Small-Scale Farmers Land Use and Socioeconomic Situation in the Mount Elgon District in Northwestern Kenya
A Minor Field Study - Combined Field Mapping and Interview

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Abstract

This Minor Field Study was carried out during November and December in 2011 in the Mount Elgon District in Western Kenya. The objective was to examine nine small-scale farming household’s land use and socioeconomic situation when they have joined a non-governmental organization (NGO) project, which specifically targets small-scale farming households to improve land use system and socioeconomic situation by the extension of soil and water conservation measures. The survey has worked along three integral examinations methods which are mapping and processing data using GIS, semi structured interviews and literature studies.

This study has adopted a theoretical approach referred to as political ecology, in which landesque capital is a central concept. The result shows that all farmers, except one, have issues with land degradation. However, the extent of the problem and also implemented sustainable soil and water conservation measures were diverse among the farmers. The main causes of this can both be linked to how the farmers themselves utilized their farmland and how impacts from the climate change have modified the terms of the farmers working conditions. These factors have consequently resulted in impacts on the informants’ socioeconomic conditions. Furthermore it was also registered that social and economic elements, in some cases, were the causes of how the farmers manage their farmland. The farmer who had no significant problem with soil erosion had invested in trees and opportunities to irrigate the farmland. In addition, it was also recorded that certain farmers had invested in particular soil and water conservation measures without any significant result. This was probably due to the time span these land measures cover before they start to generate revenue.

The outcome of this study has traced how global, national and local elements exist in a context when it comes to the conditions of the farmers’ land use and their socioeconomic situation. The farmers at Mt. Elgon are thereby a component of a wider context when they are both contributory to their socioeconomic situation, mainly due to their land management, and also exposed to core-periphery relationships on which the farmers themselves have no influence.

Keywords: land use, small-scale farmer, socioeconomic situation, sustainable soil and water conservation measures, GIS, semi-structured interviews, political ecology, landesque capital, land degradation, core-periphery relationships
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1. Introduction

Land use is about how man utilizes the land. Depending on how investments are implemented it can provide various utilities. Furthermore, unsustainable land management through overexploitation of natural resources can entail to decline in the soil potential productivity, which subsequently can lead to impacts on living conditions. The effects from a changing climate can also set the terms in how soil properties can be utilized by the land users.

In Kenya, subsistence agriculture and firewood are the main energy sources among the population, especially in rural areas. But elements such as a high population pressure on natural resources, unsustainable land management, and a changing climate have put several areas in Kenya under severe pressure. These circumstances have thus modified the work conditions for especially small-scale farmers when it has accelerated the problem with land degradation, in which productivity decline is a noticeable part. Because of these emphasized factors, the World Bank in association with the NGO organization: VI Agroforestry Programme have launched a project in the Mt. Elgon district in Western Kenya. The primary objective with the project is to improve the living condition in the area by generating inventive among the small-scale farmers to execute particular sustainable land use system. This amplified soil and water conservation measure on the farmers’ agriculture land and also decreased pressure on natural resources in the project area.

To investigate which conditions that distinguish and influence the small-scale farmers’ social and economic situation and land management, nine interviews and maps have been conducted in the project area.

1.1 Aim

This survey aims at investigating small-scale farming households’ land use and socioeconomic situation in the Mt Elgon district, Western Kenya. The farmers have recently joined a non-governmental organization (NGO) project, specifically targeting small-scale farming households to improve land use system and socioeconomic situation by extension of agroforestry practices and soil and water conservation measures. This will be carried out by interviewing the farmers and mapping their farmland. This study will be a “zero-position” survey that has the possibility for a follow-up study in about 3-5 years.

1.2 Investigated questions

The survey will be based on the following questions:

- What characterizes land use in the study area?
- How is the socioeconomic situation among small-scale farming households at present?
- Have the farmers experienced any problems with land degradation and effects of climate change, and if so, how are the problems expressed?
- How do the farmers look upon the future and what are their expectations on the NGO project?
1.3 Outline

The thesis begins with aim, question formulations and definition of particular concepts. Then follows the section *Method and material* that, for example, reports, examinations methods, working procedure and criticism of the sources. This will be followed up by the chapter *Background* which, among other things, describes information about the VI Agroforestry Programme (VI AFP) activities and the general landscape and social and economic elements in Kenya. Then follows the chapter *Theory* that treats the theoretical approach of the survey. The chapter *Result* will report the data collected from each field survey separately, which is followed by an *Analysis* where the results among the informants and how it is related to the theoretical approach are analyzed. The thesis concludes with *Discussion* and *Conclusion*, in which relevant aspects from previous chapters and suggested further research are discussed. Additionally the chapter *Reference* will present used sources in the thesis while *Appendices* will contain designed maps and questionnaire.

1.4 Explanation of terms

*Agroforestry*

Agroforestry is a land use system that combines crops and/or livestock together with trees/scrubs within same land management unit (Markensten, 1993, p. 23).

*Food security*

The term refers to sufficient food that subsequently can lead to an active and healthy life for all people at all times (Odingo, 2010, p. 2).

*Poverty*

In this thesis the term is defined as the situation of life that is lower than reasonable definition of decency of human life, in which malnutrition, diseases, illiteracy are central elements (Odingo, 2010, p. 2).

*Sustainable development*

Sustainable development is a concept that aims to present social development which does not compromise the needs and aspirations of future generations’ (Daniels, et al, 2008, p. 474).
2. Methodology

2.1 Field methodology

This survey was, together with VI AFP, conducted around Mt. Elgon in the Western Province of Kenya between November and December 2011. The field work emanated from VI AFP head office in Kitale to visit the survey farms which all were located adjacent to Mt. Elgon. The selection of informants in the survey was determined in dialogue with the staff of VI AFP.

2.1.1 Examinations methods

This thesis has been conducted along three integral examinations methods. These are *mapping and processing data using GIS*, *semi structure interviews* and *literature studies*.

*Mapping and processing data using GIS*

GIS-technology (Geographical Information System), along with an *iPhone* and the programs *ArcCatalog*, *ArcMap 9.2* and *iGIS*, were used to map the farmers land use.

The study’s working procedure with this methodology can be divided into three central steps; The *first* procedure is to create shapefiles of points, polyline and polygon in the ArcCatalog. Then each shapefile is transferred to ArcMap 9.2 to attach a text file where the user later can type information during the field mapping. Before the transfer to iPhone and its program iGIS the shapefiles must be compressed into one file. In iGIS the projection must be set to start the coordinate set of points, polyline and polygon. The *second* step is collecting data from the field by mapping points, line and polygons. The *third* stage is to transfer this data to a PC and ArcMap for adapting, analyzing and presenting the maps.

*Semi structured interviews*

Interviews were conducted with the farmers in the Mt. Elgon district. The main purpose to combine the mapping with interviews is to generate deeper knowledge about the farmer’s land use and socioeconomic situation than what the map solely displays. The questionnaire that was used during all interviews was semi structured with both open ended and closed ended questions. The objective with the questionnaire was to obtain descriptions of the interviewee’s aspects on their world and interpret the meaning of these descriptions (Brinkmann & Kvale, 2009).

In order to protect the respondent’s privacy fictitious name have been used in the thesis. In addition, to decrease the risk for outsiders to identify the farmers land no sublocation will be present. Only which division within the Mt. Elgon district where the farmland is located is presented in the result.

An English interpreter of Swahili was needed during all interviews except one. The interview where an interpreter was not used was due to the informants’ good English. Besides that the notes from the interviews and the coordinates of the respective farm location are kept by the researcher.

*Literature studies*

The collected data from the field interviews and mapping is complemented by previously published scientific articles and books which are relevant to the subject. The main reason for
applying previous scientific literature as a complement to the collected material is to secure the scientific quality of this study.

2.1.2 Working procedure
This study can primarily be divided into six works steps. The first step was to set out the purpose and questions with the survey. The second step was to collect material through literature and internet searches and to construct the questionnaire and prepare the mapping. The third step was to conduct the interviews and mapping. Later the fourth and five steps were to critically evaluate the collected material and analyze this through construction of maps and text. The final step was then to present and discuss the survey’s findings.

2.1.3 Limitation
Regarding the mapping of the farmers´ land use generalizations have been executed, which is inevitable in mapping. A map is always a generalization of the reality to make it legible to the reader. A concrete example of this was the mapping of some tree lines and areas. The examiner did not have the ability to map each tree within some areas or lines. Due to this the examiner used shapefiles of lines or polygon to generalize these. However the distance, area and approximate number of trees where delineated during this type of mapping.

The last question in this study will not be set in relation to any theory. The reason to this is to produce a baseline of the farmers´ expectations with the NGO-project which then can be evaluated by follow-up studies.

In the chapter Result, the scale of the attached maps can, to some degree, be incorrect. This because the size of the attached map has been adjusted to fit the text in this chapter. Due to the fact that the scale information is a core requirement in maps the scale information cannot be removed from the designed maps in the result. The correct scale of the designed maps is however correct in the chapter Appendices.

2.1.4 Ethical considerations
To protect the informants´ integrity before, during and after the survey four main ethical requirements have been implemented. These requirements are defined by the Swedish Research Council within Humanities and social sciences. These ethic principles are referred to as follows; (I) Information requirement: All informants were informed, before respective interview, about the purpose of the survey, their task in the study and their conditions for participating. (II) Consent requirement: All informants received information that their involvement was voluntary and they had the right to cancel their participation during the interview. (III) Confidentiality requirement: All data from the fields studies have been treated with highest confidentiality. An example of this is the use of fictitious names that accordingly has reduced the risk that outsiders can identify the informants. Moreover, no one, except the researcher and VI AFP, can identify the farms´ location when no sublocation is present (IV) Utilization requirement: The data from the field study has only been used for scientific purposes which means that it has not been used for commercial use or other non-scientific purposes (vr.se, forskningsetiska principer, 2011-10-12).

2.2 Criticism of the sources
To confirm the study’s scientific quality considerations about validity (relevance) and reliability (trustworthiness) against the collected data materials and the analysis of these have been established (Brinkmann & Kvale, 2009, p. 264-265).
Validity is used as a tool to ensure that the objective with the survey’s purpose has been executed. The validity of this study can be considered high since the data collection and analysis of these have been performed on an approach that is relevant for the study context. An example of this is that the pattern of the questionnaire is semi structured that subsequently has allowed the informants to spontaneously describe their situation within the study framework. Furthermore the collected data have been set towards a theory approach, which consequently can have enlarged both the levels of validity and reliability.

The reliability is about whether the data collection and analysis of this has been executed in an objective approach, in the sense that the researcher has reflected on his own contribution to the production of knowledge to the survey topic (Brinkmann & Kvale, 2009, p. 264-265). The reliability can be considered to be high as the informants were explicitly informed, before respective interview, about the confidentiality and utilization requirement with the collected data from interviews and mapping. This factor thus gave the informants the opportunity to answer the questions honestly. One factor that can reduce the reliability is the use of an interpreter during the interviews is due to the interviewer’s lack in the indigenous language, Swahili. This factor can therefore result in a loss of information during the interviews with the farmers.

The interpreters were tied to the VI AFP. This can entail a conflict of interest among the organization and the researchers’ objective with the survey. However, the risk that some interpreters may have interpreted the informants’ answers incorrectly can be considered very low in nine of ten conducted interviews. The interview where the interpreter can have corrected the informant’s answers were, with the map, excluded from the thesis.

All interpreters were explicitly informed that the objective with the survey was to conduct a baseline of the farmers’ land use and socioeconomic conditions, which consequently has the ability to be followed by another study to evaluate the development of these elements. This factor has most likely reduced the risk that interpreters have corrected the informants´ answer. But for a planned follow-up study it is recommended to employ interpreters that are not linked to VI AFP when this research has the ability to examine the result in how the implemented soil and water conservation measure has evolved. This element can therefore increase the risk for conflict of interest between the examiner and staff from VI AFP if the interpreters are connected to this organization.

One factor that has increased the reliability of the collected data is that the farmer and an employee from VI AFP participate in each mapping chiefly to clarify which type of crops or tree that were mapped.
3. Kenya

3.1 Physico-geographical conditions

3.1.1 Topography and vegetation

Kenya consists of a land surface of 580,000 km² and is located at the equator in eastern Africa. Kenya borders to Tanzania in the south, Uganda in the west, Sudan and Ethiopia in the north, Somalia in the northeast and the Indian Ocean in the southeast (NE, Kenya, 2011-10-11).

The landscape topography in Kenya is characterized by a complex structure with significant contrasts. A coastline is located in the southeast along the Indian Ocean. From the lowland coast areas towards the central parts of Kenya the land rises gradually to a high plateau in the central and western parts of Kenya. The highlands represent one quarter of Kenya’s land mass. In the central of Kenya Mt. Kenya is located (5200 m.a.s.l). This area is bisected by the Great Rift Valley, which consists of a system of graben, faulting and horst. In the west the central high plateau flattens out to the Lake Victoria Basin. The areas at the Lake Victoria Basin are hillocky which, among other things, consist of some tropical rainforests. North of Lake Victoria Basin near to the Uganda border the extinct volcano Mt. Elgon (4321 m.a.s.l) is located (NE, Kenya, 2011-10-11).

