Sustainable small ruminant breeding program for climate-smart villages in Kenya

Working Paper No. 127

CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)

Julie MK Ojango
James Audho
Edwin Oyieng
John Recha
Anne Muigai

Working Paper

ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

CGIAR
RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security
CCAFS

Sustainable small ruminant breeding program for climate-smart villages in Kenya

Baseline household survey report

Working Paper No. 127

CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)

Julie MK Ojango
James Audho
Edwin Oyieng
John Recha
Anne Muigai

Correct citation:
Ojango JMK, Audho J, Oyieng E, Recha J, Muigai A. 2015. Sustainable small ruminant breeding program for climate-smart villages in Kenya: Baseline household survey report. CCAFS Working Paper no. 127. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Titles in this Working Paper series aim to disseminate interim climate change, agriculture and food security research and practices and stimulate feedback from the scientific community.

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is a strategic partnership of CGIAR and Future Earth, led by the International Center for Tropical Agriculture (CIAT). The Program is carried out with funding by CGIAR Fund Donors, the Danish International Development Agency (DANIDA), Australian Government (ACIAR), Irish Aid, Environment Canada, Ministry of Foreign Affairs for the Netherlands, Swiss Agency for Development and Cooperation (SDC), Instituto de Investigação Científica Tropical (IICT), UK Aid, Government of Russia, the European Union (EU), New Zealand Ministry of Foreign Affairs and Trade, with technical support from the International Fund for Agricultural Development (IFAD).

Contact:
CCAFS Coordinating Unit - Faculty of Science, Department of Plant and Environmental Sciences, University of Copenhagen, Rolighedsvej 21, DK-1958 Frederiksberg C, Denmark. Tel: +45 35331046; Email: ccafs@cgiar.org

Photos: ILRI, CCAFS

Abstract

Improving productivity of sheep and goats (i.e. small ruminants- SR) under smallholder farming systems faced with challenges of unfavourable climatic events has been identified as one means of enhancing livelihoods of communities living in these areas. Interventions are targeted through clusters of farmers grouped into "climate smart villages" (CSV) under a collaborative action by CCAFS, ViAgroforestry, World Neighbours and the Kenya Agricultural and Livestock Research Organization. This baseline study was implemented to understand the socio-economic aspects, population structure, management practices and production constraints of SR in the CSV of the Lower Nyando basin of Kenya. The results indicate that the community is mainly comprised of young people (mainly students) and men and women above 50 years of age who manage the various households. Land sizes owned are small, with 58% of the households owning less than one hectare of land on which they grow crops and rear on average eight SR in addition to some cattle and poultry. The SR reared are mainly indigenous breeds, with some crossbreds resulting from the few introduced Red Maasai sheep and the Galla goats for improved productivity. Breeding of SR is not controlled, and since larger animals fetch better prices on the market, over time negative selection has affected the SR population. SR are generally left to graze on stovers from crops, and take a long time to grow to maturity (up to 4 years). Farmers in the CSV know what traits they desire in their SR, and are willing to learn and change their practices in order to improve their livelihoods. It is evident that the organization of the households into CSVs provides a great opportunity for capacity development which should have a strong component of engaging the youth, and the development of a selection and breed improvement program for SR in the Lower Nyando area.

Keywords

Small ruminants; small holder systems; breeding program.

About the authors

Julie M. K. Ojango, Scientist, Animal Breeding Strategies, International Livestock Research Institute (ILRI), Nairobi, Kenya, j.ojango@cgiar.org

James Audho, Research Assistant, Animal Breeding Strategies, International Livestock Research Institute (ILRI), Nairobi, Kenya, j.audho@cgiar.org

Edwin Oyieng, Research Assistant, Animal Breeding Strategies, International Livestock Research Institute (ILRI), Nairobi, Kenya, e.oyieng@cgiar.org

John Recha, Post-Doctoral Fellow, Participatory Action Research, CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) East Africa, Nairobi, Kenya, j.recha@cgiar.org

Anne W. T. Muigai, Professor of Genetics, Jomo Kenyatta University of Agriculture and Technology, Juja, Kenya, awmuigai@yahoo.co.uk

Acknowledgements

The study was financially supported by the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), East Africa under an agreement with the Animal Science for Sustainable Productivity (ASSP) project at the International Livestock Research Institute a (ILRI).

The authors would like to acknowledge and thank colleagues in the CCAFS Nyando CSVs from ViAgroforestry and World Neighbors for their support and input in the various activities that enabled us collate information from the households. Our gratitude also goes to all the livestock keepers within the Kenyan Counties of Kisumu and Kericho who took time to answer the various questions from the research team. We would like to thank all the county government officers who assisted with logistics in the villages, and to the enumerators who spent many days working tirelessly. Special thanks to Vivian Atakos and Maren Radeny of CCAFS East Africa for formatting and editing this paper.

Contents

Acronyms

CCAFS	Climate Change, Agriculture and Food Security
CGIAR	Consultative Group on International Agricultural Research
CSV	Climate-Smart Villages
ODK	Open Data Kit
SR	Small Ruminants

1. Introduction

In the Nyando Basin in western Kenya, climate change is manifested through frequent droughts, floods and variable rainfall. These greatly affect agricultural production and food security. The population density of the area exceeds 400 persons per square kilometre making it one of the highest populated rural localities in East Africa. The level of poverty is high with an estimated half of the population living below the poverty line (Macoloo et al. 2013). Over 80% of the families in Nyando experience 1-2 months in a year of hunger, when their food resources are extremely limited and they are unable to obtain any products from their farms, while 17% of the families experience 3-4 months of hunger. Farming is the primary source of income and food, however, land holdings are small, and the area suffers serious soil erosion. Heavy run-off during rainy seasons has led to formation of deep gullies, which affect about 40 per cent of the landscape.

Analysis of 50-year historical meteorological data indicates that the onset of rains in Nyando has shifted from mid-February to mid-March every year. There is, however, a great variability in the expected onset with long dry spells and extreme flooding during late onset events (Kinyangi et al. 2015). A lack of timely seasonal forecasts results in crop losses as the smallholder farmers continue to sow long season crop varieties such as maize and sorghum. Livestock reared are fed on crop residues from the harvested fields which are of poor quality. The farmers also have a challenge in feeding livestock during dry seasons. This leads to low growth rates of animals, reducing their market value and increasing the risk of death when diseases strike. The communities have limited options but to adapt to the impacts of climate variability (Kinyangi et al. 2015).

From late 2011, the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) facilitated a partnership around collective action that integrates scientific applications for delivery of development outcomes in Nyando. CCAFS partnered with World Neighbors, VI Agroforestry, Kenya Agriculture and Livestock Research Organisation (KALRO), Kenya's Ministry of Agriculture and Livestock Development and CGIAR centres and have been testing a portfolio of promising climate change adaptation, mitigation and risk management interventions. One such intervention has been the introduction of improved

strains of indigenous sheep and goats (termed small ruminants (SR)) in order to improve the productivity of the animals reared by households within Nyando. Due to their small body size, flexible feeding habits and short generation intervals, SR are well suited to smallholder farming systems. They require lower initial investment costs and play a complementary role to other livestock in the utilization of feed resources and are often owned and tended by women and children (Peacock 2005).

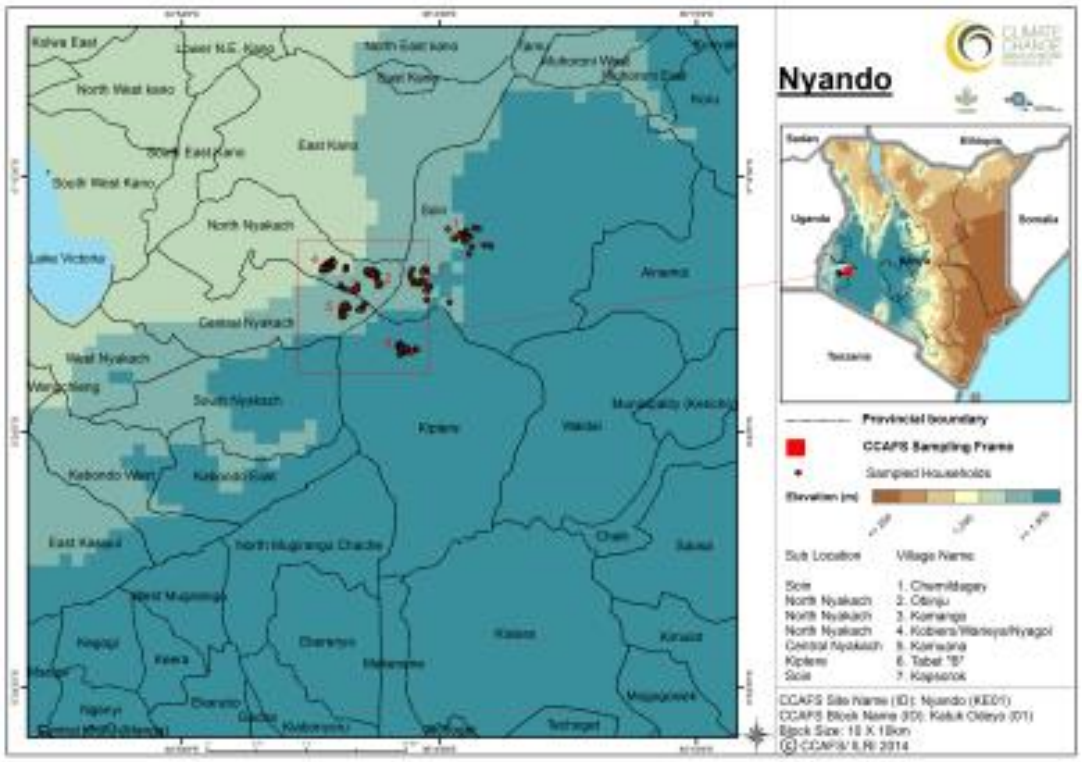
In order to clearly understand the prevailing SR population structures and the current management practices, a targeted survey was carried out to obtain household level data from a representative sample of households within the climate-smart villages (CSVs) of Lower Nyando. This report presents information on the household and SR characteristics collated as part of the collaborative action research project by the International Livestock Research Institute (ILRI), a national university —Jomo Kenyatta University of Agriculture and Technology (JKUAT), and the CCAFS project partners. The results will inform interventions in SR production that can lead to sustained improvement of the livelihoods of the smallholder farmers in Nyando by increasing their incomes and food security under the changing climatic conditions.

2. Methodology

2.1 Study area and site description

The study was conducted in the Lower Nyando Basin, covering Nyakach sub-County in Kisumu County and Soin-Sigowet sub-County in Kericho County (Figure 1). These two sites were selected because they have been affected by changing climatic conditions with recurrent droughts and floods that have, and continue to adversely affect agricultural activities (Mango et al. 2011). The main land uses in the area are cultivation of food crops and pasture. Vegetation in the area is scanty with deep gullies running across large areas thus increasingly hindering farming (see picture on page 10).

Figure 1: Map of Kenya highlighting the Nyando Basin



Source: CCAFS-ILRI 2014

Characteristics of grazing land in Lower Nyando during dry seasons. Photo: JMK Ojango/ILRI

Information was collated as a follow up of a previous CCAFS baseline household survey carried out in Lower Nyando in 2010 and 2011 involving seven villages with 139 households (Mango et al. 2011). Many of the households practice mixed-farming on a small scale and kept small numbers of cattle, sheep, goats and poultry. Sale of SR and their products is a key source of income for these households was sale of SR and their products, while the cattle maintained provided small quantities of milk for individual household needs.

2.2 Data tool and household sampling procedure

The project team developed a survey tool, following site visits and consultations with the village elders and livestock extension officers in June 2014. The information collected included a description of the household characteristics, including people, assets owned, type of houses and sources of water. With respect to SR, information on flock structure, flows dynamics, ownership, losses due to deaths, and general management practices was collected. The study was conducted in July-August 2014 using the "Open Data Kit" (ODK) information technology platform (https://opendatakit.org/). Seven villages, namely, Kamango, Kobiero/Warieya/Nyagol, Obinju, Kamuana in Kisumu County and Chemildagey, Kapsorok, Tabet B in Kericho County participated in the survey.

Of the 139 households that participated in the 2010 CCAFS baseline survey (Mango et al. 2011), 64% owned at least three sheep or goats. In order to attain the number of households targeted for the survey, an additional number of households keeping SR in the CCAFS target area were randomly selected. In total, 150 households were surveyed in this study. A summary of the households included in the study is presented in Table 1.

