Indigenous sheep to help improve market access and livelihood security among pastoralists in Kenya: Results of a baseline survey

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Indigenous sheep to help improve market access and livelihood security among pastoralists in Kenya: Results of a baseline survey

Julie Ojango, Edwin Oyieng, James Audho and Ally Mwai Okeyo

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ILRI is a member of the CGIAR Consortium

Box 30709, Nairobi 00100, Kenya
Phone: + 254 20 422 3000
Fax: +254 20 422 3001
Email: ILRI-Kenya@cgiar.org

Box 5689, Addis Ababa, Ethiopia
Phone: +251 11 617 2000
Fax: +251 11 617 2001
Email: ILRI-Ethiopia@cgiar.org

Contents

Tables

Figures

Acknowledgments

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Executive summary

Indigenous sheep breeds reared by pastoral communities have unique adaptive characteristics for the extensive systems and are not restricted within national geographic boundaries. However, widespread indiscriminate crossbreeding with breeds from South Africa, notably the Dorper, has resulted in a rapid decline in numbers of pure-bred indigenous animals. Changing climatic conditions with severe droughts in 2008–2010 have been disastrous to the pastoral animal populations in general, and especially for pure and higher grades of Dorper crosses. Indigenous sheep breeds seem to have withstood such challenges much better.

In 2009, a collaborative project between the International Livestock Research Institute (ILRI) and the Swedish University of Agricultural Sciences (SLU) was initiated to generate data and provide information that would enable more sustainable management of sheep in the arid and semi-arid lands (ASAL). Initial feedback provided from this project to the communities in parts of Kajiado resulted in a short-term collaboration between ILRI, CONCERN Worldwide (CW) and Neighbours Initiative Alliance (NIA) that aimed to identify the key constraints to access to and optimal utilization of improved sheep genetics, and determine context-specific intervention options for improved sheep production under pastoral systems. This report presents information obtained from communities living in two sites of Kajiado County representing contrasting ASAL areas occupied by Maasai communities, Iloodo-Ariak sub location and Enkaroni location.

A participatory appraisal was carried out in December 2012 involving 297 households in the target sites using tools developed to collate baseline information on household characteristics and asset endowment, number and types of animals kept, as well as information on production, management and sales specific to sheep reared. A large proportion of the respondents were female members of the households, and it was noted that within each household a majority of the members had basic primary education.

Most of the land in the areas was used for grazing. In Enkaroni location, however, a substantial proportion of the respondents (37%) also allocated land for arable use. Both communities had mixed species of mainly ruminant livestock comprising cattle, sheep and goats. They indicated that they had more small ruminants (sheep and goats) than cattle. It was also noted that goats were least affected by droughts, compared to the sheep. Among the breeds of sheep kept, farmers in Enkaroni had a larger number of Dorper sheep than the other breeds, while those in Iloodo-Ariak had flocks with more Red-Maasai sheep than the other breeds. In both sites, flocks had relatively more ewes than rams. Mortality of ewes within the two sites mainly due to diseases was noted to be higher than that of either rams or lambs. Urgent measures need to be taken to address the causes of the high rate of mortality. The most important trait with regard to the economic importance of the sheep reared in both sites irrespective of the breed was the body weight.

Discussions with community elders who introduced the project team to the various households indicated a strong desire for support and guidance on how to go about improving their livestock productivity to avoid dependence on aid when conditions were extremely dry. The communities would stand to benefit from a community based sheep breeding and management program. This would need to be developed through collaboration among partners with emphasis on capacity development of communities to boost their skills in sheep production techniques, provision of support services mainly in terms of animal health management, and ensuring sustainable management of the environment.

A large proportion of the respondents were female members of the households, and it was noted that within each household a majority of the members had basic primary education.

Introduction

In 2010, some 12.4 million people in the Horn of Africa region covering Somalia, Kenya, Ethiopia and Djibouti were affected by the worst drought in decades. Most of the affected people were pastoralists and nomads for whom livestock is key to their livelihoods. The calamity was worsened as it came soon after a drought in 2008–2009 with no recovery time for the fragile systems. Unfortunately, climatic conditions are changing, with potentially devastating impacts in East Africa due to changes in the frequency, intensity, and predictability of precipitation. If left unchecked, the pastoral communities could be in a constant state of 'recovery' from one drought to another, with little opportunity to re-establish their flocks and herds of animals. Systems-based research and development relevant to resources of interest to pastoral communities is required to help them respond to the changing social, economic and environmental contexts in which they operate (Rege et al. 2011).

The majority of livestock species and populations kept by pastoralists are the small ruminants (i.e. sheep and goats). The small ruminants play a complementary role to other livestock in utilizing existing feed resources in vast areas of natural grassland where other enterprises such as crop production would be a challenge (Baker and Rege 1994).The indigenous sheep breeds reared by pastoral communities are found in almost all the countries of the Horn of Africa and have unique adaptive characteristics for the extensive systems. Among the East African fat-tailed sheep breeds, the Red Maasai has been proven to have a considerable genetic resistance to intestinal worm parasite infections and is drought tolerant (Baker et al. 2004; Kosgey et al. 2008). Widespread indiscriminate crossbreeding with heavier mutton breeds from South Africa, notably the Dorper, has however resulted in a rapid decline in numbers of pure-bred indigenous animals. The changing climatic conditions, notably the severe droughts, have been disastrous to the pastoral animal populations in general, and especially for pure and higher grades of Dorper crosses. The indigenous sheep breeds have however withstood such challenges much better.

In 2009, a collaborative project between the International Livestock Research Institute (ILRI) and the Swedish University of Agricultural sciences (SLU) was initiated to generate data and provide information that would enable more sustainable management of sheep in the arid and semi-arid lands (ASAL) for livestock keepers in two areas occupied by Maasai pastoralists in Kenya. A total of 26 livestock keepers were involved. Initial feedback provided by ILRI and SLU to the communities participating in the project based on information generated on their sheep populations, and disseminated through focus group discussion and training programs on sheep recording and management, generated a lot of interest by the larger communities around the project sites. This resulted in a short-term collaboration between ILRI, CONCERN Worldwide (CW) and Neighbours Initiative Alliance (NIA) to characterize the pastoralists' sheep production systems in a wider area. This is aimed at generating information that could provide a basis for developing a sustainable sheep breeding program as an intervention to mitigate the impacts of changing climatic conditions on the livelihoods of pastoral livestock keepers in the ASAL.

CONCERN Worldwide is an international humanitarian organization dedicated to working with the world's poorest people to transform their lives (http://www.concern.net). They work in partnership with some of the world's most vulnerable communities to tackle poverty and suffering and to significantly reduce extreme

poverty. Since 2006, CW has been working with partners in rural development programs on emergency responses. NIA is a non-governmental organization working with the Maasai people living in former group ranches found in Kajiado County of Kenya (http://niakajiado.org/). Its core business is to empower communities through education, training, lobbying and advocating for justice, and promotion of economic stability.

Information generated through this collaborative project will provide the evidence for determining how the partners can jointly, through research in development targeted for ASAL, build and strengthen community resilience to changing climatic conditions and reduce dependence on external food aid, using existing animal genetic resources.

The overall objective of the project was to identify the key constraints to access to and optimal utilization of improved sheep genetics, and determine context-specific intervention options for improved sheep production under pastoral systems of Eastern Africa.

