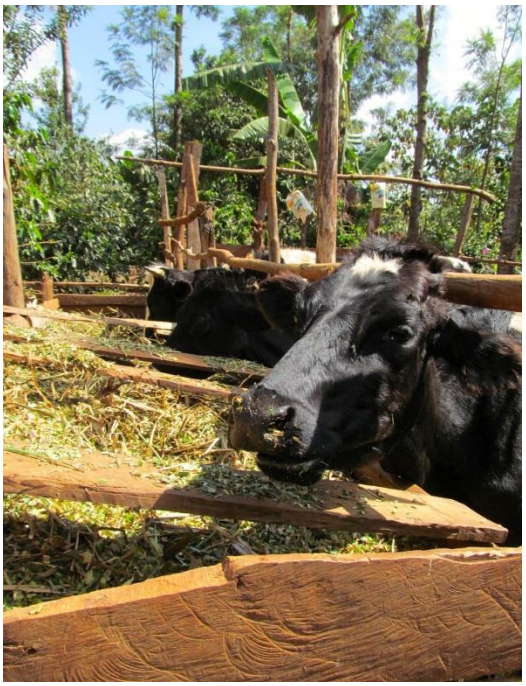
“It all comes down to the animals.”

FACULTY OF SCIENCE
UNIVERSITY OF COPENHAGEN

Analysing livestock strategy dynamics in the Central Highlands of Kenya






SLUSE 2017

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Abstract

This study aims to investigate smallholder farmers' livestock strategies and the drivers behind these strategies. Data was collected by a collaboration of students from the University of Copenhagen and the University of Nairobi during a two week field course in Kibugu, Embu County, Kenya. In order to characterize the local farming system and uncover farmers' livestock strategies, qualitative and quantitative methods were used to gather data from farmers and key informants. This study analyzes the sustainability of their livestock practices through the Sustainable Livelihoods Framework.

Farmers still depend upon a coffee/tea-cow-system. They prefer exotic cow breeds, despite their lower suitability to the surrounding environment. However, the current system still benefits farmers: coffee requires less water than other cash crops and cows provide a bountiful manure source. Conversely, the identified mediating processes and greater context suggest that farmers may not be able to maintain these strategies in the future.

Why, then, do farmers continue to employ these strategies? Social norms dictate the status of smaller livestock, and government officers are ill-equipped to provide enough training. Unlike in other locations, NGOs promoting dairy goats are nonexistent in Kibugu. Also, farmers lack the financial capital to expand production and take advantage of the market. Their lives are influenced by other external factors such as population pressure, decreasing land sizes, and increasing input prices. Coupled with the greater context of environmental shocks, there are indeed many factors that constrain the common farmers from pursuing more sustainable methods.

In conclusion, this report recommends smallholders join together to advocate for themselves. Additionally, better funded and expanded extension services could encourage new ideas and support farmers who aim to diversify, reduce risk, and lower the burden of inputs. Ultimately, it was determined that holistic approaches to further research and development could strengthen farmers' assets and help them adapt to a changing world.

Acknowledgements

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More specifically, we would like to thank Emily Kilonzi and Mary Kageni, our colleagues from the University of Nairobi. The expertise of our local guides, Roy, Karol, and Lilian, was indispensable during our fieldwork. We are ever grateful for the hospitality of our hosts, Julius Victor and his wife, Esther Njoki Njiru, Lillian Mureithi, and Angeline Njeru. We especially value Angeline, Julius, and Esther's graciousness in permitting us to conduct our meetings in their homes. Thank you to our supervisors, Christian Pilegaard Hansen and Ebbe Prag, for your invaluable guidance, and Myles Oelofse for coordinating the ILUNRM course. Finally, we thank each other for an unforgettable experience working in Kenya together!

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1 Introduction

1.1 Background

Global background

In developing countries, the livestock sector is experiencing rapid growth; currently at 33%, its share of the agricultural GDP continues to rise. This expansion is fueled by increasing demand for livestock products and services (Thornton, 2010). This demand, in turn, is driven by a burgeoning human population, rapid urbanization, and increasing affluence (FAO, 2017). Correspondingly, this "livestock revolution" could represent challenges in terms of production capacities and efficiency, as well as emerging economic opportunities for smallholder farmers. In contrast to industrial animal production, animals in smallholder systems often serve various purposes: wealth creation and risk reduction, food security and aid in farm production through traction power and nutrient inputs (Thornton, 2010).

Livestock in Kenya

As in many Sub-Saharan countries, Kenya's livestock sector plays a crucial economic role. During the 1960s, the number of livestock per capita in Kenya was among the highest in Africa. However, from 1961 to 2000, this figure was halved due rapid population growth and dismal economic performance under President Moi (Dietz et al., 2014). Eventually, Kenya's livestock sector rebounded, with a total increase in livestock from 57.0 million to 108.1 million head from 2000-2011 (Dietz et al., 2014). Evidently, livestock farming plays a significant role in Kenya's economy, comprising 42% to 45% of the nation's agricultural GDP (Ahuya et al., 2005; Sere et al., 2007). Supermarket chains are beginning to establish and livestock husbandry is slowly industrializing. Yet, most Kenyan livestock remain in pastoral, mixed crop/livestock, or non-industrial systems (Thorpe et al., 2003, Sere et al., 2007).

Our study is located in the humid Central Highlands region, where mixed crop-livestock smallholder systems, specifically the tea/coffee-cow-system, are abundant. Here, the climate is well-suited to dairy farming, and the population has a tradition of dairy consumption. There is generally a close integration of cows with coffee and maize intercropping, and each household will usually own between one and five cows (McDermott et al., 2010). Smallholders have integrated new varieties of cash crops on their farms, including some temperate crops (Jahnke & Jahnke, 1982).

Cattle in Kenya

The tea/coffee-cow system evolved from a prior system of communal land ownership, with extensive grazing of indigenous livestock in combination with subsistence agriculture. The Swynnerton Plan of 1954, along with increasing population pressures, gradually transformed the traditional farming system (Jahnke & Jahnke, 1982). After Kenyan independence in 1964, tea, coffee or maize, depending on altitude and climate, laid the foundation of the highland farming system. Coffee and tea became the strongest export crops and foreign currency earners. While before excluded by the British colonists from any commercial or improved farming, local farmers were now able to benefit from resources, high-end breeds, and already existing infrastructure, knowledge and extension services. Together with a transition toward individual landholding, these changes laid the basis for smallholder agricultural development. These unique pre-conditions put Kenya in an advanced position compared to most other African countries: the livestock sector began to prosper, producing steadily. Kenya still has one of the continent's strongest livestock sectors today (Lesschen, et al. 2004). One of the greatest impacts was the advent of artificial insemination (A.I.) services to upgrade local cattle (Jahnke & Jahnke, 1982; Conelly, 1998; Lesschen et al., 2004; Muriuki, 2011). Whereas cow manure always played a vital role in farm fertility, with European and American breeds it converted into a "cash cow" itself and contributes with its high milk productivity not only to the family's nutrition but also substantially to income (Murithi, 1998; Utiger et al., 2000). Due to population pressures and decreasing farm size, farmers transitioned from grazing to a cut & carry, or zero-grazing, system, which allowed them to produce more outputs from less land (Lesschen et al., 2004). A preference for Jersey and Guernsey and later for Ayrshire and Friesian cows (Bebe et al., 2003) has led to a progressive decimation of local Zebu breeds, especially in the Central highlands. Meanwhile, Steinfeld from the FAO (1995) forecasts that the rapid livestock increase in East Africa will put farmers and planners alike in confrontation with major challenges in terms of available feed resources.

Some stakeholders see indigenous Zebu cattle as endangered and criticize the preference for European and American breeds (Okeyo et al., 2015). If no conservation actions are taken, these valuable genetic resources could soon be lost (Kimani 2016, Okeyo et al., 2015, Sere et al., 2007). The valuable traits of local breeds, such as disease resistance, fertility adapted to the climate, and the ability to withstand droughts make these genetics so valuable and serve as reminders of their important but mostly invisible role in crossbreeds.

The main outlets for milk production are informal markets and local cooperatives, while a minor share is delivered to large companies (Thorpe et al., 2003). Farmers prefer informal markets

because they are deemed more secure, stable and easy, despite some food safety issues (Muriuki, 2011).

Goats in Kenya

Traditionally, East African goats could be found in small numbers on most highland farms for meat, insurance, money stocks, and family ceremonies (Peacock et al., 2005).

Exotic dairy goats have become increasingly widespread in the Central Highlands (Kiruiro et al., 2003). Not only is the goat milk highly nutritious, but it also yields higher prices than cow milk. Less and less land is available to produce enough fodder for dairy cattle (Place et al., 2006). Goats require less land and money to raise, so they can be an important component in the livelihoods of "resource-poor" smallholder farmers (Ahuya et al., 2005).

Also, development programs have played their role in the rise of dairy goats: *The Sheep and Goat Project*, implemented by the UN FAO in the 1970s, was intended to provide Kenyan farmers with improved breeding stock for their herds.. Unfortunately, this expensive project failed, mainly because farmers and their needs were not considered and breeding experiments were done off-farm, in disregard of genotype-environment-interactions.

However, a project initiated by FARM Africa and the German Development Corporation in the 1990s proved to be much more successful. FARM Africa succeeded because it implemented a community-based breeding scheme that conducted experiments on-farm. Participating farmers were trained in numerous aspects of goat breeding, husbandry, and healthcare, and in this way, they were able to lead the program and direct it to address their communities' needs (Ahuya et al., 2005). Not only could farmers raise more productive goats, but they could also make money by selling superior live goats. Additionally, some farmers were trained in aspects of goat health care to provide their neighbors with veterinary assistance (Ahuya et al., 2005). Through this development program, poor farmers were empowered to take the lead in community initiatives. Not only did the FARM Africa program improve the quality of goat breeds, it also showed much potential for replication in other locations and, most importantly, provided farmers with strategies to improve their livelihoods.

The role of other small livestock

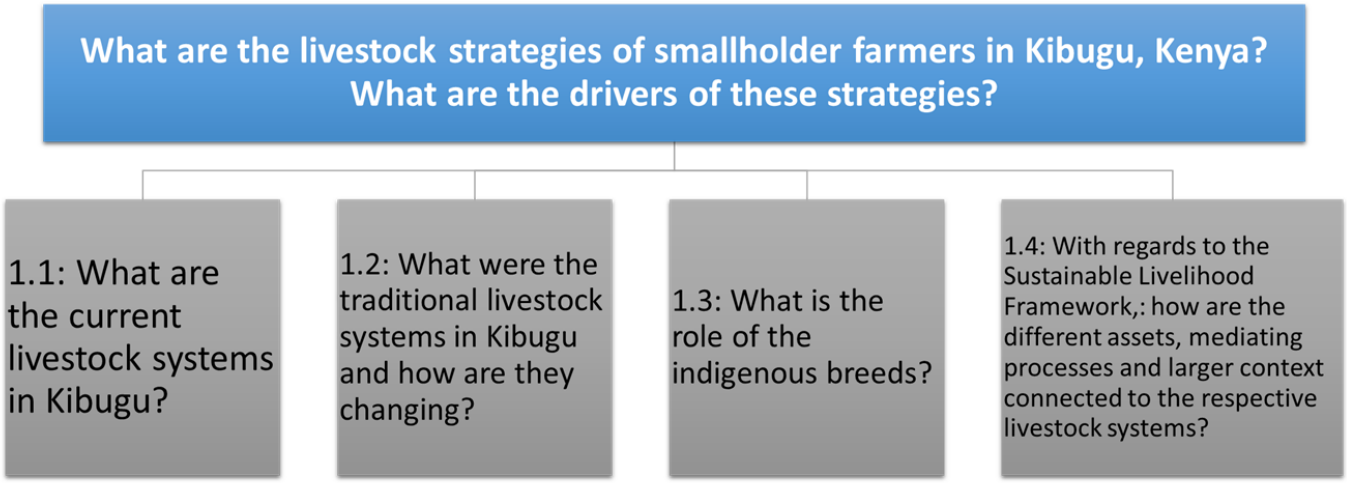
Indigenous **chicken** are the most numerous livestock; they are cheap and can scavenge on scarce resources. They therefore provide both cash and cheap animal protein for poor households (Magothe et al., 2012). Local chicken represent ⅔ of poultry and are kept by 90% of communities in Kenya (Kingori et al., 2010, Ngeno et al., 2015). Different hybrids are available on the market,

and depending on their production level they could be well suited for smallholders (Ngeno et al., 2015).

Livestock play a crucial role in Central Highland farming systems, and this role is under continuous transition. Therefore, we are interested in researching the dynamic livestock strategies of smallholder farmers.

1.2. Research questions

Research question



Hypothesis

Smallholder farmers in our study location will adapt to issues of increasing population pressure and decreasing farm size by transitioning from cattle rearing to goat rearing strategies.

Defining our concepts

Livelihood	A livelihood comprises the capabilities, assets and activities required for the means of living (Chambers & Conway, 1991)
Strategy	A plan of action designed to achieve a long-term or overall aim.
Livestock	Animals kept by a household that contribute to food security and/or income.
Livestock strategies	The farmer's approach to integrate livestock within his farm system in order to benefit their outputs.

Livestock dynamics	The term livestock dynamics is used to describe the fluid relationship and development between use of livestock.
Farm system	We will use the definition of a farm system established by the UN Food and Agriculture Organization. According to the FAO, a farm system comprises the individual household unit, along with its resources and resource flows, and the intertwined socioeconomic, biophysical, and human components of the system (Dixon et al., 2001).
Intensification	A strategy where more capital and labour are applied per unit of land to increase output.
Diversification	A strategy where a farmer raises different livestock instead of focusing on only one kind of animal.
Specialisation	A strategy where a farmer generates his main outputs from one kind of livestock.
Common farmers' livestock strategy	The livestock strategy employed by the majority of a community's households.
Farming system	A group of individual farm systems where the resources, enterprise patterns, household livelihoods and constraints are broadly similar to each other.
Household	The people living together in one house collectively, living off the same income sources, as well as the people who contribute to running the household.

2 Description of study site

2.1 Agroecological information

The study was carried out in several villages of Kibugu location in Embu County, Kenya. The area lies in the foothills of Mount Kenya at ca. 1,600 masl, ascending north-west towards the mountain and sloping down south-eastwards. Annual precipitation is 1,700 mm in a bimodal rainfall pattern: a long rain season between March and June and a shorter around November and December. Temperatures in Embu County range from a minimum 15°C in July to a maximum of 30°C in September, averaging at 21°C. The climatic regime and deep, fertile soils support tea and coffee farming as well as various types of vegetable and horticultural crops. It allows also for acclimatisation of dairy cattle, making Embu county one of the major milk producing areas in Kenya (Lesschen et al., 2004). Dairy cows are popular but other animals including goats, sheep, pigs and chicken and rabbits, are also found.

Agricultural extension is organized on county level via the Ministry of Agriculture agencies located in Embu, whilst animal health and breeding services are mostly privatised.

2.2 Demographic information

The number of households is around 2650; population densities range from 520 to 770 persons/km^2 within an area of about 15.8 km^2.

Being approximately 7 km from Embu town, the capital of the county, an urban market is within reach, however limited means of transportation, and only partial pavement of roads means that local markets are mostly used.

Most people have access to water for household needs, but irrigation is very limited in most parts. Other utilities such as electricity is limited, especially away from the town center.

3 Methodology

3.1. Theoretical Framework: The Sustainable Livelihood Framework

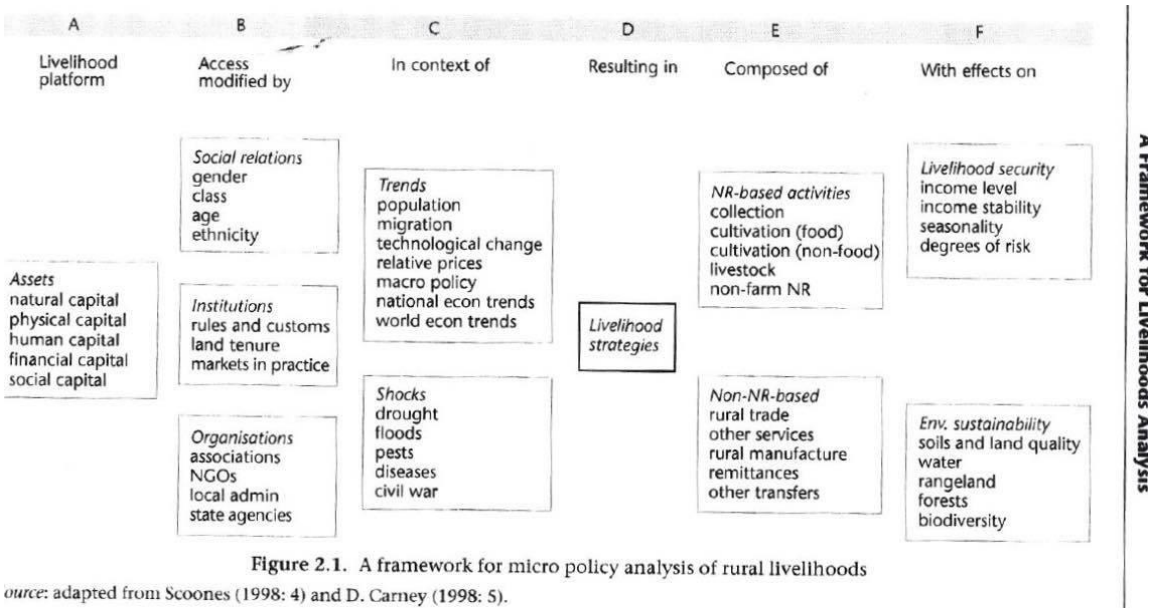


Figure 2.1. A framework for micro policy analysis of rural livelihoods

ource: adapted from Scoones (1998: 4) and D. Carney (1998: 5).

