GEF Project:

Novel forms of livestock and wildlife integration adjacent to protected areas in Africa

GCP/URT/124/WBG

Socio Economic Baseline Survey

Descriptive analysis

2005 – 2006
Lolkisale, Naitolya and Loiborsoit A villages
Monduli and Simanjiro Districts
Manyara and Arusha Regions

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Executive summary

This report presents the preliminary outcomes of a socio-economic baseline survey conducted as part of a FAO-WB-GEF Project implemented in Tanzania and entitled "Novel Forms of Livestock and Wildlife Integration Adjacent to Protected Areas in Africa: Tanzania".

The study area located in Northern Tanzania is spread over two districts, Simanjiro and Monduli, within the Arusha and Manyara regions, and comprises three villages: Loiborsoit.'A', Naitolya and Lolkisale. In total 363 households participated in the survey accounting for 17.3 % of the total household population in the selected villages.

The preliminary analysis conducted look at the characteristics of the respondent, the history and structure the households, their land ownership, the characteristics of their livestock and crop production systems, the issues they face with regard to their access to water and other facilities, and their investment strategies. It discusses preliminary recommendations to improve the livelihoods, the production systems and the crop-livestock-wildlife interactions.

Most households in these villages have immigrated recently with 62 % of the households having settled after 1990 and 87 % after 1980. Most of the households live in poverty with a mean gross income estimated at 171 USD per capita and per year and at 358 USD per capita and per year when considering the net income, herd growth and the value of the products consumed. More than 75 % of the households live with less than 2 USD per capita and per day. The households live for a large majority in traditional houses made with mud walls and grass-thatched roofs.

Human capital is poor. The population is extremely young with 57.7 % of the population below 20 and 33.8 % below 10. Fifty two percent of population over 15 did not attend school and the overall schooling rate stands at 66 % among the 9-13 age class.

Maasai are still the dominant tribe and account for 86 % of the households. Even if traditionally livestock keepers, Maasai are strongly involved into agriculture in the surveyed area. Household activities are mainly natural resource based with 83.2 % of the HH members being primarily engaged into agriculture, livestock

production, bee keeping or charcoal production. The shift between pastoral prod system toward agro-pastoral system was observed with 72 % and 65 % of the households in Lolkisale and Naitolya involved in mixed systems. Pure crop producers are also emerging and they account for 21 % of the households in Naitolya. What seems to be pastoralists (cattle producers not engaged into other activities) are only well developed in Loiborsoit.'A' where they account for 10 % of the HHs.

The development of the livestock sector is still strong as it involves 68 % of the households (57 % of the households own cattle, 60% own goats and 47 % own sheep). Even if the mean herd/flock sizes are relatively high compared to national averages (15.6 animals for cattle; 19.2 for goat and 18.7 for sheep), most of the producers only own few animals. For example 25 % of the cattle owners own less than 4 animals. The livestock production system is poorly intensified with very low destocking rates (below 5 % of the total animal population), low fertility ratio, the use of low productive but drought resistant breed and a low level of milk production (2 liters per animal and per day for cattle). The sector remains labour intensive and mobilizes in 83% of the households more than 50% of the household members. Wildlife has an important impact of the production system and account for 27 % of the reported cause of loss for goats.

Producers hold a very small quantity of land (below 1.75 acres for 25 % of the households and below 5 acres for 50 % of them). The land privatization process is a recent phenomenon with 72% of the plots acquired over the 1995-2006 period. Land is usually allocated through formal processes. Nevertheless in Lolkisale, for example, 6% of the households still report having grabbed the land. Pressure on land is strong with 76 % of the household planning to access land in the future. Crop production is widespread in the area with 80 % of the HHs practicing crop farming. The development of agriculture is a new phenomenon in the three villages with 77 % of the croppers who started their activities after 1995 in Loiborsoit.'A'. Maize, Beans and Green-Gram are virtually the three crops being produced locally. All producers are engaged into maize production which has recently become the staple food. Despite the low technical capacity locally, land preparation is massively mechanized with 68 % of the producers using a tractor to prepare the land. But the use of irrigation technologies or chemical fertilizers was virtually not observed. Regarding pesticide use, 7 % of the producers applied pesticides, but only at low levels, limiting their efficiency. As a consequence

productivity remains very low and stands at 401 kg per acre on average for maize. The total production at household level remains also very low. 34 % of the croppers produced less than 500 Kg of maize in 2005. Consequently most of the yield (53%) is used for home consumption in the case of maize. Beans, on the other hand, are principally marketed (58% of the total yield). Overall the yields produced are insufficient to cover the HH needs as 51 % of the maize producers and 43 % of the beans producers reported running out of crop in 2005.

Signs of integration between crop and livestock are being observed. Manure was collected by 8 % of the households and cut and carry is practiced by 20 % of the herders.

Forty two percent of the HHs are engaged in off-farm activities. But again agricultural and natural resources based activities were frequently observed. In Loiborsoit.'A' where large scale farming is using a large portion of the village area, 24 % of the HHs are being employed in crop farms. Firewood and charcoal sale is also commonly practiced in the three villages. This activity which is time consuming (14 working days per month on average) is generating low incomes (mean 143,050 Tsch per year), is more often practiced by poorer households and has a strong impact on the environment. Despite the proximity of the National Parks only relatively few households (4 %) were engaged into tourism related activities (hotel/lodge employee, tourism employee, hawking). But exit strategies are difficult to develop due to the low development of the human capital locally.

Access to most facilities (health centre, secondary school, banking institutions, veterinary clinic), is severely constrained in the three villages. Access to credit is also an issue despite the willingness to access it. Producers would like to access credit to improve their production systems

Producers expect to develop livestock (increasing size of the herd, breed diversification) and crop production (through intensification and extensification). This is reflected in their 10 years strategy. Furthermore 15% of the households not owning livestock are planning to get some in the next 2 years and 6% of the households currently not practicing crop production are planning to do so in the next 2 years. This process will increase the pressure on the environment. The impact of land fragmentation on wildlife will be worsened as household are starting to fence their land (15% of them have done it at least partially).

The report conclude on a series of recommendations on the need for: agricultural intensification, the development of market oriented production systems, to control of extensification, exit strategies, compensation schemes, and better informed policies for better resource allocation.

1. Introduction

The survey is part of one FAO-WB-GEF Project implemented in Northern Tanzania – Arusha entitled "Novel Forms of Livestock and Wildlife Integration Adjacent to Protected Areas in Africa: Tanzania" (NLWI). This project aims at a significant reduction in conflict over access to resources through the integration of pastoralism, cropping and wildlife conservation, as well, as through effective policy and institutional change. The project responds to Tanzania's environmental priorities for the productive management of land resources, the conservation of biodiversity, protection of wildlife resources, maintenance of ecological integrity and promotion of rural livelihoods.

The project was formulated and submitted to the Global Environment Facility (GEF) in 2001 and was approved for funding at the end of the year 2003. The World Bank is the GEF implementing agency for the project. The Food and Agriculture Organization executes the GEF funded project over a period of three years. The African Wildlife Foundation (AWF) is responsible for the local co-ordination and execution of the project, under the supervision of FAO and the national Steering Committee. Under the supervision of FAO and the national Steering Committee, the International Livestock Research Institute (ILRI) provides scientific support to the design of methodologies for various activities, and will contribute to the preparation of decision support tools.

The geographic scope of the site occurs within an ecosystem of approximately 35,000 km² in the Northern part of Tanzania. The area includes two national parks (Tarangire and Lake Manyara), the Marang and Esimingor National Forest Reserves and the watershed of the Northern Highland Forest in the Ngorongoro Conservation Area. Tarangire and Manyara National Parks are acknowledged as keystone components of Tanzania's tourism industry. They are two of the highest grossing of Tanzania's 12 National Parks in terms of revenue generated and visitor numbers.

In this area there is an important knowledge gap on the trends, linkages and scope of changes in biodiversity, land degradation, land use and land management. By integrating and modelling information on soils, vegetation, rainfall, wildlife population dynamics, livestock production and socio economic aspects,

this project aims at identifying alternative management options and assessing the potential repercussions for ecosystem health and human food security. To achieve this goal the project implements several activities that are included within three project's components:

A. Development and implementation of participatory land use plans and wildlife management areas.
B. Design and development of benefit sharing mechanisms through capturing direct and indirect wildlife values.
C. Development of decision support tools to strengthen rational resource-access and management.

This survey is part of the second component of the project

2. Overview of the study area

2.1. Location of the study area and perceived trends

In Tanzania, it is estimated that the pastoral economy is the basis of the livelihood of 10% of the population. Pastoralism is the backbone of Tanzania's livestock sector, owning approximately 99% of the livestock (Odhiambo, 2006). The study area located in Northern Tanzania is spread over two districts, Simanjiro and Monduli, within the Arusha and Manyara regions, and comprises three villages: Loiborsoit A, Naitolya and Lolkisale (maps 2.1 & 2.2). In the area, economic and social pressures seem to favour a shift from traditional livestock keeping activities to cropping activities and have therefore in turn a strong impact on livelihood strategies and land use patterns. This activity shift in the area is perceived to be driven by four simultaneous processes. First, there is a strong immigration of agriculturalists mainly due to land shortages in other areas. Populations that are initially non-native to this region are now occupying more and more land in the two districts. This recent occupation of land is favored by a lack of land use planning, enforcement of regulations and information by local residents on land tenure and related legislation, and improved access to market access (transport means; improving regional infrastructure) that allows the new settlers to sell their products outside the local market. Second, the recent grain shortages in Kenya encouraged the development of agriculture in Northern Tanzania. Regional investors developed a growing interest for the interesting agricultural potential of the study area. This led to land alienation in some Districts in Northern Tanzania for the development of commercial wheat farms. Third, with the recent droughts and the decreasing land available for grazing purposes, pastoralist populations are not able to maintain their livelihoods from livestock production alone and are forced to engage into cropping activities or to adopt other livelihood strategies. Fourth, the sedentarization process is further encouraged by the Tanzanian government, land tenure and rural development policies. Pastoral transition and the interface between traditional pastoral societies, agro-pastoralism and croppers is central to land use and livelihood dynamics in this region. The area is also characterized by a high level of heterogeneity among the actors.

Before the implementation of the survey the district authorities established briefs that were used for the design of the survey and the questionnaires. Furthermore in parallel to the socio-economic survey the NFLWI Project established land use maps that have also been used when analyzing the data (maps 2.3 to 2.5). The information provided by the district authorities can be summarized as follow :

2.2. Lolkisale

The village is located in the Monduli district within the Arusha region at 62 km from the Monduli town. The village falls within the low lying zone of the district characterized with altitude ranging from 600 to 1200 meters above sea level, temperatures ranging between 23-30 centigrade and annual rainfall ranging from 400 to 600 mm. The village has extensive plains covered with mixed bush lands, wooded grassland and open grassland. Dominant trees are acacia, ballanites, commiphora and combretum. The village had no land use plan before project implementation. The village boundary survey was not completed and was subject to conflicts with the district administration. The size of the village is approximately 1275 km^2. Access to the village is difficult. The village can be only reached though a rough muddy road and during the rainy season transport to the village is impeded. In 2000, the village included 7,599 inhabitants. Immigration from Arusha, Moshi and Monduli was high in the past, immigrants looking for arable land. But the immigration rate decreased as without irrigation, productivity was low due to unreliable rainfall patterns. Four settlement patterns can be identified: large scale farms with managers' premises, and staff quarters, small farmers, big pastoral Maasai bomas located far from the cultivated areas and medium small Maasai Waarusha bomas combining livestock with crop production. The main land use in the past was grazing, but in the 1960's few estate farms were opened in the area. Big farmers were followed by small farmers and almost half of the village land has being converted to croplands. The main source of income in the village comes from livestock and crop production and few people have also developed petty businesses. Few villagers are also engaged into the tourism industry and the village set aside an area for the development of tourism based activities. From an environmental perspective, the high immigration rate and the increased demand for seasonal workers, is increasing demand for charcoal fuelling the deforestation process. Similarly the pressure on bush meat is increasing. The village has no dispensary and medical supply is inadequate.

There is poor housing and latrines are inexistent. The village lack access to clean water resources. The level of human – wildlife conflict is low in the area but a few seasonal cases of crop damage by wildlife especially elephants are reported (AWF-LEAD, 2005).

2.3. Naitolya

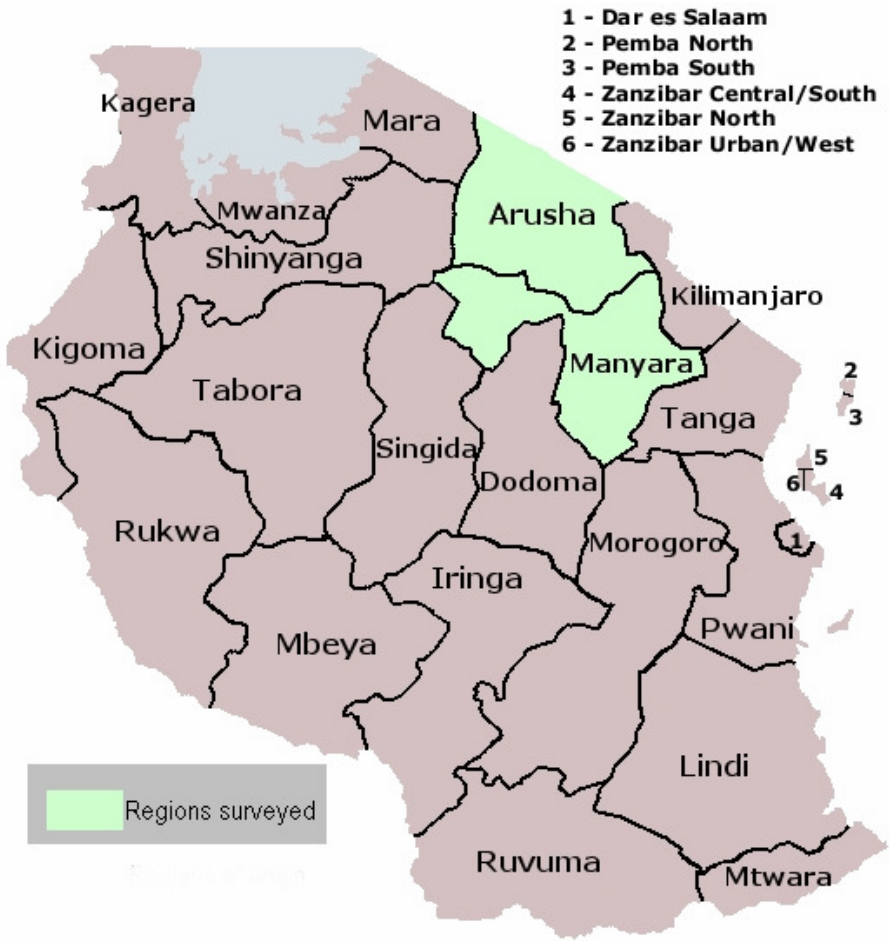
The village is located in the Monduli district within the Arusha region at 75 km from the Monduli town. The village falls within the low lying zone of the district characterized with attitude ranging from 600 to 1200 meters above sea level, temperatures ranging between 23-30 centigrade and annual rainfall ranging from 400 to 600 mm. The village has plains covered with mixed bush lands, wooded grassland and open grassland. Dominant trees are acacia, ballanites, commiphora and combretum. Nevertheless a large part of the village has been cleared for cultivation and left with weeds as fallow land. The village had no land use plan when the GEF project started. The size of the village is approximately 178 km^2. The village is along the main tarmac road from Arusha to Dodoma, which connects it to major business areas. In 2000, the village included 1,295 inhabitants. Immigration from Arusha and Monduli was also high in the past, immigrants looking for arable land. But the immigration rate decreased as without irrigation, productivity was low due to unreliable rainfall patterns. Two settlement patterns can be found: big pastoral Maasai bomas and medium/small Maasai-Waarusha bomas. The land use conversion presented for Lolkisale could also be observed in this village but started a decade latter and half of the village land has being converted to crop lands. The main source of income in the village comes from livestock and crop production and few people have also developed livestock, crop and petty businesses. There is no tourism industry in Naitolya. From an environmental point of view, a large part of indigenous forest has already being cleared for cultivation. Charcoal production is contributing to the destruction of the remaining forested area. The production is fueled by the high demand generated in Makuyuni which is the major collection center for charcoal trade. The village has also no dispensary and medical supply is inadequate. There is poor housing and latrines are inexistent. The village lacks access to clean water resources. The level of human – wildlife conflict is high as the village borders the Tarangire National Park. There are frequent reports of crop damage by elephants

and some of the farms have been abandoned because of the wildlife depredation impact (AWF-LEAD, 2005).

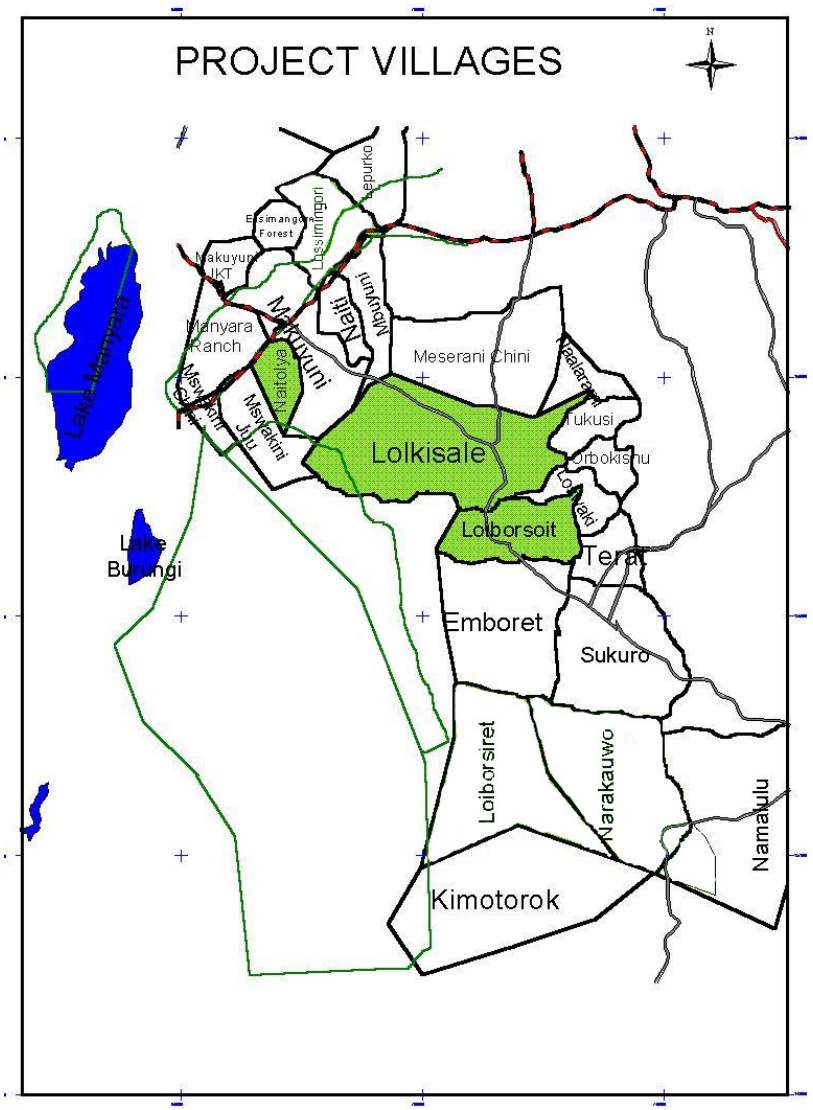
2.4. Loiborsoit.'A'

Loiborsoit 'A' is located in the Northern part of the Simanriro District within the Manyara Region. The village is located 135 kilometers away from the District Headquarters. In 2000, the village included 5,443 inhabitants. Maasai form 90% of the total population. Other tribes include Chaga, Pare, Rangi and Mbulu. The village had no land use plan when the GEF project started. The development of crop production started in the 70's because of the high productivity observed in the village which attracted producers. This particularity led to the development of large-scale farms. However, the changes in climatic patterns and the lower rainfall levels impacted crop production locally. As a response producers often tend to extensify rather than intensify their production system leading to extensive land degradation in the village. Pastoralism accounts for about 80% of the village economy while cultivation accounts for the remaining 20%. The main crops grown in the village are maize and beans. The village relies on the closest livestock markets in Sukuro and Terrat which are located 20 to 30 km away from the town center. Markets for crops are within the village and outside the village depending on the amount harvested and the demand. There is no specific market area for crop in the village. The village is located within a wildlife dispersal area and within a hunting block. Migration of wildlife from the Tarangire National Park is higher between November and December and their movements are constrained by the development of cropland. Conflicts between wildlife and crop/livestock producers are frequent. Poaching exists in the village in order to supply Arusha and Moshis' markets. Human Health Services are available in the Village. There is one operating dispensary owned by Evangelical Lutheran Church of Tanzania. Health services are offered on cost-sharing basis. There is also one Veterinary Center operated by LIRDO (AWF-LEAD, 2005).

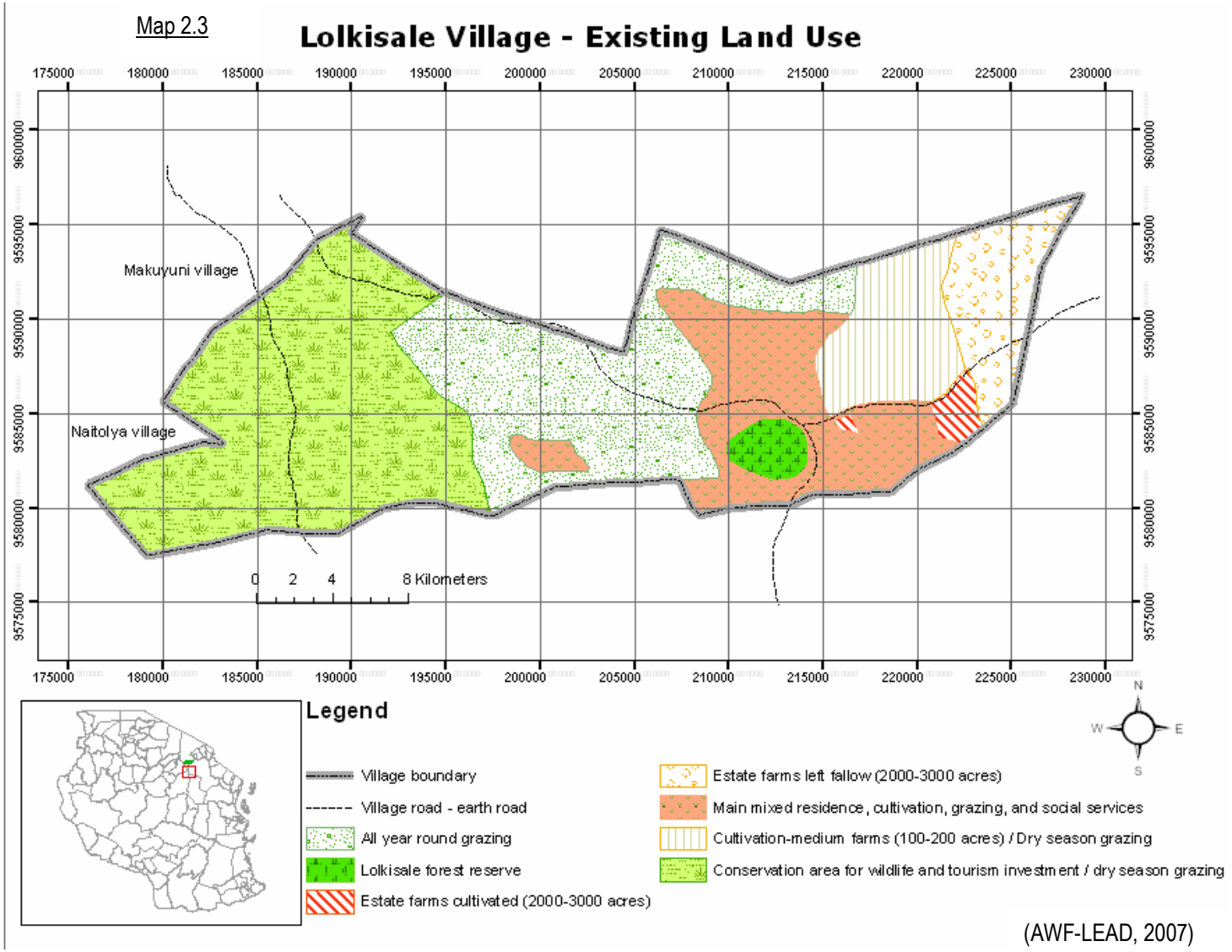
Map 2.1 : Location of the surveyed regions



Map 2.2 : Location of the surveyed village (AWF-LEAD, 2005).

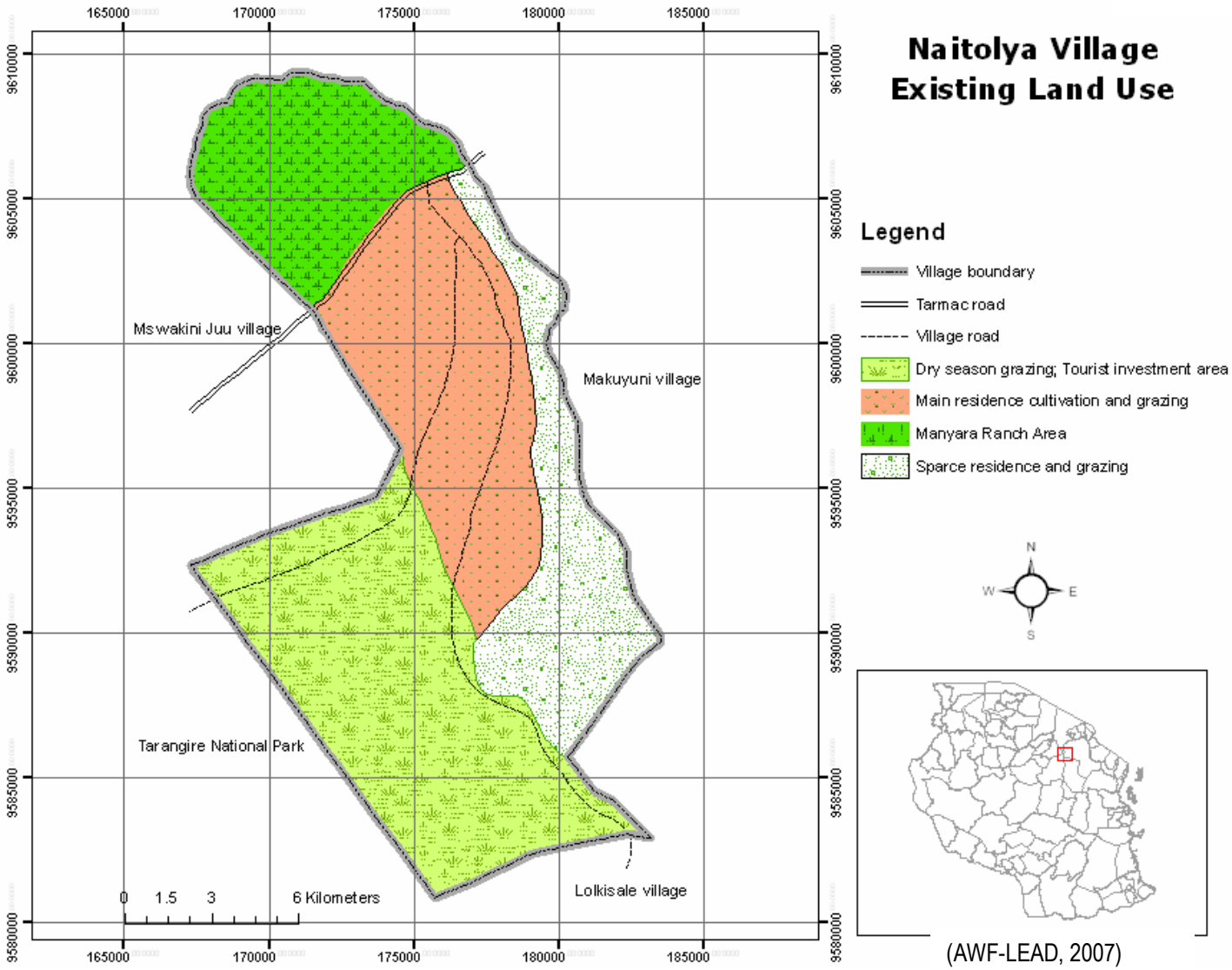


Map 2.3



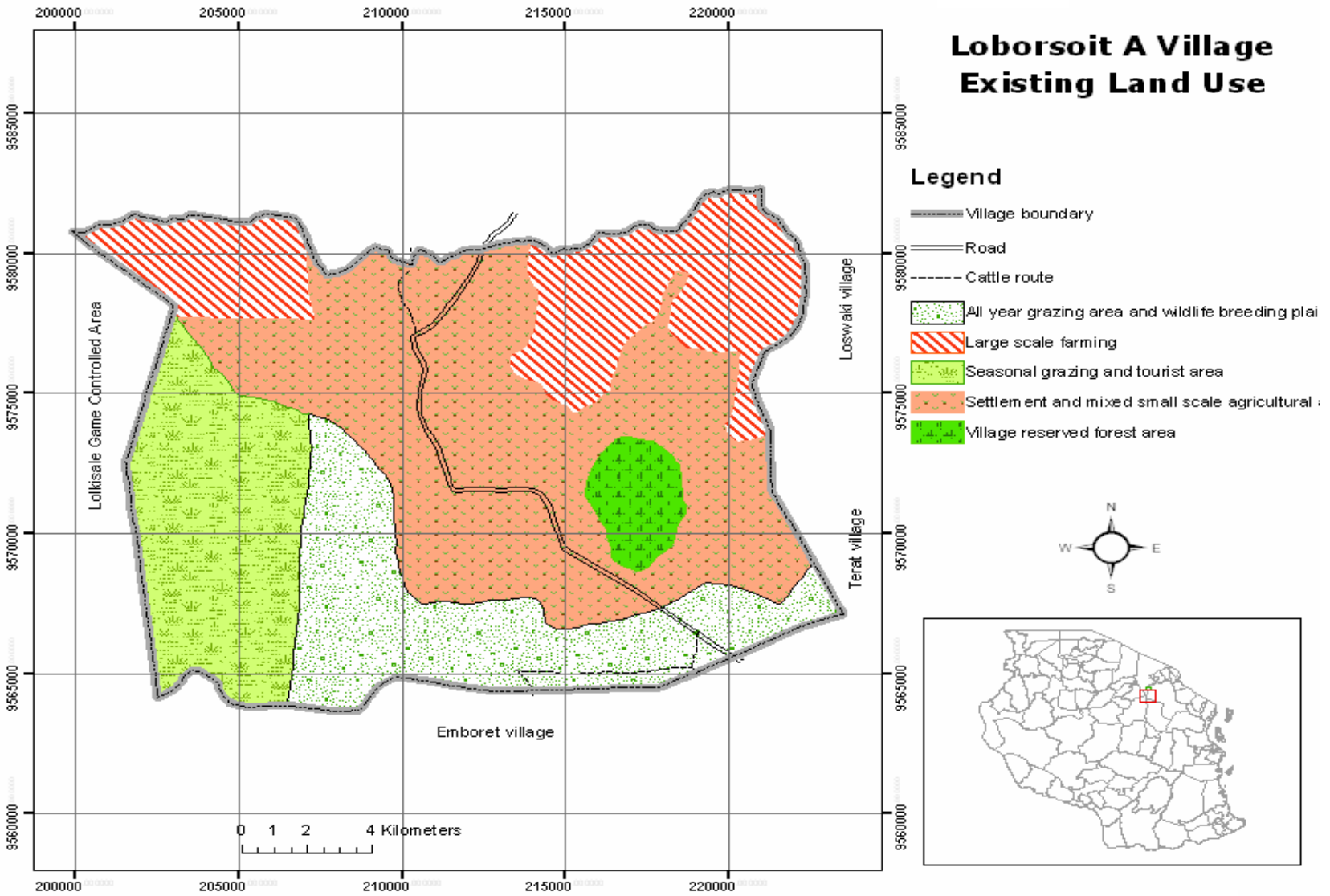
(AWF-LEAD, 2007)

Map 2.4



(AWF-LEAD, 2007)

Map 2.5



(AWF-LEAD, 2007)

3. Data collection Process

3.1. Selection of the Households interviewed

The sampling approach included a combination of a simple random sampling (at household level) and cluster sampling (at village level). The three villages were selected based on local knowledge and are representative of the dynamic at the interface between cropping and livestock rearing activities in the project area. Random sampling allowed for a good representation of the actors selected locally. In that regard, a complete list of households (HHs) was collected in the three selected villages using village government lists. In total the three villages comprised 2098 HHs. In each village 19 % of the HHs were sampled and 400 HHs were planned to be surveyed between August 2006 and February 2007 (table 2.1).

Table 2.1: HH sampling in selected villages

	Loiborsoit.'A'	Naitolya	Lolkisale	Total
Number of Households	825	429	844	2098
Number of sampled HH	157	82	161	400
Sampling ratio	19.1 %	19.1 %	19.1 %	19.1 %

3.2. Questionnaire

The questionnaire was developed with the support of FAO, ILRI, Reading University and locally AWF through discussions with international and local experts. The questionnaire was tested during the training of the enumerators and further adapted.

The questionnaire covers the following topics.

- ***Background information***: This section focuses on the description of the respondent. The description includes: the location of the HH (including GPS coordinates), education level, marital status, main occupation, ethic group and clan, place of birth of the respondent and of the mother and father of the respondent.
- ***History of the household***: This section determines the origins of the household.
- ***Structure of the household***: This section describes the composition of the HH. It includes for each HH member, information on age, gender, relationship with the head of the household (HHH), the level of

education in years, and the places of birth and living. It also includes information on the ethnic and clan group, the language spoken, whether the HHH has a leadership position (and if yes which one) or if the HHH has a family relative who has a leadership position (and if yes, which one).

- ***Land ownership***: This section describes the current land ownership and the land tenure history. For each plot, information on its location, size, type of land use and mode of acquisition was provided. Regarding the land tenure history, information on the mode of acquisition, its previous use was collected. Other information on the willingness to sell or buy land in the future was assessed.
- ***Livestock Production*****:** General information on herd history and herd management were collected including the date that the HH engaged in into livestock production, whether the family is traditionally engaged in livestock production, the number of herds, and a description of the herds. The herd structure and dynamics for cattle, sheep and goats are explored in detail. This includes information on the current herd structure in 2005 and 2006, (number of animals according to the breed, age and gender) and the dynamics of the herd including number of animals slaughtered, mortality, sales, purchases, gifts. Information on livestock marketing (including, distance to the market, prices of the animals sold, time and costs to the market, types of vendors) and meat consumption were also collected. Production and consumption of other livestock products were also investigated. This includes data on milk, poultry, hides and skins, manure and honey. Feed management was also briefly explored particularly in relation to the use of common land and mobility. Information on livestock inputs were also collected including: costs associated to drugs, chemicals and supplement, and the labor needed for the different activities.
- ***Crop production:*** General information on crop production history was collected. Planting season and outputs were investigated. This includes information on the cropping calendar for the various crops, outputs per plots and crop, land preparation techniques, and the inputs required (including labor inputs). The use of the crop products and marketing strategies were also investigated (information on quantities consumed, reseeded, sold to neighbourhood, sold to traders and gifts collected).

- ***Off-farm income**:* Detailed information on other sources of income was collected at HH level.
- ***Water management:*** Information on water facilities, livestock watering strategies and capacities and on irrigation techniques was collected.
- ***Access to facilities:*** Information on distance to major facilities was collected.
- ***Financial capacity, investments and strategy:*** This section includes information on agricultural production objective at the HH level, investors support and access to credit (from individuals and institutions), belongings and savings, investments strategies (bank account, savings, and potential future investments) and taxes.
- ***Consumption patterns***: food consumption on a weekly basis was evaluated at the HH level for both the dry and the wet seasons.

3.3. Enumerators

For the consistency of the data collected and a smooth implementation process it was decided that the enumerators selected should answer the following criteria: a) be based in the investigated villages, b) meet minimum education standards (completed form 4) and c) be geographically dispersed in order to limit transportation needs. Four enumerators were selected to complete the household survey in Loiborsoit.'A', 3 in Lolkisale and 2 in Naitolya. A 3.5 days training session for the enumerators was conducted in Makuyuni in August 2008. The training included: a) the presentation of the project and the objectives of the survey, b) the in depth presentation of the questionnaire and its translation into Maa and Swahili, c) the pre-testing of the questionnaire and the review of the data collected d) a training session on the use of a GPS and e) the selection of the HHs to be investigated. The enumerators were monitored regularly during the data collection period.

3.4. Data entry – analysis

A Microsoft Access interface to be used for improved data entry was developed and a person trained to enter the data. After being entered the data were cleaned and missing or incomplete information identified. Due to the poor initial data entry, the data base had to be cross-checked several times and inconsistencies

highlighted. Ultimately, a second round of data collection was organized in order to fill the gaps and check the observed inconsistencies before data analysis. The data analysis was conducted mid-2008 using Mat lab, Stata and Microsoft excel Software.

4. Background information on the households sampled and the respondents

4.1. Participation Ratio

In total 363 out of the 400 households (91 %) sampled agreed to participate in the survey (table 4.1). In total the survey collected 149 questionnaires in Lolkisale (93 %), 71 questionnaires in Naitolya (87 %) and 143 questionnaires in Loiborsoit.'A' (91%). The overall sampling ratio remains high: 17.3 % of the total number of HHs in the selected villages participated to the survey. The high participation ratio (95%) may be due to the strategy to use enumerators based in the surveyed villages. This allowed for the establishment of a relation of trust between the participants and the enumerators.

Table 4.1: Sampling and participation in selected villages

	Lolkisale	Naitolya	Loiborsoit.'A'	Total
Number of HHs	844	429	825	2098
Number of HHs surveyed	149	71	143	363
Sampling ratio	17.7 %	16.6 %	17.3 %	17.3 %
Participation ratio*	93 %	87 %	91 %	91 %

* % of HHs which accepted to participate among the selected HHs.

4.2. Sub-villages surveyed

The survey covered 7 sub-villages in Lolkisale (Lolkisale A, Lengoolwa A, Lengoolwa B, Lengoolwa C, Nyorit A, Nyorit B and Lemooti); 2 sub-villages in Naitolya (Engusero & Ormangwai) and 8 sub-villages in Loiborsoit.'A' (Olemooti, Losesia, Engarkash, Nyorit, Ormotoo, Madukani, Mbuko, Osilalei).

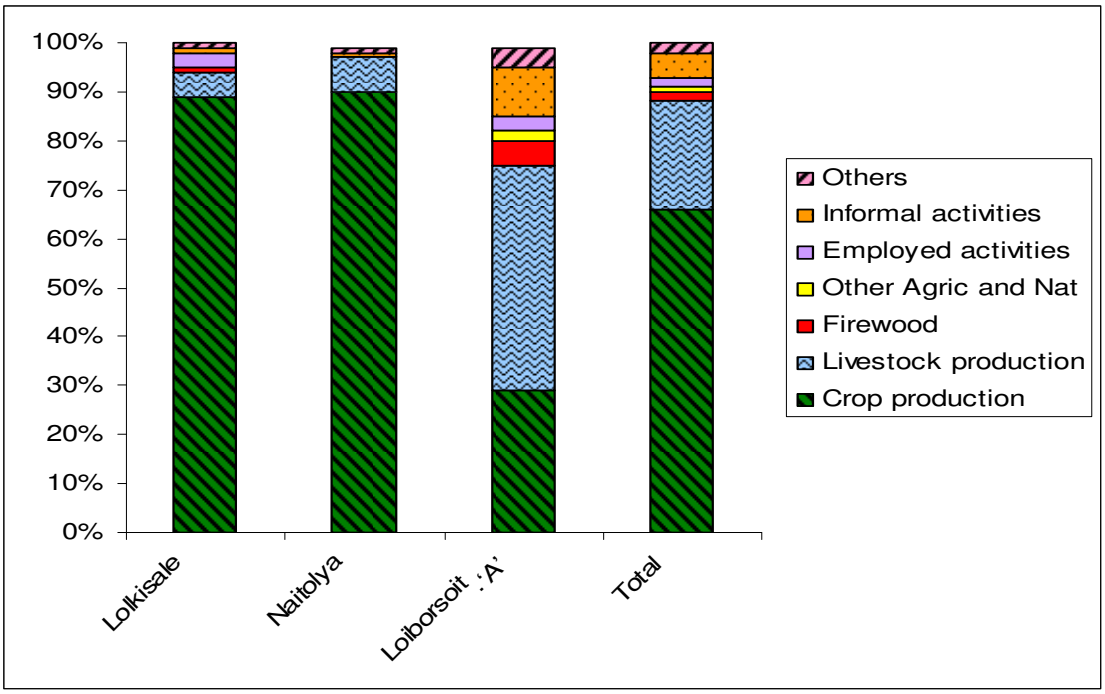
4.3. Characteristics of the respondent

Eighty percent of the questionnaires were answered by the head of the household (HHH) himself, 14 % by the wife of the HHH, the remaining 6 % were answered by either: the son, the daughter, the brother or mother of the HHH. This is in favor of a good accuracy of the data collected as the respondents are close to the daily management of the HH activities. 60 % of the respondents were male, 55 % never received a formal education but 40 % attended at least 7 years to school. Most of the respondents were young with 75 % of the respondents were below 40 years old.

4.4. Main occupation of the respondent

The main source of employment as declared by the respondent does not necessarily reflect the main source of income of the HH. It is nevertheless an indication of the importance given by the HH to an activity. This information should be compared to the relative importance of the different income generating activities of the HH. Furthermore in the case of the respondent it may be a bias in the way information is provided (or known by respondent) on the different activities implemented by the HH. Agricultural or natural resource based activities represent the perceived main occupation for 90 % of the respondents (figure 4.1 & annex 1).

