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RESEARCH ARTICLE

LIVING WITH DROUGHT: THE CASE OF THE MAASAI PASTORALISTS OF NORTHERN KENYA

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ABSTRACT

Pastoralism, which is the main source of livelihood to about 120 million pastoralists worldwide, is practiced in the drylands that are characterized by low rainfall and frequent droughts. In the semi arid and arid lands of Kenya (88% of the Kenya landmass), pastoralism accounts for 90% of the employment and 95% of the family incomes and livelihood security. It contributes to about 10% of the country's gross domestic product (GDP) and 50% of the agricultural GDP. However, frequent droughts have threatened this important sector which offers a viable production system in the vast drylands of the country. This paper highlights on the effects of droughts on pastoralism and the coping and adaptive strategies employed by the Maasai pastoralists of northern Kenya with special reference to Mukogodo Division of the semi arid Laikipia District.

INTRODUCTION

Pastoralists are people who depend primarily on livestock for subsistence. They inhabit those parts of the world where the potential for crop cultivation is limited due to lack of rainfall and extreme temperatures. There are about 120 million pastoralists in the world, of which about 50 million pastoralists live in sub-Saharan Africa, many of them roaming the dry sub-Saharan belt that stretches from Mauritania to Ethiopia (Rass, 2006). The type of livestock pastoralists keep varies with the region of the world, but they are all domesticated herbivores that normally live in herds and eat grasses or other abundant plant foods.

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For example, horses are the preferred livestock type by most pastoralists in Mongolia and elsewhere in Central Asia, cattle in East Africa, sheep and goats (shoats) in the mountainous regions of Southwest Asia. Camels are preferred by the pastoralists in the more arid lowland areas of the Southwest Asia and North and East Africa. The Saami (or Lapps) pastoralists of northern Scandinavia and the pastoralists in northern Mongolia herd reindeer (Huho *et al.,* 2009). The large share of Africa's economy depends on climate-sensitive sector mainly rain-fed agriculture with about 70 percent of the continent's population depending on agriculture for their livelihood (Huho *et al.,* 2010). Rain-fed agriculture in the ASALs of Africa involves crop farming and pastoralism for subsistence. Pastoral areas occupy 40 percent of

Table 1. Effects of recent droughts on livestock in selected African countries

Drought	Country	Livestock lost
1981-84	Botswana	20% reduction in national herd
1982-84	Niger	62% loss of national cattle herd
1983-85	Ethiopia (Borana Plateau)	37% loss of cattle
1991-92	Northern Kenya	70% loss of livestock,
1991-93	Ethiopia (Borana Plateau)	42% loss of cattle
1993	Namibia	22% loss of cattle; 41% loss of shoats
1995-97	Greater horn of Africa	29% loss of cattle; 25% loss of shoats
1995-97	Southern Ethiopia	78% loss of cattle; 83% loss of shoats
1998-99	Ethipia (Borana Plateau)	62% loss of cattle
1999-2001	Kenya	30% loss of cattle; 30% loss of shoats; 18% loss of camel
2002	Eritrea	10-20 % loss of livestock in some areas
2002	Ethiopia (Afar and Somali)	40% loss of cattle: 10-15% loss of shoats
2004-06	Kenya	70% loss of livestock in some pastoral communities
2005	Kenya (Mandera and Marsabit)	30-40% loss of cattle and shoats; 10-15% loss of camels
2009	Tanzania and Kenya	Maasai lost 70-90% of livestock
2010	Niger	75% livestock threatened
2010 (May)	Somalia	70-80% livestock lost

Source: Morton, 2006; Tearfund, 2010; Akilu and Wekesa, 2002; FAO, 2003; HPG, 2006 and Somaliland press, 2010

Africa's land mass where over 70 percent of the land in pastoral areas is unsuitable for crop farming making livestock production to remain the most viable economic activity in the ASALs. Thus, pastoralism offers a viable production system that enables huge arid and semi-arid areas to be used productively. According to 2005 statistics from the Food and Agriculture Organisation (FAO), there were about 235 million cattle, 472 million goats, 21 million pigs and 1.3 billion poultry in Africa, valued at US dollars 65 billion. Some 70 percent of the total livestock population and 90 percent of the wildlife population inhabit the area (Oluoch, 2007).

