MEKELLE UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

DETERMINANTS OF SEASONAL FOOD INSECURITY AND COPING MECHANISM IN RURAL HOUSEHOLD IN LARE DISTRICT IN NUER ZONE OF GAMBELLA,ETHIOPIA.

BY:

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DEDICATION

I dedicated this thesis manuscript to my father John Nguen Mut and my mother Mary Nyabiel Kang, for nursing me with affection, love and for their dedicated partner in the success of my life, and for their care residing in my heart made of it a safe in which to reflect and grow in my own truth

STATEMENT OF AUTHOR

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BIOGRAPHICAL SKETCH

The author was born on March 8, 1980 G.C in Mangok kebele, Lare District, Gambella National Regional State, Ethiopia. He attended his elementary education in Nyon Primary School & Itang Primary School, and Junior in Dimma Primary and Junior School and senior secondary school in Mizan Teferi and Gambella open intermediate secondary school. The author has finished his grade 12 in Gambella senior secondary school in 2002 G.C.

Following the successful completion of his high school in 2002, he was enrolled in Gambella Teachers' education and health college and obtain his diploma in mathematics in july 2004, after graduation, he worked as a teacher in Berhane selam elementary and junior school in 2004/05, he was transfer to Kuergeng junior and secondary school as vice principal, while as vice director, he was elected as member of Gambella regional council in 2005 and he was appointed as Woreda building capacity office head , after few months, he was shifted as Woreda sport and culture office head, after few month , he was promoted to zone as social affairs office head while working as social affairs office head he was appointed as regional permanent committee on development bureau.

While working, he was allow to pursue his education, he join Addis Ababa University in 2006/07 and he graduated with Bachelor of education in mathematics in 2009, after graduation, he joined Gambella Teachers' Education and health Science college as assistance lecture one in 2009, he worked as instructor as well as registrar head until he joined the school of graduate studies of Mekelle University in September 2011 to pursue his graduate studies in Economics.

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ABBREVATIONS AND ACRONYMS

AE	Adult Equivalence
CIS	Commonwealth of Independent State
CSA	Central Statistics Agency
CSAE	Centre for studies of Africa Economies
DPPC	Disaster Prevention and Preparedness Commission
EEA	Ethiopian Economics Association
EFSOR	Ethiopia Food Security Outlook Report
EFSS	Ethiopia Food Security Strategy
FAD	Food Availability Decline
FAO	Food and Agriculture Organization
FDRE	Federal Democratic Republic of Ethiopia
FED	Food Entitlement Decline
FFW	Food for Work
GAPLZ	Gambella Agro-Pastoral Livelihood Zone
GCHACLZ	Gambella Coffee, Honey and Cereal Livelihood Zone
GDP	Gross Domestic Product
GFPR	Global Food Policy Report
GMALZ	Gambella Mixed Agriculture Livelihood Zone
GPNRS	Gambella Peoples' National Regional State
HA	Hectare
HDI	Human Development Index
HFS	Household Food Security
HH	Household
HHH	Household Head

ABBREVATIONS AND ACRONYMS (Continued)

IDRI	International Development Research Institute
IFPRI	International Food Policy Research Institute
KCAL	Kilocalorie
LIFDC	Low Income Food Deficit Countries
LZ	Livelihood Zone
M AS L	Meters above Sea Level
MBS L	Meter below Sea Level
MEDAC	Ministry of Economic Development and Cooperative
MOFED	Ministry of Finance and Economic Development
NBE	National Bank of Ethiopia
NFSS	National Food Security Strategy
PASDEP	Plan for Acceleration & Sustainable Development to End Poverty
QT	Quintal (100KG)
SSA	Sub- Saharan Africa
TLU	Tropical Livestock Unit
VIF	Variance Inflation Factor
WFS	World Food Summit
WMS	Welfare Monitoring Survey

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ABSTRACT

The main objective of the study was to investigate the determinants of seasonal food insecurity status of farming rural households, to identify factors influencing rural households' food insecurity status and to find out the coping mechanism. In light of this, examinations of the demographic and socio economic characteristics of sampled households were undertaken. The necessary data were extracted from primary data of sampled rural households.