Figure 4.1: Main occupation of the respondents in the three villages



Crop production activities dominate in the sample and were declared as the main source of employment for 66 % of the respondents. Livestock production was mentioned by 22 % of the respondents. This appears to be low for a region traditionally renowned for practicing livestock-based activities. Formal employment activities are marginally mentioned by the respondents and only represent 2 % of the sample. Tourism based activities were only mentioned by 1 % of the sample. This underlines the weak contribution of the tourism sector to the local economy despite the proximity of the National Parks. Major differences can be noticed among the three surveyed villages. While crop production clearly dominate in Monduli (89 % of the

respondents in Lolkisale and 90 % of the respondents in Naitolya), Livestock production dominate in Loiborsoit.'A' (46 % of the respondent). Furthermore, income diversification was much more pronounced in Loiborsoit.'A' where 18 % of the respondents mentioned a non agricultural activity as main source of employment.

5. History of the households

5.1. Registration of the household by the authorities

98 % of the HHs surveyed were officially registered at village level.

5.2. Origin of the households

Only 44 % of the HHs declared to originally come from the villages surveyed. This ratio varied significantly among the three villages. The lowest ratio was found in Lolkisale (30 %), followed by Naitolya (51 %) and Loiborsoit.'A' (57 %). This reflects the high immigration ratio that has already been described by the literature for this area. Immigration in the region was usually linked to the development of agriculture through land allocation to individuals or through the high demand for seasonal labor generated by the development of large-scale agriculture.

Among the HHs that are not originally from the surveyed village 98.5 % indicated coming from Tanzania, 1 % from the neighboring Kenya and 0.5 % form Burundi. These HHs are declaring coming from the Regions and Districts surrounding the two surveyed District (table 5.1, annex 2 and map 5.1). These regions include Kilimanjiro, Dodoma, Tanga, Mara and Singida. It has also to be noted that most of the HHs who immigrated, did so from a village located in the same district or a district formerly attached to their current district. In that sense in Lolkisale, 60 % and in Naitolya, 70 % of the immigrants are originating from Arumeru or Monduli and in Loiborsoit.'A' 27 % of the HHs found their origins in another village in Simanjiro and 31 % in Arumeru. Nevertheless we need to take into account that they may be an important bias when recording the origin of the HHs. Many of the immigrants don't want to indicate their real place of origin as this may single them out of the community. This is especially true when the HH emigrated from a region in Kenya Kenya (Ole-Neselle and Mollel, 2006).

5.3. Date of immigration

The date of immigration is biased against the age of the head of the household. Nevertheless if we consider that the heads of the household are relatively young and that the date of immigration and settlement in the

village is recent, one could consider this indicator as a good proxy to assess immigration and settlement trends.

Immigration and settlement seems to be a recent phenomenon. In Lolkisale most of the immigration seems to have taken place in the 1990's. Furthermore 90 % of the immigrants settled in this village after 1980's. In Naitolya the immigration rate was more stable over time while in Loiborsoit.'A' this immigration is extremely recent as 72 % of the immigrants settled in the village after 1990's and 36 % after 2000 (table 5.2).

Table 5.1: Declared Region and District of origin of the immigrants in the surveyed village

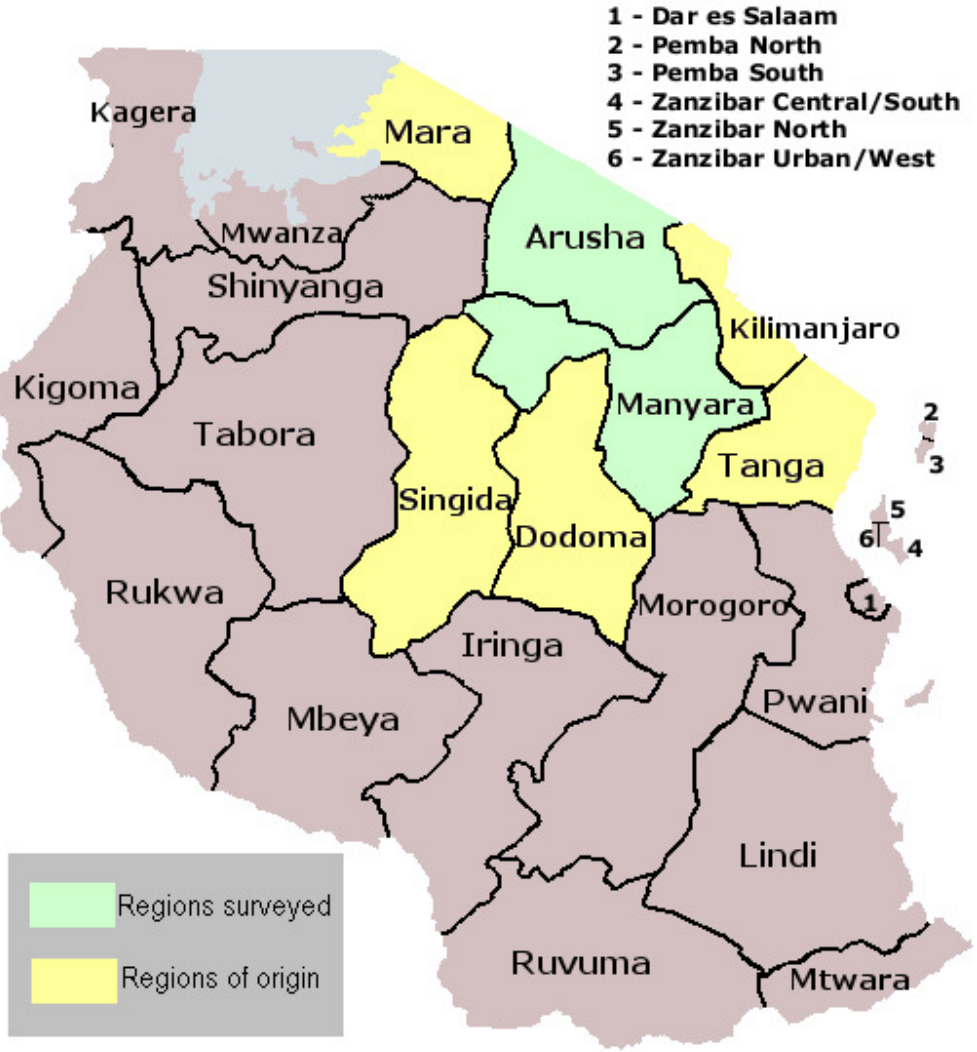
Region	District	Lolkisale	Naitolya	Loiborsoit.'A'	Total per Region
Manyara	Simanjiro	10 %		27 %	20 %
	Babati	5 %			
	Hanang	1 %	3 %		
	Kiketo			3 %	
	Mbulu	1 %	3 %	2 %	
Arusha	Arumeru	37 %	57 %	31 %	68 %
	Karatu	2 %	11 %		
	Monduli	22 %	23 %	24 %	
	Ngorongoro	4 %		2 %	
	"longido"	2 %			
Kilimanjiro	Hai	2 %	3 %	2 %	2.5 %
	Moshi	1 %			
Dodoma	Kondoa	2 %		5 %	2.5 %
Tanga	Korogwe			2 %	0.5 %
Mara	Musoma	1 %			1 %
	Tarime	1 %			
Singida	Iramba	1 %			4 %
	Manyoni	3 %			
	"Mkalama"	2 %			
	"Ilongero"			2 %	
Tanzania	Don't know	1 %		2 %	1 %
Burundi		1 %			0.5 %
Kenya		2 %			1 %

NB: The districts in italic are not official districts

Table 5.2: Decades of settlement into the surveyed village

	Lolkisale	Naitolya	Loiborsoit.'A'	Total per decades
< 1970	1 %	6 %	5 %	3 %
1970-1979	9 %	32 %	3 %	11 %
1980-1989	23 %	32 %	20 %	24 %
1990-1999	53 %	21 %	36 %	42 %
2000-2005	14 %	9 %	36 %	20 %

Map 5.1: Origin of the HHs



6. Structure of the households

6.1. Characteristics of the heads of the household

The HHHs are at 72 % male and their mean age is 40.2 years old. The HHHs are relatively young as 61 % of them are below 41 years old (figure 6.1).

The proportion of female headed HHs (28%) is slightly higher than at National level (20 % in 2006) (NBS, 2006). In fact several non-Maasai migrants who worked in the large farms as laborers died, leaving widows in charge HHs. This situation was observed in Lolkisale for example Kenya (Ole-Neselle M. and Mollel G., 2006)..

With regard to education, 55 % of the HHHs have never attended school but 32 % have also received more than 7 years of education corresponding to pre-form one in the Tanzanian educational system. There is therefore a clear dichotomy in the population among those who are illiterate and those who are in a position to read and write. This may create inequalities locally with regard to access to natural resources and in particular when securing land tenure rights. The literacy rate of the HHHs in our sample is a bit lower than what was observed during the Agricultural Sample Census, 2006 where the 40 % of the HHHs were considered illiterate for the Manyara and Arusha regions. This could be explained by the relative remoteness of the villages of our sample (and in particular before the development of the tarmac road) and the fact that traditional educational systems often failed to reach pastoral societies. It is also important to note that literacy rates were low in the two regions compared to other Tanzanian estimates. Manyara and Arusha ranked 18th and 19th out of 21 regions in terms of HHHs literacy rate.

The HHHs are at a large majority Maasai (86 %). Other ethics groups represented among the HHs include: Iraq, Rangi, Mbulu, Chaga, and Nyiramba. Only three ethnic groups are represented in Naitolya : Maasai (90 %), Iraq (9 %) and Changa (1 %), while in Lolkisale diversification is much more pronounced. In this village Maasai only accounts for 77 % of the population and a total of 15 different ethic groups were also identified (table 6.1). This can be directly put in parallel to the conclusion made in Chapter 5, where we

observed that the percentage of immigrants and the diversity of their geographical origin were the highest in Lolkisale.

Figure 6.1: Age structure of the HHHs.

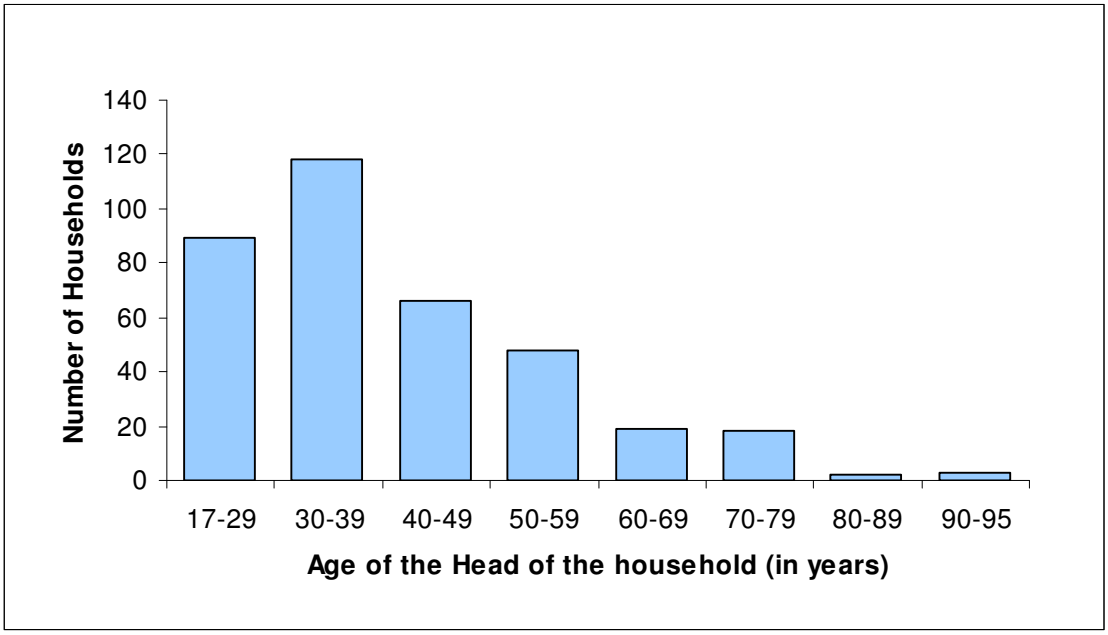


Table 6.1: Ethnic group of the HHHs.

Ethnic group	Lolkisale	Naitolya	Loiborsoit.'A'	Total
Maasai	77 %	90 %	94 %	86 %
Iraq	1 %	9 %		2 %
Rangi	5 %		1 %	3 %
Mbulu	3 %		1 %	2 %
Chaga	3 %	1 %		1 %
Gogo	2 %			1 %
Nyiramba	3 %			1 %
Others*	6 %		4%	4%

** : Meru, Sandawe, Nyaturu, Samba, Kamba, Kuria, Suami, Rundi,*

Among the Maasai, 4 different clans were identified (table 6.2). The Mollel and the Laizer dominate the picture. Maa and Kiswahili are the two languages that are spoken by the large majority of the population. Eighty-eight percent of the HHHs spoke Maa and 65.0 % spoke Swahili. The ability to speak English reflects

the level of education the HHs population and reflects the capacity of the HHs to engage into premium activities in the tourism industry. Among the HHHs only 3 % were able to speak English (against 4.9 % at National level, NBS – 2006). The highest ratio was found in Naitolya where 6 % of the HHHs speak English. This constrains the involvement of the HHs into tourism based activities.

Table 6.2: Clan group of the HHHs among the Maasai.

Maasai clan group	Lolkisale	Naitolya	Loiborsoit.'A'	Total
Laizer	45 %	20 %	58 %	45 %
Mollel	42 %	67 %	30 %	42 %
Lukumai	7 %		12 %	8 %
Kivuyo	6 %	13 %	1 %	5 %

6.2. Connection of the households to the decision making process

Holding a leadership position or being connected to someone holding a leadership position could be a factor influencing access to a communal asset and in particular land. Nine percent of the HHHs were considered as holding a leadership position. Among them 82 % referred to a leadership position within the village and sub-village administration (chairmanship, village government member, and secretary), 15 % to a traditional leadership position (clan leader) and 3 % to a religious position.

Twelve percent of the HHHs considered being linked to someone holding a leadership position. Among them 85 % referred to an official leadership position. In this case higher administrative positions were mentioned at ward level[1] for example. Ninety percent of the persons holding the leadership position were part of the close HHs family circle (son, husband, father, and mother). It is nevertheless difficult at this stage to determine the influence of such factors on land distribution for example and further analysis is required.

6.3. Occupation of the head of the households

Again the main occupation of the HHHs is at a large majority (91 %) associated with agricultural and natural resource based activities (table 6.5, Annex 3). This ratio is the highest in Lolkisale and Naitolya (with 97 % in both cases) and the lowest in Loiborsoit.'A' (91 %) where a significant part of the HHHs is engaged in

[1] Districts are divided into wards.

informal activities (11 %). In looking at the break down of the main occupation categories, crop production is the main occupation of choice (66 % of the respondent) among the three villages and indicate the importance of this activity in the surveyed area. Livestock is presented as the main occupation for 22 % of the HHHs. Profound differences can be found at village level. In Lolkisale and Naitolya, crop production was presented as the main occupation for 90 % of the HHHs, while livestock production was presented as the main occupation for only 6 and 7 % of the HHHs. In Loiborsoit.'A', livestock production remains key as 46 % of the respondents considered it as the main occupation of the HHHs while crop production was presented as the main occupation for only 29 % of the HHHs.

Looking at the total set of activities in which the HHH is declared to be engaged (table 6.4), we can note that the difference between the two villages in Monduli (Lolkisale, Naitolya) and the village in Simanjiro (Loiborsoit.'A') is striking. In Lolkisale and Naitolya, almost the totality of the HHHs are engaged into crop production (97 % and 99 % respectively) while this ratio fell at only 51 % of the HHHs in Loiborsoit.'A'. Nevertheless in Lolkisale and Naitolya a more important part of the population (79 % and 65 %) is also engaged into livestock production while in Loiborsoit.'A' this ratio is only 58 % of the population. We can conclude that while Lolkisale and Naitolya, crop production is presented as the main occupation of the HHH, they often combine this activity with livestock production while in Loiborsoit.'A' it seems that an important share of the population is specialized either in livestock or crop production. The next chapters will confirm this hypothesis. We can also note that the level of income diversification among the HHHs remains poor. The other four main activities in which the HHHs are engaged are: local business (5 % of HHs), firewood or charcoal sale (4 %), watchman (2 %) and mining (2 %).

Table 6.3: Main occupation of the HHH

Activities		Percentage of respondents							
		Lolkisale		Naitolya		Loiborsoit.'A'		Total	
Agricultural and natural resource based activities	Crop production	89.9		90.1		28.6		65.8	
	Livestock production	6.0		7.1		46.1		22.1	
	Poultry production	0	96.6		97.2	0.7	81.1	0.6	90.9
	Honey producer					0.7		0.3	
	Firewood or charcoal sale	0.7				4.9		2.2	
Employed activities	Teacher	0.7						0.3	
	Watchman	0.7	2.0			2.1	3.5	1.1	2.2
	Tourism employee (hotel lodge / trekking)	0.7				1.4		0.8	
Informal activities	Local business (retail shop, tailoring)			1.4		4.2		1.9	
	Mining	0.7		1.4		2.1		1.4	
	Mechanics		0.7		1.8	0.7	10.5	0.3	5.0
	Maasai houses constructor					0.7		0.3	
	Driver - transport					2.1		0.8	
	Local brewer					0.7		0.3	
Others	House wife					3.5		1.4	
	Evangelist		0.7			0.7	4.9	0.3	2
	Disabled - None	0.7				0.7		0.3	

6.4. Village of birth of the HHHs

Almost all of the HHHs are born in the surveyed district or in a neighboring district (table 6.6). Thirty-eight percent of the HHHs were born in the village where the HH is currently settled. This rate is lower and comparable in the two villages in Monduli (26 % in Lolkisale and 25 % in Naitolya) and higher in Loiborsoit.'A' (57 %). We can easily establish a parallel between this observation and the high immigration rate reported in Monduli (previous chapter). The fact that the HHH find his origin in the village may have an influence on his ability to mobilize local networks and influence its access to resources.

Table 6.4: Occupations of the HHH (in percentage of HHHs engaged into a given activity).

	Activities	Percentage of respondents Lolkisale	Naitoly a	Loiborsoit.'A'	Total
Agricultural and natural resource based activities	Crop production	97 %	99 %	51 %	78 %
	Livestock production	79 %	65 %	58 %	68 %
	Poultry production	1 %		0.7 %	1 %
	Honey producer		1 %	0.7 %	1 %
	Hunter	1 %			0 %
	Water fetching			1 %	0 %
	Firewood or charcoal sale	1 %	3 %	7 %	4 %
Employed activities	Teacher	1 %	1 %		1 %
	Watchman	1 %		5 %	2 %
	Tourism employee (hotel lodge / trekking)	1 %	1 %	1 %	1 %
	Machine operators			1 %	0 %
Informal activities	Local business (retail shop, tailoring)	4 %	7 %	6 %	5 %
	Mining	1 %	1 %	2 %	2 %
	Mechanics			1 %	0 %
	Maasai houses constructor			1 %	0 %
	Driver - transport	1 %		3 %	1 %
	Local brewer			1 %	0 %
Others	Evangelist			1 %	1 %
	Disabled			1 %	0 %

6.5. Size of the households

The average size of the HH is small. The mean HH include 4.8 members (variance 9.81) when only considering the HHH its wifes/husband and its direct children (figure 6.2). The mean size increases to 5.2 members (Variance 11.97) when considering all the dependants (mother of the HHH, nephew, niece and other relatives) (figure 6.3). Eighty four percent of the HH included between 1 to 7 members. The largest HH observed included 30 members. When looking at the mean composition of the HH, it includes 1.5 adult male and 1.4 adult female, 0.9 male and 0.7 female between 5 and 10 years old, 0.4 male and 0.3 female below 5 years old.

Figure 6.2: Size of the HH investigated (including HHH, wife/husband, and children)

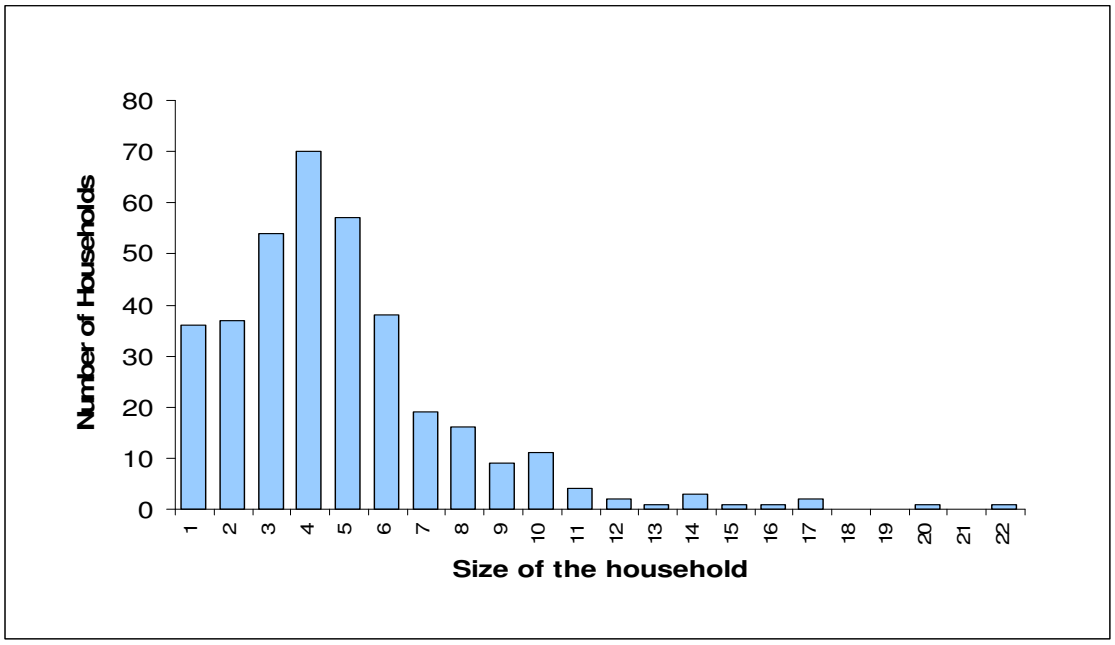
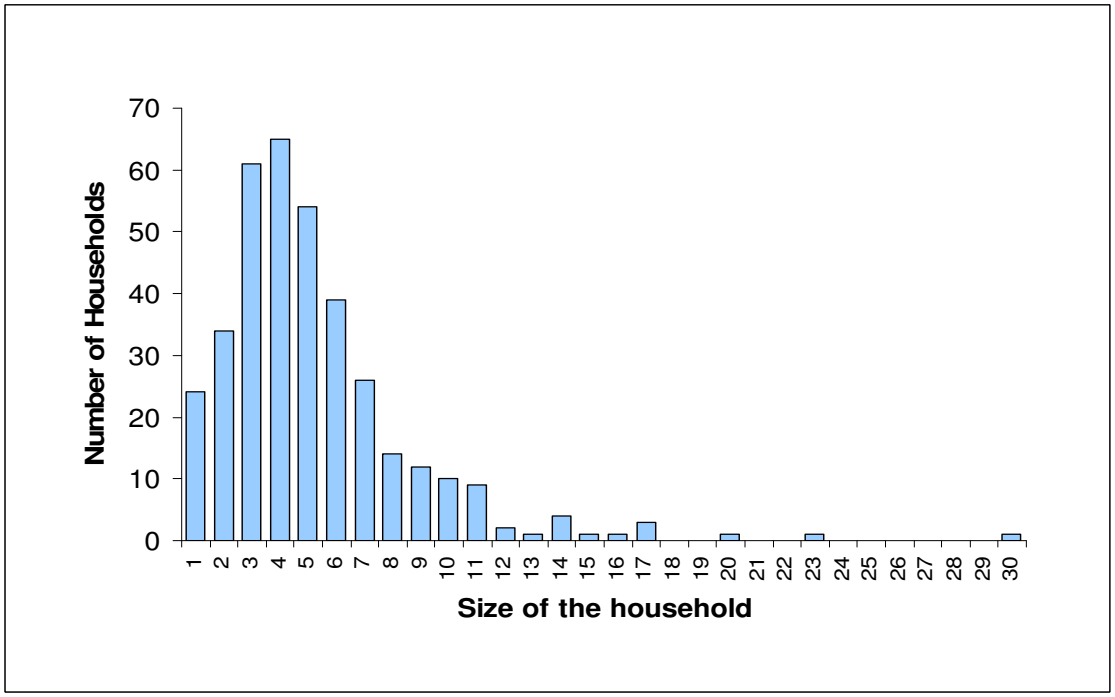


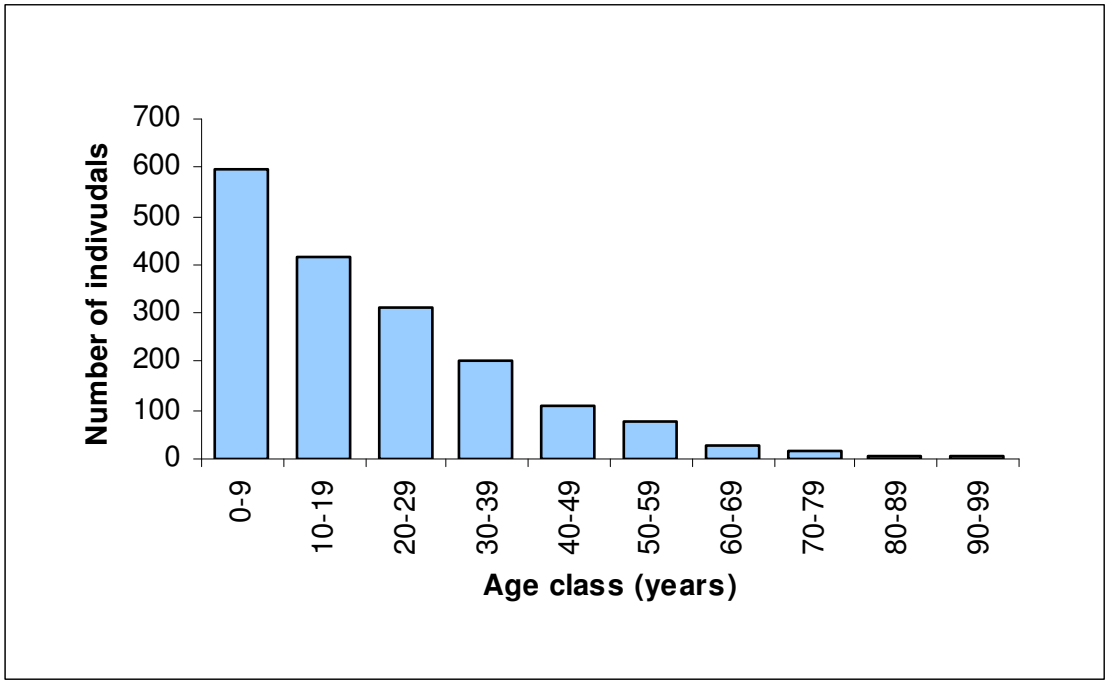
Figure 6.3: Size of the HH investigated (including all dependants)



6.6. Composition of the total population surveyed:

The total population surveyed included 1,864 inhabitants (1,756 HH members *sensus stricto*). When extrapolating this to the three villages the estimated population in 2005 is 10,775 inhabitants for the surveyed area. The population (of the HH member *sensus stricto*) is at 52.8 % male and is extremely young: 57.7 % of the surveyed population is below 20 and 33.8 % is below 10 (figure 6.4). The structure of the population is characteristic of the one of a developing country and in strict conformity with the population pyramid observed at national level (31 % of the population below 10; 58 % below 20) (NBS, 2006).

Figure 6.4: Age of the population investigated (including HH members SS)

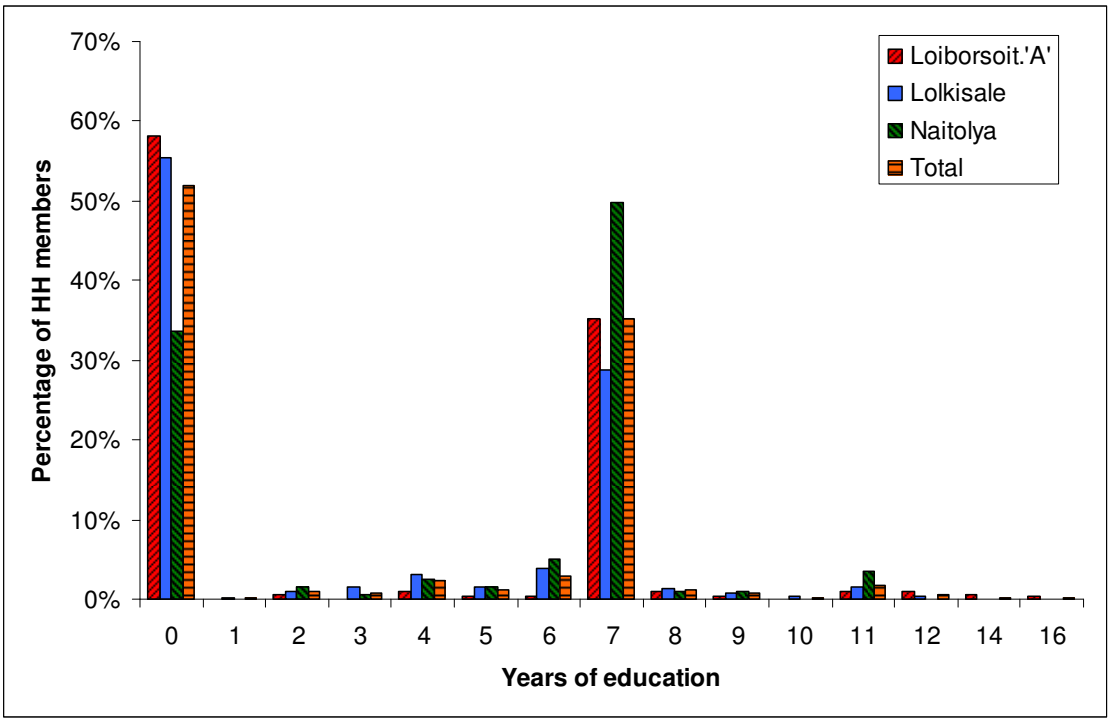


6.7. Education

51.8 % of HH members over 15 never attended school, but 39.8 % had a minimum of 7 years of education. Among the sons and daughters of the HH between 6 and 15, 59.1 % are attending school but 17 % of them are also engaged into another activity (cropping / herding). The overall schooling rate among the 9-13 is 66 %. The schooling rate greatly varies among the villages with 85 % of the children between 9-13 going to school in Naitolya, 68 % in Lolkisale and only 44 % in Loiborsoit.'A'. The overall level of education remains

low. This has of course a clear impact on the availability and accessibility of exit strategies locally. The low education level also hinders the development of tourism. In comparison to the national average, the level of literacy is lower in the three surveyed villages. In the villages: 48 % of the HH members never went to school against 40 % at national level. It has to be noted that education status in the Manyara and Arusha regions is low compared to other Tanzanian regions, Arusha ranking 19th and Arusha 16th out of 21 Regions (NBS, 2006) (Figure 6.5).

Figure 6.5: Years of education for the HH members



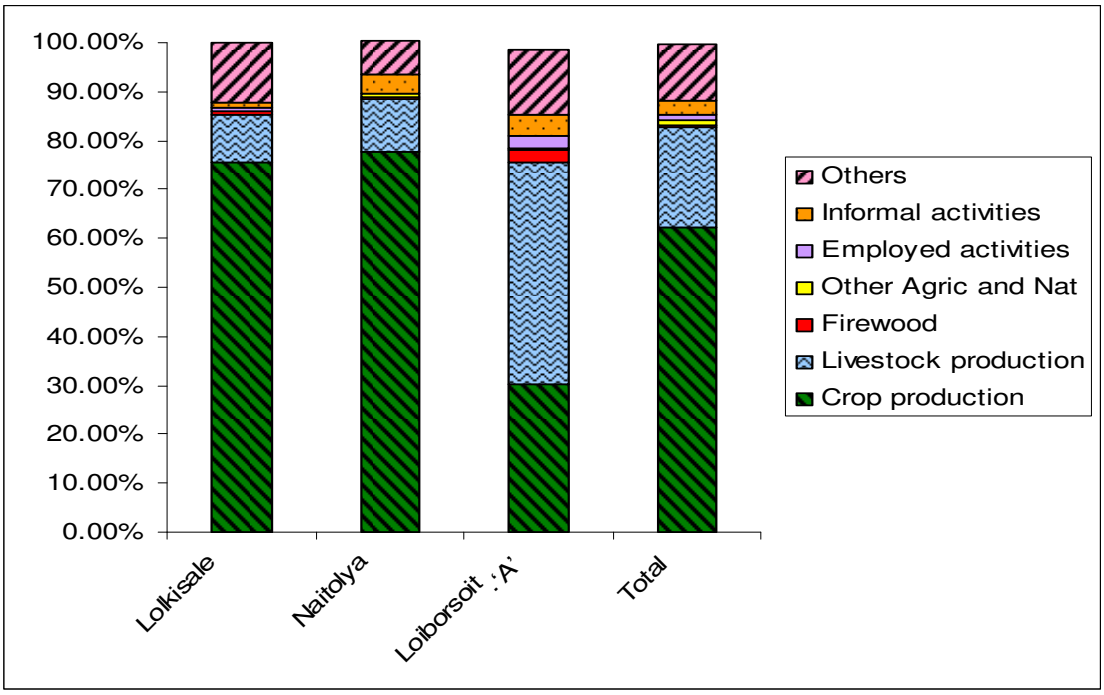
6.8. Main occupation of the HH Members

Agricultural and natural resource based activities dominate among the sample accounting for 83.2 % of the main activities of the adults (above 15 years old). The observations made at the HH level can also be drawn here. In Lolkisale and Naitolya, crop production activities are clearly dominant (75.7 % in Lolkisale and 77.6 % in Naitolya) while in Loiborsoit.'A' the livestock activities dominate (45.2 % of the adults). Income diversification is more apparent in Loiborsoit.'A' where for 6.8 % of the adults, the main activity is a non agricultural, informal or employed activity (figure 6.6).

6.9. Village of birth of the population

In total, 70.2 % of the HH members in Loiborsoit.'A' were born in the village they are currently living in, while In Naitolya and Lolkisale this ratio was of 59.2 and 58.9 % respectively. 82.8 % of the children (of the HHH) were born in Loiborsoit.'A', while in Naitolya and Lolkisale this ratio is of 76.1 % and 75.3 % respectively. This latest observation is in favor of the fact that most of the families moved and settle into a new village when the family structure was small and developed afterwards. This supports the described settlement trends in the area with traditional livestock herders becoming sedentary.

Figure 6.6: Main occupation of the HH members in the three villages



7. Land Ownership

7.1. Land owned by the household

The 2006 agricultural sample census highlighted the perceived land scarcity at HH level in the Arusha and the Manyara Regions. Arusha ranked last in terms of HHs reporting sufficiency of land (with only 30 % of the HHs declaring having sufficient land) and Manyara ranked 18 out of 21. In the surveyed area, the mean land holding by HH is 8.4 acres[2] which is high compared to the national average of 4.95 acres (NBS, 2006). This value masks variations among the HHs (variance: 129). A significant minority (3 %) is land less (figure 7.1) 25 % owns less than 1.75 acres and 50 % below 5 acres (table 7.1).

In comparing land distribution among the three villages, some differences can be noted (figures 7.2, 7.3 & 7.4). The mean land holding size is the highest in Lolkisale [9.39 acres ; 7.75 acres; 7.78 acres][3] but high variability in land size holdings can be observed in the three villages [variance : 108.1 ; 94.6 ; 169.5]. Households in Loiboirsoit'A' seems to be less endowed than in the two other villages. Land holding per caput is also almost 3 times higher in Naitolya (3.0 acres per caput) than in Loiborsoit.'A' (1.1 acres per caput) and more than 2 times higher than in Lolkisale (1.4 acre per caput).

Table 7.1: Land holding distribution (Quartiles – in acres)

	Min	Q1	Q2	Q3	Max
Loiborsoit.'A'	0	0.75	3	10	100
Lolkisale	0	2	6	12	51
Naitolya	0	3	5	10	59
Total	0	1.75	5	10.5	100

[2] 1 acre = 0.404685642 hectare

[3] The notation [X , Y , Z] refers to the estimates for Lolkisale, Naitolya & Loiborsoit.A in a sequential order

Figure 7.1: Land holding in the three villages

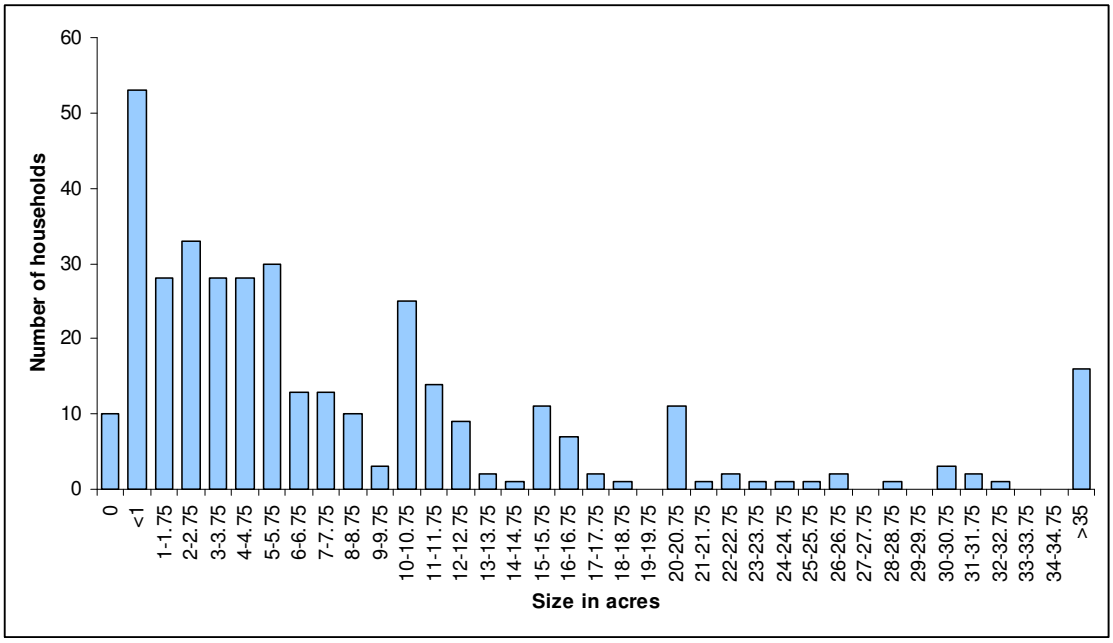


Figure 7.2: Land holding in Lolkisale

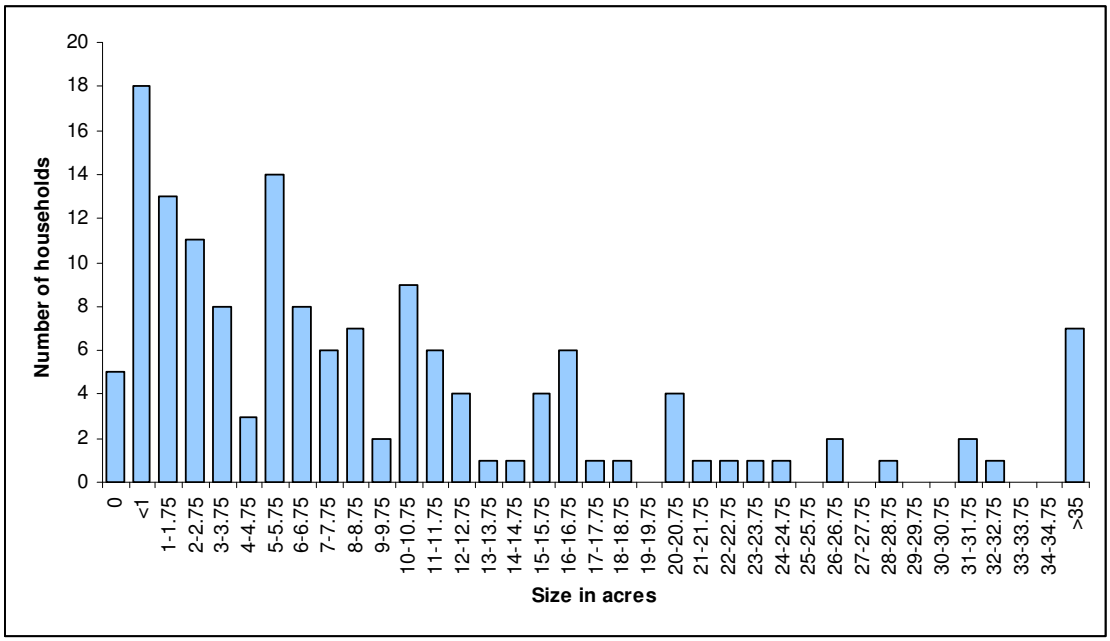


Figure 7.3: Land holding in Loiborsoit.'A'

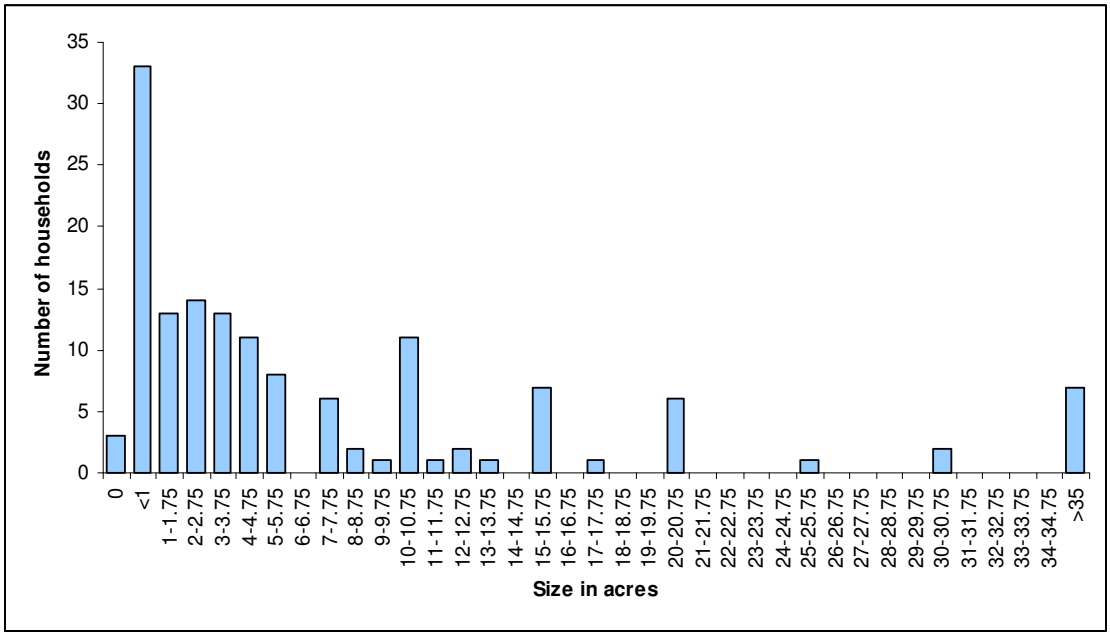
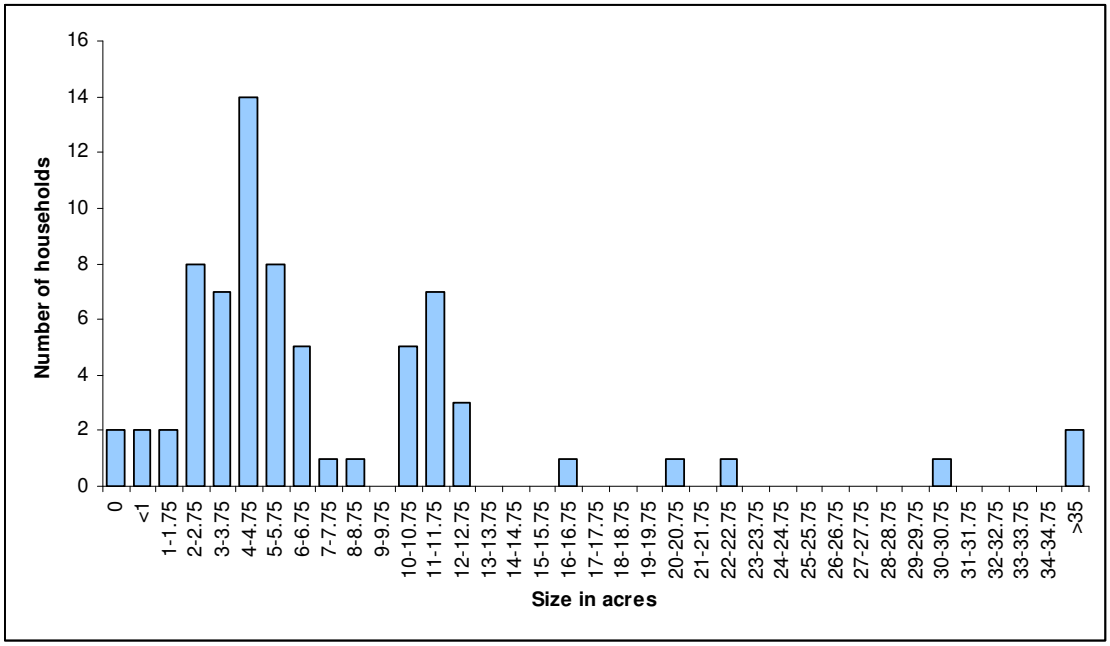


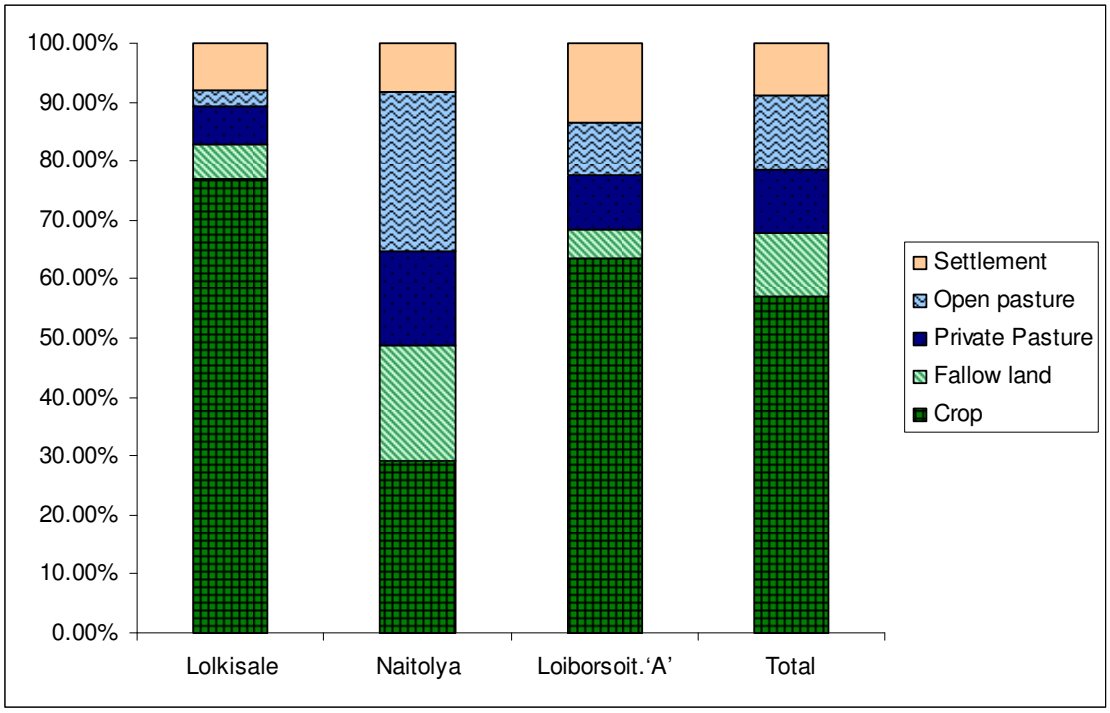
Figure 7.4: Land holding in Naitolya



7.2. Land use

Cropland is the principal land use type and accounts for 57.1 % of the total surface area owned by the HHs (figure 7.4, annex 4). This ratio increases up to 76.9 % in Lolkisale and is relatively low in Naitolya, accounting for only 29.1 % total surface area. The situation in Lolkisale is congruent with the observations at national level where HHs use 80 % of the available land (NBS, 2006). In Naitolya, private and open pasture dominates the land use (43.1 % of the total land owned). This may reflect differences in the land dynamics. In Naitolya where land holding per capita is the highest, only 29 % of the land owned is used for crop production. This goes against the traditional land tenure system and is more in phase with an organized land privatization process in this village.

