production environment, and expected post crisis herd size is an increasing function of pre-crisis herd size, herd accumulation is an effective risk management strategy followed by pastoral households (Gebru and McPeak 2004). Ultimately, larger *ex ante* herds provide an effective, albeit costly, means of insuring sufficient herd size *ex post* (McPeak and Barrett 2001).

The complex property rights and social safety nets that pervade in Turkana also seem to dampen livestock sales (Osterloh et al. 2004). As with the claim on surplus cash by family and friends, livestock are often given or loaned to family and friends during times of need through a non-market mechanism (Barrett et al. 2004).

## 3.2 Lack of market infrastructure

In terms of infrastructure development, Turkana's livestock sector is fundamentally underserved by both Local and Central Government, particularly the northeast of Turkana (ITDG 2005). Mandated support for such essential infrastructure as holding grounds, watering facilities, roads and sale yards is spartan, if not completely absent. For example, the only good road in Turkana is the one between Lodwar and Lokichoggio. Other roads in the district are generally poor and often impassable when it rains. Poor roads have the impact of increasing costs when transporting livestock throughout the district. According to ITDG (2005), stock destined for distant terminal markets take up to three days on the road due to poor road conditions, and transit requirements (ITDG 2005). In addition, poor road infrastructure also impedes the control of livestock diseases and cattle rustling (Ajele 2005).

Where market facilities do exist, pastoral communities often lack adequate management capacity and financial resources to properly manage them (ITDG 2005). Lodwar and Kakuma, where the sale yards are well used and maintained, are notable exceptions. This lack of market infrastructure, particularly sale yards, has continuously been identified in independent studies and by Turkana pastoralists as a major constraint to livestock marketing (McPeak and Barrett 2001) in Turkana (ITDG 2005). Furthermore, according to VSF-Belgium (2006), livestock marketing is severely curtailed because big buyers won't venture into the interior because of poor roads and insecurity. In the absence of livestock markets, pastoralists wanting to sell livestock are obliged to trek long distances during which their animals lose condition, and may become sick and die, or be stolen (Ajele 2005). In addition, most of the livestock markets in pastoral areas are dyadic. This means that the process of exchange involves one-to-one negotiations between buyers and sellers (Barrett 2001). This usually leads to the seller receiving a relatively low price for his livestock compared to other more transparent and competitive systems of exchange, such as auctions.

Collapse in 1987 (AGSEC 2000) of the Kenya Meat Commission (KMC) at Athi River, Nairobi, and the assured livestock markets and stable prices (Lotira 2000) it provided, destabilized livestock markets in Kenya, particularly more peripheral livestock producing areas, such as Turkana, with poor market infrastructure, high transaction costs and limited political influence. Livestock marketing in Turkana has been further undermined by continued ineffectual nature of the Livestock Marketing Division (LMD) (ITDG 2005). With the collapse



of KMC and liberalization, especially in veterinary service provision, the private sector has assumed a central role (ITDG 2005). The private sector now dominates the livestock marketing in Turkana and is responsible for the bulk of investment. In an effort to support the development of livestock marketing in Turkana, ALRMP, VSF-Belgium and other actors have played a key role in initiating Livestock Marketing Associations (LMAs) as well as developing their capacities. The LMAs comprise livestock traders and other related players. Already, these LMAs are actively involved in management of sale yards (developed by ALRMP and VSF-B), and coordinating safe marketing of stock in collaboration with the provincial administration (ITDG 2005). Turkana District has LMAs in all 12 functional markets.

### 3.2.1 Lack of institutional capacity

Despite the measures described above that have been deployed in attempts to redress the situation, a lack of institutional capacity (ITDG 2005) is often blamed for the poor management of livestock sale yards and for the demise of livestock markets, particularly after donors have discontinued their support. In some cases sale yard committees and pastoral associations are non-existent. In attempts to redress this weakness, ALRMP II, VSF-B, and the MoL and FD have supported the establishment and capacity building of LMAs and District Livestock Marketing Council (DLMC) (ITDG 2005). The DLMC was, and continues to be, supported by ALRMP and key NGOs including VSF-Belgium and AMREF (ITDG 2005).

## 3.3 Structural inefficiencies and high transaction costs

Structural inefficiencies and high transaction costs include: high transport costs; insecurity; fees, taxes and corruption; the influence of trader cartels and market brokers and; a lack of market information.

### 3.3.1 High transport costs

According to Little (2000), transport costs can account for as much as 70% of market transaction costs. Indeed, Mwangi (2005) insists that high, and constantly increasing (ITDG 2005) transport costs significantly affect market performance and efficiency. Livestock transporters often avoid using poor roads due to the high costs of vehicle maintenance. Where transport is available, it is often too expensive for traders to utilize (ITDG 2005). Indeed, as alluded to earlier, out of district traders tend to avoid many livestock markets in the district, especially those in the interior, due, in part, to the poor road infrastructure and the high costs associated with transporting stock to Nairobi and other markets. Currently, there are no incentives to attract traders into the interior. According to AMREF, it costs KES 250 to 300 to transport one goat from the markets in the northeastern Turkana to Nairobi (Dr Ernest Njoroge, AMREF, personal communication). However, according to ITDG (2005),

the cost of transporting a goat from Turkana to Nairobi is even higher; approximately half its value (KES 410; KES 55 thousand for a truckload of 135 goats) (ITDG 2005). This is compared to the cost of transporting a goat from Moyale to Nairobi, which is KES 180 to 220 (personal communications; Mike Wekesa–Acacia Consultants). Transporting cattle from Turkana is even more expensive. According to ITDG (2005), the cost of transporting a single cow/bull can be as much as KES 2500 (ITDG 2005) (KES 55 thousand for a truck load of 22 cattle). Long journeys also incur higher livestock losses, both mortalities and loss of condition (ITDG 2005).

According to ITDG (2005), it is a challenge for Turkana stock to be economically marketed in major terminal markets especially if they have to be trucked as live animals. A study by Tufts University on the cross-border livestock trade between South Sudan (Narus and Natinga—areas which border Turkana District) and Nairobi indicated that the proportion of transportation cost in the marketing margin varies between 0.07 and 0.48 per kilogram live weight for cattle (ITDG 2005); the higher the ratio, the lower the margin, the greater the disincentive to trade. For shoats, the ratio is relatively higher since the live weight per capita is lower (ITDG 2005), and so is the amount of meat—relative to bones—transported. Hence, a truck load of goats is less profitable than a truck load of cattle. As a result, livestock movement by truck is only undertaken in the primary markets of Lokichoggio, Kakuma, Lodwar and Lokichar, and is generally restricted to the transportation of livestock to terminal markets outside Turkana (ITDG 2005). Aside from a few traders from Lokichar and Lodwar who have private trucks, most of the traders rely on trucks on return trip from contract delivery to Lokichoggio and other areas. The road linking Lodwar and Eldoret is generally poor. Where the trucks have to access interior towns to collect stock such as Lokitaung and Kaaleng, among others, the roads are generally in poor state and the wear and tear increases hence forcing the transport owners to impose high charges (ITDG 2005).

For traders willing and able to afford transport, costs are high. The cost of hiring a truck to transport 200–300 goats (or approximately 35–40 cattle) to Nairobi ranges from KES 70 thousand to KES 80 thousand. In 1998, the cost was only KES 40 thousand. Conversely, the transporter interviewed in Lodwar indicated a cost of KES 65 thousand for the transportation of 250 goats (in the 13 t lorry) to Nairobi; he declined to divulge the cost of hiring his 15 t lorry that can carry 300–350 goats. LMA members from Kalemnarok also quoted the cost of hiring transport to move livestock to markets in Kenya's Western Province. Accessing Bungoma and Chwele cost the LMA KES 40 thousand, while accessing Bomala and Busia cost KES 50 thousand/lorry. Both Kerio and Kalemnarok LMAs were insistent when indicating that transportation costs swallowed the largest share of the profit. Ultimately, traders associations do not have the savings or access to credit to buy a truck of their own.

In addition to the movement of livestock both within, and primarily outside, Turkana by lorry, livestock, particularly goats, are also transported by 'bush taxi'. Most adakars and LMA reported that they occasionally used this mode of transport. Indeed, the research team was occasionally asked to provide transportation for traders with one or two goats. It was reported that, for example, a bush taxis might cost KES 150 per person and KES 70 to 80 for his/her goat.

Ultimately, trucking livestock is not a common activity. According to ITDG (2005), on average, only one truck of livestock is exported from Turkana per week. However, recent export figures suggest that in 2004 each week at least 1 truck of shoats and 1 truck of cattle were exported from Turkana, while in 1998 it would have been 3 trucks of goats and 2 trucks of cattle (using figures in Table 9, assuming one truckload can carry 300 shoats or 25 cattle). Remarkably, LMA-traders from Lokichar reported that they currently export 2 lorries of shoats a week—which we expect will be reflected in the 2006 export figures.

In attempts to keep out of pocket transaction costs low, trekking is still a preferred mode of transport, especially to secondary and primary markets. Unfortunately, due to the considerable distance and security risks, this mode is inappropriate for moving livestock between Turkana and Nairobi (ITDG 2005). This mode of livestock movement was corroborated by adakar and LMA FGDs. Some pastoralists suggested that their livestock are often trekked long distances to markets. Indeed, pastoralists from Lorugum stated that they still trekked livestock to Kakuma, Lokichoggio or even Kitale. They explained that they had no money to hire transportation. Pastoralists from Kaaleng informed the research team that they often trekked as few as three goats to Lodwar (a 6 day trek) or Kakuma (a five day trek), eating local fruits on the way.

### 3.3.2 Insecurity

Insecurity is also suggested to significantly impede livestock production and marketing (ITDG 2005). Livestock have long been subject to raids from other ethnic groups, and other clans within ethnic groups. The threat of raids poses big risks to livestock traders (Barrett et al. 2004; Ajele 2005) and producers (Ajele 2005). Insecurity is the major constraint to developing Ugandan markets (Elimlim and Ameripus 2004), including the huge potential of Moroto market (ITDG 2005). Insecurity is particularly acute in northeastern Turkana, where pastoralists contend with frequent strikes and cross-border cattle rustling from neighbouring countries (ITDG 2005). Though the GoK has ensured that home guards back up security, the situation remains unstable. Because of insecurity, transporters have several no-go zones. Indeed, the transport operator interviewed in Lodwar suggested that, in recent history, one of his lorries had had its tyres shot out by bandits, a lorry on route to Kitale was shot at on two

occasions, and, in 1999, one of his drivers was shot. Transport costs become even higher if security escorts are required (Ajele 2005). Insecurity contributes to the dearth of large-scale buyers (ITDG 2005). The district has less than 15 major livestock traders buying and trucking livestock as far a field as Nairobi (ITDG 2005). The number of terminal market traders operating in Turkana is minimal. When they do venture into Turkana, they generally offer low prices, as they have to shoulder security-related risks. When the risks are high, traders are unwilling to pay good prices for livestock (ITDG 2005). Pastoralists are also deterred from trekking to distant markets, such as Kakuma, where they expect to receive higher prices. Interestingly, it is not just the difficulties associated with transporting livestock that impedes livestock marketing in Turkana. Many traders are obliged to create innovative informal systems to transfer money or make substantial cash payments. The risk of transporting large amounts of cash across long distances from northern Kenya to Nairobi and vice versa, has long been recognized as problematic (Mahmoud 2003).

Insecurity was also noted as a key impediment to livestock marketing in both the adakar-level and LMA FGDs undertaken as part of this study and in a similar study undertaken by ITDG (2005); out of every 10 livestock producers, 7 reported increasing insecurity necessitated close proximity to markets (ITDG 2005). Indeed, LMA members from Kerio insisted that they needed to carry firearms when trekking goats to Lokichar. Lodwar LMA members suggested that concern over security was a major stimulus to the original establishment of the LMA. Before the establishment of the LMA, many animals were stolen after being purchased. Ironically, on route to an adakar near Lokichar, one of the few places where the FGD failed to identify insecurity as a major impediment to livestock production and marketing, the research team found two herdsmen sleeping with their firearms hidden under a blanket.

### 3.3.3 Fees, taxes and corruption

High GoK fees and taxes were identified as another significant, and unjustified, source of marketing costs. Local county councils collect revenue from sale yards, slaughter slabs, and from livestock hides and skins trade licences (Mwangi 2005). In Turkana in particular, the local authority (LA) owns the areas in which sale yards have been developed and therefore charges a user fee, which is collected on behalf of the LA by the respective LMAs. In Lodwar, a fee of KES 30 per goat is levied, of which KES 20 goes to the local authorities and KES 10 goes to the LMA. In Kerio, the LMA charges KES 30 for a goat and KES 50 for large livestock, of which KES 10 goes to the LMA and KES 20 goes to the local council. In Lokichar, the LMA charges a commission on livestock sales of KES 20 for a goat and a KES 100 for a camel; there is no council tax. Other infrastructure owned by the LA includes loading ramps and slaughterhouses. Disappointingly, however, there is no evidence of direct involvement of the LA in either the provision of market information or direct coordination/organization of

livestock markets; this is a continuous source of disagreement between local authorities and livestock traders in Turkana (ITDG 2005). Beyond the borders of Turkana, livestock traders transporting stock to Nairobi and other terminal markets are required to pay cess fees in each LA area that they pass through. According to ITDG, this type of taxation is a deterrent to livestock trading. In addition, the market authorities charge market fees at the destination market in Nairobi (ITDG 2005). Not surprisingly, the level of taxation associated with formal livestock marketing encourages livestock trade outside the designated areas. This mode of business was most preferred by the traders (Mwangi 2005). Likewise, problems are also experienced when (Barrett 2001) LMAs attempt to collect revenues from their members, and the DLMC attempts to collect revenue from LMAs.

In addition, livestock traders incur unnecessary/unexpected expenses while transporting livestock to the market and also at the target market (Lotira 2000). This is another factor that is suggested to reduce market performance and efficiency; particularly unauthorized levies charged by law enforcement officers (Mwangi 2005). For example, Saidi, the transporter based in Lodwar, suggested that he budgets KES 5000 per lorry load of livestock, for bribes along the way. He stated that police bribes are usually between KES 50–100.

### 3.3.4 Buyer-driven livestock marketing chains

#### Trader cartels

Promoted by concerns over insecurity and high transaction costs, trader cartels are a significant feature of livestock marketing in Turkana and the source of both much criticism and praise. While trader cartels minimize transaction costs and, accordingly, promote significant trade, it continues to be argued that market exclusions and distortions may outweigh the positive contribution of these cartels (Barrett et al. 2004). Trader cartels are generally delineated along ethnic lines but also display distinct characteristics based on wealth, age (Hussein 2001) and language skills. It is suggested that more than 95% of livestock trading partnerships are among members of the same ethnic group (Barrett et al. 2004); this is particularly evident in cattle market chains. Hussein (2001) suggests that as the trade in sheep and goats requires less investment, and has fewer risks, there are fewer actors and less need of personal and individualized trader network interactions than that for the cattle trade. The Burji, Boran, and Gabra appear to numerically dominate the cattle market chain (Hussein 2001) in northern Kenya (Marsabit) and southern Sudan; the Boran are suggested to constitute 20% of the livestock trading community (Hussein 2001). It is presumed that many of these network interactions are conducted on a highly personal and individualized basis. Trader networks span the entire marketing chain from production centres in the southern Ethiopian rangelands to the main terminal markets in Nairobi (Hussein 2001). Livestock traders in the region engage in different types of social networks

to better confront the risks and uncertainties imposed by poor dissemination of market information, a weak market infrastructure, insecurity, and highly volatile livestock prices (Hussein 2001).

Wealthy cattle traders are more likely to enter into personalized trading relationships than are poorer traders. In particular, wealthy Borana traders of southern Ethiopia often have strong networks with Kenyan traders even to the extent that informal credit is provided without collateral security. It is estimated that, 81% of livestock traders use informal networks to secure capital; only a minority use the formal banking system (Hussein 2001). Traders often rely on personal and informal means to secure resources. Hussein (2001) reported that, only 19% of traders in northern Kenya used a formal bank account to move money. The majority tend to rely on ethnic-based social networks for cash transactions and holding savings. The dominance of informal forms of credit access and cash transfers has important implications for cattle trading in northern Kenya (Hussein 2001). Importantly, this practice facilitates sales and movement of goods across the Ethiopian/Kenya border. In case of default, social mechanisms are in place to facilitate cash recovery. These mechanisms thus lower risks for lenders (Hussein 2001). Wealthier traders are key players because wealth promotes their ability to mitigate substantial risks of volatile prices, insecurity, poor information, and a weak infrastructure (Hussein 2001). Likewise, older traders may be more successful because of their experience and higher degree of capital accumulation to buffer themselves against marketing risks (Hussein 2001). Traders in general have a high fluency in several languages, and this may help them to bridge potential barriers related to ethnicity, especially in cattle marketing networks (Hussein 2001). The most successful traders have considerable language skills, which bridge ethnic groups (Hussein 2001).

### Market brokers

Brokers are part of most markets. Brokers are often used by both buyers and sellers to find clients and they receive a fee for doing so (Barrett et al. 2003). Market brokers are prevalent in certain cattle markets, especially in Nairobi, that are dominated by ethnic trader cartels. In Nairobi, key markets, particularly Kariobangi market, Kayole market and Njiru market (both part of the Dandora Complex), are dominated by brokers and are notoriously difficult for other tribes to penetrate Lotira (2000). According to Lotira (2000), market cartels (ITDG 2005; Mwangi 2005), demarcated along ethnic divisions, account for the poor links that exist between Turkana traders and brokers in Nairobi, which often translate into poor market performance and efficiency, specifically slow livestock disposal.

Fortunately, Dagoretti market in Nairobi, which deals with 10 lorry loads per day of cattle, mainly from Rift Valley, is serviced by multi-ethnic brokers and poses no problem for

Turkana brokers Lotira (2000). In addition, cattle can be transported here from Turkana, without contravening CBPP quarantine restrictions, as no animals leave the sale yard without being slaughtered Lotira (2000). Unfortunately, the number of small stock at this market is negligible. Other terminal markets, including Bungoma and Busia markets in western Kenya, have weak cartels/brokers and offer less resistance to the penetration of Turkana traders Lotira (2000).

However, according to our own investigations, market brokers and the trader cartels with which they operate extend to other livestock species, namely goats, and to several primary markets in Turkana, notably Lodwar. Indeed, some key stakeholders in Lodwar go as far as suggesting that 'the market in Lodwar is 'wasted' by brokers that pay very low prices, buying at KES 1200 to resell for KES 1700 to the Boran. However, feedback from our FGDs with LMAs was mixed. In Lokichar, LMA members suggested that they were able to negotiate fair prices and had no problems with external traders/brokers. Indeed, LMA members sold their goats in Kariobangi market, Nairobi. Lokichar traders insisted that they worked/negotiated with the Borana traders and stressed reciprocity in their relationship. They insisted that Borana traders welcomed Lokichar traders because Lokichar traders welcomed Borana traders. In Kerio, whilst LMA members believed that they were shielded from making higher profits in Lodwar and Nairobi, they received a fair share of the profit (approximately 50%). Kerio LMA members went even further by saying that they 'did not know Borana traders but wanted to get to know them and do business with them'. On the other hand, LMA members from Lorugum insisted that buyers were killing the market. They went on to say that external buyers offered as little as KES 200–300 for healthy goats. Lodwar LMA members complained that they were unaware of livestock prices in Nairobi because the Borana try to block them from the market in Nairobi by keeping the market information strictly for themselves.

### 3.3.5 Lack of market information

A lack of market information, and early warning of climatic adversity (ITDG 2005), has been cited on many occasions as a significant impediment to market performance and efficiency (ITDG 2005). According to Barrett et al. (2004), in less-favoured lands, poor communications and marketing infrastructure can create enormous informational disparities among buyers and sellers in the same location that can easily persist over the course of several hours (Barrett et al. 2004) and can contribute to low producer prices (Ajele 2005). Indeed, according to Barrett (2001), the high cost and risk of livestock trading across space arises due to poor communications. Most producer price risk arises due to local market institutions and poor information flow that often leaves pastoral sellers at a significant disadvantage *vis-à-vis* the traders (Barrett 2001). Ironically, poor market information can, on infrequent occasions, result in livestock prices being higher in Turkana than in a terminal market such as Nairobi,

specifically if the Nairobi livestock markets are flooded with livestock. Significant market variations in prices are often recorded in northern Kenya. For example, cattle sold in Moyale can fetch 27% more than those sold in Marsabit during the same period. Likewise, the mean camel price in Moyale can exceed the mean camel price in Marsabit by 71%. This cannot be explained purely in terms of transport costs. Indeed, the most likely explanation is poor spatial market integration (Fafchamps and Gavian 1996; Barrett et al. 1998; Bailey et al. 1999; Teka and Gebremariam 1999).

In many instances, market information is by word of mouth from those who have recently sold livestock. Whilst many pastoralists have a reasonable idea of livestock prices in local secondary and primary markets, most pastoralists have no knowledge of terminal market prices and will almost accept whatever price they are given. During the adakar FGD in Kerio, pastoralists stated that, whilst they were aware of livestock prices in Lodwar, only the Boran know market prices outside Turkana. Pastoralists from the Kaaleng adakar suggested that 'people who know market prices in Nairobi are those with the money and connections to organize large purchases of goats'. Occasionally, pastoralists are even unaware of where their livestock will be ultimately sold and consumed.

