

BSc Thesis

# **Gender in sustainable agriculture - Identifying opportunities for development in the Ngenge Watershed, Uganda.**

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## ABSTRACT

In this research data collected via a household survey conducted in three different parts of the Ngenge watershed is analysed to identify opportunities for resource loss reductions and sustainable agricultural development, using gender as a starting point. Interview responses from both male headed and female headed households are compared to ascertain differences in perceptions, strategies and the cultural circumstances within which these farmers operate.

It was established that women more than men are aware of sustainable farming strategies. Women are also more likely to produce goods for the market. Livestock is very important in the Ngenge watershed. Men and women both rear animals, gender differences can be observed in how and for what reason these animals are kept. A potential opportunity for sustainable agricultural development for especially female farmers was found in organic cattle production for the national and international market.

Women put more emphasis on providing household goods like fuel wood, for this reason they grow more often than men trees. Women are less likely to use manure for improving soil fertility, they do more often rely on chemical fertilizers, crop rotation and fallow periods. Tenure insecurity does not appear to be more of a problem for women. Some indications are found that women living in the highest part of the watershed suffer from reduced rights of access to the natural resources in Mount Elgon national park.

It was finally concluded that female headed farmers in the Ngenge watershed are likely to be a good starting point for fighting resource losses and improving sustainable agricultural production.

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## INTRODUCTION:

### African approaches for sustainable agriculture.

For decades the Sub-Saharan African continent is associated with low food production, extreme weather events, widespread hunger, degradation of natural resources and low investment in agricultural production. This was not always the case. For centuries the natural resources of the continent were able to supply the population with their basic needs.

Hunting and gathering, shifting cultivation, long fallow periods and communal lands managed for pastoralism and agricultural production by the community reduced the impact of population on the availability of natural resources. Generally, land was in ample supply, pressure on individual plots was small (Cleaver and Schreiber, 1992, Nair, 1993).

This changed when population grew and more land needed to be allocated to food production. While Africa's population was estimated to have grown from around 23 million in the year 14 A.D. to 190 million in 1940, from 1940 onwards population growth significantly accelerated. Biomedical and agricultural scientific discoveries reduced the prevalence of disease and famine, resulting in declining mortality rates. However, fertility rates remained high, resulting in population growth often in excess of 3% per year (Tarver, 1996). In 2009 Africa's population is estimated at 1 billion people (UN, 2009).

The traditional methods for sustaining agricultural production could no longer be maintained on land already in use for food production, so more and more land was put into cultivation, often in combination with more European technologies like monocultures, the mouldboard plough and the hand hoe (Cleaver and Schreiber, 1992, Fowler and Rockstrom, 2001, Shiva, 1993). These newly cultivated areas included lands not very suitable for agricultural production, like sloping hillsides, which were originally covered with forests or savannas. Reduced soil cover made the soil more vulnerable to erosion. Simultaneously shorter fallow periods and minimum nutrient input via manure and fertilisers depleted nutrient stocks within the soil (Muchena, et al., 2005).

Numerous attempts have been made to make African agriculture more sustainable. Governments and NGO's have set up extension services, created national parks for protection of ecosystems, formulated land reform policies, improved education, designed irrigation schemes, improved infrastructure, subsidised fertilizers and other agro-technical inputs, set up local offices, installed healthcare services and introduced new technologies, like conservation tillage, terraces and check dams. Most of these attempts having varying degrees of success (Banful, Boone, 2007, Cleaver, 1997, Davis, 2008, Hanjra, et al., 2009).

### Role of women in African agriculture.

Next to the previously described actions to make African agriculture more sustainable, an increased attention was given to the cultural elements of agricultural production, both of the (rural) society as a whole, and gender roles in specific (Tripp, 2004). Women have always played a major role in African agriculture, however the tasks and technology of the rural

female farmers changed surprisingly little since the pre-colonial era (Hay and Stichter, 1995). African women carry the responsibility of the majority of the other household tasks as well. Firewood and water collection, food preparation and storage, child care, health care, animal care (except grazing) and washing and cleaning, all has to be done next to the hoeing, sowing, weeding and harvesting. About 80% of the subsistence food is produced by the women (Homborgh van den, 1993). It is therefore logical to get African women involved in improving the sustainability of food production. Women, is thought, are closer to nature. Their nurturing and caring role and responsibility for family health within the gender based division of labour, as well as their intimate knowledge on a diverse array of useful plants within their environment are said to be indicating the tendency of women to be more 'sustainable' (Mishra, 1994).

For Argentina, Canada, Colombia, Costa Rica, El Salvador, Iran, Mexico, Panama, Peru, Paraguay, Spain, the US and Venezuela, it is shown to be true that women have more concern for their environment and strive for higher sustainability in agriculture than men (Chiappe and Flora, 1998, Karami and Mansoorabadi, 2008, Meares, 1997, Zelezny, et al., 2000). Whether this is also the case for the African continent is not yet clearly established, but a potential approach for more sustainable agricultural production via female farmers can clearly be identified.

#### Constraints for African women to apply sustainable agriculture.

Chikwendu and Arokoyo (1997) showed that women in Nigeria were willing but have little ability to improve the sustainability of their farming system. The majority of women involved in agriculture do not own land or have sufficient decision power. Women also have little to no access to funds for investment in (sustainable) agriculture. Even though women do most of the work, both in production and processing, men make the decisions. Women in this study said they are willing to practice techniques that increase the sustainability of their farming, but "they did not have adequate knowledge about them" (Chikwendu and Arokoyo, 1997).

The same story can be heard elsewhere on the continent. As women have a subordinate position in society and their concrete needs are ignored, their role is marginalised (Meena, 1992). Major constraints are the labour load resting on women shoulders and the lack of access to both means of production (like land) and knowledge. These constraints are culturally defined, and differ somewhat across sub-Saharan Africa. For instance, a lot of gender customs exist around land and land tenure. Women often marry into another clan or family. To keep land in the family, daughters do not inherit land from their parents. This is because land most often becomes property of the husband after marriage. Instead, the future husband has to pay the family of the bride a dowry, often in the form of cattle or other animals. This is to compensate for the loss of labour the family of the bride will experience when she leaves her families household to live with the husband's family. When the husband dies, the land is returned to his family, not inherited by the wife. This to assure that the land is not 'lost' from the family. In some societies the widow and children are even

inherited by a brother of the deceased husband. These customs clearly show the importance of ownership of land, as well as the weak position of many African women (Cheka, 1996, Joireman, 2008, Kleinbooi and Lahiff, 2007, Mutangadura, 2005, Yngstrom, 2002).

Ownership of the land is often said to be essential for the development of sustainable agriculture. So in order to use gender as a starting point for sustainable development, the role of gender within the tenure system needs to be understood, and maybe even strengthened. Place and Hazell (1993) show that two different views exist. The first stating that indigenous tenure systems act as static constraints, providing insufficient security to induce (male and female) farmers to make investments in land improvement. The other view argues that dynamic indigenous tenure systems react to a changing situation, like increasing population pressure and agricultural commercialization. This would result in a privatization of land rights, whereby transfer and exclusion rights over land are strengthened (Place and Hazell, 1993). In case the latter theory holds, the current use of widespread land registration and titling programs of many African governments, which are seen as a trigger for sustainable development, can be questioned.

Adjustment of the indigenous tenure system to a new one could take some time, maybe even generations, and if such a transition occurs, quite a lot of problems, like gender discrimination, emerge in the meantime (Deininger, et al., 2008). Increasing tenure security is seen as a way to trigger investment in sustainable agriculture. When the labour and capital invested can be taken away by someone else in a few seasons time, a farmer would think twice before making a long time investment. Some of these investments could be building terraces or other erosion control structures, applying manure or fertilizers, building fences to keep livestock out or planting trees and scrubs for fodder, fruit, timber and other products. On this theory a lot of empirical literature is written, unfortunately there is “little consensus on either the existence and magnitude of tenure-security effects or the desirability and possible nature of policy interventions to increase investment incentives” (Deininger and Ali, 2008). Even so, African governments and development agencies have put quite some emphasis on regulating land rights as trigger for development (Okuku, 2006, Toulmin, 2009). On the other hand, investment in land can also increase land tenure security, as stated by (Bruce, 1988) in (Besley, 1995): “Tree planting may initially be discouraged by insecurity of tenure, but... tree planting can actually produce greater security of tenure and ... act as a way of claiming land.”(p.905). Using trees for claiming land in such a manner could be seen as an opportunity for strengthening the tenure position of women, while at the same time improving the sustainability of the farming system. This must be the reason why in Nigeria women “were not encouraged to grow tree crops, so that they would not ‘feel’ like land owners” (Chikwendu and Arokoyo, 1997).