Figure 7.4: Land use in the three villages



7.3. Fencing

Fencing is a good proxy to measure the land privatization process. The development of fences that regulate movement of people, cattle and wildlife also contribute to the fragmentation of the open space and may have an impact on other actors relying on mobility for their survival (wildlife and pastoralists). Fencing that

was historically limited to the settlement areas in order to protect the household and the animals during the night is now being used to delimitate private lands and protect productive areas against livestock and wildlife depredation. In the surveyed area, almost a quarter of the total private land is fenced. Nevertheless only 15 % of the HHs have partially or totally fenced their productive parcel while 74 % had fenced their settlement area (table 7.2). The mean size of the crop surface fenced is 10.1 acre for Lolkisale, 3.8 for Naitolya, and 5.6 acre for Loiborsoit.'A'. These two elements supports the assumption that larger tracks of lands are more often fenced than smaller ones. The fencing process seems to happen predominantly in Lolkisale where 40.3 % of the land has been fenced (against 9.7 % in Naitolya and 16.1 % Loiborsoit.'A').

The fencing material of choice is the vegetation used dead or alive (82 % of the crop and fallow land and 97 % of the settlement areas are fenced with vegetation material). The use of more sophisticated fencing material such as barbed wire remains marginal (table 7.3). The main incentive for fencing the land varied from village to village. In Loiborsoit.'A' 42 % mentioned the need to demarcate the land (3 % in Naitolya or 11 % in Lolkisale). In Naitolya and Lolkisale the need to protect the crop against wildlife was more significantly expressed (51 % and 55 % of the respondents) than in Loiborsoit.'A'. Finally the need to protect the plot against cattle was only significantly expressed in Naitolya with 11 % of the respondents mentioning it.

Table 7.2: Proportion of HHs that have partially or totally fenced their parcel

	Lolkisale	Naitolya	Loiborsoit.'A'	Total
Productive area	25 %	13 %	5 %	15 %
Settlement	73 %	72 %	75 %	74 %

**The productive areas include: crop land, private pasture, open pasture and fallow land.

Table 7.3: Type of fences used

	Crop and fallow land	Pasture	Settlement
Barbed wire	2 %	0 %	1 %
Vegetation live fence	8 %	20 %	36 %
Net fence	4 %	10 %	0 %
Vegetation dead	73 %	60 %	61 %
Other	14 %	10 %	0 %

7.4. Land acquisition

As the area was traditionally used by pastoralists the date of land acquisition may be an indicator of the existing land pressure on communal resources (table 7.5 and figures 7.4, 7.5 & 7.6). There is nevertheless an important bias when making this assumption due to the relatively young age of the HHHs. But if we make the assumption that the HHHs population is relatively homogenous over the three villages, and that the privatization process is a relatively new phenomenon in the area (reported to have started in the 60's & 70's by the district authorities) the date of land acquisition by our HHHs may be an interesting proxy when measuring the privatization process. In Lolkisale, the land acquisition process by the HHHs started in the late 80's and 50 % of the plots were acquired in the 1990's. Since 2000 the pressure seems to have slowed down as only 16 % of the plots were acquired over the 2000-2006 period. In Naitolya, the acquisition process was more stable over time. In Loiborsoit.'A' the acquisition process was boosted in the late 90s as 47 % of the plots were acquired over the 2000-2006 period and 72 % over the 1995-2006 period

Figure 7.4: Years of acquisition of the parcels by the HHHs in Lolkisale

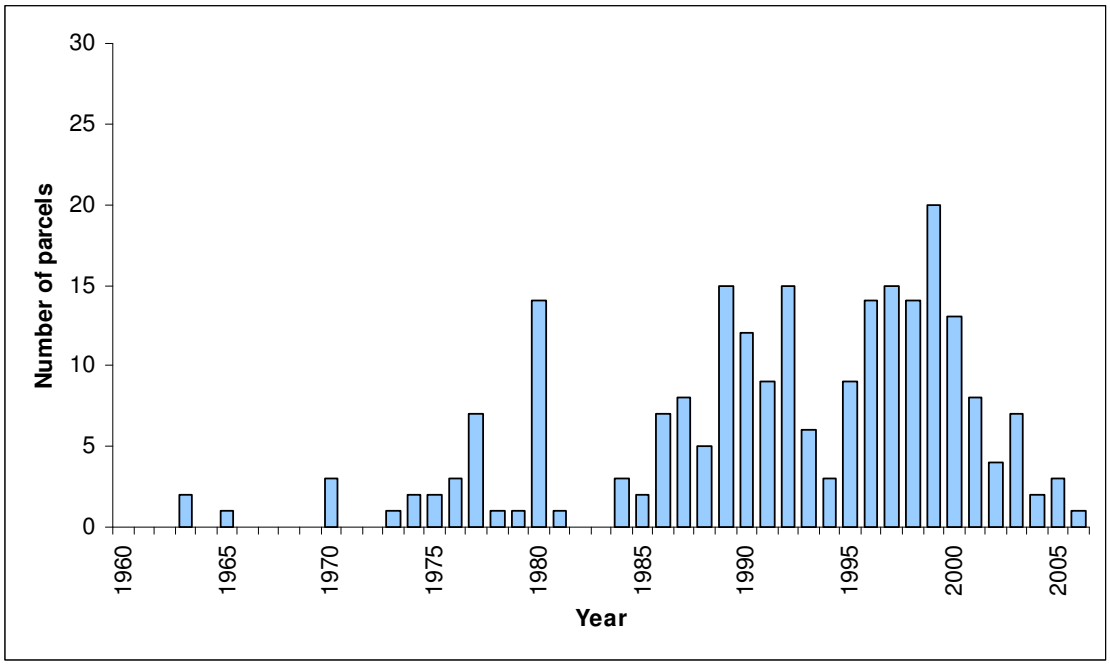


Figure 7.4: Years of acquisition of the parcels by the HHHs in Naitolya

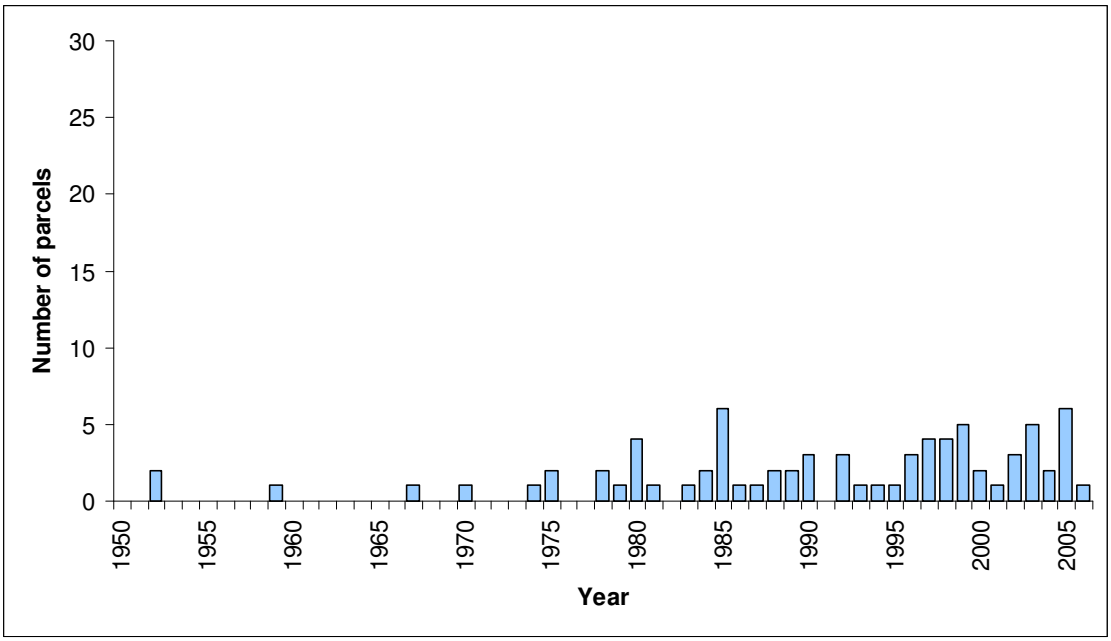


Figure 7.4: Years of acquisition of the parcels by the HHHs in Loiborsoit.A

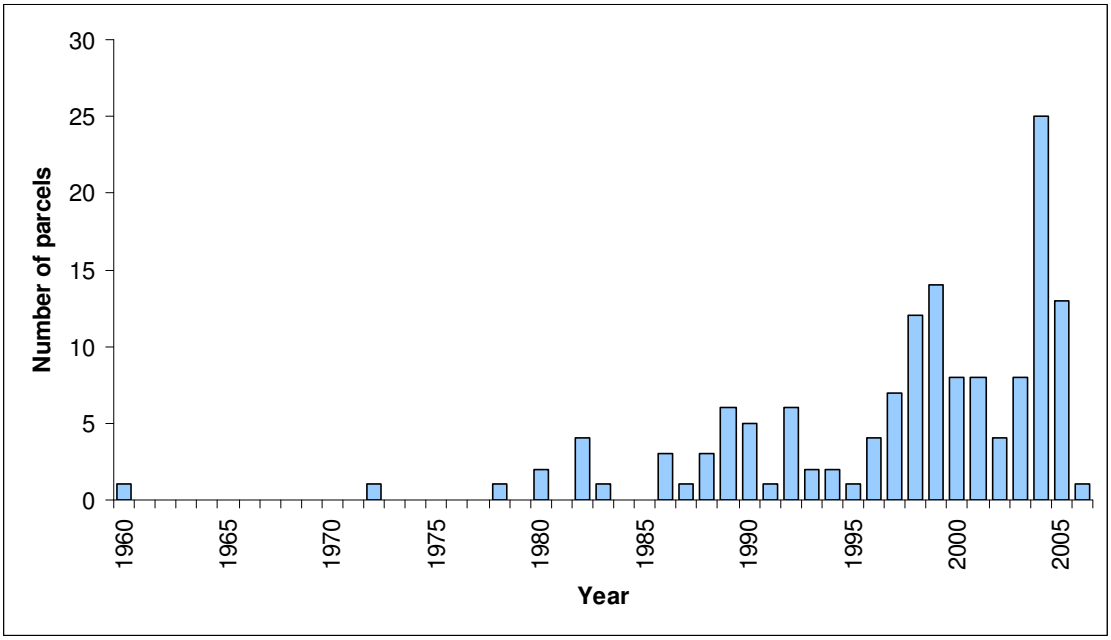


Table 7.4: Decade of acquisition of the parcels by the HHHs

	Before 1980	1980-1989	1990-1999	2000-2006
Lolkisale	10 %	24 %	50 %	16 %
Naitolya	15 %	26 %	33 %	26 %
Loiborsoit.'A'	1 %	14 %	38 %	47 %

7.5. Mode of acquisition

The mode of land acquisition is a good indicator of the existence and use of traditional, informal or formal rules and regulations or of the importance of networks that regulate access to land in the three villages. Three modes of acquisition clearly dominate the picture: the allocation by an authority, inheritance and purchase of the land from non relatives (table 7.5). In Lolkisale and Loiborsoit.'A' almost half of the parcels were allocated by a local authority while in Naitolya 55 % of the land was inherited. We of course see a high proportion of land being allocated by village authorities because under the land laws they are permitted to allocate land. In Naitolya the higher proportion of land being inherited is consistent with the fact that land allocation was more stable over time when we could observe booms in the two other villages. The relationship with local authorities at HHs may also influence land allocation on the villages if the process is not fully transparent. We can also note that in Lolkisale and Naitolya a significant proportion of the parcels were acquired by the HHs by simply moving in. This underlines failures in the formal land tenure regulation in the two villages.

7.6. Land rental

Land rental is uncommon and was practiced for only 5 plots out of the 453 (1 %) plots owned by the HHs surveyed. We can make here three suppositions: a) access to land is being somehow regulated, in the sense that not everybody can grab land. This implies the existence of an informal control over land in addition to the formal one; c) land can potentially be a scarce resource for the HH locally. Four of the 5 rented plots were located in Lolkisale. The rental fee requested per annum ranged from 2,000 to 25,000 per acre with a mean of 11,633 per acre. It seems that the price asked per acre increases as the surface being

rented decreases. In most cases the rent is being paid in kind and represents a share of the yield being produced.

Table 7.5: Mode of acquisition of the parcels in the three villages

	Lolkisale	Naitolya	Loiborsoit.'A'
Allocated by authority	53 %	16 %	47 %
Bought from family member	3 %	5 %	1 %
Bought from village chiefs	1 %	4 %	2 %
Bought from non-relatives	12 %	12 %	22 %
Inherited	18 %	55 %	28 %
Moved in[4]	6 %	4 %	
Exchanged against another plot	1 %		
Given by the husband	6 %	4 %	
Given by another HH	0.5 %		

7.7. Land price

Land price varied considerably from plot to plot. Only 12 % of the HHs indicated that they had to purchase the land in cash or in kind (through cattle exchange for example). Overall the price per acre varied considerably from 1,500 to 3,400,000 Tsch per acre with a mean of 203,395 Tsch per acre. 38 % of the HHs indicated a price paid between 10.000 and 80.000 per acre. Prices are nevertheless difficult to compare as some of the plots were acquired several years ago. Land quality, and connections between buyers and sellers may also strongly influence the prices since no land market is in place.

7.8. Land sale

Despite the fact that land sale is prohibited, 4 % the HHs admitted having sold a plot in the past [5 %; 3 %; 3%]. The proceeds were used in most cases to meet the basic needs of the HH, which highlights the fact that land sale is often the last option for the HH. Among the reasons presented by the HHs we can mention: improvement of the house (5 HHs), food purchase (4 HHs), good purchase (5 HHs) and the payment of school fees (1 HH). Less often the proceeds were invested in productive/investment activities: a plot in town (2 HHs), cattle (1 HH) and sheep (1 HH). Only 1 % of the respondents are planning to sell land. The main

[4] Implies appropriation of land that does not belong to or has not been allocated to the user.

reasons for not selling the land include social and legal reasons (clan taboo: "*not good to sell the land*", "*the village authority doesn't allow it*"), family reasons ("*transmission to my children*"), productive reason ("*good land fertility*", "*difficulty to access other plots*", "*need to access more rather than have less*").

7.9. Future land acquisition

The desire to acquire more land is a good proxy to evaluate potential future pressure on land resources and current perceived land scarcity at HH level. The conclusion of the 2006 agricultural sample census (that indicates 70 % of the HHs in Arusha not having enough land) is confirmed with 76 % of the HHs planning to get more land in the future (NBS, 2006). The reasons given included production constraints (*the HH does not have land, dryness of the area, abundance of wild animals depredating the crops*), production strategies (*to develop or diversify crop production, to develop private pasture*) and demand constraints (*increased size of the family, need to increase the overall family income*). Aspects related to pressure on land resources were also recognized by some HH (*scarcity of the land*). Among the HHs planning to get more land in the future, mobility is mainly considered at sub-village level with 59 % of the respondent planning to get more land in the same sub-village and 85 % in the same village. Profound variations are noticeable among the three participating villages with only 52 % of the respondent in Naitolya considering acquiring the new plot in the same village against 88 % in Lolkisale and 97 % in Loiborsoit.'A'. This can be juxtaposed with the low crop productivity and low level of income (see figures 9.5, 9.7 & 9.11) observed in this village. In trying to obtain another plot of land, the majority of the HHs in Lolkisale and Loiborsoit.'A' (71 % and 68 % respectively) are planning to get it from a local authority, while in Naitolya only 28 % of the HHs are considering this option. On the contrary in Naitolya, 41 % farmers are considering buying the new plot when only 6 % and 1 % of the farmers in Lolkisale and Loiborsoit.'A' considered the option. Accessing the new plot through inheritance, the clan, from a relative or by simply moving in was marginally mentioned.

8. Livestock Production

8.1. Livestock holding

The Arusha and Manyara regions are known for having a developed and widespread livestock sector compared to other Tanzanian Regions. The 2006 agricultural sample census revealed that Arusha compared to other Tanzanian regions has the highest number of pastoralist in the country and ranked third in terms of cattle population (above 1,5 million heads). Similarly with above a million head of cattle the Manyara Region ranked 6th out of 21 regions. With 44 animals per km^2 the Arusha region ranked 4th in terms of cattle density, Manyara ranking 7th with 26 cattle head per km^2 (NBS, 2006).The development of the livestock sector is confirmed in our villages with 68 % of the HHs owning livestock. This rate is higher in Lolkisale where 75 % of the HHs own livestock compared to Naitolya and Loiborsoit.'A' (66 %, 60 % respectively). Livestock rearing is also traditional in the region with 71 %, of the HHs coming from families that are traditionally engaged into livestock activities. Again this ratio is higher in Lolkisale than in Naitolya and Loiborsoit.'A' [79 %, 70 %, 64 %]. The attractiveness of the sector remains high with 63 % of the HHs not holding livestock explaining it by the fact that they could not afford it.

In analyzing the date at which the HH got his first livestock, the long tradition of livestock rearing in the areas is confirmed (figure 8.1). Indeed despite the relative young age of the overall HH population, 50 % of the HHs currently engaged into livestock activities already owned livestock in 1995. Eighty five percent of the initial herds included cattle, 79 % goat, and 65 % sheep. The initial herds were relatively small. For cattle the initial herd included 3.6 head but 57 % of the HH started with only 1 or 2 head and only 5 % started with more than 10 heads. This situation is slightly different in the case of goats where larger initial herds are more common. The initial herd included 6.4 head and despite the fact that 75 % of the HH started with 1 to 5 goats, 15 % started with 10 to 30 goats. In the case of sheep, the initial herd comprised on average 4.8 animals and for 82 % of the HHs it comprised between 1 to 6 sheep. Most of the households therefore accumulated livestock over the years to develop their asset. The traditional character is finally confirmed by the fact the majority of the HHs received their first livestock from the family (26 % from the father, 24 %

through inheritance and 11 % from a relative). More surprisingly almost a third of the HHs bought their first livestock (table 8.1). This may underline two mechanisms. First traditional livestock owners often transfer livestock to their children who will pursue a traditional Maasai livelihood based on livestock production. Second agriculturalist have started to save into livestock which play a saving role.

Figure 8.1: date at which the HHH got his first livestock

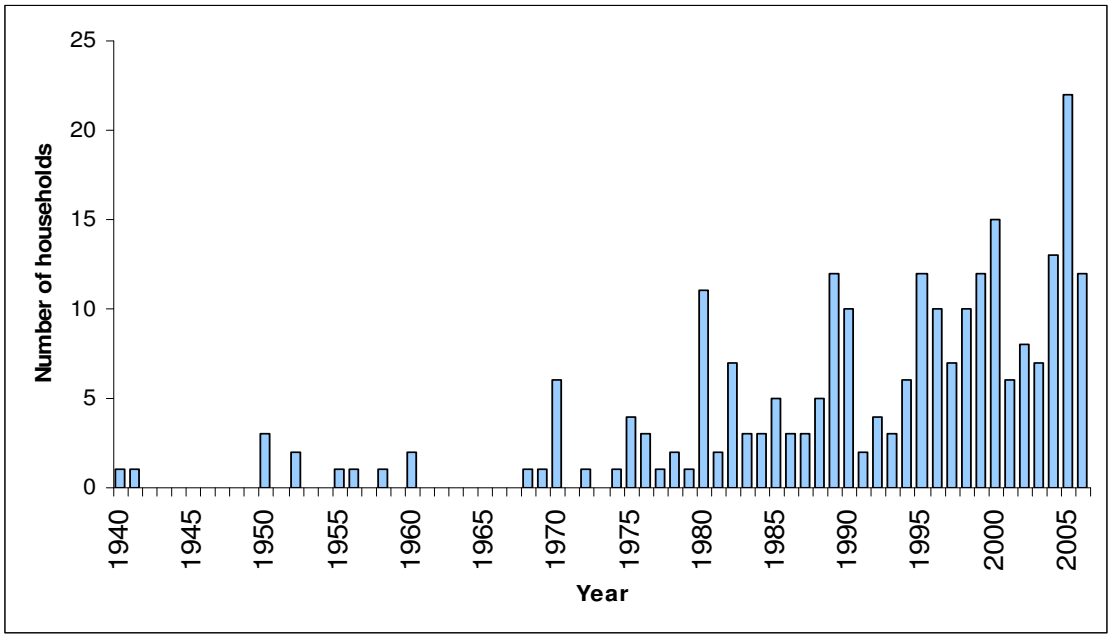


Table 8.1: Origin of the first livestock

	Lolkisale	Naitolya	Loiborsoit.'A'	total
No response	4 %	6 %	1 %	3 %
Gift from the father	22 %	15 %	38 %	26 %
Gift from relatives	9 %	0 %	20 %	11 %
Inherited	25 %	37 %	15 %	24 %
Bought	38 %	35 %	20 %	31 %
In kind payment	3 %	6 %	6 %	4 %

Small stocks account for 70 % of the total ruminant population in the sample. Accounting for 32 % of the animals [25 %, 29 %, 38 %] sheep is clearly more developed than at national level where it accounts for only 12 % of the animals. The development of sheep in the region was also underscored by the 2006 agricultural sample census. Goats account for 38 % of the animals [36 %; 52 %; 36 %]. With the

development of sheep, importance of cattle is lower and as it accounts for only 30 % of the animals [39 %; 19 %; 26 %] against 50 % at national level (NBS, 2006).

8.2. Herding

Livestock rearing is often practiced in cooperation with other HHs as 65 % of the HHs owning livestock are mixing their animal with other HHs. This practice is especially widespread in Loiborsoit.'A' where 83 % of the HHs mix their animals with other HHs. The justification provided for this practice was mainly related to time/capacity constrain: *"I don't have a herder and I can not herd on my own*", "*the children are going to* school and cannot herd the animals", "*we need to share the expenses - I have a small herd*. Other justifications provided included improved breeding, wildlife depredation and traditional livelihoods "*we are living in the same bomas*".

8.3. Herd dynamic and management

Herd size and structure. The importance of the sector in the region is confirmed. With 57%, 60% and 47% of the HHs owning cattle, goat and sheep, respectively, the involvement in the livestock sector is more widespread than at national level (37 % of the HHs for cattle; 40% for goat and 14% for sheep) (table 8.2). The average herd and flock sizes (15.6 animals for cattle, 19.2 for goat and 18.7 for sheep) is also higher than national averages and in line with the findings of the 2006 agricultural sample census for the Arusha and Manyara regions (NBS, 2006). This is nevertheless hiding the fact that a majority of the HHs hold few animals. In Naitolya, 50 % of the producers own less than 4.5 cattle head, 10 goats or 8 sheep. In Lolkisale, 25 % of the herders own less than 4 cattle head. Larger flocks are also being recorded in Loiboirsoit.'A' where 25 % of the producers own more than 30 goats or 32 sheep. Very large herds/flocks were also observed which included more that 100 cattle heads, 200 goats or 200 sheep. The total animal population in our sample included 3,217 cattle head, 4,080 goat, and 3,461 sheep in 2006 (figures 8.2, 8.3 & 8.4). Population growth was steep in 2005, the size of the cattle, goat and sheep populations increasing by 14 %, 17% and 22 % over the year. In terms of breeds, for cattle the Zebu represents almost the totality of the population. However other breeds of Boran, crossed Boran-Zebu and crossed Zebu-Frisian were also observed. Only indigenous goats were observed while for sheep Red Maasai and Black Headed Persian

were identified. For cattle the herd structure is characteristic of a low productive and non-market oriented production systems. Cows only represent 36 % of the herd when bulls, steers and immatures account for 30 % (table 8.3). For small ruminants the flock structure seems to be more productive than in the case of cattle, does and ewes accounting for 43 % and 44% of the flocks (tables 8.4 & 8.5). This is surely due to the fact that small stocks are often considered as a more liquid asset which is being sold to meet HHs expenses. The higher off-take rate is increasing the productivity of the herd.

Table 8.2: Involvement in livestock activities and size of the herds and flocks

		% of HH engaged	Herd/flock size					
			Mean	Min	Q1	Q2	Q3	Max
Cattle	Loiborsoit.'A'	55%	18.1	1	5.25	12.5	20.75	195
	Lolkisale	66%	15.8	1	4	10.5	19	225
	Naitolya	42%	8.2	1	4	4.5	11	35
	Total	57%	15.6	1	4	10	19	225
Goat	Loiborsoit.'A'	53%	26.6	1	10.5	19	30	260
	Lolkisale	66%	14.1	1	6	11	20.25	92
	Naitolya	63%	15.8	2	5	10	20	86
	Total	60%	19.2	1	6.75	14	23	260
Sheep	Loiborsoit.'A'	50%	30.8	2	12	18	32	383
	Lolkisale	44%	15.6	2	4.75	10	20	100
	Naitolya	46%	11.4	2	4.75	8	16.25	40
	Total	47%	18.7	2	6	13	25	383

Slaughtering. Cattle slaughtering remains marginal with only 7 % of the cattle owners, who had killed at least one animal from their herd. Goat and sheep slaughtering is relatively more common with 26 % and 21 % of the owners, who had killed at least one animal from their flock. The reasons given for slaughtering animals included: ceremonies (circumcision, wedding, birth, traditional Maasai during dry season, Christmas, New Year), consumption, when one gets sick or when an animal is dying. Logically 64 % of sheep slaughtered were castrates in order not to affect the productivity of the herd and for culinary preferences. Livestock slaughtering also allows for the strengthening of social networks within the communities. Indeed 21 % of the cattle owners, 46% of the goat owners and 42 % of the sheep owners are giving meat to other HHs when slaughtering animals. Producers give on average 15 kg of meat per year in the case of cattle, 9.3kg in the case of goat and 5.9 kg in the case of sheep. Meat selling was marginally

mentioned (2 % of the cattle owners, 3 % of the goat owners and 2% of the sheep owners) and the annual incomes derived from this activity remained marginal and ranged between 5,000 Tsch to 15,000 Tsch for all species.

Losses. Herds/flock in the three villages faced massive losses over the year. Seven percent, 11% and 8 % of the 2005 cattle, goat and sheep populations died over the year (table 8.6). In the case of cattle 16 % of the owners lost more than 20 % of their animals over the year. In the case of goats, 30 % of the producers have lost more than 20 % of their animals and 4 % more than 50 %. Does account for 34 % of the losses, directly affecting the productivity of the flock. In the case of sheep, 22 % of the producers have lost more than 20 % of their animals and 8 % more than 50 %. These estimates are in line with the review done by Otte and Chilonda on livestock production parameters for mixed systems in the sub-Saharan semi arid zones. In their review the mean cow, doe and mortality risk stood at 6.2 %, 10 % and 7.5 % respectively (Otte and Chilonda, 2002). Losses are mainly attributed to diseases, wildlife depredation and drought. The improvement of access to animal health services and water and better protection against wildlife depredation could clearly improve the picture.

Table 8.6: Causes of losses reported (in percentage of producers)

	Diseases	Wildlife depredation	Drought
Cattle	72 %	13 %	15 %
Goat	62 %	27 %	16 %
Sheep	66%	16 %	7 %

Contribution to HH income: Livestock marketing makes a significant contribution of the livelihood of the population in value term. Nevertheless only 25 %, 34 % and 24 % of the cattle, goat and sheep owners derived an income from the marketing of their animals. The relative higher figure for goats confirms that it is a more liquid asset than cattle which is usually considered a buffer against shocks.

The overall destocking rate remains low as only 5 %, 5% and 4% of the 2005 cattle, goat and sheep populations were sold over the year. Seventy-one percent of the cattle sold were male. In the case of goats and sheep, 43 % and 53 % of the animals sold were castrates. The destocking rates are significantly lower

than the mean rates in semi-arid zones presented by Otte and Chilonda 2006 which stand at 10.2 % for cattle, 15.6 % for sheep and 16.8 % for goats in mixed systems. The rate observed for cattle is nevertheless in line with the 5 % destocking rate found by Ngategize (1989) for the Arusha region.

For those who sold at least a cattle head, the mean annual income is 574,293 Tsch but 45 % of them are earning less than 300.000 Tsch (figure 8.5). The mean income generated by small stock marketing is considerably lower and stood at 118,693 Tsch per year. 52 % of the sellers earned less than 75,000 Tsch (figure 8.6).

The reasons given for selling cattle included: "*to buy food*", "*to pay the herder*", "*to develop cultivation*", "*to buy medicine*", "*to pay school fees*", "*to buy cattle medicines*". The third reason underlines the interconnections between crop and livestock assets. In the case of small stocks additional reasons provided underline the role played to meet basic needs : "*family problems*", "*for farm preparations*", "*to get money for family needs"* and "*to buy medicine".*

Access to cattle market is difficult. 51 % of the cattle seller indicated travelling more than 65 km to reach the market place. Cattle were exclusively trekked on foot to the markets. Moving the animals to the market takes more than 10 hours for more than 36 % of the cattle owners. The distance travelled by foot and the time taken to reach the market place is clearly hindering the cattle marketing process. Besides from the risk of potential losses faced during the transport, herders may be forced to accept lower prices at the market place in order not to bring the animals back to the herd. HHs often don't go by themselves to the market place as 64 % of the animals (table 8.6) were sold to traders and as the HHs hired a trekker in 59 % of the cases. The price paid for hiring trekkers varied between 1,500 to 6,000 Tsch per animal (mean cost: 3,345 Tsch per animal). The price at which the animals are being sold is presented in table 8.7.

Access to market for shoats seems to be easier than for cattle with 50 % of the HHs that sold an animal indicating travelling less than 16 km. It took less than 1 hour to reach the market for more than 87 % of the respondents. This is explained by the fact that markets for small stock are more local than cattle which ease their off-take. Animals were almost exclusively trekked on foot to the markets and only 4 % used a lorry. Due to the market proximity, 81 % of the HHs brought their animals by themselves to the market. This is

reflected by the important proportion of animals being sold to brokers (29 %) (Table 8.9). The price paid to hired trekkers ranged between 150 and 3,000 per head (with a mean cost of 987 Tsch per animal). The prices obtained for the animals are presented in tables 8.9 and 8.10.

The markets used for cattle included Makuyuni, Terat, Lolkisale, Duka Bovu, Kisongo, Sukuro, Minjingu, Nanja and Meserani. In addition for small stock producers used Kisongo, Sukuro, Mdori, and Loiborsoit.

Herd development. Animal purchase is not common. Only 11 %, 16% and 10% of the cattle, goat and sheep producers had acquired an animal over the year. The number of animals purchased remains marginal and represented less than 1 %, 3% and 1% of the 2006 cattle, goat and sheep populations. In the case of cattle and goat, the producers mainly focused on the development of the breeding base (calves and cows accounting for 34 % and 36 % respectively of the cattle purchased, and does for 51% of the goats purchased). In the case of goats it often constituted the start of goat herding activity. Sheep producers purchased mainly castrates (33 % of the stock purchased) and male lambs (36 % of the animals purchased). This would be in favor of an on-going ram fattening activity in the villages. The animals were bought at 81 % in the market; the rest was bought from neighbors. The reasons mentioned for animal purchase included: "*development / improvement the herd*"; "*the introduction of a new breed*" and "*to do animal fattening*". The price paid for the animals is presented in tables 8.8, 8.9 & 8.10.

Gifts. Animal gift / exchange has been widely described among pastoralist communities. This phenomenon is tightening the relationship among community members and within the social networks. But maybe because of the high value of the animals and the relatively small herd size compared to traditional pastoralists, giving away or exchanging animals remained marginal and concerned only 3 % of the cattle owners; 7% of the goat owners and 5% of the sheep owners. In total only 16 cattle head, 22 Goats and 17 sheep were given away. The reasons given for receiving/giving gifts included: "f*riendship*", "*family member from the village/town needing assistance*", "*as an exchange against another livestock*", "*as a compensation for a service*", *charity contribution to church*" or "*to a clan member seeking assistance*". This again underlines the importance of the informal networks in the dynamic of the local livelihoods.

