SCHOOL OF GRADUATE STUDIES

Institute of Regional and Local Development Studies (IRLDS)

EFFECTS OF BIOFUEL INVESTMENT ON RURAL HOUSEHOLD FOOD ACCESS AND AVAILABILITY FROM THE PERSPECTIVE OF MAJOR FOOD CROPS: THE CASE OF WOLAITA ZONE, ETHIOPIA

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A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF ADDIS ABABA UNVIRSITY IN PARTIAL FULFILLMENT OF THE REQUIRMENT FOR THE DEGRE OF MASTER OF ARTS IN REGIONAL AND LOCAL DEVELOPMENT STUDIES

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ACKNOWLEDGEMENTS

First of all, I would like to thank the almighty God for all the good things He did to me. After that, my heartfelt thanks will go on to my Advisor Dr. Aklilu Amsalu for his friendly approach and genuine advice. Then, I would like to acknowledge the commitment of the workers and the institution a whole for giving every support and cooperation during the time of data collection. The kebele administration in the study area, the woreda and zone Agriculture and rural Development office, the zone trade and investment office, the SNNP regional Bureau of Mines and energy and the Biofules development office of the Federal Ministry of mines and energy are also another contributors that should be acknowledge in this paper Because they collaborated a lot in giving the available information for the study.

Finally, my heartfelt thank goes to my brother Mintesiont Elias and my fiancée Rosa Eshetu. They helped me a lot in giving morale and in terms of income as well. So, their contribution is not forgettable.

Table of Contents

List of Tables

List of Figures

ACCRONYMS AND ABBRIVATIONS

- CARE - Cooperative for Assistance and Relief Everywhere
- CGIAR – Consultive Group on International Agricultural Research
- CSA – Central Statistics Agency
- DFID - Department for International Development
- EC – FAO – FAO's Food Security Program
- EU – European Union
- FAO – Food and Agriculture Organization
- FED – Finance and Economic Development
- FSS – Forum for Social Studies
- GBEP – Global Bioenergy Partnership
- HH. - Household
- ICS -International Centre for Science and High Technology
- IEA – International Energy Agency
- IFAD – International Fund For Agricultural Development
- IUCN - International Union for Conservation of Nature and Natural Resources
- MASL –Meter Above Sea Level
- MME – Ministry of Mines and Energy
- Mtoe – Million tones of oil equivalents
- ODI – Overseas Development Institution
- OECD - Organization for Economic Co-operation and Development
- SADC – South African Development Commission
- SOFA – State of Food And Agriculture
- UNEP – United Nations Environmental Program
- UNIDO - United Nations Industrial Development Organization
- WDA – Wolaita Development Association
- WFP – World Food Program
- WARD – Woreda Agriculture and Rural Development
- WZARD – Wolaita Zone Agriculture and Rural Development

ABSTRACT

The currently steady increasing trend in fuel prices and the mismatch between the energy supply and demand situations in Ethiopia is leading the country to be guided by the general direction of energy conservation and renewable energy source utilization. Wide range of biofuel development works are undergoing and one of its indications is the designing of biofuel development and utilization strategy by the Federal Ministry of Mines and Energy. Global Energy Ethiopia Inc. is one of the foreign private investment companies that came to Ethiopia due to investment opportunities created on the investment of biofuels. Then the study was conducted to assess the effects of the investment practices of the Global Energy Ethiopia on the food availability and access of the rural households from the perspective of major food production in Damot Woide Woreda, Wolaita Zone, Ethiopia. Data were collected through household survey from 96 rural households and semi-structured interviews are also conducted with the key informant interviews from selected rural farm households, workers of the company and respective government bodies. Descriptive statistics such as mean, percentage and cross tabulation were some of the methods used to analyze data. The study identified that; even though the investment practice had some positive effects like provision of incentives and trainings, and used as coping mechanism for destruction of food crop land by monkeys and apes, it has the overall negative effects on food availability and access in the study area due to the reducing effect on land for major food crops, land and income. So the results suggest that the production of biofuels feedstock based on contract (community) farming system by the private investment company is not sustainable way of biofuels feedstock production in the study area. To this end, promotion of local community owned biofuel development projects for rural economic and energy security is recommended.

Key Words: Biofuels, Food availability, Food access

As a partial solution for the high rise in fuel prices, the Ministry of Mines and Energy of Ethiopia has launched a Biofuel Development Strategy based on the experiences of successful countries such as Brazil, U.S.A., E. U. and some African countries. Currently, the focus is on promulgating minimum ethanol blend regulation for running cars, the supply of which will come from increasing the production of state-owned sugar factories (Addisu, 2008).

This study assessed the possible positive and negative effects of small scale biofuel investment, which is based on caster bean production, on food availability and access of the rural households from the perspective of major food production. The study focused only on caster bean production found in Damot Woide Woreda in Wolaita zone, SNNPR (Ethiopia) which was initiated by private investment company of Global Energy Ethiopia (GGE).

1.2 Statement of the Problem

Ethiopia is a net oil importer country and its annual expense for oil import covers 77% of the total export earnings (MME, 2007). The demand for fuel in the country is increasing from time to time as a result of the prevailing fast economic growth at the national level.

Currently, the steady increase in fuel price as well as the mismatch between demand and supply is becoming the barrier for stable and sustainable development for many countries, particularly for the developing world. This situation is also the case in Ethiopia (MELCA Mahiber, 2008). Because of this, energy use and development of many countries (including Ethiopia) is going to be guided by the general direction of energy conservation and renewable energy source utilization. Under this general consideration, wide range of development works on biofuels to use them as an alternative or substitute fuel for transport, rural industries and rural electrification is being carried out in Ethiopia (MME, 2007).

Despite the existence of several excellent research centers with experienced staff in Ethiopia, there is generally a lack of adequate expertise and skills and this is a major constraint on the development of biofuel (specifically of biodiesel) in Ethiopia (Forum for Environment, 2008). Compared to other countries such as Brazil, India, USA, EU and South Africa, the effort made in Ethiopia is unsatisfactory due to lack of awareness, policy and regulations, trained human resources and research and development (Forum for Environment, 2008).

Detailed researches on the issue in Ethiopia are very scarce as compared to the rate of the investment practice expansion across the country. Most of the researches are general studies about impacts of the investment on different parts of the country and they assess several issues at a time on single document.

Some studies (Forum for Environment, 2008; MELCA Mahiber, 2008) were conducted on the socio-economic and environmental aspects of biofuels investment. The results of the studies of these paper revealed that even though biofuels investment has its own advantages especially in the local economic development process of poor rural households, the current investment situation in Ethiopia, except for some practices in North Ethiopia, it is not benefiting majority of the rural households.

Other similar studies (Adisu, 2008; Aregawi, 2009) also showed that biofuels development status in Ethiopia is not bringing the desired economic benefit for the rural households, especially in improving their livelihoods. They further argued that the biofuels investment process did not result in bringing broad poverty alleviation impacts on rural households.

Further studies in Wolaita zone (G/Medihne & Yasin, 2008), has revealed that Promotion of bio-fuels feedstock production is believed to have several potential benefits but for people in Wolaita, with a limited natural resource base, bio-fuels could divert land and water away from the food production system.

All the above statements are similar in that the current biofuels investment situation in Ethiopia is not benefiting the local people in many parts of Ethiopia, except for some cases. However, all of them lack to view the effects of the biofuels investment on food availability and access from the perspective of major food production on the rural households where specifically in the context of caster bean production of Wolaita Zone. This fact calls further investigation on the issue that: can the agriculture sector of the study area meet the demand of caster bean feed stock investment for the international market with out compromising self reliance in the production (availability) and consumption (access to) of major food crops? This question holds the base for conducting this study and distinguishes this study from other similar studies.

1.3 Objectives of the Study

This study was generally carried out for analyzing the impacts of biofuel investment on food security (availability and access) especially on the small scale out grower schemes in Damot Woide woreda of Wolaita zone, South Ethiopia. The general objective of this research was to analyze effects of biofuel investment on food access and availability in the study area. It was all about showing how does company-based biofuel investment practice especially in relatively densely populated areas affect food availability, access to food (through affecting livelihood strategies), major food crops production. And was also analyzing how the investment contributing as an additional income earning activity (livelihood) for the existing community at the household level.

Whereas, the specific objectives of the study were:

- To assess food availability and access situations in relation to caster bean production in the study area;
- To assess land uses in relation to caster bean versus food production in the study area;
- To assess the pattern of agricultural production and cropping pattern in relation to major food crops vs. caster bean production in the study area; and
- To investigate the price comparison between major crops grown in the area and Caster bean.

1.4 Research Questions

The general research question of the study is: what are the effects of caster bean production for biofuels investment on the supply (availability) and access to food in relation to major food crop production? Based on this general research question, the specific research questions of this study were designed as follows:

- Did the biofuels crop (caster bean) grow by the out-grower farmers in the study area bring effects (both positive and negative) on the farmers' food availability and access?
- What seem the land use patterns for caster bean versus food production in the study area?
- What are the major patterns of agricultural production in the study area?

- What would be the policy intervention driven out of this issue for the ongoing and expanding biofuel investment practices in the country?

1.5 Significance of the study

As it is indicated in the problem statement, this paper contributes to the field of food security (availability and access) from the perspective of major food production. The facts of the study gives good insights about how to evaluate the effects of private investment activities based on agricultural lands and the contractual agreement between farmers and investors on the production system of poor rural households in general.

On the other hand, the study will also have the relevance for various stakeholders working in relation to the biofuels developments in the country in particular and globally in general. It is also an input for further researches on the issue as well. The following are some specific relevance of this paper for various stockholders of the country.

- The findings will be an input for policy makers and planners by showing directions for policy guideline revisions for the better implementation of small scale biofuel investment with out compromising the local level of self food reliance of the rural society;
- The findings will point out some path ways for the sustainable practice of small scale biofuel investment that might be a contribution for rural livelihood diversification.
- The study will provide its contribution for the food security assessment based on food crop production.
- It will serve as a stepping stone for further studies on the issue that link the assessment of small-scale biofuels production with food security and rural development.

1.6 Scope and limitation of the study

This study is focused only on the effects of caster production for biofuels from food availability and access points of view in the study area. The analysis is mainly on the production of major food crops: maize, haricot bean and sweat potato. This is because majority of the sample households grow these crops. On the other hand, the only biofuel (biodiesel) crop that has been assessed was caster bean.

The area for conducting this study is in Damot Woide woreda of Wolaita zone (south Ethiopia). The participants (target groups) in the study are out-grower farmers registered to plant caster bean for Global Energy Ethiopia, workers in the investing company in the area and respective government officials.

It has been very short period of time since the company started operation in the area. The company started its operation in 2007/08 and collection of harvest was started in the next year. So, 2008/09 is the first year of harvest of caster bean crop. Accordingly, only two years, 2008/09 and 2009/10, that is to be assessed as a production period. This situation limited the study to make a deep assessment on all effects of Caster bean production, especially on food security improvement of the community in the study area. That is why it is restricted to assess the effects at household level.

1.7 Organization of the Thesis

This study is organized in to five chapters. Chapter one is all about the introduction of the paper; whereas Chapter two of this paper is on the review of related literature; chapter three comprises the research methodology; chapter four is about results and discussion of the paper; and the paper ends with Chapter five that is on conclusion and recommendations.

1.8 Research Methodology

1.8.1 Research type, method and design

This research is an exploratory applied research; since it extensively investigates the issue from various stakeholders in the study area. This is in assumption that there are several effects of caster bean production on food availability and access that need extensive analysis. The research method used in this research was the survey research method. Bryman, in relation to survey research method, has said that; "Initially, the survey will begin with general research issues that need to be investigated. These are gradually narrowed down so that they become research questions" (Bryman, 2004).

On the other hand, the research also used both quantitative and qualitative research designs in integrated manner. This is because, as Degefa Tolossa (2006) indicated, combining qualitative

and quantitative household data in a single research project allows a comprehensive and holistic understanding of food security situations. Here, both methods were used in complementing one another.

1.8.2 Data sources

In this study, both primary and secondary data are used from various sources. Primary data was be collected from interviews (both structured and un-structured) with key informants, household survey questionnaire (both structured and un-structured) for various stake holders and field observations.

On the other hand, secondary data are used to support the primary data with useful information. The secondary data sources that are used in this paper are: documents from respective government offices, the biofuel investment company (Global Energy Ethiopia) and civic societies operating in the study area, books, policy documents, internet sources, etc.

1.8.3 Sampling procedure and techniques

i) Determining the sampling unit

What is important in determining sampling unit is that the definition of the sampling unit should be unambiguous and conform to local understanding and acceptance; and the most common ultimate sampling unit in multipurpose socioeconomic studies is the household (IFPRI, 1999). Accordingly, a single farm house hold in the study area is considered as the sample unit of this study.

ii) Determining the study population (N)

Study population has a much broader meaning than the common use of the term. It mainly refers to the 'universe' of sample units from which the study sample (n) is selected ((Bryman, 2004). So, the study population or 'universe' of the paper will be all registered household farmers in Damot woide woreda (Wolaita Zone) for the production of caster bean and produced caster for consecutive two years.

iii) Constructing a sampling frame

The frame for a sample is a list of the units in the population (universe) from which the units that will be enumerated in the sample area are selected (which may be an actual list, a set of index cards, a map, or data stored in a computer) that enables us to take hold of the universe piece by piece (Casley and Lury 1987; cited by IFPRI, 1999).

For this study, multi-stage sampling techniques are used. There are three woredas in Wolaita zone where the activity of Global Energy Ethiopia is found. Out of the three woredas, Damot Woide Woreda was selected randomly. This was because; firstly, the investment process in all parts of the zone is similar in that all are community based farming systems. Secondly, it is assumed that all the three woredas (Offa, Kindo koysha and Damot Woide) are assumed as homogenous in terms of agro-climatic conditions and major socio-economic backgrounds of the people.

Once Damot woide woreda is selected randomly from three woredas, the process to select sample households was started. There are 23 kebeles in Damot woide woreda. Out of these 23 kebeles, in 6 kebeles there is no caster production activity. Because of this, these 6 kebeles are excluded from the sampling frame since there might a probability of these kebeles to be selected in the sampling process. To prevent this sampling error, these kebeles are excluded from the sample.

Now, 17 kebeles are left in the sampling frame. At this stage cluster sampling method is used to categorize the kebeles in to clusters. For this purpose the clustering method of the company was used. The company has four clusters of kebeles which are known as 'supervision sites'; anka, Girara, Bedessa and Koyo sites. So, the kebeles are clustered in to four clusters.

Table 2.1: Registered households for consecutive two years in each cluster kebeles

Clusters	Kebeles	Registered households
Girara Cluster	Adacha	156
	Girara	149
	Motala	172
	Chifissa	142
	Oloba	53
Koyo Cluster	Ade Dawe Mundaja	126
	Sura Koyo	122
	Kindo Koyo	141
	Mayo Kote	171
Anka Cluster	Anka Shashara	137
	Degaga Lenda	121
	Mayo Ofore	104
	Tora Sadebo	76
Bedessa Cluster	Ambe Bedessa	52
	Tora wlisho	109
	Bilbo Bedessa	127
Total		*1958*

Source: compiled form the site supervisor workers of Global Energy Ethiopia, 2010

After clustering of kebeles is finished, 6 kebeles were selected through purposive sampling method from three agro-climatic zones (degga, woina degga and kola) to include all agro-climatic zones of the woreda. Whereas, simple random sampling (selecting the first two kebeles from the list of kebeles based on their agro-climatic zones) method was used to select kebeles found in each climatic zones. Accordingly, Sura Koyo and Mayo Kote were selected from degga agro-climatic zone; Girara and Oloba are selected from weina Degga agro-climatic zone; Anka Shashara and Mayo Offore are selected from kola agro-climatic zone. During this process one cluster (Bedessa cluster) is omitted so that three clusters are selected for sampling.

After six kebeles and three clusters of these kebeles are selected, 16 households were selected from each kebeles and the total sum of this sample is 96 which is 5% of the total population of the study (N)

Finally, key informants are selected purposively based on the value of the expected data to be collected from the interviewees. Accordingly, the list of key informants includes farmers, kebele leaders, development workers and civil servants in different hierarchies.

1.8.4 Techniques of data collection

This study used various instruments for different techniques of data collection. Firstly, household survey was conducted in the study area. Accordingly, after conducting a pre-test on the survey questionnaire, enumerators were trained for two days (two enumerators from each cluster) and 100 questionnaire papers was distributed to the households. Out of these 100 questionnaires, 95 were effectively returned. From the returned papers, 11 were discarded during analysis since they have encoding errors that is not tolerable. So, 84 survey questionnaires were effectively analyzed in this study. Secondly, semi-structured interviews were prepared for key informants that include: selected farmers that were producing caster, kebele administration staffs, woreda ARD office, zone ARD office, Zone Trade and investment office, SNNP Region mines and energy office and office of biofuels development in the Federal Ministry of Mines and Energy. Thirdly, observations were also made and important events and situations were captured through camera and used in analysis.

1.8.5 Methods of data analysis

Both qualitative and quantitative data was analyzed and presented in the study. The presentation of the research results and comparisons are depicted in tables and graphs. The discussions were also made by using descriptive statistics like mean, percentage, cross tabulation, etc.

On the other hand, the Household Food Insecurity Access Scale (HFIAS) was adopted and modified. The intent of Household Food Insecurity Access Scale (HFIAS) is to measure household food access. It is adapted from a guide for measuring Household Food Insecurity Access Scale (HFIAS) developed by Coates et al. (2007) for Food and Nutrition Technical Assistance Project, which is also an adaptation of the approach used to estimate the prevalence of food insecurity in the United States (U.S.) annually. The method is based on the idea that the

experience of food insecurity (access) causes predictable reactions and responses that can be captured and quantified through a survey and summarized in a scale.

HIAFS is based on a set of questions (Household Food Insecurity Access Scale Generic Questions) that have been used in several countries and appear to distinguish the food secure from the insecure households across different cultural contexts. These questions represent apparently universal domains of the household food insecurity (access) experience and can be used to assign households and populations along a continuum of severity, from food secure to severely food insecure. The information generated by the HFIAS can be used to assess the prevalence of household food insecurity (access) (e.g., for geographic targeting) and to detect changes in the household food insecurity (access) situation of a population over time (e.g., for monitoring and evaluation) (Coates & et. al., 2007).

The HFIAS questionnaire consists of two types of related questions. The first question type is called an occurrence question. There are nine occurrence questions that ask whether a specific condition associated with the experience of food insecurity *ever* occurred. Each severity question is followed by a frequency-of-occurrence question, which asks *how often* a reported condition occurred.

Each occurrence question consists of the stem (timeframe for recall), the body of the question (refers to a specific behavior or attitude), and two response options (0 = no, 1 = yes). There is also a 'skip code' next to each "no" response option. This code instructs the enumerator to skip the related frequency-of-occurrence follow-up question whenever the respondent answers "no" to an occurrence question.

Each HFIAS frequency-of-occurrence question asks the respondent how often the condition reported in the previous occurrence question happened in the previous four weeks. There are three response options representing a range of frequencies (1 = rarely, 2 = sometimes, 3 = often).

All the above procedures and interpretations are accepted by this paper but modification is needed on that each of the questions in the in the original question format were asked with a recall period of four weeks (30 days). But the consideration of only one month especially in this study is not enough to understand the background of the respondents in the study area. For

example, for the measurements those are taken from single household in several seasons, there might be a high tendency of varying results. As it was also previously indicated, there are 'bad' seasons in terms to supply of food and 'good' seasons. So the situation of households in this regard, it is highly variable. To solve this problem side of the question format, two modifications might be taken. The first one is to measure a single household more than once (e.g. once per season). The second option (that was also taken as alternative in this paper) is to convert the parameters used to measure attributes with in a month to a year. Accordingly, the following example demonstrated how the conversion factor was applied.

Finally, based on the conversion, the households are expected to reply 'rarely' if the response occurrence is encountered less than or equal to a month (at least very cloth to one month). Whereas, they are expected to reply 'sometimes' if the response occurrence is encountered at least between two months before the end of a year to four months (April to June). The response 'Often' expected to be responded by the households for the occurrences encountered before April.

CHAPTER TWO

LITERATURE RIVIEW

2.1 Biofuels Development

2.1.1 Definition and types of biofuels

Definition of biofuels

Biofuel (which is a key term in this paper) is a broad term is that defined in different ways by several authors. This term has been indicated as agrofuels in other papers but the preferred word in this study is biofuels rather than agrofuels since this term is an inclusive term for all fuels that are obtained from renewable materials (resources) of flora and fauna irrespective of their origin (whether from agricultural practices or not). Having this idea in mind, it is better to see some definitions of biofuels used by other researchers widely.

The State of Food and Agriculture (FAO, 2008) defines biofuel as a fuel produced directly or indirectly from biomass such as fuel-wood, charcoal, bioethanol, biodiesel, biogas (methane) or bio-hydrogen. A wide range of biomass sources can be used to produce bioenergy in a variety of forms. For example, food, fiber and wood process residues from the industrial sector; energy crops, short-rotation crops and agricultural wastes from the agriculture sector; and residues from the forestry sector can all be used to generate electricity, heat, combined heat and power, and other forms of bioenergy (FAO, 2008).

OECD (2007) on its part, define Biofuels as liquid fuels for road vehicles and include bioethanol made from crops such as cereals and sugar cane and biodiesel originating mainly from rapeseed-, palm- and soya oil. They are mostly in liquid form and are used to power combustion engines in road transport.

Policy Innovation Systems for Clean Energy Security (Pisces, 2009) has also defined biofuels as fuels that are directly derived from renewable biological resources, especially from purposely grown energy crops.

Lastly, World Business Council for Sustainable Development (WBCSD, 2007) defined biofuels as liquid, solid or gas fuels derived from biomass, either from recently living organisms or from their metabolic waste. Here, biomass refers to organic materials made from plants and animals.

There are also a lot of other scholars and organizations that defined biofuels on their own way of definition. But almost all definitions have two dimensions. The first one is that; biofuels are broader term that refers to all direct and indirect forms of fuels derived from a wide range of biomass. The second dimension of biofuels definition regard biofuels as liquid fuels that are derived from biological sources, mainly of purposefully grown energy crops for road vehicles.

