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Acronyms/Abbreviations

ACSI	Amhara Credit and Saving Institute
ANOVA	Analysis of Variance
ANRS	Amhara National Regional State
BOA	Bureau of Agriculture
CFW	Cash-for-Work
CSA	Central Statistical Agency
CV	Coefficient of Variation
DA	Development Agent
DFID	Development Fund for International Development
DPPC	Disaster Prevention and Preparedness Commission
EDHS	Ethiopia Demographic Health Survey
EEA	Ethiopian Economic Association
EPRDF	Ethiopian People Republic Democratic Front
FAD	Food Availability Decline
FAO	Food Agricultural Organization
FDRE	Federal Democratic Republic of Ethiopia
FED	Food Entitlement Decline
FFW	Food-for -Work
FGD	Focus Group Discussion
FGT	Foster-Greer-Thorbecke
GDP	Gross Domestic Product
GCM	Global Circulation Model
GGLM	Group Guarantee Lending Model
HABP	Household Asset Building Program
IFAD	International Food and Agricultural Organization
IFPRI	International Food Policy Research Institute
ITCZ	Inter-Tropical Convergence Zone
Kcal	Kilocalorie
KIs	Key Informants
LGDFO	Lay Gaint District Finance Office
m asl	Meter above sea level
MDG	Millennium Development Goal
MoARD	Ministry of Agricultural and Rural Development
MoFED	Ministry of Finance and Economic Development
ORDA	Organization of Rural Development of Amhara

PAR	Pressure and Release Model
PCI	Precipitation Concentration Index
PWs	Public Works
PSNP	Productive Safety Net Program
RKA	Rural Kebele Administration
SIDA	Swedish International Development Agent
SLA	Sustainable Livelihood Approach
SNNPR	Southern Nation Nationalities Peoples Region
SPSS	Statistical Package for Social Science
SSA	Sub-Saharan Africa
SRA	Standardized Rainfall Anomalies
TLU	Tropical Livestock Unit
UNDP	United Nation Development Program
UNDP-EUE	UNDP- Emergency Unit for Ethiopia
USAID	United States Agency for International Development
VIF	Variable Inflation Rate
DAO	District Agricultural Office
WFP	World Food Program
WHO	World Health Organization

Determinants of Rural Household Food Security in Drought-Prone Areas of Ethiopia: Case study in Lay Gaint District, Amhara Region

Summary

This study examines rural household food security and its determinants in drought-prone Amhara Region of Ethiopia by focusing on Lay Gaint district as a case study site. A range of factors from physical environmental circumstances to policy and institutions-related issues determine households' vulnerability to food insecurity and livelihood outcomes. The survey results showed that the majority (74%) of the sampled households experienced food insecurity. The situation was worse among female-headed households such that 86% of them were food insecure. The study revealed that, despite the low level of productivity related to local environmental constraints, rural livelihoods remain undiversified with small scale rain-fed agriculture to provide the primary source of livelihood for the large majority of households (~93% of respondents). Only about 25% of the respondents participated in some form of non-farm or off-farm activities, but with only little contribution to their total annual incomes. Food insecurity is a chronic problem in that, on average, households in the study area consume from own production for only about six months. The study found out that the majority of households (about 80%) perceived annual rainfall to be inadequate to support the growing of crops and grazing of animals. The main adaptive strategies employed by the majority of households included diversifying livestock kept, planting trees and diversifying crops. The study revealed that incidence, depth and severity of food insecurity of the food insecure households showed that *Woina-Dega* and *Kolla* agro-ecologies are prone to vulnerability to food insecurity. This suggests that development interventions that are geographically differentiated; and build household assets will improve household food security in the study area, and in other similar environments in the country.

Key Terms: Livelihoods, SLF, Food insecurity, vulnerability, smallholder farmers, perceptions, climate change, drought, adaptive strategies, Lay Gaint, Amhara, Ethiopia

Chapter 1

Introduction

*"While humanity shares one planet, it is a planet on which there are two worlds: the world of the rich and the world of the poor" (*Raanan, 1986 cited in Tofik, 2012: 173*).*

1.1. Background of the Study

Food security, which can be explained by the physical and economic access to the food needs of human beings, is often associated with food availability, accessibility and utilization. However, poverty, famine and low-income stipulations are the root causes of food insecurity for countries located in drought-prone areas of the world. Food insecurity, hunger and famine had occurred as far back as the beginning of human settlement on the planet earth. Nevertheless, the current problems are so severe and diverse that millions of people in developing countries are suffering from food shortage and die of its predicaments. Svedberg (2013) and Zerihun and Getachew (2013) indicated that more than one billion people worldwide are undernourished of which 98% are found in developing countries and the rest (2%) in developed countries. Seven countries (Bangladesh, China, Democratic Republic of Congo, Ethiopia, India, Indonesia and Pakistan) account for more than 60% of the total malnourished people in the developing countries (Zerihun and Getachew, 2013). Barrett and Lentz (2009) indicated that about 1.4 billion people in the world earn one US Dollar a day. Solh (2010) reported that an estimated of one billion people face hunger and absolute poverty and the gap between food production and demand have rapidly increased through time.

It was argued that the problems of hunger, malnutrition and chronic food insecurity in the last couple of decades remained widespread, not because of insufficient food at the global and/or national levels, but due to lack of access and redistribution at the household level

(Rosen and Shapouri, 2009; Sen, 1981; 1984). Barrett (2002) noted that although availability of food has improved noticeably over the past half century, hunger, malnutrition, and food insecurity remain widespread because of poor access and problems of redistribution at household level. This means global agriculture currently produces ample calories and nutrients to provide the entire world healthy and productive lives (McLeod, 2003); however, food is not distributed equally between regions, countries, households and individuals (Barrett, 2002). Thus, the problem of food insecurity is primarily a distributional issue, a matter of getting available food to people who need it, when they need it, and of ensuring their regular, appropriate and affordable access to food (Barrett, 2002). Rosen and Shapouri (2009) indicated that in the United States of America, the per capita food supply exceeded 3,500 kilocalories per person per day in 2005, whereas in many Sub-Saharan African (SSA) countries the per capita food supply averaged only 2300 kilocalories per person per day. Likewise, Babu and Sanyal (2009) indicated that average global kilocalorie intake had reached to 2800 per person per day, while for the SSA countries it was less than 2500 kilocalorie per person per day.

Despite the promising gains in food availability in some countries in the world, the trends of nutrient and energy consumption in SSA (where Ethiopia is located) over the last three decades has been either stagnant or declining (Davis *et al.*, 2007; FAO, 2006; Pender *et al.*, 2008). A report on UNDP (2012) showed that inadequate access to markets, low endowment of human capital, destruction of natural resources leading to environmental degradation, minimal access to credit services and failure of the poor to design development programs are the major causes for poverty and food insecurity in SSA. In recent years, there is an indication of reducing poverty and food insecurity in some countries in SSA, but the rate of progress falls far short of the MDG of cutting extreme poverty by half in 2015. This is evident from the fact that the number of people suffering from chronic hunger had increased from 800 million in 1996 to over one billion at the present of which 95% in developing world, 1.7% in industrialized countries and 4.3% countries in transition (Lemba, 2009; Hoffman, 2011). Misselhorn (2006) noted that the per capita food production in SSA has remained static or declined in the past 40 years;

nevertheless, in developed countries and in some parts of Asia, it has risen. According to Tubiello et al. (2008), SSA will surpass Asia as the most food-insecure region, with or without the impacts of climate change. Campbell et al. (2003) also noted that despite decades of investment in rural development initiatives, poverty is widespread and chronic in SSA with no sign of significant reduction. As a result, SSA is the only region in the world where per capita food production had declined or stagnated since the 1980s (Davis *et al.,* 2007; Degefa, 2005; FAO, 2006; Pender *et al.,* 2008). Nkurunziza (2006) and UNDP (2012) added that SSA is the only region where the numbers of rural people live in extreme poverty is still on the rise through time. In the region, the worst affected countries by famine, hunger and chromic food insecurity include the Democratic Republic of Congo, Burundi, Ethiopia, Malawi, Kenya and Somalia (FAO, 2006 cited in Lemba, 2009). Therefore, reducing poverty and ensuring household food security by improving livelihoods of the rural poor are critical issues and the real challenges for many SSA countries including Ethiopia.

With a population of about 91.2 million in 2013 (World Fact Book, 2013) and a physical size of about 1.13 million km^2 (Woldeamlak, 2003), Ethiopia is one of the largest and most populous countries in Africa. Ethiopia has a tropical monsoon climate characterized by wide topographic induced variations (von Braun and Olofinbiyi, 2007) which help to grow varieties of crops. This indicates that given the ecological diversity, Ethiopia has a good potential to produce different varieties of crops and species of livestock. Despite this potential, however, Ethiopia is one of the poorest countries in the world with low annual per capita income (Fransen and Kuschminder, 2009). Inability to acquire sufficient food, lack of reasonable income and productive assets, insufficient access to health and education as well as poor governance are common indicators of chronic food insecurity in Ethiopia (Devereux, 2006). The situations are aggravated by the fact that Ethiopia has been stricken by continuous occurrences of drought, famine and hunger, which are the root causes of chronic and transitory food insecurity.

1.2. Statement of the Problem

The majority of the Ethiopian population is dependent on rain-fed agriculture as the major source of livelihood, but the agricultural production and productivity showed a declining trend from the 1960s onwards (Fransen and Kuschminder, 2009). The same authors further indicated that until the 1950s, Ethiopia was sufficient in staple food and indeed exporter of food crops. From the early 1960s onwards, Ethiopia has experienced poverty and chronic food insecurity mainly caused by high population growth, land degradation, lack of appropriate technologies, land tenure insecurity, scarcity of farmland, drought, variability and unpredictability of rainfall.

As one of the poorest countries in the world, the economy of Ethiopia suffers from the lowest per capita gross national income (220 US dollar), 21% below the average of low-income countries (1,174 US dollar) (Zerihun and Getachew, 2013). The country also suffers from the lowest average per capita kilocalorie intake of 1,982 and a high incidence of poverty (Ramanaiah and Gowri, 2011; USAID, 2012). About 29% of the populations live below the poverty line (FSP, 2012) in which about 30% in rural and 26% in urban areas (MoFED, 2012). About 77.5% survive on less than 2 US dollar a day and 44% of the national population is undernourished (Ramanaiah and Gowri, 2011). With a low human development index of 0.328 (Siraj, 2012), Ethiopia ranks 174 out of 187 countries in UNDP's human development report of 2011 with a GDP per capita adjusted with the Purchasing Power Parity of US dollar 971 (compared to almost US dollar 2,000 average for SSA countries) (UNDP, 2011; FAO and WFP, 2012; Shitarek, 2012). Average life expectancy is low (55.4 years), literacy rate is 35.9% and 38% of children under 5 years of age are underweight (Fransen and Kuschminder, 2009). About 12 million people are chronically or periodically food insecure (Sewmehon, 2012) and about 8 million Ethiopians have received food assistance through the productive safety nets program on a regular basis (USAID, 2012). Though the GDP growth rate of Ethiopia is 8.4% on average, the country suffers from under-development caused by human, natural, socio-economic and institutional factors (EDHS, 2012). It is also noted that the level of

poverty is higher in rural areas where the overwhelming majority of the population resides (MoFED, 2012). All these development indicators corroborated that poverty in general and food insecurity in particular are widespread and deep-rooted in Ethiopia.

Even though considerable efforts have been made to achieve food security at the household level over the past decades, it remains a challenging task for the majority of the rural poor today. With the objectives to combat the threats of pervasive poverty and food insecurity, the Government of Ethiopia (GoE) adopted Agricultural Development Led Industrialization (ADLI) policy in 1992 (Deressa, 2010; Dorosh *et al.*, 2011). To realize this, two ambitious objectives were set (Sorensen *et al*., 2004). The first objective was to double the per capita income over a period of 15 years, and the second objective was narrowing the gap between the actual production and the demand of food within five years. However, the objectives, especially the second one, were unrealistic because food aid beneficiaries have increased from 3 million in 1996 to 8 million in 2008 (Birhanu, 2009). Vadala (2008) also indicated that during the imperial regime almost 3 million Ethiopians needed food assistance, during the Marxist Leninist regime, food aid beneficiaries had increased to 7.8 million and under the current regime chronically food insecure households had reached more than 8 million. Hence, the impact of ADLI policy is still unclear to more than 8 million people who are suffering from hunger and food insecurity.

As it is true to most SSA countries, Ethiopia is still far from transforming its economy, where the majority of its population continues to live in rural areas, and agriculture remains the major source of employment. The sector accounts for roughly 44% of the GDP, 85% of export earnings and supplies about 70% of raw materials to the manufacturing sector (Abera, 2011; Dorosh *et al.*, 2011; Kassahun, 2012). It is estimated that more than 80% of the country's population derive their income primarily from agriculture (Deressa, 2010; Abera, 2011). While the vast majority of the populations are engaged in agriculture as the major livelihood, food insecurity remains a serious problem. Put differently, the rural people who have long experience in agriculture and practicing it

as the major livelihood for generations are among the most vulnerable to food insecurity and unable to produce sufficient food to feed throughout the year.

Several reports (eg. CSA, 2011; FDRE, 2012; MoARD, 2010; UNDP, 2012) pointed out that Ethiopia has experienced sustained economic growth since the 1990s, and is considered as one of the fastest growing countries in SSA. There is also widespread evidence that total poverty has declined from 44% (Fransen and Kuschminder, 2009) to about 30% (FDRE, 2012). However, not all regions in the country have enjoyed equal economic growth. This is practically true to the northern half of the country (where the ANRS is located) in which rainfall is erratic, cultivable land is degraded, infrastructure is poorly developed and population densities are very high. Previous study (Emily, 1999) indicated that the Amhara Region is one of the primary agricultural regions in Ethiopia and at the same time it has a large portion of the most chronically food insecure population in the country. Ayalew et al. (2012) also noted that in the Amhara Region, about 2.5 million people are chronically food insecure, accounting for one third of chronically food insecure and vulnerable peoples in the country. Hence, the ANRS is the most food-aid recipient region in Ethiopia. A recent study (Getaneh, 2007; Bluffstone *et al.*, 2008) highlighted the extent of poverty in the Amhara Region in such a way that about 43% of the rural households are poor and cannot afford the minimum calorie intake (2100 kcal) recommended by WHO, and the average income per adult per day is less than 0.36 US dollar. According to the same authors, the largest share of household incomes is spent on food (71%), which is closer to the nation's average (67%), and household's average income is found to be 116 US dollar per year. MoFED (2012) also indicated that the highest poverty estimate is observed in the Amhara region (43%) followed by Tigray (37.1%) and the least was Addis Ababa (28%). By many indicators, the Amhara Region is prone to poverty and food insecurity. Current trends in population growth, poor land resource utilization, severe environmental degradation and erratic rainfall indicate that a quick recovery from chronic and transitory food insecurity is unwelcoming in the Amhara Region.

Likewise, the challenges of food insecurity in the study area (Lay Gaint district) can be summarized in the following ways. It is palpable that food insecurity is extreme in the study district and there is the need to search lasting solutions to the problem. The study area is almost synonymous with drought, low agricultural production and chronic food insecurity from the 1980s onwards (Guinad, 2001). Identifying factors, which aggravate the situation, is timely and appropriate. It is impossible to overcome the predicaments of poverty and food insecurity by merely wishing it away without understanding the nature of the problems and all their dimensions scientifically. Accurate statistical data on the agricultural resources including rainfall variability, livelihood strategies, market prices, per-capita income, input use, crop and livestock production and households' response to shocks are very scarce or non-existent and these needs to be addressed. Although Lay Gaint district is generally considered highly vulnerable to food insecurity and climate change impacts, issues on microclimate differences in the district are not studied so far. The present study is appropriate and timely to address these issues.

There are a few studies on food security issues in Ethiopia including in the ANRS (e.g. Desalegn, 1991; Webb and Braun, 1994; Markos, 1997; Deverevuex, 2000; Sorensen, 2001; Devereux *et al.,* 2003; Sorensen *et al.,* 2004; Degefa, 2005; Drimie *et al.,* 2006; Getaneh, 2007; Bluffstone *et al.,* 2008; Little, 2008; Workneh, 2008; Bogale and Shimelis, 2009; Mesay, 2009; Adugna and Wagayehu, 2012). However, most focused on the famine prone belt of the Region (North Shewa, North and South Wollo) (e.g. Desalegn, 1991; Webb and Braun, 1994; Markos, 1997; Deverevuex, 2000; Sorensen, 2001; Devereux *et al.,* 2003; Sorensen *et al.,* 2004; Degefa, 2005; Ellis and Tassew, 2005; Alemu, 2007; Little, 2008; Alebachew, 2011). Inadequate research attention has thus been given to other food insecure parts of the Region such as the site for the present study (Lay Gaint district). In addition, this study makes an important addition to the existing literature by investigating livelihood outcomes in the context of the sustainable rural livelihoods framework and by taking into account the spatial dimension of the problem by looking into the role of local scale agro-climatic factors in household food security outcomes. In other words, it tries to identify local scale opportunities and

constraints faced by smallholder farmers because of the varying geographical space and households' possession of livelihood assets. This study, therefore, fills an important knowledge gap by focusing on a severely degraded, impoverished and drought-prone area where research evidence on the extent and determinants of household level food security are lacking.

1.3. Objectives of the Study

The general objective of the study was to understand the factors that determine rural households' food security and livelihood outcomes in a drought-prone environment in highland Ethiopia using Lay Gaint district as a case study site.

The study intends to pursue the following specific objectives under this general objective:

- Examine livelihood strategies employed by the rural households and their livelihood outcomes as measured by annual total incomes,
- Explore determinants of livelihood outcomes of households as measured by annual total incomes.
- Assess households perceptions in relation to the occurrence of drought, climate variability and trends of crop production,
- Explore the effect of local climate variability on household food security in Lay Gaint district,
- Identify the coping/adaptive strategies undertaken to secure food and livelihoods,
- Identify the most vulnerable groups of people and agro-ecological zones for policy intervention, and
- Explore the determinants of households' vulnerability to food insecurity in the study area.

1.4. Research Questions

The general research question of the study was stated as . . . what is the status and determinants of household food security in the study area?

Specific research questions were:

- What are the livelihood assets owned and strategies practiced by households for food security outcomes in the study area?
- What are the determinants of livelihood outcomes of households as measured by annual total incomes?
- How do sample households perceive and respond to the natural and socio-economic factors that influence their livelihoods and/or food security outcomes?
- How is local climate variability related to household food security and livelihoods in the study area?
- What are the underlying natural causes, socio-economic constraints and institutional factors for households' vulnerability to food insecurity?
- How are the incidence, depth and severity of food insecurity in the three agro-ecological zones of the study area?
- What factors determine households' vulnerability to food insecurity in the study area?

Basic assumptions/hypotheses

The socio-economic factors such as livestock owned, engagement in non-farm activities, fruits and tree production, social capital and biophysical such as farmland owned and geographical location have significant and positive correlations with households' total annual incomes in the study area.

Households that lack the basic assets/resources to engage in viable livelihood strategies live continually under the threat of food insecurity. On the other hand, households that

live under sustainable livelihoods and favorable geographical locations are relatively better-off and are less vulnerable to food insecurity.

1.5. Significance of the Study

Despite abundant agricultural resources, Ethiopia is one of the most food insecure and food aid dependent countries in the world. Food insecurity has been the primary concern for the successive governments of the country. The situation is aggravated by the low agricultural production and productivity, which is due to backward production technologies, poor infrastructure as well as unsuitable government policies and strategies. For policy responses, it is crucial to understand how different socio-economic groups especially the poorest segment of the population are affected by chronic hunger and food insecurity. This needs a thorough investigation of the problems associated with household food security. In other words, identifying the most vulnerable households along with their coping and survival strategies may help governmental and non-governmental organizations to design appropriate development activities. Moreover, food security analysis at the household level could facilitate identification of the most appropriate strategies that could be taken either by the government or development partners or by the communities. Thus, this study has practical significance for designing a more targeted and effective food security related development intervention in the study area, and in other similar environments in the country. The findings of the study may be useful for policy makers to deal with underlying factors affecting household food security.

1.6. Scope and Limitations of the Study

The study is concerned with status and determinants of food security at household level; hence, the household forms the unit of analysis. A household includes one or more individuals, who share similar economic activities necessary for the survival of households and well-being for its members (Maharjan and Chheteri, 2006). Food security analysis at household level enables identification of appropriate combination of

interventions. The household is taken as the unit analysis because it is assumed that decisions about production, investment and consumption are taken primarily at the household level (Rashid *et al*., 2006). Food security study at the household level is imperative because national and global levels food security analyses can obscure important differences at household level. It is different from the community scale in that supports and information are exchanged among members of households more frequently than among households.

From household members, data were collected from male and female-headed households. This helped to make comparisons between male and female-headed households in terms of asset ownership, vulnerability situations and livelihood outcomes. More importantly, the study was confined to one of the food insecure and drought-prone districts (Lay Gaint) out of the 64 food insecure districts in the ANRS. It is assumed that the selected district represents the other food insecure districts in the Region because it is composed of diverse agro-ecological zones ranging from hot (*Kolla)* to cool (*Dega)* agro-ecological zones.

This study has limitations that future studies need to address. The household survey was collected at one-shot (collected only one time). However, rural livelihoods and the factors affecting household food security are dynamic that need to have longitudinal survey. This was not practiced because of time and financial constraints. Hence, future research could include longitudinal survey to see significant changes through time. However, the questionnaire survey was supplemented by key informants and focus group discussions to minimize the limitations indicated above. Sample households for this study were confined to rural areas; but this is not to say that urban dwellers are not affected by food security problems. More importantly, urban food security situations in many parts of Ethiopia are not well studied. This leads future studies on determinants of food security have to focus on rural and urban areas of Ethiopia.

1.7. Organization of the Thesis

This thesis is organized into nine chapters supplemented with a list of references and appendices. In the first chapter, general background of the study, statement of the problem and objectives and significance of the study are presented. Chapter 2 presents review of related literature and conceptual framework of the study. Under this part, basic concepts related to the development of food security and theories in relation to food security and the situations of food insecurity in Ethiopia are reviewed. These can be used to fill literature gaps and to identify variables for this study. Chapter 3 is about the general description of the physiographic and socio-economic characteristics of Lay Gaint district with the objectives to give general information about the study area. Chapter 4 presents in-depth discussions in relation to the research design, sampling techniques, data collection techniques and the methods used for data analysis. Chapter 5 gives information about the demographic characteristics of the sample respondents. This helps to have background information for the subsequent chapters. In Chapter 6, households' livelihood assets, strategies and outcomes are presented. The livelihood assets (human, social, physical, natural and financial) and livelihood strategies (farm, off-farm and non-farm activities) are the major topics dealt with. Discussing the livelihoods assets and strategies are found to be imperative to understand how much the households under this study are vulnerable to food insecurity and this section is a base for the subsequent Chapters. In chapter 7, households' perceptions about climate change/variability and households' coping and adaptation strategies are discussed. This could help to have better understanding how much the study area is vulnerable to climate change and used to assess households' vulnerability to food insecurity. In Chapter 8, assets in determining households' vulnerability to food insecurity are discussed. This Chapter therefore, can be used as a summary of the preceding Chapters. It is assumed that for sustainable livelihoods and to cope up climate related shocks, availability and accessibility of livelihood assets are found to be imperative. Chapter 9 presents a brief summary of the findings of the study and forward potential options to reduce chronic food insecurity in the study area.

Chapter 2

Review of Related Literature

'The right to adequate food is the right of all individuals'
Sorensen et al. (2004:12)

2.1. Introduction

The concept of food security had evolved more than forty years to reflect changes in policy thinking (FAO, 2006). The term originated in the mid-1970s when the world food summit defined food security in terms of food supply. Though the concept of food security dates back to a long period now, it is inherently a multidimensional concept that largely eludes precise and operational definitions (Barrett, 2002). Considering its multi-dimensional nature, food security had passed through different phases of development. Hence, this sub-topic had focused on the paradigm shifts that were caused by the changes in the development of food security. To begin with, during the 1970s, supply shortfalls created by production failures stimulated major concern on the part of international community regarding food availability (Maxwell *et al.,* 2003). Consequently, concerns about food security were directed more on food availability at the national and international levels up to the end of the 1970s. During the time, food security was defined as the "availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuation in production and prices" (FAO, 2006:1). Policies to address the problems of food security, therefore, focused on increasing consumption of agricultural inputs such as fertilizers and improved seeds that can dramatically increase yields (Fraser *et al*., 2009).

During the 1980s, the growing incidence of famine in Africa renewed global attention towards hunger and its causes. As a result, the analysis of food security shifted from

national and global levels to household/individual level (Tilaye, 2004). During the 1980s, food security was defined as "ensuring all people at all times have both physical and economic access to the basic food that they need" (FAO, 2006:1). From the definition it can be understood that access refers to the ability of an individual to acquire food, either through production or purchase, what Sen (1981) referred to as the means to acquire food (*entitlements*).

In the 1990s, focus was given to food utilization (nutritional security with an emphasis on food, health and childcare). Utilization is commonly understood as the way the body makes the various nutrients in the food to be active, healthy, energetic, and productive population in the society (Maxwell *et al*., 2003). Wiggins and Leturque (2010) stated that, it is not just food intake that affects nutrition, the way food is consumed, the care of children and above all the health of individuals can be equally important in food utilization. Sufficient energy and nutrient intake by individuals were the results of good care and feeding practices, food preparation, diversity of the diet, and intra-household distribution of food. Considering the development of the thinking of food security and its elusive nature, one can find more than 200 definitions of food security (Maxwell *et al*., 2003). In this regard, Barrett (2002) also noted that food security is an inherently unobservable concept that has largely eluded a precise and operational definition. The most commonly cited and/or workable definition of food security is:

> Achieving food security at the individual, household, national, regional and global levels for all people at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (Barrett, 2002:4).

In the 1990s, another paradigm shift took place roughly after the African famine in the 1980s (Sorensen *et al.,* 2004). It was a shift from food-first perspective to livelihood perspective. During the 1970s, recommendation was given to national development strategies on food supply to reduce reliance on food imports or food aid. However, food security is a subset of livelihood security; the latter is a necessary and often sufficient condition for the former (Maxwell and Wiebe, 1998). As a result, the evolution of the concepts and issues related to household food and nutritional security had led to the

development of the concept of household livelihood security (Chambers and Conway, 1992; Maxwell *et al.,* 2003). This is mainly due to the recognition that secure livelihoods are necessary and sufficient conditions for food security. Recently, risk is added to the food security components because it can have the power to disrupt anyone of the components indicated so far (Webb and Rogers, 2003).

To sum up, these paradigm shifts are not mutually exclusive rather they are integrated and hierarchal to each other and help to develop the development of food security. For example, food availability is necessary but not sufficient to access; and access is necessary but not sufficient for utilization (Webb and Rogers, 2003).

2.2. Theoretical Foundations of Food Security

Theories are sets of organizing principles that help researchers describe and predict events (Vanderstoep and Johnston, 2009). Many geographers have stressed the use and formulation of theories in the development of geographic thinking for many years. According to Kitchen et al. (2002), theory is a set of ideas about how the world works; as such, it is a means by which geographers seek to describe, explain or predict aspects of the world. Thus, constructing theories is one of the major goals for the development of geographic thought. Kitchen et al. (2002) associated theory with a map. This is because map is a store of knowledge about landscape, and allows users to navigate the places or situations they are interested. For instance, in food security analysis, a map is used to delineate regions of vulnerability to food insecurity.

Currently, geographers use the positivistic loom to test theories and the humanistic approaches to formulate theories. The positivistic approach is related to quantitative techniques and commonly used by physical geographers, while the humanistic (qualitative) frameworks adapted from the humanities are mostly used by human geographers (Kitchen *et al.,* 2002). Prior to the 1950s, there was much concern about the descriptive nature of geography; but from the 1960s onwards geographers had taken a

paradigm shift from qualitative description of places to quantitative techniques and the latter had helped to explain scientifically the cause and effect relationships between phenomena. The positivistic research model starts from theory, generating hypotheses, testing hypotheses, interpreting results and verifications of those theories (Vanderstoep and Johnston, 2009). Humanism, on the other hand, is concerned with man-environment relationships. This philosophy emerged from the dissatisfaction of the positivistic approach in employing rigorous models, laws and statistics in solving problems (Tuan, 1976). Humanism came into existence when the behavioral approach in geography becomes dominant. The behavioral approach assumes that man responds to the environment, as he perceived it. This approach emphasizes the world to be under the theoretical normative model (Diskshit, 2007). Questions raised in relation to food security under phenomenological tradition include how people perceive when they face unexpected shocks. Are households able to predict vulnerability to food insecurity? How do people recognize rainfall variability in particular and climate change in general? How do people understand and implement government policies, strategies and programs?

Poverty and food insecurity have spatial and temporal dimensions and are explained by people-environment relationships. In relation to this, different academicians at different times viewed diverse theories in relation to food security and these were grouped into three broad categories emphasizing the causes of food insecurity (Blaikie *et al.*, 1994; Collinson, 2003; Devereux, 1993; Sen, 1981; Twigg, 2001). They are political economy theory, food economy theories, and vulnerability theory that need positivistic and interpretative approaches in the analysis of food security. For this study, all these theories in one way or the other can have an influence on household food security outcomes. For instance, land tenure insecurity, weak targeting of safety nets, lack of accountability and transparency in local governance are grouped under political economy theory. Likewise, lack of delivery of inputs to increase agricultural production and weak marketing infrastructure, lack of access to purchase the basic needs are related to the food economy theories in respect to food availability and accessibility decline theories. High population pressure, living in marginal and drought-prone areas, drought, unpredictable rainfall and

lack access to the basic capital assets can be summarized under vulnerability theory in respect to PAR and access model. The succeeding topics therefore highlight on these theories and evaluate the debates among academicians in the development of food security theories.

2.2.1. Political Economy Theory

The distribution of power and wealth between different groups and individuals and the processes that create, sustain and transform these relationships over time can be viewed in the lens of political economy approach (Collinson, 2003). The same author also pointed out that the political economy approach looks vulnerability in terms of powerlessness rather than simply material needs of a society. People are the most vulnerable when their livelihoods and coping strategies are deliberately undermined (Keen, 1994 cited in Collinson, 2003). Recent literatures have associated the political economy theory with the complex interaction of food insecurity and conflicts/war (Lecoutere *et al.*, 2009). The same author also argued that food insecurity is a political phenomenon that is not only caused by lack of food production nor by market irregularities, but due to political powerlessness. Thus, rather than sticking to the availability of food and people's access to food as the only means out of food insecurity and famine, political economy theory proposes that interventions have to focus on state reconstruction, good governance and accountability. Devereux (1993) suggested that governments contribute to the occurrence of famine and food insecurity in the following ways. (i) Inappropriate policies (Sahel famine) (ii) failure to intervene (the Chinese famine of 1958-1960, the Bangladesh famine in 1974 and the Ethiopia famine in 1974 and 1984) (iii) by-products of war (Mozambique and Chad in 1980, Ethiopia in 1985 and Somalia in 1990) (iv) intentional government creation of famine (Soviet famine in 1933 and Dutch famine in 1994). For instance, the Ethiopian famines at different times are associated with the government's failure to overcome the situations (Vadala, 2009). The same author also indicated that famine could not be explained exclusively in terms of resource shortage, politics is no less important.

2.2.2. Food Economy Theory

Two important food economy approaches have been developed as explanations of famine and food insecurity causations. These competing approaches are grouped into food availability decline (FAD) and food entitlement decline (FED).

2.2.2.1. Food Availability Decline Approach

The FAD approach argues that disruption of food production below some minimum requirement by some natural calamity causes famines (Endale, 1992). In this regard, early thinkers of food security linked food insecurity to food availability decline. It concentrates on problems of food supply and food insecurity occurs when there is aggregate decline in food supply (Ali, 2008; Pottier, 2008; Vadala, 2009). Consequently, FAD resulted from two sets of conditions (Atkins and Bowler, 2001). First, food shortage could occur due to some natural calamities such as crop failure or lack of import and/or food aid distribution. Second, FAD could occur in broader geographical regions where agriculture is only marginally viable even in good years (Ejiga, 2006). According to this approach, people starve because of local, national or regional decline in food availability to the level below the minimum necessary for survival; because of high population pressure and climate change/variability (Pottier, 2008; Vadala, 2009; Ejiga, 2006; Degefa, 2005).

Hence, the first version of FAD approach focuses on ***population growth***. Looking the fastest growth of the Irish population Malthus hypothesized that the limited amount of farmland and high population growth would inevitably lead to hunger, famine and disease (Fraser *et al*., 2009). Malthus argued that population growth will lead to constantly increasing demand for food which agriculture, given limited farmland and other natural resources, would eventually be unable to satisfy the food demand of the population (Devereux and Naeraa, 1996; Ehrlich and Ehrlich, 1990). In other words, Malthus proposed that population growth has to be balanced with food production; failure to do so would force nature to take its own measure by wiping of the ‘excess’ (Vadala,

2009). Nowadays, Malthus's thesis has been criticized for many grounds. Firstly, viewing famine and epidemics as natural checks for population growth was a hard measure for the poor. Secondly, Malthus failed to predict the fertility transition into small families as the living standard of the people improves. Thirdly, Malthus overlooked famine primarily causes mortality of the very old, ill or young rather than the bulk of childbearing population (Pandyoyou, 2000). More importantly, Malthus was unable to see the role of innovation and technology for example, the green revolution that could play a great role in improving production (Boserup, 1965).

Ester Boserup (1965) one of the prominent challengers of Malthusian pessimistic, contended that it is not the growth of agriculture that determines population growth but population growth determines agricultural growth (Pandyoyou, 2000). Even though Boserup had given empirical evidences to the relationship between population density and agricultural intensification, many writers had severely criticized her philosophy. Dayal (1984) assumed that taking fertilizer consumption and irrigation of land being constant, the relationship between population density and aggregate productivity is found to be negative. Markos (1997) argued that traditional production methods had rarely enhanced by population pressure in Africa, and had led rural people increasingly degrade the natural resources.

The second version of FAD approach focuses on ***climate change/variability.*** This is because no natural factors affect the food availability situations more than climate related predicaments. Farmers in many parts of Africa have perceived that there is climatic variability at inter-annual and decadal time scales (Thomas *et al*., 2007). Climate change is happening and will continue in the future, regardless of what investments in mitigation measures are made (Mertz *et al.*, 2009). This change is rapidly emerging and the world is facing a greater challenge of accelerated human-induced climate change than ever before (Klein *et al*., 2003; Aklilu and Dereje, 2010). The tragedy is that those countries who contributed little to the causes of greenhouse gas emissions are the ones most affected by climate related shocks. Ludi (2009) and Alebachew (2011) for example, indicated that

Africa with little contribution to climate change is the hardest hit in climate related shocks. FAO (2008) and Ludi (2009) disclosed that frequent and extreme weather events such as droughts and increasing irregularities in rainfall patterns have immediate impacts on food security (availability, accessibility and utilization) and human health in many parts of Africa. These problems are aggravated by the limited resilience caused by economic poverty, subsistence food production and highly variable agricultural production potential (Mertz *et al.,* 2009). Aklilu and Dereje (2010) noted that non-climatic factors such as endemic poverty, hunger, prevalence of diseases, conflicts, low levels of infrastructure development and weak governance, complicate the food security situations of Africa. In response to the situations, the local people in many parts of the continent, using their indigenous knowledge have developed coping and adaptive strategies to reduce climate variability and related shocks (Nyong *et al.,* 2007). Nevertheless, because of scarcity of resources, meager skills and capabilities, poor infrastructure, weak institutional structures, the rural poor are not capable to resilience from vulnerability to climate related shocks (Deressa *et al.,* 2008; Mertz *et al.,* 2009; Hoffman, 2011; Tagel, 2012). McDevitt (2012) suggested that climate change impacts are expected to affect predominantly the world's poorest people, who have the least capacity to respond to the crises.

The Horn of Africa (where Ethiopia is located) is one of the most vulnerable regions to climate change and related shocks in the continent (Kinyangi *et al.,* 2009). In this region, out of the total population, some 70 million (45% of total) live in areas that have been subjected to extreme food shortage and hunger and experience famine at least once in every decade (FAO, 2013). According to this report, countries such as Eritrea, Ethiopia and Somalia took the largest share of these crises. Tagel (2012) indicated that almost every year, Ethiopia experiences localized drought disasters causing crop failure and jeopardizing its development endeavors. Evidently, the country had faced 15 major drought episodes that led to severe famine between 1953 and 1999 (Seid, 2012; Zerihun and Getachew, 2013). Since then, drought occurrences have become frequent, short and severe though the 1984/85, 1993/94, 2000, 2002/03 droughts were the most horrific that

had devastated huge numbers of human and animal lives (Birhanu, 2009; Alebachew, 2011; Seid, 2012). The agricultural sector, which contributes more than 45% of the GDP, 80% of labor force and 85% of foreign exchange earnings, is the first to be affected by climate change (Aberra, 2011; Kassahun, 2012). Woldeamlak and Conway (2007) indicated that the amount and temporal distribution of rainfall is thus, the single most important determinant of the country's agricultural production levels from year to year. Ample scholars such as Elisabeth (2004), Keller (2009), Aberra (2011) and Alebachew (2011) identified the major indicators of climate change in Ethiopia, which include incidence of malaria, desertification, seasonal floods, ecosystem degradation, decline of crop production and lack of clean drinking water. Likewise, high spatial and temporal variations of rainfall as well as increasing temperature by about 0.4^0C per decade are considered the key indicators of climate change in Ethiopia (Keller, 2009). Abera and Mandefro (2010) also noted that climate change is evidenced by increased atmospheric temperature, which is just one of the many indicators of ongoing climate changes. EEA (2008) substantiated that in Ethiopia mean annual temperature will increase by 0.9-1.1^0c in 2030, 1.7^0c-2.1^0c by 2050 and 2.7^0c-3.4^0c by 2080. In all cases, increase of mean annual temperature is the highest in the northern and north central parts of Ethiopia.

The FAD approach has been criticized at least for two reasons (Ali, 2008; Endale, 1992). Firstly, the method had overlooked the fact that famine can occur in an area where there is no decline in aggregate production. Secondly, some areas that cannot produce food at all have access to food through purchasing or import. In relation to this, Sen (1981) indicated that FAD model failed to describe vulnerability differences between diverse classes or households during food shortages and it deals with only the supply side; but food shortage occurs either from the supply or demand side of the food security equation.

2.2.2.2. Food Entitlement Decline (FED) Approach

The publication of Sen's book Poverty and Famine in the 1980s became a starting point for a new development paradigm within food security theories and the debate shifted from macro supply to household level (Sen, 1981). This brought Sen's professional work,

which built FED approach, an alternative approach to FAD. The entitlement approach begins by criticizing the Malthusian 'carrying capacity'. Malthusian carrying capacity is vague and unrealistic because it is difficult to estimate how many people the earth can carry to feed the population (Fraser *et al*., 2009). Hence, the entitlement approach had helped to shift the focus of international attention away from statistics describing the per capita calorie availability towards statistics describing the differential ability of individuals to command food at household level.

Sen (1981) discovered that famine affects people who cannot access adequate food because of exchange failures, irrespective of food availability at national or global levels. Exchange failures according to Sen (1984) include, production based entitlement failure (lack of access to assets); failure in trade based entitlement (failure to access to food due to price fluctuations); failure in labor based entitlement (lack of access to employment opportunities) and failure in transfer based entitlement (lack of strong social networks) (Barrett, 2002). The entitlement approach is composed of three interrelated concepts such as the endowment set, the entitlement set and the entitlement mapping (Nayak, 2000). The endowment set consists of all the legal or conventional resources a household owns (Ejiga, 2006). According to Ejiga (2006), endowments are classified as tangible resources such as land, animals, machinery, water resources, trees, forests and common property resources; and intangible resources include labor power, skill and the rights attached to membership in a community. Entitlement mapping (E-mapping) refers to the rate at which the resources of the endowments set can be converted into food. E mapping is simply the relationship between the endowment set and entitlement set[1] (Nayak, 2000).

Though Sen's entitlement approach is a base for food security analysis, it is not free from criticism. Some critiques questioned whether those people only facing entitlement failure will go hungry; because there are evidences that some poor people with ample entitlements prefer to go hungry at certain times rather than sell their assets fearing of

[1] The use of the endowments is to get final goods and services which include production, exchange or transfer (Nayak, 2000:1), or it is a means to access productive resources to enable households to produce adequate food supplies (Mulunesh, 2001:165).

future crises (Dietz and van der Geest, 2004; Ali, 2008). Devereux (2000) indicated that both food availability and food entitlement could fail at the same time causing famine; and markets cannot necessarily function well because of insufficient availability of food. Similarly, Browbrick (1986) explained the causes of famine and food shortage as the sudden fall in food supply. Above all, the main limitation of the entitlement approach is its failure to incorporate social and political crises that contribute to the decline of food security (Ali, 2008; Watts, 1991). Failure to consider intra-household food distribution, exclusion of relief entitlement and non-legal transfers, and concentration only on proximate causes of famine, such as market prices, rather than addressing the underlying causes of famine were also the major limitations of the entitlement approach (Maxwell and Smith, 1992; Devereux, 1993).

2.2.3. Vulnerability Theory

The food entitlement approach, which was used before the emergence of vulnerability theory was not comprehensive enough to deal with the factors in explaining risk, and hence it can be incomplete if it is, treated separately (Degefa, 2005). Thus, the main limitation of the entitlement approach was its failure to address famine and food insecurity as a socio-economic and political crisis in the analysis of food security. Dietz and van deer Geest (2004) indicated that for many years it was assumed that natural hazards cause drought. It is now widely accepted that natural hazards are not the only factors that lead to drought, but socio-economic and political factors combined with natural disasters aggravate drought and famine (Dietz and van deer Geest, 2004)**.** For the reasons mentioned, a new conceptual model was developed in the early 1990s as a framework for understanding vulnerability to food insecurity. They are the pressure and release model (PAR) and access model.

2.2.3.1. The PAR Model

The PAR model, which appeared from the environment of political economics and/or neo-Marxism, identifies disaster as the outcome of natural hazards on one side, and a

progression of driving forces, which shapes the degree of people's vulnerability to these hazards, on the other (Blaikie *et al.,* 2005). The model is based on the assumption that disaster occurs at the tangent between two opposing forces. That is, process that generates vulnerability on the one side; and physical exposure to natural hazards on the other side and when these two forces coincide, disaster risk happens (Blaikie *et al.,* 1994; Brikmann, 2006; Ehrlich and Schneiderbauer, 2006; Schilderinck, 2009; Twigg, 2001; Weichselgartner, 2001). Blaikie et al. (2005) underscore the driving forces, which are primarily socio-economic and political environment, that determine the extent to which people can protect themselves and recover from the occurrence of natural disaster. The conceptual framework of PAR stresses that vulnerability and the development of potential disaster can be viewed as a process involving increasing pressure on the one hand and the opportunities to relieve the pressure on the other (Brikmann, 2006). Hence, the release idea is incorporated to conceptualize the reduction of disaster. Van der Geest and Dietz (2004) strengthened that natural hazards do not cause disasters, but disaster becomes a hazard when it hits vulnerable people. Thus, social, economic and political factors act together to cause limited entitlements and therefore vulnerability. The model presents a number of human and natural factors in the cause and effect chain, such as root causes, dynamic pressure and unsafe conditions (Brikmann, 2006).

Root Causes: according to Blaikie et al. (2005), the root causes that give rise to vulnerability are economic, demographic and politics. Political power includes transparency, accountability, fair representation and technical competence (Blaikie *et al.,* 2005). It affects the distribution of resources between different groups of people in society.

Dynamic Pressures: The processes and activities transform the effect of root causes into vulnerability and channel the root causes into particular forms of insecurity (Schilderinck, 2009; Brikmann, 2006). The dynamic pressure within the society is the immediate cause of unsafe conditions, which include lack of education, training and local institutions such as health care and social services; lack of markets and financial institutions; lack of appropriate skills and technology, and limited access to resources. At macro level, rapid population growth, epidemic diseases, rapid urbanization, war, debt repayment,

deforestation and decline of soil fertility are dynamic pressures that cause unsafe conditions (Blaikie *et al.,* 1994).

Unsafe Conditions: The unsafe conditions at the local level are the vulnerable context where people and property are exposed to risk. These make communities vulnerable to a particular hazard. Examples include people living in dangerous locations (drought-prone areas) being unable to afford safe buildings, engage in dangerous livelihoods such as prostitution, high food prices, lack of disaster preparedness, fragile environment, and lack of effective protection by the government (Schilderinck, 2009; Twigg, 2001).

2.2.3.2. The Access Model

One of the weaknesses of PAR model is that the generation of vulnerability is not adequately integrated with the way in which they affect people (Wisner *et al*., 2003). The same authors further pointed out that it exaggerates the separation of the hazards from social processes in order to evaluate the social causation of disasters. To avoid this false separation of hazards from the social system, access model is employed. Some people can cope with hazards while others cannot, based on the variations in asset ownership. Hence, access model is related to households' asset ownership. Those households with better access to the basic resources are less vulnerable to food insecurity and are able to recover more quickly from shocks (Twigg, 2001). In this regard, access involves the ability of an individual, family, group, class or community to use resources to secure their livelihoods (Birkmann, 2006; Blaikie *et al.,* 2005; Twigg, 2001; Weichselgartner, 2001). However, access to resources is determined by gender, ethnicity, social position and age of household heads. Therefore, the access model considers how the relationship between households' access to various resources and the choice made within a set of structural constraints to minimize risks (Schilderinck, 2009).

2.2.4. Geographers Perspective in the Analysis of Vulnerability Causations

Researches in the field of vulnerability to hazards find their roots in social sciences and natural sciences and more particularly in geographical literature (Luerrs, 2003; Mard *et*

al., 2010). Tagel (2012) also indicated that the scientific use of the word *vulnerability* has its roots in geography, natural hazards research and the analysis of food insecurity. Hence, the works of some prominent geographers such as White (1923) and Barrows (1973) cited in Ali (2008) have represented the vulnerability study initially in the beginning of the 19th century. Kendra (2003) added that geographers have had a longstanding role to play in understanding the full range of crises brought through interactions of natural and social systems, and the discipline is generally recognized as one of the founding disciplines of hazard as a field of study. Hence, geography has many decades in recording facts and practical application in understanding and managing hazards and disasters (Kendra, 2003). Weichselgartner (2001) also noted that the vulnerability concept in geography has been developed and used for many decades dealing with the human ecological adaptation to the environment. Alexander (2004) differently stated that although specialized studies of hazardous phenomena occurred right from the earliest days of geography's existence as a separate discipline, currently both human and physical geography have strong fascination about how environmental disasters influence the human spatial organization and vulnerability causations. In general, topics related to vulnerability causations included earthquakes, hurricanes, riverine and coastal flooding, drought and increasingly global warming (Kendra, 2003).

The core concept of geography is the *spatial interaction* between humans and the environment. In line to this, several geographers suggested their views in relation to people-environment interactions. Luerrs (2003) indicated vulnerability in line with the geographic loom as a function of exposure, sensitivity, adaptive capacity, manifested within the interaction of social phenomena on the one hand and the natural environment on the other. Likewise, Brooks (2003) indicated that vulnerability as the interaction between physical environments and human interference that produces the outcomes. On the perspective of human geography, Brikmann (2006) noted that vulnerability is the result of the interaction between exposure to external stressors (exposure to risks and shocks) and the coping/adaptive capacity of the affected groups. Cutter (1996) also indicted vulnerability as the interaction of hazards of place (risk and mitigation) with the

social profile of communities. According to the same author, vulnerability is conceived as biophysical risks as well as social responses but with specific areas or geographic domain.

Mapping vulnerability to hazards as an important tool in geographic discipline began in the late 1970s. However, studies on the assessment of *spatial vulnerability* have also occurred in recent years (Wilhelmi and Wilhite, 2002). This is mainly due to the development of GIS technology, which made it possible to integrate human and physical data in the analysis of vulnerability causations. Kendra (2003) also noted that recent developments have moved geography and geographers much closer to actual emergency and disaster management tasks than previous, using GIS technology. According to the same author, the widening use of GIS has brought significant mapping and analytical capability to the desktop and, therefore, these systems can facilitate the organization and management of response operations after an event. Hence, GIS brought mapmaking capacity directly into the hands of emergency responders, and provides information for decision makers as well as validate models of human environment interaction (Kendra, 2003). In this respect, geospatial modeling is used to examine interactions between vulnerability of human populations to natural disasters. It also used to identify areas of human populations vulnerable to natural hazards. These areas tend to be locations where disasters have occurred frequently, and populations lack the social and economic infrastructure to mitigate or adequately respond to effects of disaster events. That is, vulnerability is determined by considering the degree that social capacity may mitigate risks taking into account their geospatial distribution of events (Brooks, 2003). Equipped with this perspective, geographers are able to broaden their view of both the causes and the consequences of hazards/shocks in dangerous places on earth (Kendra, 2003). Therefore, vulnerability mapping is concerned with the identification of the most vulnerable groups of people and places on earth, examining the variations in vulnerability between geographical units that practice different hazards using the GIS environment (Brooks, 2003). This helped geographers to perceive disasters better than the other fields using GIS technology. Thus, vulnerability mapping helps to target vulnerable and food

insecure places/people in many poor countries such as Ethiopia. In this regard, vulnerability assessment map contributes to mitigate risks for those areas prone to drought disaster and provide inputs for interventionists to take remedial measures (Wilhelmi and Wilhite, 2002). Vincent and Whyte (2004) pointed out that cartography is used in the mapping of environmental change and environmental hazards such as vulnerability to diseases and/or vulnerability to drought.

Currently, geographers give due attention to the *spatio- temporal distribution* of hazard impacts and people's choice about how to adjust themselves to the natural hazards through their coping and adaptive strategies (Wilhelmi and Wilhite, 2002). In this respect, the study of vulnerability to food insecurity is related to geography, because the epistemology of the discipline focuses on people's perception to the spatial as well as temporal variations of risks. Thus, *spatial variation* is a fundamental aspect of natural hazards and has been a fruitful subject for geographical study (Alexander, 2004). For example, the way a community is exposed to vulnerability to food insecurity is not automatically the same as that of its neighbors (Magnan, 2010). More importantly, communities will not have the same reaction to shocks since their responses depend on their spatial organization, assets owned and their experiences to occurrences of hazards (Magnan, 2010). Taylor and Davis (2004), on their part, noted that the ability to cope/adapt to hazards varies across environmental and socio-economic situations caused by differences in asset ownership. The same authors also indicated that failure or success of adaptive strategies is determined by the interaction between humans and the environment and it requires a model explanation that accommodates the people-environment interactions. More specifically, Smit and Wandel (2006) pointed out that adaptation is a field of political geography. According to the same authors, the relationships between ecosystems and political economy often treated as issues of adaptive management of risks are related to political and social power relations, resource use and global economies. Alexander (2004) specifically stressed how different sub-disciplines in geography are related to vulnerability. Consequently, landslide, floods, volcanic eruption and its consequences are the works of geomorphologists, while storms

are a focus of climatologists; hazard perceptions are investigated by human geographers, and risk management is the work of political geographers. Therefore, one can safely conclude that vulnerability of a specific community and its adapting/coping strategies are linked to a number of spatial dimensions. For instance, vulnerability is multi-dimensional and differential (varies across space and within social groups); scale dependent (varies across time, space and unit of analysis), and dynamic (the driving forces of vulnerability are not static) (Vogel and O'Brein, 2004, cited in Brikmann, 2006). Alexander (2004) also stressed that natural hazards are multifaceted and multi-dimensional and to avoid risks human beings faced, academic territory has to be avoided since single discipline or practitioners do not have the capacity to develop holistic solutions that need a common pool in reducing vulnerability to food insecurity.

2.2.5. Vulnerability to Food insecurity Indicators

Vulnerability to food insecurity is composed of two concepts, i.e., vulnerability and food insecurity. Food insecurity describes a situation where people lack adequate access to food which meets their dietary needs and food preferences (Devereux *et al*., 2004; Lecoutere *et al*., 2009) while, vulnerability refers to peoples' susceptibility to fall below predetermined food security threshold levels (Knowels and Løvendal, 2007). Food insecurity exists when one or more of the food security components (availability, accessibility and/or utilization) are not fulfilled while; vulnerability is concerned with the measurement and characterization of the likelihood to fall in consumption below some acceptable level. Vulnerability has thus two sides: an external side of risks, shocks and stress to which an individual or household is subject; and an internal side, which is defenselessness (lack of means to cope without damaging loss) (Chambers, 2006). Loss can take many forms such as being physically weaker, economically impoverished, socially dependent, humiliated or psychologically harmed (Chambers, 2006; Philip and Rayhan, 2004; Schoon, 2005). Combining the two terms, Devereux (2006:3) had defined vulnerability to food insecurity as 'being at risk to become food insecure'. Households with livelihoods that do not enable accumulation of the assets required to cope with

shocks will gradually deplete assets thereby increasing their level of vulnerability to, and experience of, severe food insecurity (Hart, 2009). In this instance, food insecurity is an outcome of vulnerability.

