

Ruminants and Livelihood Security

How the rearing of ruminant animals influence livelihood security in Witima Village



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Abstract

This study seeks to contribute to the unclear role that ruminant rearing plays in rural smallholder livelihood security. It is based on data collected during a two-week fieldwork in Witima village, Nyeri South district, in the central highlands of Kenya. It is becoming increasingly important to examine the role that ruminants play in livelihood security in this setup, as the main economic activity, coffee, has suffered from years of poor performance, making farmers venturing into other farm enterprises such as dairy. The study uses the Sustainable Livelihoods Framework, which helps to provide an understanding of important assets and access modifiers relevant to the rearing of ruminants as part of smallholders' livelihood strategies.

This study finds that decreasing land sizes are limiting the possibilities of rearing large quantities of animals, however it also impels farmers to keep ruminants as the manure is needed for other farm enterprises kept alongside the animals. Furthermore, ruminants are kept as storage of wealth, which can then provide financial protection in times of crises. The study also finds that ruminant production is constrained by a lack of knowledge and the limited access to financial capital. This, together with a lack of farmers groups, limits the productivity of the ruminants kept, which consequently lowers the livelihood security gained. Therefore this report concludes that ruminants play an important role in the livelihood security of villagers, but there is a need to improve management and collective action to benefit from the animals full potential.

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1. Introduction

1.1. Background

Livestock contributes to around 40% of the value of the world's agricultural outcome. Two thirds of the world's domestic animals are kept in developing countries, and 90% of them are owned by rural smallholders (Swanepoel et al. 2002). Keeping livestock supports food security and contributes to income generation, and livestock rearing is a significant component in the livelihoods of more than 60% of the world's poor. This implies that growth in the livestock sector offers a chance to reduce poverty, provide food security and improve the livelihoods of smallholder households (FAO 2009, Upton 2004, Swanepoel et al. 2002).

In Kenya, the agricultural sector is of immense importance for rural livelihoods. More than 80% of the population is estimated to derive their livelihoods directly or indirectly from agriculture. Therefore, growth in this sector holds a massive potential for reducing poverty, as it is directly linked to some of the most vulnerable groups, such as subsistence-farmers (Alila and Atieno 2006; Pica-Ciamarra et al. 2011). Livestock contributes to 12% of Kenya's GDP, 40% of the agricultural GDP and 50% of the agricultural labour force (MoLD Strategic Plan 2008-2012). However, recent studies suggest that the contribution might be even higher (IGAD ICPALD 2013).

Apart from the direct role of generating food and income, livestock is also a valuable asset. Livestock can act as storage of wealth for future investment, used as collateral for loans, and generally as a safety net during times of crisis. Livestock complements crop production, and provide a reserve against risks (FAO 2009, MoLD Strategic Plan 2008-2012). In Kenya livestock is among other things used as a medium for social exchange in the payment of bride dowry, fines and gifts to strengthen kinship ties (Upton 2004; MoLD Strategic Plan 2008-2012). Livestock plays a vital role in mixed farming systems by contributing to other parts of the system, i.e. by providing manure for crop production (FAO 2009). This supports the importance that livestock can play in rural livelihoods.

In the Central Highlands of Kenya, the agro-ecological conditions are some of the most favourable for agriculture compared to those of the rest of the country, and small-scale farming systems are the most common type of agriculture (Omore 2003). In addition to crop production, most smallholders also produce diversified livestock (Omore 2003), which is a common strategy to gain income and food security and lowering the risks faced in their livelihood.

However, it is not clear what role livestock plays in the livelihoods of smallholder farmers in the central highlands. Here the role of livestock in livelihood security may be compromised by a number of challenges. Studies have found that diseases, poor communication, lack of marketing channels of livestock produce, lack of artificial insemination services and feed and water shortages during dry season, are main challenges to livestock production (Okuthe et al. 2003). Other constraints identified by farmers in Nyeri district is high pressure on land (Van de Steeg et al 2005), lack of capital, and access to credit (Owuor et al. 2009). In Nyeri South district, the average land area is only about 0.64 hectares per household (Owuor et al., 2009). These are all factors that need to be considered in an analysis of livestock's role in livelihoods.

1.2. Implications of rearing ruminants on livelihood security

This study seeks to address the unclear issues of livestock's influence on livelihoods by examining the role of ruminants. The study does so by analysing the rearing of ruminant animals as part of smallholder livelihoods strategies, and the role it has on livelihood security. More specifically the report is based on a field study of Witima Village in Nyeri South district in the Central Highlands of Kenya. Here, most households keep livestock, with almost every household having one or two dairy cattle (Owuor et al. 2009). Also goats, sheep and poultry are common, and there are emerging markets of rabbits, pigs, quails and fish farming. However, due to the time limitations of this project, it only allows for analysis of a limited number of species. The choice of analysing the importance of ruminants has been made with the aim to target the dominant animals reared in this area, and therefore also the animals with the highest livelihood implications for the broader population at current time.

The smallholder farming systems in the central highlands have been shaped and developed over time to come to look the way they do today (Bates 2005). Land size has been declining and coffee production has become the main economic activity of the area, while the market for dairy historically experienced troubles. The market for coffee was long doing well, with coffee prices rising until its peak in the 1990's (Owuor et al. 2009). Then, in the early 2000s, the market of coffee dropped, consequently changing the setup of household livelihood strategies and the livelihood security provided by coffee production. The drop in the coffee sector has been addressed by various scholars (e.g. Dorsey 2008; Karanja and Nyoro 2002; Mude 2006). These studies all show how the failure of coffee to provide good returns has led

farmers to neglect or up-root their coffee trees to be able to engage more into other farm enterprises such as horticulture and livestock production. This enhances the importance of examining the unclear role that ruminants play in livelihood security for the smallholder farmers in Witima as it may become increasingly more important.

1.3. Objective

The objective of the report is twofold:

- Firstly, to assess what are the assets, access-modifiers and context influencing the rearing of ruminant animals as part of household livelihood strategies.
- Secondly, to determine how rearing ruminants influences the livelihood security of villagers in Witima Village.

1.4. Research questions

In order to answer the objective of the report, the report adopts the following research questions:

1. What are the assets and access-modifiers significant in regards to rearing ruminants in Witima village?
2. What trends and shocks are the villagers of Witima experiencing, and how does the context influence the foundation for rearing ruminants?
3. How does rearing ruminant animals influence income level, income stability, social relations and degree of risk of the villagers of Witima Village?

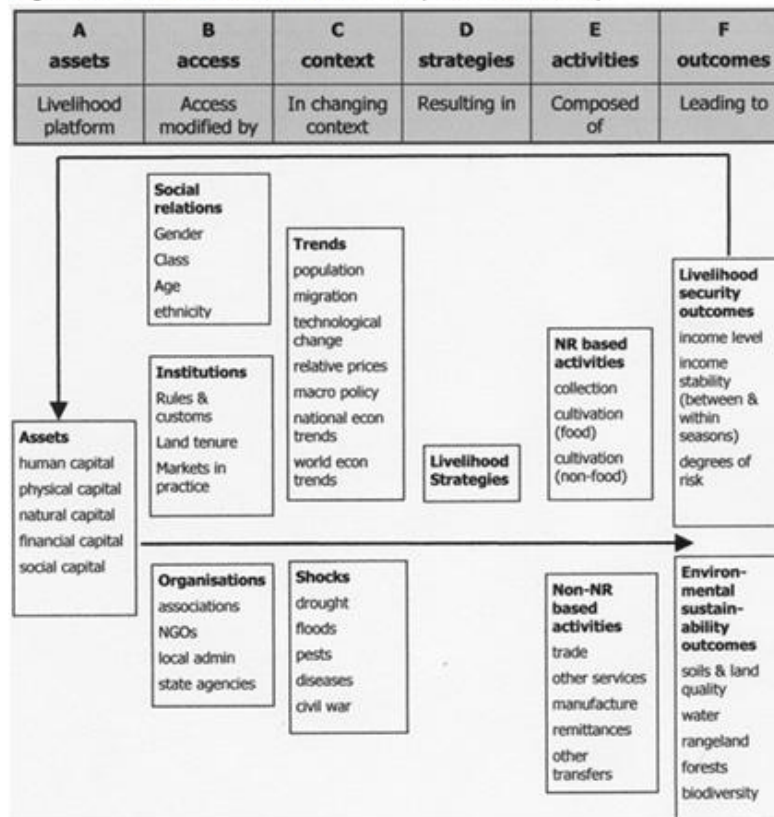
2. Conceptual Framework: the Sustainable Livelihood Framework

Analysing the importance of ruminants keeping in people's livelihoods requires having a main picture of their lifestyle. But livelihoods are complex, evolving over time, and differ from one household to another. Ellis (2000) established a framework that helps in organizing the main components of a livelihood and the links between them.

2.1. The Sustainable Livelihood Framework

Various types of Ellis' Sustainable Livelihood Framework (SLF) exist, but this project adopts the one shown in Figure 1. It is a tool to analyse the livelihood of a household or an individual. Ellis suggests that this aim can be reached by looking at one's assets, the factors modifying his/her access to these assets and the general evolution of the environment in which that person lives. With this information, the framework further helps understanding the options open to a household, the livelihood strategies they adopt, and how vulnerable they are to shocks and adverse trends (Ellis 2000; DFID 1999).

Figure 1: Sustainable Livelihood Framework (Source: Ellis, 2000)



This framework helps structuring the complexity of a livelihood by classifying the main components into six main categories: assets, access-modifiers, context, livelihood strategies, activities, and livelihood security and environmental sustainability. All categories are subdivided into field groups and general example of aspects that can be studied in one's livelihood. For example, it organizes the assets into five groups: natural-, physical-, human-, financial-, and social capital. The common access-modifiers according to Ellis are social relations, institutions and organisations. Furthermore, the context of an area is, together with the access to gains from assets, decisive for the availability and possibility of choosing different livelihood strategies. These strategies are adopted in order to achieve a desired livelihood outcome and have effects on the livelihood security of an individual or household (Ellis 2000). The dynamic nature of the framework is very important, as the different categories constantly will be influencing each other, and the diagram should therefore not be perceived as a static system (DFID 1999, Ellis 2000).

2.2. Role of SLF in this study

The framework acts as inspiration and guidance for the structure of this report. This study is an analysis of how rearing ruminants influences livelihood security in Witima Village. In practise it has been used in the formulation of research question, in the preparation and application of appropriate methods, and in the analysis of the data.

This research is expected to be done by looking at how important the assets linked to ruminants are, compared to others, such as the land use. Another way is to look if any social groups like farmers group, and organisations such as dairy cooperatives affect people's access to assets. Some overall trends also have to be accounted, such as the dairy product prices fluctuation. Another step is to analyse the emphasis people put on the activity of rearing ruminants and how that affects e.g. their income level or income stability. Another crucial step is to look at how all these aspects influence each other: over time, any change in the assets, access-modifiers, or context will modify the strategies and activities and their impact in people's livelihood security. Even though this research is based on the current situation, one's past experiences usually support the current decisions, which is why the study will also use information on the evolution of their livelihoods over time. One aspect of the framework that will not be studied is the environmental sustainability, due to time restriction.

2.3. Shortcomings and critiques

The strength of the framework is that it allows the researcher to address complex and often diversified livelihoods by ensuring that all relevant components are taken into consideration. This means that the framework has a holistic approach to understanding issues related to poverty reduction and development (DFID 1999).

Despite the recognition of the framework as useful to organize ideas into manageable categories, identify entry points, critical processes, and assist with prioritizing catalyst for change that can improve people's livelihood chances, there are limitations. One of the shortcomings of the SLF is its difficulty to capture the dynamics of livelihood systems, which in practice involves innumerable feedbacks and complex interactions between components in such a diagram (Ellis 2000; Scoones 1998). Scoones (1998) acknowledge that to gather sufficient information on all aspects of the framework may be too overwhelming, and that even major research effort may prove insufficient. Instead Scoones advocates that "optimal ignorance" must be applied in order to only seek out the information relevant to making informed action proceed (Scoones 1998). This could however lead to a normative dilemma when choosing which issues to prioritize (Kollmair and Gamper 2002). Moreover, The Sustainable Livelihoods approach has recurrently received critique and been accused of not taking into consideration the importance of power relations (De Haan 2012; Scoones 2009). It is however argued that the new generation of livelihood studies overcomes this issue and manage to incorporate power relations as part of the approach (De Haan 2012).

3. Description of Field site

The report is based on a short field study carried out in Witima Village (N 0°33'22.78" E 36°59'3.07"), which is located in the Central Highlands of Kenya, Nyeri South District (Figures 2 and 3).

Figure 2: Satellite image of Witima village (Source: Google Earth)

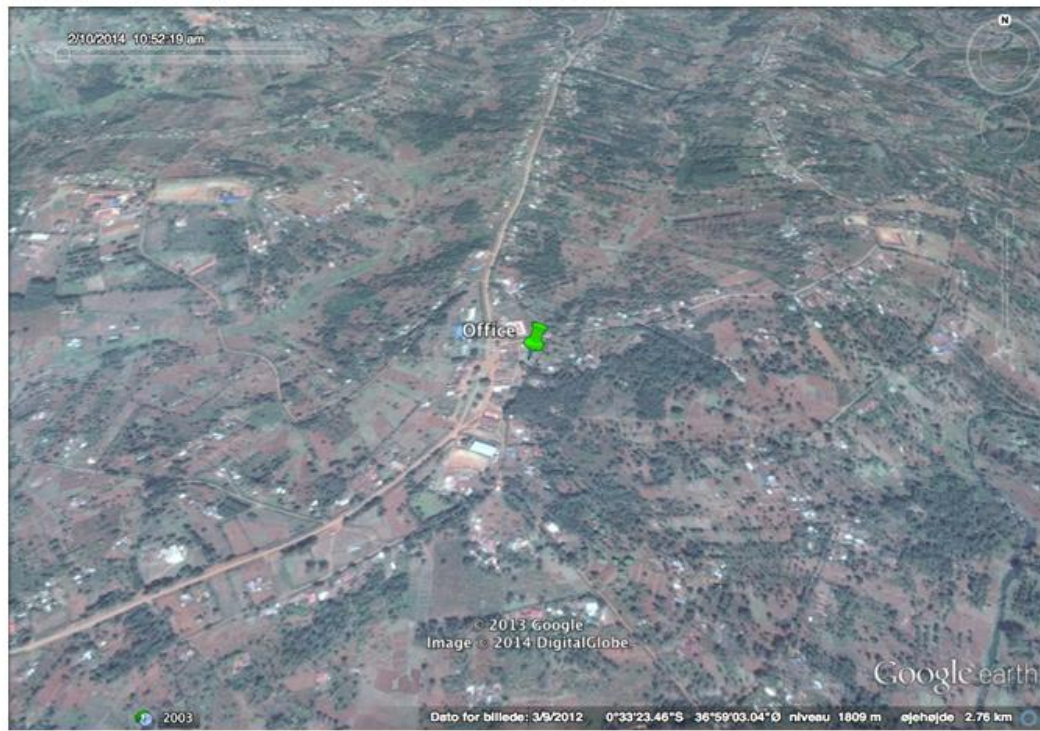


Figure 3: Map 1: Witima village (Source: GPS data)



The Karima Ward includes Witima sub-location and Itemeine sub-location. According to the Kenya 2009 Census Witima Village has a population of 3389, spread on 1013 households. It covers 7.1 Km² (KNBS 2010).