Table 1. Number of households in baseline study relative to households from previous project studies

Village	Code	CCAFS 2010	CCAFS 2014	Households Added	Total
Chemildagey	CH01	19	15	5	20
Kamango	KMO3	20	15	7	22
Kamuana	KAO5	20	12	10	22
Kapsorok	KP07	20	12	10	22
Kobiero/Warieya/Nyagol	KW04	20	15	7	22
Obinju	OB02	20	8	14	22
Tabet "B"	TA06	20	18	2	20
Total		139	98	55	150

2.3 Data analyses

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. SPSS (Version 20) and SAS Enterprise 4.3 were used to generate descriptions from the survey data.

3. Results

3.1 Household characteristics

Demographic and socio-economic characteristics

Majority of households surveyed from the two counties were headed by males (66% of all households, Table 2). Significantly, more households in Kisumu County ($p<0.005$) were headed by women than in Kericho County.

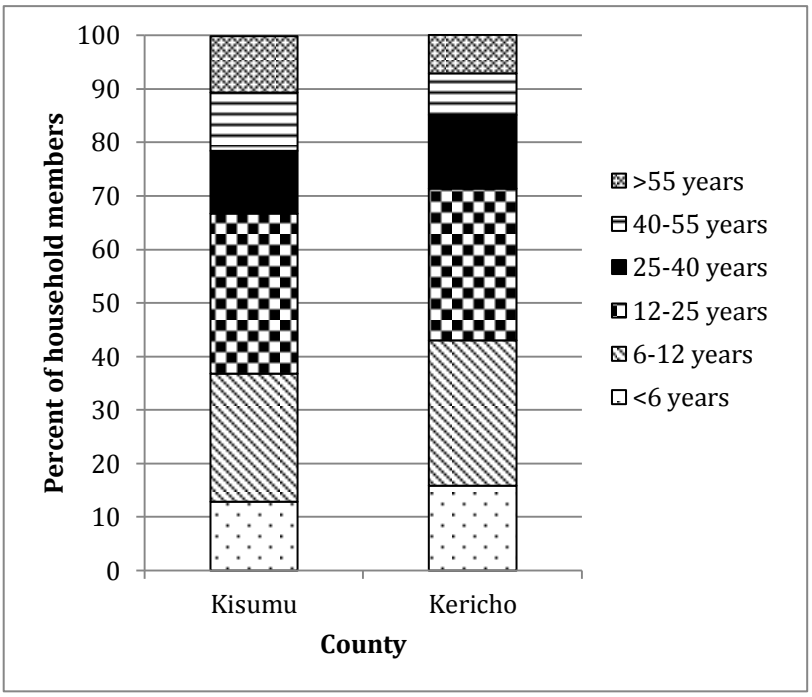
Table 2. Characteristics of respondents by gender within the different villages

County	Villages	Number of household (HH) N	Male headed HH % of N	Female headed HH % of N
Kisumu	Obinju	22	86	14
	Kamango	22	55	45
	Kobiero/Warieya/Nyagol	22	45	55
	Kamuana	22	55	45
	Sub-Total Kisumu (N)	*88*	*60*	*40*
Kericho	Chemildagey	20	55	45
	Tabet B	20	80	20
	Kapsorok	22	86	14
	Sub-Total Kericho (N)	*62*	*74*	*26*

The proportionate composition of the households within the two counties by different age groups is presented in Figure 2.

In both counties a large proportion (>65%) of household members were under the age of 25 years (i.e. school going youths, children and infants). Less than 10% of the population were said to be older than 55 years of age. In both counties, households comprised a higher proportion of adult women over 15 years of age (53.43% in Kisumu County and 53.09% in Kericho County) than adult men. The implications of the gender and age structure within households on incomes, asset ownership and livelihoods within the communities requires further investigation as this potentially has great impact on livestock development within the area.

Figure 2. Proportional composition of households by age groups



When considering the education levels within the counties, a large proportion of the household members had gone through primary education (63% in Kericho and 47% in Kisumu, Table 3). Kisumu County however had a higher proportion of the household members with a secondary level education than Kericho County (Table 3). The proportion of the population in both counties with college or university was however very low (<5%).

Table 3. Proportion of the household members with different levels of education

Education level	Percent of household members	
	Kisumu	Kericho
No formal and illiterate	7.4	9.5
No formal but literate	3.5	1.7
Primary School	47.3	62.6
Secondary School	35.3	19.6
College	4.7	3.9
University	1.8	2.7

The characteristics of the head of the household were of primary interest as this is the person who would greatly influence any decisions on SR improvement. The mean age of the household head differed depending on gender (Table 4), with women heading households tending to be older than the men heading households.

Table 4. Mean age of household head

Gender	Kisumu		Kericho	
	N	Mean age in years ±SE	N	Mean age in years ±SE
Male	53	53.55±2.2	46	45.67±2.1
Female	35	56.89±2.7	16	51.00±4.8

Significant differences ($p<0.01$) in the level of education were evident among the household heads depending on their gender (Table 5). More of the men who headed households in the two counties had at least a primary level of education. Only a small proportion of the women who headed households had a secondary school level of education.

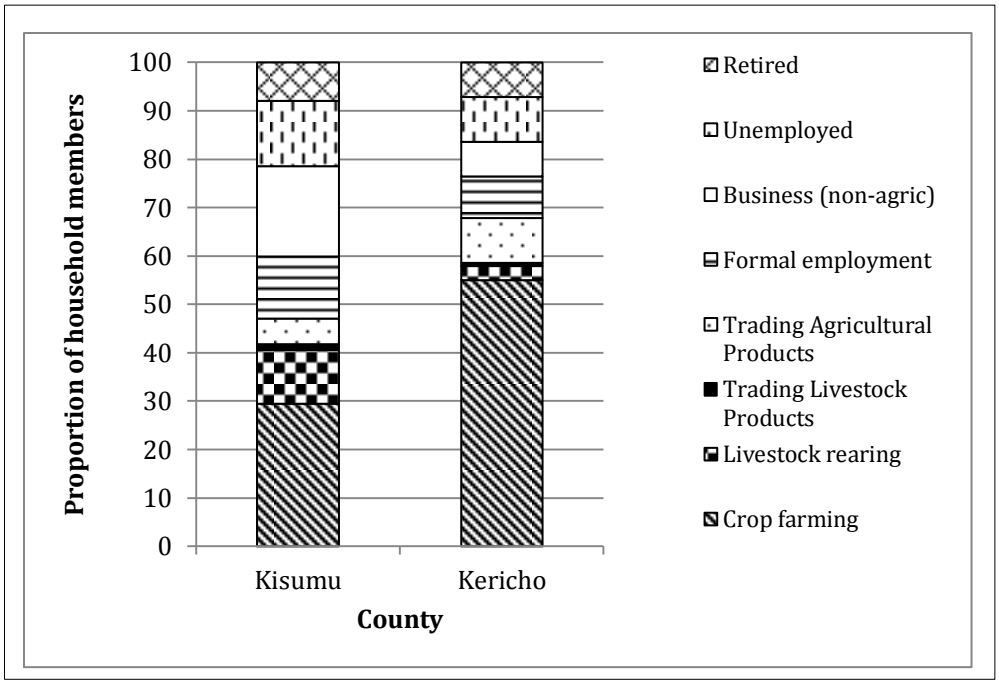
Table 5. Level of education of the head of the household (HH)

Gender of household head	Level of education	Kisumu	Kericho
		%	%
Male	No formal education	9.43	10.87
	Primary School	56.60	65.22
	High/Secondary school	33.96	23.91
	Sub-Total (N)	53	46
Female	No formal education	37.14	43.75
	Primary School	51.43	50.00
	High/Secondary school	11.43	6.25
	Sub-Total (N)	35	16

Engagement of various household members in different agricultural related activities in the two counties were significantly different ($p<0.01$, Figure 3). Though a high proportion (>25%) of the household members in both counties were engaged in activities related to crop farming, significantly more members were involved in crop farming in Kericho County(55%) than those in Kisumu County (29%). In Kisumu County however, significantly more household members were involved in non-agricultural businesses (19%) than those in Kericho County (8%). It was also evident that only a small proportion of the household members were

directly involved in activities related to livestock rearing (11% in Kisumu and 3% in Kericho), while a substantial proportion of household members were said to be unemployed.

Figure 3: Proportion of household members engaged in different socio-economic activities



The demographic characteristics of the population within the two counties presents an opportunity for training and development targeted at a younger population. Innovative means using new and emerging technologies, and tends, to be more attractive to young people, hence could be used as a catalyst to their involvement in SR production in the region.

3.2 Resource endowment of the communities in the two counties

3.2.1 Land and water resources

Farmers in the two counties had access to land, but the land was held under different tenure systems (Table 6). In Kericho County 92% of the farmers owned land for which they had title deeds, while in Kisumu County only 75% of the farmers had title deeds for their land. All the farmers in Kericho County also had additional land for which they had no title deeds; while in Kisumu County 76% of the farmers had additional land for which they had no title deeds. It was only in Kisumu County where the farmers practiced share-cropping, whereby they either rented land from neighbouring farmers to grow crops, or to graze their livestock once crops had been harvested by their neighbours (Table 6).

Table 6. Type of land available and the form of tenure held by the small holder farmers

	Tenure			
	Owned with title deed	Owned but no title deed	Public land	Rented-in / sharecropped
Kisumu	%	%	%	%
Arable land	43.2	48.9		8.0
Forest land	1.1			
Grazing land	25.0	25.0	5.7	2.3
Un-utilized land	5.7	2.3		1.1
Total-Kisumu (N)	66	67	5	10
Kericho				
Arable land	48.4	51.6		
Forest land	4.8	4.8		
Grazing land	34	32.3		
Un-utilized land	4.8	11.3		
Total-Kericho (N)	57	62		

The parcels of land owned by the farmers were however quite small (Table 7). In Kisumu County, 34% of the farmers owned less than one hectare, while in Kericho County 14.5% of the farmers owned less than one hectare. In Kericho County 27.4% of the farmers owned more than six hectares of land.

Table 1: Proportion of households owning different sizes of land within each county

Farm size in hectares	Kisumu (N1= 88)		Kericho (N2=62)	
	No of farmers	%N1	No of farmers	%N2
Less than 0.6	7	8.0	5	8.06
0.6 - 1.0	23	26.10	4	6.45
1.1 - 3.0	40	45.45	24	38.71
3.1 - 6.0	15	17.04	12	19.36
Greater than 6	3	3.41	17	27.42

Water used for either domestic purposes or for livestock was mainly obtained from rivers within the two counties (Table 8). In Kisumu County, 40% of the water used for domestic purposes was piped, however not many households used the piped water for livestock.

Harvesting and storage of rain water was mainly practiced within Kisumu County though only to a small degree, with 4.6% of the households harvesting rain water from their roofs, and 23% of the households storing rain water in water pans (Table 8). The main constraints related to availability of water within both counties were; long distances to watering points and seasonality in availability of water. Farmers noted that during the drier periods of the year, the amount of water offered to animals tended to be less than when conditions were wet. In both counties the use of boreholes or wells was minimal.

Access to water is critical for any livestock production enterprise. Small Ruminants have the advantage of having lower water requirements than larger animals. When introducing new breed-types to the environment, it is important to take into account the relative resilience of the new breeds to drought conditions in addition to improved productivity.