Conversely, LMA members from Kalemnarok and Lorugum had a rough idea of high season goat prices in terminal markets such as Nairobi, Nakuru and Eldoret. LMA members from Lokichar went further by insisting that they were in constant touch with fellow traders who sell in Nairobi, and they regularly receive up-to-date market information. Conversely, LMA members from Kerio suggested that a weekly bulletin of prices and volumes would be very useful, as they were unaware of goat prices in Nairobi. They suggested that they did not know when Borana traders were expected in Lodwar; they only realize Boran traders are buying in Lodwar when transportation arrives in Kerio and traders buy many goats. Kerio LMA traders expressed that a lack of market information was a major constraint to marketing livestock. Perhaps this phenomenon is a feature of Kerio's recent introduction to cash-based livestock marketing. However, one thing is for sure: Kerio is a classic example of the power of cartelization of marketing in the district.

As an important and interesting counterpoint, Luseno et al. (2003) suggested that a lack of price and climate information does not appear to limit pastoralist livestock marketing. Luseno et al. (2003) suggest that, on average, pastoralist households received livestock price information from two sources: primarily from livestock traders but also from informal information networks. In the Kenyan part of the study, in Marsabit District, approximately 45% of households checked livestock prices every few days and 80% checked their primary source of livestock price information at least every few weeks. In short, pastoralists in Marsabit (the district neighbouring Turkana) seem to have good enough access to climate and price information through existing channels and lack of information does not significantly



limit marketed off-take (Barrett et al. 2004). While the study appears to have been comprehensive, these findings are completely contrary to those we found in Turkana District.

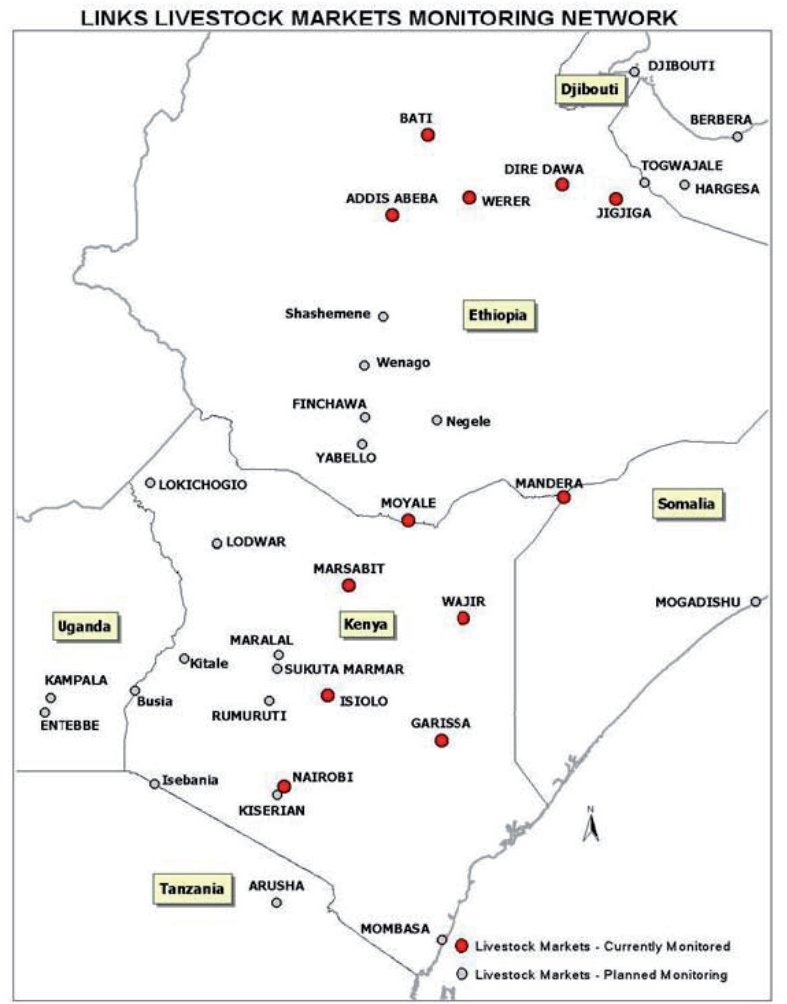
The need of pastoralists for a comprehensive livestock information system focusing on markets, forage conditions, disease incidence, water supplies and conflict hotspots has been identified by all major governments, NGOs and international agencies within eastern Africa (Jama et al. 2004). In response to this need, the USAID Global Livestock Collaborative Research Support Program (GLCRSP) funds a project titled 'Livestock Information Network and Knowledge System (LINKS) for Enhanced Pastoral Livelihoods in east Africa' led by Texas A&M University (TAMU) since October 2003. The main objective of LINKS is to help put together an appropriate ICT toolkit to ensure that the rural communities in eastern Africa are able to access and maximize the benefits from the new information technologies by integrating them into the livestock marketing programs for each of the partner country. The goal of the project of the LINKS/GLCRSP is to design and deploy an equitable livestock marketing information system that uses the cutting edge of the available ICT to provide regular and sustainable livestock price/volume information in eastern Africa along with information on forage conditions, disease outbreak, conflict and water supply to support livestock producers, traders and decision making at multiple scales (Jama et al. 2004).

LINKS, as a regional project, seeks to spearhead the establishment of a standardized and unified regional livestock market information system (LMIS) which is not only suitable for the needs of traders, producers and policy makers of the individual countries but also has relevance across national borders (see Map 3).

### 3.4 Lack of cash, cash savings and access to credit

A lack of cash and/or access to credit is a major impediment to livestock marketing in Turkana. Middle-level traders often complain about having inadequate capital, while itinerant traders complain about having no cash (Ajele 2005). This tends to restrict the number and type of livestock that itinerant and small-scale middle-level operators can trade at any given time (ITDG 2005). This situation is compounded by the fact that Turkana District lacks financial institutions (ITDG 2005); the formal banks or micro-finance institutions that are represented in the district often do not have confidence in livestock traders (ITDG 2005). In turn, livestock traders' constrained capital base lowers the bargaining power of the pastoralists (ITDG 2005).

LMA members identified the lack of credit as a major impediment to livestock marketing. LMA members from Kalemnarok stated that they had considered buying a 13 t truck to carry 300 goats for KES 15 million but were unable to access credit. In addition, they complained that where credit is available, interest rates can be 10% or higher.



**Map 3.** Livestock markets monitored in eastern Africa.

Source: Barrett et al. (2004).

In Lokichar, LMA members revealed that no formal credit was available; only credit within family groups. Occasionally, depending on the quality of the relationship, transporters were willing to accept payment for transportation after goats had been sold. Interestingly, LMA members suggested that, if credit was available, it would be used to establish kiosks as well as to purchase livestock (all species). Again, only informal credit provision was available in Kerio Division. The lack of working capital was also identified as a major constraint to marketing livestock. Lastly, Saidi, one of the principal transporters based in Lodwar, revealed that he had tried to access credit but that KCB required too much security (transport log-book and house deeds). He stressed that, if necessary, loans would be acquired in Mombasa. Saidi has considered using his own money to buy and transport goats from Lodwar to

Mombassa (Kikoawani), particularly on January 5th (religious ceremony) when demand for, and prices of, goats is high. Otherwise, he considers that buying and selling goats is not his core business. This position may have been influenced by the fact that his father had lost money buying, transporting and selling goats in Nairobi; this was allegedly due to the Borana cartel at Kariobangi market.

### 3.5 Low and variable producer prices

Problems of low and variable producer prices for livestock rank among the most widespread and serious concerns of pastoralists in the region (Barrett 2001). Indeed, markets exacerbate rather than ameliorate the biophysical risk livestock producers' face (Barrett 2001). In good rainfall years, prices are both high and stable, while in drought years they are low and volatile (Barrett 2001). Low and variable producer prices are suggested to prevail due to several factors, namely: limited throughput capacity of livestock markets; the relative high cost of Turkana livestock; poor transport infrastructure; insecurity; lack of commercial orientation of pastoralist; oversupply in dry seasons, and; poor quality of livestock and poor livestock disease control.

Limited throughput capacity has been identified as a principal contributor to volatile prices (Fafchamps and Gavian 1996, 1997; Bailey et al. 1999). This problem can be due to a lack of sellers, a lack of buyers or a combination of the two. Where the density of buyers and sellers is great, theory suggests that daily trading volumes and prices would be relatively stable, *ceteris paribus*, compared to other markets where the density is low (Barrett and Luseno 2004). Newly established markets continually face extraordinary price volatility due to low throughput capacity, which, in turn, is suggested to dampen market participation rates (Barrett and Luseno 2004). The high cost of Turkana livestock has been put forward as yet another explanation of low and variable livestock prices. Several studies have suggested that, when compared to other livestock markets, Turkana livestock is too expensive for distant traders to make profit. Though the price in the towns visited for a grade one goat was as low as KES 600 to 1000, it was apparent that producers often quoted KES 1800 to KES 2200 as the market price. The refugee camps in Kakuma have played a key role in pushing up expected prices. The prices are in contrast to KES 1500 to KES 2000 for the same sized goat sold in Nairobi. According to ITDG (2005), when they undertook a comparative analysis of market prices in Nairobi and Turkana, they discovered that the average price per kilogram of meat in Lodwar, Kakuma and Lokichoggio was KES 200, compared to between KES 90 to 160 in Nairobi (ITDG 2005).

According to Barrett (2001), poor infrastructure, and insecurity, increases the costs and risks of livestock trading, particularly in remote areas. In turn, this reduces the number of buyers

venturing into the interior and the frequency of their visits. When buyers do venture into the interior, they extract a significant risk premium from pastoral suppliers (Barrett 2001). Prices can be forced even lower if pastoralists are unaware of the cost of livestock in both secondary and primary markets (Mwangi 2005).

Livestock price volatility is also highly correlated with the seasons; livestock prices are low during dry season, when supply is high (Ajele 2005) and higher in the rainy seasons when supply is low. Moreover, market demand and supply depends in part on pastoralists' seasonal liquidity demands associated with the periodic payments of school fees, seasonal increases in grain prices and pastoralist demand for grains as milk supplies decline and on seasonality in terminal market demand (Barrett et al. 2003). Price volatility is also affected by livestock quality (ITDG 2005), breed, age, size, and castration (Andargachew and Brokken 1993). Livestock condition/quality is, in turn, affected by the lack of coherent disease control in the district (ITDG 2005). Livestock health services in the district remain inadequate and quite often livestock producers are unable to improve the health of their stock due to lack of cheap or affordable drugs, inadequate drug use knowledge and information (ITDG 2005). Nevertheless, Turkana goats are preferred by traders in Nairobi, because of their tender meat (Lotira 2000)

## Culmination of effects

As a consequence of the above, price signals originating in destination markets due to demand shocks or policy interventions may transmit to satellite markets only noisily, if at all (Barrett and Luseno 2004). Low and variable producer prices are among the most serious concerns of pastoralists and partially explain the extremely low marketed off-take rates (Barrett et al. 2003) among ASAL pastoralists, which typically languish between 1.5 and 3.5% of beginning period cattle stocks, appearing rather unresponsive to variation in mortality risk or rangeland carrying capacity (Bailey et al. 1999; McPeak and Barrett 2001; Smith et al. 2000, 2001; Barrett et al. 2003). Low prices are the most important concerns of pastoralists (Smith et al. 2000, 2001). Pastoral communities living in the northeast find themselves highly marginalized due to low pricing for livestock (ITDG 2005).

## 3.6 Lack of political capital

### 3.6.1 Livestock quarantine

Quarantines are a significant source of price risk in that they reduce expected livestock prices received by pastoralists (Barrett et al. 2003). Quarantine erects barriers to trade by impeding commerce and thinning markets in pastoral regions. These effects not only exacerbate risk but also cause substantial revenue losses for herders. Though the effects of

quarantine upon livestock prices at terminal markets in Nairobi are negligible, Barrett et al. (2003) find significant negative effects on the prices received and the price variability faced by pastoralists. Pastoralist producers absorb the price shock created by quarantines, simultaneously insulating both Nairobi consumers and protecting highland ranchers. Persistence of quarantine restrictions, particularly Contagious Bovine Pleuropneumonia (CBPP) quarantine, makes it difficult for Turkana traders to sell cattle in western Kenyan markets. Livestock trade impediments due to quarantine are even harder to accept as markets in western Kenya are not dominated by brokers (Lotira 2000). The district has been under permanent CBPP quarantine since the colonial times (Ajele 2005). The Kenyan Government enforces a continuous screening requirement for all livestock moving from the northern rangelands (unless they are destined for immediate slaughter at Dagoreti market, Nairobi) (Lotira 2000). Animals must be held and tested; this process can take up to three months and ties up more than the transactional capital possessed by cattle traders and is a major deterrent to trading live cattle. It is, however, a significant incentive to bribe officials (Barrett et al. 2003). The ultimate impact of quarantine restrictions is that, since pastoralists are generally much poorer than highland beef consumers or highlands ranchers in Kenya, 'quarantines are a distributionally regressive means of animal disease control, wherein the poor pay the costs of benefits born largely by wealthier citizens' (Barrett 2001). It is suggested that highland ranchers continue to promote livestock quarantines for protectionist reasons. Restrictions, due to CBPP, CCPP and Lumpy skin diseases, have severely limited sales of livestock to dairy producing areas (Ajele 2005). According to Barrett et al. (2004), pastoralist livelihoods would be improved by the removal of outdated quarantine restrictions.

With the introduction of the Structural Adjustment Programmes in late 1980s, the Kenyan Government hastily privatized animal health services in Turkana, as well as other ASAL regions. Due to these changes, it has not been possible to ensure disease-free zones in the pastoral areas including Turkana (ITDG 2005). Indeed, according to ITDG (2005), the privatization of animal health services has inhibited livestock marketing in Turkana due to falling livestock quality (ITDG 2005). ITDG (2005) suggests that if a concerted effort had been made to achieve a borderless Disease-Free Zone (DFZ) for livestock in the region, livestock trade in Turkana would have quickly expanded. Animal health care capacity in the district has recently been promoted through the establishment of Community-based Animal Health Workers by ALRMP and VSF-B. AMREF is also supporting training of veterinarians on a basic course and providing start-up kits for selected practitioners on an interest-free credit system in the north. ITDG has also developed the capacity in ethno-veterinarians who provide animal health support, which facilitates improvements in livestock quality and hence price. However, there is little acceptance of these private animal health providers in Turkana due to the expectation of the government among the pastoralists to provide these services at either subsidized rates or for free (ITDG 2005).

# 4 Characterizing contemporary livestock markets in Turkana

## 4.1 Relational typology of markets in Turkana

Figure 1 illustrates the relational typology of main and secondary markets in Turkana. Each main market has several secondary markets, where livestock are sourced and transited (usually by foot) to the main markets. Together, these secondary markets and the pastoral areas that supply them can be regarded as the ‘catchment areas’ of the main markets. These catchment areas are discussed below, together with tables estimating volumes of livestock traded.

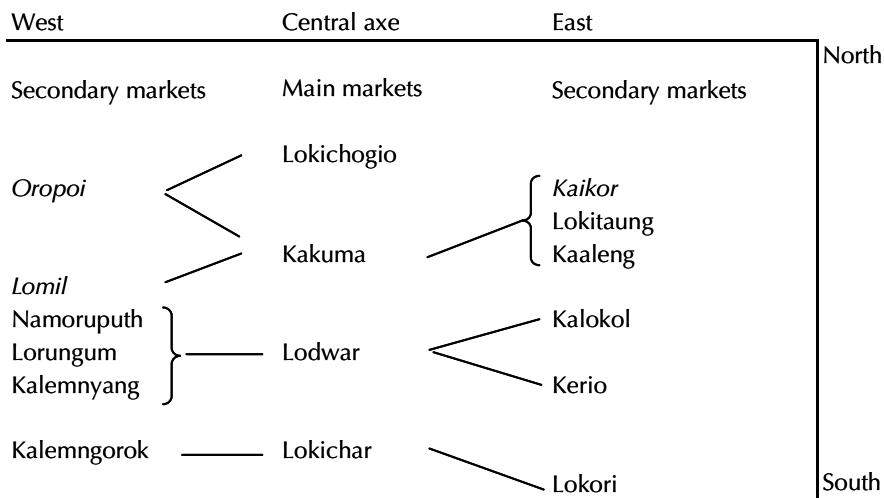


Figure 1. General overview of livestock markets in Turkana District.

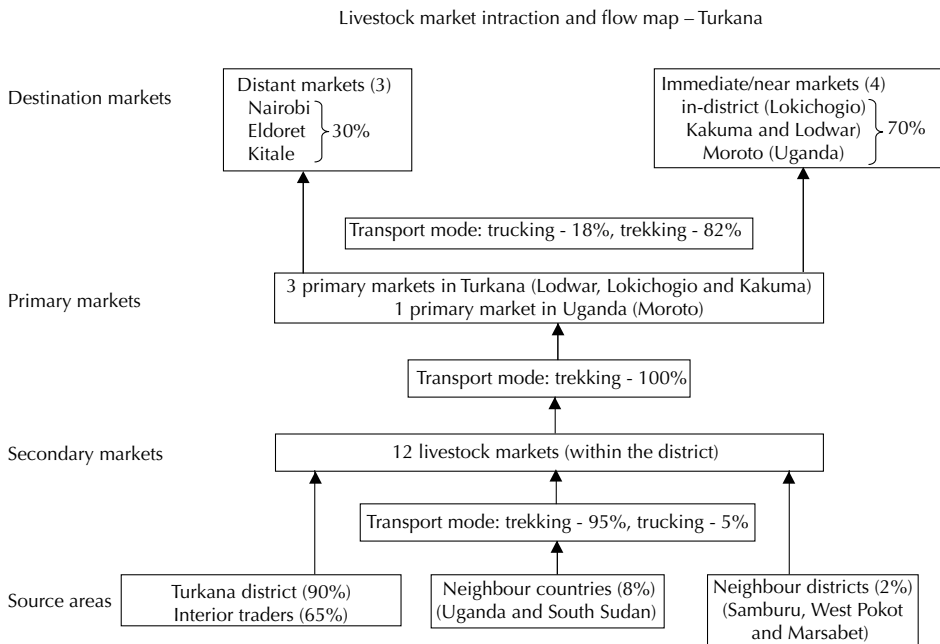
## 4.2 Markets and local demand

The primary livestock markets in Turkana are strategically located along the main transport axe through the district. Interspaced by more or less regular intervals of 90–110 kilometres, from north to south, the primary markets are: Lokichogio, Kakuma, Lodwar and Lokichar (ITDG 2005). Transportation costs from Loki or Kakuma to Nairobi do not differ substantially (approximately KES 100 thousand per truck) as the road from Lokichogio up to Lodwar is in good condition and there is a high availability of trucks, that would otherwise be returning empty after the delivery of relief food to Lokichogio. South of Lodwar, however, on the stretch to Lokichar and further on the way to Kitale, the road is in a very bad condition. It is the poor condition of the road along with other factors such as insecurity and bribes that allow operators to charge a comparatively high price per kilometre for transport to and from Turkana District. All trucks carrying livestock out of the district have to obtain a movement

permit from the Livestock Veterinary Offices in Lodwar. Renting a truck for transport of livestock from Lodwar costs approximately KES 80 thousand, while the distance to Nairobi is approximately 600 km. From Lokichar the distance is 87 km less, but the rent of a truck is still around KES 70 thousand.

The main local demand for livestock (and in particular goats) is in the main towns of Lokichogio, Kakuma and Lodwar, where there is a high concentration of people. Lokichar has grown to be more important in the recent past as an exporter of goats to consumption markets outside the district.

East and west of the central transport axe are the secondary markets. Apart from fulfilling a role for pastoralists in the provision of breeding stock, since local consumption demand is rather small, their main role seems to be as an outlet, i.e. as collection markets for livestock being trekked to the main central markets. Significantly, monetary-based livestock marketing is significantly pronounced in Kakuma, Lodwar and Lokichogio. However, most of these markets are quite distant from the livestock supplies. Where local markets are close to livestock producers, such markets are not functional due to management inefficiencies and a general absence of stock buyers (ITDG 2005).



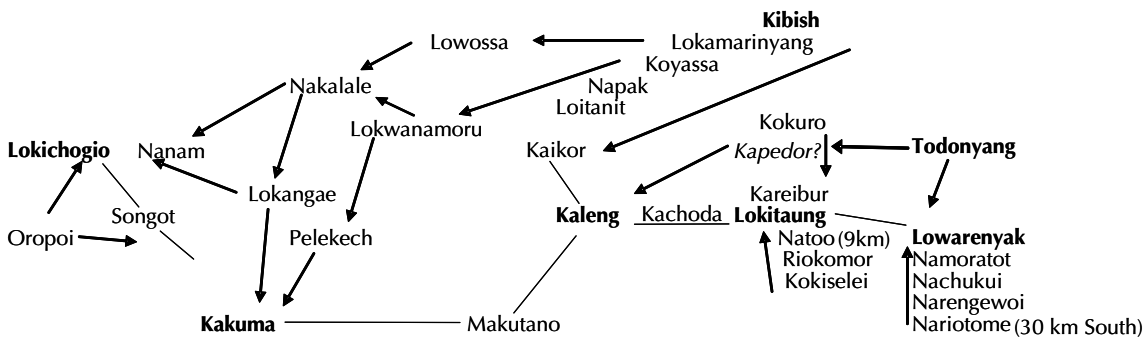
Source: Field investigations - analysis (September, 2004).