As can be shown from the above definitions, a wide range of biomass sources can be used to produce biofuels in a variety of forms. For example, food, fiber and wood process residues from the industrial sector; energy crops, short rotation crops and agricultural wastes from the agriculture sector; and residues from the forestry sector can all be used to generate electricity, heat, combined heat and power, and other forms of bioenergy and any form of energy produced from non-fossil organic matter (WBCSD, 2007).

Biofuels is also referred as renewable energy because they are a form of transformed solar energy unlike other natural resources such as petroleum, coal and nuclear fuels (ICS-UNIDO, 2007). They may be solid, liquid or gaseous and include all kinds of biomass and derived products used for energetic purposes. Besides the traditional use of bioenergy, the major uses of 'modern bioenergy' comprise biofuels for transport, and processed biomass for heat and electricity production (UNEP, 2009).

Biofuel Types and Generations

Biofuels can be classified according to their source and type. They may be derived from forest, agricultural or fishery products or municipal wastes, as well as from agro-industry, food industry and food service by-products and wastes. They may be *solid*, such as fuel-wood, charcoal and

wood pellets; *liquid*, such as ethanol, biodiesel and pyrolysis oils; or *gaseous*, such as biogas (FAO/SOFA, 2008).

In spite of their limited overall volume, the strongest growth in recent years has been in liquid biofuels for transport, mostly produced using agricultural and food commodities as feedstocks. The most significant are liquid biofuels for transport bioethanol and biodiesel (UNEP, 2009).

Any feedstock (crop used to produce biofuel) containing significant amounts of sugar, or materials that can be converted into sugar such as starch or cellulose, can be used to produce ethanol (FAO/SOFA, 2008). Ethanol available in the biofuel market today is based on either sugar or starch. Common sugar crops used as feedstocks are sugar cane, sugar beet and, to a lesser extent, sweet sorghum. Common starchy feedstocks include maize, wheat and cassava (UN-DESA, 2007; FAO/SOFA, 2007; OECD/IEA, 2008). The use of biomass containing sugars that can be fermented directly to ethanol is the simplest way of producing ethanol. In Brazil and other tropical countries currently producing ethanol, sugar cane is the most widely used feedstock. In OECD countries, most ethanol is produced from the starchy component of cereals (FAO/SOFA, 2008).

Biodiesel on the other hand, is produced by combining vegetable oil or animal fat with an alcohol and a catalyst through a chemical process known as transesterification. Oil for biodiesel production can be extracted from almost any oilseed crop; globally, the most popular sources are rapeseed in Europe and soybean in Brazil and the United States of America. In tropical and subtropical countries, biodiesels produced from palm, coconut and Jatropha oils. Small amounts of animal fat, from fish- and animal-processing operations, are also used for biodiesel production. The production process typically yields additional by-products such as crushed bean "cake" (an animal feed) and glycerin. Because biodiesel can be based on a wide range of oils, the resulting fuels can display a greater variety of physical properties, such as viscosity and combustibility, than ethanol (FAO/SOFA, 2008).

Biofuels can also be grouped in 'generations', according to the type of technology they rely on and the biomass feedstocks they convert into fuel (ICS-UNIDO, 2007). The grouping of biofuels based on 'generation' are assessed in some literatures as first and second generation biofuels (ICS-UNIDO, 2007; WBCSD, 2007; UN-DESA, 2007; FAO/SOFA, 2007 etc.).On the other

hand, others group biofuels up to third generations (OECD/IEA, 2008; CGIAR, 2008, UNEP, 2009, etc.). This is due to the differentiation between second and third generation biofuels (also called "advanced" biofuels) is not always straightforward due to overlaps regarding feedstocks and processing technologies, as well as uncertainties regarding environmental impacts (UNEP, 2008, cited in UNEP, 2009). As an example, let us see the later classification.

First generation biofuels are made from sugar, starch and vegetable oils and thus refer to those feedstocks within the food cycle, e.g., maize grain, palm oil, rapeseed, etc. using conventional technology. Whereas, *Second generation biofuels* or *'cellulosic biofuels'* refer to those feedstocks produced utilizing non-food biomass like crop residues, forest and wood chippings or wild grasses relying on bioconversion techniques such as enzymatic breakdown of lingo-celluloses to make ethanol. *Third generation biofuels* on the other hand, are made from energy and biomass crops that have been designed in such a way that their very structure or properties conform to the requirements of a particular bioconversion process. The bioconversion agents (bacteria, micro-organisms) are bio-engineered in such a way that the bioconversion process becomes more efficient (CGIAR, 2008).

2.1.2 Historical Background of Biofuels

Biofuels, especially from the context of bioenergy, is not a new source of energy since the discovery of fire, people have been using biomass (wood, charcoal, plant residue and animal waste) to heat their homes and cook their meals (UN-ECOSOC, 2008). However, the chemical process of trans-esterification for making bio-diesel has been known for only a century or two, although bio-diesel as it has come to be known emerged only in the past twenty years, in terms of the use of refined vegetable oils on a large-scale. Rudolf Diesel believed that the utilization of a biomass fuel represented the future for his engine. In 1911, he said "The diesel engine can be fed with vegetable oils and would help considerably in the development of agriculture of the countries which use it (Knothe, 2001, cited in Johnson, 2007)."

Before the era of cheap oil and during times of conflict such as World War II, biofuels have been recognized as a valuable domestic alternative to imported oil. The resurgence of interest in biofuels in recent years is in part for similar reasons of energy security, but now the added issues of rural development and climate mitigation make the case for biofuels even more compelling.

The past several years have witnessed a growing interest in fuel ethanol as a substitute to petrol in the transportation sector on a global scale (Johnson, 2007).

Interest in biofuels initially came about in the late 1970s as OPEC reduced crude oil supply on the world market and fuel prices increased substantially (Birur, 2007). Throughout the 1990s, interest re-emerged based on experiments in the 1980s and plants were opened in many European countries, especially in France, Germany, and Italy (Johnson, 2007).

2.1.3 Overview of Biofuels Production Experiences

Global Overview

This section presents a preliminary overview of the industrial biofuel production. There are several types of biofuels and many different ways of producing them. Today, almost all biofuels produced around the world are either bioethanol or esters (commonly referred to as biodiesel). Each fuel has its own unique characteristics, advantages and drawbacks (OECD/IEA, 2007).

Global production of biofuels amounted to 20 Mtoe, or 643 thousand barrels per day in 2005 – equal to about 1% of total road-transport fuel consumption in energy terms (OECD/IEA, 2007). Brazil and the United States together account for almost 80% of global supply. The United States is thought to have overtaken Brazil in 2006 as the world's largest producer of biofuels. In both countries, ethanol accounts for almost all biofuels output. US output of ethanol is derived mainly from corn (maize). In Brazil, production of ethanol is entirely based on sugar cane (OECD/IEA, 2007).

Production of biofuels in Europe is growing rapidly thanks to strong government incentives. Production and usage of biofuels in transport, heating, and industrial establishments became an increasing phenomenon and the industrial growth in the biofuels industry has been developing very fast in all EU member states. Unlike in the Americas, biodiesel remained the leading biofuel in the EU, representing 81.5% of production in 2005. Among all EU member states, Germany alone represents 52.4% of this production (ICS-UNIDO, 2007).

China and India are the largest producers of biofuels (out side EU and the Americas) mostly in the form of ethanol. The share of biofuels in total transport-fuel demand is nonetheless growing rapidly in several countries as new capacity comes on stream (OECD/IEA, 2007).

Table 2.1: Biofuel production by major producing country in 2005

Country	Ethanol (Mtoe)	Biodiesel (Mtoe)	Total (Mtoe)
United States	7.50	0.22	7.72
Brazil	8.17	0.05	8.22
Canada	0.12	0.00	0.12
European Union	0.48	2.53	3.01
China	0.51	Negligible	0.51
India	0.15	Negligible	0.15
World	***17.07***	***2.91***	***19.98***

Source: Modified from OECD/IEA, 2007

Biofuels in Africa

In the context of Africa, access to reliable energy sources and affordability issues assume special significance (UNIDO, 2006). This is because many non-oil-exporting African countries import fossil fuels to provide energy to the modern sector, particularly transportation. For African countries, this is leading to attract investors in biofuel projects, as well as growing support from bilateral and multilateral donors for incorporating biofuels into government policies and development plans (Sulle and Nelson, 2009). Biofuel production has the potential to provide at least a partial substitute for costly oil imports, which are one of the major uses of foreign exchange and sources of inflation in African economies (Sulle and Nelson, 2009).

In 2006, several countries formed the Pan-African Non- Petroleum Producers Association (PANPP) - the so-called "Green OPEC", to exchange information, share knowledge, and cooperate on the development of biofuels in Africa. The African Union (AU) has endorsed biofuels as an integral part of the sustainable energy strategy for the continent. The AU's strong interest in biofuels development goes beyond promoting economic growth; the Union believes

that biofuels will contribute to the eradication of poverty in the continent. It has called for the development of biofuels in order to minimize risks for small-scale farmers, encouraging individual African countries to design their national biofuels strategies based on their natural endowments, land tenures, and socioeconomic needs (Tsegaye and H. Glantz, 2009).

Although an increasing number of biofuel investments have been allocated land in Africa, very few have completed the process to be operational and even some land allocations remain subject to legal disputes over the properties in question (Gordon-Maclean *et al.*, 2008 as cited in Sulle and Nelson, 2009).

Amigun et.al (2008) also indicates that there are very few operational commercial biofuel systems in Africa as compared to small-scale systems. And according to the Energy for Sustainable Development/Tanzania (2008), existing biofuel (mainly of bioethanol) plants are concentrated mostly in the Southern African Development Community (SADC) region - in the southern tip of the continent (South Africa, Malawi, Swaziland, Mauritius, and Zimbabwe) and other commercial biofuel producing regions are East (Ethiopia, Kenya, Tanzania and Uganda) and West Africa (Mali, Nigeria and Ghana).

2.2 Concepts of Food Availability and Access

2.2.1 Basic Concepts of Food Security

The concept of food security was originally coined in the mid-1970s and emerged out of discussions on international food problems which focused primarily on the issue of food supply. Since then, it has evolved to incorporate new thinking surrounding the causes of famine, hunger and food crisis. The challenges of context specificity will continue to draw attention to the complexities of a universal definition of food security and impel further revision of the concept (Practical Action Consulting, 2008). However, the most widely accepted definition of this time is:

> *"Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life". (World Food Summit, 1996; cited by* Practical Action Consulting, 2008*)*

This widely accepted definition points several dimensions and interpretation by several organizations and scholars, forming several concepts of food security. But the dimensions indicated in the concept paper on food security by the FAO's Food Security Program (EC - FAO, 2008) best fits this paper.

Physical availability of food: Food availability addresses the "supply side" of food security and is determined by the level of food production, stock levels and net trade.

Economic and physical access to food: An adequate supply of food at the national or international level does not in itself guarantee household level food security. Concerns about insufficient food access have resulted in a greater policy focus on incomes, expenditure, markets and prices in achieving food security objectives.

Food Utilization: Utilization is commonly understood as the way the body makes the most of various nutrients in the food. Sufficient energy and nutrient intake by individuals is the result of good care and feeding practices, food preparation, and diversity of the diet and intra-household distribution of food.

Food Stability: Even if your food intake is adequate today, you are still considered to be food insecure if you have inadequate access to food on a periodic basis, risking a deterioration of your nutritional status. Adverse weather conditions, political instability, or economic factors (unemployment, rising food prices) may have an impact on your food security status.

To sum up the above concepts, Food security is achieved, if adequate food (quantity, quality, safety, socio-cultural acceptability) is available and accessible for and satisfactorily utilized by all individuals at all times to live a healthy and happy life. Even in the case of food aid, only food that does not change eating behaviors and is socially and ecologically adapted should be distributed to meet the physiological needs of the target groups (Gross et. al, 2000).

2.2.2 Cross-sectional issues in food security

i) Livelihood strategy (Income earning activity)

International and national agencies have used the concept and application of livelihoods analysis as a means to better understand and respond to the multidimensionality of poverty and food

insecurity (CARE, 2002, cited in WFP, 2009). The livelihood definition provided by Chambers and Conway (1992, cited in Morris et. al, undated) has been widely cited in the development literature, and with minor modifications it has been used by a number of researchers:

> *"A livelihood comprises the capabilities, assets (stores, resources, claims, and access) and activities required for a means of living." (Chambers and Conway, 1992, cited in WFP, 2009)*

From the above definition, we can understand that livelihood could be explained as a system or way of making a living that are quite diverse and made up of several components. These components include: activities households engage in to earn income and make a living, assets and other resources a household possesses and social networks and safety nets (WFP, 2009).

Generally speaking, the goal of household livelihood strategies is to improve welfare levels in some way, by ensuring: the household has enough to eat, their fluctuating income is stabilized, children are able to go to school, the household can afford or access health services or natural resources are better managed (WFP, 2009). These livelihood strategies are mostly distinguished in rural farming households between *On-farm activities* (income earned from crop and livestock production activities), *Non-farm activities* (non-agricultural wage and self employment income) and *Off-farm activities* (non-agricultural activities and agricultural wage labor) (Davis et.al, 2007).

Assets available to the household represent the basic platform upon which the household livelihood may be built. The DFID livelihood framework (as stated in Morris et.al, undated) represented these assets by five categories as human, physical, social, financial and natural assets.

ii) Coping Strategies

The concept of coping strategies is sometimes not well distinguished from activities undertaken in normal day-to-day life but coping strategies are activities reported when something extraordinary (a shock) occurs that worsens the ability of households to maintain their usual standard of life (WFP, 2009). Accordingly, Overseas Development Institute defines coping strategies as the ways a community, household, or individual adjust their livelihood strategies in response to a shock or risk (ODI, 2001). Understanding coping strategies is crucial for food-

security assessments, because the types of strategies that people use tell us what their priorities are, and indicate the severity of food insecurity (ODI, 2001).

Coping strategies encompass a wide range of economic, social, political and behavioral responses to the declining food security. While the strategies people adopt vary with their livelihoods and the type of disaster they face, there are nonetheless distinct stages of coping. Early coping strategies (reducing food intake, changing the dietary habit, switching to cheaper and less desirable foods, or reducing the number or size of meals) are reversible and cause no lasting damage to livelihoods. Eventually, these strategies become unviable, and people are then forced to adopt others that damage their livelihoods. Once all options of early coping strategies are exhausted, people face destitution and the adoption of crisis strategies (such as selling of assets and mass migration or displacement in search of charity) (ODI, 2001).

Outsiders sometimes perceive coping strategies as synonymous with economic activity. However, the social and cultural dimensions of a society are important tools to distinguish coping strategies from economic activities (ODI, 2001). For example, seasonal migration in some communities is a part of a livelihood strategy; hence it should not be considered a coping strategy. In other communities, seasonal migration is not a common livelihood strategy and should be considered a coping strategy (WFP, 2009).

iii) Agricultural production and food security

The demand side of the world food equation is relatively uncontroversial and reasonably predictable: population and income growth will lead to sustained increases in the demand for food. The long-term issues turn mainly on the future path of agricultural supply, in particular, the growth of agricultural productivity given increasing constraints on the natural resource base available for food production. Agriculture is an inherently spatial process and agricultural production and productivity are especially sensitive to spatial and inter-temporal variations in natural factors of production (Iowa State University, 2010).

Sustained growth in agricultural production is critical to improvements in food security for two reasons. First, it translates into increased food supplies and lower food prices for consumers. And second, it means higher incomes, and thus improved ability to purchase food and other basic

necessities, for many food-insecure people who earn their livelihoods through agricultural production (USDA, 2001).

At the global level, increases in agricultural productivity are essential in order to allow food availability to grow apace with demand, which is driven by population growth, higher incomes and increasing demands for non-food uses of the products (e.g., biofuels). Yet on a country and local level, a single-minded focus on the availability side of food security may be counterproductive for three reasons: (a) local food self-sufficiency may be a very costly way of achieving food security, (b) the *pattern* of resource use to achieve agricultural growth is at least equally important for improving food security as the *rate* of agricultural growth, and (c) some efforts to expand food availability through increased production may hurt food utilization (M. Staatz, 2009).

2.3 The Linkage between Food Availability and Access; and their Linkage with the Investment of Biofuels

2.3.1 Availability-Access linkages

Even though food availability is a prerequisite for food access and domestic production is one means for achieving adequate food supply, domestic production strategies are not necessarily the best means for ensuring availability, as many economists have shown that having some reliance on imports may be a less costly way of procuring domestic food needs (e.g., Jayne and Rukuni 1993, cited in Diskin, 1995). Moreover, increased food availability at national or regional levels by no means ensures increased household- level access to food.

In explaining availability-access linkage, Amartya Sen in his "entitlement theory of famine", (as indicated in ODI, 2001) said that: "famines (food insecurity) occur not because there is not enough food, but because people do not have *access* to enough food. Even though the availability of food near to the household is a prerequisite of food security, it is influenced by factors such as a community's proximity to centers of production and supply, or by market forces, restrictions on trade and international policies that affect food supplies" (ODI, 2001).

Staatz et. al (2009) also indicate that for the majority of the people in the world, including the majority in low-income countries, access to food comes at least partially through the market - having the income necessary to purchase an adequate diet rather than produce it entirely oneself. Having sufficient income to purchase an adequate diet depends not only on the amount of money one earns but also on the price of food. Here is where the availability and the access dimensions of food security become inextricably linked. Availability reflects the supply side of the food security equation, while access reflects effective demand, with food prices linking the two sides of the equation (Staatz et. al, 2009).

2.3.2 Food Availability-Access Linkages with Biofuels Production (Investment)

For the poorest households, food accounts for a major part of their expenditures, and food prices directly affect their food security (FAO/SOFA, 2008). Here, the growing biofuel market represents a new source of demand for agricultural commodities, and could reverse the declining trend in real commodity prices observed during the last decades (FAO, 2008). The views raised in FAO's on the high-level conference on world food security (on the agenda of the challenges of climate change and bioenergy) clearly elaborate the general link between biofuels production and food security (FAO, 2008):

> *"Analyzing the nexus between fuel and food is complex. Although there is a growing international consensus that the rapid increase in demand for biofuel feedstocks has contributed significantly to the current rise in food prices, its degree varies across countries and may not be quantifiable with certainty. From an aggregate perspective, there is enough food available to feed the world. The challenge lies in ensuring people's access to food. In addition, world food demand is expected to nearly double by 2050 and food security could be disrupted by more extreme weather events. These forces, combined with increased competition for land to produce biofuels, are of concern to some governments and international organizations." (FAO, 2008)*

i) Biofuels and the availability of food

The major area of the link to biofuels production with that of food availability (at household level) is the competition for agricultural resources (land, water, labor and other productive resources). With this regard, Common Fund for Commodities (2007) forwarded the following idea:

> *"In terms of availability, the key question at national level is whether the savings and gains from biofuels will outweigh additional food costs. Biofuels compete with food crops for land and for water, potentially reducing food production where new agricultural land or water for irrigation is scarce."*

FAO on its part, states that the degree of competition among food, feed and fuel uses of biomass will depend on a variety of factors like: crop selection, farming practices, agricultural yields and the pace at which next-generation biofuel technologies develop (FAO, 2008). It also indicates that competition will affect availability less if non-edible perennial crops are cultivated on unused and marginal lands that do not provide subsistence functions for the most vulnerable. Food supply may be positively affected if the market for biofuel feedstock leads to new investments in agricultural research, infrastructure development and increased production.

ii) **Biofuels and access to food**

The guiding concept of access to food refers to people's economic ability to access food as well as their ability to overcome barriers that stem from physical remoteness, social marginalization or discrimination. The primary determinants of food security for the majority of poor people are their income levels and the cost of food. Higher food prices can cause substantial problems to net food consumers including agricultural laborers, the urban poor and the large proportion of rural poor without sufficient productive assets (FAO, 2008).

Many argue that, at the household level, a critical factor for food security is access to food, because hunger is a matter of 'access' rather than 'supply', so that a focus on rural development and livelihoods makes more sense (Common Fund for Commodities, 2007). As a result, two key indicators are more sounding in assessing link between biofuels and food access: food prices and household incomes. The more income a household or individual has, the more food (and of better quality) can be purchased (FAO/SOFA, 2008).

Studies also further indicate that, in areas where food security is an issue, cultivation of biofuel crops should focus on land that would not be used for food crop cultivation. According to BEFS (Bioenergy and Food Security) project in Tanzania, the development of biofuels place particular pressures on smallholders and the rural poor due to increased demand for food crops generated by the biofuel sector (BFES/FAO, 2010).

2.4 Biofuels Development in Ethiopia

2.4.1 Background to the Biofuels Development – *why Biofuels in Ethiopia?*

Ethiopia is a non-oil producing and land-locked country, which is completely dependent on petroleum imports and this costs the country 8.6 billion birr [US$ 894 million] every year for petroleum imports on average (Atakilte, 2008). This covers 77% percent of the country's total annual export earnings in a single year, which is further, exacerbated by fast growing infrastructure and increased use of imported fuels for industry, agriculture households and other societal services (MME, 2007).

In principle, the biofuel energy option offers a number of economic, resource utilization and environmental benefits for Ethiopia (UN team in Ethiopia, 2008). Based on this, the following are the rationale why biofuels development is needed in Ethiopia (Rezene, 2009)

- Import substitute of petroleum products and export earning;
- Enhance agricultural development and agro processing; job creation and improve income of the people;
- Improve agricultural land productivity through integrations of biofuel development program with land use plan; and
- Decrease environmental pollution through the promotion of biofuel utilization.

2.4.2. Biofuel Development and Utilization Strategy of Ethiopia

The Ethiopian Biofuel Development and Utilization Strategy is developed by the Ethiopian Ministry of Mines and Energy (MME) in 2007 based on the energy policy of the country (FSS, 2008). This strategy is targeted for supply of fuels from locally produced biofuels and its objective is to ensure the production of biofuels with out affecting food self sufficiency, import substitution and improve balance of payments. The strategy document has evaluated the competitiveness of biofuels in the dimension that the development of biofuels has a benefit from the point of environmental protection and escalation of fuel price. And it indicated that the major feedstock crops for biodiesel are Jatropha curcas, caster crop and palm tree (MME, 2007).

In order to achieve the strategic objectives and principles for the biofuels development and use, the major implementation strategy contents adopted the strategy are: Accelerating biofuel technology transfer, research and development; Increasing biofuel development; Increasing biofuel use and export earnings; Involving biofuel actors; Efficient coordination and leadership for biofuel development; Increasing finance for biofuel development; and Enhancing international development for biofuel development.