Droughts, which originate from deficiency in precipitation over extended periods of time and affect approximately 60 percent of the world's population, are the major constraints to viable rain-fed agriculture particularly in the arid and semi arid lands (ASALs) (Huho and Mugalavai, 2010). For example, over 68 percent of India is vulnerable to drought with a frequency of 54-57 percent. Severe droughts occur once every eight to nine years in arid and semi-arid zones. The 2002 drought in India dipped food grain production by 29 million tonnes to 183 million tonnes compared to 212 million tonnes in 2001. In Australia, the 1982-83 drought, which was the most intense in terms of vast areas affected, led to an estimated total loss in excess of US dollars 3 billion. During the 1991-95 drought, the average production by rural industries fell about 10 percent, resulting in US dollars 5 billion cost to the Australian economy and drought relief worth US dollars 590 million provided by the Commonwealth Government between September 1992 and December 1995 (Bureau of Meteorology, 2010). In Zimbabwe, the 1990-91 drought resulted in 45 percent drop in agricultural production, 62 percent in value of stock market, a 9 percent drop in manufacturing output and a GDP drop of 11 percent. The 1999-2000 drought in Kenya cost the economy some US dollars 2.5 billion while in Eritrea, the 2002 drought caused 10-20 percent loss of livestock in some areas. The 2002 drought also struck the pastoral areas of Afar and Somali in Ethiopia leading to losses of up to 40 percent for cattle and 10-15 percent for shoats. Livestock prices fell by up to 50 percent (FAO, 2003). In Chad, the 2009 drought led to a 34 percent drop in harvested crop compared to the previous year. There was no surplus food or animals to sell (Oxfam, 2010). As a result of frequent droughts in Africa, famine has become a norm due to increased crop failures and livestock mortality (Table 1). Food aid to the Sub-Saharan Africa accounts for approximately 50 percent of the yearly budget of the World Food Aid Programme (UN Economic and Social Council, 2007).

Pastoralism in the ASALs of northern Kenya

In Kenya, over 60 percent of the national herd is held by pastoralists and it produces about 10 percent of the domestic product (GDP) and 50

percent of agricultural GDP. In the ASALs of Kenya, pastoral economy accounts for 90 percent of employment opportunities and 95 percent of family incomes and livelihood security (Huho *et al.,* 2009; USAID, 2010). In northern Kenya, pastoralism is largely practiced by the Turkanas (2.56% of the Kenya population), the Maasais (2.18%), the Rendiles (0.16%), the Samburu (0.61%), the Gabra (0.23%), the Borana (0.42%), the Orma (0.17%) and the Kalenjins (12.87%). Pastoralism in this region is nomadic in nature, where herders adapt to spatial-temporal variability in pasture and water availability through herd migration. Drought is by far the greatest cause of livestock mortality (Plate 1). About US dollar 2 billion worth of livestock is lost annually to mortality, poor quarantines, diseases and missed trade opportunities, resulting in increased food insecurity in the drought-prone ASALs (USAID, 2010).

Plate 1: Drought-stricken cattle outside a slaughterhouse south of Nairobi, Kenya during the 2009 severe drought (Source: Associated press, 2009)

Pastoralists in northern Kenya keep different types of livestock which include cattle, shoats, donkeys and camels. However, the dominant stock varies from one ethnic community to the other depending on cultural values attached to specific livestock types and also due to climatic conditions. For example, camels are the most dominant livestock type among the Turkana and Rendile while cattle dominate the Maasai, the Samburu and the Kalenjin pastoralists' herds.