In order to be able to identify opportunities for reducing resource losses and improving sustainability of agricultural production with using gender as a starting point, a specific case study is carried out. This case study will take place in Uganda.

### Uganda's need for sustainable agriculture.

Uganda is a landlocked country located in Eastern Africa at the equator, within the latitudes 5°N-1°S and the longitudes 29°E-36°E (Basalirwa, 1995). In the East, West and South-West mountain ranges are found, while the majority of the country consists of a plateau between 1100 and 1500 meters a s l. Even though this area is named a plateau, its surface is far from flat, with various rivers cutting through the landscape. Uganda is rich in water bodies, both along its borders as well as in its interior. 18% of the country consists of permanent wetlands and open inland waters (UNDP, 2007).

Uganda for the most of the country, except for the North, has two main rainfall seasons (Phillips and McIntyre, 2000). The majority of the soils in Uganda are very old (>500 millions of years) and at their final stage of weathering. Most of them are Ferruginous and Ferrallitic soils. These are characterized by low nitrogen and potassium content, low phosphorus availability, low cation exchange capacity and high sensitivity to erosion (Nkedi-Kizza, et al., 2002, Roose, 1996).

Around 85% of the population lives in the rural areas and agriculture accounts for around 77% of the employment in the country (Deininger and Ali, 2008). The country has had a strong reduction of poverty, but in 2010 it is estimated that 40% of the population living in rural areas still live in poverty (IFAD, 2010), and the number of poor has risen from 7 million in the year 2000 to 9 million people today. (James, 2010) states that "Poverty and declining agricultural productivity are deeply related problems in Uganda" (p. 360). The combination of the physical conditions of climate, slopes and soils, and inappropriate land use has resulted in high degradation of Ugandan soils. Erosion upstream results in gully formation, while sedimentation downstream causes flooding (Mutekanga, et al., 2010(II)). In order to reduce poverty, agricultural production needs to be improved and degradation stopped.

### The role of women in Ugandan agriculture.

One group heavily affected by the scale of degradation in Uganda are the women working the land. As elsewhere in Africa, responsibility for the family dinner table rests on their shoulders. In order to keep food availability sufficient, more labour has to be allocated to food production. To understand the impact of the extra workload, the cultural context of labour has to be clarified.

A clear labour division between men and women can be identified. (Yesigomwe, 2008) investigated the roles of women in natural resource management in the Kabale district, Western Uganda, and found nearly all production activities allocated to female adults (all except grazing the cattle). Some jobs (land preparation, harvest storage, bund construction, tree pruning and market shopping) are shared with male adults, but most of the work (planting, weeding, harvesting, compost making, tree nursery work, harvest transport from the field, bird scaring, food preparation, child care, house cleaning, zero grazing cattle feeding and firewood, water and natural medicine collecting) is done by the adult women, in some activities supported by the children, who as well have clear gender roles. Right of access and control of resources also shows a gender distinction. Even though women have

the same access to resources like land, equipment, cash, training and fertilizer as men, women often do not control these resources (Yesigomwe, 2008). It is, in fact, estimated only 7% of land is owned by women (UNDP, 2007). High tenure insecurity is therefore one of the problems women in agriculture face. In the Mayuge district, South-East Uganda, it was observed that when the man of the household dies, for instance as a result of HIV/AIDS, the late husband's extended family can claim the land and other assets, leaving the widow and orphans with little to nothing. In some cases the land is returned when the oldest son comes to age, though no guaranties exist (Parker, et al., 2009). Even though little land is owned by women, it is estimated around 28% of Ugandan households are female headed (UNDP, 2007), often working the land of relatives. A national household survey of Uganda shows that female headed households are not necessarily poorer when assessed by income or consumption. Also social indicators show no consistent disadvantages (Appleton, 1996).

The Ugandan tenure system has evolved considerable since colonial British rule (Bazaara, 1994). The latest land reform act, of 1998, on paper greatly improved the situation that was created by the Land Reform Decree of 1975. The 1975 decree "declared all land in Uganda to be public land to be administered by the lands commission" (Coldham, 2000). This greatly reduced tenure security (Place and Otsuka, 2002). To gender little to no attention was paid till then. The government of Uganda strived to include "co-ownership of land by both spouses in the household" in its latest land reform policy. However this act was dropped when the final version of the 1998 Land Act was formulated (Deininger, et al., 2008, Tripp, 2004). An amendment was used to introduce the concept of 'family land'. Without the consent of the children or spouse depending on this land, it cannot be transferred. So far the implementation of the 1998 Land Act failed miserably (Deininger, et al., 2008) and women are not yet given more control over (sustainable) agricultural assets. As this lack of control greatly reduces decision power of female famers, it has to be included in this study.



## RESEARCH GOALS:

*The goal of this thesis is to identify opportunities for reducing resource losses and improving sustainability of African agricultural production, using gender as a starting point.*

In order to identify these opportunities the following questions are formulated:

- What are the different roles and perspectives in regard to sustainable agricultural production of men and women in the Ngenge Watershed?*
- What are the different approaches to conserving resources used by either man or women?*
- What is the effect of land tenure and safety on the differences in agricultural perspectives between men and women?*

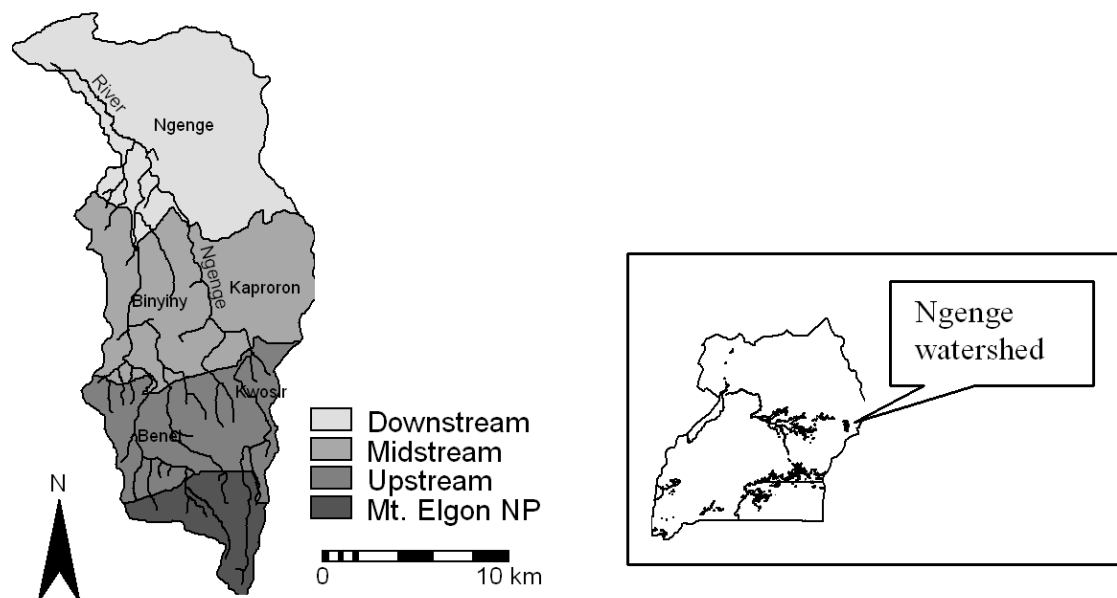
## MATERIALS AND METHODS:

In order to answer the above formulated research questions a case study is conducted. For this an area representative for Ugandan (highland) agriculture is taken.

### The study area.

The case study is conducted in the Ngenge Watershed, which is situated on the northern slope of Mount Elgon in eastern Uganda. The river Ngenge, which also feeds the Nile river system, is one of the main permanent rivers originating from this extinct volcano. The watershed, with a total surface area of 665 km<sup>2</sup>, resides between 1000 and 3000 meters above sea level. (Mutekanga, et al., 2010(II))

*Figure 1: Location of the study area in Uganda (NP stands for national park).*



The watershed can be divided in three different climatic zones. The upstream zone has a cold (average of 15.6 °C) and humid (>1450 mm y<sup>-1</sup>) climate, while midstream warmer (average of 20.4 °C) and less humid (1186 mm y<sup>-1</sup>) conditions are found. Like in most other parts of Uganda (Basalirwa, 1995), two rainfall seasons can be identified. The downstream part of the watershed is characterised by a more semi-arid environment with only one rainy season, an average temperature of 22.9 °C and a mean annual rainfall of 932 mm y<sup>-1</sup> (DSOER, 2004, Mutekanga, et al., 2010(III), Mutekanga, et al., 2010(I)). The higher slopes of Mount Elgon were originally covered with montane tropical hardwood and bamboo forests on rich volcanic soils (Himmelfarb, 2006), while the lower part of the watershed exists of savannah vegetation.