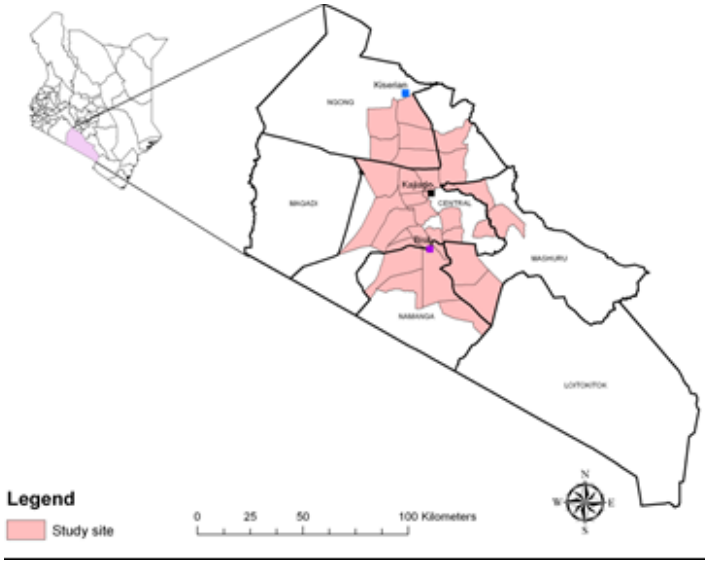
Systems-based research and development is required to help pastoral communities respond to the changing social, economic and environmental contexts in which they operate.

Methodology

Project sites and community targeted

The sites chosen for the study were identified through consultation with stakeholders and pre-site selection scoping studies. Iloodo-Ariak sub location and Enkaroni location of Kajiado County (Figure 1) were selected to represent contrasting ASAL areas occupied by the Maasai communities targeted by NIA. Kajiado County lies in agro-climatic ecozone V and VI with an annual rainfall of less than 1100 mm (Sombroek et al. 1982). The Maasai people are semi-nomadic livestock keepers who live in communal systems. Their livelihood is sustained through rearing livestock, notably cattle, goats and sheep and the management of natural resources. In addition to providing food for the households, the livestock reared provide several social benefits and are central to the economy of the Maasai people. Maasai communities move with their livestock in a seasonally defined system of rotation to access pastures and water as determined by the prevailing weather conditions. However, in recent years, due to land-use changes, these communities are adopting more sedentary lifestyles except for select age groups charged with the responsibility of moving with animals in search of pastures and water when seasons change.

Figure 1. Map of Kenya indicating the study areas.



Enkaroni

Enkaroni location is endowed with various natural resources which include a good forest cover, sand and shallow wells. Rapid expansion of urban centres within the vicinity of the location and a change in the lifestyle of the communities in recent years is however resulting in rampant degradation of the environment in Enkaroni. Infrastructure development in the area is poor as most villages are linked by roads that are mainly passable only during the dry season. This limits easy access to most areas during the rainy seasons. Pastoral livestock

production is the main economic activity within the location. Although most of the land is used for grazing, it has good potential for food crop production, and in some parts is used for subsistence farming. Water is mainly obtained from boreholes and shallow wells. Economic activities in Enkaroni are supported through access to two main markets for animals, Ilbisil and Mile 46 and the rapidly growing urban centre of Kajiado.

Iloodo-Ariak

Iloodo-Ariak is a more remote sub-location in Kajiado with wooded bush land on the hill sides and rocky ground with scarce grass cover across flatter areas. In recent years, severe droughts have been common, inter-spaced with erratic and unreliable rainfall. The main sources of water here are from tributaries of the Iloodo-Ariak springs. The area is more sparsely populated and communities mainly practice semi-nomadic pastoralism. Sub-division of the group ranches followed by the issuance of land title deeds to individual pastoral households within the sub-location has resulted in uncontrolled selling of the more productive parcels of land. This has resulted in a higher population of livestock being maintained on smaller parcels of arid land. Infrastructure is very limited in the area, and most members of the communities have no formal schooling resulting in a low levels of literacy and a strong adherence to more traditional cultural practices.

Development of rapid assessment tools

A questionnaire was developed to collect and collate baseline information on household characteristics and asset endowment, number and types of animals kept (under different categories and breeds), as well as information on production, management and sales specific to sheep reared. Using participatory and consultative processes, the tool developed was tested and translated into local dialects for use at the household level.

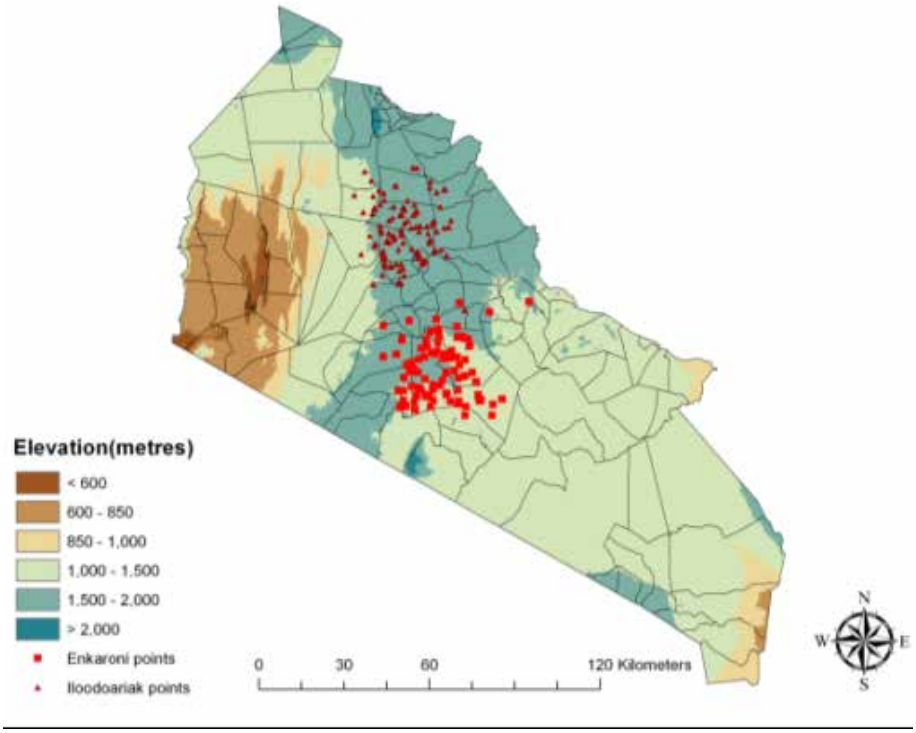
Sampling procedure and estimation of sample size for the study

To ensure inclusion of a statistically significant proportion of households in the study, NIA provided information on the number of households they target in their other project activities for each site. The number of households to be included in the study from site was then calculated using an estimated probability of 0.5 (this is the probability of a household owning a specific breed of sheep). A minimum of 120 and 156 households from Iloodo-Ariak and Enkaroni, respectively, were deemed necessary for the survey. To cater for a possible reduction in sample size due to some households failing to provide data as envisioned, a larger sample of 134 households from 6 villages in Iloodo-Ariak and 163 households from 9 villages in Enkaroni were surveyed.

Baseline data collection

Household data collection was coordinated by ILRI working in collaboration with NIA over a 10 day period in December 2012. In each location, information was collated by enumerators assisted by village elders. Within the households visited in each site, information was provided either by the household head, or by a responsible adult household member who had authority to share information. A large proportion (>60%) of the respondents were female members of the household. The distribution of households that provided information in each location as identified using Global Positioning System (GPS) coordinates is presented in Figure 2.

Figure 2. Distribution of households in Enkaroni and Iloodo-Ariak that participated in the baseline household survey.



Data analysis

Qualitative and quantitative data analysis techniques were used to evaluate information collated from the project areas. Results in this report are presented mainly using descriptive statistics. The Statistical Product and Service Solutions (SPSS) (Version 20) and Statistical Analysis System (SAS) Enterprise 4.3 were used to generate descriptions from the field data.

