

The Influence of Water Availability on Pastoralist's Resource Use in Mwingi and Kitui Districts in Kenya

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ABSTRACT Understanding where pastoral livestock grazing takes place and how water availability and distribution influences resource use, is critical in planning and management of arid and semi-arid lands. This study was carried out in Mwingi and Kitui districts in Eastern Kenya. Semi-structured questionnaires were used for data collection for five months. Watering points were established through cluster sampling by considering each administrative sub-location with the help of topographical maps. Three ethnic communities, namely, the Akamba, Oroma and Somali, utilize resources in the area. The distribution of dry season water in the area influence the distances livestock herds traveled from their homelands. There was a significant difference between number of wells and the number of households, with an overall mean number of five to eight households per well. The population of goats and camels was highest for the area, and that they walked longer and their watering frequency was low. However, diseases, predators and frequent droughts occasioned animal's losses, with goats having the highest death (6.0%) and birth (44.8%) rates. The dry season water availability may explain why livestock routes changed over the seasons and highlight the importance and ubiquity of common utilization of the range by these communities. Therefore, common rights of access prevail, although the control and organization of shallow wells is the responsibility of the Akamba 'well owner'. Water constraints and property right issues in the study area limit exploitation of the resources for livestock production. This paper highlights the need to integrate water development and improved livestock management in the arid and semi-arid areas to reduce poverty.

INTRODUCTION

Water availability and accessibility in sub-Saharan Africa poses a threat to the well-being of rural people, and Kenya is among the most affected countries in East Africa (The Water Project Inc. 2009). The situation is severe in the Kenyan rangelands, where rainfall shows considerable high variability within the region in both space and time, and often occurs as high intensity storms (Herlocker 1999; Jaetzold et al. 2006). As a result, considerable surface runoff is generated, which is exacerbated by sparse vegetation cover. Rangelands are areas that are unsuitable for cultivation due to physical limitations such as low and erratic rainfall, rough topography and high evaporative demands. They can, however support grazing and browsing animals, and are a source of valuable plants and their products (Pratt and Gwynne 1977). Herlocker (1999) defined rangelands as arid and semi-arid lands (ASALs), where other land uses, such as agriculture, are not economically feasible but they may also include areas that have in the past or may in the future be used for cultivation or forestry. These areas constitute about 47% of the earth's surface, a resource base on which more than two billion people depend for their liveli-

hoods. Rangelands of Kenya which constitute 88% of land surface, are home to a number of pastoral communities, which account for about 30% of the national human population, mostly pastoralists who depend directly on the natural resource base for their livelihoods.

Water availability in the ASALs is a constraint to production due to its high spatial and temporal variability. The ASALs are more suited to livestock grazing systems, accommodating mostly pastoralists and agro-pastoralists' communities. These communities own 50 percent of the national cattle and a small ruminant herd, and 100 per cent of the camel population in Kenya (Ellis and Swift 1988; Niamir 1991). Over the years, Kenyan pastoralists have been able to survive in the harsh conditions of the dry lands for centuries because they have developed traditional coping and risk management strategies (Ngugi and Nyariki 2005; Mworio and Kinyamario 2008). These strategies include the raising of a variety of animals with different levels of physiological and behavioral adaptation and tolerance to water scarcity, pasture quality, high ambient temperatures, and strong solar radiation.

Another survival technique of the pastoralists is that follows an established pattern of sea-

sonal movement to find pasture and water. They also distribute their livestock between pastures and watering points in an attempt to maximize the probability of survival as well as the number of people that may be supported on the land by livestock (Niamir 1990; Thrash 1998; Nyariki and Ngugi 2002). However, of late, most pastoralists in Kenya have increasingly become vulnerable to water stresses and related risks. Besides anthropogenic causes, susceptibility of pastoralists to drought and other natural stressors, and loss of range resilience is attributed to water unavailability and inaccessibility that have undermined the hitherto effective traditional practices and survival strategies. Pastoral livestock production, although constrained by these many factors associated with water availability, remains the principal means of livelihood in the absence of viable alternative options in the arid and semi-arid lands of Kenya.

