BEEF VALUE CHAIN ASSESSMENT FOR SOUTH-WEST MAU, KENYA

Prepared for:

Initiative for Sustainable Landscapes,

Program of IDH, The Sustainable Trade Initiative

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ACRONYMS AND ABBREVIATIONS

ASALS	Arid and Semi-Arid Lands
ASDSP	Agricultural Sector Development Support Programme
CFA	Community Forest Association
CIDP	County Integrated Development Plan
CRV	Central Rift valley
ECF	East Coast Fever
FGDS	Focus Group Discussions
GOK	Government of Kenya
IDH	The Sustainable Trade Initiative
ISLA	Initiative for Sustainable Landscapes
KFS	Kenya Forest Service
KMC	Kenya Meat Commission
Kgs	Kilograms
Ksh	Kenya Shillings
KWS	Kenya Wildlife Service
UNEP	United Nations Environmental Programme
S1	Study site 1 (Kiptororo ward)
S2	Study site 2 (Tinet ward)
S2	Study site 3 (Kiptagich ward)

EXECUTIVE SUMMARY

IDH, The Sustainable Trade Initiative (IDH), has implemented a private-public partnership, the Initiative for Sustainable Landscapes (ISLA), focusing on South West Mau Forest landscape. IDH initiated the beef cattle assessment study in October, 2016 in and around the South West Mau Forest block, which has ample livestock grazing in the area. This is a main driver of deforestation. The main purpose of this assessment is to find ways of reducing the livestock numbers.

The study covers villages in three wards – Kiptororo, Tinet and Kiptagich in Nakuru County – next to South West Mau Forest in the North-Eastern part. The primary data used in this study stems from qualitative research conducted in selected villages in Kiptororo, Tinet and Kiptagich. The data were collected through guided interviews with key actors in the beef value chain.

At the production stage, farmer Focus Group Discussions (FGDs) were held and key informant interviews with individual farmers and local leaders conducted. At the marketing stage, cattle traders and slaughter slabs were interviewed, as were informal and formal butcheries. Personnel in The Ministry of Agriculture and Livestock's Department of Veterinary also provided valuable information on beef production and marketing in the respective wards. In addition to qualitative research, data from different national representative surveys was used to inform our discussion.

The research conducted indicates that households in these wards or study sites practice subsistence mixed farming on less than six and a half acre plots. Most of these households depend on livestock as their main source of livelihood, and the livestock depend on the forest for grazing. Zebus and crosses are the main cattle breeds, preferred because of their ability to tolerate harsh forest conditions. Livestock of families living near the forest conform to natural cattle breeding and own less than 30 animals per home. The small herd sizes coupled with low productivity and disease prevalence limit cattle commercialization.

On the other hand, cattle domiciled in the forest do not conform to the natural breeding pattern because they are bought from individual farmers and at auctions held by cattle traders. The traders have alternative sources of income and live far away from the forest area.

With regards to livestock, the current population grazing in the forest indicates there has been an increase compared to previous years. As a result, forest degradation is rife due to overstocking. Majority of cattle in the forest include oxen and steers. The number varies based on the time and season of the year when they are brought in. The annual average net income per herd for indigenous breeds is Ksh. 11,800 while for cross breeds is Ksh. 44,300. Cross breeds are more profitable though they are less tolerant of the harsh forest conditions.

Illegal activities are prevalent in the study area. Illegal charcoal burning, logging, stock theft and wildlife poaching are common. However, the incidences have reduced as a result of alternative sources of income in the affected areas. Stock theft is conducted in one of two ways: Transit through the forest to avoid security detection and theft within herds in the forest.

In view of this, and considering ISLA objectives, it is recommended that a number of strategies be implemented to reduce the number of livestock grazing in the forest. The consultants recommend the following strategies:

- Alternative sources of livelihoods and viable production systems
- Strengthening of Community Forest Association(CFA) to facilitate in forest regeneration lead by Kenya Forest Service (KFS)
- Support improvement of KFS in order to effectively perform their mandate of conservation and enforcement
- Domiciled cattle should be banned or restricted in specific areas to allow a participatory regeneration plan by all stakeholders involved in the forest conservation
- Poaching and stock theft handled by the respective security agencies in the region

The study's Terms of Reference (ToR) are in Annex 1 of this report. The report contains a proposal to reduce livestock grazing deep in the forest, and it recommends ways to develop alternative sources of livelihood for neighbouring residents to reduce dependence on the forest.

ACKNOWLEDGEMENTS

This study is the result of efforts by many individuals. It is difficult to acknowledge everyone's input, but we are particularly indebted to the following people who played a direct role in the production of the report.

Our thanks go firstly to Dr. Kipkirui Langat, Senior Stakeholder Manager (also ISLA Kenya Board Chair) and Winnie Mwaniki (ISLA Kenya Senior Program Manager), who have relentlessly, and in a multitude of ways, supported the realization of the study during its long completion process, and also provided many insightful comments on each successive draft of the report.

Secondly, to Christian Lambrechts (Executive Director, Rhino Arch Charitable Trust) for facilitating the flight for an aerial view of the grazing fields and livestock domiciled in South West Mau Forest.

We are indebted to Alfred Kiptoo Cheruiyot (Senior Forester) and his staff at KFS Ndoinet and Mr. Too (Senior Forester) for their cooperation during the study; Mr. Richard Tuei of Ndoinet Forest station for facilitating FGDs and in-depth views of the activities in the forest; George Kairu, Titus Koech, John Malemo and Peter Lemaku (KFS). Without their invaluable contributions this report could not have been realized. Equally, we are very grateful to Samwel Maridany (Chair Ndoinet CFA) and Ambrose Malel (Kibaraa), who graciously volunteered their time to sit down with the research assistants for interviews throughout the selected villages and facilitated introductions with the local communities.

The study team would like to extend sincere gratitude to the livestock producers, livestock traders, middlemen/brokers, transporters, slaughterhouse/slab operators, butchers, livestock service providers and others, who spared their time and willingly provided information and data that formed the basis of this report.

Last, but certainly not least, we are extremely grateful to the communities in Kiptororo, Tinet and Kiptagich wards for their reception and willingness to provide information on South West Mau Forest.

CHAPTER ONE

1.0 Introduction

The Mau forest complex is Kenya's main water tower, feeding a range of the country's major water arteries that extend as far as Lakes Turkana, Natron and Victoria. Covering over 400,000 hectares, the Mau forest complex supports critical economic activities including hydropower generation, tourism and agriculture. It represents the largest remaining continuous block of mountain indigenous forest in East Africa. It borders Kericho to the West, Nakuru to the North and Narok to the South, and comprises of South West Mau, East Mau, Transmara, Mau Narok, Maasai Mau, Western Mau and Southern Mau.

South western Mau and Eastern Mau form the largest blocks of the Mau forest complex covering 61,214 and 30,620 hectares, respectively. These two forests provide environmental services essential for crop production, continuous river flow and favourable micro-climate conditions. The forests are also good for medicinal plants, firewood and grazing for the surrounding community.

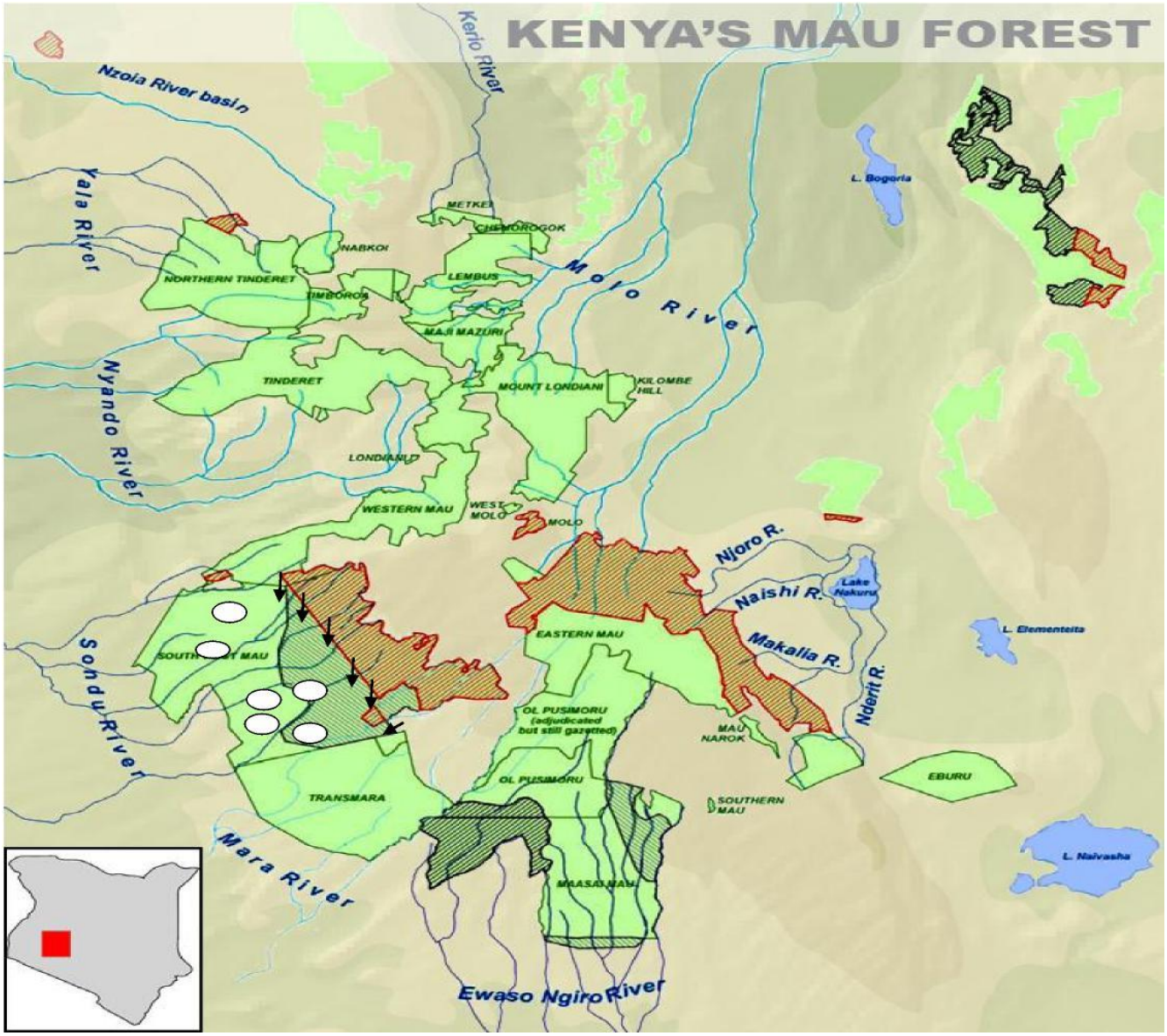
Unfortunately, forest excisions, encroachments and conversion of land for agricultural use have reduced the forest cover. These have had a negative impact on the landscape leading to threats on various sectors that rely on the climatic conditions and biodiversity that the Forest complex provides. So, in spite of its national importance, many portions of the Mau forest complex have been deforested or degraded. Much of this damage has taken place in the past few decades. Excision of forest reserves and continuous widespread encroachment has led to the destruction of over 100,000 hectares of forest since 2000, representing roughly one-quarter of the Mau complex area (UNEP 2009a).