Table 2. Percentage decrease in cattle and shoat prices during selected severe droughts in Mukogodo Division Mean prices (1986-2005): cattle = KShs 12614.60; shoats = KShs 1647.80

Year	Cattle prices (Kshs)	Shoat prices (Kshs)	Decrease in cattle prices (%)	Decrease in shoat prices (%)
1991	8000	750	36.6	54.5
1996	6000	600	52.4	63.6
2000	7500	825	40.5	49.9

Objectives of the study

i) To examine the effects of drought on pastoralism in northern Kenya and;
ii) To examine the various drought coping strategies evolved by the Maasai pastoralists.

Study area and methods of data collection

Data for this study was collected from Mukogodo Division, which lies in the northeastern part of Laikipia District, Kenya at an elevation of between 1200 and 2000m above sea level. The division lies approximately between longitudes $36^0$50' East and $37^0$24' East and latitudes $0^0$15' North and $0^0$33' North (Huho *et al.,* 2009). The division lies in the low corridor of northern Kenya, which is characterized by dry climates. The climate of Mukogodo division is characterized by bimodal rainfall with short rains from October through December, followed by a short dry period from January to February, and long rains in March through May, followed by a long dry season from June to September. Pastoralists rely on both rains for water and pasture for their animals. However, rainfall in Mukogodo Division is low, erratic and unreliable. The division's mean annual rainfall is 507.8 mm while the mean annual temperature range between 18^0 and 20^0 Celsius. The division is primarily a rangeland suitable for pastoralism. The main method used in collection of data on the effects of droughts on pastoralism and coping strategy was the use of structured interviews. Simple random sampling technique was used in selecting a total of 55 Maasai pastoralists who were interviewed. Photography and participant observation was also used. Additional information on pastoralism in the study area was obtained from agricultural extension offices in Mukogodo Division and Laikipia District documentation centre in Nanyuki.

RESULTS AND DISCUSSION

The effects of drought on pastoralism

In the ASALs of Kenya, drought is the most pervasive hazard encountered by households on a widespread level. Between 1993 to date, the government of Kenya has declared five national disasters in 1992-93, 1995-96, 1999-2001, 2004-2006 and 2008-09 due to droughts (Huho and Mugalavai, 2010). In northern Kenya, more than 3 million pastoralists are hit by severe droughts, which have been increasing in frequency and severity over time. According to Howden (2009), droughts in northern Kenya have increased in frequency from once in every 10 years in 1970s; once in every 5 years in 1980s; once in every 2-3 years in 1990s and almost every year in 2000s. In Mukogodo Division, the probability of droughts persisting for more than one year increased from 25 percent in two consecutive years to 26 and 27 percent in 3 and 4 consecutive years respectively between 1975 and 2005 (Huho, et. al., 2009) leading to the following effects on their livelihoods.

Table 3. Estimated number of livestock lost during some of the severe droughts in Mukogodo Division

Drought years	Estimated number of livestock lost			
	Cattle	Sheep	Goats	Total
1984	4050	4100	4600	12750
1991	3300	3350	3100	9750
1996	4100	4325	4000	12425
2000	4760	6200	6000	16960

Source: Field data, 2008

a) Declining livestock economy

For livelihoods that relied solely or partly on livestock in Mukogodo Division and other ASAL districts of the northern Kenya, the poor livestock body conditions and high livestock mortality rates caused by droughts had devastating effects on livestock prices. Income earned from livestock sales declined during droughts (Table 2) rendering the pastoralists to be among the poorest and the most vulnerable population in Kenya. Bevege (2009) observes that during the 2009 drought the Maasai pastoralists who once sold their cattle for as much as Kenya shillings 30,000 per cow off-loaded

Plate 2. Dry Twala stream bed during the 2009 severe drought (Source: Field data, 2008)

Plate 3. A Maasai pastoralist carrying some palatable twigs from *Olea Africana* Source: Field data, 2008

the beasts one-by-one for as little as Kenya shillings 1,000 shillings to buy feed for the rest of their starving herds and family consumption.

b) Large-scale livestock mortality

Livestock was the most important asset for the Maasai pastoralists in Mukogodo Division and to all pastoralists northern Kenya since it was the main source of livelihood. However, lack of access to forage and water resources during severe droughts resulted in loss of these valuable assets (Table 3). Livestock deaths were caused by starvation, thirst and drought-related diseases such as tick borne, foot and mouth (lukulup as known by the Maasai pastoralists), lumpy skin disease (loriri), contagious caprine pleuropneumonia (CCPP or likipei as known by the Maasai