Almost all households keep livestock with 1-2 exotic dairy cattle, and the dairy sector is the leading activity in terms of livestock (Owuor et al. 2009). Farmers are additionally keeping goats, sheep, poultry, and few also keep rabbits, quails, pigs, bees or fish farms. Coffee and tea are the main cash crops of the area, and has historically been the main economic activities. However, the coffee sector in the beginning of the 2000s suffered from poor performance, which stimulated a growth in horticultural farming and livestock production (Ibid.; Karanja and Nyoro 2002).

The infrastructure in Witima is good, and the community is currently waiting for the main road to be tarmacked. Since 2004 the community has received a health centre, a police station and currently a community hall is under construction. Everyday several dairy cooperatives and companies pass through the area to collect milk from the farmers. The Village lies within close proximity of the larger town of Othaya, and is only 2-3 hour-drive from Nairobi.

A main challenge in the area is the fragmentation of the land due to high population pressure, which limits the land sizes. In Nyeri South district the average land size is 0.64 ha² (Owuor et al. 2009). Consequently, the field study showed that people either keep fewer or smaller animals that require less space.

4. Methodology

During the fieldwork period in Witima a range of methods were conducted to collect data relevant to the objective of the report. Being able to triangulate the information found was also an important aim for the diversification of methods.

This chapter in short describes the applied methods, and secondly reflects on their shortcomings and strengths.

4.1. Interviews

4.1.1. Questionnaire survey

At the beginning of the fieldwork a questionnaire survey (Babbie 2002) was carried out with respondents from 24 households (illustration 1). The purpose was to gain general demographic information about people keeping ruminants, and to know about the context of Witima. The main questions

referred to size of landholdings, main income sources, production challenges and ruminants' inputs and outputs (Appendix 4). The sampling method was random, but only targeting people keeping ruminants. The sampling strategy was carried out by entering random households. We aimed at skipping a minimum of one



Illustration 1 – Questionnaire survey with a farmer

household before entering into a new one. The research group divided up into three subgroups targeting different localities in order to cover a spread of households for a representative sample. The results have been statistically analysed using SPSS Statistics software. The households surveyed were marked with GPS waypoints in order to show their spread (Figure 3).

4.1.2. Semi-structured interviews (SSI)

We used semi-structured interviews (Mikkelsen 2005) to get in-depth knowledge on topics concerning the rearing of ruminants in the village. The interviews therefore targeted key informants related to the rearing of ruminants and livelihoods in Witima. The discussed topics varied according to the respondent and the information we wished to obtain. Some of the interviews were planned in advance, and others arose on the spot (Appendix 8 shows interviewed people and topics).

Two SSIs were done with inspiration from the life story interview method (Atkins 2004). The interviews were conducted with two persons from different age groups and farms, to get insight in how the topics (Appendix 8) are seen from different generations.

A list of respondents is found in appendix 9.

4.2. Participatory Rural Appraisal Methods

4.2.1. Transect walk

As part of the preliminary survey of the area a transect walk (Mikkelsen 2005) was carried out. The purpose was to get an overview of the spatial composition of the area - infrastructures, distribution of land, crops grown and other sites within Witima with special interest to the project. The transect walk led to the making of the map presented in chapter 3 *Description of Field site*.

4.2.2. Focus group

Two focus group discussions were held. One with people aged 40 and above, who had been identified through the questionnaires, and a second one including younger people identified and invited by our local guide. The purpose of the first focus group was to discuss a list of questions related to rearing ruminants in Witima, and to do a seasonal calendar exercise. With the second focus group, the purpose was to discuss the motivations for keeping ruminants and the challenges and opportunities related to it. This group was afterwards also included in two ranking exercises.

The two focus group sessions evolved differently. The first one was more of a group interview without much discussion, as it proved difficult getting the people to interact with each other. This was mainly because of our facilitation and because translation was too

interruptive. In the second session settings were changed in a way that translation was only at the end of each discussion, and the participants were encouraged to talk more among the group instead of addressing the chairman.

4.2.3. Seasonal calendar

At the end of the first focus group we did a seasonal calendar (Mikkelsen 2005). This was done for obtaining knowledge about the seasonal patterns and how these affect rearing ruminants and the market for ruminant products.

4.2.4. Ranking

At the end of the second focus group a ranking session was held. First a pairwise ranking (Mikkelsen 2005), where the participants were asked to mention up to eight outcomes from cattle rearing (they came up with five). Then they were asked to do a pairwise ranking of the stated outcomes. This was done to get a picture of people's most important outcomes related to cattle production.

Another ranking exercise revolved around challenges. The participants discussed what the most pressuring challenges are, and then they ranked them individually. This taught us both the group's opinion on the most important challenges, but also that these can differ amongst people.

4.3. Feed formulation experiment

During our first days in the field it was observed that many farmers use commercial feeds. However, the high cost of this input was frequently mentioned as a constraint. We choose an example of a well-managed farm, which still had management aspects which could be improved. Their use of feeds was based on a commercial ration of



Illustration 2 – Feed formulation trial. Preparing the homemade feeding ration

concentrates. We tried to assess the potential benefits of preparing a ration covering the basic

cow's energy and protein needs with raw ingredients (illustration 2). This formula was prepared using the Winfeed 2.8 formulation software, and consisted of the following proportions (Table 1):

Table 1: Feed formulation (own source)

Ingredient	Weight (Kgs)
Maize/corn	22
Wheat bran	22.5
Pollard	23
Cotton seed cake	12
Sunflower	15
Molasses	5
Salt	1.5
Premix	2.5
Total	103.5

These materials were purchased and brought to the farm, where the feed was mixed at the exact proportions.

The trial started with a control measurement during one day, where the cow was fed with the usual ration during milking and the milk samples were collected during the three times per day the cow was milked. Following this, the feeding program was done through introduction of the feed first at 50:50 and then at 100% proportion. The milk samples were regularly measured by the farmers and the results were informed to the group members.

4.4. Observation and informal conversations

Throughout the fieldwork we did direct and participant observations. As we were hosted by local families we participated in their everyday life and daily routines. For example, we cooked, had informal conversations and got a deeper understanding of family structures. Especially the students who stayed at families with livestock gained a broader understanding of the practices concerning the rearing of ruminants.

4.5. Feedback meeting in Witima

At the end of the research period we invited people from Witima to a feedback meeting in the community hall. Here we shared our findings and also, upon request, made some recommendations for the farmers to follow. This was also an opportunity for us to listen to their comments, agreements and disagreements on our findings.

4.6. Reflections

One experiences different advantages and limitations/constraints when doing fieldwork, especially in a foreign country.

We found it helpful to be accommodated in the local society. This gave us an opportunity to experience the rural life and provided a shortcut into the village society, as we had access to sources of information right away. Also it made us visible in the community. The villagers were eager to contribute, but that could also be a challenge because we often found ourselves in situations where people wanted advice from us, which we were not able to provide.

Another beneficial factor was our Kenyan counterparts, as they had a better understanding of Kenyan culture and surroundings.

Punctuality was a factor limiting our work. When making appointments, participants were usually late. Also some group members could not avoid being late because of the daily routines in their host families.

During the fieldtrip, it started to rain. This was a sign for people to prepare their *shambas* (fields) for planting, and therefore it became a busy period, which made it harder to fit us into their time schedules. This did not prevent us from doing any of the methods, but it took a little longer to find people that did not have other commitments.

Going to Kenya placed us in a new area that in many ways differs greatly from the context we normally work in. Natural, social and cultural differences were obvious. It could also be considered a constraint that we lived with local people, two of us with assistant chiefs. The Kenyan community considers rank as a relevant factor, and it could be that the information we found is affected by whom the villagers connected us to.

Some of the issues explained here will be further explained in the chapter *Reliability of results*.

5. RESULTS AND ANALYSIS

5.1. Assets and access-modifiers influencing ruminant rearing in Witima

The following section relates to our first research question and addresses important assets and access-modifiers related to the rearing of ruminants by villagers in Witima. It highlights the factors that were found to be most critical to the livelihoods in the area. However, it should be mentioned that further assets observed to have an impact on the rearing of ruminants include access to water and human capital related to labour and health. These assets are however not included here.

5.1.1. Sources of livelihood

Figure 4: Main sources of income (Source: Questionnaire results)

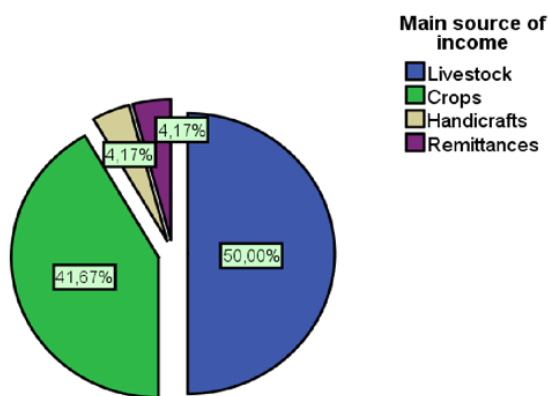


Figure 4, shows that for half of the respondents in the questionnaire survey, livestock is the main source of income, followed by crop production for most other respondents (42%). Other respondents get most of their income from handicrafts and remittances.

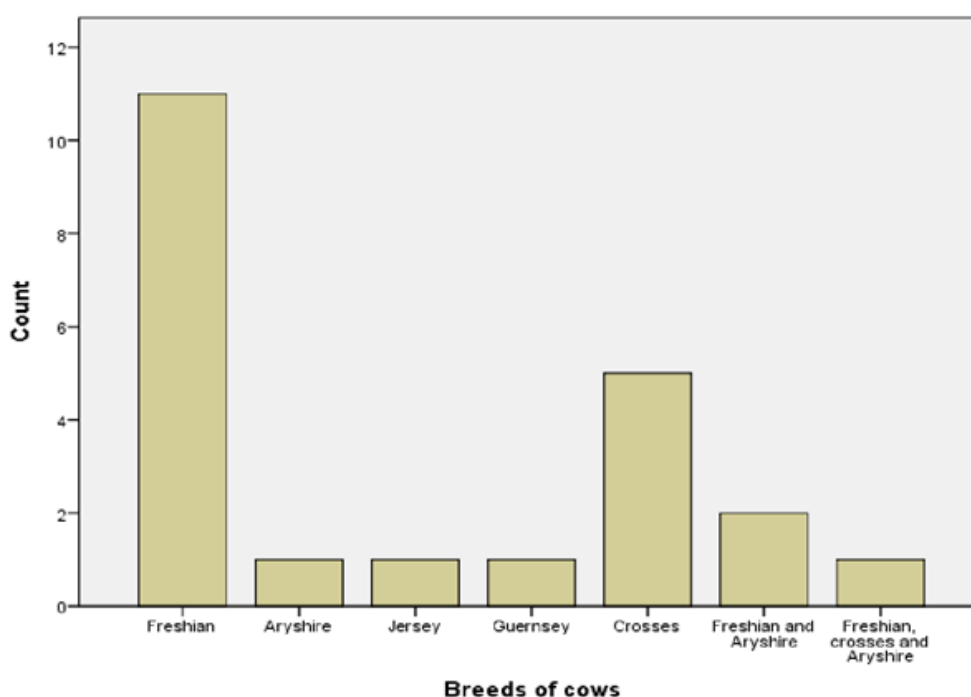
Within livestock, dairy production represents the most important economic activity. This study shows an average of 1.67 cows per household (ranging between 1 and 5) and 1.21 goats (ranging between 1 and 6) (illustration 3), whereas sheep appear in low numbers with only 0.29 per household (ranging between 1 and 3). The number of sheep kept is very little, which supports the observations done throughout the fieldwork, and therefore this study does not put much focus on the role of this type of ruminant.

The majority of the cattle are exotic breeds with Friesian as the most common. Friesians are considered a good and well producing breed of dairy cattle. This shows the importance and the potential of dairy production, where Friesians are yielding higher than other breeds (Figure 5).



Illustration 3 – Farmers' goats

Figure 5: Breeds of cows (Source: Questionnaire results)



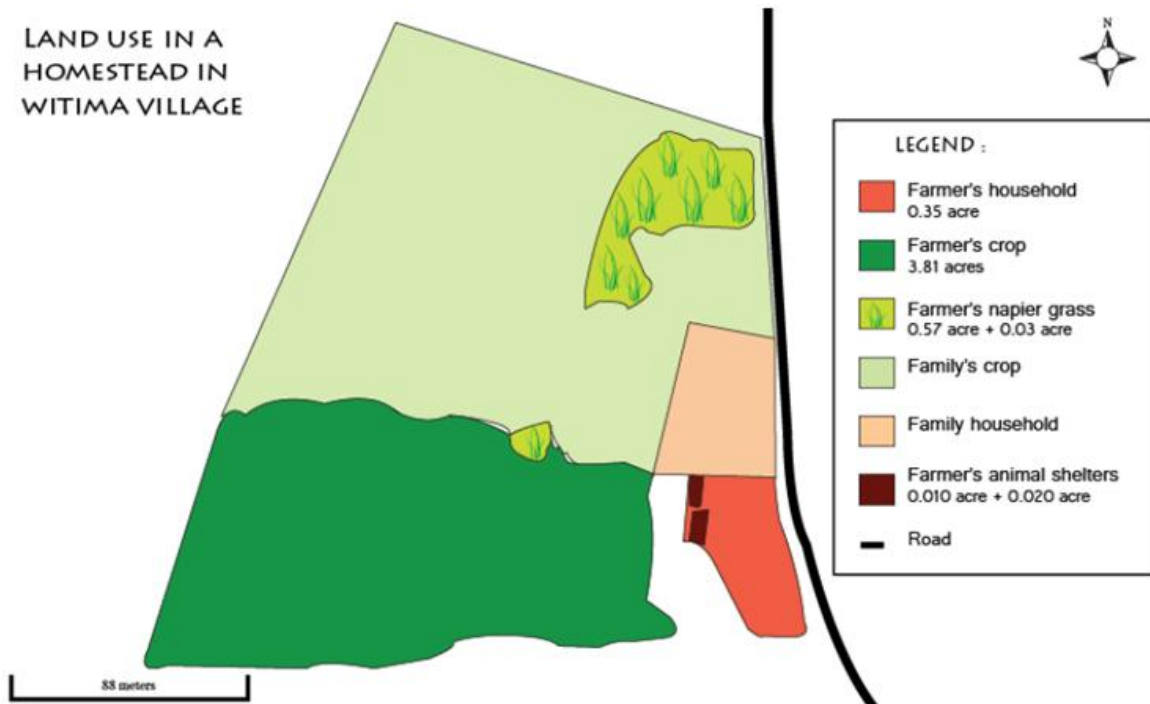
Coffee is the major cash crop in the study area. Most of the households interviewed in the questionnaires (74%) were coffee producers. According to the District Agricultural Officer in Karima location, Mr Lwangu, coffee is the main source of livelihoods followed by livestock. However, as stated by Mr John Maina, deputy Livestock Production Officer in Othaya, now the farmers are investing in other economic enterprises such as the dairy sector due to changes in other economic activities, especially within coffee production. Half of the ruminant farmers interviewed in the questionnaires stated livestock as their main source of

income, however this does not reflect data from farmers who do not keep livestock, which might have reduced the given percentage, and it is noted that 96% of the respondents also declare to have other economic activities within their household.