To help restore the Mau forest complex, ISLA, Kenya and several other stakeholders intend to rehabilitate and conserve South West Mau. One of the identified threats to sustainability and reforestation efforts is the large number of livestock grazing in the forest from neighbouring communities and livestock traders. ISLA secretariat, which is made up of the IDH, Kenya team, developed Terms of Reference (ToR) for "Beef value chain assessment." Likewise, recommendations for the North-Eastern part and inside South west Mau, Kuresoi and Ndoinet blocks, targeting the communities living near the forest boundary have been presented.

The assignment for implementation was awarded to Dr. Richard Korir as the lead consultant. He engaged a core team of local experts in the region, and in October and November he carried out a field study of the area complemented by interviews and discussions with key stakeholders.

A map of the Mau forest complex before excision in 2001 is shown in figure 1 below.

Figure 1: Overview map of Mau complex forest



Source: Michael Burnham and Nathanial Gronewold

: Cattle domiciled in the forest.

: Movement of Livestock grazing in the forest (home –night bomas)

CHAPTER TWO

2.0 The Initiative for Sustainable Landscapes (ISLA)

ISLA was configured by IDH through co-funding from the Ministry of Foreign Affairs in Netherlands. The program begun in 2014 and will run up to 2018. It aims to connect public and private stakeholders in a coalition to jointly formulate solutions for and invest in sustainable land and water management in affected landscapes.

IDH works with public, private and civil society stakeholders, providing co-funding of up to 50%, to implement agreed joint interventions. Co-investment is provided by both private and public stakeholders. The relationship is not, however, purely financial. IDH is a partner providing knowledge, exchanging ideas and making sure the projects contribute to overall landscape goals.

IDH works through implementing partners to execute projects in the landscape, and brings experience in convening coalitions of the public and private sector on sustainability and market transformation. In close cooperation with IDH's in-country and global network of partners, the program aims to:

- Convene public-private partners in multi-stakeholder governance structures
- Design business-driven interventions and investment plans that can be scaled-up
- Co-fund interventions to sustainably manage landscapes
- Share best practices and learn with a global network of experts and knowledge partners

The ISLA program in Kenya is focusing on the South West Mau Forest Landscape, which is part of the Mau forest complex. The South West Mau region is the fourth largest river basin that drains into Lake Victoria, covering an area of 3,470km2. The landscape is characterized of urban and sub-urban settlements that practice diverse land use including forestry, large and small scale agriculture, as well as running agro-based industries and hydroelectric power generation.

The region is important economically and ecologically with favourable environmental conditions good for hydropower generation, crop and agro-forestry production, supporting local communities and providing grazing opportunities for livestock and wildlife. However, these human activities and the increase in their scale and intensity over the years means pressure on natural resources and threats to the ecosystem's quality, especially due to hydrology, biodiversity and general ecological functions and processes on the landscape.

ISLA is tackling conservation challenges in South West Mau through multi-stakeholder approach with a strong involvement from the government. The program aims to support the establishment of financially viable public and private governance models, and institute sustainable, managed landscapes by 2018

CHAPTER THREE

3.1 The Kenyan beef sector

3.1.1 Beef Production in Kenya

Beef cattle production in Kenya is mainly practiced in arid and semi-arid areas, which cover about 80% of the country's land area. The area supports six million beef cattle and accounts for 70% of the total beef meat consumed in the country. The livestock sector employs approximately 50% of Kenya's agricultural labour force (Gitu, 2005), which is about 10 million people, and accounts for 4.4 to 5.4% of the gross domestic product. It's also the primary source of livelihood for an estimated six million pastoralists and agro-pastoralists that live in the country's arid and semi-arid lands (ASALs). The sub-sector supports the feeds, drugs, vaccines and equipment manufacturing industries, and provides raw materials to the agro-processing industries (GOK, 2010).

Meat consumption in the country is between 15 and 16kg of red meat (meat and offal from cattle, sheep, goats and camels) per capita annually. The national red meat consumption is approximately 600,000 metric tons based on census 2009 population. Beef cattle are the major source of red meat accounting for 77% of off-take for slaughter (Behnke & Muthami, 2011).

Over 80% of the red meat consumed in Kenya comes from cattle kept by pastoralists in the country, and from neighbouring countries which account for an estimated 20 to 25% if this. These countries include Ethiopia, Somalia, Tanzania and Uganda, making Kenya a meat deficit country (Behnke & Muthami 2011). Ranches provide an additional 2%, while the highlands produce between 10 and 13%.

There are a number of live animals exported to Middle East countries, mainly South Arabia and Yemen. Exporters and individual ranchers also export the same to Mauritius, Burundi (mainly goats), and Uganda. Additionally, the newly re-operationalised Kenya Meat Commission (KMC) and private meat exporters who use KMC's facilities for a fee also export small volumes of meat as well as Choice Meats (a subsidiary of Farmers Choice).

Key contributors in the beef value chains include input suppliers (forage producers), pastoral producers, livestock traders, ranch owners and managers, slaughterhouse, butchery and processor operators, meat packers and exporters. Important service providers, who are not technically value chain actors, include veterinarians and community animal health workers, transportation providers and brokers, who negotiate between pastoralists and traders, and play an important price-setting role. The value chains are primarily geared toward the domestic market, which consumes approximately 99% of domestic production.

3.1.2 Cattle population in Kenya

The dairy and beef cattle populations generally increased by 17.5% and 30.9% from 2010 to 2013, respectively. Growing demand for beef and milk as a result of budding populations and urban centres was responsible for this. However, the

population for both dairy and beef cattle declined from 2013 to 2014 due to drought experienced in the country. The figures in table 1 below display these changes.

Table 1: Dairy and Beef Cattle Population in Kenya 2010 – 2014

Year	Dairy cattle	Beef cattle
2010	3,673,212	10,307,309
2011	3,739,161	10,388,135
2012	4,340,278	12,874,571
2013	4,505,582	13,632,918
2014	4,316,153	13,495,692

Source: ERA, 2015

3.1.3 Sheep and goat population

The population of sheep and goats in the country generally increased from 2010 to 2014. The increase recorded during the period was 60% for sheep and 39% for goats as shown in table 2.

Table 2: Sheep and Goat population in Kenya 2010 – 2014

	Sheep		Goats	
Year	Wool	Hair	Dairy	Meat
2010	788,775	10,046,589	257,643	17,920,736
2011	798,289	10,140,621	294,279	17,694,066
2012	1,590,387	14,525,314	310,266	21,871,669
2013	1,094,018	15,506,893	360,495	24,276,898
2014	862,455	16,557,752	389,326	25,040,732

Source: ERA, 2015

3.1.4 Beef production systems in Kenya

There are four main beef production systems in Kenya.

- Nomadic pastoralism
- Ranching

- Agro pastoralism
- Feedlot system

3.1.4.1 Nomadic Pastoralism

Nomadic pastoralism involves herding livestock in search of greener, grazing pastures. This form of pastoralism entails sporadic movement patterns. It is an environmentally sustainable livelihood in arid and semi-arid areas, thus it is a system practiced predominantly in the Northern and Southern (Maasai land) parts of Kenya. Breeds popular in this system are Zebu, Sahiwal and Boran. Natural grass is the main pasture for animals in this system.

3.1.4.2 Ranching

Ranching is a capital intensive system practiced in both arid and semi-arid areas within a defined unit of land – a ranch. In this space, it is possible to maintain optimal stocking rates, conserve and preserve pasture and develop livestock support facilities such as dips and water points.

3.1.4.3 Agro-Pastoralism

This system takes place in semi- arid parts of the country where beef and crop farming are practiced together. Both farming practices complement each other where livestock feed on crop residues and crops benefit from manure and animal draught power. Breeds in the system are mostly crosses of Zebu and Sahiwal.

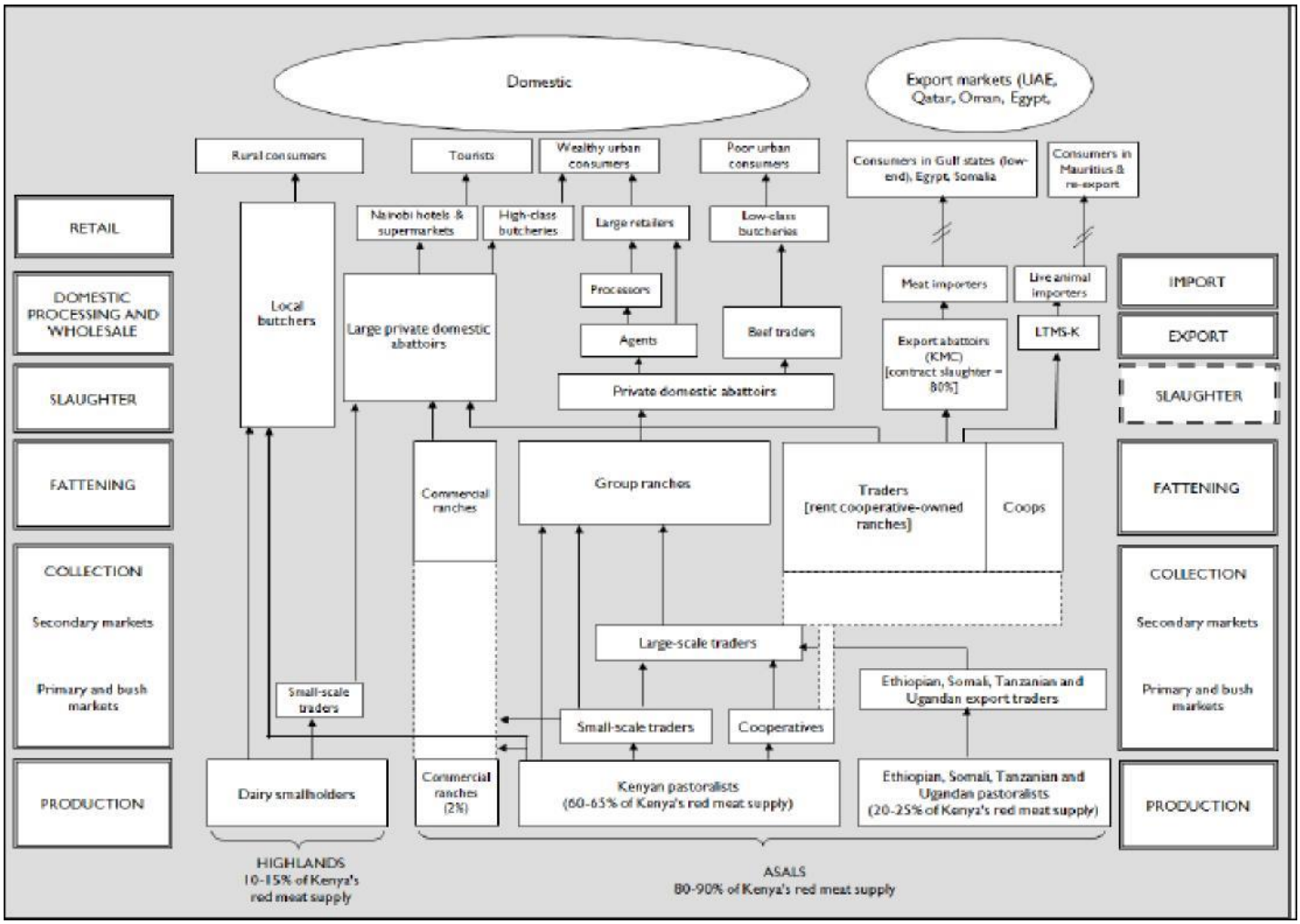
3.1.4.4 Feedlot system

These are units where immature livestock are put on an intensive feeding regime designed to fatten them to a specific market weight prior to being sold. The animals are confined in zero-like grazing units in dairy production and are fed high-energy concentrates. This system is mainly used high rainfall areas because of abundance of cattle feeds.