External contribution into the district remains comparatively small due to the polarity of the socio-cultural relations between Turkanas and their neighbours in Ethiopia and Uganda.

**Figure 2.** Livestock flows in Turkana.

### 4.2.1 Lokichoggio market

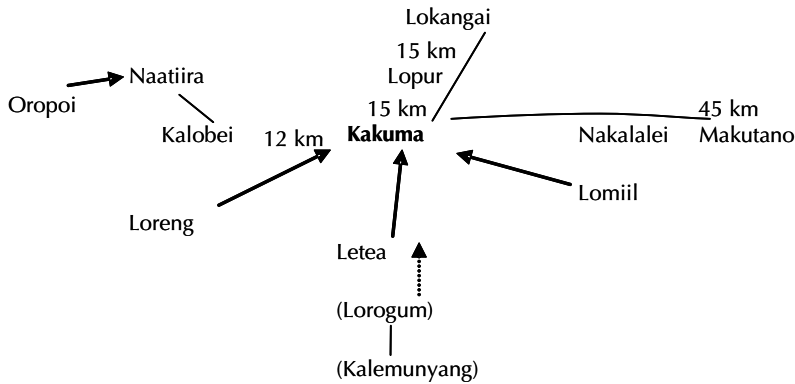
As there is a distinct lack of formal documented evidence, much of the information on northern Turkana livestock markets was obtained from key informants. Our key informants were: Francis Lore (Chairman of the District Livestock Marketing Committee, DLMC), who is also the Chairman of the Kakuma Livestock Marketing Association (LMA); and Christopher Ekuwom (Oxfam project officer involved in the Livestock Marketing Access Project for Kibish, Kaleng, Lokitaung and Lopur Divisions). Unfortunately, the opportunity did not arise to speak to a representative of the traders from Lokichoggio. However, comprehensive information on Lokichoggio and Kakuma markets was available in a consultancy report on ‘Livestock and Meat Marketing in Turkana District’ (by the University of Nairobi, for Terra Nuova, AMREF Kenya, April 2004). The combined information enabled the compilation of Figure 3, which encompasses the main livestock trade movements in northern Turkana. The Kakuma overview is only partial—only the catchment area to its north. A more complete overview for Kakuma is shown in Figure 4.



**Figure 3.** Livestock flows from northeast divisions to Lokichoggio and Kakuma.

Lokichoggio has a LMA with approximately 80–90 members. Whilst most shoats probably come from within Turkana, it is estimated that 80–90% of the cattle passing through Lokichoggio come from Sudan. This was estimated to be 100–200 head of cattle per month (University of Nairobi, for Terra Nuova, AMREF, April 2004). It makes sense that cattle be imported from outside the district as the Turkana prefer not to sell their cattle. Historically, there used to be two major livestock market centres along the Kenya–Ethiopian border: Kibish and Todonyang. Presently, however, trade at both markets is severely restricted by insecurity in the area.





**Figure 4.** Catchment area for livestock flocking towards Kakuma market.

At Kibish, 90% of livestock were said to originate from Ethiopia, with most of the rest originating from southern Sudan. The volumes of trade vary by season. In the wet season, 2 to 5 head of cattle and about 500 small stock (mainly goats) are sold. In the dry season, 200 to 300 head of cattle and 2000 small stock are sold per month. In 2004, approximately 70 to 100 head of cattle passed the border point at Todonyang each month (University of Nairobi, for Terra Nuova, AMREF, April 2004)

As discussed early, our model/projections suggest that the northern divisions have a high seasonal livestock carrying capacity. This was corroborated by key informants who regularly mentioned that the ‘Kibish-area’ has a huge livestock potential, only hampered by cross-border raids. Livestock from Kibish Division and Lotikipi Plains is trekked to Lokichoggio and Kakuma.

Another stock trekking route was said to exist from Todonyang to Lodwar, taking livestock via Lowarenyak, along the Lake Shore to Kalokol, and then to Lodwar. Unfortunately, we were not in a position to verify this. Indeed, a key informant now suggested that livestock from along the Lake Shore is brought northwards to Lowarenyak. However, it is expected that these livestock flows will change as Oxfam GB is now creating local livestock markets with sale yards in Kaikor, Lokitaung and Lowarenyak. The new sale yard in Kaikor is to service areas of the Kibish Division, from Kibish and Lokamarinyang to Loitanit. The new sell yard in Lokitaung is expected to service Nattoo, Riokomor, Kokiselei, Kachoda and centres of Lapur (Kareibur, Kokoro). Lastly, the new sell yard in Lowarenyak is expected to service the centres along the Lake. In addition, Oxfam is also encouraging traders from Kaaleng to form a LMA; their market was established by Arid Lands in 1992.

## 4.2.2 Kakuma market

The catchment area for Kakuma is illustrated in Figure 4. The secondary and collection markets for Kakuma are: Oropoi, Lokangai (which also supplies Lokichoggio), Kalobei, Loreng, Letea, and Makutano. Kakuma has a LMA with over 90 members. Makutano and Lokangai also have LMAs and Letea has another group of organized traders, all of which move some livestock to Kakuma.

There is a large demand for goats in Kakuma; the 4 refugee camps together are said to consume about 300 goats per day. In addition, residual local market demand is estimated at up to/less than 25 goats a day. Conversely, hardly any goats are exported from Kakuma or Lokichoggio, which according to the DLMC chairman is because of the high local demand. Table 5 presents estimated volumes of shoats that are pulled together to Kakuma market by the various traders in this catchment area. The overview of consumption and the sources of livestock are based on perceptions of the DLMC chairman. In summary, approximately 40% of the livestock entering Kakuma market originates from the direction of Oropoi and Kalobei, and 37% from Loreng/Letea. Most of these places are in the Rangeland Unit of Oropoi, while Letea is in the Tarach Rangeland Unit (see Map 2). Oropoi is an area of plains against the hills/mountainous border of Uganda, while Tarach has fertile plains between branches of the semi-permanent river of Tarach. Both of these rangelands are suggested to possess high seasonal livestock carrying capacities.

**Table 5.** *Estimated volume of shoats brought to Kakuma market by traders and middlemen*

Catchment Area/Direction	Traders & middlemen	Regular supply goats/area	Period	Average daily volumes	Proportions of trade
Oropoi - Kalobei	20	10	/day	200	42%
Lokangai/Lopur	10	2-5	/day	35	7%
	+ Lokangai traders 2 (out of 10)	10	daily	20	4%
Makutano	10	2-5	2-3x / week	15	3%
	+ LMA Makutano	>20	2-3x / week	29	6%
Loreng/Letea	50	2-5	/day	175	37%
				<u>474</u>	100%

Remarkably, according to our key informant's perception, only 20% of the shoats brought to Kakuma originate from the rangeland areas to its north and northeast. In the validation workshop, it was stressed that the refugee camps are mostly supplied directly by traders from the sides of Lokangai and Oropoi. Only a very small number of cattle are being marketed in Kakuma while only 1–5 are brought each day, an average of only 3 are sold. On average, once every 3 months a small herd (10–20) of cattle are trekked from Kibish.

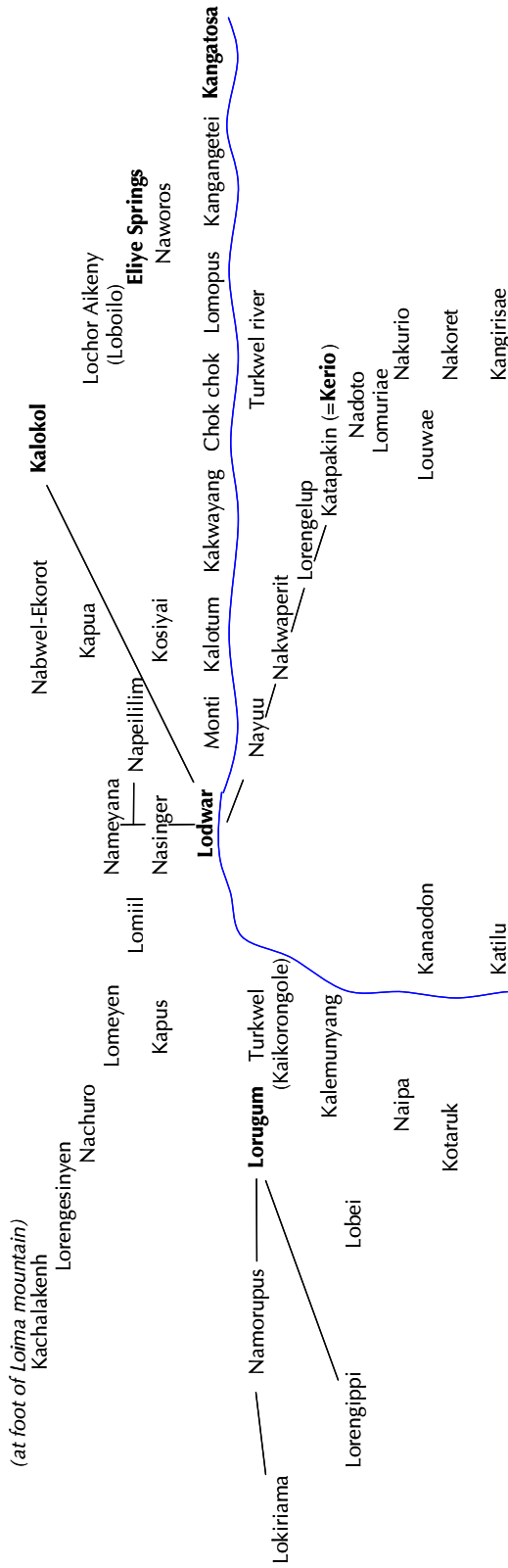


Figure 5. Catchment area for livestock flocking towards Lodwar market.

### 4.2.3 Lodwar market

The catchment area for local livestock pulled together at Lodwar market is presented in Figure 5. At the time of the data gathering, Lodwar had an LMA with approximately 420 members [during the validation workshop it was said that LMA Lodwar now had increased to 677 members], some of whom only operate at the local market, while others move into the interior to source goats. Some secondary markets within this catchment area also have their own LMA: Kerio (240 members), Lorugum (115 members) and Kalokol (relatively new). Traders from these local LMAs also bring livestock (mainly shoats) to the Lodwar market.

Local demand is approximately 300 goats per day. Nowadays, instead of exporting them out of the district, many goats are sold to the larger urban centres of demand: Kakuma and Lokichoggio. From Lodwar, a 3 ton truck carrying 60–70 goats leaves for Kakuma or Lokichoggio 2 or 3 times a week. The recent construction of a meat processing plant (by AMREF) in Lomidat near Lokichoggio is seen by the Lodwar LMA traders as a positive development. They stated that 'as the road from Lodwar to Lokichoggio is in excellent condition, the volumes of regular shoat supplies from Lodwar would only depend on demand (i.e. operating volumes of the meat processing plant).

The estimated number of shoats pulled together by traders and middlemen in Lodwar market is presented in Table 6. Of the goats brought, only about half are sold on an average market day; the rest are returned to graze overnight and are brought back the next day. Hence only about half of 740 goats [or  $370 \times 6$  market days = 2220 goats per week] must be the daily off-take from this catchment area.

The relative volumes of trade obtained through this exercise suggest that more than half (57%) of the shoats brought to Lodwar market originate from areas to its west (Namorupus, Lorugum, Lorengippi, Kalemunyang). However, when compared to the carrying capacities and the projected livestock figures (Map 2), there are inconsistencies. In a discussion with traders of the Lorugum LMA, we learned that their weekly trade is over 200 animals, most of which are goats. From Table 6 we can deduce that according to the Lodwar LMA, 270 shoats per week are brought from Lorugum.

Lodwar market appears to have a surplus of traders, half of whom (200) are rather stationary and do not contribute in the collection of goats from the hinterland. They operate as a cartel, forcing pastoralists/livestock owners to use them as middlemen. Some of the traders waylay livestock owners as they approach Lodwar with their flock on well known livestock trekking routes. If a livestock owner refuses to sell through them, they will spread the rumour among their trading colleagues that this particular individual is hard to deal with. Hence they manage, more or less, to shield the market for the cartel traders. Once at the market,

livestock may change hands between traders as many as 10 times (within the sale yard), hence increasing the number of transactions in the trade chain, while the transaction costs are not much affected. Apparently, individual traders do not only have their own interest in mind, but are willing to share a piece of the pie with their colleagues. Understanding the ins and outs of these transactions would certainly deserve more in-depth research.

**Table 6.** *Estimated volume of shoats brought to Lodwar market by traders & middlemen*

Catchment Area/Direction	Traders & middlemen	Regular supply goats/area	Period	Average volumes per day	Proportions of traded volumes
Lodwar	200	N/A			
Namorupus	30		140 /day	140	19%
Lorugum <sup>1</sup>	18		70 /day	70	9%
+ by LMA-Lorugum			20 /day	20	3%
Loirengippi	14	}	90 /day	90	12%
Lobei	10				
Kalemnyang	27		100 /day	100	14%
Nachuro/Lomiil	11		30 /day	30	4%
Nameyana	30		60 /day*	60	8%
Kapua	10		20 /day	20	3%
Kalokol <sup>2</sup>	16		70–80 once a week	13	2%
+ by LMA-Kalokol			120–130 once a week	21	3%
Eleye Springs - Kangatosa	15		40 /day	40	5%
Monti - Naworos	20		60–70 /day	65	9%
Nayuu - Lorengelup	>30		30–50 /day	40	5%
Kerio <sup>3</sup>	20		150–160 once a week	26	3%
+ by LMA-Kerio			30–40 once a week	6	1%
	<u>421</u>			<u>740</u>	<u>100%</u>

1. has its own LMA; but 18 traders from Lodwar also buy from there

2. has its own LMA; but 16 traders from Lodwar also buy from there

3. has its own LMA; but 20 traders from Lodwar also buy from there (at weekly marketday on Tuesday)

\*Only in rainy season; not in dry season

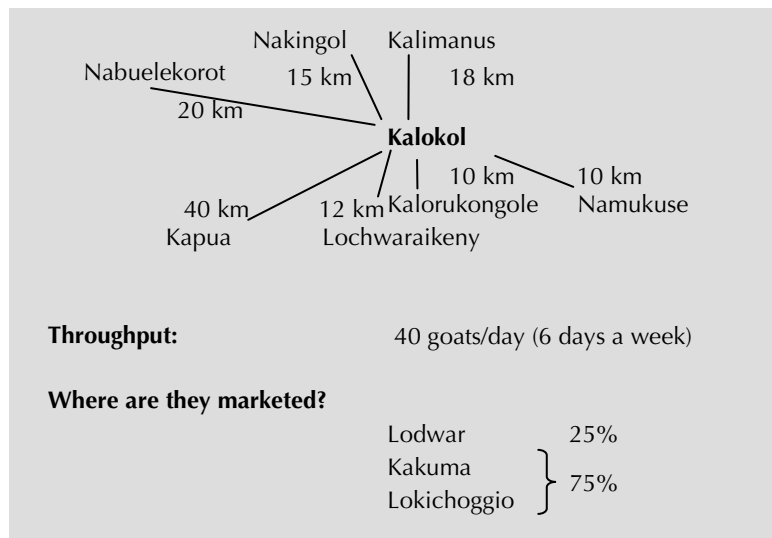
#### 4.2.4 Lokichar market

The livestock catchment area for Lokichar market is presented in Figure 6. Lokichar is on the main road and transport axe through the district. Due to the virtual absence of active local livestock markets, Lokichar market has a wide catchment area to the east and southeast, and, because of this, has gained in importance over the last few years. The LMA of Lokichar has approximately 80–100 affiliated middlemen. Kalemnarok and Lokori also have their own LMA. There is a strong inter-linkage with the livestock market of Kalemnarok as some traders from Lokichar also operate there and vice versa. Usually, livestock that is collected in the area surrounding Kalemnarok, and destined for exportation<sup>1</sup> out of Turkana, is grazed in Kalemnarok while awaiting collection by trucks that come from Lokichar (with a partial load).

1. Throughout this report: with 'export' or 'exportation' we usually mean: 'export out of Turkana'. From the context it will be clear that it is either towards major towns in Kenya, or cross-border regional trade, yet never international trade.

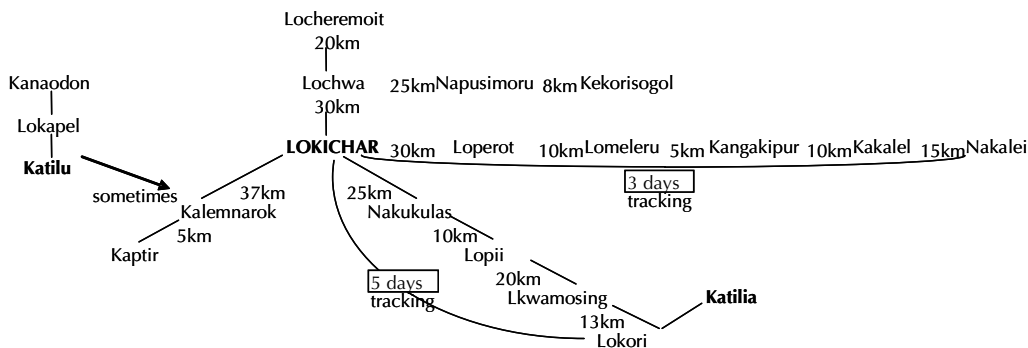
### Box 1. Case study of a secondary market: Kalokol

Kalokol, once famous for its fish factory, is a relatively large town located on the shore of Lake Turkana. With over 10 thousand inhabitants, of whom most depend on fishing, livestock is only of minor importance. Yet, as with the rest of Turkana, some livestock can be found in the surrounding rural areas.



According to Kalokol’s LMA traders, the weekly livestock throughput is approximately 40 goats (or 7 goats per day). Of the goats purchased in Kalokol, approximately 75% are trekked to Kakuma or Lokichoggio, leaving only 25%, hence 2 goats a day, for Lodwar. Unfortunately, this information was not corroborated by Lodwar LMA traders, who suggested that Kalokol LMA traders supplied 10 goats a day to the Lodwar market (see Table 6).

The estimated volumes of shoats brought together in Lokichar, or at least the proportions of trade originating from its catchment areas, are presented in Table 7. An exercise was conducted with the Chairmen, Secretary and some members of the Lokichar LMA, in which they enumerated the origins, and relative volumes, of goats brought for sale. However, when tallied, they realized that the sum of 2938 shoats per week was highly exaggerated. However, they stated that while overall numbers were too high, the proportions were correct. This was later explained by counting traders bringing goats every week, while, in fact, many brought goats less frequently. The group eventually reached a consensus that the weekly throughput of Lokichar market was approximately 705 goats (or: 117 per market day). This was based on the observation that two lorry loads of shoats leave for Nairobi each week and approximately 15 goats per day are consumed locally.



**Figure 6** - Catchment area for livestock flocking toward Lodwar market

**Table 7.** Estimated volume of shoats brought to Lokichar market by traders and middlemen

Catchment Direction	Traders & middlemen	Regular supply goats/trader	Period	Total volumes per week	Proportions of trade	Derived estimate daily volumes
Lochwa/Locheremoit/Napusimoru	10	20	per week	200	8%	9
Loperot.. Kakalel	10	10-15	per week	125	5%	6
Nakalei/Loriu	10	20-30	once/month	62.5	2%	3
Nakukulas/Lokori	40	30	per week	1200	45%	53
Kalemnarok/Katilu/Kaputir	30	5	daily!	<u>1050</u>	40%	<u>47</u>
				2638	100%	<u>117.5</u>

Within the Rangeland Units of Lokichar (see Map 2), most livestock is probably concentrated along Turkwel River on its western border and another seasonal river to its east (on the border with Kerio rangeland area). Most shoats however seem to originate to the south of Lokichar, part of which is Naroo Rangeland area which is projected to have higher concentrations of livestock. Some camels are also traded in Lokichar but in very small quantities: only 2 to 5 each day. Cattle are infrequently traded in Lokichar. Instead, cattle are mostly marketed through Kalemnarok, as they originate from the Katilu area along Turkwel River and even the rangelands across the River (from Kalemnyang to Nakwamoru). According to the LMA-traders interviewed, a big trader from Lokichar (who can get goats on credit), may transport 100 goats to Nairobi and make KES 200 thousand.

#### 4.2.5 Livestock sales

Marketed livestock off-take rates are traditionally low among pastoralists in Turkana, and, perhaps to a lesser extent, in the arid and semi-arid lands of east Africa. Using data from research undertaken in Marsabit (Turkana's neighbouring district), 80% of households participated in livestock markets as net sellers, while only 8% purchased more animals than they sold (and 12% had neither net sales nor net purchases) (Barrett et al. 2004). According to Barrett et al. (2004), households that neither sold nor bought animals own an average of 10.8 tropical livestock units (TLUs), while the households participating in markets most frequently have average holdings of over 40 TLUs. Quantities traded tend to be small. In no

three month period were average net sales greater than 1 TLU for those selling animals. This is consistent with the hypothesis that livestock sales, especially of small ruminants (i.e. goats and sheep), are driven largely by households' immediate cash needs for school fees, medical care, social events etc. (Barrett et al. 2004). In addition, the quality of livestock, particularly carcass size and body condition, are often affected by drought. Butchers complain about low carcass weight, even when body condition is good, which in turn can lead to lower profit margins. Goats are said to have high carcass weight even though they are smaller in size (Ajele 2005). Size, condition and species are important variables in determining whether animals move only within local markets or to terminal markets. Males tend to be of larger size than females of similar condition and are therefore more commonly sold for slaughter in Nairobi, while the latter will tend to be earmarked for local butcheries or for restocking local herds, especially if fertile and in good condition. Indeed, males typically account for three-quarters or more of total market transactions, while markets in fertile females are very thin (McPeak and Barrett 2001; Barrett et al. 2003).