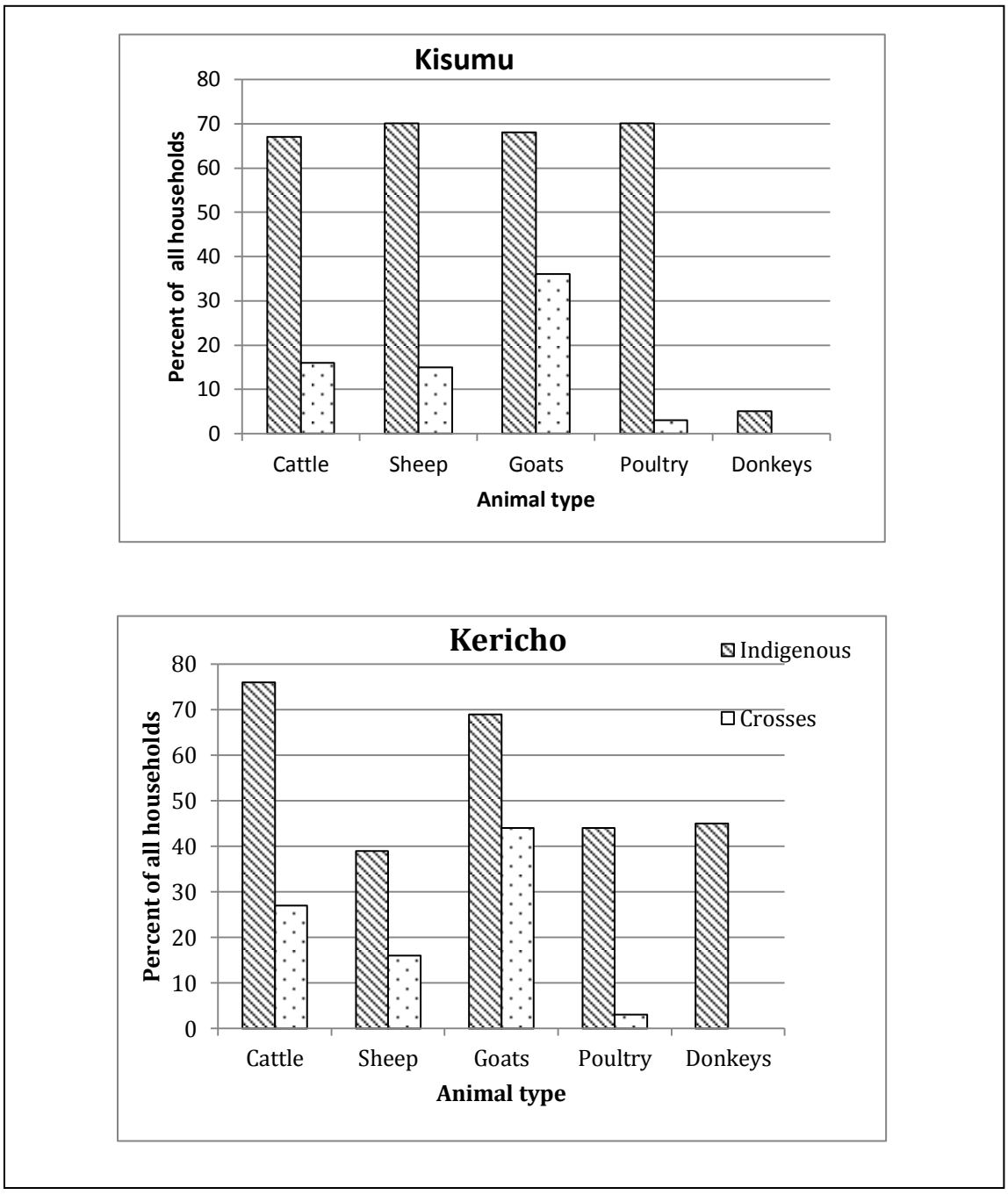
Table 2: Main sources of water and percentage of households using water for either home or their livestock enterprise

	Percentage of households sourcing water for different use			
Source of water	Kisumu (N1=88)		Kericho (N2=62)	
	Home Use	Livestock Use	Home Use	Livestock Use
	%N1	%N1	% N2	% N2
Borehole/ well	1.1	2.3	3.2	1.6
River	51.1	64.0	80.6	87.1
Roof harvested rainfall	3.4	1.2	0.0	0.0
Water pan	4.5	18.6	0.0	0.0
Piped water	39.8	14.0	16.1	11.3

3.2.2 Species of animals reared by farmers

The farmers in the two counties did not only rear sheep and goats, but had other species of animals on their farms namely cattle, poultry and donkeys as presented in Figure 4. In Kisumu County, more than 65% of all the households kept cattle, sheep, goats and poultry, while in Kericho County, 75% of the households kept cattle, 69% kept goats, and less than 45% of the households kept sheep and poultry. More households in Kericho County also kept donkeys than those in Kisumu County (Figure 4)

Figure 4. Proportion of farmers keeping animals of different types in the two counties



In both counties, farmers kept both indigenous and cross-bred cattle, sheep, goats and poultry, but to varying degrees (Table 9). The largest population of livestock reared by either men or women in the two counties were indigenous poultry. However, the number of indigenous poultry kept was much greater in Kisumu than in Kericho. Interestingly in Kericho County, unlike what was observed in Kisumu County, all (100%) of the cross-bred poultry were reared

by male headed households, while most (63%) of the indigenous poultry were reared by women headed households (Table 9).

Male headed households tended to own more of the different types of the Cattle, SR and donkeys than women headed households, except for cross-bred sheep in Kisumu, and indigenous sheep in Kericho, which were owned by a higher proportion of female headed households (Table 9).

Table 3: Number and different species of animals kept and the respective proportion of households keeping them disaggregated by gender

Kisumu County						
Animal species	Total No. of animals	No. of households (N)	% of N by gender of household head		Mean herd size ±SD	Maximum herd size
			Male	F/Male		
Indigenous cattle	285	59	63	37	4.83±3.34	20
Indigenous sheep	370	62	65	35	5.97±6.22	
Indigenous goats	184	60	63	37	3.07±2.01	8
Indigenous poultry	633	62	63	37	10.21±8.08	40
Indigenous donkeys	10	4	75	25	2.50±0.58	3
Cross-bred cattle	40	14	71	29	2.86±1.70	7
Cross-bred sheep	48	13	46	54	3.69±3.33	11
Cross-bred goats	103	32	72	28	3.22±2.12	8
Cross-bred poultry	20	3	33	67	6.67±3.51	10
Kericho County						
Indigenous cattle	200	47	70	30	4.26±2.75	14
Indigenous sheep	71	24	46	54	2.96±2.91	15
Indigenous goats	223	43	77	23	5.19±3.09	11
Indigenous poultry	242	27	37	63	6.54±3.87	20
Indigenous donkeys	35	28	71	29	1.25±0.59	3
Cross-bred cattle	75	17	94	6	4.41±2.62	10
Cross-bred sheep	32	10	60	40	3.20±1.32	6
Cross-bred goats	169	27	89	11	6.26±6.45	29
Cross-bred poultry	21	2	100	0	10.50±13.44	20

Among the livestock species reared, the farmers noted that goats were most tolerant to drought conditions mainly because of their ability to browse off shrubs, followed by sheep. Cattle were the most affected when conditions were dry.

3.3 Sheep and goat flock structures

3.3.1 Sheep and goat population

Population size

Information collected that was specific to small ruminants from the households showed that the actual number of sheep and goats owned was lower than the general figures given on the numbers of different types of animals illustrated in Table 9. For information specific to SR, farmers were requested to break-down their various flock structures by age categories, and it was apparent that when farmers provide general figures on their flocks, unless specifically requested, younger animals are often not included in the estimates given. There were more sheep in Kisumu County than in Kericho County (Table 10). The flock sizes of sheep were smaller in Kericho County than in Kisumu County (Table 10). Kericho County however had more goats than Kisumu County, and the flock sizes of goats were also generally larger in Kericho than those observed in Kisumu County.

Table 4: Average flock sizes and numbers of sheep and goats owned within the different villages

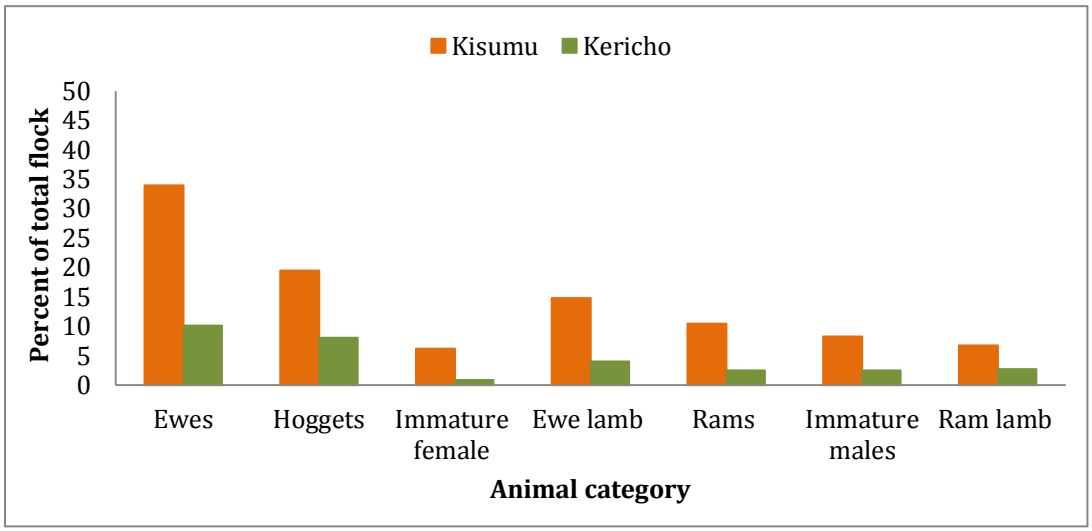
		Sheep				Goats			
County	Village	No. of households with sheep	Total No. of sheep	Mean flock size± SE	Max No. owned	No. of households with goats	Total No. of goats	Mean flock size± SE	Max No. owned
Kisumu	Obinju	15	115	6.27±1.67	28	12	67	3.75±0.46	6
	Kamango	14	70	4.71±0.83	11	12	60	4.67±1.02	13
	Kobiero/Waruea ya /Nyagol	8	35	2.63±0.60	6	6	18	2.67±0.49	4
	Kamuana	15	104	3.93±0.77	11	16	72	3.44±0.43	7
Total		52	324	4.62±0.59	28	46	217	3.74±0.34	13
Kericho	Chemildagey	13	57	3.92±0.75	10	12	64	5.00±0.92	11
	Tabet B	5	11	2.40±0.60	4	17	110	5.18±0.86	15
	Kapsorok	6	32	4.83±2.87	19	20	191	6.45±1.54	29
Total		24	100	3.83±0.81	19	49	365	5.65±0.72	29

Small ruminant population composition

The categories of sheep and goats and the relative percentage of each category kept by farmers in the two counties are presented in Figure 5. Generally, and understandably, in both counties there were more ewes compared to the rams. The farmers in Kisumu had more

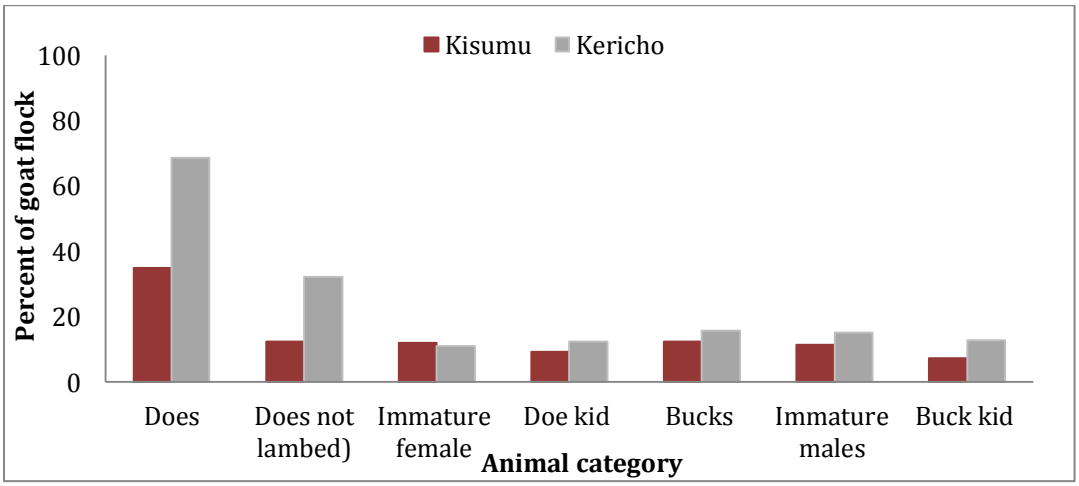
female sheep (i.e. ewes, hoggets and ewe lambs), than male animals. A similar trend was observed in Kericho though the total number of sheep owned was lower (Figure 5).

Figure 5: The percentage of sheep of different categories owned



The number of does in both Kisumu and Kericho Counties were higher than the number of bucks (Figure 6). Farmers in both counties did not practice castration of male animals, hence all male animals within flocks if not isolated could potentially mate female animals within the population. The proportion of does in Kericho County was higher than in Kisumu.

