

**Report on the forage and feed product flow in Kenya
(Busia, Bungoma, Kakamega and Siaya Counties)**

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ABBREVIATIONS

GDP	- Gross Domestic Product
IGAD	- Intergovernmental Authority on Development
KEVEVAPI	- Kenya Veterinary Vaccines production Institute
KES	- Kenyan Shillings
USAID	- United State Agency for International Development
NGOs	- Non-Governmental Organizations
GAP	- Good Agricultural Practices

Abstract

Kenyan economy expanded 4.7% in 2017 and 6% in 2018 (World Bank, 2018). This growth was mainly supported by growth in agricultural output, among other steady economic growths such as industrial activity and service sectors. Agriculture is a huge contributor in terms of GDP with livestock taking a key position in this contribution. There is high demand for livestock products, which in turn creates a high demand for forage and feed. The availability of forage and feed is challenged by inadequate rainfall, overstocking, lack of knowledge and technology among others. However, farmers are becoming persistent by using various ways in order to counter these challenges; among them production, conservation and purchase of forage and feed.

This study examines the flow of forage and feed in selected counties in Kenya. A mixed research technique was applied using questionnaire as instrument of choice to conduct interviews with livestock farmers. The study found that most of the forage and feed consumed by livestock in these areas comes from respondents' family lands. The study also found that most of the livestock diet is comprised of crop residues. Almost all the respondents in the counties agreed that planning forage and feed is not an expensive endeavor. Almost all the respondents said that buying forage and feed is an expensive engagement across the four counties. There is therefore room to increase productivity in terms of quality and quantity of forage and feed in these counties, through forage and feed farming.

CHAPTER I: INTRODUCTION

Agriculture has remained to be the backbone of Kenyan economy (Alila &Atieno, 2006) and its performance is exhibited in country's overall GDP. In 2018, Kenyan economy improved after exhibiting reduced activity in 2017. Kenyan economy expanded 4.7% in 2017 and 6% in 2018 (World Bank, 2018). This growth was mainly supported by growth in agriculture output, among other steady economic growths such as industrial activity and service sectors. According to World Bank (2018), favorable weather conditions and timely received long rains in 2018 have contributed to a strong rebound in agricultural output. Agriculture accounted for about 26 percent of GDP directly and some 25 percent of GDP indirectly through its backward and forward linkages to other sectors of the economy. It also accounted for up to 60 percent of employment and 60 percent of Kenya's exports.

The population of Kenya was estimated at 45.8 million in 2017, with an inter-censual population growth rate of 2.9 per cent and is expected to reach 52 million in 2020 and about 65 million by 2030 (UNDESA, 2017). According to Atieno (2006), 80% of the population lives in rural areas and derives their livelihood directly or indirectly from agriculture and according to USAID (2019), more than 75% of Kenyans make some part of their living in agriculture.

Livestock, not only is a key contributor in country's GDP but also a social-economic development and contribution to household food and nutritional security. The livestock sector contributes about 12% of Kenya's Gross Domestic Product (GDP), 40% to the agricultural GDP and employs 50% of agricultural labor force (KEVEVAPI, 2014). The contribution is mainly through livestock products revenue as well as food security, which mainly include milk and meat. By 2050, the demand for livestock products in Kenya among other developing nations is expected to be twice the current demand (Delgado et al, 2001).

According to IGAD (2013), milk tops in terms of the most valuable economic livestock product, with an estimated 257.811 billion Kenyan shillings, which is about four times more important than meat in terms of its agricultural contribution. This represents about 70% of the total value contribution to the agricultural sector. Cattle are Kenya's most important source of red meat, supplying by value about 80% of the nation's ruminant off take for slaughter (IGAD, 2013).

Apart from food, there are a range of financial benefits that comes with the livestock keeping. Among the benefits include credit, insurance and a means of sharing risk. The credit benefits and insurance of livestock derive from the ability of livestock owners to ‘cash in’ their animals for particular purposes at a time that they choose can. In this instance, the level of security provided to a particular individual depends on the value of that individual’s assets, so livestock ownership functions as a kind of self-insurance. Other benefits include compost manure, hides, energy power (where bulls are using to pull ploughs and carts) among others.

All these benefits create a high demand for livestock and its products, which mostly come from small-scale farmers in rural areas. According to Marsetyo, (2013) smallholder cattle farming is the major source of livelihood for over 54% of poor people in sub-Saharan Africa including Kenya, which makes them the major milk and meat producers. Even with overwhelming evidence on the importance of livestock keeping, livestock are often undernourished, which is due to lack of timely quality feeds and in the right quantities. This in turn yields to low production, susceptibility to diseases, high mortality and fertility reduction (Xue et al. 2005).

According to Marsetyo, 2013, most of the livestock keeping is done in an integrated crop and livestock system where most of the livestock annual diet is low quality crop residues. Even for livestock that depends on grazing as their major forage and feed, access to quality feed is highly dependent on seasonal rain and temperature. One of the major challenges for increasing livestock productivity is the lack of enough high-quality livestock feed especially during the dry season (Mwendia et al, 2007). According to Mnene 2004, lands in Kenya are highly degraded due to continuous overgrazing and overstocking, which results to inadequate feeds. Traditional land management practices in Kenya are collapsing because of change in climate, social-economic factors and land dynamics (Kassahum, 2008).

Worth noting that there have been various organizations such as governments, research institutions, NGOs and other private sectors have used various interventions in attempt to assist famers to increase livestock yields. However, according to Mnene, (2016), irrespective of the presence of these knowledge channels a higher number of livestock keepers have not adopted the good agricultural practices (GAP). All is not lost though because various organizations have used participatory approach successfully (Mnene, 2016). This participatory engagement has given hope to farmers and continues to change livestock farming positively. Opportunities for improvement involve forage and feed buying, production and conservation and good utilization of local feed resources (Mwendia et al,

2007). This includes movement of forage and feed from source to a final destination where livestock is able to consume it. This paper examines forage and feed production flow in Kenya; Busia, Bungoma, Siaya and Kakamega counties, with an aim to understand flow dynamics and the forage and feed productivity potential in these counties.

CHAPTER II: METHODOLOGY

The four counties were purposively selected for the study. However, random sampling was applied to determine the specific sub-counties where the respondents would come from. A further random sampling technique was used to determine the actual respondents to participate in the study. 30 respondents were selected from each county. Given the large population in these counties and that livestock keeping tend to take similar characteristics; the 30 respondents were determined to be the number where maximum variation of information would be obtained. As the number of study participants neared to 40 respondents, the information they gave was found to be repetitive hence settling for 30 respondents in each county.

A combination of qualitative and quantitative methods was applied; use of structured and semi-structured interviews to aid data triangulation. Interviews were conducted using a questionnaire as the instrument of choice. The data was collected from 17th June to 8th July 2019. The objective of the survey was to 1) Understand the feeding system applied in Bungoma, Kakamega, Siaya and Busia, 2) Assess the existing forage and feed varieties produced and their production, 3) Forage and feed movement in terms of quantities, forms and pricing, 4) assess the potential forage and feed production in these counties.

CHAPTER III: FINDINGS

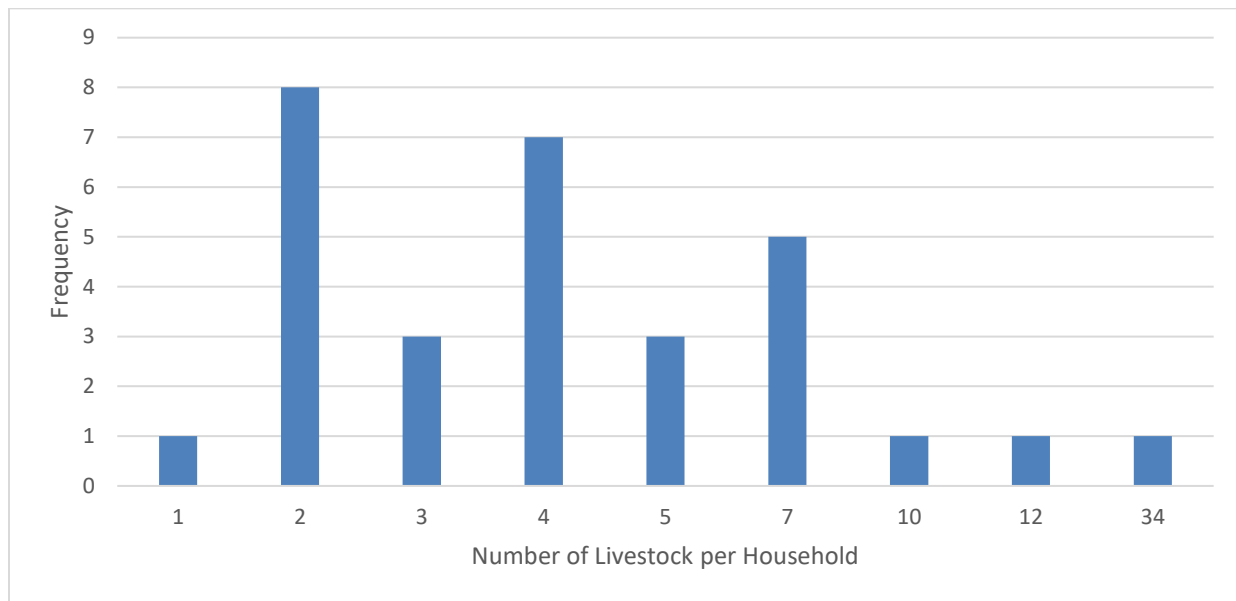
Bungoma County

Demographic

Out of the nine sub Counties in Bungoma County, Kinduyi Sub County was randomly selected for our study. 36 % of the respondents interviewed were from Bukembe Central, 33 % from Bukembe North and the rest 30 % were from Bukembe South. 43 % of all the respondents interviewed are female while the rest 57% are male. In terms of numbers of livestock, 27 % of the respondents have 2 animals in each of their household while 24 % of the respondents have 4 livestock in their

household. 17 % of the respondents have 7 livestock in their household while 10 % has 3 livestock in their household. Another 10 % of the respondents have 5 livestock in their household. Households with 10, 12, 34 and 1 livestock represents 3 % of respondents each. See livestock distribution on the figure 1 below.

Figure 1: Number of livestock distribution per household in Kinduyi, Bungoma County



Source: Researcher's data

The population has an average of 5 livestock per household and a standard deviation of 5.985. The high standard deviation indicates that the number of livestock is not normally distributed. This is also confirmed by Skewness of 4.059 and Kurtosis of 19.124 (Normal distribution has a Skewness of 0 and a Kurtosis of 3). See the summary figure 2 below.

1 Figure 2: Number of livestock summary statistics

Statistics	
Mean	5.33
Std. Deviation	5.985
Skewness	4.059
Kurtosis	19.124

Feeding system

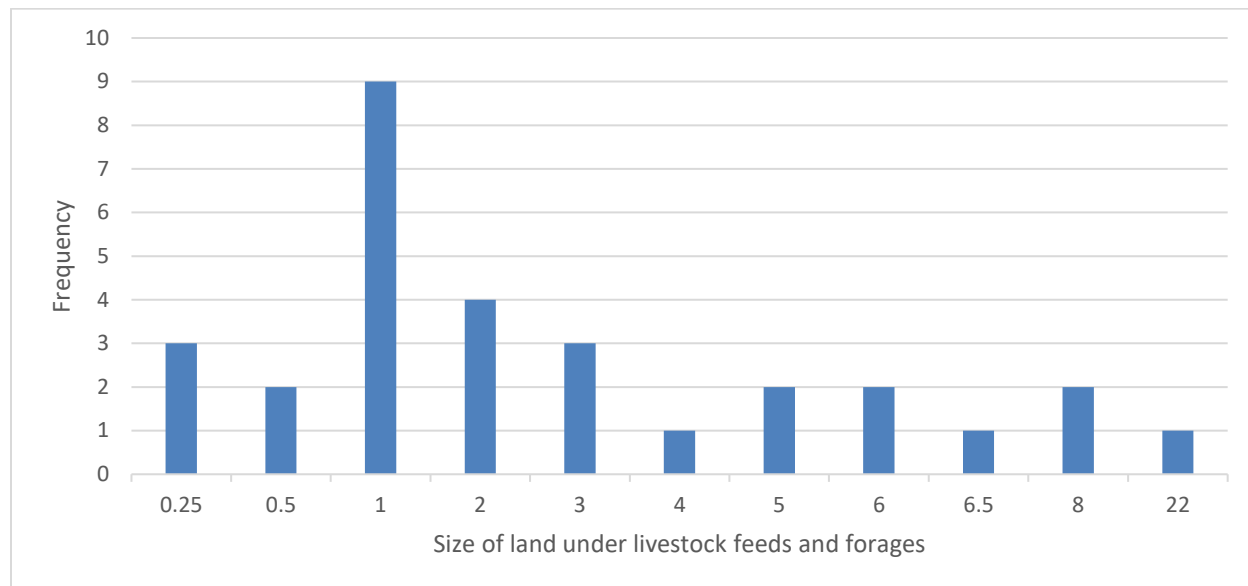
None of the farmers interviewed in Kinduyi Sub County practiced pure zero grazing. All the farmers had a mixture of zero grazing and free grazing, where they would feed the livestock in an enclosed area (shed), but also graze them grass in family land on selected days and time of the week. 73 % of the respondents said that the responsibility of feeding the livestock is done by the respondent and other members of the family while 20 % rely on hired help and 7 % of the respondents said that they feed the livestock themselves without any help from others.

Forage and feed

Land use

Respondents have different portions of land that is under forage and feed to be consumed by their livestock as well as surplus to be sold to the people within the county. 30 % of the respondents said that they have 1 acre of land under forage and feed, while those with 2 acres of land under forage and feed represents 13 % of the respondents. Respondents with 0.25 and 3 acres of land under forage and feed represent 10 % of the respondents each, while the respondents with 0.5, 5, 6, and 8 acres of land under forage and feed represent 7 % of the respondents each. Respondent with 4 and 6.5 acres of land under forage and feed represents 3 % each. See figure 3 below.