3.1.5 Mapping and description of the beef value chain

This section presents the beef value chain map, a visual representation of all connecting stages and actors involved in the beef industry in a region. Mapping the beef industry reveals the process and different channels through which beef advances from producers to the final consumers. The value chain analysis highlights the importance of each channel connecting smallholders to markets, the challenges and potential leverage points. It consists of five key stages: Input/service supply, production, marketing/processing, retailing and consumption. Through information gathered from field visits, the beef industry takes shape as presented in Figure 2 below.

Figure 2: Beef sector value chain map



Source: Farmer Elizabeth, 2012

3.1.6 SWOT analysis of the beef sector in Kenya

Strengths	Weaknesses
• *Expansive land available for production* • *Diversified agro- ecological zone for variety of breeds*	• *Weak policy and legal framework to support the beef sector* • *Low productivity due to sub-optimum management and occurrence of diseases*

• *Markets available for beef products*	• *Weak structures for support services* • *Poor infrastructure and increasing transport costs* • *Weak marketing and slaughtering infrastructure*
Threats • *Droughts and harsh weather conditions* • *Scarcity of fodder and feed for animals especially during dry seasons* • *Presence of trans-boundary animal diseases and poor capacity to control* • *Uncontrolled influx of large numbers of animals from neighbouring countries* • *Widespread cattle rustling in pastoral Areas*	**Opportunities** • *Develop feeds and pasture conservation programmes to reduce mortality during dry seasons* • *Improve on the control and prevention of trans-boundary animal diseases through a strong public–private partnership in the veterinary field* • *Scale up price differentiation for different qualities of meat, thus increasing profitability* • *Capacity building of value chain actors to facilitate sustainable business* • *Improve livestock infrastructure to reduce overhead costs*

Source: Author's edition

3.1.7 Government Policies

The government has included the livestock sub sector in Kenya's Vision 2030, which specifically aims at planning and implementing four to five Disease Free Zones and livestock processing facilities to enable Kenyan meat, hides and skins meet international marketing standards.

Mid 1980 market liberalization initiatives affected marketing for most livestock products. This, partly, led to the collapse of Kenya Meat Commission (KMC) and Uplands Bacon Factory. As a result, marketing fell in the hands of private livestock dealers who were not adequately prepared to undertake the challenges. Notwithstanding, the poor state of roads and
inadequate market infrastructure, especially stock holding grounds, became a major constrain to the development of efficient livestock markets, thus lessening returns to farmers.

The beef sector is a major economic pillar in many counties, namely Turkana, West Pokot, Marsabit, Mandera, Tana River, Isiolo, Narok, Kajiado, Taita Taveta, Lamu,

Samburu, Laikipia and Baringo. Infrastructure and market development are areas that can accelerate the returns to the sector. However, these interventions and investments are usually politically motivated.

Nonetheless, in 2010, a new constitution was signed and county governments instituted. Through investments in roads and rural electrification, resources like improved abattoirs and devolution of power by the county governments, there are emerging opportunities for the beef sector.

3.1.8 Motivation for rearing cattle

Communities keep cattle for various reasons and these tend to shape how they respond to market. During community FGDs, the following were highlighted as the main reasons for keeping cattle:

- Cattle act as a moving bank that farmers only draw from in times of need, e.g. when paying for school fees, medical bills, or purchasing farming inputs. They are also a symbol of wealth.
- Cattle are an important source of draft power and, in some cases, transportation. Most households interviewed (90%) use oxen to cultivate their farms for crop production.
- Cattle are an important source of milk, which is highly nutritious, and an additional source of income.
- For traditional uses, including payment of dowry.

CHAPTER FOUR

4.1 General assessment study sites

4.1.1 Identified areas

The guiding principle for the selection of the study sites was their close location to the Eastern boundary of South West Mau Forest, where a large number of livestock enter the forest for grazing and go back home for the night stay. These sites would help identify the number and the type of livestock. For the purpose of this study report, the three study sites recommended by IDH-ISLA, Kenya are:

- Kiptororo ward in Kuresoi North Sub-County (S1)
- Tinet ward in Kuresoi South Sub-County (S2)
- Kiptagich ward in Kuresoi South Sub-County, Nakuru County (S3).

Eight villages in Kiptororo ward were selected, namely; Kibaraa, Kesigenik, Korabariet, Tumoyot, Chemore, Ororwet, Kures and Tirita. In Tinet ward, six villages – Busiengiruk, Kapmochoimet, Lelechwet, Kapno, Cheram and Ngetundo – were chosen, while Kiptagich ward had three villages picked– Kipkongor, Lelechwet and Kiptoror.

4.1.2 Study methodology

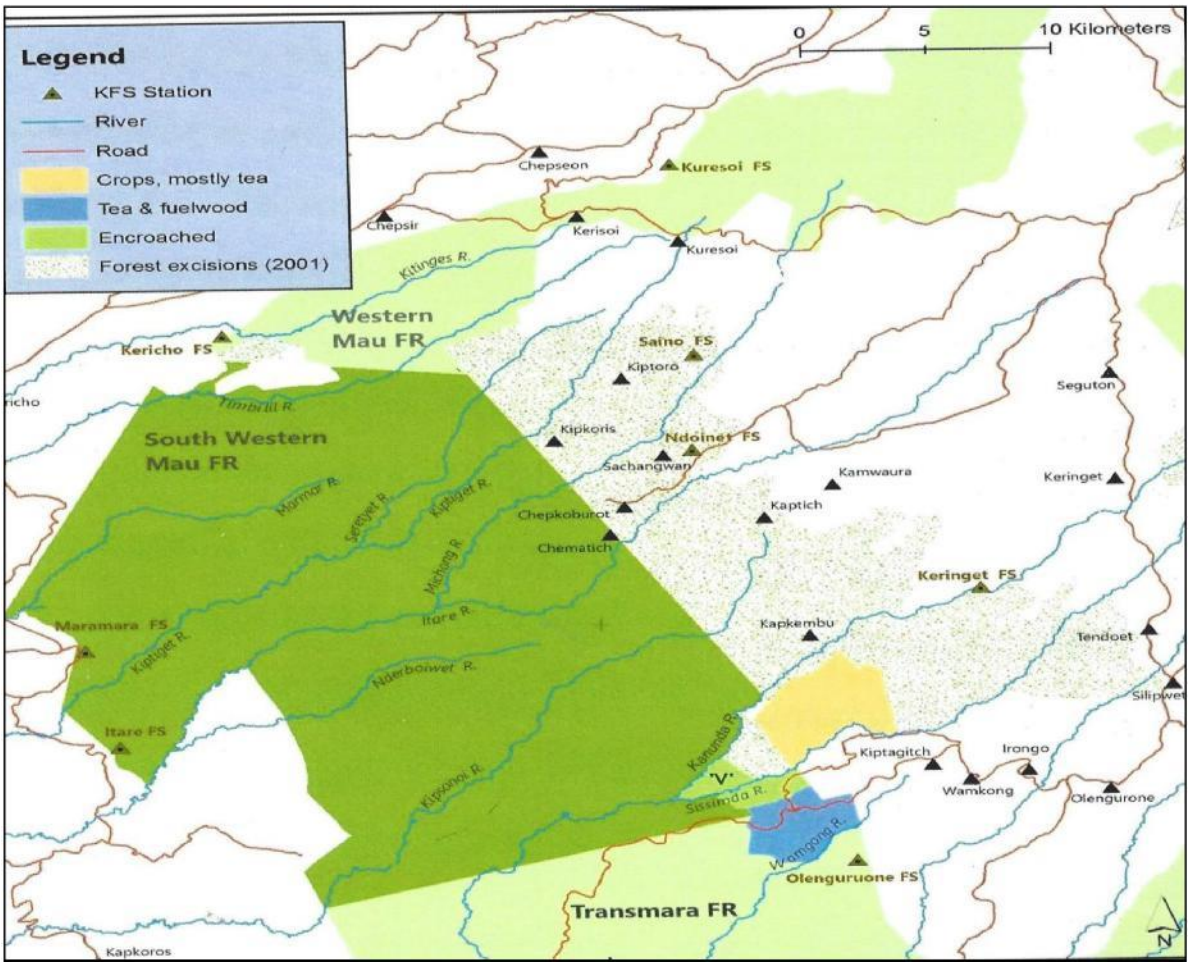
The study team carried out qualitative research assessment of the beef value chain situation in the three study sites over an 18-day period (divided into two phase assessments, four days each, two days per study site), supplemented with three days of interviewing stakeholders in the landscape outside the study sites. The qualitative research methods included interviews with individual farmers, focused group discussions, transect drives/walks across the landscape and observations. The study methodology also involved a desk study (for secondary data/information) of various relevant documents, such as ISLA, State Agencies, UNEP reports, as well as Kenya County and Government reports.

For primary data collection, in-depth, semi-structured single and group interviews were carried out in the field, guided by a checklist or questionnaire, involving key informants and stakeholders in and outside the study sites. Interviewees were individual and small groups of farmers, herdsmen, animal health service providers, opinion leaders and officers from GOK, KFS and ASDSP in Nakuru County. Interviewing key stakeholders provided an opportunity for verification, validation and triangulation of various primary and secondary data obtained. The first contextual beef value chain situational analysis was conducted during the first four days by the team for the three study sites. The study enabled identification of different beef cattle management options in the study areas, and was critical for systematic and effectual in-depth assessment the following week.

The subsequent study period involved a more in-depth analysis of the various beef cattle farming management systems, routine activities, forest grazing systems, pest management and breeding, grazing in the forest and major diseases. An assessment of beef production, as well as cost and income from the beef was applied to a number of farms in each study site to establish gross margin at the farm level from the existing management system. The study also aimed at identifying milk production per cow/day, total milk production days per year, average dairy herd and planted fodder.