Results and discussion

Household and socio-economic characteristics

The characteristics of respondents within each site and the allocation of land to different activities within the sites are presented in Table 1. A large proportion of the respondents (>60%) were female members of the households. All households had access to grazing land; however, within the two sites only some of the households had arable and forest land. The percentages of households that had land for arable and forest use, and those that used land exclusively for grazing are presented in Table 1.

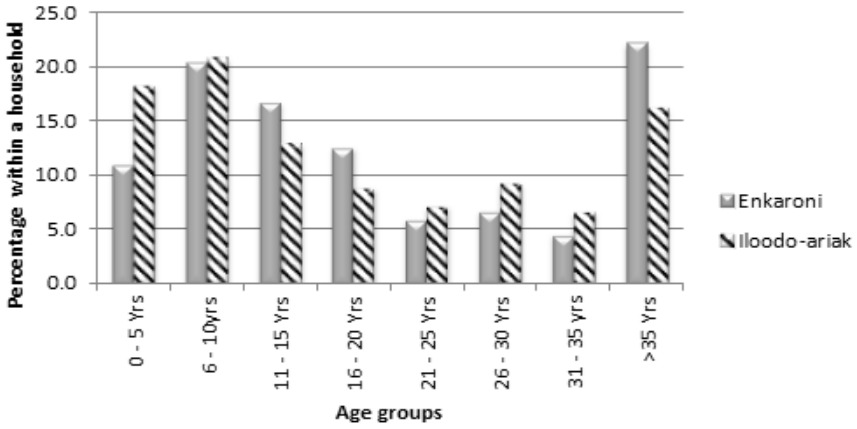
Table 1. Characteristics of respondents and percentage of households allocating land to different activities

Site	Enkaroni (no.=163)	Iloodo-Ariak (no.=134)
Sex of respondents (per cent of no.)		
Male	39.5	37.3
Female	60.5	61.9
Land use (per cent of no.)		
Arable land	37	0.8
Forest land	11	3.0
Grazing land*	52	96.2

*Households that allocated land exclusively to grazing. Does not include those that allocated land both to grazing and another use

The average household size for Enkaroni was 8 members with a maximum of 21 and a minimum of 2, while the average household size in Iloodo-Ariak was 6, with a maximum of 15 and a minimum of 1. The percentage distribution of individuals within a household by age group for the two sites are presented in Figure 3. For both project sites, a majority of the household members (>54%) had basic primary education; however, a substantial proportion of the population (>21%) had no formal education at all.

Figure 3. Percentage of individuals of different age-groups within households participating in the survey.



In both sites, most (>50%) of the respondents used their land exclusively for grazing; however, in Enkaroni a substantially larger proportion (37%) of the respondents also used the land for arable practices than those in Iloodo-Ariak (0.8%), (Table 1). Land is a very important asset among the Maasai community and all households owned land either as individuals or as a community. Members within the households however noted that the fraction of the grazing land was diminishing due to increased urbanization within the sites. Originally, the Maasai people did not grow crops. However in the last 25 years, the semi-arid grazing areas have partly changed to agricultural crop lands. The reason for this change is the associated security of land tenure. The farmers noted that land is more easily retained by households when cultivation is practised compared to when only left for grazing of livestock.

Materials used for construction of houses

Characteristics of the housing, and the materials used for buildings in both sites are presented in Table 2. A large number of the houses were made of mud/clay, and were partitioned into 3 rooms, all used for domestic purposes. In Enkaroni location, a larger proportion of houses were constructed using wood, iron sheets and bricks, compared to those in Iloodo-Ariak. Houses in all the locations were owned by the individuals and not rented. The type of material used for housing was however not a measure of the resource endowment of the household.

Table 2. Characteristics of the houses in the project areas

House characteristics	Enkaroni	Iloodo-Ariak
Wall (%)		
Mud/clay	67.5 (no. = 110)	83 (no. = 108)
Wood/iron sheets	24.5 (no. = 40)	16.2 (no. = 21)
Bricks	8 (no. = 13)	0.8 (no. = 1)
Floor (%)		
Earth	79.8 (no. = 130)	88.5 (no. = 115)
Cement	20.2 (no. = 33)	11.5 (no. = 15)
Roof (%)		
Grass	47.9 (no. = 78)	19.2 (no. = 25)
Iron sheets	36.8 (no. = 60)	39.2 (no. = 51)
Tiles	1.2 (no. = 2)	0.8 (no. = 1)
Clay	14.1 (no. = 23)	40.8 (no. = 53)

Overview of livestock reared in project sites

Both communities kept mixed species of mainly ruminant livestock comprising cattle, sheep and goats (Table 3). Livestock keepers indicated that they had more small ruminants (sheep and goats) than cattle. Very few households (5 in Enkaroni and 10 in Iloodo-Ariak) kept some poultry and only 3 households kept rabbits. For all the species of livestock reared, households in Iloodo-Ariak tended to have more in number than those in Enkaroni. This observation was commensurate with the fact that the main use of land within Iloodo-Ariak was for livestock production, while in Enkaroni land use was for both grazing and arable purposes (Table 1).

Table 3. Average herd sizes for various species of livestock reared and the percentage of households keeping them within the two locations

Species	Breed	Enkaroni (no. = 163)			Iloodo-Ariak (no. = 134)		
		Mean ± SD	Maximum herd size	% of no.	Mean ± SD	Maximum herd size	% of no.
Cattle	Local	7.99 ± 14.65	90	66.5	24.54 ± 42.85	200	66.4
	Cross/exotic	8.20 ±29.46	300	31.7	48.20 ± 114.68	700	21
Goat	Local	13.97 ± 32.21	330	61	43.13 ± 42.53	200	69.4
	Cross/exotic	6.77 ± 21.92	200	25	60.90 ± 54.59	250	17.2
Sheep	Local	5.60 ± 11.61	93	40.3	28.77 ± 28.96	100	43.3
	Cross/exotic	17.75 ± 23.61	130	70.7	54.28 ± 70.53	402	41
Poultry		2.26 ± 5.64	40	3.1	7.17 ± 5.69	22	7.5
Donkey		3.24 ± 3.02	14	84.7	7.47 ± 8.39	46	16.4
Rabbit		0.03 ± 0.39	5	0.6	8.50 ± 4.95	12	1.5

Both communities reared indigenous and crossbred animals (Table 3). A higher proportion of livestock keepers in Enkaroni kept crossbred animals compared to those in Iloodo-Ariak. Most households reared crossbred sheep in both locations, but for other livestock species less than 32% of the animals were crossbred. Information on which specific exotic types of cattle and goats were used was not obtained.

Almost all the households in Enkaroni kept donkeys (84%), while only 16% of the households in Iloodo-Ariak kept donkeys. The donkeys are mainly used as pack animals for transporting charcoal to the markets, and for ferrying water for household use.

As the study was focused on sheep production within pastoral areas, more details were obtained on the population characteristics of the sheep reared. Subsequent sections of the report thus focus on sheep production within the project sites.