Figure 3: Distribution of land under forage and feed in Kinduyi sub county, Bungoma County

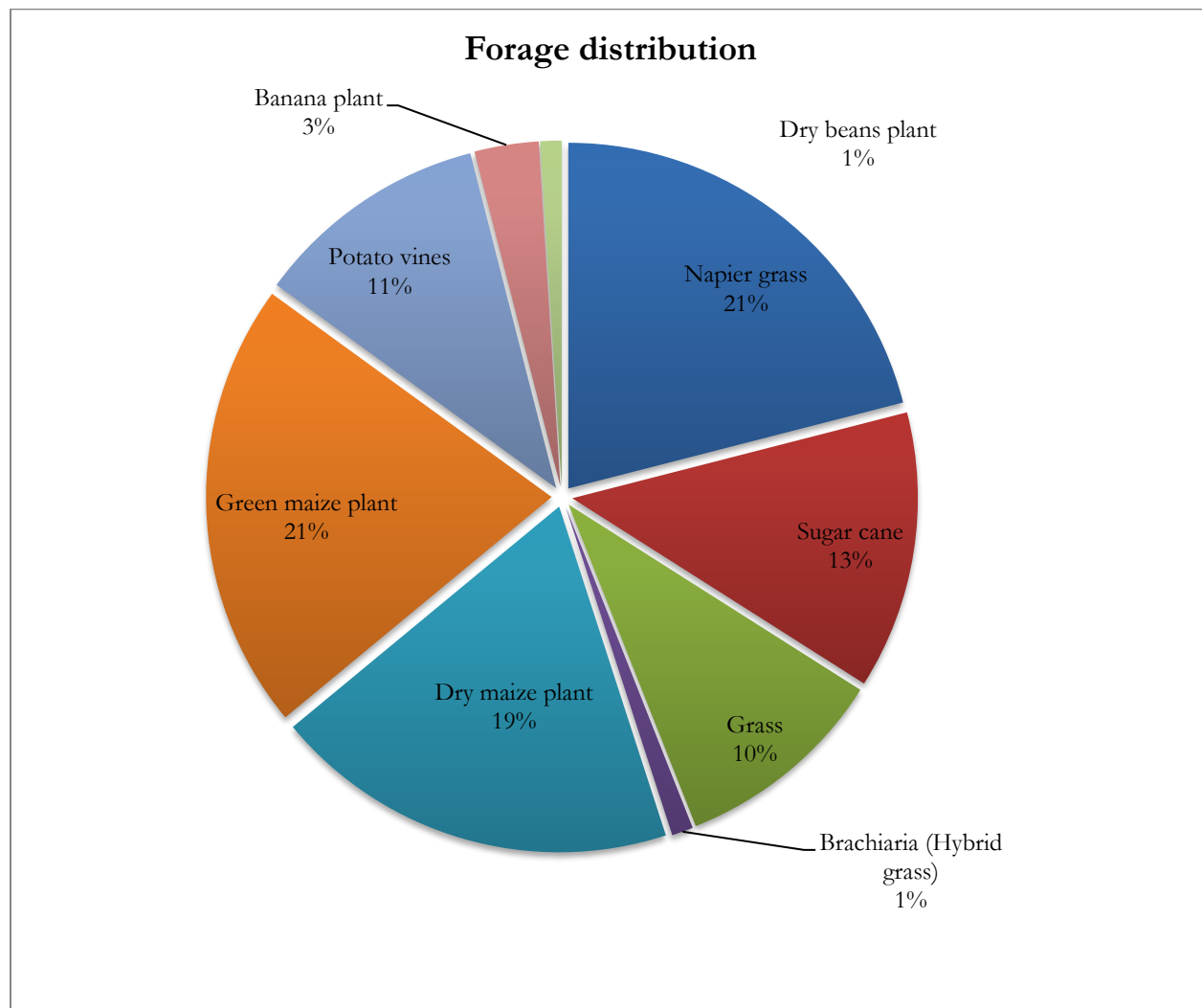


Source: Researcher's data

Feed items

Based on this study, most of the livestock feed in Kinduyi Sub County in Bungoma consists of crops residues which represent approximately 68 %, while the rest are forage and feed planted specifically for feeding livestock. The crop residues include: dry maize plant, green maize plant, potato vines, banana plants, sugar cane tops and dry beans left overs 21% of the feed basket is green maize plant (green maize plant is obtained by thinning and sometimes cutting down the maize that has not developed properly). Dry maize plant represents 19 % of the feed while 13 % of the feed is sugar cane tops (the left over after the sugar can stem is harvested). Sweet potato vines represents 11 % of the feed and dry beans vines 1%. Grass from grazing represents 10% of the feed. In terms of planted grasses, 21 % of the feed fed to livestock in the study is Napier grass and Brachiaria (hybrid grass) represented 1 % of the feed. See table 1 below.

Table 1: Livestock forage and feed distribution in Kinduyi sub-county, in Bungoma County

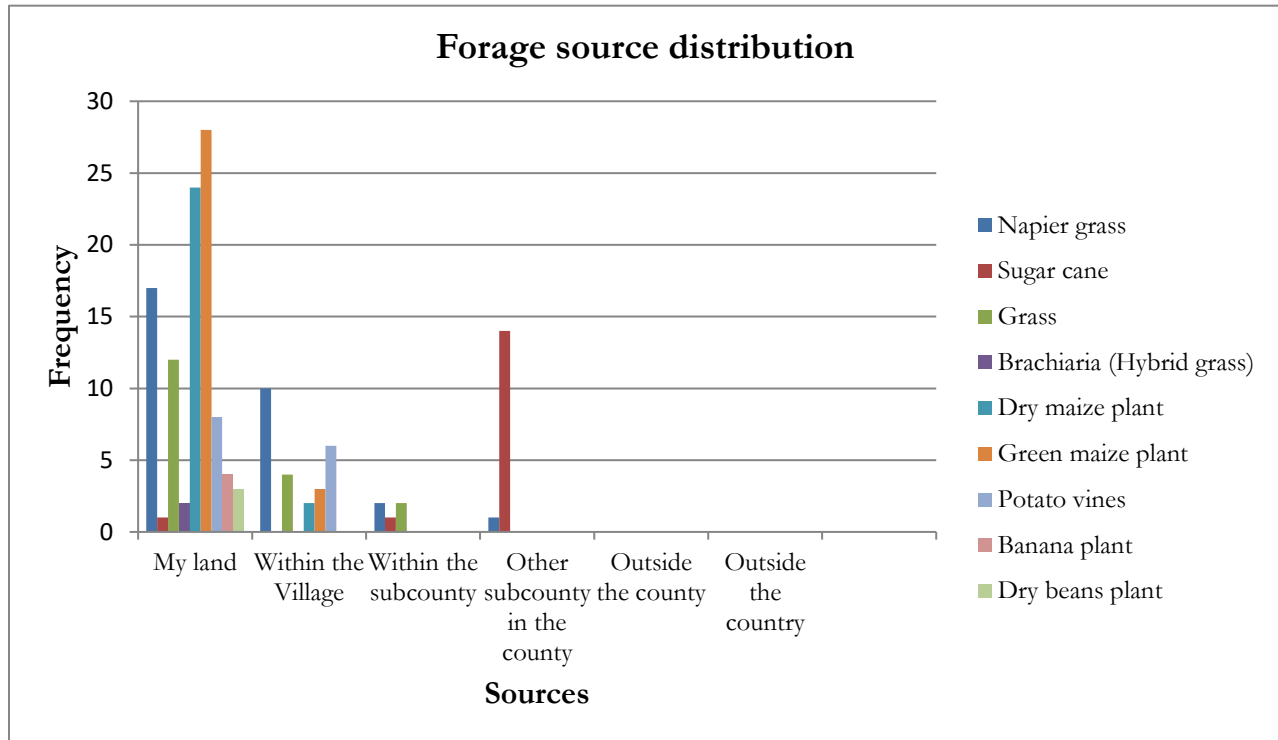


Source: Researcher's data.

Sources of forage and feed (inflow)

In general, most of the feed consumed by livestock in this study came from respondents' lands followed by the feed from within the village. See table 2 below.

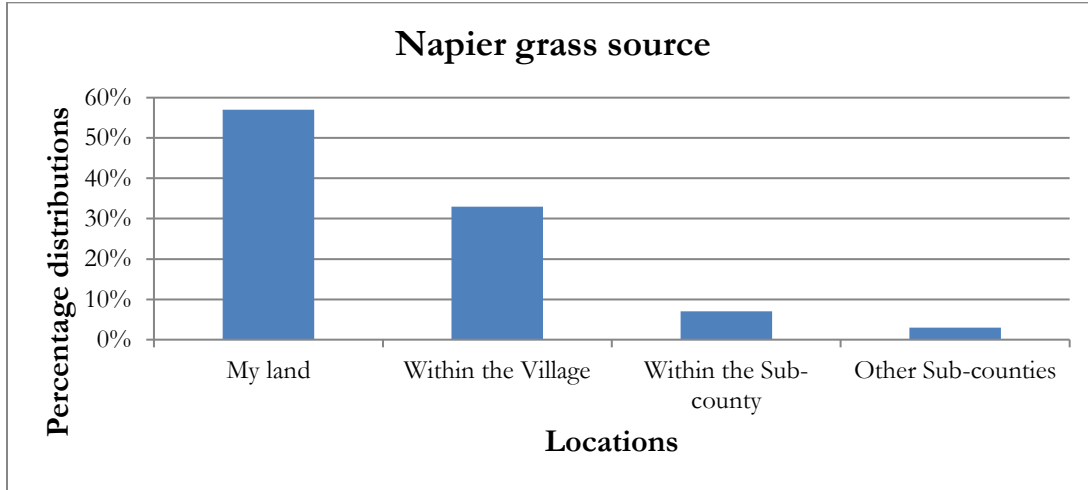
Table 2: Feed source distribution in Kinduyi sub-county in Bungoma County.



Source: Researcher's data

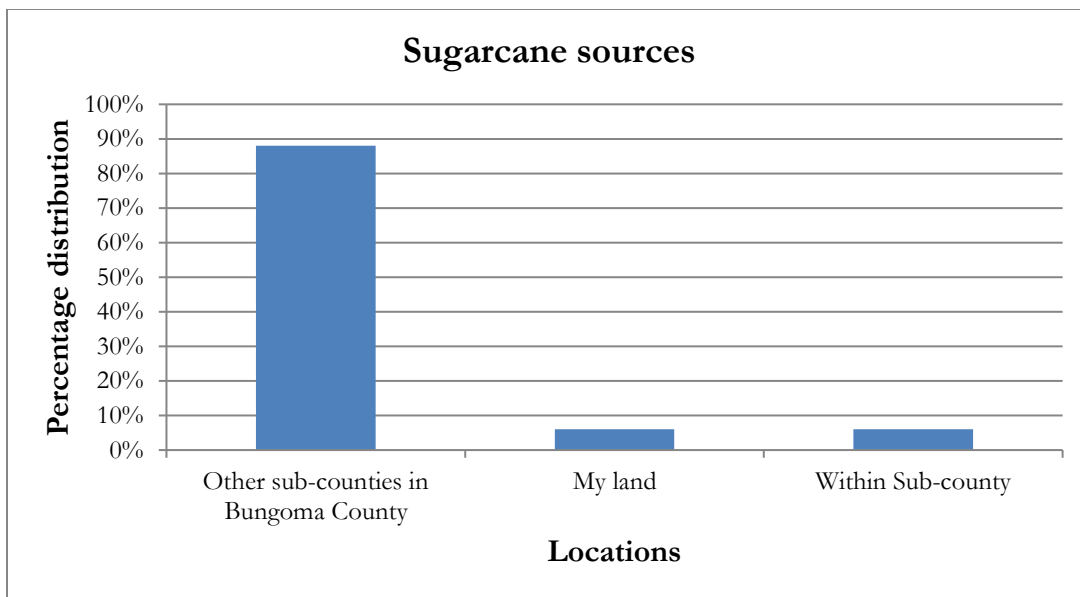
Napier grass: 57 % of the Napier grass fed to livestock in Kinduyi sub-county came from respondents' family lands, while 33 % came from within the village. 7 % came from within the Sub-county while the rest 3 % came from other sub-counties but within the same county (Bungoma County). No forage and feed came from outside the County or outside the country (Kenya). See table 3 below.

Table 3: Distribution of Napier grass sources for Kinduyi sub-county livestock.



Sugar cane tops: 88 % of the sugar cane tops come from other counties within Bungoma County (mainly Nzoia Sugar Company land), while 6 % comes from respondents’ family land while the rest 6 % comes from within the Sub-county; distributed by retailers in motorbikes or available at their local market in bundles. See table 4 below.

Table 4: Distribution of Sugar cane tops sources for livestock in Kinduyi sub-county.



Grass: 67 % of the grass grazed to respondents' livestock comes from respondents' land, while 22 % come from within the village, and the rest 11 % comes from within the sub-county.

Brachiaria (Hybrid grass): All the Brachiaria (hybrid grass) fed to respondents' livestock comes from respondents' family land. The respondents plant the grass, and harvest it after maturity. The stalks are left to grow again and periodically harvested at maturity.

Dry maize plant: 92 % of the dry maize plant fed to respondents' livestock comes from respondents' lands while 8 % comes from local village (within respondents' village).

Green maize plant: 90 % of the green maize fed to respondents' livestock comes from respondents' land while the rest 10 % comes from within the respondents' village.

Sweet potato vines: 57 % of the sweet potato vines fed to respondents' livestock comes from respondents' land while the rest 43 % comes from within respondents' village.