5.1.2. Land size

The 2.1 acres (0.8 ha) per household observed in our questionnaire data reflect the main concern about land fragmentation which was reported by many of the respondents. The biggest land owned observed was 7 acres, whereas the smallest was as low as 0.25 acre. Scarcity of land has been increasing as portions of land have become more fragmented due to its allocation to new generations of numerous descendants (see appendix 2+3 for an overview of land division based on family descent). This has been mentioned as one of the main challenges limiting livestock production, and thus restricting cattle production to zero-grazing systems. The Livestock Officer (1) states that to sustain the feeding of one cow, approximately $\frac{3}{4}$ of an acre of Napier grass are needed. Due to the small land sizes, it is difficult for households to produce enough animal fodder (Focus group 1). This is also reflected in the results from the questionnaires, where feeding issues are mentioned by 83.3% of the respondents as a main challenge in keeping ruminants. The questionnaire sample showed that an average of 0.77 acre dedicated to ruminant production, which equals to 30% of the total land size owned (example in Figure 6). This shows how ruminant production competes with other activities on the land, and the prioritization and calculation that farmers have to make due to the limited land size is now moving towards a higher prioritization of animal production.

Figure 6: Map 2: Land use in a homestead in Witima village (Source: GPS data)



5.1.3. Access to financial capital

Lack of financial capital was mentioned by most of the farmers participating in this research. In the problem ranking exercise all farmers ranked “financial capital” as the most important problem they face in the rearing of ruminants (Table 2). Many challenges mentioned in the questionnaires, such as feed, diseases and labour are somehow related to this issue. The general wish of the farmers is to have more money in form of loans or earnings in order to be able to invest in their farms.

Cows are used as insurance and a guarantee of regular income. Milk can serve as collateral for credit, which gives it an added value (Farmer 1). Goats and sheep also have a financial importance: they have often been considered as storage of wealth. Farmers invest in these animals instead of placing their money in banks, as they expect them to provide food products, and to reproduce, thus increasing the potential outcome of their investments. Farmers from both focus groups and farmers without ruminants said that they are commonly used to pay for school fees and medical expenses.

According to the Agricultural Officer, a major problem for the farmers is the inability to invest: as they have periods with irregular income due to uncertainty in the payments of

certain dairy cooperatives, their savings are limited, and as they have unexpected expenses, their opportunities of investment in their farms are often limited. The Livestock Officer (1) stated that the only financing sources available are private, such as Equity Bank that invests in livestock, and some cooperatives that can distribute loans, but no subsidies are available from the state.

Table 2: Challenges ranking (Source: PRA results)

Challenges	Total points	Ranking result	Most frequent rank
Financial capital	6	1	(1)
Diseases	21	2	(4)
Proper feeding	22	4	(3) / (5)
Lack of enough knowledge	20	3	(2)
Lack of surplus profit	21	2	(3)

5.1.4. Knowledge and skills

One farmer said that “*there is a lack of proper education*” (Farmer 1). He explained that many farmers cannot optimize their production because they know so little about ruminants. The problem ranking (Table 2) shows that all the farmers of the group agreed on “lack of enough knowledge” as a major challenge in rearing ruminants. It was ranked third after “financial capital” and “lack of surplus profit”, with some opinion differences within the group.

About 42% of the respondents of the questionnaires declared never to have received training on the rearing of ruminants. The most common type of training comes from cooperatives, as stated by 42% of the farmers, followed by training from government extension officers (29%).

Various types of training are offered in the area, both for livestock and crop production, as stated by different farmers and by the Agricultural Officer. At our



Illustration 4 – Feedback meeting with the community

feedback meeting with the villagers, a man said that the farmers in general attend trainings related to production of ruminants, such as silage making, but that in general the farmers lack the resources to apply what they learn there (illustration 4).

The lack of knowledge is addressed by the Agricultural Officer, who says that it becomes a problem as it negatively affects the production. The farmers' knowledge about detection of heat is not good; so it is a problem for artificial insemination, which needs to be repeated if not done at the right moment, and then new insemination doses have to be bought.

The Karima Chief reported that they try to help the people through a non-political development network called Ongiru. It is a network of agricultural professionals and professors from the Nyeri area that *“want to give back to their community”*, by organizing yearly field trainings, which reach up to 400 attendants, and sharing knowledge with the local population. The aim of it is *“to uplift the community and the agriculture”* (Karima Chief).

5.1.5. Facilities and infrastructure

The general observation is that farmers keep their ruminants in shelters built from wood, on their property. According to the respondents, shelters are generally not adequate as they do not protect the animals from weather changes, which play a major role in animal diseases. Also the ground is generally not well maintained for proper animal keeping. Farmers tend to increase the production of smaller animals than cows because they require less space for shelter and feed.

Few farmers chop the Napier grass in order to facilitate the cows' digestion by using a grass chopper. Others use a simple machete (illustration 5), but many of the farmers do not cut the feed. As decisions and investments are individual, no tool or machinery is shared amongst farmers, according to the Agricultural Officer. He also



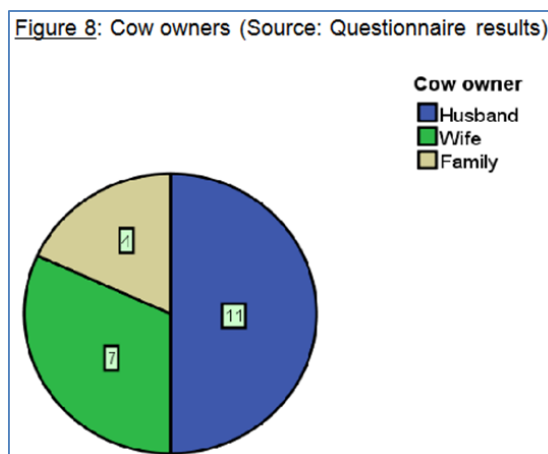
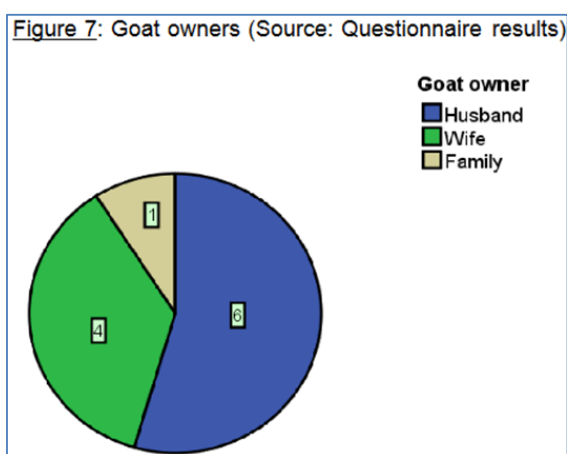
Illustration 5 – Farmer manually chopping Napier grass

mentioned that in general farmers have no machinery and few tools to ease or facilitate ruminant production. It was also observed that almost all farmers have a cell phone. It is used

for online payments, banking activities and even to be updated on agricultural products' prices; e.g. with the mobile application *Icow*.

5.1.6. Access to assets modified by gender

Gender is an important access-modifier impacting the possibility to derive from the assets of a household. As figures 7 and 8, show, women are less likely to be the owners of animals, but are often in charge of their maintenance. Especially the rearing of small ruminants, goat and sheep, falls within the work of the housewives, doing 73% of the work. In the rearing of cows men were more present (38%), but still women did the majority of the workload (76%). Contrastingly, the ownership of the animals in all categories showed a predominance of men as possessors.



An important field observation was that all the men from our host families had wage jobs outside the farm, and therefore left much of the ruminant-related work to the women, whom were also in charge of the daily domestic chores. This is sometimes in contrast with the fact that the women are indeed not the ones owning the ruminants. An important concern was also raised: often the men are the ones attending to trainings and meeting with extension officers, but it is the women who are the ones doing the practical work, and therefore much information is lost in lack of communication (Agricultural Officer).

5.1.7. Youth and agriculture

The time spent in Witima showed how different age groups are engaging in diverse activities. In an interview with an agrovet in Witima, we asked about the youth's involvement in livestock farming and he stated that: *“They [youth] have an idea that farming is an old-*

school way of getting money, instead they want to do business” (Agrovet). Furthermore the numbers from our questionnaires show us that the average age for the farmers interviewed is around 60 years. Several farmers have reported that it is problematic since people are getting older and too weak to work in such a demanding area as farming is, and they need someone to help them take care of the farm. While filling the questionnaires a young man explained that his mother was getting old and sick so he had to come and take care of her and the farm. Another older couple said that because of age and poor health they had to give up their ruminants, currently only keeping poultry.

5.1.8. Customs related to ruminants

It became clear to us from interviews and questionnaires that livestock is perceived as a symbol of wealth but it is not the only measurement because people can still be seen as wealthy without livestock. It can be used as dowry, both actual livestock and “paper-cows” (Farmer 1). Dowry is still paid, but now often in the sense of “paper-cows”, which means that the husband will be paying in cash, but equalling the amount of money that the agreed number of livestock would be worth (Farmer 1). Hence there is a shift in the cultural meaning of ruminants in the area. The earlier use of animals as currency has an impact on the present dowry, figuratively.

Ruminants are used in connection with different cultural events such as circumcision ceremonies, funerals and marriages, where people serve the meat as a symbol of gesture. It only serves as a part of the celebration and consumption which is attached to such occasions; it does not hold a ritual importance (Focus group 1).

5.1.9. The role of cooperatives

Diverse information can be deployed from the field study. Milk is the single most important product that is derived from the rearing of ruminants, and the main motivation for keeping them. The milk is either sold at farm-gate, to brokers or directly to one of the dairy cooperatives operating in the area. People themselves stated that selling to a cooperative impels a number of advantages; such as bulk prices, a secure marketing channel and access to credit and loans. However; 3 years ago, in 2011, one of the larger dairy societies collapsed without payment to the farmers. This has implications on the situation today, where several farmers said that the collapsed dairy cooperative still has a debt to pay. However, as the

majority of respondents from the questionnaire (90%) stated, there is still a good or medium access to the market.

In Witima, people mention mismanagement and corruption of previous cooperatives as an explanation of a higher degree of reluctance towards entering into a cooperative nowadays. However, 50% of the respondents from the questionnaire are part of at least one cooperative, and it was observed that there was a wide recognition to the cooperatives as important players in the access to market and profits. Cooperatives, and the history of these, hence have an impact on the access to benefitting from the rearing of ruminants.

5.1.10. The lack of farmers' groups

A striking observation made during the fieldwork was the absence of farmers' (self-help) groups or associations dealing with ruminants. Cooperatives are, as the latter shows, not uncommon in the area, which makes it even more surprising that groups doing collective action on ruminants were not to be found. As previously shown, the current dairy cooperatives provide some training on ruminant production. However, they do not provide any inputs such as commercial feeds or A.I. services, leaving these issues to the individual farmer/member. This was once the role of some previously existing self-help groups (Karima Chief); however the failure and mismanagement of such groups led to their dilution and the farmers to alternatively switch to individualized strategies. Consequently, the potential of benefitting from rearing ruminants may be limited by the lack of utilization of social relations and failure of (informal) institutionalized cooperation. This issue was discussed on the feedback meeting at the end of the field study period. Here it was put forward as a potential way to increase the benefits of rearing ruminants, and the community welcomed this recommendation positively. We were happy to find that a founding meeting of a potential farmers' group was called for on the last day of the field study.

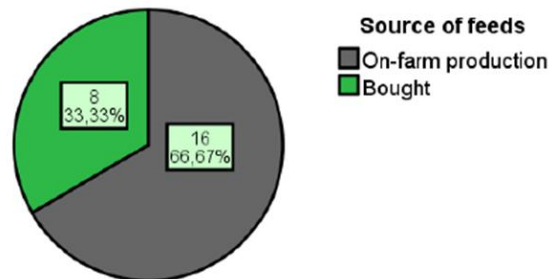
5.2. Context, trends and shocks influencing the rearing of ruminant animals in Witima

The following section focuses on answering our second research question. It includes context, trends and shocks critical to the rearing of ruminants in Witima village, and highlights the most pressing issues.

5.2.1. Seasonality

During the dry season many farmers experience a need to buy fodder from outside to sustain their ruminant needs, preferably in form of hay, which has the best dry matter. Another option is to lend or rent a piece of land from a neighbour (Agrovet + Focus group 1) to be able to have an own-production of a suitable amount of fodder throughout the year. But since people have low access to capital and the scarcity of land, the latter option is not available to the villagers in general. All the respondents indicated Napier grass as the main source of feed for their dairy cows. Also, about 67% get more of the feed from on-farm production and the rest buys most of it. (Figure 9). About 75% of the households interviewed stated that they purchase commercial feed (e.g. dairy meal, pollard, salt lick and maize germs).