Figure 6: The relative percentage of goats of different categories owned

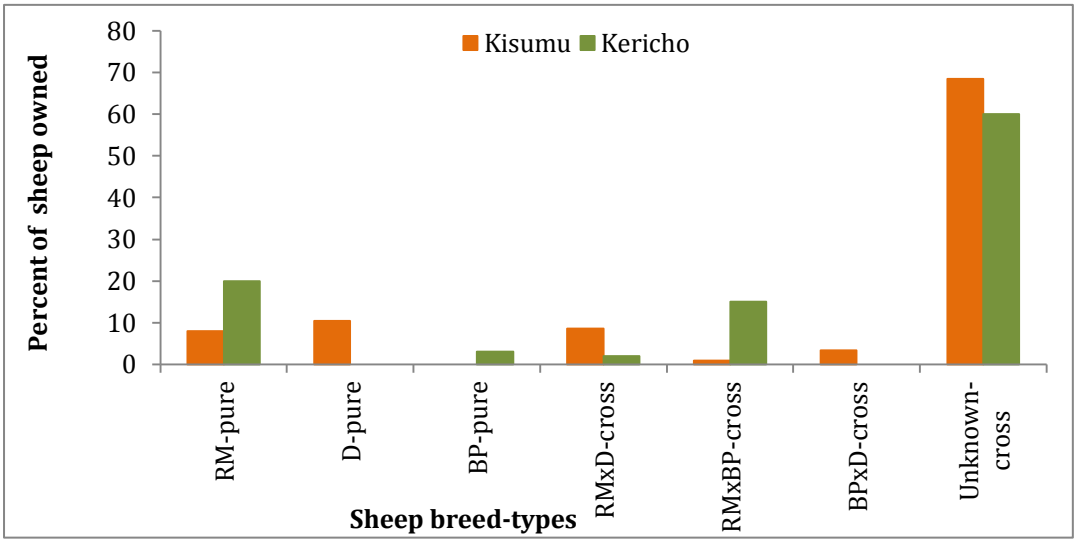


3.3.2 Sheep and goat breeds reared

The main breed types of small ruminants kept by the farmers and the relative percentage of each breed-type are illustrated (Figure 7). The largest proportion of sheep breeds kept in both counties were crosses of unspecific local breed-types. The proportion of purebred sheep kept by the farmers in both counties was very low. More pure bred Red Maasai sheep were

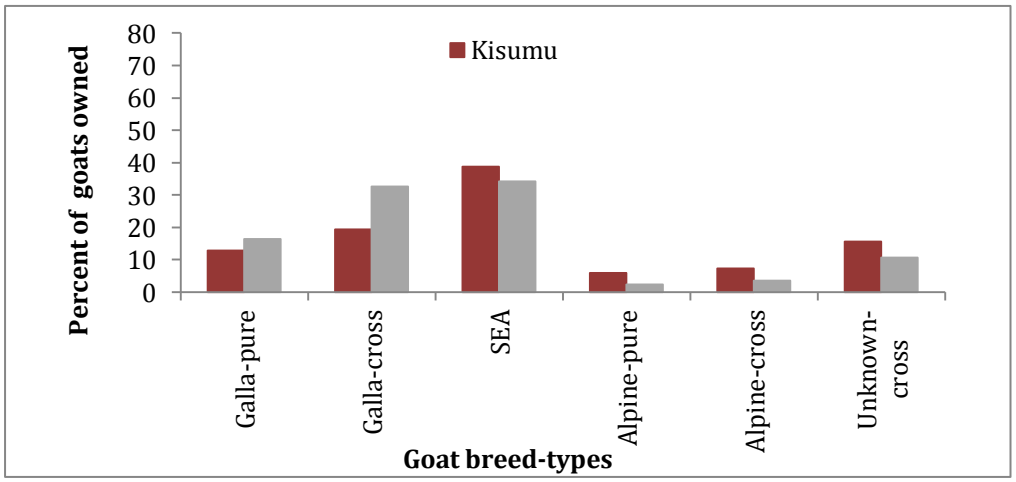
reported in Kericho than in Kisumu County. No pure Blackhead Persian sheep were reported in Kisumu County and no purebred Dorper sheep were reported in Kericho County.

Figure 7: The main breed-types of sheep and their relative percentage (RM= Red Maasai, D= Dorper, BP= Blackhead Persian)



Unlike what was observed in the case of sheep breeds, a larger proportion of the goats reared in both counties were well defined breed-wise (Figure 8), the largest number of which were the Small East African goats. Galla goats and their crosses comprised the second main breed-type of goats. Pure-bred Galla goats were few, comprising only 12.9% and 16.4% in Kisumu and Kericho respectively (Figure 8).

Figure 8: The main breed-types of goats and their relative percentage



Interestingly when gender was taken into consideration 54% of the households with sheep found in Kericho County were headed by women, while in Kisumu County more male headed households owned sheep (63%) than female headed households. However, in both counties, a

higher proportion of male headed households owned goats than female headed households (76% in Kericho and 63% in Kisumu).

The breed-types of small ruminants owned differed depending on the gender of the household head (Table 11).Though most animals were unknown crosses, a higher proportion of the female headed households owned pure Red-Maasai sheep and their crosses (Red Maasai x Dorper in Kisumu and Red Maasai x Blackhead Persian in Kericho). In Kisumu County, a higher proportion of male headed households owned Pure-bred Dorper sheep. Also in both counties, the male headed households had more of the pure-bred Galla and the Small East African goats, while female headed households owned few of the same breeds (Table 11).

Table 5: Percent of different breed types of sheep and goats owned by households headed by either men or women

	Kisumu		Kericho	
	Total number of sheep owned (N1= 324)		Total number of sheep owned (N2= 100)	
Sheep breeds	% N1 owned by male headed households	% N1 owned by female headed households	% N2 owned by male headed households	% N2 owned by female headed households
RM-pure	3.0	5.0	10.0	10.0
D-pure	9.2	1.2	--	--
BP-pure	--	--	1.0	2.0
RMxD-cross	3.0	5.6	2.00	--
RMxBP-cross	--	0.9	9.00	6.0
BPxD-cross	3.0	0.3	--	--
Unknown-cross	45.4	23.2	36.0	24.0
	Kisumu		Kericho	
	Total number of goats owned (N3= 217)		Total number of goats owned (N4= 365)	
Goat breeds	% N3 owned by male headed households	% N3 owned by female headed households	% N4 owned by male headed households	% N4 owned by female headed households
Galla-pure	12.4	0.5	11.8	4.7
Galla-cross	11.5	7.8	29.3	3.1
Small East African	30.9	7.8	26.0	8.2
Alpine-pure	3.2	2.8	2.5	--
Alpine-cross	7.4	--	3.0	0.6
Unknown-cross	4.6	11.1	9.0	1.6
RM= Red Maasai, D= Dorper, BP= Blackhead Persian				

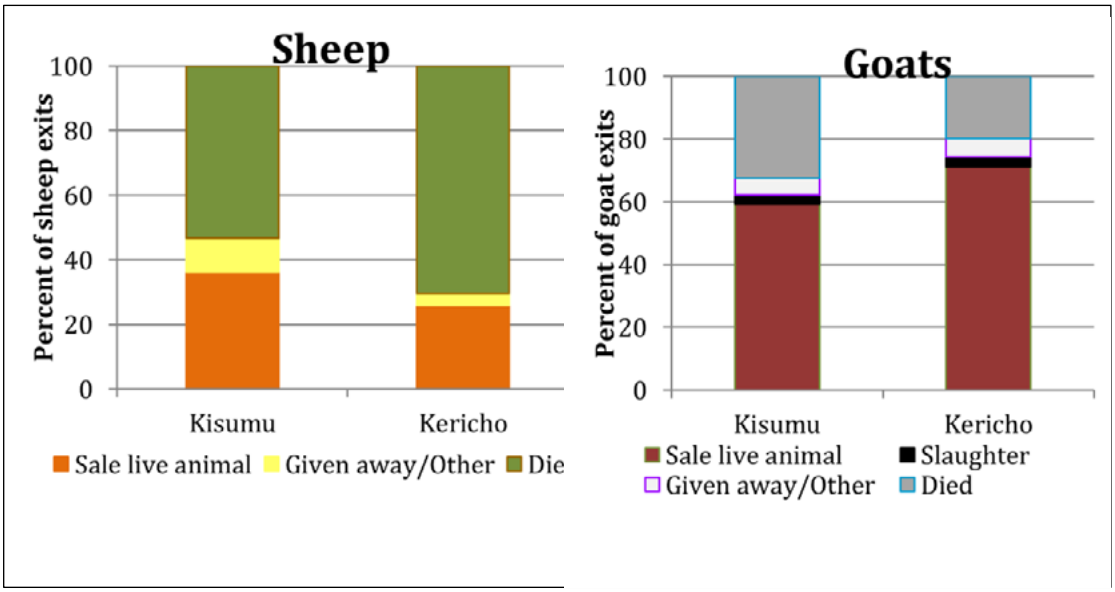
3.4 Sheep and goat flock dynamics

3.4.1 Small ruminant exits from farms

When monitoring the movement of animals off the various farms, it was indicated that in Kisumu County 22.7% of all the sheep and 25.4% of all the goats had left the farms within the last year due to different reasons. In Kericho County, 21.3% of the all sheep and 15.3% of all the goats reared had left the farms during the same period. Among the animals that left the farms, 80% of all the sheep and 60% of all the goats were of breed-types mainly classified as indigenous or crosses of indigenous to unknown breeds.

The various reasons given for animal exits, and the percentage of animals that exited the farms for each reason are presented in Figure 9.

Figure 9. Reasons given by farmers for SR exiting from their flocks



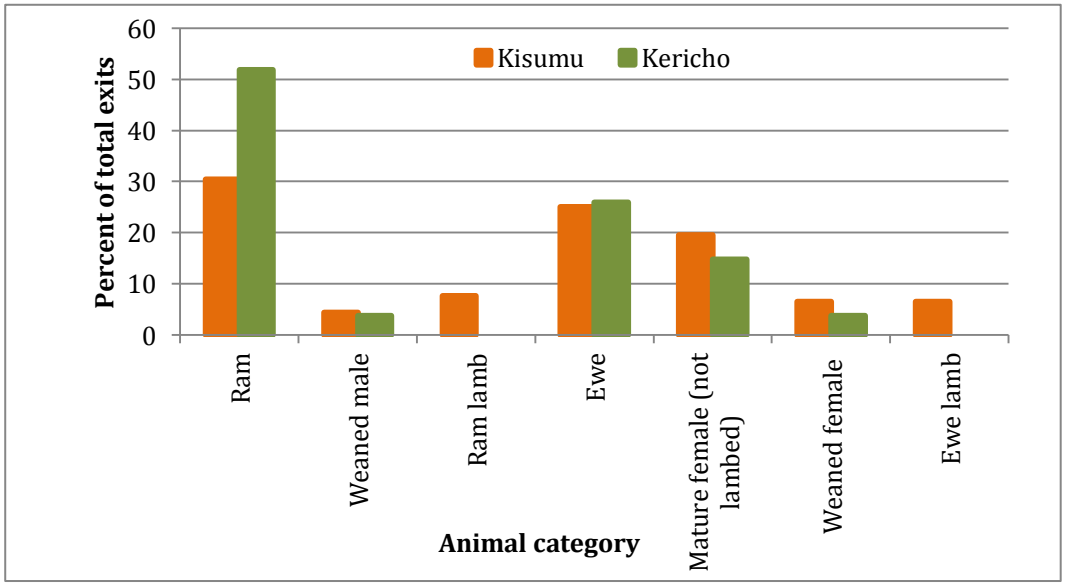
In both counties, the greatest contributor to the exit of sheep from the farms was death (53.2% in Kisumu and 70.4% in Kericho, Figure 9), followed by sale of live animals. Although a significantly large proportion of goats died within each of the two counties (32.4% in Kisumu and 19.7% in Kericho, Figure 9), a higher proportion of the goats were sold in both the counties. The various causes of death and the relative percentage of animals that died due to each cause are presented in Table 12. In both counties, the main cause of death was disease. The main diseases said to be affecting the Small Ruminants are presented in Section 3.7 of this report. Understanding the main causes of death is important as new breeds are introduced in an area. In some instances, mortality can be reduced through improving animal husbandry, while in the case of some disease conditions, additional resource allocation may be required which may not be practical.

Table 6. Relative percent of small ruminants that died due to different causes

Cause of death	Percent of SR dying from different causes			
	Sheep		Goats	
	Kisumu (N = 47)	Kericho (N=17)	Kisumu (N= 22)	Kericho (N=13)
Old age	2.3%	5.9%		
Disease	51.2%	64.7%	40.9%	53.9%
Injury	4.7%	11.8%	27.3%	38.5%
Poisoning	--	11.8%		
Drought	41.9%	5.9%	31.8%	7.7%

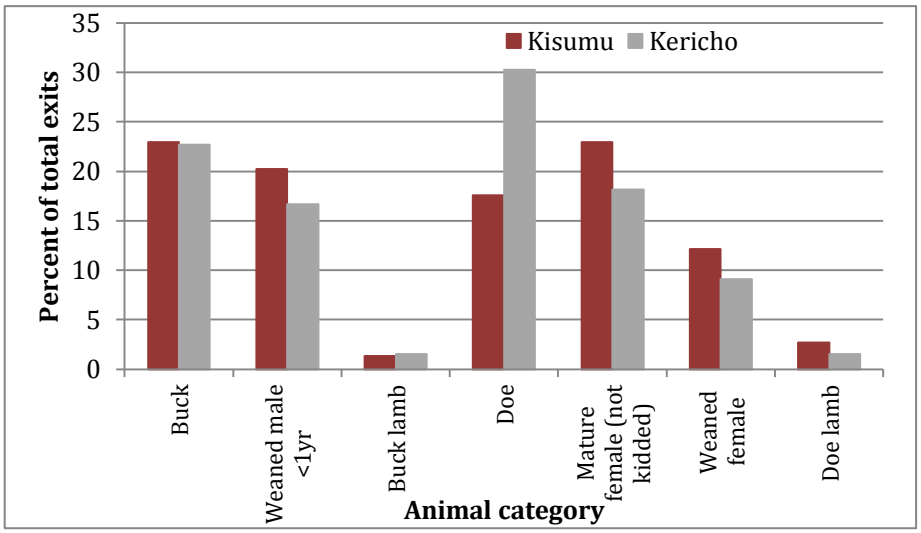
Small ruminants that exited from the farms were mainly mature animals (Figure 10 and Figure 11). In both counties, as would be expected, more mature rams were sold than Ewes. Farmers also lost female animals that had not yet lambed within their flocks. Reasons for this were not clear from the data collected.