Administratively, the Ngenge watershed lies within the Kapchorwa District. Five different sub counties encompass the watershed, which adequately correspond to the three above described climatic zones of the watershed. Benet and Kwoisi make up the upstream part,

Binyiny and Kaproron the midstream area, and Ngenge in the downstream floodplain. Parts of the forests on Mount Elgon are protected as Forest Reserve since 1938 (and from 1993 on as a National Park)(DSOER, 2004). Still the forests remain vital for the two million adjacent living people whose livelihoods and economic activities largely depend on the ecosystem goods and services they provide. Also for the around 55,100 inhabitants of the Ngenge watershed, both in the highlands and the lowlands, Mount Elgon is vital to the social and economic functioning of their society (Muhweezi, et al., 2007, Mutekanga, et al., 2010(III)).

In terms of soil fertility, the Mount Elgon farmlands are amongst the most fertile of Uganda. An average pH of 6.3, an organic matter content of 4.66%, a nitrogen content of 0.30%, a potassium content of 0.63% and in the first 20 cm of soil nitrogen stocks of 6,000 kg/ha, phosphorus stocks of 3,200 kg/ha, potassium stocks of 12,600 kg/ha were measured. The soil consists of 43.2% sand, 39.8% clay and 17.0% silt (Nkonya, et al., 2008).

The high volcanic soil fertility and abundant rainfall in the upper and middle part of the watershed create a high agricultural potential, ideal for the local population which is primarily relying on agriculture for their livelihood. Smallholder farmers, with an average farm size of 0.8 - 1.6 ha, cultivate a wide array of crops (maize, beans, Irish potatoes, wheat, barley, vegetables, bananas and coffee) in combination with livestock.

The watershed has an estimated average population density of around 262 people km<sup>-2</sup>. The density is highest upstream, followed by the midstream area. The upstream population became so dense due to resettlement of forest dwellers by the government, land seekers from outside the watershed and fleeing people from the plains. The fled people moved up in the watershed because of violent conflicts with neighbouring cattle rustlers. As a result downstream population pressure is very low. (Mutekanga, et al., 2010(III))

The deep valleys, steep slopes and high precipitation of Mount Elgon do not easily combine with deforestation and agriculture without erosion taking place (Knapen, et al., 2006). The two upper parts of the watershed suffer from severe erosion. Even though the soil is not very erodible, agricultural practices (without the required conservation measures) on very steep slopes still results in top soil loss, gully formation, high river sediment loads, flooding and landslides during the rainy seasons (DSOER, 2004, Semalulu, et al., 1999). (Mutekanga, et al., 2010(II))

#### The data collection.

The data used in this research was collected through a Formal household survey. This survey was conducted by Mutekanga as part of her PhD research for the Wageningen University titled "Participatory Policy Development for Integrated Watershed Management in the Uganda Highlands". The household survey used a structured open-ended questionnaire. Two households per village in the watershed were interviewed in order to establish:

1. the farm practices of the individual households and the physical, socio-economic, and institutional factors, which influence those practices;
2. the expectations and priorities of the households in relation to appropriate interventions

for sustainable land and water management.

The interview was conducted with the responsible person present in the household at the time of the interview. In the majority of cases this was the household head himself or his son. Respondents could give from 0 to 3 answers to a question in the questionnaire (Mutekanga, et al., 2010(II)).

### The data analysis.

The household survey consisted of 115 different questions, to which over 800 different answers were given. A total of 90 farmers were interviewed. 33 of these respondents lived in the midstream sub county Binyiny, 34 were located in Benet, the upstream sub county and 23 respondents resided in the floodplain sub county Ngenge.

All the data collected via these household interviews was put in a Microsoft Excel database for analysis. If a respondent (the rows) gave an answer to a certain question (the columns), this was marked by putting a '1' in the field corresponding with that column and row. If a certain answer was not provided by a respondent, the field was kept blank.

For this research analysis gender plays an important role. Out of the 90 respondents, 14 were women, 70 were men and of six respondents the sex was not recorded. These six respondents were excluded from the data analysis, as it was impossible to establish to which gender they belonged.

An estimated 28% of the households in Uganda is female headed (UNDP, 2007). In this survey 16.7% (14 out of 84) of the gender-known-respondents were women. Why the survey does not reflect the estimated average of the country is unclear.

In order to answer research questions; *"what are the different roles and perspectives with regard to sustainable agricultural production of men and women in the Ngenge Watershed?"* and *"what are the different approaches to conserving resources used by either man or women?"* some sections of the dataset were discarded. These were not useful for this research. Out of the 115 questions posed to the household heads, 74 were selected for further analysis. These 74 resulted in around 500 different answers.

In order to locate gender differences in this vast database, the men and women were put into two categories. The number of women providing a specific answer to a question was counted and divided by the total amount of women in the group (14). This resulted in a fraction of the total giving a certain answer. This number represents the percentage of women that gave this specific answer (%ofF). The same was done with the responses of the men (%ofM).

By subtracting %ofF with %ofM a new number is created. This number could have a positive value, a negative value or become zero. If positive, it represents the %ofF over the %ofM having given this specific answer, if negative, it represents the %ofM over %ofF. When a large number (positive or negative) is produced, a big gender difference is observed, a small number (positive or negative) represents little difference between the sexes. And because of the subtracting, it does not matter if the initial percentages of men and women within their group giving a certain answer were big or small, only the difference is important.

The values -5.0% and 5.0% were chosen as threshold points. For the numbers within this range is no gender difference is assumed.

In order to integrate the possible effect of tenure insecurity and unsafety in agricultural production and the effects it has on the perceptions of men and women, extra data analysis is needed. It is assumed (tenure-) security is the lowest in the Benet sub county (the reason for why this is assumed will be addressed in the discussion section of this report). In order to establish if there is a difference in the agricultural perspectives between men and women within this less (tenure-) secure setting (research question three), Benet will be compared with the combined data of Ngenge and Binyiny. For indicating the combined regions Binyiny and Ngenge the abbreviation 'B+N' is used. A Benet and a B+N response percentage is calculated. By subtracting the combined response percentage of N+B from the percentage of Benet a number is generated representing the difference, percentage wise, in response between these two categories. As interesting these differences might be, it is not the goal of the research to just compare Benet with B+N. To include the 'gender factor' in the analysis, the same method as described above is used to generate percentages of the female response out of the total female population in the two defined regions (Benet and N+B combined) and the difference between them. These percentages are then compared with the response of the total population of the two defined areas. When the female respondents have a different response than the whole Benet sub county in comparison with the other two sub counties, it is assumed to be an indicator of the difference in perceptions of the female population (compared with the male population) living under higher (tenure-)insecurity.

For instance: Out of the 33 respondents living in Benet, four reported to grow coffee and bananas. This represents 12.1% of the Benet population. In B+N a total of 14 also respond the cultivation of bananas and coffee. This is 27.5% of the 51 respondents from these sub counties. 12.1% minus 27.5% gives -15.3%, a number representing the percentage of B+N respondents over Benet respondents reporting the growth of coffee and bananas. Out of the eight women from Benet, two cultivate coffee and bananas (25.0%). The same goes for only one female respondent from B+N (16.7% of the female respondents). 25.0% minus 16.7% gives 8.3%. So it can be concluded that, though in general the population of B+N grows more coffee and bananas, this cannot be said of the female respondents.

## RESULTS:

In order to answer the first two research questions, the focus was put on agricultural production, animal production and the use of trees. Which indicators and why they are used for what is called 'sustainable agricultural production' within the research question will be addressed in the discussion session of this report. The following results are also summarised in Appendix 1, table one to four at pages 31-33 in the same order as here described.

Both men (95.7%ofM) and women (100%ofF) use land for the cultivation of crops. For both sexes maize is the most important crop, and no difference is observed in this regard. Men appear to give a little more attention to the growth of crops other than maize, as potatoes, beans, barley and wheat are more often reported to be grown by male (65.7%ofM) respondents than by female (57.1%ofF) respondents. No difference exists between the sexes (both 21.4%) in the growth of coffee and bananas. Both male and female respondents report that most crops are grown for subsistence (both 92.9%). Harvest is also sold for cash.

64.3%ofF sell some portion of their harvest against 44.3%ofM, a difference of 20%.

Male farmers use mixed cropping more often than female farmers (42.9%ofF vs 51.4%ofM), while female farmers report more often the use of monoculture (64.3%ofF vs 57.1ofM).

Some farmers practice both though. Mixed cropping shows no correlation with the earlier described 'other crops' like potatoes, beans, barley and wheat. Half of the female farmers (50.0%) state that mixed cropping is not good for crop production, against 42.3% of the male farmers.