Figure 1: The Sustainable Livelihood Framework (Ellis, 2000).

The strategies of smallholder farmers evolve dynamically through time and differ in various ways (Ellis, 2000). Frank Ellis (2000) developed a Sustainable Livelihood Framework (SLF) that helps us examine these diversified rural livelihoods (Ellis, 2000). We use the framework in relation to livestock strategies, not overall livelihood strategies (Ellis, 2000). The scope of this study does not allow us to take the last part of the framework concerning livelihood security and sustainability into deep consideration.

We use the framework because we want to secure a holistic view on the many factors that affects livelihoods (DFID, 1999). Since the framework focus on how the surrounding context influences the strategies it enables us to look at strategies in terms of livelihood instead of just husbandry and thus connecting social sciences to farming (Scoones, 2009).

3.2. Methods

With this theoretical framework in mind, we utilised a range of methods (for overview, see Appendix A), both qualitative and quantitative, to amass relevant data. In order to triangulate and ensure validity, we aimed to diversify our methods as much as possible within the fieldwork timeline.

Observations

Observations were conducted constantly, while doing fieldwork, with host families or at special events like the Agricultural Fair. Noted down and put into context, they helped complement the bigger picture by triangulating our other findings. Whenever relevant, our analysis will refer to observations from one of the team members.

Questionnaire

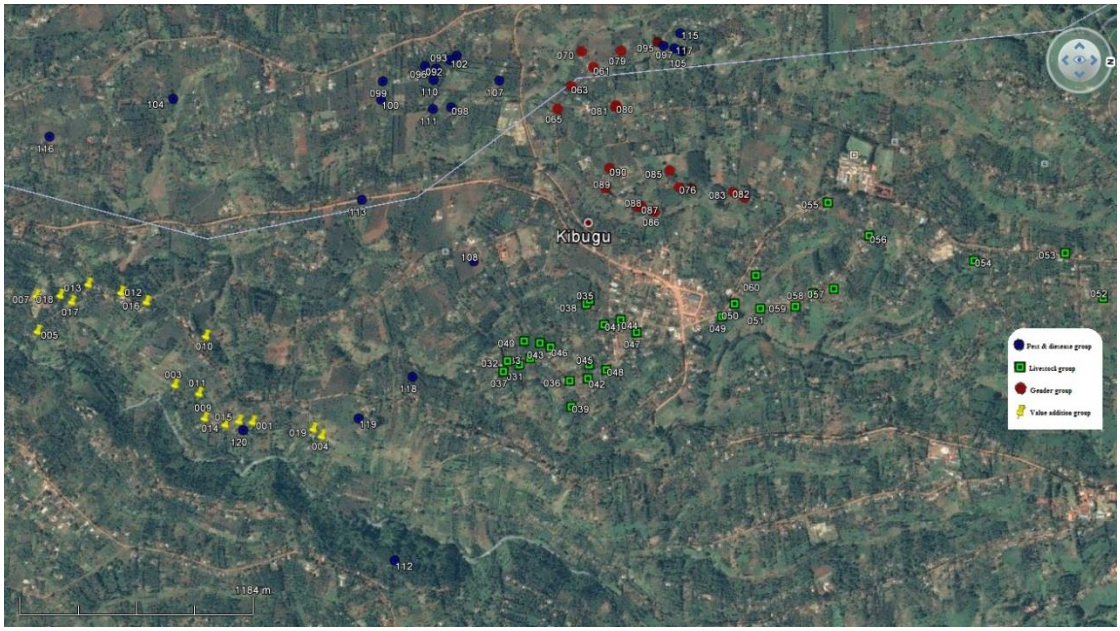


Figure 2: Distribution of questionnaire data.

We conducted a questionnaire (Appendix B) to gain an overview of the general population and quantifiable data on livestock. The questionnaire was executed in collaboration with four other student groups, to increase sample size without major impacts on workload. Each group was assigned a different area and the sampling strategy was chosen to be every third household on a route cutting through the area. 93 questionnaires were collected and we can, with a 95% confidence level and 10% margin of error, say that our population is represented with the results we found, given that the data is normally distributed.

Photo 1: Administering questionnaires. Emily with guide Lillian (L). Kenyan counterpart student Mary (R).

In addition to being a method of direct data collection, the questionnaire also acted as a guideline for our other methods of data collection. Firstly, the data from the questionnaires helped us shape the subsequent methods. Secondly, the execution of the questionnaires took us around the area of investigation. Because of this, it became natural to us, to combine the questionnaires with other data collection.

Interviews

We conducted unstructured and semi-structured interviews with both farmers and key informants.

Unstructured interviews

We went to the Embu County Agricultural Fair, which provided us with an overview of the region's farming industry and government development projects. It was an excellent location for spur-of-the-moment interviews. We interviewed a goat farmer, goat breeder, and county extension officer. We also conducted unstructured interviews while spending time with our host families. For further details, see Appendix A.

Photo 2: Doing unstructured interviews at the agricultural fair.

Semi-structured interviews

We conducted semi-structured interviews with farmers and key informants to expand upon the questionnaire information with interview guides tailored to the respective interviewee (Appendix

C). Many of the farmers selected for the SSIs were chosen from among the questionnaire participants or from the transect walks. We cast a wide net to gain as many perspectives as possible, but some characteristics were particularly interesting to us - for instance, resource-poor households, farmers possessing several dairy goats, with diverse or innovative livestock species, or with advanced commercialized livestock farming.

These interviews provided us with the larger context of livestock trends in light of the SLF and beyond the farmer's everyday life. For a list of interview respondents and copies of the interview guides, please refer to Appendix A.

Photo 3: Mr. Njeri (Livestock officer).

Participatory rural appraisal (PRA) methods

While Time constraints prevented us from conducting PRA workshops, we did incorporate PRA tools into several of our semi-structured interview sessions to triangulate the interview data.

Transect Walk

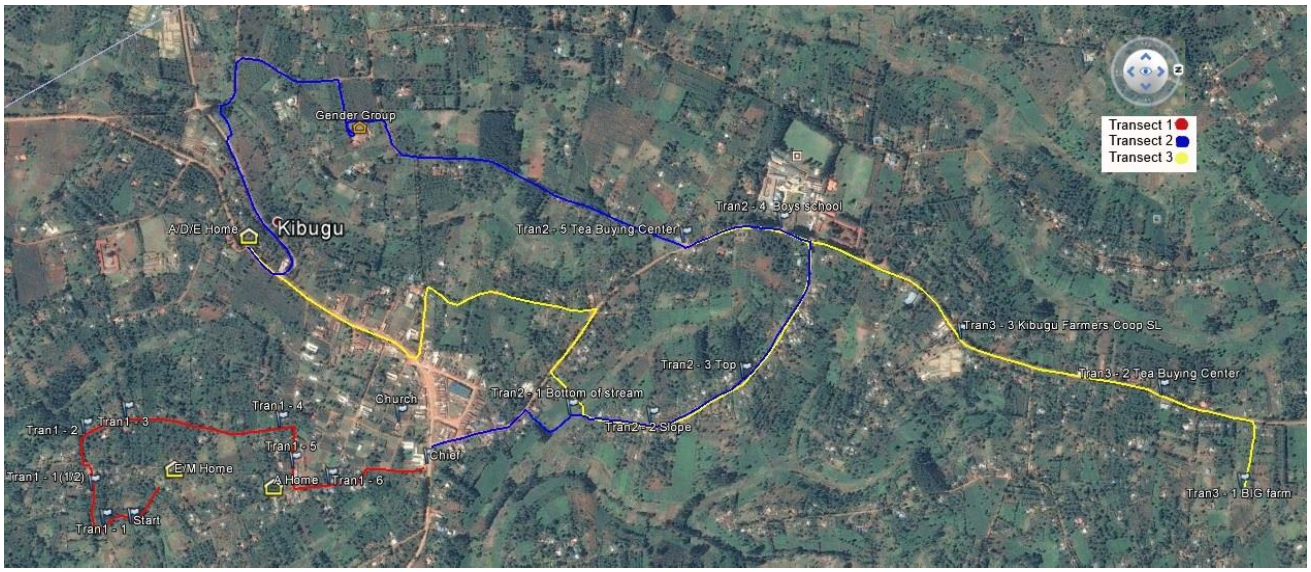


Figure 3: Map of the executed transect walks.

Two transect walks with local guides were conducted, in Kibugu (T1) and in the neighboring village of Gicherori (T2). As preparation we created several village maps with the assistance of our guides. With these maps, we could select a specific route, and the guides could also advise us on relevant locations to visit.

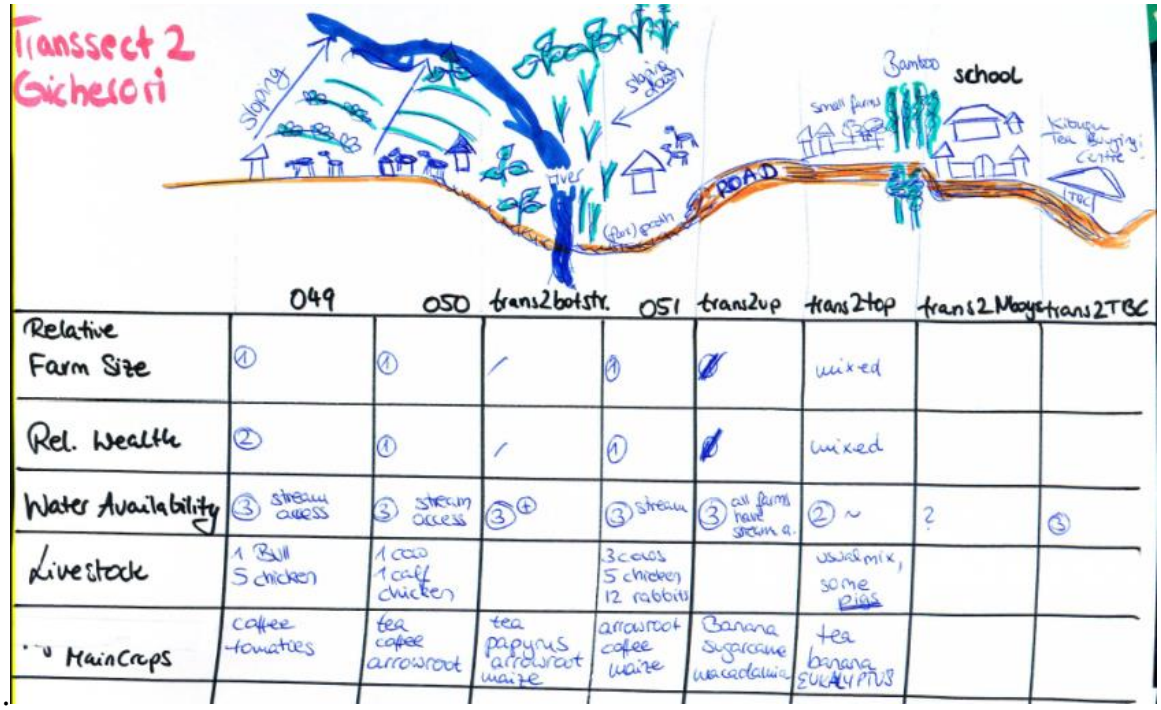
Recorded characteristics included farm size, wealth, water availability-- all estimated on a scale from 1-lowest to 3-highest-- livestock information, and prevalent vegetation. Transect-Points, which were marked in the handheld GPS, were selected based on a remarkable change in topography, land use, or farming system, yet never further than approximately 500m from the last point.

A third transect walk was done; however, this differed from the others, as it served more as a path for conducting questionnaires, SSI's and observations.

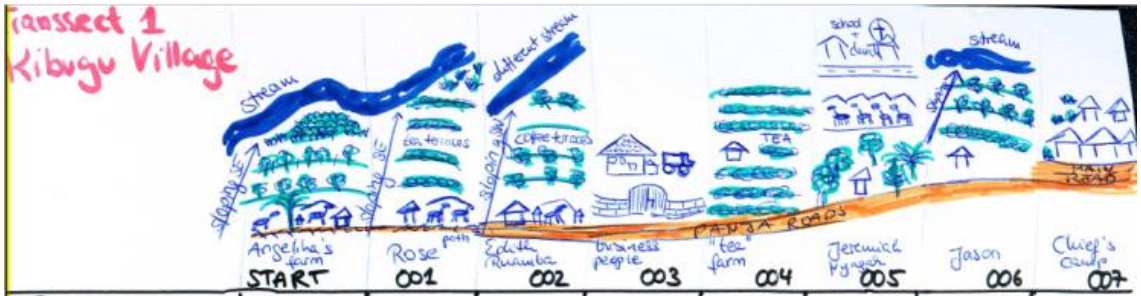
Transect 1: 1.62 kilometers

Transect 2: 4.00 kilometers

Transect 3: 4.60 kilometers



	049	050	trans2botstr.	051	trans2up	trans2top	trans2Mooy	trans2TBC
Relative Farm Size	①	①	/	①		mixed		
Rel. Wealth	②	①	/	①		mixed		
Water Availability	③ stream access	③ stream access	③+	③ stream	③ all farms have stream a.	② ~	?	③
Livestock	1 Bull 5 chicken	1 cow 1 calf chicken		3 cows 5 chicken 12 rabbits		usual mix, some pigs		
Main Crops	coffee tomatoes	tea coffee arrowroot	tea papyrus arrowroot maize	arrowroot coffee maize	banana sugarcane macadamia	tea banana EUCALYPTUS		



	START	001	002	003	004	005	006	007
Relative Farm Size	③ large	② med	③ large	② med	① small	② med	③ large	
Rel. Wealth	② med	② med	② med	③ high	② med	② med	② med	
Water Availability	③ good stream	③ good stream	③ good stream	① only tap	① only tap	① only tap	③ stream + tap water	
Livestock	2 cows chicken	1 cow chicken duck	cow goats (med) chicken	?	2 cows	4 cows goats chicken	2 cows chicken	
Vegetation / Pasture	Napier grass banana leaves + stems (cut & carry)	Napier grass banana leaves + stems (cut & carry)	same	* they have CARS	Napier banana (C&C)	Napier banana (C&C)	Napier banana (C&C)	some Napier grass
Main observed Crops	Macadamia banana	tea coffee	coffee macadamia tomatoes	coffee tea banana avocado	Tea banana macadamia avocado	Banana Avocado macadamia	Bananana macadamia tea coffee	

Photo 4: Transect walk matrix 1 (L) and 2 (R), with sketch of area and scoring of parameters.

Animal Scoring Matrix

Photo 5: Animal Scoring Matrix (L). Elias Njue ranking animals during an interview (R).

We used a livestock scoring matrix as a component of semi-structured interviews with farmers and key informants. Our informants categorised and scored the different livestock in terms of income, ease of feeding and care, and symbol of status. One shell reflected the least value of an animal, and six shells symbolized the highest value. Additionally, respondents were asked to explain their scorings. Scores reflected not only the place of livestock in the subjects' own lives, but also their perception of the prevalent societal views concerning livestock species.

Household System Analysis

These diagrams were created as a component of semi-structured interviews and not as part of a workshop with multiple farmers. The farmers were either given tools to create the map themselves or guided by the facilitator. Whenever possible, the diagrams' components were labeled in the local dialect to make sure the interviewees understood the process. Banana leaves, stones, and other materials at hand were used as symbols of fields and houses. Recorded were the number and types of livestock, the crops grown, and the input and output flows within and without the farm compound. These inputs and outputs included money, labor, feed, food fertilizers, and veterinary medicine.

Daily Activity Clock

We used a daily activity clock as a component in three SSIs. It was interesting to learn about farmers' daily tasks, who in the household carries out these tasks, and who in the household benefits financially from them.

Seasonal Calendar

During an SSI with a prominent dairy farmer, we created a seasonal calendar to show his farm's yearly agricultural cycle in relation to livestock, fodder crop cultivation and feed availability and compare it to the traditional feed calendar.

Historical timeline

During our SSI with the Livestock officer, Mr. Njeri, we created a historical timeline of livestock trends. This timeline recorded the interviewee's perception of past livestock markets and possible future trends.

Quantitative tool: statistics

In this section we will shortly describe the main purposes of the quantitative data and the thinking we did through the analysis of this data. The statistics serve two main purposes in our project: **descriptive** part and an **analytical** part. Although a lot of the same data goes into both parts, the handling of said data is very different, and while the descriptive part is fairly straight forward, the analytical part is more complicated. From the 93 datasets we selected for the most important questions (*Personal information, Household information, Livestock* questions) and imported into *IBM SPSS 24* for statistical analysis. The *Bivariate Correlation* Function gave a fast screening of correlations in the dataset. Subsequently, we used the *Partial Correlation*, to remove the influence of correlation from other factors, and thereby increase the certainty of causality between two factors.

4 Results

4.1. Traditional crop-livestock system of Kibugu

Both key informants and farmers (SSI 2, 6, 8, 11) described the historical pasture system with traditional livestock consisting of local goats, sheep and "Zebu cattle grazing everywhere" on communal land. Chickens roamed the village freely; goats and sheep grazed with the cattle. Smaller animals were brought into farmers' compounds at night; however, cows were left on the pastures. Zebu cows' main purpose was meat provision, and were only rarely milked.

The key informants remembered a time when the government played a more active role in livestock farming (SSI 6, 11). The livestock officer Mr. Njeri highlighted the advent of exotic cattle breeds and A.I. in the 1980s as a major turning point for smallholder livestock farming (SSI 6). From here the importance of improved cattle rapidly grew, thus laying the basis for current dairying. Additionally, the Vet refer to the thriving agricultural sector in the years after independence, mentioning how inseminations, health care, extension services and even building materials for stables were subsidised (SSI 11). In the 1980s, the government's role decreased: extension services eroded, subsidies and employments were cut. This in turn hindered effective and efficient extension work, which contributed to a period of regression in the sector (SSI 11, 14) . Mr. Njeri, who saw no benefits in the traditional system, advocated for a greater governmental role in animal healthcare (SSI 6). The historical timeline, (Photo 6), indicates how alternative livestock markets have slowly expanded.