Figure 8.2: Size of the cattle herds

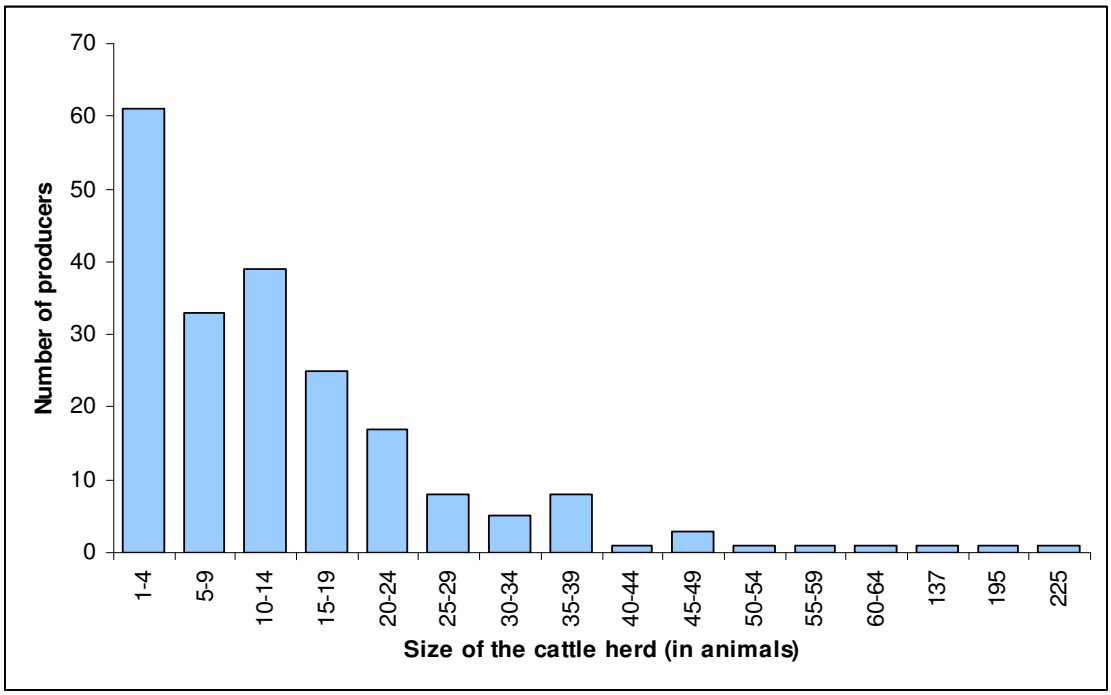


Table 8.3: Cattle Herd Structure and dynamic

	Bulls***	Steers	Immatures	Male Calves	Cows	Heifers	Female Calves	Total
Herd Structure*	8 %	11 %	11 %	11 %	36 %	13 %	10 %	
Losses**	8 %	9 %	9 %	7 %	4 %	8 %	7 %	7 %
Sold**	9 %	13 %	10 %	1 %	2 %	5 %	0 %	5 %
Purchased*	1 %	1 %	0 %	5 %	1 %	0 %	1 %	1 %
Given**	1 %	1 %	1 %	1 %	0 %	1 %	1 %	1 %
Received*	1 %	1 %	1 %	5 %	2 %	1 %	1 %	2 %

* In % of the 2006 Population

** In % of the 2005 Population

***bull: intact adult male; steer: castrated male; calve: animal that is not been weaned; cow: adult female which already have had a calf; immatures and heifers: weaned animals below two years old

Figure 8.3: Size of the goat flocks

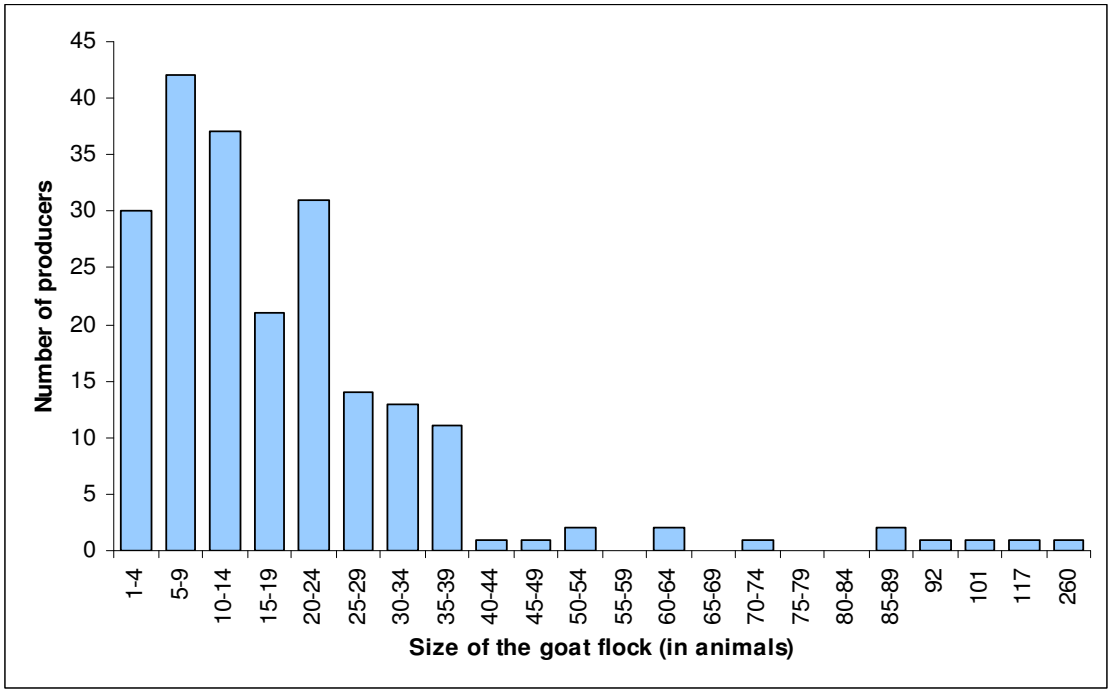


Table 8.4: Goat herd structure and dynamic

	Buck	Castrate	Kids male	Does	Kid female	Total
Herd Structure*	9 %	18 %	16 %	43 %	15 %	
Losses**	10 %	15 %	13 %	9 %	14 %	11 %
Sold**	7 %	16 %	3 %	4 %	1 %	5 %
Purchased*	4 %	3 %	2 %	3 %	0 %	3 %
Given**	0 %	1 %	1 %	0 %	1 %	1 %
Received*	4 %	1 %	1 %	2 %	2 %	2 %

* In % of the 2006 Population
** In % of the 2005 Population

Figure 8.4: Size of the sheep flocks

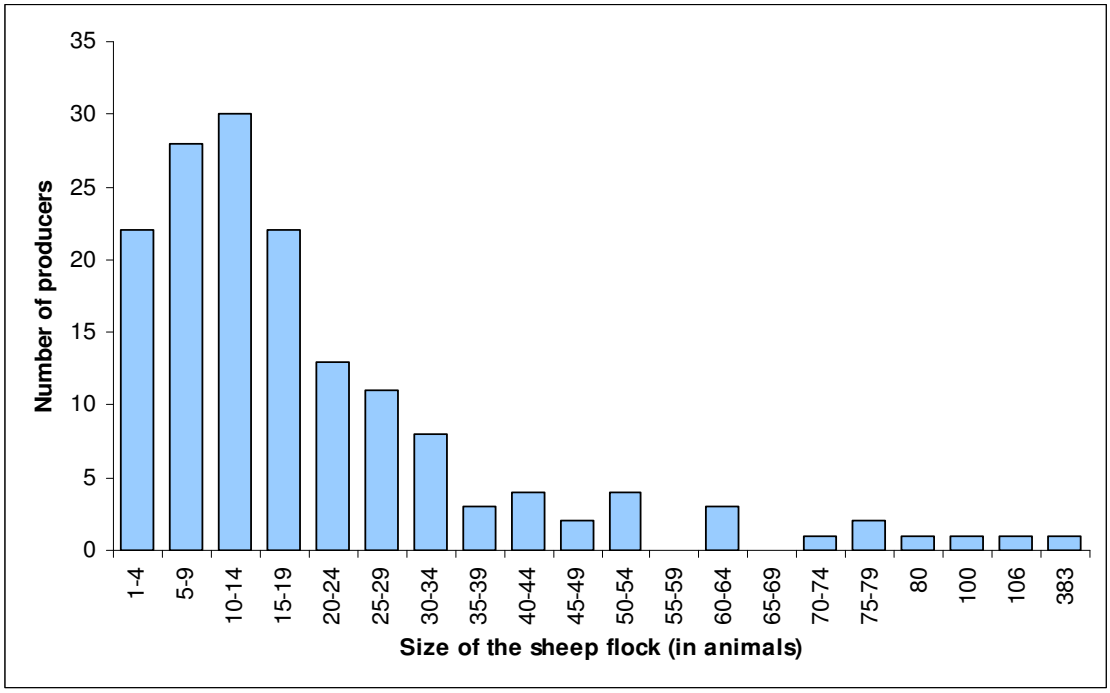


Table 8.5: Sheep herd structure and dynamic

	Ram	Castrate	Lamb male	Ewe	Lamb female	Total
Herd Structure*	9 %	17 %	15 %	44 %	15 %	
Losses**	8 %	16 %	6 %	4 %	12 %	8 %
Sold**	8 %	17 %	2 %	1 %	1 %	4 %
Purchased*	0 %	4 %	3 %	0 %	1 %	1 %
Given**	1 %	0 %	1 %	1 %	0 %	1 %
Received*	1 %	1 %	4 %	1 %	5 %	2 %

* In % of the 2006 Population
** In % of the 2005 Population

Table 8.6: Cattle marketing

	Traders	Brokers	Butchers	Neighbors	others
% of owner selling	82 %	24 %	4 %	2 %	5 %
% of animals being sold	64 %	21 %	4 %	3 %	8 %

Table 8.7: Mean prices for cattle[5]

		Mean	Lower	Higher
Bull	Selling	296,136	70,000	450,000
	Buying	221,447	15,000	420,000
Steer	Selling	267,714	120,000	460,000
	Buying	260,833	70,000	430,000
Immature	Selling	177,948	50,000	350,000
	Buying	162115	40,000	320,000
Calves m	Selling	99,304	17,000	180,000
	Buying	85,000	25,000	120,000
Cows	Selling	185,250	50,000	300,000
	Buying	116,333	10,000	280,000
Heifer	Selling	157,647	50,000	250,000
	Buying	134,142	30,000	230,000
Calves Female	Selling	106,850	17,000	180,000
	Buying	87,250	10,000	180,000

Table 8.8: Shoats marketing

	Traders	Brokers	Butchers	Neighbors	others
% of owner selling	65 %	47 %	13 %	4 %	7 %
% of animals being sold	63 %	29 %	3 %	1 %	4 %

Table 8.9: Mean goat price[6]

		Mean	Lower	Higher
Buck	Selling	35,104	13,000	75,000
	Buying	26,222	10,000	70,000
Castrate	Selling	31,812	10,000	60,000
	Buying	22,655	8,000	55,000
Kid male	Selling	13,766	7,000	20,000
	Buying	11,779	5,000	20,000
Doe	Selling	24,391	9000	62,000
	Buying	18,481	8,000	49,000
Kid female	Selling	15,346	8,000	20,000
	Buying	12,318	5,000	26,000

[5] Lower and higher prices indicate the lowest and highest values indicated when a producer has sold several animals
[6] Lower and higher prices indicate the lowest and highest values indicated when a producer has sold several animals

Figure 8.5: Income distribution among HHs selling cattle

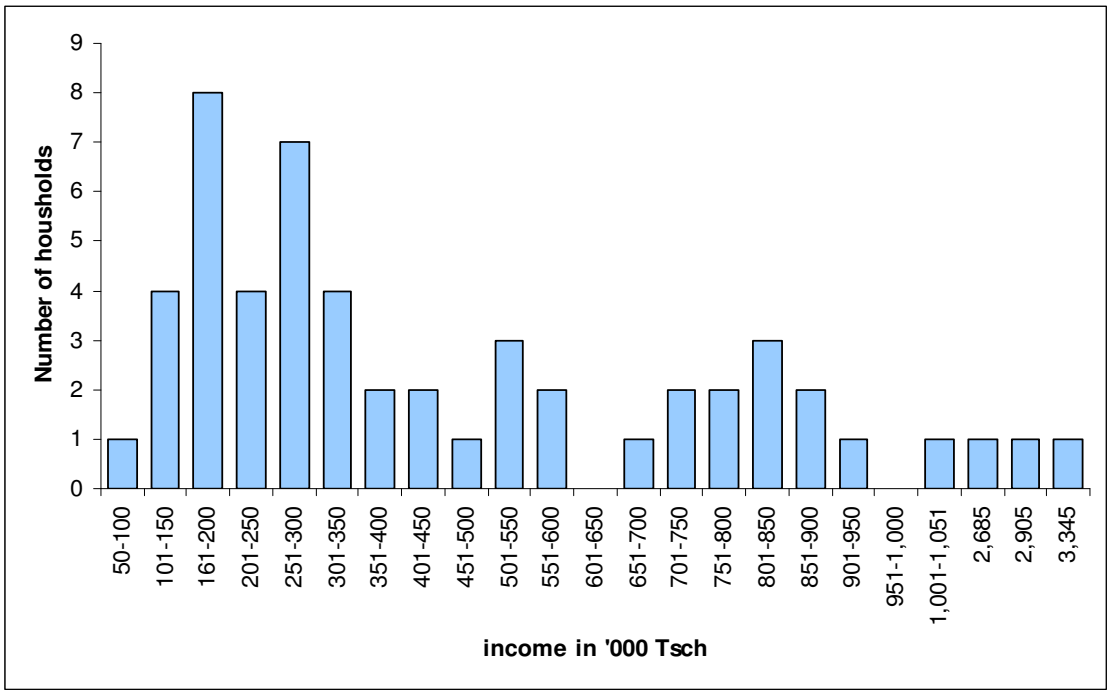


Figure 8.6: Yearly income distribution from shoats

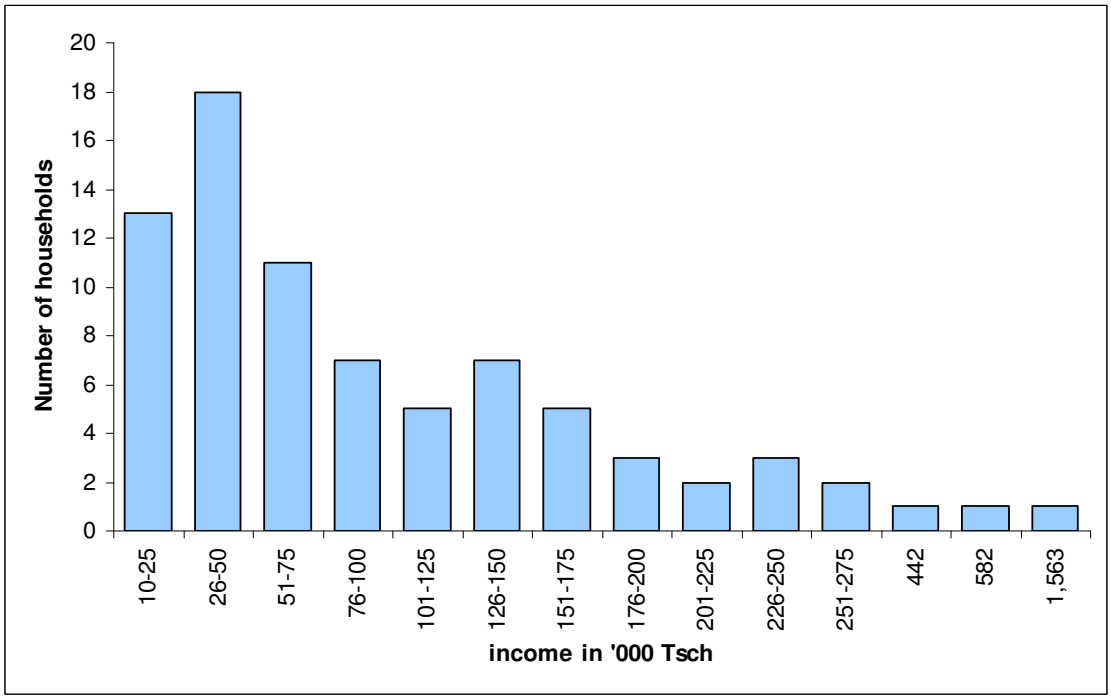


Table 8.10: Mean sheep price

		Mean	Lower	Higher
Ram	Selling	39,587	15,000	75,000
	Buying	30,611	10,000	65,000
Castrate	Selling	42,530	12,000	100,000
	Buying	30,067	9,000	70,000
Lamb male	Selling	18,813	8,000	40,000
	Buying	16,409	5,000	25,000
Ewe	Selling	24,686	10,000	40,000
	Buying	21,225	20,000	25,000
Lamb female	Selling	20,318	10,000	50,000
	Buying	18,227	5,000	80,000

8.4. Breeding

For cattle the fertility ratio is relatively high with 86 % of the cows giving birth over the year. In their review Otte and Chilonda found a mean calving rate standing at 58.2 % with a maximum standing at 89.9 %. The number of calves delivered annually per cow in the herd is 0.72 and the number of living calves per cow giving birth is 0.8. Thirty percent of the herders are trying to plan seasonal breeding and 86 % of them selected the dry season. On average, calves are being weaned at 7.5 months, males are castrated at 16.1 months and cows deliver for the first time at 34.9 months which is late and reflect the weak management of the herd. The age at first calving is still better than the average age presented by Otte and Chilonda (2002) standing at 47.4 months for the mixed systems of the semi-arid zone. Artificial insemination was virtually not practiced in the area, and bull exchange was practiced by 48 % of the cattle owners. Bull exchange is done at no cost, but may be a source of disease spreading among the herds (such as brucellosis).

For goat and sheep the fertility ratio is relatively low. Only 90 % and 95 % of the does and ewes giving birth. The number of kids delivered annually per goat and sheep is 0.8 which is also extremely low. Indeed Otte and Chilonda (2002) estimated the mean prolificacy rate at 1.1 for sheep and 1.2 for goat and the lambing and kidding rate at 119.1 % and 126 % respectively. On average offspring's are being weaned at 5.2 months, males are castrated at 10.1 months. Shoats deliver for the first time at 21.1 months which is again late compared to Otte and Chilonda (2002) estimates for the age at first lambing (16.9 months) and first

kidding (17.5 months). Fifty percent of the herders are trying to plan seasonal breeding, 96 % of them selected the rainy season. Male exchange was practiced by 48 % of the owners. Even if this may help to consolidate the genetic stock of the herds, it may also again cause the spread of disease among the herds and may be responsible for the low reproductive rates observed.

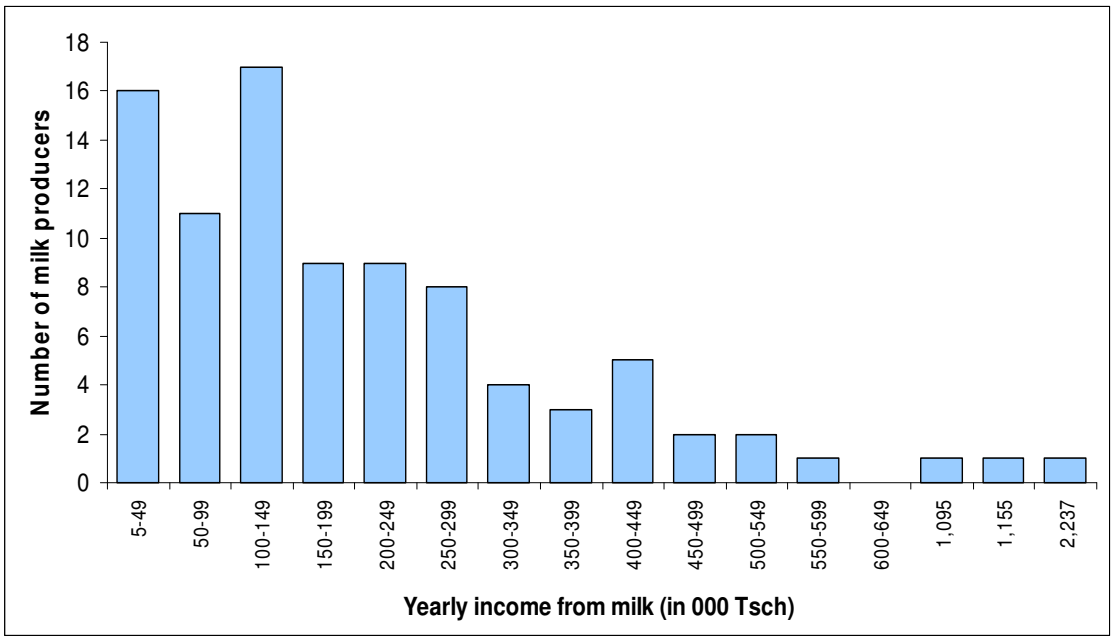
8.5. Milk production

Milk production is widespread among the herders. Eighty-one percent of the cattle owners milk their cows which produce on average 2 liters per day. This extremely low productivity is in line with the African average for extensive production system and is mainly due to poor genetic capacity, feed quality, water accessibility and the lack of animal health services (Otte and Chilonda, 2006). The milking season is the rainy season during which on average 66 % of the cows of a given herd are in milk while only 17 % are in milk during the dry season. This is easily explained by the fact that lactating animals have an easy access to feed and water during the rainy season. On average, cows are 5 months in milk during the rainy season and only 1.8 months of the dry season. The mean milk off-take stands at 408 liters per year, which is higher than the milk off-take (standing at 282 kg/lactation in mixed systems) presented by Otte and Chilonda (2002). Forty-seven percent of the milk producers are also selling part of their milk. On average the quantity of milk sold per day is low: 4.9 liters during the rainy season and 0.9 liters during dry season. During the rainy season and when selling milk, 49 % of the milk retailers sell less than 3 liters per day and only 6.2 % sell more than 10 liters per day. The price per liter ranges from 150 to 400 Tsch with an average price of 281 Tsch. There is virtually no price variation between the dry and the rainy season. The mean daily averaged income is 1188.4 Tsch per day during the rainy season and 128.9 Tsch per day during the dry season. The mean daily maximum income received is slightly higher: 1311.1 Tsch per day during the rainy season and 235.8 Tsch during the dry season. The income generated by milk marketing remains low with 18.5 % of the HHs selling milk, earning less than 300 per day on average over the rainy season. It nevertheless constitutes a regular source of income to the household practicing it.

Goat milk production is relatively well developed with 38 % of the goat owners milking their animals. Productivity is low. Does produce on average 0.9 litres of milk per day and only 14 % of the goats in a herd

were milked during the rainy season, this ratio decreasing to 4 % during the dry season. On average the goats are 3 months in milk during the rainy season and only 0.9 months of the dry season. Thirty-one percent of the milk producers are also selling part of their milk. The quantity of milk sold per day is extremely low : 1.7 liters during the rainy season and 0.4 liters during dry season. During the rainy season and selling period 77 % of the producers sell less than 1 liter per day. The price per liter ranges from 100 to 250 Tsch with an average price of 213.5 Tsch during the rainy season. The average price seems to be slightly higher during the dry season: 266 Tsch. The mean averaged income per day is very low and stands at 169.2 Tsch per day during the rainy season and 24.2 Tsch per day during the dry season. The mean maximum income received per day is slightly higher: 354.3 Tsch per day during the rainy season and 99.0 Tsch during the dry season. The income generated by milk marketing remains extremely low with 69 % of the HHs selling milk, earning less than 100 Tsch per day on average over the rainy season. Despite these low figures it also constitutes a regular source of incomes to the household practicing it.

Figure 8.7: Yearly income from milk



The milk produced is locally consumed: 73 % of the sellers sell their milk to the neighborhood, 75 % to local trade centers and only 2 % to milk companies. Despite the low average daily income generated from milk

marketing activity, its contribution to the local livelihoods remains important: 25 % of the total HHs population and 37 % of the livestock owners derive income from milk. The average income over the year remains significant: 103,170 Tsch with 59 % of the milks marketers earning less than 200,000 Tsch (figure 8.7).

8.6. Poultry production

Backyard poultry production is widespread in the 3 villages with 51 % of the total HH population owning poultry. Poultry is slightly more developed in Naitolya [51 % ; 69 % ; 56 %]. The poultry production units remain small with a mean size of 10.8 birds and with only 7 % of the producers owning more than 20 birds (figure 8.8). Eggs production and productivity is also low with an average of 15.8 eggs collected per week. Only chicken were identified in the three villages.

Eggs production is clearly market oriented as 67 % of the producers are selling part of the eggs collected. Furthermore, 37 % of the total production is sold with an average of 8.4 eggs marketed per week for those selling part of their production. Most of the eggs are sold locally with 25 % of the producers selling their eggs to the neighborhood and 78 % of the producers in local trade centers. The price per egg varies from 50 Tsch to 150 Tsch. Eggs are also used to tighten social networks with 16 % of the producers giving eggs to other HHs. Six percent of the HHs also mentioned receiving eggs as gifts. The number of eggs given or received remains small (1.7 eggs per week on average).

Chicken production is also clearly market oriented with 63 % of the chicken producers selling birds. The average number of birds sold on an annual basis is 2.1 per month with a market price ranging between 2,000 Tsch and 5,000 Tsch. Overall 39 % of the total surveyed population derive an income from the poultry sector with an average of 98,615 Tsch per year (figure 8.9) but 87 % of the producers earn less than 150,000 Tsch per year. Eggs represent 31.6 % of the total income generated by the poultry sector while the marketing of birds contribute to 58.4 %.

Only 13 % of the population reported having bought chicken. The average number of birds purchased is 2 per month at a price ranging from 1,000 Tsch and 4,500 Tsch.

Figure 8.8: size of the poultry production units

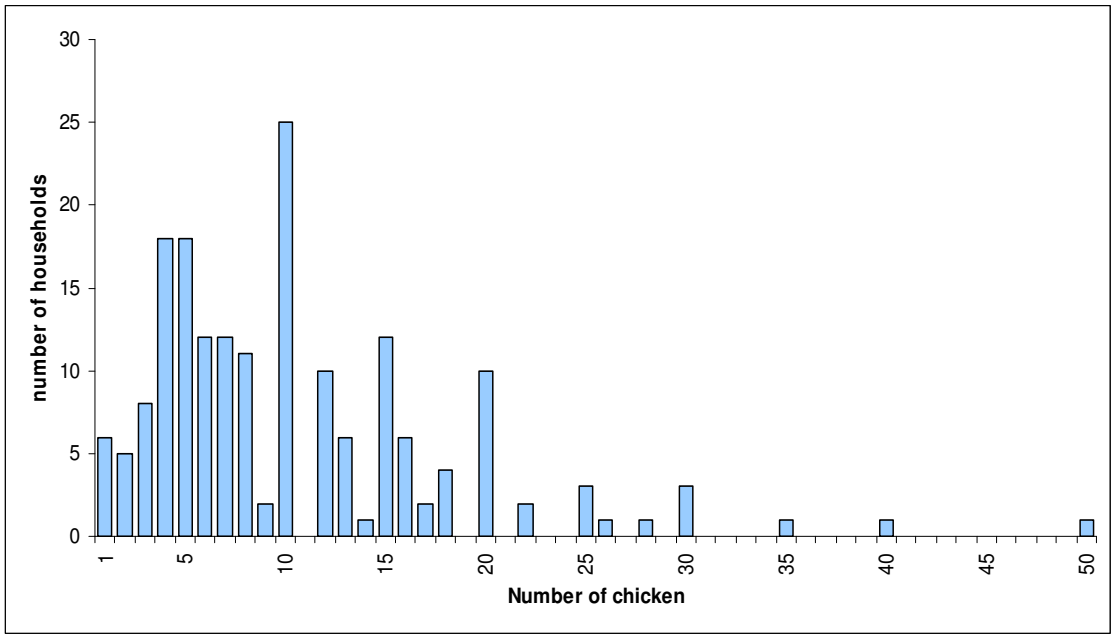
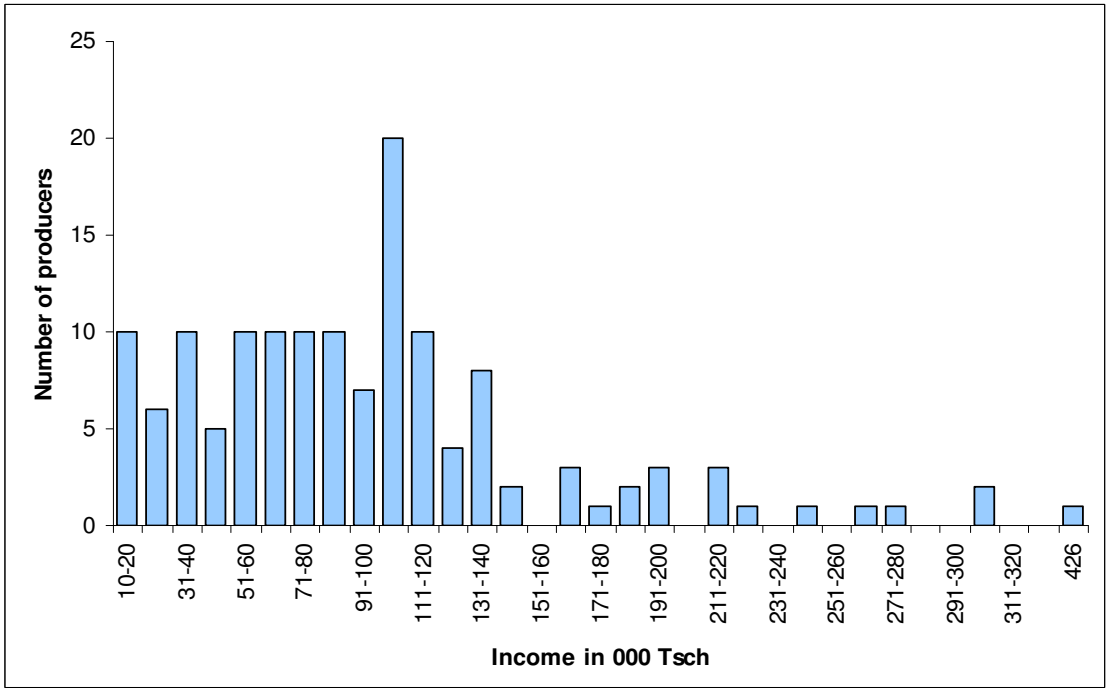


Figure 8.9: Yearly income form poultry and egg production

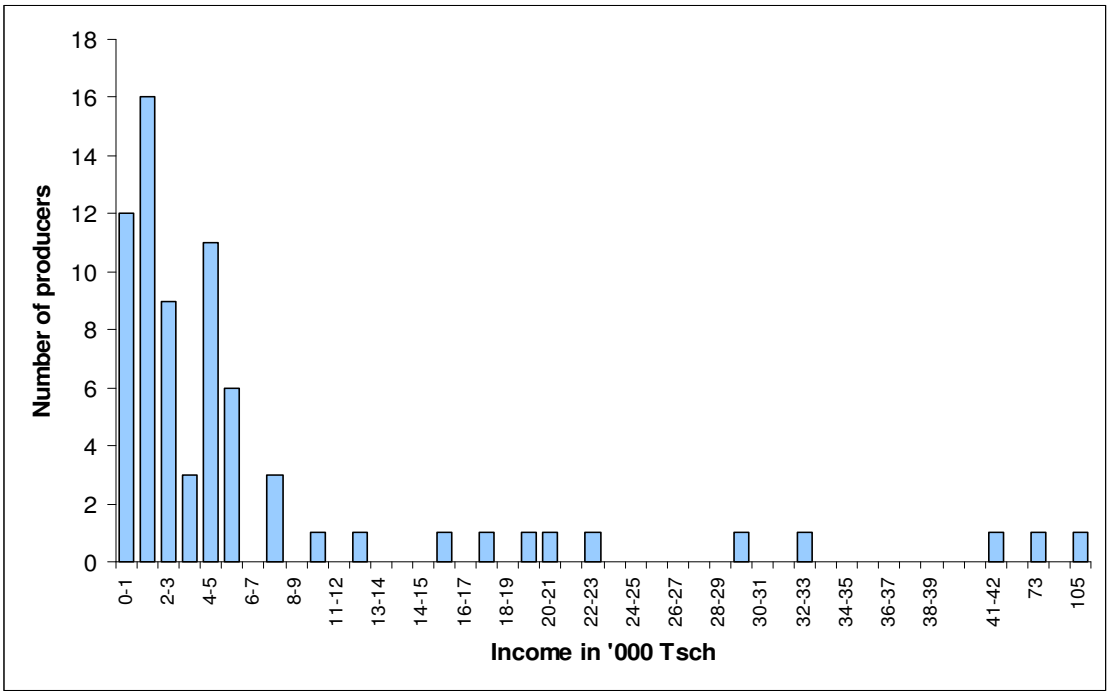


8.7. Hides and skins

The trade of hides and skin is practiced by 20 % of the total population and 29 % of the livestock producers. The activity is more widely practiced in Lolkisale which accounted for 67 % of the cattle hides, 69 % of the goat skins 50 % of the sheep skins producers identified during the survey.

Income generation from hides and skin remains low. On average those selling hides are selling 2 hides per year at a price comprised between 200 Tsch and 17,000 Tsch. The price variation is due to the difference of quality between the hides being sold. The number of skins sold is a bit higher: 4 on average for goats and 3 for sheep and at a price varying between 150 Tsch and 5,000 Tsch. Among hides and skin sellers the average income per year is 11,959 Tsch with 71 % of the producers earning less than 5,000 Tsch per year and 39 % less than 2,000 Tsch (figure 8.10). Hides and skin remains therefore an activity marginally practiced after the death or the slaughtering of an animal.

Figure 8.10: Yearly income form hides and skins



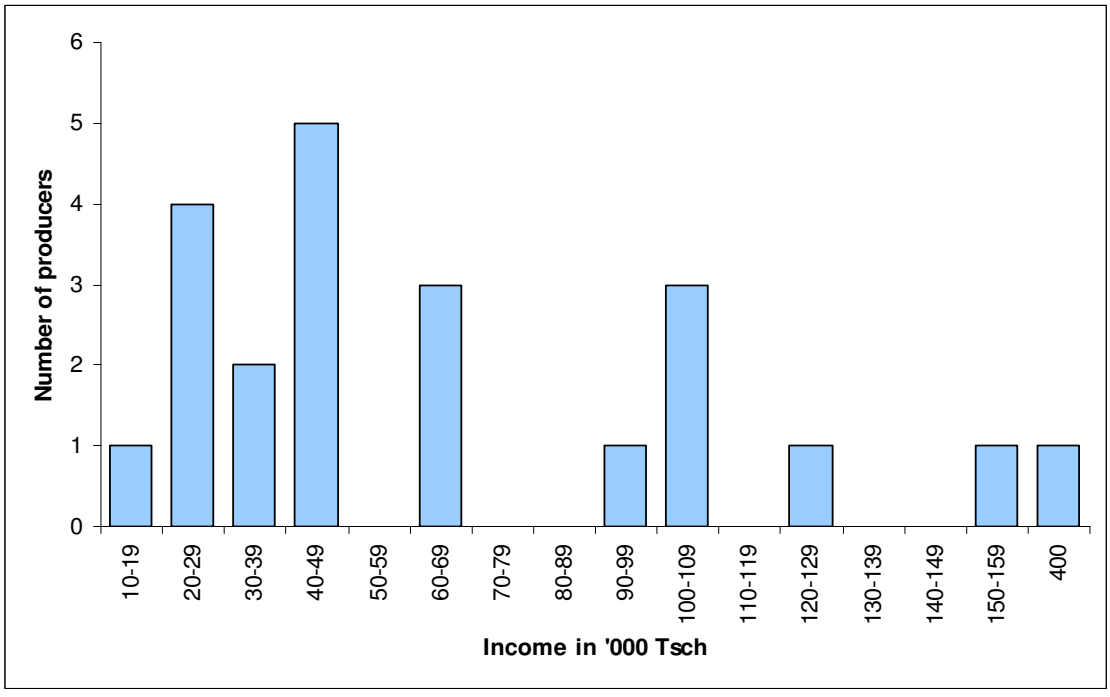
8.8. Manure collection

Manure collection though not widespread is practiced by 8 % of the total HH population. This practice was exclusively recorded in the 2 villages in Monduli and reflects the higher crop-livestock integration process in these two villages. Manure is almost exclusively collected to fertilize crops. The quantity of manure collected was extremely difficult to assess. 2 cases of HHs buying manure were observed. Manure is bought at 15,000 Tsch per lorry.

8.9. Honey production

Honey production is relatively well developed and practiced by 7% of the HHs. This activity is particularly well developed in Naitolya where 18 % of the HHs are engaged into honey production. On average producers are selling 60.8 kg of honey per year at a price varying between of 1,000 Tsch and 3,000 Tsch per kg. Fifty-eight percent of the producers are selling less than 40 kgs per year. The average income per producer is 105,292 Tsch per year (figure 8.11).

Figure 8.11: Yearly income honey



8.10. Feeding and feed production

The use of communal land to feed the animals remains the norm and is practiced by 82 % of the producers. For all three villages the vast majority of the respondents indicated using communal land within the village boundaries. In Lolkisale, 3 HHs also indicated grazing their animals in Loiborsoit.'A' and 1 indicated going to Elerai. In Naitolya 5 HHs mentioned Makuyuni while 1 HH mentioned Mswakini. In Loiborsoit.'A' 1 HH indicated grazing its animals in Lolkisale.

Cut and carry is practiced by 20 % of the HHs to supplement the feeding of their animal. This practice is more widespread in Naitolya where 43 % of the livestock owners are collecting feed [20 % ; 43 % ; 9 %]. Among the livestock owners collecting feed, 69 % are collecting grass, 47 % feed maize and 75 % feed beans. This underlines the development of crop-livestock integration in the area. But the poor operational capacity is limiting this practice to smaller herds. The herd size of the livestock owners practicing cut and carry is indeed smaller than the average size in the three villages: 8.6 cattle; 13.4 goats and 10.2 sheep. Among those not practicing this activity the main reason provided for not doing so was an ample access to feed in communal grazing areas. Other reasons included the cost (financial and in terms of time) required by this activity, the large size of the herd, the lack of means (such as bags) to practice it, the lack of knowledge and the fact that this activity is not part of the traditional way of keeping livestock.

8.11. Use of inputs

The use of inputs as presented in table 8.12 is widespread and more common for cattle than for any other livestock species. This is surely due to the significantly higher value of cattle. Cattle and small ruminant holders are in particular buying drugs (86 % of the cattle producers), dewormers (78 % of the small stock holders) and vaccines. The use of acaricides is also common. The survey also revealed that a significant majority of the producers rely on self-medication or the use traditional knowledge. Indeed only 16 % of the small ruminant holders and 39 % of the cattle holders used health service facilities over the year. The use of supplements is rare and is practiced by only 8 % of the livestock owners. In chicken production the use of inputs or services remains low. Overall the average cost of the inputs per cow is low compared to their

market value: 4,591 Tsch or 2.5 % of the mean market value of a cow. This ratio is significantly higher for shoats where the costs of the inputs per shoat is 2,985 Tsch or 12 % or the market value of a doe.

8.12. Labor input

Livestock remains a labor intensive activity mobilizing in 83 % of the HHs more than 50 % of the HH members above 5 years old for milking, herding, inspecting, selling the animals or taking caring of the young ones (table 8.13). During the dry season, livestock mobilize more than 50 % of the total working hours available in 47% of the households. The activity is more demanding during the dry season, when HH members have to look for water and feed resources for their animals. Children and elders are usually in charge of the young animals when the sons of the HHHs above 13 are usually herding the animals. The employment of a herder is common. The wage per month varied between 1,000 and 10,000 Tsch depending on the age of the herder. Adult herders are often paid in-kind and receive one offspring per year.

Table 8.12: Use and costs of inputs and services for livestock production.

		Health Serv	Vaccines	Other Drugs	Dewormers	Acaricides	Supplement	Total per year
Cattle	% of producers procuring this inputs	39 %	65 %	86 %	61 %	85 %	8 %	
	Average cost per animal per year*	772	653	2,268	1,339	1,230	554	
	Overall average cost per animal per year**	299	422	1,958	821	1,045	47	4,591
Shoats	% of producers procuring this inputs	16 %	24 %	75 %	78 %	77 %	8 %	
	Average cost per animal per year*	412	507	1,463	1,234	961	450	
	Overall average cost per animal per year**	64	120	1,085	946	733	37	2,985
Chicken	% of producers procuring this inputs	8 %	20 %	7 %	22 %	27 %	3 %	
	Average cost per animal per year*	31	113	31	118	8	240	
	Overall average cost per animal per year**	2.38	22.47	2.21	26.14	2.05	6.63	62

* The average cost presents the cost per animal for the producer using the service or input.
** The overall averaged cost presents the cost per animal for the surveyed population

Table 8.13 : Human resource and time mobilization for livestock activities*

% of the resource used at HH level	Total human resources available	Total working hours available**	
		Rainy	Dry
10 % - 24 %	3 %	24 %	17 %
25 % - 49 %	13 %	30 %	36 %
50 % - 75 %	32 %	22 %	20 %
75 % - 100 %	51 %	23 %	27 %

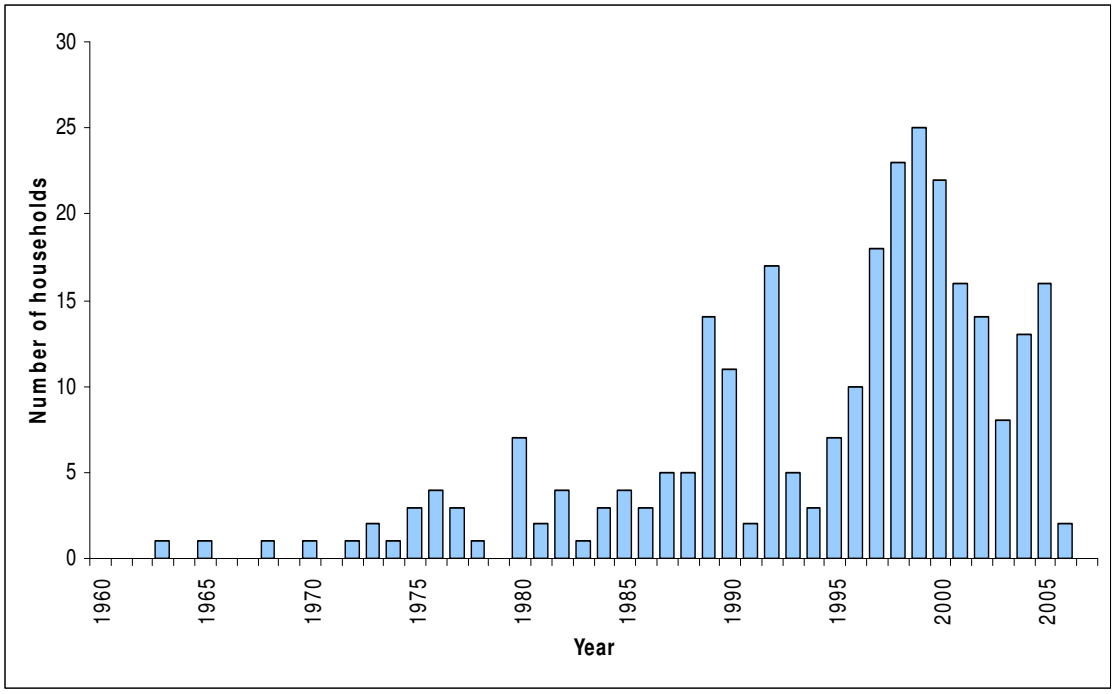
*51 % of the HHs are mobilizing between 75 % and 100 % of the human resources available at HH level
** considering 10 hours per day per HH member above 5 years old

9. Crop Production

9.1. Development of crop production

Crop production is widespread in the area with 80 % of the HHs practicing crop farming. Almost all the HHs are engaged into crop farming in Naitolya (97 %) and Lolkisale (90 %). The situation is different in Loiborsoit.'A' where crop production is comparatively less widespread with only 56 % of the HH engaged into cropping activities. The development of agriculture is a new phenomenon in the three villages which is reported to have started in the 60's – 70's by the district authorities. Even when taking into account the bias due to the relatively young age of the HHs, the phenomenon seems also to be more recent in Loiborsoit.'A'. Indeed, 77 % of the croppers started their activities after 1995 in Loiborsoit.'A' against 55 % in Lolkisale and 60 % in Naitolya. Similarly, 45 % of croppers started their activities after 2000 in Loiborsoit.'A' against 22 % in Lolkisale and 39 % in Naitolya (figure 9.1).

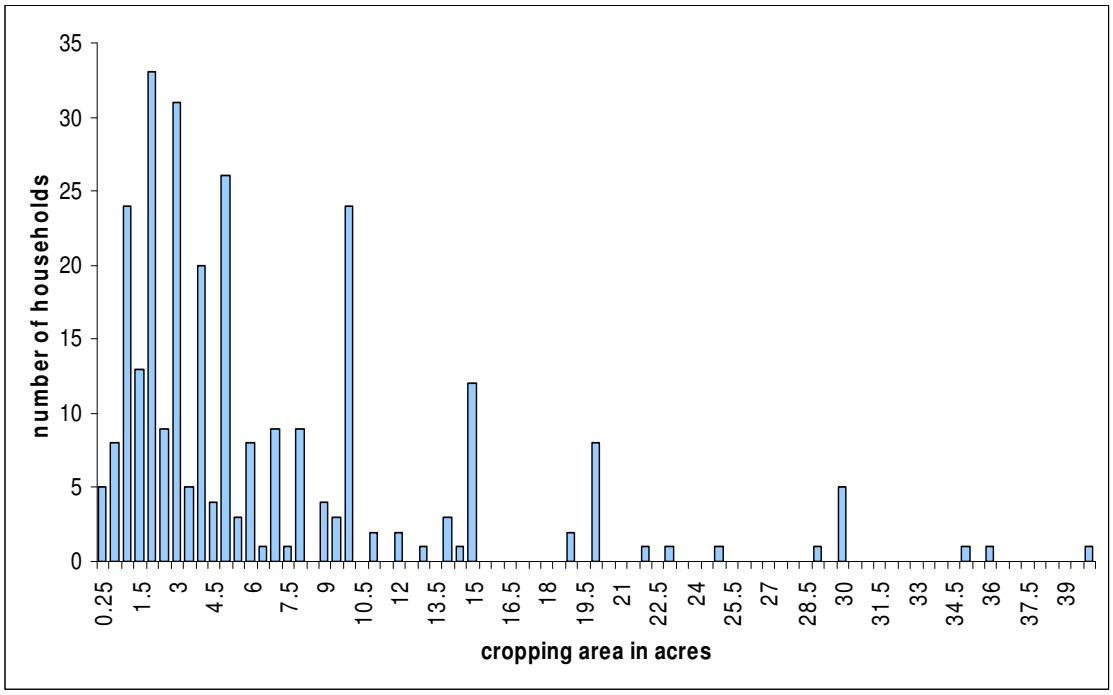
Figure 9.1: date at which the HH started cropping in the three villages



The mean cropping size per HH is 6.5 acres [8.6 ; 5.1 ; 4.2]. Nevertheless most of the producers are cropping small plots (figure 9.2). In Loiborsoit.'A' 61 % of the producers are cropping less than 3 acres (46

% in Naitolya and 31 % in Lolkisale). Larger land tracks under crop were observed in Lolkisale where 27 % of the producers were cropping more than 10 acres (against 4 % in Naitolya and 5 % in Loiborsoit.'A').