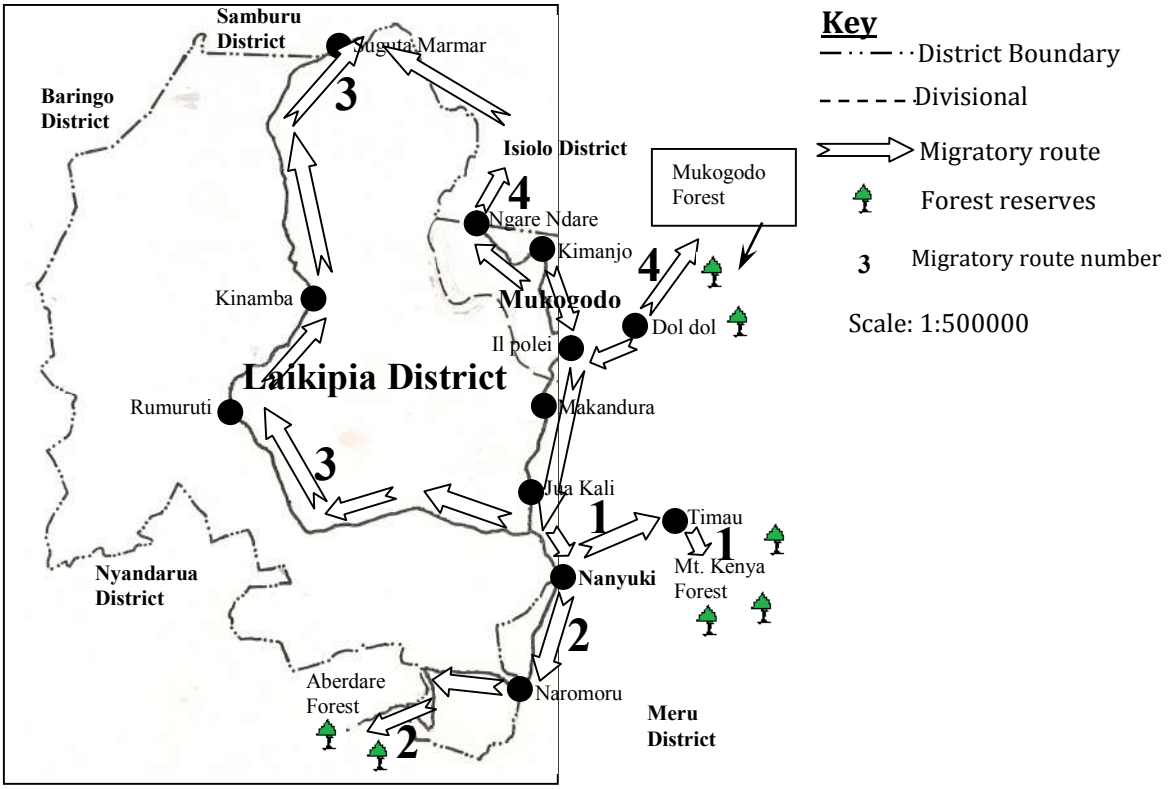

Figure 1. Livestock migratory routes followed during severe droughts in Mukogodo Division (Source: Field data, 2008)

pastoralists), contagious bovine pleuropneumonia (CBPP), shoat pox and anthrax.

c) Drying up of water sources

Droughts in Mukogodo Division led to drying up of water sources such as the streams (Plate 2), springs and dams. For example, during the 1984 drought, the Ngaboli and Ildupata springs dried up and never rejuvenated while the waters of Ilpuduk spring reduced during the 1999-2000 prolonged drought and was in the verge of drying up (Gitau, 2002). The Sepeyo and Aljijo dams dried up while water level in Dol dol dam reduced to a point that was almost drying up during the 1999-2000 extreme drought (Moyare, a Maasai pastoralist, personal communication, 2008). In other pastoral districts of northern Kenya such as Garissa, Isiolo, Wajir, Mandera and Marsabit, the 1996 severe drought in resulted in severe shortage of water.