The questionnaire delivered some basic information about recent changes in the last 5 years: changes in cattle were stated most often, the majority increasing or intensifying their cattle farming, however, a decrease in cattle was the second most common, followed by positive changes in goat and pig rearing. Over a third stated that they had not undertaken any important changes. For more details see Figure 4. Some farmers observed that in recent years housing structures for animals have become more advanced (pre-factured concrete floors/posts) and grazing almost completely extinct (SSI 12).

Photo 6: Mr. Njeri's historical timeline of livestock dynamics.

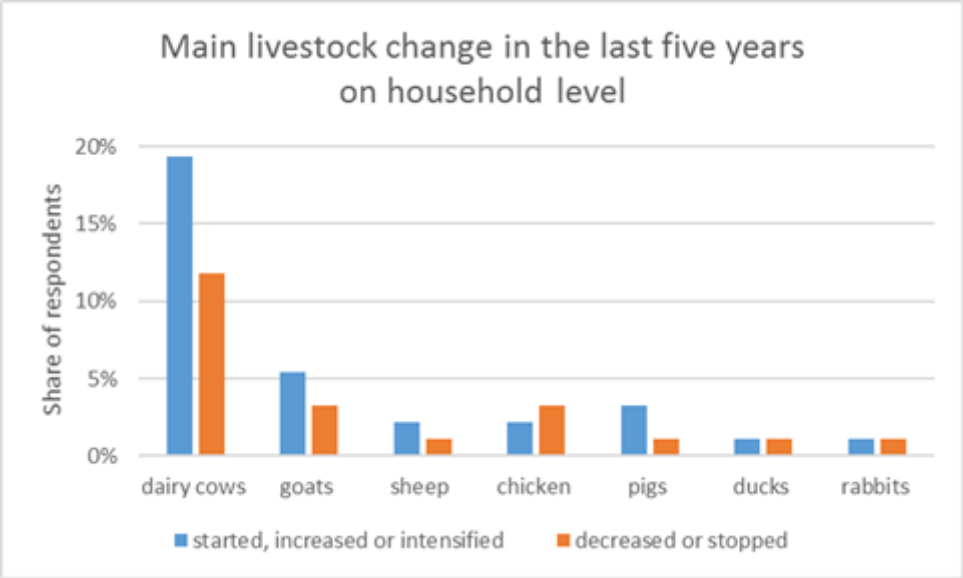


Figure 4: Livestock change within last five years.

Livestock strategies in the light of the Sustainable Livelihood Framework

The relevant mediating processes and context

Social relations

Gender

The agribusiness officer Mr. Gitari said that female-led-households tend to be less productive in terms of generating income from livestock, because the woman has many other tasks (SSI 14). From the daily activity clocks (Photo 7) and the questionnaire we see how livestock tasks tend to be split up by gender. The men had generally more free time during the day, as they could rest while the women cleaned. At the same time both often had farm work, which did however differ between genders. We found the example below as a representative household, although there are differences between households.

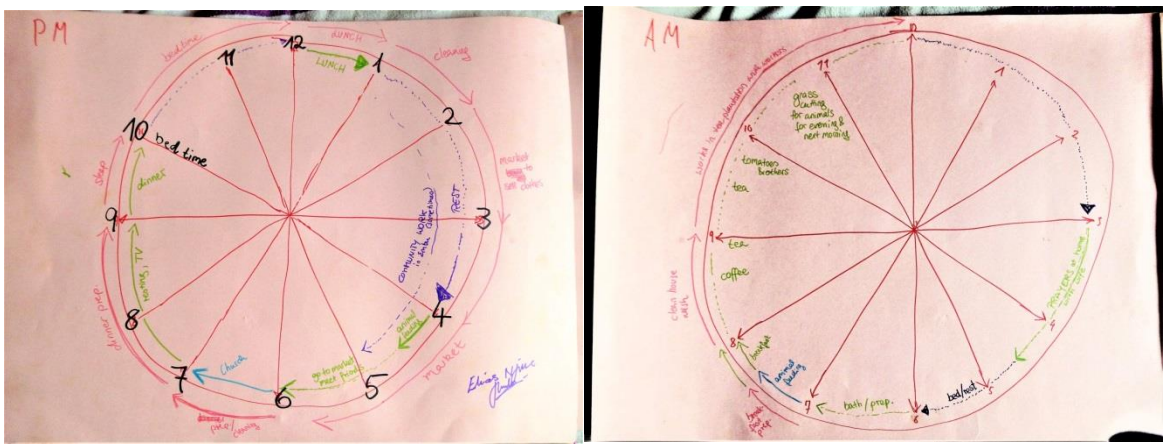


Photo 7: The daily activity clock of Elias Njue and his wife (filled out by him).

Institutions

Rules and customs

Our data showed us that there is an unwritten rule determining how the cattle signals success in the farmer's life. For example is the cow's role as status symbol illustrated in the following scoring exercise (Photo 8). Exotic cattle breeds are also perceived as high status symbols. For example, the farmer Simon explained that "*Friesians are a social status symbol and they are beautiful cows*" (SSI 5).

Photo 8: Scoring exercise: Bernard, Njeri, Murethi & Elias

Markets in practice

A large share of the farmers directly sell their products to the local market. A big share of farmers seem to sell completely or partly to informal markets. According to the Agribusiness officer many farmers have higher trust in the local market (SSI 14).

Currently there is a large unmet demand for cow's milk in Kibugu region, estimated to 40,000 L daily (SSI 4). There is a market for rabbit urine and a big market for goat milk in cities, like Embu (SSI 8, SSI 10).

Organisations

State agencies

We met some representatives of the Ministry of Agriculture located in Embu County. The livestock officer, Mr. Njeri, responsible for livestock extension services in Kibugu ward, covers approximately 8,000 households. However, because of lack in staff he estimates that he can only reach a quarter (SSI 6). Mr. Gitari, the agribusiness extension officer, covers the Ruguru-Ngandori ward and previously Kibugu ward. His staff to farmer ratio is 1:850 to 1:1000. Mr. Gitari also feels that small staff size is a constraint for providing farmers with the services they need (SSI 14). The veterinary officer, Mr. Mwaniki, specializes in breeding services and has worked in both the public and private sector. He told us that the government has not employed new vet officers since 1989, and considers this as detrimental to the quality of breeding services and farmers' knowledge on improving livestock breeds (SSI 11).

Despite these constraints, the government officials do provide some recommendations for farmers. For instance, Christopher, the extension officer from the fair, recommends that farmers with small land keep hybrid chickens or rabbits (USI 4). Mr. Njeri tries to instruct farmers' interest groups in improved practices, but he says, *"if I had some people at the grassroots for each division, I would be much more efficient"* (SSI 6). Mr. Gitari believes that farmers should focus on developing a livestock enterprise instead of trying to maintain simultaneous, unproductive enterprises of cash crop plantations and livestock. Mr. Mwaniki recommends that farmers not aim for an exotic breed that their land size cannot support. According to the him, *"sometimes you punish the farmer by giving him the cow he wants"* (SSI 11).

Livestock farmers' associations

The only breeding association we came across is DGAK (Dairy Goat Association Kenya), and locally, they have declining members (SSI 10). Mr. Gitari said that there is no organisation for goat milk marketing in Kibugu (SSI 14). The majority of cow farmers sell to a local milk cooperative.

Livestock NGOs

We heard of FARM AFRICA as the only NGO dealing with livestock in the surrounding areas. It successfully promoted dairy goats in the neighbouring county Meru. However, the FARM AFRICA's development project is not present in Kibugu and we took no notice of other livestock NGO projects.

Overall context

Trends

As elaborated in the site description, the population in Kibugu has increased while farm sizes have decreased. Several informants asserted that farmers with small land parcels should transition toward rearing small livestock (USI 4; SSI 8, 10).

Shocks

While we were in Kibugu, the area was in the midst of a drought. Crops such as napier grass had dried up, so farmers were afraid to harvest more fodder from their farms (SSI 7). During times of drought the already high cost of farm inputs increases, which puts a further strain on farmers' livelihoods (SSI 1, 6, 12, 14, 17, 22). Thus, smallholders struggle to feed their animals with anything they can, even if it may not be so nutritious (SSI 12). As milk supplies have decreased due to drought, farmers can sell their milk at a higher price (SSI 14).

The common farmers' strategies

Who is the "common farmer"?

The following description is based on median and mean values from the questionnaire (Table 2 & 3): The typical farmer of the coffee/tea-dairy system works one acre of land to care for five household members. He owns two cows, six chicken and most commonly zero goats, or one goat, which is kept for meat and insurance. 62% of all goat keepers were unable to specify their goat breed, and we also noticed confusion about distinguishing goats from sheep. The common farmer does not have any other livestock.

African Zebu cattle was never named; we suspect their remaining role is in the crossbreeds (13%), unstated cattle (5%), and in form of residual genetics in all the upgraded cattle. Exotic breeds are very popular, especially Friesians and Ayrshire which now represent 49% and 15% of all cattle in Kibugu respectively.

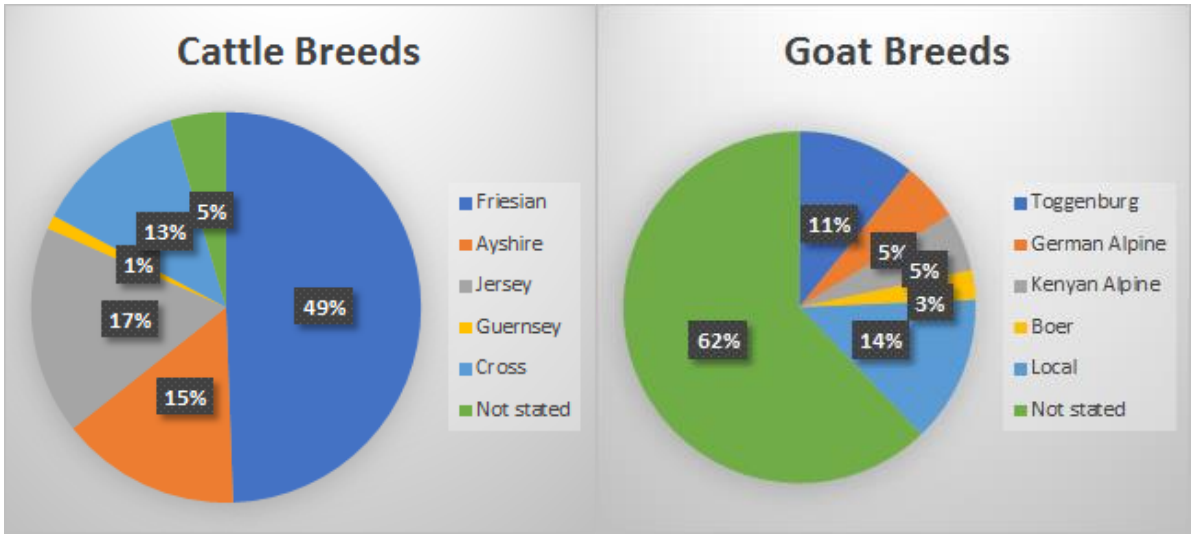


Figure 5: Distribution of cattle (L) and goat (R) breeds in Kibugu (Questionnaire data).

Table 1 Household information from the questionnaire. Ordinal and nominal scale data

.			
	% of respondents		% of respondents
Gender:		Level of Education:	
Male	41.9	None	9.3
		Primary School	47.8
Female	58.1	Secondary School	31.5
		Tertiary School	10.9
Marital Status:		Monthly Household Income:	
Single	13.0	Below 10.000	61.9
Married	70.7	10.000 - 25.000	26.2
Divorced	1.1	25.000 - 50.000	7.1
Widowed	15.2	Above 50.000	4.8

Table 2: Household and livestock data from questionnaire. Ratio scale data. Livestock units is a measure of the amount of land it takes to feed a an animal. Smaller animals has a lower coefficient, thus contributing with fewer LSU per animal. The LSU standard

	Mean	Median	Min.	Max.	Range	Std. Error of Mean	Std. Deviation
Age	51.08	50.0	23	100	77.0	1.668	15.915

Household size	4.91	5.0	1	11	10.0	0.223	2.249
Farm size (acre)	2.24	1.0	0.04	20	19.6	0.376	3.583
Number of crops	7.37	7.0	2	13	11.0	0.291	2.800
Livestock:							
Cattle	2.77	2.0	0	54	54	0.634	6.113
Goats	1.09	0.0	0	11	11	0.184	1.773
Chicken	12.14	6.0	0	150	150	2.044	19.711
Sheep	0.24	0.0	0	4	4	0.074	0.713
Pigs	0.22	0.0	0	8	8	0.119	1.15
Rabbits	0.66	0.0	0	20	20	0.283	2.733
Ducks	0.30	0.0	0	18	18	0.212	2.042
Geese	0.08	0.0	0	5	5	0.058	0.556
LSU (Livestock Units)	2.84	1.9	0	48.6	48.6	0.572	5.521

The common farmers' status of assets

In order to investigate these numbers and look at the strategies behind them, we ask what characterizes the common smallholder farmer's status of assets.

Financial capital

Most smallholder farmers in Kibugu that we talked to do not access credit in the form of loans. One farmer said he dislikes loans, because he prefers using what he has and this we found as a general attitude (SSI 12). As the statistics illustrate, 61.9% of the farmers have a monthly income below 10.000 KES (see Table 2). Thus, most farmers in Kibugu do not have access to immense stocks of money. Ellis (2000) writes that livestock often plays a critical role as a store of wealth in Sub Saharan Africa, matching Mr. Njeri's expression: "*a household without livestock is poor*" (SSI 6). Wealth in Kibugu should then not only be measured in stocks of money, but also in livestock: the common farmer has 1.9 LSU (Table 3).

Human capital

47.8% of farmers have finished primary school and 31.5% secondary school as highest level of education (See Table 2). Despite farmers' low education level, they take care of the farm and send their children to school, often as far as university. We also found disease and aging as central issues within the farmers' human capital. Harry, who was turning 80 years old understood that his productivity was declining as he aged and that he would need to find labourers outside the farm. He said that supervising them was difficult so the productivity would most likely decrease. However, other farmers' children will return to help them on the farm (SSI 13).

Natural capital

42.2% of the farmers in Kibugu have 0.5-1 acres of land. Although not quantified, we observed many farms sloping downward to streams with direct access to water. Within Kibugu location, hardly anyone except for the furthest people in Gicherori seemed to be using Mt. Kenya forest for firewood.

Physical capital

All roads around Kibugu were unpaved and partly non trafficable during rains. Grid connection and tap water has not arrived to all households yet. Irrigation is uncommon. Farmers generally prefer manual labor to expensive machinery, only a maize chopper was commonly found in the wealthier households (observations, SSI 6). Improved animal stables are becoming more popular (SSI 2, 6, 7)
.

Social capital

Our data tells us that farmers in Kibugu share knowledge with their friends and neighbours (SSI 7, SSI 10). They tend to have extended social networks and know most of the people nearby. Between closer neighbors and friends we found a higher degree of trust and reciprocity, and observed our hostmothers caring for their neighbor's children. On the other hand, mistrust existed especially among the wider neighborhood; belongings were stored inside during night and it was avoided to walk alone. Our guide from Gicherori told us that most neighbors in his village had antagonistic relationships. Therefore, the degrees of social capital also seemed to vary. From this, we can conclude that social capital, while being a crucial thread connecting households and their assets, is also a difficult asset to evaluate.

In the following section, we will discuss how the common farmers' asset portfolios are modified by mediating processes and contexts, and how these, in turn, affect their livestock strategies.

Mediating processes and livestock strategies

Land, social norms and market

Farmers have less land but still keep large animals. Thus, the question of why farmers continue to keep cows, particularly, as Figure 5 shows, high number of exotic breeds, is even more pertinent. This question can, to some extent, be answered by looking at the effects of the mediating processes on farmers' social capital. Cows, and particularly exotic breeds like Friesians, are seen as symbols of status. Said one farmer, "*if you keep Zebu here nowadays, then you are very poor"* (SSI 8).

We asked several farmers about the most prominent livestock farmer in the area. They mentioned Mune, whose story we will later present in more detail. Mune has a large social network and is a highly respected farmer. He has a high social status, partly from his family's strong financial capital but also because of their large Friesian herd. One farmer who owned three Friesians told us that he had heard many people talking about Mune. He dreamt of visiting Munes farm to learn more strategies for raising Friesians, despite his avowed difficulties in maintaining the cows he already owns.

In essence, we argue that cultural rules and customs, compounded by the common farmer's level of social connectedness, have an impact on his livestock strategies.

In the traditional coffee-cow system, cow manure had always been used for the nutrient-demanding cash crops.Thus, the large livestock had always been an integrally designed part of the system. However, many smallholders in Kibugu no longer have the land to sustainably feed their cows. Overall, keeping cows, Friesians in particular, has become more expensive for the common farmer They are caught between a rock and a hard place because animal manure is crucial to their livelihood. If smaller livestock can also provide good quality manure (SSI 1, 3, 6, 8, 9, 15) , why do these farmers still keep cows? We believe the answer relates to the social norms that dictate livestock, market and knowledge of alternative livestock systems.

In addition to social norms, the market still plays a role in the prevalence of Friesian cows. There is a high demand for large quantities of milk which Friesian cows are bred to provide. As Mr. Gitari said, in Kenya, "breakfast is tea," and this social custom contributes to the continued importance of Friesian cows in Kibugu (SSI 14).

Why no dairy goats?