Figure 9.2: Size of the cropping area in the three villages



In all cases the HHs surveyed had their sambas located in the village where the HH had established its settlement and was eventually registered. For 95 % of HHs in Loiborsoit.'A', 96 % of HHs in Naitolya and 79 % in Lolkisale, the shamba was also located in the same sub-village.

For 89 % of the HHs the land under cultivation was considered as private. The proportion of producers not officially owning their land was the highest in Lolkisale (19 % against 4 % in Naitolya and Loiborsoit.'A'). Land rental was also commonly observed with 6 % of the HH renting the land under cultivation. Logically the proportion of HH renting their land is the highest in Lolkisale [10 % ; 3 % ; 1 %]. The price paid to rent the land varied between 300 Tsch to 10,286 Tsch per acre but 78 % of the HHs paid less than 800 Tsch per acre. In most cases the rent was paid in-kind.

The fact that the proportion of HHs renting out the land they own is low compared to the higher proportion of producers renting the land they cultivate is not contradictory. Indeed it can easily be explained that a few large landholders may rent small parcels to a higher number of small producers.

9.2. Type of crop produced

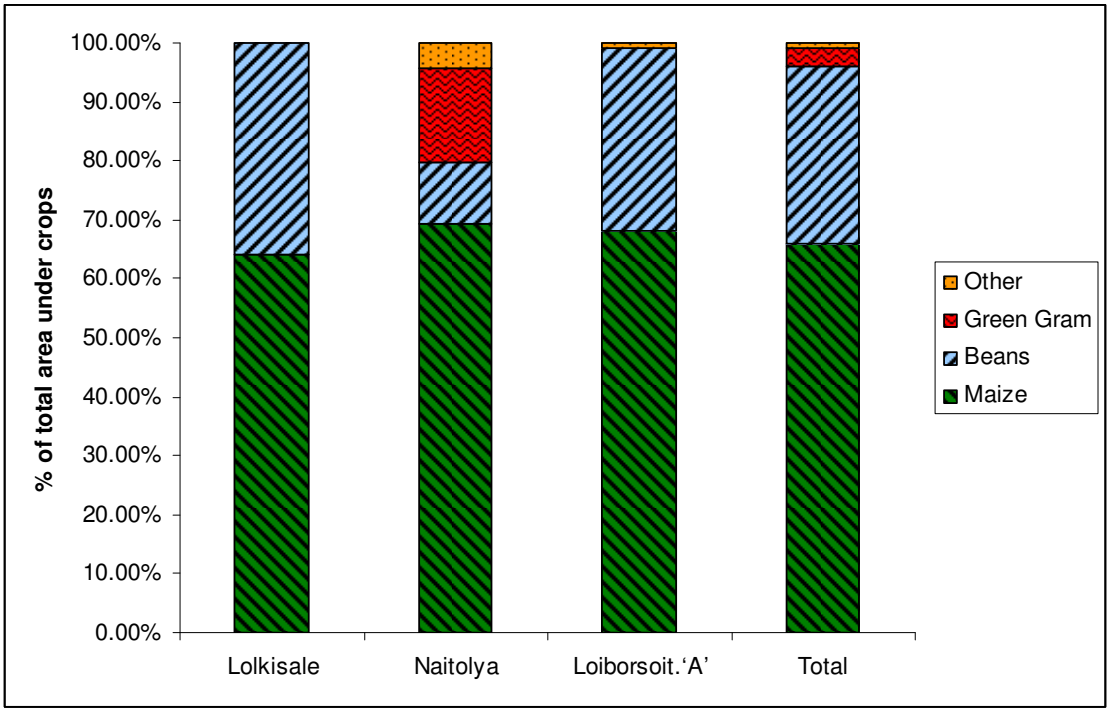
The survey identified the production of 9 crops. These crops are: maize, beans, green gram, white beans, sunflower, common peas, fingermillet, cow peas, and ngwara. Three crops, maize, beans and green gram, clearly dominate the production in the area (table 9.1). This slightly differs from what is observed at National level with maize being the most important crop grown followed by cassava, beans and paddy. Green Gram seems to be a particularity of the surveyed area and may be due to the high market prices (NBS, 2006).

All crop producers are engaged in maize production which also accounts for 65.8 % of the total area being cropped (figure 9.3 and annex 5). Maize is therefore the leading crop in the area due to its key role as local staple food. Beans are cultivated by 64 % of the producers with the highest rate observed in Lolkisale (87 %) and the lowest in Naitolya (26 %). In total beans accounts or 30.2 % of the total area being cropped. Green gram is exclusively cultivated in Naitolya and by 36 % of the producers. The other crops are marginally produced and almost exclusively in Naitolya where crop production seems to be more diversified. Logically 70 % of the producers are engaged into the production of two crops (maize and beans) (table 9.2). The cropping calendar is presented in table 9.3. In general land preparation is done between December and February, planting between February and March and harvesting between June and August.

Table 9.1*:* Proportion of Producers engaged into the production of the crops

	Total	Lolkisale	Naitolya	Loiborsoit.'A'
Maize	100 %	100 %	100 %	100 %
Beans	64 %	87 %	26 %	58 %
Green Gram	9 %		36 %	
White beans	0.4 %			1 %
Sunflower	0.4 %		1 %	
Common peas	0.4%		1 %	
Fingermillet	0.7 %	0.7 %	1 %	
Cow peas	0.7 %		3 %	
Ngwara	1 %		4 %	

Figure 9.3: Land area dedicated to the different crops



Other includes white beans, sunflower, common peas, fingermillet, cowpeas and Ngwara.

Table 9.2: single and multi crop farming

	Total	Lolkisale	Naitolya	Loiborsoit.'A'
1 crops	27 %	14 %	36 %	42 %
2 crops	70 %	85 %	57 %	57 %
3 crops	2 %	1 %	4 %	1 %
4 crops	1 %		3 %	

Table 9.3: Cropping Calendar*

		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Maize	Land preparation		X	X									
	Plantation			X	X								
	Harvest									X	X		
Beans	Land preparation			X	X								
	Plantation				X	X							
	Harvest								X	X			
Green Gram	Land preparation		X	X	X								
	Plantation					X							
	Harvest								X	X			

*In grey: months during which activities are implemented; X: indicates months frequently mentioned by HHs

9.3. Maize production and productivity

Maize production in the Manyara and Arusha regions is relatively developed. In 2006 Manyara ranked 9 out of 21 Regions in terms of planted area with 187, 898 ha and Arusha ranked 14 with 99,986 ha. In terms of productivity the two regions ranked 10 and 11 (NBS, 2006). The average total yield at household level is 1,214 kg [1,320 kg ; 952 kg ; 1,263 kg] and the maximum total yield observed is 10,300 Kg (figure 9.4). Nevertheless the production at household level remains extremely low especially in Naitolya. Three percent of the producers produced nothing, 34 % less than 500 Kg [37 % ; 45 % ; 20 %], 62 % less than a ton [63 %, 72 %, 52 %] and only 11 % more than 2.5 tons [15 %, 6 %, 10 %]. Productivity is also extremely low with only 401 kg produced per acre on average [344 kg/acre, 331 kg/acre, 559 kg/acre] (figure 9.5). The average productivity in the villages is in the magnitude of the National productivity in 2005 estimated at 443.4 kg/acre (FAOSTAT, 2008). The productivity in the villages was also in line with the productivity estimated by the NBS for the Arusha (372 kg/ acre) and Manyara (319 kg/acre) Regions in 2006 (NBS, 2006). The observed productivity ranged between 0 and 1,720 kg per acre with 25 % of the producers producing less than 160 kg per acre. Productivity is higher in Loiborsoit.'A' with only 15 % of the producers producing less than 300 kg /acre (against 60 % in Lolkisale and 58 % in Naitolya) and 4 % producing above 1000 kg /acre (against 2 % in Lolkisale and 1 % in Naitolya). The comparatively higher productivity in Loiborsoit.'A' was mentionned by the district authorities as the key driver for the development of large-scale farming in this village in the 70's.

9.4. Beans production and productivity

Bean production is extremely low at producer level particularly in Naitolya where production levels were dramatically low for most of the producers. The average total yield at household level is 1603 kg [582 kg ; 406 kg ; 738 kg] and the maximum total yield observed is 7,500 Kg (figure 9.6). One percent of the producers produced nothing, 38 % less than 200 Kg [47 % ; 68 % ; 4 %], 87 % less than a ton [87 %, 85 %, 95 %]. Productivity is also low with only 253 kg of beans produced per acre on average [192 kg/acre, 203 kg/acre, 426 kg/acre]. Productivity in the area remains in the range of the estimated productivity at National level standing at 308.7 kg/acre in 2005 (FAOSTAT, 2008). The observed productivity in the area ranged between 0 and 1,200 kg per acre with 35 % of the producers producing less than 100 kg per acre and only

13 % producing more than 500 kg per acre. Productivity is higher in Loiborsoit.'A'. In this village only 4 % of the producers produced less than 100 kg/acre (against 43 % in Lolkisale and 50 % in Naitolya) and 30 % produced above 500 kg/acre (against 5 % in Lolkisale and 6 % in Naitolya) (figure 9.7).

9.5. Green Gram production and productivity

Most of the production occurs in Naitolya. The average total yield is 225 kg but 50 % of the producers produced less than 100 kg in 2005. The maximum total yield observed is 1 ton. Productivity is also low and stands at 161 kg per acre on average. The observed productivity ranged between 3 and 60 kg per acre with 32 % of the producers producing less than 60 kg per acre.

Figure 9.4: Maize production

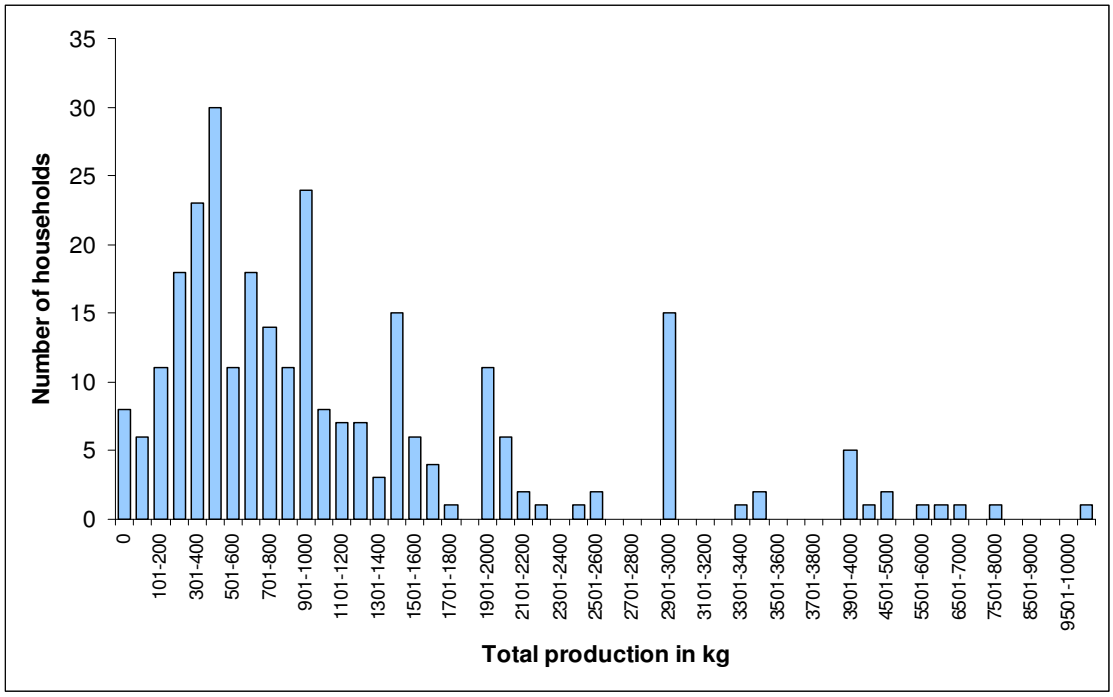


Figure 9.5: Maize productivity

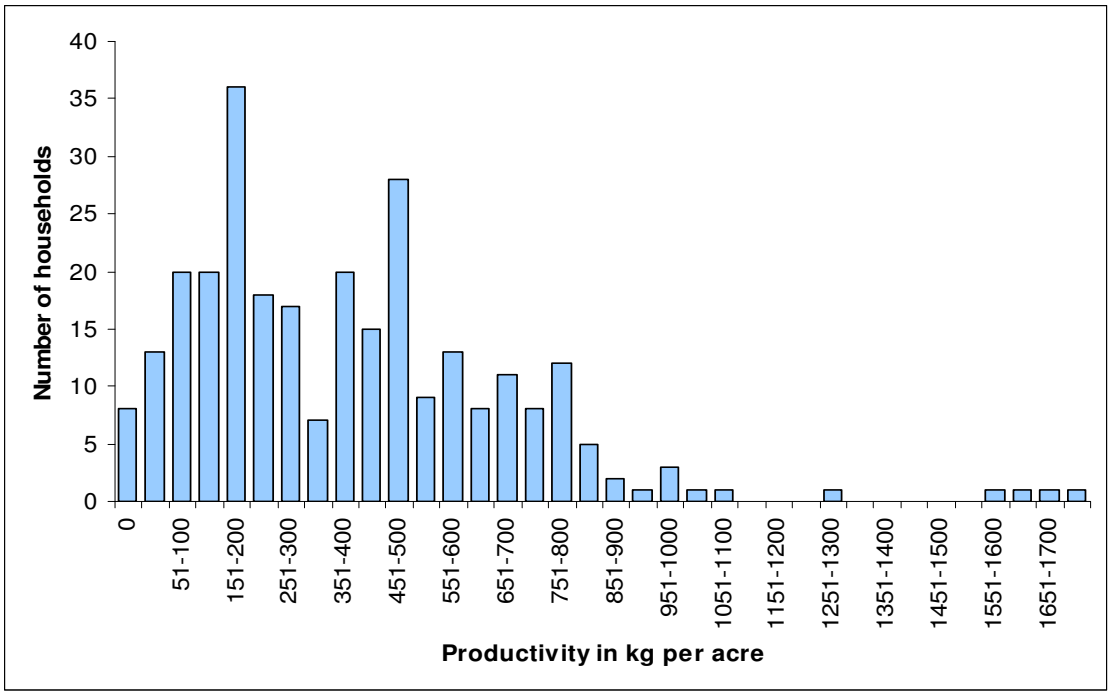


Figure 9.6 Beans production

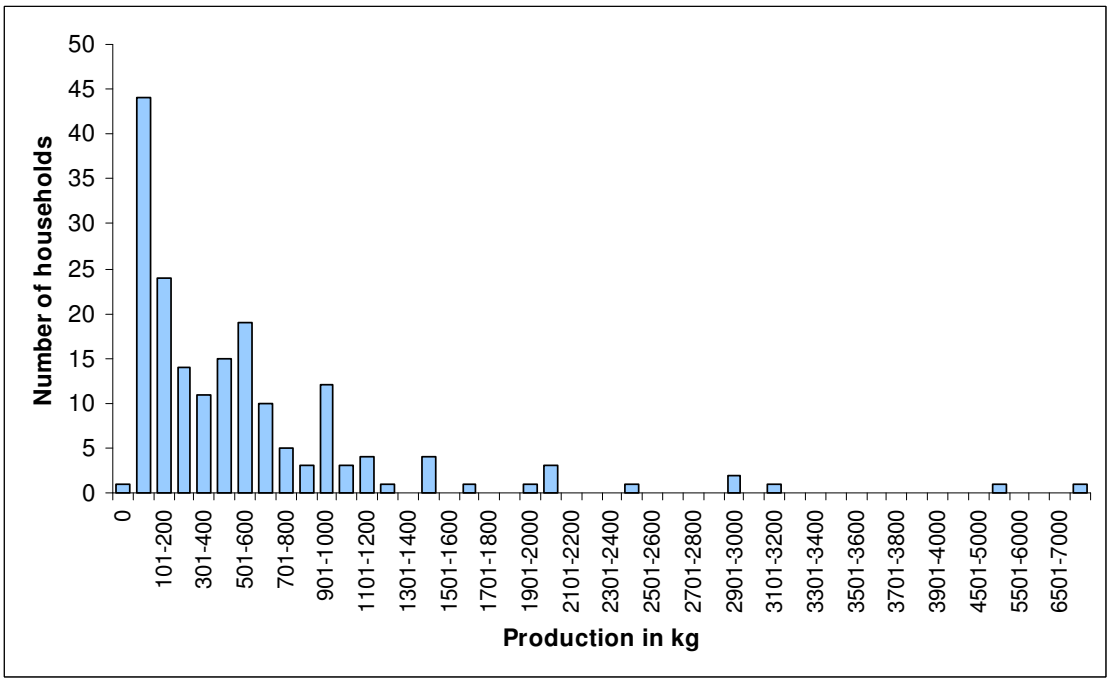
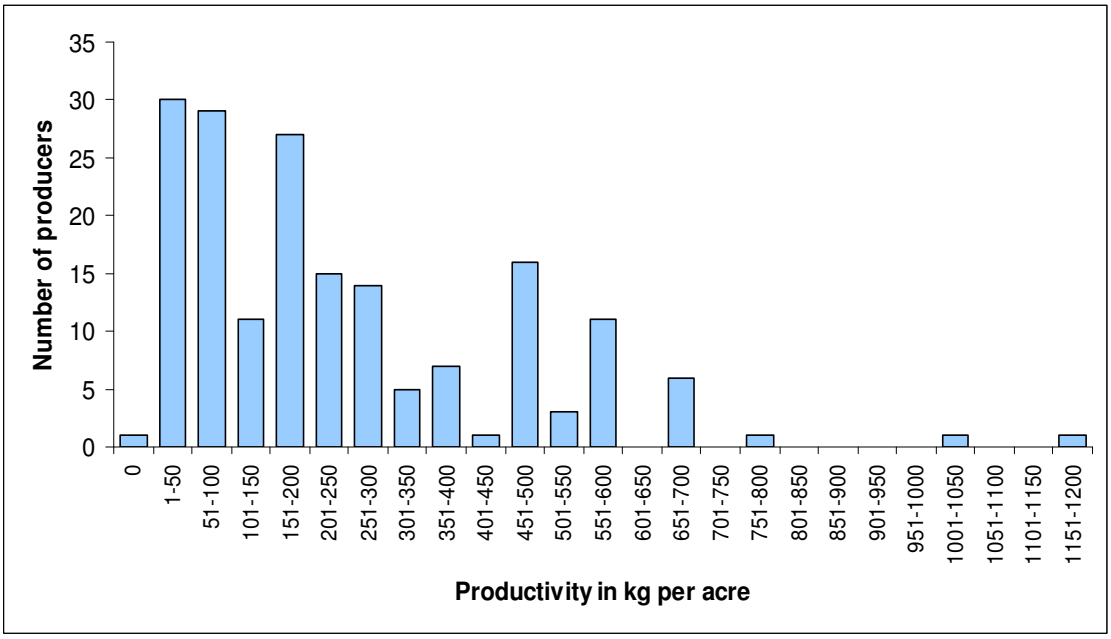


Figure 9.7: Beans productivity



9.6. Other crops

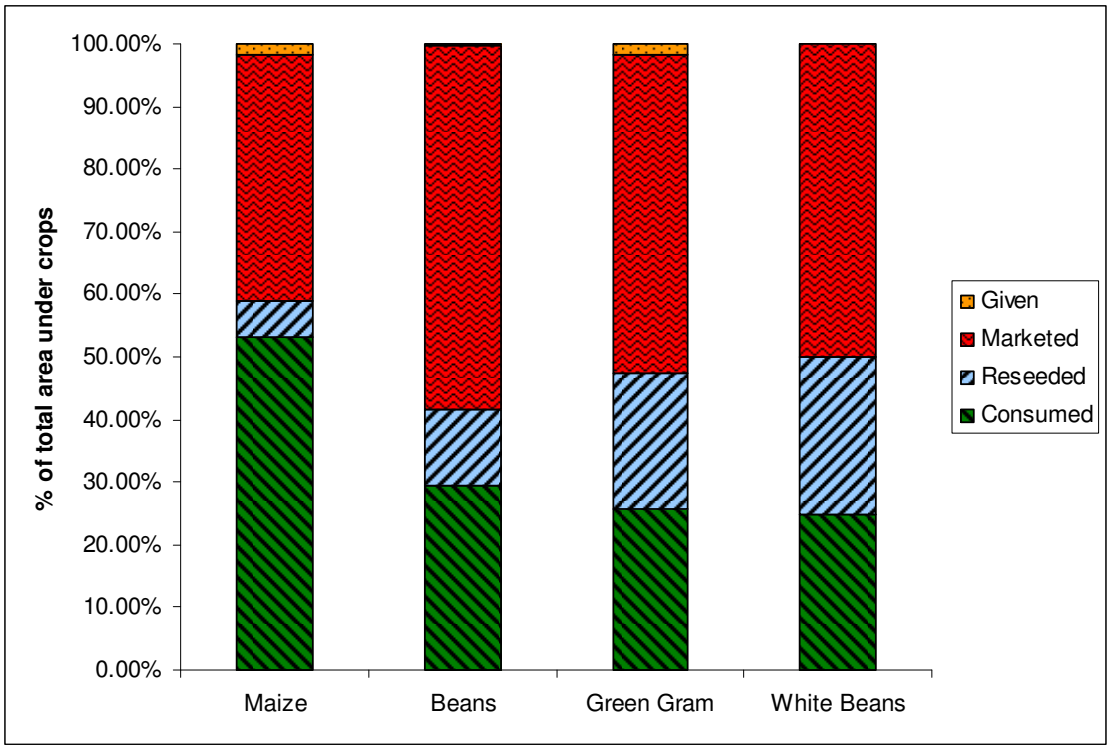
The productivity of the other crops was also very low in 2005. For white beans the unique producer produced 133 kg per acre. In the case of sun flower the unique producer produced only 50 kg per acre. For common peas the producer did not get a yield. For finger millet the observed productivities were 60 and 100 kg per acre. For cow peas the observed productivities were 100 and 120 kg per acre. For Ngwara the observed productivities were 8 kg, 80 kg and 180 kg per acre.

9.7. Use of the yield

We assessed how the HHs allocate the yield among different types of use namely: consumption, reseeding, marketing, and gifts (figure 9.8, Annex 5). For maize, beans and green gram production has a dual role as crops are both consumed at producer level and are being sold either to the neighborhood, to traders or to the market place. Nevertheless while 53.1 % of the maize production is consumed by the producers themselves, 57.9 % of the beans production and 51.1 % of the green gram are being marketed. The key role of maize as staple food is also reflected by the proportion of the total production that is given away to

other farmers which is significantly higher than for beans (1,8 % against 0.4 %). Sun flower are exclusively produced in order to be marketed.

Figure 9.6: Use of the yield by the HH



9.8. Crop marketing

For all crops most of the marketed production is being sold to the market. We nevertheless did not note for maize a significant difference between the mean prices obtained when selling the commodities to the neighbourhood, the traders or the market. This may be due to the fact that it is the staple food and prices are kept low. The mean price obtained for maize is 173.2 Tsch per kg or 17,320 Tsch per Gunia[7]. In the case of beans the mean price obtained was slightly higher when selling to traders and the lowest mean price was observed when selling to the neighborhood. Overall the mean price observed for beans is 471.9 Tsch per kg or 47,190 Tsch per Gunia. Beans production is therefore more profitable per acre (figures 9.9 & 9.10). The mean price obtained for other crop commodities is presented in annex 7.

[7] The Gunia and Debe are the two units used to measure the yields. The Gunia is equivalent to 100kg and the Debe to 25 kg.

Despite the important share of the production being marketed 28 % of the crop producers are not generating cash from crop production. This is in particular true in Naitolya where for example almost half of the producers were consuming the totality of their production. This situation is similar in Lolkisale with 39 % of the farmers producing for own consumption. In Loiborsoit.'A' production seems to be more market-oriented with only 5.1 % of the producers who did not market any products. This can partly be attributed to the higher productivity observed in this village. Among those who are selling part of yield, the mean income per year is 268,290 Tsch [335,483 Tsch/year ; 174,479 Tsch/year ; 253,613 Tsch/year] (figure 9.11). But again major variations can be observed among them. Income ranged from 5,000 Tsch to 2,850,000 Tsch in Lolkisale, from 8,000 to 1,050,000 Tsch in Naitolya and from 10,000 to 1,095,000 in Loiborsoit.'A'. Twenty-eight percent of them earned less than 50,000 Tsch, 45 % less than 100,000 Tsch [43 % ; 60 % ; 39 %], 13 % more than 500,000 Tsch [18 % ; 9 % ; 12 %] and 4 % more than 1,000,000 Tsch [9 % ; 2 % ; 3 %]. Again we can note that smaller incomes below 50,000 Tsch are common in Naitolya when larger incomes above 1,000,000 Tsch are more often encountered in Lolkisale.

Figure 9.9: Price at which maize is being sold (in Tsch per kg)

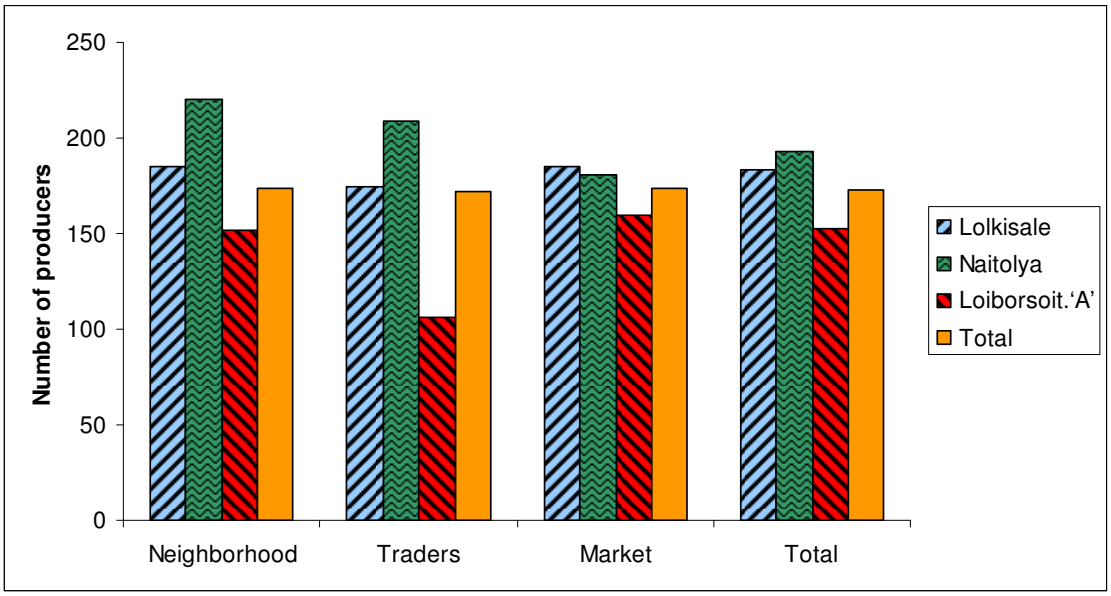


Table 9.10: Price at which beans are being sold (in Tsch per kg)

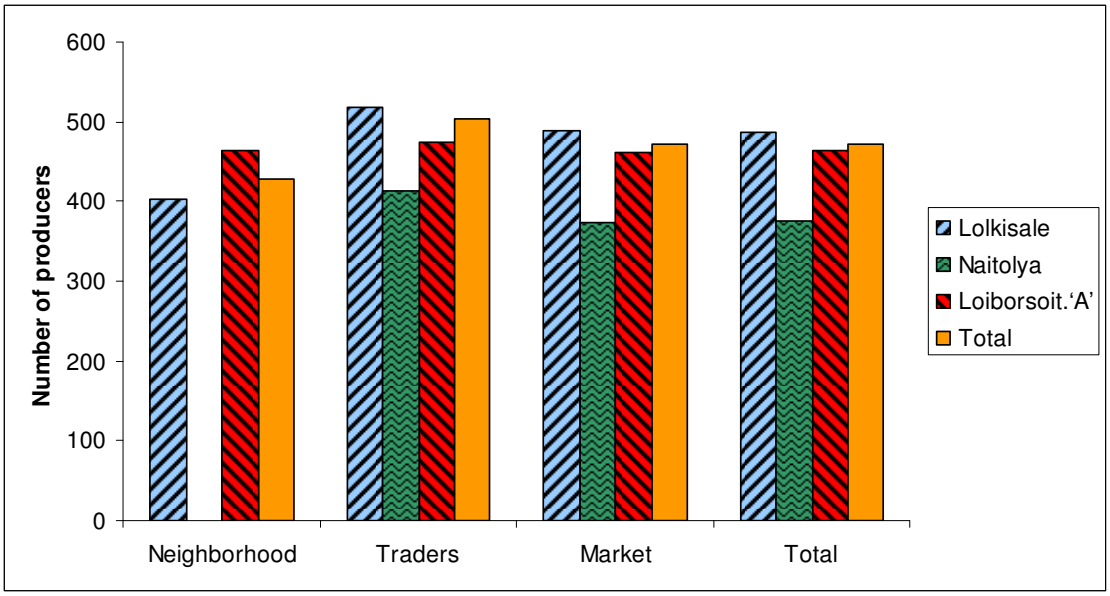


Figure 9.11 Gross income from crop production

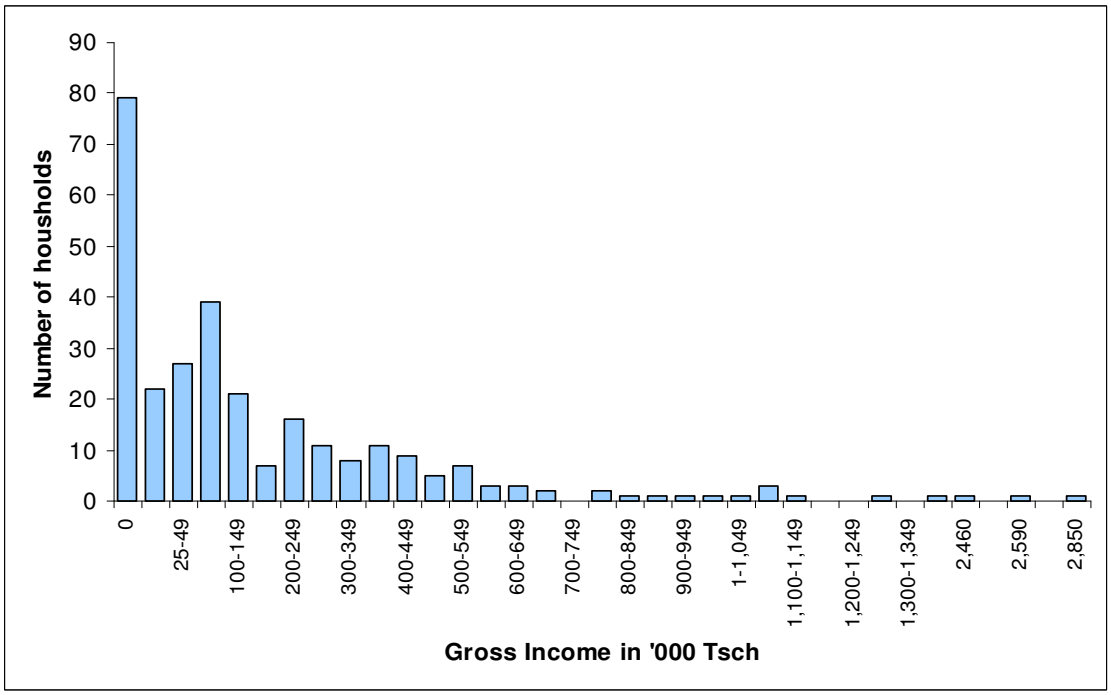


Table 9.4: Contribution of the crops to the total gross income at village level

	Maize	Beans	Green Gram	White beans	Sun Flower	Finger Millet
Lolkisale	36.7 %	63.3 %				
Naitolya	63.3 %	17.8 %	18.2 %		0.6 %	0.1 %
Loiborsoit.'A'	41.7 %	54.8 %		3.5 %		
Total	42.4 %	53.5 %	2.7 %	1.2 %	0.1 %	

With a larger share of the production being marketed and a higher price per kg, beans are the major contributor to the gross income in the surveyed area accounting for 53.5 % of the total gross income derived from crop production (table 9.4). The situation is nevertheless different in Naitolya where green gram is also being significantly produced and where maize accounts for 63.3 % of the total gross income derived from crop production.

Produces sold at the market are principally transported by tractor or lorry (table 9.5). In Naitolya, due to market proximity and lower yields, produces are usually carried to the market. 72 % of the farmers selling part of their yield in the market place had to bear a cost for transporting their yield. Transport costs on average accounts for 10 % of the value of the product being marketed. Overall transport costs averaged 2276.7 Tsch per 100 kg transported.

Table 9.5: Means of transport used to the market place

	Total	Lolkisale	Naitolya	Loiborsoit.'A'
Tractor	44 %	26 %	18 %	82 %
Lorry	28 %	55 %	14 %	13 %
Ox cart	2 %	2 %	4 %	0 %
Donkey	6 %	10 %	4 %	3 %
Carried (By head)	19 %	5 %	57 %	2 %
Other	2 %	3 %	2 %	0 %

9.9. Crop scarcity

Overall the yields produced are insufficient to cover the HH needs. Indeed 51 % of the maize producers and 43 % of the beans producers declared running out of crop over the year (table 9.6). Producers in Loiborsoit.'A' are be better off, as only 9 % of them ran out of crop over the 2005-2006 cropping season. When looking at the period during which the producers ran of food crop the precariousness of some of the

producers is striking (figures 9.12 and 9.13). In Lolkisale 45 % of those who ran out of crop did so, only 4 months after the peak of the harvest season. This in line with the conclusions of the 2006 agricultural census which estimated that only 7 % of the households can always satisfy the food requirements of the household. In the Case of Arusha and Manyara for 75 % of the households the food requirements were never or seldom met (NBS, 2006).

Table 9.6: Proportion of producers running out of crop for their own consumption in the area.

	Maize	Beans
Total	51 %	43 %
Lolkisale	67 %	53 %
Naitolya	68 %	63 %
Loiborsoit.'A'	9 %	9 %

Figure 9.12: Period during which the producers ran out of maize.

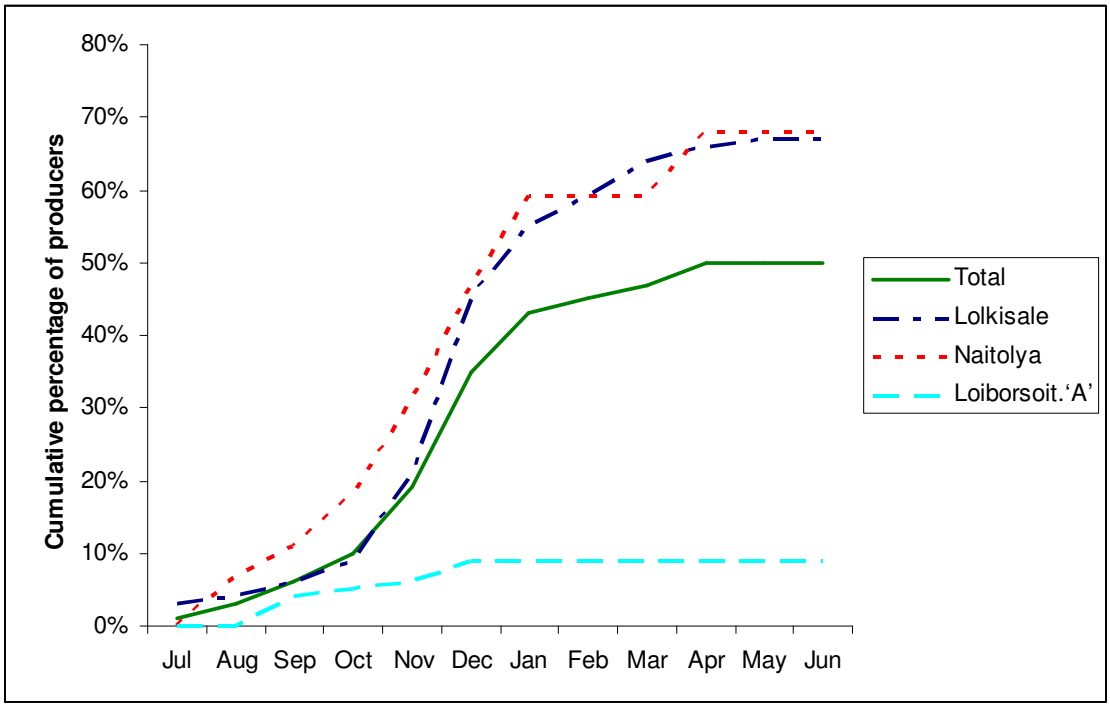
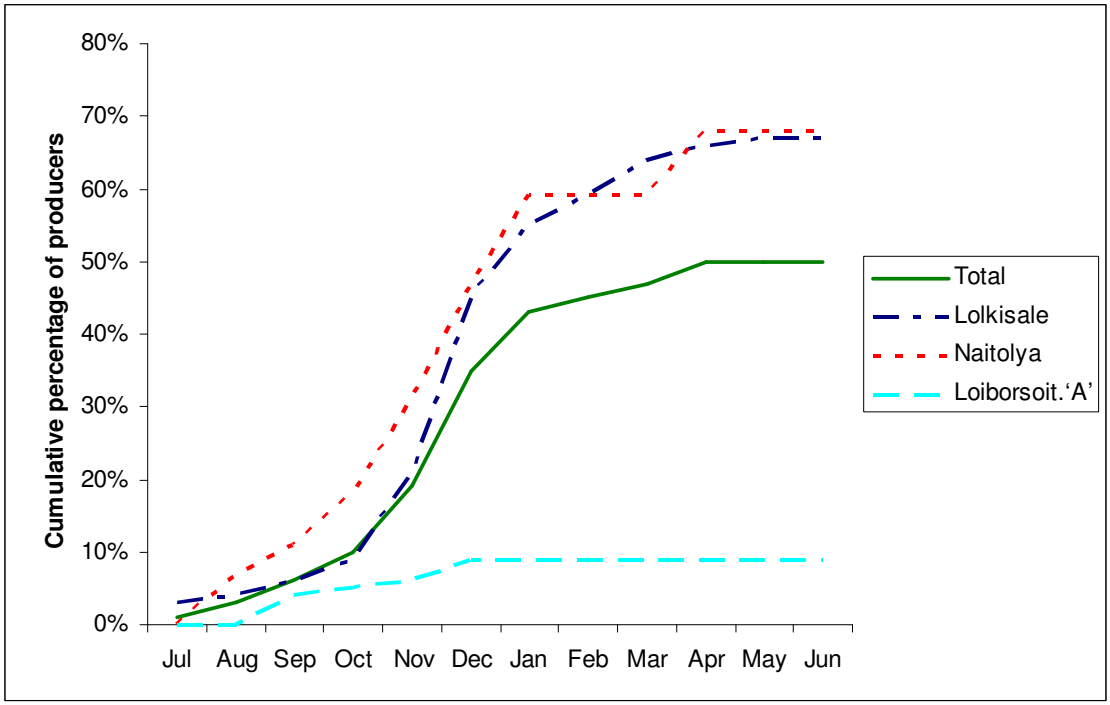


Figure 9.13: Period during which the producers ran out of beans.



9.10. Gifts

Gifts are common with 22 % of the producers declaring having given crops away as a gift. Gifts are more commonly made with maize (20 % the producers) than with beans (6 % of the producers) and with green gram (12 % of the producers). This is in line with the fact that maize is the key staple food and that gifts are often made in order to provide assistance to others (family, the clan or village members) (table 9.17). The quantity of maize given is important compared to the low production levels observed in the area. Gifts for maize ranged between 1 and 500 kg with a mean of 111 kg per HHs making gifts. For beans and green gram gifts were quantitatively lower but their values were comparable. The gifts ranged between 4 and 100 kg for beans with a mean of 39 kg and between 5 and 60 kg for green gram with a mean of 32 kg. Similarly 32 % of the total HH population received a gift.

Table 9.7: Justifications given for giving away part of the yield.

Friendship	Assistance to a			Charity		Exchange	
	Clan member	Family member in the village	Family member in town	Church	Village	Crop	Milk
20 HHs 34 %	10 HHs 17 %	15 HHs 25 %	8 HHs 14 %	5 HHs 8 %	1 HH 2 %	1 HH 2 %	1 HH 2 %

9.11. Technology and use of inputs

Despite the low technical capacity locally, land preparation is massively mechanized (table 9.8). Overall 68 % of the producers are using a tractor to prepare the land. The use of a tractor is particularly widespread in Loiborsoit.'A' where 92 % of the producers were using a tractor. In Naitolya it seems that the capacity is lower with 20 % of the producers still preparing their land by hand. Two percent (6 HHs) of the HHs engaged in crop production own a tractor. These tractors were acquired quite recently (3 after 2000, 2 in the 90's and 1 in the 70's). The cost of a tractor in the local market remains extremely high compared to the local level of incomes. Price recorded at HH level varied between 1.5 million and 9.0 million Tsch.