d) Inadequate pasture

The occurrence of prolonged droughts in Mukogodo Division had led to gradual changes in rangeland vegetation from palatable to non-palatable species such as the *Harpachne schimperi, Aristida adoensis, Sansavellia sp* (locally known as oldupai by the Maasai)*, Opuntia megacantha* (lukurasi) and *acacia sp* (olmunishoi) with an overall effect of diminishing pasture quantity and quality. Personal observations during field survey revealed that the *acacia sp* (olmunishoi) bush thicket had rendered some areas of Mukogodo Division such as Kimanjo inaccessible and devoid of palatable pasture beneath them. In Turkana District, Kenya, pasture availability within most dry season grazing areas was below normal for the season with deterioration of forage for livestock during the 1999-2000 severe drought. Similarly, the amount of rainfall received in West Pokot District during the 1999-2000 drought was not

adequate to support the regeneration of pasture and browse for livestock forcing hundreds of the pastoralists and agro-pastoralists to relocate their livestock to neighbouring Trans-Nzoia district and Uganda (ACT, 2003).

Living with droughts: How the Maasai pastoralists cope with droughts

The inhabitants of the ASALs of the northern Kenya live in harsh and very demanding environment and often live on the brink of survival. As of necessity they had evolved a variety of drought coping and adaptive strategies which enabled them survive drought events. The study identified two categories of drought coping strategies in the semi arid Mukogodo Divisions. These were the short-term and long-term strategies.

Short-term drought coping strategies

The short-term drought coping strategies were geared towards loss minimization and differed from one drought event to the other depending on the severity of the drought. These strategies included:

a) Grazing livestock early in the morning

During mild droughts the Maasai pastoralists in Mukogodo Division took the livestock to the grazing fields early in the morning and extensively roamed in the rangelands within the confines of their group ranches. Livestock were taken to grazing fields as early as 5 o'clock in the morning when the available palatable foliage was soaked with dew. This is because of two main reasons: First, the palatability of the foliage increased when the foliage was soaked with dew than when dry and; secondly, grazing in moist pasture reduced the rate at which livestock drunk water thus leading to watering of livestock once in every two day. Brown (2006) observes that one of the sources of water for livestock is water that is contained in the feed consumed.

b) Establishment of feed reserves

During wet years, the Maasai pastoralists in Mukogodo Division preserved certain grazing areas in the raised grounds within their group ranches and forested areas to allow regeneration of grass and other palatable vegetation suitable for livestock. The isolated areas (or lokeri as known by the Maasai pastoralists) acted as feed reserves and livestock were grazed during moderate droughts. Some of the feed reserves in Mukogodo Division were: Kopiyo, Siol, Sieku, Ngare ndare, Norpanga, Kipsing, Mt. Oldonyo Ng'iro, Naserian, Tambarua and the Mukogodo forest reserve. In the arid Turkana District, Kenya, the pastoralists preserved the Loima Hills as the dry season grazing reserves (Barrow, et al, 2002). Niamir (1990) observes the Il Chamus and Rendille of northern Kenya, the Sukuma of Tanzania, the Tuareg of Ahaggar in Algeria, the Tilemsi of Mali and the Berbers of Morocco set aside relatively large grazing reserves to save forage and browse for dry seasons.

c) Formation of alliances with neighbours

Under favourable weather conditions, pastoral activities in Mukogodo Division were confined within the group ranches. However, the Maasai pastoralists had formed alliances with other pastoralists outside their group ranches from which they borrowed pasture during moderate droughts after the exhaustion of pasture in their feed reserves. For example, during the 1999 moderate drought, the Maasai pastoralists from Musul group ranch were allowed to graze in Ilngwesi group ranch (Musul group ranch member, personal communication, 2008). The formation of grazing alliances is also practiced in Arabia where pastoralists in the affected territory (dirah) are often allowed to graze in other territories which they had formed alliances with. Pastoralists created organizations based on alliances and agreements, which permitted rotational exploitation rangeland resources during droughts (Betanouny, 1986).