In this study, two stage probability proportional to size sampling procedure was employed to select 6 kebeles and 120 sample households out of 28 kebeles of the study areas. For the purpose, survey questionnaire was prepared to collect the primary data from sampled rural households. The data was analyzed by SPSS statistics version 19, econometrics model and descriptive statistics. The specific statistic used includes, mean, standard deviation, percentage, tables, figures and frequency distribution. In addition, t and chi-square tests were used to compare food secure and insecure sample groups with respect to explanatory variables

A binary logistic model was used to identify the determinants of seasonal food insecurity. A total of sixteen explanatory variables, 9 continuous and 7 discrete, were included in the empirical model. Out of these, nine were found to be statistically significant. These variables include household size (HHSZE), marital status of household head(MRSTHHH), dependent ratio(DEPRATIO), owned milking cow (NUMMKCOW), livestock holding (TLU), on farm income(ONFMIN), farm land size (FLSZ), cultivated own land (CULTOWNLAND) and number of household members actively participant in activities (NUMHHMPACTS).

The result of the study revealed that 80.8% of sampled rural households in study area were food insecure and it was check by using recommended minimum calorie requirement (i.e., 2200kcal) whereas 19.2% of sampled rural household was food secure. On other hand, sale of livestock, sale milk and milky product, fishing, selling of fire wood, borrow grain/cash and gathering wild fruit, were found to be more frequently practiced as mean of coping mechanism used by people in study area.

The finding suggest the following set of policy recommendation, limiting population size, and improve the production and productivity of the agriculture sector in longer term, educate people to catch up with model technology like improved seed, utility of farm size, introducing the use of fertilizer, modeling livestock rearing, creating enable economic and saving institutional environment were recommended.

Key words: *seasonal food insecurity, copping mechanism, Lare District*

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the study

Food is both a need and human right; food security is major concern in large parts of the developing world. Food production must clearly increase significantly to meet the future demands of an increasing and more affluent world population (Save food! at Interpack. 2011 Düsseldorf, Germany). Hence the issue of food insecurity is of high importance in the effort to combat, raise income and improve food security in the world's poorest countries. Food insecurity has an impact on food security for poor people, on food quality and safety, and on economic development.

The exact causes of food insecurity vary throughout the world and are very much dependent on the specific conditions and location situation in a given country. In a broad term, food insecurity is causes by natural disaster for instance natural disaster around the world caused a record US$380 billion in 2011. That's more than twice the tally for 2010, and about US$115 billion more than the previous record (IFPRI, 2011).It was also reported that food insecurity in North Korea was a result of a bitter winter, crop loss, and a lack of resources to secure outside cereal supplies left 3.5 million people highly vulnerable to food shortage (GFPR; 2011).

Food insecurity often also involves the degradation of the social and /or natural environment. Frequently, vulnerable households can no longer manage a balance between dietary needs over the short term (survival) and the management of their means of existence (livelihood) over the long term. There is also food insecurity when people are under –fed because of the physical lack of availability of provisions, or their lack of economic or social access to provision, and /or an inadequate use of the food .

In 1996, the World Food Summit (WFS) set as a target, to halve, by 2015, the number of undernourished people in the world. This goal was later adopted by the Millennium Summit of 2000. In June 2002 at the *World Food Summit: Five Years Later*, progress and achievements

were reviewed. The outcome, which was produced from an analysis of the latest trends, has indicated that it is unlikely that this goal will be met.

Food availability for direct human consumption grew by 19% between 1960 and 1996; however, availability is still uneven. During the 1990s, the per capita growth of world agricultural production slowed. World cereal production, for example, dropped from 342 kilograms (kg) per person in the mid-1980s, to 311kg per person in 1993/95. Output then rose to 323kg per person in 1996/98. Global cereal production for 2012 is expected to fall by 2.7% from the 2011 crop records, but almost match the 'second-best' performance of 2008 (Sarah. K, 2013).