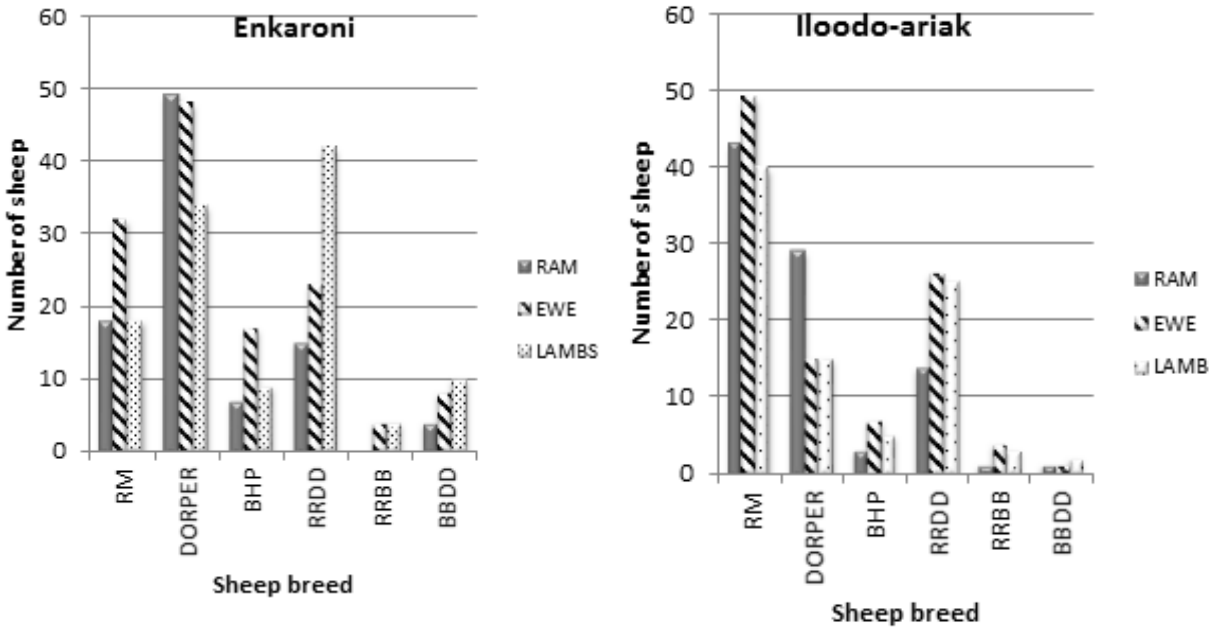
Sheep production

Flock composition and structure

The sheep flocks kept comprised a mixture of animals of different age groups (Figure 4). Farmers in Enkaroni kept a larger number of Dorper sheep than the other breeds, while those in Iloodo-Ariak kept flocks with more Red-Maasai sheep than the other breeds. This was not surprising as the environment in Iloodo-Ariak is harsher

than that of Enkaroni. In both sites, flocks had relatively more ewes than rams. It should be noted that although the number of rams kept in flocks was high in both sites, not all of these are animals used for breeding at any given time. Breeding was controlled through the use of mating aprons. A large proportion of the male animals reared tend to be sold in local markets for mutton, and in some cases to other livestock keepers for breeding. Some level of crossbreeding was practised by farmers in all sites as was evident through a significant number of crossbred animals within flocks (Figure 4).The proportion of farmers who indicated that they practised either pure-breeding or crossbreeding among the various breeds of sheep reared is presented in Table 4.

Figure 4. Average numbers of different breeds of sheep kept and the structure of flocks in terms of numbers of rams, ewes and lambs kept within the two sites.



Key: RM—Red Maasai, DD—Dorper, BHP—Blackhead Persian, RRDD—Red Maasai and Dorper cross, RRBB—Red Maasai and Blackhead Persian cross, BBDD—Blackhead Persian and Dorper cross.

Table 4. Mating system adopted by livestock keepers within the project sites

Site	Breed	Breeding practice	
		Pure breeding (%)	Cross breeding (%)
Iloodo-Ariak	RM	67.1	20.5
	DD	26.8	40.9
	BHP	3.7	0.0
	RRDD	2.4	29.5
	RRBB	0.0	2.3
	BBDD	0.0	6.8
Enkaroni	RM	32.4	11.6
	DD	50.7	72.1
	BHP	12.7	2.3
	RRDD	4.2	10.5
	RRBB	0.0	1.2
	BBDD	0.0	2.3

Key: RM—Red Maasai, DD—Dorper, BHP—Blackhead Persian, RRDD—Red Maasai and Dorper cross, RRBB—Red Maasai and Blackhead Persian cross, BBDD—Blackhead Persian and Dorper cross.

In both sites, a high proportion of farmers who reared Red-Maasai sheep practised pure breeding of the same, while a higher proportion of farmers who reared Dorper sheep practised crossbreeding of the animals (Table 4). This was notable for Iloodo-Ariak, where a higher proportion of the farmers practised pure-breeding among the Red-Maasai sheep (>67%), and in Enkaroni where more than 70% of the farmers with Dorper sheep practised crossbreeding.

Sources of rams used for breeding within the two sites and the proportion of farmers obtaining rams from the different sources are presented in Table 5.In Iloodo-Ariak, a higher proportion of the farmers used rams bred within their own flocks (43%), while in Enkaroni though a substantial proportion of the farmers used their own bred rams (28.7%), a higher proportion of them bought in rams obtained through traders or brokers (30.6%). The farmers were however not requested to distinguish the source of rams by the different breed types.

Table 5. Sources of breeding rams used by the livestock keepers in the two locations

	Enkaroni (no.=163)		Iloodo-Ariak (no.= 134)	
Source of breeding rams	No. of households	Per cent of no.	No. of households	Per cent of no.
Own bred	45	28.7	55	43
Bought from other pastoralist	24	15.3	45	35.2
Bought from individual trader/broker	48	30.6	15	11.7
Obtained as dowry	20	12.7	10	7.8
Gift from NGO/Project	1	0.6	0	0
Borrow from neighbour	19	12.1	3	2.3

Within any livestock production system, the source and choice of sire for mating is key in determining the progress in the population. Livestock keepers noted that they sourced external sires in order to improve the performance in terms of growth and adaptability, and to avoid high levels of inbreeding. They however relied heavily on selecting sires based on physical appearance, except when selecting from within their flocks where they retained those that exhibited good reproductive performance and disease resistance.

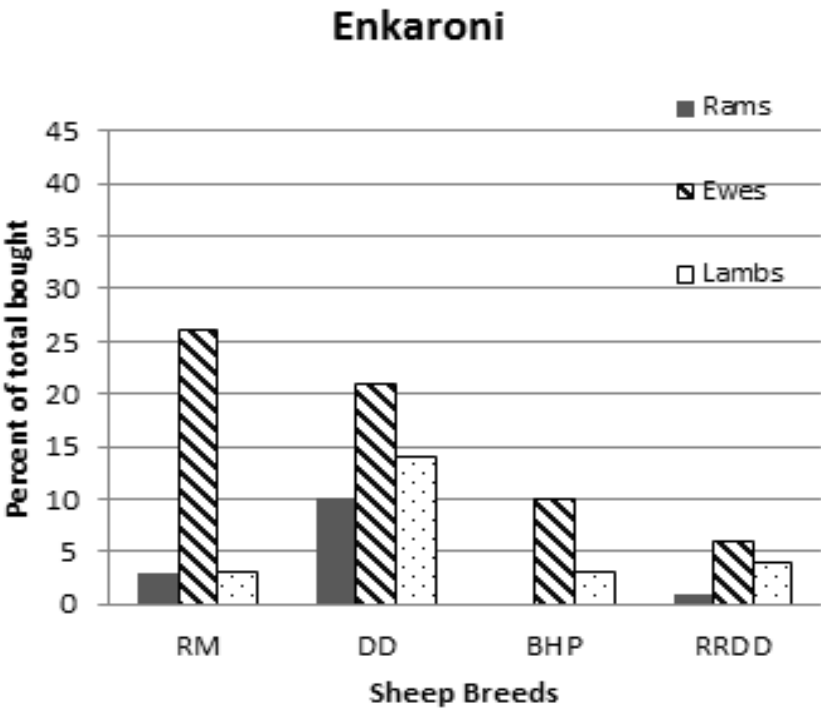
Sheep movement into and out of flocks

In order to understand the dynamics within the sheep populations reared, it was important to obtain basic information on the mobility and exchange of animals by the livestock keepers. The proportion of sheep of various breeds bought into flocks over a six month period from May to November 2012 and the types of animals bought are illustrated in Figure 5.