Male farmers have more access to manure, or at least more often report the use of manure than female farmers (38.6%ofM vs 21.4%ofF), both to crops grown in monoculture as in mixed cropping. Four male farmers reports to use manure, but do not report to own any livestock. Female farmers report more often the use of chemical fertilizers (35.7%ofF vs 24.3%ofM). All but two, so 22 of the respondents, whom report the use of fertilizers, also own livestock. One female farmer, owning more than 2 acres of land, reports the use of a fallow period to maintain the yield of her production. Female farmers also practice more crop rotation. Only one of the 70 male farmers (1.4%) reports crop rotation, while 4 out of the 14 female farmers (28.6%) practice this technique. 10% of the male respondents report to do nothing to maintain/improve yields, against 0% of the female respondents.

Diseases are far more often observed by female farmers as a problem in crop cultivation.

50% of the female respondents report this thread, against 17.1% of the male respondents.

Soil erosion is also more often reported by female respondents (42.9%ofF vs 30.0%ofM).

Vermin, pests and snakes also create problems in crop cultivation, according to 21.4% of the women and 2.9% of the men.

Flooding is also reported as a problem by 14.3%ofF and 7.1%ofM.

Male respondents are more concerned about a lack of inputs (35.7%ofM vs 28.6%ofF), infertility of the soil (12.9%ofM vs 0%ofF), less rain (7.1%ofM vs 0%ofF) and poverty (7.1%ofM vs 0%ofW).

The perceived causes of the above described problems are also investigated. Two of the seven female respondents report not to know the causes for the diseases harming their crop production. A solution for these diseases is to spray against them (21.4% of the women and 2.9% of the men responded this).

Heavy rains are the cause of soil erosion according to 14.3% of the women and 4.3% of the men. Steep slopes are the cause according to 7.1% of the women and 15.7% of the men. Only one (male) farmer mentions both heavy rains and steep slopes as the cause of erosion problems. Both sexes mention bunds and terracing (21.4% of F vs 24.3% of M) as a measure to reduce erosion. Mulching was only reported by two men. 21.4% of the female respondents and 24.3% of the male respondents observe declining yields because of erosion.

Different opinions on how to keep arable land fertile were also observed. Men more often than women report crop rotation (21.4% of F vs 28.6% of M) and manure addition (14.3% of F vs 22.9% of M) while women more often answer that the land has to be left to fallow (28.6% of F vs 17.1% of M).

Answers on how to solve the other problems observed by the respondents differs little along gender lines. In another part of the survey manure application is proposed (both 7.1%) against infertility and lack of inputs and canal digging (also both 7.1%) is nominated against flooding. Other solutions, like acquiring loans, searching for government extension workers, asking for government intervention or security and hiring oxen is only responded by a small proportion of the men. Some responders did not undertake any action to solve the problems faced in cultivation (28.6% of F vs 11.4% of M).

Next to arable farming, land is also allocated for grazing animals. Men (37.1%) more often than women (28.6%) allocate land for this purpose.

Cattle is the most important livestock in this catchment. 85.7% of the female respondents and 77.1% of the male respondents report to own cattle. This is independent of the farm size. Also farmers reporting less than one acre of land keep cattle. Donkeys are kept by 21.4% of women, and 20.0% of men. Goats are kept by 57.1% of women and 60% of men. Women report to own sheep more often than men (35.7% of F vs 17.1% of M). Some respondents keep poultry and/or pigs, and little difference in percentage between the gender groups is observed (<5% difference).

Women report to keep animals mainly for cash (71.4% of F), which is more than men do (52.9% of M). 44.3% of the men keep animals for subsistence, for example milk, as do 21.4% of the female respondents. Improving food security is another reason for keeping animals for 21.4% of the women and 15.7% of the men. Labour (13.1%) and transport (4.8%) are also reasons to keep animals. Little gender difference is observed here.

Animals are either free ranging or zero grazing. Most of animals kept in a zero grazing system are kept this way because of 'small land', even though this reason is given by farmers of all farm sizes.

57.1% of the female respondents practice zero grazing, as does 52.9% of the male respondents. 50% of the women also keep their livestock free range, as does 44.3% of the men. Some practice both ways of keeping animals. What type of animals is kept one way or

the other is not specified. All of the respondents reporting a shortage of grazing lands keep their livestock free range.

Some (23.8%) of the farmers report to use improved pastures to maintain animal production, even though 65.0% of these respondents only keep animals in zero grazing units. Women (35.7%) more often than men (18.6%) give supplements to their animals. And more often (71.4% of F vs 40.0% of M) identify diseases as a problem, even though women (7.1%) do not buy as much treatments as men (10.0%), this difference is not significant though. Both men (25.7%) and women (25.7%) identify land scarcity as a problem. Women (28.6%), more often than men (8.6%) identify manure as a possible benefit for letting cattle graze, whereas for men (10.0%) the main advantage is that cows access more grass themselves, so less extra fodder is required (0% of the women identified this advantage).

Trees and woodlots play an important role in the watershed. Around 40% of the respondents grow eucalyptus trees. Women grow twice as often local trees (14.3% of F vs 7.1% of M) and report more often to practice 'agroforestry' (28.6% of F vs 8.6% of M). Fruit trees are also more important for female respondents (14.3% of F vs 4.3% of M).

Trees are most important for providing wood fuel, 57.1% of the female respondents report this, against 32.9% of the men. Also timber (28.6% of F vs 18.6% of M) and cash (21.4% of F and 17.1% of M) are considered important reasons to grow trees. A few respondents mention environmental protection, scarcity of native trees and shade as reasons for planting trees, but no gender difference can be observed. Women more often than men report growing trees in single stands (50% of F vs 40% of M) and intercropped with crops (21.4% of F vs 10.0% of M). Men (15.7% of them) plant trees on their land because it provides more cash than other land uses. None of the women gave this same answer.

No clear indication of the way woodlots are grown, or what proportion of the respondents have created a woodlot can be derived from the survey. A question on advantages of a woodlot on the other hand is incorporated in the survey. Women more often than men observe income can be derived from a woodlot (28.6% of F vs 15.7% of M). Soil conservation is also observed as a benefit (14.3% of F vs 8.6% of M). Environmental services (14.3% of F and 11.4% of M) and fuel wood provision (21.4% of F and 17.1% of M) do not show a clear gender diversion.

Both men (22.9%) and women (28.6%) would like to incorporate tree planting in their farming system. Growing other crops (35.7% of F and 22.9% of M) is also desired. Which crops is not clear. A small amount of farmers (both male and female) would like to invest in vegetable planting, more cropping seasons or animal farming. Nine (2F, 7M) do not desire a different farming practice, and 4.3% of the male respondents want to commercialize their farm.

The household survey also produces some general gender related data on farm size, how land was obtained, how long the respondent has lived in the area, etc.

Male farmers respond a more even distribution of farm sizes throughout the watershed. 21.4% owns less than an acre, 25.7% owns around one acre, 21.4% owns 2 acres and 31.4%



owns more than 2 acres. Women report a different distribution of farm sizes. 35.7% of the female respondents own one acre, 35.7% own more than 2 acres. Only two out of 14 (14.3%) respond to have own either less than an acre or two acres. Both men and women obtained their land by either buying it or inheriting it. 50.0% of the women and 30.0% of the men bought their land. 35.7% of the women inherited their land, as did 60% of the men.

Women live not as long as men in the area. 60.0% of the male respondents lived longer than 20 years in the area, against 35.7% of women. 28.6% of women live between one and ten years in the catchment, against 10.0% of the men. No clear relation exists between a small farm size and the years a respondent lived in the area. A lot of people living longer than 20 years in the area also report a large (>2 acres) farm size, unfortunately a clear relation cannot be proven.

Both men and women try to make money by selling their crops (92.9% of F vs 88.6% of M). One remarkable finding is the other sources of income that female respondents report. Women obtain more money from animal products (28.6% of F vs 22.9% of M), their business (35.7% of F vs 24.3% of M) and formal employment (14.3% of F vs 8.6% of M) than men.

The three sub counties each know their own agricultural and socio-economic environment, as described in the study area description, yet no attempt will be made to identify these differences. In the next section the gender differences in perceptions between Benet and the combined sub counties Binyiny and Ngenge that were observed in the data analysis are reported. On these will be reflected in the hope to find an answer to the last research question; *what is the effect of land tenure and safety on the differences in agricultural perspectives between men and women?*

The following results are also summarised in Appendix 2, table five and six at page 34 in the same order as is used in the description below.

Data analysis of the different aspects of arable agricultural production of men and women shows some diversity over both the sexes and the location within the watershed, but none of these results can be linked to tenure insecurity or an unsafe environment.