Banana plant: All the banana plant fed to respondents' livestock comes from respondents land. Banana plant entails the stem and the leaves. Usually cut into small pieces and directly fed to the livestock when fresh.

Dry beans plants left over (Phaseolus vulgaris): All the dry beans plant left over fed to respondents' livestock comes from respondents land. Dry beans plant left overs are obtained when harvested beans dried and bean seeds are removed.

67 % of the respondents interviewed said that they buy forage and feed while 33 % said that they rely entirely on forage and feed from their family land. The quantity in which forage and feed is bought and sold varies depending on the understanding between the seller and the buyer. Some use quantities like arm length for Napier grass, of which the price also will vary depending seller and buyers' understanding. 'Arm length' is where a buyer stands on a portion of land under forage and feed (mainly for Napier grass) with both arms open in order to obtain a square with lengths equal to their arm length. Napier grass is also bought in terms of land portions (say a quarter of an acre), to be harvested by the buyer for a certain amount of money. However, the most common quantities used in buying and selling of forage and feed is usually in bundles. Forage and feed is tied into bundles of KES 50, KES 70 or KES 100 especially for grass and sugarcane tops as well as dry maize

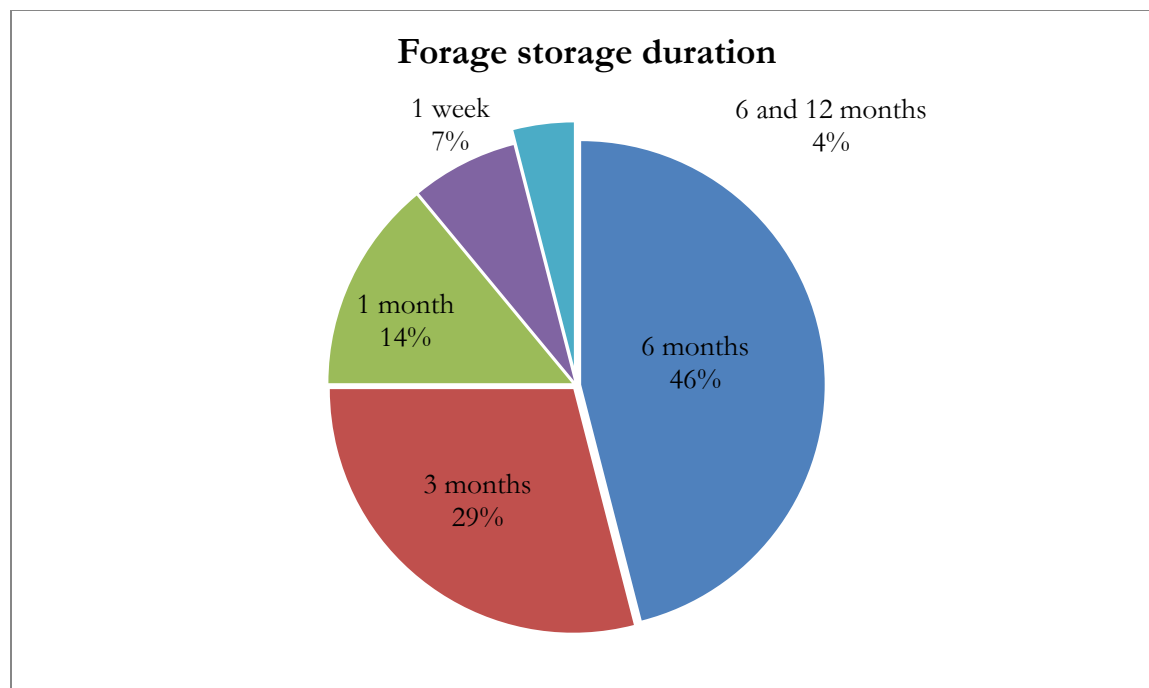
plants. Sometimes dry maize plant is sold using ox carts. A full ox cart goes for an average of KES 600.

The forage and feed is bought as both green and dry forms. None of the respondents said they buy forage and feed in others forms such as hay.

Forage and feed storage and movement (outflow)

93 % of the respondents said that they usually have forage and feed surplus after feeding their livestock, with 7% saying they do not. 46 % of the respondents with surplus store their forage and feed for about 6 months, while 29% of the respondents said they store the forage and feed for about 3 months. 14 % said they store forage and feed for about one month while 7% said they store the forage and feed for about one week. The rest 4% said they store forage and feed for about 6 to 12 months. See table 5 below.

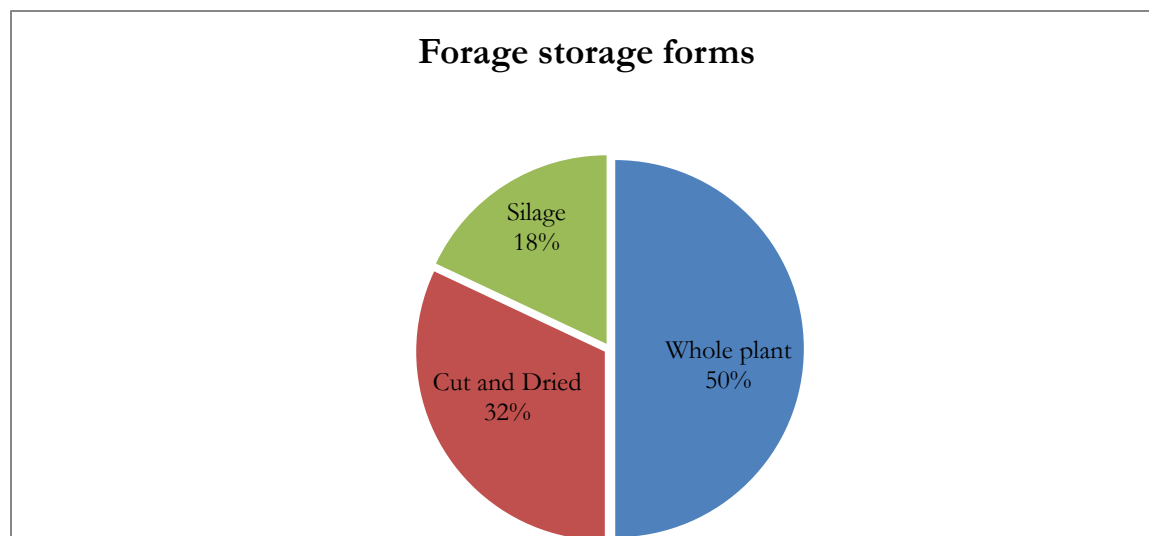
Table 5: Distribution of forage and feed storage duration in Kinduyi sub county, Bungoma County



Source: Researcher's data

50 % of the respondents said that they store forage and feed as whole plant (especially dry maize plant that is stored as a whole under a shed), while 32 % said that they cut their forage and feed and dry it up and store it like that. The rest 18 % said they store it in form of silage. See table 6 below.

Table 6: Forage and feed storage forms in Kinduyi sub-county, in Bungoma County.



Source: Researcher's data

21 % of the respondents said they sell surplus forage and feed, while 79 % said that all their forage and feed is meant for their livestock. All the forage and feed customers come from the same village as the seller (farmer). Their main forage and feed marketing strategy is a word of mouth, where the seller informs the neighbors and friends, and the information is spread in a snowballing effect. Some of the buyers basically walk around looking for forage and feed to buy, without even prior information of the presence of forage and feed on sale.

73 % of the respondents said that growing forage and feed is expensive, while the rest 27 % said it's not. 92 % of the respondents said that buying forage and feed is expensive especially in that a buyer has to buy several quantities in order to feed livestock even for a day (several KES 100 bundles of Napier grass); while the rest 8 % said buying forage and feed is not expensive. 53 % of the respondents were of the opinion that availability of forage and feed determines the number of

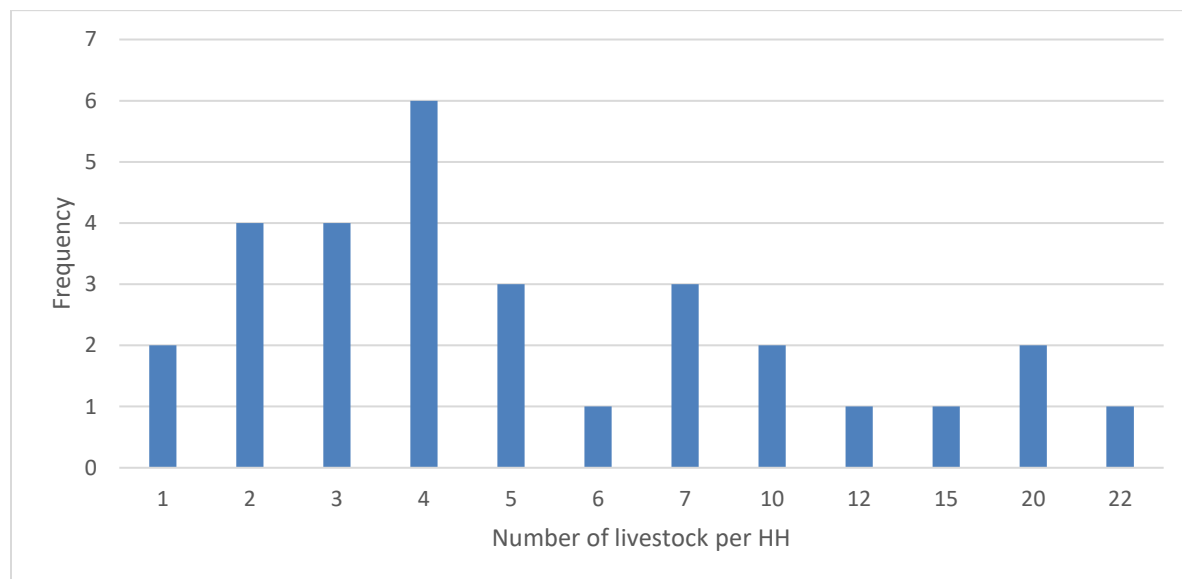
livestock they have while 47 % were of the opinion that the number of livestock is determined by other factors such as labor requirements, family needs like school fees among others. 54 % of all respondents said that they would increase their livestock if there were an increase in affordable forage and feed while 46 % said that they number of livestock would remain the same even with the increase in forage and feed.

Siaya

Demographic

2 out of 6 sub-counties in Siaya were randomly selected for this study; Alego-Usonga and Ugenya. 53 % of the respondents were from Alego-Usonga and the rest 47 % were from Ugenya. 63 % of the respondents were women while the rest 37 % were male. In terms of livestock distribution, 20 % of the respondents have 4 livestock in their household. Households with 2 and 3 livestock in their households represent 13 % of the respondents each, while the households with 5 and 7 livestock represents 10 % of the respondents each. Households with 1, 10 and 20 livestock represents 7% of the respondents each. Households with 6, 12, 15 and 22 livestock represents 3% of the respondents each. See figure 4 below.

Figure 4: Number of livestock distribution per households in Alego-Usonga and Ugenya, Siaya County.



Source: researcher's data

The population has an average of 7 (6.57) livestock per household, with standard deviation of 5.776. The number of livestock was not normally distributed with a right Skewness of 1.6 and a Kurtosis of 1.72. See livestock summary figure 5 below.

2 Figure 5: Livestock distribution summary statistics

Statistics		
N	Valid	30
	Missing	0
Mean		6.57
Std. Deviation		5.776
Skewness		1.600
Kurtosis		1.720

Feeding system

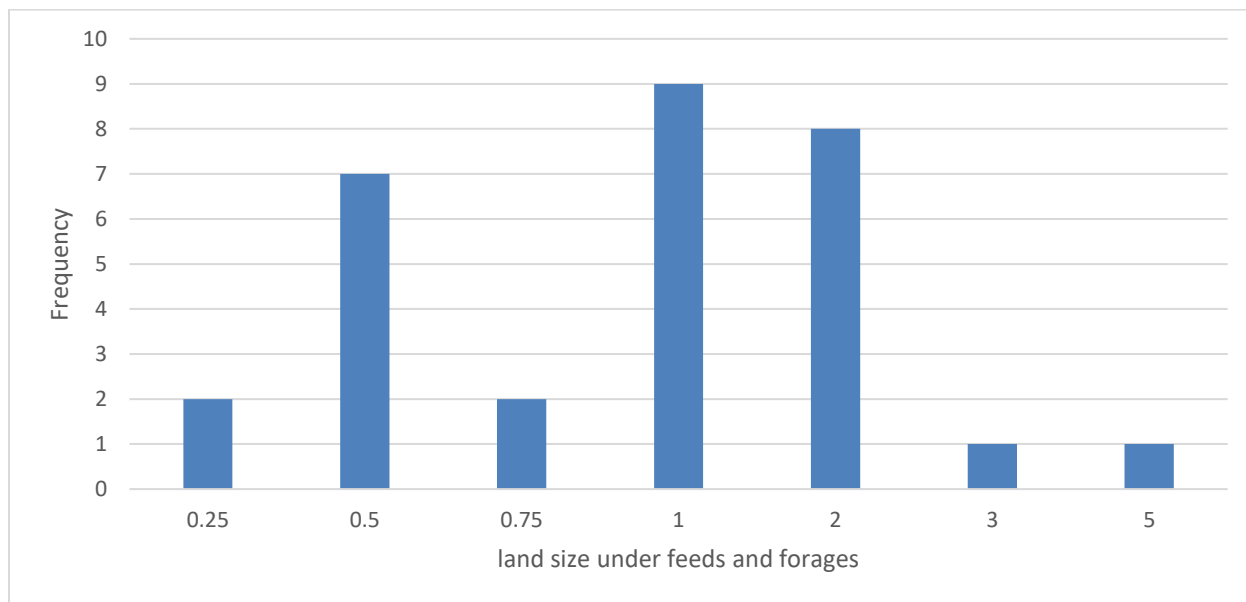
93 % of respondents practice semi-zero grazing where the farmers sometimes feed their livestock in an enclosed space as well as graze them in respondents' family land. The rest 7 % of the respondents practice zero grazing. 73 % of the respondents feed the livestock themselves with the help of the family members, while the rest 26 % have hired help to take the responsibility of feeding the livestock.