Households that bought in animals were requested to indicate the reason for purchase of animals; these are illustrated in Figure 6.

In both sites, more ewes were bought than rams. What was interesting to note was that in both sites, more Red-Maasai ewes were bought than those of other breeds (Figure 5). Additionally, in Enkaroni, a substantially higher number of livestock keepers bought in Dorper animals than in Iloodo-Ariak.

Figure 5. Proportion of sheep of various breeds and age groups bought into flocks by farmers in the project sites.



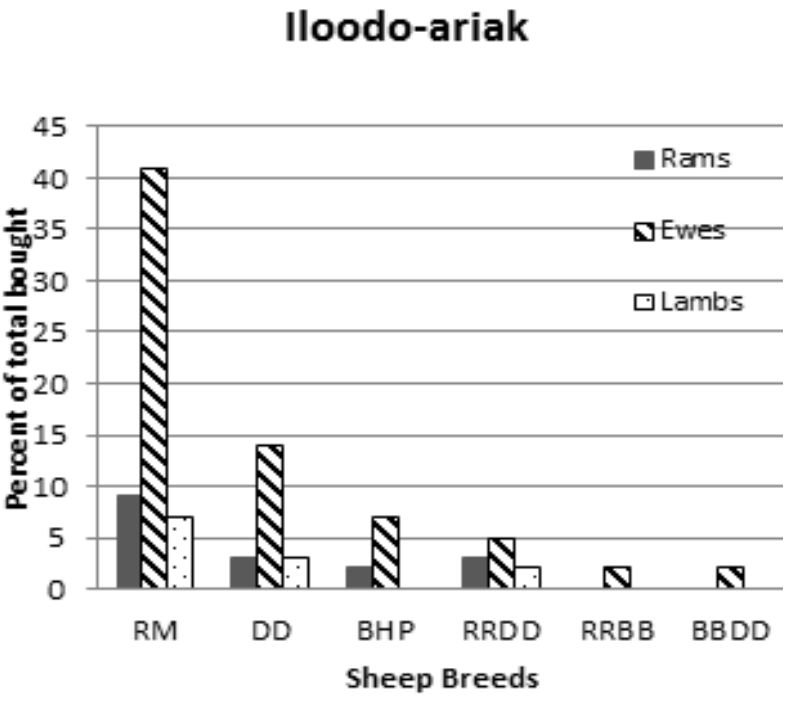
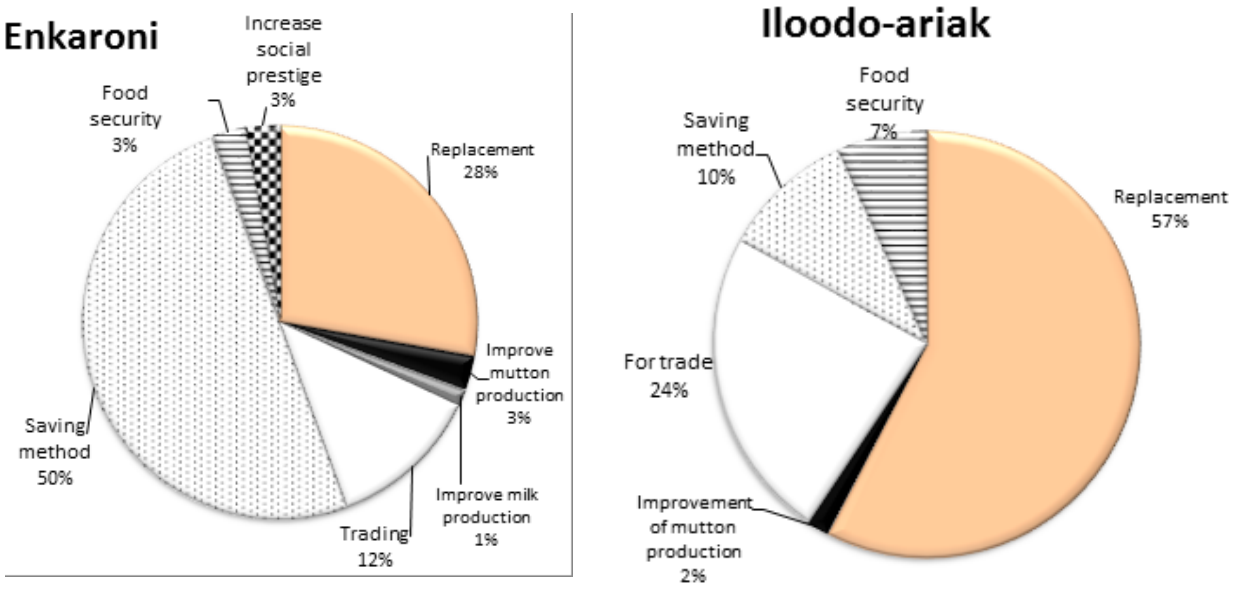


Figure 6. Proportionate responses on reasons given by farmers in the project sites for buying sheep.



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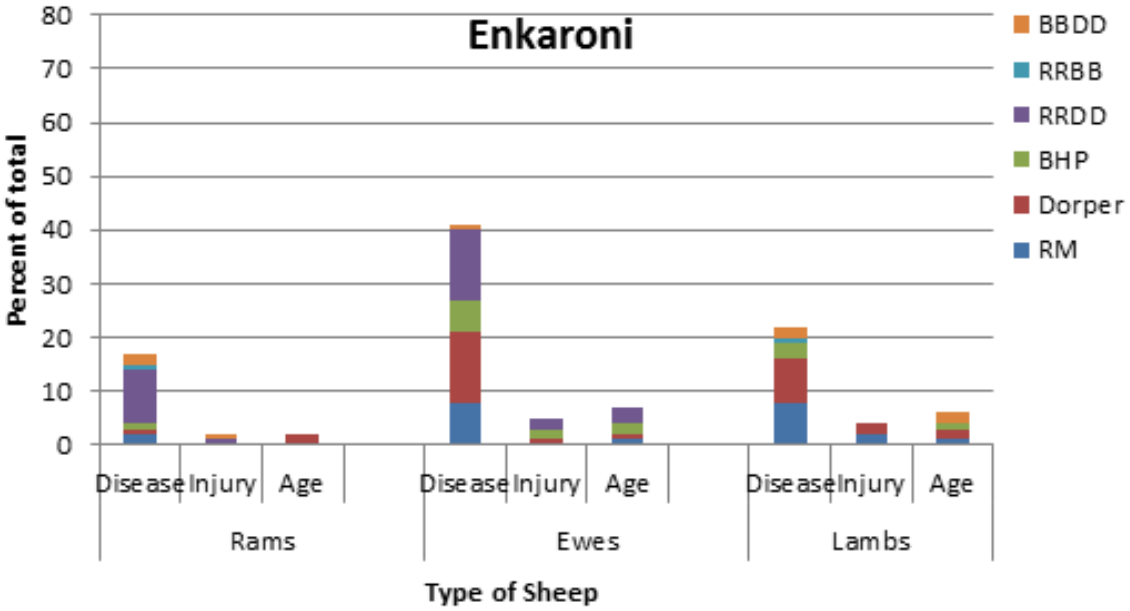
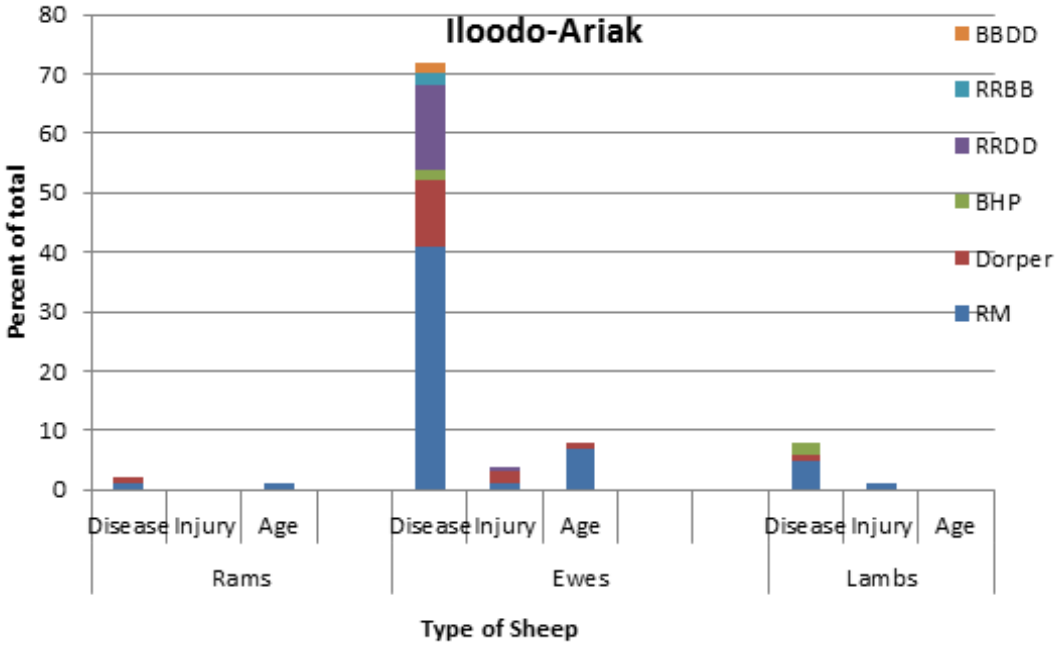
A large proportion of the farmers in Iloodo-Ariak (57%) indicated that they had mainly bought in sheep to replace animals that had been lost, while in Enkaroni, a larger proportion of farmers (50 %) bought in sheep as a means of 'saving'. This could imply a higher rate of mortality of animals within Iloodo-Ariak. From the information provided by the farmers on mortality of their animals within the last six months, a larger proportion of ewes were reported to have died in Iloodo-Ariak (72%, Figure 7) than in Enkaroni (41%, Figure 7). Diseases were the main cause of mortality in both sites. Urgent measures need to be taken to address the causes of the high rate of mortality among ewes in both sites.