Just as the cow is a symbol of high social rank; goats, on the other hand, are "*for poor people*" (SSI 13). Does this perception overshadow the dairy goats' benefits? Maybe, but we learned that the common farmer has low education and little to no formal training; therefore, he or she tends to be low in human capital. Most likely, common farmers may not be aware of the dairy goats' benefits, and there are very few actors present to provide this information. Our questionnaire also shows a statistically significant correlation between level of education and the goat keeping (Table 4). Thus, the perception that goats are for poor people and the lack of knowledge blinds them from seeing the benefits that goats could provide for low-resource farmers in Kibugu. The common farmers' human capital is low, and it remains low because of lack of government investment in the agencies that could educate farmers and a lack of policies that could encourage a trend towards dairy goats. Without any higher intervention, the common farmer may very well remain stuck between a rock and a hard place.

Table 3: Using bivariate correlation several factors were correlated with number of livestock. However, when using the partial correlation, to eliminate the influences of other factors (Control variables), we found that there was a low to moderate correlation

Correlations						
Control Variables			5. Level of education	Cattle	Chicken	Goats
2. Gender 3. Age 4. Marital status 7. How many people are a part of your household? 9. What is your household's income per month? 10. How many acres are your farm?	5. Level of education	Correlation	1.000	.118	.233	**.300**
		Significance (2-tailed)	.	.318	.046*	.009**
		df	0	72	72	72
	Cattle	Correlation	.118	1.000	.002	.046
		Significance (2-tailed)	.318	.	.985	.694
		df	72	0	72	72
	Poultry	Correlation	.233	.002	1.000	.006
		Significance (2-tailed)	.046	.985	.	.959
		df	72	72	0	72
	Goats	Correlation	.300	.046	.006	1.000

		Significance (2-tailed)	.009	.694	.959	.
		df	72	72	72	0

Now we will highlight two farmers whose situations stood out. Both farmers run successful livestock operations, the first in small scale goat husbandry, the second in intensified dairy cow production. What is most interesting to explore about these farmers is to compare their different starting points and journeys to success through the lense of the SLF.

Strategy 1: Livestock diversification into a high-value niche market (SSI 10)

Who is Purity?

Photo 9: Purity showing a fodder crop.

We interviewed Purity, a 62 year old farmer living in Ngerwe. On her four acre agroforestry farm she raises nine dairy goats, thirteen chickens, and three Friesian cows. Purity's monthly income is approximately 10,000 KES. Purity told us she had wanted to become a nurse but was unable to finish her education after becoming pregnant. Instead, she purchased a farm with her husband, who worked as a driver. In 1975 she purchased her first bull, and subsequent livestock were unproductive. It took many years of persistence and hard work for her to be able to purchase a productive Friesian cow.

With her women's group she visited a farmer with smaller acreage and eight Friesian cows. Realizing she could do the same, she prayed to God to finally find a good cow. Then, Purity met a woman who wanted to sell her Friesian cow. She scrimped and saved, eventually asking her husband to help pay the final installment. Life began to transform for Purity, who told us that "*with this cow and its first calf, prosperity came"* (SSI 10). In fact, it produced so much milk that Purity was able to build a new house.

Later, as chairwoman of her local farming association, Purity learned about goat husbandry. She was intrigued and bought her first dairy goat in 2002. From speaking with Purity and observing her farm, we see that she has cultivated a strong livelihood through goat husbandry. Her goat herd is larger than normal for Kibugu location, whereas 60% of farmers have no goats. Purity is not the only farmer to have a large dairy goat operation; Mr. Murethi has an even bigger dairy goat

operation (SSI 9). However, we think the combination of Purity's assets portfolio and the processes that influenced her journey are useful to analyze and, ultimately, compare with the common farmers' strategies.

Purity's assets

Natural capital:

Purity uses her four acre farm in creative ways. It is encircled by lush living fences of *Calliandra.* In fact, unlike other farmers in Kibugu with small acreage who must purchase expensive animal feed, she grows N-fixing fodder plants. She intercrops maize, vegetables, and fruit trees and has enough land for a large fish pond.

She attributes her goats' good health and production to *Calliandra* and told us that *"when you feed with Calliandra everything goes well"* (SSI 10). We argue that Purity has strong natural capital because she has a larger than average farm and grows most of the natural resources she needs to sustain her livestock.

Photo 10: Field of Napier grass feed for animals (L). Living fence of Calliandra (R).

Human Capital

Purity has been in good health, and she and her husband tend the crops and animals. If they need extra help, they can easily find casual laborers around the neighborhood. However, Purity told us she is cautious about bringing in outside labor (SSI 10). She also explained that her sons, who work in town, will inherit the farm after she is gone. Therefore, it seems Purity can access enough labor to ensure her continued livelihood or expand it in the future.

Perhaps an even more crucial "building block" of Purity's asset portfolio could be knowledge and education (DFID, 1999). Even though Purity could not continue to university, she is a lifelong learner. She finds ways to educate herself and improve her farm, whether through researching fodder trees or visiting other farmers and trying out new techniques. Even though Purity does not have a university education, she has a thirst for knowledge that drives her to constantly improve her livelihood.

Financial capital

Our questionnaire data shows that Purity is in the lower income range. Why is this when Purity has so much livestock and such large land? This could be answered in several ways. Firstly, her farm is self-sufficient, which keeps input costs low (SSI 10). Also, as we know from Ellis (2000), livestock are often seen as a stock of wealth, so Purity has much more wealth than simply from her income. Throughout her life, Purity has invested money in livestock, and this investment pays off financially when she sells animals, milk, and meat (SSI 10). According to Purity, animals are always giving. They generate a constant income, unlike coffee which is harvested only a few times per year. Purity told us that *"it all comes down to the animals"* (SSI 10), and we can see this from her journey. We could say that Purity does not have the highest financial capital because her income is low, but we could also say that she has greater financial capital stored in her animals' wealth.

Physical capital

We observed several livestock structures on Purity's farm. Despite starting many years ago with only one cow, Purity has increased her livestock production and reinvested the money in stables to support more livestock and even a new stone house (SSI 10).

Photo 11: Left and center: barn for 9 dairy goats. Right: feed storage barn

Purity showed us her fish pond filled with more than a thousand tilapia. She started digging a smaller pond with her husband. Then, a man from the World Agroforestry Center (ICRAF) visited her farm and offered to build a larger pond. ICRAF hired labor to dig a larger hole and finish the pond. Now, she and her family enjoy this sustainable, low-input protein source, which is itself sustained by inputs from the farm-- rainwater and the legume tree leaves. The fish pond has enhanced the sustainability of Purity's farm and diversified her family's diet. Purity's physical capital-- stables, fodder storage, and fish pond-- could help to ensure a future "flow of outputs," both outside and within her farm (Ellis, 2000).

Social capital

Purity has many connections and belongs to several associations, such as the Dairy Goat Association of Kenya, or DGAK, and some neighborhood farming and women's groups. She told us she has even worked with ICRAF, and presented at the COP 21 Summit (SSI 10). According to the DFID (1999), social networks like these are crucial ways to "facilitate innovation," and this is certainly the case in Purity's life. Purity's networks were stepping stones to the exemplary farm she cultivates today. Purity's strong social capital made possible the many innovations on her farm, which further bolstered her livelihood. In regards to her social networks, Purity said, "*I'm a lucky lady, God pushes someone across me and this person gives me help"* (SSI 10).

Purity also has a great influence within her village and social networks. She and her neighbors share knowledge about farming, and she constantly preaches the benefits of raising goats and growing N-fixing plants. Purity explained that "*those farmers that started Calliandra or other leguminous fodder trees, they will say that they learned that from Purity"* (SSI 10). Her social asset exerts a huge influence on her other assets and, as we will explain in the next section, and it is further impacted by the mediating processes.

Mediating processes for Purity

Social relations

How does gender influence Purity's asset portfolio? It certainly affected her human capital because she had to stop schooling after becoming pregnant (SSI 10). She and her husband worked together to care for the animals and crops, but some tasks were stratified by gender, such as the man gathering animal feed.

Her husband was very supportive of Purity's livestock enterprise. He worked off the farm and helped her pay the final installment for the first Friesian. In general, however, she was in control of her financial capital. She sold her own harvests and livestock to purchase new animals (SSI 10). We saw in previous interviews that women do not always have control over money from the farm (SSI 2). Purity, however, was free to reinvest her hard-earned money into new enterprises, and she had free rein to develop innovative livestock strategies.

Associations

As we explained above, social capital is quite possibly Purity's strongest asset. She belongs to several farming associations, which not only provide her with important connections but also with educational opportunities. Thus, Purity's associations not only reflect her strong social capital; they also expand her knowledge and encourage her to innovate, in some cases directly as with the man from ICRAF who was so impressed with her work (SSI 10).

As a member of organizations, Purity also has the opportunity to share her knowledge with others, which in turn improves the human capital of the other members. Purity has sung the praises of dairy goats and *Calliandra* to other farmers, particularly to women, and she has inspired other women to adopt dairy goats (SSI 10).

As we discussed previously, Embu County livestock officers feel there is a knowledge gap which holds many farmers back from realizing their full potential. Purity, therefore, plays a crucial role in filling information this gap through her social networks.

Purity's farm seen through the larger context

Markets in place

The market looks bright for goat milk, and there is increasing demand as doctors have begun to prescribe it as medicine (SSI 14). Purity has benefitted from this strong market. In Embu town she can sell goat milk for 120 KES/liter versus 50 KES/liter for cow milk (SSI 10). She has expanded her dairy goat production because she can increase her returns while decreasing production inputs such as feed and medicine (SSI 10).

Population trends

Purity is extremely conscious of the overall trend towards smaller land sizes. Thus, she actively encourages other farmers to raise dairy goats. Some farmers, however, leave the goat associations

because they still aspire to own many cows. Purity recognizes that this practice could soon be unsustainable, and according to her, "*ignorant people still focus on the dairy cow"* (SSI 10). To Purity, the benefits of goats for farmers on small land are numerous: they need less land and feed; they can be kept healthy and productive with legume fodder plants; and they reproduce quickly and can give twins (SSI 10).

Shocks

Another reason Purity prefers goats is because they are adapted to droughts, such as the one Kibugu is currently experiencing. Purity considers climate change an overarching threat to farmers in Kenya, and her agroforestry techniques are partially intended to adapt to a changing climate. Purity is even a minor celebrity; she spoke at the COP 21 Conference in 2015, which provided her a platform for sharing her experiences and expanding her social network (Rowling, 2015). In sum, Purity stands apart from the common farmer because she is knowledgeable about her place in the greater environmental context. She sees where she fits into the larger puzzle and adopts innovative, climate smart strategies.

4.3. Strategy 2: Intensification and Specialisation (SSI 4, SSI 5)

Who is Mune?

Our inquiries revealed that there is one "commercial" dairy farm around Kibugu, which we visited and were lucky to meet the owner's brother Bernhard and another employer, Simon (SSI4, SSI 5). Mune is a son of a business man, one of the richest in the area, owning some of the local pubs, restaurants and the petrol station in Kibugu, his brother also owns several shops (SSI4). Both were able to study at the university, and Mune earned a master's degree in economics.

Mune had always been interested in livestock from an early age on briefly even ventured into pig farming but soon gave up. A few years ago he was gifted two cows from his father's farm, which he then took care of and with his salary and the milk sale he enlarged this herd. He feeds his cows a mixture of maize-sorghum-sunflower silage, that he grows in three to four cropping cycles on leased land, farm-made dairy meal and purchased hay. The milk is being sold to a regional buyer who pasteurises it.

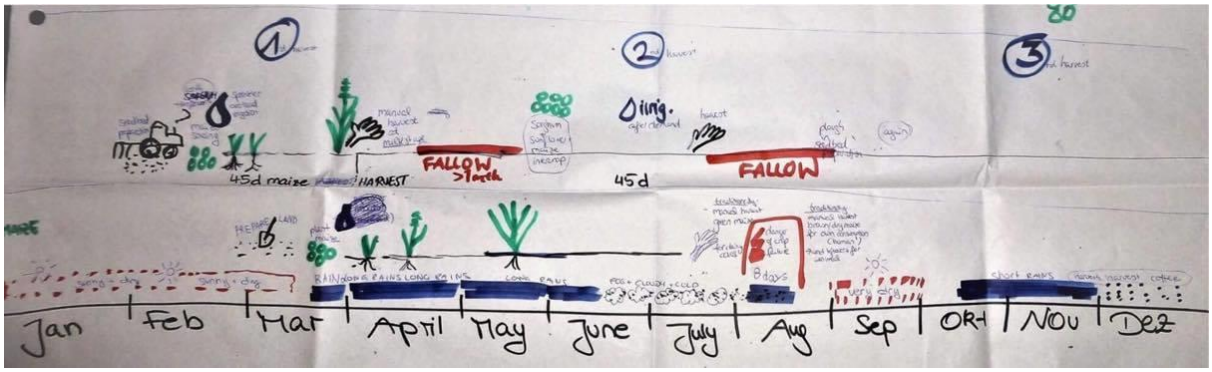


Photo 12: Season calendar made by Bernhard.

Photo 13: The maize chopper and a power generator are essential for feed conservation (L) .A member of the farm staff is milking the cows with a vacuum milking machine (R). Only very few of those can be found in Kibugu.

Photo 14: Bernhard showing his silage storage

Mune's status of assets

Natural capital

Firstly, he owns 1.5 acres of farmland, which represents his only *natural capital*. He does not have enough land to grow feed himself, but instead he leases other land and labour for feed production and buys hay when needed. However, his other strong assets, such as social, financial, and human capital, compensate for this deficiency.

Human capital

In contrast, Mune has strong *human capital*: he was born into a well-educated family with a tradition of running successful businesses, and his family helped him start his dairy herd. Besides having given him a strong professional background and business skills, his university education helped him earn initial investment money as well as provide him with insurance: Should he fail one day, he has a fall-back profession to rely. He shows good knowledge of animal husbandry, and his skills of feed conservation and storage make his farm independent of temporal feed shortages or bottlenecks such as droughts. He skillfully manages a well-trained, specialized staff that further increase his human capital with their dairy expertise.

Physical capital

He started off owning only two cross-bred cows as his main physical capital. They were the modest foundation, yet not the key factor for his success. He currently owns 57 cattle, including 20 lactating cows (Production: 20L/cow/d) and many marketable heifers. He set up a concrete open cubicle barn surrounded by an array of well-organised farm infrastructure: a pipeline milking machine (photo 13) milking 5 cows at the time, expensive A.I. equipment, a silage cutter and storage (photo 13 and 14), a power generator and vehicles. The sprinkler irrigation technology he uses on the leased fields enables him to break free from the seasonal cropping patterns determined by the bimodal rainfalls and to produce three to four harvests (of maize-sorghum-sunflower intercrop) annually, thus ideally more than tripling the output per area compared to rainfed maize cultivated by smallholders.

Social capital

He must maintain a good relationship with his family, as his brother Bernhard regularly helps out on the farm free of compensation, and his father gifted him with his first animals. Bernhard mentions how the farm creates a "positive envy" amongst smallholders, he is very happy to show

interested people around. From this we could conclude that he is benevolent with Kibugu's smallholder people, yet is is hard to evaluate. These aspects indicate his social capital.

Financial capital

More certainly we say that Mune holds above-average financial capital, as he was born into a wealthy family enabling him excellent education and providing him with initial livestock. His degree allowed him to have a high-income job, salary he in turn he could use to expand his dairy business. Currently, his farm earns more than 50,000 KES monthly. The financial capital opens doors to the improved infrastructure, which forms now his very strong physical assets.
Apart from his own capitals, certainly there were several mediating processes and the larger context involved that made his steep uprise possible.

Mediating Processes and Context

With his large milk volume, he took advantage of a huge local demand gap for cow milk. The availability of grade cattle and imported semen made his business possible, as does the technological change and the availability of milking machinery. The local cultural habit of drinking large amounts of milk, especially in the countryside, explains the high societal reputation of dairy farmers and is a reason for the big dairy market around Kibugu. Clearly, the larger context of the livestock revolution and the relative prosperity of the Central Province created an economical trend of increasing demand for dairy products on the wider scale. Bernhard estimates the regional demand to 40,000 L daily and only halfway met, which provided him with good marketing opportunities and explains his future herd enlargement plans as well as why he does not see ambitious local farmers as competitors.

Comparison of the strategies

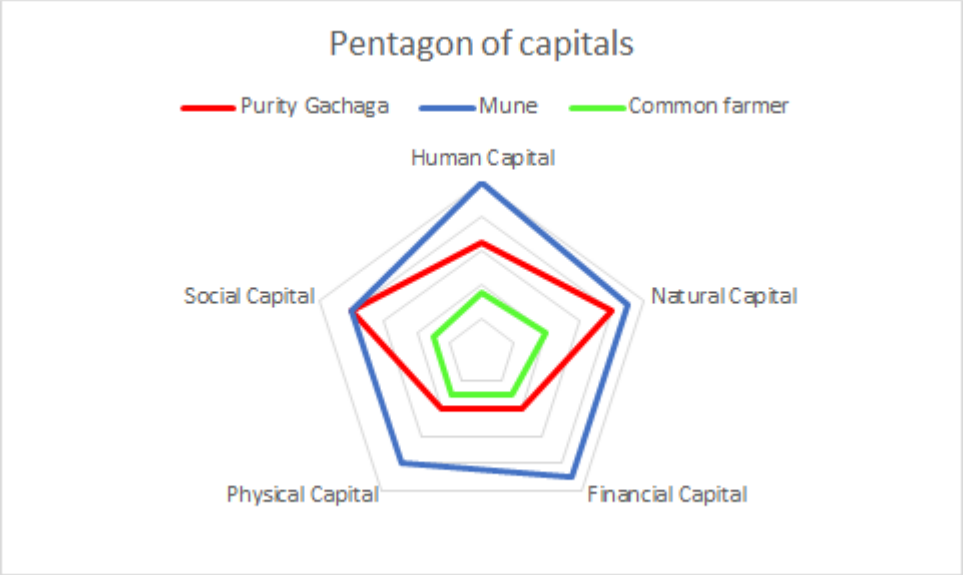


Figure 6: Pentagon comparing the five capitals of Purity, Mune and the common farmer.