Figure 10. Percent of sheep of different categories that exited from the flocks



Surprisingly, in Kericho County, the highest percent of goats exiting from the flocks were does (Figure 11). Though a reasonably high percent of male animals also left the flocks, the high percent exit of female animals was unexpected and therefore merits further investigation.

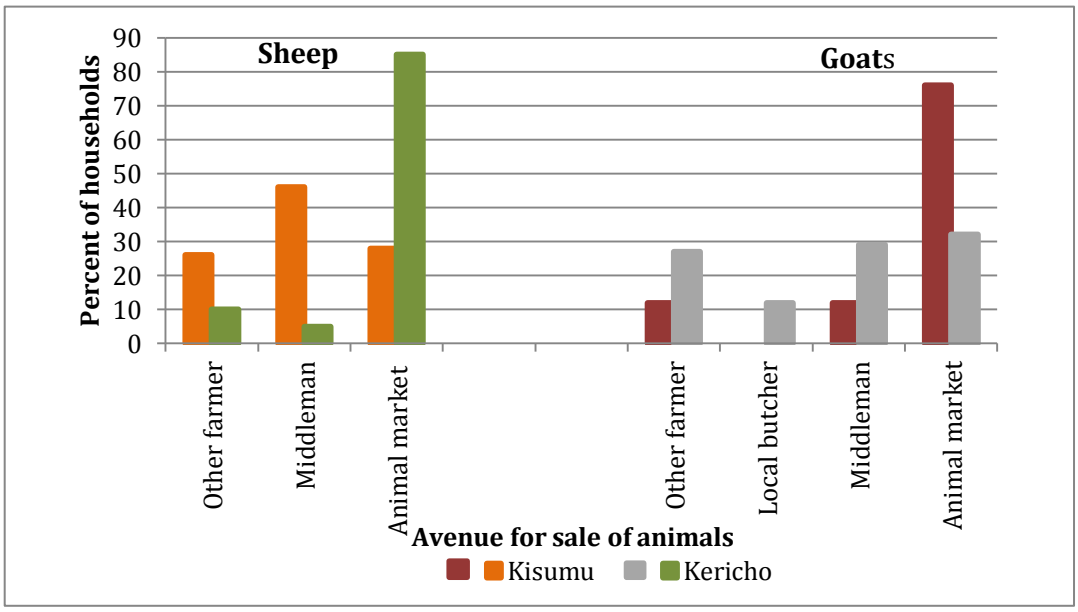
Figure 11. Relative percent of goats of different categories that exited from the flocks



Sale of Small Ruminants

In both counties, SR were mainly sold through animal markets found within the counties (Figure 12). As expected from the composition of the SR populations within the two counties, more sheep were traded in Kisumu, while more goats were traded in Kericho. In Kisumu County, more households sold sheep through middlemen (46%), while in Kericho County more households sold sheep through the animal markets (85%). For both counties, more goats were sold through the animal market.

Figure 12. Percent of households selling sheep and goats through different avenues



When either sheep or goats were sold by the farmers in the two counties, the funds generated from sales were mainly to meet either planned or unplanned household expenses (Table 13). In Kisumu County, some households sold the SR specifically to pay school fees, while in Kericho County this was not a common reason for sale of the SR.

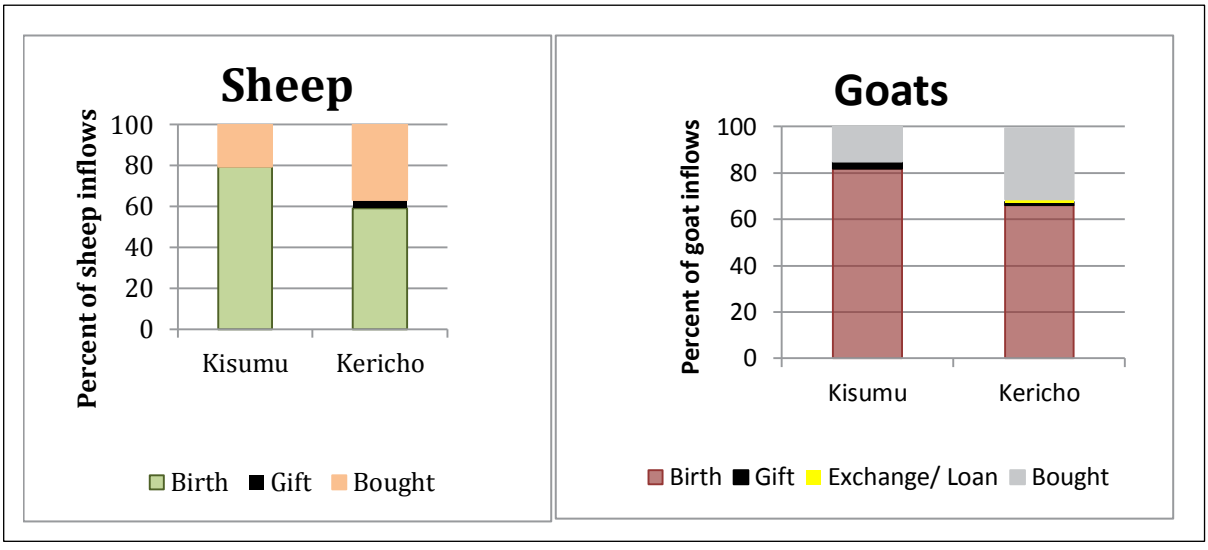
Table 7. Percent of farmers selling animals for different reasons

Reason for sale of animals	Percent of farmers that sold animals				
	Sheep			Goats	
	Kisumu	Kericho		Kisumu	Kericho
Planned household needs	61.0%	38.1%		45.0%	46.0%
Emergency household needs	29.3%	47.6%		40.0%	46.0%
Cull (unproductive/ sick)	2.4%	14.3%		2.5%	5.4%
Pay school fees	7.3%	0.0%		12.5%	2.7%

3.4.2 Small ruminant entries onto farms

Within the two counties, there were a relatively higher percentage of sheep and goats moving into the flocks than those that left. In Kisumu County, 24% of all the sheep and 31.5% of all the goats comprised new animals into the flocks. In Kericho County, 33% of all the sheep and 30.7% of all the goats comprised new animals. Most of the new small ruminants were born into the flocks (>60%, Figure 13).

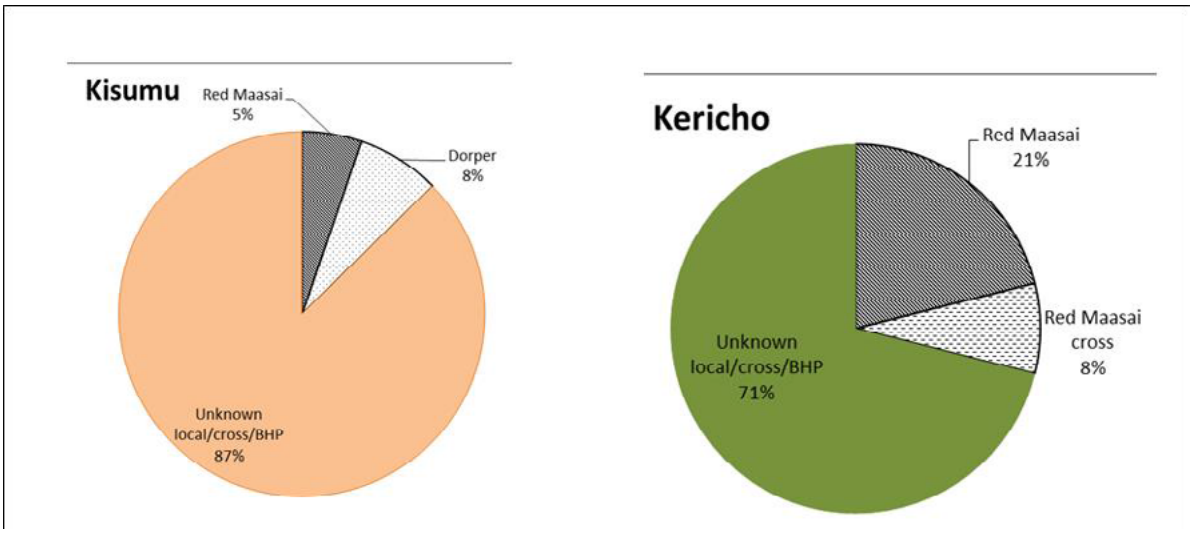
Figure 13. Percent of new small ruminants entering farmers flocks via different means



Since a high proportion of the new sheep were born into the flocks, the main breed types comprised local indigenous breeds and their crosses with introduced breeds which the farmers

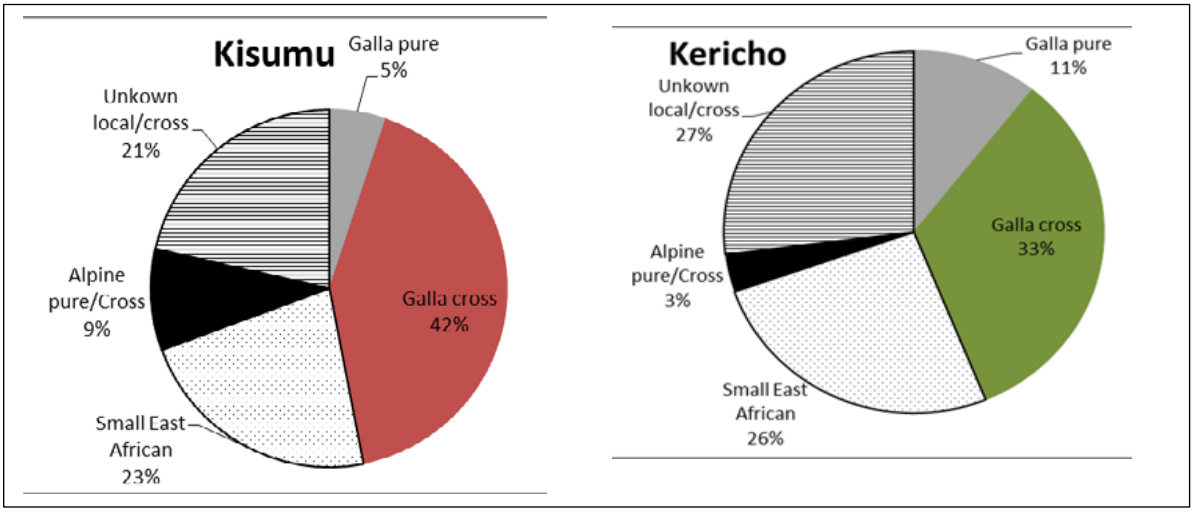
owned. Farmers in Kericho County had a higher proportion of new Red-Maasai sheep and their crosses than those in Kisumu County (Figure 14).

Figure 14. Proportion of new sheep of various breed-types coming into flocks



A high percent of new goats coming into flocks in both counties were noted to be crosses with Galla goats.