One can read the strategy document for further elaboration but the major interesting content (and also the issue related to this paper) is the strategy implementation content for biodiesel. The contents include: to produce biodiesel from Jatropha curcas, caster crop and palm tree; to ensure allocation of land for development of biodiesel such that; in low and barren areas where the rain fall is scarce with out affecting the livelihood of pastoralists and by coordinating with other farming activities with out jeopardizing the farmers food production needs; to support the participation of farmers and cooperatives in biodiesel plant development and processing; and to coordinate biodiesel development with rural and agricultural development and extension program.

2.4.3 Status of biofuel development in Ethiopia

In terms of bioethanol development, Ethiopia has three sugar industries (until 2007) which are run and administered by the national Sugar Development Agency. These include Fincha, Metahara and Wonji Shoa. From these industries, Fincha is producing 8 million liters of ethanol and the production and the production potential is going to increase in the future. The Metahara and Wonji are in preparation stage to produce ethanol with in short period of time. The short term plan in the country's bioethanol production is to reach 35.1 million liters in 2002 Ethiopian fiscal year (Rezene, 2009)

The Ministry of Water Resource Development studies (as indicated in MME, 2007) indicate that the production of ethanol in the medium and long development term can grow to 1 billion liters in identified 700,000 ha suitable land for sugar cane plantation. It should be noted that the one billion liters of ethanol to be produced annually is nearly equivalent to seven times of the current gasoline consumption of the country (MME, 2007).

On the other hand, although the production of biodiesel fuel not yet started in the country, various types of plant species which can be used to produce biodiesel grow in the country. Assessments conducted in various regions of Ethiopia indicate that there *Jatropha* grows in various places and has various names depending on the location it grows. But its wider use in these areas is for hedging and border demarcation since it is a drought resistant plant. Another plant which grows in many parts of Ethiopia and a feedstock for producing biodiesel is Caster tree. This plant is also well known and used in several parts of Ethiopia since its seed is used as source of oil for domestic uses. Imported palm tree seedlings are also planted in some parts of Ethiopia for producing oil and soaps (MME, 2007).

With regard to the area for biodiesel development at the national level, an estimated area of 23.3 million ha suitable land is available at the national level. The availability of land in million hectares by region is presented as follows (Atakilte, 2008).

Table 2.2: Availability of land for biodiesel development by region

No.	Region Name	Av. Land (In mil. ha.)
1	Oromia	17.2
2	Beneshangul-Gumuz	3.1
3	Gambela	2.8
4	Somali	1.5
5	Amhara	1
6	SNNPR	0.05
7	Tigray	0.007
8	Afar	No data
9	Hareri	No data
Total (available Data)		***25.657***

Source: Ministry of Mines and Energy (2007)

Until 2007, the progress in biofuel development shows that over 14 local and foreign investors are undertaking preparations for the investment. Of these, five investors already started implementation (MME, 2007).

2.5 Conceptual Framework

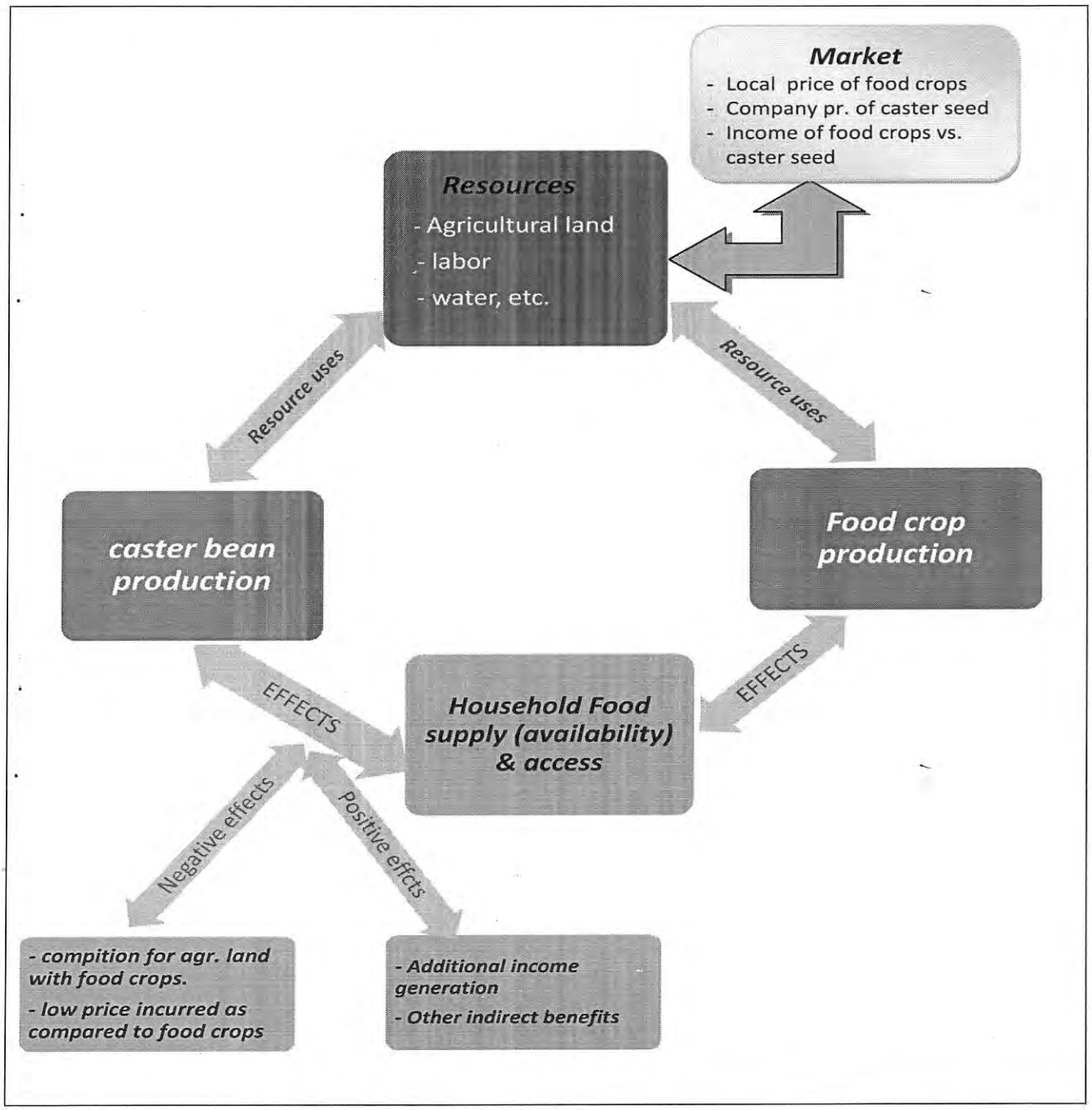
Under certain circumstances, cultivation of feedstocks for liquid biofuels may benefit rural poor people and smallholder farmers by increasing access to energy, farm incomes, and rural employment and, thus, have the potential to contribute to poverty reduction and rural development (UN-ECOSOC, 2008). However, concerns have been raised regarding the actual impact of expanding cultivation of biofuel feedstocks (ODI, 2007; UN-ECOSC, 2007; FAO, 2008; IFAD, 2008; Smolker et al., 2008; etc.).

Every investment has its own positive and negative impacts. This also holds true for the bio fuel investment, which include both merits and undesired consequences as well. Therefore, amid of equal weighing arguments on the negative and positive impacts of bio-fuel investment is vital. This is because the harms caused by bio-fuel investments are hard to ignore and tolerate especially in the developing economies (Zeacharias, 2008).

It is difficult to generalize about the impacts of biofuels on poor people because of the differing effects (ODI, 2007 & FAO, 2008). The level of positive or negative impact of biofuel investment on food security will depend on the scale and speed of change on land use practice, policy directions and technology; on the type of production system applied; on the structure of commodity and energy markets; and on policy choices in agriculture, energy, environment and trade (FAO, 2008).

One of the most discussed consequences of the growing demand for feedstock for biofuel production is the increase in prices of some food. There are a number of other reasons linked to this, but there is no doubt that biofuels are one of the main drivers. In most developing countries, this has implications for food security, especially the poor net food-consuming farming households, urban consumers and landless laborers (IFAD-Background paper, 2008; and Roundtable on Sustainable Biofuels, 2009).

Figure 2.1: Framework on the effect of caster bean production for biofuels on households' food availability and access in the study area.



Developed by the writer of this Thesis

CHAPTER THREE

DESCRIPTION OF THE STUDY AREA

3.1. Overview of Wolaita Zone

Wolaita is one of the thirteen zones and eight special *Weredas* of the Southern Nations, Nationalities and Peoples' Regional State (SNNPRS) in Ethiopia which is inhabited by 1,527,908 people (CSA, 2007). It is located between 6°51" and 7°35" North Longitude; and 37°46" and 38°1" East Latitude and at about 330 KMs south west of Addis Ababa. The name Wolaita represents both the people and area with a total area of 4,471.3 km² or 438,370 hectares (WDA, 2010). Out of the total cultivable land area of the zone, which is 232,867.12 ha, the cultivated land is 142,684.88 ha (61.3 %). 91,427 ha of total land area is covered by forest, 48, 082 ha (20.6%) is grazing land, 17, 022 ha irrigable, 3,113 ha irrigated and 31,710 ha is covered by other land uses (WDA, 2010). The recent administrational division of the zone is in to 12 *woredas* and 3 city administration (WZARD, 2010)

According to the SNNP Regional Statistical Abstract (2007, cited in WDA, 2010), the average population density of Wolaita is over 385 people per square kilo meter (ppkm²) making it one of the most densely populated areas in the country. Population density in some parts of the Zone is as high as 781 ppkm² in *Damot Gale Woreda*; and as low as 168 ppkm² in *Humbo Woreda* (WDA, 2010).

The major economic activities are agriculture (production of legumes, root crops and some cereals – predominantly maize), and livestock rearing. The source of food is 50 percent from subsistence agriculture, 40 per cent from the market and 10 percent from animal products. However, the combination of low physical appearance of cattle and increasing livestock deaths has notably contributed to diminution ration of food from animal products (WZARD, 2010).

Wolaita is recognized for its fertility and population pressure, a combination that can deceive people who are not familiar with the area. Average fertility rate of the zone is 5.6. Land shortage (0.3 ha per house hold), environmental degradation due to natural and man-made factors, loss of

land fertility due to prolonged cultivation, are major problems among others that resulted in low agricultural productivity and yield which has led to prolonged food insecurity (WDA, 2010).

During times of food stress, the term "*green famine*" is often used to describe the situation. In recent years there has been a progressive increase in food insecure households and production per capita is said to be steadily diminishing. As a result, about 45% of the population suffers from food shortage. Per capita income is about $98 and 40% of the population is below poverty line (WDA, 2010).

In terms of agro ecology the area is 9% highland (*Dega*), 56% land with medium elevation (*Weinadega*) and 35% lowland (*Kolla*). The altitude ranges from the lowest at the foot of *Omo river valley* 501 MASL to highest 2,950 MASL at peak of Mount Damota. The average temperature varies from minimum 17^0c to maximum 31^0c. Regarding the land holding size of Wolaita 6% households have less than 0.1ha, 47.3% households own 0.1-0.5 ha of land, 27% households has 0.51-1.00ha, 5.3%hh has 1.01-2.00ha, and only 4.4% households has 2 ha and above (WZARD, 2010).

The main occupation of people is agriculture. Around 92% population lives in rural areas engaged in subsistence farming. More than 85% of the population lives in rural areas. Food consumption comes from 50% agriculture, 40% market purchase and 10% animal and food aids. Regarding the relative wealth status, 20% poorest of poor, 40% poor and the rest are medium and rich. The income source is dominantly agriculture, next petty trade and daily labor wage especially poor farmers' income is 70% from daily labor and more than 75% expenditure is for food consumption (WDA, 2010).

3.2 Description of Damot Woyde Woreda

3.2.1 Physical Characteristics

Damot woyde woreda is one of twelve woredas of Wolaita zone in Southern Nations, Nationalities and Peoples Region. Its capital, Bedessa town is 26 km far away from Soddo town, zone capital (which is 380km from Addis Ababa). This town is found at 7^0 58' N and $37^0$14' E based on the rough location estimation of Wolaita Zone Finance and Economic development (2008).

This woreda is bounded by Damot Gale woreda to the north-west, Deguna Fango woreda to the east and north-east, Soddo Zuria woreda to the west, Humbo woreda to the south and Lake Abaya to the south-east. It has 23 kebeles, of which, only one kebele is urban (Bedessa 01) whereas the rest 22 are rural kebeles (Woreda ARD office, 2010).

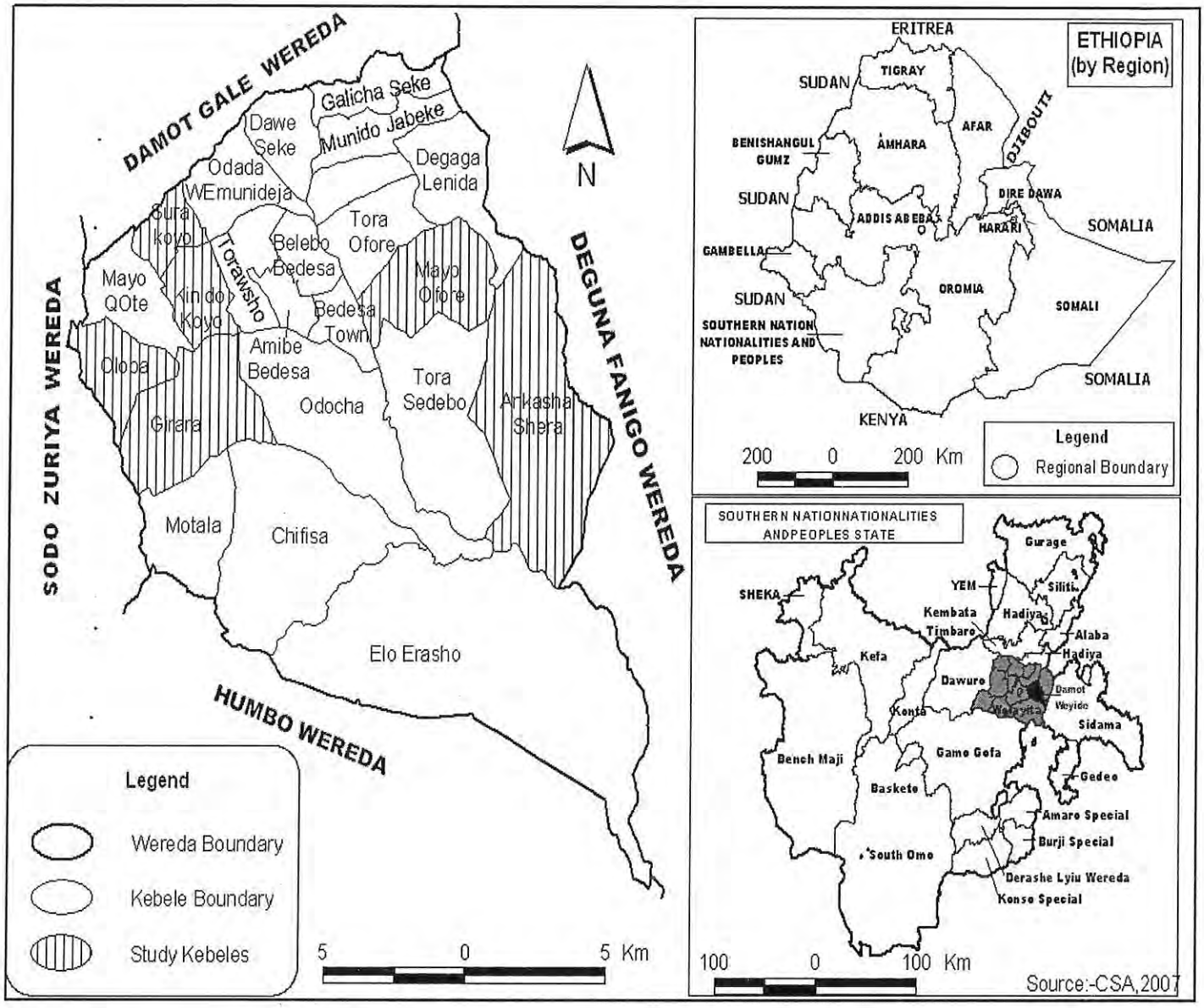
As far the size of the area is concerned, the total area of the woreda is 26,550 hectare. The total area of the woreda is classified as: 8,163ha. (31%) is cultivated land; 4,380 grazing land (16%) 3,000 ha. (11%) cultivable land; 2,228 (8%) forest and bush land; 2,417 (9%) is barren land. On the other hand, the total irrigable land in the woreda by hectare is 5,126. Out of this figure, 2,408 hectare is currently irrigated (Woreda ARD office, 2010).

With regard to agro-ecological zones, 65%, 20% and 15% of the woreda area is *Kolla* (500m-1500m MASL), *Woina degga* (1500m-2500m MASL) and *Degga* (2500m- 3500m MASL) (Zone FED, 2008). Temperatures are moderate throughout the year with a min. and max. annual temperature is range between 16^0c to 30^0c and has average annual rain fall distribution between 700mm in drier areas to 1300mm in wetter areas (G/Medhine & Yasin, 2008).

The woreda has bimodal rainfall, with maximum rainfall occurring in the months of April and July. The two rainy seasons are locally called *gaba* (from February to May) and *silla* (from June to September). Eucalyptus trees dominate the vegetation cover in the area, but there are several other economically important indigenous tree species. The woreda is also crossed by perennial rivers such as the Cherake, Bedessa, Bilate, Gilo and Bisare. There are also plenty of seasonal rivers with very limited irrigation practices mainly on river Bilate and some minor irrigation

schems like Gilo-Bisare irrigation development project (Woreda ARD office, 2010).

Figure 3.1: Location map of the study area



Source: Wolaita Zone Finance Economic Development Office, 2010

3.2.2 Demographic and Socio-Economic Characteristics

a) Demographic characteristics

In describing the basic demographic characteristics of the woreda, 96,299 people are live in Damot woide woreda; of these, 47,143 are male and 49,156 are female, and 5,301 people live in urban area whereas 90,998 people live in rural area (CSA, 2007). The population density of the woreda is 452 people per sq. km. (WZFED, 2008).

As far as the population age structure of the woreda is concerned, children in the age group of 0 – 14 are 5,1895 covering 46% of the total population number of the woreda. On the other hand, the adolescent age group (10 -19) in this woreda are 31,632 that cover 28% of the total population. The youth age group (15 -24) of the woreda 23,302, which is 20% of the total population (WZFED, 2008).

The labor force of the woreda (15 -64) is 58,762, this covers 52% of the total population. Women in the reproductive ages are 27,692 in number. This number covers around 56% from the total female population. The old age population (>65) of the woreda is 1,914, which covers only 1.7% of the total population (WZFED, 2008).

b) Socio-economic characteristics

Household distribution by land holding size

As to the woreda ARD office (2010), the total number of households in the woreda is 19,211. From the total households, 14,878 households are headed by male whereas female headed households in the woreda are 4,333. On the other hand, the average land holding size of the rural households in Damot Woide Woreda is 0.5 hectare. The details in the average land holding size indicate that 11,530 (60%) of the households in the woreda possess land below 0.5 hectare; 1,522 (8%) of the households in the woreda possess agricultural land 0.5 to 1 hectare; and 1,586 (9%) of the households possess agricultural land 1 to 5 hectares (Woreda ARD office, 2010).

Agriculture

The main production season of the woreda runs from March to November, beginning with the *belg* rains and continuing into the *kremt*. The main crops are maize, haricot bean, sweet potatoes

and Teff, which are harvested from June to November. Small amounts of other root crops (taro, yams, cassava, and Irish potatoes), wheat and sorghum are also grown in the area. Maize and beans are intercropped, while sweet potatoes and teff are grown in single stands. A second cycle of crops often planted as soon as the previous crop is harvested. Cash income is obtained from the sale of teff, coffee, maize and root crops. Seasonal food shortages occur from February to June in most years, and from November to June in a bad year. Second season sweet potatoes (harvested from March-May) play a key role in determining the severity of these seasonal food shortages and a failure of second season sweet potatoes is a key indicator of impeding crisis (Woreda ARD office, 2010).

Land fertility is declining in the woreda for two reasons; there is no fallowing of land and there is only limited use of animal manure (mainly in the home garden, on inset, coffee and garden vegetables in the wet season). The result is an increasing dependence on expensive chemical fertilizers (DAP and urea), mainly for maize and teff. Fertilizers are available on credit from the Ministry of Agriculture (based upon a one third down-payment in cash) or for cash on the open market (Woreda ARD office, 2010).

Grazing land is in extremely short supply, and cattle are raised using a 'zero-grazing' system. Under this system, animals are kept around the house and village and are given supplementary food in the form of crop residues and weeds. These residues include the stems and leaves of maize, teff, wheat, sweet potatoes and inset. There is also an active market in grass (fodder) during the rainy season, collected mainly by poorer households from community land, river valleys and eucalyptus tree plantations (WZFED, 2008).

Cattle ownership is highly skewed, and over half of households own no cattle at all. Households without livestock often care for cattle belonging to better off households according to a loan arrangement known locally as *yerbee*. Under this arrangement, the poor feed and care for the animal in return for a share of milk production (in the case of a milking animal) or a share in the sale price. An additional benefit for the poor is access to manure from the *yerbee* animal (Woreda ARD office, 2010).

Income and expenditure

Households of the woreda obtain most of their cash income from crop sales, livestock and livestock product sales, and, in the case of very poor and poor households, casual employment. The opportunities for casual employment include local agricultural work, local urban work and migratory work to places such as Awash and Metahara (where there are state farms), Alaba and Arba Minch (where cash crops dominate), and Siraro (where mining is a possible cash income source) (SSNPR Livelihood Report, 2005).

As to the expenditure pattern assessment of households in the woreda for the period July 2003 – June 2004, the most obvious difference between the wealth groups is the percentage of expenditure on staple food. Roughly 70% of very poor income went towards staple food, compared with just over half of poor income and 20% or less of middle and better off income. Expenditure on a number of other items increased significantly with wealth, most notably expenditure on inputs (mainly fertilizer and improved seeds), on social services (which includes schooling and medicine), and on clothes (SSNPR Livelihood Report, 2005).