Demography, health, education, crop and livestock production, size of farmland, savings and credit are indicators very commonly used for the analysis of vulnerability to food insecurity (Devereux *et al*., 2003; Ellis, 2003; Scaramozzino, 2006; Deressa *et al*., 2008). These variables could be grouped into livelihood assets to explore household vulnerability to food insecurity (Figure 2.1). Evidently, ownership of productive assets significantly influences livelihood outcomes of rural households. Matshe (2009) indicated that vulnerability to food insecurity is linked to livelihood assets, strong institutional support and a favorable external environment. Devereux et al. (2003) noted that vulnerability is closely linked to asset ownership and thus lack of assets is the main driving force that pushes households to be vulnerable to food insecurity. That is, the greater erosion of households' assets, the more exposed to vulnerability to food insecurity. As Chambers (2006) indicated, low assets ownership would be good indicators of vulnerability to food insecurity. Likewise, Moser (1998) indicated that vulnerability is closely linked to asset ownership; the more assets people have, the less vulnerable they are; and the greater the erosion of people's assets, the greater their food insecurity. Ellis (2003) stressed that livelihood assets and strategies together constitute the single most important factor to understand vulnerability to food insecurity. Deressa et al. (2008) indicated the determinant variables that affect rural households vulnerability to food insecurity as physical assets (livestock and number of oxen, housing units); financial assets (access to credit, off-farm employment); social assets (savings and credit associations); human assets (education, health, age and sex composition and family size) and natural assets (mean rainfall, rainfall deviation and farm size). Likewise, Khoshnodifar et al. (2012) and Tagel (2012) noted that farmers' capacity to cope with drought and food insecurity depends on ownership of access to a wide variety of resources. These include land ownership, farmers' income, farm size, educational level, gender, access to insurance, housing quality, health, access to technology, access to

credits, social networking (social capital) and public support program. Dercon (2001) also associated vulnerability to capital assets and noted that it may be worthwhile to use quantitative measures of different capital assets (including physical capital, human capital, public goods and social capital) to proxy vulnerability to food insecurity because assets are likely to assist the ability to cope with shocks. Knowels and Løvendal (2007) argued that regardless of the choice of the dependent variable and in line with the proposed framework, indicators of vulnerability to food insecurity have to be based on information about assets and the existing food security status of the households. Scaramozzino (2006) links vulnerability to food insecurity to scarce access to asset ownership including intangible ones such as social capital. As Shahbaz (2008) indicated, rural people's access to and ownership of certain livelihood assets may have a significant impact on their level of vulnerability to risks, as the limited access to livelihood assets increases the defenselessness and exposure to shocks and stress (risks). Philip and Rayhan (2004) also listed the contributing factors of vulnerability to food insecurity, which includes diminishing access to social protection, rapid population growth, poor health, low levels of education, gender inequality, fragile and hazardous location, lack access to resources and information and limited access to political power. McDevitt, (2012) differently stated that the vulnerability of the poor is generally seen as resulting from limited access to assets combined with physical exposure to predicted climate-related hazards.

Markos (1997) had concluded that households fall into vulnerability to food insecurity when they are unable to meet consumption requirements throughout the year due to scarcity of land, lack of off-farm income, dependence on food aid, having few or no livestock, lack of oxen and poor ownership of assets. Thus, the asset-based approach in the analysis of vulnerability to food insecurity describes poverty and food insecurity as it is caused by inadequate access to tangible and intangible assets. The link between the vulnerability context and people's capital assets enables to consider which assets are most affected by the vulnerability context and how people are supported to build up their livelihood assets and more resilient to vulnerability to food insecurity (Baumann, 2002).

To sum up, the extents to which households face food insecurity and the level of vulnerability are not homogenous (Knowels and Løvendal, 2007). Within similar environment, some households are chronically food insecure while others not. This shows that households are not equally vulnerable to the same shocks or stress because of variations in asset ownership. For instance, poor households might be forced to sell productive assets earlier to cope with external shocks than better-off households.

2.3. Responses to Shocks: Coping and Adaptive Strategies

Households that are vulnerable to food insecurity employ different strategies to reduce and/or mitigate risks based on their internal endowments and their access to external assistance (Mahrijan and Chhetri, 2006). In this regard, there are two types of strategies employed by the households to reduce risks. They are ex-post coping and ex-ante adaptive strategies (Degefa, 2005; Adger *et al.*, 2004; Dietz and von der Geest, 2004).

2.3.1. Ex-post Coping Strategies

In the 1960s and 1970s, poor people were often depicted in social science literature as passive victims who were economically exploited and marginalized (Dietz and von der Geest, 2004). In line with this, Webb and Braun (1994:56) raised a question about "what do people do when faced with the threat of starvation?" Maxwell (2008:2) also put a leading question as "what do you do when you do not have enough food, and do not have enough money to buy food?" People are not passive receivers of undesirable situations; they employ several strategies to manage risks. Webb and Braun (1994) also indicated that people who die during famine should not be seen as passive victims but losers of a hard struggle for survival. Therefore, when hazards or undesirable conditions happen people try to cope with and not rely much on outsiders, unless and otherwise everything becomes out of their control (Heijmens, 2001). Webb and Braun (1994) showed that coping mechanisms do not involve overnight awakening to danger, rather a progression of narrowing options from broader attempt to local in minimizing risk. Thus, coping

strategies represent a set of activities that are undertaken in a particular sequence by a household in response to exogenous shocks, which include famine, drought and other calamities (Dietz and von der Geest, 2004; Querish, 2007; Patrice 1993; Webb and Braun, 1994). Van der Geest and Dietz (2004) specifically indicated that coping strategies show a sequential pattern and that increased knowledge about the sequence could inform early warning systems to be planned to overcome famine. The same authors also added that coping strategies have discrete stages and households move to the next stage after they exhaust the first stage.

Other writers such as Devereux (1993), Corbett (1988), Ellis (2003) and Sorensen et al. (2004) do not agree to the sequential pattern of coping strategies and, in real situations, sequential approach may or may not be practical because different responses do not have similar time relevance. Though there are times when people's responses occur simultaneously, parallel processes may be taken rather than sequential events. Besides, the extent to which any household is forced to move along the sequence depends on its economic class. For example, poor households are much more likely to reach the latter stages in these sequences (selling farmland or out migration) (Corbett, 1988). Similarly, Ellis (2003) investigated that households dispose moveable assets first (savings, stocks, livestock) and later on, they may dispose buildings, even land, thus placing themselves in a position of inability to recover from shocks in the future. Scholars such as Desalegn (1991), Patrice (1993), Ejiga (2006), Wondowsen (2011), Kinyangi et al. (2009), Downing and Washington (1999) indicated that coping strategies are undertaken in a particular sequence in response to exogenous shocks in which each response is used exhaustively before the household moves on to the next response.

2.3.2. Empirical Studies on Ex-Post Coping Strategies

Desalegn (1991) in his study in *Wollo* of Ethiopia has shown four sequential stages of coping strategies: reduction in variety and quality of foods consumed, temporary migration, divestment, and crisis migration (mass deaths and wide scale dislocation of

communities). Webb and Braun (1994), in a study in Ethiopia indicated that when households face hunger and famine, they draw from their savings, use food reserves, diversify sources of income and reduce expenditure on non-food items in the initial stages of famine. During the later stages of famine, they switched to consuming famine foods and even family migration. In Bangladesh, households facing flood-created food shortages and responses include reducing the number of meals per day, changing the types of food items they consumed and borrowing food from neighbors (Frongillo and Wolfe, 2001). Quaye (2008) identified coping mechanisms used by households in northern Ghana. The author listed them as collection of wild foods, market purchases, food payment in kind, support from relatives and friends, sales of livestock, migration and engagement in wage labor. Furthermore, where the quantity of food becomes short, households limit intake between families, reduce the number of meals per day; and when it is severe, they pass the whole day without eating.

2.3.3. Ex-ante Adaptive Strategies

Adaptation is a novel concept in the climate change field (Smit and Wandel, 2006).The same authors also indicated that adaptations are considered to assess the degree to which they can moderate or reduce negative impacts of climate change, or realize positive effects, to avoid the danger. This leads the fact that people actively manage risk/hazard in a variety of ways (Ellis, 3003). Among these, the ex-ante adaptive measures help to improve food availability and access their own production and income diversification. It anticipates events of shocks in advance (Mahrijan and Chhetri, 2006; Ellis, 3003). Often reducing risk is not an option, so households try to mitigate risk via multiple livelihood strategies or diversification. Here, diversification means not putting all "one's eggs in one basket" (Pandy and Bhandair, 2009). Maintaining flexibility is also an adaptive strategy that allows farmers to switch to activities as the situation demands (Pandey, 2009). For example, a switch from the use of artificial fertilizers to compost is an adaptive strategy.

Davis (1996) and Start and Johnson (2004) indicated that the ex-ante adaptation strategies include like extensification (cultivation of more land), on-farm and off-farm

diversification (for example, change in cropping mix, wage labor), intensification of cash cropping, and investments in social capital. This principle is true for rural households who use different types of activities to reduce shocks. Thus, ex-ante adaptation is a continuous process of change to livelihoods, often geared towards enhancing existing security and wealth, and reducing vulnerability and poverty (Ellis, 2000). Since adaptive mechanisms are long-term tactics, government involvement significantly reduces the shocks. For example, implementing water harvesting techniques, employ resettlement program in suitable ecological areas, safety net programs, water-soil management practices, selecting seeds suitable to drought-prone areas, etc. reduce households' vulnerability to food insecurity (Adger *et al.,* 2004; Yaro, 2006).

2.4. The Livelihood Studies

2.4.1. Geographical Perspectives in the Study of Livelihoods

The usefulness of livelihood-based approaches to development has been recognized since the late 1980s when the concept becomes popularized by the prominent researchers such as Chambers and Conway (Devereux *et al.,* 2004; Kollmair and Juli, 2002). The growing popularity as a theoretical framework during the 1990s had helped geographers to think about livelihoods. de Haan (2000a) cited in de Haan and Zoomers (2003*)* identified the notion of livelihood for the first time in the literature of modern geography. According to de Haan and Zoomers (2003), within a specific geographical thinking there is a highly localized, rooted, stable and socially bounded connection between people and their livelihoods. Thus, in an attempt to understand variations in the world, regional or local, geographers have increasingly employed a livelihood perspective to reduce poverty and to sustain the livelihood outcomes. In relation to this, Hanson (2006) pointed out that economic geography in the realm of human geography might continue to explore livelihoods as they intersect with a wide range of social, cultural, political and environmental processes that shape them. Thus, economic geography is motivated in the understanding of people's livelihoods in all their complexity.

For many years, geographers paid much attention to the landscape and often there was a strong belief that the physical landscape determines human activities the so-called environmental determinism. During that time, geographers in their analysis of local development focused on environmental and spatial features of life, portraying people as a center of human-environment relationship. Thus, the livelihood approach is holistic and sets people at the center and shows in an integrated manner how people make their living within the context of social, institutional, political, economic and environmental contexts (Ellis and Freeman, 2005).

After long development of livelihood studies in the realm of geography, its approach in geography had completely vanished after the World War II, due to the influence of neo-Marxist approach (de Haan and Zoomers, 2003). Once the lost has been re-emerged, a much more actor oriented post-Marxist approach appeared in the development of livelihoods in human geography. Post Marxist geographers gave preference to local development as a world of lived experience, the micro-world family, network and community (Johnstor, 1993 cited in de Haan and Zoomers, 2003). During that time, attention was given more to the issue of poverty, vulnerability and marginalization at the community/local level analysis since all of them in one way or another affect the livelihood portfolios of the rural poor (de Haan and Zoomers, 2003). These situations forced geographers to broaden their approaches into two wider spectrums. Earlier approaches to poverty and livelihoods portrayed people as victims of structural constraints and focused on the material aspect of life from the specific locally bounded human-land interactions (de Haan and Zoomers, 2003). The modern geographic approach, on the other hand, recognizes livelihood as multidimensional, covering not only economic, but also political, cultural, social and ecological aspects and man can change or modify the structural constraints persistently to bring sustainable livelihood outcomes. Thus, today's livelihood approaches are based on a range of assets, income opportunities and labor availability that are distributed across regions or localities. Consequently, increasingly multi-spatial livelihood strategies become the center of the

study domains in the modern human geography and hence, the modern concept of livelihoods in geography is less focused on human -land relations as compared to its roots in Classical French Geography (de Haan and Zoomers, 2005).

Currently, the concept of livelihood is widely used in contemporary geography in poverty and rural livelihoods but its meaning can often appear elusive mainly because different scholars and organizations defined livelihoods in different ways (Cain and McNicoll, 1988). Chambers and Conway (1991:6) gave the most quoted definition in such a way that "a livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living." According to de Haan and Zoomers (2003) livelihood best expresses the idea of individuals and groups striving to make a living, attempting to meet their various consumption and economic necessities, coping with uncertainties/risks and responding to new opportunities for sustainable livelihood outcomes. The latter definition leads to the idea of sustainable livelihood framework.

2.4.2. The Sustainable Livelihoods Framework (SLF)

Originating from the 1992 Earth Summit held in Rio (Morse and McNamara, 2013), the concept of SLF is increasingly important in research for regional development, poverty reduction strategies, rural agricultural development, rural resource management and livelihood diversification. These could be the reasons why some scholars regarded as the 'operational vehicle' of human development (Singh and Gilman, 1999 cited in Morse and McNamara, 2013). Consequently, sustainable livelihood approach has become popular in food security literature since the beginning of the 1990s to the implementation of development interventions by a number of international organizations such as DFID, UNDP, Oxfam, CARE and others (Kollmair and Juli, 2002). Several international development agencies apply livelihood approach in their literature in different ways and hence, it is difficult to have one sustainable livelihood approach in the analysis of livelihoods. However, all of them had incorporated the following basic components, that is, vulnerability contexts, constituting the assets/resources, policies both micro and macro levels, livelihood strategies and livelihood outcomes (Morse and McNamara, 2013).

Ellis and Allison (2004) also suggested that the term livelihood attempts to capture not just what people do in order to make a living, but the resources owned, the risk factors and the institutional and policy context that either helps or hinders in their way of living. The vulnerability context forms the external environment in which people exist and gain importance through direct impacts upon people's asset status. It comprises trends (demographic, resource and trends in governance), shocks (human, livestock or crop health shocks, natural hazards, like floods or earthquakes, economic shocks, conflicts in the form of national or international wars) and seasonality (seasonality of prices, products or employment opportunities) (Benson and Twigg, 2007; Ellis and Allison, 2004; Kollmair and Juli, 2002) (Figure 2.1). Thus, the vulnerability context refers to the external or unpredictable events that can undermine livelihoods and cause households to fall into poverty. In this regard, it is important to distinguish between shocks originating from outside a community, which affect all people in the same locality such as landslide and drought and idiosyncratic shocks that particularly affect individual households such as death of a family and individual livestock (Alebachew, 2011). The structure associated with government (national and local) such as laws, regulations, rights, accountability, transparency, democracy and tenure security are summarized as policy and institutional context (Ellis and Allison, 2004) that can be used as opportunities or constraints for the livelihood outcomes. For instance, an enabling policy and institutional environment makes it easier for people (poor and less poor) to gain access to assets they need for their livelihoods (Alebachew, 2011). A disabling policy and institutional environment, on the other hand, may discriminate against the poor, making it difficult for them to get access to land, livestock, capital and information.

Livelihood assets include the capitals such as human, physical, financial, natural and social (Ellis and Freeman, 2005; Lautze *et al.*, 2003; Bebbington, 1999; Scoones, 1998). Although the bases of capital assets are interlinked, the relative importance of each type of capital differs between communities and wealth groups. Livelihood strategies- a portfolio of activities and choices that people make to achieve the livelihood goals

include agricultural production, off-farm and non-farm employment opportunities. However, most writers agree that the livelihood strategies are dynamic in nature and are changing overtime in responses to the constraints and opportunities households face (Ellis, 2000).

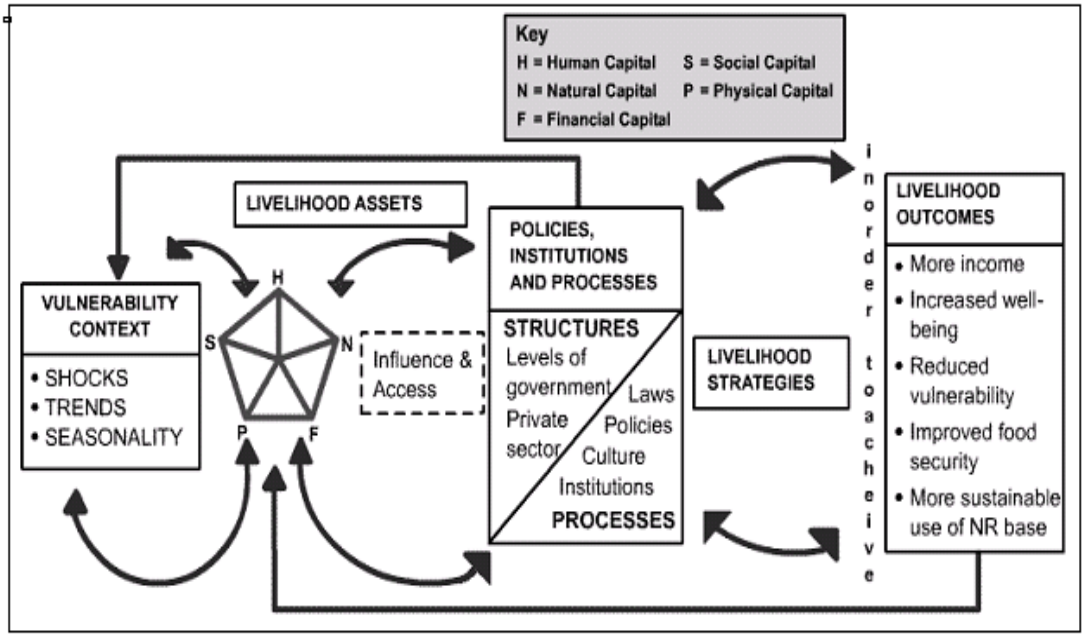

Figure 2.1. The Sustainable Rural Livelihoods (SRL) framework

Source: DFID (2001) cited in Shahbaz (2008)

The framework also considers the outcomes of the components. Kollmair and Juli (2002) indicate that livelihood outcomes are the achievements of livelihood strategies, such as more income, increased well-being, reduced vulnerability, improved food security and a more sustainable use of natural resources. Unsuccessful outcomes include food and income insecurity, high vulnerability to shocks, loss of assets, impoverishment and desperate migration.

Though SLF is important tool for poverty reduction, it is not free from criticism (Morse and McNamara, 2013). To begin with, SLA has little about 'culture' *per se* even though this is an important consideration for communities. Also absent from the SLF is *leisure*, and this can have an important impact on natural resources. SLF could result in much

detailed analysis but how this be translated into interventions, for example, policy is vague and problematic (Morse and McNamara, 2013).

2.5. Food Security Situations in Ethiopia

Ethiopia is endowed with diverse agro-ecological zones and favorable climate for the growing of a variety of crops and rearing of animals. These endowments contributed to be surplus producer in the pre 1960s and it was a period of self-sufficiency in staple food crops in the history of Ethiopia (Aberra, 2002). The same author also indicated that during the 1960s, annual export had reached on the average 150, 000 tons of grain per year. However, due to natural, human and institutional factors, the agricultural sector failed to meet the food demand of the growing population (Samuel, 2006) making food insecurity chronic and pervasive (Strintzos and Mulugeta, 2009). Consequently, from the 1960s onwards cereal production had decreased on average 4 kg per person per year (Aberra, 2002). The causes of the downward trajectory of the agricultural production are explained by physical, human, socio-economic and institutional factors (MoARD, 2009; Workneh, 2008). Alemu et al. (2005) for example, reported that availability could be constrained by inappropriate agricultural technologies, unpredictable rainfall and unsound policies. Accessibility to food and its utilization on the other hand, can be constrained by lack of economic growth, too little training, lack of job opportunities, poor infrastructure, inadequate knowledge as well as poor governance (Alemu *et al.,* 2005).

Inability to acquire sufficient food, lack of reasonable income and productive assets, insufficient access to health and education services as well as poor governance at grass root levels are common indicators of chronic food insecurity in Ethiopia (Devereux, 2006; von Braun *et al.,* 1992). In particular diminishing farm size and lack of land tenure security are singled out as serious structural constraints challenging the improvement of household food security (Devereux, 2006). In Ethiopia, all these indicators are prevalent and hence chronic and transitory food insecurity being the root causes of poverty in the country (von Braun *et al.,* 1992). Devereux (2006) indicated that transitory food

insecurity is a sudden drop to the ability of the households to purchase and/or produce enough food. John et al. (2009) also stated that food insecurity is a situation when people lack access to sufficient amounts of safe and nutritious food for normal growth and development for active and healthy life. Food insecurity may be caused by unavailability of food, insufficient purchasing power or inappropriate distribution or inadequate use of food at the household level. It severely affects vulnerable groups such as newly established landless households, pastoralists, female-headed households, children and the elderly people because of their poor mitigation strategies (Abi, 2001; Saad, 1999). According to von Braun et al. (1992), those who are the hardest hit by transitory food insecurity are the poorest segment of the population.

Ethiopia has been stricken by the continuous occurrences of drought, famine and hunger, which are the root causes of chronic and transitory food insecurity. The situations initiated the successive governments to formulate rural development policies, strategies and programs. At present, the population of Ethiopia has reached more than 90 million (Svedberg, 2013) and about 12 million people are chronically or periodically food insecure (Sewmehon, 2012). Hence, ensuring household food security needs pragmatic rural policies, strategies and programs (Bogale and Shimles, 2009). Perceiving the situations, at the beginning of 2010, MoARD launched the 2010-2014 Food Security Program (FSP) with the aim of improving food security at household level, putting them on a trajectory of asset stabilization and accumulation (FAO and WFP, 2012). The program has four components: i) the Productive Safety Net Program (PSNP) ii) the Household Asset Building Program (HABP) iii) the Complementary Community-based Infrastructure Program (CCI) and iv) the Voluntary Resettlement Program (VRP). Donor financing is allocated to PSNP and HABP capacity building activities, while Government financing to the FSP is allocated to HABP, CCI and VRP (Burns and Bogale, 2011; FAO and WFP, 2012). Launched in January 2005, the PSNP currently targets about 8 million chronically food insecure rural households. This program is expected to reach 8.3 million households in 320 districts by 2015 in eight regions including Somali region (FAO and WFP, 2012). The objectives of productive safety nets program include the reduction of

household vulnerability, the improvement of household and community resilience to shocks and breaking the cycle of dependence on food aid. The key goal is to enable chronically food insecure household to acquire sufficient assets and income in order to graduate to become food secure (Devereux and Guenther, 2007; 2009; Devereux and White, 2008; Gilligan *et al.,* 2008; FAO and WFP, 2012).

2.6. Conceptual Framework of the Study

Physical, human and socio-economic factors affect food security outcomes of households (Figure 2.2). This means demographic and socio-economic variables, institutional related factors, livelihood assets owned, livelihood strategies pursued, coping and adaptive strategies practiced are variables determining food security outcomes of households. Khoshnodifar et al. (2012) noted that farmers' capacity to ensure food security depends among others ownership or access to a wide variety of resources such as land ownership, farmers' income, farm size, educational level, access to government loans (credits), social networks, coping and adaptation strategies. Natural factors affecting household food security include rainfall variability and change, land degradation, drought, floods and hailstorms.

The amount of food produced, imported, exchanged; the prices of food and households purchasing capacity; nutritional status and working capacity of families related to health care and food safety determine household food security outcomes. The supply side of food through improved technologies results in food availability. These are the means to secure food at national and household level. However, availability of food in the study area is determined mainly by availability of rainfall, assets owned and the government's strategies and programs. Accessibility of food on the other hand is not only determined by availability of food but also households' purchasing capacity and the means to acquire it. This showed that food availability and accessibility are strongly linked to bring livelihood outcomes and/or food security outcomes. This is because food availability alone could not bring household food security unless the distribution and purchasing capacity of households are improved. Thus, if one of the components is in short supply, the food security status of households might be affected and households exposed to food

insecurity. For example, FAO (1997) indicated that to achieve food security, a country must attain three basic goals; ensure adequacy of food supplies in terms of quantity, quality and variety of food; optimize stability in the flow of supplies; and secure sustainable access to available food and nutritious supplies by all who need it. In other words, the importance of access to food dimension may not displace earlier concerns about adequate food availability, or even if people have money, if there is no food available at the market, people are at risk of food insecurity (Gervais *et al.,* 2003). This showed that the three pillars are hierarchical in nature, that is, food availability being necessary but insufficient for access and access being necessary but insufficient for utilization (Gervais *et al.*, 2003; Webb and Rogers, 2003). In general, livelihood assets, demographic structure of a populations, livelihood strategies pursued and institutional factors such as good governance and absence of corruption, unpredictable rainfall and drought are the key factors determining availability, accessibility and utilization of food at household level.

Finally, from the conceptual framework (Figure 2.2) it can be noted that climate change affects sustainable livelihoods through vulnerability context. The vulnerability context in this study refers to the external or unpredictable events that can undermine livelihoods and cause households to fall into chronic and transitory food insecurity such as erratic rainfall, seasonality and shocks. In this regard, increasing temperature, decreasing rainfall and erratic in nature associated with meteorological, agricultural and hydrological droughts affects households livelihood security outcomes. Unsustainable livelihoods that damage the environment such as deforestation, soil degradation and unprotected farming could bring local weather variability in the short-term and contribute to climate change scenarios in the long-term. Among the livelihood portfolios, traditional rain-fed agriculture is the first to be affected by climate change/variability and drought in the study area. The problem is compounded because non-farm activities that can be used as mitigation strategies for the rural poor at times of food crises are the least developed in the study area. From the demographic and socio-economic factors, educational attainment of households plays a crucial role in mitigating climate change impacts through their skills and capabilities. However, this asset is a serious constraint in the study area.

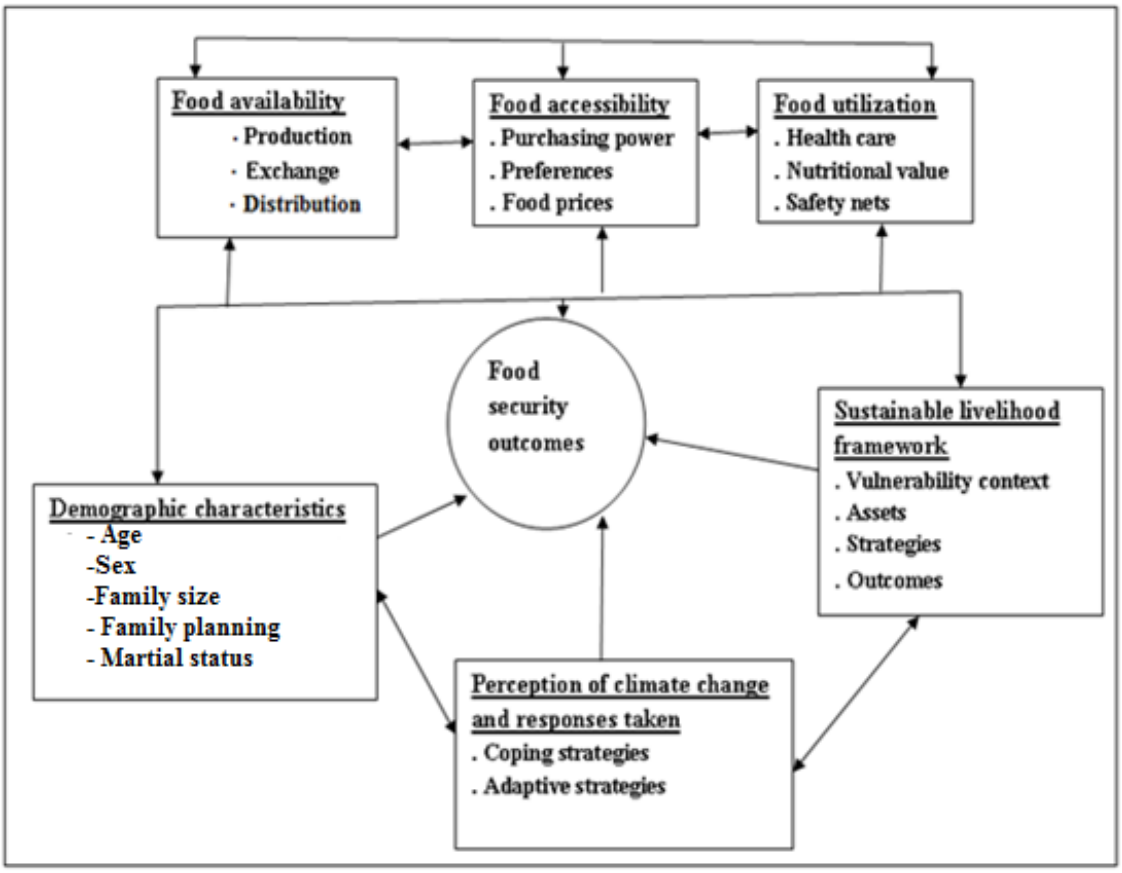

Figure 2.2. Schematic illustration of the interactions between food security outcomes and determinant factors

Source: Modified from Maharjam and Chhetri (2006)

Chapter 3

Context of the Study

3.1. The Amhara National Regional State (ANRS)

The Amhara National Regional State (ANRS) is located in the north western and north central parts of Ethiopia. The Region is rich in natural resources such as water, suitable land for agriculture, large livestock population, hardworking people and varied agro-ecological zones (SIDA, 2010). Despite these potentials, the Region suffers from deep-rooted poverty and food insecurity caused by meteorological drought, hydrological drought, agricultural drought, high population pressure, resource degradation and poor infrastructure. From the total 126 districts, 64 (51%) districts including Lay Gaint are currently food insecure and all are located in the eastern part of the ANRS (Figure 3.1). Overall- 2-3 million people are chronically food insecure accounting for one-third of the chronically food insecure and vulnerable people in the country (Ayalew *et al.*, 2012).

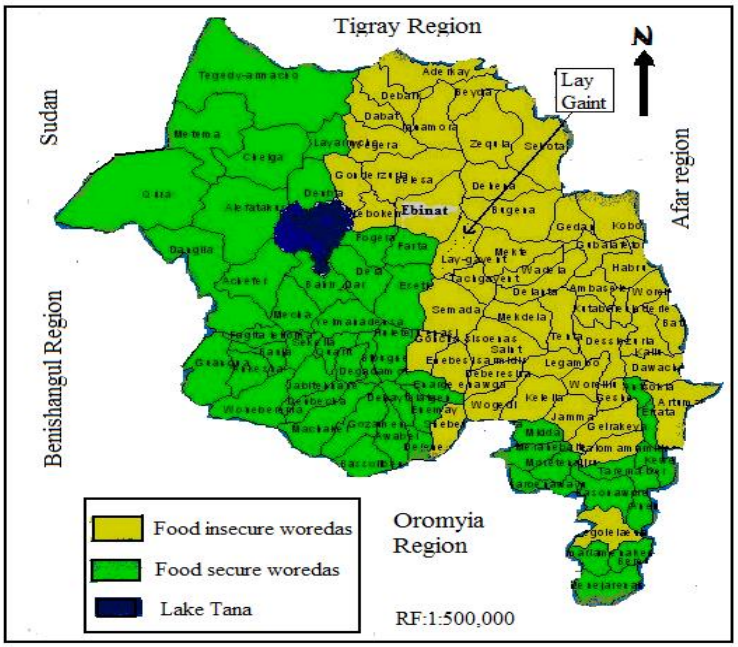

Figure 3.1. Food insecure districts in Amhara National Regional State

Source: Amhara Region Disaster Prevention and Food Security Program (2011)

3.2. The Study Area: Lay Giant District

3.2.1. Physical Features

***Location and topography*:** Lay Gaint district is located in South Gondar Administrative Zone of the ANRS. It lies within 11^0 04' to 12^0 10' N latitude and 38^0 12' to 38^0 37'E longitude (Figure 3.2), and covers a total area of 1,320.31 km^2 composed of 19 rural *kebeles*. With a total population of 242,306, the population density is about 184 persons per square kilometer. The population density of the district is higher than in the Amhara region (112 persons per square kilometer) (CSA, 2006) and the nation's average (67 persons per square kilometer) (EDHS, 2012). Lay Gaint is the fifth largest district and accounts for 11% of the total area in South Gondar Administrative zone. The district town, Nefas Mewcha is located 741 km a road distance away from Addis Ababa and 175 km a road distance far from Bahir Dar.

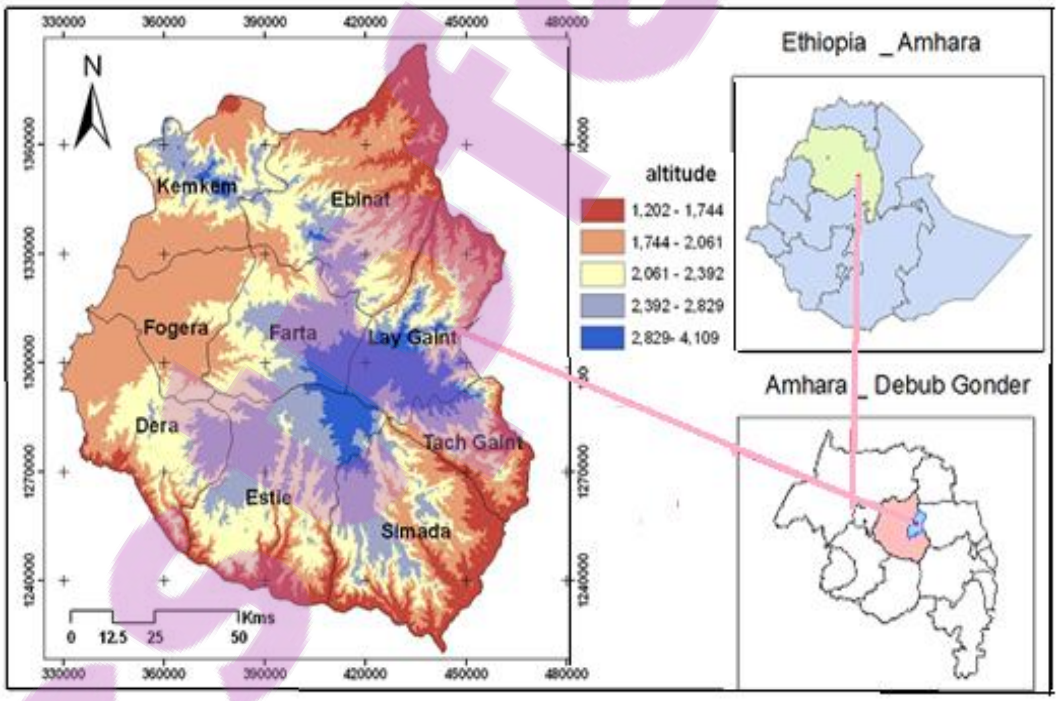

Figure 3.2. The relative location of Lay Gaint in south Gondar Administrative zone

The topography of Lay Gaint district like the other districts in the zone comprises of dissected plateaus, peaked mountains, mountain ridges and deep gorges. It has wide variations of altitude ranging from less than 1500 to more than 4000 m asl (Figure 3.3). From the three agro-ecological[2] zones, the *Kolla* zone of Lay Gaint district located entirely in the Tekeze river basin is the most inaccessible and rugged in physical settings. Aklilu et al. (2000) pointed that the *Kolla* and *Woina-Dega* zones of Lay Gaint have the most rugged and degraded topography, while the *Dega* zone has relatively elevated but flat topography. Similarly, Guinad (2001) stated that the Tekeze river basin of the *Kolla* zone is considered to be among the most inaccessible and rugged areas in the study district. The district agricultural expert also noted that the *Kolla* zone is characterized by rugged topography, while the *Woina-Dega* zone is flat to slightly rugged and the *Dega* zone is almost flat with the exception of some highly elevated places dominated by rugged topography.

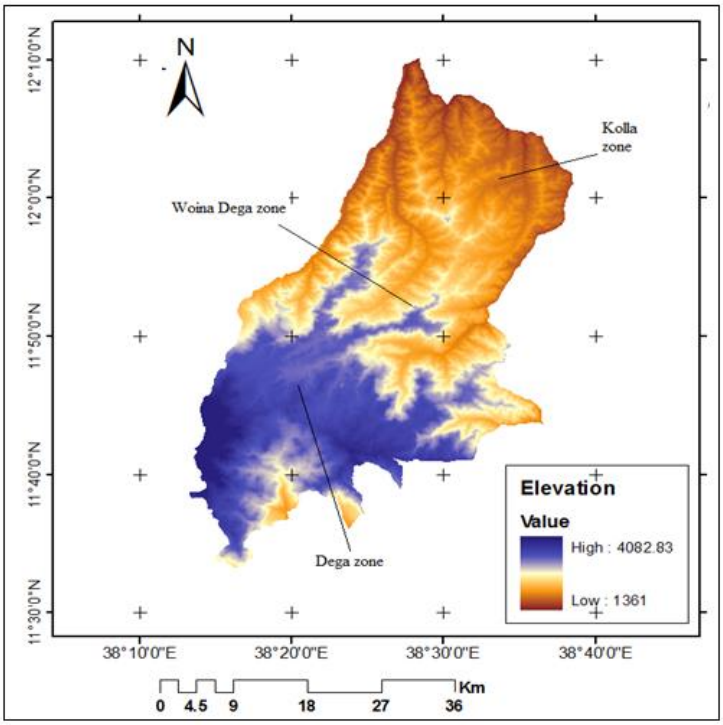

Figure 3.3. The relief of Lay Gaint district

[2] Agro-ecology is composed of two terms. Agro means the ecology of crop production while, ecology is the study of relationship among organisms as well as the relationship between them and their physical environment (Bateman *et al*., 2006).

As it can be seen in Figure 3.4, the southwestern part of the district is dominated by *Dega* agro-ecology has gentler slope but the central and the northern parts of the district are characterized by *Woina-Dega* and *Kolla* agro-ecological zones, respectively have steeper slopes. About 75% of the total area in the *Dega* zone is gentler slope with better soil fertility, while 90% of the *Kolla* zone is steeper slope exposed for severe soil erosion and covered with infertile soils (Aklilu *et al.*, 2000). In general, the relief of the district is composed of mountainous (15%), flatland (10%), rugged topography (70%) and dissected valleys (5%) (WAO, 2011).

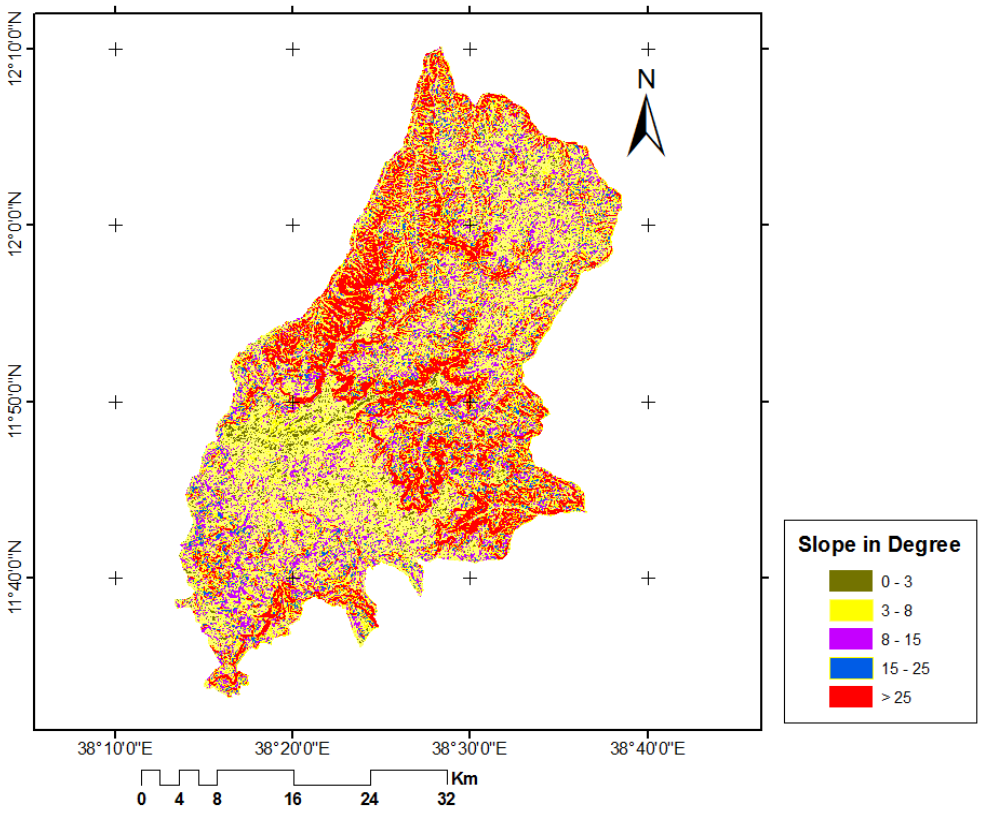

Figure 3.4. The slope of Lay Gaint district

***Soils*:** The two major soil types, widely distributed in the study area include Vertic *Cambisols* (23%) and Lithic *Leptosols* (70%) (Figure 3.5). *Leptosols* are dominantly found over the residuals of the trachyte of the upper slopes. They are mainly characterized by shallow depth below 30 cm (Engdawork, 2002). In general, *Lithic leptosols* are very widespread in the study area and they can be found only at very steep

slopes on similar environments like that of *Eutric Cambisols. Cambisols* are a mixture of red and black soils. When such kind of soils are found on gentler slopes combined with clay content, they have the properties of *Vertic Cambisols*. As far as soil distribution in the district is concerned, black and red (*Cambisols*) soils, black (*Vertisols*) soils and *Leptosols* soils are the dominant ones (Aklilu *et al*., 2000). Regarding fertility, *Cambisols* are the best soils followed by *Vertisols* soils, but *Leptosols* are the least fertile soils (Aklilu *et al*., 2000). As information obtained from the district agricultural office, fertile lands account for 10%, moderately fertile lands (35%), and infertile (waste) lands account for 55%. In general, soil degradation in the study area is regarded as the major constraint to crop production next to drought. Aklilu et al. (2000) have identified the causes for the poor soil fertility of Lay Gaint district as declining crop rotation due to limited farm size, increasing soil erosion and limited use of organic and inorganic fertilizers with the declining use of manure.

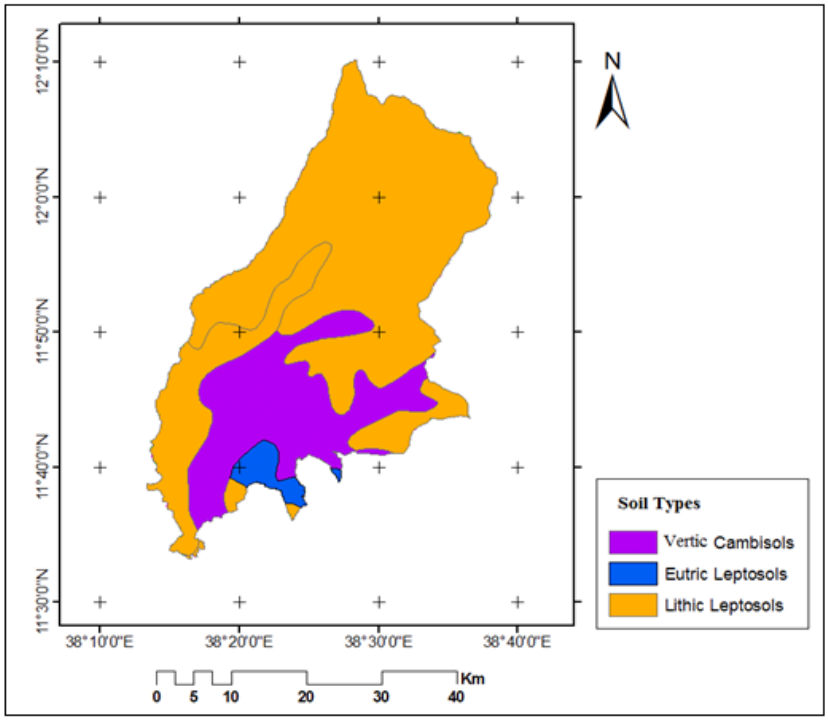

Figure 3.5. Soil classes *in* Lay Gaint district

***Drainage systems*:** The main drainage systems are found in the Tekeze and Abay River systems discharging towards north and south of Lay Gaint, respectively (Guinad, 2001).

Thus, Lay Gaint is used as a watershed separating the two major river systems to flow into different directions. Large areas of the district are found in the Tekeze drainage system.

Climate: The mean minimum and the mean maximum temperature lie within 5^0C and slightly greater than 20^0C (Figure 3.6). According to Lay Gaint District Agriculture Office (2011), the mean minimum and mean maximum temperature for the study district ranges between 5^0C and 24^0C, respectively. Specifically, mean annual maximum temperature is the highest from March to May and mean annual minimum temperature is the lowest from December to January (Figure 3.6). Halonen et al. (2009) also confirmed that the hottest period in Ethiopia in general is from March to May, while the lowest annual minimum temperatures occur in the highlands between the months of November and January. The rainy seasons in the study area include *Belg* (little rain) and heavy *Kirmet* (heavy rains) with erratic distribution varying from 600 mm to about 1200 mm (Figure 3.7).

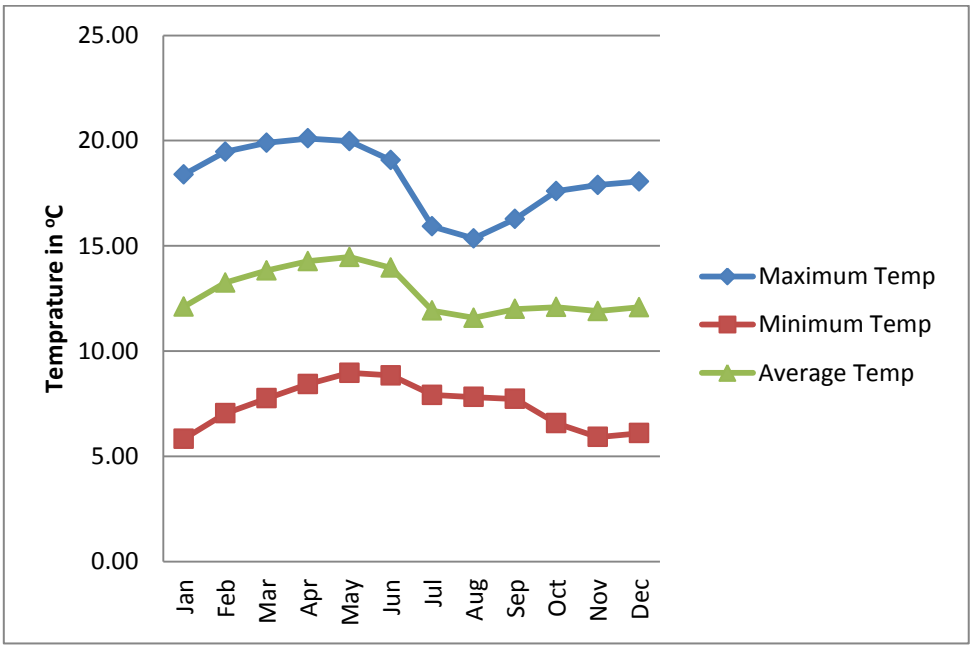

Figure 3.6. Temperature distributions of Lay Gaint district (1986-2011)

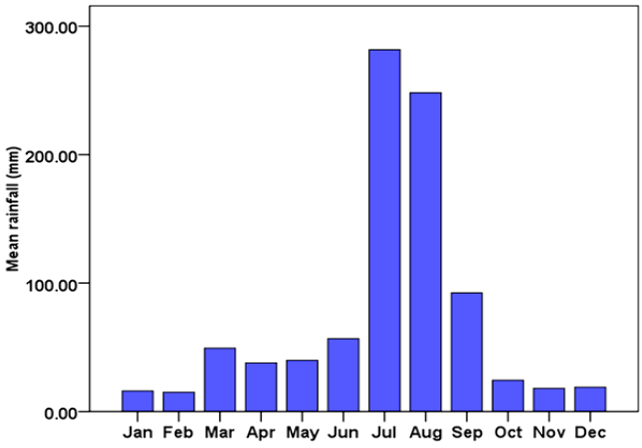

Figure 3.7. Means of monthly rainfall for Lay Gaint district (1986-2011)

The *Belg* rain helps to grow potatoes and barely in *Dega* and *Woina-Dega* zones and sorghum in *Kolla* zones. In general, heavy *Kirmet* rains in both agro-ecological zones is associated with hailstorms, thunderstorms, landslide, runoff and little infiltration adversely affecting the crop production potential (Aklilu *et al*., 2000).

Vegetation distribution: There are different types of vegetation found in Lay Gaint district. Wanza (*Cordia africana*), dedeho (*Eulea schimperi*), imbis (*Allophylus abyssinicus*), acacia (*Acacia spp*.), kega (*Rosa abyssincia*), agam (*Carissa edulis*), woira (*Olea africana*) and kitikita (*dodonia angustifolia*) are the major natural vegetation found in Lay Gaint district. These trees are found on hillsides, river borders and deep valleys, which in most cases are inaccessible. Among the plantations, eucalyptus trees, habsha tid (*Juniperus procera*) and girangire (*Sesbania sesban*) are the dominant ones. Acacia, imbis, koshim (*doualis abssinica)*, shola, woira and kitikita are found extensively in *Woina-Dega* zone. Acacia, kosso (*Hagenia abyssinica*), woira and kega are found in dominantly in *Dega* zone.

As it is shown from the vegetation map of the study district (Figure 3.8*)*, most of the areas are without vegetation cover. One cannot see original forests in most parts of the study area except around Orthodox Christian Churches due to peoples respect to the church and its compound and it is a burial ground (Figure 3.9). The problem is severe

in the *Kolla and Woina-Dega* agro-ecological zones but better distribution was observed in the *Dega* agro-ecological zone. Small patches of dense vegetation and shrub distribution was higher in *Dega* zone and decreases towards *Woina-Dega* and *Kolla* zones. The *Dega* zone seems better in vegetation distribution because of wide coverage of eucalyptus trees (Chapter 6). Currently, the dominant tree in all agro-ecological zones is eucalyptus. It is a major source of wood, fuel, construction and preparation of farm implements. Farmers call this tree '*wuletaw beza'* for their Amharic language- meaning it is everything for the farmers. In relation to this, Aklilu et al. (2000) pointed that in Lay Gaint district, forest coverage decreases rapidly mainly because of high population growth rate, expansion of cropped land, fuel wood and construction needs, income sources (from fuel wood and charcoal) and poor management practices.

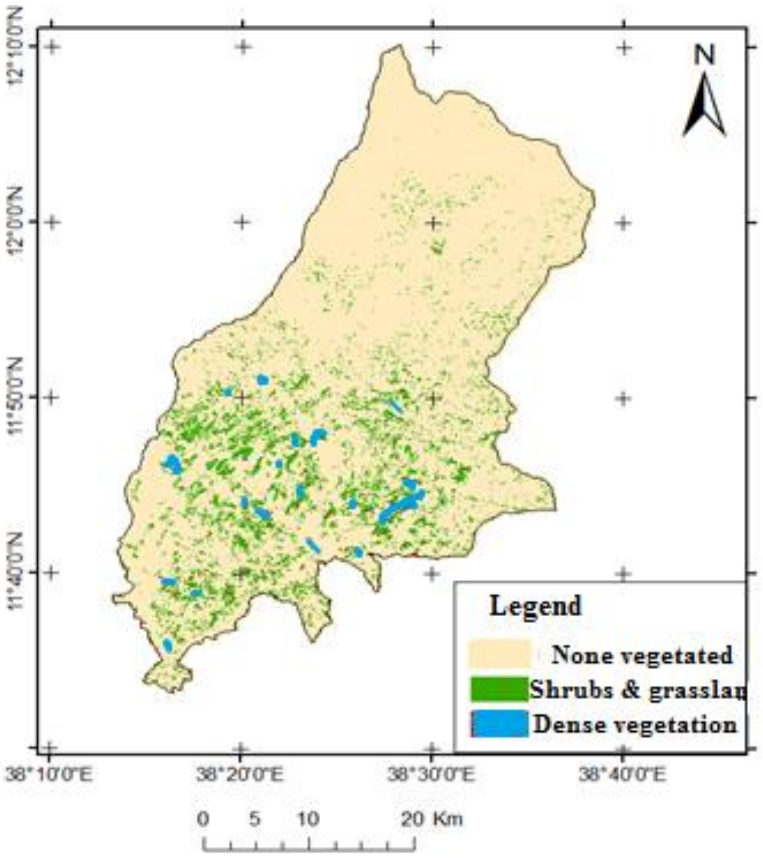

Figure 3.8. Vegetation distribution in Lay Gaint district

Figure 3.9. Remnant of original forests around Orthodox Christian Church in Lay Gaint district

3.2.2. Socio-economic Situation of the Study District

Population distribution: As it is shown in the preceding discussions, the total population of Lay Gaint district is 242,306 (District Finance and Planning Office, 2011). The majorities (99.8%) are Orthodox Christians, 99.8% are Amharas and almost all of them speak Amharic (CSA, 2011). The population density of the district is 184 persons per $km^{2,}$ which was above the ANRS average (112 persons per km^2) (District Agricultural Office, 2011). About 10% live in urban and the remaining in rural areas. Given the fragile ecosystem and the rugged terrain, the population density in the district is well above its carrying capacity. In drought-prone areas such as the study area, high population pressure has put stress on the already degraded farmland and many rural households are not able to cover the annual food consumption and are dependent on food aid for many months in the year. Aklilu et al. (2000) indicated that in Lay Gaint district total area cropped had increased but land owned per household had dramatically decreased due to high population pressure. As it can be seen in Figure 3.10, uneven population distribution exists in Lay Gaint district.