This research paper focuses on how water availability and distribution influence pastoralist's livestock grazing and resource use in Mwingi and Kitui districts in eastern Kenya. The objective of this paper is to demonstrate that water is a critical resource that determines success of pastoralism as a way of life in ASALs, and suggests remedial measures to enhance pastoral management and development in Kenya. Availability of water determines where people and livestock settle in during the different months of any given year. The premise of this research is that there is paucity of information on the influence of water availability on livestock grazing, property rights and resource use. The outcomes would lead to a better understanding of the pastoral livestock development interventions most suitable for the area. The paper supports the hypothesis that better understanding of livestock water availability and resource use will lead to development and articulation of policies that are both appropriate and conducive to the development of a vibrant pastoral economy in sub-Saharan Africa.

MATERIAL AND METHODS

Study Area

The study was carried out in Mwingi and Kitui districts of the Eastern Province in Kenya (Fig. 1). The area covers rangelands to the south-east of the two districts, and is occupied by the

Somali and Orma communities. The area falls within agro-climatic zones V and VI (Sombroek et al. 1982). Climate is generally hot throughout the year with mean annual temperatures ranging from 24°C and 30°C. Rainfall distribution is bimodal, with peaks normally in April and November. Average annual precipitation is less than 350 mm (Sombroek et al. 1982). Under these conditions, rain-fed agriculture is unsustainable (Jaetzold et al. 2006).

The vegetation of the study site is highly heterogeneous probably due to variation in both soil type and history of land use (Belkhdja et al. 2003; Jaetzold et al. 2006; Omondi 2007). Large areas of the study site are occupied by bushlands, grasslands and shrub-lands, comprising various combinations of dry land vegetation. The predominant plant association is mixture of Acacia-Commiphora bushlands. Perennial grasses such as *Eragrostis superba* Peyr., *Cenchrus ciliaris* L., *Enteropogon macrostachyus* (A. Rich.) Benth. and some *Pennisetum* species provide forage to grazing animals. Livestock production is the principal economic activity in the area, although crop production is limited to isolated pockets of cultivable land. According to Nyariki and Abeele (2004), the study area was accessed and utilized by three pastoral and agro-pastoral communities. Owing to the similarities of pastoral production systems in terms of culture, socio-economic and environmental characteristics, this approach can be extended to other pastoral rangelands in Kenya.

The People

The agro-pastoral and pastoral communities which include the Akamba, Somali and Orma are found in Mwingi and Kitui districts of Eastern Province. The Akamba are agro-pastoralists who cultivate a diverse variety of drought tolerant crops such as millet and maize, whereas the Orma and Somali herders are transhumance pastoralists who move over the area to obtain sufficient supplies of forage and water for their livestock (O'Leary 1980; Azarya et al. 1999). Transhumance is a survival strategy where the old, young, sick and the disabled people and some animals stay while the rest of the family moves with livestock far and wide in search of pasture and water (Helocker 1999). The Akamba ethnic community inhabits north and south-west of Mwingi and Kitui Districts, while the