The tractor owners derived a substantial income from renting their machine to other crop producers. Tractors owners charge between 15,000 and 18,000 Tsch per acre. The number of acres for which the tractor was rented over the year varied between 15 and 60 acres. In parallel, 67 % of the HHs engaged in crop production are renting a tractor. The price asked per acre varied between 10,000 Tsch and 21,000 Tsch but was rather homogeneous over the area. The mean price paid per acre is 15,973 Tsch.

Oxen, ox-carts and donkeys are also commonly used to prepare the land and to transport yields and the by-products used to feed livestock. Sixteen percent of the producers borrowed an ox. The producers usually needed the ox for a period which did not exceed 15 days a year. Only 2 HHs owned an ox-cart and 6 % of the producers rent an ox-cart. Fifty-five percent paid a fee to the owner. The price paid per day varied between 1,500 Tsch and 10,000 Tsch and the ox-cart was usually rented for a short period (17 out of 18 producers required an ox cart for a period not exceeding 4 days over the year). Donkeys are commonly owned (24 % of the HH population). Few HHs (2 %) had to rent or borrow a donkey at a price not exceeding 2,000 Tsch per day. Donkeys were usually required for very short periods not exceeding 12 days per year.

Irrigation is marginally practiced and was mentioned by 8 HHs (3 % of the producers), out of which 7 are located in Lolkisale. One of these HHs mentioned using an open furrow when the others mentioned using water harvesting techniques.

Table 9.8: Technology used for land preparation

	Total	Lolkisale	Naitolya	Loiborsoit.'A'
Tractor	61 %	48 %	58 %	86 %
Tractor and oxen	5 %	7 %	1 %	3 %
Tractor and by hand	2 %	2 %		4 %
Sub total tractor	*68 %*	*57 %*	*59 %*	*92 %*
Oxen**	21 %	33 %	19 %	4 %
By hand**	9 %	7 %	20 %	4 %
Donkey	1 %	1 %	1 %	
None*	1 %	1 %	1 %	

*the household does not prepare the land before planting the seeds
** the households using an oxen in conjunction with a tractor are not included

The use of chemical fertilizers was only noticed in one HH which applied 0.4 bags of chemical fertilizer per acre. Nevertheless crop –livestock integration seems to be developing in Lolkisale and Naitolya where 10 % of the crop producers applied manure to their cropland [10 % ; 20 % ; 0 %]. On average, the producers applied 1 lorry per acre. One producer indicated paying 15,000 Tsch per year to manure his land. This practice was not observed in Loiborsoit.'A'.

Regarding pesticide use, 7 % of the producers applied pesticides however at low levels [4 % ; 16 % ; 4 %]. Producers applied on average 0.45 liter per acre and per year. The price per liter of pesticide varied between 1,200 and 8,000 Tsch (mean 4,689 Tsch).

The use of purchased seeds from the market or from other producers is common in the area (table 9.9). Eighty percent of the maize producers, 75 % of the beans producer, 60 % of the green gram producers had purchased seeds for the 2005 yield. The price observed varied considerably from producer to producer. According to the findings, it seems that the quantity purchased (the less the more expensive), the location where seeds were purchased and the quality of the seeds may greatly influence the price. It was however impossible to assess the impacts of these factors on the price of seeds.

Table 9.9: Use and costs of seeds

		Total	Lolkisale	Naitolya	Loiborsoit.'A'
Maize					
Use	% of HHs	80%	78%	75%	89%
Price Per 100 kg	Mean in Tsch	68,429	75,363	88,697	42,971
Total spent	Mean in Tsch	20,197	25,101	20,769	12,414
Beans					
Use	% of HHs	75%	71%	58%	93%
Price Per 100 kg	Mean in Tsch	80,260	86,768	120,000	57,682
Total spent	Mean in Tsch	31,596	38,927	16,636	21,442
Green Gram					
Use	% of HHs	60%		60%	
Price Per 100 kg	Mean in Tsch	143,444		143,444	
Total spent	Mean in Tsch	11,753		11,753	

9.12. Labour

Cropping activities are usually mobilizing important human resources over short periods of time. For land preparation, 0.5 day was needed per acre when using a tractor, 1.21 day when using and oxen and 7.7 day per acre when done by hand. On average for maize it took at HH level 1.1 day to plant 1 acre, 2.1 day to weed 1 acre and 0.7 day to harvest 100 kg. As presented in table 9.10 at all stage of the production process more than 50 % of the total HH workforce above 5 years old is mobilized for more than 88 % of the HHs. During these working periods the involvement of children is common.

The number of workers mobilized per acre is close to one for all production stage (table 9.11) expect when the land is prepared manually were almost 3 workers are needed per acre.

Table 9.10: Mobilization of the HH workforce over the cropping season (In % of HHs)

% of the HH Workforce Mobilized*	Preparation	Planting	Weeding	Harvesting
0-24 %	6 %	2 %	2 %	2 %
25 %-49 %	16 %	16 %	7 %	6 %
50 %-74 %	32 %	31 %	33 %	30 %
75 %-100 %	46 %	50 %	58 %	62 %

*above 5 years old.

Sixty-eight percent of the HHs employs seasonal workers from the neighborhood at least at one stage of the production process (table 9.12). The demand for seasonal workers is higher during the land preparation phase as people will often be needed to maneuver the tractor. When using a tractor 1 to 5 persons were

employed by the producers. Their cost is not always incorporated in the rent of the tractor and in this case the HHs pay on average 2,110 per day. The price for the preparation of the land with an ox varied between 500 and 4,000 per person per day (mean 1,969 Tsch) and by hand between 1,500 and 3,000 per person and per day (mean 2,929 Tsch).

Table 9.11: Labor required per acre

	Preparation	planting	Weeding	Harvesting
tractor	1.26	0.92	1.03	1.09
oxen	1.01			
hand	2.85			
donkey	1.32			

Planting and weeding activities are paid by acre worked. Planting maize cost on average 2,310 Tsch per acre and weeding which is more time consuming costs on average 5,084 Tsch per acre. For harvesting the workers are paid according to the quantity of crops harvested. For maize the mean price paid for 100 kg harvested was 568 Tsch (varied between 400 and 800) while for beans the mean price paid was 3,222 Tsch per 100 kg (varied between 500 and 6,000 Tsch).

Table 9.12: Labor force employed over the cropping season (in % of producers)

Number of employees	Preparation	Planting	Weeding	Harvesting	Guarding
0	40.8 %	70.2 %	63.8 %	67.4 %	82.6 %
1	28.4 %	9.6 %	4.6 %	4.3 %	13.1 %
2	25.5 %	12.8 %	12.4 %	9.6 %	3.9 %
3	3.9 %	4.6 %	10.3 %	8.9 %	0.4 %
4	0.7 %	1.8 %	4.6 %	5.3 %	
> 5	0.8 %	0.8 %	4 %	5 %	

10. Off-farm income

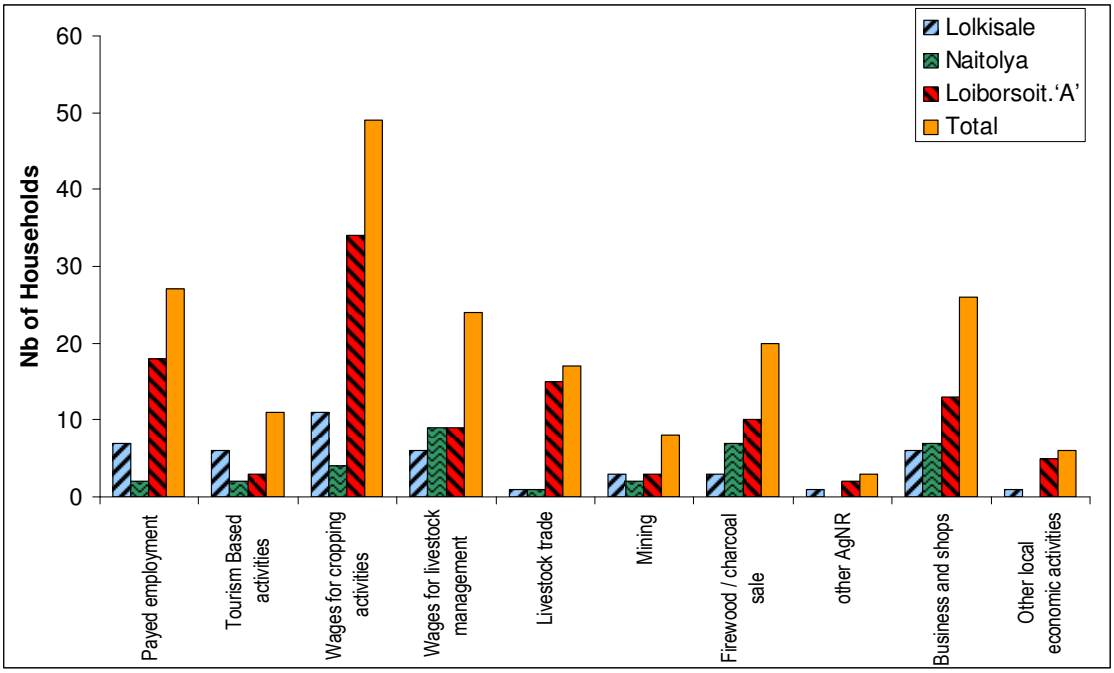
Forty two percent of the HHs are engaged in off-farm activities [28 % ; 39 % ; 58 %]. Among them, 74 % are engaged in one activity, 23 % into two and 3 % into three activities. The different off-farm activities identified are presented in figure 10.1 and annex 8. The mean income derived from these activities show their important contribution to the local livelihoods. The proportion of HHs engaged in off-farm activities in our three villages is lower than the proportion observed at regional level (57 % for Arusha and 59 % for Manyara) Nevertheless, similar rates where observed in neighboring regions such as Kagera (47 %) (NBS, 2006).

Paid employment requiring minimum education level (government employees and nurse) are getting the highest pay rate ranging between 960,000 and 1,000,000 Tsch per year. These higher level employments are rare at village level (1 % of the total HH activities).

Agricultural and natural resources based activities were frequently observed and are generally involving several members of the HH. In Loiborsoit.'A' where large scale farming is using a large portion of the village area, 24 % of the HHs are being employed in crop farms. This activity contributes significantly to the total incomes of the HH with a mean income per year of 263,622 Tsch. Over the three villages 7 % of the HH received wages for livestock management. The mean income is slightly lower than for crop production (157,625 Tsch) and is often paid in kind (calf, goats or kids). Firewood and charcoal sale is also commonly practiced in the three villages. This activity which is time consuming (14 working days per month on average) is generating low incomes (mean 143,050 Tsch per year) and is more often practiced by poorer HHs. Two percent of the HHs were engaged into mining. The income generated by this activity can be extremely appealing as they ranged from 100,000 Tsch to 3,000,000 Tsch. The variability is related to the fact that the income is a function of the quantity of gems mined by the HH member. For the HH member whom mined the highest quantity of gems the annual income was three times higher than the annual income of a government employee.

Despite the proximity of the National Parks only a relatively few HHs (4 %) were engaged into tourism related activities (hotel/lodge employee, tourism employee, hawking). The mean income for the hotel/lodge employee was low compared to other activities (70,000 Tsch per year).

Figure 10.1: Off-farm activities in the three villages



11. Water management

11.1. Private water resources

Private water resources were only observed in Lolkisale and were only described by livestock owners. It seems that there is an appropriation at private level of the water resources financed at community level and that producers considered as theirs the existing water resources at village level. In Lolkisale 22 % of the HHs declared owning a borehole (34 HHs). The borehole is only used during the dry season by all the HHs but one. Eight HHs indicated having bought the water resources. The average price paid by the HH to own the borehole seems to confirm that it is in fact community properties that have been described by the HHs in this village. The average price paid is 67,500 Tsch and the price varied between 20,000 and 120,000 Tsch. The HHs don't rent boreholes. Out of the 34 HHs, 19 indicated having paid maintenance cost last year. The maintenance cost varied between 3,000 Tsch and 150,000 Tsch (mean 56,632 Tsch). The boreholes indicated were all located in the direct vicinity of the producers with a mean distance of 1.21 km between the water source and the settlement. This may have reinforced the appropriation process. In Lolkisale 12 HHs (8 %) also indicated owning a charcoal dam which in this case is with no doubt a community resource. The charcoal dam was indicated as permanent and is being used during the dry season and during droughts. None of them indicated having paid something to own it but two-thirds (8 HHs) of them indicated paying maintenance costs every year. The maintenance costs paid varied between 2,000 and 10,000 Tsch. The charcoal dam is also located in the direct vicinity of the HH. The distance varied between 0.5 and 15 km with a mean distance of 0.3 km between the water source and the settlement. In Loiborsoit.'A', 1 household also indicated owning a small pond that he bought for 150,000 Tsch and is being used during the rainy season.

11.2. Water and livestock production

Only 4 % of the livestock owners indicated having access to enough private water resources to water their livestock. Overall 40 % of the herders were paying a fee to water their livestock. The value of this fee varied considerably and seemed to be based on the number of livestock heads watered by the HH. On average, cost for water access was low and standing at 14,460 Tsch per year if only considering the water fee and at

24,313 Tsch if considering all costs related to water access (table 11.1). Ninety-five percent of the HHs were paying their fee to the community. The remaining 5 % were paying the fee to private owners.

Table 11.1: Cost of water access

	Water access fee				Total paid for water access		
	% of herders	Mean	Min	Max	Mean	Min	Max
Total	40	14,460	1,000	100,000	24,313	1,000	225,000
Lolkisale	17 %	6,290	2,000	20,000	37,136	1,000	150,000
Naitolya	70 %	17,511	1,000	100,000	19,995	2,000	225,000
Loiborsoit.'A'	53 %	15,647	2,000	56,250	17,511	1,000	100,000

Access to water is a constraint locally, with 71 % [72 % ; 66 % 72 %] of the HHs who consider that water resources are not sufficient during a drought.

Table 11.2: Location of the water sources used during a normal year

(Number of respondents)		Village of origin		
		Lolkisale	Naitolya	Loiborsoit.'A'
Monduli	Lolkisale	105		
	Naitolya		42	
	Makuyuni		6	
	Mswakini		3	
Simanjiro	Loiborsoit.'A'	9		83
	Sukuro	1		2
	Terat			1
	Terat			1

Most of livestock owners water (94 % - [95 % ; 91 %; 94 %]) their animal in their own village during a normal period (table 11.2). 63 % [65 %; 64 %; 59 %] of the herders are partially or entirely utilizing water resources from another sub-village. This implies that when designing the land use plans such as access should be maintained. Few herders also watered their animals in other villages. In Lolkisale these herders go to Loiborsoit.'A' or Sukuro, while herders from Naitolya move to Makuyuni and Mswakini and in Loiborsoit.'A' they go to Sukuro and Terat. As presented in table 11.3 the main source of water used included charcoal dams and boreholes.

Table 11.3: Type of water used by the herders

Village	Borehole	Charcoal dam	Water pump	Stream	Ponds	Well	Spring
Lolkisale	49 %	54 %	1 %	15 %	15 %	3 %	2 %
Naitolya	62 %	75 %	13 %	2 %		2 %	
Loiborsoit.'A'	22 %	44 %	22 %	9 %	6 %	4 %	5 %
Total	43 %	55 %	10 %	10 %	9 %	3 %	2 %

% of the herders using a given type of water resources

During a drought the proportion of herders moving away from their village is increasing (table 11.4). In this case, the movements were not limited to the neighboring villages and some herders indicated moving to other districts such as Babati. Seventeen percent of the respondents in Lolkisale indicated the Tarangire National Park as a potential source of water during a drought. This may potentially generate conflicts with local authorities. The size of the herds which need to move outside their village of residence during a drought is higher than the average herd size.

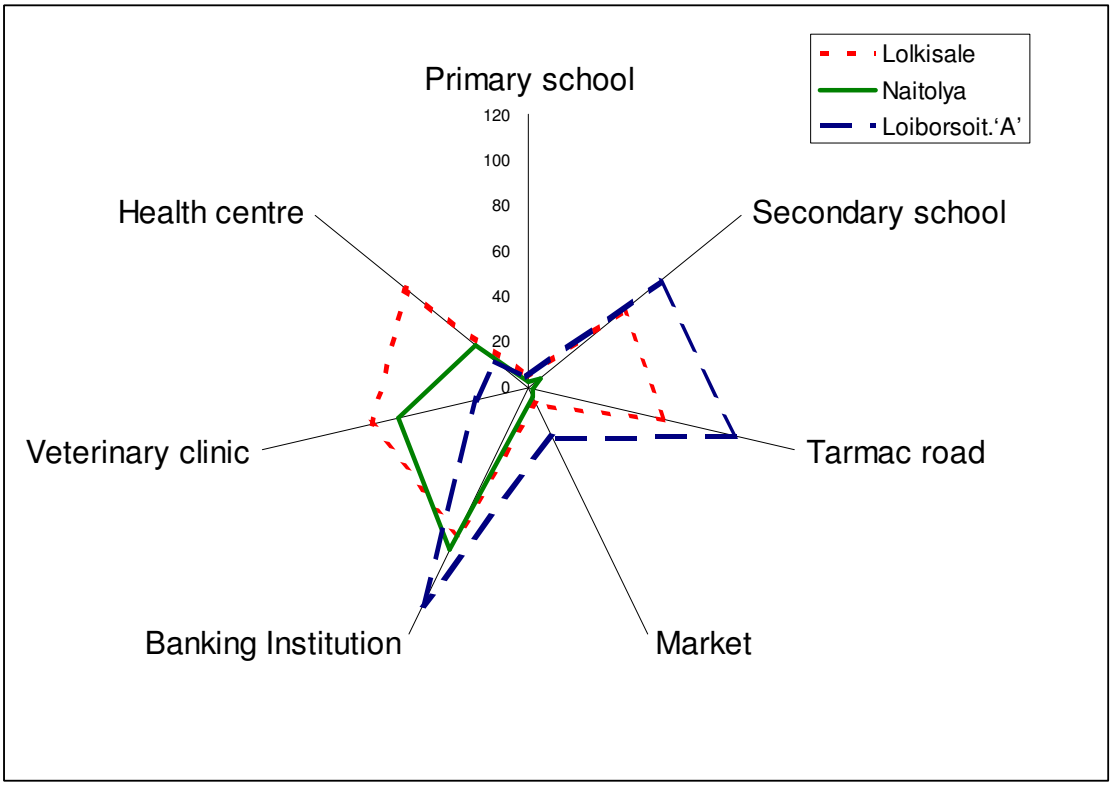
Table 11.4: Location of the water sources used during a drought

(Number of respondents)		Village of origin		
		Lolkisale	Naitolya	Loiborsoit.'A'
Monduli	Lolkisale	12		4
	Naitolya	36	1	4
	Ngorika			1
	Makuyuni	1	15	
	Mswakini		2	
Simanjiro	Loiborsoit.'A'		2	
	Emboreet	3		16
	Sukuro	1		5
	Tarangire national park	5		
	Terat	1		8
Arumeru	Kisongo			10
Babati	Bonga			3
	Mdori		1	
	Minjingu		1	
	Tarangire national park	4		1

12. Access to facilities

Access to basic facilities remains a constraint for the HHs, as it (i) limits access to basic services, marketing facilities, and agricultural inputs, (ii) constrains the development of exit strategies, (iii) increases post harvest losses, and marketing costs. The access to various facilities in the three villages is presented in figure 12.1 and annex 9. This table reflects the different opportunities that exist in the three villages. In general Naitolya seems to be better off. Access to the tarmac road, the market, the primary school or a secondary school is relatively easy. In Lolkisale and Loiborsoit.'A' the picture is clearly different. The mean distance to tarmac road in Loiborsoit.'A' is 93.5 km, to the market 24.5 km and to secondary schools 74.3 km. Access to the primary school remains easier than for any other type of facilities. But the average time taken by foot to cover the distance [2.2 hours ; 1.5 hours ; 1.8 hours] may contribute to explain the low proportion of children going to school. In all three villages, access to a banking institution, a health centre of a veterinary clinic is extremely constrained.

Figure 12.1: Mean distance to facilities in the three villages (in km)



13. Wealth, investments and strategy

13.1. Wealth of the HH

The houses were described according to their roof and their wall. As presented is table 13.1, HHs in still live in traditional houses mostly made with mud walls (at 98 % in Loiborsoit.'A') and grass-thatched roofs. When now looking at the goods of the HHs, table 13.2 reflects the poor material conditions of the HHs. The only two goods that were widespread in the three villages are the radio and the bicycle. Owning a plough is relatively common in Lolkisale. Beside from this, HHs owning a television, a video, a motorbike, a car, a sofa or a generator are marginal.

Table 13.1 : Description of the house of the HH

Roof	Maasai traditional		Grass thatched		Mabati (iron sheets)		
Wall	Mud	Earth brick	Mud	Earth brick	Mud	Earth brick	Cement
Lolkisale	6%	1%	63%		26%	3%	1%
Naitolya	12%		69%	2%	16%	2%	
Loiborsoit.'A'	5%		86%		7%		2%

Table 13.2 : Goods of the HH

	Radio	Television	Video	Bicycle	Moto	Car	Plough	Sofa	Generator
Total	64 %	0.3 %	0.3 %	34 %	1 %	0.3 %	7 %	1 %	0.3 %
Lolkisale	54 %			32 %			15 %	1 %	
Naitolya	79 %			58 %	1 %	1 %	3 %		
Loiborsoit	68 %	1 %	1 %	24 %	1 %		1 %	1 %	1 %

Six percent [9 % ; 10 ; 1 %] of the HHs had a plot in town. Out of the 22 HHs having a plot, 15 had their plot located in Moshi town, 5 in Arusha town, 1 in Monduli town and 1 in Kilimanjaro town. The size of the plots varied between 0.25 and 7 acres however 15 of them were below 1 acre.

Only 5 HHs [2, 1, 2] had a bank account. The banking institution was located in Arusha town, Kilimanjaro town, Moshi town, Makuyuni or Monduli town. The distance to the banking institution remained high and between 60 and 100km for the HH in Lolkisale and Loiborsoit.'A'. The data collected on the saving estimates were not reliable.

13.2. Other costs and taxes

These costs born by the HH could be considered as investments into the HH human capital and into community services in order to improve the living conditions of the HHs and favor exit strategies through education. Payment of school fees, taxes and health fees are presented in table 13.3.

Table 13.3 : Other costs and taxes born by the HHs

			Mean*	Min	Max
School	Primary	Per child	6,232	400	90,000
		At HH level	13,131	1,000	180,000
	Secondary	Per child	45,950	14,000	150,000
		At HH level	52,810	14,000	150,000
Taxes		Lolkisale	16,676	2,000	100,000
		Naitolya	12,754	2,000	120,000
		Loiborsoit	21,049	5,000	120,000
		Total	17,140	2,000	120,000
Health		Lolkisale	7,265	1,000	50,000
		Naitolya	10,880	3,500	100,000
		Loiborsoit	19,861	3,000	100,000
		Total	12,934	1,000	100,000

*The mean estimates only considered HH that bear these costs

For the school fees only 33 % [56 % ; 17 % ; 5 %] of the HHs having children are paying school fees. This low rate is explained by the fact that the Government and NGOs subsidizes the schooling system as an incentive for Maasai children to go to school. On average the cost per children sent to primary school was therefore low (6,232 Tsch per year). The average cost to send children to secondary schools is much higher (45,950 Tsch per year) and clearly explains the low education level observed above form 4.

Seventy eight percent [72 % ; 79 % ; 83 %] of the HHs had to cover health expenses. The mean expenses were 12,934 Tsch [7,265 Tsch ; 10,880 Tsch ; 19,861 Tsch]. But 67 % of those who had to cover health expenses paid less than 10,000 Tsch.

Seventy four percent [86 % ; 82 % ; 57 %] of the HHs are paying taxes. The common tax being paid is the contribution to local development which is being used to develop services (schools, water pumps) locally (table13.4). Other contributions being paid by the HH included school development, small water pump

development, church building development, women group, livestock market, trading and business and water access.

Table 13.4 : Type of taxes

	Lolkisale	Naitolya	Loiborsoit	Total
Contribution to local development	84.6 %	81.7 %	53.1 %	71.6 %
School development	1.3 %	7.0 %		1.9 %
Small water pump development			0.7 %	0.3 %
Church building development			0.7 %	0.3 %
Women group			0.7 %	0.3 %
Livestock market			0.7 %	0.3 %
Trading and business	0.7 %			0.3 %
Water access	1.3 %	2.8 %	0.7 %	1.4 %

*In % of the total HHs population paying a given tax

13.3. Financial support

Only two HHs located in Lolkisale received financial support from a family member located outside the village and living in both cases in Arusha. The amount received by both HHs was extremely significant compared to the local level of income. In one case the HH received 200,000 Tsch and in the other case 1,000,000. Both HHs invested part of the financial support in school fees. One HH invested in cattle and the other in a tractor. For the lowest support, the HH repaid the provider with a cow after two months. In the case of the tractor no special agreement was mentioned. We can nevertheless notice that in both cases the primary intention for financial support was the development of an agricultural activity.

13.4. Credit

Seven HHs, all located in Lolkisale, had benefited from credit from an individual over the last five years. In 4 cases, this individual was a friend and in 3 cases the individual was a relative. In 4 cases the individual was based in Lolkisale. The other credit providers were based either in Mererani or in Ilkerin. Again the amounts received are relatively important compared to the mean annual incomes derived from agricultural activities. The 7 HHs received between 150,000 and 500,000 Tsch. In 3 cases the money was used to start-up a business, in 2 cases to buy food, in 1 case to pay school fees and in 2 cases to buy medicine. The credit

was therefore either used to develop an income generating activity or to meet basic family needs. All credit had to be repaid within a three years period. The interest rate was not clearly detailed by the HH.

Access to credit is poor. In the area only 3 HHs in Lolkisale and 1 HH in Naitolya had benefited from a credit facility over the last 5 years. For 3 of them the credit institution was the NMB and for the other one the CRDB. The beneficiary in Naitolya, invested in a tractor. Two HHs in Lolkisale used the credit to meet basic needs and pay school fees while the other one, used it to develop trading activities. Again the amounts received were important compared to the average income locally. The credits received were comprised between 600,000 and 3,500,000 Tsch. All credits had to be repaid at a maximum within a three and a half years period. The interest rate was 20 % per year for all loans.

These observations are basically in line with the situation at national level where 97 % of the rural HHs did not receive credit in 2006. The agriculture sample census 2006 also highlighted the poor access to credit in Arusha and Manyara which ranked 19th and 18th out of 21 regions in terms of number of HHs receiving credit (NBS, 2006).

Willingness to access credit is high as 22 % [48 % ; 11 % ; 1 %] of the HHs expressed their desire to access credit (table 13.5). This rate varied significantly among the 3 villages as in Lolkisale almost half of the HHs expressed this desire, while in Loiboirsoit.'A 'virtually no HH expressed it. HHs that have already benefited from a credit in Lolkisale may have played a catalyser role. The amount desired varied between 80,000 Tsch and 50,000,000 Tsch with a mean of 820,381 Tsch. As presented in table 13.5 the key need expressed relates to the improvement of the living environment followed by the preference to acquire assets such as livestock and land.

Table 13.5: Willingness to access credit and activities for which the credit would be used

		Lolkisale	Naitolya	Loiborsoit.'A'
Number of HH willing to access credit		72	8	1
Credit use				
Living environment	House	61	5	1
	Goods	11	2	1
Livestock	Cattle	40	4	1
	Sheep	21	3	0
	Goat	23	5	0
Land	Shamba	35	4	0
	Town	10	0	0
	Village	20	2	0
Vehicle	Motorbike	2	0	0
	Bicycle	5	1	0
	Car	5	1	0
Agricultural Inputs	Tractor	6	1	0
	Ox cart	1	1	1
	Water for livestock	2	0	0
	Vet service.	1	0	0
Service	School	51	3	0
Savings		15	5	0
Business		2	0	1

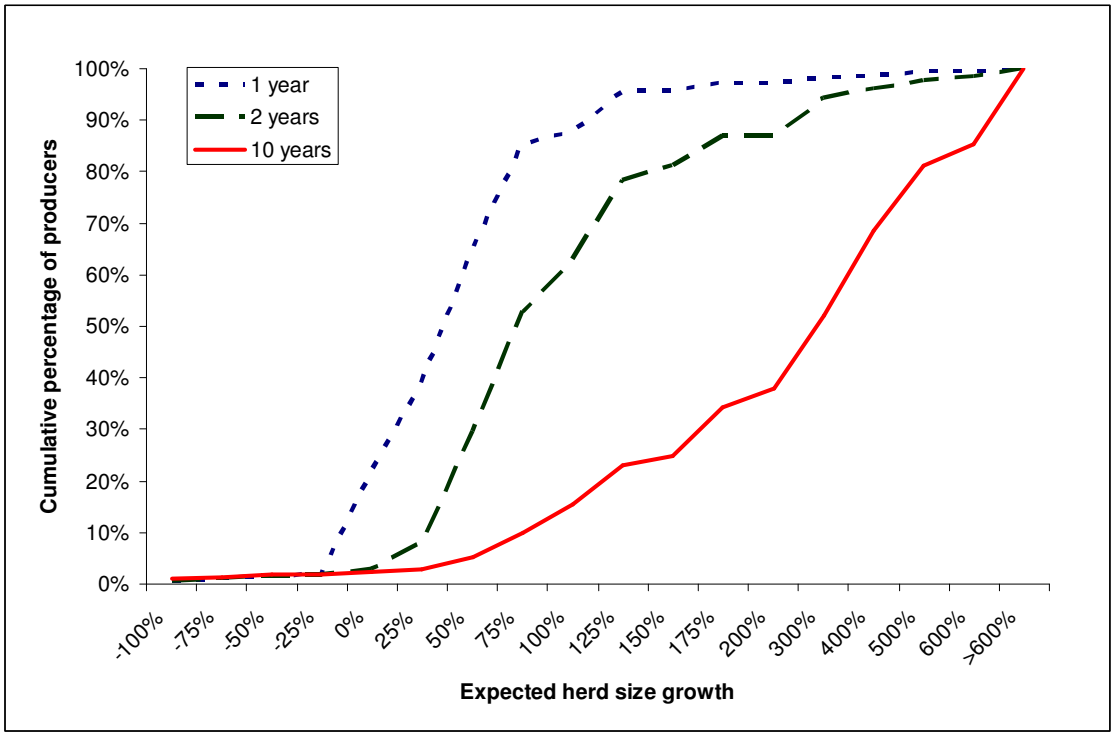
13.5. Livestock production strategy

Fifteen per cent of the HH not owning livestock are planning to get some in the 2 next years and 16 % in the next 10 years. For cattle this ratio is 15 % for the next 2 years and 17 % for the next 10 years. In the case of shoats, 16 % of those not having shoats are planning to get some in the 2 next years and 17 % in the next 10 years.

HH expectations in terms of cattle herd and shoat flock growth are presented in figures 13.1 and 13.2. In its interesting to note that for cattle these expectations remains realistic with 20 % of the producers not considering a cattle herd size growth over the next year and 37 % considering a growth below 25 %. Nevertheless the 10 years vision for cattle production is clear and confirms the well described cattle accumulation strategy. The situation is similar for shoats.

Thirty three percent of the cattle owners expressed the willingness to have another breed. They principally mentioned the Sahiwal but some producers also mentioned Boran, crossed Zebu-Frisian or crossed Zebu Sahiwal. The main source mentioned for a potential acquisition of a new breed is the Manyara Ranch which is renowned locally for the quality of its breeds (especially Boran). Other sources included the market, other herders in the village and in neighboring villages, markets in Kenya and relatives. The main reason mentionned for acquiring a new breed is to increase milk production. Other reasons included meat production, breed improvement, improved growth and fattening, and disease resistance.

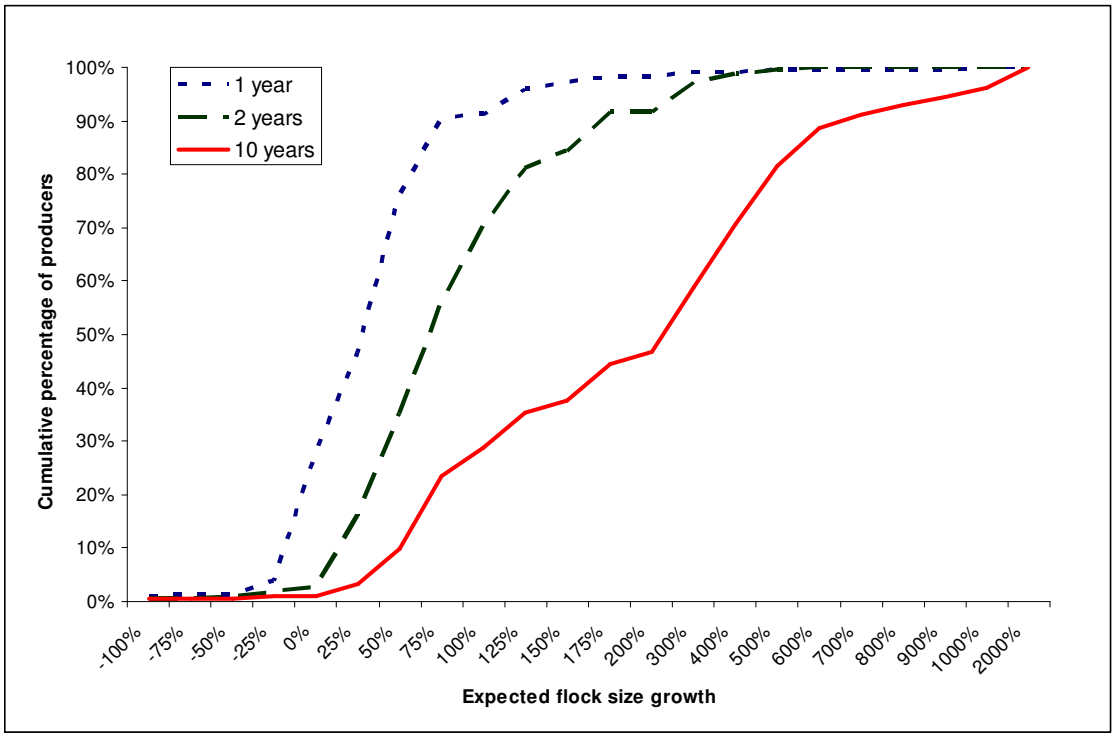
Figure 13.1: HH expectations in terms of cattle herd growth



Twenty two percent of the small stocks producers want to get another breed. Regarding goats the breed preferred is Akamba. Owners also mentioned Galla, Togenburg, crossed and exotic breeds. For sheep owners equally mentioned Dorper and Black Headed Persian. Red Maasai was marginally mentioned. Regarding acquisition of breeds, the respondents indicated "*the market*" as the first potential source and '*from neighbours*' as the second source. Producers also marginally mentioned that they could get the breed from neighboring villages, from the Kenyan market or from middle men brokers. The main explanation

provided for acquiring a new breed is milk production. Other explanation included improved meat production (including fattening), better market price, and disease resistance.

Figure 13.2: HH expectations in terms of shoat flock growth



13.6. Crop production strategy

Crop production is expected to expand as 6 % of the HHs currently not practicing crop production are planning to do so in the next two years. This will fuel the existing pressure on land resources and further support the transition of the population engaged into pure pastoralism toward agro-pastoralism activities.

Nevertheless when looking at HH expectations in terms of cropland growth we can note that 69 % of the HHs were not considering expanding their cropping activities over the next year, 51 % over the next two years and more surprisingly 30 % over the next 10 years (figure 13.3). These figures have to be put in parallel with the fact that, as presented in chapter 7, 76 % of the HHs are planning to get more land in the future because of production and demand constraints. These contradictory statements underline the fact that the desire to access more land may be hard to materialize due to land access constraints including physical lack of good agricultural land and / or the lack of connections to the land allocation authorities. HH

expectations in terms of maize or bean production (figures 13.4 & 13.5) reflect that there is a strong willingness to increase beans and maize production. Given local constraints the strategy seems to be more in favor of intensification than in favor of extensification locally (figures 13.6 & 13.7).