#### 4.2.6 Comparison of volumes flowing through main markets and catchment areas

As the most frequently traded animals in Turkana, the volumes of shoats traded are used as a proxy to reflect the relative importance of respective livestock markets. The relative volumes of the daily shoat trade for Kakuma, Lodwar and Lokichar are presented in Tables 5, 6 and 7. These estimates suggest that Lokichar's shoat trade is about one third of that of Lodwar (117/370) and about one quarter of Kakuma's shoat trade (117/474). Unfortunately, we do not have much information on the volumes of trade in Lokichoggio. However, we do know that its LMA has about the same number of members as Kakuma, and that there is a large consumption demand, principally due to the presence of several UN-camps and many NGOs. Lokichoggio also has the highest domestic demand for cattle in Turkana an estimated 100–200 cattle traded monthly, most of which originates from southern Sudan (ITDG 2005).

#### 4.2.7 Livestock projections per livestock market

In order to better understand markets and their catchment areas, livestock population projections were estimated across catchment areas. In theory, one could expect the relative volumes of livestock population in the catchment areas to correspond with the relative volumes of livestock being offered for sale at the local markets. Based on our gut-feeling, but then adjusted with the information on market flows and the relative volumes of shoats traded (as presented in the previous chapters), we now attributed portions of each Rangeland Unit to the catchment areas of different markets. Thus, livestock projections were converted, per Rangeland Units, to livestock projection per catchment area through the use of the matrix presented in Table 8.



**Table 8. Livestock Projection per market catchment area**

Rangeland Units	Catchment area's supplying livestock to the following (primary and secondary ) markets:			Livestock per Rangeland Unit						
	Lokichoggio	Kakuma	Kaikor, Lokitaung & Lowarenyak	Lodwar	Lokichar	Lokori	cross-border out of district	Shoats	Camel	Cattle
Kibish	0.2	0.1	0.6	0.1				543,658	25,959	45,035
Kaikor			1					157,439	9,367	9,050
Northern Lotikipi Plain	0.5		0.5					216,609	8,691	22,035
Southern Lotikipi plain	0.4	0.6						104,015	4,623	9,132
Songot-Mogila	0.9	0.1						343,812	19,964	20,370
Oropoi	0.2	0.8						250,594	15,548	13,151
Todenyang-Kataboi			0.8	0.2				23,437	1,420	1,265
Lokitaung			1					89,892	5,756	4,165
Kaeris-Makutano		0.3	0.6	0.1				193,239	9,950	14,213
Tarach		1						89,094	5,129	5,556
Kanakurdio		0.1		0.9				18,077	1,540	0
Ngapol hills		0.25		0.75				21,573	1,840	0
Kalokol				1				47,532	1,859	4,823
Loima Hills Plateau		0.75		0.25				76,081	4,954	3,328
Lorengippi				1				113,541	7,136	5,586
Lodwar-Lorugumar		0.9		0.9				108,906	4,818	9,821
Kerio		0.75		0.75				94,949	6,402	3,605
Lokichar		0.25		0.25				109,064	6,693	5,672
Naroo								183,814	12,271	7,621
Loriyu Plateau				0.15				48,135	3,417	1,484
Suguta Valley								43,840	2,186	3,388
Kamosin-Lomelo								98,149	7,036	2,798
Tiati Mountain								10,255	566	677
Rift Escarpment								11,142	770	396
Silalei Mountain								76,240	4,307	4,729
South Lake Shore				0.5				2,312	197	0
<b>Totals</b>								<b>3,075,400</b>	<b>172,400</b>	<b>197,900</b>
<b>Livestock per catchment area:</b>										
<b>Shoats</b>	618,192	562,958	816,524	495,789	248,526	168,418	164,993	3,075,400		
<b>Camel</b>	32,464	32,248	42,150	28,296	15,983	10,900	10,358	172,400		
<b>Cattle</b>	44,641	34,856	60,793	30,602	11,464	7,435	8,108	197,900		
<b>Livestock (%) per catchment area:</b>										
<b>Shoats</b>	20%	18%	27%	16%	8%	5%	5%	100%		
<b>Camel</b>	19%	19%	24%	16%	9%	6%	6%	100%		
<b>Cattle</b>	23%	18%	31%	15%	6%	4%	4%	100%		

Subsequently, percentages of the overall livestock population in each catchment area were computed. Logically, the derived relative volumes of livestock also reflect the presence of higher numbers of livestock in the northern (rangeland) areas. Albeit based on many assumptions, these computations suggest that the catchment areas of Lokichoggio and Kakuma have about the same volumes of shoats and camels (about 20%) while Lodwar has slightly less (14–18%) and Lokichar the least (12–13% when including Lokori). A large volume (about 30%) is allocated for the supply to markets in the north (Kaikor, Lokitaung, and Lowarenyak). As explained before, cattle are more important in the north, as presented in the northern catchment areas (including Lokichoggio).

#### 4.2.8 Off-take

So far, we have only dealt with the domestic livestock marketing system. In this section, information is collated on slaughters (local consumption) and exports out of the district, to create a fuller picture of total off-take. While our information on exports is relatively robust, official slaughter data is both incomplete and dubious, and there is a dearth of information on informal livestock slaughter/consumption. Official figures of livestock slaughter and export are brought together in Table 9. In addition, in order to improve the quality of our own data mining exercise, we have included the sum totals of the data we studied on slaughter and exports in the last two columns. They are further discussed in the subsequent subsections.

**Table 9.** Official slaughter and export figures for Turkana, compared with own findings

	1998 <sup>1</sup>	1999 <sup>1</sup>	2000 <sup>1</sup>	2001 <sup>1</sup>	2002 <sup>1</sup>	2003 <sup>1</sup>	2004 <sup>1</sup>	Oct '04- Sept '05 <sup>2</sup>	March '05 - Feb '06 <sup>3</sup>
<b>Slaughter</b>									
Goats				99200	133800	102806	115570		114355
Sheep	80354	27872	81838	9000	14800	10501	9606		5921
Cattle	1356	2028	2412	1628	1060	514	566		637
Camels	353	618	554	339	404	396	339		639
<b>Export</b>									
Shoats	51641	25411	16889	6689	17891	46910	20630	20433	
Cattle	2510	5478	4516	2252	1110	4044	1469	1353	
Camels									
<b>Total</b>									
Shoats	131995	53283	98727	114889	166491	160217	145806		
Cattle	3866	7506	6928	3880	2170	4558	2035		
Camels	353	618	554	339	404	396	339		

1. Compiled from several sources all referring to MoLD&F, Turkana District.

2. Own computations based on actual export permits (see this report Annex 3)

3. Source: Monthly Reports of MoL&FD - Department of Veterinary Services

Usually, most livestock are sold in the dry season, although the relative amounts are very small. The challenge that the stock selling pattern faces is that stock producers are willing and highly interested to sell at times when water and pastures availability is low, hence

depressing prices and negatively influencing the trading patterns (ITDG 2005). Comparing the respective role of different livestock species in the marketing chain, shoats comprise 97% of the total sales and slaughter (based on 2003 figures) (ITDG 2005), while cattle only controlled 2.8% and camel 0.2%.

#### 4.2.9 Livestock slaughters

If we were to trust only the official slaughter figures, then the following percentages of the livestock populations are slaughtered on a yearly basis: <6% of the goats; <1% of all sheep; (or together: 4% of shoats); <0.3% of cattle and <0.2% of camels (comparing Table 9 with Table 1). But the official slaughter figures are most certainly an understatement. This conclusion is based on the fact that slaughters are only recorded in certain centres: Kainuk, Lokichar, Lokori, Lodwar, Kakuma, Lokichoggio, Kaleng, Lokitaung and Kalokol (DLPO 2006), while other centres do not have meat inspectors, namely: Kerio, Elly Springs, Kanetosa, Kangirissa, Kataboy, Kibish, Namorupus, Lorangipi, Lokriama, Lapur, Loreng, Lokongi and Songot (DLPO 2006). For example, available slaughter data from the MoLF&D monthly reports of March 2005 to February 2006 (a one year period) are aggregated and presented in Table 10.

**Table 10.** *Slaughter figures Turkana (March 2005–February 2006)*

Division	Cattle	Goats	Sheep	Camels
Central	105	38,415	425	97
Katilu	0	11,366	773	55
Lokori	0	10,218	514	0
Turkwel	0	11,785	584	0
Kakuma	381	36,063	2845	395
Lokitaung	151	6,508	780	92
	637	114,355	5921	639

Source: Monthly Reports of MoLF&D–Department of Veterinary Services.

The Central Division of Turkana, which includes Lodwar and Kakuma Division, stands out as the division with the highest officially recorded slaughters. Unfortunately, other centres with large urban demand (and expected slaughter) such as Lokichoggio and Kalokol are not included, as the slaughters there are not recorded. Although the slaughter figures for cattle are not expected to be high, one would expect the figure to be much higher if the slaughters of Lokichoggio were recorded. It is assumed that the presence of WFP and NGO staff significantly elevates meat consumption in Lokichoggio, since local meat consumption by the Turkana is generally low.

Official slaughter figures for small stock (and to a lesser extent camels) are most certainly an understatement. Indeed, informal slaughters at the household level are not even included or estimated. Key informants were used to get an impression of the household slaughter habits of Turkana pastoralists. According to the DLPO, only the wealthiest families (with large herds) can afford to occasionally slaughter a camel bull for the whole household. Even large households (comprising 3 wives, each with 6 or 7 children) would not slaughter more than 4 camels a year. The slaughter of cattle, particularly a big bull, is an unusual occurrence and involves lots of friends and family. Households that can afford to will take turns in the slaughter of a big bull and invite their friends and families to join in; it's a kind of merry go around. With respect to the slaughter of goats, one can clearly see the progression depending on the size of the herd, which we here regard as a proxy for wealth. If the household can afford it, a wife and her 6–7 children would slaughter a maximum of 6 goats a year; hence each goat with a two months interval. With the decreasing size of family goat herds, the interval of slaughtering a goat is pushed to 3 or 4 months. When the family herd falls below 50 goats, the situation is perceived to be critical and no goat would be slaughtered, as all efforts would go into rebuilding the herd. Herd accumulation is the primary means of increasing productivity and providing self insurance for ASAL pastoralists. Mortality shocks can trap poorer pastoralists in poverty. Households with less than six head of cattle are expected to lose their herd within ten years (McPeak and Barrett 2001).

We see that even the wealthiest of Turkana's pastoralists would limit the number of livestock slaughtered for household consumption. Supposing 6 goats were slaughtered for an average of 6 individuals (1 wife + 5 children) then each would get one goat a year. Supposing this goat would always be a big castrate of 24 kg, with 12 kg of 'wet'-meat (8.5 kg of DM-meat), then each individual would consume an average of 1 kg of meat per month (or 33 grams/day). In a household with only 100 goats (let's assume this to be 'middle class'), where 3 large castrated goats would be slaughtered each year, in order to feed 6 persons, the meat consumption per person would be 0.5 kg per month (or 16.6 grams/day).

In the validation workshop, the participants agreed in general with the above reasoning. Although they went on to stress that there are other reasons for slaughtering goats—such as to ritually treat sickness, for wedding ceremonies and for visitors—they agreed that such occasional slaughtering is much less frequent than the slaughters for consumption by the family.

If we included sheep, the average herd of shoats per household would be just over 50 (see Table 9). This is just above the threshold presented in Table 11, below which no goats would be slaughtered. But let's assume instead that half of the 64 thousand livestock keeping households in Turkana had 75 shoats or more (and the other half had less than 25 shoats). The assumed 32 thousand households with 75 shoats would slaughter 3 goats per year, while

the others slaughter none; hence the annual informal slaughter of shoats at household level would be about 96 thousand. Adding this to the official slaughter figures for goats and sheep presented in Table 9, over 220 thousand goats might be slaughtered each year, which was 7% of the official shoat population in 2004/2005. This reduces the relative importance of shoat exports to 8.5% of the official off-take.

**Table 11.** *Slaughter habits in Turkana households of different wealth classes*

Wealth criteria	Animals slaughtered	Interval	Year average
Rich (e.g. with 3 wives) each wife: 6–7 children	1 camel bull 1 goat per wife 'a big castrate'	Per 3 months every 2 months	4 camels/year 6 goats/wife/year (household e.g. 18 goats/year)
100–300 goats	1 goat	Per 3 months	4 goats/year
<100 goats	1 goat	Per 4 months	3 goats/year
	'Not always consumed but may be sold or exchanged for cereals'		
<50 goats	'No slaughter as they need to build up their herd'		0 goats/year
	'May ask family or friends for more goats' ; 'relatives may donate 5 goats or a bull/cow'		
<10 goats			0 goats/year
	'These fall below the poverty line'; 'are not considered viable pastoralists'; 'no social status, no political power'		

Source: Interview with the DLPO of Turkana, June 2006.

#### 4.2.10 Exports

Turkana is an important livestock production district, but one which is inhibited by distance from the terminal markets and poor transportation network (ITDG 2005). However, only a very small portion of the livestock from Turkana is exported. Less than 20% of livestock from the district is destined for Nairobi. Consumer markets include Kitale and Eldoret while internal markets such as Kakuma, Lokichoggio and Lodwar are important terminal destinations (ITDG 2005). Comparing the export figures in Table 9 with the livestock populations presented in Table 1, shoat and cattle exports represent less than 1% of the overall livestock herd. In studying the livestock exports from Turkana, we were not only interested in the overall figures but also in the origin (within the district) and the destination markets. Livestock exports are usually reported in the monthly MoLF&D reports from the district. A breakdown is given of the exported livestock numbers per destination. However, the information on the origin/provenance of the livestock, which is captured on the movement permits, is not analysed further. The district livestock officials cordially gave us their full cooperation in order to study the origin of exported livestock. The research team

were given the opportunity to study the original livestock movement permits of 1998, the first 3 months of 1999 and a one year period from October 2004 till September 2005 (inclusive). Information from the movement permits, in particular the livestock-species, date, origin and destination, were captured in a database and later analysed at ILRI. This data brought together with 'Pivot tables in Excel' is presented in Annex 3.

The overall totals of exported shoats and cattle we computed for the year period from October 2004 to September 2005 and were comparable with the total exports of 2004 (see Table 9). However, some difference occurred between the total exports computed for 1998 and the official figures presented in Table 9, particularly with respect to cattle exports. Whereas our understatement of the total shoat exports of 1998 (50,801 in Annex 3 versus 51,641 in Table 9) may be caused by the accidental omission of a few original movement permits or small mistakes in data entry and handling, we are puzzled about how we could find 1146 more cattle exported (3,656) than the official figure for 1998 (2510).

#### 4.2.11 Export volumes over time

The research team choose to analyse the livestock exports of 1998 and 2004 because both were just before a drought. After a drought, the livestock cycle and the build-up of herds and flocks goes through a period of recovery with 3–5 years elapsing before the off-take levels stabilize (AGSEC 2000). Indeed, looking at the off-take levels in 2003 (in Table 9) we see that they had almost reached the levels of 1998, before the 1999 drought. However, in 2004 the export of shoats (20,630) was less than half that of 2003 (46,910). Similarly the cattle exports in 2004 (1469) were less than half of those in 2003 (4044). Was this already the influence of drought in 2004? When there is drought, the quality, hence price, of the animals is affected. With lower prices there is less incentive to sell/export. Moreover, when faced with drought, the pastoralists choose to keep larger herds as a contingency plan for the losses they might be facing in the near future. Other potential explanations for reduced exports over time could be the worsening conditions of the access road to Turkana, and the inflated transport prices as a result of the UN-WFP demand for transport of food aid stuffs to Lokichoggio for Operations Life-line Sudan (OLS). Another reason frequently mentioned was that the prices offered to pastoralists in Turkana for their livestock are generally too low due to cartels of Boran traders.

As the movement permit booklets studied also included exports for the first 3 months of 1999, it was possible to compare them with the first 3 months of 1998. The comparison presented in Annex 3b illustrates that total shoat exports were reduced by 49% in 1999. Presumably, this must have been as a result of the drought, causing shoats to be lean and less attractive to urban buyers. At the same time, pastoralists may have been less inclined to sell

as their coping strategy is to maintain larger herds, in order to remain with breeding stock even after a large chunk of their livestock have died.

#### 4.2.12 Origin of exports from Turkana

Livestock from Turkana destined for Nairobi mainly originate from Lodwar, Lokichoggio and Kakuma (ITDG 2005). It is estimated that over 90% of stock destined for the market are goats (ITDG 2005). In addition, small numbers of cattle, originating from eastern Equatorial of South Sudan and the southwestern part of Ethiopia, are routed to Eldoret and Nairobi through Lokichoggio and Lodwar (EPZA 2005). The exportation of livestock from Turkana District requires a permit from the District Veterinary Officer (DVO) in Lodwar. The origin of livestock being transported is part of the mandatory information required for the permit and a way to trace the origin of livestock destined for transportation outside Turkana. However, after analysing export permits for the district, it is our impression that, if the area of origin is uncertain, Lodwar may have been filled on the permit instead. We believe that this may have exaggerated the ‘official’ export figures from Lodwar and that this needs to be born in mind when studying the origin of livestock exports as presented in Annex 3. A selection of aggregated data from Annex 3 is presented in Tables 12 and 13.

**Table 12.** *Summary of shoaat exports (by origin) from Turkana*

Origin	1998		October 2004–September 2005	
	Nr.	%	Nr.	%
Kaalena	100	0.2%		
Kainuk	630	1.2%	170	0.8%
Kakuma	2509	4.9%	35	0.2%
Kalemngorok	80	0.2%	870	4.3%
Kalokol	200	0.4%		
Katilu	450	0.9%	200	1.0%
Lochwa	810	1.6%		
Lodwar	35,223	69.3%	9998	48.9%
Lokangae	660	1.3%		
Lokichar	2627	5.2%	8710	42.6%
Lokichogio	4302	8.5%		
Lokitaung	390	0.8%		
Lokore	200	0.4%		
Lokori	1030	2.0%	450	2.2%
Makutano	1430	2.8%		
Turkwel	160	0.3%		
<b>Grand Total</b>	<b>50,801</b>	<b>100%</b>	<b>20,433</b>	<b>100%</b>

**Table 13.** Summary of cattle exports (by origin) from Turkana

Origin	1998		October 2004–September 2005	
	Nr.	%	Nr.	%
Kaikor	21	0.6%		
Kainuk	20	0.5%		
Kakuma	153	4.2%	121	8.9%
Kalemngorok			154	11.4%
Kanukurudio	22	0.6%		
Katilu	104	2.8%	22	1.6%
Lochwa	20	0.5%		
Lodwar	388	10.6%	370	27.3%
Lokangae	228	6.2%		
Lokichar	144	3.9%	448	33.1%
Lokichoggio	2464	67.4%	217	16.0%
Makutano	66	1.8%	21	1.6%
Songot	26	0.7%		
Grand Total	3656	100%	1353	100%

It is obvious that Lodwar is the most important centre from which shoats are exported all year round (see details in Annex 3). While Kakuma and Lokichoggio have declined in importance with respect to shoat exports, Lokichar has become very important and, like Lodwar, has shoat exports all year round (see details in Annex 3).

Lokichoggio was by far the largest exporter of cattle in 1998, but nowadays this role has been taken over by Lokichar and Lodwar. At some stage, the small number of exports from Lokichoggio made us doubt whether we might have overlooked one booklet with movement permits. Although our overall total of cattle exports in 2004 was slightly lower than the official figure in Table 9, even if we assumed the difference of 100 cattle all came from Lokichoggio, this would only bring its contribution to 20% of cattle exports.

#### 4.2.13 Destinations markets for exports from Turkana

Nairobi is the largest beef market in east Africa. In Nairobi, three important livestock markets account for the bulk of animal sale: Kariobangi (goats and sheep), Njiru/Dandora (cattle), and Dagoretti (cattle). The largest of the three is Dagoretti, which accounts for sales of about 150 thousand cattle per year (Little 2000). Njiru market is almost exclusively for cattle from northern and northeastern Kenya, many of which originate from neighbouring countries (Ethiopia and Somalia). Njiru market accounts for the sale and slaughtering of approximately 35 thousand cattle per year (Little 2000). Other smaller terminal markets include Kisumu, Nakuru and



Eldoret. Of the three main types of stock marketed from the pastoral areas (cattle, shoats and camel), Turkana District in particular is recognized in the sector for contributing shoats in the trade. Between terminal markets and the source areas, there is an extensive change of hands in the trade (ITDG 2005). From the trading line and activities, stock from the district change hands up to three times (ITDG 2005). The data in Annex 3 is organized in such a way that the exported livestock per destination market is totalled at the bottom of each column.

According to the movement permits analysed, approximately 80% of all shoat exports from Turkana are destined for Kariobangi market in Nairobi, and this has not changed significantly over time. While Dagoretti received 12% of the shoats exports in 1998, it seemed by 2004 to have been replaced by Ortum (8.6%) and Eldoret (4%). In 2004, Dagoretti and Kisumu only received 1.2% of the shoats exported from Turkana. We can cross check shoat exports from Turkana to Nairobi with figures reported by the University of Nairobi (for ITDG and AMREF, December 2004): 11,490 shoats arrived from Turkana for slaughter in Nairobi in 2002, and 27,663 in 2003. Respectively, this is 64 and 58% of the official shoat exports from Turkana, reported in Table 9. For Nairobi, in 2003, shoats from Turkana constituted 26% of the overall shoats slaughtered. Unfortunately, since then the exports of shoats from Turkana have been halved (see Table 9).