On responses concerning livestock, more interesting differences between the general population and women from Benet, women from Benet and the other sub counties and the general population of Benet and B+N were observed. Poultry is more often kept in Benet (18.2%) than B+N (5.9%), but no women from Benet report to keep poultry. 50% of Benet women report keeping sheep, against 16.7% of B+N women, but goats are again far more often kept by B+N women (83.3%) than Benet women (37.5%). Donkeys are reared in both regions (21.2% of the Benet respondents vs 19.6% of B+N respondents) but only 12.5% of the Benet women keep them (vs 33.3% of B+N women). Providing labour is not a reason for keeping animals for Benet women (0%) but is for 33.3% of the B+N women.

In general around the same portion of respondents from Benet (12.1%) and B+N (13.7%) keep animals for labour. Cash is the most important reason for keeping cattle in Benet (87.9% vs 35.3 of B+N). Women from Benet (75.0%) and B+N (66.7%) on the other hand show less difference in this perspective. A bigger difference is observed in the role animal

products play in the household income generation. The people from Benet (27.3%) and B+N (21.6%) show a similar response, but the Benet women (12.5%) are far less likely to sell animal products than their B+N counterparts (50%). Cattle is more often kept in Benet (90.0% vs 70.6% of B+N) but women from Benet do not reflect this. 75% reports to own cattle, against 100% of the women from B+N. Farmers in Benet keep their animals mainly in zero grazing units (78.8% of M and 75% of F), free range is more practised in B+N (56.9% of M and 83.3% of F). Land scarcity is not a problem for female respondents from Benet (0%), but is for 50% of the women from B+N. The general Benet (30.3%) and B+N (21.6%) population is also reporting land scarcity as a problem. None of the respondents from Benet and Binyiny report insecurity and wild snakes as a problem in animal production, this problem is only reported in Ngenge.

Benet women grow more trees, both Eucalyptus and local species, but do not report the desire to start practising agroforestry in the future. 21.2% of the Benet respondents practise agroforestry already, as does 25.0 percent of the women from Benet. In B+N less people report to use agroforestry (5.9%) and few (3.9%) desire to start practising it in the future. Women in B+N appear to be slightly more often practising agroforestry and desire to start with agroforestry more often (16.7%). Women in Benet (37.5%) want to capitalise their trees more often than men (21.2%), in B+N the opposite is observed in the household survey. 15.7% of the respondents wants to make money from their trees, but none of them are women.

Providing fuel wood is another important reason for growing trees. In Benet this is reported by 54.5% of the respondents, in B+N by 25.5%. The female population of both Benet (62.5%) and B+N (50%) appear to have an higher interest in growing trees for this purpose. Some of the Benet respondents (18.2%), report that environmental services are also an important role of woodlots.

With all the findings from the data analysis, possible research results can be identified. These will be discussed in the next section.

## DISCUSSION

The research area offers a very interesting array of problems. Within the watershed major erosion problems, as well as high population pressure are observed, especially in the upstream and midstream parts. As farmers in these two sub counties own, or have access to, only a small area of land, local farming systems are highly intensive. Next to a small piece of arable land, farmers also tend to keep a lot of livestock, for which not a lot of space appears to be left. The origin for these two problems might be a result of historic development and local culture.

First a short historic background is presented. From there the findings on gender differences in arable, livestock and woodlot production are discussed to answer the first two research questions. At the end of this chapter the third research question is addressed with a focus on the observed spatial differences in livestock keeping and the role of trees in the system.

Originally the inhabitants of the forests of Mount Elgon, were forest pastoralists (the *Mosop*) who grazed forests and downhill pastures with herds of up to 50-100 heads of cattle per household, collected fruits and honey, hunted game and used bamboo for weaving baskets for trading with their kin, the *Soi*. The *Mosop* and the *Soi* both consider themselves part of the *Sabiny*. The *Soi* lived in the Ngenge plains and had better market access. They also herded cattle and considered themselves pastoralists, even though they practiced some agriculture (mainly cassava and millet). Trading women of the *Mosop* brought seed potatoes back from their trips with the *Soi* during the 1940's and 1950's and planted them in abandoned kraals (cattle enclosures) in the grasslands. The *Soi* knew private ownership of arable land while grazing grounds were communally managed, while the *Mosop* knew no private ownership of land and managed the forests and beehives together. In both cultures cattle played an important role. Wealth was measured in cattle, and both the *Soi* and *Mosop* exchanged, slaughtered and consumed cattle at important ritual occasions, such as weddings, circumcision ceremonies and offerings on ridge tops. Even though these two groups pursued radically different, yet interrelated subsistence practices, they shared common cultural practices, language, distant ancestors and a long history of exchange. During the politically unstable late 1970's and early 1980's life changed dramatically for both the *Soi* and the *Mosop*. The fall of the Idi Amin regime provided cattle rustlers, such as the *Karamojong* with firearms. The *Karamojong* have the traditional belief that every head of cattle is theirs by divine right. Cattle are for instance used in marriage negotiations, and a large herd size gives both rights and status (Wikipedia, 2011). With the now available firearms in the hands of the *Karamojong*, the *Soi* became victim of their cattle raids and had to flee up the mountain. During the same period, the Ugandan Forest Department started the Benet resettlement program. The *Mosop* were initially ignored when the original forest reserve was gazetted, but now they had to move. The first scattered living *Mosop* were relocated at the borders of the Mount Elgon National Park, along with the growing population of *Soi*. The *Soi* had to change their staple diet from cassava and millet to maize,

beans and potatoes, as climate conditions were so different from the arid flat plains. Both groups had little to no experience with intensive agriculture on steep hillsides, so little knowledge existed on how to prevent erosion (Himmelfarb, 2006).

The most important resource is land. From the survey it is unclear what ownership of the farmland entails. Most of the respondents have either bought or inherited their lands (both men and women). Within what system this is done is unclear. Soini (2007) describes the land tenure system around Mount Elgon as mostly customary. Within this system land is individually owned and can be bought and sold without the involvement of the clan. Land is passed on from one generation to the next, usually the household head sub-divides the land among his sons. Within this region it is not uncommon a woman is allowed to keep the land when her spouse dies. This could be a good explanation for the appearance of 'inheriting women' in the survey. Within the matrimonial home all land still belongs to the husband. One of the first things that one would relate to sustainable arable production is the diversity of crops grown. The more crops are produced, the less a farmer relies on one crop. If one crop fails, others are still available to provide food and/or income. In this sense male respondents appear to be more a bit sustainable than the female respondents. This observed difference in the types of crops cultivated does not necessarily imply that male farmers themselves are producing these crops. Women in the household might still be responsible for growing them, while men just report them. Female headed households are likely to have less time available for diversification and extra crops. As men often marry more than one woman and have on average seven children, they might have the labour required available (Ingram and Reed, 1996).

As described in the data analysis, male farmers more often than female respondents report the use of mixed cropping. Mixed cropping can also be marked as more sustainable over the use of monoculture. The use of mixed cropping appears to be gender related at first sight, but a closer look at the data shows a large spatial diversity of the practise of mixed cropping. Almost all Binyiny respondents, both male and female, practise mixed cropping, while most of the interviewees from Benet and Ngenge grow their crops in monoculture. These respondents, from Benet and Ngenge, are also the ones that perceive mixed cropping is not good for their crops. Binyiny respondents practise mixed cropping because of 'land small'. One sustainable other technique for improving agricultural production is crop rotation. As observed in the data analysis, female respondents practise crop rotation a lot more often than men. This could be because women also observe diseases, pests and vermin more often. Crop rotation, next to the use of chemicals, could be a strategy used to cope with them. Why only a small proportion of the men (17.1%) recognize these threats to their agricultural production is unclear. One explanation could be that the male involvement in crop production appears to be not as intensive as the female's involvement. One strange finding from this survey is that men more often than women see crop rotation as a way to keep the field fertile. Which crops they would like to incorporate in the system to improve the fertility is not clear.

Erosion prevalence is also an indicator for sustainable arable production. Not all farmers

recognize erosion as a problem on their farm. This might be due to the fact that not all farmers will experience erosion. Some will be located in areas where erosion does not occur (like the floodplains or well managed/flat fields) while others do not interpret the runoff from their fields as erosion or a problem. 43% of the women participating in the survey report erosion taking place, against 30% of the men. No indication is found that women practise their cropping on land more vulnerable for erosion, or that their farming methods create more erosion. Both men and women observe a decline in yields because of erosion and both believe creating bunds and terraces reduces erosion. Which measures were already undertaken by the farmers to prevent erosion is not clear.