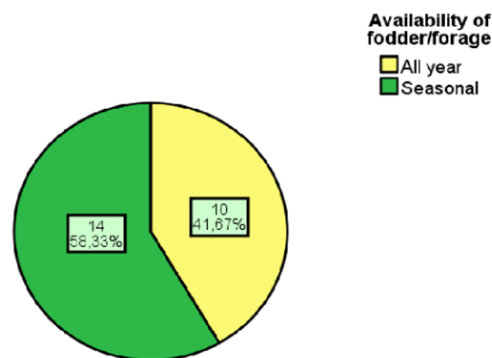
Figure 9: Source of feeds (Source: Questionnaire results)



About 58% of the respondents perceive the fodder as being available seasonally. (Figure 10) During the wet season there is plenty of fodder available, resulting in much being wasted (Karima Chief + Feedback meeting).

There is a lack of fodder conservation techniques -like silage or haymaking - when there is a surplus of fodder to save it for less productive periods of the year. But as mentioned, people lack capital to use the conservation methods introduced, and wish to apply new cheaper methods.

Figure 10: Availability of fodder (Source: Questionnaire results)



Another aspect that interferes with production of ruminants during the year is holidays. The main ones are Easter, Christmas and Jamhuri Day. During these the consumption of milk raises, because many family members that live outside the village come back home. Also meat consumption rises. Better-off families slaughter a goat or a chicken during these celebrations - especially at Christmas.

5.2.2. Fluctuating milk prices

The fluctuation in milk prices happens as a consequence of different conditions throughout the year and also it depends on who the buyer is. Farmers reported that the price for a litre of milk ranges from 25 Kenyan Shilling (KSh) to 33Ksh (questionnaires).

The participatory seasonal calendar shows that in the dry season milk production goes down due to lack of fodder for the dairy ruminants. This results in higher prices, as there is a smaller amount of milk available on the market. The opposite happens in the wet season; where fodder, in form of Napier grass, is plenty, and therefore milk production raises and prices lower. This information is supported by data from the questionnaires, namely that fodder for most farmers is considered seasonal (Figure 10).

5.2.3. Diseases

Farmers and officials as one of the main challenges addressed have mentioned diseases. This was ranked as the second most important challenge during the participatory ranking session. Also, 25% of the people interviewed in the questionnaire mentioned it as an important challenge (Table 3). The high prices of veterinary inputs -although these are generally available- are determinant in this aspect. However, management practices are also closely related to disease outbreaks. As a farmer stated: *“it is very hard to deal with diseases as veterinary services are very high and medicines are very expensive. The best option is to lower the effects of weather variation by keeping animals in a good shelter”* (Farmer 5). Another factor resulting in disease outbreaks is importation of hay from other districts. This is especially true for the tick-borne diseases of East Coast Fever (ECF) and anaplasmosis. The hay imported brings ticks which are vectors of these diseases (Agrovet). The Karima Chief mentioned a previously applied solution for tick control consisting on cattle dips. This was an initiative once economically supported by the government. However, the funding stopped and the organization for the cattle dips collapsed. Also farmers started to prefer to apply the alternative method consisting in manual spraying. Although this method proves to be less effective as the cattle dip and more expensive, people still preferred it in order to avoid transporting the animals to relatively far distances.

Table 3: Challenges ranking (Source: Questionnaire results)

Challenge	Mentioned by % of the respondents	Details
Feeding issues	83.3%	Inadequate type, scarce, expensive, seasonal, supplements not always accessible, lack of money...
Output markets	25%	Poor market for selling animals, milk industry not completing the payments, price fluctuation...
Diseases	25%	Pests and diseases in general (Mastitis), expensive medicine...
Veterinary issues	12.5%	Expensive services (artificial insemination...), veterinarians not always available...
Labor	12.5%	Lack of time for agricultural practices --> need of labor → but cannot afford it
Shelter	12.5%	Inappropriate shelters for animals, no space and no money for more and better shelters...
Water	8.3%	Lacking in dry season, inappropriate reservoirs to store water
Land	4.2%	Scarcity of land
Low productivity	4.2%	Low milk production → no income → more inputs than outputs
No challenges	4.2%	No challenge in keeping ruminants

5.3. How rearing ruminants influences livelihood security in Witima

This section presents results on and analyses how rearing ruminants influences livelihood security of the villagers of Witima. It focuses on the most relevant data connected to income level, income stability and the degree of risk.

5.3.1. Income level

It has not been possible to assess to which extent or proportion subsistence farming provides livelihood security compared to the income obtained by selling products from ruminants, as it would have required a more extensive research. Field observations and interviews point to a major importance of the ruminant species in regards to level of income than the other animal productions. Milk production provides an important part of people's livelihoods in Witima sub-location. The observed average of milk sold in households keeping lactating animals was 6.5 litres per day. The average price of milk stated by the respondents was 29.5 KSh per litre. The average profit then is 192 KSh per day.

However, the gains from the ruminant sector are insufficient for many farmers. Productivity is a core factor (Livestock Officer 1), and many factors mentioned before are related to it: land size, lack of affordability of inputs, lack of knowledge/skills, and lack of

proper formal/informal structure. In terms of average milk production, the figures showed by the questionnaires are 4.6 litres/day per cow.

However, it is believed that there is room for improvement. The Livestock Officer reported that improvements are expected because the area considered is very good for dairy production, and if farmers get paid better the possibilities for investment and purchasing inputs will increase, and hence the production potential enhanced.

Responding to the low income level, low access to capital and the low productivity of the animals, we chose to do a feed formulation experiment to investigate if it would be possible to farmers to lower their expenditure on commercial feeds, while either maintain or increase their productivity. The experiment showed promising results. The change in the feeding ration of a single cow proved to increase its milk yield by 4.3 litres per day. (Table 4)

Table 4: Effects of feed optimization (Source: Feed experiment results)

Days of experiment	Thursday	Friday	Saturday	Sunday
Sale to cooperative – 6:30 AM	4.4 L	4.2 L	4.2 L	4.8 L
Sale to cooperative – 1 PM	4.5 L	5.5 L	5 L	6 L
Sale to cooperative – 6:30 PM	5 L	6 L	6 L	6.5 L
Sale to neighbours	3 L	3 L	3 L	3 L
Kept for own consumption – 6:30 AM	1.5 L	1.5 L	1.5 L	1.5 L
Kept for own consumption – 6:30 PM	0.5 L	0.5 L	0.5 L	0.5 L
Total produced milk	18.9 L	29.7 L	20.2 L	22.3 L
Changes from usual production (18L)	+ 0.9 L	+ 2.7 L	+ 2.2 L	+ 4.3 L

An interesting observation was that the new concentrate portion was more palatable, as the cow was eating faster than usual. With an average price of 29.5 KSh/L this translates into 127 KSh per day in additional income. If represented for a whole lactation period (305 days), and assuming that the average gain through the period would remain 4.3 litres/day, the yearly gain per cow would be of 38.700 KSh. This does not include the savings achieved from the new homemade ration, which showed to be 4.4Ksh/Kg cheaper than the commercially produced dairy meal. It is difficult to make an assessment of the yearly savings for a change in the concentrated feed portion of a dairy cow, as it depends on such factors as age, lactating period, yield, breed; it is proved in the results that our homemade ration would be 308 KSh cheaper for a 70 kg bag. Lastly, it needs to be noted that the cow fed in this trial was a high yielding cow in the sub-location (18 L/day). Compared with the average daily yield from the questionnaires (4.6 L), there is a difference, and thus the potential for improvement for an average-yielding cow can be higher than 5 litres per day.

Lastly, there are other important indirect sources of income related to cattle. During the pairwise ranking (Table 5), breeding was mentioned as the most important use for which cattle is reared, followed by milk. This reflects the fact that future income will depend on the offspring of their actual animals and their performance, and also, as stated by some of the farmers, the obvious fact that without breeding there is no milk produced.

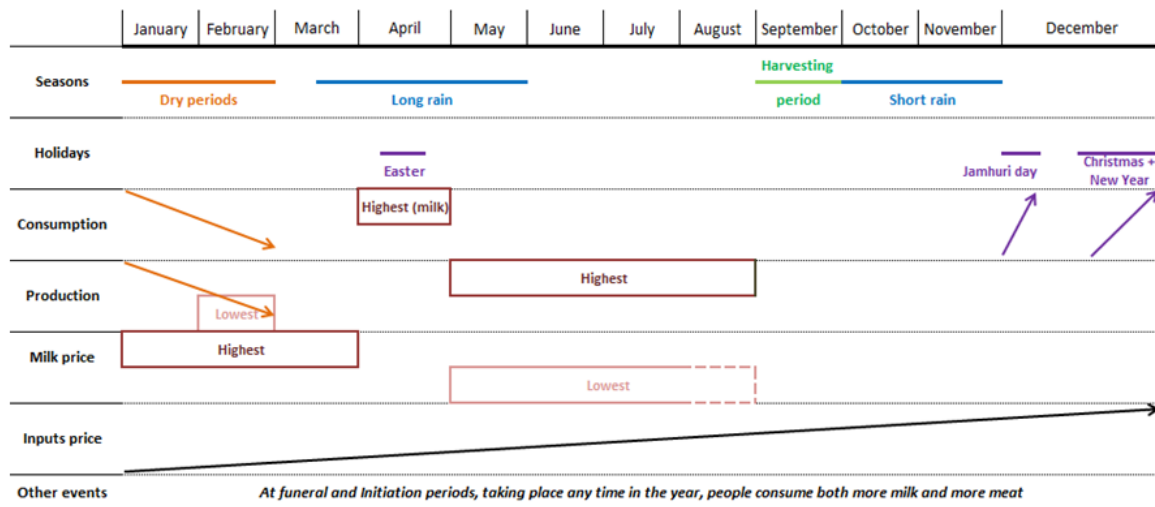
Table 5: Motivations ranking (Source: PRA results)

Motivations	Number of times ranked as preferred choice	Ranking result
Breeding	4	1
Milk	3	2
Security	2	3
Manure	1	4
Meat	0	5

5.3.2. Income stability

One of the main outcomes mentioned related to rearing ruminants is the income stability that it provides to household livelihoods. Rearing livestock in general is a way to diversify and thus increase the income stability by adding different sources of income at different times of the year. An important source of income providing stability, mentioned throughout this study, is milk production. Many interviewees have reported how useful it is to keep their dairy enterprises, as it provides them a daily income, thus reducing seasonality problems related to lack of productivity of other farm enterprises. However, there is also a seasonality pattern for milk prices (Figure 11), although this has not been stated as a main concern or challenge.

Figure 11: Seasonal calendar (Source: PRA results)



Keeping ruminants also serves as a source of economic stability in the sense that when there is a need of pay for expenses, these can be sold instead. A farmer stated that a normal pattern observed is to have seasonal fluctuating in the number of animals kept due to having to sell them at certain times of the year for yearly payments (mentioning school fees) and buying them again when the income level rises during better seasons (Farmer 4).

5.3.3. Degree of risk

The livelihood security of a household is affected by the degree of risk that threatens their livelihood. The extent to which the rearing of ruminants is affecting the degree of risk may be changing towards having a higher influence (Karanja and Nyoro 2002).

In addition to raising financial capital, keeping animals reduces the degree of risks of situations of crisis, and diversification hence acts as a buffer to lower the degree of risks. Moreover, animals are kept as storages of wealth. This provides the individual household with some resilience towards economic shocks, unemployment, disease, drought etc., which might influence the household's ability to benefit from other economic activities. It is in this sense clear that ruminants are kept with a purpose of lowering the degree of risk of the household. Also, the use of manure helps securing better yields from other (cash) crops on the farm. Even further, it is not unusual to see people making a business out of manure, and even it being transported long distances to potential buyers (Livestock Officer 1). The manure derived from the ruminants hence indirectly supports lowering the risk of the farms, which in most cases

are being intensively exploited due to the scarcity of land, leaving giving space to land under fallow (Dorsey 2008). Without the rearing of animals the household would be increasingly more vulnerable as also other activities would be affected by the lack of input currently provided by the ruminants.

Contrastingly, the rearing of ruminants is also associated with risk. None of the respondents highlighted the risk of diseases as a potential factor threatening their livelihood security. However, knowing that the keeping of animals is related to storage of wealth it may be devastating to a household to lose either products derived from the animals or the animal itself due to disease, accidents, theft, etc.

6. Discussion

6.1. How ruminants influence livelihood security

According to Owuor et al (2009), agriculture represents the main source of support to livelihood for the people in Nyeri South district. This representation align with our study of Witima, as more than 90% of the households surveyed derive their main source of livelihoods from agriculture, and 50% have livestock as their main source of income. Dairy production is the main income activity related with livestock (Ibid.). Regarding the number of animals kept per household, the given reference complies with our observations of villagers keeping 1 to 2 dairy cows per household.

According to Mude (2006), the coffee sector is a profitable sector contributing to livelihoods, but the sector has experienced challenges over time with declining prices. Karanja and Nyoro (2002) state that due to these changes other sectors such as dairy are on the rise. This is the pattern described by the Agricultural Officer, and observed in many households, who are combining coffee and ruminant production.

6.1.1. Land size and the keeping of ruminants

Owuor et al (2009) found that the mean size of land per household in South Nyeri is of 0.64 ha. Our questionnaire data for Witima show a similar pattern: 2.1 acres (0.8 ha) per household.

Dorsey (2008) saw that only an average of 0.12 ha (0.3 acres) of smallholders' total land size was left to livestock raising, settlement and vegetable gardens after the space taken up by coffee, other cash crops and food crops. In this study we saw an increase to more than twice that size, with an average of 0.77 acres of land dedicated to raising ruminants. This potentially supports an increased importance of ruminants in smallholder livelihood strategies. This is a plausible development here in the years after the decline in coffee markets, which has been described to have an impact on farmers venturing into other farm enterprises (Karanja and Nyoro 2002). Furthermore, evidence shows that having less than 3 acres of land makes it difficult for smallholders to leave their land under fallow (Dorsey 2008). This has a degrading effect on the soil fertility of the already small lands. Here, our study show how the rearing of ruminants obtain a more central role to livelihood security as it is also kept for the manure that it produce. The keeping of animals comes to support other

farm enterprises, e.g. the coffee production, hence giving ruminants an indirect influence on livelihoods. The lack of access to financial capital important here as it makes it difficult or even impossible to smallholder farmers to buy artificial fertilizers, consequently making the production of on-farm manure more important.