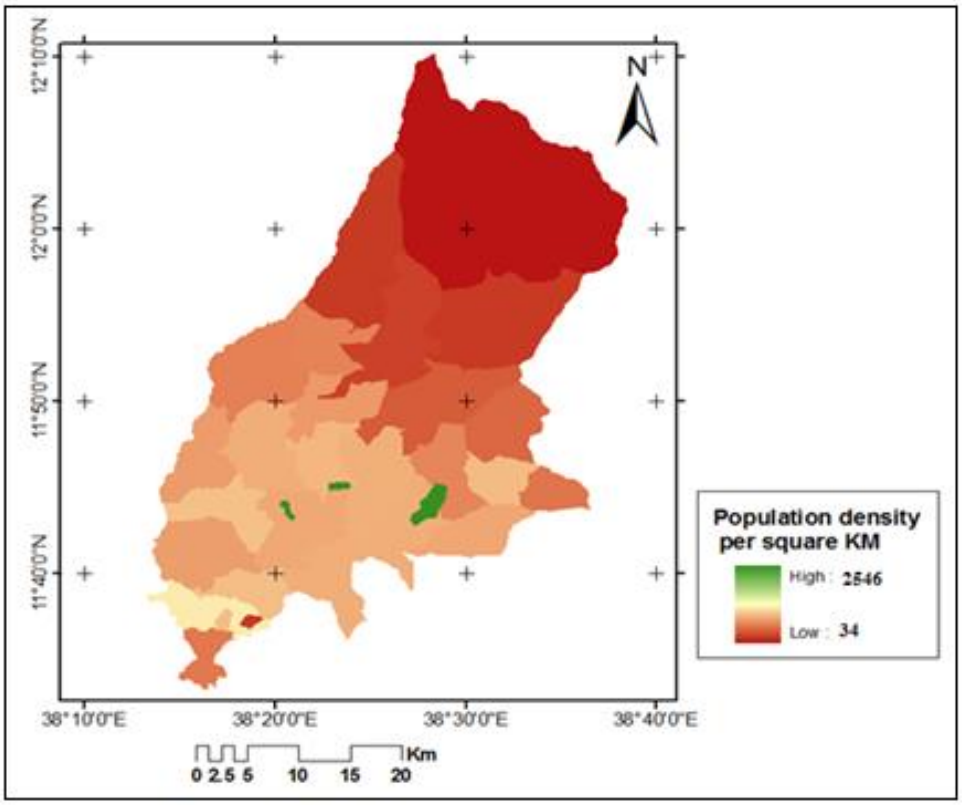

Figure 3.10. Population density of Lay Gaint district

Consequently, denser population is found in *Dega* and *Woina Dega* zones, but it becomes thinner and thinner as one moves towards the north in the Tekeze river valley with a population density closer to 30 persons per square kilometer. This shows that the distribution of population has strong relationship to the climatic condition of the area.

***Basic infrastructure*:** Many of the rural areas in the study area are not integrated with roads and are isolated from each other and from the outside world mainly due to their remoteness and rugged topography. This resulted in information diffusion to be languished and most of the areas are inaccessible to modernization and are less integrated with the marketing systems. In relation to this, Skrocki et al. (2005) stated that lack of access to information due to poor infrastructure, the rural people might produce similar crops that could negatively affect the marketing environment. Similarly, SIDA (2010) and USAID (2007) indicated that it is very difficult for the local people to break through the vicious cycle of poverty and food insecurity without the improvement of roads,

communication, safe water and school and health facilities. Though some expensive seasonal roads are constructed across the steep slopes as shown in Figure 3.11, they are very expensive to maintain because of irregular topography and high seasonal rainfall.

Figure 3.11. Road infrastructure across the north central massif of the study area

3.3. Crop Production and Rainfall Trends in the Study Area

As it can be seen in Figure 3.12, the general tendency of crop production in the study district exhibited a declining trend with high inter-annual variations. In some years, production was higher, and lower in others. For example, between 2009 and 2011 production was higher but abruptly decreased in 2013. Hence, the variations of crop production, which are the main cause of food insecurity, are the direct reflection of rainfall variability. If agricultural production in the low-income developing countries is adversely affected by rainfall variability, the livelihoods of large numbers of the rural poor will be put at risk and their vulnerability to food insecurity increased (FAO, 2008).

As it can be seen in Figure 3.12, as rainfall increases, crop production also increases. The bivariate correlation result showed that there is a strong correlation between crop production and rainfall distribution ($r = 0.88$, at $p < 0.001$). For example, in the years,

2001 and 2002, the amount of rainfall was low in the study area, and it significantly decreased the amount of crop production. In general, in drought-prone areas, such as Lay Gaint, the most important determinant factor for crop production is the availability and distribution of rainfall. In the recent history of Lay Gaint district, the year 2012/2013 can be taken as the most disastrous year.

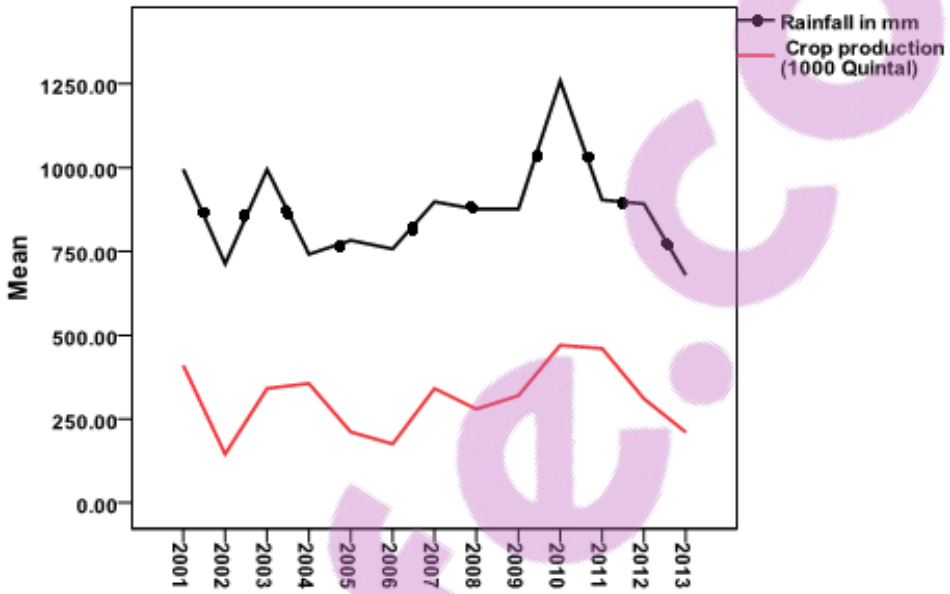

Figure 3.12. The relationship between crop production and rainfall trends *in* Lay Gaint district (2001-2013)

As the district agricultural expert indicated, crop production failed because of the late onset and early terminated rains. The problem was compounded by high intensity of rainfall associated with hailstorms, landslides and severe soil erosion in the two wet months (July and August) (Figure 3.7).

3.4. Drought-prone areas of Lay Gaint district

As it can be seen in Figure 3.13, the northern and eastern parts of Lay Gaint district are the most affected by severe to extreme drought. This is attributed to the poor vegetation cover of the area (Figure 3.8), poor soil fertility (Figure 3.5) and poor rainfall distribution (Chapter 7).

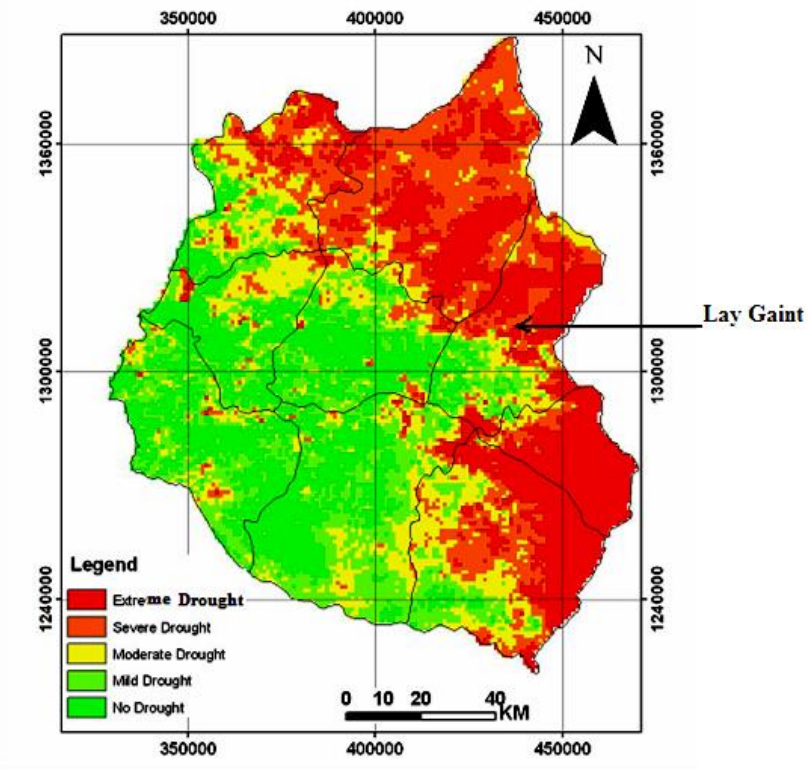

Figure 3.13. Drought map of Lay Gaint district in South Gondar Administrative zone

Source: Birhanu (2009)

This made the study district along the Tekeze river basin depend on external support for many years; and this is the norm for the majority of the rural poor that an end to this predicament could not be seen in the near future. Apart from meteorological drought, people living in *Kolla* zone of the Tekeze river basin were severely affected by socio-economic factors such as civil war over the previous two or three decades; and this has further contributed to the neo-Malthusian development path of deepening poverty and food insecurity (Barrett *et al.*, 2001; Guinad, 2001). Consequently, subsistence farmers in the drought-prone areas of the study district are usually risk-averse and less likely to use the new technologies to increase crop production and are chronically food insecure. Therefore, in drought-prone areas such as the study district, emphasis should be given to food security, crop and livelihood diversification, voluntary resettlement and local adaptive strategies (Chapter 7).

3.5. Productive Safety Nets Program (PSNP) in Lay Gaint District

The study district is characterized by erratic rainfall, land degradation, high population pressure and poor asset ownership. As a result, more than 70% of the households were not able produce their yearly minimum kilocalorie consumption from own production. In the district about 88,000 people are PSNP beneficiaries. The district agricultural expert also evidenced that the food they produce can be consumed on the average not more than six months of the year. Monthly food deficit is widespread but the problem is severe from February to September and is largely filled by food transfer program and other income generating activities (District Food security Office, 2011). The local government of the district has implemented three interrelated food security strategies such as voluntarily resettlement program, PSNP and other food security program to secure food at household level. The program focuses on chronically food insecure households and agro-ecological zones with the aims to ensure household food security. So that, chronically food insecure people have enough food to eat throughout the year, helps to prevent asset depletion, aspire to address underlying causes of food insecurity, and intend to have a positive impact in stimulating markets and injecting cash into rural economies (MOA, 2010). However, under-coverage and under-funding is a serious limitation of the program. That is, high numbers of needy households were not accessed and small transfers are not able to provide complete protection of the chronically food insecure households of the district in the different agro-ecological zones.

3.6. Conclusion

Located in the north central parts of Ethiopia, the Amhara National Regional State has good resource of potential to improve people's livelihoods. Some administrative zones (East Gojjam, West Gojjam and Awi zone) are surplus producers and they are parts of the food basket for Ethiopia. On the other hand, Administrative zones located in the east of the region, are prone to drought and are dependent on external food aid for many decades. Of the total 126 districts found in the Region, 64 districts including Lay Gaint are chronically food insecure. Agriculture composed of crop and livestock production is

the dominant livelihood source for the study district. However, the sector is dependent on traditional modes of production and frequently attacked by erratic rainfall; as a result, the majority of the rural poor are affected by scarcity of food for considerable number of months in a year. The problem is compounded by rampant soil erosion and land degradation and high population pressure. Especially in the drought-prone areas of Lay Gaint, agricultural land is scarce, degraded, overpopulated and rugged and this is difficult to apply modern inputs to improve the agricultural productivity in which considerable numbers of people are dependent on PSNP for their livelihoods.

Chapter 4

Research Design and Methodology

4. 1. Case Study Research Design

The study employed the case study research design to assess determinants of rural household food security in drought- prone and impoverished area of Lay Gaint district of the ANRS. Case study is a well-established research tradition and an important approach in geographical inquiry (Yin, 1994 cited in Tatek, 2008). Case study in this study used to investigate the problems at in-depth using multiple methods. Some writers such as Kohn (1997), Yin (2002; 1984) and Yin et al. (2006) indicated that case study is a comprehensive understanding of complex instances obtained through extensive description and analysis of a whole or a part. Comprehensive means obtaining a complete picture of what is going on at a moment while, extensive description and analysis refer to the involvement of rich information that comes from multiple data sources such as in-depth interview, observation, survey questionnaire and document analysis (Yin, 2002). The term whole means the size of the instances that can be referred to as small as one individual or as large as a community, a region, a nation or larger geographical area in a case study (Singh, 2006; Maree, 2010). Therefore, Lay Gaint district is selected as the case study to investigate the multifaceted problems rural communities encountered in achieving household level food security. Case study could be quantitative and qualitative methods in a single study. According to Kohn (1997), it is common for researchers to combine case studies with quantitative analyses that use larger data sets. Bryman (2008) also noted that case study could examine the mixing of quantitative and qualitative[3]

[3] Qualitative research thus refers to the meanings, concepts, definitions, characteristics, metaphors, symbols, and descriptions of things (Berg, 2001: 35-36). Qualitative research involves an interpretive, naturalistic approach to the world and study things in their natural settings, attempting to make sense of, or to interpret, phenomena in terms of the meanings people bring to them (Snape and Spencer, 2003).

research methods within a single study. Applying a combination of research methods in food security study is believed to be imperative, as it is the most appropriate way to explore the complex and multi-dimensional nature of rural livelihoods, vulnerability to food insecurity, climate variability/change and households response to the predicaments. Creswell (2003) and Slee et al. (2006) noted that mixed[4] research approach minimizes some of the limitations of using single method because quantitative or qualitative research methods are not sufficient to address the complex social phenomena when they are treated independently. In other words, qualitative methods suffer from the limitations of generalizing the results beyond the specific research area and go through subjectivity during data collection and analysis. The quantitative method on the other hand, always fails to capture an in-depth understanding of intra and inter-household dynamics especially when the household head is in a position to speak on behalf of his family and/or neighbors (Tsegaye, 2012). Hence, using the epistemology of mixed research approach in a case study research design helps to address the research questions and to check the validity of results (Habtemariam, 2003). When quantitative and qualitative research methods are used in combination in one study, they complement to each other and allow for a more complete analysis of the research problem (Migiro and Magangi, 2011).

As discussed in the following sections, the study employed survey questionnaire, in-depth interview, focus group discussion, life history narratives and direct observation. For that reason, the best philosophy for this study could be pragmatism. This sis due to the fact that regardless of any circumstances both quantitative and qualitative research methods can be used in a single study (Creswell, 2009; Migiro and Magangi, 2011). Migiro and Magangi (2011) indicated that pragmatism is considered the best philosophical basis of mixed method research; and justifies the combination of multiple methods in a single study. Degefa (2006) also suggested that pragmatism rejects the either/or choices associated with the paradigm tension, and instead advocates the

[4] Mixed method research is in which the researcher uses the qualitative research paradigm for one phase of a study and the quantitative research paradigm for another in order to understand a research problem more completely (Creswell 2005 cited in Migiro and Maganggi, 2011: 3757).

application of mixed research method. This study, therefore, followed the pragmatism mixed research philosophy, as it is the best method to validate the results. In relation to this, Migiro and Magangi (2011) noted that the choice of the research approach depends on the researcher's philosophical orientation (positivism, constructivism or pragmatism), the type of knowledge sought and the methods and strategies used to obtain this knowledge. The present study employed concurrent mixed research methods for the reason that both quantitative and qualitative data were collected simultaneously and the results were embedded during the analysis.

Even though the use of mixed methods is vital to triangulate the results, it is highly influenced by the purpose of the study, available time, available resources and familiarity of the researcher in the areas of quantitative and qualitative research methods (Tsegaye, 2012). Degefa (2006) added that research costs, contradictory findings arising from the use of multiple methods, the demanding of sufficient skills in quantitative and qualitative methods and balanced use of the two methods are some of the limitations in the use of mixed research methods. Some of these issues raised were also the concerns of the present study but they were not influential factors to carry out the multi-dimensions of food security at household level.

Few empirical studies were reviewed to recognize the importance of mixed methods in food security studies. A study made by Markos (1997) in drought-prone areas of northern Ethiopia employed structured questionnaire as well as formal and informal discussions with elders, community leaders, development agents and governmental and/or non-governmental officials and found out that the methods were imperative to collect complex issues related to food security. Similarly, Devereux et al. (2003) used qualitative and quantitative research methods in their destitution study of *Wollo* and they found out that the methods used were vital to capture the major variables related to destitution and poverty in one of the most drought-prone northeastern highlands of the ANRS. Dersolegn (2012), a study made in Addis Ababa, related to urban poverty indicated that in addressing the problems of poverty and food insecurity which include vulnerability, food

insecurity and marginalization, the use of both quantitative and qualitative research methods were important means in understanding wider social problems. More specifically, Degefa (2005) in his case study of Ernessa and Garbi Communities in Oromiya Zone in ANRS investigated that food security at household level can be best examined through mixed research design due to the fact that food security and poverty issues have multiple dimensions that cannot be handled easily through a single method. In general, to investigate factors affecting household food security in drought-prone district of Lay Gaint, both primary and secondary data sources were employed. Extensive literature review, sample household survey, in-depth interview, focus group discussion, analysis of statistical data and textual analysis of qualitative data were the methods used in this study.

4.2. Field Work for the Study

The fieldwork for the study was started in December 2011. From December to January 2011, some preliminary survey was made to have general information about the situation of food security in the district. The issues considered were socio-economic activities of the local people, perception about rainfall variability, trends of crop production over the last 20 years, severity of land degradation, water and energy sources, food availability, livestock and problems of grazing, environmental conservation schemes, etc. Opinions of agricultural experts, food security experts, rural *kebele* administration (RKA[5]) officials and some prominent individuals were interviewed to have general information about the food security problems in the district. The actual survey began at the mid of March 2011 and continued up to the end of April 2011. These months were selected purposely because the researcher and enumerators could move through the area easily crossing river valleys, which would be problems during the rainy season. Secondly, this period was convenient for the farmers to respond to the questionnaires; there are little agricultural activities during this time of the year.

[5] The lowest tiers in the administrative structure of the country

4.3. Selection of Sample Sites and Sample Households

Lay Gaint district was selected purposely as a case for the study. The factors that motivated the selection of the study area include the following. Firstly, it is one of the 64 food insecure districts in the ANRS and the majority of the population in the district are either seasonally or chronically food insecure. As Guinand (2001) pointed out among the nine districts in South Gondar Administrative Zone, five of them including Lay Gaint district are characterized by widespread poverty and persistent food insecurity. Secondly, there are many studies on food security issues in Ethiopia (e.g. Sen, 1981; Desalegn, 1991; Webb and Braun, 1994; Markos, 1997; Devereux, 2000; Devereux *et al.*, 2003; Sorensen *et al.*, 2004; Degefa, 2005). However, in most of these studies coverage of the ANRS was limited to the famine-prone belt of North Shewa, and North and South *Wollo*. Thirdly, the study area has diverse agro-ecological zones ranging from hot (*Kolla*) to cool (*Dega*) temperature zones, which will represent much of the economic, demographic and physical features of the ANRS. Fourthly, the researcher is familiar to the area; hence, there was not communication barrier with survey participants.

The specific RKAs were selected in a cluster sampling approach where all the RKAs in the district were first clustered into three major agro-ecological zones (*Kolla*, lowland; *Woina-Dega*, mid-highland and *Dega*, highland, with respective elevations of 500-1500, 1500-2300 and above 2300 m asl) (Figure 4.1). Then three RKAs were selected, one each from the three zones, in a random sampling procedure. The assumption was, in an agro-ecological zone, households share similar opportunities to secure livelihoods. The RKAs selected for this study were Akabet *(Dega),* Safda Giorgis *(Kolla)* and Mesqench *(Woina-Dega*) (Figure 4.1). Households in each RKA were further stratified[6] into wealth groups based on information obtained from focus group discussions (FGDs), key informants (KIs), authors prior knowledge and secondary sources. In relation to this, Barrett (2002) pointed out that adverse shocks to an economy rarely affect all persons equally, that is, certain individuals are more vulnerable to shocks than others; because of their differences

[6] Stratified sampling was involved in dividing the population into homogenous groups containing participants with similar characteristics (Mary and Majule, 2009).

in ownership of assets. This means some avoid hazards completely or recover quickly which is a serious shock for the others. More importantly, Tsegaye (2012) pinpointed that qualitative wealth ranking methods and household survey approaches can be employed in combination for better understanding of wealth differentiation and investigation of the dynamics of rural poverty and food insecurity. For that reason, grouping households based on wealth categories is imperative as discussed hereunder.

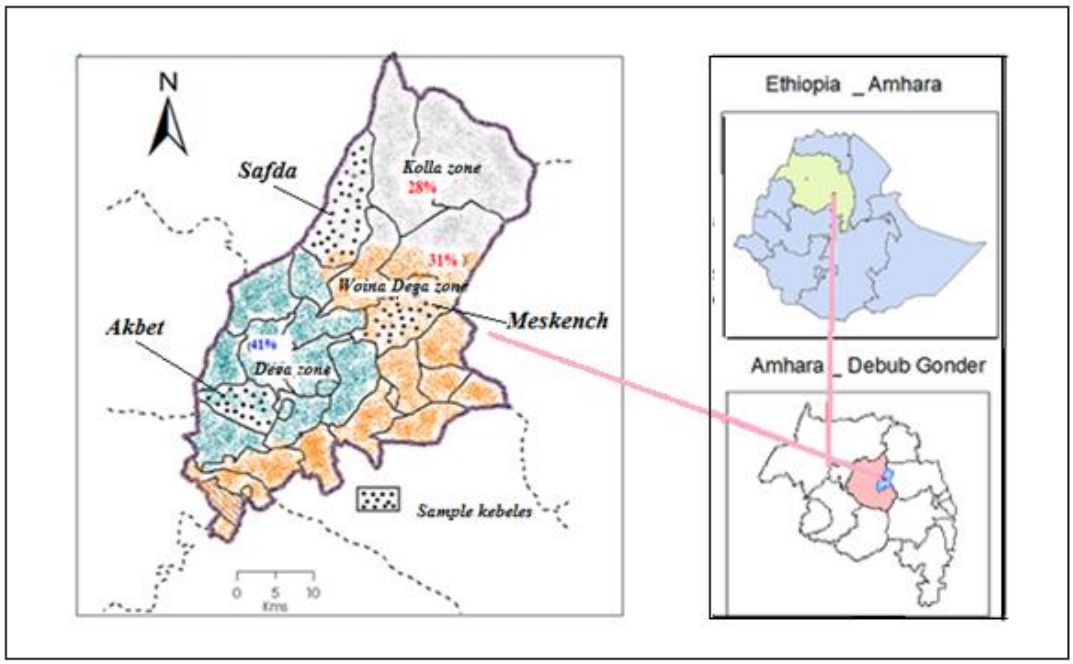

Figure 4.1. Location of the sample of RKAs by agro-ecological zone

4.3.1. Determining Wealth Categories

Grouping households by wealth categories is appropriate because the same risk/shock has different impacts on different wealth strata. Ellis and Tassew (2005) noted the significance of wealth rankings in such a way that it provides information on how communities view themselves relative to livelihood success. Secondly, it helps policy makers to distinguish those who need help during crises. Thirdly, it helps to identify upward and downward trends in people's well-being including the causal factors. Fourthly, wealth categories in drought-prone areas assist to understand the extent of variations in entitlements arising from variations in asset ownership. Consequently, the

succeeding discussions focused on identifying the variables, which are used to classify wealth categories.

Bird and Shineykwa (2005) indicated that household wealth categories are correlated with a number of variables such as household assets, household dependency ratio and livelihood diversification. Likewise, Degefa (2005) a study made in Oromyia zone of the Amhara Region attached the well-being of a household to the ownership of productive assets such as cattle, oxen, small ruminants and land. Campbell et al. (2003) also identified type of shelter, number of cattle, number of goats, number of donkey, ownership of farm implements, amount of remittances received, degree of food security and number of various types of productive equipment were vital criteria used for wealth categories in their study of Zimbabwe. A study made by UNDP-EUE (1999), in South and North Gondar administrative zones had classified wealth categories a bit detail in the following ways. The poor households have no ox, a couple of goats and sheep, some poultry, not subsistent economy, primary target for FFW, farm size ranges between 0.5 and 1 hectare, many of them are female- headed households, daily or causal labor, old people, disabled, abandoned or divorced women with no education. The middle households on the other hand, have one to two oxen, some cattle, can have considerable numbers of goats/sheep, can involve in FFW if necessary, enough land for subsistence farming, petty trade and the majority are male-headed households. The rich/better-off households were identified as having more than two oxen, more than five cattle (cows, calf), more than two donkeys/mules/horses, enough land for subsistence farming up to four hectares, engage in petty trade and have basic education. Likewise, Ellis and Bahiigwa (2003) and Smith et al. (2001), in studies made in Uganda have classified three wealth rankings. The rich were distinguished having above two hectares of land, four or more cattle, five or more goats, employing nonfamily labor, sending their children to primary or secondary school, owing non-farm services and sometimes employed monthly salary. The middle (average) wealth categories have correspondingly less of all assets than the rich have and found in selling seasonal labor rather than buying seasonal labor. The poor ones possess little or no land, no cattle, few small stock and sale labor to others,

unable to pay school fees and have few non-farm self-employments. Mamo and Ayele (2003) also indicated as those farmers having less than 0.5 hectare of land and with one or no ox were classified as extremely poor farmers.

Though secondary sources are used as a base in classifying wealth categories, KIs and Focus Group discussants from their chief experience are also unfolding in giving information about wealth categories. Elias (2006) for example, suggested that the level of wealth rankings depend on how the community views their community in relation to the assets they possess. Consequently, wealth categories (poor, middle, better-off) could be identified through in-depth interview with KIs and Focus Group discussants who have lived in the community for long periods and can represent the community in different parameters. With the conviction to get better information how people perceive wealth categories in their localities, an in-depth interview with KIs and Focus Group discussants were made.

According to informants perception, the better-off households in *Kolla* agro-ecological zone were designated having more than a pair of oxen, two to four cows, twenty or more goats/sheep, one to three donkeys, consume from their produce throughout the year, above seven family size, have fruits and trees production and possess more than one hectare of land. The poor on the other extreme do not have significant assets other than farmland (usually less than 0.75 ha). The poor mostly owned less than five goats/sheep, three to five chicken, have less than five family sizes, few eucalyptus trees and consume from their produce not more than three months. The middle is found between these two extremes. In *Dega* agro-ecological zone the better-off were classified as having one or more pair of oxen, many eucalypts tree, two or more hectares of cultivated land, ten to twenty sheep, food secured, two or more cows and one or more equines. The poor do not have significant assets except the land owned and few small ruminants. What makes the poor different from the better-off/middle were, the poor mostly engaging in causal labor, sharecropping arrangements and being beneficiaries of safety net program. In *Woina-Dega* zone, the better-off have variety of assets that could be sold during crises and/or

food shortages more than others. As a result, the better-off are not immediately exposed to distress shocks at times of food crises like that of the poor or the middle ones. The middle households in this zone owned about one hectare of land, one or pair of oxen, less than 10 small ruminants; one or two cows and engage in causal labor if necessary. In general, wealth category is a relative term, since the majority of the rural people in Ethiopia in general are poor in many development indicators (Ellis and Tassew, 2005)

Based on the information collected from KIs, FGD participants, authors knowledge and ample secondary sources; the study had identified the following criteria in classifying wealth categories in the study area. The variables employed in classifying wealth categories in this study include livestock holdings, sex of the head, farm land owned, food security status, the number of months the family consumes from own produce and livelihood diversification (Table 4.1).

Table 4.1. Criteria employed in classifying wealth categories in the study area

Criteria	Better-off	Middle	Poor
Farm size (ha)	1.75 - 3.00	1.0 - 1.75	≤ 1.0
Shoats owned	20 -25	10 - 20	3 - 5
Cattle owned	4 and above	2 - 4	≤ 1.0
Oxen owned	2 and above	1- 2	≤ 1.0
Other assets owned	Own tin roofed house, fruits and trees production	Good quality of grass thatched and tin roof houses, have trees production	Poor quality of grass thatched roof and no significant perennial trees
Food security status	Consume from own produce throughout the year.	Consume from own produce from 6 to 8 months	Consume from own produce not more than 3 months
Livelihood Activities	Farming, petty trade, sell livestock and crop production	Farming and some form of trade, can participate in PSNP if necessary	Selling fuel wood and charcoal, causal labor, participating in PSNP
Household head	Male headed	Male/female headed	Dominated by female headed households

Source: Modified from Ellis and Bahiigwa (2003); Ellis and Tassew (2005)

Selecting sample households for the questionnaire survey: As it is shown in Table 4.2, households in each RKA were grouped into three wealth categories based on the

information obtained from FGDs, KIs, authors prior knowledge and secondary sources. The total households in the three selected RKAs were 4100. For a population of about 4000, margin error = 0.03, alpha = 0.01 and t = 2.58, the minimum sample size assigned is 198 (Barrett *et al*., 2001). For this study, fear of missing data, 210 sample sizes were determined to fill the questionnaire. In relation to this, Naing et al. (2006) indicated that it is wise to oversample 10% - 20% in case there is missing data. Finally, a total of 210 households were sampled for a questionnaire survey from the three RKAs using proportional stratified random sampling techniques based on the sampling frames obtained from the RKAs offices. However, as it can be seen in Table 4.2, nine questionnaires were not correctly filled for analysis.

Table 4.2. Sample rural *kebeles* by agro-ecologies and wealth categories

RKAs	Agro-ecology	Wealth categories	population	Sample households	Questionnaire returned for analysis
Akbet		Better-off	202	10	10
	Dega	Middle	481	24	24
		Poor	740	36	36
Mesqench		Better-off	188	9	9
	Woina-dega	Middle	403	20	20
		Poor	820	41	41
Safda Giorgis		Better-off	175	10	9
	Kolla	Middle	301	20	16
		Poor	790	40	36
		Total	**4100**	**210**	**201**

In the selection of KIs and FGD participants, purposive sampling technique was employed. Twelve KIs were selected for in-depth interview. In the selection of FGD participants, information was obtained from group interviews and key informants. Three FGDs, one from each of the three RKAs, were conducted to capture issues not fully covered by the questionnaire survey and to triangulate the results. As far as their compositions and numbers are concerned, nine from *Dega*, seven from *Kolla* and ten from *Woina-Dega* were selected for group discussions composed of both male and female-headed households. It has to be noted that in qualitative sampling techniques the actual number of cases studied is relatively unimportant. The important thing is the

potential of each case to aid the study in developing qualitative insights into social life being studied (Taylor and Bogdan, 1998).

4.4. Data Collection and Analysis

4.4.1. Primary Data

Survey respondents, KIs and FGD participants were the primary data sources for this study. Survey questionnaire, in-depth interview, FGDs, life history narratives and direct observation were the instruments used to collect the primary data. Thus, intra (both closed and open-ended questions) and inter-method (questionnaire, KIs, FGD and observation) data collection techniques were employed for the study to collect the necessary information. During the fieldwork, quantitative and qualitative data were collected simultaneously, but in the case of qualitative data, two additional rounds were made to crosscheck results acquired and to overcome some of the limitations faced during the first and second rounds of qualitative data collection.

Survey Questionnaire: The primary data from household survey were collected using questionnaires. The questionnaires were composed of both closed and open-ended types of questions and covered various issues: demographic and socio-economic characteristic of respondents; livelihood assets, strategies and shocks; perceptions about climate variability, coping and adaptive strategies; and issues related to household vulnerability to food insecurity. The researcher, six enumerators and three supervisors, all speaking the local language conducted the survey. The enumerators were first trained by the researcher about how to present and explain each question to respondents. They were also advised to inform each respondent the purpose of the survey before starting the actual interview. The interviews were conducted by going to each interviewee's homestead. The time to interview households, took from one to one and half hours. Early morning, late afternoon and Sunday (the whole day) were convenient times for the interviewees. A total of 210 questionnaires were distributed and 201 questionnaires were returned, nine questionnaires in the *Kolla* zone were not correctly filled and hence excluded from the analysis. The

numbers of questionnaires returned were thus, 70 from Akbet *(Dega),* 70 from Mesqench *(Woina-Dega)* and 61 from Safda Giorgis *(Kolla)*.

Key Informant interview: The researcher made in-depth interviews with twelve key informants selected purposely. In-depth interviews covered such issues as future food security of households, land degradation and crop production scenarios, the relationship between climate change and crop production, issues related to land tenure security, land management practices, extension services, nonfarm activities, main household incomes and information related to physical capital and social relations and networks. The key informants selected were district expert of food security, heads of households, district agriculture expert, district health expert, district education expert and experts from local and international NGOs working in the study area. The checklists prepared were semi-structured and flexible. Taylor and Bogdan (1998) pointed out that in-depth interview is non-directive, semi-structured and non-standardized open-ended interview, but the checklists were not too open to manage. The checklists were used as probing and information beyond the already prepared semi- structured questions were collected during the in-depth interview periods. In-depth interviews were held near to homesteads of interviewees, at their farmlands and in some cases at elevated grounds to observe the general conditions of the study area. The average time taken to interview key informants ranged from 60 minutes to 120 minutes. Key informants were not forced if they were not interested to complete the interview. For example, one key informant from *Kolla* agro-ecological zone was not able to complete the interview period and the researcher accepted his unwillingness to be interviewed. During interviews, the four interview principles were employed: letting people talk, paying great attention to interaction, being sensitive to cases raised and being nonjudgmental. With the awareness of key informants, tape recorder was used (also for recording life history narratives and FGDs) to get time to listen and to have eye contacts with participants.

Focus group discussion: FGD was an important method of data collection during the fieldwork. As mentioned in the preceding discussions, three FGDs were conducted for

this study to get detail information about household asset ownership, climate related hazards, trends of crop and livestock production and households' coping/adaptive strategies. The discussions were used to investigate problems of food insecurity and associated factors. FGD allows participants not only to speak for themselves but also to negotiate their shared views. Checklists were used to guide discussions and allow participants to state their own experiences. During the discussion, with their consent, tape recorder was employed to record the necessary data and to have eye contact with them. Thus, in this session, the writer was a moderator and facilitator. The distinguishing feature of group discussion from other interview methods is that the former is an argumentative type that helps to get detail information on issues under discussion. The problems encountered during FGDs were that some group members' tendency to dominate the discussions. The researcher as the group leader had tried to motivate all participants to take active part in the discussions.

Life history narratives: Life history[7] narratives of individuals whose livelihood circumstances are typical and representative of communities to share their experiences were selected purposely. The case history participants were heads of households. They were asked to tell their personal histories, experiences, challenges they faced in their lives particularly during food crisis times. For this, three households (two male- headed and one female-headed) were purposively selected to narrate their life experiences in relation to livelihood assets, climate change and coping/adaptive strategies, population pressure and land degradation scenarios. The convenient places selected were around their homesteads and in their farmlands to describe the sequence of events they observed in their lifetimes. The time for the discussions took on the average two hours.

Direct observation: Personal observation was employed to get some information about the problems under investigation. Observation is a systematic process of recording behavioral pattern of participants, objects and occurrence without questioning the participants (Creswell, 2009; Maree, 2010). Direct observation helped to have a better

[7] Life history include personal experience, mental and social conflicts, crises, adjustments, accommodations and release of tensions and make theoretical sense of it (Singh, 2006:154).

understanding of the various phenomena under investigation. Some of the phenomena observed were marketing activities at market places, settlement patterns, agricultural activities (planting, weeding and harvesting), private and communal grazing lands, water points, natural resources degradation, water-harvesting techniques, available wild fruits, various social and cultural occasions and rituals relating to feasts, wedding and funeral ceremonies. Besides, enumerators were also tasked to report conditions of road infrastructure, water-harvesting techniques, management status of farmlands, vegetation distribution, housing conditions, health and school facilities, availability of water, communal and private grazing lands, and availability of fruits like highland apple and other relevant information.

4.4.2. Secondary Data

Official government statistics and other technical reports by national and international organizations such as the Central Statistical Agency of Ethiopia, the World Bank, etc. and research reports by individuals or organizations were intensively used in this study. Web sources were also included in the secondary data sources. The researcher also collected some information in relation to landholding size, the livestock owned, crop production and family size from RKAs' documents for comparison from the primary data collected in the field, as they can understate the resources owned fearing of formal and informal obligations.

4.4.3. Data Analysis

Both quantitative and qualitative data analysis techniques were employed in this study. In collection and report of the qualitative data, the researcher did not follow strict steps. Sometimes circumstances may force the researcher to revisit to the original fieldwork to verify the results. Summarizing what was heard during the discussions in to words, phrases or patterns was the major tasks accomplished in qualitative data analysis. Hence, the information collected through KIs interviews, focus-group discussions, life history narratives and observations in relation to climate change, coping and adaptive strategies,

households' perceptions about climate change, vulnerability to food insecurity, livelihood capital assets and livelihood strategies was documented and analyzed textually[8] to substantiate the statistical results from the structured questionnaire. In general, the collected data were analyzed with the help of narrations, descriptions and quotations.

The quantitative data analysis, on the other hand, was a process of tabulating, interpreting and summarizing empirical and numerical data for the purpose of describing or generalizing the population from the samples. Upon completion of the data collection, the data were coded, edited, digitized and entered into the statistical package SPSS (Statistical Package for Social Scientists) and analyzed using descriptive and inferential statistics such as frequencies, percentages and tables. Inferential statistics such as paired t- test, one way ANOVA, independent t-test, chi-square and bivariate correlations were used to investigate the relationships and differences of the variables. In general, to analyze the quantitative data, descriptive statistics and inferential statistics (bivariate correlation, linear regression and binary logistic regression modeling) were used.

4.4.3.1. Regression Modeling

Linear Regression Model

Linear regression modeling was used to identify significant factors influencing household total annual incomes as dependent variable. The productions of crops of the sample households in 2010/11 were expressed in terms of monetary equivalent to understand contributions to total annual incomes. For that reason, estimated average prices of crops produced in 2010/11 were taken during the field survey. Besides, annual incomes of households from sale of livestock during that time were considered. Annual incomes from non-agricultural activities were also estimated. Hence, the major sources of income for households in the study area were small-scale agriculture (crop and livestock

[8] If the data is in the form of text, the raw data requires some sort of organizing and processing before it can actually be analyzed. Field notes, for example, may fill hundreds of pages of notebooks or take up thousands of megabytes of space on a computer disk (Berg, 2001).

production, and sale of trees and fruits), engagement in off-farm and non-farm activities, participation in public works programs and receiving remittances. Annual income of households was taken as a proxy for the livelihood outcome of households from their diverse set of livelihood strategies, as annual incomes broadly determine food security status and wellbeing of households. Babu and Sanyal (2009) added that a household annual income is one of the determinants of household food security outcomes. Annual incomes of households reported here, sums from all sources of income, were estimated by respondents themselves. Explanatory variables included selected socio-economic and biophysical factors that were assumed to influence annual incomes of households in the study area (Chapter 6).

Binary Logistic Regression Model

Binary logistic regression model was employed to identify determinant variables affecting households' vulnerability to food insecurity. Such kind of model is suitable when the dependent variable is dummy in this case household food security as it is shown in the succeeding topics. The factors that determine households food security were grouped into natural and socio-economic factors, and the variables selected for the model were dominantly socio-economic factors.

An assessment of the Goodness-of-fit of the model

Checking the Goodness-of-fit is important for binary logistic regression model (Quinn and Keough, 2001). The Pearson χ^2 statistic based on the observed (o) and the expected (e) is used to visualize the two (binary response) and contingency tables (Quinn and Keough, 2001). This showed that the fitness of the logistic model is determined by how similar the observed values are to the expected or predicted values. The null hypothesis that the model fits the data against the alternative hypothesis was also tested using Hoemer- Lemeshow Test. Hoemer - Lemeshow's goodness of fit test indicates that the predicted frequency and observed frequency should match closely; and the more closely they match, the best fit it yields (Alemu, 2007; Tang, 2001). According to Babu and

Sanyal (2009), the binary logistic regression model best fits, if the value of the Hosmer-Lemeshow goodness of fit approaches to one.

Multicollineraity checking

Once the model is fitted to the observed and expected of the binary response variable, a thorough examination of the extent to which the fitted model provides an appropriate description of the observed data is vital in the modeling process (Alemu. 2007). According to the same author, the fitted logistic regression model may be inadequate because a particular observation, termed as outliers or influential values might have an impact on the conclusions drawn from the results. Some of the statistical techniques, which are employed to examine the model of adequacy, include multicollineraity, tolerance and variance inflation rate (VIF). Multicollinearity occurs when two or more independent variables are approximately determined by a linear combination of the independent variable in the model (Quinn and Keough, 2001). When the collineraity is perfect linear, it is impossible to obtain a unique estimate of the regression coefficient with all the independent variables. Gupta (1999) suggested that a bivariate correlation coefficient greater than 0.8 (in absolute terms) between two independent variables indicates the presence of significant multicollinearity effect. Multicollinearity indicates the strength of the interrelationship between independent variables however, how much the inflation of the standard errors caused by collinearity effect could be checked using tolerance ($1 - R^2$) and VIF (1/tolerance). As a rule of thumb, the VIF rate greater than 10 shows high multicollinearity and tolerance close to zero also indicates high multicollinearity between independent variables (Alemu, 2007).

4.4.3.2. Measurement of Food Security Status of Households

Dietary energy supply measured in kilocalorie (kcal) was used to determine food security status of a household; since it is the single most important indicator of food adequacy level (Qureshi 2007). In the calculation of kcal intake of the sample households, the amounts of calorie available to a household were determined using a modified version of

the regional food balance model, which was also used by Smith and Subandoro (2007) and Mesay (2009). The model is given as:

$$HHFA = Y+FP+FA+R/G -S - SR - PHL$$

Where HHFA = household food availability; Y = own production; FP = food purchased; FA = food aid; R/G = remittance/gift; S = amount of grain sold; SR = seed reserves (5%); and PHL = post-harvest loss (10%).

The results were then converted into kilograms and then by using the food conversion table (Appendix III), they were changed into kilocalories (adopted from FAO, 2003; Nur 2006; Mesay, 2009; Fekadu 2010). These results were then divided by the number of household members as adult equivalent[9] and the number of days in the recall period. In this study, a minimum of 2100 kilocalorie per capita per day was used to identify food secure and food insecure households. This is because the government of Ethiopia has set the minimum acceptable weighted average food requirement per adult equivalent per day to 2100 kcal (Bogale and Shimles 2009; Abebaw, *et al*., 2011). The same reference value has also been used elsewhere (Migotto *et al.*, 2007). Finally, comparison between calories available and calories required by a household was used to determine the food security status of households. Subsequently, households whose per capita available kilocalorie was greater than the minimum demand were categorized as food secure (coded as 0), while households experiencing kilocalorie deficiency were considered food insecure (coded 1). In view of this, the response variable food security status of the i^{th} household mentioned as a dummy variable was:

$$HFSi = \begin{cases} 1, & Yi < R \text{ (food insecure)} \\ 0, & Yi \geq R \text{ (food secure)} \end{cases}$$

HFSi = household food secutity status of the i^{th} household, i = 1, 2, 3, 4, . . ., 201

Yi = daily per capita calorie avialble (supply)

R = the minimum recommended national standard rate of calories per household per day (2100 kcal)

[9] Adult equivalent is calculated as: $AE = 1+0.7*(N_{adults} - 1) + 0.5*N_{children}$ (Babu and Sanyal 2009, 235)

4.4.3.3. Measurement of Incidence, Depth and Severity of Food Insecurity

Among the various measures of food insecurity, the Foster- Greer-Thorbecke (FGT) food security index is the most commonly applied (Abebaw *et al.*, 2011). This index was suggested initially by Foster et al. (1984) and has several desirable properties that have been enhanced in recent years for the purpose of food insecurity analysis (Abebaw *et al.*, 2011; Idrisa *et al.*, 2008; Maharjan and Chheteri, 2006; Tsegaye, 2009). This model was used for the present study to measure the household head count index (incidence of food insecurity), food insecurity gap (depth of food insecurity), and the square of food insecurity gap (severity of food insecurity) among the food insecure households. Amsalu et al. (2012) indicated that head count ratio describes the percentage of sampled households whose per capita income or consumption is below a predetermined subsistence level of energy (2100 kcal). Alemu (2007) added that head count index is used to measure the extent of undernourishment of households. On the other hand, the food insecurity gap, FGT (α=1), measures how far the food insecurity of households, on average, are below subsistence level of energy. Therefore, the FGT index measures the mean of household food insecurity gaps raised to the aversion parameter *a*, where it represents the severity of food insecurity. The weights attached to the sample respondents were calculated based on the calorie requirement to adult equivalent recommended by the government of Ethiopia (Bogale and Shimles, 2009). The mathematical formula of the FGT model is specified as follows:

$$F(a) = \frac{1}{ni}\sum_{i=1}^{q}\left[\frac{m-yi}{m}\right]^{\alpha}$$

$$= \frac{1}{n}\left[\frac{(m-y1)^{a}}{m} + \frac{(m-y2)^{a}}{m} + \cdots \frac{(m-yn)^{a}}{m}\right]$$

Where: *n* = the number of sample households,

q = is the number of food insecure households,

m = is the cut-off between food security and food insecurity (expressed here in terms of caloric requirement),

yi = is the food calorie intake per adult of the i^{th} household, and

a = is the weight attached to the severity of food insecurity

In this model, if $m < yi$ the household is food secure and if $m > yi$ the household is food insecure (Abebaw *et al.,* 2011). If the weight attached to the severity of food insecurity is zero, the ratio measures the incidence of food insecurity; whereas $a = 1$ measures the food security gap (depth of food insecurity) and $a = 2$ measures the severity of household food insecurity. In other words, if the food security gap is squared the result could be the severity of food insecurity. Thus, the index of severity, $F(a) = 2$ gives greater attention to the most food insecure households by weighting them according to the square of their short fall below the subsistence level (Abebaw *et al.*, 2011; Tsegaye, 2009). After the extent of food insecurity had measured and calculated, it was verified whether there is a statistical differences between agro-ecological zones and sexes of respondents.

Chapter 5

Demographic Characteristics of Respondents

5.1. Introduction

As discussed in Chapter 2, the two contrasting demographic approaches in relation to population and food nexus are still debatable issues and difficult to comprehend in one binding concept in the study area. On one hand, rapid population growth results in degradation of natural resources which in turn causes decline in per capita food availability and hence food insecurity and hunger. On the other hand, large population size is a stimulant to agricultural growth through intensification. This study neither accepts nor rejects these premises rather the study explores households perceptions to investigate the growth of the population and its impact on the local resources. The major indicator of high population pressure in the study area is manifested by households survival on a very degraded and marginal land. Thus, high population growth rate induces increased demand for resources and exacerbates the rate at which these resources are exploited. That is, with a rise in population, the demand for fuel wood and land for cultivation increases resulting in cultivation of marginal lands and hill sides and clearing of bushes. The other proxy indicator of high population pressure is high participation in family planning program, which was unthinkable in the near past in the ANRS. Ample resources revealed that rural households are willing to apply family planning program as the farmland is continuously shrinking due to high population growth and associated problems (Markos, 1997; EDHS, 2012). In Lay Gaint district, for example, about 45% married women use family planning methods during the field survey (District Health Office, 2011). USAID (2012) strengthened that the use of family planning among married women in Ethiopia has grown significantly in recent years, from 15% in 2005 to about 30% in 2011. Moreover, Markos (2001) states that environmental stress and persistent food insecurity have stimulated changes in the demographic behaviors and

attitudes of farming communities, including an increase in the acceptance rate of family planning services, change of attitudes towards early marriage and actual reduction of fertility among married women.

As it is shown in Chapter 2, the Boserupian proposition on the other hand stimulates high population pressure, which could be taken as a major cause for agricultural intensification with the objectives to increase crop production per hectare of land. Nevertheless, this argument is difficult in the ANRS in general and the study area in particular mainly because the majorities of the rural households in study area (~ 80%) are chronically food insecure. As a result, the use of production enhancing technologies such as fertilizers, pesticides, improved seeds, insecticides and modern methods of plow instruments were extremely low or nonexistent (Chapter 7).

The general objective of this chapter was to assess the demographic characteristics in the context of household food security. The specific objectives include (i) to assess the influence of family size on household food security (ii) investigate the food security situations of female headed households. The variables discussed were age, sex, family size and marital status. These variables have implications on household food security and they are used as background information for the succeeding chapters.

5.2. Age and sex composition of the Households

The total family members of the sampled households were 1052 of which 572 were males and 480 females. As far as sex ratio of the household members is concerned, males and females are more less equal with slight variations in which male is greater than female by 19. However, the result was inconsistent with EDHS (2012) which says 95 males per 100 females. The age structure of the investigated households showed that about 34% of the household members were found below 15 years of age (Table 5.1). While considering the two sexes separately, 11% of the males and 9% of females belongs to the ages group less or equal to nine years. On the other hand, the survey data revealed that 2.8% of the males

and 0.9% of the females were above the ages 64 years. In relation to this, EDHS (2012) indicated that below 15 years of age in Ethiopia accounts for 47% and above 64 years were 4%.

The rural children aged above 10 years participate in some productive activities such as herding animals, tilling the land, harvesting crops, collecting fuel wood and fetching drinking water (Mesay, 2009). Accordingly, 76% of both sexes were between the ages 10 to 64 years and are considered economically active in the study area. As it is shown in Table 5.1, substantial age variations were observed between agro-ecological zones. Consequently, of the total household members, whose ages were above 64 years, *Dega* alone accounted for 50% and *Kolla* was the least (6% of total).

Table 5.1. Age proportion of the family members of sampled households

Age group	*Dega*		*Woina-Dega*		*Kolla*		All zones	
	Male	Female	Male	Female	Male	Female	Total	% of the total
0-4	18	12	24	15	7	5	81	7.6
5-9	22	21	19	30	23	10	125	12
10-14	34	27	21	25	20	20	147	14
15-19	34	23	25	18	36	35	171	16
20-24	33	15	10	15	15	12	100	9.5
25-29	17	11	18	10	13	10	79	7.5
30-34	2	14	3	15	3	11	48	4.6
35-39	5	5	14	3	7	9	43	4
40-44	6	9	6	8	5	11	45	4.3
45-49	10	11	13	6	15	12	67	6.4
50-54	9	12	2	7	4	6	40	4
55-59	12	1	7	4	14	5	43	4
60-64	9	6	5	2	3	-	25	2
65-69	6	2	9	-	3	-	20	2
70	7	5	2	2	2	-	18	1.5
Total	224	174	178	160	170	146	1052	100

The variations might be attributed to several adverse factors that determine the low level of life expectancy. In the first case, *Kolla* seems prone to various diseases aggravated by the enervating climatic conditions. In addition, due to extreme rainfall variability, the

zone is more vulnerable to food shortfalls (Chapter 3 and Chapter 7). The *Kolla* zone is also located far away from the main health center and the services obtained from the sector were low as observed during the field survey. In this study, about 14% were female-headed households and the rest (86%) were male-headed households. The mean age was about 51 years with a standard deviation of 13.1. The high percentage of male-headed households implied that the participation of farmers in decision-making process in the study area in particular and the country in general is more of male oriented.

Age and sex compositions vary between wealth categories and agro-ecological zones. Accordingly, the better-off, the middle and the poor households had the mean age of 58, 50 and 49, respectively as it is shown in Figure 5.1.

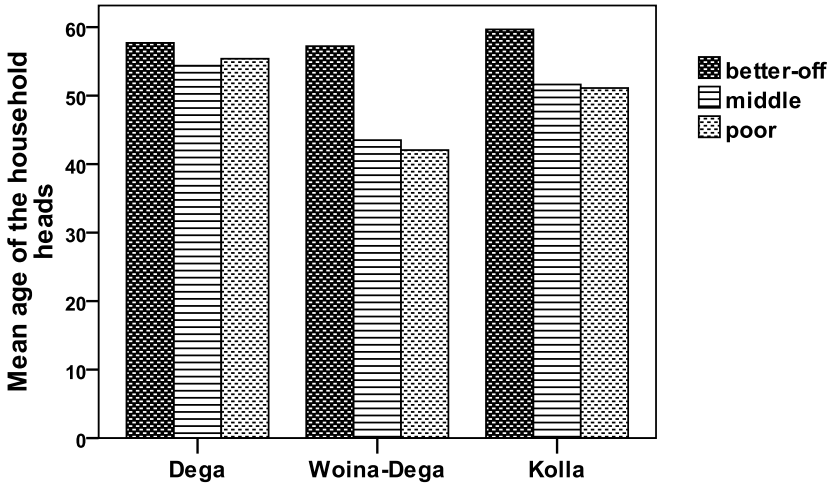

Figure 5.1. Mean age of the households by agro-ecologies and wealth categories

Sampled households *in Dega*, *Woina-Dega* and *Kolla* zones had the mean age of 56, 44 and 52, respectively. For all zones, the mean age was about 51 years with a standard deviation of 13.1. The survey data also revealed that the mean age of female-headed households was 53 and male headed was 50 (Figure 5.2).

The minimum age of the sample household was 20 and the maximum was 85. The results showed that living longer years were higher in *Dega* zone than others. Likewise, Figure 5.2 exhibited that better-off households' live relatively longer year than other wealth categories. Ayalneh et al. (2003) and Sepahvand (2009) confirmed

that as the age of the household increases, the probability to be non-poor increases, perhaps as age of the household increases the capacities to produce assets as well as gaining experience in farming activities might be improved. However, the bivariate correlation revealed an inverse relation to the findings investigated (at $P < 0.001$). This might be the reason that as the households becomes older and older; the capability to be efficient in farming activities significantly decreases. In the study area, the young, old and female headed households are the most defenseless and are exposed to vulnerability to food insecurity because the young suffers from shortage of land, while the aged and female headed households are constrained in labor availability. The study found out that about 88% of the young households having ages less than 25 years were landless during the field survey.