Figure 13.3: HH expectations in terms of crop land growth

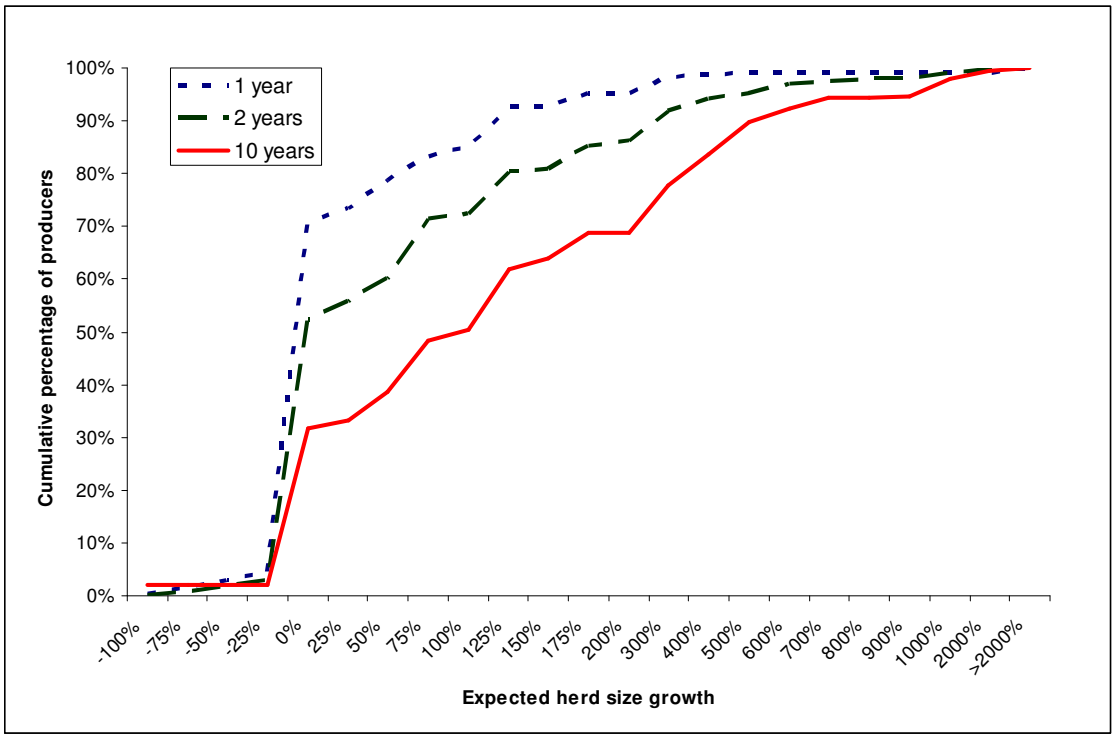


Figure 13.4: HH expectations in terms of maize production

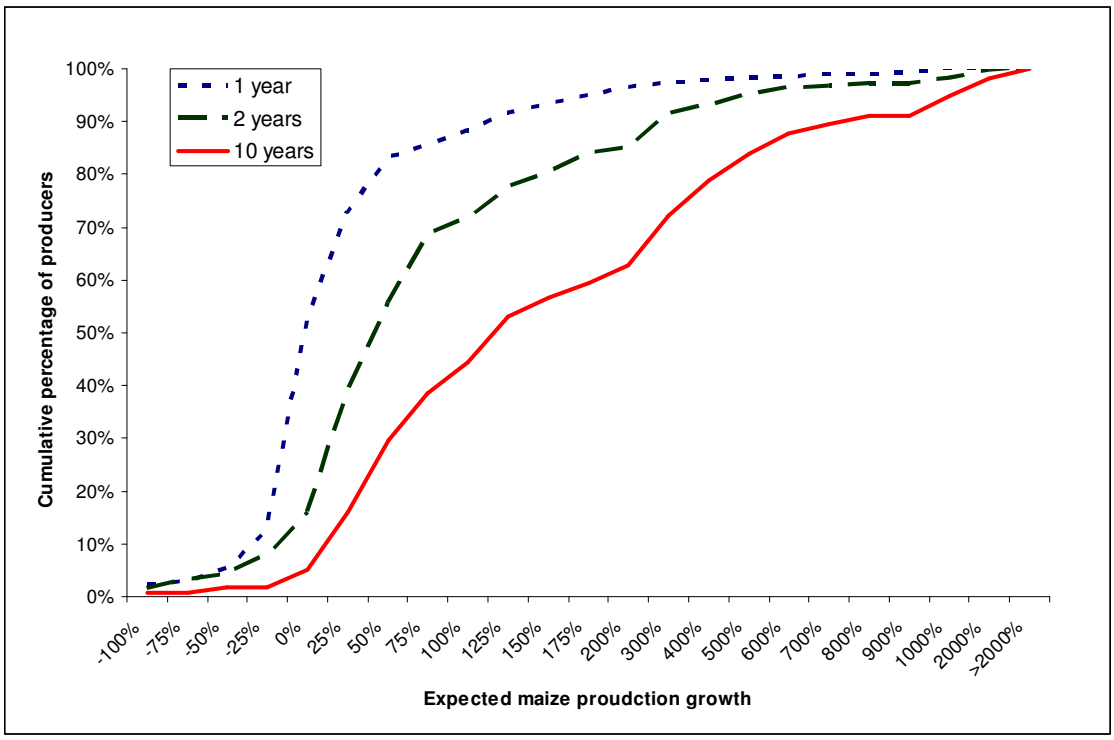


Figure 13.5: HH expectations in terms of beans production

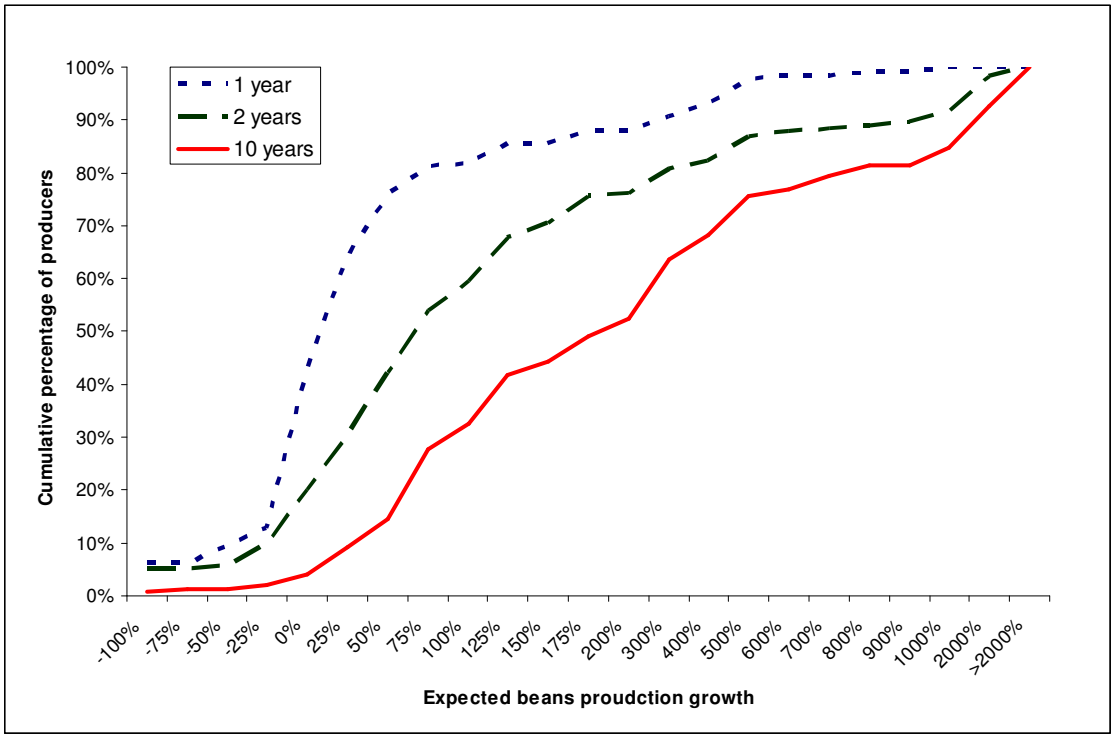


Figure 13.6: Willingness to intensify or extensify crop production within the next two years

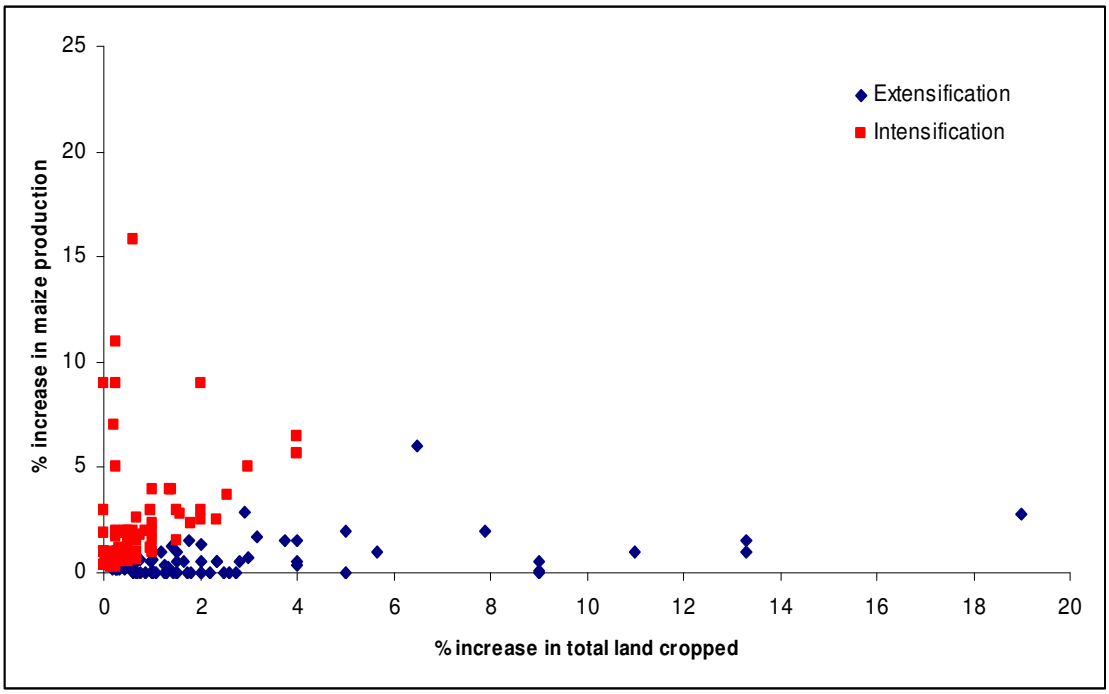
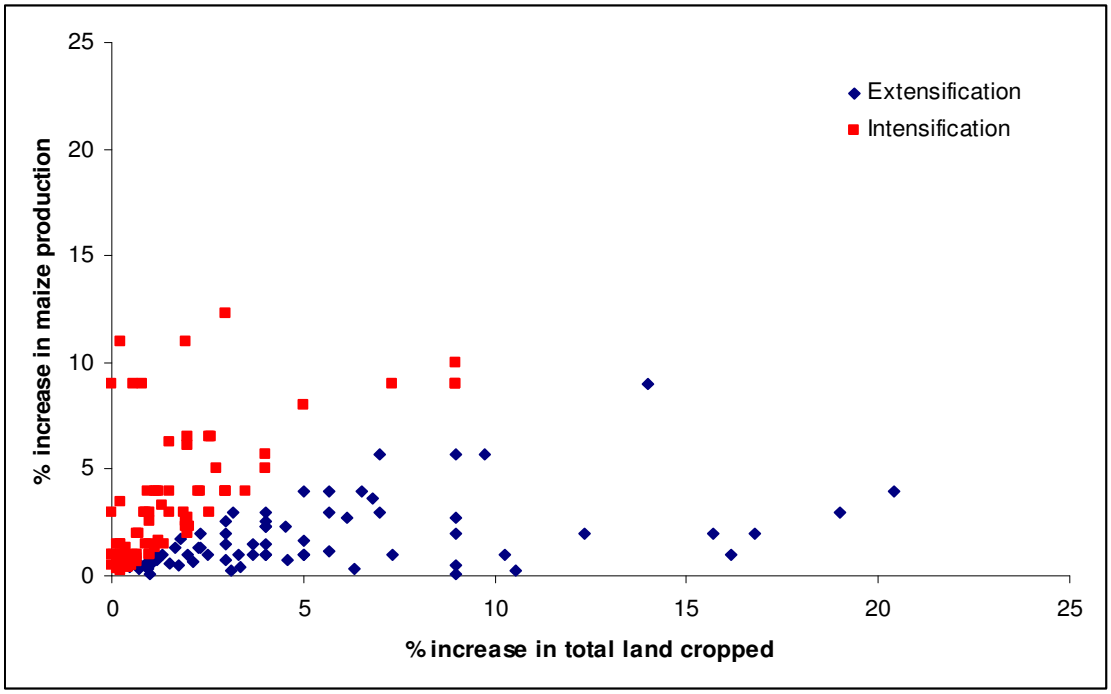


Figure 13.7: Willingness to intensify or extensify crop production within the next 10 years



Twenty percent of the croppers would like to diversify their production. The type of crop indicated varied between the villages. Preference for diversification was expressed in Lolkisale and Naitolya where several

different crops were mentioned. In Lolkisale farmers mentioned beans, ngwara, fingermillet, common peas and sunflower. In addition to these crops, the farmers in Naitolya also mentioned green gram, sorghum, white beans and simsim. In Lolkisale where few farmers expressed the desire to diversify, the two crops mentioned were: beans and catam. The justification given included: the higher price at which the crop is being sold, low wildlife depredation for that particular crop, for the crop domestic use, in order to feed poultry or for the crop drought-resistant potential.

13.7. Income diversification strategy

Forty nine percent of the HH want to diversify their source of income and engage in other activities. The different potential activities mentioned are presented in table 13.6. It is interesting to note the variations between the three villages. In Loiborsoit.'A' where there is a clear distinction between crop and livestock producers, an important part of the population wants to be engaged into the activity they are not currently engaged. This may lead to further crop-livestock integration locally. Nevertheless the pressure on land resources may increase with the extension of cropping activities and the increased number of animals.

In Loiborsoit.'A' the willingness to engage in exit strategies (especially for the children) was reflected by a significant number of HH mentioning higher education activities such as teacher, or government employee. In Naitolya, 23 % of the HH would like to diversify into businesses, 7 % retail shops and 11 % bead works. This may reflect the proximity of the transport infrastructures (in particular the tarmac road) which facilitate the development of business activities and the selling of crafts to tourists. The development of the bee keeping activities in this village was also expressed, with 10 % of the HHs willing to practice this activity. This may be due to a neighbourhood effect as 18 % of the HHs already engaged into this activity in this village,

The income diversification strategies and potential future investments were further analyzed through two questions. The first one asked the HH to rank the investments the HH would consider if the crop production was very good this year. This question was meant to analyze the short-term strategy of the HHs. The second question asked the HHs to rank the investments they HH would consider if they the equivalent in

cash of 100 heads of cattle. This question was meant to analyze the long-term strategy of the HHs. The results are presented in figures 13.8 and 13.9 (and in annexes 10 & 11).

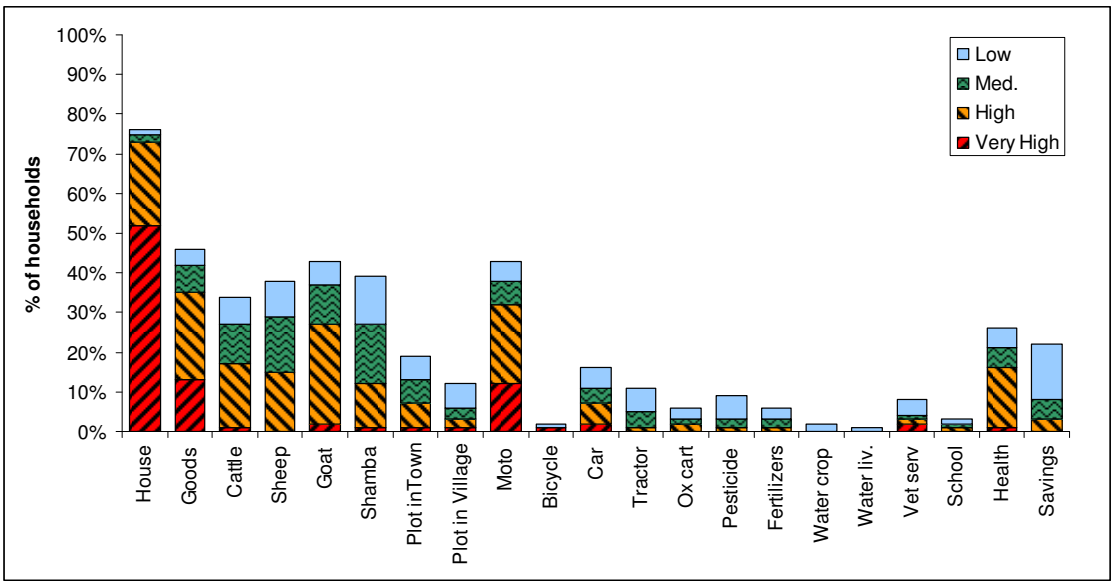
Table 13.6 Household diversification preferences.

	Lolkisale	Naitolya	Loiborsoit.'A'	Total
Crop production	1 %		11 %	5.0 %
Livestock production	3 %		16 %	7.4 %
Livestock trade	1 %	8 %	6 %	4.4 %
Skin trade		1 %		0.3 %
Veterinary medicine		0 %	1 %	0.3 %
Bee keeping		10 %		1.9 %
Teacher	1 %	4 %	7 %	4.1 %
Government employee			6 %	2.2 %
Police			1 %	0.3 %
Tourism employee	3 %		1 %	1.7 %
Hawking		3 %		0.6 %
Watchman		1 %	1 %	0.6 %
Driver	1 %		2 %	1.1 %
Transport business		1 %		0.3 %
Retail shop	1 %	7 %	3 %	3.3 %
Business	9 %	23 %	5 %	9.9 %
Bead work		11 %	1 %	2.8 %
Craft sale		3 %	1 %	0.8 %
Mining	1 %		1 %	0.8 %
Bricks making		1 %		0.3 %
Fishing	1 %			0.3 %
Bakery		1 %		0.3 %
Carpenter	1 %			0.3 %

In % of the total HH population willing to engage in a given activity

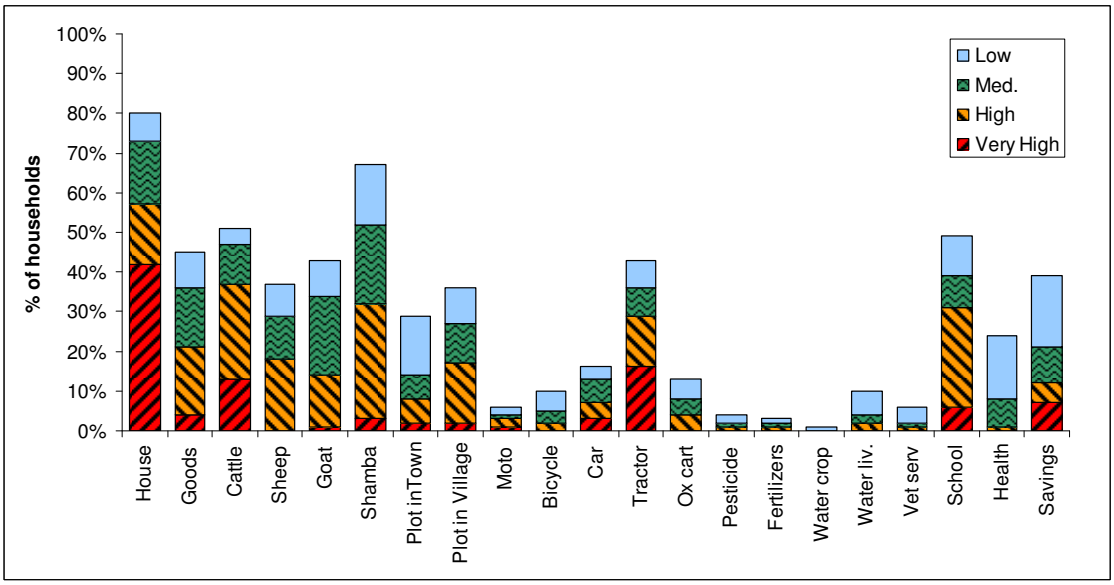
The HHs well perceived the difference between the two questions. In a short term perspective the key investments would be made to improve the immediate living conditions of the HHs (house and HH goods). Investments in agricultural productive assets (livestock or land) were the second consideration. Interesting differences can be noted among the three villages. In Lolkisale investments into goats was prevalent which is understandable considering the financial capacity generated after a good year. In Naitolya cattle is less considered and HHs seems to favor investment in land. In Loiborsoit.'A' investment in land is not considered.

Table 13.8: Investments considered by the HH if the crop production was very good this year.



**Very high: the HH ranked the proposition first, High : second or third, Medium : fourth or fifth, low : sixth and above, nil: the HH did not mention the investment (percentage are expressed separately for each investments)*

Table 13.9 Investments considered by the HH if the HH was receiving the equivalent in cash of 100 heads of cattle.



In Naitolya, the newly developed tarmac road had an influence on the needs expressed with 54 % of the HHs considering investing in a car. A high demand for motorbikes could be also noted in Loiborsoit.'A'. After

a good year investment in education of children would not be considered in the three villages while health which requires immediate attention would be considered by 26 % of the HH.

In the short term, HHs expressed the wish to accumulate land and livestock. This strategy may have an impact on the natural resources available locally and may generate tensions over communal properties.

When considering the investment they would make when receiving the equivalent in cash of 100 heads of cattle, the improvement of the living conditions remain key, but its importance is reduced by the willingness to invest in cattle and in Naitolya and Loiborsoit 'A' in a tractor. The willingness to invest in a shamba comes next with, in Lolkisale, 80 % of the HHs considering it. Interestingly sending the children to school ranks high and especially in Lolkisale where it is the 2nd or 3rd choice for 42 % of the HH.

13.8. Options during a drought

In the event of losses during a drought, we can note that the clan still plays an important role in the social network of the population. This is especially true in Naitolya and Lolkisale where more than 70 % of the HHs mentioned it as an option (table 13.7)

Table 13.7: Coping strategies in event of drought.

	Clan	Family Village	Family Town	Friends	In-laws	Migration to town for work	No option
Total	49 %	31.4 %	7.2 %	19 %	25 %	5.5 %	2 %
Lolkisale	18 %	46 %	5 %	5 %	19 %	1 %	3 %
Naitolya	70 %	31 %	20 %	39 %	37 %	21 %	1 %
Loiborsoit.'A'	71 %	17 %	3 %	24 %	24 %	3 %	1 %

*In % of the total HHs population mentioning an option; a same HH can chose different options

14. Income generation and household categorization

As we have seen in the preceding chapters the HHs are engaged in various activities and strategies to meet their needs. The categorization of the HHs is usually done based on the type of activities implemented and the level at which these activities are being implemented by the HH.

The categorization in this survey included two levels. The first one focused on the key activities that are implemented in the region: crop and livestock. The second level analyzes the involvement of the different sub-group activities identified in off-farm activities either informal (firewood collection, petty business, wages for crop or livestock activities) or formal (teacher, employee). The results of this analysis are presented in figure 14.1 and table 14.1 (and annexes 12 & 13).

This analysis confirms that agro-pastoralism (mixed systems) dominate in Lolkisale and Naitolya and is being practiced by 72 % and 65 % of the HHs. HHs only engaged into livestock production are in fact marginal in these two villages (3% and 1% of the HHs respectively). HHs only engaged into crop production are more predominant in Naitolya as they account for 21 % of the HHs. The situation in Loiborsoit.'A' is radically different. Indeed the repartition of the HHs among the subgroups is much more homogenous with 26 % of the producers only engaged into livestock, 21 % of the HHs only engaged into crop and 35 % engaged into crop and livestock production simultaneously. More surprisingly 9 % [6 % ; 11 % ; 17 %] of the HHs are only relying on formal and informal activities for their subsistence.

What seems to be pastoralists (cattle producers not engaged into other activities) are only well developed in In Loiborsoit.'A' where they account for 10 % of the HHs. Diversification seems to be higher in Naitolya where a third of the HHs engaged into mixed system are also engaged into off-farm activities. Interestingly two third of the HHs engaged into formal off-farm activities are associating it an agricultural activities. Further analysis is needed to identify homogenous sub-groups that are sharing production capacities and strategies.

Table 14.1: First categorization level of the Households

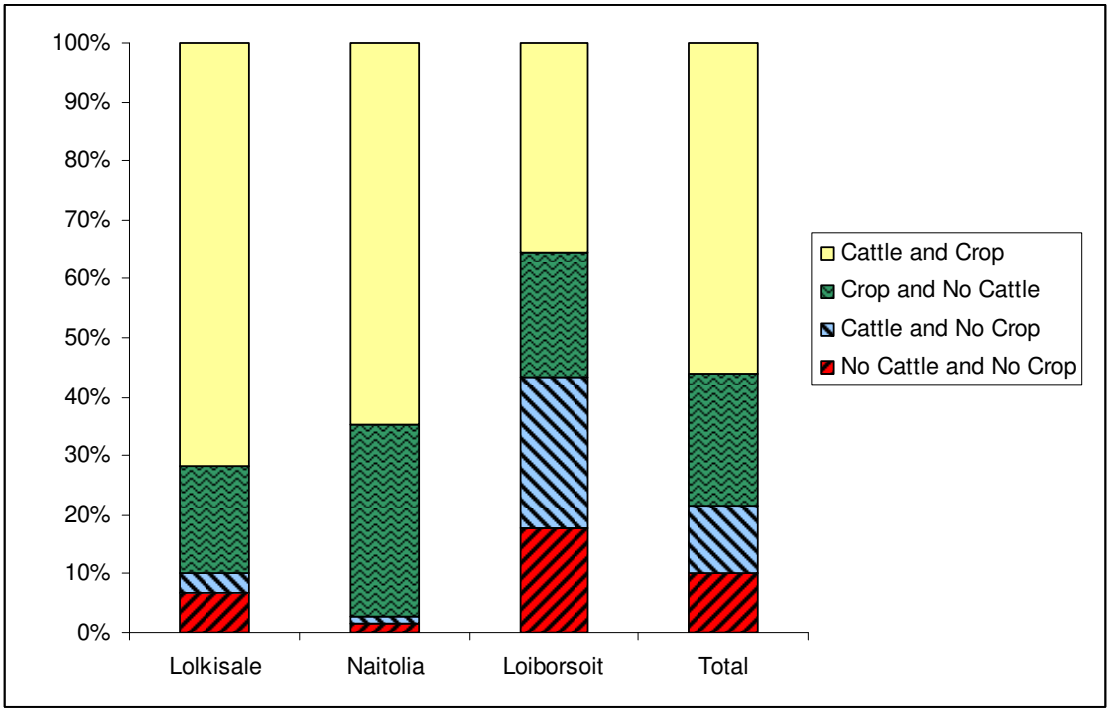


Figure 14.1: First and second categorization levels of the Households

Agricultural activities	Off farm income	Lolkisale	Naitolya	Loiborsoit.'A'	Total
No Cattle and No Crop	No off-farm income	1%		1%	1%
	Informal	4%	1%	12%	7%
	Formal	1%		4%	2%
	Informal & Formal	1%		1%	1%
Cattle and No Crop	No off-farm income	1%		13%	6%
	Informal	1%	1%	9%	4%
	Formal	1%		3%	2%
	Informal & Formal				0%
Crop and No Cattle	No off-farm income	12%	20%	6%	11%
	Informal	5%	11%	12%	9%
	Formal	1%	1%	1%	1%
	Informal & Formal			2%	1%
Cattle and Crop	No off-farm income	58%	41%	21%	40%
	Informal	11%	21%	12%	13%
	Formal	2%	1%	2%	2%
	Informal & Formal		1%	1%	1%

In the analysis of income generation at HH level, we first considered the income generated at HH level from milk, crop, livestock, honey marketing and the off-farm activities (*gross income generation*), we then

included in our calculation the value of the products produced and consumed by the HHs (*gross income and on-farm consumption*). The third step of our analysis considered the value of the variations observed in the livestock assets (*gross income, on-farm consumption and herd growth*[8]). Finally the last step of our analysis included production costs (*net income, on-farm consumption and herd growth*) (figures 14.2, 14.3, 14.4, 14.5 and tables 14.6, 14.7).

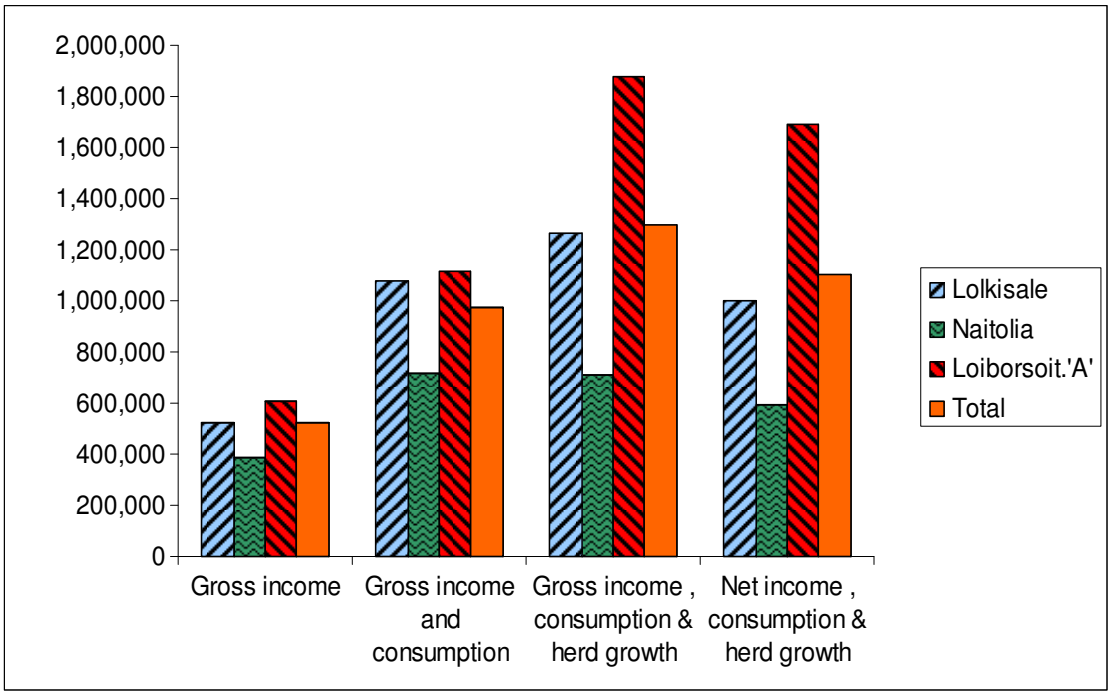
Overall the income generation at household level is low and most of the HHs are close or below to the poverty line. The mean gross income at household level in 2005 was 522,763 Tsch (418 USD) and the mean income per capita was 213,877 Tsch (171 USD). We are close to the estimate (200 USD per capita) provided by the district officer when designing the survey. The lowest gross income at household level was found in Naitolya (385,707 Tsch – 309 USD) and in the households only relying on off-farm activities (378,000 Tsch – 302 USD). The lowest income per capita was also found in Naitolya (385,707 Tsch -113 USD) and in the HHs that have cropping activities and no livestock (170,773 Tsch -137 USD). The higher poverty level in Naitolya is also reflected when looking at the income distribution in this village (table 14.7). Indeed 25 % of the population in this village has a gross income below 90,000 Tsch (72 USD) at HH level and below 28,000 Tsch per capita (22 USD). Disparities also seem to be wider (especially compared to Loiborsoit.'A') in this village as 25 % of the HHs are earning more than 606,306 Tsch per year (485 USD) at HH level and more than 200,000 (160 USD) Tsch per capita. Poverty is also high among the HHs practicing only crop with 25 % of the population having a gross income below 80,000 Tsch (64 USD) at HH level and below 31,875 Tsch per capita (26 USD). The wealthiest population is found among the HHs producing both crop and livestock with 50 % of the HHs earning more than 360,484 Tsch (288 USD) and 25 % of the HHs earning more than 803,161 Tsch (643 USD). When looking at the contribution of the different activities to cash generation, the importance of the off-farm activities to the HHs income is striking. The contribution of livestock to the HH income is the highest in Naitolya, and mainly due to the high contribution of poultry and the marketing of eggs.

[8] Herd growth value was calculated by subtracting the total value of the herd in 2005 from the total value of the herd in 2006 (calculated using the average prices estimated in section 8.3) minus the real value of the animal purchased over the year, plus the value of the animal sold over the year (using the average prices estimated in section 8.3).

The inclusion of the value of the product consumed in the analysis of the income generation clearly underlines the fact that HHs practice subsistence agriculture. Two key products are emerging: milk (accounting for 28 % of the income at HH level) and maize (18 %). Because of the high proportion of the yield marketed, the relative contribution of beans to the income is not significantly increased in this case.

When looking at the total value generated at HH level (*net income, on-farm consumption, herd growth*), the picture is changing. The highest mean total value is found in Loiborsoit'A' where it stands at 1,695,423 Tsch per HH per year (1,356 USD) and at 785,351 Tsch per capita (628 USD). The gap between this village and the two other villages has clearly increased (589,271 Tsch per HH - 234,441 Tsch per capita in Naitolya). This gap is due to the development the livestock sector in this village which accounts for 71.1 % of the total value created over the year at village level. The highest mean value created at HH level and per capita are found in HHs totally or partially engaged into livestock production. The gap between HHs that have livestock and HHs relying exclusively on crops or off-farm activities is extremely significant (663 USD per capita for livestock producers against 166 USD per capita for crop producers). These facts clearly underline the key role of the livestock sector which at the same time constitutes a capital that can be accumulated and also contributes to the subsistence of the HHs. Nevertheless most of the value generated is not converted into cash. Increasing off-take rates and offering marketing opportunities could improve the well being of the livestock producer communities

Figure 14.2: Income generation at HH level



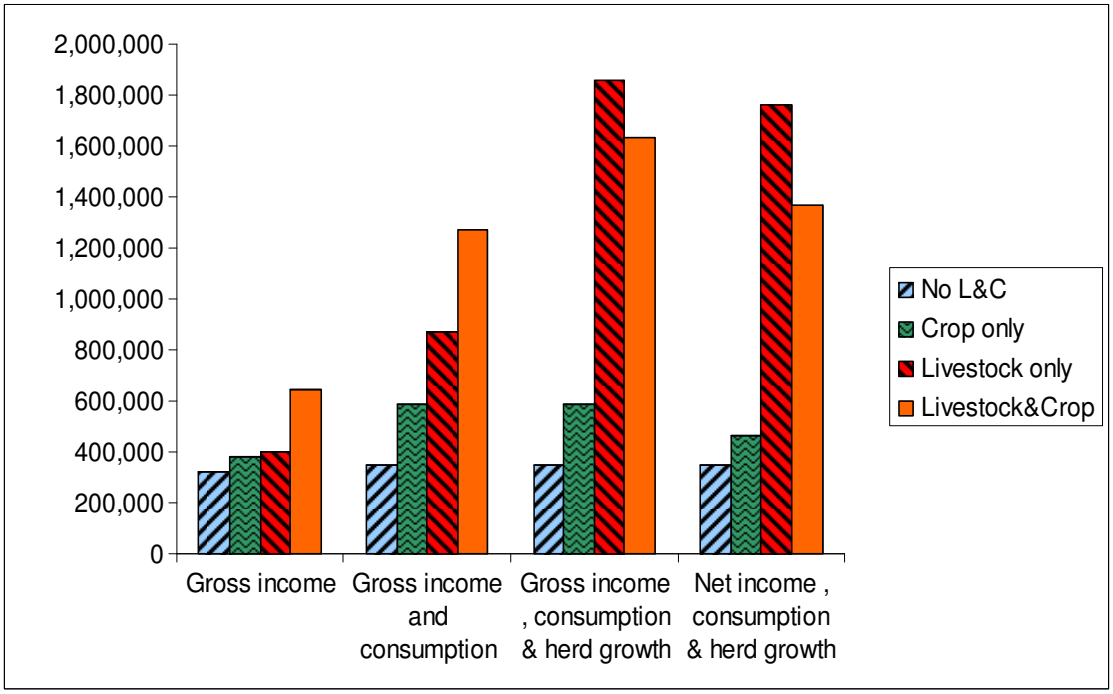
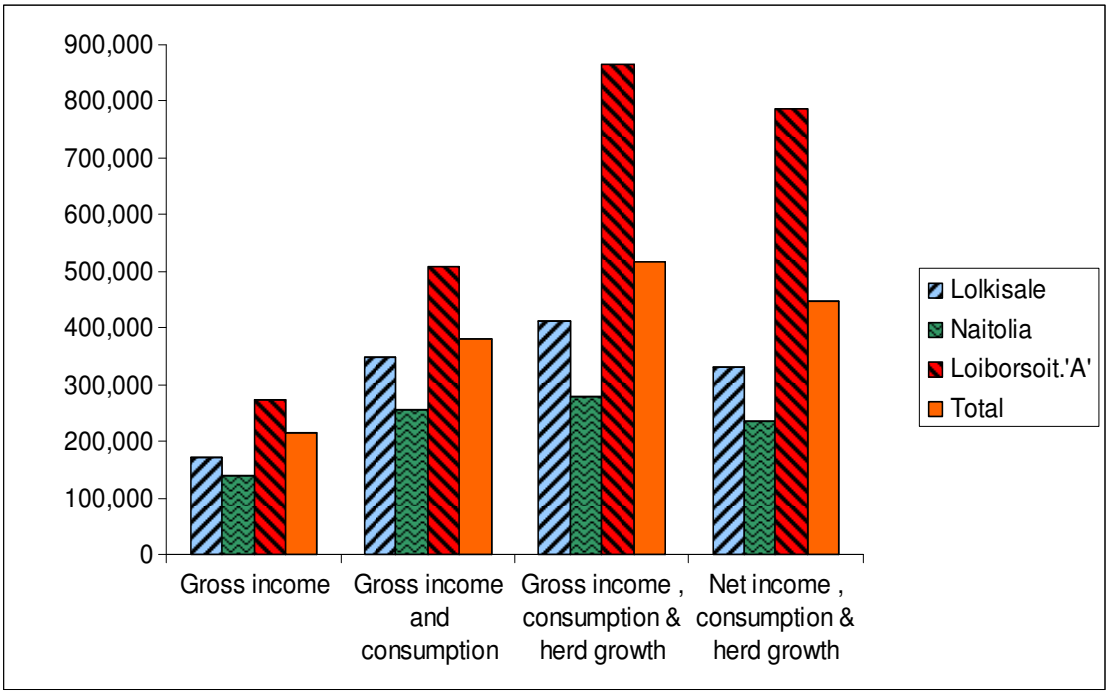


Figure 14.3: Income generation per capita (over 15)



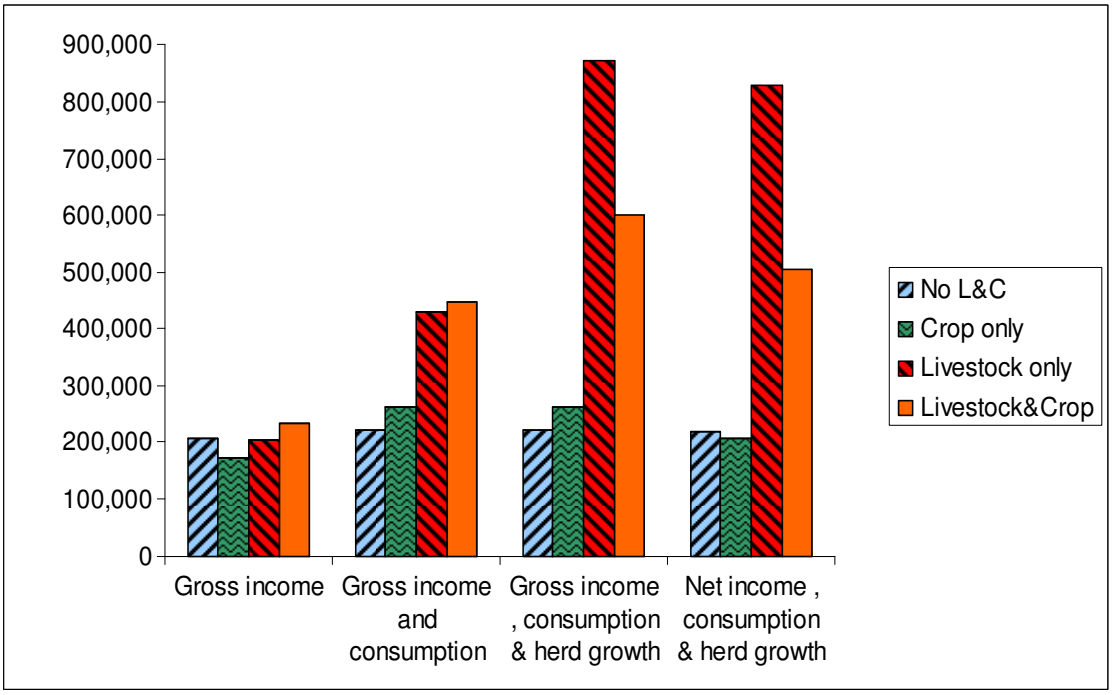


Figure 14.4: Contribution of the activities to the gross income generation

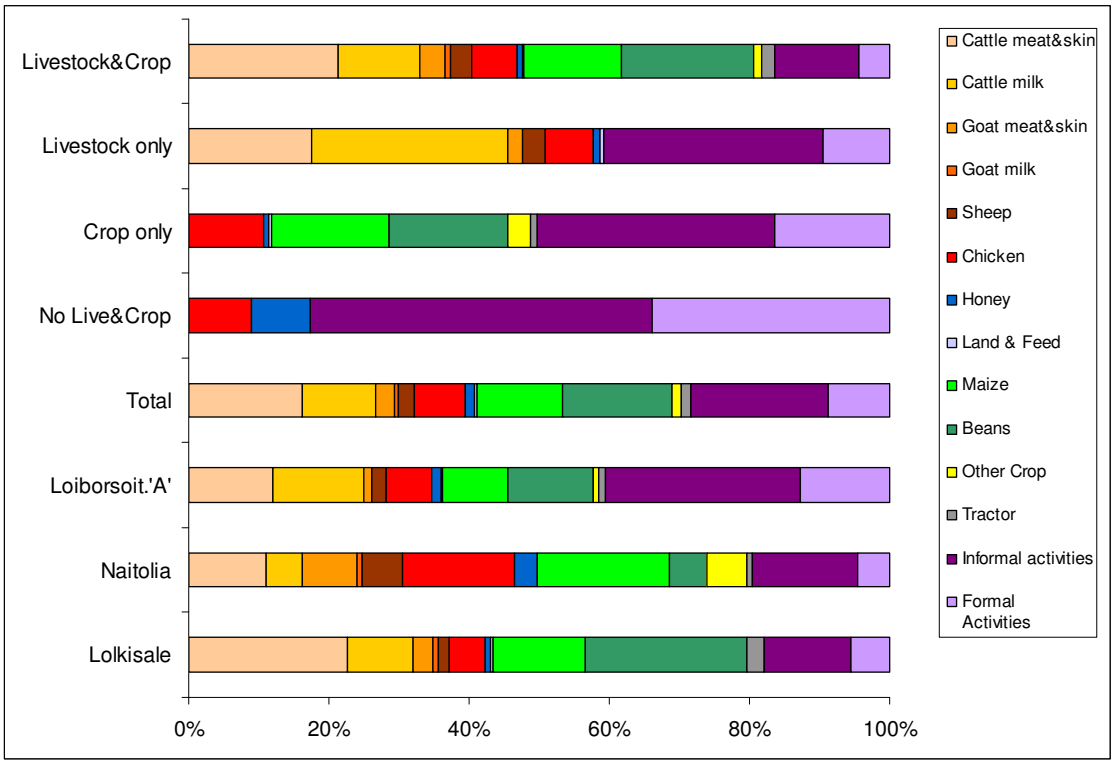
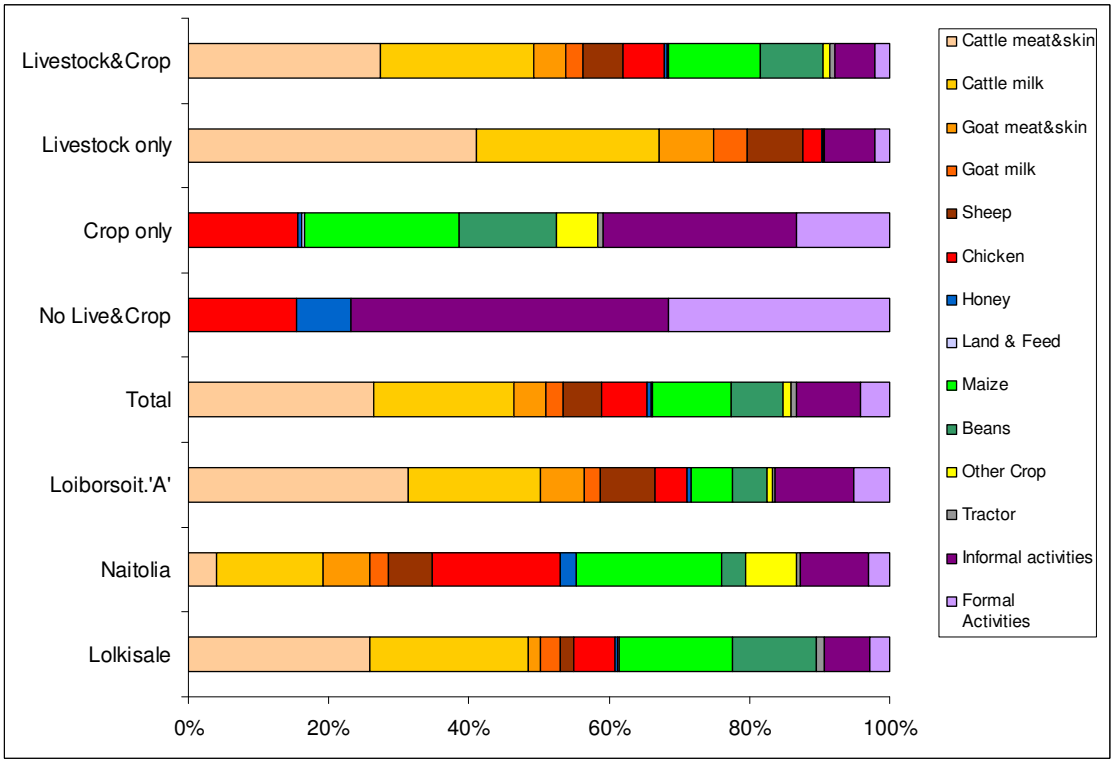


Figure 14.5 : Contribution of the activities to the net income generation (including consumption and herd growth)



15. Conclusions

Out of the preceding analysis the following conclusions can be drawn.

15.1. The need for agricultural intensification

Agriculture in the area is basically of a subsistence nature - characterized by low-input – low output. Both livestock and crop production systems are poorly intensified and productivity is kept to a minimum. For crop this often led to land degradation and extensification at farm level due to the decreasing productivity. There is nevertheless a strong potential locally for intensification. This has already materialized with the use of a tractor by 68 % of the producers, the use of organic fertilizers by 10 and 20 % of the producers in Lolkisale and Naitolya respectively or the frequent purchase of feed. Data from the survey however confirmed the limited use of manure, with only 8% of households using it for crop production. Therefore, there is a need to incorporate the use of manure in the cropping system so as to increase yield per hectare and safeguard food security in the area. On the long term, the development of adequate irrigation systems and the adapted use of agro-chemicals and chemical fertilizers would also greatly help to increase productivity locally

In order not to affect the livestock-crop-wildlife balance, this intensification should be part of a larger framework which would at the same time control the extensification of crop through the development of land use plans, exit strategies and access to banking institutions.

For livestock, intensification is also required through better access to veterinary health services, inputs, water and improved breeds. This intensification would improve the incomes at producer level but should also be used to lower the existing pressure on land resources by reducing the number of unproductive animals.