6.1.2. Unequal access to benefits

Gender is an important issue to consider in the assessment of how ruminants influence livelihood security. As seen in the latter paragraph ruminants are central in many households, however gender show unequal benefits from the keeping of them. The important role of women in on-farm activities, including ruminant related activities, has been brought forward by many scholars (e.g. Swanepoel 2002; Roberts 1996; Francis 2007; Curry 1996). Roberts (1996) uses a case study among the Keiyo district of Kenya to analyse the importance of gender and age in livestock production. What he sees is that due to male out-migration for wage labour, the women's tasks and responsibilities increase, without this necessarily leading to a higher recognition of the women's work. A similar relationship was observed in many of the households visited, and was evident in the families in which we were hosted. Here the pattern observed was that the men were having off-farm jobs in the village and hence participated less in their household farms. This study however fails to prove any particular difference where the dividing line is between who benefits from the ruminants. Women were often the ones selling the milk to the cooperatives, but it is not clear if they get to keep the surplus of profits derived from the sale. Contrastingly, the men are as owners likely to be the ones to resell the animals at markets or to slaughter, which might give them the access to the profits of such sales.

6.1.3. Low social capital

The access to derive livelihood from ruminants is modified by the role of cooperatives and the lack of farmers' groups. Okuthe et al. (2003) reported marketing of livestock products as a major constraint to cattle production in the highlands. This today contrasts with our area of study, where few people have mentioned it as an important constraint related to ruminant production. 90% of the respondents from the questionnaires stated to have a good or medium access to markets. We nevertheless observed a common mistrust towards the structure of dairy marketing channels through cooperatives due to previous experiences of

mismanagement and corruption. This factor is supported by Owuor et al. (2009) and Mude (2006) - in the case of the coffee sector. However, many of the respondents are still part of cooperatives, perhaps as the only alternative available to gain access to markets. Surprisingly we found that there are no farmers' groups related to ruminants in the area. The lack of these is important, due to the role that they can play in improving smallholders' livelihoods. Evidence supports that collective action may be a way to “*carry out profitable activities, which, if undertaken by individuals, would involve greater risk and effort*” (Kariuki and Place 2005:1). The consequences of poor cooperation and low social capital are considered by Ellis (2000) who describes that:

“A community low in social capital as manifested by weak networks and associational activities, poorly performing or perfunctory organisations, and little reciprocity occurring between households, seems also likely to be one that offers little scope for negotiating access to assets, and experiences weak management of common property resources” (Ellis 2000:39)

This description supports the potential role that a well-managed self-help group could play in improving people's access to resources. Through collective action, farmers' bargaining power could increase, potentially resulting in an increase of farm-gate product prices, a reduction of input prices, better training possibilities for farmers, better networking structures and possibility to access to low-interest credit.

6.1.4. Low productivity and livelihood gains

Due to the assets available to the farmers and the restraining or unequal access-modifiers influencing the ruminant production in the area, the farmers are showing low levels of productivity, consequently influencing the livelihood security that can be derived from the keeping of animals. According to Karanja & Nyoro (2002) the average gross margin of dairy production per year (2000/01) in Nyeri district was 12.000 KSh, a very low number if compared with other districts. This is reflected in our study with farmers mentioning the lack of surplus profit as a main challenge concerning their ruminant productions (Problem ranking). This is related to the low productivity of smallholder animal production systems, especially regarding the milk production where this study shows an average of 4.6 litres/day per cow. This is a low number compared to a national average of a Friesian cow of 13.7 litres/day in 2008 (Muriuki 2011). The low performance in Witima on the other hand leave

room for improvement. Karanja & Nyoro (2002) report that there is good potential for improving smallholder dairy productivity, and in one of our interviews (Livestock Officer 1) this was supported by stating that the conditions in Witima are good for dairy production and that, if farmers receive better payments for the products sold, improvements will be expected.

6.1.5. How ruminants influence livelihood security

As this chapter has shown so far, the role of ruminants can be viewed from two sides. On one hand ruminant keeping plays an important role in livelihood security as it a day-to-day source of income, creating stability towards risk, and essential to smallholder farmers who rely on the manure to maintain good production within other farm enterprises. On the other hand, it can be viewed as a poor source of income, as the productivity is low and constraints are many. However, three things are crucial in the conclusion of how ruminants influence livelihood security. Firstly, the fact that animals can be kept as storage of wealth make them a valuable financial asset. In a setting where the lack of financial capital is as evident as it is here, their role as protection against risk is crucial. Secondly, the role of manure to secure other economic enterprises on the land is important. With the small land sizes and intensive use households would be worse off without integrating ruminants in their farming system. Thirdly, the study shows the possibilities of improvement. The study's findings consequently leads to a conclusion that the constraints are of a character that the current poor performance of the ruminant sector has a possibility to be improved with relative small alterations and new initiatives.

6.2. Reliability of the study

The timeframe of this project is limited and more time could have provided opportunities for further understanding. A higher number of methods would have provided a more precise picture.

The representativeness of the questionnaire survey needs to be questioned. Due to time restriction the amount of questionnaires could not provide significant results. This became clear when analysing the data in SPSS. With more time, we could have expanded our questionnaires to people outside of the agricultural sector to get a better understanding of other activities influencing livelihood security, why some choose to keep ruminants if there were other options available and understand how it is evolving.

The farmers interviewed for the questionnaire were identified by our guides, which might have biased our results, since we did not have a clear idea of whether they represented a specific socioeconomic class or not. Moreover we were restricted from doing our fieldwork the way we wanted to, since everything had to go through the village chief. He wanted to assist us and recommended who we should interview. As a result we had some challenges in doing it our own way without having others taking the decisions for us.

Furthermore the language barrier influenced the answers obtained, since translation was sometimes difficult. We repeatedly had to point out that we purely needed the answers from the one being interviewed, without any personal comments from the interpreter. We were told that many English words do not exist in Kikuyu. Two out of our three translators did not have previous experience in translating.

Our position in the field as MSc students researching in ruminants possibly biased the information from informants, who thought we had expert knowledge and could contribute with recommendations. The emphasis of ruminants' role in livelihood security became more focused and overshadowed other possible income sources. The data collected is also from officials who represent different political views and therefore have different interests in what information they share.

Even though we had some constraints during our fieldwork we still managed to get a nuanced perspective by meeting people of different ages, locations and amounts of ruminants. The discussion in one focus group was limited due to cultural differences it was not easy to create a room where people felt free to argue and speak since it was their first time participating in a focus group. This also happened in other methods.

6.3. Implications of the study

The study showed a range of problems related to rearing ruminants and led to an identification of aspects, which can be improved by farmers themselves.

Firstly, the potential formation of a farmers group related to ruminant rearing would be beneficial for the farmers in order to reach interests that they could not reach individually. This was already proposed during our feedback meeting and people responded positively to it, by afterwards arranging a meeting to form a new group.

Secondly, there is room for improvement on the management side of ruminant productions - especially for cattle - without necessarily implying big investments:

- **Improvements in the feeding ration:** Data from the feed formulation experiment evidences the potential improvements that could be reached by applying a better management. By acquiring the raw ingredients for the concentrate feed portion of a dairy cow and mixing them in the adequate proportions according to the cow's needs, the milk production could be considerably increased. Its palatability is also proved to improve, and more importantly, cost is lowered.
- **Better feeding techniques**
 - Using grass choppers is essential for improving the cow's digestibility, and hence its performance. Replacing the use of machetes for grass choppers could be an important improvement.
 - One of the field observations was that nobody made use of silage techniques. Using silage does not necessarily imply a big expense and prove to be very effective; both to conserve the extra grass harvested and to enhance its digestibility.
- **Improved facilities and hygiene:** Investment in facilities may be more difficult to adopt, especially by keeping so few animals. However, many traditional animal shelters could be potentially improved without much cost. This would increase the animal's welfare, which can translate into better yields. Finally, keeping a proper hygiene of the stables is of essential importance.

7. Conclusion

A range of conclusions can be drawn on the role that ruminant animals have on livelihoods in Witima. The assets available to the villagers are significantly influencing ruminant production systems. Land is an asset progressively becoming fragmented, due to population growth, resulting in limited production possibilities.

The lack of financial capital available to most smallholders becomes central. Ruminants acquire a central role, by generating income and as storage of wealth. Furthermore, issues related to production as veterinary services, commercial feeds, infrastructures, equipment, etc., highly depend on the availability of cash. Also, lack of proper education, training programs and personal skills on rearing ruminants have shown to be a limitation to better management practices.

The role of institutions, social relations and organisations are key to people's access to many of the latter mentioned capitals, thus impacting on household livelihood strategies. Gender and age have shown to be social factors of key importance. Younger generations tend to have less interest in engaging into agricultural practices, which poses a concern to the future performance of the agricultural sector. Women are in majority the ones taking care of ruminants, although a high percentage of the ownership favours men, possibly depriving women of potential benefits from these enterprises.

Cooperatives represent a potential improvement on the access to capitals, however these are currently not providing inputs and services, and due to previous mismanagement within other cooperatives villagers state mistrust in such institutions. A key finding of this study is the lack of self-help groups. By assessing the lack of these, it is concluded that forming such groups could ease many of the factors hindering proper production conditions. Some organisations reported in this study (agricultural and livestock extension offices, Ongiru Development Network) may have a positive impact on improving people's farming knowledge and networking, but they do not facilitate access to finances.

Ruminant productions have shown to be an important part of most smallholder livelihoods, with positive effects on people's income level, income stability, and by reducing risks. These productions provide a stable income and facilitate the day-to-day livelihoods through milk production, and indirectly also have positive effects on other farm enterprises by providing manure. Furthermore, the rearing of ruminants reduces seasonal constraints and decreases risks through its role as storage of wealth. This study concludes that the role of ruminant animals as part of villagers' livelihood strategies is important and that it serves as a

significant component of their livelihood security. Knowing the crucial importance of this sector, it is also concluded that by adopting better management practices and improving collective action, ruminants could contribute significantly to improve people's livelihoods.