In 1998, cattle exports from Turkana were destined primarily for Dagoretti market in Nairobi (84%) and only 10% for Kariobangi market. [However the validation workshop participants were of the opinion that any mention of 'Kariobangi' on the export permits was a mistake, since it is not an official slaughterhouse for cattle. They mentioned Dagoretti and Njeru, saying they nowadays preferred Njeru to avoid the Dagoretti cartels]. According to the permits, by 2004, the destination markets for cattle were more diffuse, with Dagoretti and Kariobangi markets each receiving 30% and Njiru market receiving 25% of the Turkana cattle exports. Interestingly, according to the disease control regulations cattle sold from the district should be destined for immediate slaughter in Dagoretti (which has a cluster of 4 slaughterhouses). This is because Turkana is under permanent CBPP quarantine. Conversely, the livestock marketing report compiled by ITDG (2005) suggested that only 20% of the cattle exported from Turkana were destined for Nairobi; other terminal markets included Kitale and Eldoret. However, the destinations indicated on the movement permits suggested otherwise.

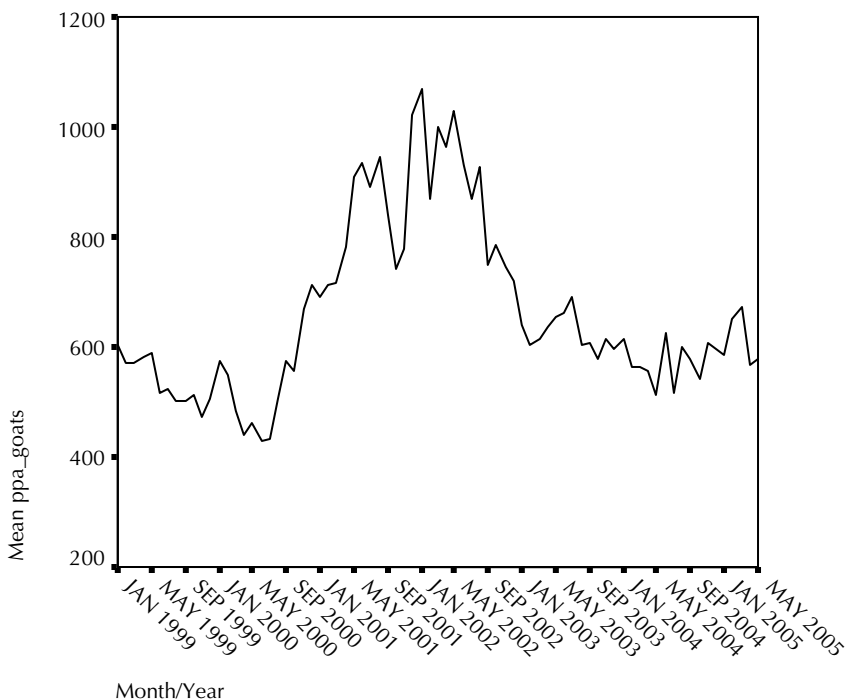
### 4.3 Livestock prices, margins and value added

#### 4.3.1 Market prices for goats sales in Turkana

Several sources of information were used to determine livestock prices in order to allow for triangulation. The first source was Arid Lands Resource Management Project (ALRMP) directed from the Office of the President of Kenya. ALRMP has been surveying 30 households

a month in Turkana for many consecutive years. This has cumulated into an impressive database, which includes animal sales and the prices received at pastoralists' household level (i.e. farm gate prices). We were given access to the database, which included prices from January 1999 to May 2005. The average (mean) prices per month received for actual transactions, were extracted from this database and are presented in Annex 4. The mean is only given for those months in which there was data (ALRMP database 2006).

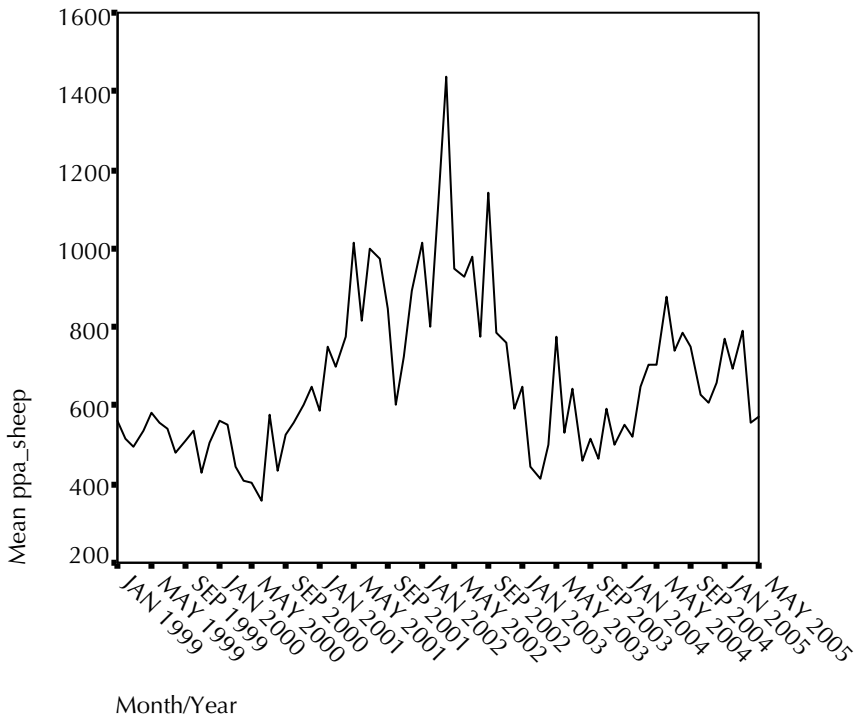
Over recent years, Figures 7 and 8 illustrate that goat and sheep seem to have fluctuated around the mean of KES 600. Unfortunately, the available sample size for cattle and camels were too small to give a representative mean. Printing a graph from such data gave us many meaningless peaks and outliers that were only based on one or two actual livestock sales. With respect to shoat prices in Annex 4 and the figures below, we can identify several high price peaks in the period from August 2001 until September 2002. A reason for this may be the reduced supply of livestock after the severe drought of 1999, which would lead to price increases until the herds were restored and the supply could increase again.



**Figure 7.** Goat farm gate price dynamics over time (based on ALRMP data).

It is noteworthy that the prices captured in the ALRMP database are farm-gate prices (adakar level) as they were gathered from households that occasionally sell an animal. In some parts of the district, there are middlemen operating at the adakar level who will pay a lower price than they expect to receive at secondary markets, where they subsequently sell them on. In

other instances, particularly in those areas where there are no local markets, the pastoralists trek their animals to the nearest market. As most transactions in these local markets involve one-on-one negotiations between the pastoralists and the traders, the pastoralist often remain unaware of the prevailing market prices, hence receive a rather low price—similar to the farm-gate price.



**Figure 8.** Sheep farm gate price dynamics over time (based on ALRMP data).

VSF-Belgium was our second source of price information. In an attempt to promote the collection of market information, VSF-B has been working with voluntary market monitors at the local sale yards they helped institutionalize. Unfortunately, due to logistical constraints, and working with volunteers, this data had periodic ‘gaps’, but it was very interesting and useful all the same. Table 14 presents some of the data on market attendance and prices gathered for Kalemunyang and Kerio markets, which are typically secondary markets away from the main transport axes through the district. Unfortunately, the records from Kerio were only retrieved for the month of September 2004, where the average price was comparable to that of Kalemunyang. The highest prices at the markets occurred in the holiday season of December, when Boran traders come to Turkana to buy goats.

**Table 14.** VSF-B market monitors' data on Goat market sizes and Prices (KES)

Kalemunyang	Averages from the daily records kept by market monitors					
	No. of daily records (sample)	No. of traders	No. of goats sold	Price of goats		
				Lowest	Average	Highest
Sept '04	n=30 days	15	23	612	<i>1086</i>	1560
Oct '04	n=31 days	27	52	532	<i>1039</i>	1545
Nov '04	n=30 days	32	55	530	<i>1053</i>	1576
Dec '04	n=31 days	18	51	498	<i>1081</i>	1663
Jan '05	n=30 days	19	58	470	<i>985</i>	1500
Feb '05	n=18 days	20	42	775	<i>911</i>	1046
March '05	n=31 days	21	46	832	<i>1076</i>	1320
April '05	n=30 days	24	30	842	<i>1105</i>	1368
May '05	n=31 days	24	53	900	<i>1119</i>	1339
June '05	n=30 days	31	50	1276	<i>1482</i>	1688
July '05	n=31 days	32	39	764	<i>1013</i>	1262
Kerio						
Sept'04	n=30 days	–	22	541	1090	2021

Note: The average prices for Kalemunyang (presented in small italics) are not based on the data (which was not available) but are the simple average of the average lowest plus average highest prices. They were added as an indicator.

Our third attempt to obtain information on prices was through FGDs held with LMA traders and livestock owners. An attempt was made to measure their perceptions on goat prices at different markets, namely: from purchases at the farm gate (adakar village level), through the market chain via secondary and main markets to terminal markets such as Nairobi. The information gathered through these exercises is captured in Table 15.

It can be seen from Table 15 that farm gate (adakar level) prices for goats ranged from KES 300 to KES 1000 assuming that KES 300 is the lowest paid for a grade 3 goat and KES 1000 is the highest price paid for a grade 1 goat. At secondary markets traders try to buy goats at prices comparable to farm-gate prices—i.e. up to KES 1000—and sell them on for up to KES 1500. At main markets goats are bought for between KES 650 to KES 1800 and are sold for between KES 1000–2500, depending on the season. A little mark-up can be earned by livestock owners when selling directly at the local market, but only by those who know how to negotiate a better deal based on their awareness of market prices. At the adakar level, there is very little knowledge of the prices at both main and terminal markets.

Ironically, the pastoralists who seemed best informed about prices at the main markets were those that, due to the virtual absence of a local market or even middlemen, have to trek their animals to Lodwar or Kakuma (main markets) in order to sell them.

**Table 15. Turkana producers' and traders' perceptions of shoat prices (KES)**

Location or adakar	seasons	Adakar level	Secondary markets*		Main markets**		Terminal markets
			buying	selling	buying	selling	
<b>Traders' perceptions</b>							
Kerio- (Market monitor)	Dry	400/600/1000!	Kerio sell yard	300/550/1100	Lodwar	../650/..	
	Wet			600/800/1400		850/./..	
Lodwar (LMA)	Dry	300-800	800	1300	1000-1800	2000-2500	Nairobi
	Wet						
Lorogum (LMA)	Dry	Jan-July	Lorogum sell yard	700-800	1200-1700		2800-3500
	Wet	Aug-Dec		1300-1500			
Kalemnarok (LMA)	Dry	}		Kalemngorok	1800		2800-3500
	Wet						
<b>Producers' perceptions</b>							
Kerio (reps from various adakars)	Dry	400/600/1000!	Kerio sell yard	450-1000	Lodwar	500+	1200-1500
	Wet						
Lougogo (Adakar near Lorogum)	Dry	300-800	Lorogum sell yard	300-1000	1000		
	Wet						
Kanakurido (reps from 2 adakars)	Low	300-600	no local self-yard available	animals trekked to Lodwar or Kakuma	1800	2600	for big he-goat
	High						
Lokichar (East of..)		500/./1000					

Where brackets are used, the prices of different grades of goats are presented as follows: grade 3 / grade 2 / grade 1

\* Selling yards away from central transport route through the district

\*\* Main markets in the district, are on the central transport route (tarred road): Lodwar, Lokichar, Kalemnarok

With regard to the main markets in Turkana (Lokichoggio; Kakuma; Lodwar; Lokichar), there seemed to be little variation between them in prices. Presumably, most goats traded are for local consumption so the distance to 'terminal' markets (Eldoret, Nakuru and Nairobi) is not really reflected in the prices. Moreover, the road from the north, from Lokichoggio via Kakuma to Lodwar, is in a good condition, while the road south of Lodwar to Kitale is in very bad shape. The latter section of the road probably has more bearing on the high transport prices. We may expect traders in Lokichar, which is 80 km closer to Kitale, to enjoy lower transport prices for their livestock transports out of the district.

While compiling this report, we found more information on livestock prices in other marketing reports about Turkana. The table below was copied from the University of Nairobi consultancy report for Terra Nuova, AMREF (2004). It gives an indication of the prices at Turkana's main markets. This data was ostensibly gathered from the LMA, Lodwar, in October or November 2003 (hence at the end of a dry season between main rains in April and short rains at the end of November/beginning of December). The goat prices at Lodwar market can be compared with those we gathered in 2006 and presented in Table 15. The bottom selling price of KES 1000 concurs while the highest price mentioned by the same LMA in 2006 was KES 2500. Table 16 further suggests that the prices for grade 2 and grade 1 goats in Lokichoggio and Kakuma are lower, while a grade 1 would fetch a slightly better price there than in Lodwar. However, it is likely that this data on prices just shows a snap-shot and/or a spur-of-the-moment response from a few traders.

**Table 16.** *Prices of various species of livestock by grade (dry season prices)*

Type of livestock	Lokichoggio			Kakuma			Lodwar		
	Grade 1	Grade 2	Grade 3	Grade 1	Grade 2	Grade 3	Grade 1	Grade 2	Grade 3
Cattle	13,000		7,000	13,000		7,000			
Goats	2,000	1,000	500 - 700	1,700 - 2,000	1,000 - 1,500	600 - 800	1,600 - 1,700	1,400 - 1,500	1,000 - 1,300
Camels	16,000	N/A	8,000	20,000	16,000	13,000	N/A	N/A	N/A

Source: Copied from University. of Nairobi consultancy report for Terra Nuova - AMREF (April 2004), which referred to: Livestock Marketing Association (Lodwar), October/November 2003

With respect to the market prices for goats in the terminal market of Nairobi, we found only these: ITDG (2005) suggested that the selling price for a goat in Nairobi terminal market was KES 1700 in September 2004, which would be in the dry season. This explains why the suggested price is far lower than the price range suggested in the Lorugum and Kalemngorok traders in Table 15. Lotira (2000) enumerated prices ranging from KES 800 to KES 2500, but this information may be a little outdated. Moreover, presumably the KES 800 would be for a grade 3 goat in bad condition (dry season).

When comparing the above sources of information on goat prices in Turkana, we learn the following:

- The average shoat price of KES 600 (from ALRMP data) was farm gate prices for average goats (i.e. grade 2 goats).
- From the qualitative information gathered, the evaluation team understands that the farm gate (or household level) price for goats can be as low as KES 300. Since traders are not interested in buying weak or thin goats, it can be concluded that this is the lowest price paid for grade 3 goats. This conclusion was generally supported by the FGDs undertaken. In two LMA FGDs, traders indicated that the lowest price paid for weak and thin goats was as low as KES 200, but more often it was stressed that nobody was interested in buying such weak goats.
- The lowest, average and highest prices collected by VSF-B market monitors at secondary markets (year averages: KES 675 / 1085 / 1440) can be interpreted as the prices for grade 3, grade 2 and grade 1 goats, respectively, at secondary markets.
- The prices at main markets in Turkana show a wide range of possibilities: buying from KES 650 for a grade 2 goat to 1200 for a grade 1 goat, and selling between KES 1000 and 1800 in the dry season or KES 1700 and 2500 in the wet season (Table 12).
- With regards to the goat prices at the terminal markets in Nairobi, we did not gather much recent evidence. However, the data we have suggests a price range between KES 1700 in the dry season and KES 2800 to 3500 for the very best goats in the wet season.

#### 4.3.2 Seasons and prices

Pastoralists in Turkana tend to sell their livestock mainly during the dry season, when their food requirements are high. The few sales which take place during the wet season, as well as during the inter-phase between the wet and dry season, are aimed at catering for non-food needs such as veterinary drugs, beads, and cloth and polythene sheets for construction of temporary shelters. Unfortunately, during the dry season, when large numbers of livestock are offered for sale, they are generally in poor body condition. They therefore fetch low prices and many succumb to effects of drought before reaching the market (Terra Nuova 2004)

Prices for goats during drought are very low, but some said that it depends on your relationship with the buyer and your ability to negotiate. One individual suggested that he received KES 2000 flat rate across the year and KES 2500 for a grade 1 goat during the drought. A medium grade goat sells for KES 1500 in a drought. In the rainy season he-goats could reach KES 3500. The worst price for a healthy, but a little lean, goat was KES 1,100 and the highest price was KES 1800. They suggested that they were used to receiving good prices. Nawoyaregae adakar representatives suggested that they sold goats for KES 1200 (weak and strong). Some individuals suggested that traders didn't want to pay more than KES 800 for goats but sellers held out until they were offered KES 1000 plus KES 100 for a bag of sugar.

In several FGDs we conducted with pastoralists and, separately, with traders, we asked about the seasonality in their livestock sales (mainly goats) and how this affects the prices.

In Lorugum, the pastoralists said: 'Now because of the drought the prices are low, however, in the dry season we sell more: (in July–March) because it includes the holidays season.' The LMA traders explained that for them the market is good from August–December as it is attended by 15–20 buyers from outside the district, hence 75% of the animals can be sold; conversely, from January to July the market is bad. Only 40% of the animals can be sold. The 15–20 buyers mentioned here would come from Lodwar, Kalemnarok or Kakuma and usually trek the animals back to their own markets; buyers from outside the district only come in November and December using a lorry.

Indeed the LMA traders of Lodwar said the prices are good in the wet season, when the animals are mainly purchased for the Boran. In the dry season, the Boran don't come as they are not interested in lean animals. So in the dry season, trade is mainly for Lodwar consumption (being bought by the butchers and restaurants).

In Kerio, pastoralists explained that when there is a drought they would offer more animals for sale. When it rains and there is pasture, and the supply of animals to the market is low, animals are healthy and produce more milk. The traders reiterated that when prices were low there was no motivation for them to sell. When it rains, it is only the traders that are still interested in buying livestock as pastoralists are busy with other activities (such as agriculture) and don't have time to trade.

In Lokichar, pastoralists seemed unaware of livestock price differences between seasons. This was in sharp contrast to the local traders who believed that seasonal price variations depended on supply and demand, and on the health and general condition of the goats. Grade 1 goats could fetch up to KES 2500 and could fetch as low as KES 2200. Grade 2 goats could fetch up to KES 1800 and could fetch as low as KES 1500.

### 4.3.3 Market prices for cattle from Turkana

Unfortunately, there was no time within this study to gather detailed quantitative information on the prices and value chains for cattle exports from Turkana District. However, quantitative information, presented in Table 17, was found on cattle prices in various other marketing reports.

A report by AGSEC consultants for AMREF (2000) explained how traders in Turkana had indicated prices ranging between KES 8000 and KES 12 thousand and suggested an average price of 10 thousand for cattle weighing over 300 kg in Turkana while the same would fetch KES 20 thousand in Nairobi. Indeed Lotira (2000) enumerated prices of cattle at Nairobi markets: KES 13–20 thousand at Dandora/Njiru markets and 8–20 thousand at Dagoretti market.



**Table 17.** *Prices of cattle in Turkana and at Nairobi markets, from various sources*

Source	Date	Turkana		Nairobi		Comment on cattle
		Specific location	Price range	Specific market	Price range	
AGSEC (2000)			8,000–12,000		20,000	over 300 kg
Lotira (2000)				Dandora Njiru	13,000–20,000	
Agri-systems (2003)		Lokichoggio	10,180		18,000	
Univ. of Nairobi (2004)	Oct/Nov'03	Kakuma & Loki	7,000–13,000 10,000 →		17,000	
ITDG (2005)	Sept'04	Kibish	6,000–8,000 7,000 →		12,000–20,000 14,600	250–300 kg

While ITDG (2005) presents recent information on the price range received by pastoralists in Kibish (KES 6000–8000) and the average price received in Nairobi (for a truck load of cattle), the University of Nairobi (2004a) and Agri-systems (2003) seem to agree on the average price for cattle at Lokichoggio (KES 10 thousand) and in Nairobi (17–18 thousand).

Unfortunately, for cattle, we do not have a break-down of the prices at all market levels, as we did for goats. As the Turkana hardly ever sell their cattle, one would need a lot of patience when collecting quantitative data on real life cattle sales in rural areas of Turkana. This is the problem faced by ALRMP in the collection of cattle and camel prices—we referred to this at the start of this chapter.

#### 4.3.4 Barter trade values

In some large interior areas of Turkana, particularly in the northeast, where there are no markets or shops, there is a virtual absence of the 'money economy', so traders use barter trade to purchase livestock from pastoralists. According to some of the livestock owners interviewed, this form of trade severely restricts the range of commodities that can be exchanged for their livestock and livestock products; in effect, they are forced to take what is on offer. However, these itinerant traders have a role to play in that they are able to penetrate remote areas, which are normally inaccessible to the big traders. An example of barter exchange rates, from the same study, is presented in Table 18.

**Table 18.** *Barter exchange rates*

Livestock Type		Beads	Maize meal	Veterinary drugs
Cattle	(1 bull =)	13 bundles	6-8 sacks of 50 kg	
Goats	(1 goat =)	2 bundles	1 bag of 45 kg (per male goat)	100 ml bottle of adamycin
Camels	(1 camel =)	11 bundles		

Source: Terra Nuova, AMREF consultancy report April 2004.