The quantitative research method included a head count of the number of livestock entering the forest to graze and livestock domiciled in the forest. Kibaraa area's inner part of the forest, in Kiptororo ward, was easy to access thus the ideal location for this research. Researchers equipped with cameras and materials to record the forest data were embedded with herders hired to look after the cattle. In addition, they counted cattle in herds and in their structure. It took three days to complete the activity.

Figure 3: Map of South West Mau



Source: T. Butynski & Y, Ade Jong, 2016

4.2 Population: Size, density and socio-economic status

Kiptororo wards (S1), Tinet ward (S2) and Kiptagich ward (S3) have a total population of 42467, 44068 and 29592 respectively, (KNBS, 2013). S1, S2 and S3 cover a total of 241.6km2, 218km2 and 114 km2 respectively, which translates to an average population density/km2 of 176 for S1, 202 for S2 and 260 for S3. Total farm households make up 92% in Kiptororo, 95% in Tinet and 90% in Kiptagich.

The three study sites are predominantly inhabited by smallholder farmers who depend on the land for their livelihood. They practice mixed crop and livestock farming in a largely subsistence manner with surplus livestock products and crops being marketed both formally and informally. Many of the residents living close to the forest have cultivated most of their land for crops leaving only a small portion for livestock grazing and night bomas. The average land size is about five acres or less for both Kiptororo and Tinet wards, and about six and a half acres in Kiptagich ward. Tinet and Kiptororo are still largely new settlements with most people having settled in the area in the last 20 years when the government subdivided the land in 1997. Livestock is the main source of livelihood for over 90% of the

households interviewed. Limited, permanent houses are common in the area, especially in Kiptororo and Tinet wards, which to some extent indicates poverty levels in the community.

4.3 Agro-ecological outlook

Kiptororo, Tinet and Kiptagich wards almost share a similar agro-ecological outlook with an altitude of 2,200 – 2,700 meters above sea level. The average rainfall per year is the same in the three areas, about 1,850 mm, experienced annually during two rainy seasons. The three study sites have loamy soil, which is red, suitable for tea growing, Irish potatoes and a range of horticultural crops. Daily temperatures range from 10 – 25°c.

The three wards therefore have suitable temperature, rainfall and soil for many cash and food crops, as well as for dairy cows and all major fodder crops that can do well in the highland areas of Kenya. However, all three study sites bordering South West Mau Forest on the North eastern part have been degraded as a result of the settlements in the forest.

4.4 Infrastructure

The three wards have similar road infrastructure, which constitutes murram roads that cover about 30 – 40% of the total road network in the study areas. The rest of the road network has no murram and is totally impassable during the rainy seasons, except by motorbikes, which are the most used means of transport for people and agricultural produce. Donkeys are also widely used for transporting less perishable products like maize, potatoes, cabbages and kale from farms to the market or accessible points.

The three wards are characterized by undulating ridges with no bridges, thus making movement from one ridge to the next long and difficult. Electricity coverage is estimated at 60% in Kiptororo, 25% in Tinet and 45% in Kiptagich. There's expectation of improved coverage in the coming years especially with government electrification programmes across the country. Overall, the three study sites are well served by numerous rivers and springs that provide water for domestic and animal use. Water is directly accessed from the river, except in Kiptagich ward where a significant number of people have dug wells.

4.5 Farming systems

Across Kiptororo (S1), Tinet (S2) and Kiptagich (S3), farmers practice subsistence mixed crop and livestock farming. Food and cash crops include maize (dominant crop in all sites), potatoes, cabbages, beans, peas, kales (all sites), and tea, which is predominant in S1 and S3, and available in a few farms in S2.

Landholding sizes average five acres per household in S1 and S2, and six and a half acres per household in S3. Cattle keeping and maize farming are largely practiced amongst farming households in all sites. Tea farming is continually gaining importance in S1 and S3, accelerated by the proximity to tea factories in the areas.

Livestock kept in the three study areas includes cattle (both dairy and beef), sheep, goats, donkeys, poultry (indigenous) and beekeeping. Predominant cattle types in the sites include improved grade cattle, mainly a few dairy, cross

breeds, for both beef and dairy purposes, and Zebus. Cross breeds and Zebus are preferred because of their ability to tolerate harsh forest conditions.

Almost all smallholder farming households in the study sites have a few milking cows, mainly cross breeds. Milk production is appreciated across the study sites for its nutrition and cash income generated from the surplus.

Small-scale farmers living near the forest bring their cows to graze there, where forest service officials charge them Ksh. 100 per cow. These cows are minimal in number compared to those domiciled in the forest, mainly owned by individuals distant from the forest, majority of who have other sources of income. Cattle kept in the forest are mainly part of a beef or meat value chain.

4.6 County agricultural sector policies and priorities

Agriculture is the key mainstay for Nakuru County's economy as explained in the County Integrated Development Plan (CIDP) 2013 – 17. The sector is largely small-holder dominant practising livestock keeping, fish farming, food and cash crop farming. Horticulture and floriculture are the county's key agricultural sub-sectors given focus and attention in the CIDP.

The county has prioritized clear policies aimed towards commercialization and intensification of agriculture, conscious of the roles for public and private sector, research institutions, as well as communities and development partners in agricultural progression. The county has identified projects and interventions significant for development of the agricultural sector. It also outlines the importance of better infrastructure in realizing the full potential of agriculture, manufacturing and tourism in the county. In addition to the above, the county plans to invest in rural infrastructure such as roads and rural electrification, which indirectly supports the agricultural sector.

The actual implementation of the plans and interventions are stated in the CIDP, as well as the source to implement the programmes. County staff on the ground stated that plans have been put in place to facilitate the development of the agricultural sector, but the main challenge in its achievement is the funds to implement.

Bilateral funding as well as partnerships with interested organizations could address the challenge, ensuring that viable projects in the agricultural sector are implemented to improve the livelihoods of the residents in the county.

CHAPTER FIVE

5.1 Current beef farming system

The beef farming system practiced in the three sites is agro-pastoralism. The average number of cattle kept by households interviewed is 19 in Kiptororo ward, 13 in Tinet ward and 23 in Kiptagich ward. Majority of the households graze their livestock in the forest and have left very minimal space for pasture and fodder in their homesteads.

Paddocking is limited in the areas and majorly done by households that do not graze their livestock in the forest. They have Napier grass for their livestock. This forms 8% of the households interviewed across the three study areas. Livestock that graze in the forest go in from around 9am and go back home between 4pm and 6pm in the evening.

In the three areas of study, cases of people coming to buy small pieces of land close to the forest for easy access to grazing fields were reported.

5.2 Breeds

Zebu and their crosses are the main breeds grazing in the forest across the study areas.
Majority of the Friesian cross breeds present do not graze in the forest. The owners have padlocked their land to allow controlled grazing. Crosses fetch high prices both in buying and selling, and take shorter periods before they are mature for sale. Crosses take up to four years to mature while indigenous breeds like Zebu take up to seven years before they reach maturity. Through FGDs held in the three study areas, the communities prefer Zebu because of their tolerance to ticks and diseases.

5.3 Literacy level

An assessment of whether there is a significant difference in production systems and livestock trading orientation between literate livestock owners and those with little education shows that the difference is quite minimal. The awareness levels are however different and, indeed, in some villages, the literate farmers have made attempts to operate more progressively.

In general, however, the gained exposure and attempts to change by literate and more progressive producers has not yet yielded any fundamental shifts in the practice. Regardless of literacy and exposure levels, all producers are generally operating on traditional production systems with little market orientation. The difference is, however, in the potential for change. Of the individuals interviewed, 35% had completed primary education. Only 16% had completed secondary education, while 48% have not completed any formal level of education as shown in table 3 below.

Ward	Number of households interviewed	Level of education completed		
		Secondary	Primary	Informal
Kiptagich	8		4	4
Kiptororo	99	13	44	42
Tinet	72	16	15	41
	179			

Table 3: Households interviewed per ward and education level of household heads 5.40 Herd composition and daily grazing in forest (home night boma)

Herd composition is an important factor in beef enterprise. The composition of the livestock, Zebu and cross breeds, conforms to natural breeding as shown in figure 4. In some cases, however, the oxen population is skewed as a result of the community keeping them for friends and relatives. In most cases, individuals sell old oxen and bulls/cows to meet the household needs that arise, as this is the main source of livelihood in the area.

Oxen and cows take up 23% and 38%, respectively, of the overall herd size. Calves accounted for 10%, steers 9% and heifers 20%. Oxen are held for four to six years, or more, to supply draft power before they are sold. Since farmers only sell old animals, this tends to limit commercialization, as there are only a limited number of animals available within a herd that can be sold. In addition, keeping an animal for that long before slaughter may be risking death, compared to selling weaners (less than a year old) or steers (One to two years).

The cattle kept in the three study areas are mainly dual purpose and beef cattle. The milk production per day, per cow is between three to five litres. The lactation periods among majority of households interviewed is three to five months. Residents across the study area face the challenge of accessing veterinary services for their livestock as there are very few government/private service providers covering a wide area.

Interviewed households who graze their livestock in the forest constitute 8.4%. The households are characterized by improved breeds, pasture establishment and improved animal feeding. Improved breeds have high productivity and require high investment which discourages households from grazing their livestock in the forest. According to KFS officials, forest grazing is legally allowed for the neighbouring community. KFS charge Ksh. 100 per cow, per month to graze in the forest, but there is no proper management to ensure that all animals are paid for, nor is there a programme to ensure sustainable use of the forest.

A number of residents stopped taking their livestock during the study period on suspicion that KFS would get information on the actual number of livestock they graze in the forest. Grazing in the forest is unregulated; goats are part of the livestock grazing in the forest though, according to KFS, they are not allowed because they destroy

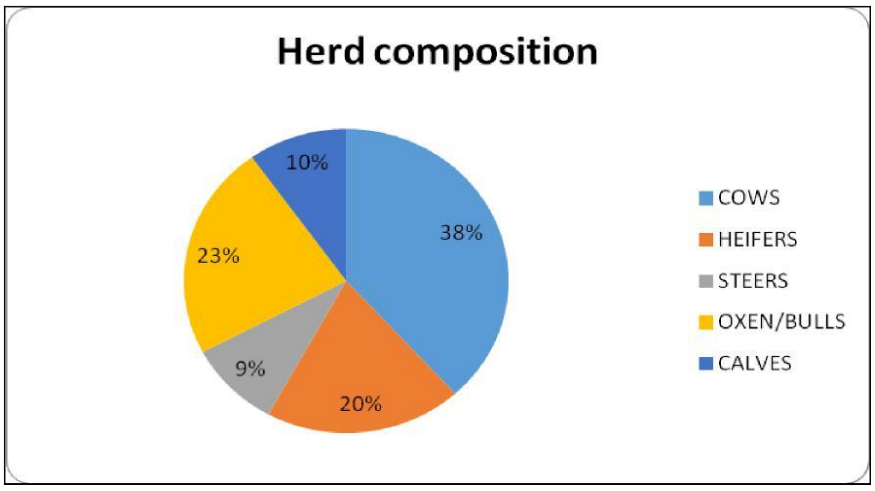
planted trees in the forest. The ineffective management at the entry points has led to degradation which has caused overgrazing in the forest. Most of the animal husbandry practices adopted by farmers have been acquired traditionally, passed from one generation to another.