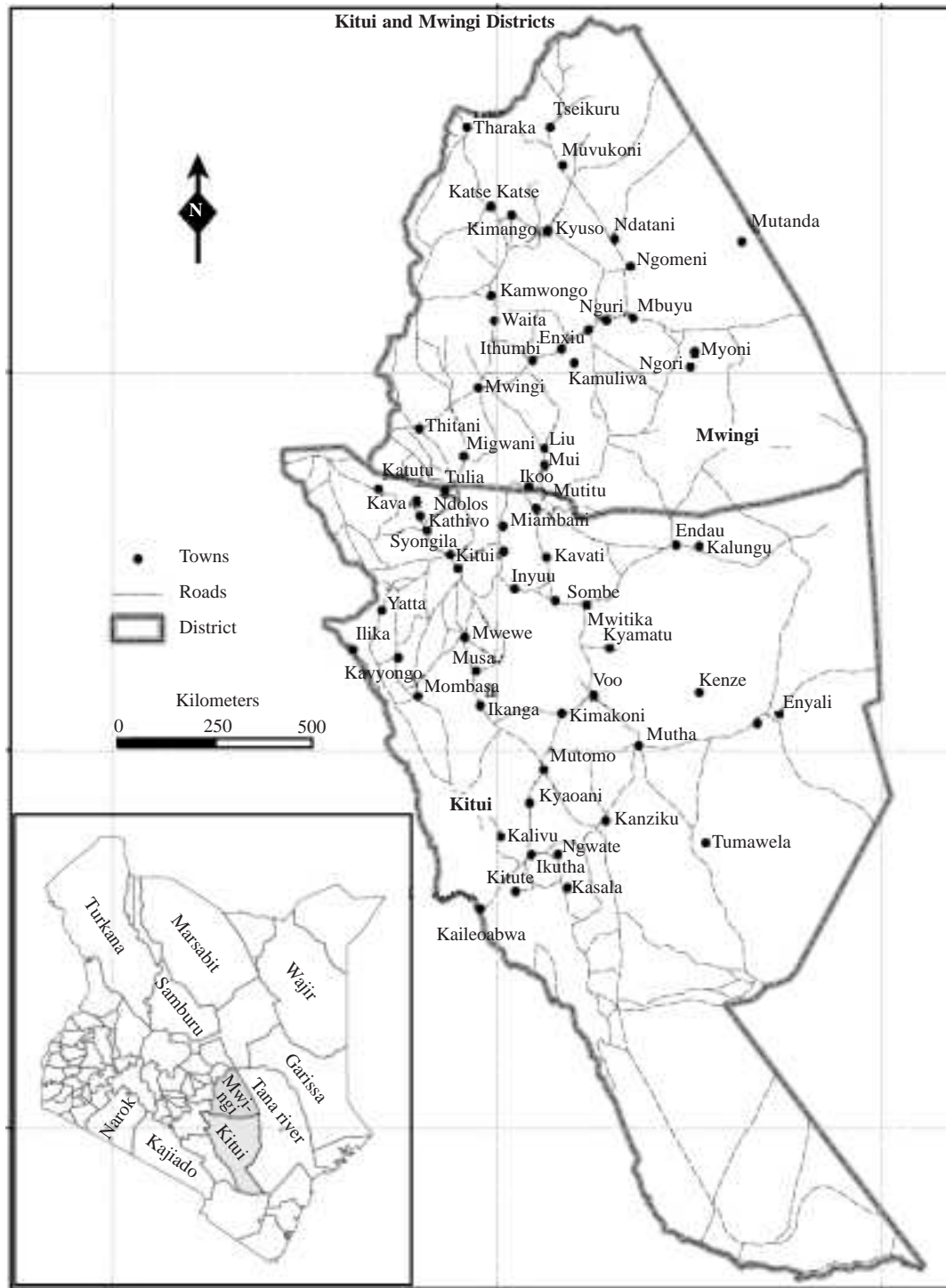


Fig. 1. The study area, Nwingi and Kitui districts (shaded) in eastern province of Kenya

Orma and Somali groups occupy the flatter areas towards Tana River and Garissa Districts. The Somali and the Orma are culturally similar in almost all aspects except for their dialect. The Orma are generally less pastoral than the Somali, despite all being Cushites (Azarya et al. 1999; Omiti and Irungu 2002).