The barter exchange rates differ from one place to another, depending on the distance from the main market centres. The information from traders and producers also tends to differ. However, there is no doubt that barter trade puts livestock producers at a great disadvantage (ITDG 2005). They illustrated this with an exchange rate for a grade 1 goat equivalent to KES 400 to 600. In contrast, we found that KES 600 seems to be the average farm gate price for average (grade 2) goats.

#### 4.3.5 Value added

##### Goat marketing chain

In a previous section, we presented information on goat prices at different market levels in Tables 15 and 16. Table 19 summarizes the conclusions we drew with respect to the ranges of prices at different market levels (and in different seasons) and presents them in the form of a value chain from which the gross margins can be derived.

**Table 19.** Theoretical value chains for goats traded from within Turkana

	Bottom end (Dry season/grade 3)		Top end (Wet season/grade 2)	
	Price	gross margin	Price	gross margin
farm gate/pastoralist	300	350	1000	500
secondary market	650		1500	
main market	1000	350	2000	500
terminal market	1700	700	2800	800

A similar value chain was presented by ITDG (2005) but it only comprised 3 levels (see Table 20). ITDG's value chain started from the producer in a pastoral area selling (at KES 600) straight to a trader from the main market, who then sold the goat (for KES 800) to a trader that brought the goat to the terminal market in Nairobi (where it was sold for 1700). We had a few concerns with this approach. First, we found that unless pastoralists bring their goats to a market (sale yard) themselves, they may not receive KES 600, but are more likely to be exploited. This is why we started our value chain at the lower end with only KES 300. Secondly, it would be rather exceptional for a main market trader to source the animals at the farm gate level and sell them straight to the export trader. In fact, most goats change hands between many traders before being sold in Nairobi. As we saw in the previous section on livestock markets, there are a multitude of secondary markets in Turkana that play a collection role. It is likely that goats go through such a secondary market before being

brought to the main markets of Lokichoggio, Kakuma, Lodwar or Lokichar. Moreover, we had several reports that at Lodwar market, goats could change hands between traders as many as 10 times before leaving the market. Hence, each of the traders involved would have a small share of the overall margin at this main market.

**Table 20.** Value chain for Turkana goat exports (including costs and returns)

SHOATS						
	Buying price	Selling price	Gross margin	Costs	Net margin	% Return
Producer (in Pastoral area)		600				
Trader (in Lodwar, Kakuma or Loki)	600	800	200	75	125	<del>20.8%</del> 18.5%
Trader (in Nairobi terminal market)	800	1,700	900	570	330	41.3% 24%

Source: ITDG report for Oxfam (January 2005) based on discussions with traders in September, 2004.

Last, but not least, the percentage returns are calculation as the net margin/the original buying price. This inflates the return. A truer picture appears when dividing the net margin by the total invested capital. Although some of the costs are variable cash flows, most of the costs, i.e. the cost renting of a truck, are invested for almost the duration of the transaction. The percentage return in Table 20 should be  $(125 / 675 =) 18.5\%$  in the main market case; and  $(330/1370 =) 24\%$  when moving livestock from Turkana to Nairobi. We borrowed the information on the specific breakdown of the costs in the above table from the ITDG report. The costs at different levels in the value chain are enumerated in Table 21.

**Table 21.** Breakdown of specific marketing costs for shoats from Turkana

Secondary market costs:		Main market costs:	
	(Ksh)		(Ksh)
Cess	40	Cess	50
Broker/trekking	30	Marking	5
Herder	5	Boma fees	5
	<u>75</u>		<u>60</u>
Transport cost to Nairobi:		Nairobi market costs:	
	(Ksh)		(Ksh)
Loading ramp	5	Herder	5
Movement fee	50	Boma fees	5
Transport Broker	5	Broker - Nairobi	30
Transport cost	<u>410</u>		<u>40</u>
	<u>470</u>		

Source: ITDG report for Oxfam (Jan'05) based on discussions with traders in September 2004.

Before applying these cost estimates to the theoretical value chain presented in Table 18, we first have to point out a caveat in our value chain approach. We do not know what the production cost of the pastoralists are; hence we do not know their net margin from producing a goat. What is the worth of their time and resources invested? Hence, we will not be able to judge whether the price they receive at the farm gate covers their costs. However, we do know that encouraging them to bring their goats to the nearest market may double their returns (see Table 19).

Meanwhile, the middlemen or itinerant trader seems to be in a good position to make the best profit: KES 350–1000 depending on how well he plays his stakes. Apart from his own labour and that of his herdsmen, he probably does not face marketing fees. He will try to bypass the secondary market by bringing his flock to the main market, and before getting there, he is likely to be intercepted by the cartel traders (unless he himself is part of the cartel). The downside of his profitable business is the risk he faces of being robbed or raided.

A secondary market trader buying from pastoralists and selling to the main market incurs KES 75 of local marketing costs, reducing his net margin to KES 275–425.

An ordinary transaction at the main markets would yield a net margin of KES 290 (KES 350 – cost KES 60); a reasonable return on a relatively low risks investment. However, as we explained above, such a transaction is likely to be broken up into many little steps, and each trader involved may only get KES 20–50 profit.

Some traders from main markets also move to the secondary markets in an attempt to optimize their profit. If they manage to buy from the pastoralist and sell at the main market, their potential gross margin may be KES 700–1000, while their net margin (after costs of KES 135) would be KES 565–865. However, once again, this is very unlikely, as many traders want their share in this game; a trader would need to have much ‘power’ in order to keep such a transaction for himself.

Last but not least, the traders who export the goats from Turkana incur the highest costs (KES 510). In Table 19, ITDG used an example whereby a goat was sold at more than twice its purchase value in Turkana. Based on our findings, we think this is a bit unrealistic. In Table 18 we presented what we think are the bottom and top-end value chains. Working from these gross margins (KES 700–800) and deducting the overall marketing costs to Nairobi (KES 510) leaves moderate net margins of KES 190–290. By dividing these net margins by the total invested capital (i.e. Buying price + all other costs), we find returns on investment of only 11.5–12.5% which are more moderate than the ITDG (2005) estimates, but certainly more realistic. This is regarded as very little, particularly when taking into account the risk involved. Exporting goats from Turkana may only ‘seem’ worthwhile because of the large

numbers of goats that can be transported in one truck. If we disregard the labour cost of the entrepreneur and the opportunity cost of invested capita, a truck load of 250 goats can yield a profit of KES 47,500–72,500 (but with an invested capital of KES 377,500–627,500).

### Cattle marketing chain

We found three recent examples of cattle value chains from Turkana to terminal markets in Nairobi. The first one by the University of Nairobi (2004b) is presented in Table 22. The prices used here were also enumerated in the section on cattle prices. Unfortunately, the costs (KES 3375) were not fully specified, but they included: 2,500 for transport by truck (truck at 50 thousand for 20 cattle), a movement permit at KES 80 per head, county council cess fees KES 50 per head, cost of hiring a farm in Kitale to let the animals graze half way KES 1000–1500 (or KES 75 per head). The remaining KES 445—to make KES 3375 per head of cattle—would be spent on loaders and un-loaders. The suggested return on investment here is  $\text{KES } 3625 / 13,375 = 27\%$ .

**Table 22.** *Trading margins (cattle): From Lokichogio/Kakuma to Nairobi*

Parameter	Estimated value (KES)
Buying price	10,000
Selling price	17,000
Marketing margin	7000
Marketing costs	3375
Gross profit	3625

Source: University of Nairobi consultancy report for Terra Nuova, AMREF (April 2004).

ITDG (2005) presented the case of the value chain for cattle in a similar way as for goats; hence we found the same over-optimistic calculation of the returns on investments in Table 23 (and the associated costs are given in Table 24). By dividing the net margins in Table 23 by the total invested capital we arrive at more realistic estimates of the returns on investment:  $(240/7260 =) 3.3\%$  and  $(3,845/10,755 =) 35.8\%$ .

**Table 23.** *Value chain for Turkana cattle exports (including costs and returns)*

CATTLE	Buying price	Selling price	Gross margin	Costs	Net margin	% Return
Producer (in Pastoral area)		7,000				
Trader (in Lodwar, Kakuma or Loki)	7,000	7,500	500	260	240	3.7% 3.3%
Trader (in Nairobi terminal market)	7,500	14,600	7,100	3,255	3,845	51.3% 35.8%

Source: ITDG report for Oxfam (January 2005) based on discussions with traders in September 2004.

**Table 24.** Breakdown of specific marketing costs for cattle from Turkana

Secondary market costs:			Main market costs:	
	(Ksh)			(Ksh)
Cess	150	}	Cess	150
Broker/trekking	100		Marking	10
Herder	10		Herder	5
	<u>260</u>		Boma fees	5
				<u>170</u>
Transport cost to Nairobi:			Nairobi market costs:	
	(Ksh)			(Ksh)
Branding	5	}	Herder - Nairobi	20
Loading ramp	5		Boma fees	5
Movement fee	300		Broker - Nairobi	200
Transport Broker	50			<u>225</u>
Transport cost	<u>2500</u>			
	<u>2860</u>			

Source: ITDG report for Oxfam (January 2005) based on discussions with traders in September, 2004.

In a forthcoming report of AU-IBAR (AM Muthee, June 2006), we found a value chain analysis (referring to Agri-systems 2003) on the basis of a cattle transport chain that originated in Sudan, moved through Lokichoggio and terminated in Nairobi. It went from purchase in Sudan (KES 8300), with cess fees (KES 700), customs (KES 400), other costs (KES 233) and transport from the border to Loki (KES 550). In concurrence with ITDG's example above, the transport cost from Lokichoggio to Nairobi was also estimated at (KES 2500). Other costs (KES 680) included security at KES 530). The net margin was KES 4640 which is 25.8% of the selling price of KES 18 thousand. We calculated the return on invested capital to be: 34.8% (and would be similar if the same cattle was be bought in Lokichoggio at its true cost of KES 10,180—after all it does not affect the net margin).

Remarkably, the export of cattle out of the district (or even from the border with Sudan) appears to be far more rewarding than that of goats. But this may be a slightly twisted picture. In the second and third cases presented above, it seems that the purchase prices in Turkana were rather low. We saw in the section on cattle prices that such low prices are not found in the main markets; a trader would have to venture into the interior (e.g. Kibish) to find pastoralist willing to sell at such low prices.

We can deduce from the above examples a more conservative/realistic model:

- Purchase price in Turkana: KES 10 thousand
- Cost from Turkana to Nairobi of around KES 3400
- Conservative estimate of selling price: KES 16 thousand

Then the net margin per head of cattle would be KES 2600. For a truckload of 20 cattle one would earn KES 52 thousand (as a return on KES 468 thousand). While disregarding the labour cost of the entrepreneur and the opportunity cost of invested capital, the suggested return on investment is 11% and is not better than that for exporting goats.

As explained in the section on cattle prices, a break-down of the prices at all market levels is not available for cattle. Therefore, we cannot do a detailed study of the value addition in the 'local market' chain. In reality, it is likely that such a 'chain' does not exist. And, as Turkana do not like to sell their cattle (if they have any), promoting this market would be even more difficult than promoting the goat trade.

## 5 Recommendations for improving livestock market access and pastoralist livelihoods in Turkana

### 5.1 Improving livestock market systems

This section is divided into four subsections that address key constraints to improving livestock marketing in Turkana, namely: transportation; security; information flows, and; creating opportunities for pastoralists to sell livestock.

#### 5.1.1 Lower the cost of livestock transportation

It is widely recognized that limited road infrastructure (DLMC Chairman 2006, personal communication; Barrett 2001; ITDG 2005; Barrett et al. 2004), and the poor state of repair of existing roads, is a major impediment to the development of profitable livestock production and marketing systems in Turkana. Indeed, the Chairman of the DLMC stressed to the research team that the poor condition of the main road in Turkana District is the main constraint to profitable livestock marketing (DLMC Chairman 2006, personal communication). This report, in line with similar reports, suggests that investment in the road infrastructure, particularly the main road that connects the main Turkana markets of Lokichoggio, Kakuma, Lodwar and Lokichar with Kitale and Nairobi, and Lodwar with Kakuma and Lokichoggio is essential to reduce the cost of livestock marketing (specifically for livestock exports), as well as the promotion of alternative livelihood opportunities in Turkana. Barrett (2001) and Barrett et al. (2004) are insistent that improving marketing infrastructure would reduce the volatility of inter-market trading margins and benefit livestock traders and pastoralists. If there is a clear commitment from National Government and principal external donors to develop Turkana District, the road must be considered an essential first step.

In addition to much needed improvements transport infrastructure, efforts should be made to further reduce the transport costs associated with livestock marketing. If mechanisms can be devised to limit abuses, subsidized transport should be considered as one possible way to reduce marketing costs. This could easily be piloted before potentially being scaled up at a later date. However, care must be taken to ensure that the benefits of subsidized transport are captured by middle-level traders and pastoralists in the district and not by external actors. Another approach would be to provide loans to LMAs to purchase their own transport. This could run independently or in parallel with a system of subsidized transportation.



### 5.1.2 Improve security

Insecurity in the district is perceived as another important constraint to profitable livestock marketing in Turkana (Lotira 2000, personal communication; Barrett 2001; McPeak and Barrett 2001; Barrett et al. 2004; ITDG 2005; DLMC Chairman 2006). Improving security in hotspot areas along the border between Turkana and its sovereign neighbours, as well as the volatile border between Turkana and West Pokot, should be viewed as essential in endeavours to provide an environment in which stable and profitable livestock production and marketing can take place. Every effort should be made to ensure that the Kenyan Government acts on its obligation to the people of Turkana by enhancing security in the district. Increased security in the area would allow pastoralists to access good dry season grazing/browsing (McPeak and Barrett 2001), which, in turn, would potentially translate into healthier and more saleable livestock, and would reduce marketing transaction costs by reducing or eliminating the need for armed escorts and place downward pressure on the premiums that middle-level and external livestock buyers impose due to high levels of insecurity in the district, particularly interior areas.

### 5.1.3 Information flows

The improvement of information flows would be another key improvement in livestock marketing systems in Turkana. It is essential that pastoral communities (through pastoral or resource users associations) (ITDG 2005) and itinerant and middle-level traders (through marketing associations) (ITDG 2005) are aware of accurate up-to-date prices and traded volumes of the livestock that they intend to both buy and sell. This information should be available for both local and export markets. Regular updates should be made available for markets in Nairobi, Mombassa, Moroto, Nakuru, Kisumu, Eldoret, Chepareria, Koibatek, Bungoma, Chwele, and Bumala. It is likely that improved market information flows would contribute to more stable inter-market trading margins (Barrett 2001; McPeak and Barrett 2001; Barrett and Luseno 2004). Many of these information related concerns should be addressed once the LINKS system becomes fully functional (ITDG 2006, personal communication). In addition, the Market Access Programme, funded by UNDP, should also promote livestock marketing by linking pastoralists and local traders with terminal markets and improving market information flows in areas such as Katilu, Kainuk, Kakuma and Lokichar (ITDG 2006, personal communication). Improved information on rangeland carrying capacity is also likely to greatly assist in both strategic livestock migration decisions and livestock destocking and restocking interventions (McPeak and Barrett 2001).

## 5.1.4 Creating opportunities for pastoralists to sell livestock

As marketed livestock off-take rates remain incredibly low in Turkana, donors and policymakers are keen to implement interventions that are likely to increase livestock marketing in order to increase pastoralists' incomes and wealth (McPeak and Barrett 2001) and their capacity to manage regular climatic shocks (Barrett et al. 2004). The creation of new livestock sale yards in feeder markets, with institutionalized market days, is a key first step to promoting livestock marketing (Mwangi 2005). Driven by VSF-Belgium in central and southern divisions and Oxfam GB in northeastern Turkana, feeder market development has already begun. In our own research, a significant demand was expressed by both pastoralists and traders alike for the re-establishment of a livestock market in Kanukurdio, Kaaleng Division. In addition, livestock traders in Kalemnarok suggested that the creation of small feeder markets was a good idea. Livestock traders from Kerio were also excited over the prospects of new feeder markets suggesting that more markets would strengthen livestock marketing in the area and generate higher profits for livestock traders whose income would trickle down to the local community. In Lokichar, traders were keen to see new feeder markets established in Kangipur, Katlia and Napusmoru. They believed that if markets are established in these areas, the cash economy will follow. They also stated that there were good profit margins associated with buying goats from feeder markets. In agreement with the DLMC Chairman, it is advised that attention should be initially focused on improving the domestic marketing system before external markets are tackled. The UN refugee camps at Lokichoggio and Kakuma, and the new AMREF meat processing factory, are big internal markets (Mwangi 2005). In Kerio, traders were extremely excited about the opening of the AMREF meat processing plant in Lokichoggio as they perceived it as a means to attain higher prices and to cut out the Lodwar livestock marketing cartel

## 5.2 Re-apportioning value-added in livestock marketing chains

### 5.2.1 Livestock auctions

Whilst the re-introduction of livestock auctions may be difficult for some, it is argued that the auction system would result in direct financial benefits to pastoralists and would indirectly catalyse livestock marketing in Turkana by making livestock marketing more financially rewarding (Barrett 2001). According to economic theory, auctions make market transactions transparent (ITDG 2005) and generally reduce price variability compared to dyadic markets in which buyers and sellers search and negotiate bilaterally or with the assistance of brokers (Barrett and Luseno 2004). Supported by NORAD in the 1980s, the auction system operated during 1960s and 1970s under LMD. According to Ajele (2005), many pastoralists would like to see the auction system reintroduced. Indeed, in our interview with the DLPO, he

reminisced about the days when livestock auctions were institutionalized. Auctions were advertised by the Ministry and buyers would come from Uganda to buy and sell sheep and goats. Auctions were established in Lorugum, Lodwar, Kaleng and Kakuma and were well promoted. Auctions were also suggested to furnish pastoralists with higher prices. They were arranged well and other commodities were bought and sold on special market days. There are very few sheep and goats in Uganda and the demand is high (DLPO-Turkana 2006, personal communication). According to ITDG (2005), livestock auctions have been used successfully in Laikipia and Samburu Districts. The institutionalization of livestock auctions would eventually evolve to differentiate livestock by weight, age and breed, and act as an incentive to pastoral communities to capture higher value. In agreement with ITDG (2005), 'this would be best developed and mainstreamed in collaboration with other agencies with interest in the livestock sector in the region such as VSF-Belgium, MoLF&D, AMREF, TERRA NOUVA, and ALRMP II.

### 5.2.2 Reducing the influence of marketing cartels

In an attempt to re-apportion value-added along the marketing chain, this report suggests that efforts should be made to reduce the influence of marketing cartels, specifically the affects of Boran traders and brokers operating in principal livestock markets in Turkana. One such effort would be devising incentives for a greater number of buyers to attend livestock markets and increase the regularity of their attendance. Another intervention that would be likely to pay dividends would be to link pastoralists and local traders with terminal markets, as well as the development of more livestock sell yards, and LMAs, market sensitization and market development (ITDG 2006, personal communication). Improved flow of information on livestock prices and volumes from key markets, both local and national, would also be likely to loosen the grip of livestock marketing cartels. Loosening the grip of marketing cartels, in combination with a reduction in livestock transportation costs, would be likely to improve pastoralists' and middle-level traders' margins on the sale of livestock. Given the political will and financial capacity, it may also be worth development-based international NGOs to consider becoming directly involved in the purchase, transportation and sale of livestock at terminal markets. Alternatively, livestock traders could be encouraged to work through brokers to make direct contact with final buyers at a range of terminal markets (Lotira 2000; ITDG 2005).

### 5.2.3 Improve marketing of regional speciality foods (RSF)

According to Lotira (2000), Turkana meat, particularly goat meat, is tasty and tender and popular in terminal market destinations (Lotira 2000). There are many private abattoirs in Nairobi and other urban centres that supply meat to hotels and other establishments that

consume relatively large amounts of quality meat. In Nairobi alone, Springfield Meat, Farmers Choice, Gilani's and Halal abattoirs/butcheries could potentially be persuaded to be end-users of Turkana goats. Indeed, it may be also be feasible to promote the export of goat and other meat to markets in the Arabian Peninsula and even further a field, possibly within a fair/ethical trade arrangement. This report suggests that attempts should be made to pilot the marketing of goats from Turkana as a regional speciality food.

#### 5.2.4 Strengthen livestock marketing associations

Whilst some of the distributional problems have arisen due to strong market oriented livestock trader associations (LMAs) and livestock brokers, strengthening LMAs would be likely to lead to the improved management of sell yards and the more effective exploitation of external livestock markets. This should involve the promotion of livestock sourcing and forward marketing as a parallel measure to break the grip of the marketing cartels. As long as transparent competition for livestock and improved market information could be achieved, livestock producers would likely benefit from higher and more stable livestock prices.

#### 5.2.5 Initiate livestock producer associations

Likewise, in agreement with the strategy of AMREF, it is essential to encourage the development of livestock producer associations (LPAs) (ITDG 2005). Pastoral associations are an essential evolutionary interface between trader groups and livestock producers. Organized pastoral communities are an essential institution for the improvement of profitable livestock production and marketing. Membership expansion of LMAs and LPAs would greatly assist in the penetration of as yet potentially untapped pools of livestock in the district's interior (ITDG 2005). These institutions would also be essential to build political capital amongst pastoral communities giving a voice to politically marginalized masses in Turkana.