Figure 15. Proportion of new goats of various breed-types coming into flocks



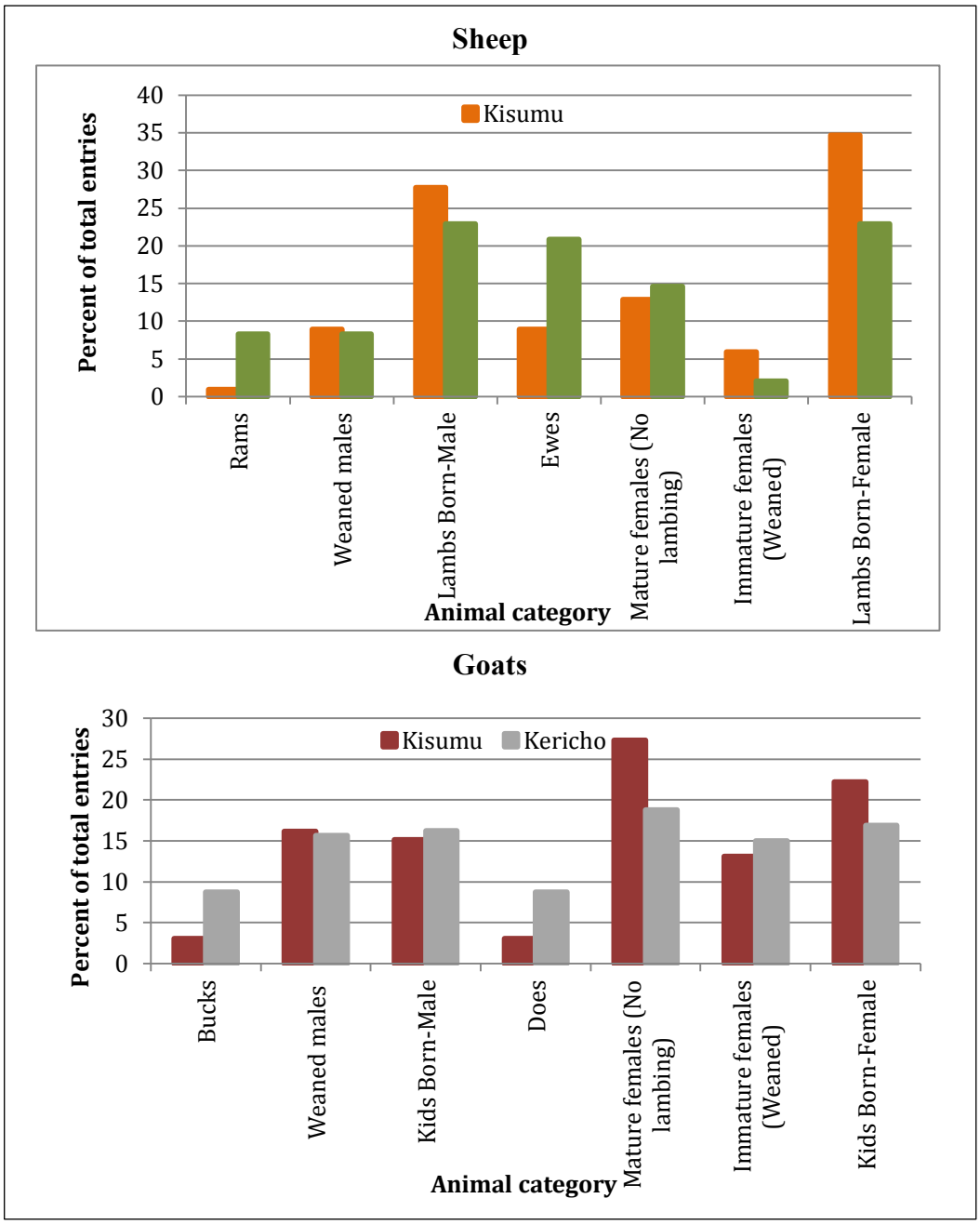
Farmers who bought in new animals purchased them for various reasons (Table 14). In Kericho County, a higher proportion of new animals were purchased to be kept as a reserve for future sale, while in Kisumu County, more goats were bought into flocks to improve the growth and meat production of existing animals.

Table 8. Reasons for purchase of new small ruminants given by different farmers

Reason for purchase	Percent of farmers that bought in new Small Ruminants				
	Sheep			Goats	
	Kisumu (n=21)	Kericho (n=18)		Kisumu (n=15)	Kericho (n=50)
Replacement animals	33.3%	5.5%		20.0%	2.0%
Animal draft	19.1%				4.0%
For future sale	38.1%	89.0%		13.3%	64.0%
Improve meat production				40.0%	10.0%
Improve milk production				--	2.0%
Other	9.5%	5.5%		26.7%	18.0%

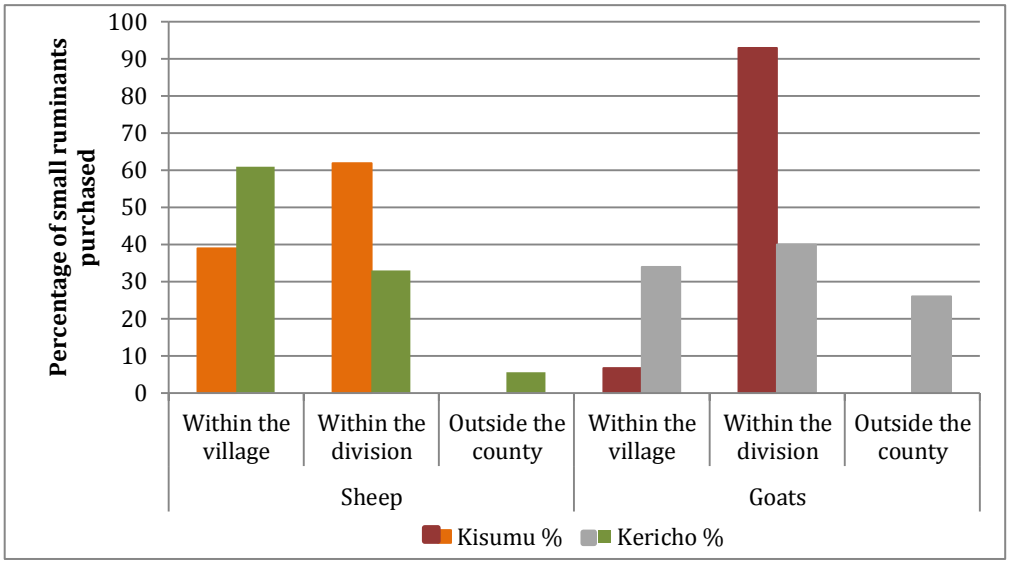
When buying new animals for their flocks, most farmers preferred mature females (Figure 16). Most of the males brought into farms were young animals, however in Kericho County farmers also brought in mature male animals for breeding. Though it may be assumed that new mature female animals in flocks will help build up numbers quickly, the farmers could in fact be re-cycling animals that have been culled in other flocks. The average performance of the indigenous SR population in terms of growth and reproduction may thus remain low. To lift the performance, the population would require an introduction of new blood-lines of animals from more distant populations raised under similar environmental conditions.

Figure 16. Relative percent of sheep and goats of different categories that were introduced in the farmers flocks



Animals bought into flocks were mainly obtained from other livestock keepers within the same county (Figure 17). It was only in Kericho County where 25% of the goats bought into the flocks were said to be sourced from outside the county.

Figure 17. Main sources of replacement small ruminants and the percentage of animals obtained from each source



3.5 Sheep and goat breeding

3.5.1 Source of breeding males

In both counties farmers obtained breeding males from different sources (Table 15). In Kisumu County, rams for breeding were mainly home-bred, whereas those in Kericho were either bought from other farmers or obtained through a project. More than 25% of the rams used were however opportunistic in that the farmers left their sheep in open pastures and any ram from within the vicinity mated the ewes.

More than 50% of the bucks used for breeding were sourced from outside the farm (Table 15). Though at least 20% of the farmers in both counties bred their own bucks, a significant proportion (>10%) of the bucks used were randomly mating in the shared/communal pastures and water points. None of the farmers indicated that they had specific measures in place to control inbreeding among the SR reared, neither did the farmers keep pedigree records.

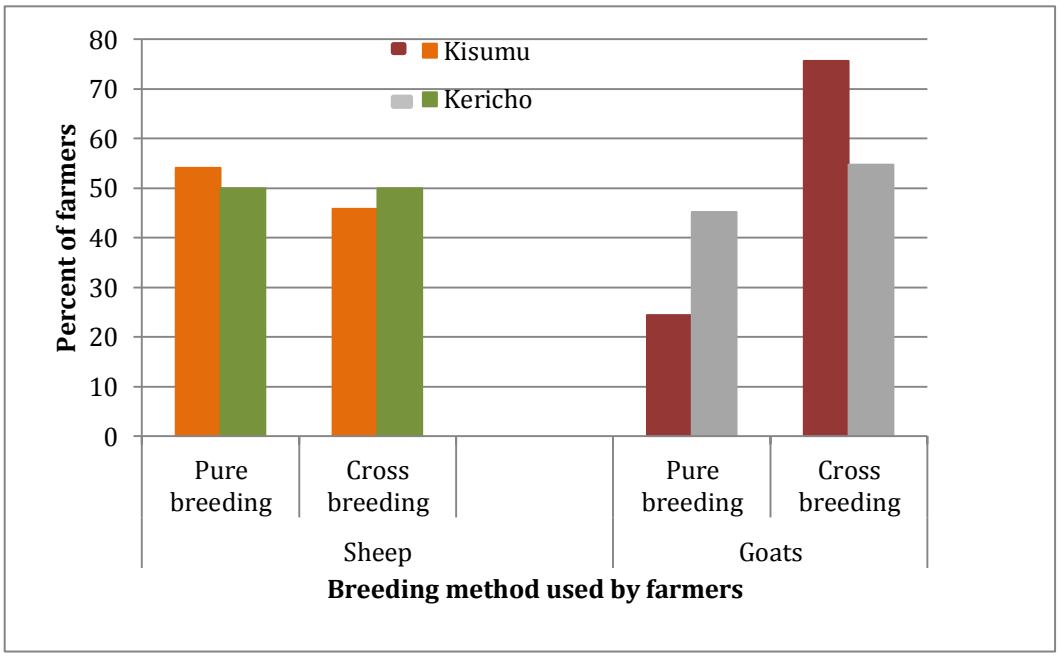
Table 9. Main sources of breeding males for breeding

	Sheep		Goats	
Source of breeding male	Kisumu (n=37)	Kericho (n=8)	Kisumu (n=43)	Kericho (n=43)
Own bred	40.5%	0.0%	20.9%	27.9%
Bought from other farmer	21.6%	37.5%	25.6%	25.6%
Bought from individual trader/broker	0.0%	12.5%	2.3%	2.3%
Obtained through project	10.8%	25.0%	39.5%	23.3%
Other (free/random mating in the field)	27.0%	25.0%	11.6%	20.9%

3.5.2 Breeding management practices

More farmers in Kisumu County (75.5%) practiced cross breeding for their goats than those in Kericho County (54.8%, Figure 18). There was no difference in the preferred method for breeding sheep in Kericho County; however there was a difference in Kisumu County, with 54% of the farmers practicing pure-breeding. This difference in breeding methods for sheep was however not significant (Figure 18). In both counties, farmers noted that cross bred animals had more desirable attributes for their environments than either pure-bred local or introduced SR.

Figure 18. Percent of farmers using different methods for breeding their small ruminants



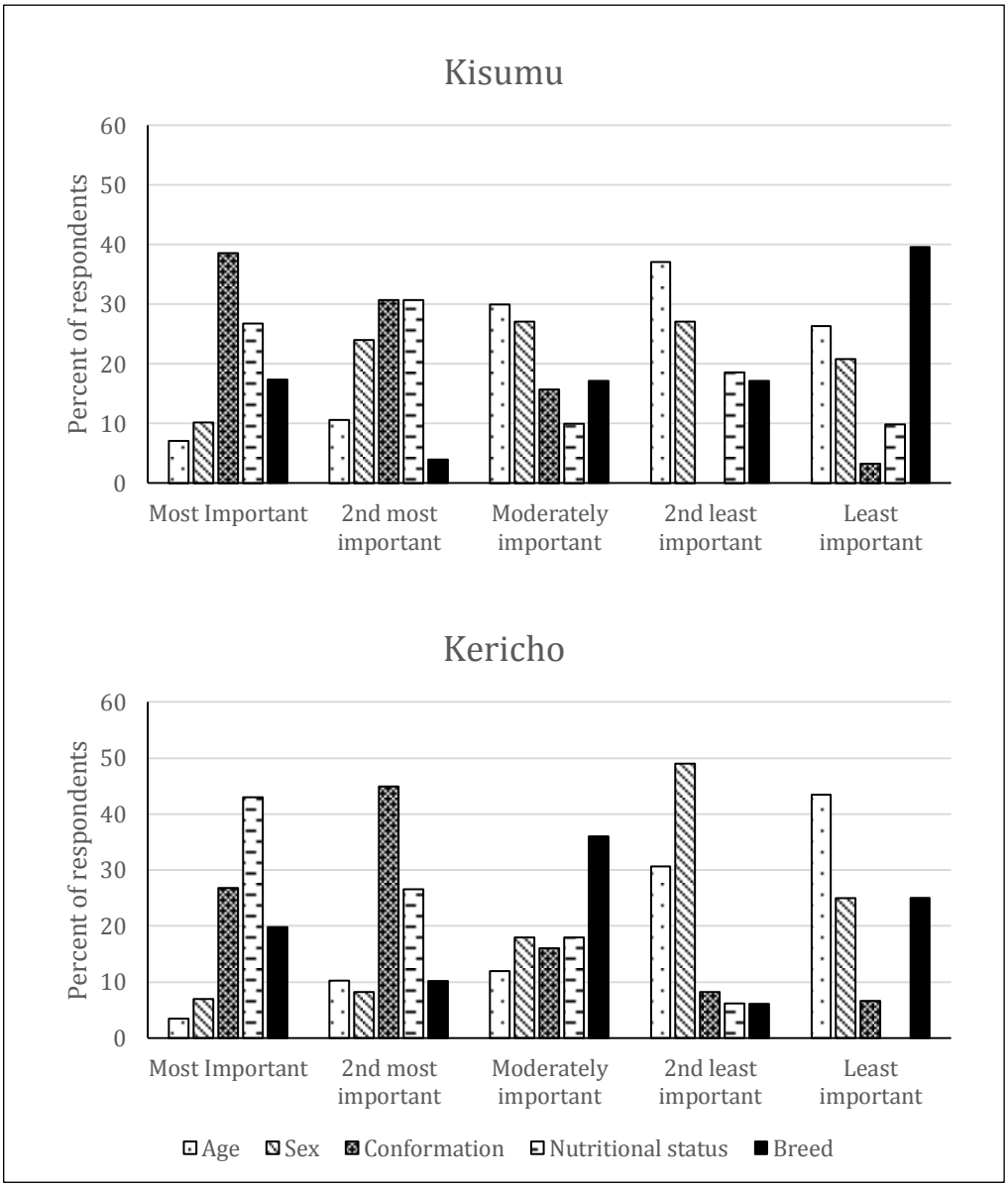
3.6 Traits of economic importance in sheep and goats

When adopting crossbreeding as an option for breeding, generally there are some attributes that the farmers are seeking to change in their flocks and herds. However, without having a clear way of measuring the change resulting from crossbreeding, farmers do not achieve the anticipated progress in their populations. It is thus critical to identify what traits are important to the farmers and the relative importance of each set of traits in order to define the breeding objectives.