The land mass in Kenya consists of approximately 83 percent of semi-arid and arid landscape (Ekbom et al, 2001, p.435.). The remaining 17 percent of the land mass consists of arable land. However, only seven percent of the arable land can be described as highly productive for farming (Ekbom, et al, 2001, p.435).

3.1.2 Climate

Because of the contrasts in the topography conditions it also affect the climate condition, both in terms of average temperature and precipitation. Two main elements affecting the climate, monsoon winds from the Indian Ocean and the diverse altitude levels in the country. The precipitation is unevenly distributed over Kenya, both in terms of geographic location and season. During the year there are usually two rainy seasons over most part of the country. Over large parts of the country there are usually two rainy seasons during the year. These rainy seasons are known as the “long rain” and the “short rain”, as these usually take place during October-December and March-May. As previously emphasized, the precipitation is unevenly distributed over Kenya and northern Kenya is drier than the southern areas (NE, Kenya, 2011-10-11).

3.2 Socioeconomic situation and Land use system

The population of Kenya consists of approximately 38 million inhabitants. The population density is 66 inhabitants per square kilometer. However, the population is unevenly distributed over the country. Approximately 75 percent of the population is located on the highlands which consist of 25 percent of Kenya’s total land mass.

In year of 2008, Kenya had a natural population growth at 2,8 percent a year. Average life expectancy for both men and women was 53 years (NE, Kenya, 2011-09-15).

The population is composed of a variety of different ethnic groups. There are more than 60 different ethnic groups in Kenya. Kikuyu, Luhya and Luo are the largest. Kenya is a
multilingual country, Swahili and English are the two official languages (NE, *Kenya*, 2011-09-15).

Regarding the business world agriculture is the main occupation in Kenya, where over half of the production consists of subsistence farming. The most common crops are; sugar, corn, wheat, pyrethrum, sisal and cotton. Additionally the tea cultivation in Western Kenya is an important export product. Moreover the manufacturing and service sectors are important components within the Kenyan employment (NE, *Kenya*, 2011-09-15).

A central element in the Kenyan land use has long been, and still is, activities related to agricultural practices. What generally characterizes the farming’s structural change is a transit from shifting cultivation to permanent cultivation. This applies both to annual and perennial cultivation of food and cash crops. The shifting cultivation was occurring between the thirties and the sixties in Kenya. The vital objective with this land use system was to maintain good fertility in the soil by letting the farmlands alternately lie in fallow to counteract leaching of essential nutrients from the soil. The shifting cultivation rarely resulted in problems with the soil fertility. In addition, no wider uses of chemical fertilizers were used during this period of time (Ovuka, 2000, p. 207).

An accelerating amount of agricultural land has been utilized since Kenya’s independence in 1963. This is both a result from the time the British colonial government removed racial barriers for land ownership and that the population has increased in Kenya (Odingo, 2010, p. 4-5). Especially larger areas of hillsides with mountain forest were cultivated. The shifting cultivation system was thus significantly reduced or even disappeared due to the increased competition over potential agriculture land (Ovuka, 2000, p. 205-207). Another factor that has played a considerable role in the extensive deforestation is that trees are a vital fuel and timber source in Kenya. Firewood is essential for the Kenyan production process, especially for the rural population but also for a large part of the urban population (Government of the Republic of Kenya, 1997, p.72). In the 1960s, Kenya’s land mass consisted of about twelve percent forest. Today, its land mass consists of approximately two to three percent of forest (Kenya Government, 2010, p. 11 & NE, *Kenya*, 2011-09-19).

A research about farmers’ perception on the subject of soil changes in two areas in Kenya between 1950 to 1990s registered that the majority of respondents experienced problems with the introduction of chemical fertilizers in their agricultural fields. Most farmers had experienced a decline of the soils natural fertility due to the implementation of chemical fertilizers. To overcome the issue the farmers add more chemical fertilizers in the soil to achieve as high output as they did before the implementation of these fertilizers. Moreover it was solely one farmer out of 40 farmers who believed that fertility had increased since the 1950s. This farmer applied ecological farming techniques without any application of chemical fertilizers (Ovuka, 2000, p. 207).

Three quarters of the population are located on the highlands, which represent 25 percent of Kenya’s land mass. The main reason for this is due to the high cultivation potential of the highlands. However the increasing population density has led to extensive deforestation and overgrazing on the steep slopes around the highlands (Government of the Republic of Kenya, 1997, p. 54-55). In addition, the overgrazing has resulted in a decline of livestock numbers, especially among the poor in Kenya (Smucker & Wisner, 2008, p. 206). The accelerating cultivation has been continued for a long time in the highlands and no extensive implementation of soil and water conservations measure have been executed (Gachene et al, 1997, p. 475). This circumstance has therefore resulted in land degradation in several of these areas in the highlands (Government of the Republic of Kenya, 1997, p. 54-55).
During the early 1970s it was established in a report to the UN that Kenya had significant environmental problems, especially with land degradation (Markensten, 1993, p. 23). One main cause of this was accordingly the absence of sustainable land management, which, among other things had intensified the leaching of essential topsoil that thereby reduced or eradicated the soil potential for crop productivity (Government of the Republic of Kenya, 1997, p. 54-55). However the implementations of soil and water conservation measures have been hampered. Especially by political instability, in which major corruption was and still is a problem within the Kenyan social strata. The widespread corruption in the country has resulted to, for instance, that aid agencies and the International Monetary Found (IMF) stopped payments to the country during the 1990s (NE, Kenya, 2011-09-17). Another factor that has worked against political stability in the country is the ethnic fragmentation in the country, which particularly is caused by the political system (Ekblom, et al, 2001, p. 436). Ethnic tensions were particularly evident in the general elections that took place in 2007 when Mwai Kibaki was declared president on dubious grounds, which generated clashes in several areas in Kenya. These contradictions had explicit features of ethnic cleansing. Official numbers report that over 1500 people were killed and over 600,000 people were displaced from their homes during the clashes (NE, Kenya, 2011-09-17).

Thus, the factors that have influence on the land management for especially small-scale farmers can be addressed from six macro-level changes. These are (I) population growth, (II) environmental change, (III) increased conflict of natural resources (IV) changes in access of land, (V) changing market condition and availability of services, (VI) political decentralisation in Kenya (Smucker & Wisner 2008, p. 205).

4. Climate change

Climate change refers to conditions as precipitation, temperature and wind that varies over time and space. The earth’s climate is driven from both external and internal factors. External factors are conditions taking place outside the earth as variations in solar radiation, while internal factors are climate conditions that take place on Earth. In addition the internal factors can be caused by both natural and anthropogenic elements. Due to external and internal factors climate fluctuations have constantly existed on the Earth. Moreover the historical causes of these have, in some cases, been raised in speculation. However it has been determined that anthropogenic driving forces have influence on Earth’s climate conditions, especially since the period beginning with industrialization (Bogren, et al, 2006, p. 27, 81).

To study the climate change conditions that affect Kenya it is essential to consider both global and national elements.

4.1 Global climate change

IPCC (Intergovernmental Panel on Climate Change) is a scientific intergovernmental body established by the United Nations Environments Programme (UNEP) and World Meteorological Organization (WMO). The IPCC objective is to synthesise worldwide scientific data and thence provide assessments on the current climate change and its potential environmental and socioeconomic impacts (IPCC, 2007, p. 26).

The IPCC last report from 2007 registers, undoubtedly, that the climate has become warmer, both concerning sea and land temperature. Consequences of this are numerous, for example, the widespread ice cover has significantly been reduced, which also has brought sea level rises. Since 1850 instrumental measurements of the ground surface have registered that the years between 1995 and 2006 was the warmest period since the measurements were launched.
The increased temperature is distributed over the entire Earth, however, the rise is highest in the northern hemisphere. What also characterizes the global climate changes in the last 50 years is that some weather events have shifted in frequency and/or intensity. For example, cold days and nights are less frequent, while hot days and nights are becoming more frequent. Additionally heat waves have occurred more frequently. Concerning the precipitation this has increased significantly particularly in eastern North and South America and northern Europe. But the precipitation has declined in some areas, such as: parts of Africa and around the Mediterranean regions. Furthermore heavy rains have increased in frequency over most land areas (IPCC, 2007, p. 8).

IPCC registers that there are both natural and anthropogenic causes to the climate change. However, the report emphasized that the anthropogenic driving forces have intensified in the last century (IPCC, 2007, p. 8). Examples of these anthropogenic factors – which nevertheless also can occur through natural processes – are (I) Increased emission of greenhouse gases, in which burning of fossil fuels from for example industry and gasoline vehicles are major contributing factors. (II) Change of soil condition such as logging to expand urban settlement results in changes of albedo. This factor can consequently lead to warmer and drier climate when the trees, among other things, give rise to a cooling evaporation and their potential for carbon dioxide sequestration. (III) The continuous increase of aerosols in the atmosphere which primarily affects the radiation balance, especially when concerning a regional level (Bogren, et al, 2006, p. 130, 152-154).

IPPC states that impacts from climate change will contribute with some benefits for some countries. However, by an overall context these are outweighed by the negative events, especially when it comes to impacts that will occur for so-called developing countries which is a result from their vulnerable socioeconomic situation and location on Earth. IPCC points especially out East Africa as an area that is most vulnerable for a changing climate, due to the area´s low adaptive capacity and geographical location. Events as drought and flood already occur in several areas in East Africa and with the climate change these circumstances are expected to increase in frequency and severity. This factor in relation to elements such as high population density, poverty, famine, limited infrastructure, low education level and absence of strong institutions will entail greater vulnerability for a changing climate (IPCC, 2007, p. 48-53, 65).

Furthermore IPCC emphasized that the impacts from global climate change, among other things, can lead to increased water stress and land degradation. For instance it is expected that crop failure and damage will be enlarged. In addition is it likely that death of livestock and wildfire will increase. These factors due to rain-fed agriculture therefore can cause severe impact on food security and consequently exacerbate malnutrition and famine for a number of African regions (IPCC, 2007, p. 48-53, 65).

4.2 A global response to the impacts from climate change

IPPC highlights the importance of a global response to the climate change. Establishment of new institutional mechanisms is essential to mitigate the effects from the changing climate. Especially it is vital to create initiative worldwide to significantly decrease carbon dioxide emissions. One measure to achieve this has been the Kyoto Protocol from the United Nations Framework on Climate change Convention. The Kyoto Protocol was adopted by 36 countries in 1997. One main objective with the protocol is to reduce the emission of greenhouse gases which is an accelerated force on the changing climate. The main approach to achieve this goal has been the establishment of the emission trading market (IPCC, 2007, p. 62).
The emission trading market is an economic instrument that allows emissions levels of greenhouse gases during a special period of time. The emission limit is set by a central authority. These caps are then allocated or sold to firms. Countries or companies that emit less level of greenhouse gases than assigned can sell their respective permits on a market, in which companies who need to enlarge the emissions can buy these available emission permits. However, most participants to the Kyoto Protocol have not succeeded to achieve the emission targets. Other factors that reduce the possibilities for the environment to benefit from the Kyoto Protocol are that USA and China have not signed the protocol. These two countries are the leading emitters of greenhouse gases (Britannica, Kyoto Protocol, 2011-11-13).

4.3 Climate change and impacts in Kenya

National Climate Change Response Strategy – Executive Brief is a report from the Government of Kenya. In this report it is stressed that Kenya’s average temperature, both regarding evening and daytime, has increased all over the country since 1960. Rainfall has increased in variety during the seasons and between years as it has become more erratic and unpredictable. Downpour has for example increased in intensity in Kenya. Regarding the average precipitation it has decreased during the rainy season in March-May, which is referred to as the “long rain”. Drought occurs also more frequently during this rainy season. However, there are indications that the “short rain” from October to December has been extended to September and even up to February. This factor has affected the hot and drought period which generally occurs between January and February (Kenya Government, 2010, p. 10).

The coastal areas in Kenya will be affected by rising sea levels in the Indian Ocean. For example it is estimated that 17 percent of the city of Mombasa will be submerged if the sea level rises 0.3 meters (Kenya Government, 2010, p. 11).

Kenya is a water shortage area both in quantity and quality of water. Since the 1990s several dry seasons have occurred in Kenya. This factor has led to reduced water volume in many rivers, or at worst, they have completely dried out. Drought has also led to that various crops either have been reduced or been wiped out entirely. This circumstance mainly concerned the production of wheat, tea, maize and sugar cane. In addition, the expected changing climate is expected to impair the water situation in the country. Besides that, due to increased frequency of heavy rain in the country floods have increased in frequency, especially in low land areas (Kenya Government, 2010, p. 11).

5. Political ecology

5.1 The theory

This study adopts a theoretical approach referred to as: political ecology. This term involves environmental changes and issues, in which the humans’ by their cultural development are an integral component of the ecosystem when they not only are involved in it but also produce it. The field of political ecology contextualizes environmental problems and a change due to its focus on political, social and economic circumstances (Sayer, et al, 2005, p. 165). This implies that the land users act within a decision and making process over their land management in a context of core-periphery relationship. The core-periphery relationship consists of combination of symptoms that lead to land degradation. An example regarding this matter can be traced to how political decisions from the state lead to consequences such as stagnated production, poverty and outmigration. These stressed elements can thereby affect how land managers utilize their land. Thus, the approach of political ecology highlights the
dialectics between the society and the land based resources (Blaikie & Brookfield, 1987, p.17-18).