Education

As the data obtained from Wolaita zone Finance and Economic Development Office (2008), 80% percent of school age children in the woreda are enrolled in school from grade 1 – 12. In short, the total gross enrolment rate of the woreda in education is 80%. The woreda also has 3 kindergarten school; 16 primary first-cycle (1 – 4) school; 11 primary second-cycle (5 – 8) school; and 1 secondary school. All the stated schools are built and owned by the government there are no schools that are either built or run by private or NGOs. The major reason for drop outs of students in the woreda is mainly related to draught and for girls; early marriage is also other important reason for school drop outs (WZFED, 2008).

Health service

Malaria, Intestinal parasites, Upper respiratory tract infection and diseases related to mal-nutrition are the major types of diseases in the woreda. As to the total health coverage of the woreda is concerned, it was 50% in 2008. Whereas, the family planning coverage of the woreda in 2008 is 73% (WZFED, 2008).On the other hand, according to the information of the zone

finance and economic development office, normal water sources for human and livestock use are springs, deep and shallow wells and rivers. Some springs are developed and the shallow and deep wells are mostly constructed by either the government or NGOs who also contribute to maintenance and repair.

3.3 Overview of Global Energy Ethiopia Inc

Global Energy Ethiopia is an Ethiopian-Belgian company performing agro-industry projects in Ethiopia by establishing biofuel projects in SNNP region through community farming. The company has started its project in 2007/08 Ethiopian fiscal year in some selected woredas of Wolaita and Gamo-Gofa zones (GEE, 2009).

Global Energy Ethiopia Company is producing caster bean in the study area based on community farming. According to the company (GEE, 2009), community farming in the area is based on cooperation between the farmers and the company, and cooperation with administration at all levels. The company also claims that it is using the existing community structures for the investment project.

The introduction of caster bean production to the community by the company is that caster is an additional crop grown for cash. This means that farmers are expected to contribute a small amount of land (not more than 25%) out of the total land. Based on the assumption of the company, farmers will benefit from the production of caster bean in that: it is an introduction of new source of income; is also good for crop rotation; the introduction of new agricultural practices through training of farmers; it is a draught resistant plant; and creating new employment opportunity.

Generally there are four major functions of the company in the community farming system of caster bean production. First, the company supplies the farmers with caster seeds, fertilizers, sprayers, chemicals and any other facilities that need to the growth of caster bean. Secondly, the company gives trainings on how to grow caster bean regarding sawing, weeding, harvesting, etc. Thirdly, the company monitors the plots during the whole season. Fourthly, the company will buy the caster yield from the farmers (GEE, 2009).

During the first production year the company did not allow intercropping of caster bean with other crops but in the second year it was permitted to intercrop caster. Accordingly, allowed crop

types to intercrop with caster bean are haricot bean, ground nuts, peas, onion and watermelon. The company manager was also responded that the caster seeds are imported from china until now but it will soon start to use the Ethiopian variety from the seed distribution centers of Awash Melkasa and Wendo Genet.

As to the interview response of the company manager of Global Energy Ethiopia, when the company arrived to Ethiopia, it has only 30% (out of 100 Birr million initial investment capital) of its investment capital and the rest is going to be obtained from the Development Bank of Ethiopia. The delay in the supply of credit on time from the bank was one of the major challenges during the initial period of the project. Together with the world's financial crisis, the company was also late in paying the farmers' payments.

Another big challenges of the company comes from the dropping of caster seed by 50% at the international market (since the company totally sells caster bean at the international market) and at the same time, the demand of farmers to increase the amount of money for selling per kilogram (as it was observed from field survey, the company was forced to increase caster from 1 Birr/kg to 1.80 birr/kg). And, as to the company, while thousands of other similar companies were shut down due the financial crisis, the company still exists (GEE, 2009).

CHAPTER FOUR

RESULTS AND DISCUSSION

The following results and discussion of this study are focused generally in the assessment of the effects of caster bean production for biofuels on food security (availability and access), which is through the contract agreement between the farmers in the study area and the company of Global Energy Ethiopia Inc. Besides elaborating the basic demographic and socio- economic characteristics of the sample respondents, this chapter has two main bodies. The first is information related to food availability and access of the households. This gives background about the conditions of households in relation to food availability and access. Secondly, the paper try to link the information of food availability and access to the caster bean production process of the households so as to assess the effects of the production of caster bean on food availability and access from the perspective of major food crops production.

4.1 Demographic and socio-economic characteristics of the respondents

4.1.1 Sex of sample households

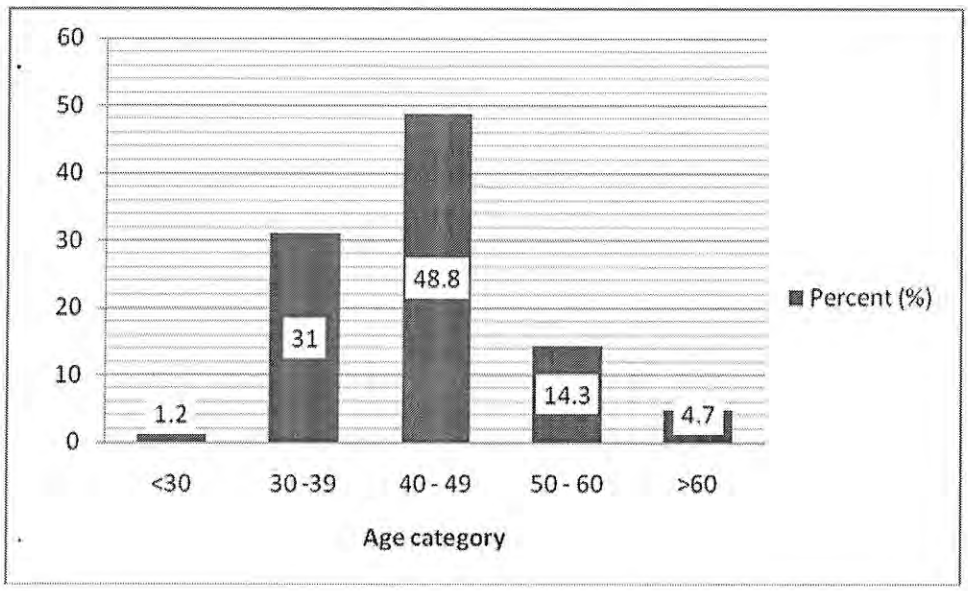
The sex composition of sample respondents is dominated by male-headed households. It was only one female-headed household included in the sample. The other female-headed households were excluded because they are not target groups of the study since they did not plant caster bean for consecutive two years. Accordingly, only 1.2% of the respondents are female-headed households. This case might fit with the idea of Rossi and Lambrou (2008) which says: "Biofuels production might exacerbate inequalities, contributing to the socio-economic marginalization of women and female-headed households and threatening their livelihoods, with negative implications in particular for their food security".

As to the observation during field survey on the other hand, most of male-headed households sent their wives for taking seed and fertilizers to the company's seed and fertilizer distribution centers. As to the interview why they came, most of the wives replied two answers. The first one is their husband is going to work on farm (since the time of field observation was sawing season) so that he can not come. Whereas the second reply was their husband is going to travel to adjacent town

that morning. This by itself might bring effect on information gap on farming practice related to caster production.

4.1.2 Age composition of the household-heads

Figure 4.1: Age Composition of Sample households



Source: Household Survey, 2010

Figure4.1 illustrates the age composition of sample respondents in the study area. The age of the household heads range between 28 and 78. The average age is 43 and 94% percent of the respondents are between the ages of 30 to 59 years. This shows that most of the respondents are found in middle age, which is economically active age, especially for agricultural practices that need human labor and it is also the crucial age for the improvement of their livelihoods in general.

4.1.3 Marital status and religious background of the respondents

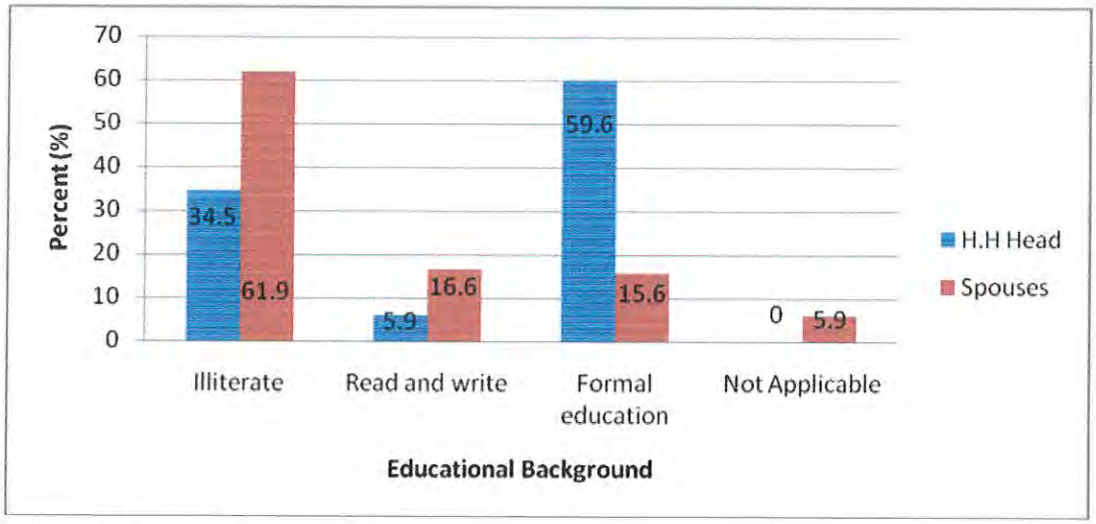
With regard to marital status, most of the respondents (90.4%) are married. The rest 6% and 3.6% of the respondents are widowed and single, respectively. This might be because most respondents are found in middle age (30 - 59), in which marriage is generally expected from the social perspective. On the other hand, 72.6% of the respondents are Protestant Christians, 26.2% are Orthodox Christians and only one (1.2%) respondent is a catholic Christian.

4.1.4 Educational background

As to fig.4.2, the educational background of household heads is relatively better than their spouses. Majority (61.9%) of the spouses are illiterate whereas more than half (59.5%) of household heads were engaged in formal education (at least go to school). On the other hand, the information from the respondents on the specific educational background for household heads that had formal education indicate that; 92% of them were below grade nine. This shows that most of the household heads dropped before high school education. As far as the formal education background of the spouses is concerned, only 15.4% of them were involved in formal schooling. Of these, 84.6% dropped out before grade seven. This situation had its own influence on inequalities variations in income and other decision making aspects between the household heads and their spouses.

On the other hand, majority of the household heads (59.6%) had formal schooling background. This educational background of household heads might be the reason that could be applicable for many respondents about their acceptance of new technologies or ideas (caster production).

Figure 4.2: Educational background of household heads and their spouses



Source: Household survey, 2010

4.1.5 Family-related information of households

This sub topic is based on details about total household number (including household head), age composition of children, the size of children and general sex composition of the households. These details might enable us to understand the general background of the households' family members in terms of their basic demographic characters.

With regard to the total number of the household including household head, the average number of households is 6.5 with minimum 2 and maximum 12. In addition to this, 67.8% of the households have a household size with in the range of five to nine. The size (number) of children per household on the other hand, varies from households with no children at home to ten children (maximum size is mostly related to household heads having two or more wives). Majority (60.7%) of the households has numbers of children from 4 to 7.

As far as the age composition of children is concerned, 52.4% of children in the households are found with in the age range of 11 – 18 years whereas 36.9% of them are between the ages of 6 - 10 years, which is making 89.3% together. The age category of these groups (between 6 and 18) show that majority of children in the household are at their schooling age and this might had influence on the households' expenditure structure. What even more is, the age category of 11-18 years is where most of children are found above seventh grade, and for those who learn in high schools, it is expected to go to nearby towns where high schools are found. This again might incur the households with other major additional costs.

Additional information concerning the demographic characteristics of households which is gathered by the household survey was the sex composition of the households. For 46.4% of the households, the number of male members of the household is greater than the number of females; whereas in 34.5% of the respondent households, the number of the female members of the households is greater than the male members.

Table 4.1: Family-related information of the households

Characteristics	N	Percent	Total	
			N	%
H.H. Size (including head)				
2 – 4	19	22.6	19	22.6
5 -9	57	67.8	57	67.8
10 – 12	8	9.6	8	9.6
Total	***84***	***100***	***84***	***100***
Age composition of children				
1 – 5	3	3.6	3	3.6
6 – 10	31	36.9	31	36.9
- 18	44	52.4	44	52.4
>18	2	2.4	2	2.4
Households without children	4	4.7	4	4.7
Total	***84***	***100***	***84***	***100***
Number of children/H.H.*				
1 -3	21	25	21	25
4 - 7	51	60.7	51	60.7
8 - 10	8	9.6	8	9.6
H.H.* with out children	4	4.7	4	4.7
Total	***84***	***100***	***84***	***100***
Sex composition of H.H.*				
H.H with male no. is greater than female members.	39	46.4	39	46.4
H.H. with female no. is greater than male members.	29	34.5	29	34.5
Total	***68***	***80.9***	***68***	***80.9***

Source: Household survey, 2010 ***NB***: * - H.H. refers to 'households'

4.1.6 Assets of the households

As it was discussed in the literature part of this paper, there are at least five groups of assets identified in the rural households. However, the selected household assets for the assessment in

this paper are land and livestock assets. This is because of two reasons. In the first case, land is the most important asset that determines the production system in the rural households and the relationship between the crop and caster bean production (in terms of food availability). This is because there is no landless household or household member that was selected by the company to produce caster. So land entitlement is the major criteria for selection of households by the company. Secondly, livestock production also needs land (for grazing or feed production). This makes it to compete with caster production. This does not to mean other assets (like farm and social assets) are not necessary to be assessed. But it will be time consuming compared to its use to assess assets that have indirect relationship with land.

i) Land assets

The most important details considered in relation to land are: total area of land entitled by the household, plot size for food and non food crops, plot size only for food crop production and the proportion or percent of plot size for food crop production from the total entitled land. It is because this gives background to the major asset that determine production in the zone in general and in the study area in particular (WDA, 2003). The comparison for the land asset details will be presented as follows:

Table 4.2: Land asset details based on entitlement and use

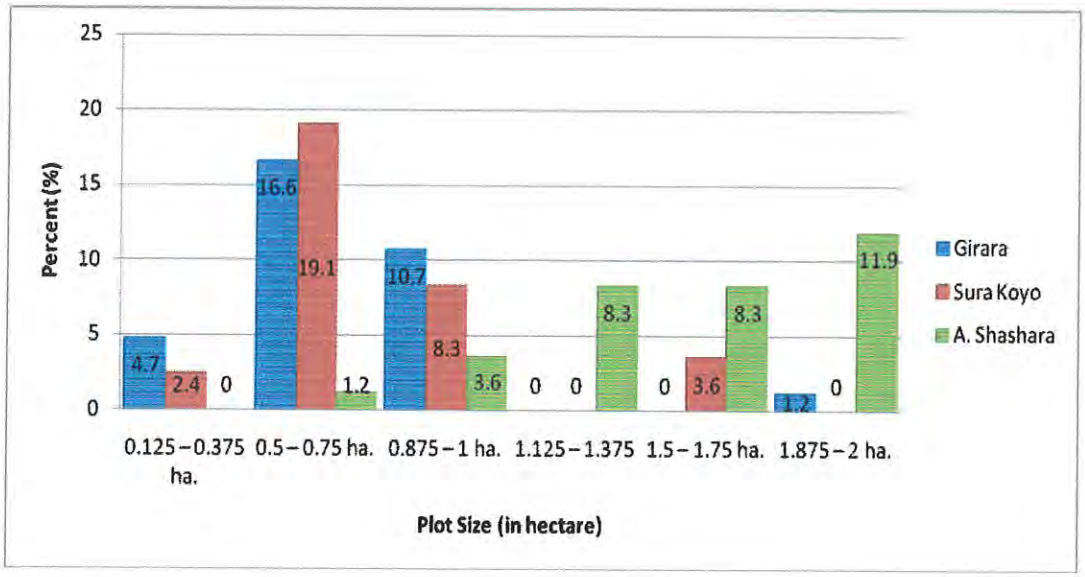
Plot size category	**Tot. entitled plot**		**Plot for all crop types**		**Plot for food crop only**	
	N	**%**	**N**	**%**	**N**	**%**
0.125 – 0.375 ha.	6	7.1	15	17.7	19	22.7
0.5 – 0.75 ha.	31	36.9	30	35.7	32	38.1
0.875 – 1 ha.	19	22.7	12	14.4	13	15.4
1.125 – 1.375	7	8.3	18	21.4	12	14.4
1.5 – 1.75 ha.	10	11.9	6	7.2	6	7.1
1.875 – 2 ha.	11	13.1	3	3.6	2	2.3

Source: Household survey, 2010

Table4.2 illustrates the land assets based on entitlement and use. As to the illustration, 66% of the households had entitled agricultural land below 1 hectare and majority of the respondents (60%) have the total land entitlement between 0.5 and 1ha. The plot size then; getting to decline in its size for allocating in to various purposes. This fact is confirmed by the comparisons made between the total entitled plot size with plots of land allocated for various purposes (for cash crops and food crops, fore example). Accordingly, 68% of the respondents used the plot size below 1 hectare for the production of both food and cash crops. Whereas, 76% of the sample households responded that they allocated below 1 hectare of plot size for the production of food crops. These figures might indicate that not all portions of land are directly used for planting food crops, some fraction of the land are used to other purposes (grazing, tree planting, cash crop, etc).

The land variation in terms of total entitlement also differs when it is observed by classifying the households in to clusters. Accordingly, 75% of the respondents in Sura koyo cluster entitled the total agricultural land between 0.5 and 1 hectare whereas 85.7% of the respondents in Girara cluster had total land entitlement between 0.5 and 1 hectare. Eventhuogh the propotion of household with totalland entitlement below 1 hectare is higher in the cluster of Girara, the above two clusters (Girara and Sura koyo) had relatively closer in terms of total land entitlement as compared to the cluster of Anka Shashara. On the other hand, majority of the respondents (85.7%) in the cluster of Anka Shashara had total land entitlement between 1.125 and 2 hectares. This difference might be as a result of difference in population density among the clusters. Because Anka Shsharan cluster is relatively had sparse population density as compared to the two clusters.

Figure 4.3: Crosstab of total entitled land by clusters

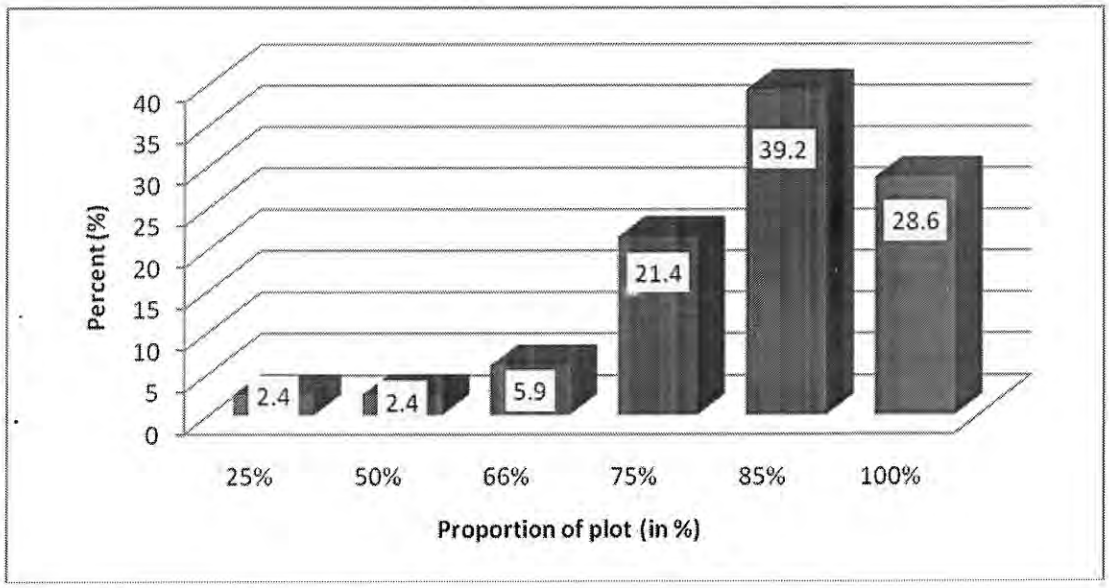


Source: Household Survey, 2010

Interviews made with key informants during field survey also confirm that land shortage is not the issue in Anka Shashara cluster. According to the interviewees, rain fall and land productivity are major issues in determining agricultural production and productivity of this cluster. They also responded that the amount of the production obtained from the agricultural land is low when it is compared to other clusters but as the result of the availability of relatively larger agricultural land for cultivation, the quantity of the production for this cluster is relatively higher (especially for maize and sorghum) for the production season with abundant rainfall. In addition to this, the interviewees were also responded that the effect of rain shortage on the households' food availability is severing as compared to other parts. Rainfall availability is one of the most important factors in determining any agricultural production and livelihood activities in the study area.

Further investigation on land assets was also made on the proportion of land allocated for food crops from the total plot size and it is elaborated in percent. As can be shown in Figure 4.4, large number (39.2%) of the respondents replied that they used 85% of their land for food crop production whereas, 28.5% of the sample households used the entire agricultural lands for food crop production only.

Figure 4.4: proportion of land for food crop from the total entitled land in percent



Source: Household Survey, 2010

ii) Livestock assets

Table 4.3 indicates the general category of households based on the number of each animals raised by them as compared to four years ago and now. Accordingly, animals raised by the households in the study area are oxen, cows, sheep, goats, chicken, bee-hives and donkeys. The later two (bee-keeping and donkeys) are not widely possessed by most of the households either four years ago or in the current year. In addition to this, the table also shows the trend in livestock assets (whether increased or decreased). The general figure does not show there is a change either to decrease or increase four years ago and in the current year. This fact shows that it is difficult to associate the trend or change in the livestock possession of the households with the production of castor bean.