The means by which yield is maintained are also an indicator of sustainable agriculture. The data show men more often than women use manure to improve crop production and women more often use fertilizer. Women more than men report to own cattle and other livestock, so manure must be just as available to them. As no difference is observed in the origin of the manure (both zero grazing and free range) one can only suspect the labour involved in collecting and applying manure might limit use of manure by women. One other explanation might be the fact that women do not herd the animals themselves, as it is could be culturally unacceptable, as it is in other parts of Uganda (Yesigomwe, 2008), and thus herding cannot be combined with manure collecting. As men were also the only ones to answer that free ranging is better for livestock because the animals collect more grass themselves, it can be assumed men are the only ones watching the cattle graze. When the fertility of the soil did not require extra manure addition to enhance crop growth, the extra fertilizers would not be needed as well. The fact that women more often than men apply fertilizer gives a clear indication of the market access of female headed households. Fertilizer is expensive, and the fact that 35.7% of the female respondents report to use it is significant. Fertilizers are often seen as an unsustainable practise. This is not always the case. For instance, a small amount of phosphorus can really help to establish a legume crop that provides much needed nitrogen to the soil. For this case it is not clear whether it is more sustainable or not to apply fertilizer.

The prominent role of livestock as described in the history of the watershed has clearly not changed, as reflected in the survey. The high prevalence of cattle, both in female headed households and male headed households shows that their cultural and economic importance is still high.

First the sustainability of raising cattle in general has to be established. A study done in the district of Pallisa, about 140 kilometres west of the Ngenge watershed used wealth indicators to categorize farms and establish the sustainability of their livestock production. Pallisa has, more or less, the agro-ecological characteristics of the Ngenge floodplain and the demographic circumstances of the midstream and upstream sub counties Binyiny and Benet. The farms surveyed in the Ngenge watershed would nearly all be categorized as small farmers with livestock if included in this study. By analyzing the nutrient flows, it was establish that the Pallisa equivalent of the average Ngenge watershed farm would mostly show a negative nutrient balance, especially for nitrogen (Ebanyat, et al., 2010). This would

mean soil nutrient stock would slowly but surely be depleted, even when only minor erosion is taken into account. This means, technically, it is likely soil depletion is taking place and the system is not sustainable. Luckily for the farmers in the Ngenge watershed, especially the mid and upstream farmers, the nitrogen stocks in the first 20 cm of soil are so vast that it would take several centuries to deplete them (Nkonya, et al., 2008).

Within the literature concerning cattle clear gender roles are identified, especially concerning herding (Yesigomwe, 2008). What clearly can be identified in the survey is the different function livestock has for men and women. Women keep their animals far more often for cash than men (even though still 52.9% keep livestock for cash), while men more often than women report to use animals for subsistence goods like milk. This might be indicating women also sell more of the goods that men tend to use within the household. Female respondents also more often report they keep animals to improve their food security., they might put more emphasis on the strategies that enable them to continue doing so, even in times of crisis.

Even though male and female respondents both report they allocate land for grazing (37.1% of M and 28.6% of F), it is not clear where fodder or other grazing opportunities are derived from. 50.0% of women and 44.3% of men keep livestock free range. One explanation is that only small livestock (like goats, sheep, poultry and maybe pigs) are set roaming for themselves, while the most valuable livestock, the cattle, are kept in zero grazing units. Indeed most of the women (57.1%) and men (52.9%) report the use of zero grazing. But the farm sizes are hardly large enough to support even one head of cattle (unfortunately no data on the amount of cattle was recorded during the survey). Unless the number of cows per farmer is really low, which is unlikely considering the history of the people, there must be (communal) grazing grounds available or fodder has to be brought in. Women more often than men report to provide supplements to their livestock. One reason for this could be a lack of grazing area. Some survey respondents also identify a shortage of land for grazing as a problem, but those respondents all practise free ranging instead of zero grazing. Another explanation for feeding supplements to cattle by women is the different role cattle appears to have within female headed households. As animals are more often reported by women to be used for generating cash, it is logical they also invest more in their cattle to generate higher return, in the form of supplements. Within the survey it is unclear what is meant with the 'improved pastures' in the survey, and the role they fulfil in this system. Napier grass is grown in this area as fodder crop. The area allocated to this could be seen as an improved pasture, but also as just a fodder crop, as 65% of those reporting improved pastures keep their livestock in zero grazing units. A different survey done in this area showed a lot of multi-purpose trees and shrubs that could be used as a fodder crop were already established but not utilised by the local population (Ingram and Reed, 1996)

Trees play also a vital role in the agricultural and economical systems of the Ngenge watershed. Of Kapchorwa, the region in which the Ngenge watershed is located, is observed that trees are better integrated in the highland farming systems than most other areas surrounding Mount Elgon National Park (both the Ugandan and Kenyan side)(Soini, 2007).

This is also reflected in the responses to the household survey. Women especially are shown to be relying on trees for multiple goods and services. The most important is the providence of fuel for cooking. Timber is also important, but it remains unclear for what this timber is used as 'construction' is another identified purpose of trees within the questionnaire. Women also use trees for making extra money. This could be by selling firewood, poles, construction timber or other tree products. It is unclear which products are sold. Women report to practise more 'agroforestry', which sounds highly sustainable. Unfortunately it is not clear what type of agroforestry is practised. This could be the growth nitrogen fixing fodder crops, vegetation rows that prevent erosion and provide fruit or growing large trees to provide shade for coffee, livestock or family members. Men and women both plant trees but women more often than men. It is not clear if women within a male headed household are allowed to plant trees as well, because of local tree-tenure customs. Female household heads appear not to be limited in the planting of trees. Reasons for planting trees can be multiple, as shown in the data analysis. Quite some responses on the advantages of a woodlot were collected, but the prevalence of woodlots in the watershed is unclear. The respondents might be able to identify certain benefits of owning a woodlot, it does not mean they have established one themselves. The fact that respondents can identify these benefits could make it easier to motivate them to participate in agroforestry or soil conservation projects that incorporate trees and shrubs. For instance 14.3% of F and 8.6% of M identified woodlots as a mean for soil conservation, and nearly as many respondents identified environmental services as a benefit. These results are quite nice indicators of the attitudes of both men and women in respect to sustainable agricultural production, and the different approaches they have in conserving resources.

Sustainable agricultural production has also an economic component build into the concept. As making money, and being able to continue making money in the future is very important for a farmer. This is why cash crops play an important role as well. In this sense it is not strange that the respondents report the production of coffee and banana's. Uganda is Africa's biggest banana producer, and 2<sup>nd</sup> largest coffee producer (van Asten, et al., 2011). The presence of banana and coffee is therefore also proof (some) farmers in the Ngenge watershed have access to markets. Women more often than men report to sell parts of their crop, livestock and woodlot production. Because women are producing for cash, it is reasonable to think they also invest more cash in the form of fertilizers or pest control chemicals.

The reason why Benet was chosen as the sub county representing the most (tenure-) insecure part of the watershed needs to be clarified. One might argue that picking Ngenge would have been better, as only from here responses concerning unsafety were obtained. Literature also already pointed out that violence has had a huge impact on the local population over a long period of time. The people living in Benet, both men and women, appear to enjoy much more peace. But this is not necessarily the case. Since the

establishment of the Benet resettlement area numerous conflicts have been reported along the borders of Mount Elgon national park. When for instance the local population discusses park rangers they use their native word for soldier instead of ranger. (Dutch) reforestation programs for carbon sequestration and offsets exchange were attacked by farmers as the trees were planted on land they felt belonged to them, after which they were shot at by park rangers (Himmelfarb, 2006).

The haphazard reallocation program of the 80's was completed in just six weeks, during which no clear property boundaries or forest access restrictions were made clear to the local population. The descendants of the *Mosop* still feel they own the right to graze their cattle within the national park boundaries, as they have done this for centuries. Only now they risk being caught by park officials, who charge the herders high fees when captured. On the other hand, shortage of grazing grounds within the resettlement area creates herd starvation, so illegal grazing is the only option they have. The fees inflicted upon them can only be paid when they sell some cattle, which also reduces the herd size on the long term. Since then bribes of local officials for land titles, deforestation, mounting population pressure and loss of productivity due to erosion have certainly not improved the tenure safety in this area. For this reason Benet was chosen as the sub county best suited for comparing the difference in female and male perspectives on agricultural production (Norgrove and Hulme, 2006).

Even though it is thus now assumed higher (tenure-) insecurity exists in Benet, it is not certain this is also represented in the household survey. The population living the closest to the borders of Mount Elgon national park are the ones living in the highest uncertainty. Benet is the sub county closest to the border, but respondents living here can still be located quite some distance away from the 'problem areas'. It was not feasible to dig deeper in the dataset and use only the respondents from Benet bordering Mount Elgon national park. Therefore, even though a high chance of misrepresentation exists, the whole of Benet is assumed to represent tenure insecurity related to or generated by the national park.