A concept that is central within political ecology is the exploitation of the planet’s natural resources. This term can be defined as something valuable for the human society, which further implies that the consideration of a natural resource has shifted through time and space. So thereby something that man values today will maybe not be valued in the future. An example of this is that oil and gas only have been vital energy sources relatively recently in the human history (Daniels, et al, 2008, p. 106-107).

The value of resources and the control over their access are central components within a political and economic context. Thereby the control of particular natural resources occasionally has given rise to conflicts and even wars among parties (Daniels, et al, 2008 p. 106-107).

The present-day pattern of the natural resources consumption consists in several cases of an explicit distinction between so-called “developed” and “developing” worlds. For example, the worlds high-income countries have 15.7 per cent of the world’s population, but they are accounted for 50 per cent of the world’s emission of carbon dioxide. Furthermore in 2007 these high-income countries produced 77.7 per cent of the global Gross Domestic Product (GDP), according to the World Bank. This implies that a higher level of energy consumption results in a higher level of GDP. This circumstance specially shows that the “developed” world has better conditions, due to their economic potential, to overcome problems with natural resources with technical solutions compared to the “developing” world. In addition, the bulk of the world’s population live in developing countries, in which forestry and subsistence agriculture are the prime energy sources. And when environmental issues occur in one of these countries, such as extensive logging which thus reduces the availability of firewood, these people have marginalized conditions to handle this environmental problem compared to most countries in the “developed” world. Thus, the symbiosis between the demand for natural resources and the pressure on the environment is explicit concerning the exploitation of resources (Daniels, et al, 2008, p. 106-107,128,133).

A term that explicitly can illuminate the significance to apply political ecology when it comes to studies of environmental changes and problems is the myth of desertification, especially concerning the studies of the environmental situation in Sahel during the 1970s. Sahel is located on the southern edge of the Sahara (Daniels, et al, 2008, p. 265).

On The United Nations Conference on Desertification it was declared that the Sahara deserts had expanded due to human mismanagement and over-exploitation of land. These factors had been the major forces that enlarged the vulnerable situation for the people in Sahel, according to the scientific scholars. However the situation in Sahel was more complicated than the scientists had emphasized. They had not registered that the climate in Sahel and Sahara has changed dramatically over the past 10 000 years. The result of these variations was thus that the Sahara desert has both expanded and contracted during this time span (Daniels, et al, 2008, p. 265).

The natural factors were thus forces that had caused the drying in Sahel during the 1970s. Furthermore human activities and conditions accelerate the vulnerability for the people in Sahel by factors such as increased population, extensive poverty and unsustainable cultivation. These factors were the driving forces that, among other things, intensified the erosion process in Sahel. Another factor that caused the vulnerable situation in Sahel was the scarcity of firewood, which thus was and still is essential for production process in Sahel. The
factors that caused the vulnerable situation in Sahel the late 20th century were thereby impacts from a combined process where both natural elements and human misuse almost certainly were the driving factors (Daniels, et al, 2008, p. 265).

Thus, the main objective with political ecology is subsequently to wipe out environmental myths, using both scientific and social studies that can reveal particular ecological models that are constructed on false assumptions and unsuitability (Daniels, et al, 2008, p. 264-265).

5.2 Land degradation

The concept: land degradation, refers to its productivity decline if not effective practices are executed to restore productivity and to check further losses (Blaikie & Brookfield, 1987, p.1). The term involves the combined effects of processes which subsequently can lead to several consequences, such as loss of biological diversity, soil loss, nutrient imbalance and reduction in soil organic matter. Moreover it leads to decline in water infiltration and water withholding capacity and accordingly entail disrupted hydrological cycles from floods and water shortages, which mainly are caused by enlarged surface runoff. Vegetation cover is thus a vital component as this, either directly or indirectly, affects all the emphasized elements. These degradation processes can subsequently lead to social and economic consequences such as poverty, famine and social unrest (Markensten, 1993, p. 9-10). Land degradation is therefore a social problem (Blaikie & Brookfield, 1987, p.1).

The causes of land degradation depend mainly on the depletion of nutrients and organic material from the soil. These factors are closely linked to biophysical, social and economic circumstances, which consequently imply that biophysical land degradation can be a result of social and economic behaviour (Syers, et al, 1996, p. 484-485). The degree of land degradation is certainly caused by natural factors such as types of soil, topography, vegetation and climate when these elements lay down the structure and degree of land degradation. However, activities such as land strategies, ownership of natural resources, economic systems and population growth have direct affects in how land resources are exploited. Land management can therefore influence the extent of land degradation when it has the ability to affect its physical, chemical and biological processes (Markensten, 1993, p. 8-9).

5.2.1 Soil erosion forces on land degradation

Soil erosion emerges when soil particles are detached from land areas and subsequently transported by water, wind or other forces e.g. mass movements. These types of processes can also be referred as an exogenic forces. An exogenous force is a process that works to degrade land areas when it equalizes elevations by working from the surface and downwards. The common process of all exogenic forces are erosion, transport and deposition (Perhans, 2004, p. 3).

Erosion is a natural process which can depend on water, wind or gravity. But soil erosion can also be accelerated by human activities, in which deforestation, overgrazing by livestock and the application of unsustainable agricultural techniques can be key causes to the erosion process within an area (Markensten, 1993, p. 8).

Erosion does not only lead to land degradation where the soil is lost, but also to sites where the soil is deposited. For example, enlarged transport of sediment lead to pollution of water sources, siltation of dams and destruction of coastal and marine environments. But it can also bring benefit to the areas where the sediment deposit takes place and the soil fertility can rejuvenate (Markensten, 1993, p. 10-11).
5.2.2 Course of event of related erosions process

As previously pointed out wind- and water erosion and mass movements can cause land degradation. But neither of these processes do often occur independently, instead it is usually a part of various coherent erosion processes. An explicit example of this is the following course of events:

The soil structure is eroded by splash erosion, which occurs in areas where the surface is directly exposed to rain drops. Soil particles are consequently released and moved down in the terrain due to gravity. This event leads to that nutrient-rich topsoil is eroded away thus reducing the areas production potential. In addition, the released raindrops can be insulated in the soil pores and therefore result in reduced water infiltration through the soil. Two significant consequences of this are increased surface runoff and reduced groundwater capacity (Christiansson, et al, 1993, p. 16-18).

When water flows over the surface rills are formed that erode furrows in the soil. In areas with sparse vegetation and higher ground gradient these rills can expand by becoming deeper and wider and as a result formed gullies (Christiansson, et al, 1993, p. 16-18).

Mass movements can occur in sloping areas with incomplete vegetation cover. Because of the gravity force soil particles on slopes can be set in motion. One factor which usually gives rise to reduced soil friction is when large amounts of rainfall occur, which subsequently leads to that soil particles are released and transported along the slope (Christiansson, et al, 1993, p. 16-18 & Perhans, 2004, p. 16-18).

5.3 Landesque capital

A central term within political ecology is landesque capital. Landesque capital refers to investment made in land with the specific objective to generate capital for future generations’ maintenance of land capability. Landesque capital investments consequently focused on improvements beyond the present crop, or crop cycle by its substantial input to secure future production (Blaikie & Brookfield, 1987, p. 9).

It is necessary to be aware of the fact that conservation measures in relation to investment in landesque capital are not often made by individual decision-makers, as they do not want put up with all the cost and/or draw all the advantages with the investments. The decision-making over land management instead exists in a context of core-periphery relationships. Due to this it is necessary to explicitly identify the land manager(s) or the hierarchy relationship that influence the decision-making process. These actors can for example be farmers, landlords, agricultural enterprises, government or a NGO-organisation. In addition, these actors can all have different claims and demands on the same land area (Blaikie & Brookfield, 1987, p. 9-10, 17, 74).

5.3.1 Examples of landesque capital investments

Agroforestry

Agroforestry is a land use approach with the opportunities to compensate for loss of forest vegetation through tree and/or scrubs planting in agriculture areas (Olson, 1998, s. 169-170). Agroforestry has the ability to enhance the production potential and resistance against soil erosion for small-hold farmers (Markensten, 1993, p. 8, 23-24). This when the land use system in a sustainable way can improve production conditions, as it both increases the yield
and at the same time replenishes the soil fertility of the farmland (Sanchez, et al, 1997, p. 949).

Methods of agroforestry can for example be to plant crops with trees/scrubs in parallel hedgerows along contours, so called alley cropping. Or trees can be planted as windbreakers to prevent winds to erode the farmland and also keep the soil moist.

Real benefits with agroforestry can be (I) The trees within an agroforestry system can provide households with several different products such as food, timber, firewood, medicine and feeding stuff for the livestock. Production of these can therefore enhance household’s self-sufficiency when primarily the year-around production can be improved. Moreover a production surplus can be sold (Franzel, et al, 2001, p. 37-38). (II) Increased soil fertility by enlarged nutritional supplement as leaves from trees manure the soil and that trees also fix nitrogen (Sanchez, et al, 1997, p. 949-950) (III) Trees have a cooling effect due to the shade they bring, which consequently can decrease the soil temperature and thereby prevent that the soil dries out. (IV) The trees provide nutrition to animals that subsequently can be brought back as fertilizer for trees and crops and thereby eradicate the demand of artificial fertilizer (Törnqvst, Markvård, 2011-09-02). (V) Tree planting on agriculture land can as well mitigate or even combat the effects of climate changes by, inter alia, trees capacity of carbon sequestration, which thereby can affect the climate conditions as carbon dioxide is a greenhouse gas that is emitted from humans activities (Britannica, carbon sequestration, 2011-12-06).

Terracing

Another land measure to decrease soil erosion on slopes is the construction of terraces. Terraces can be constructed in different ways. Moreover for example nappia grass, trees and bushes can be planted along the terrace. The main function with terraces is to stabilize bunds and thus reduce surface runoff and increase groundwater capacity when the water infiltration through the soil increases. Additionally terraces can also contribute to enlarging the diversity and productivity of for example firewood, fodder and fruits (Markensten, 1993, p. 48).
6. Project and Survey area

6.1 VI Agroforestry Programme (VI AFP)

The VI Agroforestry Programme is a Swedish NGO with over 30,000 private donors and in which the Swedish International Development Agency (SIDA) is an annual contributor. VI AFP has its base area around the Lake Victoria Basin. The VI AFP has 25 years of experience working with special planting methods of trees and crops, so-called agroforestry. The ambition of these methods is to mitigate land degradation and the negative effects from climate changes and so improve living conditions for the small-scale farmers who implement agroforestry practices. Moreover the VI AFP’s education in business enterprise and micro finance is also essential to achieve sustainable economic growth in the areas surrounding the Lake Victoria Basin. In addition, the work is to improve women’s social standing, by integrating them in the work with farming and business development is also vital for the VI AFP driven project in the countries around the Lake Victoria Basin. (VIAF, organization, 2011-03-05)

The VI AFP approach to implement agroforestry strategies is to focus on the families in the project areas. In families knowledge of sustainable development can be anchored. When individuals grow up with agroforestry, they will also get experience of social and environmental benefits of these planting strategies. Because of this factor the VI AFP works directly with small-scale farming families. At present the organization works with around 150,000 families, which include one million people. Additional, the VI AFP ambition is to support many more in the future.

6.2 Cooperation between VI Agroforestry Programme (VI AFP) and Dalarna University (HDa)

Geographers from the Dalarna University and the VI Agroforestry Programme have been collaborating for some years in the countries surrounding the Lake Victoria Basin (Kenya, Tanzania, Uganda and Rwanda). During these years geographers from HDa have been working with two interacting methods. One method is through field work with GIS-technology (Geographical Information System) to map, analyze and present land cover and land use relationships, extension of agroforestry and degradation of tropical forests. The second method consists of interviews at household level, to generate profound knowledge of about issues in these survey areas. The cooperation between HDa and VI AFP has led to five previous MFS-studies and several field courses. This research has led to mutual exchange of knowledge between geographers from HDa and VI AFP’s staff and members of the households in the areas around the Lake Victoria Basin (Törnqvist & Westholm, 2009).

6.3 Survey area

The areas that have been investigated are located adjacent to Mt. Elgon slopes in the Western Province of Kenya, along the Kenya/Uganda border. The specific survey areas are Kopsiro, Cheptais and Kapsokwony (Project description, VI AFP 2010).
The overall climate in Mt. Elgon is moist to moderately dry. The general rainfall pattern over the area is bimodal as it comes in two seasons. The “short rains in October-December and the “long rains” in March-May. The annual rainfall is over 1270 mm and the temperature varies between 14°C and 24°C (Akoto, 2011).

Subsistence farming is the main working chore in the survey areas. The dominant crops are maize, Irish potatoes, beans, onions and coffee. Free range is the common rotation system for the feeding of the livestock. (Akoto, 2011). Andisol is the dominant soil type in the survey areas (Project description, VI AFP 2010). Andisol consists of volcanic-ash parent material that, under favorable conditions, has high content of mineral nutrients and good ability for erosion-resistance (Britannica, *andisol*, 2011-12-13).