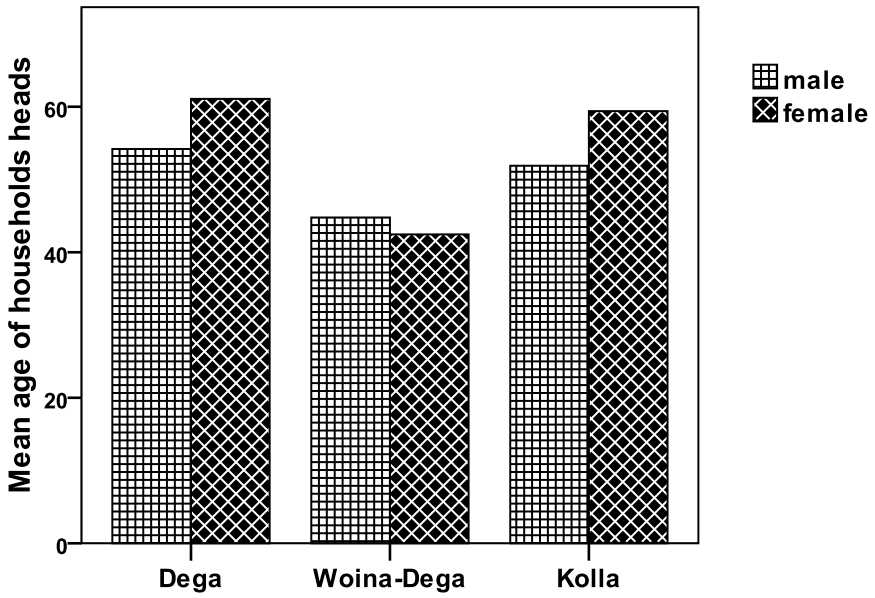

Figure 5.2. Mean age of the household heads by sex and agro-ecologies

5.3. Family size

The average family size for the surveyed households was 5.2 with a standard deviation of 2.0. As it is shown in Figure 5.3, the distribution of family size is normal and the highest frequency is found in between four and six family sizes. The family size of the

study area was higher than the national average 4.3 and the regional average 4.5 (CSA, 2010).

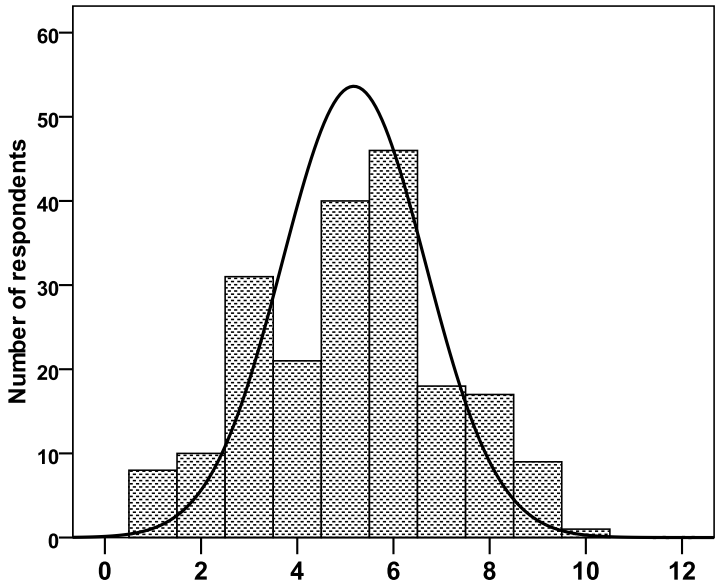

Figure 5.3. Household size of the sample respondents

As it can be seen in Table 5.2, 65.2% of the respondents in all agro-ecologies had a family size between four and seven, while 24.4% had one up to three family members. The largest family size was 10 and was reported in *Dega* agro-ecological zone of the study area. Family sizes of three and below were explained by *Dega* (22%), *Kolla* (16%) and *Woina-Dega* (35.7%) while, *Dega* (48%), *Kolla* (41%) and *Woina-Dega* (34.3%) have six and above family sizes.

Table 5.2. Household size by agro-ecological zones (% respondents)

	Family size					
Agro-ecological zone	0-1	2-3	4-5	6-7	8-10	Total
Dega	8.0	14.0	30.0	27.0	21.0	100
Woina-Dega	-	35.7	30	30	4.3	100
Kolla	3.3	13.1	42.6	37.7	3.3	100
% share	4.0	20.4	33.4	31.8	13.4	100

As it is shown in Table 5.3 and Figure 5.4, 57% of the better-off households, 55% of the middle and 31% of the poor households had six and above family sizes. On the other hand, none of the better-off, 11.6% of the middle and 37.2% of the poor households had a family sizes below or equal to three. By wealth categories, the better-off households had average family size of 6.6, while the poor had average family size of 4.4. This is due to the fact some of the family of the poor might migrate to other areas searching jobs. The One-way ANOVA confirmed that there is statistically significant difference between family size and wealth categories (at $p < 0.001$).

Table 5.3. Household size by wealth categories (% respondents)

	Family size					
Wealth categories	0-1	2-3	4-5	6-7	8-10	Total
Better - off	-	-	42.9	21.4	35.7	100
Middle	3.3	8.3	33.3	45	10	100
Poor	5.3	31.9	31.8	27.5	3.5	100
% share	4.0	20.4	33.4	31.8	13.4	100

As indicated, female-headed households had much lower family sizes at 3.1 against 5.5 of their male counter parts (Figure 5.5) and about 90% of them were food insecure. Consistent with this result, Mossa (2012) found out that female-headed households are more likely to be smaller family size (mean = 3.83), and male-headed households are likely to be larger (mean = 6.59) than the average (mean = 4.6 members). Frankenberger et al. (2007) stated that vulnerable households tend to have a larger proportion of female-headed households and fewer household members and short of household labor. Dolan (2005), in the three districts of Uganda also established similar results in which the mean family size of the female-headed households is smaller than their counter parts. The same author also indicated that 73% female-headed households containing one or fewer economically active adults than 17% of the male -headed households.

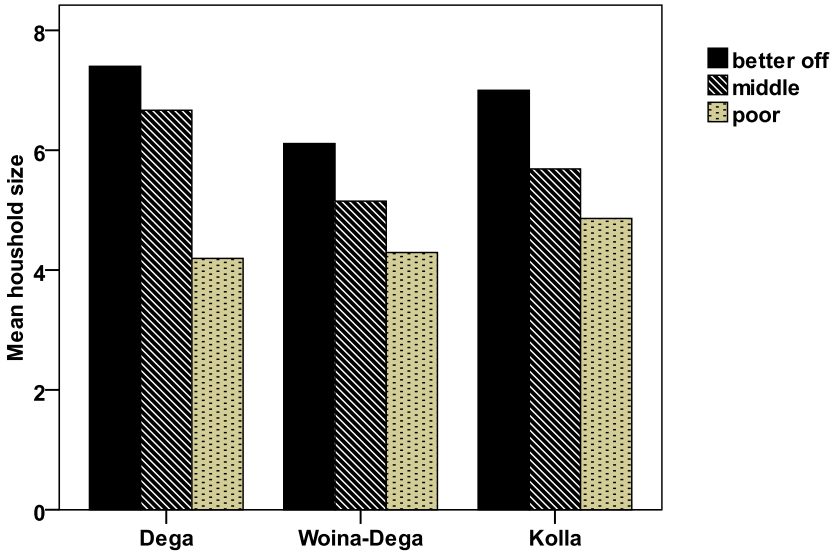

Figure 5.4. Mean family size by agro-ecology and wealth categories

As it is depicted in Figure 5.5, family size of female-headed households was low. The maximum average family size of female-headed households was observed in *Woina-Dega* (3.7), and the minimum in *Dega* zone (2.5). It was also observed that, family size was relatively low in *Kolla* and *Woina-Dega* agro-ecological zones. This is mainly due to the fact that the indicated agro-ecological zones are chronically food insecure and some household members might migrate somewhere to search job.

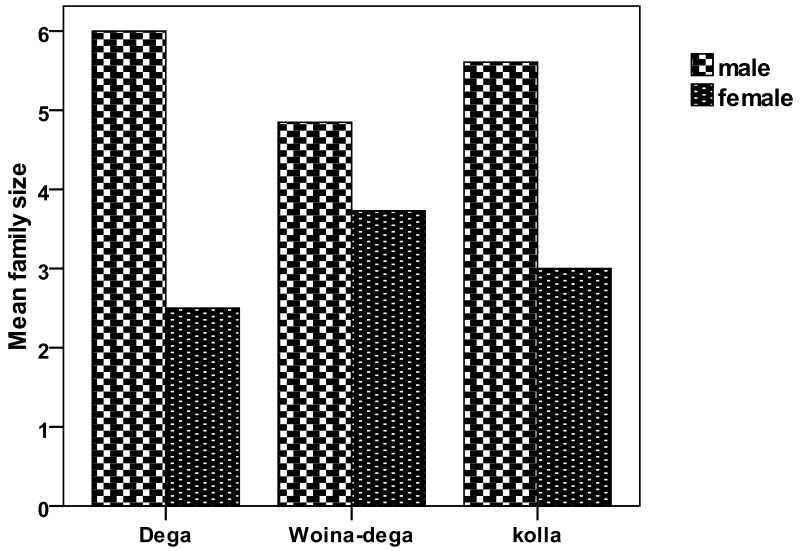

Figure 5.5. Average family size by agro-ecological zones and sex of the heads of households

As the district health expert indicated, in *Kolla* zone there is seasonal and chronic health problems such as malaria, which is the major cause for the death of children that might lower the average family size of the households. In relation to this, McDevitt (2012) noted that children are particularly susceptible to disaster-related and health impacts of climate change including an increased prevalence of malaria, diarrhea and under-nutrition.

The influence of family size on food security status of the households depends, among other things, on age and sex composition, educational levels and skill mix of the members as well as the productive resources at disposal of the household. Family size also influences the food share and the welfare of individual members in the house. The findings of this study revealed that about 90% of the sample households with one family member were vulnerable to food insecurity (Table 5.4). About 80% and 97% of the sampled households with 2 and 3 family members were also vulnerable to food insecurity, respectively.

Table 5.4. Household family size and vulnerability to food insecurity (% respondents)

Family size	Non-vulnerable households	vulnerable households
1	11.1	88.9
2	20.0	80.0
3	2.7	97.3
4	36.4	63.6
5	18.2	81.8
6	28.9	71.1
7	66.7	33.3
8	52.9	47.1
9	55.5	45.5
Above 10	100	-

Table 5.4 also indicated that 67% of the sampled households with 7 family members and 53% with 8 family members were non-vulnerable to food insecurity. Table 5.4 revealed that the average family size for non-vulnerable and vulnerable households were 6.0 and

4.7, respectively. In relation to this, Frankenberger et al. (2007) noted that the average family size for vulnerable households is smaller than non-vulnerable households, which were 5.4 and 6.6, respectively.

In their study of northern Ethiopia, Devereux et al. (2003) found an inverse relationship between family size and being a destitute household. They reported that more than two-thirds of destitute households (69% of total n = 293) had only one to three members. Non-destitute household had more than nine members while, the largest non-destitute household had 14 members. This substantiated that large families are not necessarily poorer, and a larger number of the poor are found among single-person households (Devereux *et al*., 2003). Likewise, Sepahvand (2009) showed that chronic food insecurity was higher for family size less than three as compared to those that have nine members. Wisner et al. (2003) a study made in India also got similar conclusions in which the wealthy households had an average of six family members with six draught oxen, while the poor on the average had only four members with one draught ox. Dolisca et al. (2006), Anley et al. (2007) and Birungi (2007) designated that large family size is expected to take up labor-intensive adaptation measures to secure food at household level. The result of the paired T test also showed that the differences were statistically significant (at $p < 0.001$).

In relation to this, a key informant from *Dega* zone narrated his experience as follows:

> In my opinion, large family size has enormous advantages to the better-off households than the poor. The better-off households have considerable number of livestock, large areas of farmland obtained from redistribution, hiring, sharecropping and in some cases through purchasing. They are also engaged in non-agricultural activities like petty trade, honeybee production and growing of trees for sale, which need large labor power. The better-off households in my locality are advantageous to collect abundant production because of available working labor. Likewise, if someone with a small family size is sick, no one supports him and no one keeps his animals or keeps his crops from pests located far from residence. On the other hand, if a poor household has a large family size, they might have trouble in feeding them all, so they may be forced to sell the available assets (especially small and big ruminants) to feed their family. This is very common to the poor households in my locality. In my view, I can say that large or small household size is a relative term and it depends up on the wealth status of the households.

As opposed to the findings of this study, writers such as Degefa (2005), Adugna and Wagayehu (2012), Wondwosen (2011), Markos (1999) and Fekadu (2010) indicated that the poor and destitute households have larger family size than the better-off households. Markos (1997) specifically found out that as the family size increases, per capita crop production decreases. Maharjan and Chheteri (2006) stated that food secure households have smaller family size than food insecure households.

The study found out that family size decreases as the ages of the households becomes older and older and the middle ages (between 40 and 70) was the peak of having large family size (Figure 5.7). As the ages approaches to 80s; family size of the households' dramatically decreases and faced scarcity of labor and are vulnerable to food insecurity.

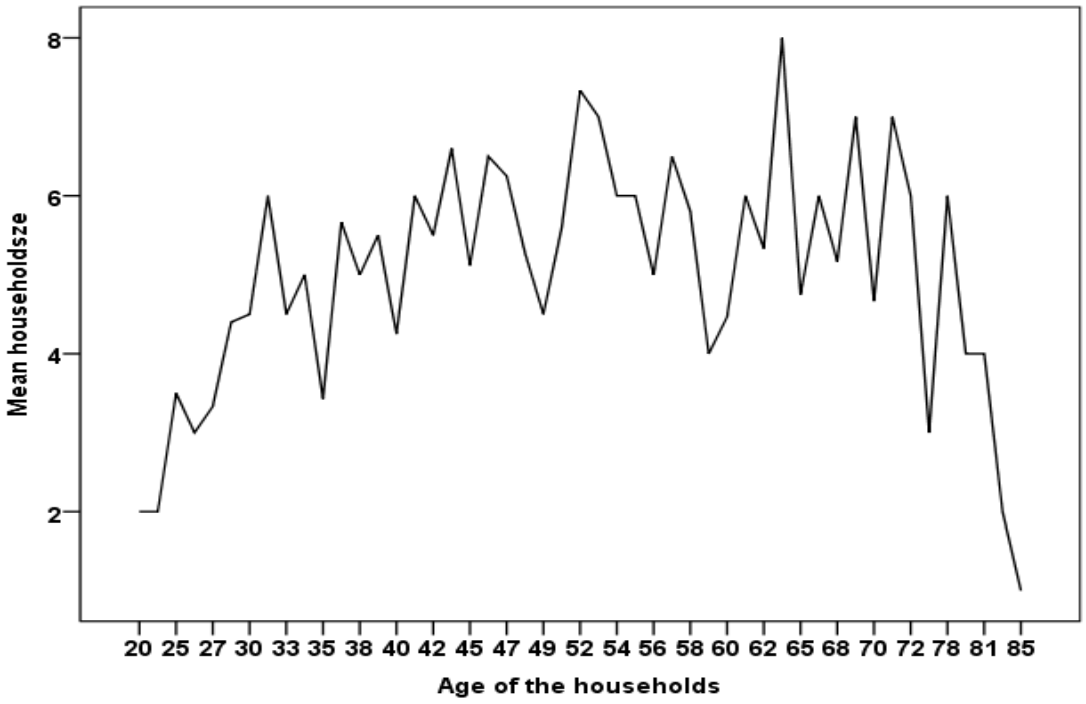

Figure 5.7. The relationship between age and family size of the households

***Problems associated with scarcity of labor**:* Labor availability is promising proxy indicator of household food security for the reason that labor is the most

determinant factor in livelihoods and food security. Barrett (2002) indicated that labor is a primarily factor in production based entitlements. Thus, the proximate cause of food insecurity is therefore relatively low labor productivity. The study found out that almost all poor households have limited labor availability and were engaged in sharecropping arrangements. In this regard, women key informants informed that sharecropping arrangement is intertwined with multifaceted problems. In the first case, the sharecropper may not protect the land from severe soil erosion and other land degradation process. As a result, the land gets degraded soon and the productivity of the land declines aggravating households' vulnerability to food insecurity. The other problem mentioned was the owner of the land could be easily cheated during harvesting and distribution of the production. Besides, agricultural activities are more of seasonal; they need large labor power during planting, weeding and harvesting, in which the vulnerable groups of people such as female headed, elderly and destitute are running with scarce labor power. From the writer's experience of this study, if these activities are delayed from the normal calendar by some weeks/days, production decreases significantly from the normal (Chapter 6).

Division of labor in intra-households*:* As information obtained from KIs, FGD participants and writers' previous knowledge, there was a strict division of labor and some activities entirely belonged to certain sections of the household members. Mulunesh (2001), in a study made in Dangila of the ANRS indicated that although rural women, like elsewhere, are engaged in fully agricultural activities, the division of labor in rural Ethiopia is quite traditional that certain jobs are reserved for men and others for women. Preparation of food, for example, is entirely the work of women and girls, while selling of big livestock is the responsibility of men. Men do not participate in domestic activities due to the norm of the society, but domestic work as a norm is the responsibility of women in the study area. This is because men are considered head of the household, the breadwinner. Plowing and sowing except in few exceptional cases, are the roles of men. Boys at the age of 10 and above can perform enormous agricultural activities such as plowing in the field and looking after cattle and small ruminants. EDHS (2012) indicated

that the proportion of children engaged in productive labor is substantially higher among rural children (30%) than urban children (13%). Aklilu et al. (2000) also revealed that children in rural Ethiopia greater than 10 years old assist in keeping cattle, protecting crops from birds, and engaging during threshing. With the exception of few activities, children in the study area perform almost all activities (Table 5.5). These exemplify that division of labor and the roles between women, men and children in intra-household are well defined in the study area. From Table 5.5, it can be concluded that children and women are the most critical human resources in intra-households.

Table 5.5 Types of activities and division of labor in intra-household in the study area (√ = who participated)

Type of activity	Women	Men	Boys	Girls
Keeping livestock	-	-	√	√
Collecting firewood	√	-	√	√
Fetching water	√	-	√	√
Plowing the field	-	√	√	-
Planting crops	-	√	-	-
Weeding	√	√	√	√
Harvesting crops	√	√	√	√
Preparing food	√	-	-	√
Selling small ruminants	√	√	-	-
Selling big livestock	-	√	-	-
Selling crops	√	√	-	-
Selling chickens	√	-	√	√
Care of family	√	-	√	√
Child rearing	√	-	-	√
Grinding grains	√	-	-	√

.

More specifically, women are responsible for food processing for household consumption, gathering of fuel wood, and fetching water besides the farming activities. In relation to this, Alebachew (2011), in a study made in Meket and Raya Azebo of northern Ethiopia close to the present study, listed the work of women as managing

ruminants, dairy production, fetching water, making dung cakes, gathering fuel wood and working on the farmlands such as weeding and harvesting.

Mulunesh (2001) pointed out that grinding, cooking, fetching water, and collecting firewood are entirely the roles of women. The same author also indicated that African women provide 33% of the work force, 70% of the agricultural workers and 60-80% of the labor to produce food, about 100% of the processing of basic foodstuffs, 90% of hoeing and weeding work and 60% of the harvesting and marketing activities. This shows that women in the house are the most burdened with many assignments and are restless.

5.4. Marital Status of the Households

The survey results showed that unmarried, divorced and widowed household heads were very few (15%) in number (Table 5.6). The majorities of surveyed respondents (85%) were married and live together while, 14% were divorced and widowed. In relation to this, EDHS (2012) indicated that 11% were divorced or widowed in Ethiopia. This showed that marriage seems stable in the study area. The lowest proportion (1%) have never been married supports the idea that marriage is nearly universal in the study area. The proportion of currently divorced varies by wealth categories. The survey result indicated that divorced households were higher in poor households (about 91.4%) than the middle or the better-off households. The study also revealed that 96.4% of the better-off households were married and lives together during the field survey. The implication is that the poor households were resource scarce and are not able to lead their family; and this in most cases brought marriage to be fragile. As it is shown in Table 5.6, from the total divorced household heads, about 50% were from *Woina-Dega* zone. KIs also informed that *Woina-Dega* is the most food insecure zone in the study district.

Table 5.6. Marital status by agro-ecological zones and wealth categories

(% respondents)

Agro-ecological zone	Wealth categories	Married and live together	Unmarried	Divorced	Widowed
Dega	Better-off	90	-	-	10
	Middle	100	-	-	-
	Poor	75	-	13.9	11.1
Woina- Dega	Better-off	100	-	-	-
	Middle	90	-	10	-
	Poor	70.8	2.4	26.8	-
Kolla	Better-off	100	-	-	-
	Middle	93.8	6.2	-	-
	Poor	86.1	-	5	-
	Total	85	1	11.5	2.5

KIs and FGD participants in all agro-ecological zones indicated that divorce of marriage is seasonal. The season that most households separate was during *Kiremt* when there was scarcity of food at home. In relation to this, Desalegn (1991) confirmed that famine does exacerbate pre-existing family conflicts and uneasy filial relations, which at times lead to family disintegration during food shortage seasons. In-depth interview with KIs and FGD participants also evidenced that young couples frequently practiced divorce. This happened because of lack of experience and tolerance. The informants further pointed that the majority of the divorced women do not have the right to stay at home; they are forced to leave their homes and reside with their parents. Staying with their parents is not easy, and many of them migrate to the nearby towns to be hired as a maidservant, or become hotels/bars workers. After they gained some experiences, they further migrate for similar purposes. Therefore, it could be said that poverty in general, and food shortage in particular were the major causes for many couples to divorce in the study area.

5.5. Female-headed Households and Food Security

The household survey revealed that from the total sample households, about 14% were female. Likewise, CSA (2011) pointed that 15.5% of the total households in Ethiopia were female-headed households. The proportion was lower than the previous study

(Codjoe, 2010) who reported that female headship is estimated to be 22% in Sub-Saharan Africa. Female-headed households were very few because women were not decision makers at home. USAID (2006) also indicated that household heads are predominantly males, a common feature in most African countries including Ethiopia. However, in some countries such as South Africa, female could be head of the households though they are married and live together (Oladele and Modirwa, 2012). In the study area, females will be head if they are divorced or widowed. As the information collected from KIs, female-headed households in the study area were characterized by having small size of farms, serious constraints of labor, limited sources of cash, and lack of valuable assets for farming. For instance, from the total sample female-headed households, 93% did not own a single ox. Ownership of farmland by female-headed households varies between agro-ecological zones. Consequently, in *Kolla* agro-ecological zone, they owned on the average 0.25 hectare of land, while in *Woina-Dega* and in *Dega* zones, it was 0.43 and 0.60 hectare of land, respectively (See Chapter 8). As KIs pointed, female headed households usually sale or engaged in sharecrop arrangements to the better-off households due to scarcity of labor power and/or farm oxen. These disclosed that female-headed households were vulnerable to food insecurity. KIs and FGD participants collectively indicated that the reasons for female-headed households' vulnerability to food insecurity were unequal access to and control over resources or poor asset ownership and scarcity of labor. Babatunde et al. (2008) in a study made in three countries in Africa stated that though vulnerability to food insecurity is a general problem among poor households, few studies have shown that the magnitude of the problem is deep rooted to the female-headed households. The same author also evidenced that rural women in Zimbabwe, Zambia and Malawi were poorer and exposed to vulnerability to food insecurity than their counter parts.

Key informants indicated that female-headed households dominated the informal sector such as selling alcohol, tea and food with very low price. They also shouldered greater burden to feed their family. For example, they collect water and fuel wood for household consumption. According to a report by UNPF (1995), demand for fuel wood which is

usually cut by women, is often blamed for felling trees, which could be a cause for vegetation degradation. However, high population growth, pressure on limited resources and environmental degradation created problematic for female-headed households to acquire such necessities as fuel wood and water. In this regard, female-headed households are, indeed on the front line of exposure to the impact of environmental change (UNPF, 1995). The study also corroborated that environmental problems have had a disproportionate impact on women as they search fuel wood and water for longer distances (Chapter 8). As women key informant indicated, the problem become severe for pregnant women when they engaged in hard work for a long period of time.

5.6. Conclusion

As it is true to other drought-prone areas `of the ANRS, the rural community in the study area are chronically poor, living on annual per capita income of Birr 215.2 with an average family size of 5.2. The study area is characterized by high population density (184/km^2) and severe eco-system degradation. However, the study investigated that there is an encouraging and promising practices in the use of family planning methods. During the field survey, 45% of the married women in the study district used family planning methods against 30% of the nation's average. The mean age of the household was 51 years and only 7.5% of the sample households were having ages less than 30 years. The study also indicated that there were significant variations in family size between wealth categories and sex of households. This has great implications on household food security. It was also identified that there was division of labor in the house and women were highly burdened either inside the house or outside the house.

Chapter 6

Rural Households' Livelihood Assets, Strategies and Food Security Outcomes[10]

6.1. Introduction

In the study area, drought, erratic rainfall, backward production technologies, small size of farmlands, and land degradation are the major causes for the low productivity of the agricultural sector. Among these, drought is the most significant trigger that often leads to transitory food insecurity; a slight change in rainfall often leads to dramatic declines in crop yields. That is why, currently, about 88,000 people are either chronically or transitorily food insecure and depend on the government's safety nets program as the main source of livelihoods (District Food Security Office, 2012). Besides, more than 90% of households are engaged in agriculture as the major economic activities, which are highly sensitive to climate related shocks. Livelihood diversifications that can supplement households' source of income are extremely rare and few households were participated in non-farm/off farm activities during the field survey.

This Chapter therefore, investigates livelihood outcomes in the context of the sustainable rural livelihoods and taking into account the spatial dimension of the problem by looking into the role of local scale agro-climatic factors in household food security outcomes. Thus, this section has practical significance for designing a more targeted and effective livelihood security related interventions in the study area, and in other similar environments in the country. The specific objectives were to: (i) describe rural households' possession of livelihood assets, (ii) examine livelihood strategies employed by rural households in drought-prone environments and their livelihood outcomes as

[10] Arega, B., Woldeamlak, B. and Melanie, N. 2013. Rural households' livelihood assets, strategies and outcomes in drought-prone areas of the Amhara Region, Ethiopia. *African Journal of Agricultural Research* 8(46): 5716-5727

measured by annual total incomes and (iii) explore determinants of livelihood outcomes of households as measured by annual total incomes. The topics presented under this Chapter include livelihood assets, strategies (crop and livestock productions and off/non-farm activities) and food security outcomes. Finally, multiple linear regression modeling was employed to determine major factors for household total annual incomes as it determines household food security.

6.2. Livelihood Assets of the Sample Households

Livelihood assets owned by households represent the basic building blocks upon which households undertake production, engage in labor markets and participate in reciprocal exchange with other households (Ellis, 2000). These include skills and experiences of household members (human capital), their relations within wider communities (social capital), their natural environment (natural capital), and physical and financial resources (Gebrehiwot and Fekadu, 2012). In the study area, possession of these capital assets varies among households and agro-ecological zones, as presented in the following paragraphs. This reflects the fact that different geographic locations provide different resource endowments, and hence people face different constraints and employ different strategies to achieve livelihood outcomes (Barrett and Webb, 2001).

Human capital: Household sizes, age, education, vocational training, health status, households' experience in farming activities are the major human resources to improve livelihoods. In other words, skills, knowledge, good health and physical capability together enable people to pursue livelihoods (Morse and McNamara, 2013). Among these, skilled labor power is considered vital human resources to bring development. In the study area, about 89% of the total children had access to primary and secondary schools during the field survey, but 61% of the total households sampled cannot read and write. About 7% of them have some form of formal education. The percentage of the enrollment of children was much higher than the nation's average, which is 73% (CSA, 2012). Of the total female-headed households, only 7.5% were able to read and write. An assessment was made to see the influence of education on households' vulnerability to

food insecurity. The result revealed that 60% of the illiterate households were vulnerable to food insecurity. The average family size was 5.2. As said by Key informants land degradation, scarcity of farmland and the decline of crop production, households in the study area need to have small family size. Malaria was identified as a major health problem in the *Kolla* zone, while water borne diseases were reportedly common in the *Dega* zone of the study area.

Social capital*:* local informal institutions/neighborhood associations, religious groups, self-help groups, kinship structures, small credit schemes and cooperatives were found to be important social capital assets in the study area. Social capitals according to Morse and McNamara (2013) include networks, social claims, social relations, affiliations and associations. The different institutions in the study area are known by different local names: *iddir* (mutual support particularly related to loss of a family member due to death), *equib* (local savings groupings), and *mahiber (*an association for feasts and labor sharing). These institutions offer mechanisms for the people to help each other in times of need, solve internal conflicts, and thus reduce powerlessness and mitigate adverse effects of immediate social problems. These are in addition to the formal political structures such as RKAs that are supposed to provide services to communities. During the field survey, about 94%, 58% and 21% of sample households were involved in *iddir*, *mahiber* and *equip*, respectively. Twigg, (2001) noted that poor societies who are well organized and cohesive are able to cope with disaster better than divided communities are by race, religion, class or caste. In other words, people that share strong ideologies or beliefs and have good experiences of cooperation are more likely to help each other during times of crises than people who feel fatalistic or dependent. The more members a household has, the more possibilities it has to social networks to promote positive livelihoods.

Physical capital*:* Roads, markets, schools, health centers, shelter, access to information, water harvesting and soil conservation structures were identified as vital physical assets by KIs and FGD participants. In short, physical capital refers to basic infrastructure and producer goods. The study Districts' Education Office expert pointed out that distribution of schools was relatively better in the *Dega* zone compared to the other zones. The district

as a whole had 94 primary schools, 2 secondary schools and 1 preparatory school. Nevertheless, all the secondary schools and the preparatory school are located in the *Dega* zone. It was also found out that in every RKA, there was one health post but there was serious shortage of trained professionals. For instance, the ratio of health extension workers to the population was 1:3,000. In road infrastructure, the study district is the most underserved partly because of the topography of the area (Chapter 8). From the total sampled households, about 83% of the poor lived in thatched-roof houses. Water harvesting is an important physical asset in drought prone areas such as Lay Gaint, but about 20% of the households had the access to this vital physical resource. Access to information in relation to agricultural extension, weather conditions and market price of agricultural products are fundamental to improve livelihoods. The study found that people living in the *Dega* zone had better access to such information than the other zones (Chapter 7). In general, infrastructure is considered essential to reduce poverty; however, this is not adequately available in the study area.

Natural capital: In the study area, the rural households considered farmland as the most important natural capital. Respondents also mentioned that availability of water, grazing land, soil conditions and fuel wood are important natural assets. All of these resources however, were reportedly very scarce in the study area. The study result showed that 92% of the sample households did not own any grazing land. In general, landholdings were small and varied between agro-ecological zones in the study area (Chapter 8). The average landholdings in *Dega* and *Woina-Dega* were 1.1 and 0.7 ha, respectively; and the average landholding of the entire sample households was 0.88 ha. By wealth categories, better-off, middle and the poor owned, on average, 0.92, 0.88 and 0.80 ha of land, respectively. The One-Way ANOVA confirmed that these differences are statistically significant (at $p < 0.001$).

About 57% of respondents had access to piped water, while 26% used unprotected springs and the rest obtained their water from nearby rivers and streams (Chapter 8). The study found out that water in the *Kolla* zone was a serious problem and on average

women in this zone traveled a round-trip of about four hours a day to fetch water. Almost all households (98.9%) used fuel wood as their primary source of energy for cooking and lighting (Chapter 8). Because of vegetation degradation, the sampled households traveled a round-trip of more than three hours a day on average to collect fuel wood.

***Financial capital**:* These refer to financial resources such as cash, savings and availability to credit, wages, liquid assets (livestock, jewelry), pension and remittances (Kollmair and Juli, 2002). In the study area, the major sources of finance include agricultural products (crop and livestock production, fruits, eucalyptus trees), engagement in food-for-work/cash-for-work activities, remittances and non-farm and off-farm activities. As it is shown in Table 6.15, the estimated average total annual incomes of the sample households from the different sources were Eth. Birr 43,825. Among this, annual income from agricultural products was dominant and accounted for 88.5% (of total). On the other hand, annual income from off-farm and non-farm activities was low (7.3% of total). Livestock, as financial asset, contributes to household livelihoods in many ways in the study area. It begets income through sale of animals and/or animal products, which enables purchasing of food and agricultural inputs as necessary. Meena and O'Keefe (2007) noted that livestock can be considered as a liquid asset that can be turned into other forms of financial capital relatively quickly. As it can be seen in Table 6.10, the annual income from the livestock sector was Eth. Birr 15,753, which is next to the estimated average annual incomes from crop production (Table 6.3). This means agricultural products are considered the leading source of income in the study area and grain production is the major activity for the sample households. Besides, food-for-work/cash-for-work, remittances and *equib* accounted for an estimated average annual income of Eth. Birr 301.8, 243.0 and 282.00, respectively.

6.3. The Livelihood Strategies of the Sample Households

The major farming system in Lay Gaint district is crop-livestock mixed agriculture dominated by subsistence economy. However, rapid reduction of grazing land, continuous decrease of cropping land, land fragmentation, rampant land degradation,

high input price, decline of agricultural production, erratic rainfall and frequent occurrences of drought, the agricultural production are not able to feed the growing population in the study area. These could be the reasons why livelihood diversification becomes a norm for many rural households and very few households collect their income from single source (Barett *et al*., 2001). Tsegaye (2012) indicated that poor households have to engage in diversifying livelihoods against risks and uncertainties to secure their sources of income. Likewise, Burke and Lobell (2010) reported that the inherent seasonality and year-to-year variability of agriculture enforced the rural poor to engage in livelihood diversification. In the study area, households seek additional income from non-agricultural activities such as causal labor during the dry months of the year.

As information obtained from KIs, diversification can help households from environmental and economic shocks and seasonality as well as to reduce vulnerability to sources of cash. As it is shown in Figure 6.1, households participated in crop and livestock production, non-farm and off-farm activities as major sources of income. However, the livelihood strategies pursued by the sample households was dominated by agricultural activities (~ 93% of total). Supporting the result, Ayele (2008), in his study of Walaita in Southern Region of Ethiopia, investigated that diversification of the households was limited and highly dominated by agricultural activities (80%) because of poor infrastructure, lack of opportunities, lack of assets and shortage of credit services to engage in non-agricultural activities. Tsegaye (2012) highlighted that regardless of increasing livelihood diversification as a source of income and livelihood security, agriculture continues to play a significant role in growth, employment opportunities and livelihoods security in most sub-Saharan African countries, though food security remains at risk in this region. Previous study (Yared, 2001) states that in most parts of Ethiopia, agriculture is the most important source of income, while, non-farm/off-farm incomes are generally limited because of poor endowment of capital assets. A study made by Josef and Laktech (2009) in Ethiopia and Mamo and Ayele (2003) in Libo kemekem *woreda* of the Amhara Region confirmed that nearly 90% of the rural poor are dependent on agriculture composed of both crop and livestock production.

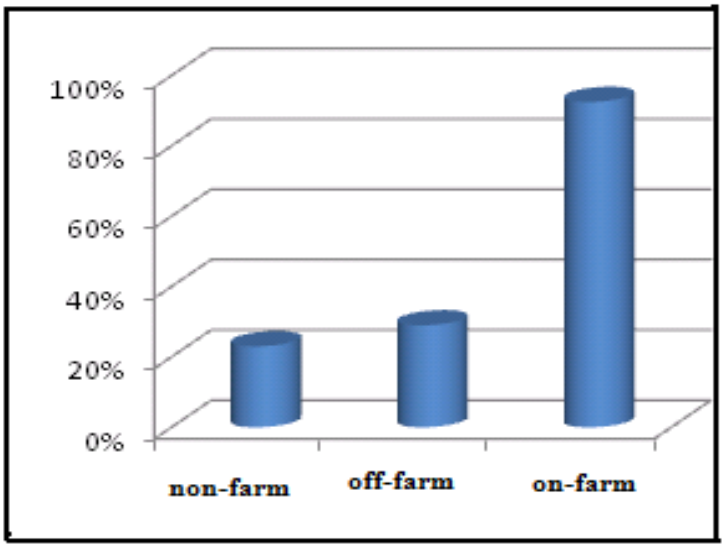

Figure 6.1. Livelihood strategies employed by the sample households

The following discussions focus on crop and livestock production followed by households' sources of income and the role of non-farm/off-farm activities in supplementing households' sources of cash.

6.3.1. Crop Production

Crop production is the major livelihood strategy for the majority of the sample households in the study area. The district agricultural experts pointed out that high sensitivity to climate change, nutrient depletion; over-cultivation, overgrazing and deforestation, crop production had shown a declining trend over the years in the study area. Among the factors indicated, inter and intra-rainfall variability (prolonged dry spell and shortage of rains) are the major factors reported by 85% of the sample households (Chapter 7). The ox/horse-drawn plough, which has been used since ancient times, is still in use in the study area (Alemneh, 1990; Boale and Shimles, 2009). Mixed farming is the major economic activity and crop production is the dominant activity, characterized by rain-fed, low input and low output. Cereals, pulses and oil seeds are the major crops grown, but their importance varies from one agro-ecology to the other based on microclimate differences and households preferences (Aklilu *et al*., 2000).

Because of diverse agro-ecological zones, different types of crops are grown in the study area. The major crops grown in D*ega* zone in order of importance include potatoes, wheat, barley, triticale, faba bean, and field peas (Table 6.1). Likewise, wheat, maize, barely, *tef (*eragroties *tef)*, triticale and sorghum are the major crops grown in *Kolla* zone and almost all the crops listed are grown in *Woina-Dega* zone. Among the total crops grown, barely, wheat, triticale and *tef* accounted for 74.3% in all agro-ecological zones. Barley and wheat shared of about 53.1%, while wheat alone account for about 39% of the total crop production in the three agro-ecological zones. KIs indicated that the largest share of wheat is consumed at household level and some of it is used as source of cash. As it is shown in Table 6.1, the percentage share of pulse crops such as *faba* beans and field peas in 2010/11 was very low (12.2%). The reasons given by the agricultural experts were climate change, nutrient depletion and plant diseases such as chocolate spot, asochyta and broomrape. Previous study (Aklilu *et al.*, 2000), in Lay Gaint district indicated that total production of the major pulses such as beans and peas showed a declining trend because of drought, hail damage, soil degradation and diseases.

Table 6.1. Crop production by agro-ecological zones (in quintal, 1 quintal = 100 kilogram)

Crop	*Dega*	*Woina-Dega*	*Kolla*	Total	Total per household	% of total
Barely	166.5	40.5	64.0	271.0	1.3	14.3
Wheat	544.0	123.8	74.0	741.8	3.7	38.9
Triticale	115.0	76.5	12.0	203.5	1.0	10.7
Teff	60.0	50.0	90.0	200.0	1.0	10.5
Faba beans	84.8	9.0	18.0	111.7	0.5	5.9
Field peas	53.0	35.5	31.0	119.5	0.6	6.4
Maize	0.0	11.0	115.0	126.0	0.7	6.6
Sorghum	0.0	72.1	53.0	125.1	0.7	6.6
Total	1032.3	418.5	457	1905.6	9.5	100
Total per household	14.7	6.9	7.5	9.5		

Source: Field survey (2011)

Markos (1997) also noted that the decline of pulse crops had persisted for the last three decades and the share of pulses reduced from the 1980s on wards. The study showed that more than 80% of the crops produced were used for household consumption.

As it is shown in Table 6.2, about 70% of the sample respondents had produced below ten quintals. Those who produce above twenty quintals accounted for about 14%. About 90% in *Kolla* and 77% in *Woina- Dega* zone had produced below ten quintals. The One-Way ANOVA showed that the differences among the three zones were statistically significant (at $p < 0.001$).The mean crop production of the entire sample households was 12 quintals. The survey result from the three zones, however, indicated that sample households require on average 20 quintals of crop production per year to carry out the minimum food requirements of their family. Crops produced in 2010/11 showed that 20% of the male-headed households produce more than 30 quintals, while female-headed produced only 3.6%. The result of the Chi square test confirmed that there was a statically significant difference between sex and the mean crop production (at $p < 0.001$).

Table 6.2. Crop production by the sample households in 2010/11 (% respondents)

Crop production (Quintal)	*Dega*	*Woina- Dega*	*Kolla*	Total
Below 10	44.3	77.1	90.2	69.7
10-20	31.4	8.6	8.2	16.4
21-30	15.6	5.7	1.6	8.0
31-40	2.9	1.5	-	1.5
41-50	2.9	2.8	-	2.0
Above 50	2.9	4.3	-	2.4
Total	100	100	100	100

Source: Field survey (2011)

Farm size also influences significantly the crop production potential of the sample households. The study revealed that 86% who produced less than 10 quintals owned less than one hectare of land, while 56% who produced in between 20 and 30 quintals owned greater than one hectare of land. The paired T test showed that there was a significant association between farm size and crop production (at $p < 0.001$). Ownership of farm oxen had great influence on crop production in the study area. Of the total 140 sample

households who produced less than 10 quintals, 64% owned less or equal to 1 ox and about 36% did not own a single ox. On the other hand, of the total 33 households who produced between 11 and 20 quintals, 58% owned more than two oxen. The paired T test also showed a significant difference between mean crop productions and the number of farm oxen (at $p < 0.001$).

Table 6.3 shows estimated annual income of the sample households from crop production at averages of *Bega* (dry season) and *Kiremt* (wet season) prices for the year 2010/11. The produces were expressed in terms of monetary equivalents to enable comparisons and for a better understanding of the situation. Prices of crops in Ethiopia are generally lower during *Bega* (December, January and February); and increase from the *Belg* (spring) season onwards to the *Kiremt* season (when it is often highest). KIs and FGDs unanimously agreed that in *Kiremt* season, prices of crops peak and often become unaffordable for the poor who always face scarcity of cash. Informants further noted that *Kiremt* is the period when majority of the poor are unable to feed their families. For that reason, estimated average prices of crops produced in 2010/11 were taken during the field survey**.**

As it is shown in Table 6.3, *Dega* agro-ecological zone accounted for the largest share of the average annual incomes from crop production (54% of total) followed by *Kolla* zone (23.7% of total). From the different crops grown in the study area, wheat was a good source of income for the entire sample households (37.3% of total) followed by barley (13% of total). From the total annual income from wheat, 72% explained by *Dega* zone and 16% by *Woina-Dega zone*. *Tef* was dominant in *Kolla* (48% of total). Triticale, a newly introduced crop in the study area has become a good source of income for the *Dega* zone (60% of total).

Table 6.3. Estimated average incomes of the sample households from crop production (Eth. Birr) in 2010/11 (Eth. Birr 17.67 = US$ 1.0)

Crop	*Dega* *n = 70*	*Woina- Dega* *n = 70*	*Kolla* *n =61*	Total
Barely	1,660.0	405.0	734.4	2,799.4
Wheat	5,828.6	1,317.9	909.8	8,056.3
Triticale	1,314.3	874.3	-	2,188.6
Teff	857.1	714.3	1,475.4	3,046.8
Faba beans	771.4	128.6	265.6	1,165.6
Field peas	758.7	500.0	609.8	1,868.5
Maize	-	39.3	471.3	507.6
Sorghum	-	741.6	625.6	1,367.2
Potatoes	457.1	102.9	26.2	586.2
Total	11,647.2	4,823.9	5,118.1	21,586.2
% of total	54.0	22.3	23.7	100

Source: Field survey (2011)

The surveyed households grew five to twelve different types of crops either in combination in the same field or in small separate plots. They did not think in terms of either market values or land suitability in their choice of crops, but for self-sufficiency and mitigation of risks from crop failure. That is, if one or more of the crops fail due to unexpected weather conditions, it might be possible that other crops will survive. Specialization in terms of crop choice, in the words of respondents, was equivalent to 'storing all of one's eggs in one basket'. Crop diversification is therefore a preferred livelihood strategy to specialization among farmers of the study area. A study made in SSA by Zhang et al. (2007) also indicated that within the agricultural sector, crop diversification is often used as a coping strategy for reducing the vulnerability of one crop over the other crops.

6.3.1.1. Crop production in 'Good' and 'Bad' Years

Crop productions at various levels of output are presented in Table 6.4. The questions asked to the respondents were, the amount of food crops produced during good and bad

harvesting seasons. This method might be better than simply asking the amounts of food crops produced during the last cropping year. According to the respondents' perceptions, good, bad, or normal harvesting season is simply differentiated by the availability or scarcity of rainfall in each season. According to their opinion, good harvesting season is when there is some spring rain followed by sufficient amount of *Kermet* rain that extends from June to September. On the other hand, if the short *Belg* rain is absent followed by the delay of *Kermet* rain, there exists food shortage and this is a bad harvesting season. As it can be seen in Table 6.4, during good harvesting season, more than 50% of the households could produce greater than ten quintals and 28% produce less than five quintals.

Table 6.4. Food crops produced during 'good' and 'bad' harvesting seasons by agro-ecologies

Options	Quintal	*Dega*		*Woina- Dega*		*Kolla*			
		Count	%	Count	%	Count	%	Total	%
Good harvesting seasons	≤ 5	14	20.0	33	47.14	10	16.4	57	28.0
	6-10	18	26.0	24	34.28	12	19.70	54	27.0
	11-15	8	11.42	6	8.6	18	29.50	32	15.92
	16-20	11	15.7	2	2.85	6	9.83	19	9.45
	21-25	4	5.7	1	1.42	3	4.91	8	3.98
	26-30	6	8.6	4	5.7	4	6.55	14	6.96
	> 30	9	12.85	-	0.0	8	13.11	17	8.45
	Total	**70**	**100**	**70**	**100**	**61**	**100**	**201**	**100**
Bad harvesting seasons	≤ 5	28	40.0	62	89.0	35	57.37	125	62.2
	6-10	16	22.85	4	5.7	17	27.9	37	18.40
	11-15	9	12.85	1	1.42	8	13.11	18	8.95
	16-20	7	10.0	3	4.28	1	1.64	11	5.47
	21-25	3	4.28	-	0.0	-	0.0	3	1.49
	26-30	4	5.7	-	0.0	-	0.0	4	1.99
	> 30	3	4.28	-	0.0	-	0.0	3	1.49
	Total	**70**	**100**	**70**	**100**	**61**	**100**	**201**	**100**

During bad harvesting season, more than 80% of the respondents could produce less than ten quintals and 62.2% of them could produce less than five quintals. The survey results indicated that households' perceptions vary between agro-ecological zones. For instance,

in *Woina-Dega* agro-ecological zone, more than 80% of the respondents reported that they could produce less than ten quintals during good harvesting season. In *Dega* agro-ecological zone, above 40% of the respondents reported that they can produce greater than 16 quintals and the majority of the respondents (about 52%) confirmed to produce greater or equal to 11 quintals during good harvesting season. In general, the survey results showed that in good season households can produce 15.3 quintals on average with a standard deviation of 12.9, while in bad season they can produce 7.4 quintals with a standard deviation of 7.62. Estimating of crop production between bad and good seasons in relation to wealth categories are also presented in Table 6.5.

Table 6.5. Households' perceptions of food crops production during 'good' and 'bad' harvesting years by wealth categories

Seasons	Quintal	Better-off		Middle		Poor			
		Count	%	Count	%	Count	%	Total	%
Good harvesting seasons	< 5	2	7.14	7	11.66	50	44.25	59	29.35
	6-10	1	3.57	15	25.00	38	33.64	54	26.86
	11-15	2	7.14	11	18.33	19	16.81	32	15.92
	16-20	1	3.57	12	20.00	6	5.30	19	9.45
	21-25	0	-	8	13.33	-	-	8	3.98
	26-30	7	25.00	5	8.33	-	-	12	5.97
	> 30	15	53.57	2	3.33	-	-	17	8.45
	Total	**28**	**100**	**60**	**100**	**113**	**100**	**201**	**100**
Bad harvesting seasons	< 5	-	-	25	41.67	97	85.84	122	60.7
	6-10	7	25	15	25.00	16	14.19	38	18.90
	11-15	4	14.29	13	21.67	-	-	17	8.45
	16-20	7	25	4	6.67	-	-	11	5.47
	21-25	3	10.71	3	5.00	-	-	6	2.98
	26-30	4	14.29	-	-	-	-	4	1.99
	>30	3	10.71	-	-	-	-	3	1.49
	Total	**28**	**100**	**60**		**113**	**100**	**201**	**100**

The survey results indicated that about 80% of the better-off can produce more than 26 quintals during good harvesting season, while more than 50% of the middle households can produce less than 15 quintals. The poor households on the other hand, reported to produce less than 10 quintals during good harvesting season. At times of bad harvesting year, about 86% of the poor households evidenced to produce less than 5 quintals. From the results, it can be concluded that when there is food crisis because of unexpected rainfall or hailstorms, the most suffered from the crises are the poor households whom in most cases deprived of productive assets that can be used as coping mechanisms.

6.3.1.2. Seasonal Calendar of the Major Crops of the Study Area

As it is shown in the seasonal calendar (Figure 6.2.), different types of crops have distinct seasons for preparing, planting, weeding and harvesting. If one of the activities is delayed because of scarcity of farm animals/labor, the outputs could be lowered noticeably from the normal. Therefore, understanding the seasonal calendar helps to identify the seasonal farming activities and their constraints. In this regard, KIs and FGD participants were the major sources of information. As it is shown in Figure 6.2, for many of the crops except *tef*, preparation months include February, March and April. After the land had been prepared, the next step is planting the seed. The planting months in all agro-ecological zones extend from May to July and sometimes to August for *tef* crop. In the study area, sowing is exclusively the works of men, but for the rest of activities, there is no major differentiation between sex and age. For example, weeding is done by men, women and children and taking place during the growing season (July, August and September). Weeding is entirely accomplished by family labor and no one responded to the use of herbicides. After weeding, famers wait for a month or more to harvest the matured crops.

The harvesting period is during the dry season (from October to January), while December is the peak month. Harvesting is accomplished with manual labor with simple curved sickles with wooden handles. Cutting the mature crops needs large family labor but it is a constraint to the poor and female-headed households. After harvesting, threshing is done by simple process of driving animals over the sheaves. After the crop is

well threshed, the next step is winnowing. It is accomplished with the help of wooden spade throwing in the air so that the grain, which is heavier, sorted down and the chaff is carried out by wind slightly a further distance. Hence, the grain is collected and stored either in pit outside the home or in some containers inside the home. Among the activities indicated, KIS and FGD participants agreed that threshing, winnowing, and storing are critical stages for crop wastage in the study area. Babu and sanyal (2009) noted that poor grain storage remains one of the most common problems in developing countries and estimated of grain loses range from 33-50% though during threshing and winnowing, the losses are highest in magnitude. Likewise, Adane (2008) indicated that in Ethiopia 20-30% of the total harvest is wasted during post-harvest period mainly due to lack of appropriate storage facilities and poor transport systems. Hunger season is also included in the calendar, because identifying the hunger seasons associated with seasonal households' migration is imperative for policy trust.

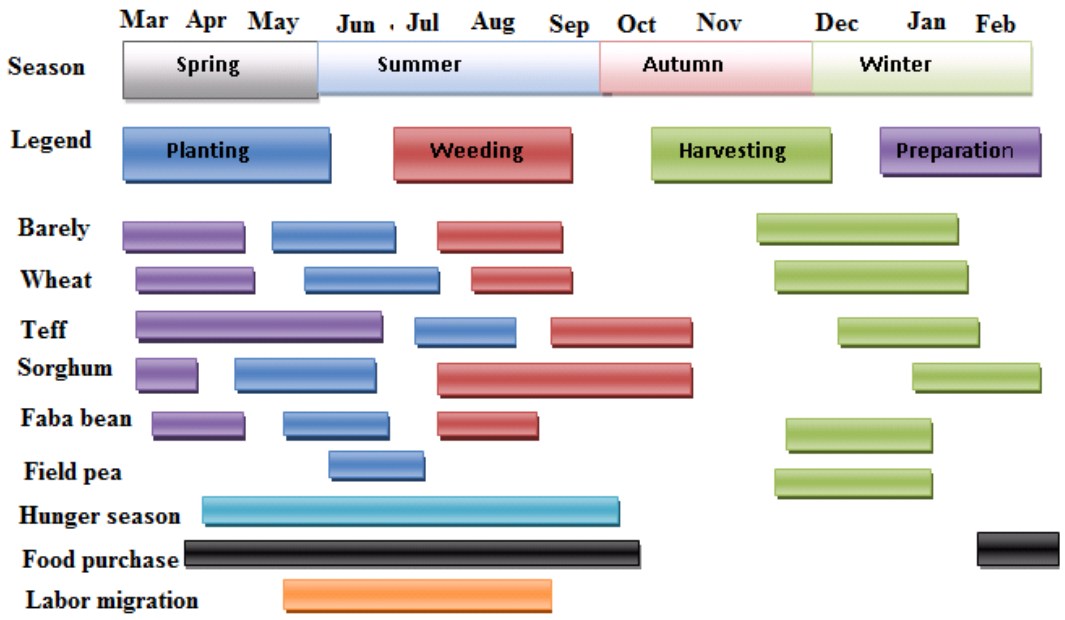

Figure 6.2. Cropping calendar, hunger season and labor migration in the study area

As it can be seen in Figure 6.2, seasonal migration was the highest during *Kiremt* season mainly because of shortage of food in the house. The survey data revealed that some 34% of the family members had migrated to search for jobs in the Amhara Region.