As we can see from the assets pentagon, Mune's financial capital is strong. This enables him to own many cows, which has elevated his social status and, therefore, increased his social assets. Therefore, other farmers are interested in getting to know him, and he can attract a large social network. But how was Mune able to build up this cattle empire when the common smallholder was not? The common farmer remains dependent on the coffee-cow-system; he does not have the same financial capital and human capital to expand his operation. Because he is not able to expand his farm, it is difficult to profit from the high demand for cow milk; therefore, he remains stuck in a farm system of with coffee, crops, and only one or two cows.

Instead of building up a large dairy cow herd, which is connected to high investment costs and high risks, Purity and Mr. Murethi chose an alternative pathway. The entry into goat dairying is characterised by a lower threshold for resource-poor farmers to overcome. For instance, a young goat can be purchased for a fraction of a heifer's price and farmers do not necessarily need a loan for this investment. One could say that less financial capital is required for farmers to become serious about dairy goat farming. Furthermore, goats can quickly compensate farmers: their milk can be sold at a high price and their numerous offspring can be used to expand a herd or sell for money. Accordingly, this pathway comes with lower risks because goats can more easily cope with droughts and, in turn, better help farmers recover. Despite these benefits of dairy goats, why are so few smallholders pursuing them?

As is clear from the above diagram, Purity's human and social capitals greatly differ from those of the common farmer. She was able to overlook goats' low status symbol and recognize their

advantages - because she had knowledge about them. Because of her high social capital she was able to respond to the mediating processes that could provide her with training, knowledge and possibilities, which further strengthened her human capital. Purity has low financial capital compared to Mune; therefore, she chooses a different strategy than intensifying and specialising on cows. Instead, her low financial capital drove her to diversify her livestock system and take advantage of dairy goats' benefits. Purity's natural capital is also stronger than the average Kibugu farmer's, and this enables her to expand into diverse livestock while keeping feed costs low and maintaining her animals' health.

5 Discussion

5.1 Discussion of Results

Refute the hypothesis

During our field work, some of our findings indicated a slowly emerging dairy goat sector - in contrast to the literature indicating that Mt. Kenya was a region of relatively high dairy goat rearing (Mbindyo, 2012). On the first day we saw many goat farmers, breeders and promotion for dairy goats at the regional agricultural fair, which were located behind the dairy cow exhibition and thus catching less attention. Moreover, the DGAK., organising and supporting dairy goat breeders, is present in Embu county and also in Kibugu, even if not very active in the latter. Within Kibugu location, we were only able to find three active dairy goat farmers, two of them DGAK members, and heard about very few others, thus the DGAK does not seem very active in Kibugu and we can conclude that the transition from dairy cow to goat rearing is not a trend yet.

The hypothesis that *"Smallholder farmers in our study location will adapt to the issues of increasing population pressure and decreasing farm size by transitioning from cattle rearing to goat rearing strategies"* has to be rejected. Although we were able to find some pioneers (Purity, Mune) that were going that way, we clearly could not observe a distinct trend towards that direction yet.

Compare the results to literature

Compare the historical farming system

The literature findings on the traditional farming system and on the role of cattle and dairy cattle in the traditional system were almost identically triangulated through our results. However, we were able to gain a deeper understanding and more details of the traditional farm-set up in the highlands especially through the Interviews with the Livestock Officer, the vet, a goat breeder, and farmers (SSI 2, 6, 8, 11, 12).

Confirm the goat benefits

We did not find any contradictions in the results in regard to the benefits of keeping goats (Ahuya et al., 2005; Peacok, 2005; Peacock, 2008; Peacock, 2011). Farmer's SSI's confirmed that they were cheaper to buy (SSI 1, 8) and maintain (SSI 7, SSI 8, USI 5), they eat less (SSI 8) and are well-adapted while providing several services. The nutritious goat milk was ranked as more nutritious and dense by goat keepers (SSI 1, 8, 7, 5, 10), the rich manure highly valued for coffee production

(SSI 1, 3, 6, 8, 9, 15) and marketable offspring is produced in higher quantity and frequencies than in cows (SSI 7, SSI 8). Purity's and Mr. Murethi's feeding strategies confirm the research findings (Kiruiro et al., 2003) that dairy goat diets can be enriched or even based upon leguminous fodder trees.

Confirm the main target group of dairy goat development

Based on our literature findings we had expected to find resource-poor households to turn towards goat dairying. Because FARM Africa is a very active and big NGO and some of the goat projects were based in neighbouring districts we assumed the trend would have sloped over. Based on our results we learned that this was clearly not the case.

According to literature goat dairying would have the highest beneficial impact on resource-poor farmers, that are hit hardest by fluctuating coffee prices (Peacock, 2005; Ayele & Peacock, 2003). Yet, the few pioneers we observed were not resource-poor. Purity had fought her way out of poverty with dairy cattle, *before* she started dairy goats. Also her 4 acre farm is clearly one of the bigger landholdings. We did not get the chance to explore Mr. Murethi's background very well, but he owns an above-average-sized farm (1.5 acres) and as he transitioned to goat dairying after decades of meat goat rearing and always maintained a small dairy cow herd, we will not categorize him as resource-poor either.

Confirm the developmental theories and approach

Some development researchers criticize the increased incidence of already privileged farmers to be the beneficiaries of development initiatives and NGO programmes (Boyazoglu, 2005). In case of Purity we could see that she benefitted from ICRAF support, although she was doing well already. On the other hand, apart from the ICRAF activities, the absence of development initiatives, be it because the location was not evaluated as appropriate, maybe not first priority in terms of needs or maybe FARM Africa and GIZ simply have not reached until there yet, helps explaining why goat dairying is so little popular currently. The extension services and the government officers seem to be the only advisers for now, and do not play a big role in farmer's decisions.

As Peacock (2005) mentions, due to this fragile governmental extension network the role of NGOs is vital to the Kenyan agricultural landscape. The role of NGOs should ideally be to initiate and facilitate community-based goat breeding programs with access to good breeding stocks and infrastructure a holistic approach based on farmer's self-organisation and knowledge sharing (Ayele

& Peacock, 2003; Peacock, 2008; Peacock, 2011). The absence of this could explain why goat dairying currently has such limited popularity.

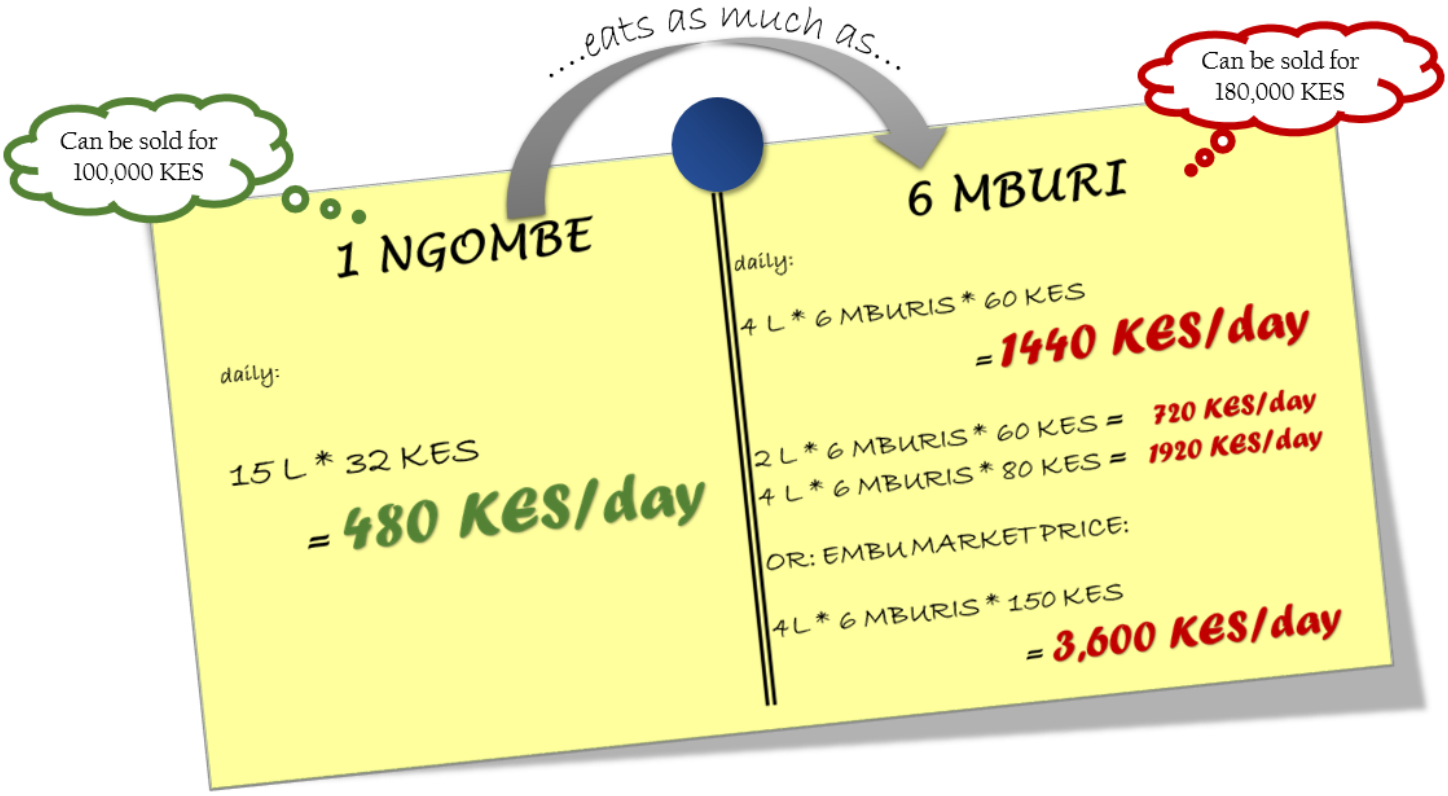


Figure 7: A rough calculation on financial benefits of goat dairying based on farmer's SSI's.

Limitations of the study

One of the most obvious limitations of the study is the time factor. Conducting an in depth study, that relies on humans, is virtually impossible in such a short timeframe, since an important factor in work such as this, is establishing a certain level of trust with the informants, to verify the credibility of the information. The informant might not be lying to you, but you can not be certain that the they will be comfortable sharing the whole truth about the the topic in question. Another issue the timeframe engenders, is the time to do data collection is limited.

The fact that we cooperated on doing a general questionnaire with three other groups had a definite influence on the results we got from it. Relying on others always has its pros and cons, and this example is no exception. The most significant pro being the amount of data collected, increasing the sample size to a level not possible within the timeframe we had, if we were to gather the data

ourselves. However, there are also cons, that are worth mentioning, as it might have had crucial impact on what we got from the questionnaires.

Some of the less significant errors, such as the fact that when different people are using different GPS's to map where the interviews were done, it is a hassle to incorporate into a single map, as the coordinates are written in several different ways, are one thing. But more detrimental for the results is it, that upwards of 30 people has been conducting the questionnaires, which means that one answer might be understood and recorded in various ways, especially since each group had to ask questions within a field outside their area of expertise.

5.1 Learning experience

Paying attention to group dynamics

During the preparation the group gathered for a group dynamics session, also called SWOT analysis (Urmilla et al., 2005). The purpose was to share academic and personal strengths, weaknesses, preferred working style and expectations. The session made us get to know each other and based on this familiarity we hoped to be able to facilitate a good working process and equal participation for all. In the field we continued discussing group dynamics.

When scientific and social science approaches meet

Our group consisted of one agronomist, two students from agricultural development and one anthropologist. This engendered challenges because abstract concepts of characterizing anthropology met the quantifiable and verifiable approaches of natural sciences. Considering, that a key purpose is to enable the development of an interdisciplinary workforce we faced this challenge with interest and sought to find compromises and ways in which both approaches could meet (Urmilla et al., 2005). We believe that our general focus on group dynamics played an important role in this development.

Cultural divides

"*An understanding of cross cultural differences is of critical value in the specific context of the SLUSE course*" (Urmilla et al., 2005). In order to understand the cultural differences we made time to just sit and talk with the Kenyan students about each other lives, how it is to be Kenyan, what family, relationships, work and love meant to them. Thus, through friendship we tried to understand the cultural differences between us and it had a positive effect on our group work.

However, some things made it challenging to work together cross culturally. We worked separately before we left for Kenya, and when we finally met it took time to integrate our different ideas into one project.

One Kenyan student tea in our group dropped out the course before the fieldwork began. We have considered the chance that this missing Kenyan student might have given us, the students from Copenhagen University, more "power" in discussions and decision making. "*It's surprising how different cultures can come together and agree to one decision*," a student expressed about the 2005 SLUSE course (Urmilla et al., 2005). Considering our group composition with only 2 Kenyan students and 4 students from Copenhagen it is not so surprising how different cultures can come together to a decision because one "culture" outnumbered the other in our case. On the other hand a group of 5-7 members are said to foster participation and enhance learning because the contribution of each member increases (Urmilla et al., 2005). Maybe the smaller group size made it easier to contribute and participate.

We experienced a difference in the Kenyan students' way of collecting data. The Kenyans were confronted last-minute with a requirement from their supervisor to collect 20 semi structured interviews. This created a discrepancy in the way we did interviews in the last days, because they needed the interviews to be short whereas we wanted to do long, in-depth interviews.

Although being aware of the sensitivity of this topic, we have to admit that the Kenyan attitude to punctuality is a challenge when arriving from Denmark. This challenge was further enhanced because we lived a distance away from each other and therefore we spend a lot of time organising. Finally, this time spent on organising sometimes felt like a waste because no one would stick to the time schedule after all. However, it is interesting to note, that in the end of the field course we, the students from Copenhagen, adapted to this lack of punctuality and got used to the fact that probably nothing would stick to the plan.

Living with host families

As elaborated above, it was difficult to organize meetings and each group stayed in families away from each other. This meant that we were not able to have a social life with the other students so we focused on spending time and getting to know our host family. Therefore, we were able to get an insight in their daily lives and routines. For example we were able to find out what the tea-custom meant to them and their daily lives.

The role of the translator

In retrospect, we realized it is important to fully integrate translators into the project so they can understand the researcher aim to find out. Sometimes, we were not clear with some of our translators about what data we wanted to collect during an interview or PRA exercise. During the livestock scoring exercise, for instance, we missed out on some valuable data because we had not explained to a translator that we wanted to know why the farmers ranked their livestock in a certain way.

Ultimately, however, we all agree this course was a valuable experience in working with colleagues of different backgrounds and that SLUSE prepared us for our future development and anthropological work.

6 Conclusion

What are the current livestock systems in Kibugu?

The current livestock system in Kibugu is still mainly the typical coffee/tea-cow system, where the cow is highly valued as a source of manure, food, and income. It holds a central role both for farming and for cultural reasons. The majority of farms have around 2 cows, to support the coffee that is the one most abundant cash crop; and a handful (6) of chicken, because they require both extremely low initial and maintenance costs (care, inputs, land, feed, stable) while contributing a cheap animal protein source. Other important cash crops are macadamia (88% of farmers) and tea (28%). In terms of diversification, goats are the most common enrichment to livestock (40% of farmers) and other diversification strategies towards smaller animals with commercial value include sheep, rabbits, pigs, ducks and geese in small proportions of the population.

What were the traditional livestock systems in Kibugu and how are they changing?

Older community members could still recall the subsistence farming with grazing cattle on communal land. This system can be called the pre-independence farming system of Kibugu. Locals remember the change coming with the introduction of individual land ownership, introduction of cash crops and dairying, and, arrival of improved dairy breeds and respective infrastructure. Nowadays, the integrated coffee/tee-cow-system that arose is considered as the "traditional" system by locals, where apart from the local cows a few chicken and a small ruminant as meat and insurance provider can be found.The current system, whilst on the first glance still very similar to the traditional system, has some distinct differences that evolved as a response to a higher food demand, smaller land sizes and more available cash thanks to horticultural crops. Indigenous Zebu cows have been replaced by crossbreeds and increasingly pure exotic breeds while external feeds and new techniques have been introduced. Looking forward, there is a general drive to have many pure Friesian cows, although farmers already struggle to properly maintain the cows they have. However, some farmers have pursued emerging income alternatives such as the sale of rabbit meat, rabbit urine, duck eggs, and goose eggs. Commercial goat dairying seems to be a growing trend since the 1990s in Embu, but has not yet spread to Kibugu, except for a few innovators who have yielded impressive success with their alternative strategies.

What is the role of the indigenous breeds?

The indigenous Zebu cattle has been squeezed out of the common farming system by outcrossing over generation with exotic dairy breeds, that are now argued to be Kenyan ecotypes of the exotic breeds, like the Kenyan Friesian.

A similar development can be observed in the goat population: if farmers aim for goat milk production, local breeds are replaced by European dairy goats or Kenyan varieties of them. Although this study did not quantify the exact composition of goats in Kibugu, we gathered that, while they were not milked, indigenous breeds like the Small East African goat still represented the majority of the goat population. Local chickens were abundant, and layer hens and hybrid chickens were only sporadic.

With regards to the Sustainable Livelihood Framework, how are the different assets, mediating processes and larger context connected to the respective livestock systems?

Most farmers in Kibugu still depend upon the coffee/tea-cow-system. They continue to aim for high maintenance exotic cows, despite these animals' lower suitability to the Kenyan environment. In many ways, however, the current system still benefits farmers in Kibugu. Coffee demands little water compared to other cash crops and cows provide households with a bountiful manure source. Conversely, the mediating processes and greater context we identified suggest that the predominant livestock strategies are unsustainable.