Between 1995 and 1997, 820 million people were estimated to be undernourished with 96% of these living in developing countries. Though this number dropped by 40 million between1980/82 and 1995/97, this improvement is seen to be uneven owing to overall reduction of 100 million people in 37 countries. The remaining countries, on the other hand, collectively saw an increase of 60 million undernourished people. This fall in absolute number was too low to achieve the world food summit goal of reducing the number of undernourished individual by half by 2015, as this would necessitate a reduction of 20 million people each year until 2015(Article by Sarah K. Jan16, 2013 consultancy Africa intelligence).

Despite improvement in some countries, the Africa state of affairs concerning food security has worsened since 1970 particularly in Sub-Saharan Africa (SSA) where the proportion of the population that is malnourished has remained at a level between 33% and 35% this figure varies from region to region, being the lowest in North Africa (at 4%) and highest in Central Africa (at 40%). It is estimated that 70% of all people considered to be food insecure live in rural areas, and the remaining 30% are the urban poor.

The United Nation Food and Agriculture Organization (FAO) committee on food security reviews a set of six indicators derived from observation of the global cereals market. These are (i) ratio of world cereal utilization; (ii) ratio of supplies to requirements in the five main exporters; (iii) ratio of closing stock in the five main exporters to the domestic consumption plus export; (iv) cereal production in three main importers (China, India, and the commonwealth of

independent states (CIS); (v) cereal production in low-income food deficit countries (LIFDC); and (vi) production in LIFDC except China and India.

A key difficulty in interpreting these indicators is that no mention is made of the ability of a country to meet increased Import requirement. Developing countries in general face a number of risks associated with trade. The world prices of primary commodities that developing countries export fall over time, relative to the price of imported goods. A related problem in this field is the unpredictable of the global prices of primary, especially agricultural, goods that are exported. These prices are determined in market, far beyond the influence or control of developing countries. Furthermore, agriculture output goods are also susceptible to climatic weather conditions, so droughts and heavy rainfall events can damage or drastically reduce agricultural output (Sarah K, 2013).

With more than one in four Africans being undernourished and 90% of food in SSA grown under rain-fed agriculture; food production in the region has become vulnerable to changes in weather conditions. An environmental change brought about by altered weather patterns has the potential to seriously impact on food security. Especially in Africa's most vulnerable regions – Sub-Saharan Africa making up the bulk of these (Sarah K, 2013). .

In developing countries, agriculture remains the largest economic sector, and international agricultural agreements are therefore crucial to maintaining a country's food security objectives. Smallholder farmers produce more than 90% of the continent's food supplies in the developing world, Agriculture accounts for 9% of the gross domestic product (GDP) and more than half of total employment in countries where over 34% of population is considered to be under-nourished, agriculture can account for as much as 30% of the GDP(Sarah K. , 2013).

Historically, Ethiopia has been relatively food secured in the Imperial period (before 1960's). However, since early 1960's domestic food supply failed to meet the requirements of the people, both at national and household levels. In line with this, food insecurity problem became an important agenda through time. In the 1990's about 30 million people were estimated to be food insecure in Ethiopia. In addition, 50-100 kilogram per capita food gap has occurred (Frehiwot, F. 2007). Among this food insecure people large number is found in rural areas of the country. The proportion of people who are unable to attain their minimum nutritional requirement is reported

to be 52% of the rural population (MEDAC, 2009).

Ethiopia is worldwide one of the poorest late developing countries, ranking at 174 out of 187 on Human development index with an HDI score of 0.363 well below the average for Sub-Saharan Africa of 0.463. Its population has for long periods of time grown at an average of 3% a year increasing from 39.8 in 1984 to 53.4 in 1994 up to 73.9 million in 2007 census and was stated by Altenburg (2010) to be at 80.7 million in 2010.He also emphasizes that the economics structure has been stagnant.

In Ethiopia‘s case this means that the manufacturing sector, which is almost entirely made up of simple agro-processing activities, has contributed with a constraint of only 5% of GDP in the last 20 years and overall production is based on a very low technological level, i.e. only 4% use technologies licensed by foreign countries and also only 4% have ISO certification; this is in both cases compared to an average of 12% in Sub-Saharan Africa. However in recent year years, Ethiopia has seen consecutively high GDP growth rates, especially since the last eight years. In 2010/11, real GDP growth was 11.4% moderately higher than the 10% a year earlier (NBE, 2010/11).