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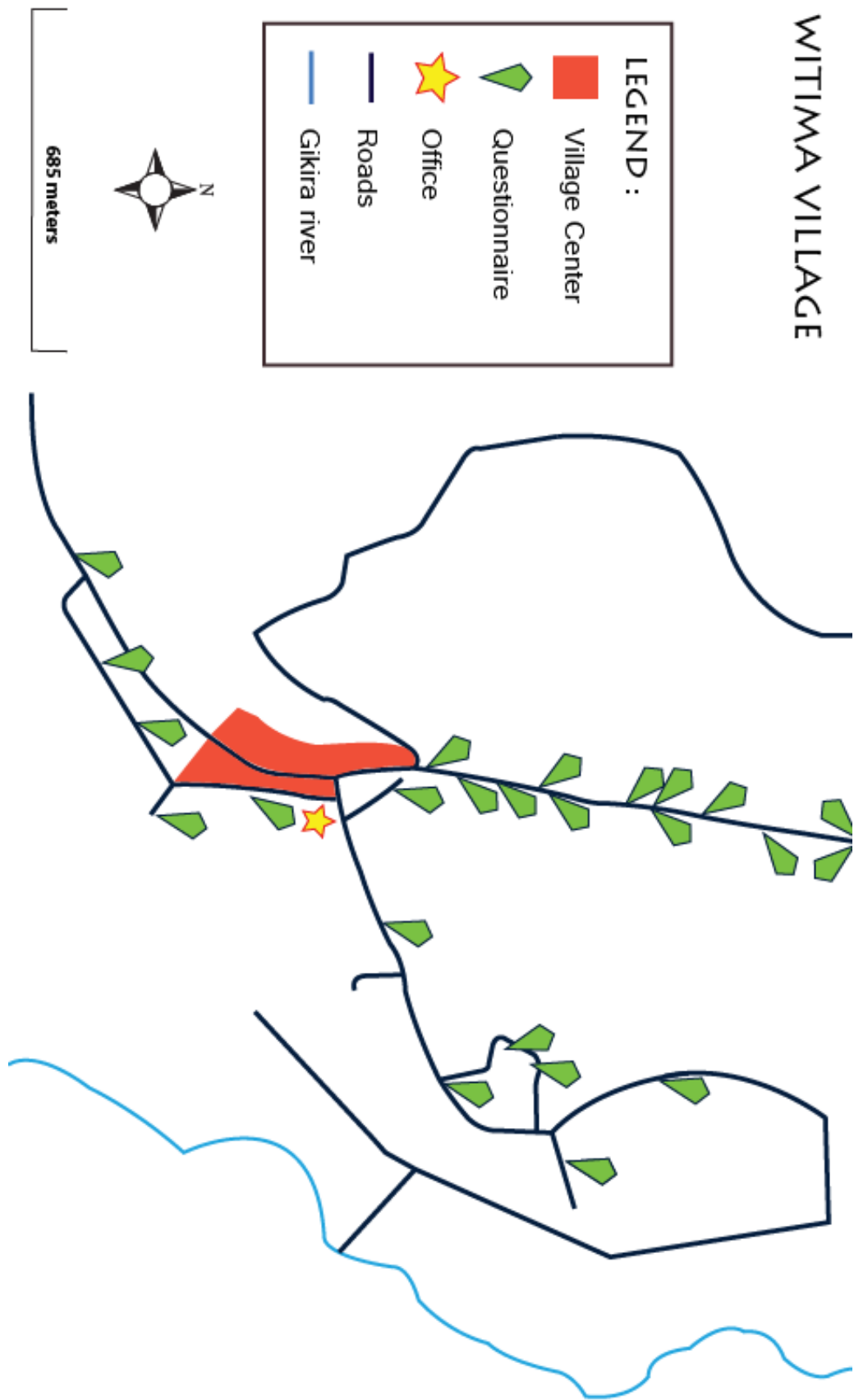
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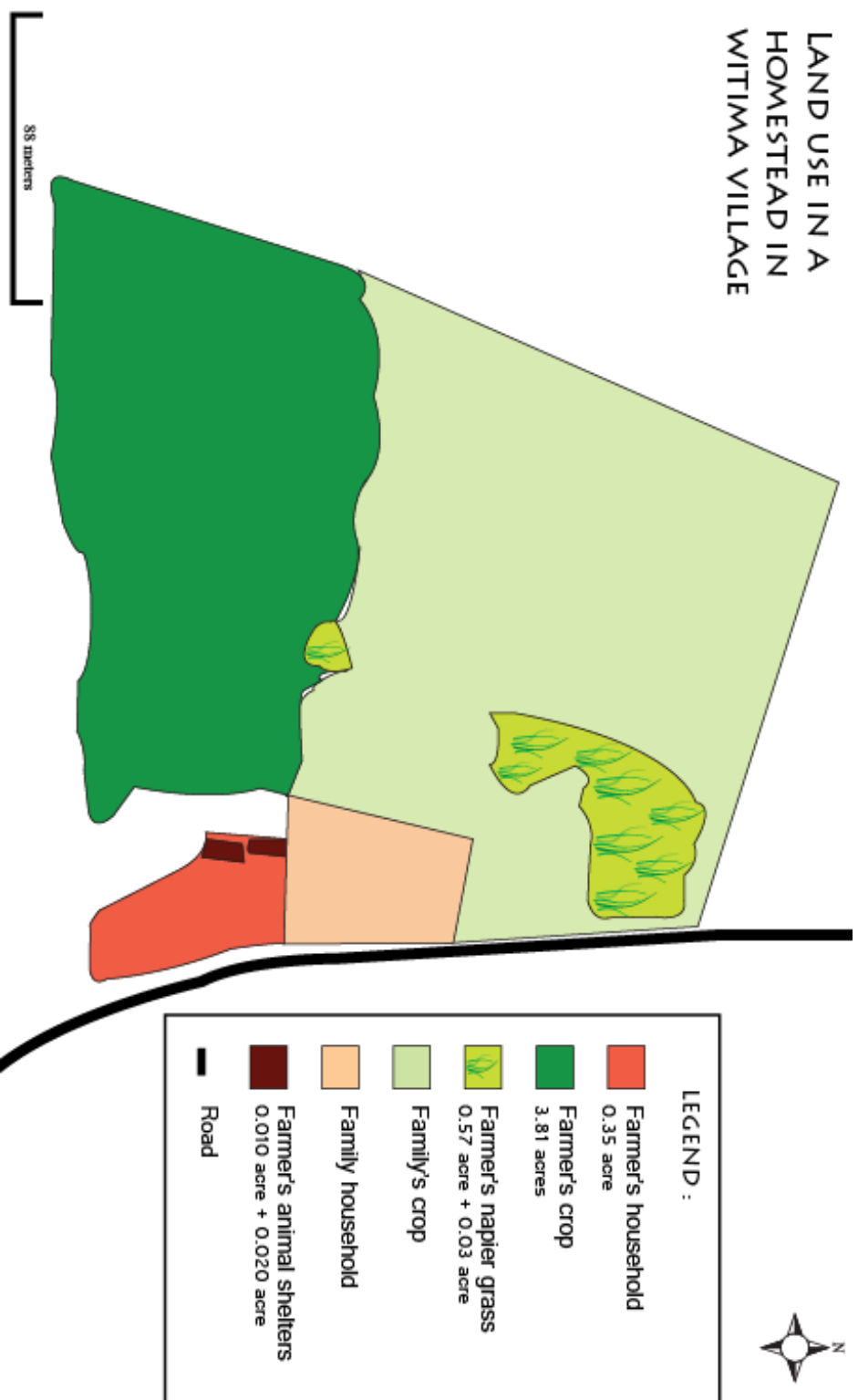
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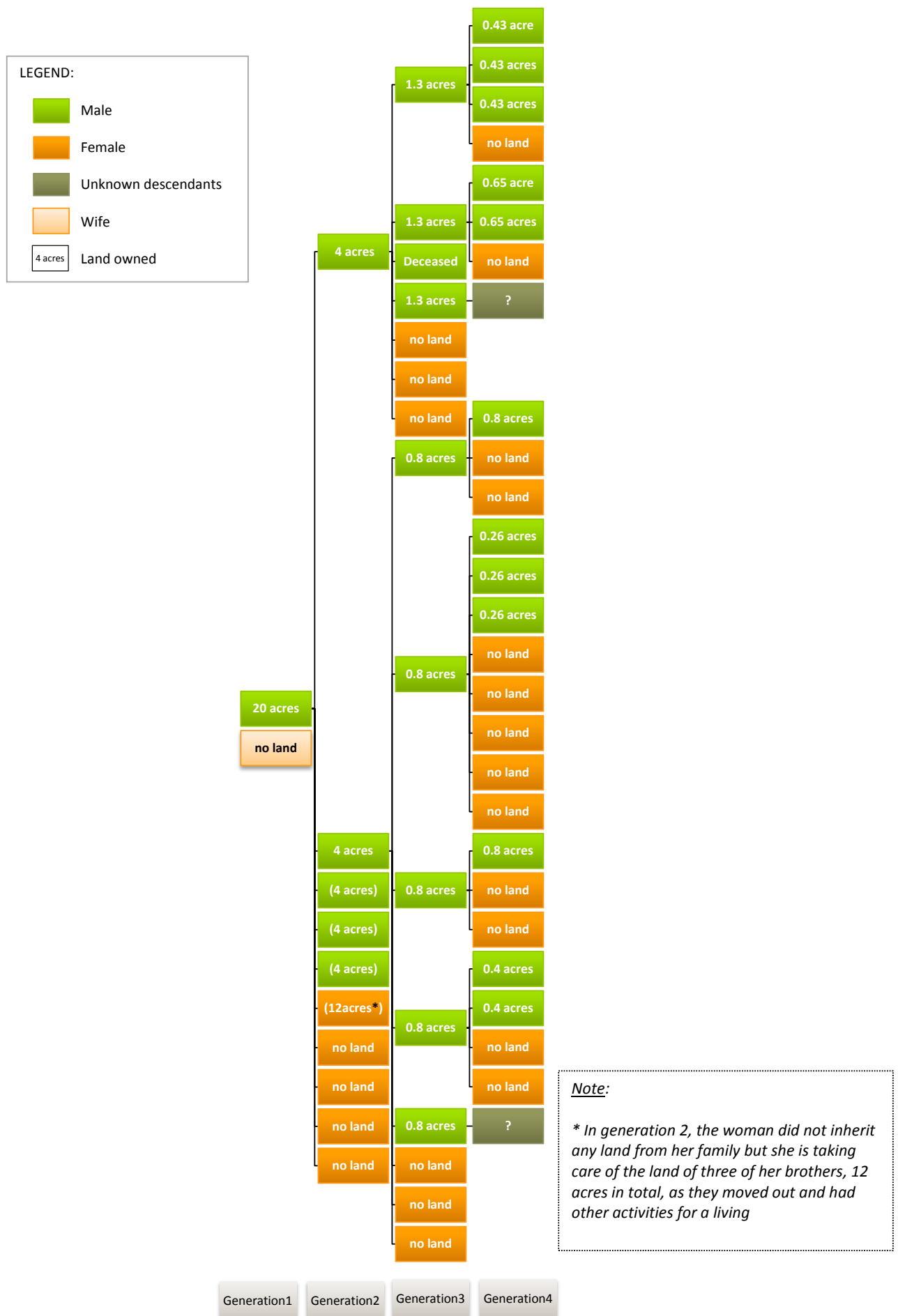
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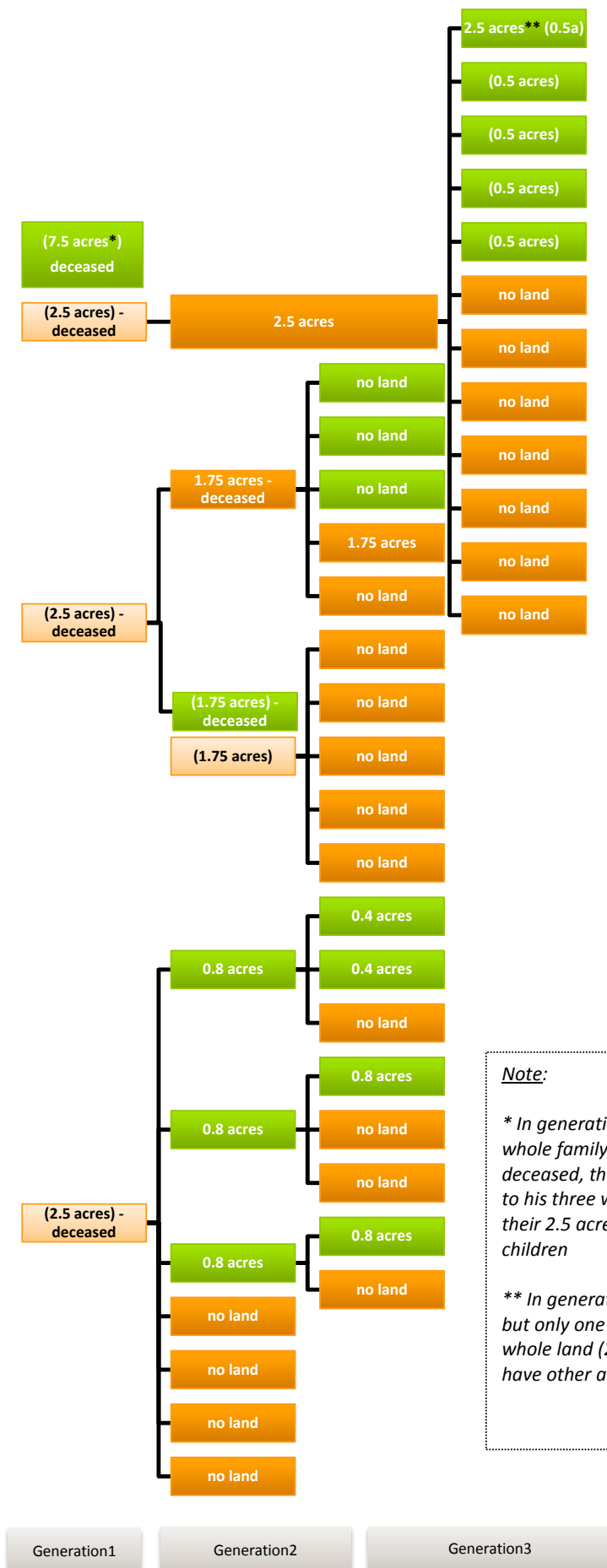
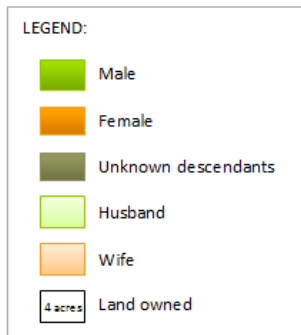
LAND USE IN A HOMESTEAD IN WITIMA VILLAGE



APPENDIX 2: Family tree from Lifestory 1



APPENDIX 3: Family tree from Lifestory 2



Note:

** In generation 1, the grand-father of the whole family owned 7.5 acres. When he deceased, the land was equally distributed to his three wives. When they deceased, their 2.5 acres were distributed to their children*

***** In generation 3, each son has 0.5 acre, but only one of them is taking care of the whole land (2.5 acres) because his brothers have other activities for a living***

APPENDIX 4

Introductory Questionnaire

Date:

Interviewer:

Note taker:

GPS-point:

Introduction

1. Full name:
2. Age:
3. Gender/ F or M
4. Marital status:
5. Number of children:

Land and land usage

6. How many acres do you hold? _____
7. How much land is used on livestock production? _____
8. What is the ownership over the land? Family___ Individual___ Other___
9. Do you have a land title deed? _____
10. What other activities are carried out on the land? _____

Sources of income

11. Which sector gives the main source of income to the household?

Livestock_____ Crops_____ Horticulture_____ Handicrafts_____

Sales_____ Services_____ Only subsistence_____ Remittances_____

Other: _____

Ruminants

12. N^o of ruminants:

Sheep _____

Cows/bulls _____

Goats _____

13. Which breeds of cows do you keep?

Freshian____ Aryshire____ Jersey____ Guernsey____ Local____
Crosses____

14. How did you acquire your goats/cattle/sheep?

Goats: Inherited____ Bought____ Gift____ Others____
Sheep: Inherited____ Bought____ Gift____ Others____
Cattle: Inherited____ Bought____ Gift____ Others____

15. Who owns the ruminants? (Please specify for all types of ruminants)

Goats: Husband____ Wife____
Sheep: Husband____ Wife____
Cattle: Husband____ Wife____

16. Who keep/maintain the ruminants? (Please specify for all types of ruminants)

Goats: _____
Sheep: _____
Cattle: _____

17. Do you have employ labor to keep the ruminants?

Casual labor____ hour's spent____ Wage pr./hour____

Permanent labor____ Hours spent____ Wage pr./month____

Productivity

18. How many liters of milk do you produce pr. day? _____

19. How many wheelbarrows of manure do you produce pr. day? _____

Feeding

20. What is the main source of feeds? _____

21. Where do you get the feeds?

Own farm production____ Bought____

22. What is the availability of the fodder/forage?

All year____ or seasonal____

23. Do you use commercially produced feeds (like dairy meal)? _____

Access to extension services

24. How is the access to veterinary services?

Good_____ Medium_____ Low_____

25. How is the access to markets?

Good_____ Medium_____ Low_____

Marketing

26. Where do you sell your:

Milk:_____ Price/kg_____

Meat:_____ Price/kg_____

27. Are you a member of a cooperative? _____

28. Which month are the prices of milk highest_____ and lowest_____?

Knowledge/skills

29. Do you have any training in ruminant keeping? _____

30. Do or have you received any training from:

a. Government extensions ____ b. Cooperatives ____ c. CBOs/NGOs ____

Challenges

31. Mention the three most important challenges faced in ruminant production:

A: _____

B: _____

C: _____

Additionally: _____

THANK YOU!!!

APPENDIX 5

Interview + Focus group guides:

SSI w. Farmers with livestock

1. How many animals do you own?
2. What kind of species?
3. What is the size of your land?
4. What are the land usages?
5. What are your income sources?
6. Who owns the animals?
7. Who keeps them?
8. Where do you sell your products?
9. How much do you get?
10. Historically, did you use to have animals? Do you have more or less now?
11. What is your motivation to keep livestock?
12. What is the income stability in keeping livestock compared to other economic activities?

SSI w. Farmers without livestock

1. What is the size of your land?
2. What are the land usages?
3. What are your income sources?
4. Historically, did you use to have animals?
5. Why do you not keep livestock now?
6. What is the income stability in keeping livestock compared to other economic activities?

SSI Life story with farmers

Topics:

1. Motivation to keep ruminants
2. Family history
3. Development in family structure
4. Current life situation
5. Dreams and hopes for the future

SSI w. Karima Chief Stephen Wahome

1. What are the general concerns of people in Witima?
2. How many people in Witima keep livestock?
3. Is the amount of livestock going up or down, and why?
4. How does the government help people – in agriculture/livestock?
5. Do you encourage community groups?
6. Is Witima different from surrounding areas (concerning livestock/agriculture)?
7. How is the land size problem addressed by the county/government?
8. Are there any fights over land? Already answered
9. Do people sell their landholdings (and who is buying)?
10. Which markets (livestock) are on the rise in Witima?