In the last 25 years, the semi-arid grazing areas have partly changed to agricultural crop lands. The farmers noted that land is more easily retained by households when cultivation is practised compared to when only left for grazing of livestock.

Figure 7. Number of sheep reported to have died due to various causes over a six month period in the two project sites.





Key: RM—Red Maasai, BHP—Blackhead Persian, RRDD—Red Maasai and Dorper cross, RRBB-Red Maasai and Blackhead Persian cross, BBDD—Blackhead Persian and Dorper cross.

The pricing of animals sold was quite different between the two sites. Rams tended to be the most expensive animals, being sold at up to KES 20,000 (USD 238.00) per animal in Iloodo-Ariak (Table 6). Information on prices for the different breeds was not available but such information would be very useful for planning a sustainable sheep development program.

Table 6. Numbers of animals reported to have been sold from the flocks over a six month period respective prices

Site	Type of animal	% of no.	No. of sheep sold	Average price± SD	Maximum price (KES)
Enkaroni (no. = 163)	Rams	19.63	166	4835 ± 1641	12,000
	Ewes	44.78	228	4417 ± 1134	9000
	Lambs	23.92	308	3159 ± 675	5000
Iloodo-Ariak (no. = 134)	Rams	17.9	80	6409 ± 4950	20,000
	Ewes	56	129	3773 ± 1020	6000
	Lambs	9	66	4042 ± 1456	6000

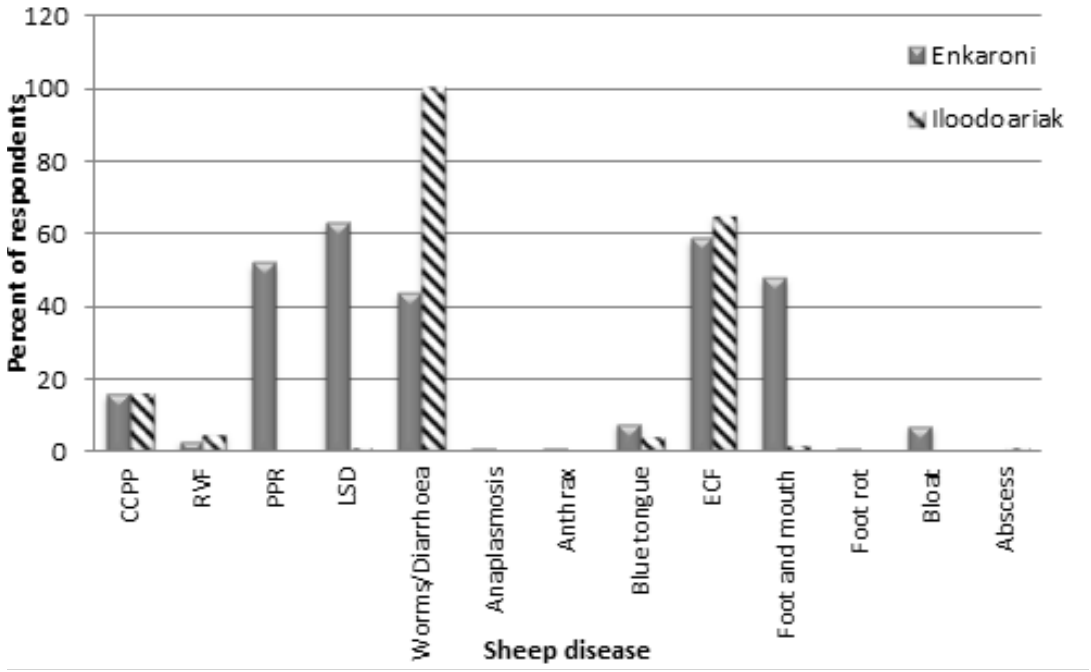
In both sites, animal trade was mainly carried out by men, and mainly done through livestock traders. An in-depth study of the markets and the different market agents available within the project sites is required to obtain a better understanding of the dynamics in the sale of sheep.

Sheep health

The farmers in Enkaroni were quite knowledgeable in local diseases and ably described the various diseases that affect their sheep. In most instances they had local names by which they identified key diseases, and could easily describe their symptoms. The proportion of farmers who indicated the specific diseases that are a challenge are presented in Figure 8. Within Enkaroni, lumpy skin disease (LSD) was reported as the most prevalent disease followed by East Coast fever (ECF), while worm infestation causing diarrhoea was reported as the most prevalent disease followed by ECF in Iloodo-Ariak. Vaccination and tick control services were rarely available and practised in the project areas.

Within any livestock production system, the source and choice of sire for mating is key in determining the progress in the population.

Figure 8. Proportion of farmers indicating challenge of various sheep diseases within project sites.