Ethiopian Economy is based on subsistence agriculture that accounts for 48% of GDP in 2004/05(IMF, 2011), the share declined gradually, but steady and reached 41.1% in 2010/11. It Employ 85% of the population (PASDEP, 2012). In Ethiopia 85% of population live in rural areas and are engaged in rain-fed agricultural production providing barely for their subsistence. The agricultural sector is very inefficient due to a number of natural and manmade factors. On national level Ethiopia is characterized by a large gap of food self-sufficient and at the household level food insecurity is widespread.

The population engaged in agricultural production in the northern highland struggle to make ends meet due to degraded land while in the South and South-western areas poverty persists on large scale in the midst of plenty and arable land. This situation has been the centre of academic and policy attention for more than five decades and the sector is still to see any significant change (Ethiopia food security outlook, June 2012).

The extent of food insecurity in Ethiopia in the recent years has been alarming and its coverage in drought periods has reached as high as 45% of population. It is frequently aggravated and turns out to be more acute and on the top of these based on the joint government and humanitarian partners' requirement document released on the 12th of January reported that, about 3.2 million people required food assistance in the first half of 2012. They also report that net food requirement was around 158,000 Metric Tons (Ethiopia food security outlook, June 2012).

Federal Democratic Republic of Ethiopia (FDRE) issued Ethiopia's Food security Strategy (EFSS) in Nov, 1996 and updated in Jan, 2010, the government tried to elaborate on the availability and accessibility of food to meet individual food needs to be sustainable (Beruk, 2011).

In general, the objective of EFSS is to ensure food security at household level. The strategy document highlights the government's plan to address problem of food insecurity in the country. To ensure sustainable food security in the country; rural development policies and strategy were also formulated.

The rural development policy envisages that development and food security would be ensured through Agriculture-led and rural centered development. The policy emphasized targeted intervention for drought-prone and food insecurity areas such as Gambella region which is characterized by erratic rainfall, recurrent flash flood hazard, high incident of diseases, pests and weeds which causes food insecurity in the region and in lare district in particular (H/Mariam et al. march, 2011).

Therefore, this study focus on the determinants of seasonal food insecurity and coping mechanism in rural households in Lare Woreda of Nuer zone of Gambella, Ethiopia

1.2. STATEMENT OF THE PROBLEM

In spite of the fact that Ethiopia has abundant natural resources, most of its socio-economic indicators are extremely low and discouraging. In Ethiopia food shortage has aggravated the

already poor economy of the country. Since Ethiopia is one of the poorest countries in the world today it has received enormous amount of food aid over the past several decades through short run and long run programs. It includes safety net and similar support programs that aimed to alleviate the problem of food shortage to the maximum. If not, it aimed to narrow the gap between the demand and supply of food aid to the minimum (Frehiwot F. 2007).

Numerous studies have confirmed that there is a problem of food insecurity in Ethiopia with wide range of area to be covered and large number of people to be attended for different identified causes of food insecurity problem. Among these causal factors per capita land holding with increasing population growth, livestock availability, education, per capita income of the household from agricultural and non agriculture activities, soil fertility, conflict, under-funded agriculture are the major and commonly mentioned factors (Gebre-Selassie 2005; Negatu, 2010;Ramakirshina et al, 2009; Madeley 2007).

Ethiopian government and international donors are implementing different categories of responses to food insecurity to attain food self–sufficiency and reduced food aid dependency. These categories are based on Supply Based responses (Increasing the level and stability of production, Increasing food reserve, and Influencing international food markets), Demand Based responses (Improving income, productive assets available to vulnerable groups, and other market and non-market transfer), and Disaster Prevention and Preparedness Capabilities having adequate early warning systems (IDRI and IFPRI, 2010).

Despite such effort food insecurity remains the main problem in our country and the need For food aid become increasing. There were and still are different food aid responses taken to solve the problem of food insecurity problem through both emergency reliefs as well as development works. But, many literatures come to different, incomparable and somewhat controversial results on the effect of food aid on the overall agriculture development, marketing behaviors and consumption patterns (Habtewold 2010; Maxwell 2009; Clay et al 2011).