Why, then, do most farmers not adopt goat dairying, which could be a more sustainable strategy? This could be explained by social norms surrounding goats and their status, as well as underfunded government agencies ill-equipped to provide thousands of farmers with valuable technical and business training. NGOs that promote dairy goats are nowhere to be found in Kibugu, and farmers lack the financial capital to expand production and take advantage of the market. Additionally, farmers' lives are influenced by other external factors such as population pressure, decreasing land sizes, and increasing input prices. Coupled with the greater context of environmental shocks and the threat of climate change, there are indeed many factors that constrain the common farmer from strengthening his asset portfolio and pursuing innovative strategies. After interviewing innovators such as Purity and Mune, however, we can identify pathways for empowerment that could help farmers break through these constraints. Mune, Purity, and even the goat farmer Murethi showed us how capital assets can combine and compound each other to drive livelihood improvement strategies. Purity certainly showed us how an ordinary farmer with low financial capital can work hard, strengthen her human capital through self-education, and bolster

her social capital through networking. Therefore, we will present some ideas we believe could help farmers strengthen their asset portfolios and adapt their livelihoods to an ever-changing world.

7 PERSPECTIVES

Implications for the farmers

- Join hands! - Smallholders are strongest when they collaborate
- Formation of farmers' associations is a pathway to empowerment
- Livestock diversification can be a risk reduction strategy
- Alternative livestock strategies should be sought if the farm system struggles to maintain dairy cattle
- Specialisation can be a viable option for farmers high in assets, especially financial, but also implies higher risks because of the exposure to to one single market
- There is an unused potential of agricultural training and education that should be consulted and demanded stronger by farmers

Implications for legislation

- Investment into livestock and agricultural extension is needed
- Think outside the box! - it needs political will and determination to find sustainable solutions that might lie in unconventional pathways.

Implications for development projects

- Employ a value-based and holistic community development approach, that does not only focus on agronomic aspects but equally integrates the creation of farmers self-help groups, value-addition, sustainable value-chains and more factors that will foster human, social, physical and financial capital of participants and ensure the sustainability of the interventions
- beneficiary-identification is important to target the most vulnerable section of the population
- find novel communication channels - social media, schools, etc.
- Teach to fish! - train local experts in spreading skills

Ideas for further research

- Investigate the effect of fertilisation with goat manure only on the coffee-production
- sustainability assessment of the in- and outflows of the modern coffee/tea-cow-system
- explore sustainable goat breeding pathways to avoid running into the same problems faced in intensive dairy cow husbandry

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9 Appendixes

Appendices

Appendix A – Data overview

Questionnaires		
Group	**Sub location**	**Number of questionnaires**
Value addition	Ngerwe	19
Livestock	Gichagi/Gicherori	29
Gender	Kithiria	21
Pest & Disease	Kathakwa	25
Total	Kibugu	**94**

Type / #	Respondent	Information	Additional Methods	Day
USI 1	Johnson	Had goats		3-3-2017
USI 2	Anonymous Goat Breeder			3-3-2017
USI 3	Sammy Kimeny	BIOGAS		3-3-2017
USI 4	Cristopher	Embu Livestock extension officer		3-3-2017
USI 5	Philip	Old farmer with Goats and ducks		3-3-2017
USI 6	Matti Spiecker	Founder of Macadamiafans		10-3-2017
SSI 1	Damaris	Farmer	Farm sketch, Daily Clock	6-3-2017
SSI 2	Jeremiah	Farmer	Daily clock,	7-3-2017
SSI 3	Rosemary	Farmer	Questionnaire	7-3-2017
SSI 4	Bernhard	Big dairy farm, owner	Animal Scoring Matrix	7-3-2017
SSI 5	Simon	Big dairy farm, manager	Questionnaire	7-3-2017
SSI 6	Mr. Njeri	Livestock officer	Animal Scoring Matrix, Timeline	8-3-2017

SSI 7	Njiru Nyaga	Single dad	Animal Scoring Matrix	8-3-2017
SSI 8	Elias Njue	Old, educated farmer	Animal Scoring Matrix, Daily clock	8-3-2017
SSI 9	Mr. Murethi	Big dairy goat farmer	Animal Scoring Matrix	8-3-2017
SSI 10	Purity Gachaga	Dairy goat farmer, well developed farm system		9-3-2017
SSI 11	Mr. Mwaniki	Veterinary officer		9-3-2017
SSI 12	Harry Johnson	Sheep guy	Questionnaire,	9-3-2017
SSI 13	Esther	Farmer, Host mom		9-3-2017
SSI 14	David Gitari	Agribusiness officer		10-3-2017
SSI 15	Lydia Wambeti	Farmer		10-3-2017
SSI 16	Alice Wambugi			10-3-2017
SSI 17	Sophia Muthoni	Farmer		10-3-2017
SSI 18	Charity Njura	Old farmer lady		10-3-2017
SSI 19	Nazari Njiro	Driver, farmer		10-3-2017
SSI 20	Angelina Njue	Farmer, Host mom		10-3-2017
SSI 21	Mbeeru Margret	Shop keeper		10-3-2017
SSI 22	Pascalina Munyiba	Farmer		10-3-2017
PRA 1	Rose	Old lady farmer	Farm sketch, Animal Scoring Matrix	7-3-2017

Appendix B – Final questionnaire

General Questionnaire for Kibugu

GPS-point: x: y: z:	**Interviewer:**
Sub-location:	**Group Number:**
Note taker:	**Translator:**
Picture:	**Date and time: / / : :**

Personal information

1. Name: _____

2. What is your gender? Male _____ Female_____

3. How old are you? _____

4. Marital status:
a) Single_____ b) Married_____ c) Widowed_____d)Divorced_____

5. Which levels of education did you finish?
None educational background
Primary school
Secondary School
Tertiary level
Bachelor degree
Master degree

Other: specify _____

6. Are you a part of any of the following networks? (place an "X" in all choices that apply)
- Church
- NGO
- Cooperative
- Political party (you don't have to specify which party)
- Social club
- Others _____

Household information

7. How many people are part of your household (including workers, children and relatives contributing)?

_____

8. Name the 3 main income sources for your household?

_____

_____
_____

9. What is your household's income pr. month?

- Below 10.000
- 10.000-25.000
- 25.000-50.000
- Above 50.000

Farm characteristics

10. How many acres are your farm?

_____

I don't know ____

11. How big is your farm compared to the rest of the village?

a) Small _____ b) Medium_____ c) Large_____

12. How did you obtain the land of your farm?

- Inheritance
- Purchasing
- Renting
- Other:_____

Pests and disease Management

13. Have you heard of the Plantwise Plant Clinics organized by Centre for Agricultural Bioscience International (CABI)?

Yes
No

If no

- Have you visited any other agro-vet?

Yes
No

14. Have you any experience with using the plant clinics?

Yes
No

If yes

- How many times have you visited the Plant Clinics?

_____

- How will you characterize your experience with the Plant clinics?

Not satisfied
Satisfied

Very Satisfied

15. What are your most important crops? Add the disease/pest if any are present (list most important first - please state crop followed by pest/disease)

1. _____ _____
2. _____ _____
3. _____ _____
4. _____ _____
5. _____ _____

16. What are the most important crops infected with pests and diseases? (list most important first - please state crop followed by the pest/disease)

1. _____
2. _____

Gender

17.

Activity Crops	Which crops do you produce in your household?	Of the crops you produce in your household, which do you sell?	Of the crops you produce in your household, which are consumed in your household?
Mango			
Banana			
Passion fruit			
Avocado			
Kale			
Tomato			
Carrot			
Butternut			
Watermelon			
Potato			
Coffee			
Tea			
Cotton			

Macadamia			
Other			

Livestock

18. How many of the following animals do you have in your household?

Livestock group	Number of heads	Types/Breeds
Cattle		
Goats		
Sheep		
Poultry		
Rabbits		
Donkeys		
Pigs		
Others		

19. Which household member has the right or responsibility to which areas of livestock husbandry? *(Place an "X" in the boxes that applies)*

	Daily care				**Income from milk sales**				**Income from animal sale (meat or alive)**			
Type of livestock	**Husband**	**Wife**	**youth**	**Hired labour**	**Husband**	**Wife**	**Youth**	**Hired labour**	**Husband**	**Wife**	**Youth**	**Hired labour**

20. What do you think is the main livestock change you did in the last 5 years?

_____

21. Are you **member in a breeding association** or **milk cooperative**?
If yes, please specify:

	Goat breeding/husbandry	Cattle breeding/husbandry	Milk cooperative	other, please specify
Put X if yes				

Post-Harvest Management

22. What are the storage technologies that you use?

List here _____

23. Have you adopted new storage technologies in the last 3 years?

- Yes
- If yes, what are they? _____
- No

24. Over the last 5 years, how many new crops did you begin growing? What are they?

_____

25. After harvest, what is the main cause/factor of crop losses?

- Pests, rodents,
- Rainfall
- Temperature
- Other: _____

26. Per harvest season, how much of harvest crops do you lose on average? And for which crop?

_____

Crop:

_____

27. Who do you sell your crops to?
    - Retail, i.e. Supermarkets
    - Middleman
    - Direct sale to consumers, i.e. Local market
    - Wholesale markets
    - Auto-consumption

28. Do you process your crops on the farm to add value?

    Yes
    No

If yes, state here:

_____

Appendix C – SSI Guides

SSI's questions for farmers etc.:

General Questions:
Name:
Gender:
Age:
Educational Level:

Do you practise only livestock or also other kinds of farming?
What do you consider the traditional livestock in this household/village?
Which animals do you currently have?
How and when did you get each of your animals?
Will you explain the reason for having each of animal?
What are the advantages/disadvantages in having each animal?
Will you rank your animals in importance?
Have you made any changes concerning livestock in the past 5/10/20 years?
Why did you make this change?
Do you see any advantages in the indigenous breeds) (in all livestock)
- Do you still use indigenous breeds?

Does your household prefer drinking goat's milk or cow's milk? Why?
Which cow's milk do you prefer? Why?
Do you sell goat or cow milk or both?
- Why is this/these one(s) best/good for selling?

What is the grazing system and feed sources for your cow?
What is the grazing system and feed sources for yout goat?
Do you use health services?
- Which ones?
- How much does it cost pr. month?

Are you a member of a breeding association?
- Concerning which animals?
- What benefits and disadvantages do you get from this?

Who is the most prominent livestock keeper?
Who is the most popular animal health technician?

Later added questions:

Do you have access to any credit/banking?
What will happen to the farm if you get sick and can't work?
What will happen to the farm when you get old?
When you need help, can you then depend on your family and friends?
Do you have access to machinery?

Key-informant specific questions:

What services do you provide?
What area do you cover?
How many people do service?
What are the farmers' current milk marketing strategies?

Could you describe the value chain steps for the -

- The cow?
- The goat?

Could you describe the marketing trends for -

- The cow milk?
- The goat milk?

Have you noticed any changes/trends in -

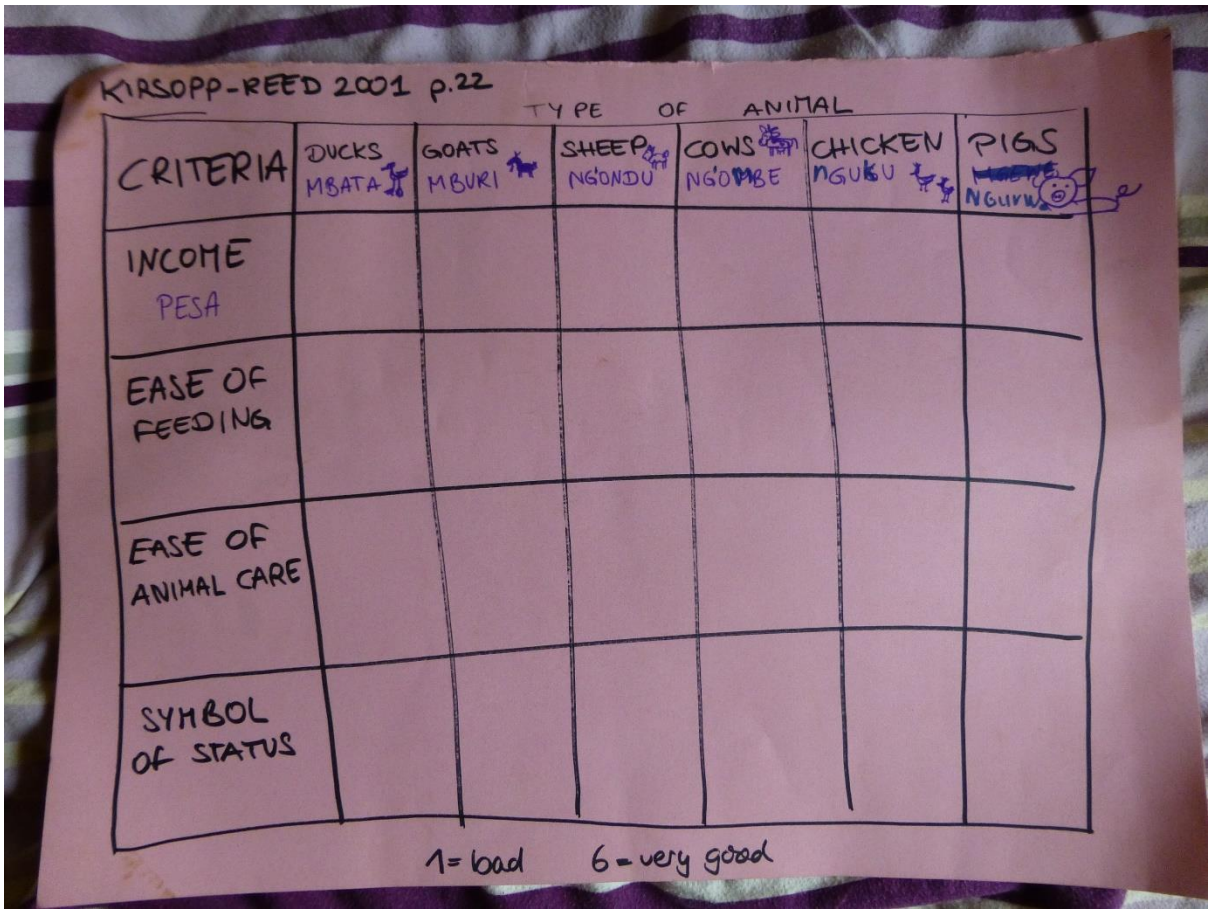
- livestock keeping in the past 5/10/20 years?
- in milk markets/peoples preferences?

Do you think goat/cow milk can be profitable for small scale farmers -

- currently?
- In the future?

What do you see as general future trends in livestock keeping?
What is your recommendations to farmers to increase income?
What are the challenges/constraints for farmers in Kibugu?
What are your thoughts on small livestock such as rabbits and chickens?
What do you think characterizes livestock keeping for old/sick/low education etc.?
Have you seen any gender based differences in trends concerning livestock?
Have you noticed any difference in profitability between male/female headed households?
Can being in a cooperative be profitable/recommended for farmers?

Appendix D – Animal Scoring Matrix template



KIRSOPP-REED 2001 p.22

TYPE OF ANIMAL

CRITERIA	DUCKS MBATA	GOATS MBURI	SHEEP NG'ONDU	COWS NG'OMBE	CHICKEN NGUKU	PIGS NGURUWE
INCOME PESA						
EASE OF FEEDING						
EASE OF ANIMAL CARE						
SYMBOL OF STATUS						

1 = bad 6 = very good

Appendix – Statistics

Correlations

			log LSU	5. Levels of education
Spearman's rho	log LSU	Correlation Coefficient	1.000	.343**
		Sig. (2-tailed)	.	.001
		N	87	87
	5. Levels of education	Correlation Coefficient	.343**	1.000
		Sig. (2-tailed)	.001	.
		N	87	93
	9. What is your household's income pr month?	Correlation Coefficient	.265*	.361**
		Sig. (2-tailed)	.019	.001
		N	78	84
	LSU	Correlation Coefficient	1.000**	.301**
		Sig. (2-tailed)	.	.003
		N	87	93
	log Cattle	Correlation Coefficient	.901**	.315**
		Sig. (2-tailed)	.000	.006
		N	76	76
	log Goat	Correlation Coefficient	.437**	.499**
		Sig. (2-tailed)	.007	.002
		N	37	37

			9. What is your household's income pr month?	LSU
Spearman's rho	log LSU	Correlation Coefficient	.265*	1.000**
		Sig. (2-tailed)	.019	.
		N	78	87
	5. Levels of education	Correlation Coefficient	.361**	.301**
		Sig. (2-tailed)	.001	.003
		N	84	93
	9. What is your household's income pr month?	Correlation Coefficient	1.000	.236*
		Sig. (2-tailed)	.	.030
		N	84	84
	LSU	Correlation Coefficient	.236*	1.000
		Sig. (2-tailed)	.030	.
		N	84	93
	log Cattle	Correlation Coefficient	.266*	.901**
		Sig. (2-tailed)	.030	.000
		N	67	76
	log Goat	Correlation Coefficient	.176	.437**
		Sig. (2-tailed)	.328	.007
		N	33	37

			log Cattle	log Goat
Spearman's rho	log LSU	Correlation Coefficient	.901**	.437**
		Sig. (2-tailed)	.000	.007
		N	76	37
	5. Levels of education	Correlation Coefficient	.315**	.499**
		Sig. (2-tailed)	.006	.002
		N	76	37
	9. What is your household's income pr month?	Correlation Coefficient	.266*	.176
		Sig. (2-tailed)	.030	.328
		N	67	33
	LSU	Correlation Coefficient	.901**	.437**
		Sig. (2-tailed)	.000	.007
		N	76	37
	log Cattle	Correlation Coefficient	1.000	.330
		Sig. (2-tailed)	.	.075
		N	76	30
	log Goat	Correlation Coefficient	.330	1.000
		Sig. (2-tailed)	.075	.
		N	30	37

Table Caption
**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Partial Correlations

Control Variables			Cattle	Poultry
2. Gender & 3. Age & 4. Marital status & 7. How many people are a part of your household? & 9. What is your household's income pr month? & 10. How many acres are your farm?	5. Levels of education	Correlation	.118	.233
		Significance (2-tailed)	.318	.046
		df	72	72
	Cattle	Correlation	1.000	.002
		Significance (2-tailed)	.	.985
		df	0	72
	Poultry	Correlation	.002	1.000
		Significance (2-tailed)	.985	.
		df	72	0
	Goats	Correlation	.046	.006
		Significance (2-tailed)	.694	.959
		df	72	72

Control Variables			Goats
2. Gender & 3. Age & 4. Marital status & 7. How many people are a part of your household? & 9. What is your household's income pr month? & 10. How many acres are your farm?	5. Levels of education	Correlation	.300
		Significance (2-tailed)	.009
		df	72
	Cattle	Correlation	.046
		Significance (2-tailed)	.694
		df	72
	Poultry	Correlation	.006
		Significance (2-tailed)	.959
		df	72
	Goats	Correlation	1.000
		Significance (2-tailed)	.
		df	0

Appendix F – Synopsis

FACULTY OF SCIENCE
UNIVERSITY OF COPENHAGEN

Analysing ruminant livestock strategies in Kibugu, Kenya

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Course: ILUNRM 2017

Inhalt

Glossary

Livelihood	A livelihood comprises the capabilities, assets and activities required for the means of living (Chambers & Conway 1991 p.6)
Sustainable Livelihood	A livelihood is sustainable when it can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels in the short and long term. (Chambers and Conway 1991 p.6)
Farm system	We will use the definition of a farm system established by the UN Food and Agriculture Organization. According to the FAO, a farm system comprises the individual household unit, along with its resources and resource flows, and the intertwined socioeconomic, biophysical, and human components of the system (Dixon et al., 2001).
Livestock dynamics	The term livestock dynamics is used to describe the fluid relationship between the use of cows and goats as well as the use of indigenous breeds, exotic breeds, or a combination thereof. In this study the term refers to the current situation as well as to local trends.
Ruminants	When referring to ruminants in this paper, only the study-relevant ruminant species are included, which are cattle and goats.
Livestock Strategies	The farmers approach to integrate livestock within his farm system in order to benefit from the livestocks outputs. Livestock diversification or livestock specialization eg. on dairy cattle, are possible livestock strategies.