6.3.2. Livestock Production

The study area is described as crop dominant economic zone and much more attention has been given to the development of crop production than livestock production. However, the importance of livestock in the mixed farming system could not be underestimated, because it plays vital role in households' day-to-day activities such as cultivation, planting, threshing and transporting as well as source of cash and manure for crop production. Barrett and Webb (2001) pointed out that liquid asset such as livestock offer households the ability to smooth consumption overtime and guarding against transitory shocks. As the KIs informed, livestock are cash at hand, empower the households to purchase inputs and food crops, provide security, accumulate assets and maintain social capital. Devereux et al. (2003) also noted that households with some livestock are more secure during emergency and more able to cope with shocks than who owns nothing. Even though, slaughtered animals for a range of ceremonies and occasions are unproductive, in practice, they have high value to secure social capital and seen as a respected part of a society. KIs and FGD participants unanimously indicated that households that own large numbers of livestock have better position in the community and enhance coping strategies than those who own little or nothing. Due to these important functions, livestock play an imperative role in improving food security and alleviating poverty (Benin *et al*., 2003). The survey data revealed that from the total annual income households collected in the year 2010/11, livestock alone explained 36% (Table 6.15). In relation to this, one key informant from *Dega* zone expressed the use of livestock in his localities as follows.

> . . . Livestock serves as intermediary resources in the acquisition of different capital goods. Small and big ruminants are purchased, fattened and sold to buy food, or to pay formal and informal obligations. In my locality, households who own large numbers of livestock are advantageous to purchase food at times of food crises, pay off debts, or purchase materials to construct a tin- roofed house. Livestock sales also provide crucial liquidity in emergencies such as illness, death, or to pay for children's schooling. In my locality, rainfall is unpredictable, so do is true of crop production. As a result, the food requirements of my family are supplemented from selling of livestock, primarily small ruminants. Because of these multiple use-values,

livestock in my locality are convenient forms of savings or good source of wealth and prestige.

Sample households were asked to list the number of oxen, cows, calves, heifer, equines, sheep, goats, and poultry owned during the field survey. The result is presented in Table 6.6. The total livestock for the sample households was 1617 composed of cattle, small ruminants and equines. In all agro-ecological zones, sample households owned on average eight livestock. Among the livestock, small ruminants (49%) were the dominant followed by cattle (about 40%) and the least was equines (11%). Mules and horses accounted for only about 4% of the total livestock population. The total chickens owned were 358 with 1.8 chickens per household. KIs indicated that priority is given to cattle, shoats and donkeys because of their economic value and social prestige.

Table 6.6. Possessions of livestock by agro-ecologies in the year 2010/11

Livestock	*Dega*	*Woina-Dega*	*Kolla*	Total	% of total	TLU[11]/household
Cows	94	44	46	184	11.4	0.9
Ox	101	57	56	214	13.2	1.06
Calves	130	40	45	215	13.2	1.1
Sheep	397	98	141	636	39.3	3.2
Goats	19	53	85	157	9.7	0.8
Mules	19	4	8	31	2.0	0.2
Horses	31	4	0.0	35	2.2	0.2
Donkeys	52	38	55	145	9.0	0.7
Total livestock	843	338	436	1617	100	8.0
Livestock/HH	12.0	1.7	2.2	8.0	-	-
Total TLU	336.7	128.8	156.2	621.7	-	-
TLU/HH	4.81	1.84	2.56	3.1		-
% TLU	54.2	20.7	25.1	100		-
Chicken	151	81	126	358		1.8

In the study area, better-off and middle households dominantly owned big ruminants including pack animals. The poor without equines carry goods on their heads from remote areas to market places. A study made by Woldeamlak (2003) indicated that given

[11]Tropical Livestock Unit is equivalent to a livestock weight of 250 kg, and the conversion factors vary according to the type of livestock. Accordingly, an ox = 1.0 TLU, cow = 1.0 TLU, sheep/goat = 0.13 TLU, calf =0.2 TLU, horse/mule = 1.1 TLU, donkey =0.7 TLU (Fekadu, 2010).

the country's largest physical expanse, physiographic irregularity and the indolent economic growth, the significance of equines as a mode of transport appears to remain indispensible for a long time to come. The paradox is that the majority of the sampled households (73.5% of total) were without these vital assets. In the ownership of equines, the largest percentage goes to donkeys (69%) followed by horses (17%) and the least were mules (14%). Though they are important source of cash, means of transport and draught power in the crop production process, the major constraints that limit the productivity of equines have been given less attention and many of the problems linked to them are not well studied so far. In general, the choices of livestock rearing in the study area are determined by households' choice for animals, availability of fodder and suitability of agro-ecological zones. In case of choice, better-off households prefer to have cattle and mules partly for prestige and more importantly as an investment and savings. Due to agro-ecological setting, horses and sheep are more appropriate in *Dega* zone, while cattle and goats are more important in *Kolla* and *Woina-Dega* zones of the study area.

From the small ruminants, sheep alone accounted for about 39% of the total number of livestock. *Dega* zone with 62% of the sheep population was suitable area for these animals, while 54% of total goats were found in *Kolla* zone. According to KIs, low risks, less feed requirement, and rapid reproductive cycle and speedy returns to investment make small ruminants the most preferred animals by the surveyed households. The district agricultural experts indicated that there is a plan to rear sheep and goats in a modern way with the objectives to increase households' source of income and to secure food at household level. Currently, in few RKAs in *Dega* zone, improved sheep is reared (Figure 6.3) but its dissemination to other RKAs was very low.

Figure 6.3. Rearing improved sheep in *Dega* agro-ecological zone

Average TLU of the entire agro-ecologies was 3.1, which was higher than a study made in Tigray region of Ethiopia (1.7 TLU) (Gebrehiwot and Fekadu, 2012). As it is presented in Table 6.6, the *Dega* zone, with 54.2% concentration of TLU was the leading in all agro-ecological zones. The One-Way ANOVA also ascertained that the mean of livestock owned by agro-ecological zones has statistically significant difference (at $p < 0.001$). The FGD participants and KIs also confirmed that *Woina-Dega* zone is the poorest agro-ecology in livestock endowments followed by *Kolla* zone. According to Devereux et al. (2003), 2.2 TLUs of cattle could be taken as pair of oxen. With this level of measurement, *Woina-Dega* was the most vulnerable to cattle ownership in the study area (Table 6.6).

The survey data revealed that about 20% of the poor households had no livestock at all, while all of the better-off owned more than 6 livestock and 97% of the middle households owned one or more livestock. The One-way ANOVA confirmed that the differences were statistically significant (at $p < 0.01$). As it is shown in Table 6.7, the better-off owned more number of livestock than the middle and the poor households. As the KIs noted, the better-off is different from the poor and the middle households, not only by the size of farmland owned but the number of livestock possessed. Consistent to this finding, Ashley and Nayneenya (2005) indicated that the poor households had chickens, goats and pigs, but wealthier households possessed all species, notably with a greater likelihood of keeping big ruminants.

Table 6.7. Type of livestock owned by wealth categories in 2010/11

Type of Livestock	Wealth categories						Total average
	Better- off	average	Middle	average	Poor	average	
Cows	57	2.0	67	1.1	60	0.5	0.9
Oxen	69	2.4	88	1.5	57	0.5	1.2
Calves	88	3.1	81	1.4	46	0.4	1.1
Sheep	302	10.8	219	3.7	115	1.0	3.1
Goats	95	3.4	33	0.6	29	0.3	0.8
Mules	17	0.6	10	0.2	4	0.0	0.2
Horses	14	0.5	15	0.3	6	0.1	0.2
Donkeys	49	1.8	59	1.0	37	0.3	0.7
Chickens	79	2.8	111	1.9	168	1.5	1.8

In this regard, livestock ownership is taken as one of the major criteria defining household wealth categories (Chapter 4). Livestock ownership also showed variations between sexes of the households. Consequently, 92% of female-headed households owned less or equal to five livestock against 49% of the male-headed households (Table 6.8). The result of Chi square test showed that these differences were statistically significant (at $p < 0.001$). From the total households sampled, above 54% owned less or equal to five livestock. As the survey data revealed, above 70% of female-headed households do not own ox against 28% of the male-headed households. It was also noted that only about 7% of the total female-headed households owned pair of oxen during the field survey (see Figure 6.5). The study concluded that one way or another, female-headed households suffered from scarcity of the major productive assets, particularly big ruminants.

Table 6.8. Ownership of livestock by sex of household heads (% respondents)

	Number of livestock							Total
Sex	≤ 5	6-10	11-15	16-20	21-25	26-30	≥ 31	
Male	49	23	14	6	3	3	2	100
Female	92	8	-	-	-	-	-	100
Total	54.2	21.4	12.4	4.5	2.5	3.0	2.0	100

As it is shown in Table 6.9, about 37%, 35%, 50%, 72%, 53.3%, 84.1% and 84.6% of the respondents do not own cows, oxen, sheep, goats, donkeys, horses and mules,

respectively. The maximum number of livestock owned by the sample households was sheep (40 in number). As it is shown in Table 6.9, the coefficients of variations were unexpectedly high, indicating that the differences between the minimum and the maximum livestock ownership among sample households were the highest in all cases indicated. More specifically, coefficient of variations was the highest in the ownership of small ruminants. It was also true to the study area and in other parts of Ethiopia that, households reared livestock mainly for three conditions: as source of cash, source of food and social prestige.

Table 6.9. The maximum and minimum livestock owned by households

Livestock	Count	% owned	Minimum	Maximum	Standard deviation	CV
Cow	127	63.0	0	5	0.9	47
Ox	130	64.8	0	4	0.9	40
Calves	105	52.00	0	10	2.7	78
Goats	56	27.8	0	30	9.0	86
Sheep	100	49.8	0	40	10.0	83
Donkey	94	46.7	0	5	1.0	50.5
Mule	31	15.4	0	3	0.6	69
Horses	32	15.9	0	4	1.1	60

However, consumption of meat as a diet and food is accessible only during religious ceremonies such as *enqutatash (*New Year), Easter and family celebrations like weddings. In the case of milk products, those households who own milking cows can get better production during the wet months when there is good feed for their animals. Selling of milk is highly prohibited in the rural surroundings to uphold their prestige. Selling of milk is considered as an indication of poverty and humiliation. Annual incomes of the sample households from sale of livestock in 2010/11 are presented in Table 6.10.

Small ruminants accounted for 50% of annual incomes of households from the livestock sector, with sheep as income sources accounting for about 33% of the total annual income. Agro-ecologically, *Dega* accounts for 55.4% income from sheep and *Kolla* was the least (about 7% of total income). On the other hand, goats were the major sources of

income in *Kolla* zone (95% of total). In general, sheep in *Dega*, cattle in *Woina-Dega* and goats in *Kolla* were the important financial resources, which together constituted about 80% of the annual income of the sample households from the livestock sector.

Table 6.10. Estimated average incomes of the sample households from the sale of livestock (Eth. Birr) in 2010/11 (Eth. Birr 17.67 = US$ 1.0)

Livestock	Agro-ecological zone			Total	% of total
	Dega	*Woina-Dega*	*Kolla*		
Cows	1,142.9	3,000.0	196.7	4,339.8	27.5
Ox	392.9	714.3	344.3	1,451.5	9.2
Calves	400.0	228.6	170.49	799.1	5.1
Sheep	2,857.1	2,008.7	295.1	5,160.9	32.8
Goats	-	142.9	2,655.7	2,798.6	17.8
Mules	71.4	-	131.14	202.5	1.3
Horses	428.6	-	0.0	428.6	2.7
Donkeys	142.9	101.4	3,27.9	572.2	3.6
Total	5,435.8	6,195.9	4,121.3	15,753	100
% of total	34.5	39.3	26.2	100	

6.3.3. Ownership of Oxen

A pair of oxen is an indispensable asset in cereal producing areas of Ethiopia. Households who do not have a pair of oxen are late to prepare their land and depend on less suitable animals (like cow) and are exposed to food shortage. Because of these and other factors, draft power is treated independently from the livestock sector in this study. As it is shown in Table 6.11, 35.3% of the sample households were without ox and are highly vulnerable to food shortage. Households who own less or equal to one ox accounted for 67%. In an area where crop production is the dominant livelihood and pair of oxen is a means for the production process, owning a single or no ox is an indicator of the households' vulnerability to food insecurity. In the study area, households owned on average 1.2 oxen. A study conducted by Kawamura et al. (2009) in East *Gojjam*, West *Gojjam* and South *Gondar* of the ANRS found 1.09 as average number of oxen owned by households. A similar study in south *Gondar* administrative zone also revealed that out of

the total sample households, 35% were without oxen and 39.2% had only one ox (Tilaye, 2006).

As observed in the field, the quality of oxen is highly deteriorated because of continuous plowing and poor feeding associated with scarcity of fodder. KIs and FGD participants pointed out that the numbers of oxen owned by the households have decreased from time to time mainly because of lack of grazing land, forced sale of oxen to buy food and some killer diseases. Aklilu et al. (2000) have also found a similar result in which the majority of the rural farm households in *Lay Gaint* district owned fewer oxen mainly because of sale of oxen in drought years to purchase food and animal diseases prevailing in the area.

Table 6.11. Ownership of oxen by agro-ecological zones in the year 2010/11 (% respondents)

Agro-ecological zone	Number of oxen owned						Average oxen
	none	1	2	3	+3	Total	owned
Dega (n=70)	31.4	15.7	38.6	10	4.3	100	1.5
Woina-Dega (n=70)	31.4	52.9	14.3	1.4	-	100	1.1
Kolla (n=61)	44.3	24.6	27.9	1.6	1.6	100	1.2
% of total	35.3	31.3	27	4.4	2.0	100	1.2

According to Devereux et al. (2003), those households who lack a pair of oxen are destitute and those without ox are vulnerable to food insecurity. According to this single parameter, 31.3% of the households were destitute and 35.3% were vulnerable to food insecurity. Agro-ecologically, the share of sample households with no oxen accounts for *Dega* (31.4%), *Woina-Dega* (31.4%) and *Kolla (*44.3%). Likewise, households with only one ox account for *Dega (*15.7%), *Woina-Dega* (53%) and *Kolla (*25%) (Table 6.11). The One-Way ANOVA showed that the differences were statistically significant (at $p < 0.01$). The better-off households in *Dega, Woina-Dega* and *Kolla* zones owned on average 2.9, 1.8 and 2.6 number of oxen against 0.8, 0.5 and 0.3 for the poor households, respectively (Figure 6.4).

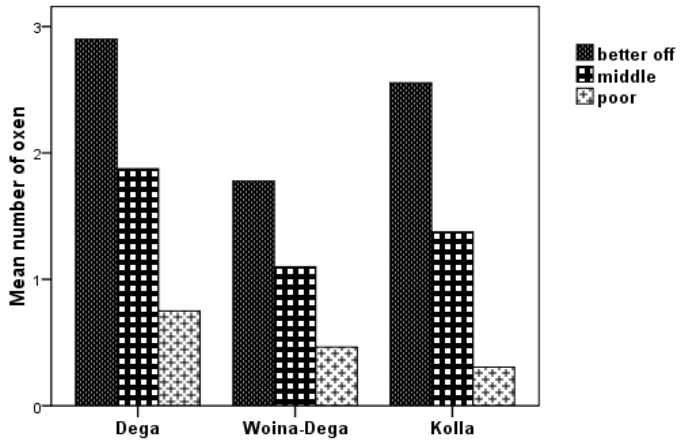

Figure 6.4. Mean number of oxen owned by agro-ecology and wealth category

There were also variations in the ownership of oxen between gender and agro-ecological zones. Consequently, female-headed households in the *Dega* zone owned on average 0.5 number of oxen, while the male-headed households in similar zone owned 1.6 (Figure 6.5). The paired T-test also confirmed that the differences between gender and ownership of oxen were statistical significant (at $p < 0.01$). In all agro-ecological zones, female-headed households owned on average 0.4 and the counterparts owned 1.2 indicating that female-headed households were disadvantageous in the ownership of ox; and this problem was severe in *Kolla* agro-ecological zone (Figure 6.5).

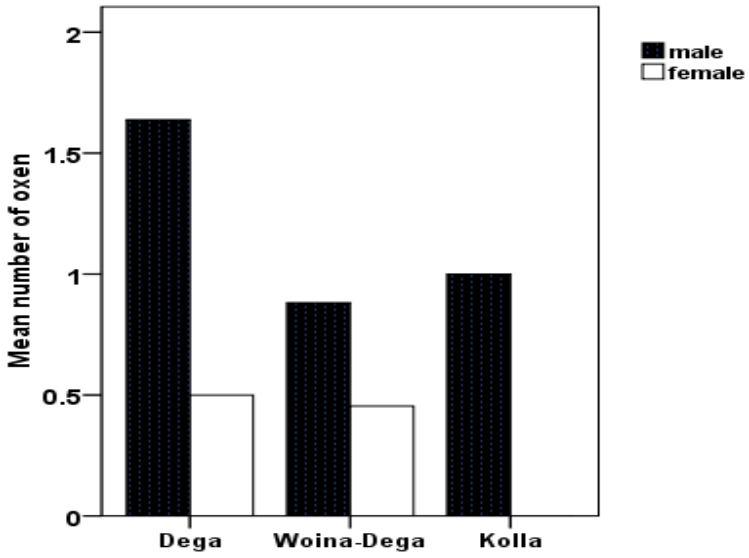

Figure 6.5. Mean number of oxen owned by gender and agro-ecology

Key informants also indicated that the farmlands owned by female-headed households were not cropped timely and efficiently because of lack of oxen. This reduces crop production and productivity of the female-headed households.

The study also investigated that ownership of oxen revealed significant relationship with the households' dietary energy supply (Table 6.12). About 67% of the sample households who consumed less than 600 kilocalories did not own a single ox. Those households who consumed greater than 4100 kilocalories owned above a pair of oxen. The Pearson correlation coefficient showed that there was statistically significant and positive correlation between ownership of ox and dietary energy supply ($r = 0.7$, $p < 0.001$). The study also found out that the number of oxen owned is a proxy indicator of total crop production. About 40% of the sample households who produced less than 10 quintals of crops do not own ox. On the other hand, about 30% of the respondents who produced greater than 20 quintals owned more than pair of oxen. The Pearson correlation coefficient showed that the differences were positively and statistically significant ($r = 0.8$, $p < 0.001$).

Table 6.12. Number of oxen owned and kilocalorie consumption of households

kilocalorie	Number of oxen owned (% respondents)						% of total
	0	1	2	3	4	5	
≤ 600	15.0	6.5	0.9	-	-	-	22.4
601-1100	10.5	9.0	1.5	-	-	-	21.0
1101-1600	5.5	8.0	4.5	0.5	-	-	18.5
1601-2100	3.0	4.5	4.0	0.5	-	-	12.0
2101-2600	0.5	1.5	3.5	-	0.5	-	6.0
2601-3100	-	1.5	3.0	0.4	0	-	4.9
3101-3600	0.3	0.3	1	1	-	-	2.6
3601-4100	0.5	-	4	1	-	-	5.5
4101-8500	-	-	4.5	1	1	0.5	7.0
% of total	35.3	31.3	26.9	4.4	1.5	0.5	100

6.3.4. Challenges faced the livestock sector

The livestock resource is everything for the rural households who depend on agriculture for their main livelihoods. Nevertheless, the sector has faced irreversible problems of feeding in the study area. As observed in the field, overgrazing, recurrent drought and extreme soil erosion have resulted in increasing deterioration of the pastureland. In *Dega* and *Woina Dega* agro-ecological zones, the growth of pastures is very slow during the rainy season, owing to water logging and high stocking density, which is beyond the carrying capacity of the land. As a result, collecting silage to their livestock becomes scanty or very expensive nowadays. High population pressure, expansion of cropping land and poor land use policy were the reasons given by the KIs for scarcity of grazing land in the study area.

Households commonly graze their animals along riverside and roads, rugged areas and other wastelands, which are not suitable for crop production. These lands serve as feed sources for dry and wet seasons. However, the sizes of grazing lands are decreasing and farmers are forced to keep their animals on hilly and degraded areas, which are prone to land slide during the rainy season. During the dry season, the types of feed are crop aftermath, crop residue, censored grasses for feed from bottomland and collect around their homesteads (Figure 6.6). In this regard, the district agricultural expert indicated that the inherent nutritive value of crop residues (mainly *tef)*, which is the most common fodder during the dry season, is generally low; that is, it is with low protein but high fiber content that does not help much for the health and growth of animals. In the feeding of hay and/or crop residue, households give priority to oxen followed by milking cows with the objectives of plowing the field and getting better milk.

Sample respondents were asked to list the challenges the livestock sector faced in the study area. Poor nutrition (45% of respondents), scarcity of forage and grazing land (92% of respondents), shortage of water (56% of respondents), poor management practices (23% of respondents) and prevalent diseases (95% of respondents) were the main

constraints of the livestock sector. Among the reasons listed, drought manifested through scarcity of forage and prevalent diseases affects the livestock sector more than others. As one KI from *Kolla* zone indicated, the low productivity of the livestock sector is emanated from the poor veterinary services, shortage of adequate and quality of feed, lack of water points, animal diseases and lack of productive breeds. According to the informant, the major livestock diseases in the study district include coocidiosis, foot and mouth disease, lumpy skin disease and blackleg/mastitis. As Devereux et al. (2003) pointed out, in some areas of Ethiopia, shortage of drinking water for livestock in the dry season was also mentioned as an important factor for the declining of livestock but the major one was lack of grazing land and poor veterinary services.

Figure 6.6. Crop residues collected closer to homesteads

The KIs in both agro-ecological zones informed that big ruminants especially cows and oxen are underfed and are extremely weak physically either to give milk or to plough in the field. This is mainly because of scarcity of fodder in which most of the fields are without vegetation or grass cover even during the wettest season. A previous study (Rami, 2002) indicated that in Lay Gaint district, no fodder is left currently and the livestock were emaciated because the landscape is barren and full of gully. Ellis and Tasew (2005), in a study made in *Raya Kobo* district close to the study area, also indicated that the poorest and most vulnerable groups in rural Ethiopia are suffered from

scarcity of livestock due to animal diseases and grazing failure in drought years. Gebrehiwot and Fekadu (2012), in a study made in eastern Tigray region of Ethiopia, stressed that almost all households own low average sizes of livestock reflecting the scarcity of grazing land, food shortage, adequate veterinary services, improved breeds and water. Sample households forwarded the solutions to the problems, which include introduction of selected breeds (27% of respondents), decreasing the enclosure/protected areas (80% of respondents), reducing farmland (75% of respondents), reducing the number of livestock (14% of respondents) and increasing communal grazing land (68.5% of respondents). Especially the second option does exacerbate environmental degradation that needs awareness creation for the farmers.

According to the federal government's Sustainable Development and Poverty Reduction Program, one of the national priority objectives in agriculture and rural development is to strengthen livestock development through forage development, improved breed, veterinary services, and livestock marketing with the view to improve livelihoods, diversify income, and ensure food security (Devereux *et al*., 2003). In this regard, the study investigated that no sample households owned improved cattle. The forage development system and the veterinary services were also weak and there is great dissatisfaction with the communities about the services delivered. KIs and FGD participants summarized that scarcity of water caused by frequent droughts and poor water storage and conservation measures (enclosure areas) taken by the local government resulted in scarcity of grazing land in their localities. As long as open access grazing continues and cut-and-carry types of feeding are not implemented, the problem of feeding and rearing livestock could be taken as the major challenge for the majority of rural households in the degraded and drought-prone areas.

6.3.5. Sources of Income Other than Crop and Livestock Production

Located in drought-prone and vulnerable agro-ecologies, sources of income were extremely low in the study area. Currently, highland apple and eucalyptus trees are the two major sources of income for the majority of the rural poor in the study area. Highland

apple is a recently introduced fruit and enhanced sources of cash for the poor farmers in the *Dega* zone (Figure 6.7).

During the field survey, an expert from ORDA informed that one farmer in *Dega* zone had collected more than Eth. Birr 2,000 by selling apple fruits in the year 2009/10. The present study also found out that the minimum was Eth. Birr 24 and the maximum was Eth. Birr 3,000. The key informants in the *Dega* zone also informed that after apple had grown, our income is relatively improved. The survey result revealed that 67 households were participated in the growing of apple in all agro-ecologies. Among these, 46 (69) were from *Dega,* 7 (10%) were from *Woina-Dega* and 14(21%) were from *Kolla*. In all agro-ecologies, households collected average income of Eth. Birr 312 in the year 2010/2011 by selling apple fruits (Table 6.15). The major problems in the growing of highland apple according to KIs opinions were scarcity of water during the dry season and poor marketing systems.

Figure 6.7. Highland apple in the study area

As observed in the field, the land is degraded and rocks are outcropped and difficult to grow crops and rear livestock (Chapter 3). Hence, planting eucalyptus trees is found to be an encouraging source of income for the poor households. This made the growing of

eucalyptus trees as a major source of cash in the study area. Growing of eucalyptus trees is the most vital source of income for the farmers in the *Dega* zone and its coverage dramatically extended to the other zones nowadays. As observed in the field, vehicles were moving interior to the villages and the logs were loaded and transported to the consumers. As a result, farmers extensively grow eucalyptus trees on marginal lands and around their homesteads (Figure 6.8). The survey result showed that households in all agro-ecologies collected average income of Eth. Birr 268.6 in selling the logs of the eucalyptus trees in the year 2010/2011 (Table 6.15). Holden et al. (2003) noted that planting eucalyptus trees on lands unsuitable for crop production could increase households' source of income if the marketing systems are well integrated. Amare (2010) also noted that the growing of eucalyptus trees in the degraded lands was largely motivated by the scarcity of construction materials and fuel wood, more importantly to generate source of cash for the poor households.

Figure 6.8. Eucalyptus tree forest on the degraded and marginal lands

In general, shorter maturing rates and high growing density made eucalyptus trees one of the most profitable plants in the degraded agro-ecologies of the study area. In relation to this, Birru et al. (2013) indicated that the tree species are preferred more than others due to their fast-growth, coppicing ability, easy silvicultural management, poorly palatable to

animals and their adaptations to a wide range of ecological conditions. The major problem observed during the field survey was, farmers grow eucalyptus trees near their homesteads, which could be used for the growing of cereals and root crops such as potatoes and barely that could be used as food stopgaps for the poor households.

What makes the writer of this study more surprising during the field survey was the woody fruits (buds)[12] of eucalyptus trees were used as source of cash for the rural poor. As the key informants informed, it is used mainly for cooking food and replaces charcoal and cake dung. During the marketing day, one sack of eucalyptus woody fruits was sold up to Eth. Birr 25.00 (Figure 6.9).

Figure 6.9. Selling of eucalyptus woody fruits during the market day. Photo was taken with their consent.

6.3.5.1. Non-farm and Off-farm Incomes

Under ecological stress and/or severe land degradation, unpredictable rainfall and scarcity of farmland, livelihood diversification is a necessary condition in which the agricultural activities alone are not able to ensure household food security. Livelihood diversification in this study includes non-farm, off-farm and on-farm activities. Non-farm incomes include wage paying activities and self-employment in commerce, remittances,

[12] The woody fruits or capsules are roughly cone-shaped and have valves at the end, which open to release the seeds.

traditional/cottage industries and other services in rural areas (Ellis, 2000; Mseay, 2009; Kune and Mberengwa, 2012). Off-farm incomes on the other hand, refer income obtained from causal labor within the agricultural activities and from local environmental sources (Mseay, 2009). In the study area, off-farm activities include participating in casual labor, selling of fuel wood, charcoal, grass and cake dung, while non-farm activities consist of petty trading, handcrafts, grain milling, blacksmith, weaving and selling of local alcohols. The survey results showed that public works and causal labor were the major activities in the three agro-ecological zones and accounted for 49% and 15.4%, respectively. Causal labor was the highest in the *Dega* zone because of its accessibility to the main road and its nearness to the main town of the district (Nefas Mowucha). The least reported activities were carpentry (1%), blacksmithing (2%) and weaving activities (2.4%). As the KIs and FGDs informed, the majority of the communities in the study area consider these activities as inferior jobs performed by the poor and dismayed households. Kune and Mberengwa (2012) indicated that despite the age-old importance of blacksmiths and other cottage industries in producing, shaping and repairing farm tools, the community attached derogatory names for their services and people looked them down.

The study found out that in all agro-ecologies, about 25% of the respondents were engaged in non-farm/off-farm activities during the field survey, which is lower than the country's share (30%) (Tadesse, 2010) and higher than the ANRS (20%) (MoFED, 2012). Evidences from rural villages in Tanzania showed that, on average, 50% of the households income came from crops and livestock and the remaining half from non-farm wage employment, self-employment and remittances (Ellis and Mdoe, 2003 cited in Baiphethi and Jacobs, 2009). Previous study (Bryceson, 2002 cited in Campbell *et al*., 2002), in a study made in southern Zimbabwe indicated that non-farm activities reported between 60% and 80% evidenced that there is a continued movement into non-agricultural activities.

The total income per household of the sampled households in all agro-ecologies in the year 2010/11 was Eth. Birr 1,129.1 (Table 6.13). On per capita basis, it was Eth. Birr

215.2. Agro-ecologically, the *Dega* zone with the total income Eth. Birr 2,013 per household was the leading in non-agricultural activities and the *Woina- Dega* zone with the total income Birr 443 per household was the least among the three agro-ecological zones. This means non-farm activities as an alternative strategy in generating additional income outside agriculture is the least developed in all agro-ecologies in the study area. Josef and Laktech (2009), a study made in Ethiopia indicated that non-farm activities are small and own very little capital and the average per capita income per household was roughly Eth. Birr 194 in 2009. KIs and FGD participants indicated that lack of wage labor, shortage of startup capital, limited skills, weak marketing systems and less importance given by the district authorities were the major factors contributing to the poor performance of these activities in the study area. Davis (2003) noted that access to non-farm incomes at the household level is determined by the level of education, the community's social capital, the availability of credit and physical infrastructure and information of the household. Previous study (Yared, 2001) also indicated that low demand for the products, lack of financial know how, low labor stipulation and distance from urban centers were some of the bottlenecks to engage in non-farm activities.

Table 6.13. Total incomes from non-farm and off-farm activities by agro-ecological zones (Eth. Birr) in 2010/11 (Eth. Birr 17.67 = US$ 1.0)

Sources of income	*Dega*	*Woina- Dega*	*Kolla*	Total	% of total
Grain trading	14,760	500	3500	18,760	8.27
Livestock trading	3,000	4,300	5000	12,300	5.42
Selling local alcohol	380	1,250	6807	8,437	3.72
Weaving	2,300	-	5,850	8,150	3.9
Selling commodities	1,000	600	-	1,600	0.7
Carpenter	-	280	-	280	0.1
Public works	29,200	19,630	15,500	64,330	28.3
Blacksmith	5,000	0.0	1,300	6,300	2.8
Grain milling	48,000	0.0	2,000	50,000	22.0
Causal labor	25,047	4,150	2605	31,802	14.0
Selling cake dung	2,000	-	3270	5270	2.3
Selling of charcoal/fuel wood	7,145	-	7,000	14,145	6.2
Selling of grass	3,080	300	2,200	5,580	2.5
Total income	140,912	31,010	55,032	226,954	100
Total	2013.0	443.0	902.2	1129.1	

The study revealed that grain trading, grain milling and public works were the dominant sources of income in *Dega* zone. However, the total share of income from grain milling seems the highest, insignificant households (2%) in all agro-ecological zones were participated in this activity. With the exception of one, none of them was engaged in crop and livestock production. Three of them found in *Dega* zone and the rest (one) is found in *Kolla* zone. Likewise, selling cake dung and local alcohol were dominated by households in *Kolla* zone and selling livestock as a major source of income was imperative in *Kolla* and *Woina-Dega* zones (Table 6.13). In this regard, *Dega* was better in sources of income than the other zones. *Dega* zone was also much closer to the main town of the study district.

6.3.5.2. Wealth Categories and Engagement in Non-Farm and Off-Farm Activities

Taking wealth categories in to account, the average incomes for the better-off, the middle and the poor households were Eth. Birr 2,633.7, 688.1 and 990.35 per household, respectively (Table 6.14). This showed that the poor were relatively better than the middle because the poor might engage in causal labor and out migration, more than middle households. Misselhorn (2006) in her close analysis of the interview findings indicated that, while financial source is undeniably an important indicator of vulnerability to food security, the means to generate non-farm income significantly differs between wealth categories. As it is shown in Table 6.14, grain mills, and grain trading (that need high start-up capital) were dominated by the better-off households, while causal labor and public works (which demand little capital) were the major activities of the poor households. Consistent with this result, Adugna and Wagayehu (2012) noted that off-farm activities (agricultural wage, land rent and environmental gathering) are survival mechanisms pursued mainly by the poor households.

From the discussions, it was found out that the majority of the better-off households were engaged in non-farm income sources (grain and livestock trading and grain milling), while substantial number of poor households were engaged in off-farm income sources such as causal labor, public work, selling of charcoal and fuel wood. Barrett et al. (2001),

in a study made in Rwanda, evidently stated that the poor with the least agricultural assets and income are also typically the least able to make up this deficiency through non-farm earnings because they cannot meet the investment requirements (start-up capital) for entry into remunerative non-farm activities. Baiphethi and Jacobs (2009) supplemented that the proportion of non-farm income was higher for upper income groups than for the lowest income groups. The poor households were therefore more rely on agriculture and off-farm activities, which are more of seasonal. In relation to this, Freeman and Ellis (2005) indicated that the poor obtained considerable amount of income from off-farm activities such as collecting firewood, making robes and selling of charcoal; but these activities are characterized by lower entry and lower returns of household assets. The same authors also indicated that the richest households derive more than half of their income from non-farm activities.

Table 6.14. Total incomes from non-farm and off-farm incomes by wealth categories (Eth. Birr) in 2010/11 (Eth. Birr 17.67 = US$ 1.0)

	Wealth category			
Source of income	Better-off	Middle	Poor	(%) of total
Grain trading	14,400	2,360	2000	8.3
Livestock trading	6000	3300	3000	5.4
Selling local alcohol	0.0	1187	7250	3.7
Weaving	0.0	1000	7150	3.9
Selling commodities	0.0	400	1200	0.7
Carpentry	0.0	280	0.0	0.1
Public work	0.0	9,085	55,245	28.3
Blacksmithing	4000	1000	1300	2.8
Grain milling	46,000	4000	-0.0	22.0
Income from causal labor	687	8,250	22,865	14.0
Selling cake dung	570	1500	3,200	2.3
Selling charcoal/ fuel wood	800	7445	5900	6.2
Selling grass	1300	1480	2800	2.5
Total income	73,757	41,287	111,910	100
Total	2,634.2	688.1	990.4	

Thus, the better-off as opposed to the poor have greater freedom to choose among a wider range of non-farm activities. The survey result also confirmed that more than 90% of the

sample households who did not own farmland and oxen were not engaged in non-farm income sources. Nevertheless, some writers such as Alebachew (2011), Davis (2003) and Chambers (1995) cited in Degafa (2005) indicated that the poor were engaged more in non-farm activities than the non-poor. These differences might arise because of spatial, temporal and financial variations.

6.3.5.3. Sex of Households' and Engagement in Non-Farm and Off-Farm Activities

The study showed that there were variations in non-farm/off-farm activities between sexes of the households in which 33% female-headed households were engaged in non-farm/off-farm activities against 21% male-headed households. The result was consistent with Josef and Laktech (2009) a study made in Ethiopia who found out that 35% of female-headed households participated in non-farm/off-farm activities against 25% of male-headed households. Nkurunziza (2006) noted that only 26% of African female-headed households are engaged in rural non-farm/off-farm activities, which was much lower than the present study. Though female-headed households were busy in domestic roles such as childcare, cooking, washing cloth, gathering fuel wood, fetching water, they were also engaged in non-farm and off-farm activities to supplement their meager sources of cash. For example, as women KIs indicated, activities such as selling of charcoal, fuel wood, local alcohol (*tella, arqie*) and food during marketing days were the major activities run by female-headed households in the study area. This evidenced that female-headed households were self-employed. On the other hand, poor male-headed households were engaged in causal labor hired by better-off households. Dalon (2005) confirmed that female-headed households are highly dependent on selling cooked food, alcohol and charcoal, which are an indicator of women's self-employment activities compared to their male counterparts. The result was inconsistent to the works of Smith et al. (2001) which says female-headed households engaged in less diversified activities than their counterparts. In relation to these scenarios, one female-headed household in *Woina-Dega* zone narrated her experience as follows:

> I engaged in selling *tella* and *arqie* (local alcohol) to the surrounding communities. During marketing days, I also sell food (*injera* with *wot*, tea and

> bread). All these activities helped me to have some cash to buy food to my family. I have five family members, most of them are dependent and I am the responsible person to feed them. The incomes obtained from different sources are used for household food consumption and no more savings. The land I owned was sharecropped but the productions collected were too small to feed my family. Before engagement in non-agricultural activities, my family suffered from food shortage. Presently, I am also a member of PSNP run by the government of Ethiopia.

From the discussions, it can be concluded that female-headed households in the study area are employed in relatively varied livelihood portfolios to satisfy their needs; however, there is no sign of reducing the problem of food security and hunger since about 86% of the female-headed households were food insecure during the field survey. Thus, non-farm/off-farm activities run by female-headed households did not uplift them from asset poverty; they were rather in a vicious cycle of destitution. This is because they were engaged in such activities as selling alcohol, fuel wood and charcoal that paid least for the products. If non-farm/off-farm incomes were taken as a proxy indicator of welfare, female-headed households were extremely disadvantageous since more than 92% against 60% male-headed households earn a total annual income much less than Eth. Birr 1500 from these activities. Dolan (2005) confirmed that the mean per capita income of female-headed households was much lower than that of the male-headed households in the three districts of Uganda. This highlights the fact that there is a need of humanitarian assistance for female-headed households to uplift them from poverty and destitution.

6.3.5.4. Variables and Their Relations to Non-Farm and Off-Farm Activities

With the endeavors to show the relationships between some selected variables and engagement in non/off-farm activities, the One-Way ANOVA was employed. An assessment was made to show the relationships between geographical location and engagement in non-farm and off-farm activities. From the total sample households who engaged in non-farm/off-farm activities in 2010/11, *Dega* alone accounted for 39%, *Woina-Dega (*20%) and *Kolla (*18%). The result of the One-Way ANOVA confirmed that the relationships between agro-ecologies and engagement in non-farm and off-farm activities were statistically significant (at $p < 0.001$). For this study, education has

significant effect on the participation of extra income generating activities (at $p < 0.05$). The result was inconsistent with the works of Tadesse (2010) and Gebrehiwot and Fekadu (2012). Farm size has strong relations to non/off-farm activities in which 71% of the sampled households who owned less or equal to one hectare of land were engaged in these activities. The differences were statistical significant (at $p < 0.001$). The result was also consistent with the works of McDongh (2005) which says people engaged in non-farm/off-farm activities in areas where land becomes too scarce to run fully the farming activities. This showed that households who suffer from scarcity of farmland are supplemented by non-agricultural activities to overcome shortage of cash. It was assumed that households who do not have a pair of oxen employ non-agricultural activities better than others to secure food. The survey result also confirmed that from the total sample households who engaged in off-farm activities during the field survey, 64% owned one or no ox. The differences were statistically significant (at $p < 0.05$). Family size also exhibits a strong association with non-agricultural activities. The survey result indicated that 70% of the households with family size greater than five were engaged in non-farm and off-farm activities. The result was also consistent with the works of Gebrehiwot and Fekadu (2012). It was also assumed that households who produce better yields are less participated in non-farm and off-farm activities. However, the differences were not statistically significant (at $p > 0.1$). Finally, the poor households with scarce productive assets participated more in off-farm activities than the other wealth categories. This difference was statistically significant (at $p < 0.001$).

6.3.5.5. Challenges to Engage in Non-Farm and Off-Farm Activities

Non-farm and off-farm activities can supplement the farming incomes where the latter are not able to satisfy the needs of the households. As information collected from KIs, FGDs and household survey, non-farm/off-farm activities have faced multifaceted problems that directly affect the improvements of the households' livelihoods. For example, poor access to credit and high interest rate (18%) were the major drawbacks mentioned by KIs and FGD participants to engage in non-farm activities. Weak infrastructure and poor staffing situations that did not have the capacity to spread non-

farm activities in the rural areas were also the barriers for the development of the sector. In this regard, KIs in the *Kolla* zone indicated that there is lack of integrated market situations and infrastructure, especially roads, to sell the products to consumers (Chapter 8). The other serious problem mentioned by KIs and FGDs were products produced from non-farm sector (weaving, blacksmith, tanning) were not competitive to the manufactured goods and services. Among these, weaving and tanning have potential threat to compete with the modern products partly because of lack of demand. For example, clothes made of nylon and polyester with different colors has attracted the rural women who were once the most consumers of locally woven products. Hence, nylon and/or polyester, which are durable and easy to wash, are the dominant type of clothes almost for all households in the study area. Industrial sacks replaced tannery products such as local sacks (*aqumada*). As compared to other non-farm activities, petty trading had shown better development, though it is suffered from twin problems. One of the problems was lack of finance (85% of the respondents). The other problem mentioned by KIs and FGDs was it is more of seasonal, commonly practiced for not more than three or four months (from January to April) in the year. This result was also consistent with the works of Kune and Mberengwa (2012). In the other months, farmers were busy in agricultural activities. What makes non-farm activities peculiar in the study area is that much of the work is done by very few or a single person. This is very small in nature to make significant contribution to improve the livelihoods of the poor. This means, the income derived from non-farm/off-farm sources was not sufficient to meet the food demand of the sample households (let alone savings).

6.3.6. Migration

The emergence of landless households and recurrent drought, large number of people constantly migrate towards the south and western parts of Ethiopia for job opportunities. For many years, this strategy was successful and the income gained helped them to smooth consumption and to purchase tangible assets. As a result, migration forms a central part in risk mitigation strategies and livelihood diversification. Nevertheless, at

the current situations, because of severe ethnic conflict and decentralized political systems, migration to other regions other than the ANRS becomes a serious problem. Woldeamlak (2003) pointed out that the current regionalization, which is based on ethnic-linguistic groupings, posed a serious constraint for the movement of people outside their villages. During the field survey, no respondents had informed the movement of their family outside the ANRS. As information obtained from KIs, the temporary migrants were not able to accumulate cash to their families as a result, neither the family nor the community benefited economically from the migrants. Instead, the temporary migrants brought malaria that greatly affects the wellbeing of their family. Though food insecurity problem is pervasive in the study area, 66% of the sampled households responded that no family member migrated to other areas during the field survey. Considerable number of the poor sample households (34%) responded that some family members had migrated within the ANRS to search job during the field survey. Key informants indicated that out migration is dominated by landless households and youth in the study area.

6.3.7. Household Annual Incomes as Livelihood Outcomes

As it is shown in Table 6.15, the major sources of income for the sample households were agricultural production (sale of trees, fruits, crops and livestock), off-farm and non-farm activities, public works and remittances. The survey result indicated that income from agricultural production was the dominant (~ 85%), distantly followed by non-farm/off-farm incomes sources (7.3%). However, the agricultural production in the study area is constrained by scarcity of farmland, land degradation, frequent drought, erratic rainfall, scarcity of farm oxen, and low use of yield enhancing inputs. As opposed to the current study, non-farm/off-farm income sources had reached to 74% in some countries in Africa (Tasie *et al.*, 2012) and 46% in some countries of in Latin America (Sanchez, 2005). The study revealed that total annual income from the different sources varied by agro-ecological zones. In this regard, *Dega* zone was relatively better than the other zones because of more favorable environmental circumstances and modest rainfall distribution. KIs and FGD participants informed that *Woina-Dega* and *Kolla* zones frequently affected

by droughts and farmlands are extremely degraded. In addition, households in this two zones suffered from asset poverty and overall household incomes from the different sources were low (Table 6.15)

Table 6.15. Estimated average incomes from different sources by agro-ecological zones (Eth. Birr) in 2010/11 (Eth. Birr 17.67 = US$ 1.0)

Sources of income	*Dega*	*Woina-Dega*	*Kolla*	Total income	% of total
Crops produced and consumed	11,647.2	4,823.9	5,118.1	21,589.2	49.3
Stored for seed reserve	435.0	332.4	349.0	1,116.4	2.5
Selling of eucalyptus tree	200.0	86.0	-	286.0	0.7
Selling of fruits (highland apple)	311.9	-	-	311.9	0.7
Selling of livestock production	5,435.8	6,195.9	4,121.3	15,753	36.0
Off-farm and non-farm incomes	1,867.3	443.0	894.0	3,204.3	7.3
Public works	417.1	280.4	254.1	951.6	2.2
Gift/remittances	545.1	22.9	44.3	612.3	1.3
Total income per year	20,859.4	12,184.5	10,780.8	43,824.7	100
% of total	47.6	27.8	24.6	100	

6.3.8. Institutional Factors in Livelihood Outcomes of Households

The livelihood portfolio of the surveyed households was influenced by covariate, idiosyncratic and institutional factors. For example, access to credit, communication systems, market facilities and extension services are institutional factors that affect livelihoods of the rural poor. This means that institutions assist rural poor households to employ particular adaptive strategies to mitigate food insecurity outcomes. Targeting safety nets beneficiaries and creating household assets for graduation from the program are also important institutional factors in the study area. The study revealed that the safety nets program of the government covered 56% of sample households. However, 82% of the sample households expressed dissatisfaction with the services from the safety nets program. For instance, the majority of respondents in the poor income category for this study (61.1% of the respondents) had no clear idea about the beneficiaries targeting and selection criteria. This suggests that lack of transparency and accountability in

targeting safety nets beneficiaries is a limitation of the local institutions. Similarly, respondents also mentioned high interest rate (18%) of local microfinance institutions and poor infrastructure as major institutional constraints to their livelihoods. Land tenure insecurity, 'voluntary resettlement program' and unfair distribution of food transfer handouts were also important institutional factors to households' livelihood outcomes as cited by KIs and FGD participants.

Degefa (2005) indicated that inappropriate tenure system, inefficient and unstable rural policies, marginalization of some groups of people and lack of participation in decision-making process are power and policy bottlenecks that could result in negative livelihood outcomes and food insecurity. Lecoutere et al. (2009) differently stated that rather than sticking to the availability of food and people's access to food as the only means out of food insecurity/livelihood insecurity, political economy theory proposes that interventions have to focus on state reconstruction, good governance and accountability/transparency at household level. Blaikie et al. (2005) also indicated that political power, which includes transparency, accountability, fair representation and technical competence greatly affects the distribution of resources between different groups of people in a community. Gamage (2010) in his part stressed that the most important pre-requisite for creating sustainable livelihoods and to achieve sustainable development is good to have accessible governance; and the link between the community and the state has to be strengthened, based on transparency and accountability. The situations give some clue to local leaders and regional government to revisit the implementation of different programs in response to food insecurity at household level.

6.3.9. Determinants of Household Livelihood Outcomes

A range of biophysical, socio-economic and institutional factors generally influences rural households' livelihood outcomes. In this study, annual total income of households was taken as a proxy to their livelihood outcomes and hence the dependent variable for the regression modeling. Explanatory variables considered include a range of biophysical

and socio-economic factors, and a total of 12 variables were selected for the model (Table 6.16). Seven variables were significant at 1%, 5% and 10% probability levels. The maximum likelihood estimates of the multiple regression model showed that livestock ownership, fruits and trees production, access to credit, agro-ecology and engagement in non-farm activities were the determinant factors influencing annual incomes of households, and thus their livelihood outcomes. The coefficient of multiple determinations is 0.828, indicating that about 83% of the variation in total annual income of the sample households was captured by the model.

Agro-ecology as a variable captures influence of locational factors on household annual incomes. It was found out that households in the *Kolla* and *Woina-Dega* areas earned less annual incomes compared to those living in the *Dega* agro-ecological zone. This could be explained by their inaccessibility and poor infrastructure. Livestock ownership was strongly and positively correlated to annual income of households (at $P < 0.001$). A unit increase in livestock ownership (in TLU) increases annual household income by a factor of 0.33. Previous studies in different parts of Ethiopia have reported similar results that livestock possession positively and significantly influenced household incomes (Devereux *et al., 2003;* Mesay, 2009; Deressa 2010; Million, 2010).

Access to credit showed positive and significant correlation with annual income of households (at $p < 0.001$). As credit availability increases by one unit, annual income of households increases by a factor of 0.242. A similar, positive and significant credit-household income relationship was reported by Beyene (2008). In the drought-prone areas of Ethiopia where crop production is highly affected by amount and temporal distribution of rainfall, access to credit fills food gaps of households and helps households to diversify their livelihood options. Among the surveyed households, some 40% had actually taken credit from different sources, while almost all agreed that credit service was available in their area but did not take themselves. Non-farm/off-farm incomes were positively and significantly correlated with annual income of households (at $p < 0.001$). Other variables held constant, engagement in non-farm/off-farm activities

increases households' annual incomes by a factor of 0.059. This result was consistent to the works of Campbell et al. (2002).

Table 6.16. Multiple linear regression results

Explanatory variable	Unit of measurement	Standardized coefficients Beta	t	P vale
(Constant)			0.591	0.555^{NS}
Agro-ecology	Categorical (1= Dega, 2= Woina-Dega, 3 =Kolla)	-0.269	-5.234	0.000***
Family size	Number	0.112	1.932	0.055*
Sex of HHHs	Dummy (0= F, 1=M)	0.050	0.943	0.347^{NS}
Age of HHHs	Number	-0.027	-.547	0.585^{NS}
Education of HHHs	Dummy (0 = illiterate, 1= literate)	0.011	.215	0.830^{NS}
Farm size	ha	-0.014	-.294	0.769^{NS}
Number of farm plots	Number	0.115	2.04	0.043**
Engagement in non/off-farm Activities	Dummy (0 = yes, 1= no)	0.141	-2.489	0.004***
Livestock ownership	Number of livestock in TLU	0.338	4.765	0.000***
Access to credit Services	Dummy (0 = yes, 1= no)	0.242	4.981	0.000***
Membership in *equip*	Dummy (0= yes , 1= no)	0.038	.601	0.548^{NS}
Fruits and trees production	Income from sale of produce in Birr	0.311	6.068	0.000***
F = 22.5, df (12, 188), $p < 0.001$ R = 0.91 $R^2 = 0.828$				

* Significant at 0.1, ** Significant at 0.05, *** Significant at 0.01, ^{NS} not significant, HHHs = household heads

Growing of fruits and trees was found to be important in livelihood outcomes of households in the study area. It was found out that fruits and trees production increases households' annual incomes by a factor of 0.204. A similar finding was reported by an earlier study that selling and trading of eucalyptus tree had become the main source of income along the main road that connects Gondar to Mekele- the two major towns in the northern half of the country (Rami, 2002). Number of farm plots owned was positively and significantly correlated with annual income of households; other variables held constant, a unit increase in number of plots owned increases households' annual incomes

by a factor of 0.077 (at $P < 0.05$). The result was inconsistent with the works of Mesay (2009). Though weak, family size showed positive and significant correlation with household annual incomes (at $p < 0.1$). This result was consistent with the findings of Tasie et al. (2012), but contradicts those of Chukwuemeka et al. (2011) and Fausat (2012) who reported negative and significant correlation between family size and household total annual incomes. Age and sex of the households were not significant (at $p < 0.1$). As it is shown in Figure 6.16, sex is positive but age is negative to the beta coefficient. Since the reference is male, as the male household increases households to become food secure increases but insignificantly. In the case of age, the beta coefficient was negative. This is due to the fact that as household head becomes older and older the total annual income of the households decreases but insignificantly. The reason for the insignificance of the p value might be almost all the households in one way or another are suffered from chronic food insecurity. Thus, the total annual income obtained between households did not show significant differences.

Linear regression analysis identified livestock ownership, fruits and trees production, agro-ecology/location, access to credit and engagement in non-farm/off-farm activities as significant determinants of annual incomes of households (Table 6.17). Stepwise regression analysis showed that livestock alone had explained 53% of the variances of the total annual incomes of the households. The five important variables livestock, fruits and trees production, agro-ecological zone, credits and engagement in non/off-farm activities had explained nearly 80% of the total variations of the annual incomes of the households.

6.4. Conclusion

In this chapter, the major livelihoods and sources of income as well as the factors affecting the livelihoods were examined. An in depth analysis of the general livelihoods of the sample households such as capital assets, farm output, livestock production and other supplementary sources of income (non-farm/off-farm) were assessed. The results showed that households explored were under considerable stress of livelihood insecurity. Survey respondents and KIs reported that use of traditional farming technology, low use

of inputs, limited number of farm oxen, small farm size, much-degraded ecosystem, erratic rainfall and frequent occurrences of drought cause the decline of the livelihood outcomes for the bulk of the rural poor in the study area. It was also identified that lack access to the basic assets, market dependence on food consumption and seasonal food shortage caused the majority of the sample households to become chronic food insecure for considerable months in the year.

In the study area, crop and livestock production are declining, food transfer beneficiaries and chronic food insecure households are continuously escalating. The study revealed that livestock play a role of assurance for the households to access loans or direct cash by disposing them at the market; but the number of livestock owned per household dramatically declined contributing towards destitution and marginalization of the farm households. It was also indicated that the resource bases such as farmland, grazing land and forests have reached their critical stage of degradation, and they are the main causes for the decline of the agricultural production and productivity. crop production had shown a declining trend for the last twenty years as perceived by the respondents mainly due to low levels of fertilizer application, erratic rainfall, scarcity of farm oxen, unavailability of improved inputs and lack capability to improve the necessary farm practices.