Forage and feed

Land use

30 % of the respondents have 1 acre of their land under livestock forage and feed. 27 % of the respondents have 2 acres of land under forage and feed while 23 % of the respondents have 0.5 acres of their land under forage and feed. Respondents with 0.25 and 0.75 acres of land under forage and feed represents 7 % of the respondents each while those with 3 and 5 acres under forage and feed represents 3 % of the respondents each. See figure 6 below.

Figure 6; Distribution of land under forage and feed in Alego-Usonga and Ugenya sub counties, Siaya County

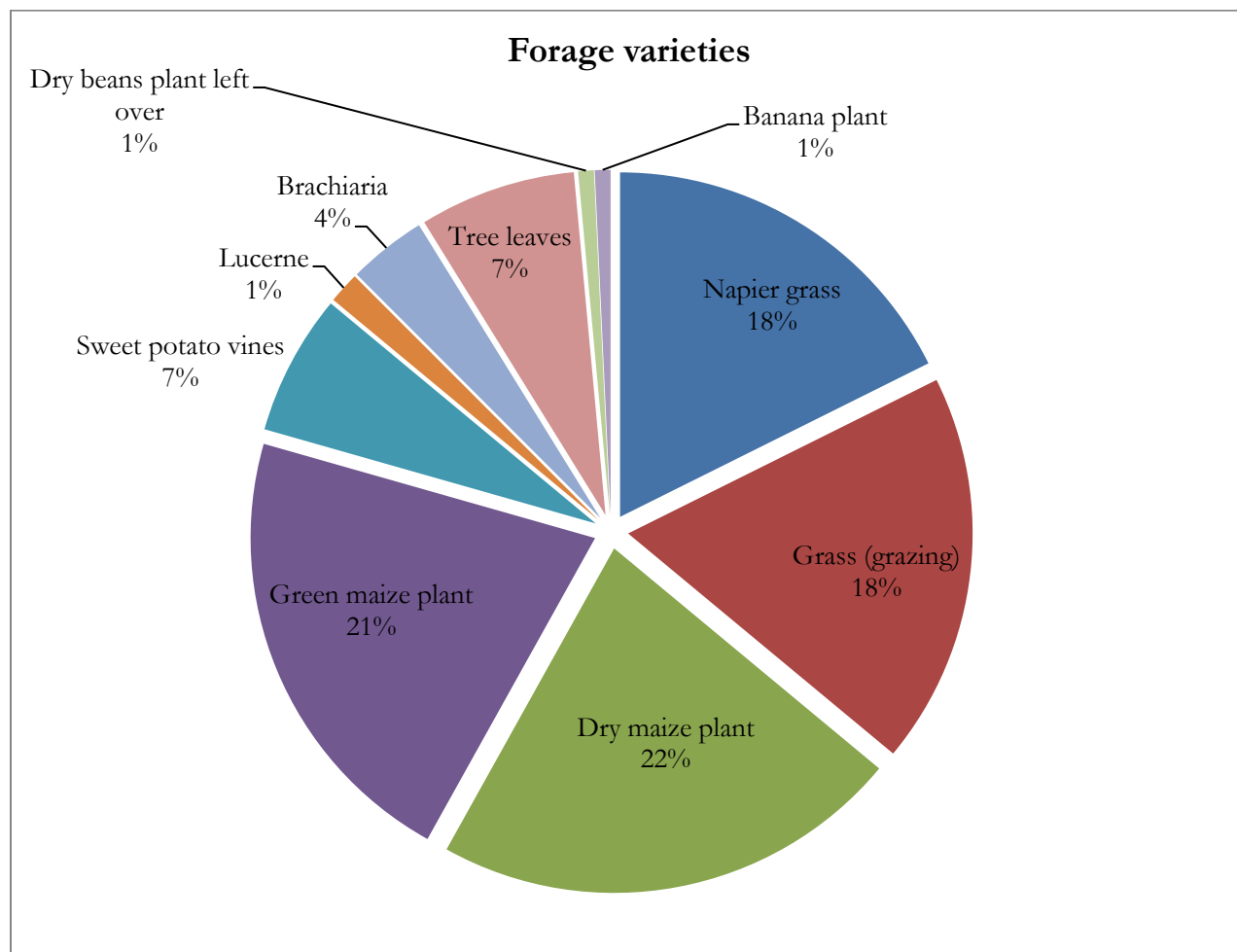


Source; researchers data

Feed types

Most of the livestock forage and feed comprises of crop residues, which include maize plants, sweet potato vines, beans, banana among others. Dry maize plant represents 22% of the feed fed to the livestock, while green maize represents 21 %. Napier grass and grass (field grazing) represents 18 % of the forage and feed each. Tree leaves (mostly mango) and sweet potato vines represents 7 % of the feed each. Brachiaria represents 4 % of the feed fed to the respondents' livestock while banana plant (stem and leaves), Lucerne and dry beans vines represents 1 % of the feed each. See table 7 below

Table 7: Forage and feed distribution in Alego-Usonga and Ugenya, Siaya County

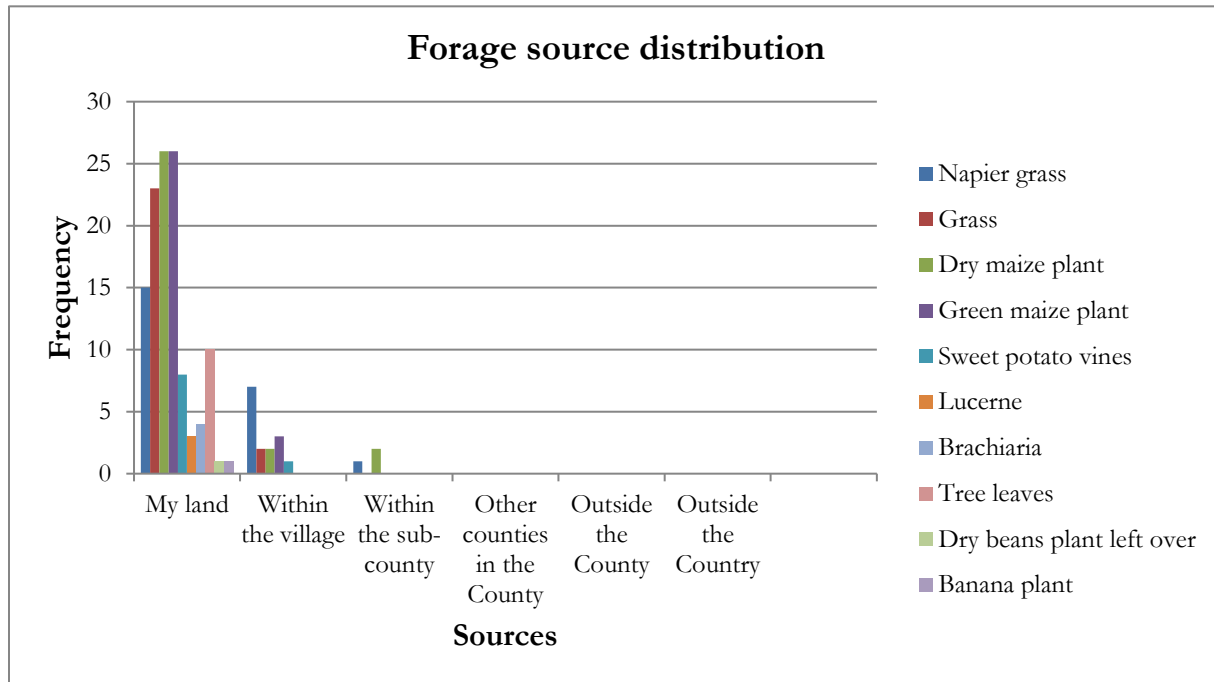


Source: Researcher's data

Source of feed (Inflow)

In general, most of the forage and feed comes from respondents' land. All the forage and feed comes from within the sub-county of respondents' residence. See table 8 below.

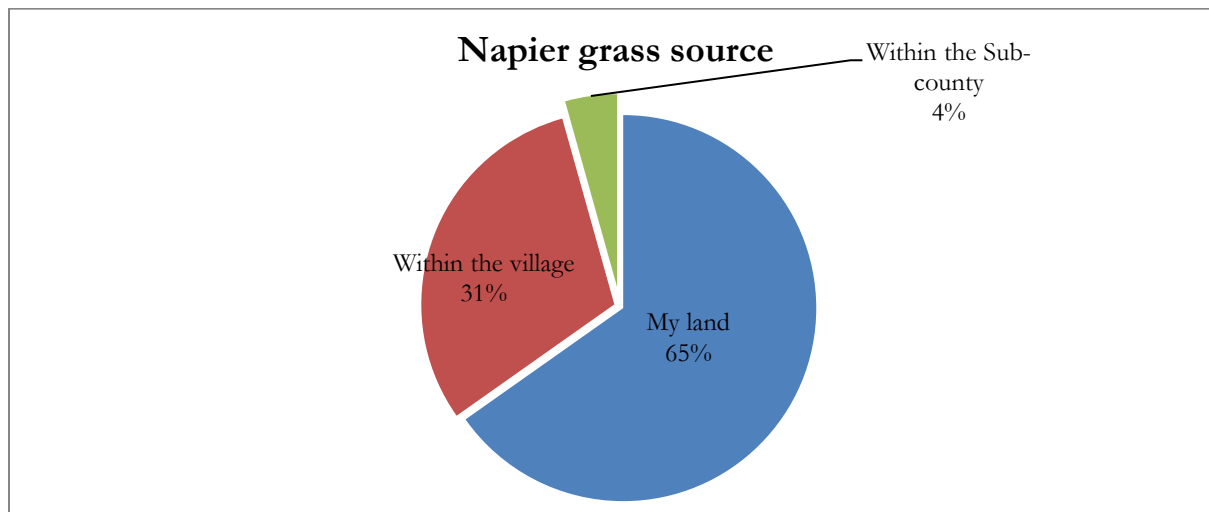
Table 8: Forage and feed source distribution in Alego-Usonga and Ugenya sub-county, in Siaya County.



Source: Researcher's data.

Napier grass; 65% of the Napier grass fed to respondents' livestock come from respondents' lands while 31% comes within their village of resident. The rest 4% comes from within respondents' sub-county of residence. See table 9 below.

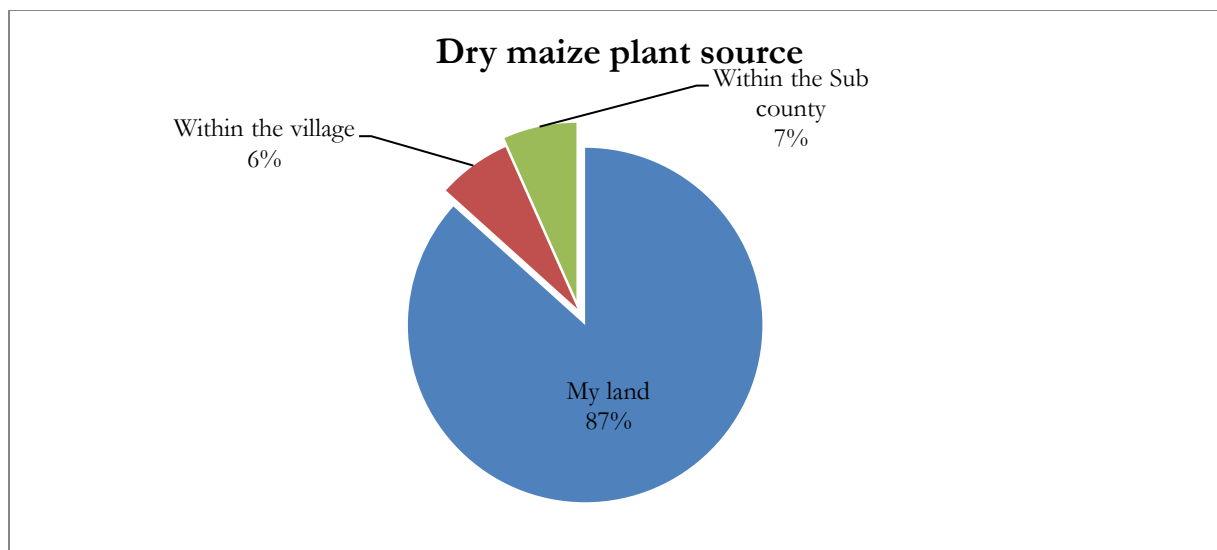
Table 9: Napier grass source distribution for livestock in Alego-Usonga sub county, Siaya County



Source; Researcher's data

Dry maize; 87% of the dry maize plant forage and feed comes from respondents land, 7% comes from within the sub county while the rest 6% comes from within the village. The dry maize plant coming from within the village or within the sub county is either bought or given for free to the respondents by friendly individuals from these areas. See table 10 below.

1 Table 10: Dry maize plant source distribution in Alego-Usonga Sub County in Siaya County



Source; researcher's data

Grass (field grazing); 85 % of the grass fed (grazed) to respondents livestock comes from their own land, while 15 % comes from within the village; grazing from neighbor's land for free or sometimes cut and fed to the livestock.

Green maize; 90 % of the green maize plant forage and feed comes from respondents lands, while the rest 10 % comes from within the village.

Sweet potato vines; 89 % of the vines comes for respondents land while the rest 11 % comes from within the village. The vines from within the village are given freely to respondent by their neighbors and friends (not sold).

Lucerne, Brachiaria, tree leaves (mostly mongo leaves), dry beans left over and bananas plants fed to the respondents' livestock come from respondents' land.