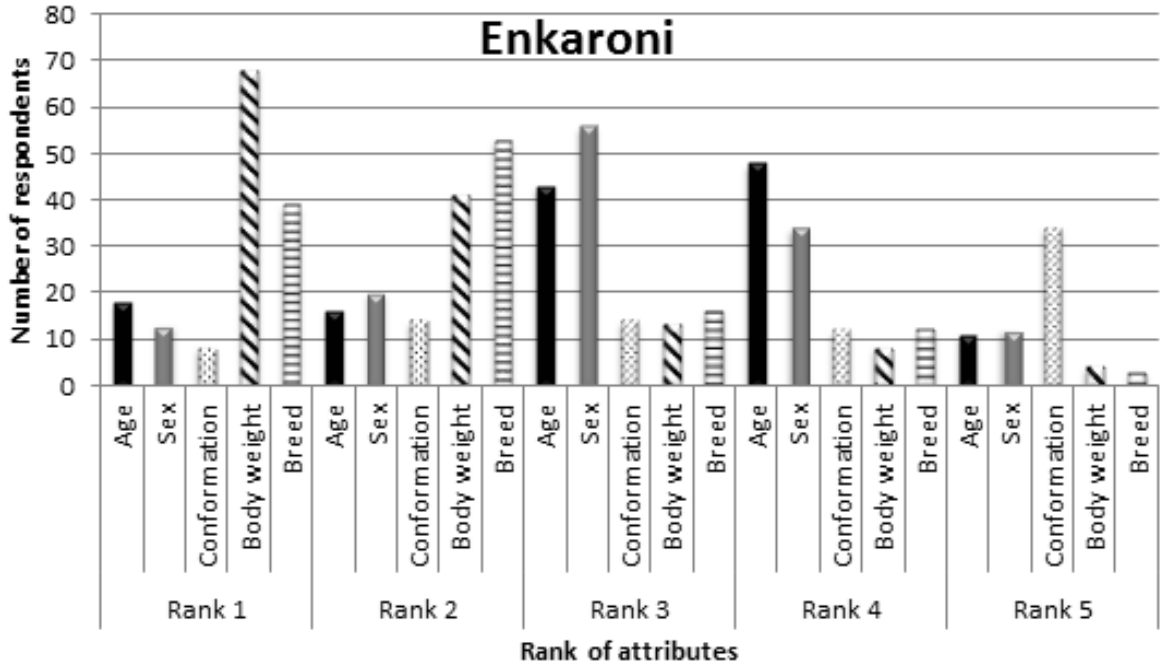


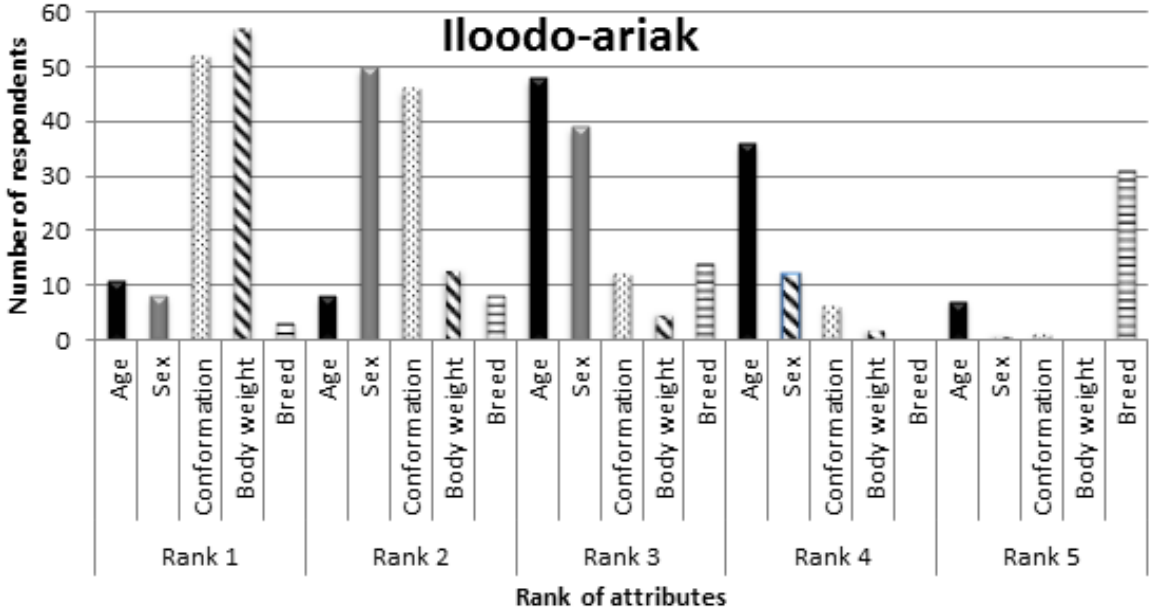
Key: CCPP—Contagious caprine pleuropneumonia, RVF—Rift Valley fever, PPR—Peste des petits ruminants, LSD—Lumpy skin disease, ECF—East Coast fever.

Traits of importance when selling sheep

Traits considered important when buying sheep as ranked by livestock keepers are presented in Figure 9. The most important trait in both sites irrespective of the breed of sheep was the body size/weight for age. The second most important trait was either confirmation or breed depending on the site. In Iloodo-Ariak, conformation was the second most important trait, while in Enkaroni, the breed of the animal came second. The sex of the animal was considered more important than the age within both sites. Information on the specific sex of animal and why it was important was not obtained. This information would be useful as it influences the management and dynamics within a flock. Results of the ranking of traits highlight the importance and need to carefully consider what breeds should be promoted when implementing a sheep improvement and breeding program within these sites. It was evident that the objectives of the farmers in the two sites were divergent. Farmers in Enkaroni sought to produce animals with a high demand on the market yet able to survive in the environment, while those in Iloodo-Ariak sought an animal more able to adapt to the environment.

Figure 9. Relative rank of attributes considered during the sale of sheep in the project sites.





Sheep feeding

Grazing was the predominant system of feeding sheep in both sites. Some farmers, particularly in Enkaroni fed their sheep on crop residues and also purchased and fed hay (Table 7). Use of mineral supplements was also commonly practised in both sites, with more farmers in Enkaroni practising this.

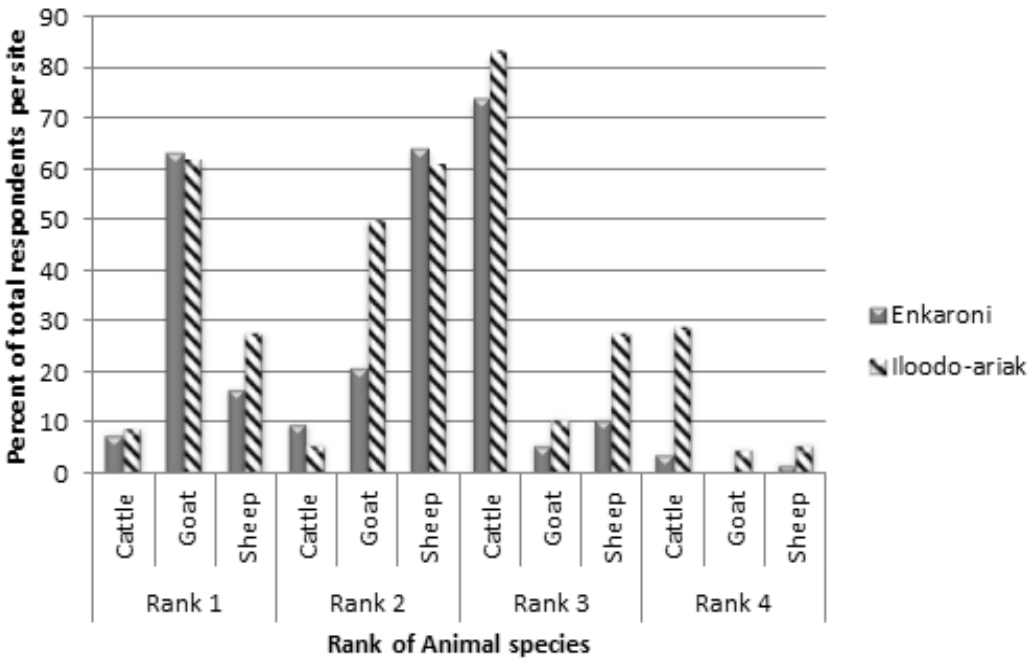
Table 7. Proportion of respondents feeding sheep on purchased feeds, crop residues and mineral supplements in the project sites

Feed	Enkaroni		Iloodo-Ariak	
	No.	%	No.	%
Purchased feed	81	50.3	22	17.5
Crop residues	70	43.5	11	8.3
Mineral supplements	152	94.4	59	45.1

Sheep and drought

As droughts are increasingly becoming common occurrences within the project sites, livestock keepers were requested to rank the different animal species kept in terms of their ability to tolerate dry conditions (Figure 10). In both sites, the goat was highly ranked (1st) as the species least affected by drought, followed by the sheep. Cattle were ranked lowest. Livestock keepers noted that the effects of droughts have led to drastic reduction of the number of cattle kept in recent years.