List of Abbreviations

GDP Gross Domestic Product

SLF Sustainable Livelihoods Framework

1 Introduction

1.1 Background

In the developing countries, the livestock sector is experiencing rapid growth; currently at 33%, its share of the agricultural GDP continues to rise. This expansion is fueled by the increasing demand for livestock products and services from the inhabitants of the developing world (Thornton, 2010). This demand, in turn, is driven by a burgeoning human population, rapid urbanization, and increasing affluence in some developing countries (FAO, 2017). Correspondingly, the rising demand for animal products could lead to many economic opportunities for smallholder farmers. Apart from providing them with strategies for wealth creation and risk reduction, animals can also ensure food security and aid in farm production through traction power and nutrient inputs (Thornton, 2010). As is the case in many Sub-Saharan countries, Kenya's livestock sector plays a crucial economic role.

During the 1960s, the number of livestock per capita in Kenya was among the highest in Africa. However, from 1961 to 2000 this figure was halved due to dismal economic performance and rapid population growth (Dietz et al., 2014). After this major fall in livestock per capita, Kenya's livestock sector experienced a boost, with a total increase in ruminants from 29.5 million to 63.7 million head beginning in the year 2000 (Dietz et al., 2014). Evidently, livestock farming plays a significant role in Kenya's economy, contributing 42% to 45% of the nation's agricultural GDP (Ahuya et al., 2005). According to the UN FAO (2005), most livestock farming in Kenya is nomadic and occurs in the arid and semiarid regions. However, mixed crop-livestock smallholder systems are indeed abundant in the Central Highlands region.

1.2 Ruminant livestock systems of the Kenyan Central Highlands

The deep, well-drained soils of the Kenyan Central Highlands support a diversity of farming systems, from small subsistence farms to larger operations geared toward cultivation of cash crops such as coffee and tea (McDermott et al., 2010). The climate is well-suited to dairy farming, and the population has a tradition of consuming dairy products. In a typical farming system of the Central Highlands, there is generally a close integration of maize and coffee intercropping with dairy cows, and each household will usually own between one and five cows (McDermott et al., 2010). The once typical coffee-dairy cow system, however, has begun to transform in recent decades. Dairy goats have become increasingly widespread in the Central Highlands, thanks to several important factors (Kiruiro et al., 2003). Not only is goat milk highly nutritious, but many farmers have begun to realize there is more profit to be made in raising goats than in growing coffee, whose returns have faltered in the past decade (Kiruiro et al., 2003). As a result of high population densities in the Central Highlands, farms are typically small, at a mean of 1.3 hectares (Place et al., 2006). Population pressure and the traditional land inheritance system have served to further decrease the size of household farm holdings. Thus, there is less land available to produce fodder and support dairy cattle (Place et al., 2006). Ultimately, goats require less land and money to raise, and, therefore, are an important component in the livelihoods of "resource-poor" (p.199) smallholder farmers (Ahuya et al., 2005). Additionally, development programs in the highlands have also played a key role in the rise of dairy goat farming.

1.3 Goat breeding development projects

The Sheep and Goat Project, implemented in the 1970s by the United Nations Development Program, was intended to provide Kenyan farmers with improved breeding stock for their herds by crossing indigenous goats with exotic breeds, such as the Toggenburg, to increase productivity and milk yields (Ahuya et al., 2005). Unfortunately, despite huge financial investments, the project failed to reach its goals. This failure stemmed from the fact that the program did not consult with farmers nor consider their needs. Additionally, breeding experiments took place not on local farms but on government

stations, and genotype-by-environment interactions of improved goats were not taken into account by breeders and researchers (Ahuya et al., 2005). However, a project initiated by FARM Africa and the German Development Corporation in the 1990s proved to be much more successful.

The FARM Africa program succeeded because it implemented a community-based breeding scheme that conducted experiments on-farm. Participating farmers were trained in numerous aspects of goat breeding, husbandry, and healthcare, and in this way, they were able to lead the program and direct it to address their communities' needs (Ahuya et al. 2005). The farmers formed breeding groups and established rotating buck stations to maintain the improved goat stock. Due to this program, the original population of improved goats more than doubled to 90,000 head in just seven years (Ahuya et al., 2005). Not only could farmers raise more productive goats, but they could also make money by selling superior live goats. Additionally, some farmers were trained in aspects of goat health care and could then provide their neighbors with veterinary assistance (Ahuya et al., 2005). Through this development program, poor farmers were empowered to take the lead in community initiatives. Not only did the FARM Africa program improve the quality of goat breeds, it also showed much potential for replication in other locations and, most importantly, provided farmers with strategies to improve their livelihoods.

1.4 Research focus: Ruminants

For the purposes of this study, we will focus exclusively on cattle and goats. We acknowledge that smallholder farm systems in Embu could include a broad variety of livestock. However, according to Dietz (2014), cows and goats are the most important types of livestock in Kenya, and this indeed applies to the Central Highlands. By concentrating on cattle and goats, we can narrow our focus and gain a deeper insight into a specific topic.

We intend to investigate the ruminant trends and related livelihood strategies at our village in Kibugu. To start, we will gather basic data on the ruminants owned by the farmers. Next, through interviews and participatory methods, we will discover the various resources available to the farmers, the constraints they face in livestock production, and the strategies they employ to sustain their way of life.

1.5 Research objectives

Presented below are the objectives that will guide our data collection and analytical processes.

Objectives:

-To identify the ruminant livestock strategies on smallholder farms in Kibugu.

-To determine what drives these ruminant livestock strategies.

1.6 Research questions

Here we will present our overarching research question, as well as our guiding sub-questions.

Research question:

What are the ruminant livestock strategies of smallholder farmers in Kibugu, Kenya, and what are the drivers of these strategies?

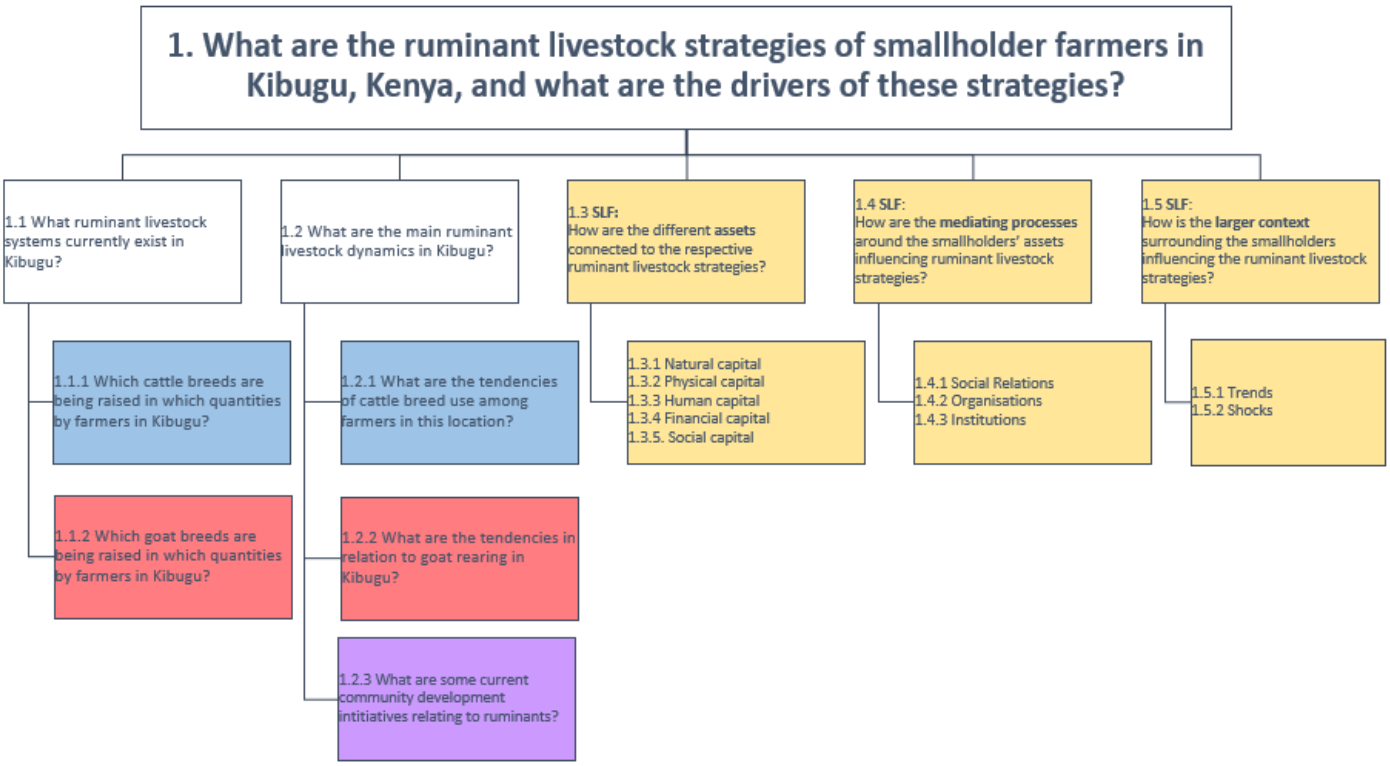

Figure 1 Research question tree

2 Methodology

This project's data collection methods will be guided by an empirically-grounded framework. In the following sections, we will describe the theoretical frame that will serve as a basis for our data collection methods and eventual data analysis.

2.1 Conceptual framework - The Sustainable Livelihoods Framework

We will base our definition of livelihoods on that of Chambers & Conway (1991), as indicated in the glossary. Following Frank Ellis (2000), who first established the Sustainable Livelihoods Framework, this definition pays particular attention to the link between assets and people's ability to generate income and secure survival. We focus on livelihood strategies, but more specifically on these strategies in relation to ruminants. As mentioned above, our aim is to understand ruminant strategies in Kibugu as well as the drivers behind these strategies. The different assets, mediating processes, and factors in the larger context of the SLF are relevant because identifying these will bring us closer to answering our research question. Thus, our focus will be on the assets, mediating processes, larger context and livelihood strategies of the SLF, and, therefore, we will leave out the last part of the framework.

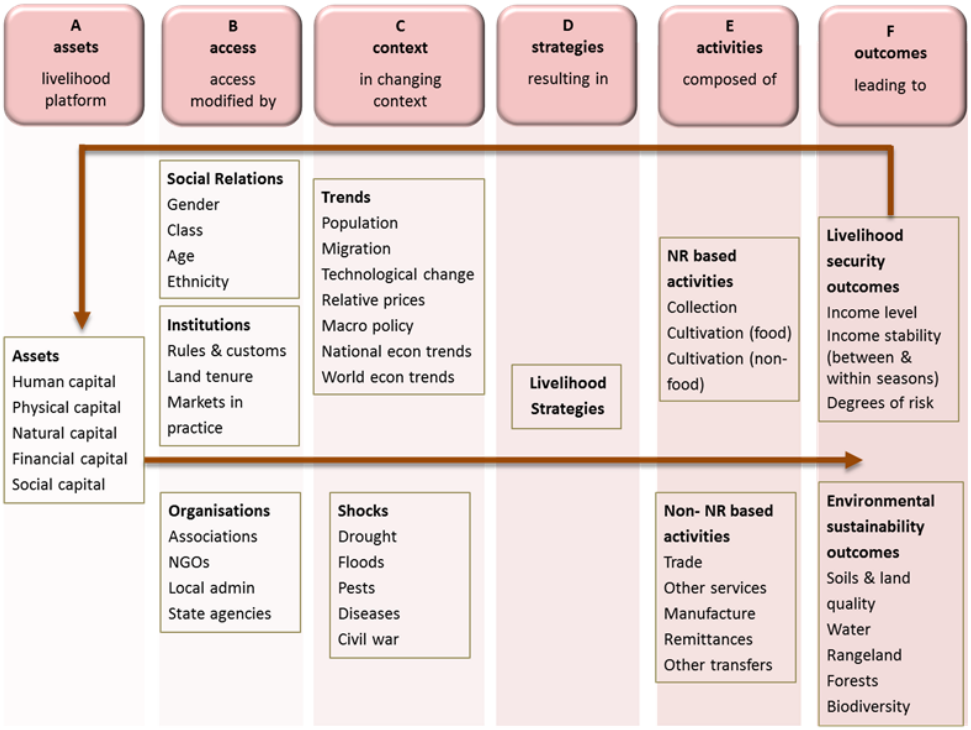

Figure 2 Illustration of the Sustainable Livelihood Framework (SLF) from Ellis (2000, p.30)

3 Methods

Taking the lead from the SLF, we aim at collecting data on social, physical, political, natural, political and cultural parameters. This aim is reflected as we approach our data collection with a mixture of quantitative and qualitative methods. In the following section we will present the methods we plan to use in our data collection process, as well as the theories underlying these methods.

3.1 Interviews

We will use several types of interviews, each with different purposes, benefits and pitfalls.

3.1.1 Questionnaires

3.1.1.1 Questionnaire 1

A questionnaire is an effective way to collect large amounts of quantifiable information from a considerable number of informants, as well as getting an overview of the study location and its people (Bernard, 2011). In collaboration with four other student groups, we will do a general questionnaire, with basic questions related to the village households, as well five specific questions for each group's theme. Before distribution, we will pilot-test them for understandability and relevance. We will read through and test the questions with our Kenyan counterparts and local experts, and re-work accordingly. A sampling strategy will be agreed upon by the questionnaire group.

Ultimately, by working with the other student groups, we can access a larger subject pool and gather data more efficiently. Questionnaire 1 is intended to gain a basic understanding and direct us toward key informants.

3.1.1.2 Questionnaire 2

Next, we will conduct a second questionnaire to gain more in-depth information on selected farmers. To save time and link our data, we will administer the questionnaire in conjunction with the participatory milk monitoring. We will use this questionnaire to gather information concerning feeding, grazing systems, water, milking frequency, health management and breeding practices.

Both Questionnaires 1 and 2 will take place as structured interviews, where each respondent is exposed to the same questions, which can make the answers easy to compare (Bernard, 2011). The method we use for collecting questionnaire data will be a personal face-to-face method. This could be helpful because it would give us the opportunity to explain questions if an informant does not understand (Bernard, 2011).

3.1.2 Semi-structured interviews

Semi-structured interviewing is most often a pre-meditated activity. While open-ended, it follows a general guide and covers a list of topics (Bernard, 2011). The semi-structured interview will function as a fundamental method in our data collection, and we will use it continuously throughout the fieldwork. Steinar Kvales' (1994) description of an interview guide could be useful as we craft our own guides. Interviewee selection will be based on our questionnaire data. A household that has experienced a drastic change in livestock, households with different levels of income, or different sizes of households could be interesting to explore, but ultimately, the choice depends on what data we are going to find.

3.1.3 Unstructured interviewing

Unstructured interviewing happens constantly; in homes, walking along the road, or hanging out in a bar (Bernard, 2011). Although unstructured interviewing can take place anywhere, it is not informal because one still conducts an interview based on a clear plan (Bernard, 2011). At the same time, unstructured interviewing is characterized by a minimum of control over respondents' answers (Bernard, 2011). We will, as Bernard (2011) describes, be doing unstructured interviews all time, but especially while interacting with our hosts and doing the daily clock and transect walk activities.