The largest ethnic group in the survey areas are the Luhyas and the Sabots. Local cultural norms and groupings have influence on livelihood strategies and access to resource (Akoto, 2011).

The poverty level is very high in Kopsiro, Cheptais and Kapsokwony. Extensive deforestation in combination with increased population and unsustainable agricultural practices have resulted in a decline of soil fertility and crop production (Akoto, 2011).

Cheptais consists of 4500 km² and the total population is approximately 160 000 (Akoto, 2011). Kopsiro consists of 6000 km² and is one of six districts in the Western Province, Kenya. Kopsiro (Okello, 2009). The Kopsiro population is estimated to be 40 000. Kapsokwony has around 25 000 residents who are spread over an area of 2000 km² (Kenyanredcross, 2007).

When Mwai Kibaki was declared president on dubious grounds after the general election in 2007 clashes erupted within areas at Mt. Elgon. The estimate number of deaths from Mt. Elgon was 600. Moreover several people were displaced from their homes (Medard 2007, s. 339). The clashes were especially severe in Kopsiro, where several people were killed, injured and displaced (Akoto, 2011).

### 6.4 Mount Elgon Integrated Watershed Management Project

VI AFP has, in cooperation with the World Bank, recently launched a project in the Mt. Elgon water catchments’ area that targets 7000 households. The objective with the project is to improve living conditions and resilience against the effects of climate change. This through reducing the pressure on Mt. Elgon’s natural resources subsequently contributing to its rehabilitation (NDF, *Mount Elgon Integrated Watershed Management Project*, 2012-01-10 & Akoto, 2011).
Mt. Elgon is an extinct volcano that is located in western Kenya along the Kenya and Uganda border. The mountain has a vital role in the Kenyan ecosystem when it is one of the country’s five strategic and main water suppliers that feeds into the Nile Basin. Mt. Elgon is a source of at least twelve rivers which all drain into the Lake Victoria Basin. A serious problem affecting Mt. Elgon areas and its ecosystem is from land use changes which are mainly caused by extensive deforestation due to agricultural expansion and commercial forest overexploitation (NDF, Mount Elgon Integrated Watershed Management Project, 2011-01-10 & Akoto, 2011).

Agriculture is essential for the Mt. Elgon economy, however the agricultural production is inefficient because of low productivity due to decreasing soil fertility, which consequently has put the Mt. Elgon districts under severe stress. This situation is mainly a consequence of a high population pressure, climate changes and unsustainable land use management. A concrete example of these is drought, flooding, reduced water availability, major soil erosion, loss of biodiversity and soil moisture. The land use in this district is characterized by extensive deforestation because of logging and agricultural expansion, which among other things, has lead to water stress by reduced volume in downstream water flow (NDF, Mount Elgon Integrated Watershed Management Project, 2011-01-10 & Akoto, 2011).

The project’s objective will be achieved by sustainable land use management practices, in which agroforestry, agronomy, nutrient-, water- and livestock management, agricultural carbon dioxide sequestration and rehabilitation of land are essential elements within the project. These practices have the ability to decrease problems regarding to soil erosion and therefore increase soil fertility within farms. Moreover these practices have the ability to reduce the vulnerability against climate change (NDF, Mount Elgon Integrated Watershed Management Project, 2012-01-10).

The project will also meet these elements by focusing strategies that are based on participatory and demand-driven advisory that can increase capacity building in the Mt. Elgon communities. One important component to guarantee sustainability of the intervention is to enlarge the awareness about the effects from climate change, natural resource management and protection of water resources within the Mt. Elgon communities (NDF, Mount Elgon Integrated Watershed Management Project, 2012-01-10).
7. Result

7.1 Farm 1 - Kapsokwony

Albert is a man of forty years of age. Albert has always lived in the area where his farm is located. His family consists of his wife Anne who is between 30 and 50 years, a boy around 5 to 15 years and the two males between 15 and 30 years. These children attend primary- and secondary school and college. The parents’ biggest expenses during a year are the fees for these schools. Moreover the present cultivated farmland will be inherited by and divided among the children. Albert and his wife are both farmers and members of a group with 22 members. Albert’s farm consists of 3.25 acres and has been cultivated since 1998. The tenure system is communal land. Besides that, the family has more agricultural land close to their homestead.

The most important crops on the farm are maize, beans and onions. These are processed using a plough. The family has five heads of cattle, five chickens and three donkeys. Of these cattle give the highest income. Albert’s and Anne’s rotation system to feed the livestock is free range. There is no irrigation on the farm, however, chemical fertilizers as DAP and CAN are used for planting and top dressing.

Albert and Anne hire labor when it is time for planting or harvesting. They do no exchange products with other farms nor do they buy food, but their products are sold at a local market. Additionally, Albert and Anne give away products to relatives and vulnerable persons due to their Christian faith.

All members of the family take part in planting. However, the woman is the one who does most work on the field while the men mostly take care of tree planting, management and they sell the farm products. Collecting water and firewood is mostly done by the female. It is approximately two km to the nearest spring water source. Due to this distance the household has lack of water for domestic use. The distance to obtain firewood is approximately five km and the female spends about six hours per day to collect tree species such as Bridellia, Chornet, Elgon teak and Eucalyptus to meet the family’s energy demand. In addition, these tree species are also used as fences.

In particular, because of the clashes during the election in 2007, Albert has not planted any trees around his homestead. The unstable situation led to that Albert did not dare to plant any trees as it takes time for trees to provide income. However, he has planted about 20 trees on
the other farm outside the homestead and the seedlings for this he received from a plant nursery.

Albert has problem with soil erosion, especially from heavy rain when it both destroys the crops and causes leaching of soil nutrients. To eradicate the erosion issue on the farmland certain soil and water conservation measures have been executed, such as terracing, grass strip and planting of tree species which are friendly for water conservation.

Concerning factors on the subject of climate change Albert has since approximately ten years experienced changes in rain fall. Before this change, the rain generally came in February, today it is often a prolonged drought between December to April. Due to these changing climate conditions, the family plant their crops later than before.

Albert’s knowledge about the objective with The Elgon Integrated Watershed Management Project is that the project will help them to plant trees to decrease erosion and thereby increase the soil fertility on the farmland. Besides the enlarged tree planting will also bring a positive change in the climate. Albert’s primary objective to participate in the project is that it will benefit the whole community.

**Situation compared to five years ago:**

The current situation of crop production, soil fertility, livestock number, fruits availability have all declined, which thus has lead to a worse situation compared to five years ago. Because of extensive deforestation, overgrazing and climate change the availability of fuel wood and timber is much worse today. These pointed factors together with high cost of living with, for example higher purchase prices have thereby brought a worse economic situation for Albert’s family. However, due to reduced livestock number and executed soil and water conservation practices the current problem with soil erosion is better compared to five years ago. Furthermore the water availability is also better due to protection of water sources and that the number of eucalyptus trees has been reduced on the agriculture land.

### 7.2 Farm 2 – Kapsokwony

Jacob cultivates five acres of farmland. However, it is only three acres that is utilized for agriculture purpose. This farmland has been cultivated since Jacob’s grandfather moved to this area in 1994. The people living on the farm at present are ten people. Two boys and two girls are between 5 and 15 years and they go to primary school. Six persons are between 15 and 30 years and three of them are females. Two females and one man are around 30 to 50 years. In addition, it is also a female over 50 years living on the farm. The occupation for all these individuals is farming.

The land tenure system is owned and it has been subdivided among Jacob’s brothers. Jacob’s children will inherit the farmland and it will be divided between them. Jacob is a member of a group with 30 members.

Every family member plants, works in the fields and takes care of tree planting and management. When it comes to the sale of farm products this task is mostly done by the females at a local market. Furthermore the females are the ones who collect water and fuel wood. It is approximately 500 meters to the spring water source while the firewood mostly is collected within the homestead’s compound. About two hours of fuel wood collection is sufficient for a whole month and the common collected tree species are; Grevillea Robusta, Nandi flame, Nakhamia Lutea. Jacob has planted over 200 trees this year through his own
collection of wild seedlings and distribution from VI AFP. Besides that, the family replaces trees that are taken down inside the compound.

The livestock on the farm consists of six heads of cattle, fifteen chickens and one donkey. The cattle give the highest income. These animals are fed by the rotation system zero grazing on the farm. The most important crops on the farm are maize, beans, onions and bananas. Plough and pesticide sprayer are the most common equipments used on the farm. Jacobs’s family solely uses using organic manure as fertilizer. Sometimes during planting and harvesting the household hires labor. No irrigation is used on the farm.

The family’s food supply is satisfied through their own production or products exchanged with other farms. Moreover they also give away products to neighbors who are in vulnerable situation. They have no external income except these income sources and their biggest annual expenses are school fees.

Soil erosion is a problem on the farm, especially in 2011 due to more occurrence of heavy rain which accordingly destroyed the soil. Moreover severe dry seasons have reduced the soil fertility. To overcome these erosion issues Jacob has executed land measures such as tree planting and terrace constructions along the contour lines in 2011.

Jacob has experienced changes in rainfall during his working years in the area, especially from increased frequency of unpredictable downpour. Furthermore the drought has been exacerbated when it is prolonged from December to April. Before that, the rain usually came in March. This factor has led to that the spring water source occasionally dries up during these periods, which consequently causes lack of water for domestic use.

However Jacobs’s family has never bought water because of its high cost.

Besides that Jacob’s experience of more prolonged droughts has resulted in a decline of the number of livestock due to food shortage.

Jacobs prime objective to join The Elgon Integrated Watershed Management Project is to be a role model in the community. This will be achieved his execution of more sustainable agriculture practices that thus can improve the living condition for him and the whole village. Moreover is it important to build up stronger groups so these elements will be achieved.
Jacob became aware of this project through a community meeting that was held by VI AFP. From the meeting Jacob got knowledge about agroforestry practices. Jacob believes that the goal of the project is to change people’s attitude to tree planting. For if this achieved it will subsequently improve the living condition by increasing production from crops and livestock. Additionally, the objective is also to reduce the effects from the climate change.

**Situation compared to five years ago:**

The present soil-fertility and erosion is worse against than it was five years ago. The main causes to this are increased frequency of heavy rain and dry periods. In addition, extensive deforestation due to agricultural expansion has a significant role in this situation. These factors have thereby also entailed worse conditions regarding productions of products from crops and livestock and availability of fuel wood, timber, fruit and water. Moreover higher purchase prices and decline variety of external income sources have led to much worse economic situation compared to five years ago.

7.3 Farm 3 – Cheptais

Isabella’s family consists of eight people, in which four children are between 1 and 5 years and two them are girls. One male and female are around 15 to 30 years while two of each sex are between 30 to 50. All of the family members are farmers and they do not belong to any group. Besides the head of Isabella’s family was born in Cheptais.

The family has since three years cultivated 2,5 acres of communal land. And this land will be inherited by the children and it will be divided between them. The family has no agriculture land outside their homestead.

In Isabella’s household everybody plants and sells farm products. However it is mostly men who work in the fields and as well as take care of tree planting and management. The women
mostly take care of the collection of firewood and water. The females have to walk approximately 100 meters to a water pipe and about 200 meters to the closest source to collect firewood. The females spend about one hour per day to collect fuel wood from the tree species Eucalyptus, Lanterina and Camara. They also use these tree species for timber material. In addition, the household also utilizes charcoal as an energy source.

Isabella and her family have one head of cattle and one sheep, six chickens and four donkeys. These animals are fed by the rotation system free range. The cattle gives the highest income. Onions, tomatoes, vegetables, bananas, coffee, maize and beans are the most important crops on the farm. None of these crops are given away but all is sold or exchanged locally. These crops are processed by hoe, plough and pesticide sprayer, where the latter is used on tomatoes and onions. Furthermore the chemical fertilizers CAN and DAP are used on tomatoes, onions and vegetables. No irrigation is used on the farm.

The largest expenditure in a year goes to hire labour and to purchase pesticide sprayer. Moreover Isabella and her family members often buy maize, rice and sugar. As regards incomes from extern sources, Isabella’s family have no other income than what is produced on their own farmland.

Isabella has problems with wind erosion on the farmland. Some years ago the family had major problem with water erosion, but due to implementation of soil and water conservation measures such as terrace constructions and nappia grass this problem has been wiped out. But the wind erosion is still an issue on the farmland.

Isabella has problem to satisfy the family’s demand of domestic water during the droughts during December to January. This circumstance leads to that the water flow in the pipe is significantly reduced or completely stops during this period. However the family has never bought water. Isabella has experienced that the drought period between December to January is more severe than before. Moreover she has experienced an increased frequency of unpredictable downpour. However, due to these pointed out elements, Isabella considers that she cannot execute any particular measure except to plant as late as possible. Isabella received information about The Elgon Integrated Watershed Management Project through a message from church. Isabella believes that the goal with the project is to go to a VI AFP training center to learn planting trees. Her personal objective to participate in the project is to expand the family’s land. In addition, Isabella has some knowledge about agroforestry practices, especially tree planting.

**Situation compared to five years ago:**

Regarding the conditions with soil erosion compared to five years ago Isabella has experienced no change for the better. Tree and nappia grass planting has declined the water erosion but the wind erosion is still a problem on the farm. The availability of water and fruits are better due to construction of water pipes and tree planting within the farmland.