15.2. Development of market oriented production systems

Livestock off-take remains too low in the three villages. This has two consequences. First, most of the value generated is not converted into cash and may be lost with the death of the animals. Second, the household keep unproductive animal that increase pressure on existing resources. The livestock sector should be

capacitated to be more market oriented. This also applies for crop production. Crop produce is mainly being sold locally as access to other markets is constrained.

This could materialize though improved access to infrastructures such as market places or roads. In Lolkisale and Loiborsoit.'A' access to the tarmac road for example is a constraint and crop producers may have difficulties to reach better markets. Similarly, livestock producers often have to walk long hours to reach the market. However, destocking will only take place if other saving and investment opportunities (outside land accumulation) are accessible.

15.3. Control of extensification

For extensification of crop production three phenomenon are at play. They involve a multitude of actors engaged into different dynamics.

First, the willingness to expand production is strong and is due in the surveyed villages to the low productivity per hectare and the low production observed at HH level.

Second, some actors are also receiving support from individuals or credit institutions. This support is usually invested into a productive asset and in particular tractors that support the development of cropping activities locally.

Third, the land allocation is not fully under control (at least by the official authorities) as we observed that some household simply decided to develop a parcel without obtaining authorization of a formal authority. These three phenomenon are fuelling the extensive development of cropping activities locally. Crop extensification should be controlled though the development of land use plans that would regulate access to land locally.

Livestock producers tend to accumulate or have are willing to accumulate the animals leading increasing pressure on natural resources. This process also does not favour the intensification of the system. Livestock accumulation could be controlled through increased off-take, increased productivity, better livestock-crop integration and a better access to banking institutions. Cultural issues will nevertheless have to be overcome as livestock symbolism is still strong.

15.4. Development of exit strategies

Pressure on natural resources is high in the area. Exit strategies should be favored locally in order to reduce this pressure. Nevertheless the low level of education clearly constrains the involvement of the actors in non-agricultural activities. Access to education should be improved and children attendance to school should be encouraged and facilitated. The distance to school should be reduced and the poorest families supported or the schooling system adapted as in most of the cases the children are used in production activities. Non-agricultural employment opportunities should also be promoted in particular those related to the tourism industries. These activities should be adapted to the existing potentialities at HH level.

15.5. Development of compensation schemes

If we want to preserve the balance between crop, livestock and wildlife a strong and efficient compensation mechanism should be put in place. Currently in all three villages the involvement of the HH members into tourism based activities is too low to be effective. Furthermore with the extremely low level of income observed at HH level it is clear that the population is not in a position to bear the costs associated with wildlife conservation.

The compensation mechanism could be used to compensate the losses (in terms of yields or animals) due to wildlife depredation or to compensate the measures taken to protect the HH assets against wildlife depredation. These measures should of course not affect wildlife.

This compensation could take many forms. It could be through the development of a Payment for Environmental Services scheme, through the development of a compensation fund or through the development of employment opportunities. The Payment for Environmental Services scheme or the compensation fund could be developed at private or community level.

15.6. Development of better informed policies for better resource allocation

A number of questions have emerged from this survey related to the resource allocation among the actors identified. It is clear that a number of intrinsic factors may directly influence the capacity that one has to invest in agricultural activities and in particular in accessing land. This applies in particular to the conversion of common land into private land. Highlighting the role of social capital in that process, may highlight

distortions in the land distribution process. These distortions may be at the origin of the marginalization of some groups that may be excluded from the community in the long term. Looking at the population trends and the increased pressure on natural resources a good understanding of the production and diversification strategies at the interface is key for the sustainability of livelihoods and ecosystems that support them. Further analysis in that regard is also needed.

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17. Annex

Annex 1: Main occupation of the respondent in the three villages

Activities		Percentage of respondents							
		Lolkisale		Naitolya		Loiborsoit.'A'		Total	
Agricultural and natural resource based activities	Crop production	89%	95 %	90%	97%	29%	82%	66%	90%
	Livestock production	5%		7%		46%		22%	
	Poultry production					1%		0.3%	
	Honey producer					1%		0.3%	
	Firewood or charcoal sale	1%				5%		2%	
Formal Employment activities	Teacher	1%	3%				3%	0.3%	2%
	Watchman	1%				2%		1%	
	Tourism employee	1%				1%		1%	
Informal activities	Local business		1%	1%	1%	4%	10%	2%	5%
	Mining	1%				2%		1%	
	Mechanics					1%		0.3%	
	Maasai houses constructor					1%		0.3%	
	Driver - transport					2%		1%	
	Local brewer					1%		0.3%	
Others	House wife		1%	0%	1%	3%	4%	1%	2%
	Evangelist			0%		1%		0.3%	
	Disabled			0%		1%		0.3%	
	Student			1%				0.3%	
	None	1%		0%				1%	

Annex 2: District of origin of the HHHs.

Region	District	Lolkisale	Naitolya	Loiborsoit.'A'
Manyara	Simanjiro	12 %		26 %
	Babati	3 %	2 %	
	Hanang	1 %	2 %	
	Kiketo			5 %
	Mbulu	2 %	2 %	2 %
Arusha	Arumeru	41 %	64 %	31 %
	Karatu	2 %	8 %	
	Monduli	19 %	19 %	25 %
	Ngorongoro	5 %	2 %	2 %
	"longido"	2 %		
Kilimanjiro	Hai	1 %	2 %	3 %
	Moshi	1 %		
Dodoma	Kondoa	3 %		5 %
	Dodoma rural	1 %		
Tanga	Korogwe			2 %
Mara	Tarime	1 %		
Singida	Iramba	1 %		
	Singida urban	1 %		
	"Mkalama"	2 %		
	"Ilongero"	3 %		
Kenya		1 %		

Annex 3: Main occupation of the HH members in the three villages

Activities		Percentage of respondents							
		Lolkisale		Naitolya		Loiborsoit.'A'		Total	
Agricultural and natural resource based activities	Crop production	75.7 %	85.7 %	77.6 %	89.1 %	30.3 %	76.1 %	62.1 %	83.2 %
	Livestock production	9.7 %		10.9 %		45.2 %		20.8 %	
	Poultry production					0.3 %		0.1 %	
	Honey producer			0.5 %		0.3 %		0.2 %	
	Hunter								
	Water fetching								
	Firewood or charcoal sale	0.4 %				2.6 %		1.0 %	
Employed activities	Teacher	0.2 %	1.0 %		0.0 %	0.3 %	2.6 %	0.2 %	1.3 %
	Watchman	0.2 %				1.3 %		0.5 %	
	Tourism employee	0.4 %				1.0 %		0.5 %	
	Nurse	0.2 %						0.1 %	
	Machine operators								
	Government employee					0.3 %		0.1 %	
Informal activities	Local business	0.6 %	1.0 %	3.5 %	4.0 %	1.3 %	4.2 %	1.4 %	2.6 %
	Mining	0.2 %		0.5 %		1.0 %		0.5 %	
	Mechanics					0.3 %		0.1 %	
	Maasai houses constructor					0.6 %		0.2 %	
	Driver - transport	0.2 %				1.0 %		0.4 %	
	Local brewer					1.0 %		0.3 %	
Others	Evangelist		12.3 %		7.0 %	0.3 %	13.2 %	0.1 %	11.5 %
	Disabled					0.3 %		0.1 %	
	House wife	3.8 %		1.0 %		10.6 %		5.4 %	
	None	6.4 %		1.5 %		1.0 %		3.8 %	
	Student	2.0 %		4.5 %		1.0 %		2.2 %	

Annex 4: Land use in the three villages

		Crop		Private Pasture		Open pasture	Fallow land[9]		Settlement		Total	Total fenced
		Total	Fenced	Total	Fenced	Total	Total	Fenced	Total	Fenced		
Lolkisale	Surface*	1074.75	371.25	90	85	39.5	84.5	23	109.66	84.83	1398.41	564.08
	Ratio **	76.9 %	34.5 %	6.4 %	94.4 %	2.8 %	6.0 %	27.2 %	7.8 %	77.4 %		40.3 %
Naitolya	Surface*	324.25	45	179	0	301.25	219	0	91.5	63.25	1115	108.25
	Ratio **	29.1 %	13.9 %	16.1 %	0.0 %	27.0 %	19.6 %	0.0 %	8.2 %	69.1 %		9.7 %
Loiborsoit.'A'	Surface*	349.75	26.75	51.5	2.5	48.5	26.5	0	74.95	59.7	551.2	88.95
	Ratio **	63.5 %	7.6 %	9.3 %	4.9 %	8.8 %	4.8 %	0.0 %	13.6 %	79.7 %		16.1 %
Total	Surface*	1748.75	443	320.5	87.5	389.25	330	23	276.11	207.78	3064.61	761.28
	Ratio **	57.1 %	25.3 %	10.5 %	27.3 %	12.7 %	10.8 %	7.0 %	9.0 %	75.3 %		24.8 %

* In acres

** The total ratio presents the ratio of the surface allocated to a given form of land use against the total land use in the village. The fenced ratio presents the ratio of the surface fenced for a given form of land use against the surface allocated to a given form of land use.

Annex 5: Land area dedicated to the different crops

		Maize	Beans	Green Gram	White	Sun flower	Common peas	Finger millet	Cow peas	Ngwara
Lolkisale	acres	744.75	417					1		
	%	64.1 %	35.9 %					0.1 %		
Naitolya	acres	241.85	36.25	56		5	2	1	0.9	5.75
	%	69.3 %	10.4 %	16.1 %		1.4 %	0.6 %	0.3 %	0.3 %	1.6 %
Loiborsoit.'A'	acres	227.25	103.5		3					
	%	68.1 %	31.0 %		0.9 %					
Total	acres	1213.85	556.75	56	3	5	2	2	0.9	5.75
	%	65.8 %	30.2 %	3.0 %	0.2 %	0.3 %	0.1 %	0.1 %	0.0 %	0.3 %

[9] Crop land left to rest when farmers practice crop rotation

Annex 6: Use of the yield by the HH

Maize	Consumed	Reseeded	Sold				Given
			Neighborhood	Traders	Market	Total	
Lolkisale	62.5 %	4.3 %	4.3 %	4.5 %	22.3 %	31.2 %	2.1 %
Naitolya	47.4 %	9.3 %	1.3 %	15.8 %	24.0 %	41.0 %	2.3 %
Loiborsoit.'A'	40.2 %	6.7 %	6.0 %	5.9 %	40.2 %	52.1 %	1.0 %
Total	53.1 %	6.0 %	4.2 %	7.1 %	27.9 %	39.2 %	1.8 %

Beans	Consumed	Reseeded	Sold				Given
			Neighborhood	Traders	Market	Total	
Lolkisale	33.5 %	11.5 %	4.3 %	7.9 %	42.3 %	54.5 %	0.5 %
Naitolya	37.8 %	10.5 %	0.0 %	3.1 %	47.3 %	50.4 %	1.3 %
Loiborsoit.'A'	20.1 %	13.6 %	6.3 %	5.9 %	54.1 %	66.3 %	0.0 %
Total	29.6 %	12.1 %	4.6 %	6.9 %	46.3 %	57.9 %	0.4 %

Green Gram	Consumed	Reseeded	Sold				Given
			Neighborhood	Traders	Market	Total	
Lolkisale							
Naitolya	25.6 %	21.7 %	3.8 %	4.7 %	42.6 %	51.1 %	1.6 %
Loiborsoit.'A'							
Total	25.6 %	21.7 %	3.8 %	4.7 %	42.6 %	51.1 %	1.6 %

White Beans	Consumed	Reseeded	Sold				Given
			Neighborhood	Traders	Market	Total	
Lolkisale							
Naitolya							
Loiborsoit.'A'	25.0 %	25.0 %	0.0 %	0.0 %	50.0 %	50.0 %	0.0 %
Total	25.0 %	25.0 %	0.0 %	0.0 %	50.0 %	50.0 %	0.0 %

Sun Flower	Consumed	Reseeded	Sold				Given
			Neighborhood	Traders	Market	Total	
Lolkisale							
Naitolya	0.0 %	0.0 %	0.0 %	0.0 %	100.0 %	100.0 %	0.0 %
Loiborsoit.'A'							
Total	0.0 %	0.0 %	0.0 %	0.0 %	100.0 %	100.0 %	0.0 %

Annex 7: Price at which the crops are being sold (in Tsch per kg)*

Maize	Neighborhood			Traders			Market			Total
	mean	min	max	mean	min	max	Mean	min	max	mean
Lolkisale	184.9	50	300	174.3	100	320	184.7	83	525	183.2
Naitolya	220.2	100	300	208.6	100	300	180.9	100	350	192.8
Loiborsoit.'A'	152.1	100	300	105.9	86	200	159.3	100	300	152.4
Total	173.3	50	300	172.3	86	200	173.4	83	525	173.2

Beans	Neighborhood			Traders			Market			Total
	mean	min	max	mean	min	max	Mean	min	max	mean
Lolkisale	403.1	200	700	518.6	167	667	489.8	133	800	487.1
Naitolya				412.5	240	536	373.6	183	500	376.0
Loiborsoit.'A'	462.8	250	600	475.0	450	500	462.5	300	600	463.6
Total	428.4	200	700	503.7	167	667	471.5	133	500	471.9

Green Gram	Neighborhood			Traders			Market			Total
	mean	min	max	mean	min	max	Mean	min	max	mean
Lolkisale										
Naitolya	672.7	400	700	400	389	421	494.8	300	600	499.2
Loiborsoit.'A'										
Total	672.7	400	700	400	389	421	494.8	300	600	499

White Beans	Neighborhood			Traders			Market			Total
	mean	min	max	mean	min	max	Mean	min	max	mean
Lolkisale										
Naitolya										
Loiborsoit.'A'							3300	3300	3300	3300
Total							3300	3300	3300	3300

Sun Flower	Neighborhood			Traders			Market			Total
	mean	min	max	mean	min	max	Mean	min	max	mean
Lolkisale										
Naitolya							200	200	200	200
Loiborsoit.'A'										
Total							200	200	200	200

Fingermillet	Neighborhood			Traders			Market			Total
	mean	min	max	mean	min	max	Mean	min	max	mean
Lolkisale										
Naitolya							300.0	300.0	300.0	300.0
Loiborsoit.'A'										
Total							300.0	300.0	300.0	300.0

*min : Lowest price observed in the sample max: Highest price observed in the sample

Annex 8: Off-farm activities in the three villages

	Number of Households				Days per month	People/ HH*	Income per year		
	Total	Lolkisale	Naitolya	Loiborsoit.'A'			min	max	mean
Payed employment									
Nurse	1 (1 %)	1 (1 %)	0	0	25	1	1,000,000	1,000,000	1,000,000
Teacher	4 (1 %)	1 (1 %)	1(1 %)	2 (2 %)	24.8	1	360,000	1,440,000	960,000
Government employee	1 (1 %)	0	0	1 (1 %)	20	1	1,200,000	1,200,000	1,200,000
Representative	1 (1 %)	1 (1 %)	0	0	20	1	275,000	275,000	275,000
Driver	4 (1 %)	1 (1 %)	0	3 (2 %)	17.5	1	100,000	1,200,000	715,000
Transport business	1	0	0	1	28	1	30,000	30,000	30,000
Machine operator	1 (1 %)	0	0	1 (1 %)	5	1	300,000	300,000	300,000
Mechanics	1 (1 %)	0	0	1 (1 %)	25	1	400,000	400,000	400,000
Watchman	13 (4 %)	3 (2 %)	1 (1 %)	9 (6 %)	27.5	1	100,000	540,000	276,539
Tourism Based activities									
Tourism employee	6 (2 %)	2 (1 %)	1 (1 %)	3 (1 %)	19.7	1	100,000	700,000	475,000
Hotel/lodge employee	2 (1 %)	2 (1 %)	0	0	17.5	1	40,000	100,000	70,000
Hawking	2 (1 %)	2 (1 %)	0	0	6	1	60,000	160,000	110,000
Beadwork	1 (0 %)	0	1 (1 %)	0	18	1	50,000	50,000	50,000
Agricultural and natural resources based activities									
Wages for cropping activities	49 (13 %)	11 (7 %)	4 (6 %)	34 (24 %)	5.3	1.5	25,000	800,000	263,622
Wages for livestock management	24 (7 %)	6 (4 %)	9 (13 %)	9 (6 %)	21	1.25	40,000	480,000	157,625
Livestock trade	17 (5 %)	1 (1 %)	1 (1 %)	15 (10 %)	10.2	1.1	30,000	350,000	193,118
Selling water	2 (1 %)	0	0	2 (1 %)	17.5	1	25,000	50,000	37,500
Hunter	1 (0 %)	1 (1 %)	0	0	5	1	75,000	75,000	75,000
Mining	8 (2 %)	3 (2 %)	2 (3 %)	3 (2 %)	23.3	1	100,000	3,000,000	1,031,250
Firewood / charcoal sale	20 (6 %)	3 (2 %)	7 (10 %)	10 (7 %)	13.4	1.3	50,000	500,000	143,050
Other local economic activities									
Retail shop	12 (3 %)	3 (1 %)	1 (1 %)	8 (6 %)	22.1	1.6	40,000	700,000	374,375
Business	14 (4 %)	3 (2 %)	6 (8 %)	5 (3 %)	20.7	1	75,000	200,000	137,857
Tailoring	1 (0 %)	0	0	1 (1 %)	25	1	80,000	80,000	80,000
Home maker	1 (0 %)	0	0	1 (1 %)	1	1	50,000	50,000	50,000
Local brewer	3(1 %)	1 (1 %)	0	2 (1 %)	24.3	1.3	100,000	150,000	133,333
Maasai houses constructor	1 (0 %)	0	0	1 (1 %)	20	1	100,000	100,000	100,000

* mean number of household members participating to the activity

Annex 9: Mean distance to facilities in the three villages

	Number of respondents	Villages	Distance in Km			Distance in hours		
			Mean	Min	Max	Car	Foot	Bicycle
Tarmac road	363	Lolkisale	60.7	10.0	129.0	2.1	3.4	
		Naitolya	2.1	0.3	8.0		1.1	
		Loiborsoit.'A'	93.5	60.0	150.0	2.9		
Market	363	Lolkisale	7.8	0.0	100.0	1.8	2.3	1.5
		Naitolya	4.7	0.5	12.0	0.3	1.8	0.8
		Loiborsoit.'A'	24.5	2.0	100.0	2.6	3.1	1.5
Primary school	363	Lolkisale	4.9	0.0	120.0		2.2	0.7
		Naitolya	2.5	0.0	8.0		1.5	
		Loiborsoit.'A'	4.9	0.0	25.0	0.3	1.8	0.7
Secondary school	243	Lolkisale	53.9	2.0	150.0	2.0	2.2	
		Naitolya	6.8	1.0	18.0	1.3	3.0	1.7
		Loiborsoit.'A'	74.3	0.0	120.0	4.1	2.3	
Banking Institution	260	Lolkisale	71.9	51.0	150.0	2.1	2.3	
		Naitolya	78.6	8.0	120.0	2.2		
		Loiborsoit.'A'	106.3	70.0	200.0	3.2	3.3	
Veterinary clinic	259	Lolkisale	70.8	0.0	150.0	2.1	2.3	0.7
		Naitolya	58.1	4.0	120.0	2.2	2.0	
		Loiborsoit.'A'	23.8	0.5	200.0	2.8	2.9	1.3
Health centre	347	Lolkisale	69.0	2.0	150.0	2.1	1.9	1.5
		Naitolya	30.0	2.0	120.0	2.2	2.0	1.5
		Loiborsoit.'A'	18.7	2.0	100.0	3.4	3.0	1.2

Annex 10: Investments considered by the HH if the crop production was very good this year.

		Total					Lolkisale					Naitolya					Loiborsoit.'A'				
		Very High	High	Med.	Low	Nil	Very High	High	Med.	Low	Nil	Very High	High	Med.	Low	Nil	Very High	High	Med.	Low	Nil
HH Needs	House	**52%**	**21%**	2%	1%	24%	**69%**	**6%**	1%	1%	23%	**57%**	**27%**	3%	2%	11%	**32%**	**34%**	**2%**	1%	31%
	Goods	**13%**	**22%**	7%	4%	53%	**18%**	**34%**	6%	0%	42%	**8%**	**16%**	**16%**	21%	40%	**11%**	**13%**	**4%**	1%	71%
Livestock	Cattle	1%	**16%**	**10%**	**7%**	66%	3%	**21%**	**15%**	2%	58%	0%	3%	**14%**	**25%**	57%	0%	**16%**	**3%**	4%	77%
	Sheep	0%	**15%**	**14%**	**9%**	62%	0%	**22%**	**22%**	5%	51%	0%	**10%**	**14%**	**25%**	51%	0%	**10%**	**7%**	5%	78%
	Goat	2%	**25%**	**10%**	**6%**	58%	1%	**47%**	**12%**	5%	35%	3%	**11%**	**13%**	**14%**	59%	2%	**9%**	**6%**	2%	81%
Land	Shamba	1%	**11%**	**15%**	**12%**	61%	3%	**15%**	**23%**	**17%**	42%	2%	**22%**	**21%**	**16%**	40%	0%	1%	3%	4%	91%
	Town	1%	**6%**	**6%**	**6%**	81%	1%	**9%**	**9%**	**11%**	70%	3%	**8%**	**10%**	**2%**	78%	0%	2%	1%	4%	93%
	Village	1%	2%	3%	6%	88%	0%	1%	4%	8%	87%	5%	**6%**	**5%**	**8%**	76%	0%	1%	2%	2%	95%
Vehicle	Moto	**12%**	**20%**	6%	5%	57%	1%	**8%**	2%	5%	84%	5%	**29%**	**13%**	3%	51%	**27%**	**27%**	**6%**	**7%**	34%
	Bicycle	1%	0%	0%	1%	99%	0%	0%	0%	1%	99%	0%	0%	0%	2%	98%	1%	0%	0%	1%	98%
	Car	2%	5%	4%	5%	84%	0%	3%	1%	3%	93%	**11%**	**17%**	**14%**	**11%**	46%	0%	1%	1%	5%	93%
Agricultural Inputs	Tractor	0%	1%	4%	6%	88%	0%	1%	1%	1%	97%	0%	5%	**19%**	**22%**	54%	0%	1%	1%	2%	96%
	Ox cart	0%	2%	1%	3%	95%	0%	1%	1%	3%	96%	2%	3%	0%	0%	95%	0%	2%	1%	4%	93%
	Pesticide	0%	1%	2%	6%	91%	0%	1%	0%	2%	97%	2%	**13%**	**6%**	**13%**	67%	0%	0%	1%	4%	96%
	Fertilizers	0%	1%	2%	3%	94%	0%	0%	1%	2%	97%	0%	2%	0%	3%	95%	0%	2%	4%	4%	90%
	Water crop	0%	0%	0%	2%	98%	0%	0%	1%	0%	99%	0%	0%	0%	0%	100%	0%	0%	1%	4%	95%
	Water liv.	0%	0%	0%	1%	99%	0%	0%	1%	0%	99%	0%	0%	0%	0%	100%	0%	0%	0%	2%	97%
	Vet serv	2%	1%	1%	4%	91%	0%	0%	1%	3%	96%	0%	0%	5%	3%	92%	6%	1%	1%	7%	85%
Service	School	0%	1%	1%	1%	98%	0%	0%	0%	1%	99%	0%	3%	2%	0%	95%	0%	0%	0%	1%	99%
	Health	1%	**15%**	**5%**	5%	74%	0%	**6%**	1%	2%	91%	0%	**8%**	**5%**	8%	79%	2%	**28%**	**9%**	7%	55%
Savings		0%	3%	**5%**	**14%**	78%	0%	1%	**7%**	**12%**	81%	2%	**16%**	**8%**	**40%**	35%	0%	0%	2%	4%	94%

**Very high: the HH ranked the proposition first, High: second or third, Medium: fourth or fifth, low: sixth and above, nil: the HH did not mention the investment (percentage are expressed separately for each investments)*

Annex 11: Investments considered by the HH if the HH was receiving the equivalent in cash of 100 heads of cattle.

		Total					Lolkisale					Naitolya					Loiborsoit.'A'				
		Very High	High	Med.	Low	Nil	Very High	High	Med.	Low	Nil	Very High	High	Med.	Low	Nil	Very High	High	Med.	Low	Nil
HH Needs	House	**42%**	**15%**	**16%**	7%	20%	**67%**	**13%**	**3%**	1%	15%	22%	**24%**	**13%**	3%	38%	**25%**	**14%**	**31%**	**14%**	16%
	Goods	4%	**17%**	**15%**	9%	55%	1%	7%	4%	6%	82%	2%	11%	16%	6%	65%	7%	**29%**	**26%**	**14%**	24%
Livestock	Cattle	**13%**	**24%**	**10%**	4%	48%	**15%**	**45%**	**8%**	**1%**	32%	**21%**	**14%**	**27%**	**11%**	27%	**9%**	**9%**	5%	4%	74%
	Sheep	0%	**18%**	**11%**	**8%**	62%	0%	**26%**	**18%**	**5%**	51%	0%	**16%**	**8%**	**19%**	57%	1%	**12%**	**6%**	5%	76%
	Goat	1%	**13%**	**20%**	**9%**	57%	0%	**15%**	**33%**	**7%**	45%	2%	**17%**	**24%**	**14%**	43%	1%	**9%**	**6%**	7%	77%
Land	Shamba	3%	**29%**	**20%**	**15%**	32%	3%	**29%**	**28%**	**20%**	20%	**5%**	**22%**	**10%**	**17%**	46%	2%	**32%**	**18%**	9%	39%
	Town	2%	**6%**	**6%**	**15%**	71%	2%	**6%**	**12%**	**16%**	64%	**5%**	**10%**	**14%**	5%	67%	1%	**4%**	**1%**	**14%**	81%
	Village	2%	**15%**	**10%**	**9%**	64%	0%	3%	6%	10%	81%	5%	8%	8%	10%	70%	2%	31%	16%	7%	44%
Vehicle	Moto	1%	2%	1%	2%	94%	0%	0%	0%	1%	99%	0%	0%	0%	0%	100%	3%	4%	1%	4%	87%
	Bicycle	0%	2%	3%	5%	90%	0%	0%	0%	2%	98%	2%	8%	13%	17%	60%	0%	1%	2%	1%	96%
	Car	3%	4%	6%	3%	83%	0%	1%	3%	4%	92%	**11%**	**3%**	**2%**	2%	83%	3%	7%	12%	4%	75%
Agricultural Inputs	Tractor	**16%**	**13%**	**7%**	**7%**	57%	1%	4%	3%	4%	88%	**19%**	**22%**	**14%**	10%	35%	**31%**	**17%**	**7%**	9%	37%
	Ox cart	0%	4%	4%	5%	88%	0%	1%	1%	1%	98%	0%	16%	14%	17%	52%	0%	1%	1%	4%	93%
	Pesticide	0%	1%	1%	2%	96%	0%	0%	0%	0%	100%	0%	0%	0%	0%	100%	0%	2%	3%	5%	90%
	Fertilizers	0%	1%	1%	1%	96%	0%	0%	1%	0%	99%	0%	0%	0%	2%	98%	0%	3%	2%	3%	92%
	Water crop	0%	0%	0%	1%	99%	0%	0%	0%	1%	99%	0%	0%	0%	0%	100%	0%	0%	1%	2%	97%
	Water liv.	0%	2%	2%	6%	90%	0%	1%	1%	3%	95%	0%	0%	5%	6%	89%	1%	4%	1%	9%	86%
	Vet serv	0%	1%	1%	4%	94%	0%	0%	1%	3%	96%	0%	0%	0%	2%	98%	1%	2%	2%	6%	89%
Service	School	**6%**	**25%**	**8%**	**10%**	52%	**9%**	**42%**	**9%**	**9%**	30%	5%	**11%**	**8%**	**17%**	59%	**3%**	**14%**	**6%**	7%	71%
	Health	0%	1%	7%	16%	75%	0%	0%	4%	7%	90%	0%	2%	3%	8%	87%	0%	1%	13%	30%	55%
Savings		**7%**	**5%**	**9%**	**18%**	61%	1%	2%	**8%**	**15%**	74%	2%	**14%**	**19%**	27%	38%	**15%**	**4%**	**5%**	**18%**	58%

**Very high: the HH ranked the proposition first, High: second or third, Medium: fourth or fifth, low: sixth and above, nil: the HH did not mention the investment*

Annex 12: Income generations – Contribution of the activities

	Contribution														Tsch		USD	
	Cattle		Goat										Informal	Formal	Income at HH	Income per	Income at HH	Income per
	meat&skin	milk	meat&skin	milk	Sheep	Chicken	Honey	Land & Feed	Maize	Beans	Other Crop	Tractor	activities	Activities	level	capita	level	capita
	Gross income generation																	
Lolkisale	22.70%	9.30%	2.80%	0.90%	1.40%	5.20%	0.70%	0.40%	13.10%	23.20%	0.00%	2.40%	12.30%	5.50%	519,143	171,899	415	138
Naitolia	11.00%	5.20%	7.70%	0.70%	5.70%	16.10%	3.20%	0.00%	19.00%	5.30%	5.60%	0.80%	14.90%	4.60%	385,707	140,763	309	113
Loiborsoit 'A'	12.00%	13.10%	1.10%	0.00%	2.10%	6.40%	1.30%	0.20%	9.30%	12.30%	0.80%	0.90%	27.80%	12.80%	602,238	272,358	482	218
Total	16.20%	10.40%	2.70%	0.50%	2.40%	7.30%	1.30%	0.30%	12.20%	15.70%	1.20%	1.50%	19.60%	8.70%	522,763	213,877	418	171
No Live&Crop	0.00%	0.00%	0.00%	0.00%	0.00%	8.90%	8.40%	0.00%	0.00%	0.00%	0.00%	0.00%	48.80%	33.90%	324,429	206,373	260	165
Crop only	0.00%	0.00%	0.00%	0.00%	0.00%	10.60%	0.80%	0.50%	16.60%	17.00%	3.10%	1.00%	34.00%	16.30%	378,000	170,773	302	137
Livestock only	17.50%	28.00%	2.20%	0.00%	3.10%	6.80%	0.90%	0.60%	0.00%	0.00%	0.00%	0.00%	31.30%	9.50%	401,207	205,359	321	164
Live&Crop	21.30%	11.50%	3.70%	0.70%	3.00%	6.50%	0.80%	0.20%	14.00%	18.90%	1.00%	2.00%	12.00%	4.40%	642,088	234,031	514	187
	Gross income and on farm consumption																	
Lolkisale	11.80%	21.50%	2.40%	2.70%	1.40%	5.50%	0.30%	0.20%	21.50%	22.90%	0.00%	1.20%	5.90%	2.70%	1,078,165	349,165	863	279
Naitolia	9.20%	13.00%	5.70%	2.40%	3.70%	15.30%	1.70%	0.00%	24.20%	6.40%	7.40%	0.40%	8.10%	2.50%	713,755	254,502	571	204
Loiborsoit 'A'	7.70%	28.40%	1.00%	3.50%	1.80%	7.00%	0.80%	0.10%	11.40%	12.50%	1.20%	0.50%	16.50%	7.60%	1,115,097	509,305	892	407
Total	9.80%	23.10%	2.30%	3.00%	1.90%	7.50%	0.70%	0.10%	17.80%	16.30%	1.50%	0.80%	10.50%	4.60%	976,734	381,153	781	305
No L&C	0.00%	0.00%	0.00%	0.00%	0.00%	15.60%	7.70%	0.00%	0.00%	0.00%	0.00%	0.00%	45.20%	31.40%	350,097	220,115	280	176
Crop only	0.00%	0.00%	0.00%	0.00%	0.00%	12.50%	0.50%	0.30%	26.30%	22.40%	5.10%	0.60%	21.80%	10.50%	589,475	263,212	472	211
Livestock only	8.80%	53.00%	1.50%	9.70%	1.90%	5.70%	0.40%	0.30%	0.00%	0.00%	0.00%	0.00%	14.40%	4.40%	873,842	428,769	699	343
Live&Crop	12.20%	24.20%	3.00%	2.70%	2.30%	6.50%	0.40%	0.10%	19.70%	18.40%	1.20%	1.00%	6.10%	2.20%	1,267,939	447,925	1014	358
	Gross income , on farm consumption and herd growth																	
Lolkisale	22.70%	18.40%	2.70%	2.30%	2.50%	4.70%	0.30%	0.20%	18.30%	19.60%	0.00%	1.00%	5.10%	2.30%	1,262,572	412,149	1010	330
Naitolia	4.40%	13.10%	7.30%	2.40%	6.30%	15.40%	1.70%	0.00%	24.30%	6.40%	7.40%	0.40%	8.10%	2.50%	710,226	279,844	568	224
Loiborsoit 'A'	30.30%	17.60%	6.60%	2.10%	7.80%	4.40%	0.50%	0.10%	7.10%	7.70%	0.70%	0.30%	10.20%	4.70%	1,879,394	865,952	1504	693
Total	24.50%	17.40%	5.10%	2.20%	5.50%	5.70%	0.50%	0.10%	13.40%	12.30%	1.20%	0.60%	7.90%	3.50%	1,295,139	517,146	1036	414
No L&C	0.00%	0.00%	0.00%	0.00%	0.00%	15.60%	7.70%	0.00%	0.00%	0.00%	0.00%	0.00%	45.20%	31.40%	350,097	220,115	280	176
Crop only	0.00%	0.00%	0.00%	0.00%	0.00%	12.50%	0.50%	0.30%	26.30%	22.40%	5.10%	0.60%	21.80%	10.50%	589,475	263,212	472	211
Livestock only	41.60%	24.90%	8.60%	4.50%	8.50%	2.70%	0.20%	0.10%	0.00%	0.00%	0.00%	0.00%	6.80%	2.10%	1,858,536	873,217	1487	699
Live&Crop	24.90%	18.80%	5.20%	2.10%	5.80%	5.00%	0.30%	0.10%	15.30%	14.30%	0.90%	0.80%	4.70%	1.70%	1,633,573	599,151	1307	479
	Net income , on farm consumption and herd growth																	
Lolkisale	25.90%	22.50%	1.80%	2.80%	2.00%	5.80%	0.40%	0.20%	16.10%	12.00%	0.00%	1.30%	6.40%	2.90%	1,002,210	330,077	802	264
Naitolia	4.00%	15.10%	6.70%	2.80%	6.20%	18.30%	2.10%	0.00%	20.70%	3.50%	7.20%	0.50%	9.80%	3.00%	589,271	234,441	471	188
Loiborsoit 'A'	31.40%	18.90%	6.20%	2.30%	7.60%	4.70%	0.50%	0.10%	5.70%	5.00%	0.80%	0.40%	11.20%	5.20%	1,695,423	785,351	1,356	628
Total	26.50%	19.80%	4.60%	2.60%	5.40%	6.50%	0.60%	0.10%	11.20%	7.40%	1.20%	0.70%	9.30%	4.10%	1,105,907	447,731	885	358
No L&C	0.00%	0.00%	0.00%	0.00%	0.00%	15.50%	7.80%	0.00%	0.00%	0.00%	0.00%	0.00%	45.30%	31.50%	349,455	219,794	280	176
Crop only	0.00%	0.00%	0.00%	0.00%	0.00%	15.50%	0.60%	0.40%	22.10%	13.80%	5.90%	0.80%	27.50%	13.30%	465,860	207,238	373	166
Livestock only	41.20%	25.90%	7.90%	4.70%	7.90%	2.80%	0.20%	0.10%	0.00%	0.00%	0.00%	0.00%	7.10%	2.20%	1,759,521	828,266	1,408	663
Live&Crop	27.40%	21.80%	4.60%	2.40%	5.70%	5.90%	0.40%	0.10%	13.20%	8.90%	0.90%	0.90%	5.70%	2.10%	1,364,514	506,443	1,092	405

Annex 13: Income generations - Quartiles

		Gross income				Gross income and consumption				Gross income , consumption & herd growth				Net income , consumption & herd growth			
		Per houshold		Per capita		Per houshold		Per capita		Per houshold		Per capita		Per houshold		Per capita	
		Tsch	USD	Tsch	USD	Tsch	USD	Tsch	USD	Tsch	USD	Tsch	USD	Tsch	USD	Tsch	USD
Lolkisale	Min	0	0	0	0	0	0	0	0	-3,006,286	-2,405	-501,048	-401	-3,148,986	-2,519	-541,188	-433
	Q1	122,525	98	48,000	38	301,538	241	115,242	92	308,326	247	118,795	95	248,057	198	89,274	71
	Q2	300,000	240	121,261	97	630,286	504	240,588	192	704,478	564	277,940	222	568,131	455	234,070	187
	Q3	647,686	518	239,040	191	1,240,573	992	470,219	376	1,681,077	1,345	662,761	530	1,488,466	1,191	540,240	432
	Max	5,062,156	4,050	2,028,175	1,623	8,479,782	6,784	2,826,594	2,261	22,790,776	18,233	7,596,925	6,078	22,377,367	17,902	7,459,122	5,967
Naitolya	Min	0	0	0	0	0	0	0	0	-1,440,674	-1,153	-374,135	-299	-1,475,174	-1,180	-541,188	-433
	Q1	90,000	72	28,000	22	303,075	242	88,425	71	273,074	218	83,110	66	150,000	120	65,107	52
	Q2	244,538	196	86,484	69	633,534	507	208,796	167	652,091	522	223,025	178	478,805	383	154,201	123
	Q3	606,306	485	200,000	160	1,356,660	1,085	415,230	332	1,807,233	1,446	480,601	384	1,500,364	1,200	408,271	327
	Max	5,062,156	4,050	1,687,385	1,350	8,479,782	6,784	2,826,594	2,261	11,539,138	9,231	3,846,379	3,077	9,428,142	7,543	3,142,714	2,514
Loiborsoit.'A'	Min	0	0	0	0	49,002	39	24,501	20	-3,006,286	-2,405	-501,048	-401	-3,148,986	-2,519	-524,831	-420
	Q1	151,450	121	57,330	46	294,504	236	119,493	96	287,991	230	123,714	99	221,041	177	89,444	72
	Q2	292,800	234	100,000	80	495,923	397	195,360	156	526,615	421	195,360	156	436,555	349	150,000	120
	Q3	463,750	371	194,086	155	866,508	693	338,969	271	902,901	722	380,967	305	766,241	613	322,877	258
	Max	2,329,000	1,863	582,250	466	4,050,768	3,241	1,012,692	810	5,045,304	4,036	1,261,278	1,009	4,328,354	3,463	1,133,606	907
No L&C	Min	0	0	0	0	0	0	0	0	-3,006,286	-2,405	-501,048	-401	-3,148,986	-2,519	-541,188	-433
	Q1	121,250	97	79,875	64	150,321	120	92,500	74	150,321	120	92,500	74	248,057	198	89,274	71
	Q2	242,100	194	134,130	107	258,881	207	150,000	120	258,881	207	150,000	120	568,131	455	234,070	187
	Q3	390,000	312	230,000	184	410,113	328	254,325	203	410,113	328	254,325	203	1,488,466	1,191	540,240	432
	Max	1,120,000	896	840,000	672	1,120,000	896	967,691	774	1,120,000	896	967,691	774	22,377,367	17,902	7,459,122	5,967
Crop only	Min	0	0	0	0	41,200	33	16,467	13	41,200	33	16,467	13	-18,080	-14	-9,040	-7
	Q1	80,000	64	31,875	26	214,165	171	72,315	58	214,165	171	72,315	58	117,189	94	54,430	44
	Q2	200,000	160	100,000	80	437,198	350	201,500	161	437,198	350	201,500	161	294,483	236	122,135	98
	Q3	426,250	341	199,890	160	774,287	619	382,867	306	774,287	619	382,867	306	551,561	441	271,500	217
	Max	2,966,400	2,373	988,800	791	3,588,188	2,871	1,196,063	957	3,588,188	2,871	1,196,063	957	3,131,488	2,505	1,043,829	835
Livestock only	Min	0	0	0	0	0	0	0	0	-345,518	-276	-345,518	-276	-345,518	-276	-345,518	-276
	Q1	102,394	82	42,675	34	256,266	205	100,620	80	505,266	404	230,746	185	475,641	381	214,871	172
	Q2	291,100	233	118,706	95	558,076	446	255,723	205	1,214,332	971	423,845	339	1,170,332	936	414,595	332
	Q3	441,538	353	236,325	189	1,214,314	971	617,999	494	2,497,446	1,998	1,211,323	969	2,298,045	1,838	1,136,899	910
	Max	3,010,400	2,408	1,505,200	1,204	3,705,968	2,965	1,852,984	1,482	7,708,760	6,167	3,854,380	3,084	7,333,760	5,867	3,666,880	2,934
Livestock & Crop	Min	0	0	0	0	0	0	0	0	-3,006,286	-2,405	-501,048	-401	-3,148,986	-2,519	-541,188	-433
	Q1	166,453	133	46,439	37	493,176	395	148,427	119	526,131	421	155,862	125	415,513	332	105,084	84
	Q2	360,484	288	125,550	100	871,549	697	292,246	234	1,087,697	870	352,239	282	864,844	692	278,575	223
	Q3	803,161	643	254,800	204	1,684,890	1,348	561,667	449	2,190,680	1,753	819,335	655	1,851,228	1,481	663,030	530
	Max	5,062,156	4,050	2,028,175	1,623	8,479,782	6,784	2,826,594	2,261	22,790,776	18,233	7,596,925	6,078	22,377,367	17,902	7,459,122	5,967
Total	Min	0	0	0	0	0	0	0	0	-345,518	-276	-345,518	-276	-345,518	-276	-345,518	-276
	Q1	164,930	132	75,120	60	350,000	280	146,831	117	418,624	335	209,312	167	345,259	276	181,113	145
	Q2	348,000	278	161,969	130	711,485	569	304,270	243	1,062,721	850	420,326	336	947,412	758	390,423	312
	Q3	812,181	650	381,931	306	1,376,599	1,101	646,039	517	2,197,491	1,758	984,139	787	2,007,601	1,606	912,695	730
	Max	4,056,350	3,245	2,028,175	1,623	7,190,070	5,752	2,421,679	1,937	22,790,776	18,233	7,596,925	6,078	22,377,367	17,902	7,459,122	5,967