Table 4: Livestock numbers entering forest grazing fields through different points

Villages	COWS	HEIFERS	STEERS	OXEN/ BULLS	CALVES	SHEE	GOATS	DONKEYS
BUSIENKIRUK	110	54	35	61	11	99	0	12
CHAPTALUKIAT	115	47	34	41	16	81	5	3
CHEMATICH	28	23	12	13	21	19	17	3
KABOSWA	34	23	17	34	17	26	0	
KALENGURA	39	31	13	9	18	34	0	3
KAPKEMBU	46	30	29	32	22	15	0	11
KESIGENIK	131	51	3	55	15	203	13	
KIBARAA	148	84	60	163	47	192	207	21
KIPKOIMET	16	17	0	24	6	20	0	1
KIPKORIS	167	100	34	111	14	177	28	38
KIPKORIS 2	85	42	3	80	12	42	18	3
KIPKORISE	8			2		8		
KIPTENDEN	37	12	11	7	1	34	0	0
KORABARIET	102	68	44	85	68	214	245	17
KURES	150	125	59	67	91	544	103	40
ORORWET	68	75	42	70	23	111	123	26
TIRIIGOI	57	30	34	42	10	54	0	2
TIRIYTA	639	209	51	285	120	520	338	59
	1980	1021	481	1181	512	2393	1097	239
	5175					**4786**	**2194**	**478**

Source: Author's own edition

Figure 4: Livestock structure grazing in the forest (home night bomas)

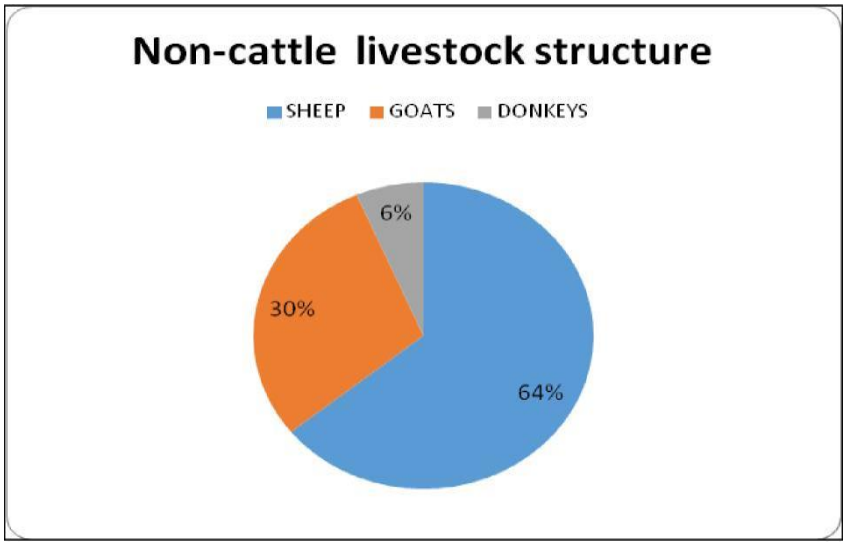


Source: Author's edition

5.4 Structure of non-cattle livestock in the area

Non-cattle herds, which include donkeys, sheep and goats, also graze in the forest. Sheep take up 64%, goats 30% and donkeys 6% as shown previously in table 4, and below in figure 5. Interaction with forest service staff indicated that goats grazing in the forest are not allowed because of their destructive nature to trees, especially young replanted trees.

Figure 5: Non-cattle structure



Source: Author's edition

5.5 Cattle domiciled in the forest

Herd sizes are difficult to estimate since communities are reluctant to disclose the actual numbers of their livestock. They cited a historical occurrence in 1977

in the area whereby their livestock was taken away from them, and this has made them suspicious of any survey regarding livestock numbers. Clarifying the objective of our study, however, yielded some results and they were able to cooperate and express their willingness to support the forest conservation program.

Analysis of information generated from FGDs and follow up survey on the herds in one of the grazing fields in the area adjacent to Kiptororo ward shows that the number of cattle domiciled in the forest are more than those grazing and going back home by 60 – 70%. It's been reported that the number of cattle in the forest have increased in the last three to four years due to lack of strategy to reduce their numbers. Majority of the cattle domiciled in the forest are owned by individuals living in areas far from the forest, and in some cases are not residents of the county. An impression has been created that the forest is free for anyone to use as opposed to only those in the surrounding community. It also shows that the herd structure does not conform to natural breeding as illustrated in table 5 and figure 8. Oxen/steers take up 80%, cows 15% and heifers 5%. The animals depend on grass and occasionally feed on mineral salts using troughs as shown in figure 7.

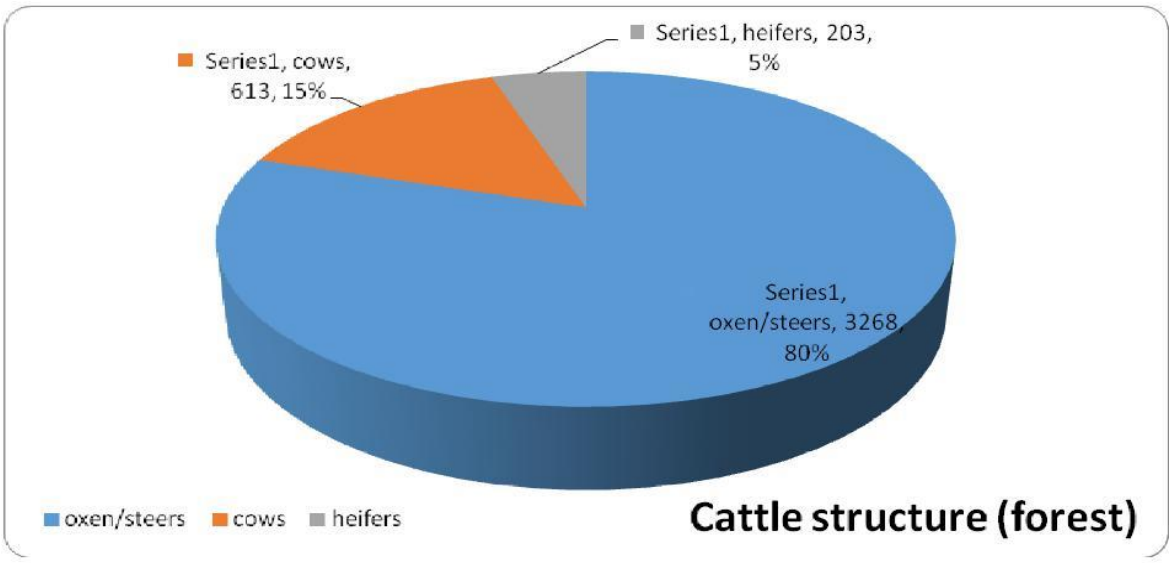
Cattle owners source the animals from nearby auction markets in the area to form herds which are driven to grazing fields deep in the forest. These owners have alternative sources of income and live far away from forest. They have taken beef fattening as a business. Bought beef cattle stay in the forest for some time before they are sold. In some cases, the cattle owners form groups (business clubs) which they use to keep the cattle together. The herdsmen, in most cases at least two per herd, shelter in structures constructed deep in the forest as illustrated in figure 9.

Table 5: Herds of livestock domiciled in the forest (Kibaraa area)

Cattle type	Herd 1	Herd 2	Herd 3	Herd 4	Herd 5	Herd 6	Herd 7	Herd 8	Herd 9	Herd 10	Total
oxen/steers	242	432	388	217	306	354	259	389	377	304	3268
Cows	45	81	73	41	57	66	49	73	71	57	613
Heifers	15	27	24	14	19	22	16	24	24	18	203
Totals	302	540	485	272	382	442	324	486	472	379	4084

Source: Author`s edition

Figure 6: Livestock structure domiciled in the forest



Source: Author's edition

Figure 7: Oxen taking Mineral salts deep in the fores

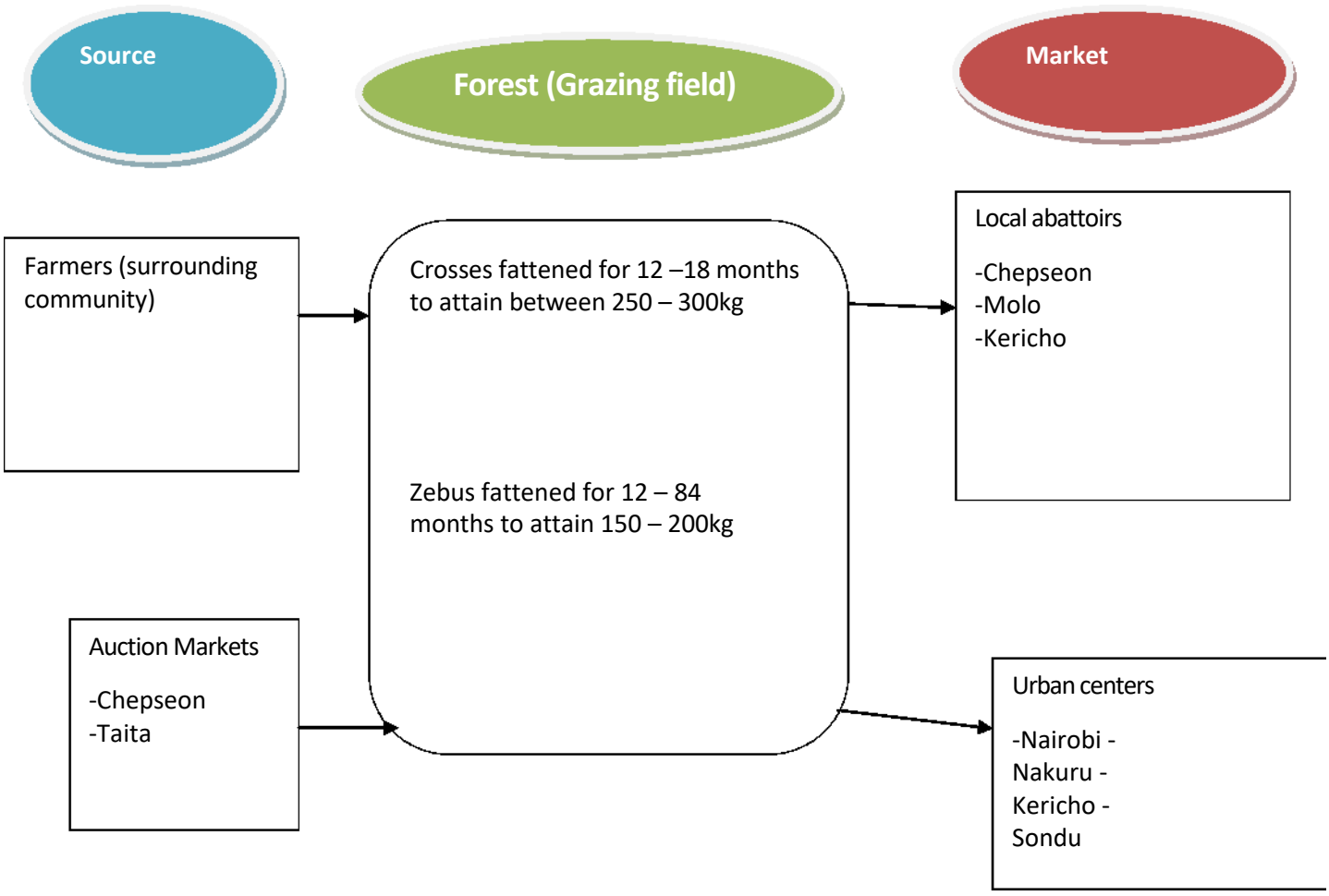
Figure 8: Beef cattle mostly oxen grazing deep in the forest

Figure 9: Shelter structure used by herd's men deep in the forest

5.6 Market & auction for beef cattle domiciled in the forest

Beef cattle domiciled in the forest are regularly sold through auctions in Taita and Chepseon. Some are sold directly to local and urban abattoirs in Sondu, Kisumu, Nakuru and Nairobi. The off-take varies per year and season. Most sales are in November through March. This coincides with the dry season, which leads to less pasture thus the need to offload the stock to the market. On average, 30% of the herds are sold annually based on information from the herdsmen. The value chain map for cattle domiciled in the forest is illustrated in figure 10.