The food poverty gap index is estimated to be 10.5% while it is 11.1% for rural areas and 7.3% for urban areas. Similarly, the national food poverty severity stood at 0.046 with rural food

severity index (0.05) being slightly higher than that of urban areas (0.029). The overall result indicates that all kinds food poverty indices (incidence, depth and severity) is higher in rural than in urban areas.

The trend in food poverty in the national food poverty index declined from 38% in 2004/05 to 33.6% in 2011 while it declined from 42% in 1999/00 to 38% in 2004/05. This show that food poverty index declined by 12% from 2004/05 to 2010/11 while it declined by 9% from 1999/00 to 2004/05. When food poverty is decomposed into rural and urban areas, we see more decline of food poverty in urban areas (by 21%) than in rural areas (by 8%) between 2004/05 to 2010/11. Despite the huge decline in rural food poverty incidence and gap between 2004/05 and 2010/11, no decline has been observed in severity of food poverty (square poverty gap) during the same period in rural areas.

Given the degree to which Ethiopia remains primarily a rural, agrarian society, of which the agricultural production generated approximately 41.1% of Ethiopia's gross domestic product and employed 85 percent of the working population, it is imperative that seasonal fluctuations in food availability are tackled in order to maintain healthy living conditions as well as economic stability (Ethiopia Economy Profile, 2011/12)

Ethiopia Food Security Outlook reports(EFSOR) on (Oct, 2011- march 2012) showed that the Meher harvest in Akobo, Wanthoa and Jika districts of Gambella region was not promising due to repeated dry spell and moisture stress; Maize crop in Lare district was damaged by flash flood. While, Maize was harvested in Agnuak and Mejenger zones of the region while sesame and sorghum were at flowering stage.

The poor and very poor households in districts along the border of Republic of South Sudan, like Akobo, Wanthoa, Lare and Jikaw in Gambella were reported to face food insecurity for last year; while the remaining districts in the regions was reported not to have acute food insecurity

Poor households in districts with expected below normal harvest (Akobo, Wanthoa, Lare and Jikaw of the region) were expected to remain at Stress food insecurity level. But, the food insecurity is likely to deteriorate to crisis level if the region continued instability due internal

conflict in the border woredas of Gambella. The other parts of the region were reported not to have an acute food insecurity problem throughout the outlook period (EFSOR,2011/12).

In the last three decades the region faced with frequent climatic variability and agro ecological change. It is evident that the agronomic calendar of the region pushed forward with one month duration. The average annual temperature of Gambella town surrounding and Lare district was relatively low than the current annual temperature. These trends increase in alarming rate from time to time synergic with the current climatic change (H/Miriam et.al march 2012).

Climate variability and change is likely to intensify the desertification of arable areas. It is also Predicted that the humid agro-climatic zones are likely to shift south east ward,

Subsistence economy is the norm for rural farmers of the Gambella region. Rain fed agriculture is the commonest practice of cultivation for the rural farmers and agro pastoralists. This agricultural practice is exposed to these farming communities to poverty and food deficit, because of the erratic nature of rainfall resulted from climate change. Food deficit prevails in most districts of the region is in average 3-6 months (H/Miriam et.al march 2012).

These urge a need to harmonize life with the climate change impact by designing different environment friendly coping mechanisms.

Have this statement of the problem; the theme of this research is to investigate the determinants of seasonal food insecurity and coping mechanism faced by rural farm households in Lare district in Nuer zone of Gambella Region.

1.3. OBJECTIVE OF THE STUDY

This study has the following objectives:

- To investigate the causes of the seasonal food insecurity in Lare District.
- To study the demographic and socio- economic factors that contributes to seasonal food insecurity in Lare district.
- To examine the seasonal food insecurity situation and estimate the seasonal food insecurity gap and its severity.
- To identify the copping mechanism used by household during food shortage.