Table 4.3: Livestock asset information of households four years ago and now

Animal	*No. of animals four years ago*						*No. of animals in the current year*					
	0	1	2-5	6-10	11- 15	> 16	0	1	2-5	6-10	11- 15	> 16
oxen	22	32	29	1	0	0	21	42	20	1	0	0
cows	16	32	35	1	0	0	16	39	28	0	1	0
sheep	42	9	32	1	0	0	46	17	21	0	0	0
goats	62	2	18	2	0	0	62	6	14	2	0	0
chicken	31	1	29	22	1	0	31	2	30	17	2	0
Bee hives	80	0	3	1	0	0	79	2	1	2	0	0
Donkeys	74	10	0	0	0	0	79	5	0	0	0	0

Source: Household Survey, 2010

In addition to the above assessment, respondents were also asked whether their livestock number is increasing, decreasing or no change. Accordingly, 46.4% of the respondents replied that their livestock assets is decreasing whereas 35.7% of the households replied that their livestock asset is increasing and the rest of the respondents replied there is no change in their livestock possession. Additional questions were presented for the households who responded that their livestock asset was decreasing were also further asked the reasons for decrease in the number of livestock size. Accordingly, the main reasons forwarded by the households were: death of animals due to drought, sales of livestock for problems (excluding selling for food), sales of livestock for food, death of animals due to disease and unavailability of animal feed and grazing land. This fact also shows that no respondent has related the reduction in livestock possession with the production of caster bean. This response of the respondents might be due to the reason that most of the allocated land for the production of caster bean at present is previously occupied by food crop production rather than grazing lands (as we see later).

4.2 Household income, expenditure and food crop consumption

4.2.1 Livelihood strategies (income earning activities)

As it is already indicated in the literature review part of this paper, the concept and application of livelihoods analysis is used as a means to better understand the multidimensionality of poverty

and food insecurity at the community and household level. It was also indicated that livelihoods comprises activities required for a means of living. These activities are distinguished as: On-farm activities (income earned from crop and livestock production activities), Non-farm activities (non-agricultural wage and self employment income) and Off-farm activities (non-agricultural activities and agricultural wage labor).

Table 4.4: Major livelihood activities in terms of total involvement and ranks in each activity

Livelihood Activities	Total involvement		Rank of activities						
	No.	%	1st	2nd	3rd	4th	5th	6th	NA
On-Farm Activities									
Sales of food crop	81	96.4	66	13	2	-	-	-	3
Sales of cash crop	73	86.9	11	46	10	5	1	-	11
Sales of caster bean	*84*	*100*	-	-	*34*	*38*	*11*	*1*	-
Sales of livestock & home made milk & milk products	43	51.2	2	11	19	7	2	1	41
Sales of home produced honey	2	2.38	-	-	-	1	1	-	82
Non-Farm Activities									
Self-employment & casual labor (farming & non-farm.)	4	4.7	-	1	-	2	-	1	80
Food for work (PSNP or other programs)	25	29.7	2	5	6	6	5	1	59
Sales of own produced artisanal products	3	3.6	-	1	2	-	-	-	81
Off-Farm Activities									
Petty trading	20	23.8	-	6	7	3	4	-	64
Income from rental activities	4	4.7	-	-	1	1	1	1	80
Seasonal urban migration	0	0	-	-	-	-	-	-	84
Remittances (domestic & abroad)	0	0	-	-	-	-	-	-	84

Source: Household survey, 2010

As can be shown in Table4.4, except for seasonal migration to urban areas for work and remittances, all other livelihoods are applicable for all respondents even though their importance varies from household to household. Excluding selling of honey, on-farm activities are the major livelihood sources of the sample respondents in the study area because 83.6% of the respondents on average replied that they are engaged in this livelihood category.

Another important thing concerning the table is that; a sale of caster bean production is separated from sales of cash crop production. This helps to identify the contribution of caster bean production on the income of the respondent households. Accordingly, all the respondent households are getting income from selling of caster seed. But no respondent has replied sale of caster is either first or second rank from the household total income earning activities. This might indicate that the income obtained from sells of caster seeds is not significant compared to other income sources of the household.

The interviewed farmers also mentioned that income obtained from sales of caster bean is not the major source of their income. They said that it is 'incomparable' in terms of amount of income obtained from sales of food and cash crops. Even though it is highly variable, selling of livestock is also very important source of income. This is because caster bean production is less in terms of price and also in terms of yield per unit of land as compared to other crops grown in the study area (as we see later). But the major importance of income obtained from sales of caster is: the first thing, it diversified their income sources. The second thing, for the households that have no cash crops to sell and relatively small land, sales of caster is good source of income especially for covering minor and unexpected expenditures. In addition to this, the farmers had still other rationales that could be considered as 'indirect benefits' which is more influential than the 'direct benefit'; that is income earning in the context of the production system existing in the study area. As we see later these indirect factors, they are highly influential than the direct benefit of income earning in the decision of the households to continue to produce caster bean though the are not benefiting in terms of income.

Interviewed farmers' response also indicated that the diversity and type of livelihood strategy of each household is highly variable based on: seasons, type of agricultural production, age of children, family size and land size. For example, during harvesting season of food crops, the highest share of households' income is based on selling food crops whereas during the times of

holidays, the income they obtain from livestock selling become relatively higher than other income earning activities, etc.

As to the general trend of household income of the respondents for the last four years, the responses reveal that the income tends are highly variable among households. About 33.3% of the respondents responded that their income is decreasing, 38% of them replied 'sometimes increasing and sometimes decreasing', and 27.4% of them replied it increased in the last four years.

Finally, Respondents were also further asked to respond on the number of family members engaged in income earning activities. Then their response showed that only 19% of the household were dependent on the house hold head only. But in the rest (81%) of households, at least two members in the household were engaged in income earning activities. For our information, relatively larger number (37%) of the households replied that all adult members of the households were engaged in income earning activities.

4.2.2 Household expenditure

Household expenditure in this paper refers to all the costs spent by the households for their diversified needs that could be either in kind or in money. All these expenditures are also classified as food expenditure and non-food expenditure for the purpose of categorization and making contrasts among diversified expenditures of the households.

Accordingly, the households were asked to respond which expenditure category is the major expenditure in the household and majority of the respondents (79.8%) replied that food related expenditure is the major expenditure compared to non-food expenditure. This implies that food related costs are the main issue in the households' expenditure.

It was very hard to measure the specific amount of money spent in each cost by the sample households. But details obtained about the three major types of household expenditure (by rank) by asking the sample respondents. This might give the general background about the major expenditure items in terms of importance. Accordingly, starting from the most ranked household expenditure; six major households' expenditures were identified. These are: Food purchase, cost of children education, cost of agricultural inputs, cost of buying cloths, health cost and tax

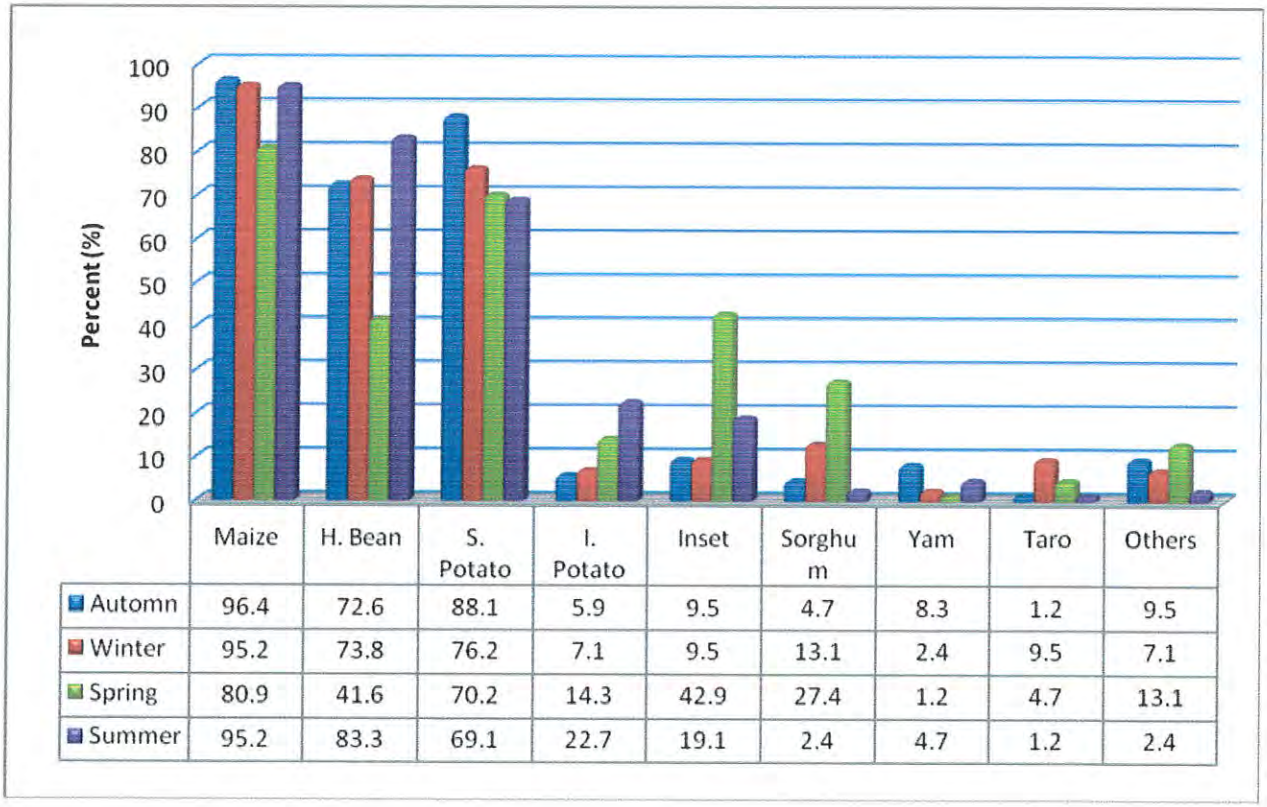
payment. Of these costs, food purchase is the most single important expenditure of most households; 72.5% of the respondents replied that food purchase cost is their first expenditure when compared to other household expenditures.

4.2.3 Household food crop consumption

There are several ways of measuring household food consumption. Most literatures recommend that it is better to use household calorie intake to measure household food consumption and consumption-related issues in food security. However, for the purpose of this study, analyzing the consumption pattern of major food crops consumed by the household is more convenient parameter since the target of this analysis is to see the effect of caster production on the production of major food crops consumed by the households.

Accordingly, the respondents were asked to reply on the three main crops they consumed (by importance) for each season. Their response will be presented in bar graph as follows:

Figure 4.5: Major food crops consumed by households in each season



	Maize	H. Bean	S. Potato	I. Potato	Inset	Sorghum	Yam	Taro	Others
Automn	96.4	72.6	88.1	5.9	9.5	4.7	8.3	1.2	9.5
Winter	95.2	73.8	76.2	7.1	9.5	13.1	2.4	9.5	7.1
Spring	80.9	41.6	70.2	14.3	42.9	27.4	1.2	4.7	13.1
Summer	95.2	83.3	69.1	22.7	19.1	2.4	4.7	1.2	2.4

Source: Household Survey, 2010

As it is shown in fig.4.5, the consumption pattern of the sample households is highly dependent on the first three (from left to right) crop types; namely: maize, haricot bean and sweet potato. These three crops are the most dominant food crops in which most diets in the households are made. The other crop types could be considered as 'minor crops' for consumption since they are rarely consumed.

As interviews with selected farmers and development workers in the study areas show, the major dietary system of the study area is based on maize because most food items are made from maize as a full ingredient or at least partly maize. In addition to this, this crop is also served in the food item almost constantly for most months in the year. This might also be related to that maize is the first preference for most of the households and most of the farm land cultivated areas are predominantly occupied by maize (as we see later).

Another interesting response from the interviewees was obtained on the consumption pattern of sweet potato. They call it in local language as 'the food of bad season' (*Minjjaa qumma)*. This name was given for this crop because, once it is ready for harvest (4-6 months based on agro-ecology of the area), the households could use it for relatively long period of time (up to one year) unless rainy season comes (rain could spoil the root). Dry season increases the amount of production; so that (as we see later) its yield is highly variable based on the number of months it stayed on the field. Because of this, most households, especially the poor, survive long dry seasons of winter and spring by consuming sweat potato as a major item in their diet.

Interviewees also indicated that the consumption of additional crops rather than maize, haricot bean and sweet potato and livestock products in the study area are highly linked with the wealth (economic) status of the households. The diets prepared in poor households are highly restricted to the above stated three crop items whereas relatively better-off households consume more diversified food items.

Households were also asked to tell their main sources for accessing food. Table4.5 is compiled based on their responses. The entire respondents replied that; at least part or all of their consumption is accessed predominantly through the means of own production. Besides own production, market purchase of food is also another important means of access to food next to own production. Interviewed farmers also indicated that the proportion of food consumption to be

covered by own production and through market purchases is variable based on seasons. All the households cover their food consumption through own production during harvest seasons and the proportion of consumption to be covered by own production getting to decline until the next harvest season. On the other hand, interviewees also replied that there is a general decline in the proportion of household food production and its importance on the contribution of household food consumption mainly due to climate change (decline, fluctuation and variation in precipitation) and shortage of agricultural land. Because of this, many households in the study area are becoming to depend on sources to access food such as: exchange of labor for food, working on others land for equal share and food aid.

Table 4.5: Major sources of households' food access

Food accessing sources	***Yes***		***No***	
	N	***%***	***N***	***%***
Own production	84	100	0	-
Market purchases	69	82.1	15	17.9
Gifts from relatives	5	5.9	79	94.1
Loans from merchants	6	7.1	78	92.9
Labor exchange for food	5	5.9	79	94.1
working on others land for equal share	45	53.6	39	46.4
Food aid	46	54.8	38	45.2

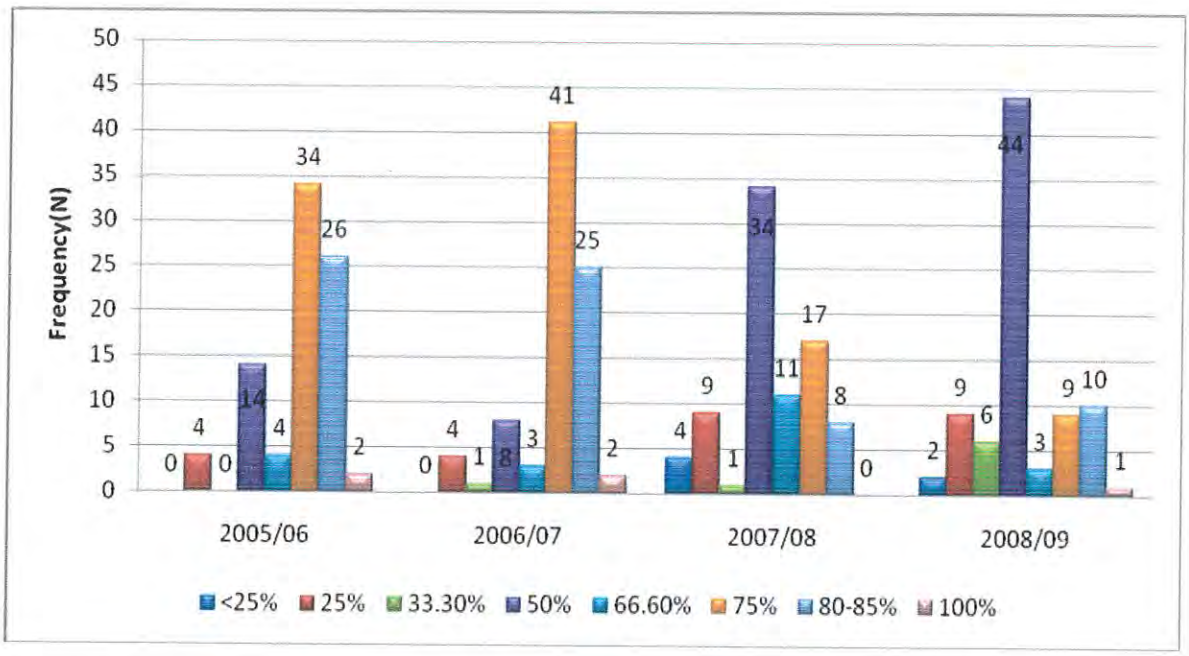
Source: Household survey, 2010

Households were also responded on how much portion of their own production contributes to household consumption in the last four years. As to the responses of the respondents, the proportion of consumption covered by own production has a decreasing trend so that it is to be covered through other sources rather than own production. It should be noted that the later two years, 2007/08 and 2008/9 (see fig. 4.6), are the years that the households produced caster bean.

As the graph (fig4.6) shows, nearly 75% of the sample households in average responded that the amount of household food consumption to be covered own production is between 75% and 85%. Whereas, the rest has to be covered through other means (predominantly market purchase). On

the other hand, in the year 2007/08, 74% of sample households covered between 50% and 75% of their consumption from own production. In 2008/9 this proportion further declined so that 72% of respondents replied that their own food crop production covered below 50% of the households' food consumption. This shows that there is a general decreasing trend in the proportion of the households food consumption to be covered through own production; that is household food self-sufficiency. This fact might show that together with other reasons, caster been production is aggravating the decline in the proportion of household food crop consumption to be covered through own food crop production (food self-sufficiency). This is because, in the later two consecutive years (2007/08 and 2008/09), the proportion of household food crop consumption to be covered by own production has declined among majority of respondent households and the indicated two consecutive years are accompanied with caster bean production.

Figure 4.6: Proportion of household consumption covered by own production in the last four years.



Source: Household survey, 2010

Furthermore, interviews with key informants also indicated the trend in the proportion to covered by own production is become worse in this year (2009/10). This is because most of the

households in the study area faced high amount of decline and even failure (in some households) in crop production. This condition was also acknowledged by the assessment unit from the Wolaita Zone Agriculture and Rural Development Office. The decreasing trend in production, especially related to rain failure is not a new phenomenon in the area. But no matter what the reason/reasons is/are, the result from the household survey revealed that there is a general decreasing trend of the proportion of food consumption covered by own production and this condition might lead to ask a critical question which was asked in the introduction of this paper; that is; can the households meet the demand of GEE on caster bean feed stock investment with out compromising food self-reliance? This question might be a question to be answered by various stakeholders.

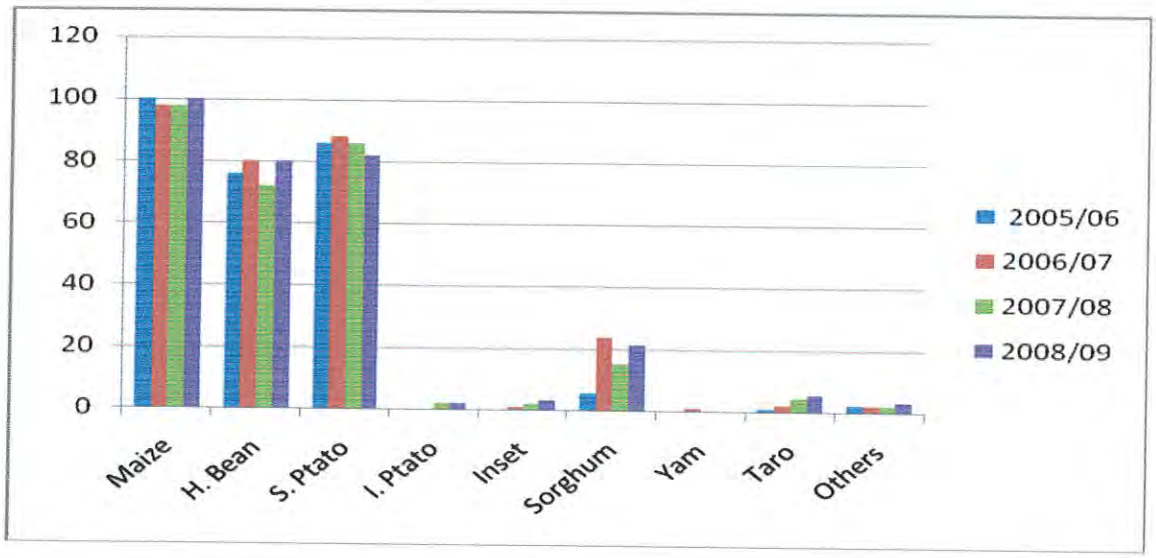
Finally, the responses also showed that the contribution of livestock products on food consumption is very low. 51% of the respondents' response was that they consume livestock products only in occasions; like holidays and ceremonies. 42% of the respondents also replied that they consume livestock products not more than once in a month. Only 7% of the respondents replied that they consume livestock products at least once a week; and milk and milk products cover the main consumption category of this kind.

4.3 Description of food Security Situation (Access & Availability) in the Area

4.3.1 Cropping Patterns of the Households

For poor rural households whose main-stay (livelihoods) are predominantly based on agriculture, agricultural production is a key issue for every success and improvements of the households. As it was indicated in the literature review, agriculture; especially the practice related to food production is one of the factors that contribute to the food availability (supply) in the rural households and also partly linked to their food security situation. Based on this ground, the study in this sub-topic analyzed conditions of cropping pattern for both major food and cash crops in the study area.