d) Separating livestock to areas of different ecological zones

During moderate droughts the Maasai pastoralists subdivided their stocks into non-productive and productive stock. The non-productive stock, mainly dry cows, young and male animals were grazed in the neighbouring ranches or district while the productive stock such as the lactating cows and

shoats were grazed near the homesteads. Separation of productive and non-productive livestock to different areas of ecological zones ensured maximum use of all available rangeland foliage and also continued availability of food for the family by leaving behind the lactating cows and shoats. In Borana region in Ethiopia, herd division was common during droughts, a practice known as Warra (Village herd) and Fora (satellite herd). Warra herds were usually grazed near the homesteads and closer to permanent water point and included immature and lactating animals, shoats and camels. On the other hand, Fora herds, which included dry cows, young and male animals were grazed far away from the village. This dual herding system allowed uniform utilization of the rangeland and helped in minimizing feed and water shortage (Yonad Business Promotion and Consultancy PLC, 2009)

e) Feeding livestock with tree twigs and branches

Tree twigs and leaves from *Euclea divinorum* (Olkingei as known by the Maasai pastoralists), *Acacia nilotica* (Olkiroriti), *Acacia lahai* (Oltepesi), *Olea africana* (Lorien) and Olkerosha were used as feed for shoats, young and sick cattle, which could not move with other livestock during severe droughts and lactating cows, which provided milk for the family. Livestock fed on twigs and leaves of all these tree species but fed on pods from *Acacia nilotica* (Olkiroriti tree) (Plate 3). The pods from *Acacia nilotica* were only fed to livestock while dry since the green pod led to abortion in sheep (Moyare, a Maasai pastoralist, personal communication, 2008). In Turkana District, Kenya, pods from large riverine trees (ekwar, as known by the Turkana pastiralists) were used both as animal and human food. Pods are also fed to lactating animals to increase milk yields. Twigs from *Acacia tortilis* provides a staple browse especially for camels and goats since forage is available throughout most of the dry season when other sources are scarce (Fagg, 1991). The use of tree twigs and branches as livestock feed during droughts is common among the pastoralists in other parts of the world. For example, in Indian arid zones, Saxena (1993) observes that when all known available forage species were either non-existent or exhausted, many poor livestock farmers searched for alternative forage such as tree twigs and leaves to feed their animals. Some of the tree species that were fed on the livestock the in Indian arid zone included: *Azadirachta indica, Aerva persia, Typha angustata, Phoenix dactylifera and Calotropis procera*. Pastoralists in parts of northern Senegal, for example, rely on high-quality supplements of browse-leaves, fruits and seed-pods from trees and shrubs-for at least six months of every year, to keep their herds alive and healthy (FAO, 1992).

f) Migration

During the severe droughts in Mukogodo Division the Maasai pastoralists moved as far as the slopes of Mount Kenya (aprox. distance of 29 km) and Aberdare ranges (aprox. distance of 38 km) in search of pasture. For instance, during the severe drought of 2000 the Kenya government allowed pastoralists to graze their livestock in the otherwise forbidden Mt Kenya and Aberdare forest reserves (Mkutu, 2006). There were four migratory routes in which the Maasai pastoralists followed during severe droughts (Figure 1). Citing examples of pure pastoralists migratory distances in eastern Africa, Ndukuman *et al*. (2000) observes that in northern Kenya, the mean distance travelled is about 9 km during mild, 22 km during moderate and 46 km during severe droughts while in southern Kenya, the mean distance increases from 4 km during mild to 7 and 9 km during moderate and severe droughts respectively. In southern Ethiopia, distance increases to about 15 km during mild droughts, 54 km during moderate and up to 75 km during severe droughts. In northern Tanzania, the distance traveled is about 5, 8 and 12 km during mild, moderate and severe droughts respectively.