Figure 10: Value chain map of cattle domiciled in the forest (South Western Mau)



Source: Author's edition

Based on visits to major auction markets in Taita and Chepseon, the crosses offered for sale were between 250 – 300kg (live weight), their ages estimated to be three to four years. For indigenous breeds (Zebus), their mature live weight was estimated to be between 150 – 200kg, aged four to six years. The selling price for crosses ranged from Ksh. 50,000 – 70,000 while the Zebus were between Ksh. 20,000 – 30,000 per animal. The detailed gross margins are illustrated in table 6.

Based on analyzed data from interviewed households, 7.8 % participate in rural livestock trading to supplement livestock farming as an alternative source of livelihood. They acknowledged that they have been pushed to the business by the need to have an alternative source of income to meet their household requirements. The cattle owners of the cattle domiciled in the forest do not participate in the local auction markets.
They make arrangements through middlemen to sell their cattle to urban centres. They off take their beef to Nakuru and Nairobi for slaughter. The community living around the forest participates in the local auction markets of Chepseon and Taita.

Table 6: Breakdown of number of cattle grazing in the forest and proposed solution

Total animals going in and out of the forest	12,633 (5,175 cattle heads)	Households own these (with 1% from family elsewhere)
		Set up livestock projects with communities
Total residential animals	12000	Not owned by the village people along the cutline. Appointed by outsiders, managers, with on average of three foremen. *Address through law enforcement in collaboration with KFS and others*
	(An estimated 10% is stolen)	
Total animals grazing in the forest	24,633	
Hectares needed to graze	15,037	
Estimated carrying capacity of the forest ha	5000	*Based on 2 acres per cow. One cow is equivalent to 5 shoats (goat or sheep)*
Overburdening of the forest ha	10,037	

Table 7: ANNUAL GROSS MARGIN ANALYSIS OF BEEF PRODUCTION IN SOUTH WEST MAU

Costs	Quantity	(KES)Amount
Labour (2 people)		**120,000**
Drugs		**24,000**
Dipping		**12,000**
Trekking (market)		**2,000**
Grazing fee		**60,000**
Total variable costs per year		**218,000**
Buying prices – Indigenous per animal	(Btw Ksh. 11,000 – 13,000)	**125,000**
Buying prices – Cross breed	(Btw Ksh. 16,000 – 22,000)	**19,000**
Selling prices – Indigenous per animal (Btw ksh. 18,000 – 30,000)		**24,000**
Selling prices – Indigenous per animal (Btw ksh. 35,000 – 65,000)		**50,000**
Indigenous – Revenue	(30% off-take)	**360,000**
Crossbred – Revenue	(30% off-take)	**750,000**
Annual gross margin – Indigenous animals		**142,000**
Annual gross margin – Crossbred animals		**532,000**
NB: Calculation is based on 50 animals in a herd		

Source: Author's edition

5.7 Animal health

Based on information obtained through FGDs, in-depth interviews with key informants and a simple questionnaire administered to 179 households to supplement the information obtained from these other sources, the study team estimated an average of 20 animals die each month across the study areas. Diseases such as East Coast fever, red water and black leg are the main causes of death. While some herds are sprayed against ticks, which are the major disease vectors in the area, farmers are also using modified crushes on a weekly basis as shown in figure 11. Stockmen have learned to provide rudimentary veterinary treatments using ethical veterinary drugs. However, majority of the herds are not sprayed hence the prevalent deaths attributed to tick-borne diseases.

Figure 11: Crush used for spraying cattle domiciled in the forest

5.8 Carrying Capacity

Information from the Forest service staff indicates that there are 5,000 hectares of grazing fields in the forest that can accommodate 10,000 grazing animals. The current population of livestock grazing in the forest next to the three study areas is well over 15,000, while over 12,000 cattle are domiciled in the forest.

CHAPTER SIX

6.1 Threats to forest conservation

6.1.1 Illegal logging

Few cases of illegal logging occur in the study area, especially in Kiptororo ward (Kibaraa and surrounding areas), based on study analysis generated from FGDs. Illegal logging has reduced compared to previous years as a result of employment opportunities in tea planning at the forest border line, as well as establishment of the Kuresoi Tea Factory, which has given opportunities to a number of youth in the area. Cooperation between the community and forest service staff in the study areas also attributes to the reduced cases in the area.

6.1.2 Stock theft

There are two kinds of stock theft in the three study areas according to key informants and FGDs. Theft among cattle domiciled in the forest and those on transit to their points of sale. Minimal stolen stock is sold in the auction markets at Taita and Chepseon, with the latter having at least five cases of stock theft reported each month. Coordination between livestock traders coupled with the support provided by security administration in the area has minimized stock theft at the Taita auction market as shown in figure 12.

The key informant and FGDs also discovered a few more things, notably, the dry seasons are notorious for cattle theft; Brooke in Kericho is one of the exit areas from the forest, and a group of stock thieves assist each other in case they are arrested. The view of the people and the reports from the auction markets, the people prefer that they handle suspected cases of stock theft without involving the police. They reported that previous cases handled

by the police ended up without prosecution. They believe that it was as a result of corruption.

Figure 12: Auction in Taita, Tinet ward

6.1.3 Over-Grazing

Livestock grazing is not linked to the carrying capacity of available grass in some fields near the study areas. This has led to forest erosion in some areas as shown in figure 13. Further, the increase in livestock populations and declining farm sizes next to the forest has led to increased grazing demand inside the forest. As a result, segmented forest degradation is occurring due to overgrazing in certain forest blocks. During the dry season, the situation is worsened by livestock influx from neighbouring pastoralist communities, especially in the areas adjacent to Kiptagich and Tinet ward.

Figure 13: Degraded area in the forest, Kibaraa area

6.1.4 Wildlife poaching

Wildlife poaching, especially for elephant tusks, remains a threat in South West Mau Forest. Poaching takes place deep in the forest, done mainly using traps set up in elephant routes. Community members interviewed suspected the involvement of local residents in the vice.

6.1.5 Illegal charcoal production

Analysis of information generated from FGDs during the study show that illegal charcoal production occurs in the forest mainly in Kibaraa. Residents noted that the incidences have reduced as a result of alternative sources of youth employment in the area, mainly in tea planting at the forest border line as well as opportunities

offered at the tea factory. In other areas, residents reported that the incidences have reduced drastically. Forest service staff acknowledged that community support in Tinet and Kiptagich ward has led to case reductions.

6.2 Current status of the Community Forest Association

Based on information obtained from FGDs and through in-depth interviews, the organization is currently weak. There is no recognition for its leadership, there are no activities that bind the organization together, its formation was solely out of requirement as stipulated in the Forest Act and some villages were not even aware of the existence of such an organization.

CHAPTER SEVEN

7.1 Proposed project

Based on recommendations from the dairy and beef value chain studies, there is need for a multi partnership approach for effective conservation and rehabilitation of the forest. However, beef cattle grazing in the forest pose a big hindrance to this. It is therefore necessary to develop strategies that can reduce the need for the neighbouring communities depending on forest pasture to feed their animals.

There needs to be enhanced dairy developments in order to reduce beef cattle keeping in the long run. Crossbred or high grade dairy animals are not suited for forest grazing, which makes them preferable in these study areas. They produce a lot of milk that can supplement the income of communities living along the forest. If sustained through intense artificial insemination, introducing high grade animals in the areas will improve livestock production. Adoption of dairy livestock will not only elevate the livelihoods of the community, but also enhance forest conservation. For effective implementation of the project, 18 villages along the forest will each have a lead farmer who acts as a focal training point for group members.