The study indicated that non-farm/off-farm activities are vital to supplement the incomes gained from agricultural activities. However, it was investigated that the returns from non-farm/off-farm activities were extremely low, though there was some heterogeneity in its performance during the field survey. The study found out that few sampled households were engaged in off-farm/non-farm activities and the incomes per household were very low in augmenting households' cash deficit. This showed that the livelihood strategies pursued by the sample households was entirely dependent on rain-fed agriculture-extremely vulnerable to natural and human induced factors. It was also learnt that the total annual incomes gained from different sources could be taken as proxy indicator of livelihood security outcomes.

Chapter 7

Households' Perceptions and Coping/Adaptive Strategies to Climate Variability and Change

"Let us recognize that the effects of climate change affect us all. And that they have become so severe and so sweeping that only urgent, global action will do." UN Secretary General Ban Ki-moon, November 17, 2007

7.1. Introduction

The eastern part of the Amhara Region (where the present study is located) (Chapter 3) could be taken as the epicenter of drought and famine caused mainly by scarce and erratic distribution of rainfall. In this region, as high as 80% of the variability in the agricultural production is caused mainly by the disturbance of weather and related factors (John *et al*., 2009). Lay Gaint is one of the most vulnerable districts in the ANRS to climate variability and change. Climate variability manifested by erratic rainfall poses a huge threat to poor farmers in the district, because the majority of households (~ 93%) rely on small-scale subsistence agriculture, which is too sensitive to climate changes. McDevitt (2012) noted that the rural poor would be the hardest hit by the impacts of climate change, especially those whose livelihoods are heavily dependent on the use of natural resources such as agriculture.

This Chapter investigated households' perceptions about climate variability and change and their coping and adaptive strategies. This is due to the fact that farm households need to perceive the changes of climate, identify potentially useful coping and adaptive strategies to resilience from climate related shocks. Identifying potential coping and adaptation strategies against climate shocks can help policy makers and rural communities to mitigate adverse impacts of climate variability. The general objective of the study was to understand households' perceptions about climate variability/change and

the coping and adaptation strategies undertaken to mitigate climate shocks in the study area. The specific objectives were (i) to assess the perceptions of households' about climate change/variability; (ii) to investigate the rainfall and temperature distributions in the district, and (iii) identify the coping and adaptive strategies employed by the sampled households during crises times. The topics discussed under this Chapter include households' perceptions about climate variability/change; the nexus between crop production, climate change and food security; temperature and rainfall distribution in the district; and the coping and adaptive strategies employed by households for positive livelihood outcomes.

7.2. Households' Perceptions about Climate Variability and Climate Change

The perceptions of climate variability/change were assessed at household level. Households in the study area perceived that there has been decline of rainfall and increase of temperature for decades. In relation to this, Mertz et al. (2009), in a study done in Eastern Saloum, Senegal indicated that households generally agreed that temperature increased throughout the year, cold periods have become shorter and the hot season extended over longer periods. This shows that farmers are able to recognize the changes of temperature and rainfall in their localities using their indigenous knowledge.

The main indicators of climate change according to KIs were related to their day-to-day farming activities. For instance, drought, decrease of rainfall, increase of temperature and increase the speed of wind are the main indicators of climate change perceived by elderly KIs. Among these, both survey respondents and KIs identified drought and erratic rainfall as the main causes of climate variability in their localities. As it is shown in Table 7.1, sufficiency and distribution of rainfall, changes in temperature and incidence of drought were indicators of climate variability in the study area. In all the parameters indicated, rainfall was the most unpredictable. As it can be seen in Table 7.1, about 99% sample households in *Woina-Dega* and 79% in *Kolla* indicated that rainfall is extremely irregular during the growing of crops. In all agro-ecological zones, around 80% of the respondents confirmed that the entire distribution of rainfall was unsatisfactory. More importantly,

sample respondents have witnessed the continuous decrease of rainfall, and the problem was severe for *Kolla* agro-ecological zone (~ 90% of respondents) but less low for *Dega* zone (~35% of respondents). Similar studies in three Tigray districts showed that 99% of respondents indicated they witnessed the irregularity of rainfall in amount and distribution during the main rainy season (Nigussie and Girmay, 2010). In the current study, 84% of the total sampled households predicted the occurrence of drought in the future. Key informants also indicated that rainfall starts late and ends early, associated with drought spells and high intensity.

Perceived changes in temperature showed that 82% of respondents in all agro-ecologies ascertained the increment of temperature in their localities (Table 7.1). However, the perceived changes in temperature varied between agro-ecological zones, in which about 98% of the respondents in *Kolla* zone and 82% in *Dega* zone agreed that there was a rise in temperature. Key informants reported that because of increasing temperature during the *Belg* months (March and April) they could not move bare foot at mid-day due to the scorching sun. Furthermore, streams/springs and in some localities perennial rivers extremely declined or dried up during the dry season because of high evaporation and low infiltration rate. According to KIs, the major indicator of rainfall variability is the change of the planting months for the major crops. Elderly informants unanimously indicated that for the last 20 years, farmers planted crops in the middle or end of May. However, currently, the planting period has completely been changed to the middle or end of June. This showed that the onset of rainfall shifts from May to June, which is not suitable for some crops such as potatoes and barley that are used as food stopgaps for the poor households. Consistent with above the result, Kassa et al. (2012) indicated that, in the past people could see fully germinated crops till 12 July and matured crops till 22 August. However, the rains, which normally used to start in mid-June shifted to July and ceased much earlier (mid-September) than was normally the case. Mary and Majule (2009) also evidenced that changes in rainfall pattern and intensity result in the change of planting season, increased risk of crop failure, stunted growth and drying of crops. To minimize the risk of harvest failure, farmers in the study area opted for short maturing

crops rather than long cycle crops and developed water-harvesting techniques, though poorly implemented in the study area.

Table 7.1. Sample households' perceptions about climate variability (% respondents)

Options	Response	*Dega*	*Woina-Dega*	*Kolla*	Total
Has rainfall decreased for the last 20 years?	Yes	34.6	65.7	89.7	63.3
	No	65.4	34.3	10.3	36.7
Does rainfall come on time?	Yes	42.9	1.4	65.5	17.4
	No	57.1	98.6	93.5	82.6
Do you observe enough rain at the beginning of the rainy season?	Yes	81.4	2.9	13.1	33.3
	No	18.6	97.2	86.9	66.7
Is there enough rain during the planting and growing season?	Yes	39.6	1.4	21.3	20.4
	No	61.4	98.6	78.7	79.6
Does the rain stop on time in your locality?	Yes	18.6	1.4	19.7	19.9
	No	81.4	98.6	80.3	87.1
Is there rain during harvesting period frequently?	Yes	91.4	68.6	34.4	66.2
	No	8.6	21.4	65.6	33.8
Do you think that your RKAs will be affected by drought in the future?	Yes	66.0	96.0	95.0	84.0
	No	34.0	4.0	5.0	16.0
Do you think that food shortage can occur in your *kebele* in the future?	Yes	16	59	54	43
	No	84	41	46	57
Perceived change of temperature for the last 20 years	Increasing	82.0	67.0	98.0	82.0
	Decreasing	18.0	33.0	2.0	18.0

Taking the existing situations into account, elderly and experienced farmers in the study area informed that drought occurred at an interval of two to five years and this scenario may continue in the future, which was not true for the last 20 years. Consistent with this result, CS-CAFÉ (2011) indicated that on average, the frequency of drought occurrence is perceived to increase from about once in seven years to about once into two years. World Bank (2006) noted that, in Ethiopia, drought is a widespread phenomenon, which occurs in between three and five years. Likewise, Wilhite (2010) summarized that climate change and variability due to anthropogenic factors is projected to result in greater exposure to drought through an increase in the frequency, severity and duration of droughts events in drought-prone regions of the word.

At present, climate change and climate related hazards are felt by the rural communities at grassroots, manifested through erratic rainfall and an increase in temperature (EEA, 2010). The major indicators were soil degradation, severe deforestation and the deterioration of underground water. In relation to this, a key informant in *Kolla* zone shared his experience as follows:

> . . . Temperature has increased and the rate of change is high. Changes in rainfall amount and seasonal distribution are evident; the amount of rainfall tremendously dropped, and rainfall starts late and ends early. Adjusting to the changing climate is really a complex and unsuccessful task for the majority of the farmers including me. Following dry spells, outbreak of pests and the frequency of drought occurrence have increased through time making the farming activities more complicated. Perennial rivers have become ephemeral and springs and streams completely dried up during the dry seasons creating burden to my livestock and household consumption. During October and November, when the crops reach maturation, a very strong wind aggravates the transpiration of crops and they soon wilt dramatically reducing the total crop production in my locality. In my opinion, all these predicaments are the result of climate change.

7.3. Households' Perceptions about the Definitions and Causes of Drought

The survey data showed that sample households defined drought in different ways. About 35% defined it as the short of rainy season and/or lack of rainfall before the maturity of crops. About 41% defined it as a shortage of food or famine and 82% expressed a decline of rainfall from the normal distribution. About 90% of the respondents defined it as a failure of crop production. Almost all the respondents (98%) agreed that drought is one of the most frequent and severe problems in their localities. In relation to the causes of drought, households were different in their perceptions. As it is shown in Table 7.2, about 95% of the respondents reported erratic rainfall as the major cause of drought, while about 80% of households believed that deforestation is the principal cause of drought in their localities. On the other hand, about 33% reported soil degradation as the main cause of drought. About 94% mentioned population pressure as the major cause for the occurrence of droughts. In this regard, a key informant in the *Woina-Dega* zone shared his experience as shown below:

Drought is caused by deforestation, which results from over-cultivation, overgrazing and population pressure. Degradation of farmlands and soil erosion from hill lands, erratic rainfall and incidence of various natural events such as blight and frost, weather and climate changes are the major causes for the frequent occurrence of droughts in our locality. In my opinion, it is a measure taken by God for our transgression.

Table 7.2. Sample households' perceptions about the causes of drought (% respondents)

Options	*Dega*	*Woina-dega*	*Kolla*	Total
Erratic rainfall	90	97	98	95
Deforestation	75	85	80	80
Soil degradation	25	30	45	33
Overgrazing	78	89	92	86
Population pressure	94	93	94	94
Low use of inputs	15	25	19.8	19.9

Drought has direct and indirect impacts on the livelihoods of communities. The direct impacts of drought, according to Wilhte (2000), include crop loss, loss of forest productivity, increase of fire hazards, reduction of water levels and drying up of streams, increase of livestock mortality and damage of wildlife. The survey result showed that 87% of the respondents associated direct impact of drought with the loss of crop production. About 34% and 27% of the respondents perceived that declining water levels and mortality of wildlife are the direct impact of droughts, respectively. About 69% and 58% of the respondents indicated that reduction of income level (increased poverty) and social instability are the indirect impacts of drought, respectively. Some respondents also added that increase of price of food (84%) and conflict over the use of water resources (68%) are indirect impacts of drought in their localities.

In general, the impacts of drought could be manifested through social, economic, institutional and environmental situations. In this regard, loss of crop and livestock production and loss of income were mentioned by 79% and 32% of the respondents, respectively as the major economic impacts of drought in their localities. About 75% of the respondents mentioned land degradation as the major environmental impact of

drought. Another 38% considered the loss of biodiversity as the major environmental impact of drought. About 52% of the respondents explained that conflicts arising from shortage of water are causes of social unrest and are the main institutional impacts of drought in their localities. These corroborated that drought is the single most important climate related natural hazards impacting the livelihoods of the rural poor at most.

7.4. Households' Perceptions of the Dissemination of Climate Information

Reason frequently cited for not adapting in time to climatic impacts is lack of reliable climate monitoring and forecasting data (Kurukulasuriya and Rosenthal, 2003). Hence, available information about climate variability helps rural households to perform farm activities duly on time, to consider the time needed for the crops to mature and to rear the type of livestock that could adapt better to the changing climate. Kadi et al. (2011) indicated that the timely provision of climate information may help vulnerable societies and individuals to prepare for these extreme events, thus mitigating the costs associated with bad years and allowing them to better capture the benefits associated with favorable climatic conditions. It can also help to minimize the problems associated with inadequate water during the dry season. The timely dissemination of climate information and early warning to farmers (including information on risks) can strengthened the ability of farmers to cope with and optimize the management of hydrological variability and change (Kurukulasuriya and Rosenthal, 2003). In relation to this, sample respondents were asked about climatic information dissemination, specifically rainfall. As high as 75% of the respondents in all agro-ecological zones did not get any information in relation to the climate from radio or any other means of communication. The rest 25% indicated that they had some type of information from district agricultural experts, radio broadcast and from their neighbors. Spatial and temporal variations in the dissemination of information were also assessed. Households in *Dega* zone had better information because of accessibility to the district main town. Climate and weather information was the least disseminated in the *Kolla* zone because of its inaccessibility and remoteness. Twenty-five percent of the respondents in all agro-ecologies indicated that dissemination

of information is much better in recent years because of the availability of radio and fair distribution of extension agents.

Important sources of communication, according to the respondents, were extension workers (54%) followed by farmers themselves (28%) and radio broadcast (15%). Consistent with this result, Meena and O'Keefe (2007) indicated that the principal sources of farming information are agricultural extension officers (32%) and farmers themselves (36%). This leads to the fact that in an increasingly uncertain climate, traditional knowledge of when to sow and harvest and when to expect rains, may no longer be enough to keep farmers from vulnerability to food insecurity. Therefore, providing the right information in the right way at the right time in remote and inaccessible areas is found to be imperative to mitigate the impact of weather variability.

7.5. The Nexus between Rainfall Variability, Crop Production and Food Security: Households' Perceptions

As indicated in Chapter 6, the major livelihood of the sample households in the study area is mixed farming dominated by crop production. The crop production system is highly dependent on climate related factors, but droughts associated with erratic rainfall are the major causes for the decline of crop production, which forces households' to be vulnerable to food insecurity. Nyong et al. (2007) noted that increasing temperature and declining rainfall cause ecological stress affecting crop production and food security status of the rural poor. An example for this can be the African Sahel. Thus, changes in precipitation patterns and amount, and changes in temperature could influence crop growth through changes in soil water content, runoff and erosion, nutrient cycles, salinization, biodiversity, and soil organic matter (Verchot *et al.*, 2007).

Sample households' perceptions about the general trends of crop production and food security situations for the last 20 years were assessed. The indicator variables were agro-ecology, age, household size and sex of household heads (Table 7.3). This is because households who have long experience in farming can predict the trends of crop

production better than young households can. Markos (1997) and Kassa et al. (2012) noted that households' perception is very much related to age; that is, as age increases, households can perceive changes in their lifetimes. As it is shown in Table 7.3, households who perceived that crop production has increased for the last 20 years were relatively aged farmers. About 56% of the households who responded about the increment of crop production were between the ages of 40 and 49 years. As far as family size is concerned, there were mixed results. However, it could be argued that households with small family size perceived that the decline of crop production had occurred through time. On the other hand, about 60% of the sampled households who have family sizes between seven and nine responded that crop production has got better for the last 20 years and they were food secure. In general, the survey data revealed that 85% of the households believed that there has been a decline of crop production, while 13.4% argued that there had been an increment of crop production (Table 7.3). About 83% of the male-headed and 100% of the female-headed households had perceived that there was a decline of crop production for the last 20 years. Kune and Mberengwa (2012) and CS-CAFÉ (2011), indicated that about 66% and 77% of the respondents, respectively believed that there had been a decline of crop production over the years. Sample households were also asked to respond to the situations of food insecurity for the last 20 years. About 82% mentioned that the situations got worse, while 13.4% indicated that it was better. About 87% of the respondents indicated that the situations of food insecurity in their localities could be worse in the future because of land degradation, high population pressure and erratic rainfall. As elderly informants indicated, climate related shocks are the major cause for the reduction of crop yield, food shortage, food insecurity, death of livestock and soaring food prices.

In relation to this, a key informant aged 55 years in *Woina-Dega* zone shared his feelings as follows:

> A few decades ago, the numbers of children in the house were small, production was plenty, land was available, many of the communities owned a large number of livestock and grazing land was not a problem. During that time, no significant food shortage was observed: there was food security. Many rivers that dried up were perennial, and, therefore, there was no problem of water for the cattle and household consumption. Now, things are

> completely changed or reversed. Land becomes too scarce, production extremely decreased, rainfall is unpredictable and the frequency of drought has increased. The land I owned is degraded, and now it is not productive and the production obtained is not sufficient to feed my family.

Agro-ecologically, respondents from *Dega* (68%), *Woina- Dega* (96%) and *Kolla* (90%) replied that crop production has shown a decreasing trend for the last 20 years (Table 7.3). Birhanu (2009), in a study made in the south Gondar administrative zone of the Amhara Region, found that in 2001, crop production in Lay Gaint district was 409,877 quintals and had decreased to 341,421 quintals in 2005, and it dropped to a little greater than 250,000 quintals in 2013 (Figure 7.1). This might be the reason that, currently the largest share of the PSNP beneficiaries in the south Gondar administrative zone is found in Lay Gaint district. Of the three agro-ecological zones, households' perceptions for getting worse of crop production were the highest in *Woina-Dega* (96%) and *Kolla* (90%) (Table 7.3). The results showed that the two zones are the most degraded, drought-prone and exposed to chronic and transitory food insecurity for the last two or three decades (Chapter 3 and Chapter 8). Of the 27 sample households who replied that, crop production had increased 74% the respondents were from *Dega zone,* 18% from *Kolla* and the rest were from *Woina-Dega* zone. The largest percentage respondents in *Dega* zone indicated that rainfall was fairly distributed and the topography of the land was relatively better for crop production. The district agricultural officer also categorized *Dega* zone potentially better in terms of cereal production. The survey data also revealed that 41% of the sample households in *Dega* zone were food secure as compared to 6% in *Woina-Dega* zone. Though the regional government is working hard to increase crop production to realize food self-sufficiency at household level, the program is not successful in many drought-prone areas such as Lay Gaint in which erratic rainfall is the major challenge for crop production.

Table 7.3. Households' perceptions about the trends of crop production for the last 20 years (% respondents)

		Got worse	Got better	No change
Agro-ecological zone	*Dega*	68.6	28.6	2.8
	Woina-Dega	95.7	2.9	1.4
	Kolla	90.2	8.2	1.6
	Average	85.0	13.4	1.6
Sex	Male	82.8	15.5	1.7
	Female	100	-	-
Age	20-29	5.8	-	34.3
	30-39	14.6	7.4	-
	40-49	32.7	55.6	66.7
	50-59	21.0	29.6	-
	≥ 60	25.7	7.4	-
	Total	100	100	100
Household size	1-3	28	3.7	33.3
	4-6	52.6	29.6	-
	7-9	17.5	59.3	33.4
	≥ 10	1.7	7.4	33.3
	Total	100	100	100

Households' perceptions about the trends of individual crop production for the last 20 years were also examined. Accordingly, the average crop production in all agro-ecological zones exhibited a negative trend ($r = -0.42$, at $p < 0.01$) over the years. Among the crops grown, triticale, wheat and barley showed significant positive correlation ($r = 0.76$, 0.65 and 0.48, respectively, at $p < 0.01$), while crops such as *faba* bean, field peas and *tef* had shown statistically significant but negative correlation ($r = -0.87$, -0.56, -0.34, respectively, at $p < 0.05$). Inconsistent with the above results, Kassa et al. (2012) investigated that barley, wheat and chickpea showed a significant and negative correlation with *r* values of - 0.69, - 0.51 and - 0.49, respectively.

As it is shown in the preceding discussions, the crop production for some selected crops, which could be taken as the major means of livelihood for the majority of the sample households showed a declining trend over the years. The reasons for the decline of crop

productions were erratic rainfall (98% of respondents), lack of capital to buy inputs (97% of respondents), land scarcity/too small a plot (89.7% of respondents), soil fertility decline (81.7 of respondents) and soil erosion (83% of respondents) (Table 7.4).

Table 7.4. Households perceived causes for the decline of crop production

Perceived causes	**% respondents**
Soil infertility	81.7
Soil erosion	83
Water logging	29
land scarcity/too small a plot	89.7
Rugged topography	67.9
Drought/erratic rainfall	98
Pests and diseases	51
Shortage of labor	23
Scarcity of farm oxen	67
Lack of capital to invest on inputs	97
Weak extension system	45

Note: the total is not 100 due to multiple options

Supporting about the results, McDongh (2005) had listed the factors for the decline of crop production, which include livestock and crop disease, poor soil fertility, land fragmentation, lack of access and/or high cost of agricultural inputs, weak agricultural extension, variable weather conditions, long period of drought and destructive rainfall. KIs and FGD participants were also asked to list down the constraints of crop production based on severity. Accordingly, rainfall variability, drought, land degradation and shortage of land were the major constraints of crop production and ranked as 'very high' in all agro-ecological zones. Likewise, feed shortage, livestock and crop diseases and pests, hail damage, shortage of oxen, high cost of input packages, lack of adequate supply of improved varieties and rugged topography ranked 'high' in the three agro-ecological zones. The multiple response results showed that use of compost (91% of respondents), terracing (91.5% of respondents), crop rotation (73.6% of respondents), chemical fertilizers (48% of respondents), fallowing (18.3% of respondents), tree planting (60.7% of respondents), and contour plowing (93% of respondents) were the measures taken to increase crop production in the study area. The low response rate for chemical fertilizers

was associated with the high cost of price and the low purchasing capacity of the sample households, severe land degradation and erratic rainfall and/or drought. Woldeamlak (2003) substantiated that the use of artificial fertilizers and other factor inputs that will improve productivity (such as improved seeds, herbicides, pesticides) is very low, and indeed beyond the reach of the majority of the poor farmers. As a result, sample households consumed on average less than half a quintal of chemical fertilizers and insignificant amount of improved seeds and no one reported the use of pesticides and herbicides in 2010/2011 cropping year. In general, the wide fluctuations of agricultural production in the study area for many years attested that agriculture is dependent on the vagaries of weather conditions. Hence, it can be concluded that the spatial and temporal variations of rainfall is a real challenge to farmers for food security outcomes. So far, households' perceptions about climate variability and trends of crop production (Chapter 3) have been discussed. In the following topics, the meteorological data obtained at Nefas Mowcha (11^0 04' to 12^0 10' N latitude and 38^0 12' to 38^0 37' E longitude) is compared against households' perceptions to climate variability. For this purpose, the monthly rainfall and temperature data for 26 years (1986-2011) were employed for the analysis and discussion.

7.6. Analysis of Climate Data of Lay Gaint District

7.6.1. Rainfall Variability

The main rainy season in the study area, which is also true to the north central highlands of Ethiopia, is determined by the Inter-Tropical Convergence Zone (ITCZ), which covers the north-west of the country commonly referred to as *Kiremt* rain (FAO and WFP, 2012). The general distribution of annual rainfall is seasonal and varies in amount, area and time as it moves from the southwest to the northeast of Ethiopia (MOI, 2004 cited in EDHS, 2012). The study area enjoys the maximum rain during the northern summer (*Kiremt*) originating from the Atlantic Ocean, which spans from June to September. However, the *Belg* rain originating from the Indian Ocean gives little rain to the study area from January to April. This indicates that the seasonal movement of the ITCZ

controls the rainfall distribution of the study area. It is also strongly influenced by the diverse topography that ranges from hot *Kolla* to cool *Dega* agro-ecological zones. Depending on the movement of the ITCZ**,** there is high inter-annual and intra-annual rainfall variability in the study area. For instance, in 1991 the mean rainfall recorded was 605.1 mm and greatly increased to 1192.2 mm in 1998 and dropped to 700 mm in 2002 (Figure 7.2). Hence, the mean annual rainfall in the study area as measured at Nefas Mowchia (11^0 04' to 12^0 10' N and 38^0 12' to 38^0 37' E) ranges from 601mm to 1200 mm, with wide seasonal and annual variations (Figure 7.2). Consistent with this result, Lay Gaint District Agriculture Office (2011) indicated that the mean minimum and the mean maximum rainfall for the district are 605 and 1200 mm, respectively. Aklilu et al. (2000) also noted that the average annual rainfall in Lay Gaint district ranges between 600 and 1100 mm.

As it is shown in Figure 7.2, the amount of rainfall showed a decreasing trend, negatively affecting the planting and growing periods of crops. Especially from the 2000s onwards, the trends of rainfall showed a decreasing loop which is below the mean rainfall for more than a decade. Ayalew et al. (2012) indicated that the total rainfall in the north central highland of Ethiopia (where the current study is located) remarkably declined in the second half of the 20^{th} century. According to the same authors, most widespread and potentially devastating impact of the north central highlands of Ethiopia would be change in the frequency, intensity and predictability of rainfall. The same authors further pointed out that yields could be decreased by 50% in the year 2020 because of irregular trends of rainfall in Africa.

In addition to the inter-annual variability, there is also *spatial variability* of rainfall in the study area (Figure 7.3). KIs and FGD participants informed that there is a significant difference in amount and distribution of rainfall between the lowlands (*Kolla)* and the highlands (*Dega)* agro-ecological zones (Chapter 3). Considering its elevations, the *Dega* zone receives higher mean annual rainfall than the lowland (*Kolla*) zone (Figure 7.3). Tilaye (2004), in a study made in north Shoa of the Amhara Region, also noted that highland areas receive high amount of *Belg* and *Kiremt* rain than the mid-altitude and

lowland zones. Average rainfall was the least in the northeastern and eastern parts of the study area, while the southern and southwestern areas receive relatively higher amount of rainfall explained by variations in elevation (Figure 7.3).

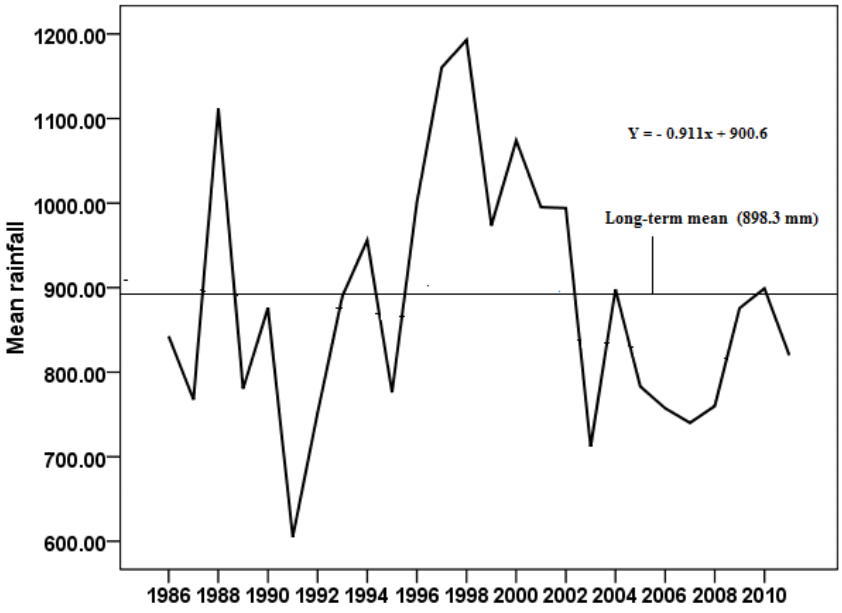

Figure 7.1. Mean annual trends of rainfall at Lay Gaint district (1986-2011)

Source: ANRS meteorological office

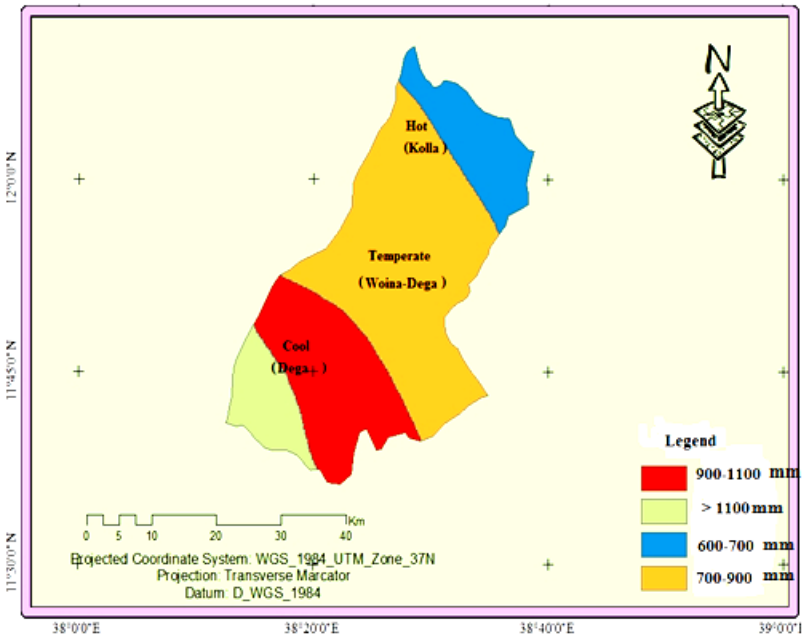

Figure 7.2. Spatial distribution of mean annual rainfall in mm of Lay Gaint district

Because of the inter- annual and intra-annual rainfall variability, farm households in the study area are not rely on the *Kiremt* rain let alone the little *Belg* rain that frequently changes its pattern. The *Belg* rain in the study area is very crucial because potatoes and cabbage, the most stable and fast maturing food crops, can be grown during this season. In addition, it helps for timely preparation of seedbeds, which can be taken as determinant factor for the next growing season. In this regard, McCann (1990) stated that the effect of seasonality and inter-annual variations on crop production in the northern highlands could be seen as the impact of the *Belg* rains, which plays a critical role in the rural economy; and the crops grown are used as food stopgaps. However, the *Belg* rain is the most unpredictable in the study area.

The study area located in less favored and moisture deficit areas of the north central highland of Ethiopia have suffered from agricultural, meteorological and hydrological droughts. As observed in the field, there is a clear soil moisture stress and many of the rivers, streams and springs were without water and/or dried up in many parts of the study area during the dry seasons. With the exception of few wet summer months, *Belg* and *Bega* in most cases are recognized by prolonged deficit of precipitation. This, in turn, affects the agricultural activities practiced during the *Belg* season, which are used for the growing of barely, cabbage and potatoes as McCann (1990) called food stopgaps. Gregory et al. (2005) strongly emphasized that among the most frequently cited drivers of food insecurity and failure of crop production, variability of rainfall could be cited as the underlying, ongoing and a short-lived shock.

7.6.1.1. The Coefficient of Variation and Precipitation Concentration Index

The mean annual rainfall in Lay Gaint district for the 26 years was 898.3 mm with a standard deviation of 165. The mean annual rainfall could be sufficient for crop production, if the amount of rainfall is fairly distributed for the growing months. However, this is not the case for the study area. For example, long-term mean rainfall showed that about 70% of the total amount of rainfall is concentrated into two wet

months (July and August) aggravating soil erosion, floods and landslides (Chapter 3). The coefficient of variation for the 26 years was 20.5%. As it is shown in Figure 7.4**,** the coefficients of variation ranges from a little lower than 12% to above 24%, indicating that there was considerable variability of rainfall between years. A recent study (Alebachew, 2011) in a drought prone area of south Wollo close to the study area also calculated the CV to be 21^0C. The CV was higher for *Belg* (32%) but lower for *Bega* (18%) and *Kiremt* (12%). The results obtained were consistent with Rosell and Holmer's (2007), Ayalew et al. (2012), Woldeamlak and Conway (2007), Kassa et al. (2012) and Elisabeth (2004). As the regression line Figure 7.4 showed, the general trend of the CV seems decreasing. This is associated with the decreasing of rainfall of the study area through time (see Figure 7.2).

The calculated precipitation concentration index (PCI) for the study district was about 21%. Woldeamlak and Conway (2007) showed that the PCI less than 10 indicates uniform distribution, between 11% and 20% shows high concentration and greater than 20% indicates very high concentration. This showed that the rainfall distribution in the study area was highly concentrated in the few wet months (July, August and September) (Chapter 3).

High concentration of rainfall in few wet months means there is high soil erosion, over flooding, landslides and hailstorms. Likewise, van der Geest and Dietz (2004) indicated that intra-annual variability could pose problems to farmers when there is too much rainfall in a short period, while for the rest of the year, too little rain for the full development of crops. The percentage distributions of rainfall for the 26 years showed that 8.7% for *Bega*, 75.6% for *Kiremt* and 15.7% for *Belg* season. In relation to this, Adugna (2005) employed 40 years of rainfall study for Gondar zone and found out that the average *Belg* rain was 16.8%, while the *Kiremt* rains accounted for 74.2%. Woldeamak and Conway (2007) noted that the contribution of *Kiremt* rain to the annual total ranges from 64% in *Combolcha* to nearly 85% in *Gorgora*. The results indicated

that the contributions of *Belg* and *Bega* rains to the total were very low; and this evidenced that the study area exhibited a mono-modal pattern of rainfall.

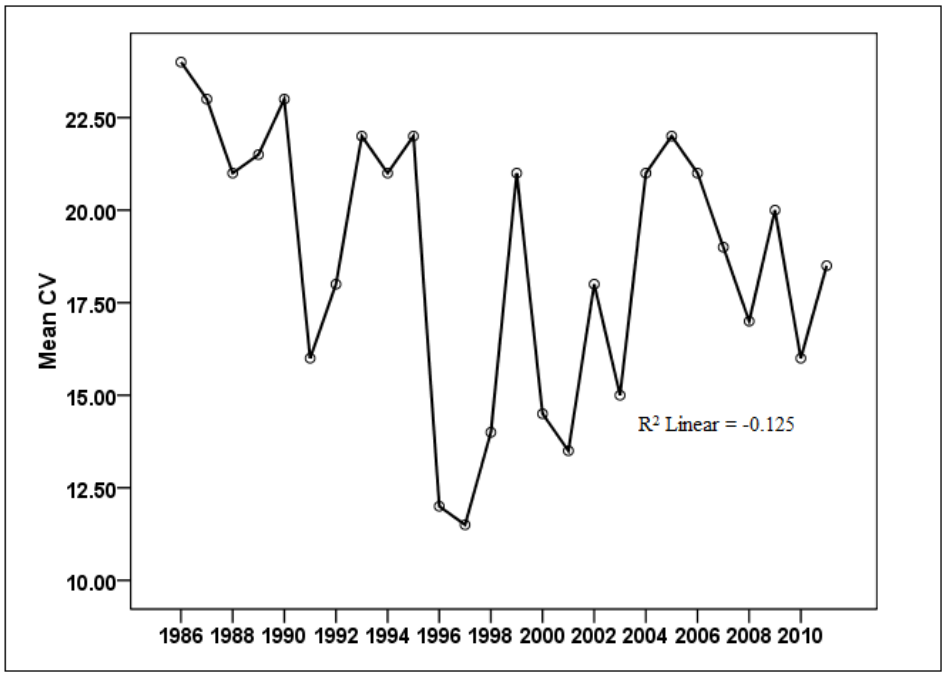

Figure 7.3. Coefficient of rainfall variation of the study area (1986-2011)
Source: ANRS meteorological office

7.6.1.2. Standardized Rainfall Anomalies (SRA)

As it is shown in Figure 7.4, from the 26 years of SRAs, about 53% were negative. In this regard, Hauskin (2000) stated that above 50% of rainfall anomalies below the mean considered severe metrological drought. Thus, the study area experiences severe meteorological drought for the last couple of decades and there is a tendency towards greater frequency of dry years. Ayalew et al. (2012) also noted that the standardized rainfall anomalies for the Amhara region range from 46.7% for *Debark* to 63.3% for Metema. Figure 7.5 also showed that three years (1988, 1991 and 2002) were the most severe or extreme drought occurrences recorded. The years from 1986-1996 were characterized by deficiency of rainfall in the study area. The overall results showed that the study area like most of the northern highlands was predominantly characterized by moderate to severe drought.

The drought severity classes of Lay Gaint district is presented in Table 7.5. From the total SRAs calculated, 55% are found between moderate and extreme drought. Years with no drought accounted for 45% indicating that drought is a serious problem in the study area. Kinyangi et al. (2009) calculated the severity index for the northern highlands of Ethiopia and said that drought becomes severe even when many highland regions in Ethiopia receive sufficient amount of precipitation. The same authors also indicated that there is a higher likelihood for the occurrence of droughts in the north central and eastern parts of Ethiopia for the coming decades.

Table 7.5. Drought severity classes in the study area (1986-2011)

Drought severity classes	Status of drought	% Total
- 2.0 and less	Extreme drought	3.8
- 1.5 to -1.99	Severe drought	7.7
- 1.0 to -1.49	Moderate drought	43.5
- 0.99 or above	No drought	45.0
	Total	100

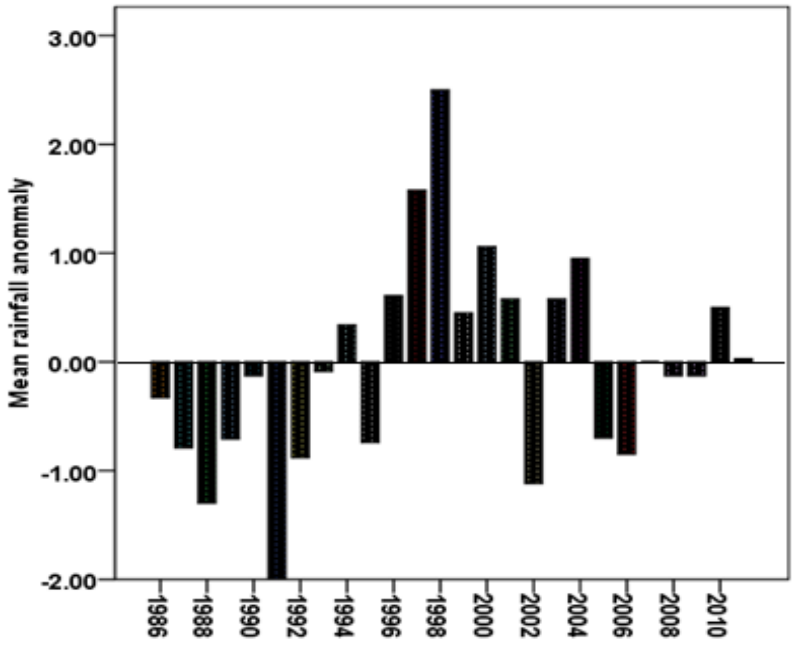

Figure 7.4. Standardized rainfall anomalies in Lay Gaint district

Source: ANRS meteorological office

7.6.2. Temperature Variability of the Study Area

The mean annual temperature showed that there was a great change in distribution in Lay Gaint district (Figure 7.6). The paired t-test showed that the variability of temperature over the years was statistically significant (at $p < 0.01$). More importantly, the result of the temperature data in the study area revealed that there was an increase of temperature by about 1.25^0C for the last three decades. Supporting the result, World Bank (2006) reported that the mean annual temperature for Ethiopia had increased by about 1.3^0C between 1960 and 2006. Halonen et al. (2009) indicated that for the period between 2040 and 2069, temperatures are projected to increase between 1^0C and 3^0C for Ethiopia. Keller (2009) also indicated that the patterns of temperature in Ethiopia showed an increasing trend but the increase is more pronounced since 2000; and this result is quite similar to that of the present study. The Spearman's rho test, for example, evidenced that there is a positive and statistically significant change in mean temperature over the years in the study area ($r = 0.56$, at $P < 0.01$).

The increasing of temperature especially in the degraded and drought-prone areas aggravates evaporation directly affecting the moisture absorbing capacity of the soils. Halonen et al. (2009) argued that higher temperature would also probably increase the rates of evaporation and, assuming other influences remain unchanged, increase surface water evaporation affect the soil moisture balance. Tropical diseases common to the study area such as malaria, yellow fever and meningitis (among others) are mainly caused by temperature variability and change. For example, as KIs indicated, cooler areas once suitable for living are invaded by mosquito now days. The district health expert also informed that meningitis becomes one of the killer diseases in the *Kolla* zone of the study area during the very hottest season.

Kinyangi et al. (2009) have also reported a correlation between high temperatures and incidences of in-patient malaria; suggesting that malaria epidemics might migrate to highland regions that are experiencing an increase in maximum and minimum temperatures. Verchot et al. (2007) also indicated that diseases and insect populations are

strongly dependent upon temperature and humidity, and changes could alter their distributions. Disruption to agricultural production, reduced food security, increased malnutrition resulted in drought, reduced access to clean water, more favorable conditions for the spread of vector-borne diseases; increased heat stress are the results of climate change (McDevitt, 2012).

To sum up, the decline of crop production and increasing safety nets beneficiaries were the result of erratic rainfall, land degradation, high population pressure and increasing frequency of droughts. Consequently, households in the study area suffered from chronic and transitory food insecurity for many years; and the extent of the crisis was more broad and deep. Failure or unpredictable rainfall is the main cause for the decline of crop production and incidence of food insecurity. Especially, late rains have brought the total failure of maize, barely, potatoes and cabbage, which can be used as transition food for the poor. Thus, food self-sufficiency at household level is mainly caused by drought and erratic rainfall. To this end, responsive measures such as livelihood diversification, coping and adaptive strategies could be taken to become food self-sufficiency and hence food security.

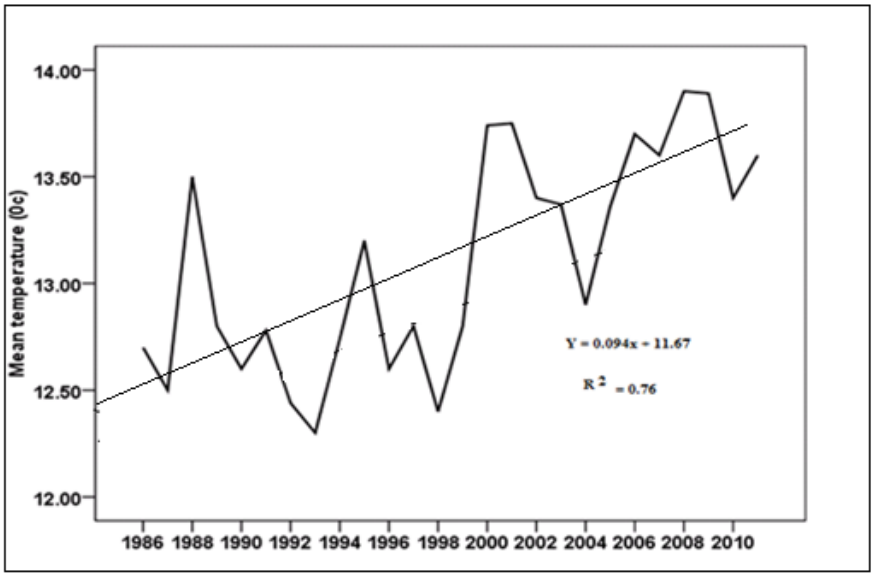

Figure 7.5. The trend of temperature in Lay Gaint district (1986-2011)
Source: ANRS meteorological office

According to Halonen et al. (2009), taking the potential increase in climate extremes into account, Ethiopia will have to find ways to adapt these scenarios. Likewise, Thomas et al. (2007) pinpointed that individuals, communities, and nations have to cope with and adapt to climate variability to mitigate the changes. As discussed in the preceding topics, the frequency and severity of droughts have increased through time that demands to develop diverse coping and adaptive strategies based on the resources owned to secure food at household level. For that reason, detail discussions have been made on households' coping and adaptive strategies based on agro-ecological zones and wealth categories.

7.7. Households' Coping and Adaptive Strategies

The agricultural activity in the study area is characterized by low level of technology, low crop production and risky subsistence. Even in the modest harvesting years, the use of production enhancing technologies and crop production were extremely low. In addition, there are severe constraints in livestock sector in general and draught animals in particular. These situations forced the poor households to engage in short-term (coping) and long-term (adaptive) strategies to climate and climate-related shocks. Adaptations strategies are more of planned and anticipated, while coping strategies are usually spontaneous and have greater damage to the natural environment (Chapter 2). Sample households in the study area employ both coping and adaptive strategies in the face of wide variety of risks through their own labor, capability and resources to relieve the challenges. Thus, the succeeding discussions focus on the coping and adaptation strategies employed by the sample households during food crises and climate change scenarios.

7.7.1. Ex-Post Coping Strategies of the Households

As it is shown in Chapter 2, the strategies taken by the households to reduce the crises follow logical sequences, starting from easily reversible tactics to irreversible, which erode the asset base of the households. As it is indicated in Chapter 2, the study employed the summary of Lobell and Burke (2010), Patrice (1993) and Wondowsen (2011) coping

strategy models (Table 7.6). The survey results showed that for the majority of the sampled households; reducing the quantity of meals (69% of respondents), postpone special festivals (78% of respondents), selling small ruminants (64% of respondents), harvesting immature food crops (58% of respondents), selling big livestock to buy food (54% of respondents) were the main coping strategies employed in all agro-ecologies (Table 7.6). Households in the study area sell their key productive assets, which they usually fail to rebuild (restock) after the disasters had stopped its catastrophes. Damaging coping strategies such as out-migration of the entire families were practiced in the *Kolla* zone, indicating that coping strategies are exhausted in this agro-ecology. It was also learnt from key informants that *Kolla* is the most vulnerable part of the district to food insecurity.

Table 7.6. Households' coping strategies (% respondents)

Coping strategy	*Dega*	*Woina-Dega*	*Kolla*	Total
Reductive strategy (minimizing risk)				
Reducing the quantity of meals	81.4	71.4	44.3	69.0
Reducing the numbers and types of meals	8.2	65.7	77.1	52.0
Postpone special festivals	67	78	89	78
Selling small ruminants	75.7	75.7	36.1	64.0
Selling charcoal and fuel wood	22.9	42.9	36.1	34.0
Depleting strategy (absorbing risk)				
Harvesting immature food crops	82.9	52.9	36.1	58.0
Selling big livestock to buy food	54.3	75.7	27.9	54.0
Consuming seed reserves	52.9	54.3	37.7	49.0
Selling expensive assets	18	13	16	15.6
Maintaining strategy (risk taking)				
Out-migration of family members	51.4	30.0	61.0	47.0
Going without food throughout the day	54.3	31.4	11.5	33.0
Selling land to purchase food	14.3	25.7	47.5	28.0
Consuming wild foods	40.0	28.6	9.8	27.0
Begging	7.1	1.4	21.3	9.0
Regenerative strategies (livelihood diversification)				
Engaging in casual labor	41.4	31.4	37.7	37.0
Engaging in petty trade	28.6	28.6	24.1	27.1
Changing coping into adaptive strategies	18.0	12.0	14.8	14.9

Previous study (Guinand, 2001), for example, investigated that in the Simien Mountains (part of the study area) coping mechanisms were limited to sale of livestock and out-migration of the whole family. Markos (1997), in a study made in drought- prone areas of northern Ethiopia, listed the coping strategies as reducing consumption (83%), relief assistance (82.3%), and livestock sale (69.2%). Remittance (9.9%) was the least used.

The discussions revealed that sample households in the study area employ ample coping strategies but the tactics used differ from household to household based on the available resources they possess. The study found out that coping strategies are important tactics for the poor and female-headed households than the rich as it is shown in the succeeding discussions. Agro-ecologically, selling of big livestock, which could be taken as the major depleting of assets was common in *Woina-Dega* zone (Chapter 6). Silvestri et al. (2012) also indicated that selling of livestock was an important strategy for poor households to coup up climate-related shocks. The study also revealed that postpone special festivals is commonly practiced in *Kolla* zone (Table 7.6).

As it is shown in the preceding discussions, the study area is characterized by high population pressure, low resource endowments, erratic rainfall and fragile ecosystem; but they survived until now because they have developed indigenous coping and adaptive strategies. In-depth interview with KIs and FGD participants showed that during mild periods, households commonly employed reducing meals, selling small ruminants and selling non-productive assets. If the severity of food shortage increases, households start selling big ruminants such as cows and farm oxen. This showed that during food crises, the basic asset for the poor households was livestock especially small ruminants. A key informant from *Woina-Dega* zone narrated his experiences as follows.

> Animals ranging from small to big are vital for survival. They are used as traction power, source of milk and butter and sources of cash at times of food crises. For the last fiscal year, my family was in food crises. I was having a considerable number of small shoats and I sold some of them and purchased food and seed crops. Now, I am left with only two sheep, one ox, one donkey and three chickens.

Repeatedly selling of productive assets such as livestock, land and farm oxen is an indicator of depleting tangible assets and exposes households to chronic food insecurity. Guinand (2001) investigated that the repeated failure of rainfall has exhausted the coping options of the target population, making them fall back on the consumption of seed and sale of farm implements for their survival. This has significantly reduced the copping ability of households and threatened future food production and food availability in all the districts of the Semien Mountains, including Lay Gaint. Sample households were also asked to give their opinion to the continuous use of coping strategies for survival. The majority (95% of total) perceived that the continuous use of coping strategies would result in depletion of assets and leads to severe food insecurity. In relation to this, a key informant from the *Dega* zone shared his experiences as shown below:

> Because of the failure of spring rain and delay of summer rain in 2009/10 crop year, my family faced food shortage. I have seven family members and two of them were high school students in 2011 academic year. To overcome the food crises and to educate my children, I sold one milking cow and in the next year I sold the only ox I owned and now I am left with considerable numbers of apple trees, one calf and two sheep. If the spring rain becomes scanty or summer rain delays, my family will go to starve. The problem was severe because I am not a member of the safety net program; though I can qualify for the criteria to become a member of productive safety nets program.

Though land is a vital asset for the households, it could not be sold during food crises for the reason that land is the property of the state. The farmers have the right to use but are not entitled to sell their land. This might be the reason that few (28% respondents) sold their land at times of food crises as a major coping strategy. In relation to this, Bluffstone et al. (2008) indicated that use rights over land in the Amhara Region could therefore be characterized as highly uncertain. The same author added that since land is the state ownership, in times of distress, it could not function as a true asset, with no use as rental, sales and mortgage. From the discussions, it can be summarized that the endowments of human and physical assets, the levels of production and the ability to diversify incomes are the major determinants of households' coping strategies.

7.7.2. Ex-ante Adaptation Strategies[13]

As it is shown Chapter 2, adaptation is a long-term strategy of averting a threat with consistent responses. In the study area, local level adaptation strategies include livelihood diversification, livestock diversification, growing perennial trees, animal fattening, growing fast maturing, and drought resistant crops (Table 7.7). In relation to this, Ayele (2008) , Geberemhedin (2009), Deressa et al. (2008) indicated that farm management practices (improved seeds, chemical fertilizers, water harvesting, soil conservation and cultivating fast maturing plants), tree planting, and diversification of crops and increasing water conservation and livelihood activities are imperative long term adaptive strategies.

As it can be seen Table 7.7, the major adaptive strategies among the sampled households include diversification of crops (72.2% of respondents) such as barely, triticale, wheat, pulses, diversification of livestock kept (72.5% of respondents) including sheep, goats, cow, donkey, chickens and seed reserves (64.4% of respondents) and growing of eucalyptus trees (about 64% of respondents). In-depth interview with key informants indicated that adaptive strategies employed by the sampled households in the study area have improved the availability of food and sources of income. Diversification of livestock as a strategy was found dominant in the *Dega* and *Woina-Dega* agro-ecological zones of the study area (Table 7.7).

Planting of eucalyptus trees was common in the *Dega* zone because of accessibility to the main road that links Bahir Dar and Mekele regional cities. Rami (2002) argued that selling and trading eucalyptus tree is the main adaptive strategies along the main road that connects Gondar and Wollo over impressive mountain ridges and highland plateaus. From households' opinion, it was learnt that in drought-prone areas where natural

[13] Ex-ante adaptive strategies as a means of adjustment, whether passive, reactive, or anticipatory, that is proposed for ameliorating the anticipated adverse consequences associated with climate change (Schoon, 2005:13).

resources are exhausted/degraded, adaptation strategies alone could not improve chronic food insecurity; and hence, it has to be aided with PSNP and other food security programs such as voluntary resettlement and other food security programs as recently changed into household asset building program (HABP).

Table 7.7. Adaptive strategies of the sample households by agro-ecological zones (% respondents)

Adaptive strategies	*Dega*	*Woina-Dega*	*Kolla*	Total
Diversifying crops	89.7	79.6	67.2	72.2
Diversifying livestock	98.6	82.9	36.1	72.5
Seed reserves	95.7	84.3	13.1	64.4
Growing eucalyptus trees	94.3	78.6	18.3	63.7
Fattening livestock	85.7	61.4	21.3	56.1
Growing fast maturing plants	92.8	31.4	34.4	52.9
Diversifying plots[14]	88.6	61.4	0.0	50.1
Livelihood diversification	39.5	21.8	14.9	25.4
Water harvesting	28.6	30.0	0.0	20.4
Saving expensive materials	8.6	34.3	0.0	14.4
Natural resource conservation	76.4	56.5	23.5	52.1

Soil and vegetation conservation, which is an important strategy to sink carbon emission, was also better accomplished in *Dega* zone. In relation to this, Nyong et al. (2007) stated that in the African Sahel, mitigation activities are traditionally employed as natural resources conservation measures, but they generally serve the dual purposes of reducing the emission of GHG from anthropogenic sources and enhancing carbon sink. Diversifying farm plots, growing a range of crops, diversifying income sources into non/off-farm enterprises that are sensitive to climate change are adaptive measures in order of importance to climate change in drought-prone environments (Lobell and Burke, 2010). The green economy currently being practiced by the government of Ethiopia could be best exemplary to reduce the greenhouse gas emission and to conserve the soil from rampant highland erosion.