SSI w. AgroVet in Witima Village

1. What are peoples buying capacity?
2. How many animals do people have?
3. Who owns them?

4. Where are the animals located?
5. What has been the historical development of livestock in the area?
6. What are the challenges that people tell you that they meet?
7. What opportunities for improvements do you see in the livestock sector in Witima?
8. Which diseases are most common here?
9. What diseases are economic important?
10. Do you use traditional treatments? (Preference)
11. Prices, availability of feeds? Use of extension services in the area?

SSI with Livestock and Agricultural Officers:

1. How much livestock are there in Witima?
2. What other activities are bringing the income to the households?
3. How is the livestock management in Witima?
4. How is the livestock production in Witima?
5. How has livestock developed historically?
6. What is the future for livestock?
7. What are the challenges? And opportunities?

Focus group 1

1. Discuss how important is for you to rear such animals as cattle, sheep and goats / how would it affect to them if they didn't have these animals. Explain the reasons.
2. Which animals give them the most profit (either from sales and own consumption) and why.
3. Do they involve themselves in any common activities with other neighboring farms? For example, lending equipment, borrowing money/animals, helping with tasks, selling any products to other neighbors,...
4. What are the main constraints they face for rearing these animals?
5. Which are their future expectations according to the keeping of cattle, sheep and goats?
6. Are they satisfied with their actual level of life?
7. Which improvements would they like to have in these sectors? (cattle, goats, sheep / livestock in general)
8. What do they think could be done for improving the sector

Focus group 2

1. What is livestock significance?
2. What motivates you to keep ruminants?
3. Do keeping ruminants help you day to day?
4. If you did not keep ruminants what else would you do for a living?
5. How is ruminants complemented by other sources of income?

APPENDIX 6

PROBLEM RANKING

Challenge	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6	SUM	RESULT
Capital financial	1	1	1	1	1	1	6	1
Diseases	2	4	3	4	4	4	21	2
Proper feeding	4	3	2	3	5	5	22	4
Lack of enough knowledge	5	5	4	2	2	2	20	3
Lack of surplus profit	3	2	5	5	3	3	21	2

A handwritten version of the problem ranking table, created using yellow sticky notes on a piece of paper. The sticky notes are arranged in a grid corresponding to the printed table above. Each sticky note contains a number representing a ranking. The names of the six persons (Agnes, Miriah, Karim, Josephat, Augustine, Silas) are written above the columns, and the challenges (Capital Financial, Diseases, Proper Feeding, Lack of Enough Knowledge, Lack of Profit (Surplus)) are written to the left of the rows. The sum of rankings for each challenge is written to the right of the grid, and the final result (rank) is written at the bottom right of each row.

	AGNES ①	MIRIAH ②	KARIM ③	JOSEPHAT ④	AUGUSTINE ⑤	SILAS ⑥		
CAPITAL FINANCIAL	1	1	1	1	1	1	1 6	
DISEASES	2	4	3	4	4	4	2 4 21	
PROPER FEEDING	4	3	2	3	5	5	5 22	
LACK OF ENOUGH KNOWLEDGE	5	5	4	2	2	2	2 20	
LACK OF PROFIT (SURPLUS)	3	2	5	5	3	3	3 21	

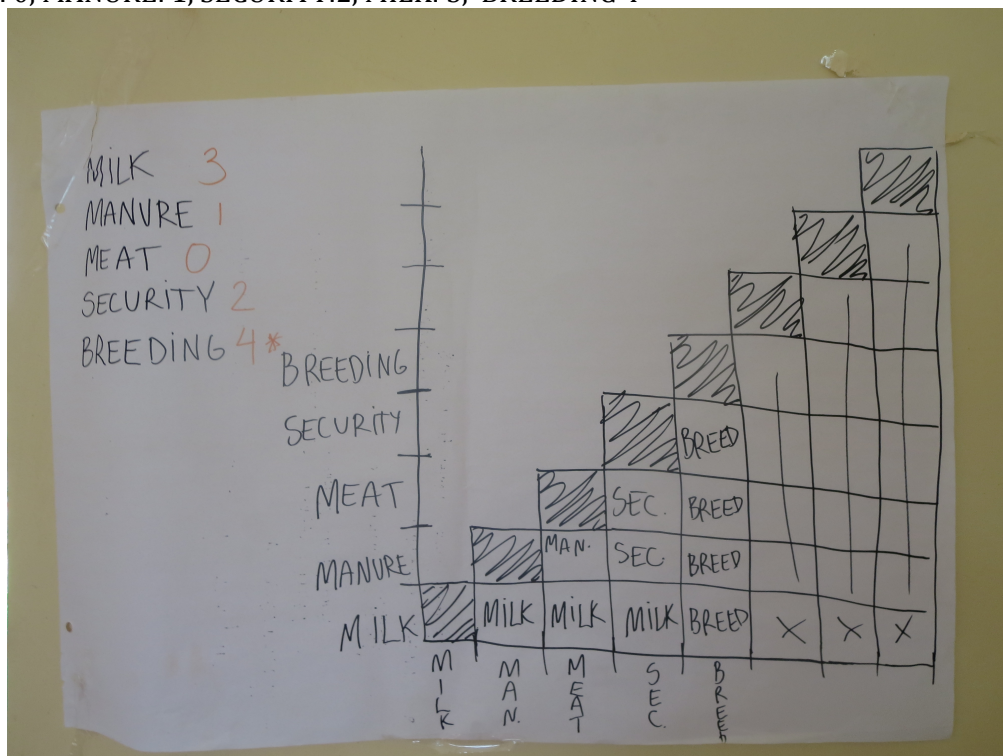
APPENDIX 7

PAIR WISE RANKING

Breeding					
Security					Breeding
Meat				Security	Breeding
Manure			Manure	Security	Breeding
Milk		Milk	Milk	Milk	Breeding
	Milk	Manure	Meat	Security	Breeding

RESULT:

MEAT: 0, MANURE: 1, SECURITY:2, MILK: 3, BREEDING 4



APPENDIX 8

METHOD	NUMBER	SPECIFIED	
			TOPICS
SEMI-STRUCTURED INTERVIEW	12	5 Farmers with livestock	Livelihood, future, management of animals
		3 Farmers without livestock	Livelihood, past, future
		Karima Chief	Witima, land size, community groups, government, problems
		Agricultural Officer	Livestock population, agricultural sector, challenges/opportunities
		2 Livestock Officers	Livestock sector, animal production systems, inputs, dairy, challenges/opportunities
		AgroVet	Diseases, feeding, historic development
QUESTIONNAIRES	24	3 groups with 8 households each	
FOCUS GROUPS	2	Group 1: Farmers with ruminants	
		Group 2: Mixed group with and without ruminants	
PARTICIPATORY + DIRECT OBSERVATION + INFORMAL TALKS	-	Ruminant rearing, daily life in Witima Talking with farmers, shopowners, officials, translators, our guide	
PRA	4	Transect walk with village elder	
		Seasonal calendar with focus group 1	
		Problem ranking with focus group 2	
		Pairwise ranking of outcomes with focus group 2	
FEEDBACK MEETING	1	With villagers from Witima	

APPENDIX 9

List of respondent/activity, location and date

Focus group 1, Witima, 6.3.14

Focus group 2, Witima, 8.3.14

Farmer 1, Witima, 1.3.14

Farmer 2, Witima, 7.3.14

Farmer 3, Witima, 7.3.14

Farmer 4, Witima, 8.3.14

Farmer 5, Witima, 8.3.14

Life story 1, Witima, 5.3.14

Life story 2, Witima, 6.3.14

Farmer without ruminants 1, Witima, 4.3.14

Farmer without ruminants 2, Witima, 4.3.14

Farmer without ruminants 3, Witima, 4.3.14

Karima Chief, Witima, 7.3.14

Livestock Officer 1, Othaya, 5.3.14

Livestock Officer 2, Othaya, 11.3.14

AgroVet, Witima, 6.3.14

Feedback meeting, Witima, 10.3.14

Livestock and Livelihood Security in Witima Village



Synopsis
21.2.2014

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Introduction

Livestock contributes to around 40 % of the value of the world's agricultural outcome. It supports the food security and livelihoods of nearly a billion people. Also, the livestock sector is one of the fastest growing sectors in the world's agricultural economy, largely driven by structural changes and new technologies (FAO 2009). Growth in the livestock sector offers a chance to reduce poverty, provides food security and improves the livelihoods of smallholder households. However, some of the problems with these rapid changes are that the smallholders are in risk of being left out and marginalized in the process (FAO 2009, Upton 2004).

In Kenya, the agricultural sector is of importance for rural livelihoods. More than 80 % of the population are estimated to derive their livelihoods directly or indirectly from agriculture. Therefore, growth in this sector also holds a massive potential to reduce poverty as it is directly linked to the most vulnerable groups, such as the subsistence-farmers who survive from this sector (Alila and Atieno 2006; Pica-Ciamarra et al. 2011). However, not only there is a need for a growth within the agricultural sector, but in order for it to sustain real poverty reduction, the growth also needs to include the poor households (Pica-Ciamarra et al. 2011).

Additionally, rural households could find a strategy to escape poverty by investing in on-farm activities, that is not solely depending on crop production (Kristjanson et al. 2004). This points to the possible benefits of investing in livestock. However, this investment is probably beyond most households' financial abilities and high animal death rates due to diseases and funeral customs are pointed to as drivers for Kenyan households falling into poverty, thereby making livestock a poverty trap (Kristjanson et al. 2004).

Despite the mentioned risk of keeping livestock, in Kenya the livestock sector contributes with a livestock population valued at about 308 billion KShs. This is consisting of livestock species that are indigenous, exotic and cross breeds (MoLD Strategic Plan 2008-2012).

Livestock contributes 12 % of Kenya's GDP, 40 % of the agricultural GDP and 50 % of the agricultural labor force (MoLD Strategic Plan 2008-2012). However, recent studies are critical to this data and indicate that the contribution of the livestock sector to the agricultural GDP is two and a half times higher than what is represented in the official statistics (IGAD ICPALD 2013), meaning that the livestock sector is possibly more important to the national economy than what is officially considered.

Apart from the direct role of generating food and income, livestock is also a valuable asset. Livestock can act as storage of wealth for future investment, used as collateral for loans and generally as a safety net during times of crisis. Livestock complements crop-production, and provides a reserve against risks (FAO 2009, MoLD Strategic Plan 2008-2012). Furthermore,

livestock in many cultures represents different cultural values; in Kenya it is among other things used as a medium for social exchange in the payment of bride dowry, fines and gifts to strengthen kinship ties (Upton 2004; MoLD Strategic Plan 2008-2012). Additionally, livestock plays a vital role in mixed farming systems, by contributing to other parts of the system (i.e. as draught power for ploughing and transport; FAO 2009). This supports the importance that livestock can play in rural livelihoods.

Various farming systems can be found in Kenya. In the rural highlands, the agro-ecological conditions are the most favourable for agriculture than in the rest of the country (Omore, 2003). Small-scale farming systems are the most common agricultural production systems in this region (Omore, 2003). The average land area is only about 0.64 hectares (Owour et al., 2009). In addition to the crop production, most of those smallholders also produce diversified livestock (Omore 2003), which is a common strategy to gain income and food security and lowering the risks faced in their livelihood in general. The mixed farming systems are also a way to optimize the natural resources available i.e. by using crop residues for feeding livestock or utilizing manure for crop production (Van de Steeg et al 2005). In this region, almost three fourth of the households have at least one to two cows (Owour et al., 2009; Omore, 2003)

In the Central Highlands, diseases, poor communication, lack of marketing of livestock produce, lack of artificial insemination services and feed and water shortages during dry season have been identified as main challenges to livestock production (Okuthe et al. 2003). Other main limitations to livestock production identified by farmers from the Nyeri District in the Highlands are the high pressure on land, due to fragmentation (Van de Steeg et al 2005) and the lack of capital and access to credit (Owour et al. 2009). In livelihoods, generally there has been a lack of analysis of the livestock-poverty linkages (Pica-Ciammara et al. 2011). These linkages are important to understand and be able to discuss potential policy interventions on the livestock sector. Moreover, livestock, due to its potential central role to livelihood improvement, is a key element to analyze when talking about rural kenyan households.

In this project we are using the framework for livelihood analysis by Ellis (2000:28). Livelihood systems approaches are used to analyse different areas of livelihood such as sustainable rural livelihoods (Ellis 2000:28). Since we are analyzing the importance of livestock as the main source of income, among others, and as a possible tool for poverty reduction, for the members in Witima village it is necessary to understand the options open to them, the strategies they adopt for survival, and their vulnerability to adverse trends and events. This will be interpreted by looking at how the assets status of households influences livestock rearing in household livelihood strategies.

Thus the framework is a useful theory to organise ideas into manageable categories, identify entry point and critical processes, and assist in prioritizing catalysts for change that can improve people's

livelihood chances. However, there are also limitations, such as the difficulty to capture the dynamics of livelihood systems that in practice involve innumerable feedbacks and complex interactions between components in such a diagram (Ellis 2000:29).

This study looks into the linkages between livestock and rural livelihoods in Witima village located in the central highlands of Kenya. It does so by investigating the vulnerability context of Witima Village and the impact that household capitals have on the centrality of livestock in livelihood strategies. Ultimately this will lead to an analysis of livestock's role in livelihood security for smallholder farmers in Witima by answering the following problem formulation:

Problem statement

What are the assets, access-modifiers and contexts influencing livestock rearing in household livelihood strategies in Witima village, and how does keeping livestock affect household livelihood security?

The problem statement is structured by elements from the Sustainable Livelihood Framework. We choose to focus on livelihood security, which means we are excluding the environmental effect of livestock in our study. Furthermore, we should point out that when we get to the field site, we will choose one species of livestock, and thereby narrowing the scope of things to look at.

Methods

This research is conducted in three different stages: research design, field data collection and analysis of results.

The research design phase, which is conducted during three weeks (prior to moving to the field site), consists of problem formulation, statement of objectives, formulation of research questions relevant to the study, identifying the data needed and the methods through which this data is to be obtained.

The field data collection lasts two weeks and involves the following methods:

Transect walk

This method is to be conducted during the first day of fieldwork by all the group components and a local person with an advanced knowledge of the field site and its characteristics. A GPS is to be used in order to draw a map of Witima village containing the households, clusters of households and points of interest (input markets, butchers, cooperatives,...). At the same time, field notes will be taken, describing features of interest such as land use, natural resources, crops, livestock keeping, etc. (part of the direct observation method).

Questionnaires

These are to be conducted during the first days of the field research. For reasons of time optimization, the questionnaires will be conducted during 1-2 days by groups of 3 people (one interpreter in each group). The format of the questionnaire consists of a section of questions related to socio-economic features of the household and another section related to household livelihood and livestock production (see appendix).