The availability of fuel wood and timber is much worse because of extensive deforestation in the village. However, due to enlarged cultivation of grazing land the number of livestock is better than before. When it comes to the crop production and soil fertility these elements have become worse, especially concerning onions and tomatoes. This when cold condition, primarily during nights, result in damage of these vegetables.
Increased purchase prices and decreased demand of crops has resulted in a **worse** economic situation compared to five years ago. Concerning external income it is **no change for the better**.

### 7.4 Farm 4 – Kopsiro

The woman Aluna and her family’s farmland consists of two to three acres of owned land, which has been cultivated for fifteen years. In addition, the family has more farmland outside their homestead in Kopsiro. These farmlands will be inherited and divided among the children in the family. Aluna’s family is composed of ten people. Five children are 1 to 5 years of which three are girls. One is 5 to 15 years and two female and two male are 15 to 30. Finally there is a person 30 to 50 living on the farm. The occupation for all of the family members is farming. Aluna does not belong to any group.

Aluna’s livestock consists of four heads of cattle, ten chickens and one donkey. The donkey is the one that gives the best income as it transports products to the market. The rotation system for these animals is free range.

The most important crops growing on the farm are onions, maize, vegetables, beans and bananas. These crops are processed by hoe, plough and pesticide sprayer. The family fertilizes the soil with the chemical fertilizing agent, DAP. Moreover they take water from a pipe from the nearby river that is located just right by the farmland to irrigate the cropland. The river also satisfies the family’s domestic water. There it is no lack of water and the family has never purchased water.

Everybody in the family plants and works in the fields. But only the men take care of tree planting and management and selling farm products at a market which is situated six kilometres from the homestead. Onions and maize are the most important products that are sold. The collection of firewood and water is managed solely by the females. The women spend approximately six hours per day to walk eight kilometres to collect firewood from tree species as Eucalyptus and Bamboo. Additionally Elgon Teak is used for timber.

Aluna’s family has no other extern income than selling on the market. The family exchanges maize, beans and vegetables with other farms. They also give away maize to relatives. Beyond that, Aluna buys rice and hires labour during planting and harvesting on the farm. The
biggest expenses during a year for the family are costs linked to the pipe of around 100 000 shillings in a year.

Aluna has no present problem with erosion on the farm. But three years ago, the water erosion was a severe problem. To solve the problem the household executed soil and water conservation measures such as tree and nappia grass planting. In 2011 more than 120 trees have been planted within the farmland. The tree seedlings have been taken from a private dealer in the area. As well, trees that are taken down are replaced by new tree seedlings.

Aluna has experienced changes in rainfall during her working years, especially from increased frequency of heavy rain. Due to this change Aluna has enlarged the use of pesticide sprayer on her crops. She also plants later than before. Aluna also considers that it is raining more between April and August while dry conditions are more common between December and April.

The objective with *The Elgon Integrated Watershed Management Project* is to control erosion through tree planting according to Aluna. Aluna became aware of the project early in 2011. Her own personal objective to participate is to control erosion and at the same time extend the productivity from the farmland. It is thus important to increase the household income. Aluna has knowledge about agroforestry practices.

**Situation compared to five years ago:**

Aluna finds that the availability of fuel wood, timber and fruits is *much worse* due to extensive deforestation in the area. Additionally it is *worse* with the number of livestock because of increased competition of grazing land. However, the knowledge of crop- and erosion condition is *better* due to the planting of trees and different types of crops. This circumstance has also resulted in *much better* conditions with soil fertility.

The economic situation is classified as *no change for the better* due to higher purchase prices of sugar, decline in the demand of own produced crops and increased price of onions. For instance the sugar price has increased from 40 shilling to 200 shilling today. The external income is *better* as it easier to borrow from the bank. The water availability is *much better* because of increased water flow in the river.

**7.5 Farm 5 – Kopsiro**

Abby lives in Kopsiro together with her family that consists of thirteen people. Two boys and one girl are between 1 and 5 years. Three girls and four boys are somewhere between 5 and 15 years. One girl and one boy are 15 to 30 years. One male and female between 30 and 50 years and one woman over 50 years also living on the farmland.

Abby’s family owns five acres of agriculture land. This land has been cultivated since the head the family moved to the present homestead in 1989. In addition, the family owns more farmland which is located approximately five kilometres from the homestead. These land areas will be inherited and divided among Abby’s children. The family does not belong to any group.

The nearest water source is a spring that is located approximately 200 meters from the homestead. No irrigation is used on the farm, but the fertilizers DAP for planting and UREA for top dressing are utilized. Used equipments are hoe, plough and pesticide sprayer. The most important crops on the farm are maize, beans, Irish potatoes and onions. Abby’s family also
has ten heads of cattle, four sheep and four chickens, of which the cattle gives the best income. These animals are fed by free range.

In the family everybody plants and works in the fields. But when it comes to the sale of farm products and tree planting and management these chores are solely managed by the men. The females are those who are in charge of water and firewood collection. Common tree species that are collected are Eucalyptus, Bamboo and Elgon teak, in which the females spend around fours hour per day to walk three kilometres to collect these tree species. In addition, these tree species are also used as timber material.

Abby’s family gives away self-produced products to relatives and friends. They also exchange products with other farms and purchase maize and beans during the time they do not have self-produced maize or beans. When it is time for planting or harvesting the family usually hires labour for these chores. Furthermore Abby’s family members’ have extern income sources by working on other farms and selling at a local market. Their highest expenses during a year are school fees, which cost around 50 000 shilling per year. And are farm expenses are high annual costs for the family.

On Abby’s farm water erosion is a severe problem as it destroys the crops and causes leaching of nutrients in the soil. Abby has implemented terraces and trees on the farmland to wipe out this issue. In 2011 approximately 100 trees have been planted and the seedlings to this have been taken from a plant nursery.

During her working years Abby’s has experienced changes in rainfall, especially as it is harder to predict. Either it rains too much or too little. This circumstance accordingly affects the work on the farm when it destroys the crops. When it rains too much the erosion accelerates and too little rain causes that the crops dry out. For instance, between January to February is often drier than before, which, among other things, causes lack of water.
Nevertheless the family has never bought water due to this condition. To deal with these changing conditions Abby plants later than before in anticipation of the rain.

Abby found out about *The Elgon Integrated Watershed Management Project* from a village meeting in year 2011. She believes that the objective is to enlarge tree planting on the farm and thereby decrease soil erosion and enlarge the firewood availability. Abby’s personal goal with the project is to control soil erosion and get firewood from her own farm. Furthermore it is important to increase the productivity from crops and fruits. Besides Abby has no experience of agroforestry practices.

**Situation compared to five years ago:**

Because of extensive deforestation Abby finds that the availability of firewood, timber and fruits is *much worse*. This circumstance has also brought a *worse* situation with both soil erosion and soil fertility. However the crop production is *better* due to the use of DAP and UREA. Abby’s opinion of this is that production was inferior when she didn’t use these chemical fertilizers. The number of livestock and water availability are *better* because of more cultivation and spring construction. Moreover the economic and external income situations are *better* as the productivity has been enlarged and there are more job opportunities on other farms.

### 7.6 Farm 6 – Cheptais

William is a teacher and a farmer. He has always lived in Cheptais. His family consists of two girls between 1 and 5 years, three boys around 5 to 15 years, one female is between 15 and 30 and one female is somewhere between 30 to 50 years. The boys that are between 5 and 15 go to primary school. All of the family members, except the two youngest, are farming. William owns 0.5 acres of land since 2002. This land will be inherited by William’s children and it will be divided among them. William belongs to a group of 22 members.

Maize is the only crop that is cultivated on the farmland. Furthermore William shares farmland close to the homestead, in which tomatoes, onions and beans are growing. These crops are sold locally and given away to relatives and friends. However, the family does not exchange products with other farms. Concerning livestock the family owns 30 chickens, one bee-hive and two heads of cattle which give the highest income. These animals are fed by free range.

Williams uses overhead irrigation and DAP for planting and CAN for top dressing. The equipment are hoe, plough and pesticide sprayer. The pesticide sprayer is used on tomatoes and onions. This year William has planted five trees on the farmland and he has received the seedlings from a plant nursery. In addition, when a tree is cut down on the farmland it is not replaced by a new tree.

When it comes to planting, working in the fields and the sale of products these chores are managed by everybody in William’s family. The females mostly take care of water and firewood collection. The water is collected from a tap within the homestead while firewood is collected between 30 meters to one kilometre from the household. The females spend approximately two hours per day to collect firewood from tree species as Eucalyptus, Grevillea Robusta, Markhamia and Cordia. These tree species are also used as timber. Moreover it is mostly men who take care of tree planting and management.

The biggest annual expenses are school fees. Moreover the family generally buys products such as rice, flour and sugar and hire labour for planting and harvesting during the year.
William has a major problem with water and wind erosion on the farmland. Due to this issue he has executed tread rotation system, in which he rotates between to two areas when he plants maize.

Concerning possible changing conditions in the climate William has experienced an increased frequency of heavy rain compared to previously. In addition, the rain is more unpredictable today. When heavy rain occurs it sweeps away the soil within the farmland. In addition, the wind-force is stronger, particularly in June. These changes of climate conditions have thereby intensified the issue with erosion on the farm. William has as well experienced more droughts between December and January. However, due to the overhead irrigation, William has no major problem with these droughts as the river never has any lack of water. The family has never bought water.

Williams’ attitude to the objective with *The Elgon Integrated Watershed Management Project* is that enlarged water storage in the soil will be achieved by extent tree planting on the farm. He was informed about the project from a group meeting in 2001 and got knowledge about agroforestry practices from a learning center. William’s personal expectations to participating in the project are primarily three; (1) Reduced water and wind erosion on his farm. (2) Enlarged firewood productivity. (3) Erased damage on the family’s crops through tree planting on the farmland.

**Situation compared to five years ago:**

Due to William’s job as a teacher along with increased use of chemical fertilizers the present external income, economic situation and crop production are better than before. In addition, William’s use of tread rotation has influenced in the increase production. Moreover the water availability is much better after the construction of the tap water source. The extensive deforestation in the area where the homestead is located has caused much worse conditions of firewood and timber availability. The availability of fruits has no change for the better.

William holds the attitude that the soil fertility and erosion are worse than previously, which is a result of lack of soil and water conservation measure on the farm. The livestock numbers are worse due to less land for grazing. This decline is a result of high annual living costs which has resulted in that the family no longer can a afford to have the same number of livestock as five years ago.
7.7 Farm 7 – Cheptais

Chege’s and his wife Sadiki farmland is between 1 and 1.5 acre large. The tenure system is communal land and has been cultivated for over three years. Chege has inherited the land from his father who was born in the area where the present farm is located. Chege also owns and leases two agriculture areas outside his homestead, which both are approximately one acre large. In addition, Chege belongs to a group of over 400 members.

Chege and his wife are between 15 and 30 years old and they have no children. Chege’s profession is nurse and farmer while Sadiki has graduated from secondary school. When it comes to who does the various task on the homestead it is mostly women who collect firewood and water while men mostly handle sale of farm products and tree planting and management. They are both planting and working in the fields.

The most important crops on the farm are maize, beans, cassava, sweet potato and coffee. The couple also owns two heads of cattle, one is an ox, three goats, two sheep and five chickens. The cattle are fed by zero grazing and the rest of the animals are fed through free range. The cattle give the highest income for the household.

The main tools used by the farmers are plough and pesticide sprayer. No constant irrigation is used on the farm. However, during severe drought a donkey is used to transport water from a spring water source that is situated approximately 100 meters from the homestead. Firewood and timber is only collected on the farmland and the common tree species are Grevillea Robusta, Eucalyptus and Crotons. Furthermore the couple uses branches from trees and crop wastes as energy sources. DAP for planting and CAN for top dressing are used.

![Figure 9: Farm 7 - Cheptais](image_url)
Chege and Sadiki exchange products with other farms and buy food products such as rice, sugar and tea. Their own products are both sold at a market in Cheptais and at a local market. The couple also gives away their own products to relatives.

The biggest annual expense is to buy and rent land. Moreover the hire of manpower on their farm is a high-year cost. Except from working on their own farm and selling at the market they also work on other farms and get income from that. Chege does not buy water, apart from the seminars with his group where he sometimes purchases water.

Chege has significant problem with soil erosion, especially from water. The water erosion comes from heavy rain that sometimes causes mass movements. To manage this issue Chege has planted more coffee plants instead of cassava when these plants control the water flow more effectively than cassava. The couple has also executed soil and water conservation measure such as terrace and ditches constructions together with nappia grass and tree planting. During 2011 the couple has planted more than 40 Grevillea Robusta. Moreover crop rotation is utilized on maize and beans.

For the last four to five years Chege has experience changes in temperature and rainfall. Compared to previously the rainfall is more unpredictable. As well, downpour occurs more frequently today. Furthermore droughts are more common in January and February and even in May. This has subsequently resulted in shortage of water from the spring water source. These changes in the climate have led to that some months it is too much rain while other months are too dry. Except for the use of the donkey to transport water from the spring and thereby irrigate the land during dry conditions, it is not possible to execute any major measure that can decrease the impacts from these climate elements, according to Chege.