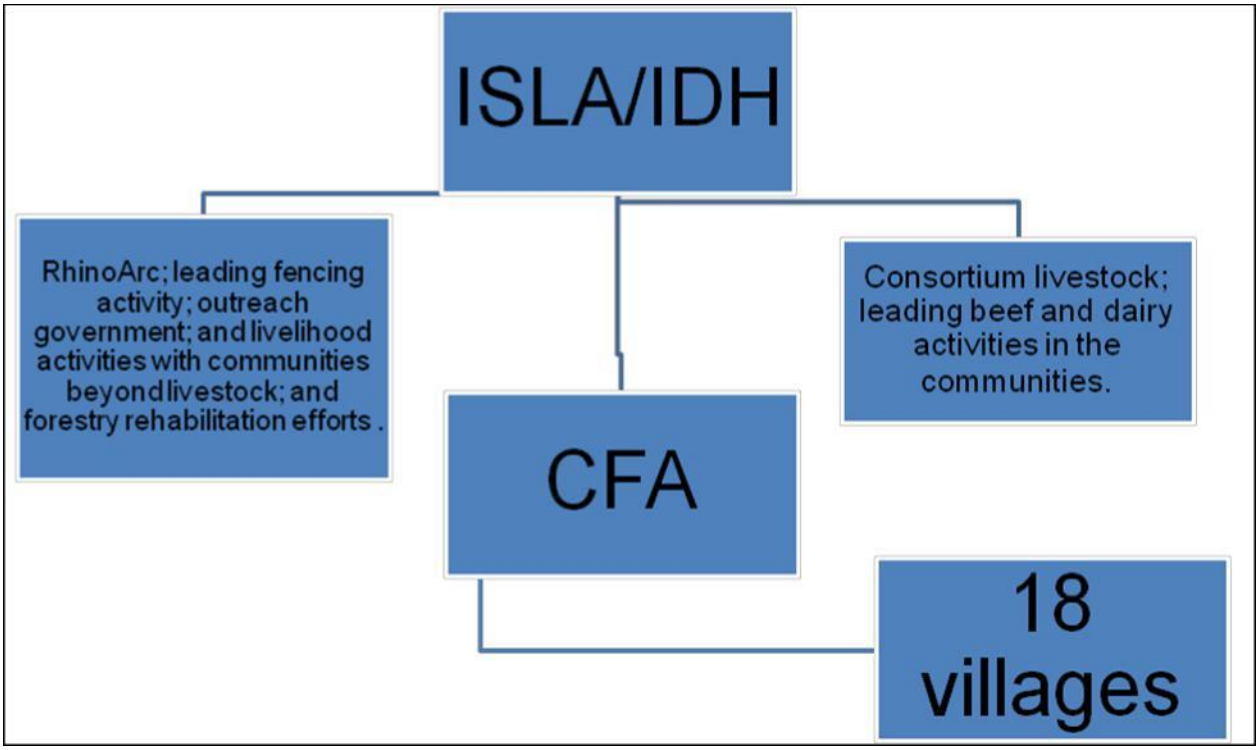


Figure 14: Proposed projects

- *Phase 1. Inception, Analysis and Design (8 months):*

  The Inception, Analysis and Design Phase will be overseen by a consortium team in partnership with the line ministries. This group will trigger the work required to select and launch the value chain, and producer group identification studies. The identification process will be driven by stakeholders in respective areas and value chains, including farmers and government officials responsible for agriculture and cooperatives development. This phase will also ensure collection of background knowledge and data needed to provide an information and evaluation baseline for the project, identify potential value-chain resources, e.g. farmers, producer groups, funding, and develop detailed project implementation plans, both overall and for the first year.

- *Phase 2. Project Implementation* (14 months):

  The Implementation Phase is the core component of the project and will generate virtually all of the outputs and success indicator products if the project evolves as planned. Nonetheless, project management teams must be open to alterations in focus and operational activities if changing conditions or new information suggests that modifications to implementation plans will better achieve project objectives and desired results.

- *Phase 3. Project Completion* (2 months):

  The Project Completion Phase will ensure promotion of the project approach to other development partners and insure effective transition to those business-oriented groups developed during the project as well as to strengthened local support institutions. In addition to end-of-project evaluations, third party specialists will be asked to review the project to provide additional insights and recommendations. On the basis of a sound evaluation, it will develop strategies for either exit or continuation of interventions, if necessary, through local institutions to ensure sustainability. The project will also strengthen its efforts to publicize lessons learned and diffuse the models and materials for further producer group and value-chain development recommending, among others, future producer group or value-chain work.

7.2 Project Implementation Time-Plan or Gantt Chart

			Timeline											
Project Phase	Major tasks	Responsible	Year 1 - 2017				Year 2 - 2018				Year 3-2019			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Incention Phase	Matching of dairy &beef value chains	IDH												
	Identification of staff, consultants, contractors and local service providers	IDH												
	Stakeholder meetings	IDH/ Consortium												
	Identify existing and the potential for dairy producer groups	Consortium												
	Establish New producer groups	Consortium												
	Needs assessment& identification of model farms	Consortium												
	Baseline study	Consortium												
	Development of a detailed implementation plan & specific	Consortium												
Implementation Phase	Registration of farmer groups	Consortium												
	Farmer trainings (breeding, fodder, horticultural production & market linkage)	Consortium												
	Infrastructure support	Consortium												
	Farmer exhibitions	Consortium												

	Farmer tours/exchange visits	Consortium													
	Milk collection hubs development & capacity building	Consortium													
	Final project evaluation	IDH													

CHAPTER EIGHT

8.1 Recommendations - general

- Improved dairy breeds are the pillar to reducing the number of livestock in the forest. The community has acknowledged that these breeds have high productivity but are less tolerant of harsh forest conditions hence it discourages them from grazing in the forest. The dairy value chain study already conducted concurs with this view. Therefore, residents should be encouraged to reduce cattle in the forest by selling them off, and then invest in establishing and conserving fodder for the remaining dairy crosses, as they work on adopting intensive dairy production. Considering most of the residents' education level, a lead farmer approach in the project implementation will work effectively in changing their farming from subsistence to intensive sustainable systems.

- The communities are currently facing challenges with tick-borne diseases, investments on dipping infrastructure as well as artificial insemination support programs. There is need to encourage private veterinary service providers to supplement veterinary services to the county government. Besides technical skills required for adoption of good animal husbandry practices, farmers will also need to build their skills to profitably manage their farm enterprises. It will be necessary to develop training and seminar programs for dairy farmers in the area.

- Forest degradation caused by overgrazing cattle domiciled in the forest needs to be handled by the KFS. Stakeholders involved in forest conservation led by KFS should designate areas for rehabilitation and ban livestock grazing on the same areas. This can be done progressively with a timeframe to eventually stop cattle domiciled in the forest. The Forest Act does not allow cattle to stay in the forest beyond 6pm. KFS should enforce this law so as to discourage additional beef cattle in the forest. It's important for KFS to create public awareness that sustainable utilization of the forest is only for residents living around the forest and not free for all as perceived.

- As recommended by early studies of the area, fencing the forest and having gates at entry points is highly recommended for effective management of the number of cattle grazing in the forest as well as reducing human wildlife conflict in the area.
- Communities living adjacent to the forest are mainly peasant farmers depending on subsistence crops and livestock keeping as their livelihood. To ensure effective conservation of the forest, alternative income sources such as dairy farming, high value horticultural farming, bee keeping and cottage industries need to be established in the area.
- These communities have a strong cultural attachment to cattle and milk. Dairy farming could therefore be easily accepted and adopted, thus reducing reliance on cattle grazing in the forest. Land sizes in the area are relatively small hence intensive dairy production provides a viable option for the community.
- The amount of rainfall and the type of soil in the area is good for growing Napier grass, Desmodium and Rhode grass, which can be baled as hay and is a good fodder supplement.

- High value horticultural production needs to be encouraged in the area to increase sources of income for the community. Favourable conditions in the area provide value chain enhancements for horticultural crops such as Irish potatoes, cow peas and passion fruits.
- There is need for public awareness in the community on the importance of education. There is a good number of school children who have stopped or have not started going to school. Education will increase their capacity to improve their way of life.
- The Forests Act provides for stakeholder participation in forest management. It recognizes Community Forest Associations (CFAs) as major stakeholders in the management and conservation of forests, and provides for their participation through joint management agreements, as well as representation in Forest Conservation Committees. The Community Forest Association in the area is currently weak and needs strengthening in terms of capacity building to ensure communities benefit, while protecting the forest estate for purposes of water, soil and biodiversity conservation, sustainable production of wood and non-wood forest products. The Community Forest Association will also play an important role creating public awareness on the importance of forest conservation. There is need to explore the possibility of having two CFAs with affiliate organizations across the region as members for better governance and participation of majority of the residents. The challenge here seems to be lack of awareness of the existence and role of CFA's by the community.
- There is need for KFS to set a limit for neighbouring residents on the number of cattle allowed to graze in the forest residents so as to minimize degradation as a result of overstocking.
- Involvement of local administration in Kiptororo, Tinet and Kiptagich wards and key stakeholders in the region will be crucial in successful implementation of the projects. People representatives in the wards, as well as constituency representatives in Kuresoi North and South will also play a crucial role. The key stakeholders in the region are the line department in the county of Nakuru, state agencies and the community and development partners. This is the role of CFA - so focus should be on strengthening the area CFAs.
- Mobility challenge for forest service staff in the study areas poses a challenge in pursuit of institutional mandates. There is need to avail means of transportation to ease their movement. One motorcycle per post will go a long way in achieving this.
- It was noted that KFS staff residences were a distance from the cutline hence limiting them from effective supervision of activities taking place in the forest. There is need to facilitate their movement and improve on their welfare to aid in forest conservation.
- A participatory forest regeneration plan is necessary to achieve sustainable forest management. It will require economic efficiency, equity and sufficient incentives for all stakeholders who are expected to contribute. The community and stakeholders will then agree and participate in the areas to start reforestation and limit livestock from accessing the reforested areas. Micro-fenced forest blocks would provide an opportunity for this.
- Poaching and stock theft are illegal activities. KFS, Kenya Wildlife Service (KWS) and security agencies should collaborate on strategies to stamp out the vice in the region, and build cooperation with the communities adjacent to the forest.
- Currently, most active members of CFA are not the lead dairy farmers in the region. It is our view that for a successful dairy value chain, a separate dairy

cooperative should be established. The cooperative's major role should be to market milk from farmers, provide farmer trainings and procure inputs for dairy farmers. The cooperative should establish a milking collection hub model to ensure its viability and efficiency in improving the livelihoods of the community. A milk collection hub refers to a farmer owned collection and chilling center supporting multiple enterprises that deliver farm supply and other services to the community. Culturally, dairy farmer organizations led by non-lead-non-dairy farmers have challenges getting support from lead dairy farmers.

- Agro-forestry should be practiced among the residents. It will provide for their future wood fuel, supply timber and other wood requirements. This will reduce their need to source for wood from the forest.
- Development of diversified ways to increase household incomes for communities living along the forest, e.g. taking part in high value horticulture production of items such as peas, passion fruit, Irish potatoes, cabbages and tomato. The crops are favored by both the soil and climatic conditions in the area. Other economic activities that can be incorporated in the area are poultry and bee keeping.

8.2 Recommendations on diary

Develop alternative livestock management for the communities living along the forest. This will involve encouraging reduction of beef cattle and progressively improving their dairy sector by adopting several strategies such as:

i. Introduce breeding through Artificial Insemination which will upgrade the present stock to better milk producers. The outcome of this will be more crossbred and high grade dairy cows that cannot withstand harsh forest conditions, but produce more milk and increase the household income.
ii. Sustainable development of the system requires supporting services, which entails improved pasture, fodder production and conservation.
iii. Improved veterinary services through the combined efforts of the cooperative and line ministry in the county and national government.
iv. Extension services and farmer training to enhance technology adoption and sustainable farming practices.
v. As a result of improved milk production, there will be a need to develop milk handling, collecting, bulking and marketing through farmer managed cooperatives (milk collection hubs).

REFERENCE

ERA, 2015: Economic Review of Agriculture, Ministry of Agriculture, Livestock and Fisheries, 2015

GoK (2011). Economic Survey, 2011. Government of Kenya (GoK), Nairobi.

Behnke, Roy and David Muthami for IGAD 2011. *The Contribution of Livestock to the Kenyan Economy*. Great Wolford, UK, IGAD Livestock Policy Initiative.

County Integrated Development Plan, Nakuru County, 2013 – 2017

Farmer, Elizabeth. End Market Analysis of Kenyan Livestock and Meat. Rep. no. Micro Report #184. USAID, Mar. 2012.