The price for forage and feed varies a lot, mainly depending on the understanding between the seller and the buyer. However, there are some constant quantity measures. For instant, dry maize plant residues are sold in ox carts which have a price range between KES 800 and KES 1000. Napier grass is bought and sold in ox carts which have a price range of KES 1500 and KES 2000. However, Napier grass is mostly bought and sold as a portion of land. This is where the buyer is shown a portion of land under Napier grass, which he/she is to harvest and they agree on a fee. They can either harvest it at once and store it or harvest it in small quantities up to a certain period specified by the seller (Say one month).

The forage and feed is bought as both green and dry forage and feed. None of the respondents said they buy forage and feed in others forms such as hay.

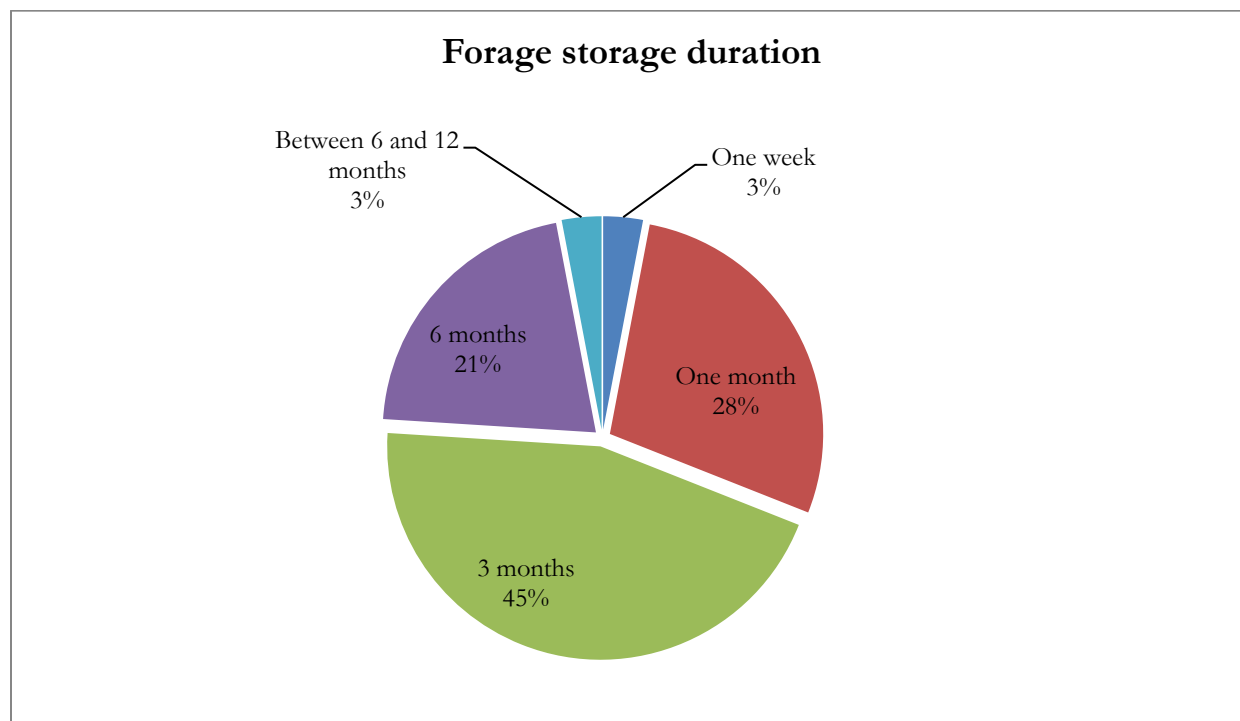
Forage and feed storage and movement (outflow)

All the respondents said they do forage and feed surplus. 97 % of the respondents said they store their surplus while 3 % said they do nothing to it; they leave in their lands to be grazed by their livestock or to be used as compost manure for next planting season. A good example of the plants left in the land after harvest is maize, where the farmer just harvests the corn without cutting down the entire plant. 45 % of the forage and feed is stored in form of silage, while 28 % is kept after being cut and dried. The rest 27 % is kept as a whole plant after drying it. Most of this storage type (as whole plant) was associated with maize plant and sometimes Napier grass.

In terms of storage duration, 45 % of the respondents store the forage and feed for about three months, while 28 % of the respondents store the forage and feed for about one month. 21 % of the

respondents store forage and feed for about six months while respondents who store forage and feed for about one week and between 6 and 12 months represents 3 % each. See table 11 below.

Table 11: Distribution of time respondents store their forage and feed in Alego-Usonga and Ugenya sub counties, Siaya County



Source: Researcher data.

10 % of the respondents who stored their surplus sold some of it to other livestock farmers while 90 % stored their entire surplus to be consumed by their livestock. The marketing strategy is through the word mouth. This is where the seller informs a few of the neighbors and friends and then the information is spread in a snowballing effect. The selling price and quantities follows the same as that of buying explained in the forage and feed inflow section above.

When asked whether forage and feed availability affect the number of livestock, 80 % said 'Yes' while 20 % said 'No'. When asked whether if forage and feed availability was increased (more forage and feed), 63 % said they would increase their number of livestock, while 37 % said they wouldn't

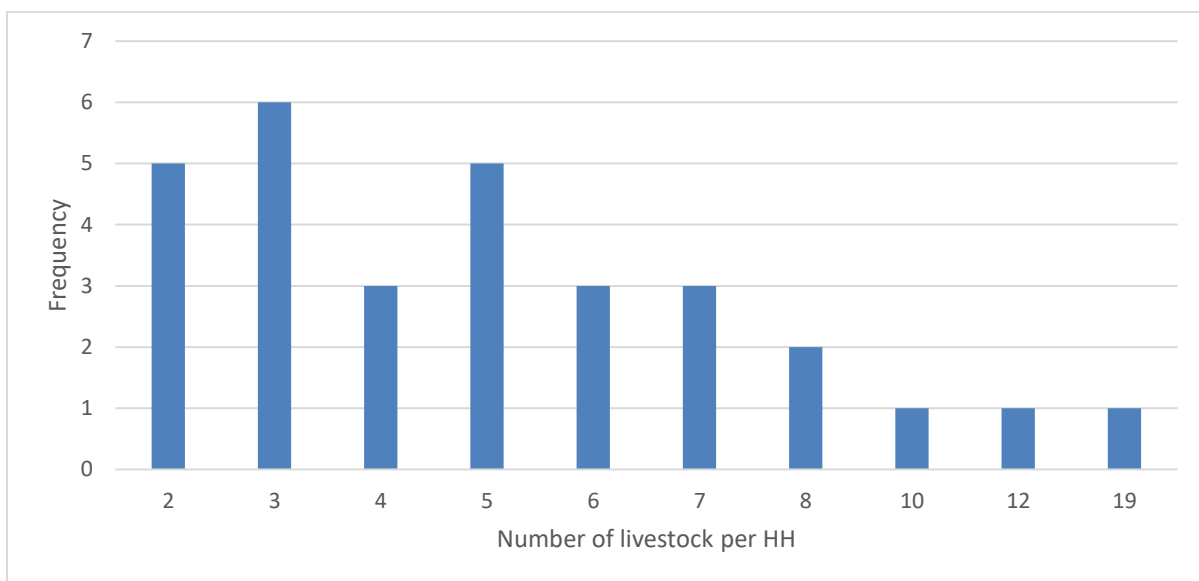
add the livestock number. 82 % of the respondents said that growing forage and feed in their land is not expensive while 18 % said that it is expensive. All respondents said that buying forage and feed is expensive.

Kakamega

Demographic

Out of 12 sub-counties in Kakamega county, two were randomly selected; Matungu and Likuyani. 70 % of the respondents were from Likuyani sub-county while 30 % were from Matungu sub-county. 73 % of the respondents interviewed were women with the rest 27% representing men. In terms of livestock distribution, 20% of the respondents have 3 livestock in their households. Households with 2 and 5 livestock represent 17% of respondents each (those with 2 livestock 17% and those with 5 livestock represent 17%). Households with 4, 6 and 7 livestock represents 10% of the respondents each and those with 8 livestock represents 7% of the respondents. Households with 10, 12 and 19 livestock represents 3% of the respondents each. See figure 7 below.

Figure 7: Number of livestock distribution per household in Matungu and Likuyani, Kakamega County



Source; researcher's data

The population has an average of 5 livestock per household, with standard deviation of 3.577. The number of livestock was not normally distributed with a right Skewness of 2.178 and a Kurtosis of 6.488. See livestock summary figure 8 below.

3 Figure 8: Number of livestock summary statistics

Statistics		
N	Valid	30
	Missing	0
Mean		5.37
Std. Deviation		3.577
Skewness		2.178
Kurtosis		6.488

Feeding system

7 % of the respondents practice zero grazing, while 93 % practice semi-zero-grazing. Respondents practicing semi-zero-grazing graze their cows in the fields as well as enclosed or tethered on a rope and fed from a single feeding point. 80 % of the livestock feeding responsibility is done by the respondent and his family members while the rest 20 % have hired help in charge of feeding the livestock.

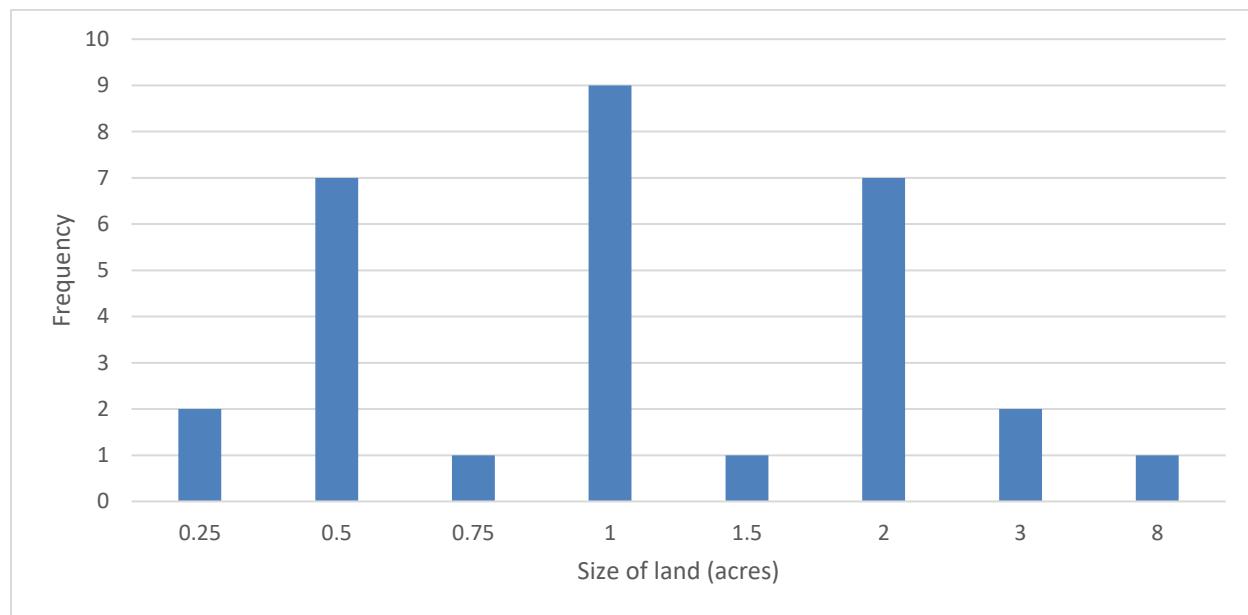
Forage and feed

Land use

Respondents have varying portions of land under livestock forage and feed. 30 % of respondents have about 1 acre under forage and feed. Respondents with 0.5 and 2 acres represent 23 %

respondents each. Respondents with 0.25 and 3 acres represents 7 % of the respondents each while those with 0.75, 1.5 and 8 acres represent 3 % of the respondents. See figure 9 below.