3.2 Participatory Rural Appraisal

The methods of Participatory Rural Appraisal, or PRA, have been developed to empower local communities to assert a central role in the development process by analyzing their own problems and designing their own solutions (Sontheimer et al., 1999). PRA was first championed by Robert Chambers (1994) as a way to bring development back to its roots-- from "top-down to bottom-up" (p. 953). According to Mikkelsen (2005), it can also be a useful method for triangulating the data we collect from questionnaires and interviews. We plan to spend several days doing PRA workshops with a group of representative farmers selected from the questionnaires. In the following sections, we will briefly discuss the PRA tools we will use. It is important to note that our methods are based upon the work of Mikkelsen (2005).

3.2.1 Transect walk

A transect walk is a method during which researchers systematically walk with informants through an area while observing, meeting people, listening, discussing and identifying different zones (Chambers, 2002) This method will be conducted on the first or second day with a local expert. While doing the transect walk we will carry a GPS in order to map important points, households and clusters of households. During the village walks and informal discussions we will try to recognize key indicators of the status and well-being of livestock and get an understanding of the local livestock situation (Kirsopp-Reed, 1994).

The transect walk could also be useful to combine with the method that Strang (2010) calls *cultural mapping.* This method is based on the idea that places reflect the physical materialization of cultural beliefs and values. It entails going on "walkabouts" with informants (Strang, 2010 p.132). Cultural mapping will then let us focus on how the different places are tied to different stories and thus how the people interact with these different places.

3.2.2 Farm sketch

To get a holistic picture of crop-livestock integration at the farm system level, one of the first things to do at each selected representative farm will be to draw a sketch with the compounds (household, subsistence, cash cropping, livestock, (in- and out)flows) together with the farmers, who will teach us about the layout of his or her farm (Defour, 2000; Fangr-Asia n.d.).

3.2.3 Participatory Milk Yield Monitoring

If the questionnaires and SSIs do not reveal enough information about comparative milk yields, we plan to conduct a simple participatory milk measurement while administering Questionnaire 2. In our identified representative households we could identify the lactating animals, mark their milking buckets with a measuring scale in 0.5L steps (using an Edding) and distribute simple tables to be filled in by farmers for each individual animal (with respect to lactational stage) and to be collected the next day. This could give us some rough data to compare to insights we gain through the other methods and literature about the relative productivity of cross-breeds or exotic breeds. This exercise could also be very interesting for the farmers, who will learn more about their dairy production levels.

3.2.4 Participatory Ranking

Participatory ranking is integral to the PRA toolbox because it can be a good method for identifying indicators in regards to people's expectations, beliefs, judgements, attitudes, preferences and opinions (Mikkelsen, 2005). For our study problem, preference, wealth, and pair-wise ranking could be useful tools to facilitate farmer-led discussions on various topics such as production constraints, drivers of adopting a certain breed of ruminant, comparisons between ruminant production, and indicators of household wealth. Ultimately, we hope to use the information from ranking exercises to piece together farmers' significant capital assets and the reasons why they adopt certain ruminant strategies (cf. Kirsopp-Reed 1994).

3.2.5 Daily Activity Clock

A Daily Activity Clock is a useful tool for showing a farmer's routine. This method includes organising focus groups with representatives from different socio-economic groups. Each informant plots their daily activities onto a circle representing a clock (Sontheimer et al., 1999). This method will enable us to compare the informant's workloads, tasks, activities, leisure time and hours of sleep (Cavestro, 2003).

3.2.6 Social mapping

In social mapping, a group draws a map of the community, including households. The informants can then mark the number of livestock, level of wealth, social rank and well-being in each household (Kirsopp-Reed 1994). We will use this method to gather material on the local livestock population, the different households' characteristics and the local wealth levels (Kirsopp-Reed 1994). This method is a way for us to see how socio-economic factors are linked to livestock without asking respective households directly since this could be a sensitive issue.

3.2.8 Area mapping

We will use the GPS on our transect walk to map the area and mark interesting points and those important for ruminants. Moreover, the GPS will be useful to our data collection because it can measure land, crop, and livestock areas within each household to compare households in the area.

3.2.8 Participant observation

Participant observation is a method that, through the researcher's own presence, involves observing and recording information about other people's lives (Bernard, 2011). This includes the daily activity clock and the time we spend participating in the lives of our hosts.

*For further details see Appendix 1.

Appendix 1: Data Matrix

Research question	Sub question	Sub-sub-questions	Data required	Source	Method	Equipment	Facilitator	Participants	Potential Risks	Risk remediation	Key:
1. What are the ruminant livestock strategies of smallholder farmers in Kibugu, Kenya, and what are the drivers of these strategies?	1.1 What ruminant livestock systems currently exist in Kibugu?	1.1.1 Which cattle breeds are being raised in which quantities by farmers in Kibugu?	Data showing which cattle farmers in Kibugu raise (Animal census)	Representative households, local experts, interpreter	3.1.1 Questionnaire 1	GPS, Questionnaires, paper, pencil, "breed guide"	*"to be filled out in the field"*	farmers (sampling frame)	commence or snowball sampling, inappropriate questions	discuss sampling strategy in GI Master group, carefully pilot-test	Qualitative methods
					Area mapping (through the transect, GI, or selected farms)	GPS, paper, pencil		local expert, interpreter, maybe a farmer	get wrong geographic data	carefully follow Torben's tips	
		1.1.2 Which goat breeds are being raised in which quantities by farmers in Kibugu?	Data showing which goats farmers in Kibugu raise (Animal census)	Representative households	Questionnaire 1						Quantitative methods
					?. Area mapping (through the transect, GI, or selected farms)						
	1.2 What are the predominant ruminant livestock dynamics in Kibugu?	1.2.1 What are the tendencies of cattle breed use among farmers in this location?	Future ruminant diversification intentions	Representative households	Questionnaire 1						goats
					Participatory milk yield monitoring	Scoring, milk data sheets,		selected representative HH, interpreter, local expert	farmers unable to read/write, the animals could get confused	use only simple, big numbers. Clearly identify the animals beforehand	
					SSI	Recorder, paper, pens		selected representative HH, interpreter, local expert	losing track, not finding out about our main interest	prepare and stick to interview guides	
		1.2.2 What are the tendencies in relation to goat rearing in Kibugu?	Future ruminant diversification intentions	Representative households	Questionnaire 1						cows
					SSI	Recorder, paper, pens		representative HH, interpreter, local expert			
		1.2.3 What are some current community development initiatives relating to ruminants?	Current diversification projects in place in Kibugu.	*"to be identified"*	Observations (Focus groups)	Recorder, paper, pens					goats + cows
					SSI	Recorder, paper, pens		selected representative HH, interpreter, local	losing track, not finding out about our main interest	prepare and stick to interview guides	
	1.3 SLF: How are the different assets connected to the respective ruminant livestock strategies?	1.3.1 Natural capital	(property size), (land fertility), (# of cows, goats, other LS), (crops grown), (water availability - rain/river), (communal ressources),	Representative households	Questionnaire 1						
					Questionnaire 2	GPS, Questionnaires, paper, pencil, "breed guide"		selected representative HH, interpreter, local expert	identify "appropriate" households		
					Participatory milk yield monitoring						
					Farm sketch	big papers, different colours, sticky notes, notebook, pen		selected representative HH, interpreter	if detailed, could be too time-consuming	make a daily timetable the evenings before	
		1.3.2 Physical capital	(Equipment&Machinery), (Road Proximity), (Distance to market), (Buildings-stable/storage), (Irrigation Infrastructure?), (Energy source&availability), (phone or internet)	Representative households	Daily activity clock in selected HHs.	big papers, different colours, sticky notes, notebook, pen		selected representative HH, interpreter	if detailed, could be too time-consuming	make a daily timetable the evenings before	
					Social Map	big papers, different colours, sticky notes, notebook, pen		selected representative HH, interpreter	might touch sensitive contents	carefully consider how to define the social status	
					Area Mapping Observations						
		1.3.3 Financial capital	Savings, credit, remittances, livestock, crop stores, pensions	Representative households, households taking part in quest	Daily activity clock in selected HHs						
					SSI						
					social map village map						
					Questionnaire 1						
		1.3.4 Human capital	Labour (Family size, age), skills (Education, crafts), knowledge + info (, health (Disease)	Representative households, households taking part in quest	Daily activity clock						
					social map						
					SSI, participant observation						
					Questionnaire 1						
		1.3.5 Social capital	Social networks (community groups, ...), membership of associations, organisations, relationship of trust and reciprocity, access to institutions, political parties, authorities	Households taking part in quest., representative households	Daily activity SSI observation						
	1.4 SLF: How are the mediating processes around the smallholders' assets influencing ruminant livestock strategies?	1.4.1 Social relations	Gender, class, age, ethnicity	Representative households	daily activity clock, social map						
					SSI, observations						
		1.4.2 Organisations	Associations, NGOs, local admin., state agencies	Literature, representative households, locals, institutions, organisations	SSI	Recorder, paper, pens		*"to be identified"*	not identifiable, not accessible	talk about this with Kenyan counterparts and local experts from 1st day on	
					observation						
		1.4.3 Institutions	Rules and customs, land tenure, markets in practice	Literature, representative households, institutions, organisations	SSI	Recorder, paper, pens		*"to be identified"*	not identifiable, not accessible	talk about this with Kenyan counterparts and local experts from 1st day on	
					observations transect walk						
	1.5 SLF: How is the larger context surrounding the smallholders influencing the ruminant livestock strategies?	1.5.1 Trends	population dynamics, migration, technological change, relative prices, macro politics, national and international economics, climate change	Literature, institutions (breeding institutions, schemes), households	SSI Observations						
					Questionnaire 1 Questionnaire 2						
		1.5.2 Schocks	Drought, floods, pests, diseases, civil war	Literature, households	SSI						
					observations						
					transect walks						

Appendix 2: Preliminary time schedule of field work

Task	Methods	Day 1 02.03.	Day 2 03.03.	Day 3 04.03.	Day 4 05.03.	Day 5 06.03.	Day 6 07.03.	Day 7 08.03.	Day 8 09.03.	Day 9 10.03.	Day 10 11.03.	Day 11 12.03.
1.1.1 Which cattle breeds are being raised in which quantities by farmers in Kibugu?	Questionnaire I											
	Area Mapping											
1.1.2 Which goat breeds are being raised in which quantities by farmers in Kibugu?	Questionnaire I											
	Area mapping											
1.2.1 What are the tendencies of cattle breed use among farmers in this location?	Questionnaire 1											
	SSI (A)											
	Participatory Milk Yield Monitoring											
	Questionnaire 2											
1.2.2 What are the tendencies in relation to goat rearing in Kibugu?	Questionnaire 1											
	SSI											
	Participatory Milk Yield Monitoring											
	Questionnaire 2											
1.2.3 What are some current community development initiatives for ruminant diversification?	Observations											
	SSI											
1.3.1 Natural capital	Questionnaire I											
	PRA: Farm Ressource Mapping											
	Farm System & Nutrient Flow Analysis											
1.3.2 Physical capital	Daily activity clock in selected HH's											
1.3.3 Human capital	HH duties											
	Social map											
	Chapati diagram											
	Daily activity clock											
	SSI											
	Participatory observation											
	Questionnaire 1											
1.3.4 Financial capital	Daily activity clock in selected HH's											
	SSI											
	Questionnaire 1											
1.3.5. Social capital	Daily activity clock in selected HH's											
	SSI											
	Participatory observation											
1.4. SLF:How are the mediating processes around the smallholders' assets influencing ruminant livestock strategies?	SSI, Questionnaires											
	Observation											
1.5. SLF: How is the larger context surrounding the smallholders influencing the ruminant livestock strategies?	SSI, Questionnaires											
	Observation											

Appendix 3: Questionnaire 1

General Questionnaire for Kibugu

GPS-point: x:_____ y:_____ z:_____	**Interviewer:**
Sub-location:	**Group Number:**
Note taker:	**Translator:**
Picture:	**Date and time: / / : :**

Personal information

1. Name: _____

2. What is your gender? Male _____ Female_____

3. How old are you? _____

4. Marital status:
a) Single_____ b) Married_____ c) Widowed_____d)Divorced_____

5. Which levels of education did you finish?
None educational background
Primary school
Secondary School
Bachelor degree
Master degree
Other: specify _____

6. Are you a part of any of the following networks? (*place an "X" in all choices that apply*)
- Church
- NGO
- Cooperative (Specify_____)
- Political party
- Social club(Specify_____)
- Others _____

Household information

7. How many people are there in your household (including living outside the village)? Please state their relationship to you, ages, gender, occupation and whether they work on your family farm:

Relationship	Age	Gender	Occupation	Does he/she work in the farm?
1)				
2)				
3)				
4)				

5)				
6)				
7)				
8)				
9)				
10)				

8. How do you consider your household's income level?
Low income _____
Medium income_____
High income_____

9. What are the **3 main income sources** for your household? (mark 1 for the highest source of income, 2 for medium source, 3 for lesser source)
Cash crops _____ Horticulture _____ Livestock _____ Handicrafts _____ Off-farm employment _____ Services _____ Remittances _____ Only subsistence_____ Other income source, please specify: _____

Farm characteristics

10. How many acres are your farm?
_____

11. How big is your farm compared to the rest of the village?

a) Small _____ b) Medium_____ c) Large_____

12. How did you obtain the land of your farm?
- Inheritance
- Purchasing
- Renting
- Other:_____

Crop Technology

13. How fertile do you think your soil is?
Low _____ Medium____ High _____

14. Do you think you are losing topsoil? Yes__ No____ if yes What signs (types) of erosion can you see in your fields?

15. Are you doing anything to prevent soil loss?
if yes, what are you doing?
- Terracing
- Contour lines
- Across slope tillage
- Cover crop
- Planting trees
- Stone bunds
- Other _____

16. How would you rate the slope at your farm?
low - medium - high

Pests and disease Management

17. Have you heard of the Plantwise Plant Clinics organized by Centre for Agricultural Bioscience International (CABI)?
Yes
No

18. Have you any experience with using the plant clinics?
Yes
No

If yes
- How many times have you visited the Plant Clinics?

_____

- How will you characterize your experience with the Plant clinics?

Not satisfied
Satisfied
Very Satisfied

19. What are your 2 most important crops infected with pests and diseases? (list most important first - please state crop followed by the pest/disease)

1. _____
2. _____

Gender

20. Has there been any changes during the last 5 years in what types of hybrids/crops your household is producing?
- yes, we made changes about the type of crops we are producing
- yes, we made changes about the type of hybrids we are using
- No, we don't make any changes
- I don't know if we made changes

- *comments: The interviewer has to write here the type of change made (type of crops, type of hybrids) by the household if possible*

21. Has there been any changes during the last 5 years in what crops/hybrids your household is selling?
- yes
- no

comments: The interviewer has to write every comments mentioned by the respondent

22. How much are you selling of the total production (of agricultural/horticultural crops)
a. Pie charts: less than 25 %, between 25% and 50 %, between 50% and 75 %, more than 75%

comments: The interviewer has to write every comments mentioned by the respondent (directly sell, use of an intermeedee)

23. Has this amount changed in/during the last 5 years?

24. Has there been any changes in the labor division inside the household during the last 5 years?
b. Yes, there has been changes in who is selling the crop at the market
c. Yes, it's not the same person producing the same crops as it was before
d. No, there have been no changes.

Livestock Questions

Ruminants = cattle, goats, sheep, (giraffes, antelopes, camels)

25. Number of ruminants in household?

Cattle: _____
Goats: _____
Sheep: _____
Total number of ruminants: _____
if zero, why not: _____

CATTLE CENSUS	Bohan	Sahiwal	Gir	Other/Unknown local breed	Friesian (cross)	Ayreshire (cross)	Jersey	Guernsey	Other/Unknown improved/exotic breed
lactating									
dry									
heifer (1st gestation F)									
calves									
bulls									

GOAT CENSUS	Galla/Borana/Somali eg: Degyir, Degun	Small East African	Other/Unknown local breed	Anglo-Nubian	German Alpine(cross)	Toggenburg (cross)	Saanen		Other/Unknown improved/exotic breed

				(cross)					
lactating									
dry									
heifer (1st gestation F)									
kids									
bucks									

26, Which household member has the right or responsibility to which areas of ruminant husbandry? *(Place an "X" in the box that applies)*

	Daily care				**Income from milk sales**				**Income from animal sale (meat or alive)**			
Ruminant	**Husband**	**Wife**	**Shared**	**other**	**Husband**	**Wife**	**Shared**	**other**	**Husband**	**Wife**	**Shared**	**other**
Cow herd												
Goat herd												
Sheep herd												

If you don't have goats, please skip to #6.

27. For how many **years** have you had goats?

28. What are your **5 main reasons for keeping goats**?*(Place an "X" in all choices that apply)*

- Low labor required
- Low feed demands of goat
- Low space demand
- Short generation cycle
- Nutritious milk
- Milk tastes good
- good market for goat milk
- cheap to buy a goat
- was the only ruminant available to buy
- Other reasons. Please specify:
- Manure provision
- Financial insurance

29. Are you **member in a breeding association** or **milk cooperative**?
If yes, please specify:

	Goat breeding/husbandry	Cattle breeding/husbandry	Milk cooperative	other, please specify
Put X if yes				

Post-Harvest Management

30. What are the storage technologies that you use?

- Plastic containers
- Plastic bags
- Wooden boxes
- Storage baskets
- Jars
- Gourd
- Burlap/Jute sacks
- Silos (Plastic or metal)
- Aerial storage
- Other: _____

31. Have you adopted new storage technologies in the last 3 years?

- Yes
- No

32. Over the last 5 years, how many new crops did you began growing? What are they?

_____

33. After harvest, what is the main cause/factor of crop losses?

- Pests, rodents,
- Rainfall
- Temperature
- Other: _____

34. Per harvest season, how big a percentage of harvest crops do you lose on average? And for which crop?

- 10%
- 25%
- 50%
- 75%

Crop:

_____

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