Chege and his group requested that VI AFP would come to their community and it was from there he became aware of The Elgon Integrated Watershed Management Project. Chege holds the attitude that the objective with the project is to reduce the climate change, which thus will be achieved by changing people’s attitude to planting more trees within Mt. Elgon communities. For if this is reached it will enlarge the production of crops, fruits and firewood within farms and subsequently increase living conditions for people who live around Mt. Elgon. Chege’s personal goals to participate in the project are the previously emphasized factors as well as increased opportunities to reach new and better markets. In addition, the investment in agroforestry practices will fight diseases within cropland. The knowledge about these practices Chege has obtained from seminars with VI AFP.

Situation compared to five years ago:

Chege considers that the present economic situation is better due to improved opportunities for saving and borrowing money from banks and that the crop production conditions are better. The crop production has increased due to the input of the DAP and CAN. Before these fertilizers were used the output from the crop production was very low. On the other hand the soil fertility and erosion conditions are worse, where leaching of important soil nutrients have been a significant consequence. The climate change and a great lack of agricultural knowledge of soil and water conservation measures have been significant causes of this problem.

The improved economic situation has also resulted in better conditions with livestock number. Because of tree planting the availability of firewood and fruits is better. However the timber availability is worse as these trees take longer time to grow compared to firewood and fruits.
The water availability is worse due to the alternation of great rainy and dry seasons. Regarding external income there is no change for the better.

7.8 Farm 8 – Kopsiro

Robert and his family have for over 40 years cultivated three acres of owned land in Kopsiro. Robert has no more farmland outside the homestead. Robert was born in area where the present farm is located and belongs to a group of 15 members. The family consists of one male over 50 years, one male and female around 30 and 50 years, one girl who is between 5 and 15 years and two girls and one boy who are somewhere around 1 and 5. The children will inherit the land and it will be divided among them.

Everybody in the family is planting and working in the fields. But when it comes to sale of farm products, collection of water and firewood these chores are mostly taking care of by the females. Water is collected both from a spring 200 meters from the homestead and from a pipe located close to the farmhouse. There sometimes lack of water during January to February. Nevertheless the family has never bought water. The firewood and timber is collected within the homestead, mostly from the tree species Eucalyptus and Grevillea Robusta. From seedlings from their own plant nursery more than over 500 trees have been planted in 2011. The family regularly replaces trees that are taken down. In addition, the men are mostly in charge of tree planting and management.

The most important crops on the farm are beans, maize, coffee and groundnut. Concerning livestock the family has tree heads of cattle which are fed by the rotation system, free range. The equipments used by the farmers are hoe, plough and pesticide sprayer. Pesticide sprayer is mostly used on beans and vegetables. The family fertilizes the soil trough DAP and organic manure. Additionally they use dripping irrigation on the crops.

The family sells their products at a local market while coffee is sold through a cooperation to an industry. Products are also given away to relatives, but they do not exchange products with other farms. Additionally the family buys products, such as rice and wheat flour. Apart from sales of own products the family picks coffee on other farms for pay. The biggest annual expenses are
school fees, farm inputs and hire of labour for planting and harvesting.

Robert has a major problem with soil erosion, especially from water. The water erosion damages the crops by both rain splash and from water flowing from the slope over the farmland. Robert has invested in trees and terraces to manage this erosion problem.

Since the start with the cultivation of the present agriculture land Robert has experienced changes in rainfall. It is raining more now than before, especially heavy rain. In 2011 it has been raining a lot more than usual between November and December. Usually the family plants during these months but under present-day conditions it is not possible as the downpour damages the crops. Moreover Robert has experienced prolonged droughts during the “long rain” season. Before the rain generally came in March but today it starts raining in April. When dry conditions occur it is not possible to irrigate the farmland, or when it rains too much it is not possible to plant. Due to these circumstances Robert often plants later than before.

The objective of The Elgon Integrated Watershed Management Project is to decrease soil erosion through extent tree planting on the farmland, according to Robert. He collected the information about the project from a seminar. Roberts’s primary expectations with the project are to enlarge his tree nursery and increase the implementation of agroforestry practices, which thereby can eradicate the problem with the soil erosion process. Additionally, Robert already had knowledge about agroforestry strategies before he got information about the project.

**Situation compared to five years ago:**

Roberts’s extensive tree planting within his farm has led to better availability of firewood, timber and fruits. However the situations with crop production and soil- fertility and erosion are worse due to extensive deforestation on the slopes close to the farm. This circumstance has consequently increased the water flow from the slopes and caused erosion on the farm. However Roberts´s recent tree planting has, to some extent, declined the erosion on the farm but nevertheless it is still an issue for him. The livestock number is worse as the space to utilize free range has decreased. Due to these factors in relation with higher purchase prices the economic situation and also the external income conditions are worse. The water availability is however better because of the pipe construction.

7.9 Farm 9 - Kopsiro

Ita was born in the area where his present farm is located. Since two years he cultivates three quarters of acre together with his family. Ita also cultivates two acre outside the family’s homestead. The tenure system for both farms is owned. Ita´s family consists of two boys and girls around 1 and 5 years, three females where one is between 5 and 15 years and the other two are around 15 to 30 years. Furthermore there is a male somewhere between 30 and 50 years old. The children in the family will inherit the farmlands and it will be divided between them. Ita belongs to a group of 20 members within his community.
All the family members are planting and working in the fields. Tree planting and management and sale of farm products at a local market are only handled by the men. The collection of firewood and water is solely taken care of by the women. The firewood is collected approximately one hour per day two kilometres from the homestead. Common tree species that are collected for firewood and timber are Eucalyptus, Grevillea Robusta, Cordia and Croton. Water is collected from a pipe approximately 200 meters from the household. This pipe is also utilized for overhead irrigation on the farmland.

The most important crops are maize, sweet potatoes, beans, vegetables and bananas. The main tools used by the farmers are hoe, plough and pesticide sprayer on vegetables. In addition CAN for top dressing and DAP for planting are used. As regards livestock, the family has one head of cattle, one sheep and one donkey. They also have ten chickens. The cattle gives the highest income and are fed by free range.

Concerning the economic conditions the purchase of seedlings and chemical fertilizers are the biggest annual expenses. The family also hires labour for planting and harvesting and purchase products such as maize and rice. The family pays a fee to use the pipe water source. Ita exchanges products with other farms and gives away own products to neighbours, relatives and friends. Apart from the sale at the local market the family’s income sources are paid work on other farms.

Ita has a major problem with water erosion on the farm. He uses erosion control practices as nappia grass and trees. In 2011 Ita has planted more than 30 trees within the farm and the seedlings he received from a plant nursery. Additionally, trees that are taken down are replaced by new trees.
Ita has experienced changes in rainfall and temperature. Colder temperature occurs more frequently now which subsequently causes damage on the crops. Moreover the rainfall is more frequent today, especially through unpredictable heavy rain. Ita’s strategy to handle these climate changes is to fertilize the soil more.

The objective with The Elgon Integrated Watershed Management Project is to enlarge tree planting and thereby increase income sources for the farmers, according to Ita. He became aware of the project from a group meeting. Ita’s personal expectations on the project are to improve the farming techniques and enhance tree planting, which can improve the soil fertility through reduced erosion on the farmland. In addition Ita has some experience from agroforestry practices.

**Situation compared to five years ago:**

From the use of chemical fertilizer the crop production is better. This factor in relation with enlarged utilizing of grazing land has resulted in better conditions with the number of livestock. On the other hand the soil fertility is worse due to the occurring erosion process on the farm. However the executed soil and water conservation measures have given rise to a better situation with the soil erosion than before, but it is still an issue on the farmland.

The extensive deforestation in the area where the farm is located has brought on a worse situation with the availability of firewood, timber and fruits. Furthermore the economic situation and external income sources are worse, which primarily is a result from higher purchase prices and a decline in the demand for own products. In addition, the water availability is better thanks to the pipe construction.
8. Analysis

This chapter is divided into two sections. In the first section the general characteristics of the farmers’ land use and socioeconomic situation are analyzed. The second section sets the collected data against the study’s theoretical approach.

8.1 General characteristics of the farmers’ land use

The most common crops growing on the informants’ land are maize, beans and onions. Crops such as bananas, coffee, Irish- and sweet potato are also important on some farms. The main part of the farmers use hoe, spade and pesticide sprayer, of which the last one is used on vegetables. It is only farmer 1 who doesn’t use pesticide sprayer. It is farmer 2 who solely uses organic manure while the other farmers use chemical fertilizer. However, farmer 8 uses organic manure together with DAP.

Due to the proximity to water and pipe constructions farmers 4, 8 and 9 use irrigation on their farms. Of these informants it is only farmer 8 who has lack of water, which occurs between Januaries and February. All the farmers who do not use irrigation have production problems when droughts occur. Additionally it is only farmers 2 and 7 who find that the water availability situation is worse compared to five years ago.

Concerning rotation system with livestock free range is the most widely used among the farmers. Only farmers 2 and 7 utilize zero grazing. In addition cattle gives the highest income for all farms except farmer 4 where the donkey is the highest income source. Moreover, the farmers 3, 5, 7 and 9 maintain that the situation of the number of livestock is better compared to five years ago. The reason for this is mainly extended cultivation of grazing land and improved economic situation. The other farmers consider a worse situation with the number of livestock as the competition for grazing land has accelerated over time.

Farmers 2, 7 and 8 are self sufficient with firewood from their own agriculture land while the other farmers collect firewood outside their homestead. It is exclusively females who collect firewood and water. Moreover firewood is the main energy source for all the households. It is only farmer 3 who also utilizes charcoal together with firewood. Regarding the farmers who are self sufficient with firewood farmer 8 considers that the availability with this and also fruits and timber is better compared to the situation five years ago. Farmer 7 argues that the firewood and fruits availability has been better while the timber availability has become worse. The reason for this position is that trees for timber take longer time to grow than trees for firewood. In addition, due to higher population density farmer 2 considers that the availability of firewood, timber and fruits are worse today, regardless of the fact that tree planting already is established on this farmer’s farm.

Regarding other chores than water and firewood collection it is most common that everybody in the families works in the field and plant. However, for farmer 1 it is mostly women who are in charge of the fields while for farmer 3 it is the opposite.

Tree planting and management is taken care of only or mostly by men. But for farmer 2 everybody in the family takes care of these tasks. When it comes to sale of farm products it is split up among the farmers. For farmers 4, 5, 7 and 9 it is only or mostly men who take care of sale of farm products, while concerning farmers 1 and 8 it is the females that mostly take care of this chore. When it comes to farmers 2, 3 and 6 it is divided among the genders.
8.2 General characteristics of the farmers’ socioeconomic situation

The most of the farmers’ sell their products at local markets. Farmer 8, on the other hand, sells coffee to an industry through a cooperation. Except for farmers 1, 6 and 8 the other farmers exchange products with other farms. When it comes to giving away products it is only farmer 3 who does not give away any products to persons outside the family.

Apart from farmer 1 all the other farm households generally purchase food, such as rice and sugar. These farmers also emphasized that especially higher price on sugar has become an economic problem.

To sell products at the market characterizes the extern income source for all farmers. Moreover farmers 5, 7, 8, and 9 also works at other farms. Regarding the external income situation compared to five years ago it is fragmented between the classifications worse, much worse and better. Farmers 2, 8 and 9 consider this condition worse due to poorer variety of other jobs, while farmers 4, 5 and 6 consider the external situation better by primarily enhanced incomes and improved opportunities to borrow money from banks. The classifying of the remaining farmers’ attitude was no change for the better.

Six informants emphasized that school fees are the biggest annual expense. Farmer 4 stresses that the irrigation management is the largest expense while farmer 7 considers that buying and renting land is the biggest cost in one year. Farmers 3, 5, 8 and 9 underline that farm inputs is the largest annual expenses for the household. Besides that, all the farmers hire labor for planting and harvesting during the year.

The classification of the economic development the last five years consists of an uneven distribution among the farmers. Farmers 5, 6 and 7 classify the economic situation as better while the other farmers, except farmer 4, classify it as no change for the better, worse or much worse. The farmers who claim improved economic condition do this primarily to increased production while the other farmers with an opposite attitude experience both decline in production and crop demand and higher purchase prices.

When it comes to the clashes during the general election that took place in 2007 and early 2008 it is solely farmer 1 who experienced issues from this event. This farmer expressed that no tree planting had taken place due to the unstable situation, in which the fear to lose the farm was significant. The main reason where that the farmer 1 did not dare to execute tree planting as it takes time for trees to provide income.

8.3 General characteristics of the farmers’ experience of land degradation and effects from climate change

Except for farmer 4 every farmer has problem with soil erosion process on the farm. However the extent of the problem and the implementations of soil and water conservation measures are diverse among some farmers.