1.4. Significance of the Study

The study of determinants of seasonal food insecurity and coping mechanism in rural household is vital because it provides with information that will enable effective measures to be undertaken so as to improve food security status and bring the success of food security development programs. It will also enable development practitioners and policy makers to have better knowledge as to where and how to intervene in rural areas to bring food security or minimize the severity of food in security. Moreover the empirical analysis carried out in this study was also expected to contribute toward better food gap estimation. Hence such studies are important in that they could help in designing food security development programs and food security related policies.

Furthermore, little work has been done about rural livelihood in the study areas (MOARD;2010). Hence beside it is narrowing potential of wide gap of knowledge about livelihood stratagies. It was also expected to equip the different organizations and policy makers with more pertinent information of livelihood strategies adopted by rural households of the area. This in turn can help them to design ways so as to build their intervention system on the strength of the rural households.

1.5. Scope and Limitation of Study

The study was conducted to identify the determinants of seasonal food insecurity at household level in rural household and coping mechanism they uses and also to assess the severity of the problem at this level. The study covers only 6 kebeles of the 28 kebeles of the study area. Moreover, the study deals with limited number of households and focused on the determinants of seasonal food insecurity and copping mechanism. Beside to this, the data were collected at one time period. The scope of this study was limited by time, budget and other resource limitation. Even if the study was restricted in term of its coverage, its output can be used as spring board for more detailed and area specific studies.

1.6. Organization of the Thesis

This thesis is organized into six chapters. The first chapter deals about introduction, background of study, statement of problem, objective of the study and scope and limitation of the study, second chapter focus on literature review that includes theoretical framework of food security and empirical studies made in the country and elsewhere in the world, third chapter touches the brief description of the study area ,the fourth chapter discuss about the methodology employed in data collection and techniques of data analysis, fifth chapter goes in dealing with the result and discussion of descriptive and model results of the research and finally the sixth chapter present conclusion and recommendations based on the finding of the research.

CHAPTER TWO: LITERATURE REVIEW

2. CONCEPTUAL FRAMEWORK

2.1. Definition of concepts

Food security is a concept that considerably over time. Most definitions of food security vary around that proposed by world bank (Maxwell.1996); where in, food security defined as access by all people at all time to enough food for an active and healthy life" (World Bank 1986, 1).

The essential of this definition are the **availability** (adequate supply of food); access through home production, purchase in the market or food transfer but also **food access** through home production, purchase in the market or food transfer; stability, when availability and access are guaranteed at all times and

Utilization refers to the appropriate biophysical conditions (good health) required to adequately utilize food to meet specific dietary need and security, as the balance between vulnerability, risk and insurance; and time (Maxwell and Frankenberg, 2009).

Food availability means that sufficient quantities of appropriate, necessary types of domestically produced food, commercial imports or food aid are consistently available to individuals or are within reasonable proximity to them.

At the national level, it is the sum of domestic food stocks, net commercial imports, food aid, and domestic production. Individuals have sufficient access to food when they have “adequate incomes or other resources to purchase or barter to obtain levels of appropriate foods needed to maintain consumption of an adequate diet/nutrition level”. Finally, adequate food utilization is realized when “food is properly used, proper food processing and storage techniques are employed, adequate knowledge of nutrition and child care techniques exists and is applied, and adequate health and sanitation services exist” (USAID 1992).

Gradually, the concept of food security took on a more subjective meaning than at the outset, integrating the quality and diversity of needs from one individual to another, respect for local

eating habits beyond a purely quantitative approach. Food security is a multidisciplinary concept, which includes economic, political, demographic, social, cultural and technical aspects (EC, 2009). Food security and its achievement can be targeted at global, regional, national, sub-national, household or individual levels. However, nowadays, the latter two have increasingly become a focus of study.

Food utilization is also defined as proper biological use of food, requiring a diet with sufficient energy and essential nutrients, potable water and adequate sanitation, as well as knowledge of food storage, processing, basic nutrition and child care and illness management.

Food insecurity;- is a situation that exists when people lack secure access to sufficient amounts of safe and nutritious food required for normal growth and development and an active and healthy life (WFP, 2004). It is a dynamic phenomenon: its impact varies depending on its duration, its severity, and the local socioeconomic and environmental conditions (EC, 2009).