Results from the data analysis show some indicators of a different approach of women from Benet in tackling the problems they face because of their local situation. For instance the use of zero grazing by female headed households can be an indicator that is unsafe for them to graze their cattle on the pastures within the national park boundaries (or let them be grazed by male relatives). By planting their own trees and woodlots women are less dependent of the forest for collecting for instance fuel wood or bamboo. Women in Benet more often than the women in the other sub counties practise these strategies, which could indicate they experience some problems accessing essential goods. For instance, keeping small animals can be a substitute for the loss of access to wildlife for hunting. Even though the survey analysis provided not a lot of insight in the effect of land tenure and safety problems in a gender perspective, some indicators can be identified. Land tenure insecurity is not more of a problem for female respondents, rights of access to natural resources is a more likely threat to women in Benet, as it is, but less, for men. This does not mean men or women have negative view on sustainable resource management. A survey carried out on the



border of Mount Elgon national park was able to establish that more than 75% of the 328 respondents had favourable attitudes toward the conservation of the park's forest and wildlife resources. Exposure to conservation education, perceived benefits of the conservation for the local population and previous conflicts over the use of park resources were, among others, the factors that influenced the attitudes of the local community towards the national park (Oonyu, 2009), unfortunately no gender related conclusions could be derived from this study.

One of the potential pathways for reducing resource losses and improving sustainable agricultural production via female farmers, within this specific setting, that could be identified in this research is the production of organic cattle and other livestock for the (global) market. As the watershed has better market access since a road between Mbale and Kapchorwa was finished in 2002 (Soini, 2007), new opportunities can be identified. Unlike many other parts of Uganda (Ebanyat, et al., 2010), environmental degradation as a result of small scale cattle herding is slow to show in the Ngenge Watershed, because of the very high soil fertility. Livestock production does also appear not to enhance soil erosion within the watershed and could have a positive impact on the ecology of the landscape of Mount Elgon, as grazing is shown to be important for the maintenance of species rich grasslands in Mount Elgon National Park, thus grazing improves biodiversity (Reed and Clokie, 2000).

Women in the watershed already, more often than men, capitalise their livestock production, as revealed in the survey. Culturally, men regard herd size important as it is seen as a reflection of their wealth and status. Because of this, men are more likely to only sell heads of cattle when truly necessary, like in times of crisis. Women, on the other hand, have shown to invest more in their livestock via supplements and appear to be more aware of diseases harming their livestock. These observations, combined with a study of Nalubwama, et al.(2011) on organic livestock production in Uganda, gave rise to this idea. And if something could be done about the lack of safety in the Ngenge plains, more land would become available for sustainable cattle production, reducing the pressure of production upstream. Naturally, further research is needed to identify the true potential for the Ngenge watershed in producing organic livestock and to understand the relations between animal production strategies, national park access for grazing, economic importance of cattle and maintenance of yields, supplements, overgrazing and cattle population dynamics, human population pressure increase and park policy reforms, especially in relation to gender, as so many differences pop up.

Some critical remarks concerning the distribution of women in the dataset and the effect this has on the data analysis are located in Appendix 3.

## CONCLUSION

- Clear gender differences were identified in the Ngenge watershed. Most indicators for sustainable agriculture show a higher female response, both in perception as in production strategy. Women are also more focussed on capitalising their production. In grazing livestock some cultural restrictions exist, for which alternatives are developed for instance in the form of zero grazing. Higher utilisation of tree products shows a distinct preference for controlling the supply of vital household goods.

- Resource conservation shows some gender distinction. Women do not as often as men use manure for instance, but more often respond they apply fertilizer to improve soil fertility. Erosion is more often seen as a problem by women, but this does not result in more measures against erosion being taken by women. Subtle differences are observed in how yields are maintained. Men utilise manure more often, women have a higher tendency to use crop rotation, fallow periods, fertilizers and pesticides. Women also substitute important forest resources, like wood fuel and timber by a range of planted trees.

- It was observed that men and women in Benet faced specific challenges because of the local tenure security and safety situation. The presumed insecurity concerning access to arable farming land, especially for women was not demonstrated. Instead indications of reduced female access to the natural resources in Mount Elgon national park were identified. Women in Benet showed some tendency to reduce their dependency from the natural forest and appeared to put more emphasis on production for cash.

So, one question remains; *can opportunities for reducing resource losses and improving sustainability of African agricultural production, using gender as a starting point be identified?* As it turns out, it is hard to link the specific situation within the Ngenge watershed with other African farming systems. According to the household survey, female household heads participating in this research appear, relatively to male headed households, to be able to handle themselves quite well within the local physical, climatic, economical and social environment. Though room for improvement remains, the circumstances within which the women in the survey have to operate do not appear to be as dire as those of other female headed households elsewhere in Africa, as described in the literature.

The women in this survey have shown to be more often than men observant of the problems within their farming system, and less prone to seek 'outside solutions' to these problems. Enhancing their self reliance via the provision of specially targeted knowledge and technology might prove to be a good idea. Even though nothing can be said of the opportunities women living within male headed households might have, female headed households are a good starting point for fighting resource losses and improving sustainable agricultural production in this small part of Africa, for they appear to already have a small head start.

## CONCLUDING REMARKS

One of the main problems with this research is the scientifically unsound manner in which data is used and analyzed. One would normally formulate research questions and a hypothesis within a certain conceptual framework, devise a mean for collecting the required quantitative/qualitative data, analyze this data along predefined (mathematical/statistical) methods, discuss results and formulate conclusions that prove/discard the hypothesis and answer the research questions, in this order.

In this thesis, instead of formulating research questions first, collecting data second, the opposite was done. The social survey used in this thesis was originally set up with completely different research goals in mind. So with only this data in hand the search began to find and formulate research questions that could be answered by this data (and literature support). Because of this, this research might not feel as satisfactory in its conclusions as one might hope or expect. In order to provide better underpinned conclusions, it is recommended to tailor a different survey to the in this research formulated research questions and methodology.

## PERSONAL REMARKS

A special thanks is in order for the music of Dire Straits, Lady Antebellum, Simon and Garfunkel, Ilse de Lange, The Alan Parsons Project, Guano Apes, Jesus Christ Superstar, Evanescence, The Beatles, Caro Emerald and Cat Stevens, as well as Maredsous, Grolsch, Gulpener and some Italian red wines who all, not only supported me through the nights of hard working, but also provided the hard needed inspiration to continue working till dawn.

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## APPENDIX 1

Table 1

<i>Differences between men and women concerning arable production</i>			
Questionnaire response:	%ofF	%ofM	%ofF - %ofM
Main Land Use: Cultivation	100.0%	95.7%	4.3%
Crops grown: Maize	78.6%	77.1%	1.4%
Crops grown: Other annuals	57.1%	65.7%	-8.6%
Crops grown: Coffee and bananas	21.4%	21.4%	0.0%
Purpose of those crops: Subsistence	92.9%	92.9%	0.0%
Purpose of those crops: Cash	64.3%	44.3%	20.0%
How crops are grown: Mixed cropping	42.9%	51.4%	-8.6%
How crops are grown: Monoculture	64.3%	57.1%	7.1%
Why that method: Mixed cropping not good for crop	50.0%	42.9%	7.1%
How yield is maintained: Manure addition	21.4%	38.6%	-17.1%
How yield is maintained: Fertilizer addition	35.7%	24.3%	11.4%
How yield is maintained: Crop rotation	28.6%	1.4%	27.1%
How yield is maintained: Nothing	0.0%	10.0%	-10.0%
Problems faced in cultivation: Diseases	50.0%	17.1%	32.9%
Problems faced in cultivation: Soil erosion	42.9%	30.0%	12.9%
Problems faced in cultivation: Vermin, pests, snakes	21.4%	2.9%	18.6%
Problems faced in cultivation: Flooding	14.3%	7.1%	7.2%
Problems faced in cultivation: Lack of inputs	28.6%	35.7%	-7.1%
Problems faced in cultivation: Infertility	0.0%	12.9%	-12.9%
Problems faced in cultivation: Less rain	0.0%	7.1%	-7.1%
Problems faced in cultivation: Poverty	0.0%	7.1%	-7.1%
How problems are solved: Spray for diseases	21.4%	2.9%	18.6%
Causes of the problems: Heavy rains	14.3%	4.3%	10.0%
Causes of the problems: Steep slope	7.1%	15.7%	-8.6%
How problems are solved: Bunds, terracing	21.4%	24.3%	-2.9%
How problems are solved: Trenches, mulching	0.0%	2.9%	-2.9%
Other problems faced concerning land&water use: Declining yields due to erosion	21.4%	24.3%	-2.9%
How the land is made to continue being productive always: Crop rotation	21.4%	28.6%	-7.1%
How the land is made to continue being productive always: Manure addition	14.3%	22.9%	-8.6%
How the land is made to continue being productive always: Leave the land to fallow	28.6%	17.1%	11.5%
How problems are solved: Manure as fertilizer	7.1%	7.1%	0.0%
How problems are solved: Dig canals	7.1%	7.1%	0.0%
How problems are solved: Nothing	28.6%	11.4%	17.2%