g) Hiring of pasture

The severe shortage of pasture during severe droughts forced the Maasai pastoralists to hire pastures from the commercial ranches in Laikipia Districts. The ranches were fenced and grazed by limited number of livestock thus acting indirectly as feed reserves. During the severe drought of the year 2000, for example, the Maasai pastoralists hired pasture from Mpala, Ol-Jogi, Daiga, Sololo and Enasoit commercial ranches in Laikipia District (GoK, 2000). The cost of hiring pasture

ranged from 130 to 150 shillings per cow. Unfortunately, shoats were not allowed in commercial ranches because of their eating habit which destroys vegetation cover. This coping strategy was very expensive to the Maasai pastoralists and was opted as the least option. The ranchers also restricted the number and the type of livestock to be grazed. For instance, during severe drought of the year 2000, the Ol-Jogi ranch allowed 400 cattle from every location in Mukogodo Division (GoK, 2000). Hiring of pasture during severe droughts is also practiced in Northeastern Province of Kenya where pastoralists hire pasture from private ranches in Taita Taveta in Coast Province. In Ethiopia, pastoralists hire pasture from private land owners. This is done through giving all offspring of livestock that are grazed on the private holdings to the land owner in exchange for pasture (http://www.future-agricultures.org/, 2010). In southern Zimbabwe, (Scoones, 1992) observes that pastoralists hires grazing fields during droughts periods.

h) Digging of shallow wells on the river beds

To cope with severe shortage of water during severe droughts, the Maasai pastoralists dug shallow wells on the dry river bed (ol sinyai as known by the Maasai pastoralists) and on the dry water pans (rare). Surface water in permanent rivers and water pans during severe droughts dries up leaving subsurface water as the only source of water. The Maasai pastoralists scooped sand on the dry riverbeds and dug shallow holes on dry water pans to reach the water for their livestock and other domestic uses. As a drought coping strategy, digging of shallow holes in dry riverbeds is common among the pastoral communities in other arid and semi arid regions. For example, Rutten (2005) observes that the Maasai pastoralists in Kajiado District, Kenya, made use of dry riverbeds during the drought periods by scooping sand in search of water. In Samburu District, pastoralists dug shallow well in the riverbeds where water accumulated during rainy seasons and to be used during drought periods (Lemunyete, 2003).

Long-term drought adaptive strategies

Drought adaptive strategies involved risk spreading. They were practiced during wet and dry years but with an aim of cushioning the Maasai pastoralists against livestock losses during drought periods. The drought adaptive strategies evolved in Mukogodo Division and the larger northern Kenya included:

a) Keeping livestock of mixed species

The Maasai pastoralists in Mukogodo Division kept a mixture of grazers (cattle and sheep) and browsers (goats) in their herds. Addition to cattle and shoats were donkeys and camels though they were reared by less than 10 percent of the Maasai pastoralists in the division. Different livestock species adapted differently to drought and therefore this practice ensured that there were survivors in whatever climatic event. For example, the shoats, donkeys and camels survived on forbs and browse, which was the only available foliage during severe droughts and were therefore less affected by droughts. Although camels were not popular among the Maasai pastoralists, increase in drought frequency and severity had forced the pastoralists to introduce them in their herds (Table 4). In 1995, a camel promotion project was initiated by the government through ASAL funded projects with an aim of introducing camels in Mukogodo Division as a source of milk to the Maasai pastoralists. The project triggered a 150 percent rise in camel population by the year 1998. The massive loss of cattle and shoats during the 1999-2000 extreme drought prompted the Maasai pastoralists to buy camels as an alternative enterprise (GoK, 2004). In Turkana District, Kenya, pastoralists keep camels, cattle, goats, sheep and donkeys since each livestock species has different food and water requirements (McCabe, 2009).