The traits considered when selling sheep were ranked as presented in (Figure 19). The most important SR attribute in Kisumu County was the body conformation while the nutritional status of the animal was considered most important SR attribute in Kericho County. The SR's nutritional status and body conformation were ranked second in Kisumu and Kericho

Counties respectively. The breed of the animals was considered to be moderately important in Kericho County, but not very important in Kisumu County.

Figure 19. Relative ranks given for different attributes in SR by the farmers

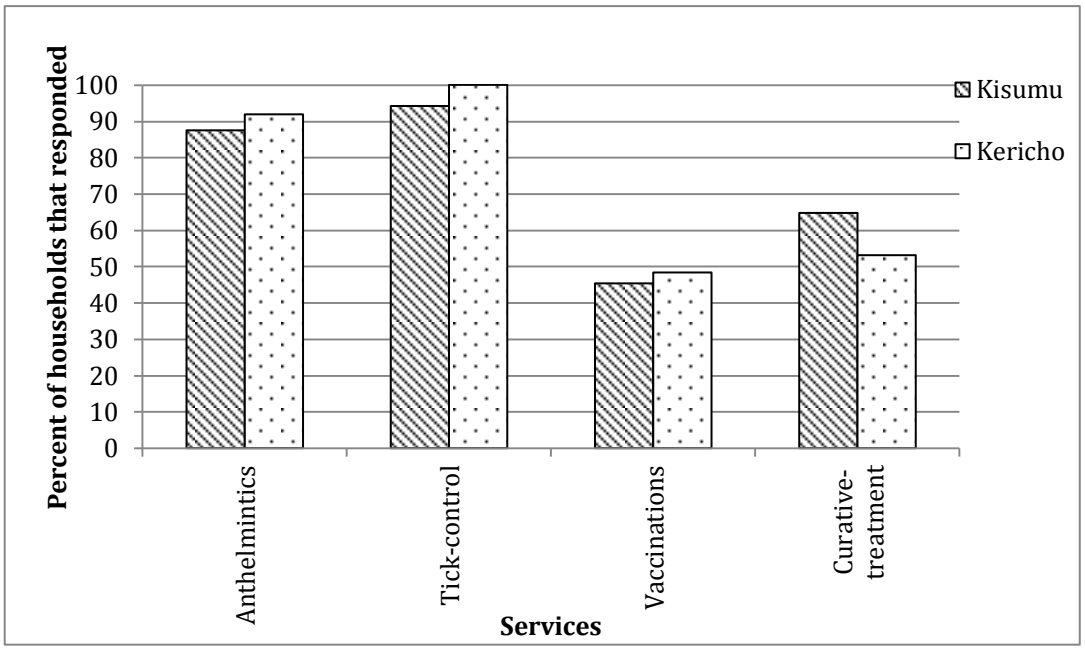


3.7 Animal health

3.7.1 Types of animal health services available

The main animal health services that were available to the farmers in the two counties are presented in Figure 20. Generally all the households that indicated they had access to a particular animal health service available to them also used the service. The main services available and used were Anthelmintics and tick control. Vaccination of animals was carried out on less than 50% of the households' flocks and herds (Figure 20).

Figure 19: Types of animal health services available



The main diseases that affected the SR and were known to the farmers and are presented in Table 16. A larger number of diseases were said to affect sheep than goats.

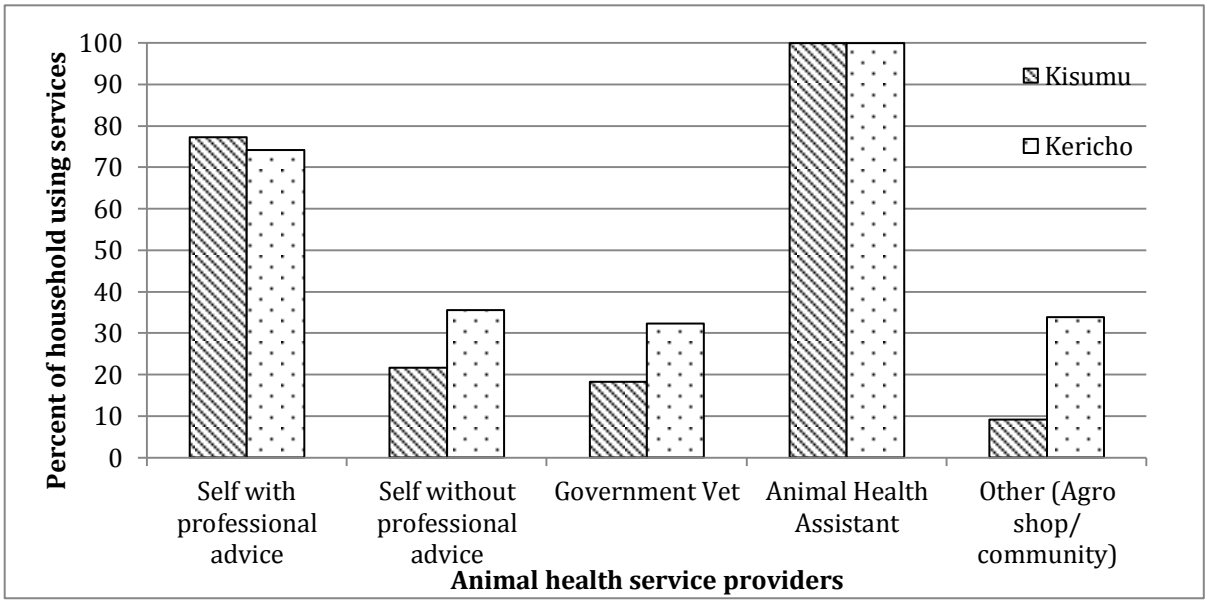
Table 10. Main diseases noted to affect small ruminants

	Species affected	
Disease	Sheep	Goats
CCPP	✓	✓
Sheep pox	✓	✓
RFV	✓	--
Blue tongue	✓	--
Lumpy skin	✓	✓
Diarrhea	✓	✓

3.7.2 Animal health service providers

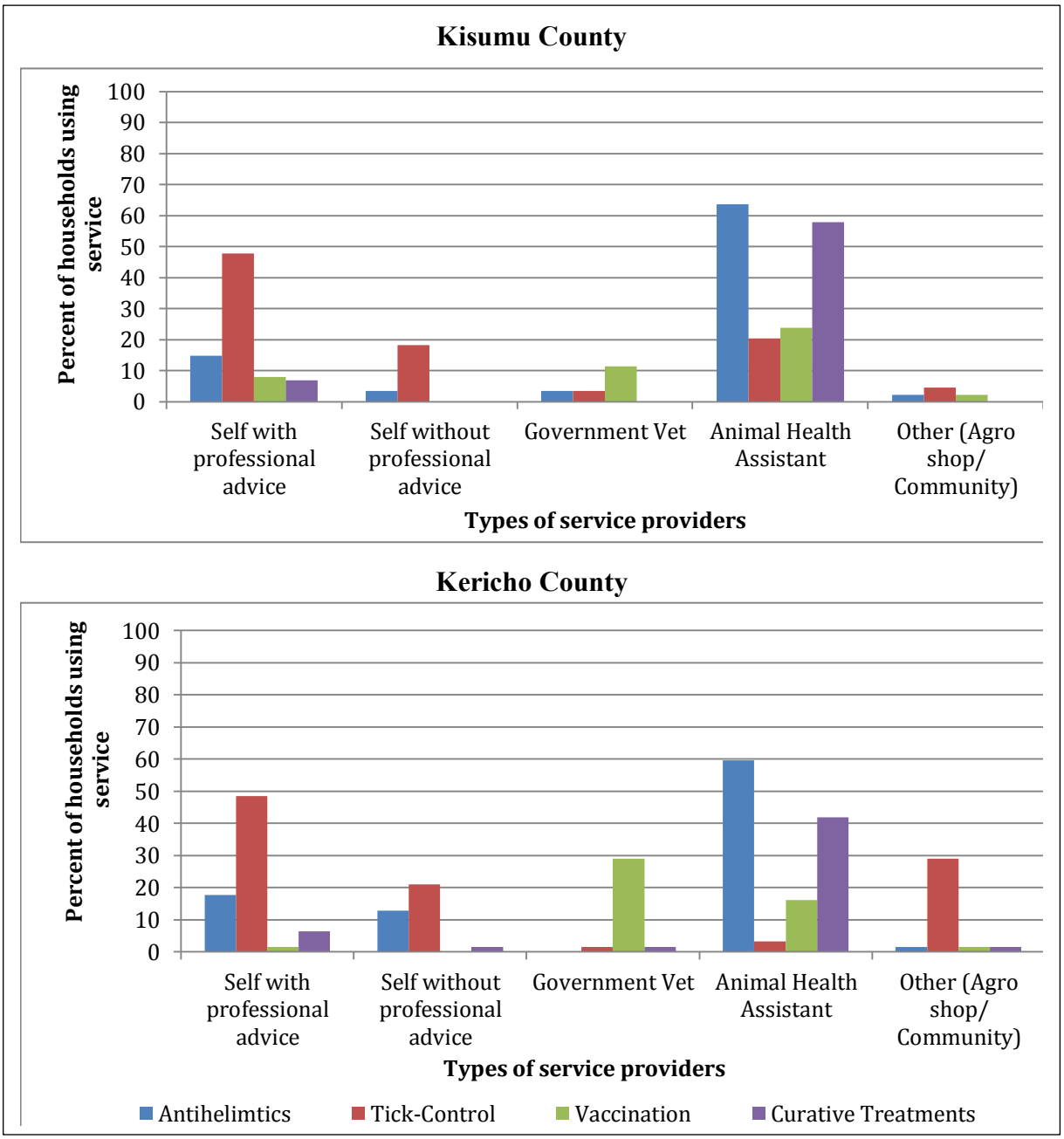
In both counties, the farmers noted that Animal Health services were provided mainly by animal health assistants (Figure 21). Several of the farmers noted that in many instances they depended on their own knowledge when determining the course of treatment for their animals. However 77% of the farmers in Kisumu County and 74% of the farmers in Kericho County indicated that though they treated the animals themselves, they would seek some professional advice. Limited government veterinary services and shops that supply agricultural products (Agro-shops) provided guidance on treatment at the farm level.

Figure 20: Percentage of farmers indicating the availability of different types of animal health service providers



Animal health assistants mainly provided Anthelmintics and some medications to treat specific disease conditions identified (curative treatments, Figure 22). Control of tick borne diseases was undertaken mainly by the farmers themselves with some professional advice on the choice of drug. Government veterinary services were mainly availed for the vaccination of animals, but only 11% of the households in Kisumu County and 29% of the households in Kericho County used them. A more in-depth understanding of the actual disease conditions that affect the SR in the CSV is required as the practice of farmers defining medication doses on their own often leads to resistance to drugs by the disease causing organisms.