### 5.3 Improving access to credit

Improving access to credit is another essential step required to improve returns to livestock marketing for both pastoralists and traders. Credit should be made available to pastoralist associations, traders, traders' associations for the purchase and transportation of livestock to main and terminal markets; this could be in the form of a revolving fund or some kind of micro-credit arrangement. However, the provision of credit is only recommended where grant-sponsored pilot initiatives have proved successful and up-scaling is principally limited to a lack of working capital. Credit support to pastoralist associations, traders and traders associations could be undertaken on a revolving credit basis, based on the strength of the trader and pastoralist association, which would act as financial resources guarantors. According to ITDG (2005), this approach has been used successfully in the past. In addition

to providing external credit for livestock marketing activities, the report suggests that traders and pastoralists should be strongly encouraged to make investments and engage in economic activities using cash savings and merry-go-around finance.

## 5.4 Training for livestock traders and pastoralists

In order to capture a higher proportion of the benefits associated with expanding livestock marketing, it is essential that human capital (knowledge and skills of pastoralists and livestock traders) is developed (UNDP 2006). Training should include areas such as animal production, particularly for improving livestock health, market-based drought mitigation, response and recovery, livestock marketing, and business skills. If appropriate levels of financial support could be assured, FFS or a similar approach would be a suitable mechanism for such a capacity building intervention (ITDG 2005). This approach should be accompanied by production and marketing-based exchange visits (UNDP 2006), which would expose key livestock producers and traders to new and more profitable ways of doing business.

Human capacity building should go hand in hand with social and institutional capital building discussed in the previous two sections and should be under-pinned with credit provision. In agreement with ITDG (2005), it is expected that better-organized pastoralists and traders' associations present a more effective vehicle to achieve a more efficient integrated livestock marketing system in Turkana as well as creating more effective policy advocacy platforms with which to lobby for investments in infrastructure and security.

## 5.5 Policy recommendations

- National Government and international donors should be lobbied to make significant improvements to the road infrastructure in Turkana
- National Government should be lobbied for a review and justification of current quarantine restrictions in Turkana District
- National Government should be lobbied to improve security along the West Pokot, Ugandan, Sudanese and Ethiopian borders (UNDP 2006).
- A review should be initiated to analyse and justify the structure of county council livestock marketing fees.

## 6 Research needs

### 6.1 Assess spill-over effects of newly established livestock markets and AMREF/Terra Nova meat processing plant

In an attempt to underpin effective and efficient development efforts in Turkana, it is essential that future decisions are based on a solid understanding of the outcomes of past and current interventions. It is essential to understand both the impact and impact processes of interventions aimed at promoting livestock marketing in Turkana, namely, the establishment of sell yards, and the institutionalization of market days, the promotion of LMAs and the operationalization of the AMREF meat processing plant. Conversely, it is equally important to investigate the spill-over effects of livestock market-centred interventions on the growth of cash-based micro-enterprises such as kiosks, shops, and hotels etc.

### 6.2 Livestock disease management and livestock marketing

It is also essential to develop a better understanding of the animal health constraints to profitable livestock marketing in Turkana (ITDG 2005). As ITDG (2005) state, although 'livestock marketing has become an urgent concern and an issue of major interest among pastoral communities, little effort has been made to address livestock health aspects especially for stock meant for the market'.

### 6.3 Is there a role for women in livestock trading?

Time is now at hand to investigate the potential role of women in expanding livestock marketing in Turkana. According to ITDG (2005), women constitute approximately 7% of the livestock trading community in Turkana and are primarily involved in trading small stock (goats). Given the entrepreneurial bent of women in the district and the expressed desire to become more involved in livestock marketing, a gender-focused comparative analysis of livestock marketing systems in Turkana is long over-due.

### 6.4 Institutional dynamics in Turkana and the promotion of efficient and effective livestock production and marketing

As the institutional capacity of Turkana expands, it is essential to assess the role of institutional structures in the promotion of efficient, effective and sustainable livestock production and marketing innovation systems in Turkana.

## 6.5 Transition from subsistence livestock-based economy to a market economy

Last, but certainly not least, it is essential to investigate the opportunities for, and constraints to, pastoralists making the successful transition from a traditional subsistence-based livestock economy to a fully integrated market economy.

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# Appendix 1. Computing 'carrying capacities' per Range Land Unit of Turkana

Range Unit	Name	Land Area	Median rainfall (mm)	Permissible forage biomass (kg/ha)	Max Stocking density (at maintenance + production level) ha/TLU	Optimal grazing days	Carrying capacity on accessible land during optimal grazing days <sup>1</sup> (no. of animals)	Carrying capacity on accessible land spread out over the year <sup>2</sup> (no. of animals)	Converting TLU to livestock <sup>3</sup>
							C = acc land / A	(B/365) °C	
							A	B	
1	<b>Kaikorr</b>	3480 km <sup>2</sup>	251	Herb layer	8.0%	113	Cattle	62,865	7,750
		total					348,000	61,973	
		PAF					0.56	301,927	
	accessible land	194880 ha		Shrub layer	16.8%	119	Goats	27,448	7,144
							Camels	23,766	7,162
2	<b>Northern Lotikipi</b>	331700 ha	203	Herb layer	35.0%	386	Cattle	301,545	33,046
		total					3,170,952	259,648	
		PAF					1.00	1,684	
	accessible land	331700 ha		Shrub layer	30.0%	159	Goats	47,386	11,684
							Camels	40,451	11,637
3	<b>Songot - Mogila</b>	275200 km <sup>2</sup>	406	Herb layer	13.5%	320	Cattle	134,848	14,778
		total					74,916	12,315	
		PAF					0.49	12,789	
	accessible land	134848 ha		Shrub layer	24.5%	314	Goats	51,865	140,674
							Camels	44,949	12,931
4	<b>Oropoi</b>	2901 km <sup>2</sup>	342	Herb layer	12.6%	248	Cattle	111,459	13,742
		total					60,507	10,775	
		PAF					0.73	55,730	
	accessible land	211773 ha		Shrub layer	29.2%	305	Goats	613,027	159,555
							Camels	48,130	14,505
5	<b>Southern Lotikipi</b>	302000 km <sup>2</sup>	200	Herb layer	23.7%	256	Cattle	96,408	10,565
		total					53,332	8,767	
		PAF					0.83	19,282	
	accessible land	250660 ha		Shrub layer	25.0%	130	Goats	212,097	52,298
							Camels	16,600	4,775
6	<b>Tarach</b>	1949 km <sup>2</sup>	214	Herb layer	12.5%	146	Cattle	58,470	6,408
		total					30,955	5,084	
		PAF					0.81	24,334	
	accessible land	157869 ha		Shrub layer	24.3%	139	Goats	234,670	57,864
							Camels	18,357	5,281
7	<b>Lorengippi</b>	2053 km <sup>2</sup>	283	Herb layer	7.5%	120	Cattle	17,018	5,129
		total					11,652	4,150	
		PAF					0.63	13,334	
	accessible land	129339 ha		Shrub layer	18.9%	156	Goats	146,673	64,295
							Camels	12,202	5,850

# Appendix 1. Computing 'carrying capacities' per Range Land Unit of Turkana

Range Unit	Name	Land area	Median rainfall (mm)	Permissible forage biomass (kg/ha)	Max stocking density (at maintenance + production level) ha/TLU	Optimal grazing days	Carrying capacity on accessible land during optimal grazing days <sup>1</sup> (no. of animals)	Carrying capacity on accessible land spread out over the year <sup>2</sup> (no. of animals)	Converting TLU to livestock <sup>3</sup>		
							(TLU)	(TLU)			
							C = acc land / A	(B/365)°C			
							A	B			
8	Loima Hills Plateau total PAF accessible land	2202 km <sup>2</sup> 220200 ha 0.26 57262 ha	322	Herb layer	67	5.6	45	10,224	1,260		
				Sheep		65	9.9	1,030	57,830	10,299	
				Goats		95	8.9	1,674	70,761	18,417	
				Camels	101	10.3	110	5,558	1,675	3,891	1,173
9	Lodwar - Lorigumar total PAF accessible land	3287 km <sup>2</sup> 328700 ha 0.96 315552 ha	173	Herb layer	201	2.1	35	150,263	14,409		
				Sheep		55	4.1	11,957	76,964	115,973	
				Goats		85	11.6	6,335	27,203	299,230	69,684
				Camels	101	13.7	100	23,033	6,310	16,123	4,417
10	Kaeris - Makutano total PAF accessible land	4804 km <sup>2</sup> 480400 ha 0.79 379516 ha	200	Herb layer	146	2.5	40	151,806	16,636		
				Sheep		60	4.6	13,562	82,503	135,622	
				Goats		90	9.0	10,398	42,168	114,375	
				Camels	103	10.5	105	36,144	10,398	25,301	7,278
11	Lokitaung total PAF accessible land	2677 km <sup>2</sup> 267700 ha 0.52 139204 ha	243	Herb layer	76	4.7	40	29,618	3,246		
				Sheep		60	8.6	2,661	16,187	26,608	
				Goats		90	8.6	3,991	16,187	43,903	
				Camels	106	10.0	105	13,920	4,004	9,744	2,803
12	Todenyang - Katabo total PAF accessible land	1235 km <sup>2</sup> 123500 ha 0.64 79040 ha	152	Herb layer	48	5.0	30	15,808	1,299		
				Sheep		50	10.3	7,874	76,738	10,512	
				Goats		80	13.3	1,303	5,943	65,371	14,328
				Camels	55	15.8	95	5,003	1,302	3,502	911
13	Kanakurdio total PAF accessible land	2335 km <sup>2</sup> 23500 ha 0.48 11280 ha	125	Herb layer	0	discourage	20	0	0		
				Sheep		40	discourage	0	0		
				Goats		98	22.0	513	5,640	1,082	
				Camels	29	26.7	85	422	98	296	69
14	Kalokol total PAF accessible land	2677 km <sup>2</sup> 26700 ha 0.88 23496 ha	100	Herb layer	?	?	10	?	?		
				Sheep		30	?	?	?		
				Goats		60	?	?	?		
				Camels	75	?	?	?	?	?	?

# Appendix 1. Computing 'carrying capacities' per Range Land Unit of Turkana

Range Unit	Name	Land area	Median rainfall (mm)	Permissible forage biomass	Off-take	Max stocking density (at maintenance + production level) ha/TLU	Optimal grazing days	Carrying capacity on accessible land during optimal grazing days <sup>1</sup> (no. of animals)	Carrying capacity on accessible land spread out over the year <sup>2</sup> (no. of animals)	Converting TLU to livestock <sup>3</sup>
		(km <sup>2</sup> )	(mm)	(kg/ha)	(kg/ha)	(ha/TLU)	(days)	(no. of animals)	(no. of animals)	(no. of animals)
						A	B	C = acc land / A	(B/365)*C	
15	Ngapoi Hills total PAF accessible land	2008 km <sup>2</sup>	121	Herb layer	45	discourage	15	0	0	
		200800 ha				discourage	35	0		
		0.74				15.3	9,737	1,734	107,111	19,075
16	Lokichar total PAF accessible land	4551 km <sup>2</sup>	191	Herb layer	70	discourage	40	51,479	5,641	51,479
		455100 ha				11.3	27,789	4,568	277,893	45,681
		0.69				13.0	24,155	5,958	285,708	65,517
17	Kerio total PAF accessible land	314019 ha	166	Shrub layer	84	discourage	105	20,659	5,943	14,461
		4388 km <sup>2</sup>				9.0	33,154	3,633	33,154	3,633
		438800 ha				16.6	17,975	2,955	179,749	29,548
18	Naruo total PAF accessible land	298384 ha	320	Shrub layer	67	discourage	105	23,495	5,793	288,443
		2499 km <sup>2</sup>				3.0	47,481	6,504	47,481	6,504
		249900 ha				5.2	27,393	5,253	273,929	52,534
19	Loriyu Plateau total PAF accessible land	142443 ha	193	Herb layer	220	discourage	115	33,915	9,292	373,069
		2603 km <sup>2</sup>				4.8	29,676	9,350	20,773	6,545
		260300 ha				17.9	5,962	898	5,962	898
20	South Lake Shore total PAF accessible land	107100 ha	177	Herb layer	3	discourage	55	3,546	7,286	35,456
		2603 km <sup>2</sup>				30.1	6,429	1,849	70,720	20,344
		0.41				16.6	6,429	1,849	70,720	20,344
21	Suguta Valley total PAF accessible land	106723 ha	200	Shrub layer	51	discourage	120	5,617	1,847	3,932
		1071 km <sup>2</sup>				discourage	75			
		107100 ha				113.5	236	68	2,595	746
22	South Lake Shore total PAF accessible land	28775 ha	177	Shrub layer	27	discourage	120	206	68	145
		1071 km <sup>2</sup>				3.9	26,903	4,422	26,903	4,422
		122000 ha				6.4	16,394	3,593	163,938	35,932
23	Suguta Valley total PAF accessible land	122000 ha	200	Herb layer	170	discourage	80	7,441	2,548	26,903
		0.86				12.4	8,461	2,550	163,938	35,932
		104920 ha				14.1	7,441	2,548	93,074	28,050
24	Suguta Valley total PAF accessible land	104920 ha	200	Shrub layer	112	discourage	125	5,209	1,784	5,209
		122000 ha				3.9	26,903	4,422	26,903	4,422
		0.86				6.4	16,394	3,593	163,938	35,932

# Appendix 1 Computing 'carrying capacities' per Range Land Unit of Turkana

Range Unit	Name	Land area	Median rainfall (mm)	Permissible forage biomass (at maintenance)	Off-take (kg/ha)	Max stocking density (+ production level) ha/TLU	Optimal grazing days	A	B	Carrying capacity on accessible land during optimal grazing days <sup>1</sup> (no. of animals)	Carrying capacity on accessible land spread out over the year <sup>2</sup> (no. of animals)	Converting TLU to livestock <sup>3</sup>			
								C = acc land / A	(B/365)*C						
22	Kamosing - Lomelo accessible land	2811 km <sup>2</sup> total 281100 ha PAF 0.47	262	Herb layer	41	2.8%	Herb layer	11.1	60	11,902	1,957	11,902			
								15.3	80	7,220	1,582	72,195	15,824		
								9.0	110	14,680	4,424	161,476	48,664		
		132117 ha		Shrub layer	106	14.1%	Shrub layer	10.3	125	12,827	4,393	8,979	3,079		
23	Tiati Mountain accessible land	224 km <sup>2</sup> total 22400 ha PAF 0.25	380	Herb layer	139	6.3%	Herb layer	8.6	150	651	268	651			
								12.0	170	467	217	4,667	2,174		
								15.4	200	364	199	4,000	2,192		
		5600 ha		Shrub layer	119	10.0%	Shrub layer	16.5	215	339	200	238	140		
24	Silalei Mountain accessible land	1012 km <sup>2</sup> total 101200 ha PAF 0.35	390	Herb layer	185	8.1%	Herb layer	4.0	115	8,855	2,790	8,855			
								5.8	135	6,107	2,259	61,069	22,587		
								7.0	165	5,060	2,287	55,660	25,161		
		35420 ha		Shrub layer	171	14.0%	Shrub layer	7.7	180	4,600	2,268	3,220	1,588		
25	Rift Escarpment accessible land	372 km <sup>2</sup> total 37200 ha PAF 0.25	227	Herb layer	27	2.2%	Herb layer	14.0	60	664	109	664			
								23.1	80	403	88	4,026	882		
								14.8	110	628	189	6,912	2,083		
		9300 ha		Shrub layer	54	8.8%	Shrub layer	16.8	125	554	190	388	133		
99	Kibish <sup>4</sup> Rangeland GIS data: accessible land	649393 ha PAF 0.75 [own estimate]		Herb layer	300	25.0%	Herb layer	1.2	45	405,871	50,039	405,871			
								2.14	65	227,591	40,530	2,275,910	405,299		
								4.95	95	98,393	25,609	1,082,322	281,700		
								5.7	170	85,448	25,751	59,813	18,028		
								<b>Totals:</b>							
								brief Peak capacity (in TLU)		year round capacity (in TLU)		brief Peak capacity (nr. of animals)		year round capacity (nr. of animals)	
								1,733,254		204,530		1,733,254		204,530	
								948,107		164,933		9,481,072		1,649,324	
								560,376		145,732		6,164,141		1,603,051	
								483,836		145,981		338,685		102,186	
								<b>Cattle</b>		<b>204,530</b>		<b>1,733,254</b>		<b>204,530</b>	
								<b>Sheep</b>		<b>164,933</b>		<b>9,481,072</b>		<b>1,649,324</b>	
								<b>Goats</b>		<b>145,732</b>		<b>6,164,141</b>		<b>1,603,051</b>	
								<b>Camels</b>		<b>145,981</b>		<b>338,685</b>		<b>102,186</b>	

Totals:

Max Stock Densities calculated (with RCF assumed: 0.80) and:

Herb layer 300

Shrub layer 175

Cattle 204,530

Sheep 164,933

Goats 145,732

Camels 145,981

<sup>1</sup>restricted = only in the period (specific number of days) when grazing was judged sustainable..

<sup>2</sup>unrestricted = assuming the same amount of forage biomass could be spread throughout the year..

<sup>3</sup>one TLU = 1 cattle, 10 sheep, 11 goats, 0.7 camels

<sup>4</sup>A polygon (hence: Landarea) was available for Kibish in the digital data from the Rangeland Handbook; other factors were estimated based on Northern Lotikipi Plains and Kaikoi.

**Nota Bene:** These number of animals are NOT additive as they all compete for the forage biomass! Moreover, cattle and sheep use the herb layer competitively, while goats and camels compete for the forage in the shrub layer.

# Appendix 2a. From carrying capacities to livestock projections per Range Unit of Turkana District

Rangeland Unit (RU)	Land area (ha)	Estimated carrying capacity <sup>1</sup>				carrying capacity per hectare			'relative' carrying capacities of livestock				
		MaxCattle	MaxSheep	MaxGoats	MaxCamel	Cattle/ha	Sheep/ha	Goats/ha	Camels/ha				
Kibish	649,393	50,039	405,299	281,700	18,026	0.0771	0.6241	0.4338	0.0278	12.1%	12.2%	7.8%	7.8%
Kaikorr	327,103	7,508	60,032	76,123	4,857	0.0223	0.1781	0.2258	0.0144	3.5%	3.5%	4.0%	4.1%
Northern Lotikipi Plain	32,644	256,486	126,961	8,046	8,046	0.0996	0.7828	0.3875	0.0246	15.7%	15.3%	6.9%	6.9%
Southern Lotikipi Plain	11,229	93,181	55,586	3,553	3,553	0.0350	0.2903	0.1732	0.0111	5.5%	5.7%	3.1%	3.1%
Songot - Mogila	14,787	123,227	140,763	9,057	9,057	0.0537	0.4475	0.5112	0.0329	8.4%	8.7%	9.1%	9.3%
Oropoi	300,241	14,222	111,518	165,132	10,508	0.0474	0.3714	0.5500	0.0350	7.5%	7.2%	9.8%	9.9%
Todenyang - Kataboi	114,037	1,200	9,707	13,230	842	0.0105	0.0851	0.1160	0.0074	1.7%	1.7%	2.1%	2.1%
Lokitaung	264,647	3,209	26,305	43,402	2,771	0.0121	0.0994	0.1640	0.0105	1.9%	1.9%	2.9%	3.0%
Kaeris - Maktutano	480,342	16,634	135,606	114,361	7,278	0.0346	0.2823	0.2381	0.0152	5.4%	5.5%	4.3%	4.3%
Tarach	202,800	6,667	52,947	60,209	3,846	0.0329	0.2611	0.2969	0.0190	5.2%	5.1%	5.3%	5.3%
Kanakuridio <sup>2</sup>	233,497			10,747	684	0.0000	0.0000	0.0460	0.0029	0.0%	0.0%	0.8%	0.8%
Ngapoi Hillis <sup>2</sup>	208,698			19,773	1,260	0.0000	0.0000	0.0947	0.0060	0.0%	0.0%	1.7%	1.7%
Kalokol <sup>3</sup>	260,808			41,501	2,201	0.0000	0.0000	0.1591	0.0084	0.0%	0.0%	2.8%	2.4%
Loima Hills Plateau	223,938			18,730	1,193	0.0057	0.0468	0.0836	0.0053	0.9%	0.9%	1.5%	1.5%
Lorengippi	208,680	1,282	10,473	41,501	2,201	0.0250	0.2021	0.3132	0.0199	3.9%	3.9%	5.6%	5.6%
Lodwar - Lorugumar	318,630	13,967	112,420	67,549	4,282	0.0438	0.3528	0.2120	0.0134	6.9%	6.9%	3.8%	3.8%
Kerio	438,600	3,632	29,534	63,697	4,031	0.0083	0.0673	0.1452	0.0092	1.3%	1.3%	2.6%	2.6%
Lokichar	467,752	5,798	46,951	67,339	4,276	0.0124	0.1004	0.1440	0.0091	2.0%	2.0%	2.6%	2.6%
Naroo	247,264	6,436	51,980	101,131	6,476	0.0260	0.2102	0.4090	0.0262	4.1%	4.1%	7.3%	7.4%
Loriyu Plateau	261,216	902	7,311	20,416	1,297	0.0035	0.0280	0.0782	0.0050	0.5%	0.5%	1.4%	1.4%
Suguta Valley	119,066	4,316	35,067	27,375	1,741	0.0362	0.2945	0.2299	0.0146	5.7%	5.7%	4.1%	4.1%
Kamosing - Lomelo	279,892	1,948	15,756	48,455	3,062	0.0070	0.0563	0.1731	0.0109	1.1%	1.1%	3.1%	3.1%
Tiati Mountain	20,986	251	2,036	2,053	131	0.0119	0.0970	0.0978	0.0062	1.9%	1.9%	1.7%	1.8%
Rift Escarpement	49,954	147	1,185	2,797	178	0.0029	0.0237	0.0560	0.0036	0.5%	0.5%	1.0%	1.0%
Shialei Mountain	88,938	2,452	19,850	22,113	1,396	0.0276	0.2232	0.2486	0.0157	4.3%	4.4%	4.4%	4.4%
South Lake Shore	102,732			716	46	0.0000	0.0000	0.0070	0.0004	0.0%	0.0%	0.1%	0.1%
										100%	100%	100%	100%

<sup>1</sup> Carrying capacities derived by dividing the LandArea by the Maximum stocking densities (ha/TLU) given in GTZ Range Management Handbook for Turkana (Vol II,9). Resulting livestock figures in TLU (1) were converted to: cattle (1), sheep (10), goats (11), camels (0.7)

**Nota Bene: The carrying capacity amount of animals are NOT additive as they all compete for the forage biomass!**

**Moreover, cattle and sheep use the herb layer competitively, while goats and camels compete for the forage in the shrub layer.**

<sup>2</sup> The GTZ Range Management Handbook did not give/calculate maximum stocking densities, arguing that permissible forage biomass off-take can not be calculated due to the combined effects of low rainfall (125 mm) and severe erosion. We have used their data however to this for goats and camels feeding on the shrub layer.