Sampling strategy: The sampling design is to be done after the transect walk, once identified the household types and locations. The sampling strategy is planned to be random, although this is subject to possible changes depending on the situation found in the field. The sample will consist of 25 to 30 households rearing livestock.

Area measurements (GPS)

An important objective of this study is to assess the importance of livestock production compared to other household-level productions. For that, measuring the possible crop area used exclusively for animal feed may be an useful empirical indicator. This is to be related with the crops produced and their seasonality, marking the possible changing patterns of area used.

Analysis of feeding strategies - feed optimization (optional method)

The fodder portions fed to dairy cattle from 2-3 households are to be weighed during a period of 5 days. Data collected through other methods regarding seasonality of production, crops produced, nutritional content of different feeding crops, characteristics of the breeds used, prices of seed/concentrates and potential availability of other crops may be used for a possible future feed formulation method (after field site work).

Depending on the availability of time, the production of milk may also be measured by weighing. This combined with the proportion of milk sold and the farm gate prices of milk may give an assessment of the income directly related to this production.

Participatory Rural Appraisal

Participatory Rural Appraisal methods were invented with the purpose of getting quality data quickly (Chambers 1983; Mikkelsen 2005). It employs the participation of the people involved to shape the research according to their situation. The methods under this category are therefore suitable for this field project, as the timeframe is very short. We consider the villagers as the center of this study as they are experts on their locality and the contexts. The villagers are therefore a core source of information.

These methods will be conducted towards the end of the research and will include many factors/variables found relevant during the previous stages of this study.

Seasonal diagram (calendar)

Livelihood strategies may be influenced by seasonal variations and events happening within a year. These may be seasonal climatic variations affecting production, income, workload, expenditures, periods of major consumption of animal meat due to cultural traditions, seasonal incidence of diseases, market fluctuations... Therefore, a session will be planned where villagers will draw important events/periods meaning changes important for livestock production.

Ranking

Ranking can be used to quickly identify main problems, opportunities or preferences of different individuals or groups (Mikkelsen 2005). This study uses ranking as a tool to do several of these things. It can thus be rankings of different nature, e.g. problem and opportunity ranking of keeping livestock, preference ranking of livelihood activities and species, and wealth ranking related to livestock. Within each ranking session much is left to the participants to decide and they will be involved in generating which indicators to be ranked.

Pair-wise ranking

In order to know what are the different uses from livestock and their relative importance, a pair-wise ranking session is to be conducted among livestock herders. Different species will be considered here (these will be chosen once the field work gives us an idea of the 2 or 3 potentially most important animal species for household livelihoods). First, the household members will have to mention all the uses (economic and non-economic) for which they rear the different species considered. Once they have mentioned all of them -if necessary, with our help-, they will have to rank them in preference by pairs. Afterwards, the numerical ranking is to be made.

Examples of possible uses are: Meat, manure/fertilizer, draught, milk, capital wealth/social status, renting, sales, skins, traditions/ceremonies... (Swanepoel 2002)

Semi-Structured Interviews

A backbone of the fieldwork will be the use of semi-structured interview. We will prepare interview guides constituted by a number of themes. The use will be flexible and thereby give room to follow leads or topic of special interest. Furthermore, the interview guides will continuously be revitalized and refined. We create specific interview guides according to informant (farmer, official, key-informant). We plan most interview will last around 1 hour depending on the situation. The SSI's will be used to gather information on the linkages between livestock and livelihood, cultural practices and the context. As the method itself is an open form of interviewing, where the interviewee or the interviewer can bring up new ideas and directions during the conversation (Mikkelsen 2005), it is a way of providing in-depth understanding about practices involving livestock in livelihood- strategies and security.

Focus Groups

Using focus groups is relevant, as we believe that the dynamics of a group can be relevant for gaining faster or additional information (Mikkelsen 2005). We use focus group interviews to get insights on opportunities and challenges of rearing livestock, how it affects social relations and the degree of risk of households. Often the focus group sessions will be followed by PRA-sessions of ranking, mapping and/or drawing seasonal diagrams.

Participant Observation

Being in the field gives us the possibility of using participant observation. Using this method is a way to get insight in the informants' daily life. It can provide information on what activities villagers engage in, their chores, and how people interact. We will try to participate as much as possible in the daily life of the host families. However, we do acknowledge that we are coming as outsiders and therefore can never be considered as *complete participants*, but rather as participant observers (Bernard 2011). By participating, we hope to gain a deeper understanding of what

livestock represents to livelihoods in a village like Witima. The observation me make will be included in our field notes (next paragraph).

Fieldnotes

Field notes will play a vital part of our data collection. It represents the opportunity to record more than just words, and enables us to also pay attention e.g. body language and the surroundings (Emerson, Fretz and Shaw 2011). Furthermore it gives us the possibilities to continuously record our own impressions and make memos and reflections (Ibid.).

When we are doing fieldwork (interviews, transect walks, etc.) we will make jottings. It is these jottings that later will be transcribed onto computer. We will pay special attention to what seems important to people, why it is important and to whom. We will aim at writing the field notes on computers, while the experiences are still fresh in mind. This will be done to assure as many nuances as possible (Emerson, Fretz and Shaw 2011).

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Appendix 1

Matrix:

Problem Statement			
What are the assets, access-modifiers and contexts influencing livestock rearing in household livelihood strategies in Witima village, and how does keeping livestock affect household livelihood security?			
Objectives			
- To identify the assets, access-modifiers and contexts influencing livestock rearing in household livelihood strategies in Witima village - To determine how livestock keeping affects the household livelihood security, in Witima village			
Research questions	Sub-research questions	Data required	Methods
What are the assets, access-modifiers and contexts influencing livestock rearing in household livelihood strategies in Witima village?	1. What are the assets influencing livestock rearing?	- Assets (H, F, S, P, N) - Keeping and production techniques of animal products - Infrastructure (e.g. access to roads...) - Land possessed - Productive potential of species - Competition for land use with other economic activities	Questionnaires Transect walk Natural science methods PRA: mapping, ranking, seasonal diagram Participant and direct observation FGI – focus group SSI
	2. What are the access-modifiers influencing livestock rearing?	- Access (Social relations, institutions, Organizations) - Access to markets (input accessibility, output, location, seasonality, demand)	Questionnaires Transect walk Natural science methods PRA: mapping, ranking, seasonal diagram Participant and direct observation FGI – focus group SSI
	3. What is the vulnerability context influencing livestock rearing?	- Context vulnerability → Trends: - Population, migration, technological change, relative prices - Keeping and production techniques of animal products - Seasonality of fodder/forage for animals - Extension of (veterinary) services → Shocks - Extension of (veterinary) services - Market fluctuations (input prices, farm gate prices...)	Transect walk PRA: mapping, ranking, seasonal diagram FGI – focus group SSI

		- Shocks (drought, floods, pests, diseases, civil war/unrest)	
How does livestock rearing affect household livelihood security?	1. How does livestock rearing affect income level?	- Identify NR-based and non-NR based activities (portfolio of activities) - Proportion in which livestock contributes to the farmers' total income - Livestock products or services that provide the highest household income related to livestock - What species contribute the most to the last point - Competition for land with other economic activities (Dr. Odera)	Questionnaire SSI Ranking Weighting
	2. How does livestock rearing affect income stability?	- Seasonality of income: wet/dry, religious/cultural festivities period... - Potential uses of animals for diversification of income - Fluctuating milk (products) prices - Other income sources? - Seasonal availability of fodder/forage for animals	Seasonal diagram Questionnaire SSI
	3. How does livestock rearing affect food security?	- Quantify how much of their food comes directly from their livestock - Find out if livestock fodder production takes up place from food crops production - Seasonality of food access - Competition for land with other economic activities	SSI Transect walk GPS Seasonal diagram
	4. How does livestock rearing affect social relations?	- Identify the social outcomes that household could be interested in? - Social identity related to rearing livestock - Cultural practices linked to livestock (Dowry, conflict resolution, ceremonies, rituals) - Meaning of livestock in social status - Institutions/organizations related to livestock	SSI Direct observation Participant observation FGI
	5. How does livestock rearing affect degree of risk?	- People's perception of risk - People's perception of livestock as a good or a bad thing in coping with risks - The poverty level - Factors influencing the risk level of the	FGI Questionnaire Ranking risks (low, medium, high)

		HH's - Safety net (social relations, etc) Hypothesis: Diversification - less degree of risk?	
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Appendix 2 - Tentative timeline

[illegible]

Legend

	Main activities - whole group
	Main activities - split into small groups
	time off from project
	Individual at specific times
	Not available for work
	Periods
GPS	Waypoints, tracking and area measurements

Appendix 3

Tentative questionnaire

Questionnaire n°:

Name of interviewer:

Date:

Name of interpreter:

QUESTIONNAIRE

Section A: Features related to livelihood

1. Sector which gives the main source of income to the household:

Livestock	Crops	Horticulture
Sales	Artisany/handicrafts	Only subsistence
	Services	
	Other: _____	

1.1. Which concrete sector? (which crop, animal, product,...)

1.2. Which sector represents the second source of income?

1.3. Non-farm activities (in case agriculture is main source of income)

2. N° of animals (pets are not included):

Pigs	_____	_____	Sheep
Cows/bulls	_____	_____	Chicken
Goats	_____	_____	Rabbits
Other:	_____	_____	Other:

(if the household has no livestock, questionnaire ends here)

3. Which animal sector provides the major source of livelihood to the household?

4. Who owns these animals? _____

5. Who keeps them?

6. If having cattle, how many are exotic/indigenous? _____
/ _____

7. Reasons for having livestock (mention the two/three most important):

8. What do you use your livestock for:

9. Mention the three most important constraints faced with cattle production (in case no cattle in the farm, mention the first animal production). The first has to be the most important.

- a.
- b.
- c.

Additional.

10. Harshest season for maintaining livestock (indicate month/s):

11. Water accessibility

Very bad Bad Average Good Very good

12. Which are the main animal diseases affecting the family income (mention at least 3, in descending order of importance. Mention for what species it is about).

DISEASE

SPECIES

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____

13. In case of having cattle, mention the three most important diseases, in descending order of importance:

—

14. In the last 12 months, how many and which animals did you lose due to disease?

—

15. In the last 12 months, how many and which animals were received as a gift/payment for services/customary ceremonies?

—

16. And how many were given away?

—

17. During the last 12 months, how many and which live animals did you buy/sell?

Bought:

Sold:

18. (in case having cattle) Did you slaughter any cattle during the last 12 months? _____

19. What is the main purpose of livestock products originating from cattle?

Subsistence Commercial Other
(specify): _____

Section B: Management and input

20. What kind of breeding/insemination is followed? Natural Artificial

20.1. State a reason:

20.2. In case of A.I. method, ¿where do you get the doses from?

21. What is your breed preference for your household production? Indigenous
Exotic

21.1. State the reason:

22. What are the major feeding practices for **cattle** in the household? Select two main

Only grazing/scavenging
Mainly grazing/scavenging with some feeding
Mainly feeding with some grazing/scavenging
Only feeding
Tethering
Other (specify): _____

23. What crops grown at home (if any) are used for feeding cattle? (or most important animal production in the household). During which seasons are these produced?

SEASON	CROP
--------	------

1. _____

2. _____
3. _____
4. _____
5. _____
6. _____

(should we add a question relating to type of feed? (silage, hay,...))

24. Has this household paid for feeding its cattle during the last 12 months? Y / N

25. In which months? _____

26. How much has been paid for feed during the last 12 months? (bags of X):

27. Where do you get these inputs from?

28. What are the two main sources of water used for cattle?

Tap water	Borehole	Dam	Well	River
Spring				
Stream	Constructed water points			Rainwater harvesting
Other				

29. What housing system for cattle does this household mainly use?

None	Confined in sheds	Confined in paddocks
	Confined fences	

30. Has this household vaccinated/cured any cattle during the last 12 months? (if none, q.37)

All animals	Some animals	None
-------------	--------------	------

31. Who administered this vaccination/curation services?

Private vet clinic
District vet clinic
NGO/project
Other (specify): _____

32. Against which diseases did you vaccinate your cattle?

33. Did the household hire any labour for keeping/herding livestock in the last 12 months?

Y / N

33.1. Cost of external labour: _____ kSh

Section C: Meat production

34. How many and which animals were slaughtered for meat in the last 12 months? (if none, skip to Section D)

35. What is the live weight, on average, of the cattle (or most important animal to the household income) that this household slaughtered?
_____ kg/head

36. How much of the meat of cattle (or most important animal to the household income) produced did you sell in the past 12 months?
_____ kg

37. Where/to whom do you mainly sell meat from your livestock?

Government / LC
Private trader in local market/village
Private trader in district market
Consumer at market
Neighbour/relative
Other (specify): _____

38. Who controls the revenue from the meat products in the household?

Section D: Milk production (if applicable)

39. Which animal provides the most important milk production in the household?

Cow

Sheep

Goat

Other (specify)

40. How many [...] were milked in the last 12 months? _____ (if 0, skip to next)

41. How many days, on average, were these animals milked for? _____ days

42. What was the average of milk production/day of these animals per milking animal? ____
L

(i would suggest skipping the suckling question)

43. How much of the milk produced by [...] was consumed by your household (either as milk or processed products) in the last 12 months?

44. How much of the milk produced by [...] did you convert into processed dairy products in the last 12 months?

45. How many litres of [...] milk did you sell in the last 12 months?

46. Where/to whom do you mainly sell your [...] milk?

Government / LC

Private trader in local market/village

Private trader in district market

Consumer at market

Neighbour/relative

Other (specify): _____

47. Who controls the revenue from the milk products in the household?

48. Does this household make any use of the dung produced by cattle (or other important animal)? LIST TWO MAIN USES

Manure building Fuel (cooking) Feed to other animals Construction of

Sales use Other (specify): _____ No

Section E: Context & economy

49. Does the state give you any kind of financial support for your production? Y / N

50. Are you part of any local cooperative? Y / N

50.1. If not, do you use to participate with other households in any business-related aspects? (i.e. buying inputs together, selling products together, sharing/exchanging produce, lending animals/technology/money, participating in other household's work activities, sharing common resources (water, land, facilities, electricity))

Y / N

51. Have you taken any loan during the last 12 months?

Section F: Socio-demographic features

52. Gender Male Female

53. Age: _____

54. Religion: _____

55. Education level: TO COMPLETE WITH KENYAN STUDENTS

56. Personal occupation:

57. (for households) Number of people living in the household: _____

58. Question which gives an idea of social status (i.e. how many bags of (rice) did you buy last month?)

59. How much area does the household own/share?