Figure 21: Percentage of farmers indicating that they used different animal health service providers for specific treatments

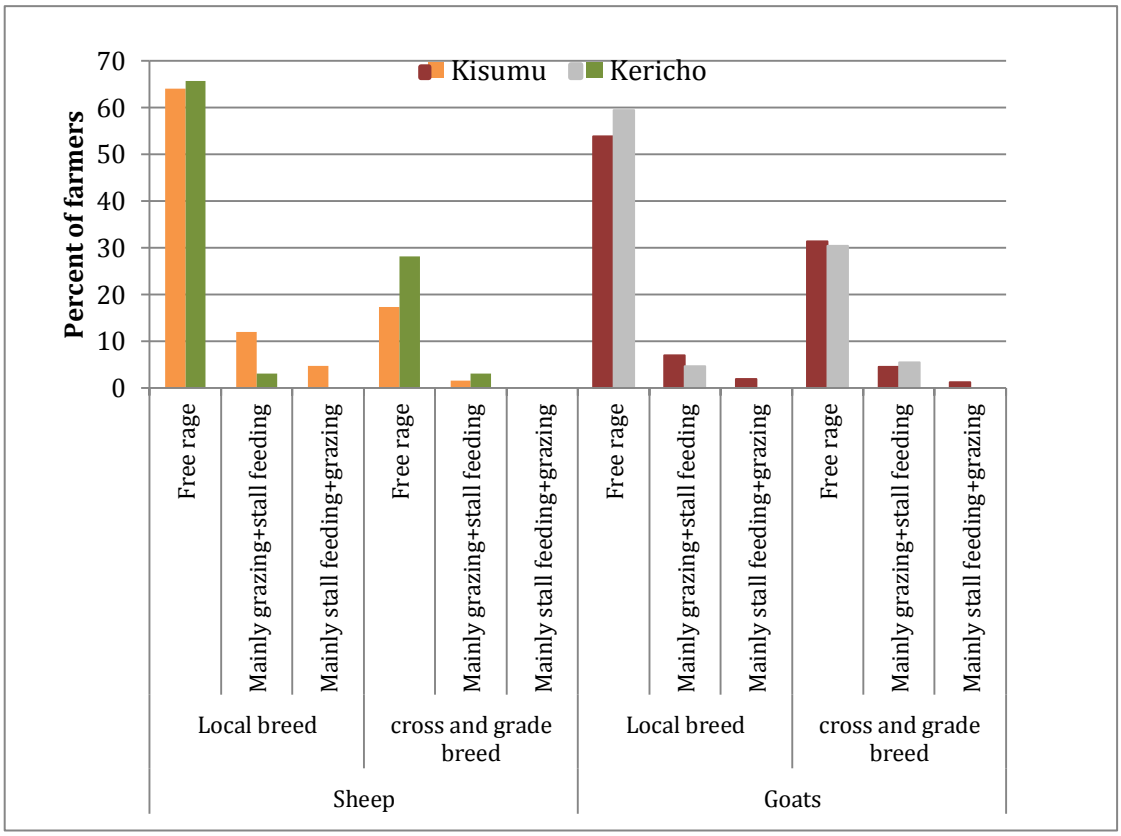


3.8 Feeding practices

3.8.1 Feeding system

The main type of feeding practiced by the farmers in both counties for all types of sheep and goat breeds was free range grazing (Figure 23). There was very little stall feeding and transhumance grazing in both counties. There was also no significant difference between the feeding system adopted by the farmers during the dry and rainy seasons.

Figure 22. Main systems for feeding both local, crossbred and introduced (grade) small ruminants



3.8.2 Type of and source of fodder for the SR

Residues from crops planted in the farmers' fields served as a main source of feed for the SR. This was more notable in Kisumu County where 72% of the households indicated that they used crop residues as livestock feeds while only 52% of the households in Kericho County practiced the same. The main crop residues available were maize stovers (84% in Kisumu and 68% in Kericho), Millet and Sorghum stover (14% in Kisumu and 27% in Kericho), and some little stover from legumes and sweet potatoes. In some instances, mainly in Kisumu County, farmers purchased dry crop residue stovers from neighbouring farms to feed their animals.

Stover was generally obtained from the fields directly by the animals, however, 58% of the households in Kisumu and 65% of the households in Kericho County indicated that they sometimes chopped the stover into smaller pieces using a hand held "panga" prior to feeding it to their small ruminants.

Concentrates and/or mineral supplements were sometimes provided for the SR (25% and 37% of farmers in Kisumu and Kericho County respectively). Some farmers also purchased

processed feeds for their SR (26% in Kisumu and 55% in Kericho). Information on what influenced decisions on purchasing feeds was not obtained. Moving forward, it is important to understand factors that contribute to various choices in management practices adopted by farmers so as to adequately plan and implement capacity development programs.

3.9 Equipment available for small ruminant production

The use of equipment for animal breeding and management is important especially for growing, harvesting and providing feeds for the SR, and for handling and restraining animals. Not all the farmers owned equipment for tilling their land (Table 17), thus greatly limiting their ability to provide food for themselves. Fewer households owned equipment for controlling diseases, and almost no farmers owned equipment for implementing animal husbandry practices (Table 17). An understanding of the benefits of equipment, and availing basic equipment for animal husbandry is needed prior to introducing any SR improvement program.

Table 11: Tools owned by farmers for the management of SR

Tools used in management practices	Kisumu (N1=88)	Kericho (N2=62)
	% of N1	% of N2
Spraying pump	42.0	48.4
Burdizzo	0.0	1.6
Ear tag applicators	4.5	1.6
Hoof clippers	0.0	1.6
Panga	76.1	64.5
Hoe	64.8	61.3
Scythe	8.0	6.5
Total (N)	88	62

4. Discussion

4.1 Household characteristics

The demographic characteristics in the two counties indicated that the largest proportion of the population comprised young people either students in school or youth in the community. This means that any improvement to the livestock industry would have to involve the youth in order to obtain substantial and sustainable results. Innovative approaches are required that can attract the involvement of young people in livestock improvement activities.

The majority of the population in the two counties had a primary level of education with very few individuals having college or university education. In preparing training materials or conducting workshops, trainers should be cognisant of this and ensure the training materials are packaged in such a way that they can be understood by the target population.

The communities in the two counties were mainly engaged in activities related to crop farming, with livestock production considered as a secondary activity. The farmers however noted the importance of livestock as a commodity available all year round as opposed to crops which were harvested seasonally. They used residues from the crops to feed their livestock, however, the quality of residue was quite low. A need was evident for training and capacity building on SR feeding as an initial step in improving their productivity.

4.2 Land and water resources

Land sizes owned by farmers were very small, with more than 58% of the households owning less than three hectares of land. Although most of the farmers owned the land that they farmed, some of the farmers did not have title deeds for their farms. Unclear land tenure often hinders development within areas.

Access to water is critical for any livestock production enterprise. The main sources of water in both counties were rivers which were at times seasonal. Water harvesting, digging of wells or boreholes and harvesting of rain water was not widespread in both counties. This presents an opportunity for the farmers to be trained on water resource management activities in order to ensure access to water throughout the year. Water harvesting could reduce dependency on river water, and reduce the challenge of walking long distances to water points for livestock species kept especially in the drier months of the year.

4.3 Small ruminant flock dynamics

The flock sizes of small ruminants within the area were generally small. However, despite having small flock sizes, most households owned mature bucks or rams for breeding. Mating of animals within the farms was also quite random with no close attention given to avoid in-breeding. Ideally, in small ruminant production systems, one well-nourished and healthy male animal is able to continuously serve up to 30-40 females within a mating period of six weeks. Keeping of a large number of mature entire males in the population should be discouraged. The existing ram and buck population provides an initial opportunity for selection as a first step to improving reproduction and growth of SR in the area.

There was a lot of movement of animals both into and out of farmers' flocks. Many new animals were born on the farms, however, management of young animals was a challenge, and many died prior to becoming productive. Mortality of sheep, mainly due to diseases was also noted to be high (65% Kericho, 51% Kisumu). Farmers thus brought in new animals to boost their flock sizes and replace lost animals. The farmers were very clear on the attributes that they considered to be most important in SR. Animals in good condition generally fetched better prices.

A large number of goats were sold as live animals showing a demand for animals. The farmers also indicated that goats were more tolerant to dry conditions, however the sheep were said to be easier to manage in grazing areas than goats.

4.4 Small ruminant management

Little efforts were made by the farmers to control mating among their small ruminants. Farmers tended to leave their SR for mating in the fields by their own rams/ bucks, however, animals were also mated by neighbours' animals when taken to common watering points. In few instances, farmers that had pure-bred female Galla goats or Red Maasai or Dorper sheep restricted their grazing range by tethering the animals in order to avoid random mating with unknown breeds.

The main feeding system practiced by the farmers was free range grazing with some limited stall feeding when conditions were dry. Crop residues formed the bulk of feeds as the SR were left to graze in fields after crops had been harvested. Fodder harvesting and storage was not a common practice. Animal health services for small ruminants were also limited with a large majority of the livestock keepers depending on their own knowledge and expertise in the management of disease conditions.

4.5 Gender and small ruminant production

A significantly high proportion of households in the area were headed by women (40% in Kisumu and 26% in Kericho). Interestingly, the type of small ruminant breeds kept varied depending on whether the household was headed by a male or a female. The female headed households tended to have more sheep, while the male headed households had a higher proportion of goats. This has great implications on the control over use of resources attained from different small ruminant species. In introducing improved animals, due consideration must be given to the gender of the household head. Women headed households should be provided with improved species that they can have both access to and control over decisions taken in their management and disposal.

Results from this baseline study provide an indication of the immediate interventions and more long term trainings and practices that are required in the area in order to sustainably improve small ruminant productivity. Additional information is required on the market structure and key drivers in order to actually make a change to the household incomes accrued from the change in productivity of animals reared.

5. Recommendations

There is great potential for improving productivity of the SR within the CSV and the communities are ready to change their current state. However, several interventions are required to catalyse the desired change. At the outset, training and capacity development to boost SR productivity is required. Deliberate efforts should be put in place to engage young people in SR improvement activities as they form a bulk of the existing population of the area.

Practical demonstrations on the feeding and husbandry practices for SR need to be provided. Interventions are also required to stem the high rate of death of animals on the farms.

In order to help change the current SR population to achieve improved growth and reproductive efficiency, measures are required to restrict the random mating in the populations. This could be through practices such as castration of males not ear-marked for breeding, and the isolation of male animals in specified locations with selective mating. Additionally, the introduction of recording, monitoring and use of information in decision making would provide evidence to the communities on the benefits of planned mating.

A mapping of the SR value chain in the area is required in order to provide information on the opportunities for income from SR, and the livelihood implications. Additionally a market

analysis is required to provide information on prices and requisite costs of producing SR within the CSV.

The current organization of the farmers in the CSV provides a good platform for the development of a community based breeding and improvement program of SR within Nyando. Using information from the market analyses, breeding objectives can be developed and an index derived that will guide the selective mating of SR within the CSV.

References

Kinyangi J, Recha J, Kimeli P, Atakos V. 2015. Climate - smart villages and the hope of food security in Kenya. CCAFS Info Note. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, Denmark. Available online at: www.ccafs.cgiar.org.

Macoloo C, Recha J, Radeny M, Kinyangi, J. (2013). Empowering a local community to address climate risk and food insecurity in Lower Nyando, Kenya. Case study for Hunger, Nutrition and climate justice, A new dialogue: putting people at the heart of global development. Dublin, Ireland, April 2013.

Mango J, Mideva A, Osanya W, Odhiambo A. (2011). Summary of baseline household survey results: Lower Nyando, Kenya. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen. Denmark.

Peacock C. (2005). Goats—A pathway out of poverty. Small Ruminant. Research. 60 (1):179–186.

RESEARCH PROGRAM ON
Climate Change, Agriculture and Food Security

CGIAR

CCAFS

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is a strategic initiative of CGIAR and Future Earth, led by the International Center for Tropical Agriculture (CIAT). CCAFS is the world's most comprehensive global research program to examine and address the critical interactions between climate change, agriculture and food security.

For more information, visit www.ccafs.cgiar.org

Titles in this Working Paper series aim to disseminate interim climate change, agriculture and food security research and practices and stimulate feedback from the scientific community.

CCAFS is led by: CIAT

Strategic partner: futureearth research for global sustainability

Research supported by:

CGIAR Fund; Danida; European Commission; IFAD; Schweizerische Eidgenossenschaft Confédération suisse Confederazione Svizzera Confederaziun svizra Swiss Agency for Development and Cooperation SDC; IICT; UKaid from the British people; Australian Government AusAID; Irish Aid Ireland's commitment to a world without poverty and hunger; Ministry of Foreign Affairs of the Netherlands; Government of Canada / Gouvernement du Canada; NEW ZEALAND MINISTRY OF FOREIGN AFFAIRS & TRADE MANATŪ AORERE