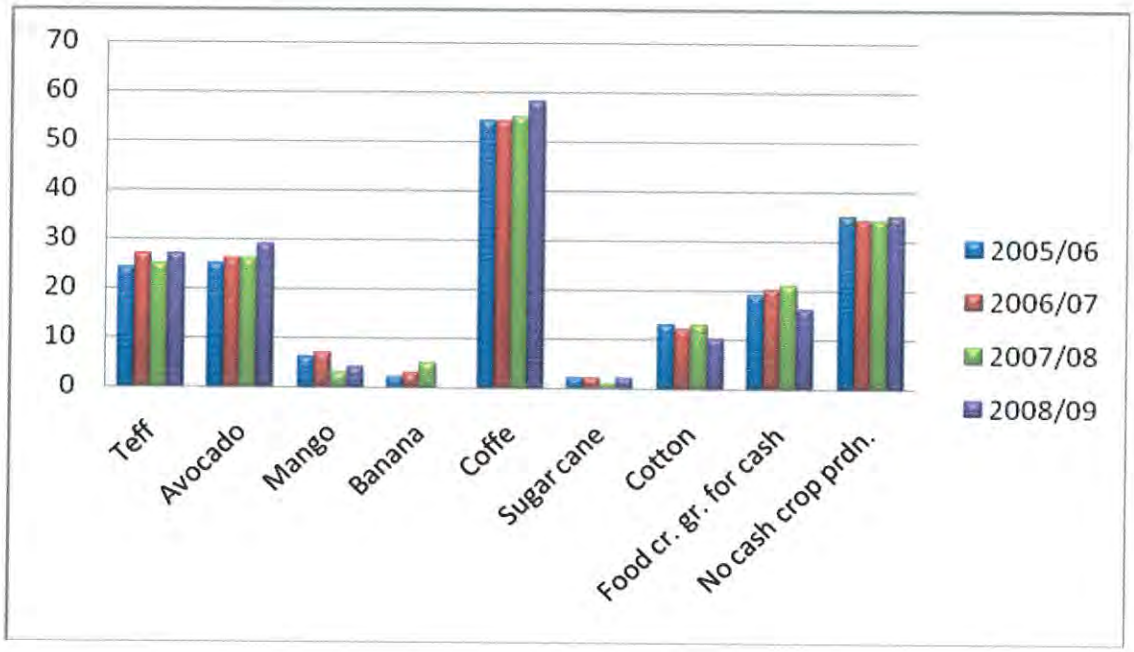
Figure 4.7: Major food crops grown by households in the last four years



Source: Household Survey, 2010

As can be shown from figure4.7, maize, haricot bean and sweet potato are the major food crops grown by the households in four consecutive years. In each column represented by a crop (x-axis), there are four bars that represent four consecutive years (y-axis). The first two bars from left to right (blue and red), represent the cropping pattern before caster production starts. The last two bars (green and violet) on the other hand, represents cropping pattern of households after caster production (2007/08 and 2008/09 fiscal years). If we see the general trend of cropping pattern in the study area by dividing four years in to the period before and after caster production, caster production has no effect in changing the pattern of major food crops. This means that there are other effects (climate, crop preferences by the household) in determining the selection major food crops.

4.8: *Major cash crops grown by the sample households in the study area*



Source: *Household Survey, 2010*

The other cropping pattern analyzed for this study was major cash crops grown by the households excluding caster production (will be analyzed independently later). Fig.4.8 shows the major cash crops grown by the households and households that do not possess any crops for cash. More than 40% (n=34) of the households replied that they did not grow any cash crops. This situation might be the factor that derived these households to grow castor as cash crop. The techniques to interpret the data in this graph are also the same with the fig 4.7. Accordingly, coffee, Teff, avocado, minor food crops grown for cash, cotton, mango, banana and sugar cane are the main crop varieties grown for cash. Teff is considered as cash crop in this study since the entire cash crop growing households produce for market not for home consumption. This is because Teff is not indigenous plant in the study area and culturally it is not included in people's dietary system. They produce and totally sell to the markets of adjacent towns where urban Teff consumer population is found. In addition to this, there are also food crops grown by the households entirely for the purpose of earning cash. The main ones are: wheat, pulses, yam, taro and cassava.

The households were also further asked to respond on the three most important food and cash crops for relatively long period of time. Maize, haricot bean and sweet potato still remained the major preferred food crops to plant by the households. Out of 84 respondents replied to this

answer, 80 (95%) responded that maize is their first rank food crop preferred for growing where as haricot and sweet potato together (interchangeably) cover the second (88%) and third (86%) preferences (in some households haricot bean stands second and in some third).

Finally, based on the results of aggregate parameters (consumption pattern, the trends in the cropping pattern and households preferences for cropping), the most dominant food crops that need to be analyzed in this paper are maize, haricot bean and sweet potato. In the coming sessions most of the analyses are based on these three food crops.

4.3.2 Household food deficits and coping strategies

Based on the responses from the households, the prevalence and nature of food shortage and the responses of food deficit households to food shortage are issues assessed in this sub-topic. The first question respondents asked to reply was whether they encountered food shortage or not in recent years. Most of the respondents (94%) then responded to this answer 'Yes'. Accordingly, respondents who replied 'No' (5%) were excluded from further questions that are related to the issue since they did not experience any form of food shortages.

Respondents who replied 'Yes' for the above question (n=79) to food shortage were further asked to reply on the form of food shortage (whether seasonal or through out the year) they encountered and the entire households asked to reply on this question were responded that they experienced seasonal food shortages. These respondents were also further asked to give their value judgments by nominating their judgments as 'high' 'medium' and 'low' based on the severity of food shortage in each season they faced. Sample respondents replied for this request and their responses are presented in table and graph as follows:

Table 4.6: food shortage condition by season (based on value judgment of respondents)

Seasons	**High**		**Medium**		**Low**		**Not Applicable**	
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Autumn	0	0	0	0	79	94	5	6
Winter	10	11.9	53	63.1	16	19	5	6
Spring	52	61.8	25	29.8	2	2.4	5	6
Summer	12	14.3	15	17.9	52	61.8	5	6

Source: Household Survey, 2010

Table 4.6 illustrates the evaluation of the respondents on their own house-level food shortage based on their experiences. As to the responses, the seasons that judged as 'low' occurrence of food shortage are autumn and summer. This is because almost the entire food crops are harvested (or consumed in the pre-harvest) and yields are not expected to be totally consumed during totally these seasons. Winter season distinguishes the poor households from better households. So, in households with poor harvest, food shortage will start in this season. However, majority (63%) households responded that this season is better to be 'medium' in terms of food shortage conditions. On the other hand, spring season is judged by the households as very difficult or 'bad' season in terms of the availability of food in the household. The harvest of crops be diminish in this season and most households are totally dependent on market purchases for food consumption and the food price will be very high and households begun to use other options (coping strategies) considered as out of the usual ways .

Respondents that replied 'Yes' for the experience of food shortage (n=79) were also asked to give their response about what are their mitigation measures (coping strategies) used during the time of food shortage. Accordingly they give the responses about their coping strategies and these responses are categorized in to three levels (level 1, level 2 and level 3) based on the severity of the response items. Level 1, for example, indicates the mitigation measures taken by sample households to relatively 'less sever' food shortage occurrences whereas level 3 refers to the responses relatively 'most sever' food shortage conditions.

It should be noted that the copping strategy items and their category based on severity was organized after pre-test of the household survey and preliminary interviews with farmers development workers (DAs) in the study area. Table4.8 then presents the coping strategies and their response by the households.

Table 4.7: Major coping strategies of the households *(n=79)*

Coping Strategies	n	%
Level 1		
Use of less preferred foods	53	67.0
Consumption from stocks	23	29.0
Consumption reduction	62	78.5
Purchasing from market	69	87.0
Level 2		
Selling labor in exchange to food or money	6	7.5
Borrowing grain from kin (friends or relative)	11	14.0
Borrowing grain or cash from merchants	8	10.0
Food aid (from government or NGOs)	44	55.5
Level 3		
Short term migration for wage in adjacent urban area	4	5.0
Selling of domestic assets (excluding land)	13	16.5
Selling livestock	46	58.0
Pledging land (for food)	10	12.5
Selling part of land (for food)	3	3.8

Source: Household Survey, 2010

As can be shown from Table4.7, the coping strategy response items are presented in three categories as level 1 level 2 and level 3. The transition of each household response from the first level to the next (both in items and categories) indicate the transition of the household coping mechanism experiences from the less sever to the more sever.

Accordingly, majority (66% average) of the households used the coping strategy items indicated in level 1 category. Whereas, the most widely selected coping strategy items outside level 1 are food aid and sells of livestock for purchasing food (58% and 55% respectively).

Interviews with farmers in relation to the above idea also indicate that food aid (either from the government or NGOs) is becoming one of the main sources of food for many households in the study area, especially during the failure of seasonal rainfall. Sells of livestock and purchasing

food crops (especially cereals) is also occurring in the drier parts of the study area where relatively larger number of livestock population is found. This is because having large number of livestock during the occurrence of rain shortage is not economical to feed them as interviewees say; so that they sell them (reserving only few, mainly two oxen for farming and a cow) and use the money mainly to purchase food crops.

On the other hand, as can be seen from the responses of households on the issue in general, all items listed in the coping strategy from 'the least sever' (uses of less preferred foods) to 'the most sever' (selling part of land due to food shortage) were selected by the sample households. In addition to this, an average 20% of the respondents responded that they used a coping mechanism items listed in level 3. These items are generally considered as 'crisis strategy mechanisms' by the people in the study area (as indicated in the literature part). This information might need the concern of all stakeholders involved in the production of caster bean because the households that are using the most sever coping strategies (level 3) are facing a crisis that might not be reversible by themselves and also asks relatively longer time to return the households to the previous situation even the humanitarian activity is also added.

4.3.3 Modified Household Food Insecurity Access Scale (HFIAS)

The frame on measurement format of HFIAS is found in the methodology part of the study but two indicators selected for this study. These are Household Food Insecurity Access ***Scale Score*** and Household Food Insecurity Access ***Prevalence.***

The HFIAS score in this study refers to a continuous measure of the degree of food insecurity (access) in the household in the past year. First, a HFIAS score *variable* is calculated for each household by summing the codes for each frequency-of-occurrence question. The maximum score for the respondent households is 26 (the largest score expected is 27, where household response to all nine frequency-of-occurrence questions was "often", coded with response code of 3); the minimum score is 0 (the household responded "no" to all occurrence questions, frequency-of-occurrence questions were skipped and subsequently coded as 0). On the other hand, the average score of the respondents is 11. In general, the higher the score, the more food insecurity (access) the household experienced. The lower the score, the less food insecurity (access) a household experienced.

The next indicator that was analyzed in this sub-topic is Household Food Insecurity Access Prevalence (HFIAP). It is a categorical indicator of Food Insecurity Status that can be used to report household food insecurity (access) prevalence and make geographic targeting decisions (Coates & et. al., 2007).

The HFIAP indicator categorizes households into four levels of household food insecurity (access): food secure, mild, moderately and severely food insecure. Households are categorized as increasingly food insecure as they respond affirmatively to more severe conditions and/or experience those conditions more frequently (see appendices).

A food secure household experiences none of the food insecurity (access) conditions, or just experiences worry, but rarely. A mildly food insecure (access) household worries about not having enough food sometimes or often, and/or is unable to eat preferred foods, and/or eats a more monotonous diet than desired and/or some foods considered undesirable, but only rarely. Because it does not cut back on quantity nor experience any of three most severe conditions (running out of food, going to bed hungry, or going a whole day and night without eating). A moderately food insecure household sacrifices quality more frequently, by eating a monotonous diet or undesirable foods sometimes or often, and/or has started to cut back on quantity by reducing the size of meals or number of meals, rarely or sometimes. But it does not experience any of the three most severe conditions. A severely food insecure household has graduated to cutting back on meal size or number of meals often, and/or experiences any of the three most severe conditions (running out of food, going to bed hungry, or going a whole day and night without eating), even as infrequently as rarely. In other words, any household that experiences one of these three conditions even once in the last year is considered severely food insecure.

Table 4.8: Household food security status of respondents in the last year (2008/9)

Food security status	**N**	**Percent**
Food secure	10	11.9
Mildly food insecure	16	19.0
Moderately food insecure	31	36.9
Severely food secure	27	32.1

Source: Household Survey, 2010

Table4.8 presents the household food security status of the respondents based on the measurement of HFIASP. Accordingly, nearly 70% of the respondents are categorized under either moderately food insecure or severely food insecure, which means they are found at the third and fourth rank in the household food security status during past year based on the modified HFIASP measurement. Whereas, for only 12% (f=10) of the respondents the results show that they are food secure. This measurement might give us some understanding about the general condition of the sample respondents about access to food

On the other hand, the modified HFIASP measurement is also applied by categorizing the households in to clusters (sites). Table4.9 presents this data.

Table 4.9*:* Food security status of respondents by clusters

Food security status	Girara		Sura koyo		A.Shashara		Total	
	N	%	N	%	N	%	N	%
Food secure	1	1.2	3	3.6	6	7.1	10	11.9
Mildly food insecure	3	3.6	6	7.1	7	8.3	16	19.1
Moderately food insecure	14	16.6	10	11.9	7	8.3	31	36.9
Severely food secure	10	11.9	9	10.7	8	9.6	27	32.1
Total	*28*	*33.3*	*28*	*33.3*	*28*	*33.3*	*84*	*100*

Source: Household Survey, 2010

Table 4.9 represents the food security status condition of the clustered households. Accordingly, Anka shashara cluster has relatively better status in terms of modified HFIASP measurement since relatively large number of the respondents in this cluster is labeled in food secure category. On the other hand, Girara cluster is relatively the worst because most (85%) of the respondents are categorized under either moderately food insecure or severely food insecure.

The company management (the general manager of Global Energy Ethiopia plc. and the woreda coordinator of the company) workers also further interviewed to reply on whether their company has information about food security background of their clients (farmers). However, they did not

have any records about the food security condition of the households. But they claim that they are working towards the improvement of the households in terms of food security by improving their income there by contributing to access to food.

4.4 Caster Bean production and food security (access and availability)

4.4.1 Information channel in the production of caster

The information channel in this sub-topic refers to the existing communication system (information exchange) starting from the first time the information disseminated to the area up to the present day information transfer pattern in the production system of caster. It also refers to the awareness (to what extent they are informed) of other stakeholders (such as woreda and zone Agriculture and Rural Development Office, Zone Trade and investment Office, the region Bureau of Water and Mineral Resource Development and the Federal Ministry of Energy and Mines).

Firstly, farmers were asked to respond on how they get information first to plant caster. The identified information sources based on the responses of households are: from the company workers, kebele meetings, from Development Workers of the government (DAs) and from relatives and neighbors. Out of these information sources, the majority of the responses (86%) show that the sample households got the first in formation to produce caster from the promotion of company workers and kebele meetings.

Figure 4.9: How in formation is disseminated to the households by the company workers

Source: Global Energy Ethiopia (Anka Shahara kebele, Wolaita zone), Apr.2009

As to figure4.9, the company workers call volunteer households for meetings (through *kebele* administration) and they promote about the company and give workshop on the production of caster bean. This activity of the company workers is continuous in the start of each year in each of their supervision sites. Then, volunteer households will come for registration and sign a contract for that specific year.

In addition to the responses of sample households from the household survey, several government offices staring from the kebele administration to the federal government offices were interviewed about to what extent the investment of the Global Energy Ethiopia on caster bean production in the area (the names of interviewees are not indicated as to the right of unonimousity). Accordingly, the respective kebele administrative leaders were responded that they well aware and informed about the activity of the company in their respective area. They had a frequent link especially with farm assistants (FAs) since they are selected from the local people. The kebele leaders are also replied that there is frequent community meeting with people and hear the voices of the people regarding the activity.

The woreda ARD office also responded that it communicating the company with through the woreda coordinator but the office have no information regarding the total number of number of farmers registered to produce caster the amount of caster produced each year and the total amount of income obtained from selling of caster. This might be due to the absence of caster from the list of agricultural forecast (pre and post-harvest) in the office's statistics gathering system.

When we come to the zone level, Wolaita zone ARD office and Wolaita zone Trade and investment office. As to the ARD office, the communication does almost not exist; the respondent said that the company is not sustainable mainly in terms of profit making (from both the perspectives of the company and the producing farmers) so it is a matter of only two or three years that the company to abandon the investment by it self (as far as it is not forcing the farmers to produce caster they will quit the contract by them selves). Whereas, the zone Trade and investment office replied that they know that there were two companies in the zone namely: Sun Biofuel Ethiopia and Global Energy Ethiopia in 2008 which asked them to give the investment lands and started to develop biofuels. However, both companies officially return the land after a year later. Since then, there are no relations between the companies and the office. So the office has no information concerning the biofuels investment in the zone.

The SNNP regional Water and Mineral resources Development office on its part, replied that it has very limited information about the company's activity which is through only through the information provided to them by the company. The Federal Biofuels development office in the Ministry of Mines and Energy also knows that the company has got the license and started caster production through community farming but without information beyond this.

4.4.2 Production of caster in relation to other agricultural production in the area

This sub-topic deals with the major production practices of caster in relation to other agricultural productions. The first response of the households was on the major reasons why they decided to plant caster. The question was open ended in order to include all the ideas of the respondents. After gathering the responses, all responses are categorized under six response categories. These are: income source (livelihood diversification); soil improvement; coping mechanism to destruction of crops by monkeys; coping mechanism for household crop wastage; its suitability for intercropping; to get fertilizer and use it for other crops.

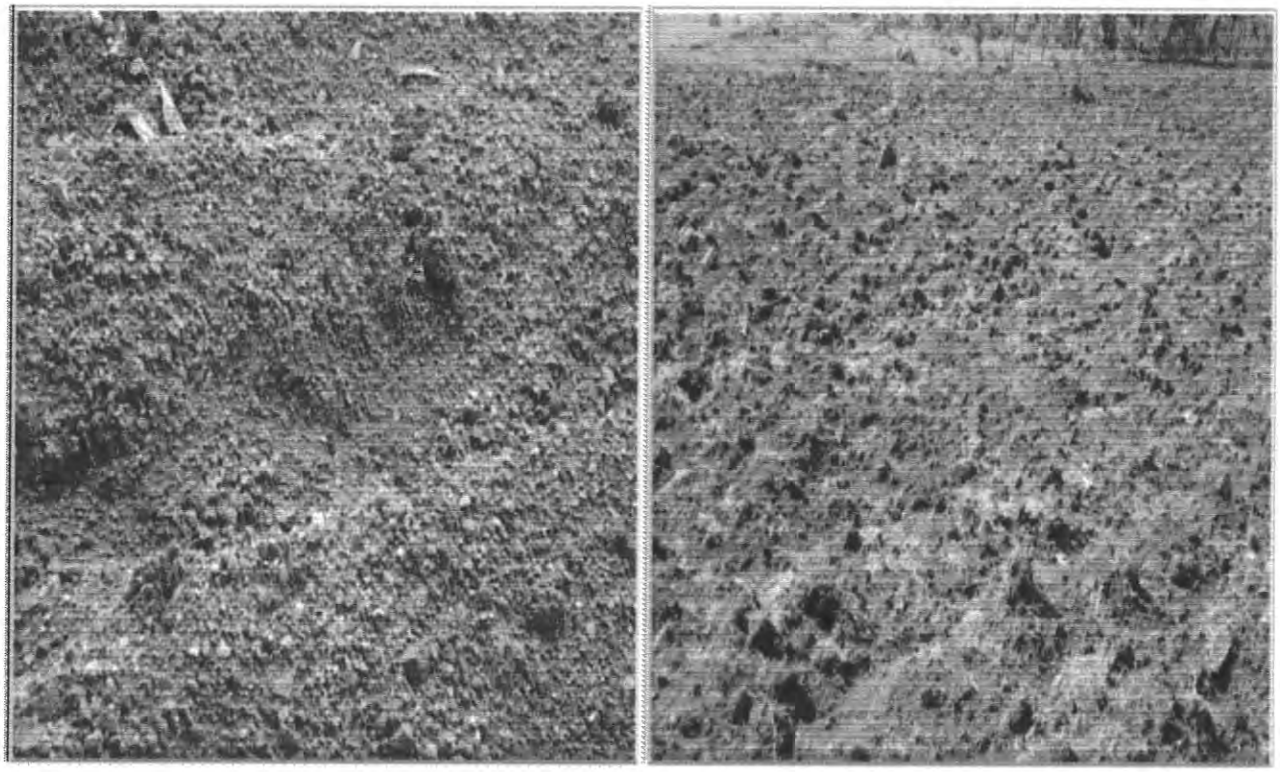
On the other hand, the production of caster bean in the area is not based on the land size. There is no criterion set by the company for the minimum land size to sign contract for planting caster. The only requirement for producing caster was having land. As can be shown from figure4.10, the land holdings of the households are highly variable from a very fragmented land (right) to relatively wider land holdings (left).

Figure 4.10: variation in land size among the households

Source: Household Survey, 2010

The land occupied for caster production is also not considering the fertility of land. Agricultural lands that are very productive and yield relatively high food crops previously were occupied by caster production now. On the other hand, the agricultural land characterized as very poor soils with coarse textures and unproductive is also found in the production of caster and this create a highly varied yields of caster production. Figure4.11 reveals this situation.

Figure 4.11: Varying agricultural lands prepared for planting caster seed



Source: Household Survey, 2010

Figure 4.11 shows agricultural lands prepared for planting caster seed. This picture was taken during field survey conducted in the study area. The picture in the left side was taken from Anka Shashara cluster whereas the picture in the right side was taken from kebele in the cluster of Sura koyo. As can be shown easily from the pictures presented in right and left in figure4.11, the soil structure in the left (which is from Anka shashara) is course and not rich in humus where as the picture in the right side show the plot with fine texture soil and rich in humus. It might be important if the company also consider this situation because when relatively fertile agricultural are taken for caster production there might be a reduction in the total supply of food crops to the local market. The effects might not be well felt but it can cause un-seen reduction in the total supply of food crops in the local market even though the respective household is benefiting from the income obtained from caster production.

Another condition related to caster production that is linked to food production (food supply) in the study area is the land use pattern before planting caster bean. Accordingly, the sample households were asked to respond on what purpose they were using the land before using it for caster production. 90% of the respondents were replied that they were using the land for producing food crops and the rest (6% and 4% respectively) were replied that they used non-cultivable and grazing lands for producing caster.

The respondents who replied the land that they are now using for caster production was previously used for food production; were also further asked to respond on what types of food crop category they were planting.

Table 4.10: Crop category most grown in the area before caster bean plantation

Crop category	**N**	**Percent**
Cereal crops	43	51.2
Root crops	3	3.6
Legumes	20	23.8
Fruits (for home use)	1	1.2
Cereals and root crops	8	9.5
Cereals and legumes	2	2.4
Not Applicable	7	8.3

Source: Household Survey, 2010

Table4.10 illustrates the food crop categories mostly grown in the area before the start of caster production. As to the responses, the most affected crop categories (75%) by the land occupation of caster are cereals and legumes. As it was shown previously the major food crops in these crop categories are maize and haricot beans. Root crops are the third to be affected by the land occupation. This might indicate that caster bean production is contributing to the reduction of land size for the major three crops in terms of consumption and production. This might affects the household food supply from own production (household food self-sufficiency) negatively.

On the other hand, the interviews with the households also indicated that it was in the second year that inter-cropping of caster with other crops, especially with legumes was permitted. As it is shown in figure4.12, in the first planting season, caster bean plantation was permitted only to plant it alone.