[14] Diversifying plots refer having different types of land with different soil quality as well as different topography with their micro climate differences

Adaptive strategies by wealth categories showed that the better-off households practiced growing of trees (92.5%), diversifying crops (89.2%), diversifying fields (75.7%) and natural resource conservation (82.8%) (Table 7.8). The survey data showed that diversification of livestock kept was the main adaptive strategy for the better-off and the middle households. The majorities of the poor (70.8%) have grown fast maturing plants such as barely of different species, teff of different varieties (*bungn*) and potatoes to alleviate immediate problem of the food crises. However, the key informants pointed out that the amount of productions per hectare for fast maturing plants were low. Livelihood diversification to non-farm/off-farm activities is found to be important adaptive strategy and it can be said that livelihood diversification is not only a choice, but it is mandatory in order to survive in the face of an eminent climate variability and change. Nevertheless, as it is shown in Table 7.8, livelihood diversification was limited because of lack of income sources, poor social network, low credit availability and high interest rate and low value given by the concerned bodies. Table 7.8 also showed that the better-off households because of their enhanced capital investment dominated the livelihood diversification in to non-farm activities, while the poor were involved more in doing causal labor and move to other places to search for job opportunities. As it is shown in Table 7.8, because of asset poverty, saving expensive and precious materials for insurance strategy was the least in all wealth categories. Though water harvesting is a vital strategy in drought- prone areas such as Lay Giant, the survey result showed that it was the least strategy for the sample households.

From the qualitative information, it can be recapitulated that the poor households in both agro-ecologies were engaged in dominantly in coping strategies to avert the unfavorable situations, while the better-off farmers were dominantly engaged in planned strategies. Petty trading, livestock fattening, livestock diversification, growing perennial trees such as eucalyptus and apple fruits are commonly employed by the better-off households in the study area. Smoothening consumption, borrowing from relatives, public works, sale of charcoal/fuel wood, sale of cake dung, being engaged in causal labor, and desperate

out-migration are strategies commonly practiced by the poor households in the study area.

Table 7.8. Adaptive strategies of the sample households by wealth categories

(% respondents)

Adaptive strategies	Better- off	Middle	Poor	Total
Diversifying crops	89.2	75.6	54.9	72.2
Diversifying livestock	78.6	78.3	62.1	72.5
Seed reserves	78.5	65	50.3	64.4
Growing of saleable trees	92.5	63.3	45.2	63.7
Fattening livestock	71.4	59.7	37.5	56.1
Diversifying fields	75.7	46.7	29.2	50.1
Growing fast maturing plants	42.1	45.7	70.8	52.9
Natural resource conservation	82.8	53.4	22.3	52.1
Livelihood diversification	37.8	22.7	15.9	25.4
Water harvesting	33.1	20.0	8.6	20.4
Saving expensive materials	33.2	11.4	0.0	14.4

Finally, households were asked to state the factors affecting in employing adaptation strategies. The majority of the sample households indicated that level of education, wealth of households, access to extension and credit services, rainfall variability, agro-ecological settings and climatic related information are important factors influencing households adaptive strategies against climate change in the study area.

7.8. Conclusion

The study revealed that the high inter-annual and inter-seasonal rainfall variability were the primary cause for the decline of crop production and households' vulnerability to food shortage. This could be the reason that the majority of the respondents faced food deficit for several months in the year and the gap is filled by the government safety nets and other income generating activities. In this regard, the study noted that 56% of the sample households were PSNP beneficiaries. Both the survey and KIs results showed that there were significant changes in rainfall and temperature for the last 20 years in their

localities. In all agro-ecological zones, about 80% of the respondents perceived annual rainfall to be inadequate to support the growing of crops and grazing of animals. About 84% of the total sampled households predicted the occurrence of drought in the future and 87% of respondents indicated that the situations of food insecurity could be worse in the future because of land degradation, high population pressure and erratic rainfall. The study investigated that planting trees for the market, livestock fattening, and stocking seed reserves were found to be vital adaptive strategies employed by the majority of the better-off households. Short-term responses to meet the shortfall of consumption needs, selling charcoal and fuel wood, taking loans/credits and borrowing in kind or cash from friends and/or relatives, consuming seed reserves and selling productive assets were the major ex-post coping strategies practiced by the poor and vulnerable households.

Chapter 8

Analysis of Vulnerability to Food Insecurity[15]

8.1. Introduction

The study area is designated as chronically food insecure for the reasons that the majority of the households (74%) are food insecure and major recipient of food aid for the last couple of decades (Lay Giant District Food Security Office, 2011). In relation to this, Bird and Shinyekwa (2005) noted that if a community or a region is under food insecurity for continuous five years or above, that community is considered to be chronically food insecure. Likewise, Abi (2001) indicated that food insecurity situations could be worse where the largest numbers of people are safety nets beneficiaries for consecutive three or more years. Thus, the study district could be categorized under vulnerable to food insecurity for the reasons that large number of people are chronically food insecure for the last two or three decades; and currently above 88,000 people are chronically food insecure and are PSNP beneficiaries (Lay Gaint District Food Security Office, 2012).

Identification of the food insecure groups of people and/or agro-ecology and having better understanding of the determinants of vulnerability to food insecurity are crucial for designing effective food security strategies and programs for intervention. Thus, analysis of vulnerability to food insecurity is fundamental for policy makers to identify which groups of the community and geographical regions are susceptible to hazards and need policy interventions to reduce the predicaments. Accordingly, the incidence, depth and severity of food insecurity by agro-ecologies were discussed which might help local governments to target PSNP beneficiaries. It can be said that poor selection of indicators and lack of comprehensive analysis of vulnerability to food insecurity lead to ineffective

[15] Arega, B. and Woldeamlak, B. 2013. Analysis of vulnerability to food insecurity in drought-prone areas of the Amhara Region of Ethiopia: case study in Lay Gaint Woreda. *Eastern Africa Social Science Research Review* 29: 25-49.

targeting and wastage of resources in designing development interventions. In this regard, this Chapter has practical significance for designing a more targeted and effective food security related interventions. It has also merits for which empirical analysis at household level vulnerability to food insecurity is relatively unexplored field in the study area. The productive safety nets program run by the local government also needs to be evaluated through a forward-looking analytical basis. This section therefore, fills in an important knowledge gap by focusing on a severely degraded, impoverished and drought-prone area where research evidence on extent and determinants of household vulnerability to food insecurity is lacking. The general objective of the study was to identify factors that determine rural households' vulnerability to food insecurity in the study area. The specific objectives were to: (i) investigate indicator variables to household vulnerability to food insecurity in the study area, (ii) identify food insecure agro-ecological zones and households using the Foster- Greer-Thorbecke (FGT) food security index and (iii) identify determinant factors affecting households' vulnerability to food insecurity. This Chapter specifically covers issues such as livelihood assets in relation to households' vulnerability to food insecurity, the food security situations of the study area and households' incidence, depth and severity of food insecurity by sex and agro-ecologies.

8.2. Conceptual Framework

As it is shown in Chapter 2, vulnerability indicators are related to capital assets such as human, social, physical, natural and financial assets. As it can be seen in the conceptual framework (Figure 8.1), human capital indicators such as age and sex composition and educational level of the household can affect households' food security status. Infrastructure as physical capital is used as an indicator of household food security and increases households' financial and other capitals. Financial incomes obtained from different sources such as non-farm and off-farm activities, credit and households' savings help to reduce vulnerability to food insecurity and enhance households' human, physical and other capitals. Access to land for farming and grazing is important natural capital for improved food security outcome of households.

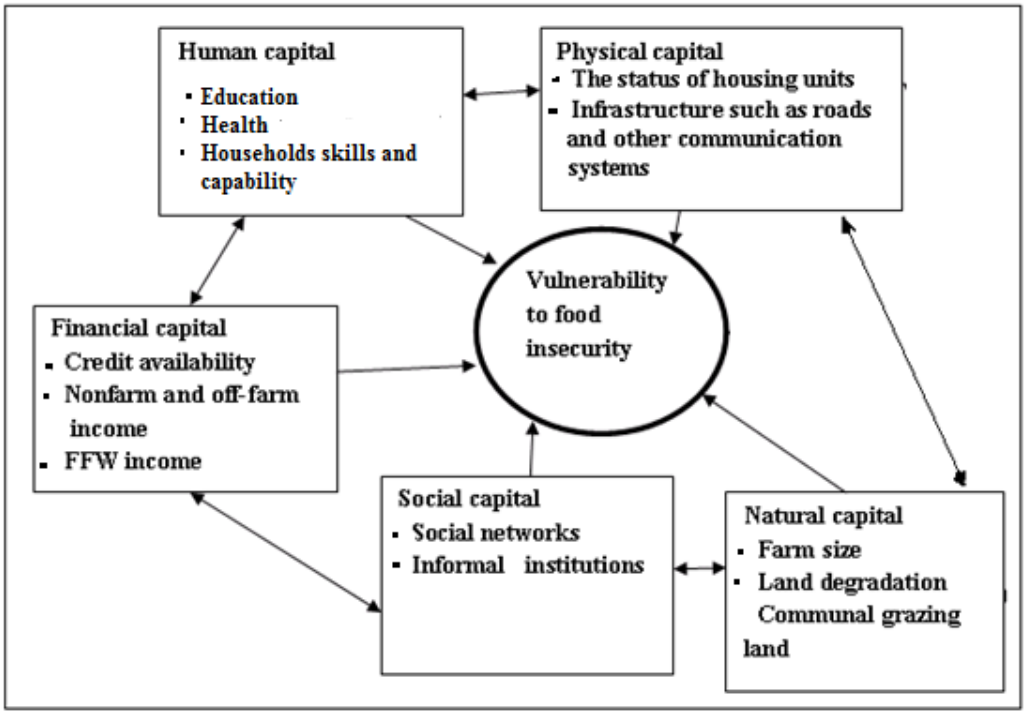

Figure 8.1. The conceptual framework to explore household vulnerability to food insecurity

Source: Modified from Deressa et al. (2008)

From the discussion, it can be said that increasing capital assets is a primary strategy for improving people's livelihood outcomes, as people require a range of capitals to pursue their livelihood strategies. However, capital assets can be destroyed and created because of trends, shocks and seasonality (Baumann, 2002) and continuously modified for betterment of livelihood outcomes. For example, intensive use of agriculture on marginal lands can destroy the natural capital (soil degradation); on the other hand, land management practices can improve the natural capital (land). According to Baumann (2002), sustainable development could be expected in the accumulation as well as substitution of different types of capital assets for better livelihood outcomes. In general, sustainable use of the five capitals can bring the food security outcomes, whereas stressed and unsustainable livelihoods can bring borderline food insecurity outcomes. In other words, a critical and accelerated depletion or loss of capitals results in chronic food insecurity outcomes. If the capital assets are completely collapsed, the result is famine

and/or catastrophic humanitarian crises, which are commonly true to the degraded and drought-prone areas of the northern highlands of Ethiopia where the country study is in place.

8.3. Livelihood Assets and Households' Vulnerability to Food Insecurity

8.3.1. Human Capital

Following the study by Deressa et al. (2008), Nkurunziza (2006) and Degefa (2005), human capital was defined in terms of skills, education/knowledge and health. They are key elements needed to pursue different types of livelihood strategies. For this study, education is found to be vital in revealing the human capital as it is shown in the succeeding discussions.

8.3.1.1. Educational Attainments of Household Heads

The level of households' education determines the use of family planning methods and raises farmer's agricultural production and productivity. Maharjan and Chhetri (2006) indicated that higher education in the rural community opens up better employment opportunity and diverts people from subsistence agriculture to non-agricultural activities. Hence, education is one of the major demographic factors that influence the person's behavior and attitude (USAID, 2006) and improves the living conditions of human beings. However, the survey data revealed that about 61% of the sample households in both agro-ecological zones could not read and write, while 6.5% of the respondents have some form of formal education (Table 8.1). The study also showed that 92.5% of the female-headed households could not read and write. The results obtained were generally low as one compares with the illiteracy rate of female-headed households in the ANRS, which was 79.5% (Freihiwot, 2007). In fact, all of the female-headed households except one were in the poor wealth category. Campbell et al. (2003) noted that women have less time for leisure and almost none of their time is devoted to academic activities. CSA

(2012) stated that 46.8% of the population in rural Ethiopia are educated, with females (38.8%) compared to males (61.2%). Mossa (2012), in his study of Libokemekem of the Amhara region also indicated that male-headed households are better than female-headed households in overall educational attainment and illiteracy rate is highly correlated with poverty. Tadesse (2010) also found out that female-headed households were less educated than their counter parts. It was assumed that the low level of education could be taken as a constraint in improving the agricultural practices. Nevertheless, the paired T-test did not exhibit association even at 10% significance level. The reasons might be the knowledge they earned did not help to improve the agricultural practice since the farming activities are more of traditional, which do not demand high skills and capabilities. Key informants informed that households who can read and write have assigned to be head of *kebele* administration to perform some political matters.

Table 8.1. Educational status of the sampled households

Education level	Frequency	Percent	Cumulative percent
Cannot read and write	122	60.7	60.7
Can read and write	63	31.3	92.0
Primary school	11	5.5	97.5
Secondary school	2	1.0	98.5
Special training	3	1.5	100
Total	201	100	

Investment in education is imperative in building human capital thereby reducing chronic poverty and food insecurity at household level. Devereux et al. (2003) reveals that farmers can also benefit from education for the reason that literate farmers are likely to be better-off than their illiterate neighbors. For that reason, an assessment has been done about the educational status of the sample households by agro-ecological zones and wealth categories (Table 8.2). The majority of the poor households (72% of respondents) cannot read and write, while the corresponding value for relatively better-off was 43%. Consistent with this finding, Matshe (2009) investigated that human capital is strongly related to the level of wealth in which poorer head of households are generally less educated than those of the richer ones. EDHS (2012) also supplemented that among

males 14% of those in the wealthiest households have no education, compared with 54% of the poorest households.

Table 8.2. Level of education by agro-ecological zones and wealth categories

(% respondents)

Ecological zone	Wealth category	Illiterate	Read and write	Primary school	Secondary school
Dega	Better-off	40.0	20.0	30.0	10.0
	Middle	50.0	41.7	8.3	0.0
	Poor	83.3	16.7	0.0	0.0
Woina-	Better-off	33.3	66.7	0.0	0.0
Dega	Middle	40.0	55.0	5.0	0.0
	Poor	70.7	24.4	4.9	0.0
Kolla	Better-off	55.6	33.3	0.0	11.1
	Middle	50.0	43.7	6.3	0.0
	Poor	61.1	30.6	8.3	0.0
Total		60.7	32.3	6.0	1.0

From the discussions, it can be noted that the overall level of educational attainment among households in the study area indicates low level of human capital development. Indeed, Devereux (2000) stated that human capital is extremely low in rural Ethiopia and thus it has been both a cause and consequence of food insecurity due to adverse synergies between poor education, health and labor productivity. Despite the high illiteracy rate of farm households prevailing in the study area, no adult educational services (once flourished during the Marxist-Leninist regime) were accessed during the field survey. On the other hand, the enrollment of children in primary and high schools is highly improved across all agro-ecological zones. As information obtained from the district educational office, the total coverage of formal education in the district had reached to 90%.

Rural households invest considerable amount of money and labor to educate their children. Their expectation is, at the end of their education; they may employ and can help financially their parents. Parents have also good experience from their neighbors

receiving remittances from their educated children. In relation to this, a key informant from *Dega* zone shared of his experience as follows:

> In the past, all the educated adults were employed by governmental and non-governmental organizations. They were good sources of income to their parents and were role models for others. Now, many students including my son have completed their tertiary education and yet they are not employed. The worst side to my son and others is they are engaged in bad practices, which is a problem for the community. In my opinion, schoolchildren can be encouraged if the government employs them.

The writer of this study also observed the situations during the field survey. A considerable number of students who completed University education were not employed. In relation to this, Campbell et al. (2002:26) evidently stated that:

> Lack of employment opportunities has discouraged children from completing the basic four years of secondary education. It is now common to hear young children querying why they should keep on going to school given to that their brothers and sisters, who completed secondary and even tertiary education, are unemployed. Rather than wasting time in schools, many students decided to migrate towards the Republic of South Africa from semi-arid regions of Zimbabwe to seek jobs.

8.3.2. Social Capital

Social capital is a form of social network in which people share values through interactions with their neighbors for mutual advantages. According to Nkurunziza (2006), social capital includes networks, relationships and trust, which rural people have in search of livelihood opportunities. Formal political structures such as RKAs and informal systems, which include religious institutions, connections to social support base for example, remittances, local self-help groups and different co-operative institutions are defined as social capital assets in the study area. According to KIs, mutual support at time of crises such as grain and cash loans, reciprocal labor exchange and some form of informal institutions is commonly practiced social network in the study area. Adeger (2003) cited in Misselborn (2006), indicated that social capital includes reciprocity and exchange, common rules, norms and sanctions, membership of political parties in power,

social connectedness and social networks and groups. Social networks focus on how people are organized and solve internal conflicts and reduce powerlessness and solve immediate social problems. Twigg (2001) indicated that societies who are organized and cohesive are able to resist shocks better than divided communities. However, the poor who are devoid of productive assets are the most disadvantageous to take loans from their relatives and/or neighbors, and, in most cases, are marginalized from social networks.

Sampled households in one way or another participate in different social networks based on volunteerism. These included formal political structures such as RKAs, and informal systems which include *Iddir* (mutual support association), *Equib* (local savings association), and *Mahiber* (an association for mutual aid and relief to soul) *and debo* or *wenfel* (agricultural labor groups) through which people get things done. As far as their importance is concerned, Seleshi (2006), in a study made in Tach Gaint district, presented the 'sayings' of the local communities in the following ways (Table 8.3).

Table 8.3. Local expressions of traditional institutions

Local sayings	Paraphrased meanings
'Kebariye' *(iddir)*	That celebrates my funeral
'Lechigrie derash, lekfuken derash' *(iddir)*	An immediate responder to my problem
'Gebena debik' (*iddir*)	Living like the neighbor
'Lenfese maderia' (*mahiber)*	Relief to my soul
'Sewen sew yadregew' (*equib*)	That makes humankinds wealthy

Mahiber is a very traditional ritual, but it is still a powerful belief both in urban or rural of the study area. The key informants in all agro-ecological zones indicated that *mahiber* was powerful during the last couple of years; but at the current situations, many households are not a member of *mahiber* mainly due to asset poverty to prepare some drinks and food to the members during the ceremonial day. Desalegn (1991) indicated that *mahiber* was quickly phased out in many communities in *wollo* as more and more households found it difficult to meet the informal obligations. The survey data pointed out that 96.4% of the better-off and 50% of the poor participated in *mahiber* during the field survey. Agro-ecologically, 80% of the sample households *in Woina-Dega* zone

participated in *mahiber* followed by *Dega* (56%) and the least was *Kolla* (34%). In total, 58% of the sampled households in all agro-ecologies participated in *mahiber (*Table 8.4*).*

Equib is a type of saving or revolving fund arranged by its members and gives services to its clients to save money at times of crises (MoFED, 2008). According to Wolde-Selassie (2001), *equib* is a voluntary money pooling institution rotating the sum among members weekly, bi-weekly or monthly. Membership of *equib* is determined by the capacity of the households to pay the pre-arranged cash. As a result, the better-off in all agro-ecologies participated more than the poor and the middle households (Table 8.4). From the total sampled households, only 21% participated in *Equib* during the field survey indicating that savings at times of crises was low. Participation in *Equib* was the least for the poor households in all agro-ecological zones. As it can be seen in Table 8.5, 34% of the better-off and 12% of the poor participated in *Equib* which means the poor do not have the capacity to pay the prearranged payment for *Equib*.

Table 8.4. Local informal institutions by agro-ecology and wealth categories (% respondents)

Agro-ecological zone	Wealth categories	Local informal institutions		
		Equib	*Iddir*	*Mahiber*
Dega	Better- off	67	100	100
	Middle	65	80	45
	Poor	5	98	52.5
Woina-Dega	Better- off	-	90	90
	Middle	10	95	85
	Poor	5	80.5	73.2
Kolla	Better- off	33.3	100	95
	Middle	31.3	100	25
	Poor	27.7	100	25
	Total (%)	21	94	58

Its low contribution to be a member and treats its members on equal basis regardless of wealth strata, ethnicity and religion makes *iddir*[16] one of the most powerful social networks in the study area. Wolde-Selassie (2001), in a study made in the relocated rural households of the Beles valley noted that *iddir* is the strongest multi-purpose mutual institutions of the communities in the valley. As a result, the majorities (94% of total) in this study were participated in *iddir* during the field survey (Table 8.4).

Its accountability, transparency, responsibility, sense of ownership added the importance of *iddir* in the study area and elsewhere in Ethiopia. More importantly, *Iddir* helps members mainly during bereavement, in establishing and maintaining good relations among members, coordinating members to prevent crime and carrying out development projects wherever necessary. In all informal institutions, *Dega* was the leading followed by *Woina-Dega* zone. However, elderly key informants informed that social networks with the exception of *iddir* are declining because of the problems associated with the payment of some informal obligations.

8.3.3. Physical Capital

Indicators of physical capital include availability and access to transport systems, water and sanitation supply, availability of fuel wood and housing units (Chapter 6).

8.3.3.1. Housing Units and Household Equipment

The types and modes of houses constructed are important assets since it directly generates utility and serve as a store of wealth. The huts in the surveyed areas are mostly thatched roofs, circular walls made of wood and plastered with mud while, the tin roofed houses are rectangular. The quality of housing units of the surveyed households was assessed to serve as an indicator of vulnerability to food insecurity. Brooks (2003), for

[16] *Iddir*- is a traditional community based insurance scheme in which a household contributes a pre-determined amount of cash/in kind to the membership in order to be insulated from cash shortfalls in the event of death of a specific member of his family or himself (MoEFD, 2008).

example, indicated that the quality of housing would be an important determinant of community's vulnerability to flood, hygiene, disease, windstorm, etc. CSA (2012) added that many key indicators of multidimensional poverty are related to housing and housing facilities. In the study area, the majority of housing units (70% of total) were thatched roofed huts with one room and without adequate ventilation or windows (Table 8.5). Consistent to the result, MoEFD (2008) pointed that in Ethiopia, 74% of the households construct their house from mud and wood and 20% from corrugated iron sheets. According to CSA (2012), more than half of the total rural households (51%) reside in single-room houses and 31% live in dwelling units that have two rooms. The result is consistent with the study made in Uganda by Bird and Shinyekwa (2005) which says about 50% of the poor households live in huts made of wood, grass and mud. Tin-roofed houses are owned by better-off households and the community considers these households as 'rich'. About 86% of the better-off households had tin-roofed houses, while 84.1% of the poor owned thatched roof houses. Most of the households with tin-roofed houses also had smaller thatched roof for use as kitchen as well as shelter for their animals.

Table 8.5. Type of housing units by agro-ecological zones and wealth categories (% respondents)

		Type and status of housing units			
Ecological zone	Wealth categories	Thatch roof	Tin roof	Have windows	No windows
Dega	Better-off	0.0	100	100	0.0
	Middle	33.3	66.7	66.7	33.3
	poor	69.4	30.6	30.6	69.4
Woina-Dega	Better-off	0.0	100	100	0.0
	Middle	100	0.0	0.0	100
	poor	100	0.0	0.0	100
Kolla	Better-off	44.4	55.6	55.6	44.4
	Middle	93.8	6.2	6.2	93.8
	poor	77.8	22.2	22.2	77.8
Total percentage owned		70.1	29.9	29.9	70.1

Van der Geest and Dietz (2004) revealed that the poor live in poor housing conditions exposed to different calamities. Wisner et al. (2003) also indicated that the rural poor has a thatch and pole house, while the rich has a brick house with better ventilation. Faridi and Wadood (2010) noted that in rural Bangladesh, households who are living in houses built with straw roofs (hemp/hay/bamboo) are the poorest segments of the population and they are chronically food insecure. There was also variation in the quality of housing units by the agro-ecological zones considered (Table 8.5). About 72.4% of the sampled households in *Dega*, 13% in *Woina-Dega* and 46.2% in *Kolla* zone owned tin-roofed houses. This was partly because of scarcity of grass for thatching in the *Dega* areas. More importantly, the *Dega* zone is better in asset ownership. All the better-off households in *Dega* and *Woina-Dega* zones owned corrugated iron sheets. It was also observed in the field that the households had only very basic and traditional household utensils and equipment such as jogs, pots in different size, saddle, farm tools and crop storage made of mud.

In the study area, the three basic assets such as land, livestock and housing units have close associations in telling the well-to-do of the households. During the field survey, it was observed that those households who owned tin-roofed houses have also larger number of livestock (12 livestock per household on average) than those who owned thatched houses (1.7 livestock per household). Though land is a vital asset for the rural farm households, it does not discriminate the poor from the better-off, since re-distribution of land that had been taken at different times had made more or less uniform ownership of land in the study area. However, livestock ownership and type of housing units owned were determinant factors of wealth status of the sample households in the study area.

8.3.3.2. Basic Infrastructure

Basic infrastructure refers to physical environment, which helps people to meet their basic needs and to become more productive in livelihoods (FAO and WFP, 2012). Among others, basic infrastructures include roads and communications and are vital for

household food security. Infrastructure, such as roads, is not developed in the study *woreda* and is highly underserved by feeder roads (Figure 8.2). Aklilu et al. (2000) reported that infrastructure such as schools, clinics, roads seem to be improved in Lay Gaint *woreda* with the help of GOs and NGOs through public work but the rate is too slow to cover the area.

Figure 8.2. Road transport in Lay Gaint district

Source: Bureau of Amhara Finance and Economic Development (2012)

This is mainly attributed to the dissected and rugged terrain in which most parts in the study district are isolated from each other and difficult to provide information that improves local livelihoods. As observed in the field, more than 90% of the sampled

households carry their produce by human and pack animals and this is found to be the main limiting factor for trade exchange in the study area. That is, agricultural inputs, outputs for marketing and so on are all transported by people or using pack animals. Poor infrastructure and inaccessibility constitute a significant barrier for households to engage in income generating activities. For example, in the more remote and inaccessible parts of the district, opportunities for engagement in non-farm and off-farm activities are simply non-existent. In relation to this, Teshome (2006) indicated that in the rugged and difficult geography, livelihood diversification in augmenting the agriculture income is hindered by lack of the basic infrastructure such as roads.

Josef and Laktech (2009) and Nkurunziza (2006) noted that non-farm activities are the highest in rural towns and the lowest in remote/inaccessible rural areas. The more access people have to various rural infrastructures, the more livelihood choices they can make, thus reducing risks and vulnerabilities. Likewise, Bezabih et al. (2010) reported that in low-income rural economies with little infrastructure and thin supplementary markets, the potential of non-farm/off-farm opportunities as alternative to agriculture may be limited. In the *Kolla* zone (the northern extreme of the study district) (Figure 8.2), accessibility is a difficult task that hinders the movement of food transfer at times of emergencies. Thus, the development of roads is critical to the availability of agricultural inputs otherwise, the price of agricultural inputs and outputs may increase. Besides, the most basic infrastructure such as access to safe water, education, communication and health services are also very limited in the *Kolla* agro-ecological zone. As Rami (2002) indicted, the rugged highlands of Lay Gaint district in South Gondar administrative zone are the most inaccessible places in the country and are chronic food insecure. Chamberlin and Schmidt (2011) also noted that Ethiopia's biophysical geography; particularly the northern highlands are the challenges for building and maintaining infrastructures because of its rugged and mountainous landscapes (Chapter 3). A previous study by Devereux et al. (2003) evidenced that chronic food insecurity was highly associated with poor access to infrastructure such as roads, towns and markets. The same authors raised Zambia as an example and stated that remoteness measured as distance from a major road was closely

associated with household and community level poverty and food insecurity. In general, during the field survey, the writer observed that FFW/CFW program contributed much to the construction of feeder roads in integrating the marketing situations and the development of non-farm activities.

8.3.4. Natural Capital

Natural capital refers to the natural resource stock from which resource flows and services such as land, water, forests, air quality and watershed management important to livelihoods are derived (Chapter 6). Natural capitals are composed of physical natural capital (land, tree, pastures, water, etc.), communal or private grazing land and intangible natural resources (environment/biodiversity, atmosphere). Among these, land stock is the most vital and best indicator of natural capital in the study area and elsewhere in Ethiopia. Rainfall distribution, degree of land degradation and extent of soil erosion are also natural capital, which directly affect the livelihoods of the communities.

8.3.4.1. Access to Land

The average landholding size of the sampled households was 0.88 hectare a little lower than the Amhara Region's average (one hectare) (Bluffstone *et al*., 2008). On per capita basis, average farm size was as low as 0.17 hectare. The result was higher to the study made by Kune and Mberengwa (2012) in *wollo* which was on the average 0.53 ha per household and lower to the country's average which is 1.04 ha (MoFED, 2012). This means the farm households in the study area, whom they are subsistence in nature, are performed on average landholdings less than a hectare of land. The majority (76% of total) owned less or equal to one hectare of land (Table 8.6). McDongh (2005) in a study made in three districts of Uganda also established similar results such that 60% of the total sample households owned less or equal to one hectare of land.

Those households who owned above 2.0 hectares of land accounted for only 3% and all of them found in the *Dega* zone. As it can be shown in Table 8.6, about 34% of the poor

had less or equal to 0.5 ha of land. On the other hand, 70% of the better-off owned above 1.0 ha of land. As it can be seen in Table 8.6, the average farm size of the better-off households was 0.92 ha, while the middle and the poor households owned 0.74 and 0.89 ha of farmland, respectively. The better-off households owned relatively larger farm size than the poor/middle households through purchasing, sharecropping and hiring. For example, from the total sharecropped land during the field survey, the share of the better-off was 94%.

Table 8.6. Landholding sizes by agro-ecological zones and wealth categories (% respondents)

Agro-ecological zone	Wealth categorie	Landholding size owned by sampled households (ha)				
		≤ 0.5	0.5 - 1.0	1.01 - 1.51	1.51 - 2.0	> 2.0
Dega	Better-off	-	-	40	20	40
	Middle	4	42	50	4	-
	Poor	30	56	14	-	-
Woina- Dega	Better-off	-	33	67	-	-
	Middle	-	90	10	-	-
	Poor	29	71	-	-	-
Kolla	Better-off	-	22	78	-	-
	Middle	19	50	31	-	-
	Poor	39	56	5	-	-
Total % (agro-ecology)		28.0	49.0	19.5	0.5	3.0

Likewise, from the total purchased land by the sample households in 2010/11, the better-off households accounted for 96%. Households were also asked to inform how they obtained the farmland they are cultivating. They obtained through sharing with families and relatives (70%), inheritance (79.1%), share cropping (29.5%), rent (49%) and purchase (28%). By agro-ecological zones, the average landholding size exhibited variations in which the *Dega* zone owned about 1.1 ha of land on average, while in *Woina-Dega* and *Kolla* zones, it was about 0.7 and 0.9 ha, respectively (Table 8.7). These differences are explained mainly by variations in population density. Mesay (2009) in a study made in north *Shewa* zone of Oromyia Region of Ethiopia also got similar results

in which people in *Dega* zone owned larger farm size than those in *Woina-Dega* and *Kolla* zones. Samuel (2004) investigated that households owned below 0.5 ha of land are destitute, 0.5-1.0 and above 1.0 ha of land are vulnerable and viable, respectively. Based on this single indicator, 28%, 49% and 23% of the households sampled were destitute, vulnerable and viable, respectively (Table 8.7). Taking the present population growth rate 2.6% (CSA, 2010) into account, the scarcity of farmland will be severe and crop production per household may significantly decline in the future (Chapter 5). Of the total sample households, 76% responded that land holding size had dramatically decreased since redistribution of land. About 90% of the sample households indicated that high population growth is the main cause for the scarcity of farmland. Almost all farmers responded that the current farmland is too small to carry out the major agricultural activities fully (livestock and crop production). Though the land owned is small, degraded and suffers from erratic rainfall, 77% of total was not volunteer to resettle in areas where land is abundant and the soil is fertile. The remaining percent volunteered to move in the resettlement areas mainly because land scarcity (36% of respondents), soil infertility (27.4% of respondents) and drought related predicaments (98% of respondents).

Table 8.7. Summary of farm size by agro-ecology and wealth category

Agro-ecology	Mean	Standard deviation	Minimum	Maximum
Dega	1.1	0.52	0.20	2.5
Woina-Dega	0.72	0.72	0.12	1.5
Kolla	0.86	0.34	0.25	1.5
Wealth categories				
Better-off	0.92	0.37	0.25	2.5
Middle	0.74	0.35	0.12	2.0
Poor	0.89	0.46	0.12	2.0

Landholding size exhibited variations between sexes of household heads. Consequently, female-headed households owned less than male-headed at an average holdings of 0.68 hectare (Figure 8.3). The paired T-test showed that the difference is statistically significant (at $p < 0.01$). From the total female-headed households, about 39% had no land at all. The result is also confirmed by the works of Dolan (2005) in which on the

average 1.6 ha of land for male and 0.8 ha for female-headed households. Thus, landless, smallholdings and inequity distribution could be taken as some of proxy indicators of land access problems on the side of female-headed households in the study area. According to women KIs, the differences mentioned exhibited mainly due to limited activities of women in local institutions, gender bias of the local authorities and their poverty at most.

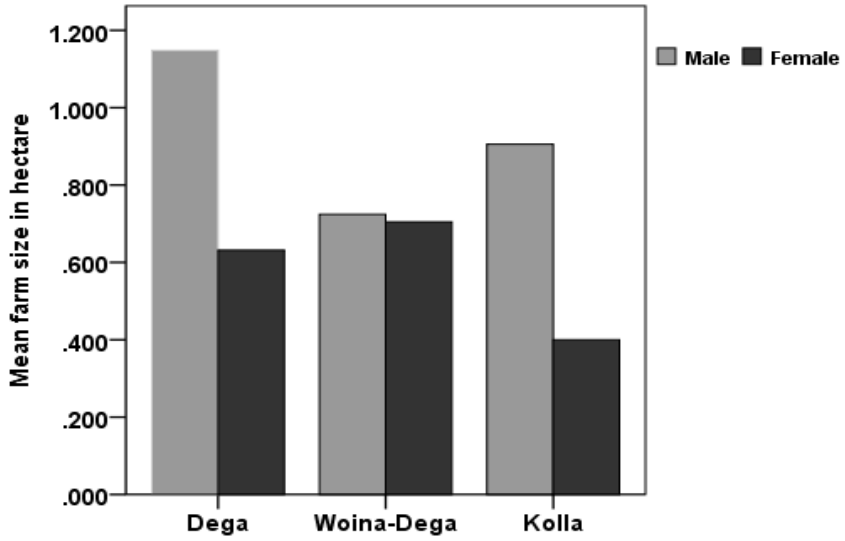

Figure 8.3. Farm size by agro-ecological zone and sex of the head of the households

Figure 8.4 showed that landholding sizes also differed by household size. Households whose family size is large also owned large landholdings. As the landholding size increases, household size also increases proportionally. The paired T test showed that the difference is statistically significant (at $p < 0.01$). KIs and FGD participants (from their experience) indicated that re-distribution taken at different times in their localities had considered household size as a major criterion. As it is shown in Table 8.4, about 52% of the sample households in the food secure category had landholdings greater than one hectare of land. While, only 13% of the households in the food insecure category had landholdings more than one hectare of land. The study also revealed that 13.5% of the households in the food secure category had more than 1.5 ha of land while, for counterpart it was 0.7%. The result showed that landholding size has played significant

role in household food security. The Pearson chi-square test also evidenced that there was significant relation (at $p < 0.001$).

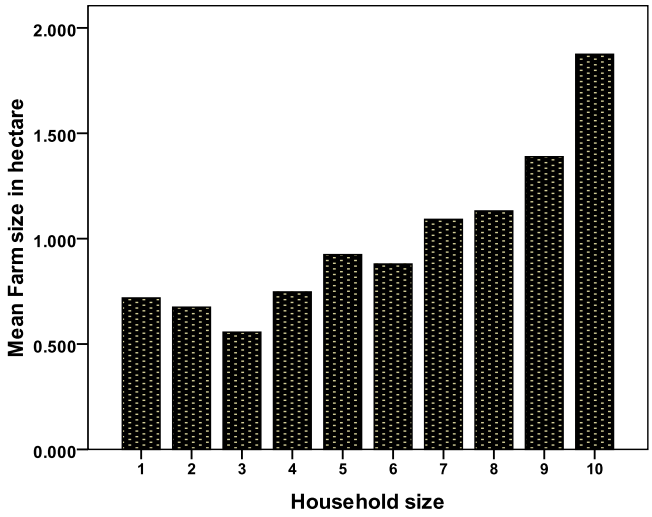

Figure 8.4. The relationship between landholding size and family size of the respondents

Table 8.8. Food security status of the households by farm size

Household food security status	Farm size					Total
	≤ 0.5	0.51-1.0	1.01-1.5	1.51-2	2.0-4.0	
Food insecure	52	78	18	0	1	149
Food secure	4	20	22	1	5	52
Total	56	98	40	1	6	201
χ^2 = 46.1 p = 0.000						

8.3.4.2. Source of Water and Fuel Wood

Key indicators of multidimensional poverty are related to access to safe drinking water. Safe drinking water according to CSA (2012) means tap inside the house or in the compound, private, shared or communal, water purchased from a kiosk, acquired from a protected private or shared well. Unsafe water means unprotected well, water from a river, lake or pond or other unspecified sources. As it can be seen in Table 8.9, 57% of

the sampled respondents use communal piped water for household water consumption and for their livestock, while 26% use unprotected springs; and the rest fetch from nearby rivers and streams. A study made by USAID (2006) showed that rural households obtained water from protected spring (38%), protected dung well (4.5%), streams and rivers (87%), and communal pipe water (12.3%). In the study area, using streams and rivers was low because during the dry season, many of the rivers and streams dried up and they were not important sources for home consumption and watering their animals. The District Health Officer informed that households who frequently use unprotected spring were exposed to water borne diseases; and this was commonly observed in *Kolla* agro-ecological zone. The study found out that availability of water in the *Kolla* zone was a serious problem and on average women in this zone traveled a round-trip of about four hours a day to fetch water, but women in the *Dega* zone travel for less than an hour.

Table 8.9. Sources of water and sources of light/energy for the sample households

		Dega	*Woina-Dega*	*Kolla*	Total	% of total
Source of water	Communal piped water	65	19	30	114	56.7
	Tube well/borehole	7	2	-	9	4.5
	Protected spring	1	20	5	26	12.9
	Unprotected spring	13	22	17	52	25.9
	Stream/rivers	3	2	8	13	6.5
Source of fuel/light	Bottle lamp (kerosene)	48	13	5	66	32.8
	Cake dung	33	6	5	44	21.9
	Fuel wood	68	60	52	180	89.6
	Flash battery	7	42	39	88	43.8

Water stress in the district in general, and the *Kolla* zone in particular, can be taken as the main indicator of drought-proneness and food insecurity. As observed in the field, ORDA is promisingly helping the local people to have clean water in the *Dega* zone. The source of energy for the majority of the respondents (about 90%) was fuel wood (Table 8.9). Consistent with this result, CSA (2012) also indicated that the majorities (91%) of rural households use fuel wood to prepare food and as a source of light. Likewise, EDHS (2012) also estimated that 86% rural Ethiopia use fuel wood for light and preparing food.

Nevertheless, fuel wood is a very scarce resource in the study area and women and children have to move a long distance to collect it. Households who planted eucalyptus trees have significantly reduced the problems of fuel wood in all agro-ecologies. Using cake dung as a source of fuel was low (21.9%) in the study area, and this is different from the Akililu's (2005) finding which says, in rural areas where there is scarcity of fuel wood, cake dung could be taken as the best alternative source of fuel wood and good source of cash. The low use of cake dung could be explained by the scarcity of cattle and fodder in the study area. This figure is still high if one considers the average use of cake dung in the country, which was 7% (EDHS, 2012).

8.3.5. Financial Capital

Financial capital refers to cash sources that people use to achieve their livelihood objectives and includes flows and stocks that can contribute to further production and consumption (Chapter 6). It comprises credit availability, savings such as *equib* (local savings), insurance, remittances and different sources of income. Among these, the availability of credit plays a vital role in ensuring food security and enhancing investment in the study area. Getaneh (2007) stated that the ANRS are prone to poverty and food insecurity and almost 42% of the total population cannot afford the minimum calorie intake (2100) recommended by world health organization. With the objectives of improving households' sources of cash and ensuring food security at household level, the regional government employed several strategies among which microfinance is a good entry point to reduce poverty and food insecurity. The Amhara Credit and Saving Institution (ACSI) is the one, which was established in 1997 taking the initiatives by ORDA to achieve the stated objectives. Its primary mission was improving the economic situation of low-income productive poor households through increased access to loan and saving services. Aklilu et al. (2000) indicated that ACSI is a rural micro-financial organization, which provides credits for the poorest of the poor in the community with minimal interest rate. The objective was to give credit to purchase small ruminants for fattening, small-scale trade, and handcrafts. The delivery system of the loans to the poor is the Group Guarantee Lending Model (GGLM). As the

borrowers indicated, this system is full of constraints in taking and returning loans. Getaneh (2007) has expressed his fear that the current methodology run by ACSI might distract the existing traditional social networks that existed for many generations.

8.3.5.1. Access to Credit Services

In drought-prone areas where crop production is highly determined by rainfall amount and variability, credit accessibility fills the food gap, enables investments and ensures household food security. The purpose of credit is to buy agricultural inputs, to expand business and to fill food gaps. An in-depth interview with key informants in the different agro-ecological zones confirmed that there was a possibility of access to finance from ACSI. Consequently, in the year 2010/11, 41% of surveyed households had taken credit from ACSI. According to the informants, borrowers are often encouraged to use the money for animal fattening, petty trading and purchasing of small and big ruminants. A major problem mentioned by key informants was that borrowers often use the money for other purposes than those agreed upon with the lender (ACSI). On the part of the borrowers, the interest rate was considered too high (which was 18% per annum). In some instances, borrowing from ACSI had reportedly led some households much poorer, as they were forced to sell out their assets to pay back their debts. In relation to this, Devereux et al. (2003) noted that credit was a double-edged sword with a potential to enhance household incomes, but also to impoverish the debtors who cannot repay. Coates et al. (2010), cited in McBriarty (2011) added that two-third of livestock sold in many rural parts of Ethiopia was for the purpose of repaying debits. Households in the study area received fertilizers on credit. When the crops fail or are damaged by unexpected hail (commonly practiced in the study area), the loss is doubled and households go to starve. This means the poor farmers are forced to pay the loans regardless of the failure of crop yields. Berhanu (2001) indicated that farmers who lack the money to pay back are imprisoned until they repay their loans. KIs and FGD participants indicated that many of the farmers have had to sell their farm oxen or milking cows to pay off debts. According to Nkurunziza (2006), access to credit is vital to improve the livelihoods of the poor households, if the borrowers receive reasonable size of loans with realistic periods of

maturity. In relation to this, a key informant in *Woina-Dega* sampled RKA had expressed his grievances as follows.

> At present, I owned 0.75 ha of land, one calf and two sheep with six family members. Accordingly, the safety nets program grouped me to the poor wealth category. I received a credit of Birr 2500 in the year 2009/10. I borrowed the money to buy small ruminants with the intention to build assets and return the money with its interest rate. However, the situations were not supportive as I thought. Some of the sheep I bought have died because of drought-associated problems. I changed my idea and bought sheep for petty trade and the profit collected was not encouraging, and I am highly confused how to return the money with its high interest rate at one-shot. The situation brought my marriage to be dismantled and now, I am living with my four children. The researcher for this study also evidenced that no significant utensils practically seen in his home except pots, jogs, and simple bed made from wood and leather.

KIs indicated that many farmers have mortgaged their imminent harvest to borrow grain for survival from their richer neighbors or local traders. They will have to pay back their borrowings with interest rates ranging from 100% to 200%. This showed that the poor face the most severe difficulties to feed their family and to pay back their debates. KIs and FGD participants also indicated that there was low level of access to financial capital across all groups of people in their localities. The survey data also revealed that 75% of the respondents did not participate in non-farm activities because of lack of credit and/or fearing of high interest rate. Gebrehiwot and Fekadu (2012) indicated that lack of access to credit remains the key problem in livelihood diversification. As it can be seen in Table 8.10, about 87% of the sample households received credit less than Birr 500, and 13% received above Birr 500. Agro-ecologically, about 16% (*Dega*), 11.4% (*Woina-Dega*) and 5% (*Kolla*) sample respondents received credit above Birr 500 in 2010/11. In general, because of high credit for agricultural inputs, borrowing loans from neighbors or traders with high interest rate and poor saving ability, many of the poor households in the study area are exposed to vulnerability to food insecurity.

Table 8.10. Households received credit by agro-ecology in 2010/11 (Eth. Birr 17.67 = US$ 1.0)

Credit (Birr)	Agro-ecological zone (number of respondents)			Total	% of total
	Dega	*Woina-Dega*	*Kolla*		
< 500	59	62	53	174	86.6
501-1000	0	2	0	2	1.00
1001-1500	2	1	5	8	4.0
1501-2000	1	3	1	5	2.5
2001-2500	2	0	0	2	1.0
2501-3000	3	0	0	3	1.5
3001-4000	3	2	2	7	3.4
Total	70	70	61	201	100

8.4. Other Factors Influencing Households' Vulnerability to Food Insecurity

8.4.1. Socio-cultural Factors

In the study area, traditional and religious beliefs determine the agricultural activities more than others. Due to numerous holidays in each month and other socio-cultural occasions, the farmers wasted several working days in the year, which have profound implications on their livelihoods. The study found out that a household in the community spends more than 12 days per month without working in the fields because of holidays. Such farming activities like plowing, weeding and threshing are strictly forbidden on 'Saint-days' including Saturday and Sunday (this is strictly true for Orthodox Christian followers). The study identified that of the total sample households, 97.7% were Orthodox Christians. Assuming that there are 216 working days and 144 holidays per year, the average percentage of person-days spent on holidays; in both agro-ecological zones were about 40% of total. The community is well aware of the negative repercussion of holidays on household food security. Nevertheless, they do not work on holidays because they are afraid of God's anger, and the penalty that can come in the forms of hailstorms or other kinds of natural calamity. There is also penalty from the community side as well. Any member who works in the field on holidays is outcast by

the community (Ellis and Tasew, 2005). In relation to this, one key informant in *Dega* zone shared his experience as shown below:

> I do not plough and harvest on religious days. If I work on religious days, hailstorms, thunderstorms, flood, frost and other natural calamities could occur and my harvest will be partially or totally lost. I do have good experience that many farmers were punished by working on 'Saint' days. Recently, some community members started to do some agricultural activities on holidays, and I observed some calamities, such as occurrence of drought, late rain and unexpected heavy showers. Priests in our locality are responsible for community teaching and controlling of holidays- acting as a bridge between the people and the supernatural being (God).

Sample households in the study area also employ other socio-cultural ceremonies such as weddings, *teskar*, epiphany and other numerous festivals commonly practiced during food surplus seasons that could be taken as a major cause for households' vulnerability to food insecurity. Besides, poor rationing of production and poor savings are major causes for households' food insecurity. In relation to this, Degefa (2005) confirmed that extravagancies for few months (the immediate post-harvest) because of religious or cultural ceremonies, lead rural households to be vulnerable to food insecurity. The problem is that when the households are loaded with massive work during peak agricultural activities, availability of food in the home collapses, negatively affecting the working capacity of the families. In this regard, elderly key informants informed that a household who prepares weddings during *Bega* would not be free from food shortage during *Kiremt* season. Therefore, the socio-cultural practices prevailing in the study area and elsewhere in the country waste substantial amount of food which otherwise could be consumed during the peak agricultural activities in the year. Key informants also indicated that one of the major reasons households are exposed to starvation is associated with wastage of food crops during slack periods in which many households are not engaged in farming activities. The survey data revealed that of the total income obtained in 2010/11, 27% was devoted for the preparation of festivals and religious ceremonies.

8.4.2. Seasonality: Seasonal Food Shortage

As elderly informants pointed, in the remote past, prices of crops either during *Kiremt* or *Bega* seasons were relatively lower for the reason that rural households were not purchaser rather seller of crops produced. Nevertheless, at the present situations, the majority of the populations are a net purchaser, making the price of crops to be soared during *Kiremt* season. The survey data also revealed that about 86% of the households were a net purchaser of food for about six months. Baiphethi and Jacobs (2009), in a study made in South Africa also evidenced that in the past, rural households produced most of their food, but recent studies have shown increase dependence on market purchase both the urban and rural households.

The information collected from District Finance and Economic Office (2011) supports this argument. As it is shown Figure 8.5, during December, January, and February, stores were relatively full of grains and many households are forced to visit the markets to satisfy their formal and informal obligations. High grain prices and meager stores of crop production during peak agricultural activities (June-September) forced the poor households to sell the livestock, especially small ruminants. However, as KIs indicated, the prices of livestock during this period were very low. FAO and WFP (2012) confirmed that the central and northwestern parts of Ethiopia usually face food shortage between June and September (Figure 8.6). Previous study (Desalegn, 1991) also indicated that prices of crops decrease during *Bega* because farm households are burdened by extraneous obligations such as taxes and loans for which they had to sell their crops. Ayantoye et al. (2011), in a study made in West Nigeria reported that the majorities (86.1%) were sliding into food insecurity during the planting season because of high price at the market. Wheeler et al. (2006) and Tliaye (2004) summarized that high prices of food are observed during the mid-year months of June, July, August and September (planting season) and was the least severe in November, December and January (during harvesting season). Thus, seasonal food shortage in the study area affects food availability for all people at all times.

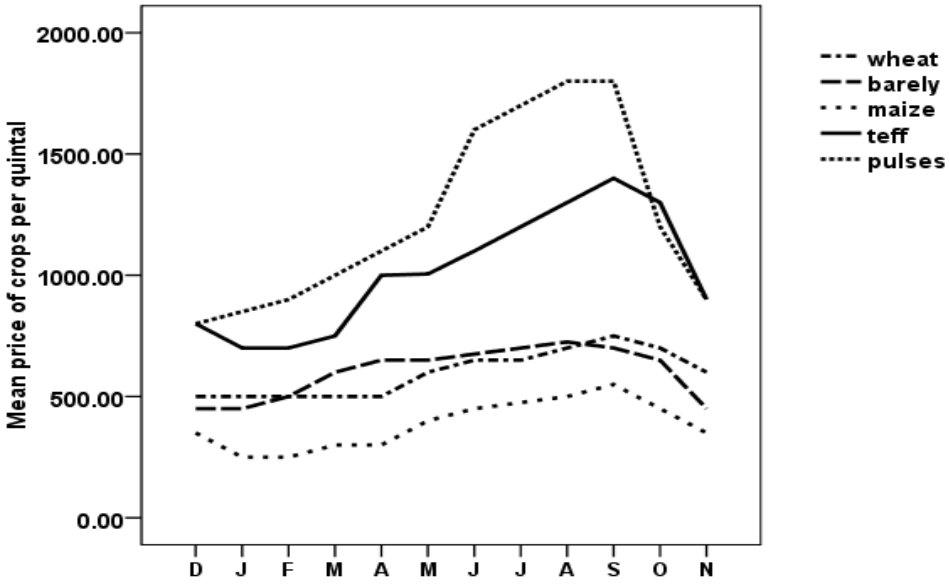

Figure 8.5. Monthly prices of major crops per quintal in Lay Gaint district for the year 2010/11

Source- District Finance and Economic Office (2011)

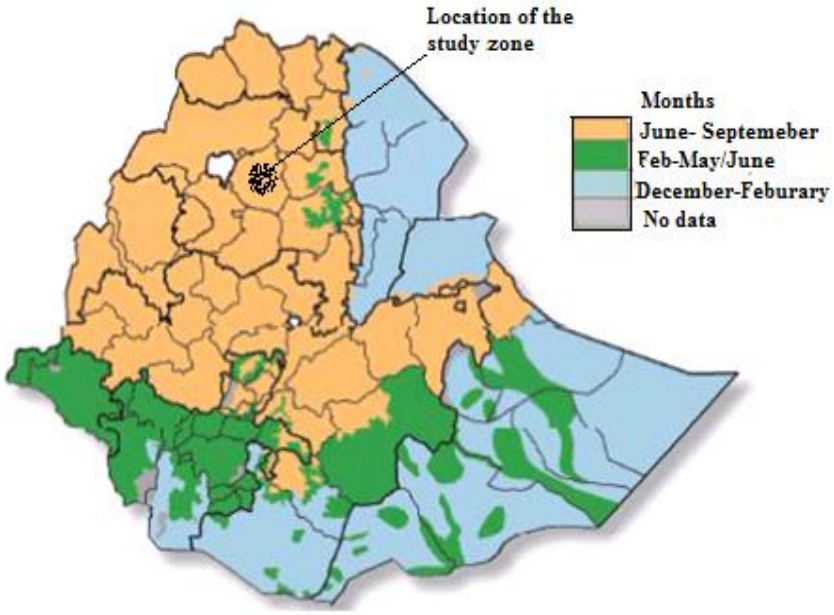

Figure 8.6. Food shortage seasons in different parts of Ethiopia

Source: FAO and WFP (2012)

8.4.3. Fragmentation of Landholdings

Fragmentation of landholdings is perceived differently by farm households. Ownership of a large number of plots gives chance to have varied soil types and reduce the impacts of weather conditions and pest damage. On the other hand, fragmentation of holdings can result in wastage of time and labor to move from one plot to the other. The survey result indicated that the majorities (90.5%) of the respondents owned more than two plots (Table 8.11).