<sup>3</sup> Biomass production and stocking densities (and the derived carrying capacities) could not be calculated for cattle & sheep (both grazers), since the vegetation is mainly supported by flood and ground water, rather than precipitation (100 mm).



# Appendix 2b. From carrying capacities to livestock projections per Range Unit of Turkana District

Rangeland Unit (RU)	Land area (ha)	Estimated carrying capacity <sup>1</sup>				(% of total per species) per RU			Livestock Projections					
		MaxCattle	MaxSheep	MaxGoats	MaxCamel	% cattle	% sheep	% goats	% camels	Cattle	Sheep	Goats	Camels	Shoats A+B
Kibish	649,393	50,039	405,299	281,700	18,026	24.5%	24.6%	17.0%	17.1%	48,428	259,147	343,538	29,540	602,685
Kalkorr	337,103	7,508	60,032	76,123	4,857	3.7%	3.6%	4.6%	4.6%	7,266	38,384	92,833	7,959	131,218
Northern Lotikipi Plain	327,861	32,644	256,486	126,961	8,046	16.0%	15.6%	7.7%	7.6%	31,593	163,996	154,831	13,187	318,827
Southern Lotikipi Plain	320,987	11,229	93,181	55,586	3,553	5.5%	5.7%	3.4%	3.4%	10,868	59,579	67,788	5,822	127,367
Songot - Mogila	275,375	14,787	123,227	140,763	9,057	7.2%	7.5%	8.5%	8.6%	14,311	78,791	171,663	14,843	250,454
Oropoi	200,241	14,222	111,518	165,132	10,508	7.0%	6.8%	10.0%	10.0%	13,764	71,304	201,382	17,221	272,686
Todenyang - Kataboi	114,037	1,200	9,707	13,230	842	0.6%	0.6%	0.8%	0.8%	1,161	6,206	16,134	1,379	22,341
Lokitaung	264,647	3,209	26,305	43,402	2,771	1.6%	1.6%	2.6%	2.6%	3,105	16,819	52,930	4,541	69,749
Kaeris - Makutano	480,342	16,634	135,606	114,361	7,278	8.1%	8.2%	6.9%	6.9%	16,099	86,706	139,465	11,926	226,171
Tarach	202,800	6,667	52,947	60,209	3,846	3.3%	3.2%	3.6%	3.7%	6,453	33,854	73,426	6,303	107,281
Kanakurdio <sup>2</sup>	233,497		10,747		684	0%	0%	0.6%	0.7%	0	0	13,106	1,121	13,106
Ngapoi Hills <sup>2</sup>	208,698		19,773		1,260	0%	0%	1.2%	1.2%	0	0	24,114	2,065	24,114
Kalokol <sup>3</sup>	260,808		41,501		2,201	0%	0%	2.5%	2.1%	0	0	50,611	3,607	50,611
Loima Hills Plateau	223,938	1,282	10,473	18,730	1,193	0.6%	0.6%	1.1%	1.1%	1,241	6,697	22,841	1,954	29,538
Lorengippi	208,680	5,213	42,184	65,354	4,163	2.5%	2.6%	3.9%	4.0%	5,045	26,972	79,700	6,822	106,672
Lodwar - Lorugumar	318,630	13,967	112,420	67,549	4,282	6.8%	6.8%	4.1%	4.1%	13,518	71,881	82,377	7,017	154,258
Kerio	438,600	3,632	29,534	63,697	4,031	1.8%	1.8%	3.8%	3.8%	3,515	18,884	77,679	6,606	96,563
Lokichar	467,752	5,798	46,951	67,339	4,276	2.8%	2.8%	4.1%	4.1%	5,612	30,020	82,121	7,007	112,141
Naroo	247,264	6,436	51,980	101,131	6,476	3.1%	3.2%	6.1%	6.2%	6,228	33,236	123,331	10,613	156,567
Loriyu Plateau	261,216	902	7,311	20,416	1,297	0.4%	0.4%	1.2%	1.2%	873	4,675	24,897	2,126	29,572
Suguta Valley	119,066	4,316	35,067	27,375	1,741	2.1%	2.1%	1.7%	1.7%	4,177	22,422	33,384	2,853	55,806
Kamosing - Lomelo	279,892	1,948	15,756	48,455	3,062	1.0%	1.0%	2.9%	2.9%	1,885	10,074	59,092	5,018	69,166
Tiati Mountain	20,986	251	2,036	2,053	131	0.1%	0.1%	0.1%	0.1%	243	1,302	2,504	215	3,806
Rift Escarpment	49,954	147	1,185	2,797	178	0.1%	0.1%	0.2%	0.2%	142	758	3,411	292	4,169
Shialei Mountain	88,938	2,452	19,850	22,113	1,396	1.2%	1.2%	1.3%	1.3%	2,373	12,692	26,967	2,287	39,659
South Lake Shore	102,732			716	46	0%	0%	0.0%	0.0%	0	0	873	75	873
						100.0%	100.0%	100.0%	100.0%	197,900	1,054,400	2,021,000	172,400	3,075,400

6,803,238

<sup>1</sup> Carrying capacities derived by dividing the Land Area by the Maximum stocking densities (ha/TLU) given in GTZ Range Management Handbook for Turkana (Vol II, 9). Resulting livestock figures in TLU (1) were converted to: cattle (1), sheep (10), goats (11), camels (0.7)

**Nota Bene: The carrying capacity amount of animals are NOT additive as they all compete for the forage biomass!**

<sup>2</sup> Moreover, cattle and sheep use the herb layer competitively, while goats and camels compete for the forage in the shrub layer.

<sup>3</sup> The GTZ Range Management Handbook did not give/calculate maximum stocking densities, arguing that permissible forage biomass off-take can not be calculated due to the combined effects of low rainfall (125 mm) and severe erosion. We have used their data however to this for goats and camels feeding on the shrub layer.

<sup>3</sup> Biomass production and stocking densities (and the derived carrying capacities) could not be calculated for cattle & sheep (both grazzers), since the vegetation is mainly supported by flood and ground water, rather than precipitation (100 mm).

## Appendix 3a. Data on livestock exportations from Turkana

Computed from official (export) movement permits, issued by the District Veterinary Offices.

The information on livestock-species, date, origin and destination of movement, were manually captured with assistance of VSF-B staff in Lodwar, and then entered into a database at ILRI Nairobi. The database was manipulated with help of Access and then brought into Excel to be used in 'Pivot Tables'.

### Shoats exportations from Turkana - in 1998

Origin	1998	Destinations:										Grand Total	
		Kitale	Kisumu	Bungoma	Eldoret	Kericho	Nakuru	Nairobi		Mombasa	OTHER		
Kaalena	April	100										100	
Kainuk	April	80										480	
	September											150	
Kakuma	February											400	
	March											990	
	April											200	
	August	108											508
	October											400	
	November	11											11
Kalemngorok	April	80										80	
Kalokol	August											200	
Katilu	September											450	
Lochwa	January	135											135
	February	90											90
	March	105											105
	April	220											320
	July	80											80
	December	80										80	
Lodwar	January			80			100	600				780	
	February	2	80			560	2620	7			3269		
	March	30			200	3680	950				4860		
	April	21	85		200	4246	20				4572		
	May	54											1304
	July											1662	
	August											3453	
	October	277											4337
	November	80			1	50	6010	90	20			6141	
	December	2	120			8	100	4615				4845	
	Lokangae	March											400
		November											100
December												160	
Lokichar	January			20							20		
	February			90	48			200	200				552
	March	110	240									350	
	April	100	80									180	
	May											80	
	June											0	
	July			80					420				500
	August			160								160	
	September			255					60	20		335	
	October			85					200				285
	November			80								80	
	December			85								85	
Lokichogio	February	160										240	
	March											272	
	April											1560	
	May											640	
	July											440	
	August											740	
	September											150	
	October											260	
Lokitaung	January	20										20	
	April											120	
	July											250	
Lokore	March											200	
Lokori	March											240	
	April											200	
	September											390	
	December											200	
Makutano	June											0	
	July											200	
	August											400	
	September											200	
	October											400	
	December	50											230
Turkwel	May											160	
<b>Grand Total</b>		1292	737	1580	69	8	50	6010	39523	1360	172	50801	

## Appendix 3a. Data on livestock exportations from Turkana

### Shoats exportations from Turkana in first 4 months of 1999

Origin	1999	Destinations:										Grand Total
		Kitale	Kisumu	Bungoma	Eldoret	Kericho	Nakuru	Dagoreti	Ka'bangi	Mombasa	OTHER	
Kainuk	January								150			150
Kakuma	February	60										60
Kalemngorok	March	40										40
Katilu	March									160		160
Lochwa	January	80										80
Lodwar	January		30						1230		7	1267
	February		240		40		4		1150		15	1449
	March	70	50						524	440	2	1090
	April	3	50						400			453
Lokichar	January			80	200							280
	February	170						200				370
	March	70							600			670
	April	200			400							600
Lokichogio	January								22	20		42
	February	60										60
	March									200		200
Lokori	April								230			230
Lorugum	January									200		200
	March									200		200
<b>Grand Total (4 months)</b>		<b>753</b>	<b>370</b>	<b>80</b>	<b>640</b>	<b>4</b>	<b>4</b>	<b>200</b>	<b>4306</b>	<b>1220</b>	<b>24</b>	<b>7601</b>

### Shoats Exportations from Turkana - during 12 months: October 04 – September 05

Origin	Month	Destinations:											Grand Total
		Ortum	Kitale	Kisumu	Bungoma	Eldoret	Nakuru	Naivasha	Dagoreti	Ka'bangi	Niiru	OTHER	
Kainuk	March						60						60
	April						55					55	110
Kakuma	August									14			14
	October								21				21
Kalemngorok	May	170								450	250		870
Katilu	April									100			100
	September									100			100
Lodwar	January		4							200			204
	March									950			950
	April									650	4		654
	May									740			740
	June			2						600			602
	July									700		3	703
	August					100				1850		10	1960
	September					150				1603		2	2005
	October									870			870
	November						5			1300		5	1310
	Lokichar	January									500		
March		150								450	140		740
April							100			1100			1200
May		250											250
June		280								450			730
July		320					80						400
August		300					230			650			1180
September		300					230			200			730
October							80			1380			1460
November								20		1500			1520
Lokori		July									200		
	October										250		250
<b>Grand Total</b>		<b>1770</b>	<b>6</b>	<b>250</b>	<b>5</b>	<b>835</b>	<b>20</b>	<b>21</b>	<b>250</b>	<b>16557</b>	<b>250</b>	<b>469</b>	<b>20433</b>

## Appendix 3a. Data on livestock exportations from Turkana

### Cattle exportations from Turkana in 1998

Origin	1998	Destinations:					Grand Total
		Kitale	Eldoret	Dagoreti	Ka'bangi	OTHER	
Kaikor	December				21		21
Kainuk	May			20			20
Kakuma	February						0
	March			131			131
	April			22			22
Kanukurudio	February			22			22
Katilu	November			44			44
	December			60			60
Lochwa	April			20			20
Lodwar	February			168			168
	March			141			141
	April			69			69
	June						10
Lokangae	February						0
	April			60	62		122
	May			44	40		84
	June						0
	August			22			22
Lokichar	February		30				30
	March	30					30
	April					40	40
	July			44			44
Lokichogio	February						0
	March			284			284
	April			646			646
	May			130			130
	June						0
	July			370			370
	August			306			306
	September			40	250		290
	October					88	88
	November			44			44
	December			306			306
Makutano	January			22			22
	February			44			44
Songot	December					26	26
Grand Total		30	30	3059	373	154	3656

## Appendix 3a. Data on livestock exportations from Turkana

Cattle exportations from Turkana in first 4 months of 1999

Origin	Destinations				Grand Total	
	1999	Kitale	Dagoreti	Ka'bangi		
Kakuma	February		1		1	
Kalemngorok	February			50	50	
	March			75	75	
Katilu	March			20	20	
Lodwar	April			10	10	
Lokangae	January			43	43	
	February			42	42	
	March			22	22	
Lokichar	February			22	22	
	March			20	200	220
	April			27	85	112
Lokichogio	January			64	64	
	February			130	130	
	March			66	66	
	April			88	88	
<i>Grand Total (4 months)</i>			1	679	285	965

Cattle exportations from Turkana - during 12 months: October 04–September 05

Origin	MONTH	Destinations					OTHER	Grand Total
		Kitale	Naivasha	Dagoreti	Ka'bangi	Njiru		
Kakuma	July			84				84
	August			14				14
	October						23	23
Kalemngorok	April						30	30
	May						30	30
	July						56	56
	August						38	38
Katilu	October						22	22
Lodwar	May						32	32
	June		1					1
	July			114	24			138
	September			24				24
	October			22	5		46	73
	November			79		23		102
Lokichar	March			70	30		140	240
	April					30		30
	June					28		28
	October					30		30
	November					90	30	120
Lokichogio	May		12					12
	August				43			43
	October				45			45
	November				117			117
Makutano	August			21				21
<i>Grand Total</i>		1	12	428	429	343	140	1353

## Appendix 3b. Data on livestock exportations from Turkana

Shoats Exportations from Turkana in first 3 months of 1998 and 1999

Origin	1998	Grand Total
Kainuk		
Kakuma	February	400
	March	990
Kalemngorok		
Katilu		
Lochwa	January	135
	February	90
	March	105
Lodwar	January	780
	February	3269
	March	4860
Lokangae	March	400
Lokichar	January	20
	February	552
	March	350
Lokichogio	February	240
	March	272
Lokitaung	January	20
Lokore	March	200
Lokori	March	240
Grand Total		12923

Origin	1999	Grand Total
Kainuk	January	150
Kakuma	February	60
Kalemngorok	March	40
Katilu	March	160
Lochwa	January	80
Lodwar	January	1267
	February	1449
	March	1090
Lokichar	January	280
	February	370
	March	670
Lokichogio	January	42
	February	60
	March	200
Lokori		
Lorugum	January	200
	March	200
Grand Total (4 months)		6318

49%

## Appendix 4. Prices of livestock in Turkana, extracted from ALRMP database

Month/ Year	Goat prices			Sheep prices			Cattle prices			Camel prices		
	Mean	N	Std. Devia- tion	Mean	N	Std. Devia- tion	Mean	N	Std. Devia- tion	Mean	N	Std. Devia- tion
Jan-99	605	359	225	561	47	143	8167	3	907	7500	2	1414
Feb-99	572	345	171	516	51	133	7638	8	2359	9450	4	3900
Mar-99	572	266	308	496	50	120	4603	15	1724	6536	5	940
Apr-99	583	274	162	537	48	117				5000	2	1414
May-99	591	229	419	583	54	99	4833	3	2970			
Jun-99	515	258	298	557	42	158	5467	3	2608			
Jul-99	524	237	205	539	49	218	5194	8	1653	7517	3	1052
Aug-99	502	222	203	479	44	145	6222	9	3024	7114	7	967
Sep-99	501	249	185	510	41	199	9607	15	5708	6725	4	608
Oct-99	512	280	208	534	44	265	8106	16	5858	5600	5	1377
Nov-99	474	241	159	430	42	81	4385	8	1067	6333	3	1457
Dec-99	507	248	156	506	68	120	8099	13	4384	6400	8	1689
Jan-00	573	202	227	563	36	150	5713	4	705	7050	6	1346
Feb-00	551	211	177	554	25	183	5606	9	612	7488	8	745
Mar-00	485	199	147	446	26	215	8612	13	6559	7933	9	4825
Apr-00	441	210	164	411	30	228	3901	8	1071	4913	4	1054
May-00	462	116	149	403	11	123	4850	8	1214	5543	7	1918
Jun-00	429	81	146	356	8	145	3600	6	860			
Jul-00	434	40	131	575	4	50	14000	2	7071			
Aug-00	507	104	290	433	8	185	5186	7	1424	6375	2	35
Sep-00	574	116	206	528	10	260	8571	7	1718	13933	3	6357

Oct-00	557	131	168		555	15	246		8425	4	1090	8400	1	.
Nov-00	670	124	217		603	16	190		7558	6	1139			
Dec-00	712	114	287		650	9	245		6500	1	.	8000	3	200
Jan-01	690	123	205		587	11	297		6000	4	3440	12650	2	4738
Feb-01	711	134	283		748	8	368		7000	2	707			
Mar-01	715	126	279		700	11	248		7000	2	707	9000	1	.
Apr-01	783	94	368		777	10	430		8500	1	.	8700	1	.
May-01	910	104	424		1013	6	571		8400	1	.			
Jun-01	935	84	452		814	7	380							
Jul-01	889	108	383		998	10	759							
Aug-01	944	101	474		976	7	567		9300	1	.			
Sep-01	842	117	406		848	11	393							
Oct-01	740	89	306		600	1	.		7500	1	.			
Nov-01	777	92	429		725	4	233							
Dec-01	1021	111	542		890	5	394							
Jan-02	1070	119	696		1014	7	604		8600	3	854			
Feb-02	869	132	503		800	4	294		17500	2	3536	18000	1	.
Mar-02	999	141	654		1110	5	368		11875	4	4366			
Apr-02	962	94	509		1438	8	686							
May-02	1028	87	537		950	7	582							
Jun-02	932	99	534		930	5	524							
Jul-02	869	105	453		981	8	518					7750	2	354
Aug-02	929	133	585		774	12	367					14000	2	1414
Sep-02	748	148	397		1143	9	681		6650	2	1202	9834	2	4007
Oct-02	786	186	442		785	23	379		8467	3	850			
Nov-02	746	206	461		758	23	324		8170	5	871	8500	1	.



Dec-02	722	225	456	591	24	283	7525	4	1250	11700	2	4667
Jan-03	639	191	200	646	17	319	11375	4	2626	17000	2	1414
Feb-03	604	227	191	445	19	132	7650	2	212	13000	1	.
Mar-03	615	250	319	413	26	176	14500	1	.			
Apr-03	637	273	289	500	20	121	10467	3	2214	14667	3	1528
May-03	653	214	278	774	19	943	4600	1	.			
Jun-03	661	184	239	529	14	144						
Jul-03	691	202	286	641	21	253	4250	2	354			
Aug-03	605	229	242	458	30	205	5000	4	3559	6400	1	.
Sep-03	607	201	248	515	27	211	9000	2	1414			
Oct-03	576	190	220	463	33	192	5667	3	1893			
Nov-03	616	221	189	592	31	171						
Dec-03	597	238	183	501	32	157				16000	1	.
Jan-04	615	239	296	549	29	342	8250	8	2268	11000	1	.
Feb-04	563	288	241	520	37	207	7000	1	.	13000	2	2828
Mar-04	563	284	237	647	35	315	9486	7	2714	11000	2	11314
Apr-04	556	243	243	703	51	253	8238	25	1514	9062	13	1079
May-04	514	177	220	705	26	339	3900	2	4384	11500	4	5583
Jun-04	626	201	317	875	26	463	8500	3	500	13000	5	2449
Jul-04	517	228	230	739	16	204	10000	1	.	8000	6	2280
Aug-04	601	213	253	788	33	325	8717	6	1234	8400	4	2776

Sep-04	577	217	231	750	22	304					12000	2	2828
Oct-04	543	195	192	629	19	232					7333	3	1528
Nov-04	607	220	272	608	25	194					9000	3	3606
Dec-04	598	145	240	658	10	238	12000	1	.		14000	1	.
Jan-05	585	190	249	770	10	303	7000	1	.		8250	4	5377
Feb-05	651	202	244	695	26	196					10000	3	2646
Mar-05	672	217	476	792	25	236	9000	1	.		12667	3	3215
Apr-05	566	236	205	557	46	282	6333	3	577				
May-05	578	213	224	570	44	192	4000	2	0		7833	3	4481
Overall Mean	631	14142	329	600	1773	302	7341	294	3633		8756	167	3683

Source: ALRMP database.