Figure4.12: When cater is planted alone on the previously food crop land

Source: Global Energy Ethiopia (Girara Kebele, Wolaita Zone), 2009

Respondents were also replied in the proportion of land (in percent) was under food crops and cash crop production for the last two years. In average (with in the two production years), majority of the respondents (86%) replied that they planted food crops on 65% - 80% of their total land. And majority (70%) of the respondents also replied that they planted caster seed on 15% - 25% out of their total land size. But there is one concern here that there are 30% respondents that replied they planted caster on 30% - 50% out of their total land. This is because as to the information from field workers of the company, the maximum portion of the land provided by the registered farmers is 25% (which is the maximum portion of the land permitted

by the company to grow caster). However, the above data (the respondents that planted caster on greater than 25% of the total land) is not known by the field workers (supervisors). This condition might seriously affect the household food supply condition when it is combined with other natural disasters (like draught).

On the other hand, respondents were also asked whether they planned to plant caster seeds or not this year. 29 (35%) sample households out of the total 84 households are replied that they refused to plant caster bean in this year where as the rest (65%) are planned to plant caster seeds. Additional questions are also presented for both groups that refused or planned to plant caster seeds why they either refused or planned to produce caster bean further. The major reasons for those who respond to plant caster seeds are that; they are getting benefits from selling and from incentives (like fertilizer which is given by the company). Whereas, majority of the households who refused to plant caster bean this year are responded that producing caster is not profitable compared to producing of other crops.

Further investigation is also made through interviews with the interviewees on why some farmers in the study area refused to plant caster bean. The responses indicate that the major complains on caster production is on the profit the households get out of it. The first thing, it occupies the land which is the major land that could also be used to produce other crops, especially food crops. The second thing is that it also needs careful attending of the plant to gain large yields. After making these things (provision of land and labor), the amount of production and the price accrued from selling of caster seed are not rewarding. This response of the households might imply that caster production might have negative effect on both household food supply and access to food on the households that were refused to produce caster bean further. But to get complete information on this issue, it is better to see the discussions in the coming sessions.

4.4.3 Comparing caster production with major food crops in terms of yield and income

Yield and income from caster and the major three crops (maize, haricot bean and sweat potato) are analyzed in this part of the study. Households are given questions that comparing caster in terms of yield per timad and the income accrued from caster and the three major food crops. Accordingly, their response on the yield (quintal per timad) and the (price per kilo) they obtained during two years of caster bean harvests (2008/09 and 2009/10) for caster and the major food

crops. The response they gave was analyzed the average of the responses is presented in table format as follows:

Table 4.11: Yield per timad and price per kilo (in Eth. Birr) for caster seed and major food crops

Year	*Cater Bean*		*Major food crops*					
			Maize		*H. Bean*		*S. Potato*	
	Yield	*Price*	*Yield*	*Price*	*Yield*	*Price*	*Yield*	*Price*
2000 E.C. (2008/09)	2.3	1	11.7	6	2.7	5.40	16	1.50
2001 E.C. (2009/10)	1.7	1	7.7	5.30	3.4	4.80	11	1.40

Source: Household Survey, 2010

The average results are presented to compare caster bean with major food crops in terms of yield and price in Table4.11. Accordingly, sweat potato has the highest yield in both years. On the other hand, maize is the second food crop in terms of yield whereas haricot bean is the least in the amount of yield. This might be this crop is intercropped with other crops most of the time. The response about the yield of sweet potato shows that the yield obtained from this crop is highly variable. This might be because; as interviews show the amount of yield obtained from sweat potato varies based on the months it stayed on the field.

Caster bean is the least of all the crop items indicated. Accordingly, this crop has relatively good yields in wetter kebeles of the study area which yields up to four quintals per timad and has lower yield in drier kebeles (up to two quintals per timad). One of the main complains with regard to the yield of caster bean by the respondents is that; on the field, caster bean seems highly productive but when it is dried up it has a large volume with very low weight compared to its proportion. They also said that when the take caster to the reception sites of the company filling the seed with sacks, it has a weight not more than 40 kilo. The workers of the company also approved this situation and replied that the average weight of the sack filled with caster is 35 kilo grams.

As far as the trend of the yield of food crops in the second harvesting year is concerned, there is a general decline in the yield obtained by the households except for haricot bean. The interviews

also augment this idea in that; there is a decline (and even crop failure in some households of drier kebeles) in the yield obtained from the harvests of the last year. This situation is even worth in the harvest of this year due to the general decreasing trend of rain.

The other comparison made between caster and the major food crops is in terms of the price in the local market. As to the response of the respondents, maize is sold in relatively higher prices in the local market. As to the interview to the petty traders of the study area, maize is one of the most valuable crops from the crops grown in the area. The crop prices are also high by the standards of many households in the area and together with the fear that the prices for food crops might increase in the near future, many households in the study area do not sell food crops as usual as previous times.

Haricot bean is also the crop with relatively higher price. But due to short supply as a result of low production per timad the sells of haricot bean for most seasons is at higher price from expected medium local market price. The responses obtained from interview indicate that haricot beans is not mainly produced for market sell rather for home consumption and it do not usually pass three months from the time of harvest to the end of consumption.

On the other hand, the price of sweet potato is not high as its yield. This situation makes sweat potato to be included in the usual (ordinary) food item. Beyond its benefit for food, it is also important for animal fattening. Maize, sorghum (in drier kebeles) and inset are also included in this category but sweat potato is highly preferred for animal fattening in the study area.

As to the price condition of caster, it has the lowest price of all the crops compared with it. As it is already indicated, the average holding of land for caster bean among all households is 0.75 timad. The average productivity of caster per timad is two quintals. Based on this information, we can estimate that the average yield for caster obtained by the households is less than two quintals (1.75 quintal) and this means the average respondents earned 175 birr from selling the harvest. This might be the main reason that the households complain they are not benefiting from caster bean production and even 35% of the respondents refused to plant caster seed in this year.

It should be noted that caster bean production in the study area is based on the full willing of farmers to produce but as it is shown in the above paragraph, both in terms of price and yield per unit of land, caster bean plant is lower than the main food crops. So, there is a mismatch between

the farmers' actual gain in terms of income and their expectation. This situation could be interesting and invites to assess whether there is other 'indirect' benefits other than income and the interviewed farmers replied what kind of indirect benefits they are getting (as we see later). So, indirect benefits might be the major factors that made the farmers to continue in producing caster bean though they are not getting direct benefits from the production.

With Regard to the above paragraph, the manager of the company responded to the interview that the existing price gap between caster and other food crops (since all crops are not necessarily consumed by the households, part of it or some crop category might be planted for market sale only) was expected to be covered by maximizing the production of caster per unit of land. This is because, if caster is properly treated, it could yield 40 to 60 quintals per hectare (though the existing average yield per hectare is not more than 2 quintals). But this plan of the company was unsuccessful due to two reasons. The first one is; as it is true for all crop types, the frequent decline in rain is decreasing the yield obtained from production of caster. Secondly, the poor attending practice of households for caster. He said that there is a tendency to view caster plant as if it is not one of their crops. They consider it as the crop of the company. The picture in figure4.13, which is obtained from the company, witnesses this condition. Caster plant is totally overwhelmed by weeds.

Figure 4.13: poor weeding by farmers resulted in production decline

Source: Field survey from Global Energy Ethiopia (Sura Koyo Kebele), 2009

The company manager also indicated that the major farmer-related problems for not getting high yield other than failure in frequent weeding are: not using the fertilizer provided by the company for caster as input, not totally planting (taking caster seed together with fertilizer and not planting the seed) and do not early announce during the occurrence of pests and diseases related to crops including caster.

4.4.4 Labor force participated in the production of caster and food crops

As to the responses of the sample households, the major thing in labor allocation for caster bean and food crop production is that the same labor force (even though the number decreases for labor allocated to caster production) that is producing food crop is also engaged to produce caster. One of the misconception by the farmers (as to the response of the interviewees) and also the wrong promotion done in the study area about caster bean is that caster bean plant needs easy work of land which is restricted tilling the land before planting and weeding only once during the seedling stage then expecting it to give yield. However this idea is really wrong. As to the interview of the company manager, if the caster plant is needed to give maximum production, this

plant needs at least as equal work for other food crops is done. The main thing here is the caster plant does not totally die or totally stop to give production when working on the caster land is poor. Rather, it highly declines in its amount of production. This situation (lack of effective work on the plot of caster plant) might be one of the major factor that affecting the amount of production of caster in the study area.

One of the good things that as to the field observation when the company doing and understood from interview is giving trainings for farmers during distributing seed and fertilizers and in the promotion time of each year. This might have a positive effect in developing the social capital of labor force in the study area.

As far as the labor force allocation is concerned, majority of the respondents (67%) replied that the labor engaged in the production of food is greater than the labor involved in the production of caster. Whereas, all the remaining households (33%) responded that the labor involved in food crop production is equal to the labor engaged in caster production (the same labor of the household produces both food crops and caster bean). It might be important to see that; after indicating land and price factors, the third link between food crops and caster production is labor.

4.4.5 Assessment of effects of caster production in the study area

The assessment is based on the production experiences of caster production by combining with food crops. This might give the background about whether the households experienced undesired effects in their production process.

Accordingly, the first question that they were asked to respond on whether the caster production brings negative effects on the major food crops they produced. 82% of the respondents replied that producing caster bean by itself has no negative effect on the production of food crops whereas only 18% are replied that they experienced negative effects. Most (88%) of the respondents those who replied caster production has negative effects on food production responded again for the questions that what kind of major negative effects did they experience are: it reduced household food production and it is highly labor demanding compared to food crops. This response of the households (the later one) is obtained from those households that are either relatively very small land holdings and households with large family size. This might indicate that relatively very small land holdings and large family size might contribute to create negative effects on food crop production when households with such characteristics produce caster bean.

In addition to the household survey, key farmer informants were also asked about the issue. As to the interviewees, they are conscious about the effects but it did not affect them until now. The major thing is that; the production of caster is based on their willing so that they might refuse the contract if they are affected. But they did not deny that it has negative effect on the contribution of income generation. However, the households still remained to produce caster bean due to other indirect acceptable contribution by the measures of the people in the study area.

The first in the indirect positive effect which is argued by almost interviewed farmers is the fertilizer they get from the company. It is known that the credit access fro fertilizers since recent years is discouraged. On the other hand, farmers might have no money to buy fertilizers during sawing season so that the sawing time is going to pass; and the company has on coercive power on farmers to force the registered farmers forcing to add the fertilizer farmers took on cater plant only. At this time, farmers have no option rather register and take caster seed and fertilizer and use fertilizer for other food crops and plant caster without fertilizer.

The second indirect positive effect is related to copping strategy for destruction of food crops by monkeys in sparsely populated drier kebeles of the study area. Here, land is not the issue of the households for production rather the availability of rain and the destruction of farm lands by monkeys. These households responded that with the recent expansion of human settlement in the area, the feeding ground of monkeys is highly treated so that these monkeys are even becoming violent and very tactful to come and destroy farms. The households then said that; there is only one plant (except un-edible trees) in the area that monkeys do not destroy: Caster bean plant.

Thirdly, the permission of intercropping caster bean, especially with haricot bean is another good thing replied by interviewees that encouraged them to produce caster bean. Haricot bean, even before the introduction of caster, it is usually grown by intercropping with other crops (like Irish potato, Maize and sorghum).

The last but not the least is some households also responded that caster bean also helpful for preventing crop wastages before harvest. The household members rather than the household head, especially spouse of the house hold, get considerable income by selling crops before they are harvested. But caster bean, except in the selling site to the company they are almost not sold in the local market (since every body could get caster seed from the wild caster plant). However, this situation might increase the already existing income gap between the household head with the household spouse.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study was conducted to assess the effects of biofuels (caster bean production) on availability and access to food from the perspective of major food crops produced in the study area in the area. The backgrounds of the sample households were also assessed that had relation to this effect (like livelihoods, coping mechanisms and agricultural practices).

The results of the study revealed that a sale of caster bean is not the major income earning sources for the households. Whereas, the most important source of income for the households is from sales of food production. But food related expenditures, especially purchasing of food, is also the most important expenditure of the households.

The results obtained from assessing of food crop consumption also indicate that own production is still the dominant source of food consumed by the households but most of the households' own food crop production is not enough to fulfill the households total food consumption needed through out the year so that households are dependent on purchased food at least for some months in the year. In addition to this, due to several factors the proportion of household to be covered by the households' own production is getting to decline.

Assessments on the households coping strategies indicated that households developed their own coping mechanisms based on the severity of food shortage situations they faced that are categorized in to three levels based on the severity of the conditions. And, majority of the households used 'less' sever coping strategies but some households already used coping strategies that are considered as 'crisis strategy' even by the standards of the households in the study area.

Based on the results obtained from assessing the households' major consumption and cropping pattern, maize, haricot bean and sweet potato are the most dominant food crops consumed and grown in the study area. On the other hand, the assessment on the previous uses of the land occupied now for caster bean production indicated that the land was predominantly used for

producing the stated three food crops. This will have the negative effect at least on the households' food supply from own production so that negatively affecting the availability of food (household food self-sufficiency) of the households. However, the analysis made on the households' perception on the effects of caster production on households food supply (from both the household survey and interviews) show that most of the households in the study area did not feel the negative effect as directly related to the production of caster bean.

Assessments on the households' sources of access to food and the seasonal consumption pattern are also revealed that the households' access to food is highly variable based on seasons through out the year. Households' food accessing source is totally covered with own production from the end of summer and throughout autumn season. Food supply from own production as a predominant source of accessing food declines from the end of winter and households depend on food purchase as a major food accessing source in spring season.

The results obtained from measuring of households' food insecurity/security status by using HFIAS also indicated that majority of the households are moderately and severely food insecure in the last year. Whereas, very few households are categorized as food secure in terms of food access related measures of HFIAS.

Based on the assessment made on how information is disseminated among various stakeholders involved or found in the production system of caster bean, information is well provided for farmers on time and in every aspects of the production of caster. On the other hand, the respective government bodies starting from the woreda to the federal, lack detailed information and most of the information was provided by the company itself. This information might be distorted or not give clear situation on the real understanding of the condition.

Land and labor related conditions of the households are the major area of influence of caster production on either improving or harming the households' food supply conditions; and this more likely reflect food availability of the household. Price on is also other area of link in the existing production system of caster bean. Based on the assessments made through comparing the major food crops with caster bean production, farmers in the study area give more 'value' for food crop than caster bean production due to the price conditions in the local market (producing more food crop benefit more the households).

Evidences also indicated that, as a result of low yield per unit of land and low price, the caster bean production is decreasing the income of the households to obtain through the production of food crops on the land occupied by caster production. This event indicate that there are trade-offs as a result of caster bean production by replacing the major food crops both from the perspectives of households' food supply (availability) and access to food. However, majority of farmers still decided to produce caster bean and sell to the company. On the other hand, there are two conditions that farmers already experienced through the period of caster production. The first experience is insignificant contribution of caster production on the direct income generation of the household (when compared to income obtained from production of food crops for sale). The other experience of the sample households is 'indirect' benefits they are getting from producing caster. It is well observed that households in the study area are making a decision based on these two experiences. Households that felt the direct income benefit obtained from caster bean production as insignificant when compared to food crop production are more likely to refuse caster production whereas those households who felt the indirect benefit of caster production is more benefiting are more likely to resume caster bean production.

5.2 Recommendations

Based on the conclusion reached in the previous sub-topic recommendations are made for the study. Accordingly, these recommendations are valuable for policy making and regulatory issues for the future development of biofuels on one hand and the improvement of poor rural households in Ethiopia on the other.

- It is better the company to make an assessment on the socio-economic profile and other background of its clients before deciding to make contracts with farmers in the study area.

- It is better for the future that the permission for such private investments similar to the Global Energy Ethiopia plc. Company are asked first for the environmental and social impact assessment by respective local, regional and government bodies (such as the woreda and zone ARD offices, regional and federal mines and energy offices, trade and investment offices, etc.), and frequent and independent field survey on the process of the production is also needed.

- It is better the company to restrict its caster production only on unproductive lands or at least should not occupy the land which was previously for production of major food crops. This is because Producing caster bean on the land that previously occupied by food crop production has negative effects on both food availability and access of the people in the study area even though the households did not feel they are experiencing such condition as a result directly related to caster production.

- The respective government body should work on the provision of fertilizers on time and credit facilities for those households fail to buy fertilizers in cash. This because one of the major influencing factor that made the households in the study are resume caster production, though they perceived it has negative effects, is the provision of fertilizers by the company. The decision of farmers should not influence on such condition any more because it could be possible to say that farmers are using a crisis strategy for the problem of shortage of agricultural inputs for producing food crops.

- Alternative biofuel development ways should also be revised by high level policy makers based on other country experiences. Accordingly, the alternative of small scale development of biofuels by rural households should be more encouraged and emphasized for both income generation and home energy consumption. Because this option might have the potential to link the rural 'fuel producers' with urban small enterprises; it is also a means to improve food security (access) through creating better income earning conditions than investment (company) based biofuels development; enhancing rural energy security; and mitigate the existing high level of forest destruction (environmental degradation).

REFERENCES

Addisu Abebe (2008). *Competition between Food and Biofuel Production in Ethiopia: A PartialEquilibrium Analysis.* Published M.Sc. Thesis. March 2008, Wageningen.

Amigun B., Sigamoney R. and Blottnitz H. (2008). *Commercialization of Biofuel Industry in Africa: A Review;* Environmental and Process Systems Engineering Research Group, Department of Chemical Engineering, University of Cape Town, R.S.A.

Aregawi Hagos (2009). *The Impact of Agro-Fuel Investment on Livelihoods of Local Community: The Case of Midhega Tolla Woreda, Eastern Hrerghe, Ethiopia.* Unpublished M.A. Thesis. Addis Ababa, Ethiopia.

Atakilte (2009). *Governance challenges related to outsourcing of African land for energy and food – implications for smallholders, human rights and the environment.* Summary of a workshop at the Nordic Africa Institute, 2009.

Global Bioenergy Partnership (GPEP) and FAO (GPEP/FAO) (2010) *A Review of the Current State of Bio-Energy Development in G8+ 5 Countries.* GPEP Secretariat and the Environment, Climate change and Bioenergy Division of FAO, Rome.

Birur D., Hertel T. and Tyner W. (2007). *The Biofuels Boom: Implications for World Food Markets.* Paper prepared for presentation at the Food Economy Conference Sponsored by the Dutch Ministry of Agriculture, The Hague, October 2007.

Bryman, A. (2004). *Social Research Methods.* Second Edition. Oxford University Press Inc., New York, 2004.

Coates J., Swindale A., and Bilinsky P. (2007) *Household Food Insecurity Access Scale (HFIAS) for Measurement of Household Food Access: Indicator Guide (v. 3).* Washington, D.C.: Food and Nutrition Technical Assistance Project, Academy for Educational Development, August 2007.

Common Fund for Commodities (2007). *Biofuels: Strategic Choices for Commodity Dependent Developing Countries.* Prepared for The Common Fund for Commodities by Anne

Dufey, Sonja Vermeulen and Bill Vorely, International Institute for Environment and Development, London, UK.

Çooperative for Assistance and Relief Everywhere (CARE) (2008). *Coping Strategies Index: Field Methods Manual.* Cooperative for Assistanceand Relief Everywhere, Inc., January 2008.

CSA (Central Statics Agency) (2007). *Summary and Statistical Report of the 2007 Population and Housing Census.* Published by UNFPA. Addis Ababa, Ethiopia, December 2008.

Davis B., Winters P., Carletto, G. Covarrubias, K. Quinones, E. A. Zezza, K. Stamoulis, G. Bonomi, and S. DiGiuseppe (2007). *Rural Income Generating Activities: A Cross Country Comparison.* Background Paper for the World Development Report of 2008.

Degefa Tolossa (2006). *Combining household qualitative data and quantitative data in food security research.* Acta Geographica – Trondheim.

Department for International Development (DFID) (2004). *Agriculture, Hunger and Food Security.* DFID, August 2004, UK.

Diskin P. (1995). *Understanding Linkages among Food Availability, Access, Consumption and Nutrition in Africa: Empirical Findings and Issues from the Literature.* Technical paper No. 11, Department of Agricultural Economics, Michigan State University, U.S.A, August 1995.

Embassy of Japan in Ethiopia (2008). *Study on the Energy Sector in Ethiopia.* Embassy of Japan in Ethiopia, September 2008.

Energy for Sustainable Development/ Tanzania (2008). *Scoping Exercise (Situation Analysis) on the Biofuels Industry within and Outside Tanzania (Final Draft Report).* October 2008, Kindoni, Dar es Salam, Tanzania.

FAO Food Security Program (EC – FAO) (2006). *Food Security.* A Policy Brief on Food Security (Issue 2), June, 2006.

Food and Agriculture Organization (FAO) (2006). *Agriculture and Poverty in Commodity Dependent African Countries: A Rural Household Perspective from the United Republic of Tanzania.* FAO, Rome, 2006

(2008). *Bioenergy, Food Security and Sustainability – Towards an International Framework.* Paper Presented on the High-Level Conference on World Food Security: The Challenges of Climate Change and Bioenergy, Rome, 3 – 5 June 2008.

Forum for Social Studies (FSS) (2008). *Digest Ethiopia's National Policies, Strategies and Programs.* Forum for Social Studies, 2009 – Second edition. Addis Ababa.

Forum for Environment (2008). *Agrofuels Development in Ethiopia: Rhetoric, Reality and Recommendation.* Forum for Environment, August 2008, Addis Ababa, Ethiopia.

Gebremedhine Birega and Yasin Botto (2008). *Rapid Assessment of Recent Developments of Investment in biofuel Feedstock Production in Wolaita, Ethiopia: Case Study of Three Woredas; Offa, Damot Woide and Kindo Koysha.* August 2008, Wolaita Soddo.

Global Energy Inc. (2009). *Damot Woide Woreda Presentation.* April 2009, Wolaita, Ethiopia.

Gross R., Schoeneberger H., Pfeifer H., Joachim H. and Preuss A. (2000). *The Four Dimensions of Food and Nutrition Security: Definitions and Concepts.* April, 2000.

International Center for Science and Technology and United Nations Industrial Development Organization (ICS-UNIDO) (2007). *Background Paper on Biofuels Production Technologies.* Working Document. ICS-UNIDO, November 2007

International Energy Outlook (IEO) (2009). *International Energy Outlook 2009.* Energy Information Administration/International Energy Outlook, may 2009.

International Food and Policy Research (1999). *Choosing Outcome Indicators of Household Food Security.* IFPRI, Washington, D.C., U.S.A.