Table 8.11. Number of plots by agro-ecological zones in 2010/11

Agro-ecology	Number of plots (% respondents)				
	≤ 1	2-3	4-5	6-7	8-9
Dega	-	65.7	24.3	8.6	1.4
Woina-Dega	14.3	67.1	12.9	5.7	-
Kolla	14.8	63.9	19.7	1.6	-
Total	9.5	65.7	18.9	5.5	0.4

On average, households owned three plots of land, which was much lower than the Amhara Region's average (five plots) (Bluffstone *et al.,* 2008). In all agro-ecological zones, about 66% owned between two and three plots of land. The study revealed that 34.3%, 18.6%, 21.3% of the respondents in *Dega*, *Woina-Dega* and *Kolla,* respectively possessed four or more plots of land. This showed that land fragmentation is relatively higher in *Dega* zone than the other zones. The paired T-test also showed that the difference is statistically significant (at $p < 0.001$). It was noted that relatively small number of food insecure households were also found in *Dega* zone. According to wealth category, 71.4% of the better-off households owned greater than or equal to four plots of land (Table 8.12). On the other hand, 31.7% of the middle and 10.6% of the poor households possessed greater than or equal to four plots of land. Larger differences between wealth categories showed that the better-off households might purchase, rent or hire land from female or aged household heads who frequently faced scarcity of labor. Table 8.12 also indicated that over 89% of the poor owned less than

or equal to three plots of land but the better-off and the middle households account for 28.6% and 68.3%, respectively.

From the discussions, it can be concluded that, farmlands in the study area are fragmented and small. In relation to this, Measy (2009) pointed that land fragmentation results in more time to travel, and a challenge in protecting the crops against wild animals and decreases the overall crop production of the households. Besides, it creates a problem of transporting agricultural inputs and outputs from long distance where the majority of the households face scarcity of equines (Chapter 6). The Pearson correlation coefficient showed that there is statistically significant but inverse relationship between crop production and number of plots (at $p < 0.001$).The result showed that fragmentation of land associated with high population pressure significantly reduces the crop production potential in the study area.

Table 8.12. Number of plots by wealth category in 2010/11

	Number of plots (% respondents)				
Wealth category	≤ 1	2-3	4-5	6-7	8-9
Better-off	-	28.6	39.3	28.6	3.5
Middle	5	63.3	26.7	5	-
Poor	13.3	76.1	10.6	0	-
% of total	9.5	65.7	18.9	5.5	0.4

8.5. Food Security Status of the Surveyed Households

Compared with the recommended per capita daily calorie intake of 2100 (Bogale and Shimless, 2009), it was found out that about 74% of the households were food insecure (Table 8.14). Therefore, food security is a challenge task since only 26% of the sample households were food secure. Sample households were asked to give reasons why the majority of the households were food insecure. The majorities (98%) responded scarcity of farmland as a major cause, while almost 100% of the respondents attributed to unpredictable rainfall. High price of fertilizers, shortage of draught power, and lack of

finance were also cited by 56%, 67% and 59% of the respondents, respectively as a major cause for the declining of food security in their localities.

As it is shown in Table 8.13, the largest food insecure households resided in *Woina-Dega* followed by *Kolla* zone. Lay Gaint district food security officer substantiated that among the three zones, *Woina-Dega* is the most vulnerable to food insecurity. The survey data also evidenced that about 40% of the sample households in *Woina- Dega* zone wanted to move into the new resettlement sites planned by the regional government as opposed to the *Dega* zone, which was only 10% of the total. As the KIs pointed out, farm households in *Woina-Dega* zone become defenseless and the coping and adaptation strategies employed are not sustainable, and almost all the sample households face food shortage throughout the year.

Of the total female-headed households, about 86% were food insecure, indicating that they are the most vulnerable segments of the population in the study area (Table 8.13). Tsegaye (2009) found out that male-headed households were better food secure as compared to their counterparts. Dolan (2005) supplemented that female-headed households may be among the most vulnerable of the country's population in Uganda. The current study noted that from the total female-headed households, 80% were under poor category, while the corresponding figure for male headed was 53%. Bigsten et al. (2003), Dolan (2005) and Oladele and Modirwa (2012) confirmed that female- headed households face higher probability of falling into chronic food insecurity than male-headed households mainly because asset poverty and triple burden accomplished at home. Dolan (2005) specifically stated that a number of female-headed households claimed for scarce endowments of land and inputs hindered their ability to raise farm output to maintain food security. During the fieldwork, KIs reported that poverty has pushed men to migrate into big towns and in some commercial farms for job opportunities, leaving their partners to look after their children and other dependents. As observed in the field, the situations exposed the family to extreme food shortage. In general, female-headed households have the lowest access to human and natural

recourses (endowments) and have low employment opportunities. Therefore, they are the most chronically food insecure.

Table 8.13. Summary statistics of selected determinants of food security (% respondents)

Indicator	Percent of households Food insecure	Foods secure	χ^2	*P*-value
Sex of the household				
Female	85.7	14.3		0.059
Male	69.5	30.5	104.6	
Age category				
20 - 30	6.9	8.8		
31 - 40	18.1	10.5	193.1	0.46
41 - 50	30.6	19.3		
51 - 60	26.4	38.6		
above 60	18.1	22.8		
Farm size				
0 - 0.5	35.4	8.8		
0.51-1.0	52.8	40.4	206.2	0.000
1.01-1.5	11.8	40.4		
1.51-2.0	0.0	1.8		
2.0-4.0	0.7	8.8		
Participate in safety net program				
Yes	64.4	26.8		0.009
No	35.6	73.2	167.8	
Agro-ecological zone				
Dega	68.6	31.4		
Woina Dega	94.3	5.7	34.8	0.052
Kolla	75.4	24.6		
Average	74	26		
Credit availability				
Yes	34.2	43.1	230.7	0.850
No	65.8	56.9		
Trends in crop production				
Increasing	13.2	87.0	205.1	0.000
Decreasing	87.4	13.1		

Informants were also asked about their expectation of future food security situations to their families. About 87% feared that the situation could be worse in the future. At present about 56% of the food insecure households were safety nets beneficiaries of the government. However, 82% of the sample respondents showed their dissatisfaction of the program and 45% were not aware of the criteria employed in selecting the PSNP beneficiaries. The survey result also evidenced that about 27% of the food secure households were included to the safety nets program, while about 36% of the food insecure households were excluded from the program (Table 8.13). As it is shown in Table 8.14, 66% of the food insecure households did not take credit, because of the problems associated with inability to pay back the borrowed money. The majorities (87.4%) of the food insecure households indicated that there is a decreasing trend of crop production since re-distribution of land. As opposed to this, MoARD (2010) stated that the per capita grain production increased from below 150 kg in 2003/04 to 213 kg in 2007/08, which is closer to meet the minimum 2,100 kcal per day per person nutritional standard.

8.6. Incidence, Depth and Severity of Food Insecurity

To determine and describe the extent of food insecurity among the survey households, Foster et al. (1984) measures of food insecurity were employed (Abebaw *et al*., 2011). This is because among the various measures of food insecurity, the Foster-Greer-Thorbecke (FGT) index is the most commonly used method to show the incidence, depth and severity of food insecurity of the food insecure households (Bogale, 2002 cited in Abebaw *et al*., 2011) (Chapter 4). Sample households' incidence, depth and the severity of food insecurity are presented in Table 8.14. The survey result showed that the calorie intake approach of incidence of food insecurity was about 74% indicating that only 26% of the sample households were able to get the minimum required calorie recommended for subsistence. Food insecurity gap index (the depth of food insecurity) measures how far food insecure households, on average, are below the recommended subsistence energy requirement level. For this study, the depth of food insecurity for the food insecure households was 0.39 (Table 8.14). This means if the local government could mobilize

resources to meet 39% of the daily calorie requirement and distribute these resources, it would bring each food insecure household up to the daily caloric requirement level and then, at least in theory, food insecurity will be eliminated. In other words, the sample households have to be supplied with 39% of the daily minimum calorie requirement to get out of the food insecurity problem. The extent of the calorie deficiency gap for the sampled households was therefore, 819 kcal per adult equivalent per day. This means on average 819 kcal per adult equivalent a day of additional food energy would be needed to take the households out of the vicious cycle of food insecurity. The result was much higher than other related studies such as Abebaw et al. (2011), Maharjan and Chhetri (2006) and Tsegaye (2009) which were 483, 626, 672 kcal per adult equivalent per day, respectively. This evidenced that the depth of food insecurity was higher in the study area that requires special policy attention. The survey data showed that the severity of food insecurity (calorie deficiency) for the sample households was 0.24 (Table 8.14). That is, the square of food insecurity gap (severity of food insecurity) among the sample food insecure households was 24%. This measurement gives more weight to the average income shortfall of the most food insecure of the food insecure households (Tsegaye, 2009). The severity level was also much higher than the ones reported by Maharjan and Chhetri (2006), Tsegaye (2009) Abebaw *et al.,* (2011), Zerihun and Getachew (2013) which were 14%, and 18%, 14% and 1.8%, respectively. In all accounts, the extent of food insecurity in the study area is severe and horrifying that needs policy issue at least to minimize the predicaments.

As shown in the Table 8.14, incidence of food insecurity was higher in *Woina-Dega* (94.3%) but lower in *Dega* agro-ecological zone (61.4%). Depth of food insecurity in *Woina-Dega* agro-ecological zone (57%) was about three times higher than that in the *Dega* zone (23%) and the average depth of food insecurity was 39%, which was much higher than the study made by Tilaye (2004) which was 25%. Likewise, severity of food insecurity was the highest in *Woina-Dega* zone (38%) followed by *Kolla* agro-ecological zone (24%). According to KIs opinion, the reasons for the severity of food insecurity in *Woina-Dega* and *Kolla* agro-ecological zones were, the land is rugged and degraded;

rainfall is unpredictable and frequent occurrences of droughts. As discussed in Chapter 3, the most vulnerable agro-ecological zone is characterized by rugged topography and soils, low and variable rainfall and poor market access. In-depth discussions with focus groups evidenced that places located along the Tekeze river valley are prone to drought and inaccessible to the food aid delivery center of the study area and a considerable numbers of poor households (during food crises time) do not have any other option than starve. As the writer of this study observed during the field survey, households from *Kolla* zone and in some remote areas of *Woina-Dega* zone took more than a day to receive the safety nets and if they do not have pack animals, this problem becomes severe.

As it can be seen in Table 8.14, incidence of food insecurity was higher for female-headed households than male-headed households. However, in the case of depth of food insecurity, there was no significant difference between male and female-headed households. In severity of food insecurity, it was higher in female-headed households than male-headed households. As discussed in the preceding topics, female-headed households in the study area were severely food insecure for the reasons that they are asset poverty (scarcity of oxen, labor, farmland), socio-cultural constraints and problems arising from sex differences (double and triple jobs females do at home, unable to plough in the field, problems in the decision making process). In general, the average calorie intake of the sample households in this study was 1900 kcal, which was 10.5% below the national minimum recommended daily allowance of calorie intake (2100 kcal).

Table 8.14. Incidence, depth and severity of food insecurity of the study area

Agro-ecological zone	Incidence of food insecurity	Depth of food insecurity	Severity of food insecurity
Dega	68.6	0.23	0.13
Woina-Dega	94.3	0.57	0.38
Kolla	75.4	0.36	0.24
Average	74.0	0.39	0.24
Male headed households	70.0	0.50	0.31
Female headed households	86.0	0.60	0.41

8.7. Determinants of Household Food Insecurity

The binary logistic regression model was used to establish the relationships between food security and a set of predictor variables. It was selected as it can be used with continuous, discrete and dichotomous variables mixed together (Alemu, 2007). Twelve predictor variables were selected to explain the dependent variable (food security). Out of the total predictor variables, ten variables were significant at 1%, 5% and 10% probability levels (Table 8.16). The omnibus test of model coefficients has a Chi-square value of 97.01 on 11 degrees of freedom, which is strongly significant at $p < 0.001$ indicating that the predictor variables selected have a high joint effect in predicting the status of household food security. The predictive efficiency of the model showed that out of the 201 sample households included in the model, 169 (84.1%) were correctly predicted. The sensitivity (correctly predicted food insecure) and specificity (correctly predicted food secure) were found to be 91.6% and 66.7%, respectively.

The binary logistic regression results showed that livestock ownership, involvement in the productive safety nets program, number of plots, education of household heads and geographical location (agro-climatic zone) were important determinants of household food security status. Livestock ownership is important such that the larger the number of livestock owned, the less likelihood that a household would be food insecure. As livestock ownership increased by one unit (in TLU), the odds of being food insecure decreases by a factor of 0.918, which is significant (at $p < 0.05$). Previous studies in different parts of the country have reported similar results that livestock possession positively influences household food security outcomes (Bogale and Shimles 2009; Temesgen, 2010; Devereux *et al*., 2003; Million, 2010). The regression result also shows strong relation with household food security (at $p < 0.001$). Other variables being constant an increase of number of oxen by one unit, households' food insecurity decreases by the odds ratio of 0.490. As hypothesized, educational attainment of household heads was found to be an important factor in households' food security. As educational attainment of household heads increases by one unit, the odds of a household

being food insecure decreases by a factor of 0.344 (at $p < 0.05$). The result is consistent with the works of Wondwosen (2011).

Table 8.15. Determinants of household food insecurity

Predictor variable	Coeff.(β)	S.E.	Wald	Sig.	Odds ratio
Livestock in TLU	-0.086	0.043	3.941	0.047**	0.918
Number of oxen	-1.703	.443	14.767	0.000***	0.490
Farm size	0.040	0.203	0.039	0.843^{ns}	1.041
Participation in PSNP	1.897	0.539	3.131	0.077*	1.414
Agro-climatic zone (*Dega*)	-1.269	0.139	17.709	0.000***	0.789
Woina- Dega (1)	1.008	0.705	7.241	0.007***	1.674
Kolla (2)	1.201	0.579	4.810	0.028**	1.190
Age of household head	-0.003	0.018	0.021	0.884^{ns}	0.997
Education of household head	-1.067	0.506	4.446	0.035**	0.344
Household size	-0.477	0.157	9.184	0.002***	0.621
Number of land plots	-3.959	0.558	4.633	0.031**	0.101
Trends in crop production	-1.277	0.519	6.052	0.079*	0.584
Constant	-1.269	0.768	26.598	0.000***	0.004

*Significant at 0.1, **significant at 0.05, *** significant at 0.01, *ns* = not significant

With respect to agro-ecology, it was found that location in *Kolla* and *Woina-Dega* zones increased the odds of being food insecure by factors of 0.190 and 1.674, respectively, which is in agreement with findings by Temesgen (2010). The number of land plots possessed, used as indicator of land fragmentation, was hypothesized to have a negative effect on household food security outcomes, but the regression result showed otherwise. Other variables held constant, an increase by one unit of land plots decreases the odds of a household being food insecure by a factor of 0.10 (significant at 5% level). The result is in agreement with Mesay (2009). The survey result also revealed that about 89% of the better-off households owned more than three plots of land, while 84% of the poor had less than three plots of land.

Family size in this study has mixed ideas. Household with large family labor are able to prepare, plant and harvest the agricultural activities on time. On the other hand, large family size means more mouth to feed. As it is shown in Table 8.15, other variables being contestant, as the number of family in the house increases by one unit, the odds of a household being food insecure decreases by a factor of 0.621 (at $p < 0.01$). The result is consistent with the works of Frankenberger et al. (2007), Devereux et al. (2003) and Mossa (2012) and inconsistent with Degefa (2005), Adugna and Wagayehu (2012), Wondwosen (2011), Frehiwot (2007) and Fekadu Nigussie (2010).

Participation in the productive safety nets program was positively correlated with household food insecurity. The odds ratio in favor of food insecurity increases by a factor of 0.414 as participation in the safety nets program increases by one unit. This captures the fact that households that were beneficiaries of the safety nets program are still food insecure. MoARD (2009) cited in Burns and Bogale (2011) also noted that although the safety nets program had a significant impact on smoothing consumption and protecting assets of the chronically food insecure households, little progress had been made in terms of graduating households from the program to be food secure. Similarly, Mengistu et al. (2009) reported that high risk of dependency syndrome on the part of the beneficiaries and small number of graduating households was a major drawback of the safety nets program. It was also observed during fieldwork of this study that more than 88,000 people were beneficiaries of the safety nets program run by the government in Lay Gaint district.

Forward stepwise (likelihood ratio) showed that number oxen alone had explained 44% of the total variances in household food security outcomes and agro-ecology and household size explained 55% and the five most important variables number oxen , agro-ecology, household size, number of livestock and number of plots had explained 61% of the total variances in household food security.

8.8. Conclusion

In the study area, both food self-sufficiency and food security were full of constraints. In the case of food self-sufficiency, the majority of the sample households were not able to produce their yearly consumption and on average, the food they produce can feed their family only for about six months. In the case of food security, there was a problem of food availability because of erratic rainfall, land degradation and high population pressure. There were also serious constraints in cash to purchase food at the market because of asset poverty emanated from limited wage labor opportunities, lack of capital and limited markets for non-agricultural products. Given the current performance of the agricultural sector, population dynamics, extent of environmental degradation and erratic rainfall, the prospects of both food self-sufficiency and food security are dismal in the future.

The results of the study showed that factors that determine household vulnerability to food insecurity are related to capital assets, which vary between agro-ecology, wealth categories and sex of households. The results also revealed that the study area was highly underserved by feeder roads, which are considered important physical capital assets. Consequently, many places in the study area are isolated from each other and are difficult to provide information that improves the livelihoods of the poor. Poor infrastructures as well as inaccessibility constitute a significant barrier for the poor households to engage in diverse non-farm/off-farm activities to improve their sources of cash.

Vulnerability to food insecurity varied by agro-ecological zones such that the proportion of the sample households who were food insecure accounted for 94.3% of the respondents in *Woina-Dega* zone, while the proportion for *Kolla* zone was 75.4%, taking into account the 2100 kcal as a benchmark. For the three agro-ecologies, the mean per capita kcal availability per person per day was 1900 kcal. Thus, it can be said that *Woina-Dega* zone was the most vulnerable to food insecurity followed by *Kolla* zone. The study also found out that the calorie intake approach of incidence of food insecurity was high indicating that the sample households were able to get the minimum required kilocalorie

(2100 kcal) recommended by the government of Ethiopia. The study found out that there were variations between wealth categories (better-off, middle and poor households) in their vulnerability to food insecurity. It was identified that the better-off households with their ample assets have the capacity to withstand food crises than the poor households. The study area is characterized by land fragmentation and small size of farm because of high population pressure and marginality of the land. It was also observed that cultivating the marginal land becomes a common practice, which was not exercised in the near past.

Chapter 9

Conclusions and the Way Forward

9.1. Conclusions

Rural households' livelihood assets, strategies and outcomes

This study explored livelihood assets, strategies and food security outcomes of rural households by using Sustainable Rural Livelihoods framework (SLF) as a guiding conceptual frame. The major finding is that despite the low level of productivity related to local environmental constraints, rural livelihoods remain undiversified with small scale rain-fed agriculture providing the primary source of livelihood for the large majority of sample households (~93% of respondents). Very few households (25%) were engaged in off-farm/non-farm activities. Lack of access to non-farm and off-farm activities is perhaps a major cause for the low coping and adaptive capacities of households in times of food security crises. Education of the human capital, infrastructure of the physical capital and micro credits and savings of the financial capital were the assets poorly developed in all agro-ecologies, though they are the basis for the improvements of the livelihoods of the rural poor. Sample households and KIs mentioned availability of water, grazing land and fuel wood as important natural assets; however, all these resources were very scarce in the study area.

The study found out that poor veterinary services and lack of professionals, environmental degradation and scarcity of water and feed; the returns from the livestock sector in augmenting households' cash constraints were extremely low. The study identified that the resource bases such as farmland, grazing land and forests have reached their critical stage of degradation, dwindling crop production and productivity of the entire agro-ecologies. Rainfall variability was found to be a major contributor for the

poor performance of the crop production system in all agro-ecological zones of the study area but this problem is more severe in the *Woina-Dega* and *Kolla* agro-ecological zones, where the majority of the food insecure households reside. The use of yield-enhancing agricultural inputs such as chemical fertilizers and improved seeds were extremely low and this was attributed to high prices of inputs, severe land degradation and rainfall variability. Food insecurity is a chronic problem in that, on average, households in the study area consume from own production for only about six months, and depend for the remaining period on the safety nets program and other casual income generating activities. It was found out that the PSNP run by the local government was full of constraints starting from selection of beneficiaries to graduation of households. The study also investigated that non-farm activities that can be used as a base for cottage industries are faced technological challenges. As a result, their importance has declined from time to time partly less attention given by the local governments and socio-cultural influences.

Multiple linear regression analysis identified livestock ownership, fruits (apple) and tree production (eucalyptus), agro-ecology/location, access to credit and engagement in non-farm/off-farm activities as significant determinants of total annual incomes of households. Stepwise regression analysis showed that livestock alone had explained 53% of the variances of the total annual incomes of the households. The five important variables livestock, fruits and trees production, agro-ecology/location, credit and engagement in non/off-farm activities had explained nearly 80% of the total variations of the total annual incomes of the households.

Households' Perceptions of Climate Change and Coping/Adaptive Strategies

Located in the drought-prone areas of the ANRS, the study area is characterized by irregularity in the arrival of the first rains, inadequacy in the amount received and failure in the middle of the growing of crops; but these problems were severe in *Woina-Dega* and *Kolla* agro-ecological zones. It was also observed that households from their accumulated knowledge suggested that there should be food shortage in the future because of unpredictable rainfall. Qualitative results, household survey results and local

climate data collectively indicated that there are high rainfall and temperature variability in the study area over the years. The study found out that the mean annual temperature had increased by 1.25^0C for the last three decades. This study also identified that recurrent drought, high population pressure and land degradation depleted the already scarce resources; and households are less resilience to minor shocks. At present, these problems are more complicated because the frequency and severity of droughts have increased considerably through time. The study found out that drought occurred in between two and five years which was not practiced for the last ten or twenty years. Besides, crop-growing months dramatically decreased from April/May to June/July. It was also investigated that households' perceived the cause of drought and the majority of the participants indicated that erratic rainfall and the decline of crop production are the major causes for the predicaments. As data obtained from the District Finance Office, total crop production for the last 10 years in the district has shown a decline trend. More importantly, the less use of fertilizers partly explained by the frequent occurrences of drought commonly observed in the study area.

The responses taken against climate variability and change were growing of fast maturing plants, growing of eucalyptus trees and fruits, livelihood diversification (crop production, livestock production, non-farm activities and off-farm activities) and crop diversifications (growing barely, potatoes, wheat, triticale, etc), stocking seed reserves, soil conservation measures, early planting and use of water harvesting techniques. The study investigated that planting trees for the market, livestock diversification, stocking seed reserves and natural resource conservation are vital adaptive strategies employed by the majority of the better-off households. Short-term responses to meet the shortfall of consumption needs, selling charcoal and fuel wood, taking loans/credits and borrowing in kind or cash from friends and/or relatives, consuming seed reserves and selling productive assets were the major ex-post coping strategies practiced by the poor and vulnerable households. The local government's effort in mitigating climate- related risks were also examined. Productive safety nets program and the green economy run by the

regional and national governments were imperative responses through an extensive soil and water conservation practices to the severely degraded ecologies of the study area.

In general, high dependence on rain-fed agriculture, under development of water resources, high population growth, low economic development, weak adaptive capacity and weak institutions are the major causes of household' vulnerability to climate related shocks.

Vulnerability to Food Insecurity

Vulnerability to food insecurity is determined by interrelated factors such as land holding size, number of livestock owned, household labor availability, infrastructure, rainfall amount and distribution, livelihood diversification, availability of credit and support for human development capabilities. The study found out that poor infrastructures as well as inaccessibility constitute a barrier for the poor households to engage in non-farm/off-farm activities to improve their livelihoods. The study also established that households with poor resource endowments, predominantly female-headed households were highly vulnerable to food insecurity. The study investigated that, there are encouraging ties among households through social capital like *iddir* and *equib* at times of food crises and households' shocks that need further policy issues. Shortages of farmlands were serious constraints in the study area. During the field survey, it was observed that marginal lands highly susceptible to erosion; were cultivated by land hungry farmers. The study identified that education coverage is promising in the area of formal education but informal education (adult education) once flourishing during the Marxist and Leninist regime ceases to function. As result, the majority of households sampled was illiterate and cannot read and write. High interest rate and less accessibility of credit services made the sample households' to be vulnerable to food insecurity. The study found out that the situations resulted in the low use of inputs particularly fertilizers, which is the best means to increase crop production per hectare. The study found out that socio-cultural factors play significant role in contributing household vulnerability to food insecurity. Among these, religious holy days become a constraint to the agricultural activities that need an

intensive labor and time during certain peak periods. The study also assessed that there are distinct months and seasons in which agricultural prices become low and on the other hand, the prices turn out to be extremely untouchable for those farmers who purchase food crops and the urban poor.

Vulnerability to food insecurity varied by agro-ecological zones such that the proportion of food insecure households was 94% of the total sample households in *Woina-Dega* zone and 62% of the total sample households in *Kolla* zone. In total, 74% of the sample households were food insecure based on the commonly used food requirement of 2100 kcal per adult per day recommended by the government of Ethiopia. Likewise, the incidence, depth and severity of food insecurity of the food insecure households showed that *Woina-Dega* and *Kolla* agro-ecological zones were prone to vulnerability to food insecurity. In general, the study found out that households with low levels of ownership of basic assets such as female-headed households, aged households, young household heads and households who do not own livestock are exposed to vulnerability to food insecurity.

The binary logistic regression results showed that geographic location, trends in crop production, number of plots, livestock in TLU, family size, education of the household heads and PSNP participations were determinant variables for household food security. Location as it affects agro-climatic and ecological conditions was an important factor in household food security status. It was also found out that participation in the safety nets program had not lifted beneficiaries out of chronic food insecurity. The number of livestock households' owned found important determinants of household food security since it is the main sources of cash, means of instrument and food for the majority of the households. Nevertheless, the sector is faced multifaceted problems in relation to feed shortage and veterinary services.

9.2. The Way Forward

The largest percentage of the rural poor in the study area relies on crop production for a significant share of annual incomes. However, the study found out that crop productions in the study area are constrained by multifaceted factors such as scarcity of farmland, land degradation, erratic rainfall, high input price, storage problems, post-harvest lose, pests, wild animals and prevalent diseases. These need the farm households to be cautious in land management practices and implementing both biological and non-biological protection methods to minimize the damaging capacity of wild animals and pests.

Livestock is also a vital asset used as a source of cash, draft power, source of food, investment and social prestige. However, the livestock sector is severely affected by feed shortage and animal diseases commonly exhibited in *Kolla* agro-climate zone. Hence, seasonal and perennial forage crops, natural pasture and crop-residue management techniques have to be given equal weight to the existing crop production systems. More importantly, veterinary services have to be extended in remote agro-ecological zones such as the *Kolla* zone where animal diseases are frequently observed as well as scarcity of professionals is the highest in magnitude. Households interviewed indicated that there is quality compromise in professional trainings in the area of animal husbandry and other related skills. Hence, the government of Ethiopia has to reconsider the quality, quantity and appropriateness of skill trainings running in all higher educations in the area of agricultural extension and animal husbandry.

The agricultural sector in the study area is not only vulnerable to rainfall variability but it becomes unable to support the increasing population. Perceiving this fact, considerable numbers of households are employing non-farm and off-farm activities to enhance their sources of cash. However, most of them lack the necessary skills and finance to engage in these activities. These need the provision of credit system with affordable interest rate and maturation periods. Besides, creating awareness how to use the credits for livelihood

security are imperative for the rural communities. Furthermore, farm households need to be motivated to increase their farm income with the growing of fruits such as apple and eucalyptus tree in the degraded ecology, expanding bee keeping activity, and fattening small and big ruminants. Households mentioned that there is a problem of marketing accessibility for the production of fruits such as apple. This needs the local government to search markets to increase apple production for the future that can be used as important cash crop for the study area. Non-farm activities such as weaving, metalwork, carpentry, tanner and others have to be expanded and assisted by policy makers because they are the base for cottage industries.

In drought-prone areas such as Lay Gaint district, the serious problem for agricultural production is scarcity and unpredictable of rainfall. Consequently, smallholder farmers in the study area are exposed to erratic rainfall that can be taken as important ingredients for rain-fed agriculture. These need to adapt early maturing and drought resistant varieties, use of water harvesting techniques and strengthened the safety nets program run by the local government for positive livelihood outcomes. The food security strategies in the study area include voluntary resettlement program, productive safety nets program and other food security programs. These strategies have their own limitations that need policy revision. As the KIs indicated, the PSNP run by the local government is full of problems from targeting to graduation. From the study, it was learnt that the local authorities need the safety nets program to continue sometimes in the future. This needs the regional and local governments to evaluate and follow-up its implementation by the local authorities to minimize the predicaments indicated above. More importantly, the government needs to consider other strategies for the reason that PSNP develops dependency syndrome. The writer forwarded that household asset building program (HABP) has to be given more attention because it could bring sustainable livelihoods for the rural poor.

Rural communities in the study area employ diverse coping and adaptive strategies to solve individual and social problems. The strategies employed could have an input to design strategies for policy makers. This leads to the fact that their indigenous coping and

adaptive strategies should be understood and considered by the local authorities. That is, the indigenous coping and adaptive strategies practiced by the rural households for generations should be strengthened rather than trying to replace with new technologies. Delivery of drought resistant varieties such as maize, sorghum, potatoes, barley and wheat to the local communities with affordable prices and quality assurance helps to minimize the risks associated with drought and scarcity of rainfall. Besides, modern technologies that have the capacity to predict changes in local climate have to be available to farm households on time and in a readily accessible manner for better preparation to climate related shocks. The study also forwarded that households' vulnerability to food insecurity have to be minimized by employing appropriate and targeted risk reduction and management interventions that are well integrated to climate change-adaptation strategies.

Promoting integrated community based natural resource management is found to be vital with the objectives to improve soil and water resources, restore degraded lands and improve microclimatic conditions. This showed that natural resource management is one of the most important adaptation measures to secure livelihoods and helps to reduce income risks and to mitigate the negative impact of climate variability. Besides, there is a need to rehabilitate the degraded ecology. For that reason, measures to conserve the environment at the same time that generates sources of cash like bee keeping should be strengthened. Hence, improving food security of rural households in the study area requires integrated rural development interventions aimed at improved natural resources management and diversification of livelihood strategies including interventions to create access to credit and non-farm employment opportunities.

Since vulnerability to food insecurity is correlated with lack of assets, any development intervention that increases poor's control over assets may directly enhance household food security and livelihood security. Thus, reducing poverty of capital assets is the key in improving food security of the vulnerable and smallholder farmers. These include access to clean water, education, health, micro rural credit, infrastructure, tenure security, agricultural inputs and promotion of employment and income generating schemes to the

rural poor. More specifically, households in the study complain to the high interest rate and poor access to credit services. Besides, there is high prices of fertilizers beyond the purchasing capacity of the local farmers. The government of Ethiopia is currently retreating from subsidizing agricultural inputs with the name of free market because of which the price of the inputs has been increased alarmingly. This no doubt has resulted in less use of inputs per unit of land. Therefore, the government of Ethiopia should reconsider the rural development strategies and continue to subsidize the inputs to enhance their purchasing capacity. This in turn can increase the use of farm inputs, which is said to be one of the most important variables affecting crop production per unit area.

Finally, the socio-cultural factors, particularly religious holy days which affect hard working people, need policy issues. The number of working days will have to be increased by decreasing religious holydays and other occasions. This change could be internalized through educating the farm households and by raising their general outlook. Furthermore, local cultural ceremonies that militates the potential of farmers such as marriage ceremony, epiphany, burial ceremony, etc. should be reduced by creating common awareness among farm households so that households can have better potential to repay the price of inputs and credits delivered duly on time.

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Appendix I. Questionnaire survey

1. General Information of the Household Head

1. RKAs _____
2. Village/ *Gote* _____
3. Language spoken: 1. Amargna 2. Agewgna 3. Tigregna 4. Orogna 5. Other (specify)_____
4. Ethnic group: 1. Amhara 2. Oromo 3. Tigray 4. Other (specify)

6. Marital status: 1. Married 2. Single 3. Divorced 4. Widowed
7. Religion: 1.Moselm 2. Orthodox 3. Catholic 4. Other (specify)
8. Sex: 1. Male 2. Female
9. Age: 1. < 25 2. 25- 35 3. 36- 45 4. 46- 55 5. 56- 65 6. > 65
10. Educational status attained: 1. Illiterate 2. Read and write 3. Grade 1-8 4. Grade 9-12
11. Capable to work 1. Yes 2. No
12. Number of permanent household members: 1.Male _____2. Female_____

2. Household Characteristics

2.1 Now we request you to provide information about household characteristics of the HH members

NO.	Name	Relation to Head	Age	Sex	Level of edn.	Economically active	Occupation
1							
2							
3							
4							
5							
6							

2.2. Is this your village of origin? 1. Yes 2. No
2.3. If not, what was the year you came here? ---------- Year
2.4. In the past 3 years, your family members ever displaced from their normal place of living? 1. Yes 2. No
2.5. If yes, how many times you change your place of residence in the past 3 years? _____times
2.6. Is there is any person from your family migrated to search employment opportunities? If yes where?

3. Housing and Household Facilities

3.1 What type of house do you have?
1. Tin roofed 2. Hut 3. Thatch 4. Other, specify
3.2. What is the main drinking water for your household?
1. Piped in 2. Tube well/borehole with pump 3. Protected dug well
4. Open/unprotected well 5. Protected spring 6. River/stream
3.3 How long does it take to go there to get water and comeback? _____ minutes/hours
3.4. Who normally collect water for the household? 1. Men 2. Women 3. Both
3.6. What is the main source of lighting for the house?
1. Bottle lamp 2. Kerosene 3. Candle 4. Wood fire 5. Other (specify)
3.7. What is the main source of cooking fuel for the household?
1. Wood 2. Charcoal 3. Gas 4. Kerosene 5. Dung
6. Crop residue 7. Other (specify)

3.8. If you collect wood, how long it takes to go there and comeback? _____ min/hours
3.9. Who normally collect firewood for the family? 1. Men 2. Women 3. Both
3.10. Do you own the following items? (Mark ***X*** if you have)
1. Sprig bed 2. Chairs 3. Wrist watches 4. *Fanos* 5. Weaving equipment
6. Full farm equipment 7. Table 8. Radio 9. Kerosene stove
10. Gold (Jewelry) 11. Saddle 12. Others (specify)

4. Access to Natural Capital, Land Tenure and Resources

4.1. Do you have access to land for agricultural use? 1. Yes 2. No
4.2. If yes, how did you get it?
1. Through land redistribution 2. Shared with the family/relatives
3. Inherited from parents 4. Share cropped- in 5. Rented from relatives
6. Purchased 7. Other (specify) _____
4.3. What is the total size of the following land types do you have?

Land type	Unit in local measure ('*kada or timmad*[17]') or hectare
Cultivated land	
Fallow land	
Grazing land	
Forest land	

4.4. What changes did you observe to the size of your land holdings for the last 10 years?
1. increased 2. Decreased 3. No change
4.5. If you say decrease/increase, what are the reasons?
4.6. During the last agricultural season how many *timmad* of land did your household cultivate?
4.7. During the last agricultural season, did you cultivate any land belonging to someone else?
1. Yes 2. No
4.8. If yes, how is the arrangement made?
4.9. Did you give any of your land to someone else to farm? 1. Yes 2. No
4.10. If yes, how is the arrangement made?
4.11 How many parcels of land do you have? _____number of parcels/plots
4.12 Would you tell us about the characteristics of your plots of land?
4.13. Have you share cropped out your plot/s to other farmers on equal basis? 1. Yes 2. No
4.14. If yes, what are the reasons? (Multiple responses are possible)
1. lack of draft power 2. Lack of seed
3. Unable to buy purchasing inputs 4. Unable to farm due to age
5. Having extra land 6. Other (specify) _____
4.15. Have you ever sharecropped in land from other people? 1. Yes 2. No
4.16. Is there land in your RKAs that are used as communal? 1. Yes 2. No
4.17. What benefit do you get from the communal land?
1. Grazing livestock 2. Collecting fire wood 3. Fire wood for selling
4. Source of construction materials 5. Other (specify) _____
4.18. From where you graze your livestock?
1. Communal land 2. Relatives/friends in your RKAs 3. Land rented in the RKAs 4. Other (specify) _____
4.19. Do you think that the communities in your RKAs have the problem of grazing?
1. Yes 2. No
4.20. If yes, what would be the solution to the problem?

[17] A *timad* is a local measure of land, equivalent to what an adult male can plough in a day using a pair of oxen; on average it is approximately equal to 0.25 hectares. Malmberg, B. and Tegenu, T. 2006

1. Reduce farmlands for grazing 2. Abandon reaforestation areas
3. Introduce selected breeds of cows to reduce livestock population 4. Other (specify)

4.21. Do you like to move to other areas voluntarily where there is abundant land and fertile soil?
1. Yes 2. No

4.22. If you say yes or no, give reasons _____

4.28. Constraints faced regarding of your crop production activities (Multiple responses are possible)

1. Land scarcity 2. Soil infertility 3. Soil erosion
4. Water logging 5. Uneven topography 6. Stoniness 7. Inequality of land holdings

4.24. Which practices commonly used by the farmers to conserve soil erosion? (Multiple responses are possible)

1. Crop rotation 2. Using composite 3. Soil/stone bunds
4. Strip cultivation 5. Fallowing 6. Contour ploughing
7. Tree planting 8. Chemical fertilizers 9. Other (specify)_____

5.14. Who is responsible for environmental protection?
1. The peasants themselves 2. The community 3. NGOs

5.15. Are there any environmental protection/rehabilitation schemes such as reforestation, land closures and others in your *kebeles?* 1. Yes 2. No

4.25. Did you satisfy the land redistribution activities taken at different years in your RKAs?
1. Yes 2. No

4.26. If you say no, what are the reasons?

4.27. Do you feel uncertainty to use your land fearing of redistribution of land in the future?
1. Yes 2. No

Table. Sample households' perception about climate variability

Options	Yes	No
Has rainfall decreased for the last 20 years?		
Did rainfall come on time?		
Did you observe enough rain at the beginning of the rainy season?		
Was there enough rain during the planting and growing season?		
Did the rain stop on time in your locality?		
Was there rain during harvesting period?		
Do you think that your RKAs will be affected by drought in the future?		
Do you think that food shortage can occur in your *kebele* in the future?		
Perceived change of temperature for the last 20 years (decreasing or increasing		

4.28. Would you please define and identify the causes of drought?

4.29. Would you please tell us the direct and indirect causes and impact of drought?

4.30. How did you perceive climate change in your locality for the last 20 years?

4.31. According to your opinion what measures should be taken to minimize climate change?

4.32. Would you please state the impact of drought to the economic, political and social crises of the people?

4.33. Indicate the major causes for the decline of crop production?

4.34. How did you hear climatic information?

5. Household Livelihood Strategies and Activities

5.1. How much production in quintal would you produce from your total plots during good, bad and normal harvest years?

1. Good harvest season _____quintals
2. Normal harvest season_____quintals

3. Bad harvest season_____ quintals

5.2. In general conditions, for the last 20 years the trend of your crop production

1. Get better 2. Get worse 3. No change

5.10. What are the main causes for the decline of agricultural production in your village? /Multiple responses are possible/

1. Climatic problems/ drought 2. Pests 3. Crop disease
4. Soil fertility 5. Land scarcity 6. Non use of fertilizer

5.3. If you think the trend is declining what would be the reasons for its decline?

5.3. Which crop show decline and which crop showed increasing trend?

5.4. What measures should be taken to increase crop production?

5.5. In which of the farming activities your household is engaging at the current situations?

5.5. In your locality how did you get climate related information?

5.6. The type of activities you employed

Farming activities	**1. Yes 2. No**
1. Crop production	
2. livestock rearing	
3. fruit production (apple)	
4. Bee keeping	
5. other (specify)	

5.7. Do any of your household members work in activities apart from crop production?

1. Yes 2. No

5.7.1. If yes, in which of the **off-farm** activities your household is engaging at present?

Off-farm activities	1. Yes 2. No	Estimated annual income
1. Sale of agricultural labor		
2. Sharecropping (cash or food)		
3. Livestock herding		
2. Sale of fire wood or charcoal		
3. Sale of grass or fodder		
4. Sale of wood		
5. Migratory labor (for a week or more)		

5.7.2. If yes for ques. No. 5.7, in which of the **non-farm** activities your household is engaging at?

Non-farm activities	1.Yes 2. No	Estimated annual income in birr
1. Trading grains and pulses		
2. Trading livestock		
3. Drinks production and sales		
4. Weaving /spinning		
5. Carpentry		
6. Pottery		
7. Blacksmithing or metal work		
8. Traditional healers		
9. Renting out pack animals		
10. Mills		
11. Others(specify)		

5.7. What are the major reasons to participate in non/off-farm activities?

5.8. For what purpose you used the income obtained from nonfarm/off farm activities? (Multiple responses are possible)

1. Buy food 2. Saving 3. Buy clothes
4. Pay taxes 5. Pay loan 6. Buy inputs

5.9. If you think that there is a constraint in engaging in nonfarm activities, what are the reasons? (Multiple responses are possible)

1. Lack of spare time from agriculture 2. Lack of awareness about its use
3. Lack of work skills 4. Unable to work due to old age
5. Health problem 6. No employment opportunities
7. Jobs are too far away 8. Poverty/lack of funds
9. Income is intermittent

5.10. If there is a problem of growing perennials, fruits and vegetables, what are the problems?

5.11. Would you please tell us the number of livestock you own at present?

Type of animals	**Number**	**Equivalent in cash**
Cows		
Oxen		
Heifers/calves		
Sheep		
Goats		
Mules		
Horses		
Donkeys		
Chickens		

5.11. Would please tell us the problems encountered the livestock sector?

5.12. What measures should be taken to overcome the problems?

5.13. How much quintals is the actual annual grain requirement of your household? (Estimate) _____ Quintals

5.14. List the type of agricultural inputs you used in the 2010 crop year

Type of agricultural inputs	**Responses 1. Yes 2. No**	**Total amount used in Kg.**	**Total amount of costs incurred**
1.Chemical fertilizers			
2.Pesticides, herbicides			
3.Improved seeds			
Other (specify)			

5.15. If there are constraints in the use of agricultural inputs, what are the problems? /Multiple responses are possible/

1. Drought/erratic rainfall 2. High price of inputs 3. Lack of cash
4. Indebtedness 5. Farm land is inappropriate to use of fertilizers 6. Crop disease
7. Excessive rain 8. Unavailability of improved seed 9. Untimely input distribution

5.15. How did you plough your land? 1. Using pair of oxen/horses 2. Using hand hoe

6. Source of Income

6.1. How much money did the household earn from the following sources during the 2010 crop year? (Estimate on it)

Sources	**Estimate income in birr**
1. Sale of cereals/agricultural products	
2. Sale of cash crops (for example, apple or eucalyptus)	
3.Sale of small and big livestock	
4. Sale of livestock products/butter	
5. Sale of firewood and charcoal	
7.Food for work/cash for work	
8. Food aid sales	
9. Oxen rent	
10. Hand crafts	
11. Petty trade	
12. Credit	
13. Remittances received	
14. Daily labor	
15. Other specify	

6.2. Constraints in utilizing of agricultural credit /Multiple responses are possible/

1. Assets bought through credit are not profitable
2. Members or groups who took credits are not able to repay on time
3. Insufficient availability of credit
4. Creditors are unwilling to give credits according to our interest
5. High rate of interest
6. Short period of repayment
7. Untimely provision of loan

6.2. Has your income level changed in the last two or three years? 1. Yes 2. No

7. Social Networks and Relations

7.1. In which of the following community based organization do you participate and the amount of money you contribute?

Type of community organizations	Cash/year
1. *equb*	
3. Religious social groups/*Idir*	
4. other , specify	

7.2. Do you participate in various community labor organizations? 1. Yes 2. No

7.3. If yes, which of the following organizations do you take part? / Multiple responses are possible/

1. *Debo* 2. *Wonfel* 3. Group work for disabled persons
4. Other, specify

7.4. Do you receive remittances for the last 12 months? 1. Yes 2. No

7.5. If yes, from where did you get and what is the relationship from you and how much money you received?

8. Food Security and Copping Strategies

8. 1. Indicate the months your family were food deficit.

8.2. Name of the months your family received enough food

8.3. How many meals do you have per day?

1. One meal 2. Two meals 3. Three meals

8.4. If you grow your own food, how do you produce taking in to account the recurrent drought exhibiting in the area?

1. Rainfall is sufficient 2. Growing resistant crops 4. Using water harvesting techniques 5. Other (Specify)

8.5. If you use water harvesting as a coping mechanisms, what are the constraints you faced?

8.6. How much is it effective in raising your income?

8. 7 What kind of crops you grow commonly using water harvesting techniques?

8.8. If your households did not meet their food needs; do you or any one in your household use any of the following coping (short-term) strategies?

Coping strategies	***Times per week***			
	1.Every day	**2. 3-6 times**	**3. 1-2 times**	**4. never**
1.Shift from preferred to lower status of foods				
2. Reduce number of males eaten per day				
3. Reduce the amount of food eaten by adults in order to something to eat for small children				
4. skip an entire day without eating				
5. Purchase food on credit				
6. Collect wild food/ hunt wild animals				
7. Work for food only/ rely on relief gains				
8. Liquidate productive asset (livestock sale)				
9. Migrate out for week or more				
10. Permanent migration				
11. Send children to live and to eat with relatives				
12. Harvest immature crops				
13. Sale assets/land				
14. Sending household members to beg				
15. Consume seed stock held for the next season				
16. Fire wood and charcoal selling				
17. Borrow food from family/friends				
18. Rely on less preferred and less expensive food				
19. Feed working members with the expense of non-working members				

8. 9. If your households faced vulnerability to food insecurity; do you or any one in your household use any of the following adaptive (long-term) strategies?

Adaptive strategies	**1. Yes**	**2.No**
1. Saving expensive materials		
2. diversifying crops		
3. Natural conservation		
4. Fattening livestock		
5.Livelihood diversification		
6. Diversification of herds (donkey, horse, sheep, cattle, etc)		
7. Fruits and Tree growing		
8. Fattening livestock		
9. Growing fast maturing plants		
10. Seed reserve		
11. Water harvesting techniques		

8.10. According to your opinion, why some people are food insecure while others are not?

8.11. Who are the most vulnerable to food insecurity? Why?
8.12. How is the resource base of female-headed households? Their decision making power
8.13. when and how people divorce in your keeled?

9. PSNP and Food Security

9.1. Did you participate in safety net programs? 1. Yes 2. No
9.2. Do you know the criterions used to select safety net beneficiaries? 1. Yes 2. No
9.3. If yes, what are the criteria used to select safety net beneficiaries?
9.4. If no, what measures should be taken to overcome the problems?
1. Reduce the number of household head included in safety net program.
2. Reduce the number of members in each household
3. Other, specify
9.5. Do you observe any complaints in your village in regard of safety net program?
1. Yes 2. No
9.6. If yes, what are the complaints and for whom they complain?
9.7. According to your opinion what will be the best criteria for selecting public work and direct support beneficiaries?
9.8. What kind of work you involved during food for work or cash for work?
1. Terracing 2. Help disabled persons 3. Road construction
4. Tree planting 5. Other, specify_____
9.9. What were the months you practiced public works? _____ _____months
9.10. If you are not benefited from the safety net program, why you did not be a member of the beneficiaries?
9.11. According to your opinion how is the safety net program differ from relief/aid?
9.12. Under safety net program
1. Who receive direct support?
2. Who participate in public works?
9.13. Is there any household who receive both public work and direct support? 1. Yes 2. No
9.17. If yes, give reasons

Appendix II: Qualitative checklists

A. In-depth interview with key informants (household interview)

1. Demography and education of the household – human capital

1. Name, family size by sex and age, place of birth (kebele) and agro-climatic zone
2. Perception towards large family size and the advantage and disadvantage of large family size
4. Discussion on the knowledge, attitude and practice of family planning services in the village
5. Discussion on the rights, duties and powers of women in decision making
6. Formal and informal education systems in your RKAs

2. Access to natural capital

1. Land holding size and number of plots
2. Ways of getting access to land
3. The trend of land holding size (decrease or increase or no change)
4. The general conditions of the available land (fertility, land fragmentation, topography, etc)
5. Main problems of farmland (land degradation, protection and grazing, complaints on land closures, etc)
6. Land management practices
7. Problems in relation to exploitation of natural vegetation and interest in planting trees
8. Perception towards drought and erratic rainfall and temperature change
9. How is the availability of rainfall in the area? 10. How is the trend of rainfall in the area?

3. Financial capital

1. Trends in production (decrease, increase or no change)
2. Perennial crops grown for cash crops (eucalyptus, papaya, apple, orange, etc)
3. How is the purchasing power of the household during food shortage?
4. How do they get the cash to buy food?
5. Livestock owned and constraints faced
7. Main expenditure
8. Housing situations (utensils and assets of the household, type of houses, etc.)
9. Availability, constraints and use of credit

4. Availability and accessibility to physical capital

1. Health services
2. Schooling
3. Access to water for human and livestock
4. Agricultural extension services
5. Roads
6. Telecommunication
7. Electricity

5. Social Relations and Networks – Social Capital

1. Participation in informal institutions (*Idhir, Equib,* etc.)
2. Participation in labor organization (*wonfel, debo*, etc.)
3. Labor support from neighbors
4. Discussion on cultural ceremonies (weddings, *Teskir*, various festivals)

6. Government intervention – political capital

1. Land redistribution and land tenure system
2. Perception towards resettlement program

7. Discussion on vulnerability to food insecurity and coping strategies

1. in your opinion do you think that there is food insecurity in your village at the present situations?
2. What do you think are the causes of food insecurity in your village?
3. Can you describe how these factors affect the problem of food insecurity? Which causes are more serious? Why?
4. How do you see your future food security conditions? (Anticipated problems)
5. During famine which category of the community were most affected to food crises?
6. What responses and general steps the communities do when food crises occur in your area? (Discussion on coping and adapting strategies)
7. What measures have been or are being done by the government/ NGOs to solve food shortage problems? (Government's and NGOs' coping/adaptive strategies)
8. Do you think the government is doing enough to alleviate the problem of food security in your village? What do you think the government need to do?
9. How such government's measures are/were effective?
10. Did you participate to nonfarm and off farm activities?

B. Interview with development agents (DAs)

2. Landownership and tenure issues in the woreda
3. Major agricultural extension services
4. Constraints to deliver proper extension services to the community and to the individual farmer
5. Major problems in livestock and crop production, non-farm generating and use of common resource issues
6. Discussion on land degradation and people's complaint on land closure
7. Do you think the communities in the worked have enough food?
8. For how many months the food produced from own produce can cover households' food requirement?
9. If they are unable to cover the yearly food requirements, what do they do to satisfy their necessities?
10. Do you find a household who is supplemented through remittances or FFW or CFW?

11. What kind of household is most vulnerable to food shortage?
12. What measures have been taken to overcome the undesirable situations (food shortages or famine)?
13. What do you think are the causes of food insecurity?
14. Did you observe distribution of food/cash by the governments/NGOs?
15. Was the food distribution to the food insecure households during food crises sufficient?
16. How did you perceive the attitudes of the people towards food aid?
17. In your opinion do you think that food aid is necessary for the community?
18. Do you think that the government is doing enough to alleviate the problem of food shortage in the Woerda?
19. How is the availability of rainfall in the area?
20. How is the trend of rainfall in the area?
21. How is the change of temperature?

C. *Woreda* Safety Net Taskforce

1. In your view what is the objectives of the safety net program?
2. How does safety net differ from the other relief/food aid?
3. Under safety net program, who receive direct support and who receive through participatory work?
4. What are the problems you observed when implementing PSNP?
5. Do you think the transfers of funds /aids reach to the beneficiaries on time?
6. How is the change you observe before and after the implementation of PSNP? (Asset creation, food consumption, develop positive attitude towards work, etc)
7. According to your experience, what are the constraints of the PSNP?
8. What criterions are used to select the beneficiaries?
9. Did you observe some complaints in related to safety net program?

D. Checklist for focus group discussion

1. What are the main ways of getting food in your kebele? How do evaluate the production systems?
2. How is the trend of crop production in your Kebele?
3. Do you think that the people in your kebele have enough food throughout the year?
4. What do you think that the causes of food insecurity? What other ways people have to do to improve food security in this area?
5. 6. What is the dominant livelihood strategies pursued by the people in the area?
7. What do the communities do when there are food shortages?
8. Is there population pressure in your kebele and how can you evaluate its impact on food security, on land and livelihoods?
9. Do you think that the government is doing hard to alleviate the problem of food insecurity in the area? How?
10. How is the influence of drought on crop production?
11. What are the causes of drought?
12. How is the trend of rainfall and temperature for the last 20 years?
13. What are the causes for the decline of crop production?
14. How are the infrastructure and social services arranged in your kebele? (Roads, health centers, schools)
15. How can you anticipate food insecurity in the future?

Appendix III: Conversion factors of major cereals (kcal)

Sorghum (whole)	3550
Maize (whole)	3630
Wheat (whole)	3400
Beans	3200
potatoes	1140
Barely	2439
Tef	1823

Source : Zenebe (2012)

Appendix IV: Kcal of adult equivalent

age	Male	Female
<1	0.33	0.33
1-2	0.46	0.46
2-3	0.54	0.54
3-5	0.62	0.62
5-7	0.74	0.7
7-10	0.84	0.72
10-12	0.88	0.78
12-14	0.96	0.84
14-16	1.06	0.86
16-18	1.14	0.86
18-30	1.04	0.8
30-60	1.0	0.82
> 60	0.84	0.74

Source : Dercon (2001)

Appendix V: Conversion factor to tropical livestock unit (TLU)

Animal type	Unit
Ox	1.0
Cow	1.0
heifer	0.5
Calve	0.2
Sheep and goat	0.15
Horse	1.1
Mule	1.15
Donkey	0.65
Poultry	0.005

Source : Fekadu, 2010

Tropical Livestock Unit is equivalent to a livestock weight of 250 kg, and the conversion factors vary according to the type of livestock.