The Somali ethnic group exhibits traditional subsistence economy that is purely pastoral, majority of its members being transhumant, herding cattle, small stock, camel and sometimes donkeys communally. It is in these pastoral communities that livestock are kept for a wide variety of reasons. Besides the provision of meat and milk for subsistence, hides and skins for household use, livestock have important social and ceremonial roles (Nyariki and Abeele 2004). Unlike other animals, donkeys are used as pack animals by the Akamba. They also keep cattle, goats (to some extent) and sheep. Chicken are kept in most homesteads under free ranging system. The Orma and Somali keep camels both for transport and as a source of milk and meat. Livestock are the main source of food and income for the three communities. Livestock also serve other functions; they are used as bride price. The oxen are also used by the Akamba for draught power like ploughing. Goats are normally sold for requirements that do not need large sums of money while cattle are sold to meet large expenses by the three communities.

Data Collection

Semi-structured questionnaires were used for data collection between June and November 2003. Watering points were established through cluster sampling procedure by considering each administrative location within the arid parts of Mwingi and Kitui Districts. The enumerators were trained and stationed at the sampled watering points for a period of one to two weeks to interview livestock herders bringing the animals to water. Topographical maps 1/50,000 were used to help identify the watering points, distances from the 'homesteads' to the dry season pasture and watering points were measured using Geographical Positioning System-GPS (Garmin 12X).

The data collected through questionnaires were analyzed using descriptive statistics such as simple correlations, cross tabulations and percentages to elucidate the information gath-

ered. The rest of the data were summarized to describe information gathered from the topographical maps and GPS points.

RESULTS AND DISCUSSION

Human and Livestock Populations

The population of Kamba herders was found to be the highest (66.3%) in the area followed by Orma and Somalis making 20 percent and 13 percent respectively. Available data (CBS 1999) shows that the total human population in Kitui district is 515,422 persons, while that of Mwingi Districts stands at 303,828 persons, averaging at a population density of 28 persons per km² (CBS 1999).

Over the years, human numbers have increased as Orma and Somali pastoralists immigrate from the drier north, to come closer to the Tana River, which is the only permanent river in the region. The rapid growth has not only been in numbers but also in the diversity of ethnic groups that share two district's resources. The arrival of pastoralist groups has caused resource use conflict among the settled population, especially in Twambui, Ngwaniwa and Malalani areas. Results showed that gender roles are clearly defined among the three ethnic communities inhabiting Mwingi and Kitui districts. The women who constitute 62 percent of the total human population in the study area work for subsistence and contribute to families' basic needs while boys undertake most of the routine work as herding on a rotating basis.

Pastoral communities maintain a flexible mixture of stock species with differences in feeding, production, disease and drought resistance. The livestock kept in the area are cattle, camels, donkeys, goats and sheep. On average, it was found that cattle make up 30.9 percent of total livestock population in the area, goats 35.7 percent, sheep 6.7 percent, donkeys 1.6 percent and camels 18.9 percent. The high population of goats and camels in the area was attributed to their drought and disease resistance. According to Animal Production Division of the Ministry of Agriculture annual reports, most of the livestock in Kenya is kept in the eastern and north Eastern provinces (Mogoa and Nyangito 1999; Omiti and Irungu 2002). It has been estimated that eastern rangelands have the second largest national livestock herd (including camels and

Table 1: Mean number of livestock species owned per household (H/H)

<i>Ethnic tribes</i>	<i>Akamba</i>	<i>Orma</i>	<i>Somali</i>
Species per H/H ¹			
Sheep	1	15	40
Goats	50	150	142
Cattle	40	45	58
Camels	0	70	65
Donkey	4	2	1

¹A single nuclear family or household was regarded as the basic unit of livestock ownership, grazing of the livestock is done collectively within a 'homestead'.

donkeys). Thus, the eastern rangelands of Kenya play a significant role in livestock production to meet human needs.

The Akamba regard livestock keeping mainly as a security against crop failure. However, they recognize that different animal species have different feeding habits and prefer different plant life forms. Cattle and sheep are grazers preferring grassland, while goats and camels are browsers and prefer bushland. Table 1 presents mean number of livestock specie owned per household with different ethnic communities utilizing the study area. It was reported that each livestock species is kept by the community to ensure efficient use of land, ensure herd survival, offer a broader spectrum of animal products and secure a steady supply of food to the household.