International Fund for Agricultural Development (IFAD) (2008). *Biofuel Expansion: Challenges, Risks and Opportunities for Rural Poor People; How the poor can benefit from this*

emerging opportunity? Paper prepared for the Round Table organized during the Thirty-first session of IFAD's Governing Council, 14 February 2008.

Iowa State University (2010). *The Shifting Patterns of Agricultural Production and Productivity Worldwide.* The Midwest Agribusiness Trade Research and Information Center, Iowa State University, 2010.

Johnson, F. (2007). *Bioenergy and Sustainability Transition: From Local Resource to Global Commodity.* Prepared for the World Energy Congress (WEC). Nov. 2007, Rome.

MELCA Mahiber (2008). *Rapid Assessment of Biofuels Development Status in Ethiopia and Proceedings of the National Workshop on Environmental Impact Assessment and Biofuels.* MELCA Mahiber, September 2008, Addis Ababa, Ethiopia.

Ministry of Mines and Energy (MME) (2007). *The Biofuel Development and Utilization Strategy of Ethiopia.* The Federal Ministry of Mines and Energy, September 2007, Addis Ababa, Ethiopia

Morris M., Butterworth J., Lamboll R., Lazaro E., Maganga F., and Marsl N. (undated). *Understanding Household Coping Strategies in Semi-Arid Tanzania.* This paper is an annex to the Natural Resources Systems Program Final Technical Report for research project R7805 funded by the UK Department for International Development (DFID).

Organization for Economic Co-operation and Development and International Energy Agency (OECD/IEA) (2007). *From 1st – to 2nd – Generation Biofuel Technologies: An Overview of Current Industries and RD & D Activities.* The Report for a contribution to the Global Bioenergy Partnership (GBEP), November 2008.

Overseas Development Institute (ODI) (2001). *Food-Security Assessments in Emergencies: A Livelihoods Approach.* Humanitarian Practice Network (HPN). June 2001, DS Print & Re Design, Enfield, UK. (2007). *Biofuels, Agriculture and Poverty Reduction: Natural Resources Perspectives.* Overseas Development Institute (ODI), June 2007, UK.

Practical Action Consulting (2008). *Scoping Study in to the Impacts of bioenergy Development on Food Security.* Prepared for PISCES by Practical Action Group. November 2008.

Rezene Fessehaie (2009). *The Status of Biofuels Development in Ethiopia: Opportunities and Challenges.* Paper presented on the IUCN Regional Workshop on Biofuel Production and Invasive Species fom 20 – 22 April 2009, Nairobi, Kenya.

Rossi, A. and Lambrou, Y. (2008). *Making Sustainable Biofuels Work for Small-Holder Farmers and Rural Households: Issues and Perspectives.* Food and Agriculture Organization of the United Nations. Rome, 2009

Roundtable on Sustainable Biofuels (2009). *RSB Food Security Guidelines (Version 1.0).* Roundtable on Sustainable Biofuels, November 2009, Lausanne, Switzerland.

SNNPR Livelihood Assessment Report (2005). *Damot Woide Woreda Livelihood Profile.* Implemented by FEWS NET in Collaboration with DPPA/B, 2005.

Staatz M., Boughton H., and Donovan C. (2009). *Food Security in Developing Countries.* Staff Paper 2009-03, April 2009, Michigan State University East Lansing, Michigan

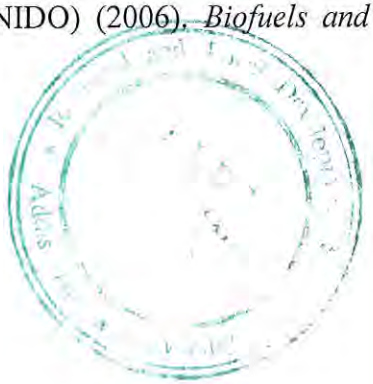
Sulle, E. and Nelson, F. (2009). *Biofuels, Land Access and Rural Livelihoods in Tanzania.* IIED, London.

The State of Food and Agriculture (FAO-SOFA) (2008). *Biofuels: Prospects, Risks and Opportunities.* Food and Agriculture Organization of the United Nations, Rome, 2008.

Tsegaye, W. and Glantz, H. (2009). *Biofuels in Africa: A Path way to Development.* International Research Center for Energy And Economic Development. Occasional Paper No. 43, 2009, U.S.A.

UNEP (United Nations Environment Program) (2009). *Towards Sustainable Production and Use of Resources: Assessing Biofuels.* ISBN: 978-807-3052-4

United Nations Industrial Development Organization (UNIDO) (2006). *Biofuels and Energy Security in Africa.* UNIDO, 2006.



United Nations Economic and Social Council (UN-ECOSOC) (2007). *Small-Scale Production and Use of Liquid Biofuels in Sub-Saharan Africa: Perspectives for Sustainable Development.* Background Paper No. 2, prepared for Commission on Sustainable Development Fifteenth Session 30 April-11 May 2007, New York.

_____ (2008). *High-Level Segment Thematic Debate on Rural Development: "Bioenergy, Sustainable Livelihoods and the Rural Poor".* Issue paper, July 2008.

UN-Team in Ethiopia (UNCT, Ethiopia). *"biofuel": A Viable Source of Energy.* Knowledge Sharing Forum of UN-Ethiopia. July 2008, Addis Ababa, Ethiopia.

Wolaita Development Association (WDA) (2010). *The Three Year Strategic Plan (2010 – 2012).* Wolaita Development Association, January 2010, Wolaita Soddo, Ethiopia.

World Business Council for Sustainable Development (WBCSD) (2007). *Biofuels.* Issue brief on Energy and Climate Focus Area. WBCD, November 2007.

WBGU (2008). *Bioenergy and Global Food Situation Until 2020/2050.* WBGU, 2008, Berlin.

World Food Program (WFP) (2009). *Comprehensive Food Security and Vulnerability Analysis Guidelines.* January 2009, World Food Program.

Wolaita Zone Agriculture and rural Development Office (Amharic Version) (2010). *Rapid Assessments in Humbo, Damot Woide and Duguna Fango Woredas on Food Security.* Wolaita Zone Agriculture and rural Development Office, February 2010, Wolaita Soddo, Ethiopia.

Zeacharias Fassil (2008). *Biofuel Investments and the Precautionary principle.* Sixth International Conference on Ethics and Environmental Policies *Ethics and Climate Change.* Scenarios for Justice and Sustainability, 23-25 October 2008

Wolaita Zone Finance and Economic Development Department (2008). *Zonal Basic Socio-Economic and Demographic Information.* August 2008, Wolaita Soddo, Ethiopia.

ANNEXES

Annex 1: Questionnaire for Household Survey

1. General Information

Region_____ Zone _____ Woreda _____ Kebele _____

Name of the household head _____ Sex _____ Age _____

Religion _____ Marital Status _____ Educ. Level _____

Name of enumerator _____ Date of interview _____

2. Household's Demographic Characteristics

No.	Name of the household member	Sex	Age	Religion	Relation to Hhd. head	Educ. level	Occupation
				Code 1. Islam 2. Orthodox 3. Protestant 4. Others		**Code** 1. Illiterate 2. *Read & write* 3. *Formal educatio n (specify grade level)*	**Code** 1. Farmer 2. Trader 3. Student 4. Specify (if any)

3. Household Farm Plot Details (for current year)

Total entitled plot size (including non-cultivated area) in 'timad'	
Total plot size for crop production (for both food & non-food crops) in 'timad'	
Total plot size for food crops only in 'timad'	

4. Household income, expenditure and food crop consumption

4.1 What seems the general trend of your household income for the last four years?

No.	*Trend*	*YES*	*NO*
1	Decreasing		
2	Increasing		
3	No change		
4	Some times increasing and some times decreasing		

4.2 Approve the following income earning activities (livelihoods) for the last four consecutive years in the table below, give them ranks based on their importance and specify approximate share of each income earning activities from the total share in percentage. Please put 'NA' if one or more stated income earning activities below are not applicable for any member of the household.

No.	*Income earning activities*	*Rank*
1	Sales of staple (food) crops	
2	Sales of cash crops (excluding caster bean)	
3	Sales of caster bean	
4	Sales of livestock and home produced milk and milk products	

5	Employment and casual labor (excluding seasonal urban migration for work)	
6	Seasonal urban migration for work as laborers	
7	Petty trading in the nearby markets	
8	Food for work (through Safety Net or other programs)	
9	Selling of own honey production from bee keeping in home	
10	Artisanship (pottery, blacksmithing, tannery, etc.)	
11	Rental income (animal and tools)	
12	Remittances (both domestic and outside the country)	
13	Specify if there are other income earning activities (livelihoods)	

4.3 Do you tell me how many members of the household are engaged in income earning activities? _____

4.4 Identify household members that are participants in income earning activities:

No.	*Household members*	*YES*	*NO*
1	Head of the household only		
2	Spouse of the household only		
3	Parents (husband and wife) only		
4	Women only		
5	Men only		
6	Adults only		
7	Children only		
8	Women and children		
9	Men and children		
10	Every body in the household		

4.5 List down the three major types of the household's expenditure

1. _____

2. _____

3. _____

4.6 Which expenditure is the major expenditure of the household?

1. Food expenditure 2. Non-food expenditure

4.7 List down the main three crops consumed at home for the last year for each season (please mention them from the most frequently eaten to the next).

Season	Main three food crops consumed in each season
Autumn	1. _____ 2. _____ 3. _____
Winter	1. _____ 2. _____ 3. _____
Spring	1. _____ 2. _____ 3. _____
Summer	1. _____ 2. _____ 3. _____

4.8 What are the main sources for access to food (food sources) for your household? Rank from the most important to the least and put 'NA' for the choice/s that is/are not applicable for the household.

No.	***Food accessing sources***	***Rank***
1	From own production	
2	From market purchases	
3	Gifts from relatives	
4	From loans	
5	Labor exchange for food	
6	Working on others' land for equal share	
7	From food aid (NGOs, Government)	
8	Specify (if any) other sources	

4.9 List the proportion of your household food consumption covered by your own production for the last four consecutive years.

No.	Year	Proportion (%)
1	1998 E.C. (2005/06)	
2	1999 E.C. (2006/07)	
3	2000 E.C. (2007/08)	
4	2001 E.C. (2008/09)	

5. Livestock Assets

5.1 Please compare the number of (farm) animals you own four years ago & now in your household:

No.	*Animals*	*Four yrs. ago*	*Current year*
1	Oxen		
2	Cows		
3	Sheep		
4	Goats		
5	Chicken (hens)		
6	Bee hives		
7	Donkeys		
8	Horses		
9	mules		

5.2 What happened in your general numbers of farm animals? (Encircle one)

A. Decreasing B. Increasing C. No change

5.3 If your answer is 'decreasing' for Q. 5.2, indicate your three most important reasons for it.

1. _____

2. _____

3. _____

5.4 The contribution of your own livestock production to the household food consumption (give your own value judgment)

No.	*Consumption pattern*	*YES*	*NO*
1	Frequently		
2	Some times		
3	Only in holy days and ceremonies		

5.5 If you said 'Frequently' for Q.5.4, what produces are more frequently used by the household? Give ranks.

No.	Consumption type	Rank
1	Milk and milk products	
2	Chicken and egg	
3	Meat (beef)	

6. Agricultural Productivity and Cropping patterns

6.1 What kind of staple (food) crops and cash crops did you produce during the last consecutive four years on you main farm plot? List the three most important crops (in rank order) based on the amount of production.

Crop category	*Year*	*Crop type*	*Area cultivated in timad*	*Yield/ timad (excluding home consumption)*	*Seed preserved (in kg.)*
Food crop	*1998 E.C. (2005/06)*	1st _____			
		2nd _____			
		3rd _____			
	1999 E.C. (2006/07)	1st _____			
		2nd _____			
		3rd _____			
	2000 E.C. (2007/08)	1st _____			
		2nd _____			
		3rd _____			
		1st _____			
		2nd _____			

		3rd _____			
Cash crop	*1998 E.C. (2005/06)*	1st _____			
		2nd _____			
		3rd _____			
	1999 E.C. (2006/07)	1st _____			
		2nd _____			
		3rd _____			
	2000 E.C. (2007/08)	1st _____			
		2nd _____			
		3rd _____			
	2001 E.C.	1st _____			
		2nd _____			
		3rd _____			

6.2 List the three most important staple crops usually grown by the household for relatively long period of time (put them in rank order).

1st _____ 2nd _____ 3rd _____

6.3 List the three most important cash crops usually grown by the household for relatively long period of time. Put them in rank order.

1st _____ 2nd _____ 3rd _____

6.4 Is your own production enough to feed your household throughout the year for the last four consecutive years?

1. YES ***2. NO***

6.5 If your answer is 'NO' for Q. 6.4, do you tell me your harvest month and the last month you stop to consume your own production of your most important food crops (you listed in Q. 6.2) for the last four consecutive years?

Year	*Crop rank*	*Harvest month*	*Last month of consumption*
1998 E.C. (2005/06)	1st _____		
	2nd _____		
	3rd _____		
1999 E.C. (2006/07)	1st _____		
	2nd _____		
	3rd _____		
2000 E.C. (2007/08)	1st _____		
	2nd _____		
	3rd _____		
2001 E.C. (2008/09)	1st _____		
	2nd _____		
	3rd _____		

7. Household food deficits (food shortage) and copping strategies

7.1 Have you experienced food deficit (food shortage) for the last consecutive four years?

1. YES 2. NO

7.2 If your answer is 'Yes' for Q. 7.1, which type of deficit (shortage) did you face?

1. Seasonal 2. Throughout the year

7.3 If your answer is 'Seasonal' for Q. 7.2, rank seasons by nominating them as 'High', 'Low' and 'Medium' in terms of the occurrence of food deficit (shortage) based on your own value judgment.

Season	*Value judgment*
Autumn	
Winter	
Spring	
Summer	

7.4 If again your answer is 'Seasonal' for Q. 7.2, what are your major copping strategies?

No.	*Copping strategy*	*YES*	*NO*
1	Use of less preferred (famine) foods		
2	Borrowing grain from kin (relatives and friends)		
3	Consumption from stocks (using stored foods)		
4	Selling labor power in exchange of food or money		
5	Short term migration for wage work to adjacent urban areas		
6	Consumption reduction		
7	Purchasing from market		
8	Selling livestock		
9	Borrowing grain or cash from merchants		
10	Selling domestic assets (excluding land)		
11	Food aid (from government and NGOs)		
12	Pledging land		
13	Selling land		
14	Specify others (if any)		

8. Household Food Insecurity Access Scale (HFIAS)

No.	Question	Response options	Code
1.	In the past year, did you worry that your household would not have enough food?	0 = No (skip to Q2) 1=Yes	....|___|
1a.	How often did this happen?	1 = Rarely (one or two weeks with in the four seasons of past year) 2 = Sometimes (three to ten weeks with in the four seasons of past year) 3 = Often (more than ten weeks with in the four seasons of past year)	....|___|
2.	In the past year, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	0 = No (skip to Q2) 1=Yes	....|___|
2a.	How often did this happen?	1 = Rarely (one or two weeks with in the four seasons of past year) 2 = Sometimes (three to ten weeks with in the four seasons of past year) 3 = Often (more than ten weeks with in the four seasons of past year)	....|___|
3.	In the past year, did you or any household member have to eat a limited variety of foods due to a lack of resources?	0 = No (skip to Q2) 1=Yes	....|___|

3a.	How often did this happen?	1 = Rarely (one or two weeks with in the four seasons of past year) 2 = Sometimes (three to ten weeks with in the four seasons of past year) 3 = Often (more than ten weeks with in the four seasons of past year)	….|___|
4.	In the past year, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	0 = No (skip to Q2) 1=Yes	….|___|
4a.	How often did this happen?	1 = Rarely (one or two weeks with in the four seasons of past year) 2 = Sometimes (three to ten weeks with in the four seasons of past year) 3 = Often (more than ten weeks with in the four seasons of past year)	….|___|
5.	In the past year, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	0 = No (skip to Q2) 1=Yes	….|___|
5a.	How often did this happen?	1 = Rarely (one or two weeks with in the four seasons of past year) 2 = Sometimes (three to ten weeks with in the four seasons of past year)	….|___|

		3 = Often (more than ten weeks with in the four seasons of past year)	
6.	In the past year, did you or any household member have to eat a fewer meal than you felt you needed because there was not enough food?	0 = No (skip to Q2) 1=Yes	....|___|
6a.	How often did this happen?	1 = Rarely (one or two weeks with in the four seasons of past year) 2 = Sometimes (three to ten weeks with in the four seasons of past year) 3 = Often (more than ten weeks with in the four seasons of past year)	....|___|
7.	In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?	0 = No (skip to Q2) 1=Yes	....|___|
7a.	How often did this happen?	1 = Rarely (one or two weeks with in the four seasons of past year) 2 = Sometimes (three to ten weeks with in the four seasons of past year) 3 = Often (more than ten weeks with in the four seasons of past year)	....|___|
8.	In the past year, did you or any household member go to sleep at night hungry	0 = No (skip to Q2) 1=Yes	....|___|

	because there was not enough food?		
8a .	How often did this happen?	1 = Rarely (one or two weeks with in the four seasons of past year) 2 = Sometimes (three to ten weeks with in the four seasons of past year) 3 = Often (more than ten weeks with in the four seasons of past year)	....|___|
9. . .	In the past year, did you or any household member go a whole day and night without eating anything because there was not enough food?	0 = No (skip to Q2) 1=Yes	....|___|
9a. .	How often did this happen?	1 = Rarely (one or two weeks with in the four seasons of past year) 2 = Sometimes (three to ten weeks with in the four seasons of past year) 3 = Often (more than ten weeks with in the four seasons of past year)	....|___|

9. Caster bean production

9.1 Where did you get the information about planting caster bean production?

No.	Source of information	YES	NO
1	From friends and relatives		
2	From the Development agents (Das)		
3	From kebele meetings		
4.	From the promotion of the GEE workers in the locality		
5	Specify (if any .....)		

9.2 For what purpose you were using the land before planting caster bean?

No.	Land use pattern	YES	NO
1	Food crop		
2	Cash crop		
3	Grazing land		
4	Non-cultivable land		
5	Specify (if any) _____		

9.3 If you said 'food crop' for Q. 8.3, which crop type you have grown most in the area?

1. Cereal crops
2. Pulses
3. Root crops
4. Legumes
5. Vegetables
6. Fruits (for home use)

9.4 What amount and proportion of land was under caster bean and food crop production for the last two years and what amount and proportion you planned for current year? (mark ' - ' if the household do not plan to plant caster bean for the current year)

Year	Caster bean		Food crop	
	Amount (Timad)	Proportion (%)	Amount (Timad)	Proportion (%)
2000 E.C. (2007/08)				
2001 E.C. (2008/09)				
Current year (your plan)				

9.5 Do you cultivated or planned for cultivate caster bean in your farm plot in the current year and for the future?

1. YES
2. NO

9.6 If said 'YES' for Q.8.9, is your reasons match with the reasons stated below? (Mark 'YES' if so and mark 'NO' if not)

No.	*Reasons*	*YES*	*NO*
1	I get a lot of profit from caster bean production		
2	I get well incentives and supports (even though the production is not profitable)		
3	There is imposition by the 3rd party (local gov't, company, etc)		
4	I have no reasons (but still planned producing it)		
5	Specify (if any .....)		

9.7 If said 'NO' for Q.40, is your reasons much with the reasons stated below? (Mark 'YES' if so and mark 'NO' if not)

N0.	Reasons	YES	NO
1	It is not profitable when compared to food crops		
2	I recognized (from my experience) that it has negative effects for food production and I need to produce more food crops.		
3	DAs told me that it has negative effect on food production		
4	I have no enough land to produce caster bean		
5	The company refused to buy the produce or the company did not keep its promise for paying on time.		
6	Specify (if any----------)		

9.8 Compare yield per Timad and the total income accrued from the sale of caster bean with the three most widely grown food crops by the household (as indicated in the rank order of Q. 6.2) for the same years (take price per kilo as a measuring unit for each)

Year	*Crop rank*	*Caster bean (yield/timad)*	*Food crop (yield/timad)*	*Caster bean (price/kilo)*	*Food crop (price/kilo)*
	1st rank food crop				
2000 E.C. (2008/09)					
2001 E.C. (2009/10)					
	2nd rank food crop				
2000 E.C. (2008/09)					
2001 E.C. (2009/10)					
	3rd rank food crop				
2000 E.C. (2008/09)					
2001 E.C. (2009/10)					

9.9 List down the number of household labor that participated in caster bean production and food crop production for the last two years.

Year	*No. of labor participated for caster bean production*	*No. of labor participated for food crop production*
2000 E.C. (2007/08)		
2001 E.C. (2008/09)		

9.10 Based on your caster bean production experience, did you think your caster bean production has negative effects on the major food crops you produce?

1. YES 2. NO

9.11 If you said 'YES' for the Q. 9.12, what kinds of major negative effects did you experience?

No.	*Negative effects*	*YES*	*NO*
1.	Reduce hhd. Food crop production		
2.	Degrade resources for next harvesting season		
3.	Has toxicity effects to grow for other crops		
4.	It is highly labor demanding compared to food crops		

Annex 2: interview checklists

Checklist for selected farmers

- The contribution of live stock as income earning activity
- The major food crops consumed
- Major food crops consumed
- The proportion of food covered by own production
- The condition of food shortage conditions of food shortage conditions
- The major copping strategies and their severity
- source of information for producing caster
- The major reasons for planting caster bean
- Yield income obtained from caster bean and major food crops
- Benefits obtained from caster been as compared to major food corps.
- Is cater bean production competing with major food crops?
- Effects of caster bean production on food security.

Checklists for the respective government bodies

- To what level they are informed about the investment practice.
- The contact they are making to the company
- Whether regulations and supervisions are made

Checklists for the workers of the company

- Back ground of the company
- The aim of the investment
- The relationship of the company with General
- Realization of the contribution or affection of caster production on food security
- .Major challenges faced by the company
- Price aspects of caster been
- Profitability and production of caster bean

DECLARATION

I, the under signed hereby declare that, this thesis is my original work and has not been presented for a degree in any other University, and that all sources of material used for the thesis have been duly acknowledged.

Declared by

Name Dereje Elias Berega

Date 15/07/2010

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Confirmed by Advisor

Name Aklilu Amsalu (Dr.)

Date _____

Signature _____