Figure 9: Distribution of land under livestock feeds and forages



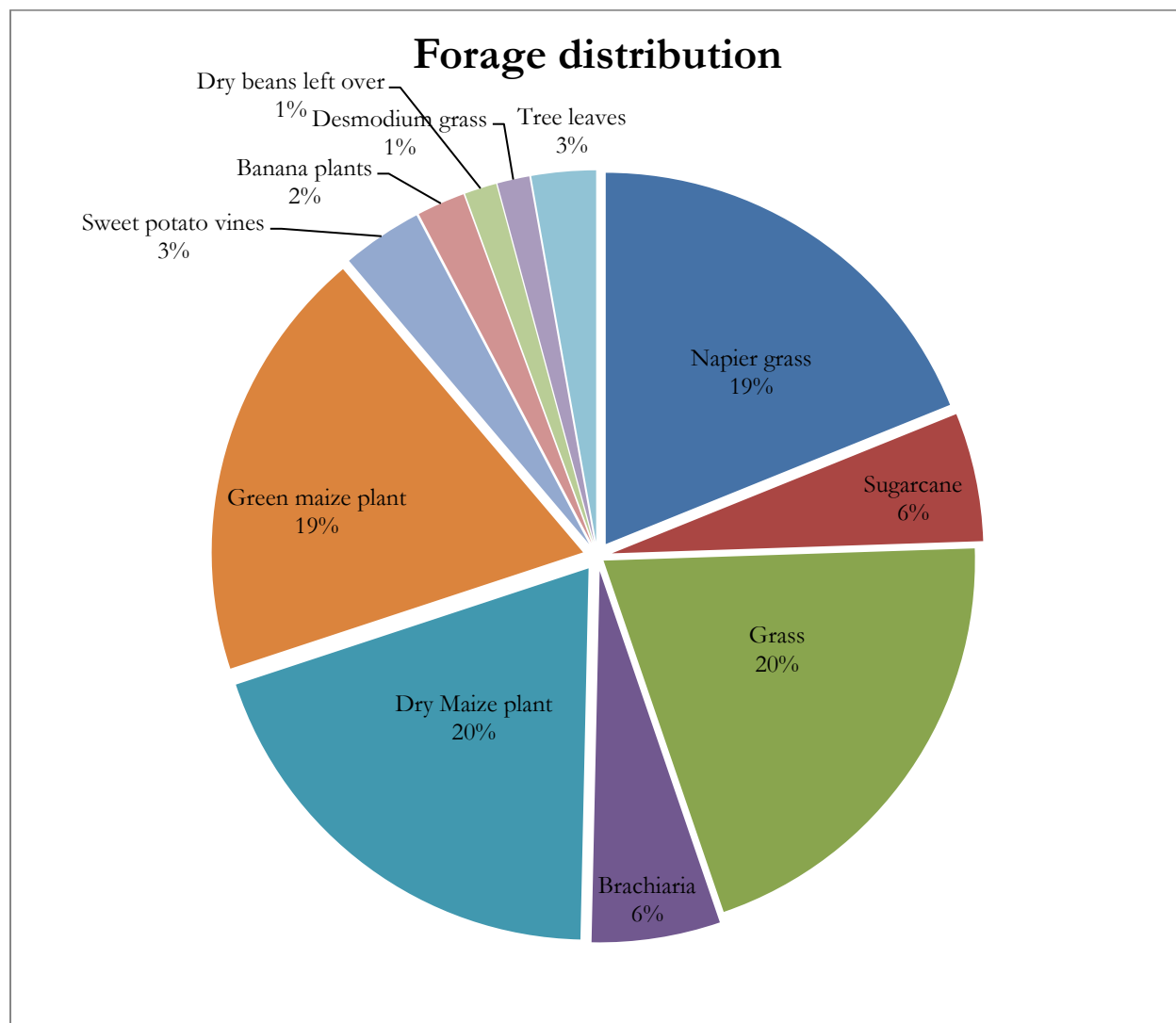
Source: Researcher's data

Types of forage and feed

Based on this research, most livestock feed on crop left overs as compared to forage and feed that is planted purely for animals. Crop left overs include maize plants, sweet potato vines, banana plants, beans plants, sugar cane tops among others, while those planted purely to feed livestock include Napier grass, grass (field-grazing), Desmodium grass, tree leaves and others legumes. 20 % of the forage and feed fed to respondents' livestock is grass. This is both fields grazing as well cutting and feeding the livestock tethered on a post or in an enclosed shed. Dry maize plant represents another 20 % of the forage and feed fed to respondents' livestock. Napier grass and green maize plant represents 19 % the forage and feed fed to the livestock each. Sugarcane tops and Brachiaria (hybrid grass) represents 6% of the forage and feed each while sweet potato vines tree leaves represent 3 % of the forage and feed fed to the respondents' livestock each. Banana plant (stem and leaves)

represents 2 % of the forage and feed while dry beans plant left over and Desmodium grass represents 1 % of the forage and feed fed to the livestock each. See table 12 below.

2 Table 12: Distribution of forage and feed consumed by respondents' livestock in Matungu and Likuyani, Kakamega County

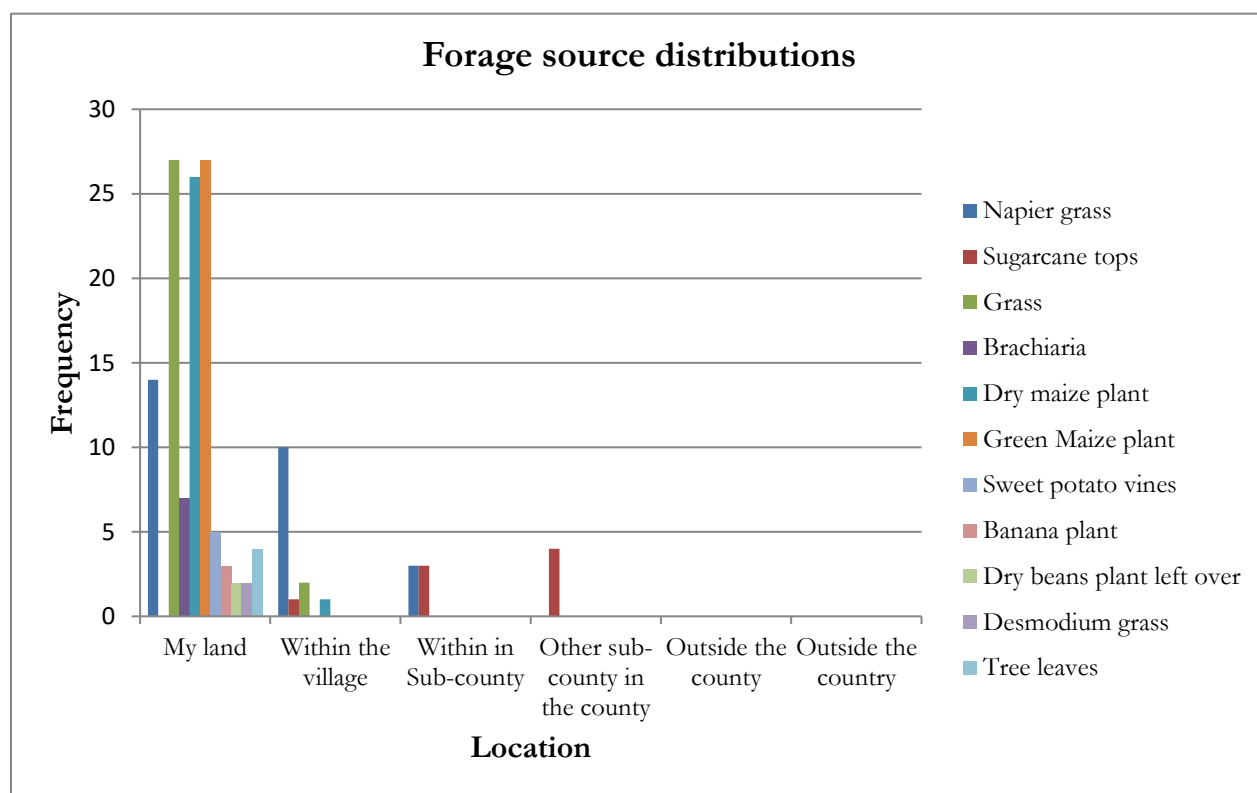


Source; researcher's' data

Source of feed (Inflow)

In general, most of the forage and feed comes from respondents land, with exception of sugarcane tops, which most comes from other counties within the country. See table 13 below.

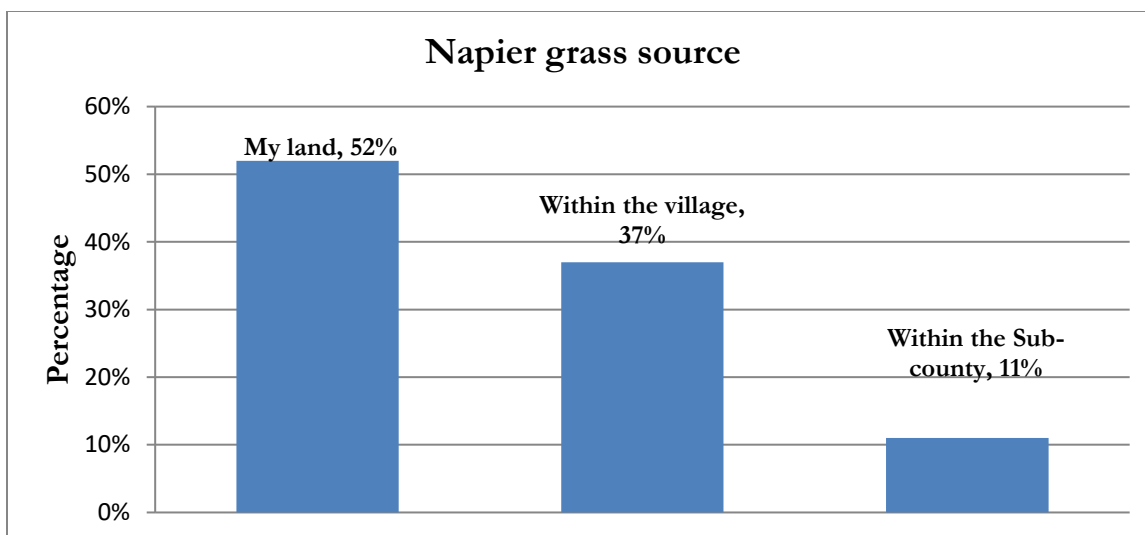
3 Table 13: Distribution of forage and feed type and source, in Matungu and Likuyani sub-county, in Kakamega County.



Source: Researcher's data.

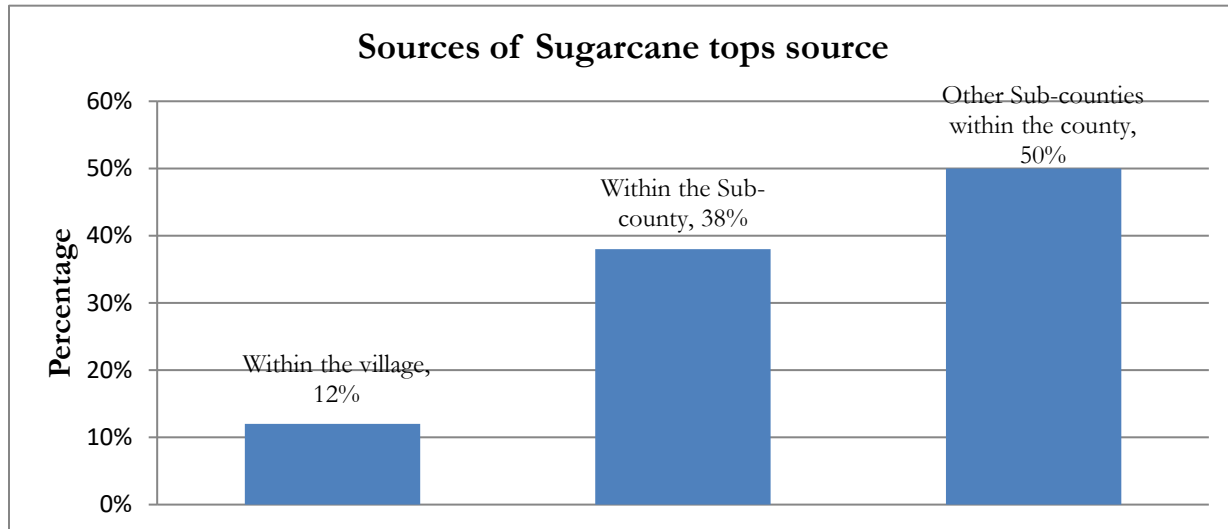
Napier grass: 52 % of the Napier grass fed to respondents' livestock comes from respondents' family land, while 37 % comes from within the village and the rest 11 % within the sub-county (Matungu and Likuyani). See the table 14 below.

Table 14: Distribution of sources of Napier grass fed to Matungu and Likuyani residence in Kakamega County



Sugarcane tops (crowns): 50% of the Napier grass tops of the sugarcanes come from other sub-counties within the county, while 38% comes from within respondent cub-counties of residence and the rest 12% comes from within the respondents' village of residence. See table 15 below.

Table 15: Distribution of sources of sugarcane tops fed to Matungu and Likuyani residence in Kakamega County.



Grass (grazing): 93% of the grass grazed by respondent livestock comes from respondents family land while the rest 7% comes from within the village where respondents either grazes in a friend's/neighbors' land or cut the grass to feed the livestock at home.

Dry maize plant: 96 % of the dry maize plant fodder fed on respondents' livestock comes from their family lands, while 4 % comes from within the village either through buying or obtained for free to neighbors.

The rest of forage and feed comes from respondents' land. The forage and feed includes; green maize plants, Brachiaria, sweet potato vines, banana plants, and dry beans plants left over, Desmodium grass and tree leaves.

Quantity and price of the forage and feed bought varies mostly depending on the understanding between the buyer and the seller. Some of the quantities used to buy dry maize plant are a full ox cart ranging from KES 300 to KES 700. Other buys forage and feed like Napier grass based on the size the land under Napier grass, say an eighth for KES 2000. Other measures includes bundles of KES, 50, 100 and KES 150, especially for Napier grass as well as sugar cane tops.

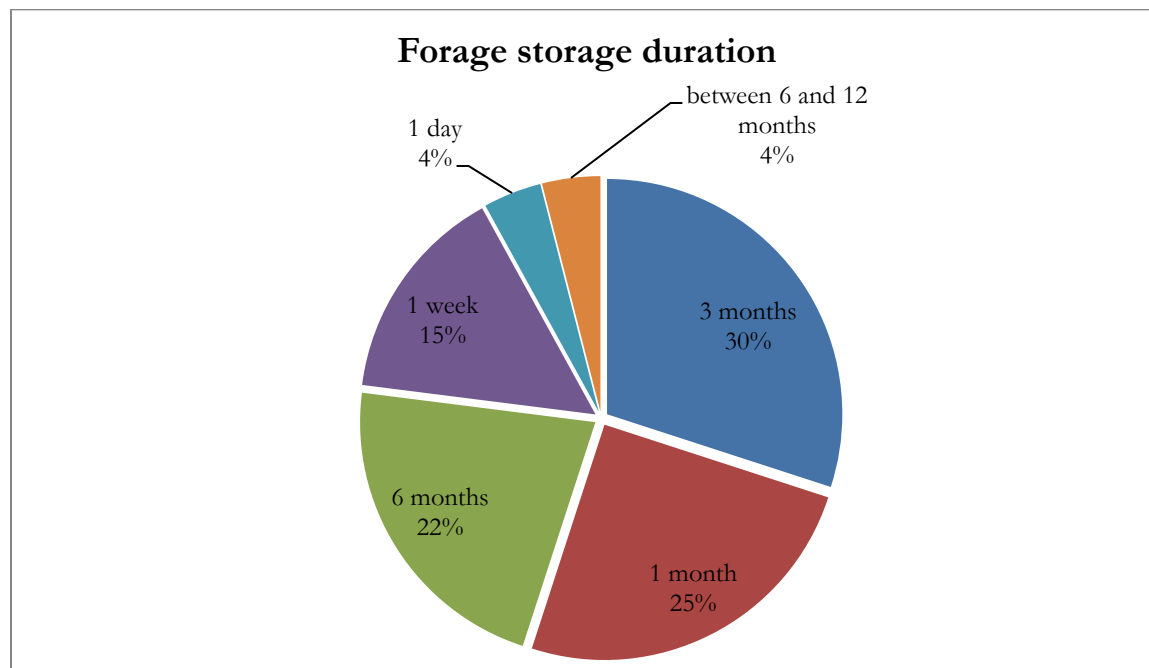
The forage and feed is bought as both green and dry. None of the respondents said they buy forage and feed in others forms such as hay.