The common livestock breeds of cattle are the Boran and the Small East Africa Zebu kept primarily for milk and meat. The Somalis and Orma

regard Zebus as breeds well adapted to heat, drought and poor feeding conditions. The small East African goat is the most widespread goat breed. It is small and hardy and generally has smooth, short-haired coats that are white, black or brown. The Somali or Galla goat kept by the three communities is an important type of small East Africa white goat well adapted for the arid lands. This breed can survive in overgrazed and eroded areas. Sheep of red Maasai breed are mainly kept by the Orma and Somalis and to a lesser extent by the Akamba because of cultural beliefs. The Akamba believe that eating mutton or keeping sheep reduces ones' protection against witchcraft. The type of donkey found in the study area, is a small and usually grey donkey kept by the Akamba, Orma and Somali in decreasing order respectively. Camels kept by the Orma and Somalis are valued for their drought resistance and milk production. They are used for transporting goods over a long distance, they require less frequent watering than other livestock kept by the Somali and Orma in the study area.

Livestock Birth and Death Rate

Figure 2 represents percent birth and death rates of different livestock species in the study area. Data collected showed that goats had the highest birth rate of 44.8 percent, while donkeys and camels had almost the same birth rate

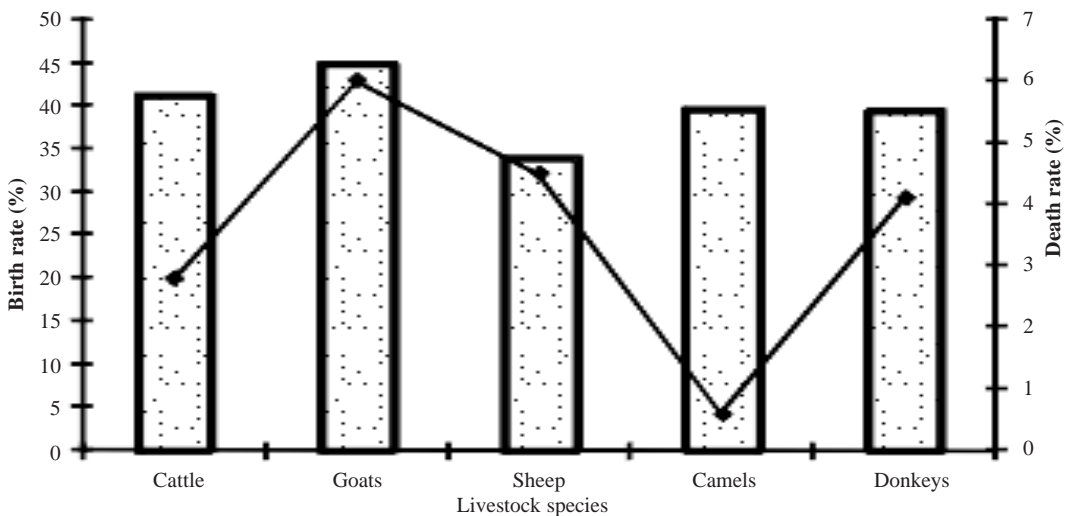


Fig. 2. Births and mortality rates of the livestock in Mwingi and Kitui districts in the past six months

of 43.7 percent and 44.1 percent respectively. Camels had low mortality rate of 1 per cent, while goats and sheep had the highest mortality rate of 6 and 4.5 per cent respectively.