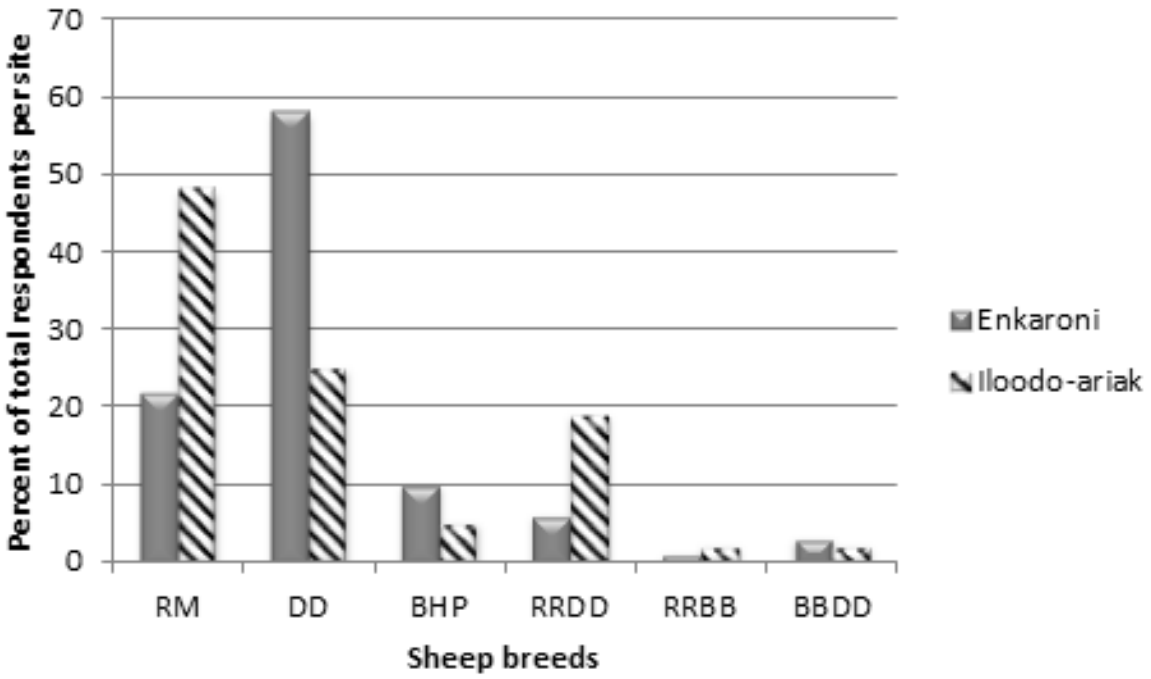
Figure 10. Relative ranking of different species of animals regarding their ability to tolerate droughts.



Note: Rank 1–4, where 1 is least affected by drought, 4 is the most affected by drought.

When asked to rate the breeds of sheep reared in terms of their ability to tolerate droughts, farmers in the two sites differed on which breed rated highest. Iloodo-Ariak farmers ranked the Red Maasai breed as the highest followed by the Dorper, while in Enkaroni, the Dorper surprisingly rated highest followed by the Red Maasai (Figure 11). The difference in ranking of the breeds in Enkaroni could be due to the fact that Enkaroni experiences less severe droughts than Iloodo-Ariak. Follow up on the actual survival of the different breed types is important to corroborate this information.

Figure 11. Farmer rating of sheep breeds in terms of their ability to tolerate droughts.



Farmers in Enkaroni sought to produce animals with a high demand on the market yet able to survive in the environment, while those in Iloodo-Ariak sought an animal more able to adapt to the environment.

Conclusions

Based on the information generated through the household survey, it is evident that sheep are an important resource to the pastoralists within the project sites. The communities were striving to build up their flock sizes, but would not hesitate to cull animals that were weak or sickly. Communities also had a reasonable understanding of the diseases that affected their sheep, although they did not have cures for all conditions and sought information and advice from the enumerators on what could be done to improve the health of their flocks. Gaps were however evident in information and knowledge of how to enhance the sheep productivity and take advantage of strategic marketing opportunities to improve household incomes.

Discussions with community elders who introduced the project team to the various households indicated a strong desire for support and guidance on how to go about improving their livestock productivity to avoid dependence on aid when conditions were extremely dry. The communities would stand to benefit from a community based sheep breeding and management program. This would need to be developed through collaboration among partners with emphasis on capacity development of communities to boost their skills in sheep production techniques, provision of support services mainly in terms of animal health management, and ensuring sustainable management of the environment.

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Annex

Developing sustainable livestock breeding programs is a process that would involve a series of steps. Genetic improvement could be generated in a small fraction of the population, then disseminated to the wider population of the communities targeted. This could be achieved through applying the principles of open nucleus breeding schemes. The general steps for developing a breeding program are:

Description of the production system: It is important to have a clear understanding of the range of production systems for which genetic improvement is intended. This is important because there may be no single 'genotype' that is 'best' in all production environments. In this stage, information needs to be collated on:

- Nature of the production system
- Feeding regimes
- Environmental conditions (diseases, temperatures, water availability)
- Animal herd/ flock structures
- Social-economic environment

Choice of the breeds to use: The decisions on the choice of species and breeds are made in collaboration with the key stakeholders who are the custodians of the animals.

Formulation of the breeding objective: This is a critical step as it determines 'where to go' with the animal improvement program. The breeding objective is intimately related to the production system. To achieve this, one must identify what traits are of importance to the communities at present and what traits would be important in the future. Both economic and intrinsic values of traits also need to be determined.

Development of selection criteria: The selection criteria are those characters closely related, but not necessarily identical, to the traits in the breeding objective. The selection criteria are about 'how to get there'. Selection criteria may be different from the traits in the breeding objective.

Design of a genetic evaluation system: Key to a genetic evaluation system is the maintaining of records on animal performance, relationships between animals, breeds, environmental conditions and main management decisions that would impact productivity within the target environment.

Selection of parents and mating systems: Ideally only the 'best' individuals would be reproduced. In practice, a compromise is made between selecting from among a very few, and selecting from a large enough population to avoid inbreeding and the fixing of very limited traits within a population.

Design of a system for expansion and dissemination of improved stock: Designing a system for expansion and dissemination of genetically improved stock typically takes place in a very small fraction of the population. The improvement achieved in superior animals is then disseminated to the larger population. This can either be through a closed or open nucleus breeding program design.

Monitoring the genetic improvement program: This is important to ensure that the anticipated genetic gain is achieved, and if not, that action is taken to rectify the situation.

Changing climatic conditions with severe droughts in recent years have been disastrous to the pastoral animal populations in general. Indigenous sheep breeds seem to have withstood such challenges much better.

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