Forage and feed storage and movement (outflow)

97 % of respondents said they usually get forage and feed surplus. 93 % of respondents with surplus forage and feed said they store it while 7 % do nothing to the forage and feed; to be grazed by livestock from the farm or to be re-used as compost manure for the next planting season. 59 % of respondents store forage and feed as silage while 19 % cut and store it dry. 22 % of the respondents store the forage and feed as whole plant, especially maize plant stored in the form it was harvested in.

30 % of the respondents store the forage and feed for about three months while 25 % of the respondents store the forage and feed for about one month. 22 % of the respondents store the forage and feed for about six months while 15 % store it for about one week. Respondents storing forage and feed for about a day and between 6 and 12 months represents 4 % of the respondents each. See table 16 below.

Table 16: distribution of duration of forage and feed storage in Alego-Usonga and Ugenya sub counties, Siaya County



Source: Researchers data.

87 % of the respondents said they don't sell their surplus while 13 % sell some of their surplus to other farmers within their village. All their customers come from the same village that the respondent resides in. Their marketing strategy is usually by word of mouth to their neighbors who spread the news to their neighbors in a snowballing fashion.

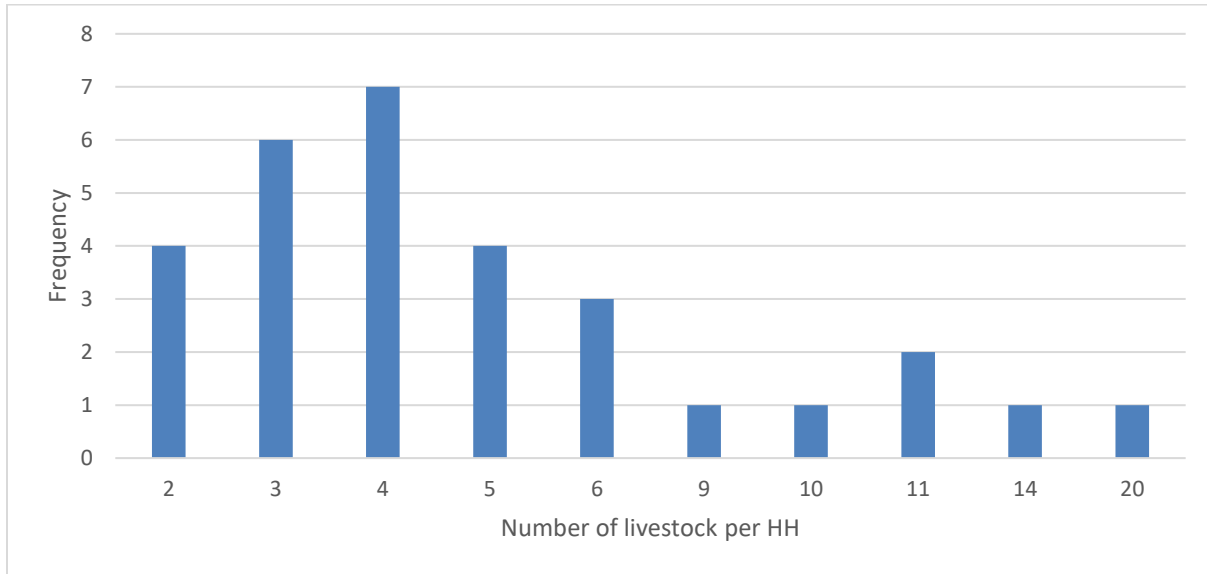
77 % of the respondents said that availability of forage and feed determines the number of livestock to keep, while 23% believes the number of livestock kept depends on other factors. 70 % of the respondents said they would increase the number of livestock they is forage and feed availability increases, while 30 % said forage and feed increase will not have effect on the number of livestock. While all the respondents said that growing forage and feed is not expensive, almost all the respondents (96 %) said buying forage and feed is an expensive engagement. The research revealed a general suggestion to reduce the price of forage and feed.

Busia

Demographic

2 out the 6 sub-counties in Busia County were selected at random for this study; Nambale and Funyula, where each sub-county had equal numbers (50 % each). 40 % of the respondents were women and the rest 60 % were male. Women were not the household heads while men were household heads responsible to major decisions in the homestead. In terms of livestock distribution, 23 % of the respondents have 4 livestock in their households while 20 % of the respondents have 3 livestock each in their households. Households with 2 and 5 livestock represent 13 % of the respondents each respectively. 10 % of the respondents have 6 livestock in their households while 7 % of the respondents have 11 livestock in their households. Households with 9, 10, 14 and 20 livestock represents 3 % of the respondents each respectively. See figure 10 below.

Figure 10: Livestock distribution



Source: Researcher data

The population has an average of 6 (5.57) livestock per household, with a standard deviation of 4.066. The number of livestock was not normally distributed with a right Skewness of 2.06 and a Kurtosis of 4.685. See figure 11 below.

Figure 11: Summary statistics of livestock distribution.

Statistics		
Livestock Number		
N	Valid	30
	Missing	0
Mean		5.57
Std. Deviation		4.066
Skewness		2.059
Kurtosis		4.685
Minimum		2
Maximum		20

Feeding system

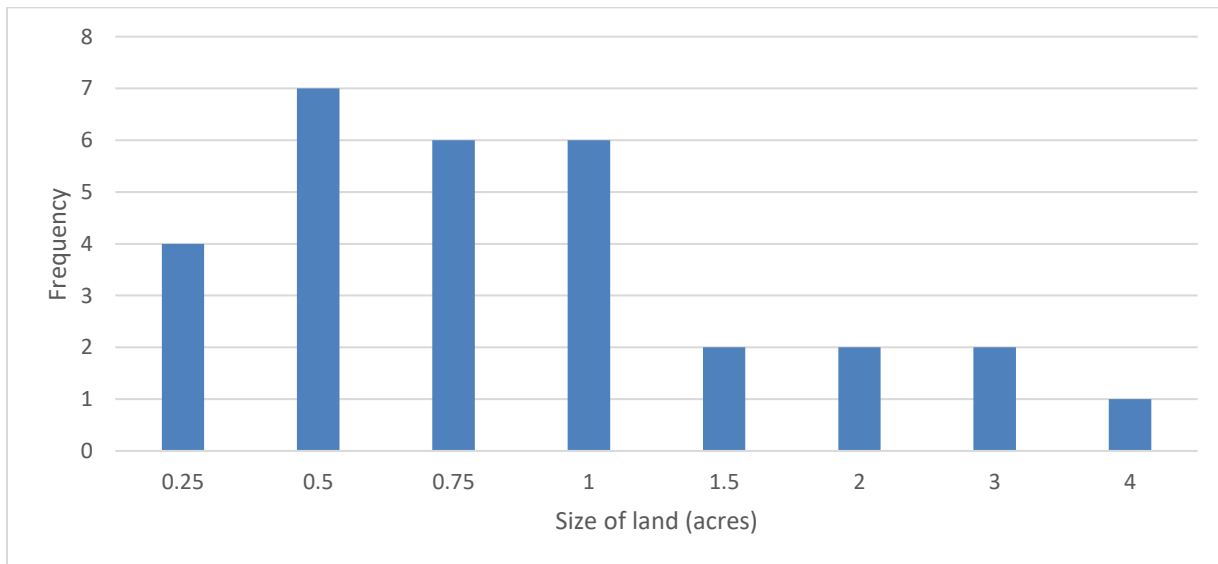
87 % of the respondents practice a semi-zero-grazing while the rest 13 % practice zero grazing. 53 % of the respondents feed the livestock themselves while 40% are assisted by their family members and the rest 7% the feeding responsibility is taken by hired help.

Forage and feed

Land use

Respondents in Funyula and Nambale sub-counties have an average of 1 acre of land under livestock forage and feed. 23 % of the respondents have 0.5 acres of their family land under forage and feed. Respondents with 0.75 acres and 1 acre of land under forage and feed represents 20 % each respectively while the 13 % of respondents have 0.25 acres of their land under forage and feed. Respondents with 1.5 acres, 2 acres and 3 acres of their land under forage and feed represents 7% each respectively. The rest 3 % of the respondents have 4 acres of their land under forage and feed. See figure 12 below.

Figure 12: Distribution of land under forage and feed in Funyula and Nambale sub-county in Busia County.

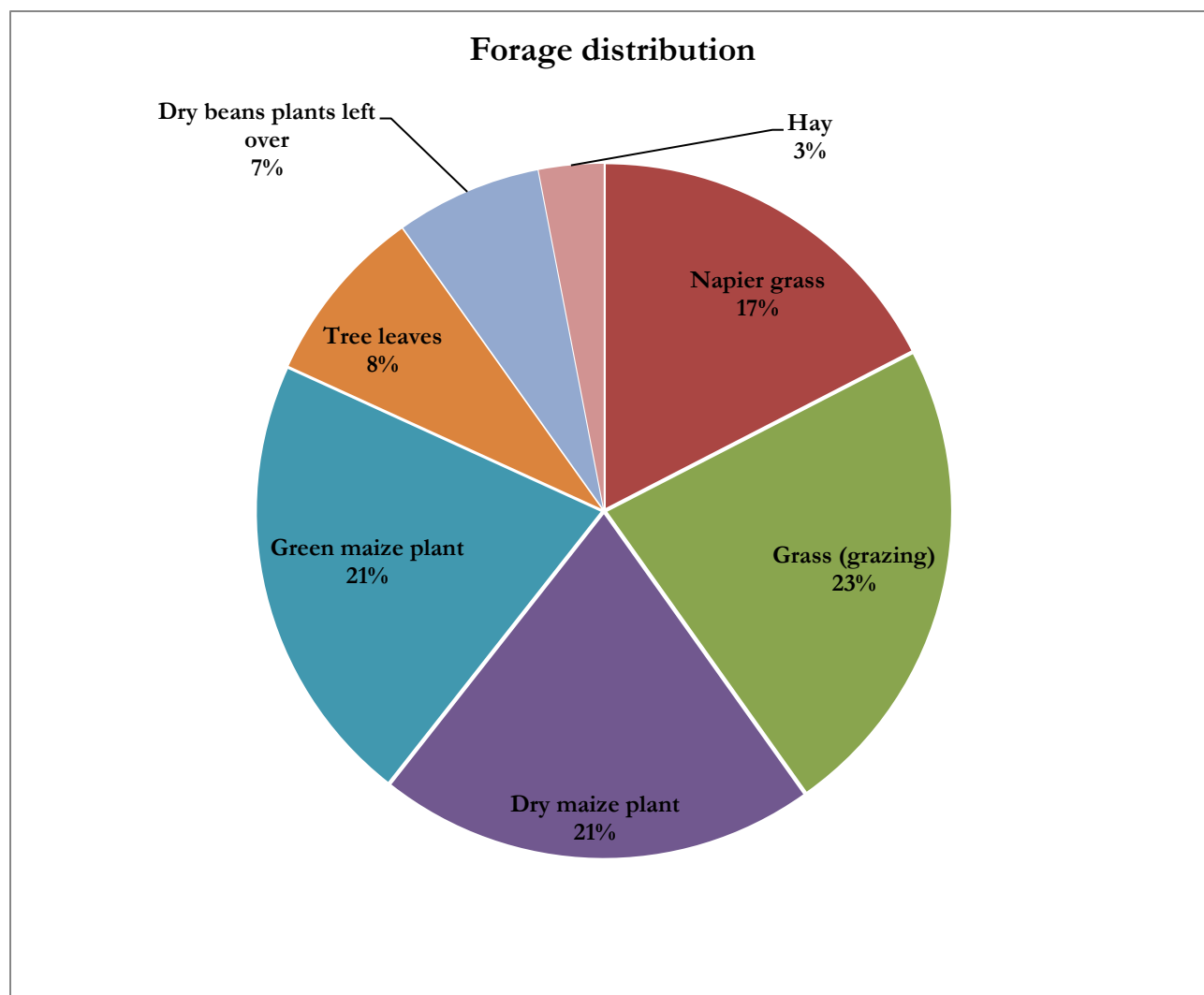


Source: Researcher's data

Types of forage and feed

Livestock feed in Busia County is mostly made up of the crop plants and crop plants residues; maize, beans. Grazing (grass) represents 23 % of the forage and feed while dry maize plants and green maize plants represent 21 % each respectively. Napier grass represents 17 % of the forage and feed while tree leaves 8 %. Dry beans plants residues represent 7% of the feed, while hay represents the rest 3%. See table 17 below.

Table 17: Distribution of feed types in Nambale and Funyula sub-counties in Busia County.