Livestock species losses were occasioned by predators especially hyena, leopard and snakes. Other losses of animals were occasioned by frequent droughts that reduce the availability of pastures and water. Calves and old cattle are most vulnerable to drought, and heifers and dams reduce their calving rates, because of poor physical condition in the rangelands (Dahl and Hjort 1976). The other most important animal health constraint to livestock productivity in the two districts is endemic diseases, mainly vector borne, whose severity is strongly influenced by the environment. Some common diseases include Foot and Mouth Disease, East Coast Fever, Rinderpest, Contagious Bovine Pluero-Pneumonia (CBPP), and Contagious Caprine Pluero-Pneumonia (CCPP). Herders reported that conventional veterinary centres in the area are extremely costly and inefficient. Therefore, the problem of poor delivery of animal health services in the study area should be dealt with by strengthening rural extension and conventional veterinary services to deal with pastoral livestock needs. At the same time, ethno-veterinary services by the local herders should also be encouraged.

Availability and Access to Water

Seasonal rivers and streams form a major source of water for domestic use and livestock watering in the study area. Other water sources are sandy riverbeds, shallow wells, earth dams and bore holes. Tana is the only permanent river present in the study area. The dry riverbeds of Enziu River provide water for both livestock and human populations. In addition, Ngwaniwa earth dam is a seasonal dam located in Malalani location and it is used for livestock watering during the dry season. As a result of the influx of Orma and Somalis, livestock population water is stored for a short period in Ngwaniwa dam. Local herders cite the problem of siltation and trampling around the edges of the dam as hastening the drying up of the dam.

It was observed that the availability of dry-season water for livestock is the main constraint to pastoral livestock production in the study area. There was a significant ($P < 0.05$) dif-

ference between number of wells and the mean number of households, with an overall mean number of 5 to 8 households per well. During the dry seasons, most of the herders have to dig wells at the bottom of river Enziu to meet water requirements for their livestock. The locals cited water problem and land tenure rights as the major challenge to the livestock industry in the area. Except the Tana River, rivers and streams are not a sustainable source of water in the study area since they are ephemeral. However, the potential for water harvesting in the area is enormous.

Water supply and its availability in Mwingi and Kitui districts is dependent on the seasons, with big variations between wet and dry seasons. Severe shortages are usually reported during the dry seasons, which is a common occurrence in the area. Piped water is available only in Malalani area, meaning few households have piped water at home. In general, water supply in the area can be categorized into three major groups: (i) direct use of natural water sources such as rivers, and streams; (ii) developed surface water sources, such as earth dams, sand/subsurface dams, tanks and pans; and (iii) developed groundwater such as shallow wells, waterholes and boreholes.

However, it has been argued that bringing development to ASALs by increasing the number of water points for livestock may not necessarily achieve the desired results (Thurrow and Herlocker 1993). This is because traditionally, water availability in the dry season was the critical factor that limited livestock populations and pasture access balancing carrying capacity to available forage.

Access to water was taken to mean the proximity to a water source by the community, depicted by the distance to a water point as specified by a radius of 10-20, 21-30, 31-40 and 41+ km (Table 2). Data obtained from the study showed that during the dry season many camel herds travel up to 41+km a day, adding up to 243km a week, in order to drink. However, various stock have different watering frequency (Pratt and Gwynne 1977). In dry seasons, livestock are not necessarily watered daily, the Somali, Orma and Kamba water their cattle once every 2-3 days, sheep and goats every three and two days respectively, and camels every 3-5 days. Donkeys are watered every 1 to 3 days since they are mostly used to carry water for ho-

Table 2: Distribution of flock and herds in relation to water during dry seasons, determine using GPS analysis

Species	Water frequency (d)	Distribution of flocks and herds (%)			
		Distance between homesteads and well (km):			
		10 – 20	21 - 30	31 – 40	41 +
Camels	3 - 5	20	25	40	15
Cattle	2 –3	15	70	10	15
Donkey	1- 3	80	20	0	0
Sheep	3	31	55	14	0
Goats	2	60	40	0	0

usehold use. Field observations indicate that livestock subjected to water stress and trekking for more than 31 km (>62 km return) is avoided, especially for donkeys, sheep, goats and calves. Akamba, Orma and Somali respondents indicated that the maximum distance to water should not exceed 31 km from any homestead. However, some homesteads were about 41+ km from the nearest water source; such homesteads had no donkeys or shoats and experienced acute water shortage.