Table 4. Camels population in Mukogodo Division (1983-1998)

Year	Number of camel	Year	Number of camel
1983	25	1991	110
1984	28	1992	100
1985	50	1993	600
1986	70	1994	1000
1987	150	1995	1400
1988	50	1996	2600
1989	56	1997	3000
1990	60	1998	3500

Source: Mukogodo Division livestock extension office, 2008

b) Increasing the number of shoats in the herds

The traditional cattle-dominated herds of the Mukogodo Maasai pastoralists were being replaced by shoat-dominated herds because of the following three reasons: First, the shoats survived on poor quality forbs and browse during severe droughts and were therefore, less affected by the droughts compared to cattle. Second, the rate of reproduction for shoats was higher (average gestation period for shoats is 150 days) than that of cattle (average gestation period for cattle is 280 days). Due to the faster rate of reproduction, shoats replaced the herd lost during severe droughts quicker than cattle. Third, shoats were easily sold compared to cattle during drought events enabling the Maasai pastoralists to liquidate their herds to avoid further losses and to get some cash to buy grains from crop farmers. These factors led to deliberate increase in the number of shoats. The study established that 75-80 percent of the Maasai pastoralists herds were composed of shoats. Toutain, et. al, (2010) observes that as droughts continue to increase in frequency and severity, pastoralists are opting to keep more drought resilient livestock. In Sub-Saharan Africa for example, the Sahelian pastoralists have replaced cattle with more-resilient shoats and camels since cattle have become less adaptive to frequent and severe droughts. In Ethiopia, the Borana pastoralists have reduced the number of cattle and increased shoat population in their herds (Akillu and Catley, 2010).

c) Keeping of indigenous livestock breeds

The Maasai pastoralists in Mukogodo Division kept indigenous livestock breeds that were resistant to diseases and tolerated drought. The dominant indigenous breeds were the east African Zebu cattle, east African goat and the black headed Maasai sheep (GoK, 2001). About 90 percent of the Maasai pastoralists' herd comprised of indigenous breeds and only about 10 percent were improved livestock breeds. As an adaptive strategy, keeping of indigenous livestock breed is a common practice among the pastoralists in the ASALs of the world. For example, in Tanzania and Uganda, over 95 percent of the livestock are indigenous and are kept in drylands (Nassef *et al.,* 2009) while in India, the estimated number of indigenous cattle population in 2003 was 156.87 million while that of cross breeds was 22.07 million (Aruna and Arand, 2010).

d) Keeping of female dominated herds

As a form of insurance against loss of the entire herd during severe droughts, the Maasai pastoralists kept more female than male animals. In Mukogodo Division, the ratios for female to male animals were: 3:1 for cattle and sheep, 4:1 for goats and camels. The female animals were preferred because of their ability to reproduce thus replacing the herd lost during droughts. Therefore, female animals acted as nucleus for herd replacement. This adaptive strategy against droughts is very common among pastoralists in arid and semi arid areas. For example, in Ethiopia, over 70 percent of the pastoralist herds are composed of female livestock (http://www.mbali.info /Doc313.htm, 2007) while in northern Nigeria, 60-73 percent of the Fulani pastoralists' herds were female livestock (Iro, no date).

e) Increasing of herd sizes during inter-drought periods

The Maasai pastoralists increased the number of livestock during inter-drought periods by restricting commercial sales or slaughtering. Large livestock population acted as insurance against loss of the entire herd to droughts. About 40 percent of the Maasai pastoralist respondents stated that they increased their herd sizes, when weather conditions were favourable, through purchasing of livestock and natural reproduction while 60 percent stated that they depended on natural reproduction only. This practice is common among the pastoralists in other areas of northern Kenya such as in Baringo District (Ngaira, 1999) and in Turkana District (McCabe, 1990).

Conclusion

Drought was the major challenge to pastoralism in Mukogodo Division causing large-scale livestock mortality and a general dwindling of the pastoral economy among the Maasai pastoralists. However,

the Maasai pastoralists had evolved a number of short-term and long-term drought coping strategies that cushioned them against massive loss of livestock. The short-term strategies were geared towards minimizing livestock loss and therefore differed from one drought event to the other depending on the severity of the drought. The long-term adaptive strategies involved risk spreading and were practiced across all season but with an aim of cushioning the pastoralists against livestock loss during droughts. Therefore through the evolved drought coping strategies, the Maasai pastoralists have been able to live in the drought prone areas of the northern Kenya.

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