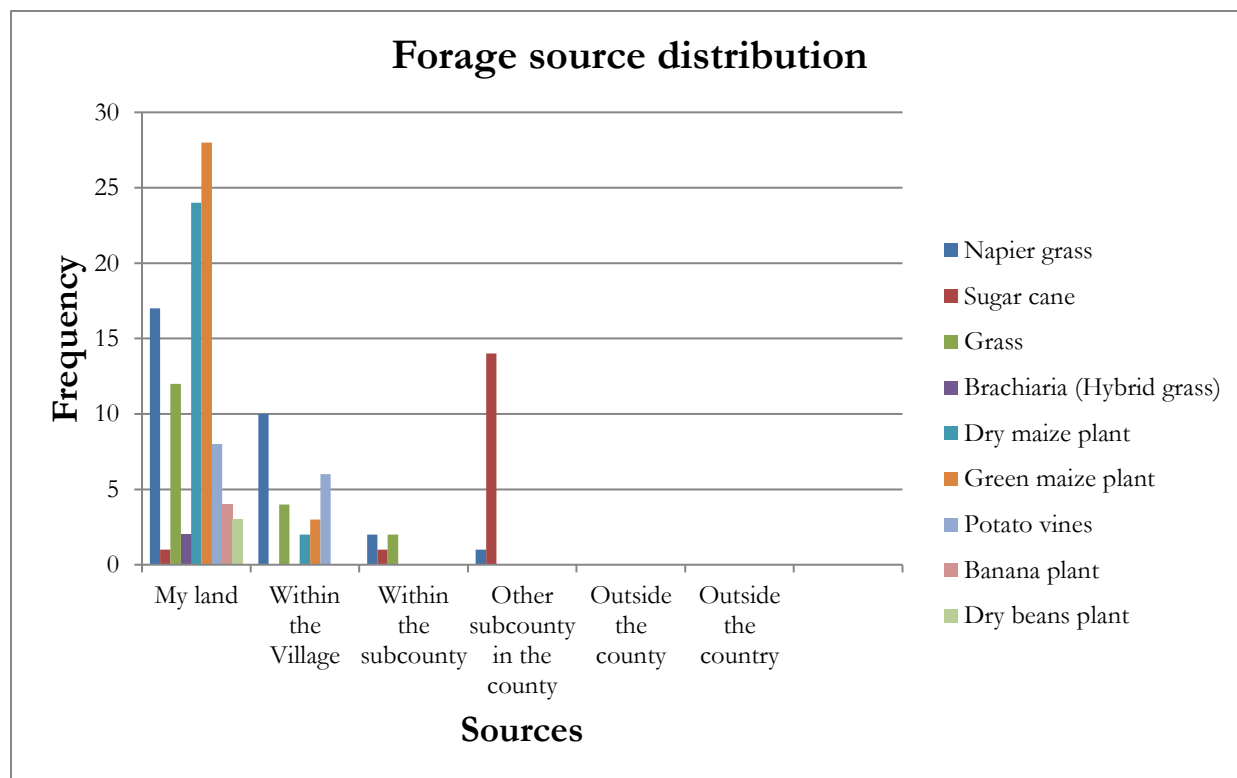


Source: Researcher's data

Sources of forage and feed (inflow)

Most of the forage and feed is grown by respondents in their land. 63 % of forage and feed comes from respondents' family land while the rest 37% of the forage and feed comes from other sources See table 18 below.

4 Table 18: Distribution of forage and feed sources in Nambale and Funyula sub-counties in Busia County



Source: Researcher data.

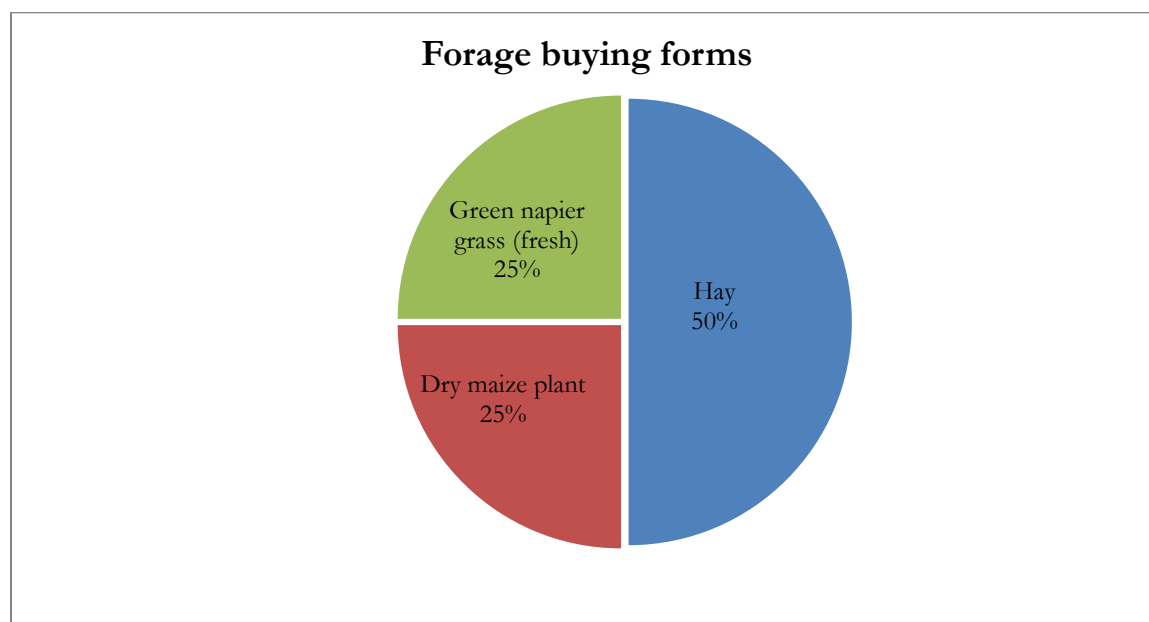
Napier grass; 71 % of the Napier grass fed to respondents livestock comes from respondents lands while 29 % comes from within the respondents' village of residence.

Dry maize plant; 93 % of the dry maize plant comes from respondents land while the rest 7 % comes from other sub-counties within Busia County.

All the hay fed to respondents’ livestock comes from other sub-counties within Busia County. All the other types of forage and feeds consumed by respondents’ livestock come from respondents land as shown in the figure 4 above. They include dry beans plants left over, tree leaves, green maize plants and grass (grazing).

50 % of the feed bought in form of hay, while 25 % is bought as dry maize plant while the rest 25 % is bought as green Napier grass (fresh). See table 19 below.

Table 19: Distribution of forage and feed buying forms in Nambale and Funyula sub-counties and Busia County.



Source: Researcher’s data.

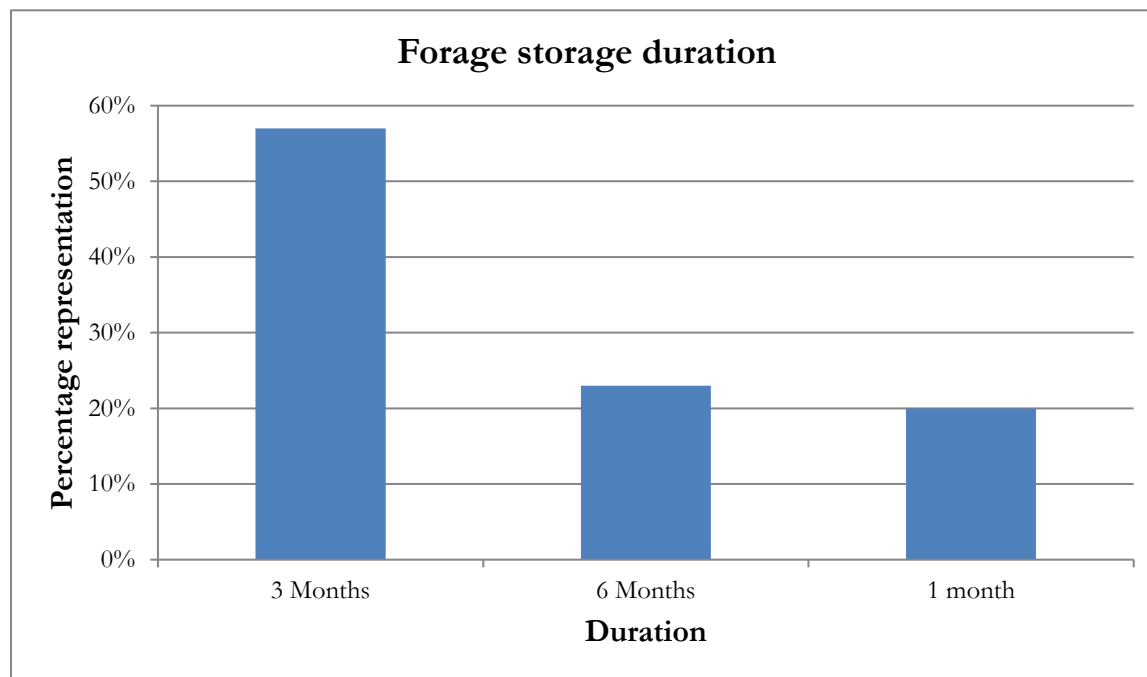
Hay is bought in bales, which are usually 40 to 45 Kilograms with a price range of KES 150 to 300 per bale. Dry maize plant is measured in different forms including a full ox cart, which range from KES 900 to KES 1000. Napier grass is measured using bundles of different quantities, which ranges from KES 100 to KES 200. The weight of the dry maize plants and Napier grass is not constant and it’s measured by way of observation (eyes). Napier grass is also measured as a portion of land, where

the seller shows the buyer a portion where he/she will harvest, and they agree on a fee. The fee highly varies depending on the understanding between the buyer and the seller.

Forage and feed storage and movement (outflow)

All the respondents said they get surplus at some point in the year, and the respondents also said they store their surplus to either feed their livestock at a later date or sell it to other farmers. 57 % of the respondents said they store their forage and feed for about three months, while 23 % of the respondents store forage and feed for about six months and the rest 20 % said they store forage and feed for about one month. See table 20 below.

Table 20: Distribution of duration forage and feed is kept for in Nambale and Funyula sub-counties in Busia County



Source: Researcher's data.

57 % of the surplus is just cut and dried and stored like that while 17 % of the forage and feed surplus is stored in form of hay, and the rest 27 % is stored in form of silage.

20 % of the respondents with surplus said they sell it to other farmers while 80% feed it to their livestock until depleted. All the customers forage and feed comes from within respondents' village of residence. Prices for dry maize plants range from KES 900 to KES 1000 for a full ox cart, while the rest depends on buyer and seller bargain understanding. The marketing strategy for this forage and feed is usually by word of mouth, where neighbors and friends assist in informing about the presence of forage and feed for sale.

When asked whether availability of forage and feed determines the number of livestock kept, 80% said it does while 20 % said it doesn't and alluded that forage and feed is always available. When asked whether forage and feed growing (planting) forage and feed is expensive all the respondents said it's not. When asked whether buying forage and feed is expensive, all the respondents agreed it is an expensive engagement.

CHAPTER IV: CONCLUSIONS AND DISCUSSION

In Kenya, demand for livestock and livestock products keeps on growing with time, and expected to double by 2050. This has therefore created demand for forage and feed. Farmers in Kenya continue to feed inadequate forage and feed to their livestock where most of the livestock diet is comprised of crop residues. This diet seems to revolve around three major feeds; Maize plants which represents most of the diet, grazing (kikuyu grass among other grass) and Napier grass. Most of their forage and feed comes from their family land, which rely mainly on rainfall. This exhibits underutilization of agricultural lands in terms of forage and feed production.

There exists a variety of forages that would do well in western Kenya climate, yet farmers have not adopted it fully. There is relative better amount of rainfall received in these areas as compared with other parts of Kenya leading to the area being termed as 'Kenya food basket' yet farmers have not fully utilized this aspect in forage production. It can be assumed that farmers will be willing to try different forage varieties in order to boost their animal products quality and quantity. All the farmers interviewed had reserved at least a portion of land that was under forage, but mainly under grazing grass. Based on this study, planting (growing) forage was considered to be an inexpensive engagement, it's therefore expected that livestock farmer would have utilized this aspect by having a variety of forages in their lands, which is not yet common practice. This could therefore mean that forage production and trade potential is in the seeds/seedlings/tubers market, coupled with a community

sensitization of the benefits of the forages in terms of quality and quantity for on farm feeding as well as a commercial product under precondition of land availability.

Most of the farmers depend on forage and feed from their land, but some buy forage and feed from other farmers (sellers). The main forage and feed traded are Napier grass and maize crop residues. 43 % of Napier grass in Bungoma comes from other farmers land (traded). 35 % of Napier grass in Siaya, 48 % of the Napier grass in Kakamega and 29 % Napier grass in Busia comes from other farmers. The quantities vary and are sold in bundles, ox carts and standing material (a portion of planted land). The prices equally vary depending on the buyer's and seller's agreement (bargain). Maize crop residues, are only sold during the harvest season and slightly in January when dry season sets in. Similar to Napier grass, the quantity and pricing varies depending on the bargain between the buyer and the seller. Other feeds and forages are traded in limited incidences.

Therefore, there is a poor entrepreneur strategy for forage and feed in these counties. Standard measure of quantity and quality of forage and feed and their respective prices are unreliable but functional. A farmer in a different sub-county is able to buy same amount of feed for almost 70% of another sub-county price of the same quantity; KES 100 for a bundle of Napier grass in Kinduyi sub-county as compared to almost similar bundle going for KES 150 in Nambale sub-county. This price is sometimes different within the sub-counties in the same county. Quantity and price of forage and feed greatly varied, making it difficult to calculate the cost and the revenue expected from sale of forage and feed. There is a poor marketing strategy for forage and feed as well, where farmers use a word of mouth to spread the news about sales and purchases of forage and feed, which limits the market area eventually, pushes the price of forage and feed downward due to surplus and reduced demand. A standard quantity and quality measure coupled with a more elaborate marketing strategy would go a long way in improving the sale and purchase of forage and feed.

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