Table 2

<i>Differences between men and women concerning animal production</i>			
Questionnaire response:	%ofF	%ofM	%ofF - %ofM
Main use of land: Grazing	28.6%	37.1%	-8.6%
Animals kept: Cattle	85.7%	77.1%	8.6%
Animals kept: Donkeys	21.4%	20.0%	1.4%
Animals kept: Goats	57.1%	60.0%	-2.9%
Animals kept: Sheep	35.7%	17.1%	18.6%
Purpose of animals: Cash	71.4%	52.9%	18.6%
Purpose of animals: Subsistence eg milk	21.4%	44.3%	-22.9%
Purpose of animals: Food security	21.4%	15.7%	5.7%
Purpose of animals: Labour	14.3%	12.9%	1.4%
Purpose of animals: Transport	7.1%	4.3%	2.9%
How animals are kept: Zero grazing	57.1%	52.9	4.3
How animals are kept: Free range	50.0%	44.3%	5.7%
How yield is maintained: Improved pastures	21.4%	24.3%	-2.9%
How yield is maintained: Supplements	35.7%	18.6%	17.1%
Problems faced with grazing: Diseases of cattle	71.4%	40.0%	31.4%
How yield is maintained: Treat diseases and give salt	7.1%	10.0%	-2.9%
Problems faced with grazing: Land scarcity	21.4%	25.7%	-4.3%
Advantage of grazing: Manure	28.6%	8.6%	20.0%
Advantage of grazing: Cows access more grass themselves	0.0%	10.0%	-10.0%

Table 3

<i>Differences between men and women concerning trees and woodlots</i>			
Subject	%ofF	%ofM	%ofF - %ofM
Tree types being grown: Eucalyptus	42.9%	38.6%	4.3%
Tree types being grown: Local trees	14.3%	7.1%	7.1%
Tree types being grown: Agroforestry	28.6%	8.6%	20.0%
Tree types being grown: Fruit trees	14.3%	4.3%	10.0%
Purpose of trees: Woodfuel	57.1%	32.9%	24.3%
Purpose of trees: Timber	28.6%	18.6%	10.0%
Purpose of trees: Cash	21.4%	17.1%	4.3%
How the trees are grown: Single stands	50.0%	40.0%	10.0%
How the trees are grown: Intercrop with crops	21.4%	10.0%	11.4%
Why land is used for trees: More cash from trees	0.0%	15.7%	-15.7%
Advantage of woodlots: Income	28.6%	15.7%	12.9%
Advantage of woodlots: Soil conservation	14.3%	8.6%	5.7%
Advantage of woodlots: Environmental services	14.3%	11.4%	2.9%
Advantage of woodlots: Fuel wood	21.4%	17.1%	4.3%
Other desired farming practise(s): Tree planting	28.6%	22.9%	5.7%
Other desired farming practise(s): Other crops	35.7%	22.9%	12.9%



Table 4

<i>General differences between men and women</i>			
Subject	%ofF	%ofM	%ofF - %ofM
Size of land: <acre	14.3%	21.4	-7.1%
Size of land: an acre	35.7%	25.7%	10.0%
Size of land: 2 acres	14.3%	21.4%	-7.1%
Size of land: > 2 acres	35.7%	31.4%	4.3%
How land was acquired: Bought	50.0%	30.0%	20.0%
How land was acquired: Inherited	35.7%	60.0%	-24.3%
How long lived in this area: 1-10 years	28.6%	10.0%	18.6%
How long lived in this area: 11-20 years	35.7%	30.0%	5.7%
How long lived in this area: > 20 years	35.7%	60.0%	-24.3%
Major sources of income; On-farm sources: Crops	92.9%	88.6%	4.3%
Major sources of income; On-farm sources: Animal products	28.6%	22.9%	5.7%
Major sources of income; Off-farm sources: Business	35.7%	24.3%	11.4%
Major sources of income; Off-farm sources: Formal employment	14.3%	8.6%	5.7%

## APPENDIX 2

Table 5

<i>Gender perception differences on livestock between Benet and Binyiny + Ngenge combined</i>		
Subject	Gen. Benet - B+N	Women Benet - B+N
Animals kept: Poultry	12.3%	-16.7%
Animals kept: Sheep	36.5%	33.3%
Animals kept: Goats	-8.2%	-45.8%
Animals kept: Donkeys	1.6%	-20.8%
Purpose of the animals: Labour	-1.6%	-33.3%
Purpose of the animals: Cash	52.6%	8.3%
Major sources of income; On-farm sources: Animal products	5.7%	-37.5%
Animals kept: Cattle	20.3%	-25.0%
How the animals are kept: Zero grazing	41.5%	41.7%
How the animals are kept: Free range	-29.6%	-58.3%
Problems faced with grazing: Land scarcity	8.7%	-50.0%

Table 6

<i>Gender perception differences on trees and woodlots between Benet and Binyiny + Ngenge comb.</i>		
Subject	Gen. Benet - B+N	Women Benet - B+N
Tree types being grown: Eucalyptus	30.1%	45.8%
Tree types being grown: Local trees	1.2%	25.0%
Tree types being grown: Agroforestry	15.3%	-8.3%
Other desired farming practise(s): Agroforestry	-3.9%	-16.7%
Purpose of trees: Cash	5.5%	37.5%
Purpose of trees: Wood fuel	29.1%	12.5%
Advantage of woodlots: Environmental services	10.3%	25.0%

## APPENDIX 3

### General remarks on gender distribution in the database.

It is not safe to assume that women interviewed during the survey also represent female headed households. Even though it is far from an unknown phenomenon in African as well as Ugandan agriculture (Appleton, 1996), it was not established these women represent such households in this dataset. A significant portion (28%) of the Ugandan farms is run by women. It is not certain that our female portion of 16.7% of the total respondents belongs to the group of female headed households, but there is no reason to assume they are not. So for sake of the analysis the assumption was made that women interviewed during the survey can be identified as the household head.

As the group of women is not very large (14 out of 84 respondents), a small number of women giving a certain answer during the interview has a huge impact on the analysis, percentage wise. Each woman is 'worth' 7.143% in this sense. For obtaining the same value in the group of male respondents 5 of the 70 men have to give the same answer, as one man only represents about 1.428% of the group. One might then argue that because of this difference in group representation, analysis cannot be done in the way it is carried out in this research. Indeed, when only one female respondent gives a certain answer, and zero men, the 5% threshold is reached and a gender difference assumed. But does the fact that none of the male respondents provided this same answer make the female response worthless from an analytical point of view? And what alternatives could be identified to tackle this problem? Attempting to interview as many female headed households as male headed households would make the survey not representative for the region it is conducted in, while reducing the amount of men in the analysis would create the dilemma of how to discard the majority of male respondents randomly without rendering the research useless. Only by extending the survey to a lot more households in the region, or increasing the threshold value for identifying gender difference this problem could theoretically be solved. Increasing the values between which no gender difference is assumed (towards for instance -10% to 10%) would render 'small', and often just as interesting differences (because of a lot of answers were given by both sexes to a specific question), worthless. It is therefore recommendable to increase the sample size when conducting this kind of research, in which a small portion of the population is compared with a larger group.

One other critical note has to be made on the distribution of the female respondents over the different regions within the watershed. The three different sub counties (Benet, Binyiny and Ngenge) know, for instance, different climatic and demographic conditions, so their cropping systems do also differ. It is unclear how female headed households are distributed in each of these regions, but the different regions are not evenly represented by women in the survey. As more women (in fact eight) represent the women population in the upstream part of the catchment, they over-represent this agro-ecological zone within the group of

females. Midstream is represented by four women and the floodplains of Ngenge by only two. This makes that a reply by a woman from Benet, representing their upstream position, is amplified because fewer women from the other two regions can represent their situation and balance it all to form the more general opinion/answer of female respondents.

The male respondents are more evenly distributed, thus more evenly representing their local conditions. 25 live in Benet, 24 in Binyiny and 21 are located in Ngenge. So when only analyzing differences among men between these regions no problems will be created.

Comparing all women (the three sub counties combined) with all the men (again all sub counties together), could result in an over-representation of the male viewpoint of the Ngenge farming system, as little women from this area can give their position. Within this research it is assumed none of the above described effects take place, as it is hard to balance the comparative calculations and it is unclear if these effects do occur and to what degree they harm the analysis of the data percentage wise.