The Orma and Somali small boys and older girls attend to the small stocks together unlike the Akambas'. At the watering points getting water for livestock from the wells is a male activity, while women drive cattle to the drinking troughs. These findings demonstrate the poor status of access to water by livestock in the study area and are typical of ASALs where the most acute water problems occur (Soussan and Arriens 2003). Water resources are scarce, overexploited and erratic in availability, while poverty is very high and both services and institutions are poorly developed. Water scarcity is a condition where demand exceeds supply (Seckler et al. 1998). Water access was rated very highly not only for domestic uses, but also for watering cattle during the dry season when water sources in the plains, as well as seasonal streams from Endau and Engamba hills, dry up.

Livestock Grazing

Grazing system in the study area is characterized by common utilization of the range by the Akamba, Orma and Somali pastoral communities. The management and herding system is based on a long tradition of opportunistic cattle-goat-sheep and in some cases camel herding. The camels, in this area are normally separated from other livestock herds, and herded by camel-boys. However, mixed herding of cattle, goats and camels is occasionally practiced by

both the Orma and Somali. The results of this study demonstrated that Orma and Somali regard herd dispersal as a perfect practice to reduce the chances of an entire herd being lost to drought, diseases or lack of water and pasture. Livestock dispersal is carried out in the following ways: i) stock exchange between individuals or households and this can endure for many years, ii) dry season dispersal of herd elements to different areas, and iii) dry season division of herds into lactating and non-lactating.

Result showed that livestock grazing of the Akamba takes place from the homelands (in dry seasons) in the west through the study area to Tana River, Ngwaniwa, Engamba and back. Likewise, the Orma and Somali herders graze from the east and north-east towards the study area, Engamba hills up to the seasonal river Enziu and back to the east. It was observed that livestock routes change over the seasons/years.

In January, the Akamba livestock herds move from Vulini to Ndovoini, while the Somalis and Ormas move from their homelands to Enziu ranch on the west part of Tana River and back. During the long rainy seasons in April to June, only a small fraction of the Akamba, Orma and Somali ethnic communities continue to graze away from their homeland. During the wet seasons, the Akamba who are agro-pastoralist go back to their homeland where they restrict the movement of the cattle as they embark on cultivation of subsistence crops such as maize, millet, cow-peas and sorghum for subsistence use. However, immediately the wet grazing seasons ends in June, the Akamba, Orma and Somali move back to the study area for dry season grazing between the months of July and September.

Property Rights

Property rights in Mwingi and Kitui districts are traditionally based on the philosophy that land is a communal resource. However, tradi-

tional systems and well-defined rules governing access to resources and their utilization exist. For instance, the control and organization of shallow wells is inherited within a lineage and is the responsibility of the 'well council' to oversee its use. It was observed that the purported 'well owners' who are Kamba elders carefully consider the allocation of watering rights for the Orma and Somalis who are considered as 'outsiders' by the Akamba. The decisions taken by the 'well owner' or Akamba elder's normally include exclusion of 'outsiders', the allocation of water and grazing sites to outsiders for use in the Akamba homeland is negotiated by the 'clans' who determine resource use patterns.

Result showed that during the dry grazing season, the Orma and Somalis herders pay Akamba for each well they used for their livestock watering. Although the payment varies with various 'well owners', in various locations they all pay on a given range. A whole herd for a period of one month is charged between Kenya Shillings (Ksh) 2,000 to 10,000 whereas for each cattle, donkey and camel it ranges between Ksh 40 to 50, goats and sheep are charged Ksh 3 to 5 for each animal (Table 3). In some cases herders barter watering rights for small stock. In addition, herders sometimes rent grazing land in order to feed their cattle while they are present in the area.