Farmer 3 has issues with wind erosion while the other farmers have problems with water erosion. The water erosion occurs especially from downpour, which subsequently damages the crops and leads to depletion of essential nutrients in the soil. This factor characterized especially the situation for farmer 1, 2, 5, 6, 7 and 9. In addition, farmer 2 stresses that the erosion as well occurs from severe droughts which thus can lead to that crop dries out.
On the topic of the execution of soil and water conservation measure all farmers have invested in something. However, as previously stressed, the extent of the problem is fragmented among the farmers. The most common land measure that has been implemented by the farmers are terraces, trees and nappia grass. Farmer 4 has invested in several trees on the farmland and has no problem with soil erosion. Farmers 2, 7 and 8 have made similar tree planting but nevertheless they have problem with erosion. Moreover, farmer 9 who considers that the soil erosion situation has been better the last five years has on the other hand still erosion problem on the farm. One factor that can highlight this circumstance is the time span when the farmers have executed their tree planting. Farmers 2, 7, 8 and 9 invested in trees this year or the last year, while farmer 4 has done it the past three years.

Farmers 2, 5, 6, 7 and 8 who classify the present situation with soil erosion to be worse compared to five years ago has this position primarily because of lack of trees, unsustainable cultivation and increased frequency of heavy rain. In addition, farmers 5, 6 and 7 considered that the present condition with crop production has become better while the soil fertility has become worse. The same circumstances also apply for farmer 9. The main reason for this position among these farmers depends on increased erosion issues and impacts from the changing climate conditions, especially from heavy rain. In addition, farmer 3 who classifies the erosion situation no change for the better although the water erosion has been reduced. Nevertheless farmer 3 still has problem with wind erosion on the farmland.

The farmers who express the view that the situation with soil erosion is better do this generally because of tree planting and terrace construction.

When it comes to farmers 1, 2 and 8 who considered that the situation with crop production and soil fertility is worse, they occupy this position due to increased frequency of heavy rain, prolonged droughts and extensive deforestation in their villages. In addition, farmer 3 also considers that the situation with crop production is worse due to increased cold damages on the tomatoes and onions.

Concerning the farmers´ view on potential changes in rainfall, temperature or wind everyone feels that changes in rainfall have occurred especially increased frequency of heavy rain. In addition, farmers 2, 3, 5, 6, 7 and 9 express that the rainfall is more unpredictable than before. Every farmer, apart from farmer 9, also expresses that present drought conditions occur more frequently than before. However the opinions on the time span for this circumstance are divided among the farmers. Farmers 1, 2, 4 and 8 stress that dry conditions have become prolonged between December and April, before it generally rained in March. Farmers 3 and 6 experience that drying primarily occurs between December and January. The view of farmer 7 is that the droughts often occur in January to February and also in May. Farmer 5 doesn’t give any precise time when the dry conditions generally occur.

Farmers 3 and 6 have moreover experienced changes in the wind, particularly that is has become stronger in contrast to previously. However, farmer 6 experiences stronger winds in December while farmer 3 has no exact time when the wind gets stronger.

The attitude to the implemented measures to handle these changed conditions in the climate is diverse among the farmers, which consequently depend on different circumstances and personal preferences. Farmer 6 who has irrigation facilities and expresses the opinion that droughts occur more frequently than before increases the irrigation during the dry season. Additionally farmer 7 uses a donkey to transport water when it gets dry. Furthermore farmers
1, 3, 4, 5 and 8 plant as late as possible in anticipation of the rain to occur. The same principle is followed by farmers 3 and 8 when it rains too much. Farmer 4 amplifies the use of pesticide sprayer while farmer 9 fertilizes the soil more to handle the impact of the changing climate.

Farmers 3 and 7 express the attitude that they cannot do anything when it rains too much. In addition, farmer 2 states the view that when dry conditions occur it leads to shortage of food to give the animals. Due to this factor this farmer has reduced the number of livestock on the farm.

Farmers 3 and 9 have experienced colder temperatures which primarily cause damage on their crops.

8.4 General characteristics of the farmers’ expectations with the NGO project

The farmers’ attitudes concerning the objective with The Elgon Integrated Watershed Management Project are fragmented between the farmers. On one hand, most farmers emphasized the importance to plant trees on the farms, but nevertheless the attitude of this is uneven among the farmers. Farmers 1, 4, 5 and 8 emphasized that tree planting will reduce the soil erosion. And farmer 5 means it will increase the firewood availability while farmer 1 thinks it will change the climate. Farmer 9 stresses that tree planting will lead to enlarged income for the household. Farmer 3 means that the objective with the project is to learn to plant trees while farmer 6 considers that tree planting will increase the water storage in the soil. The view of farmers 2 and 7 about the purpose is that it will increase tree planting and thereby reduce the impact of the climate change and as well increase the production from farmland. These two farmers also emphasized the importance of changing people’s attitudes to tree planting if these pointed elements can be achieved.

Personal expectations are also different between the farmers. Most farmers emphasized the importance to control erosion and increase the productivity from the farm. However it is solely farmer 3 who expresses the ambition to expand land.

Farmers 1 and 2 want to achieve stronger groups within their village. Besides that, farmers 5, 6, 7 and 9 express that they want to increase the production of firewood on their farms. Moreover farmer 7 want to achieve improved opportunities to reach new markets.

8.5 Results linked to the literary sources

The informants who classify that the present situation with crop production is better while the soil fertility has become worse during the last five years period, can be related to the research about farmers’ perception in relation to soil changes in two areas in Kenya between 1950 and 1990. This study registered that the majority of the farmers experienced problems with the introduction of chemical fertilizers in their agricultural fields. Due to this circumstance the farmers had to add more chemical fertilizers in the soil to achieve as high output as they did before the implementation of the chemical fertilizers. However, one farmer who solely used organic fertilizer expresses the view that the soil fertility had enhanced since the 1950s. And with this previous study, it can explain why the informants that used chemical fertilizer and have experienced reduced soil fertility even as the crop production has increased. Also conditions regarding the climate change can cause a decline in soil fertility, especially for the farmers who have experienced higher frequency of heavy rain and prolonged droughts. These
factors can consequently, among other things, enhance the surface run off and rain splash which cause leaching of essential soil nutrients.

The farmers’ view about climate changes is that there is an increased frequency of unpredictable downpour and prolonged droughts. The consequences from these changes are mainly enlarged water stress and land degradation. These aspects can be applied on the IPPC report that, among other things, emphasized that heavy rain and droughts have increased and will continue to increase in frequency. The average temperature has risen, as the IPPC report stresses, but no farmer has emphasized this during the interviews. Two informants have instead stressed that cold conditions occur more often today.

No farmer expressed any benefits with the changes in the climate. This circumstance may be related to what IPCC also underlines regarding that the overall positive impacts from the climate change totally and continually will be outweighed by the negative events, especially concerning areas in East Africa. This is due to the vulnerable situation which characterizes the areas in East Africa, both when it comes to their exposed geographic location and marginal socioeconomic conditions which consequently cause low adaptive capacity to handle the impact of the changing climate. The factors that the IPCC report emphasized, high population density, poverty, limited infrastructure, low education level and the absence of strong institutions distinguish all the farmers’ villages.

The farmers´ pointed out experiences of the changing climate conditions can also be applied to the National Climate Change Response Strategy – Executive Brief from the Government of Kenya. This report emphasized, as certain informants do, that rainfall has increased in variety during the seasons and between the years as it has become more unpredictable. Moreover heavy rain has increased in intensity, which both the national climate report and the informants have emphasized. Furthermore certain informants’ position and the national brief are consistent concerning that the situation with water stress characterizes Kenya during dry seasons.

The national brief underlines that the average precipitation has declined during the rainy season in March-May, which is referred to as the “long rain”. The consequence of this change is more droughts in the country. This part can be related to the farmers who have experienced that the precipitation starts in April instead of March. Moreover the national brief emphasizes that the “short rain” season from October to December has been extended from September to January and even up to February. This can, at some parts be related to the farmers’ interview answers. Most of the informants express that it is more rain during the “short rain”, however it is generally heavy rains that take place. Nevertheless no farmer implies that is raining up to January or even February, which the national brief state.

The numbers of trees and terraces and also irrigation opportunities have significance concerning the extent of the farmers’ experience of land degradation. Additionally the informants’ experiences of the changes in rainfall are important. The farmers who have not invested in several trees, terraces or else have opportunities to irrigate the farmland have all major issue with land degradation, especially from water erosion, wind and even droughts. The farmer who has not experienced issues with land degradation depends primarily of the investment in trees and terraces and also irrigation opportunities. Due to these pointed factors it can be registered that strategies as agroforestry and terrace constructions can be resistant to land degradation.
The symbiosis between the demand for natural resources and the pressure on the environment is clearly consistent according to all the informants’ answers. This is mainly due to the deforestation that characterizes all the informants’ villages, which consequently has led to reduced availability of firewood, fruit and timber for those who collect these natural resources outside their homestead. The main cause of this situation is an increasing population and lack of laws that can prevent the overexploitation of these natural resources. The farmers who are self-sufficient with firewood, fruits and timber are this due to extensive tree planting on the farmland, which consequently has led to good opportunities to provide the household with products such as food, timber, firewood and feeding stuff for the livestock. Due to these factors and that firewood even is essential within the Kenyan production processes, especially inside rural communities, it stresses that a implemented land use approach as agroforestry has the ability to meet farmers´ demand of firewood without putting the environment under severe press as the trees are growing on the farmers´ land.

The theoretical approach has underlined that agroforestry practices, among other things, can enlarge the ability for carbon sequestration on the farmland which thus is vital as trees can reduce the greenhouse effect. Moreover trees on farms can reduce the soil temperature as they give shadow. These factors in relation to that agriculture is the main occupation in Kenya, in which half of the production goes to subsistence farming, it can be highlighted that tree planting on farmland, aside from the economic benefits, accordingly can contribute to mitigate or even combat the climate change. This implies that the farmers at Mt. Elgon can be a contributive element to combat a changing climate.

However, the result from the interviews register that it takes time before the investment in agroforestry systems generates revenue, especially concerning stopping erosion process and availability of timber. Certain farmers have relatively recently (1-2 years) executed agroforestry practices but they have still not experienced improvements with the erosions process and timber availability. In addition, this issue can be illuminated by the clashes that occurred after the general election 2007 where a large number of people were displaced. At least one informant considers that the situation of unrest after the election entailed that the farmer did not dare to plant any trees due to the risk of losing the farm, in which the main reason that it takes a long time before the trees start to generate income after they have been planted. This factor can therefore highlight one of the cornerstones in political ecology approach in terms of a unstable political system can reduce land managers incentive and ability to invest in landesque capital.
9. Discussion

A combination of internal and external elements affects how the informants have utilized their respective farmland. And with this, the thesis has highlighted how global, national and local elements act in a context with each other in the conditions that affect the farmers’ land use and socioeconomic situation. These elements will be discussed in this chapter.

One factor that specially highlights the relationship of global, national and local elements is when it comes to facing and handling the impact from the climate change. The climate change affects the whole world, but some areas are more vulnerable than others, such as East Africa. This circumstance the IPCC report has stressed. Besides it has for a long time been difficult to establish an effective global response to mitigate or even combat the acceleration of the changing climate. A concrete example of this is the Kyoto Protocol, in which the emission trading market is a central component. However, the Kyoto Protocol is ineffective in some points, especially as the two leading emitters of greenhouse gases, USA and China, have not participated to the protocol terms. The protocol is also relatively inoperative as it only committed a few countries with obligations. Furthermore the emission trading market has no major incentive to get certain countries to reduce the emission of greenhouse gases as they can buy emission allowances from other countries.

The lack of a global effective binding agreement leads mainly to consequences for the countries which are exposed due to their geographic location and marginalized by social and economic conditions. Kenya is accordingly one of these countries.

Kenya has faced, and continues to face impacts from the changing climate. And also as an individual country Kenya has no influence on these changing conditions when they occur globally. Nevertheless can Kenya still mitigate the impact by replacing land use systems that are unsustainable and shift to extensive and sustainable land measures. Furthermore this type of pathway can entail positive effects for the country as a whole, especially to achieve food security for the Kenyan people. Although there are approaches to execute these land measures there also exist some obstacles that can complicate the implementation.

In this survey it has been recorded that several of the informants have awareness of the benefits and consequences respective investing or not in a particular land system on their farms. But due to obstacles such as (I) An unstable political situation which entails that one farmer had not the courage to execute investment in trees because of the insecurity to maintain the farm. (II) Opportunities to borrow money from banks which, among other things, can enhance the farmers’ facility to invest in certain soil and water conservation measures which take time before they generate income. (III) High economic expenditure, generally school fees, farm inputs and high prices to buy products such as rice and sugar. These emphasized elements can consequently have reduced the farmers’ incentive to execute certain soil and water conservation measure. This factor therefore confirms that dynamic socioeconomic factors are a foundation in how the small-scale farmers utilize their farmland. Thus, if incentive should be formed to achieve an extensive adoption landesque capital among the small-scale farmers in Kenya these types of elements must, among other things, be highlighted. In addition, a central factor that hampers comprehensive and land measure a general land management in Kenya depends mainly on the structure of the landscape and that subsistence farming is the major occupation in the country. Thereby these factors make it complicated to adopt any general land system for the Kenyan farmers when a system, for instance, must take into account knowledge, conditions and claims at a local level. Besides, several of the Kenyan small-scale farmers are in a vulnerable situation due to the fact that
they have marginalized preconditions to invest in any major land measure if they cost too much. In addition, the Kenyan state is weak to help small-scale farmers with the ability to implement certain land measures chiefly due to the amount of corruption within the social strata. A comprehensive political stability that is based on the population and their preference are thereby an essential part in how the pathway for the farmers’ future work can be established by the state.