Gitu K.W. (2005): Market Access of Kenya's Livestock and Livestock Products to the European Union Market (KEPLOTRADE- Ministry of Commerce and trade)

Kenya Vision 2030, 2007: Kenya Vision 2030: A Globally Competitive and Prosperous Kenya, Government of Kenya, Nairobi

Butynki.T.M. &De Jong A.Y.: Game proof barrier feasibility study, 2016

Michael Burnham and Nathanial Gronewold, (http://www.eenews.net/stories/91049)acessed on 18.12.2016)

The Forest Acts 2005, Kenya Gazette Supplement, November 2005, Nairobi

UNEP IIPBES (2009a). Second ad hoc intergovernmental and multi-stakeholder meeting on an intergovernmental science-policy platform on biodiversity and ecosystem services, Nairobi, 5–9 October 2009. Summary of perspectives from the scientific community and broader civil society. UNEP/Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES)

Michael Burnham and Nathanial Gronewold, (http://www.eenews.net/stories/91049)acessed on 18.12.2016)

APPENDICES

APPENDIX 1: Terms of Reference

Beef Value chain South-West Mau
October-December 2016

I. Scope of the work

ISLA Kenya needs support of a consultant to assist in the analysis, verification and evaluation of a beef value chain along the north eastern boundary off and inside Southwest Mau Forest Block (Ndoinet Forest, and Kuresoi Forest)

II. Period of Activities

October to November, 2016

III. Description of activities

Analysis of Beef value chain

a. Define the nature of livestock grazing in the forest on a daily basis and determine if they are beef dairy or dual purpose in nature, the herd structure and the ratios of any such classification.

b. Determine if such cattle conform to natural breeding pattern in the herds or if there are mature bulls or steers imported into the area.

c. Through a proven methodology determine the status of cattle population that do daily grazing as opposed to those that are permanently domiciled in the forest.

d. Determine the ownership structure of the beef or dual purpose or young stock in relationship to the permanent residence in the area

e. Review the reports from local auction markets to determine if they owners of cattle do participate in the buying and selling.

f. Provide an ear to the ground report on whether the forest is used for illegal activities such as stock theft and the existence of records of arrest of any

g. Further to the above provide an observation and estimate and opinion on the carrying capacity of the general area and the effect of livestock grazing on the forest

h. Propose a production and management system to improve current system or any system you may propose

IV. Methodology

Provide a simple methodology that will be used in the study both scientific and non-scientific

(may include the use of a private eye investigator)

V. Deliverables

A. a qualitative report on findings on the activities

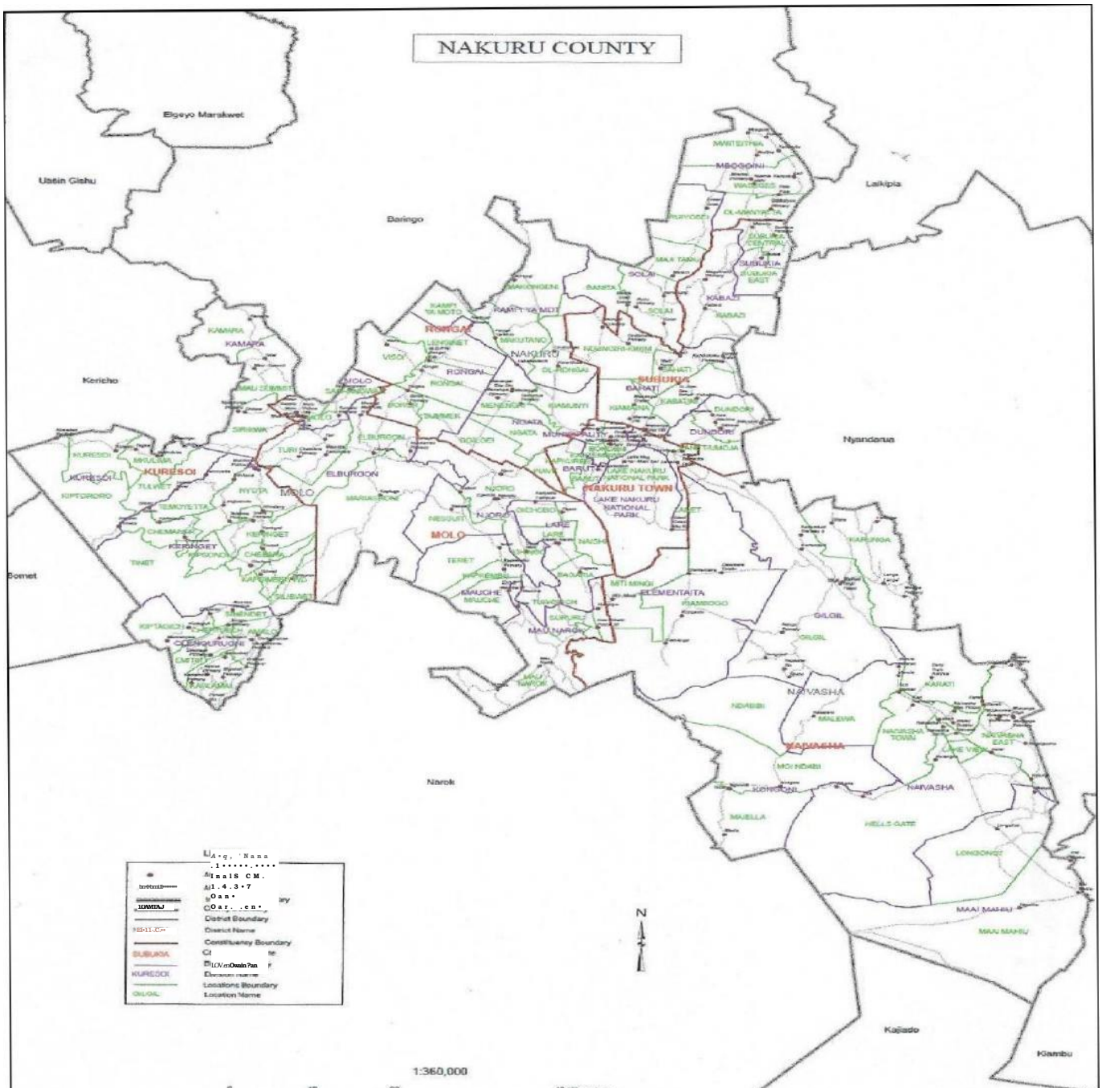
B. a quantitative report on an excel sheet showing livestock numbers and trends for the various categories

APPENDIX 2: Wards and population in North and South Kuresoi Constituency, Nakuru County

Constituency	Ward	Area in Km^2	Population (2013) Projections
Kuresoi North		559.7	140146
	Kiptororo	241.6	42467
	Nyota	174.2	44574
	Sirikwa	63.4	19253
	Kamara	80.5	33851
Kuresoi South		583	130413
	Amalo	87.6	23822
	Kapsimbweywo	163.4	32931
	Kiptagich	114	29592
	Tinet	218	44068

APPENDIX 3: Focus group discussion at Kapkembu Forest Service Station

APPENDIX 4: Map of Nakuru County



APPENDIX 5: Oxen grazing in the forest forming the largest portion of the herd

APPENDIX 6: Focus group discussion attendees in Kipkoris, Chematich, Kibaraa and Kapkembu

	Name	
1	Richard Langat	Kipkoris
2	David Sitonik	Kipkoris
3	Francis Koske	Kipkoris
4	Daniel Tuei	Kipkoris
5	Christopher Kiprono Koske	Kipkoris
6	David Towett	Kipkoris
7	Simion Maridany	Kipkoris
8	David Rutto	Kipkoris
9	Joel Kitur	Chematich
10	Stanley Maritim	Chematich
11	Samwel Chirchir	Chematich
12	Irine Sigilai	Chematich
13	Florence Kirui	Chematich
14	Sharon Bett	Chematich
15	John Mibei	Chematich
16	Johnson Kalya	Chematich

17	Joshua Rono	Chematich
18	David K. Langat	Chematich
19	Josphat Kipkirui Yegon	Chematich
20	Maritim B. Cheruiyot	Chematich
21	Leonard Kipkemoi Mutai	Chematich
22	Samwel K.Maridany	Chematich
23	Josphat Kipkorir	Chematich
24	Robert K. Siele	Chematich
25	Stephen K.Kilel	Chematich
26	Samwel K.Koskei	Chematich
27	Simon Terer	Chematich
28	John Ruto	Chematich
29	David Kikwai	Chematich
30	Joshua Tonui	Chematich
31	Joseph K. Rotich	Chematich
24	Roseline Cherotich Mibei	Chematich
25	Recho Chirchir	Chematich
26	Mercy Arusei	Chematich
27	Hellen Tuei	Chematich
28	Cpl Peter Lemaku	Kenya Forest Service
29	Michael Chepkwony	Chematich
30	Emily Yegon	Kibaraa
31	Elizabeth Soi	Kibaraa
32	Rael Tonui	Kibaraa
33	Sarah Tirob	Kibaraa
34	Gladys Yegon	Kibaraa
35	Shelina Kilel	Kibaraa
36	Sarah Rotich	Kibaraa
37	Emmy Korir	Kibaraa
38	Winny Rotich	Kibaraa
39	Faith Korir	Kibaraa
40	Ambrose Molel	Kibaraa
41	JosephChelogoi	Kibaraa

42	Joshua Ruto	Kibaraa
43	James Mosonik	Kibaraa
44	Abraham Koech	Kibaraa
45	David Sigilai	Kibaraa
46	David Sitienei	Kibaraa
47	David Bii	Kibaraa
48	Simon Maritim	Kibaraa
49	Francis Chebochok	Kibaraa
50	Raphael Chelule	Kibaraa
51	Jefferson Kirui	Kibaraa
52	Richard Maritim	Kibaraa
53	Stanley Langat	Kibaraa
54	Reuben Mutai	Kibaraa
55	Wesley Bett	Kibaraa
56	Joel Chepchilat	Kibaraa
57	Junicen Rotich	Kibaraa
58	Richard Rotich	Kibaraa
59	Joel Korir	Kibaraa
60	Kibet Siele Wesley	Kapkembo
61	Kipkirui Leonard Towett	Kapkembo
62	Joseph Kilel	Kapkembo
63	Bismark Bii	Kapkembo
64	Koskei John	Kapkembo
65	Ezekiel Kones	Kapkembo
66	Ezra Rotich	Kapkembo
67	Richard Tuei	Kapkembo
68	Charles Langat	Kapkembo
69	Walter Kirui	Kapkembo
70	Samwel Maridany	Kapkembo
71	Siele Robert	Kapkembo
72	Daisy Kirui	Kapkembo
73	Eunice Langat	Kapkembo
74	Gladys Misoi	Kapkembo

75	Winnie Maritim	Kapkembo
76	James Tonui	Kapkembo
77	John Sitienei	Kapkembo
78	Paul K. Keror	Kapkembo
79	Luka Keror	Kapkembo
80	Titus Koech (Forest service)	Kenya Forest Service
81	George Kairu(Forest Service)	Kenya Forest Service
82	John Malemo	Kapkembo
83	Alfred Kiptoo Cheruiyot	Kenya Forest Service