Table 3: Payment for watering the herds and flock in the shallow wells

<i>Watering payment of livestock herds and flock</i>	<i>Kenya Shillings</i>
Pay per herd/ period (1 month)	2,000-10,000
Pay per head of livestock (cattle, donkey and camels)	40-50
Small stocks (per stock)	3-5

(1 US Dollars = 75 Kenya Shillings)

This arrangement does not apply beyond river Enziu towards the west, where the Akamba under their grazing regulations cannot allow Orma and Somali herders to graze. Although land in the study area is communally owned, Akamba clans' control grazing rights for those perceived as 'outsiders'.

The study showed that the conflicts in the study area largely occur between different ethnic groups. The conflict centres on access to dry season water sources in Malalani and Twambui. Orma and Somali pastoralists find themselves in

regular confrontation with the neighboring Akamba. Much of the conflict has also to do with the increasing shortage of pasture. Resource scarcity is exacerbated by recurrent droughts and overgrazing of palatable and more nutritious grasses. In addition, weak and inappropriate formal institutions in the two districts coupled with the inability of traditional institutions to manage conflicts and secure property rights contribute to the intensification of violent conflicts and animosity among resource users in the area. The area suffered major resource use conflict in late 1990s, which began as cattle rustling and escalated to full-fledged armed battles between the ethnic groups. Most recent conflicts took place in the year 2000, with fighting between the Akamba and Somali/ or Orma communities over grazing lands and water access.

Common property rights is one the most critical feature of African pastoral production systems. It has been used as a means of ensuring equitable use of the available land and water resources. Communal land use is a prerequisite for herd mobility in pastoral production systems, as it allows flexibility in access of grazing resources but only under certain regulations to avoid misuse. However, common property rights have been blamed for land degradation in African pastoral areas which is linked to the concept of 'tragedy of the commons' advanced by Hardin (1968). However, these old paradigms have been faulted, and dismissed as myths and misconceptions on the facts that common property regimes in pastoral Africa are not equivalent to 'open-access'. Access to common resources was governed by appropriate traditional institutions and enforceable sanctions making it less possible to willfully misuse such resources (Lenehan and Reid 2001; Nyariki and Ngugi 2002; Sandford 1983).

It has been argued that many changes for property rights and land use can be accommodated within existing pastoralist's social and legal institutions and customary systems. However, some demands may not be accommodated, particularly demands regarding mobility of livestock and exchange of property rights by persons perceived by locals to be outsiders. Individuals may then try to cause direct change in social and legal institutions by openly defying the institutions, appealing to local rule makers or rule-enforcers, or forming coalitions with

others. Individuals will likely appeal to those institutions and organizations (at local, regional or national levels) that are accessible to them and which will respond favorably to their demands for change. We referred this as 'forum shopping'.

CONCLUSION

The study findings corroborate the assumption that water is a critical resource determining success of pastoralism as a way of life in ASALs. Availability of water determines where livestock graze in during the different seasons of any given year. During the dry season, all the temporary water sources in Mwingi and Kitui districts dry up making the people and livestock rely solely on shallow wells. Unclear land tenure policies and property rights in the area leads to competition for the limited water, resulting in conflicts. The conflicts have a negative impact as valuable resources are diverted to its management at the expense of provision for basic needs and development.

RECOMMENDATIONS

The study identified the recommendations as actions that would address water availability and under pastoral livestock production in the ASALs. They include the following:

- a) Opportunity exists to increase the water productivity of livestock at scale ranging from households to seasonal river basin found in Mwingi and Kitui districts.
- b) The process of developing water points for rural communities need to incorporate equitable arrangements for sharing the water and facilities and account for the legal framework of use as the potential for conflict is high.
- c) To ensure that productivity gains to reduce poverty are not offset by associated degradation of rangeland resources, there is need to integrate water development, resolve land tenure issues and improved livestock management in the area.
- d) The role of institutions such as community-controlled, co-operatives or herders associations and the role they play in ensuring efficient utilization of water resources need further investigation.
- e) Finally, more work is urgently required on

assessment of below ground water sources, neglected bush control methods and on the introduction of proactive water policies that would address traditional production systems.

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