Just as the theory part and the analysis of the interviews underline it exists an indispensable symbiosis between the demand for natural resources and the pressure on the environment, in which an increasing population is central. Tries to diminish the pressure of overpopulation and thereby reduce the deforestation which characterized all the informants’ villages cannot probably be established the next few decades. Therefore it is most likely that the only approach to solve this issue is to generate incentive among farmers to plant trees on their farms. Thus, due to the fact that subsistence farming and firewood is the major energy source for the rural production process in Kenya, a land use system as agroforestry can reduce the pressure on the forest and at the same time meet the demand of this natural resource. And it can be established regardless of today’s overpopulation. This factor has been stressed by the informants that particularly express the view that firewood and fruit availability has been improved because of their own tree planting on the farmland. The timber accessibility is however still a problem as it takes longer for these types of trees to grow, according to the informants.

Another relevant aspect in the relationship between the demand for natural resources and the pressure on the environment is some of the farmers’ issues to feed their livestock. Almost all the informants use the rotation system free range. And due to the increasing competition of grazing land it has intensified the problem to feed the livestock. The cause of this is probably not that the individual farmer has too many animals, especially when some farmers claim that their economic situations are poorer due to less number of livestock. And some farmers mean that they have reduced the number of livestock due to the difficulty to feed them. The source of the issue can instead be that there is no adequate space to use free range within a community where the population density is high and at the same time no restrictions exist how common grazing land can be utilized among the farmers. Due to these pointed factors almost certainly the only solution for the individual farmer to solve this problem is to shift to a grazing system that the farmer has control over. To enable this it is central to take advantage of, for example, leaves and crops residues from their farms to feed the animals. One approach that can achieve this transition is to get the farmers to execute agroforestry practices.

Furthermore it has been registered by some farmers that trees and/or terraces constructions can decline erosion process on the farm. Aside from the farmers’ personal benefits with this it is also essential through a wider perspective. Just as the thesis has highlighted, erosion does not only entail land degradation where the soil is lost but also where the soil is deposited. Therefore it is essential to get everybody within a catchment area to execute soil and water conservation measure to prevent a process which can cause land degradation. For example, if one farmer located upstream and has not implemented any land measures while farmers located downstream have done it, these measures can be useless for farmers downstream, especially with surface runoff during heavy rain. Such factors are crucial to consider as all of the informants have experienced increased frequency of downpour which consequently has accelerated erosion processes on farms.

The implementation of agroforestry practices and terrace construction can, as previously emphasized, be done for relatively small costs. However, the farmers’ investments in
agroforestry practices have also their drawbacks, particularly concerning the time span the system covers before it starts to generate revenue. This circumstance can primarily be problematic for the farmers who live under conditions of poverty and consequently are tremendously sensitive to bad harvest seasons. And as previously stressed an unstable political situation can decline the incentive of farmers to execute certain land measures. Such factors may thus entail that some farmers only have the potential to prepare the soil for the next harvest season. Thus, it is vital for poor farmers to get the ability to cope with the time span the agroforestry system covers.

The farmers who invest in trees not only draw own advantages of this, but also contribute to mitigate or even combat the effects of climate changes, in which the tree’s ability to carbon sequestration and reduced soil temperature are central elements. This circumstance consequently highlights how the small-scale farmers can be a contributing force to handle the climate change.

10. Conclusion

In conclusion it may be emphasized that the correlation of the environmental and socioeconomic processes are complex elements in the how the farmers utilize their land. However, it can be established that there exists an inevitable symbiosis between these elements, in which global, national and local aspects are key elements concerning the cause and effect of the farmers’ land management and socioeconomic situation.

That the individual farmer at Mt. Elgon is a component in a wider context becomes explicitly evident from the consequences of the climate change, which consequently has modified the farmers’ work conditions. The single farmer is affected by the climate change but is, just like any other, able to contribute in mitigating and combating these changing impacts through the investment, particularly land measure. Moreover the lack of a global and effective climate agreement affects the farmers’ working conditions around Mt. Elgon. Nevertheless the farmers in this area are dependent on the NGO project that the World Bank has launched in association with VI Agroforestry Programme.

Thus, the impact of the changing climate might not be registered by you because of your place on Earth. Furthermore your socioeconomic situation maybe has significance in how you perceive the consequences of the changing climate. But from the interviews with the nine farmers around Mt. Elgon it is evident that the climate changes really occur and that they have tangible consequences on their living conditions. Furthermore, it has been noted how some of these farmers, with relatively small funds, can improve their living conditions through investment in certain soil and water conservation measures on the farm. However social and economic conditions can result in impact in the farmers land use. This can thereafter entail an inverse impact on their social and economic conditions. Because of these emphasized elements it can therefore be declared that several of the informants’ living conditions are a result of social, economic and political elements. Of course the individual farmer has a significant importance for his living condition through his land management. However the farmer cannot solely be blamed to be a cause of the extent of land degradation, in which the Kenyan state and the lack of global and effective climate agreement also are contributing factors on the farmers’ condition.

In conclusion, the farmers at Mt. Elgon are a component of a wider context when they both are contributory to their socioeconomic situation specifically by their land management, but are also exposed to core-periphery relationships in the decision-making process over land management, which the farmer’s themselves have no influence on.
11. Proposals for future studies

It would be both relevant and important to evaluate the development of the informants land use and socioeconomic situation through a follow-up study in about 2 to 4 years. This to examine how the farmers’ implementation into agroforestry strategies have resulted on the production conditions. It would also be relevant to examine the circumstances that distinguish the small-scale farmers work in groups. In which both factors concerning their work to help each other to boost the living conditions and as the significance of how local cultural norms and groupings influence the individual farmers’ land management in the communities around Mt. Elgon.
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12.7 Figures
Figure 1: Kaati, Patrik., ArcGIS Explorer., 2012-01-22
Figure 2: Kaati, Patrik., ArcGIS Explorer., 2012-01-22
Figure 3: Kaati, Patrik., ArcMap 9.2., 2011-12-08
Figure 4: Kaati, Patrik., ArcMap 9.2., 2011-12-08
Figure 5: Kaati, Patrik., ArcMap 9.2., 2011-12-08
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Figure 8: Kaati, Patrik., ArcMap 9.2., 2011-12-12
Figure 9: Kaati, Patrik., ArcMap 9.2., 2011-12-12
Figure 10: Kaati, Patrik., ArcMap 9.2., 2012-12-10
Figure 11: Kaati, Patrik., ArcMap 9.2., 2012-12-12

13. Appendices

13.1 Maps
13.2 Questionnaire

Questionnaire

Date:__________  Interviewers:__________  Interpreter: __

Location:__________  Sublocation:__________`

Farm no.:__________  Owner:__________

1. People living on the farm/shamba at present:

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Male</th>
<th>Female</th>
<th>Occupation</th>
<th>Prim.sch</th>
<th>Sec.sch</th>
<th>Other training or education</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5</td>
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<tr>
<td>5-15</td>
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<tr>
<td>15-30</td>
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<tr>
<td>30-50</td>
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<tr>
<td>&gt;50</td>
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</tr>
</tbody>
</table>

2a) Was the head of the family born in this area?  Yes □  No □

2b) If no, where? __________________________________________

2c) Why did you/he/she move to this area and when?__________________________

3. What kind of land tenure system do you have?

Owned □  Leased □  Communal land □  Other _______________________

4. Do you have children to inherit this land one day? Yes □  No □
5. If yes, will the land be divided between them?  
Yes ☐  No ☐

Details: ________________________________________________________________

6. For how long have you cultivate your land (period of residence)

7. How large is your farm? _____________________________________________

8. Do you have agricultural land outside your farm with homestead? Yes ☐  No ☐

9. If yes, where and how far is it from the homestead? __________________________

10. From where does the household take its water?

   Well on farm ☐  Well outside farm ☐  Stream water ☐  Spring water ☐  Pipe water ☐

   Other ________

11b. Distance to water? _________________________________________________

12. Who does the various tasks?

<table>
<thead>
<tr>
<th>Task</th>
<th>Only men</th>
<th>Only women</th>
<th>Mostly men</th>
<th>Mostly women</th>
<th>Children</th>
<th>Everybody</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work in the fields</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tree planting and management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collection of firewood</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Collection of water</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Sell of farm products</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

13. Do you belong to any group?

   ________________________________________________________________
14. Which five crops are most important grown on the farm?

1. 
2. 
3. 
4. 
5. 

15. What equipments are used on the farm? (Hoe, spade, plough, tractor, pesticide sprayer etc)

Details: 

16. Do you use any kind of irrigation? Yes □ No □

If Yes: Flood irrigation □ Drip irrigation □ Farrow □ Overhead □

17. Do you use fertilizer? Yes □ No □

<table>
<thead>
<tr>
<th>FERTILIZER</th>
<th>USE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>
18. What kind of animals do you have on your shamba/farm and how many? (Put number in the boxes and ones with highest income)

<table>
<thead>
<tr>
<th>Animal</th>
<th>Number</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fish</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goats</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sheep</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pigs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chicken</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rabbits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Donkey</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bee-hive</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

19. How do you feed your animals?

__________________________________________________________________________

20. What type of energy do you use on the farm?

Fuel wood ☐  Charcoal ☐  Dung ☐  Crop wastes ☐  Kerosene ☐  Propane ☐  Solar ☐

20b. If you collect fuel wood, how long distance (km) do you have to walk to collect fuel wood and how much time (hrs) do you spent on collecting fuel wood per day?

Details:__________________________________________________________________________

20c. Which are common tree species you use for fuel wood? ____________________________

__________________________________________________________________________

21. How many trees have you planted this year?

If no: why do you not plant trees? (Is there any hindrances),

59
22. Where do you get seedlings? (own seeds, plant nursery, private dealer, neighbors, wild seedlings)

23. Do you regularly plant trees to re-place trees that are taken down? Yes □ No □
Details:

24. How do you use other tree products?

<table>
<thead>
<tr>
<th>Part of tree</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

25. Do you normally sell anything from the farm? (crops, wood, firewood etc)

<table>
<thead>
<tr>
<th>Farm produce</th>
<th>Where it is sold</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>
26. Do you give away any products to someone outside the farm? Yes □  No □

<table>
<thead>
<tr>
<th>Product (crops, firewood, wood etc)</th>
<th>Give it to</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

27. Do you exchange products with other farms? Yes □  No □

If yes, list the Products:
1. ______________________
2. ______________________
3. ______________________
4. ______________________
5. ______________________

Do you normally buy food? Yes □  No □

If yes, list the Products:
1. ______________________
2. ______________________
3. ______________________
4. ______________________
5. ______________________

28. Which non-farming incomes have you or your family members had during the last 12 months? (For example, paid work on other farms/shambas, selling on the market, sewing against payment, remittances from family members or relatives living elsewhere?)

1. ______________________
2. ______________________
3. ______________________
29. What are biggest expenses you have in a year?

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost in a year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

30. Do you hire labor at certain times of the year?  
   Yes ☐  
   No ☐  

Details: ____________________________________________
____________________________________________________

31. Is soil erosion a problem on the farm?  
   Yes ☐  
   No ☐  

Details (how big is the problem, kind of problem, what is done to manage the problem, what more could be done etc):__________________________________________
____________________________________________________
____________________________________________________
____________________________________________________

32. Which soil conservations measure do you use? (erosion control practices)

Details: ____________________________________________
____________________________________________________
____________________________________________________
____________________________________________________

33. Is there any lack of water for domestic use and if so, what time of the year?

____________________________________________________
____________________________________________________

34. Have your household at any time bought water, and if so, why?  
   __________

____________________________________________________
____________________________________________________

35. Have you experience any changes in rainfall, temperature or winds during your working years? ( Yes ☐  
   No ☐ (if no move to question 36)
35b. If yes, what kind of change have you experience and when did you start experience this/these?

Details:________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

35c. How have these changes affected your work? (implement any strategy/measure etc.)

Details:________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

36. Do you know the objective of Vi Agroforestry project and how it will affect your future work?

Details:________________________________________________________________________
________________________________________________________________________

36b. How did you become aware of this project?

Details:________________________________________________________________________
________________________________________________________________________

36c. What are your main objectives to participate in this project? (primary expectations/goals of the project) What do you want to achieve?

Details:________________________________________________________________________
________________________________________________________________________

37. Do you have any experience about agroforestry practices?

Details:________________________________________________________________________
________________________________________________________________________
Classify and explain and the following question:

Compare the following with what the situation was 5 years ago

<table>
<thead>
<tr>
<th></th>
<th>Much worse</th>
<th>Worse for the better</th>
<th>No change</th>
<th>Better</th>
<th>Much better</th>
<th>No opinion</th>
<th>Main reason for different situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop production</td>
<td></td>
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</tr>
<tr>
<td>Soil fertility</td>
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<tr>
<td>Livestock number</td>
<td></td>
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<tr>
<td>Fuel wood availability</td>
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<tr>
<td>Timber availability</td>
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<tr>
<td>Fruits availability</td>
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<tr>
<td>Economic situation</td>
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<tr>
<td>Soil erosion</td>
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</tr>
<tr>
<td>Water availability</td>
<td></td>
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