Chronic (permanent) food insecurity refers to a continuously inadequate diet resulting from lack of resources to produce or acquire food (Reutlinger, 1987). It is argued that chronic food insecurity at the household level is mainly a problem of poor households in most parts of the world.

Transitory food insecurity refers to a temporary decline in the households' access to enough food. It results from instability of food prices, production or incomes. The worst form of transitory food insecurity is famine. Hence, transitory food insecurity faced by farm households should be understood in the study as a seasonal food shortage of any magnitude ranging from mild to severe.

We should also note here the concepts ***of transitory food insecurity*** and ***seasonal food shortage*** are synonymous and will be used interchangeably.

Another important concept that should be defined here is ***seasonality***. Thomas and Leatherman (1990) define it as a fluctuating phenomenon that entails significant alterations in the biotic potential of the landscape within the annual cycle. Seasonality exerts a strong organizing

influence on the actions of agricultural producers, especially those dependent on the local environment to provide food and other basic needs. Rain-fed agriculture that dominates in the Ethiopian farming system would rightly demonstrate how seasonality adversely affects the food security situation of the country.

Livelihood: is the combination of all activities (agricultural and non- agricultural) making up the resources (economic and food) which allow the household to continue to exist (to meet its basic needs) and to develop.

Coping strategies: refers to the practices that households fall back upon in order minimize the risks threatening their survival in the short, medium or long term. These strategies help households to maintain their diet, preserve their capital and the necessary resources to ensure their livelihood and that of the future generations.

We can distinguish two types of mechanisms used by population or households faced with crisis: **Coping mechanisms** and **adaptive mechanisms.**

Coping Mechanisms: responses to reduce or minimize effects of a stressful event or an unfavorable situation where food access is abnormally disrupted, for instance by drought, flood, earthquake or military activity.

Adaptive mechanisms: measures used to manage and minimize the risk from chronic food insecurity and recurring situation**. Adaption** is a process of adjustment to a longer- term solution, for instance nomads' move to areas of better rainfall and pasture growth.

Vulnerability: in general terms, the level of vulnerability of a household and/or individual is determined by risk of failure of coping strategies. It is the inadequate of their adaptive mechanisms, coping mechanisms or accumulated capital or food stocks to meet their daily needs.

More specifically, **Food vulnerability** refers to the entire range of factor that place people in danger of food insecurity. The degree of vulnerability for an individual. A household or a group

of people is determined by its exposure to risk factors and by its aptitude to confront crisis situation and to survive them (FAO, 1996).

2.2. Theoretical orientation

There exist two broad methodological approaches to the analysis of famine. The first approach is the "general explanation". In this regard, a number of environmental and socio-economic attributes assumed to explain famine have been pointed out. The principal ones include: rapid population growth, war and civil strife, drought, ecological degradation, government mismanagement, unequal access to resources and unequal exchange, and socio-economic and political dislocation (Da Corta 1985 cited in Getachew 1995).

The argument of this approach is that one or a combination of these can disrupt food production. However, production failure may or may not result in famine. Due to this fact, the attributes (factors) are not precise explanations of the causation of the process of famine. It is in response to this major weakness that the specific models of famine emerged (Degafa, 2002).The second approach comprises models of famine as Food Availability Decline (FAD) model and Food Entitlement Decline (FED) model.

2.2.1. The food availability decline (FAD) approach

The Food Availability Decline Approach had been a dominant theoretical explanatory framework for food crises since the eighteenth century until the year 1980. As quoted in Getachew (1995), Sen (1980) defined FAD as “The availability decline per capita of food for consuming unit”. This approach conceived famine as shortages of food supplies per capita, motivated by natural factors; e.g., drought, floods and other calamities that undermine crops; or demographic factors, i.e., vegetative growth that goes beyond supply (Hewitt, 1993: cited in Diana, 2007).

The central argument of this model is that “anything which disrupts food production such as drought, flood or war can cause famine, the logic being that a drought, flood or war causes crop failure and cattle death, reducing the availability of food in the affected region, and that such a food availability decline for an extended period by definition constituents of famine” " (Devereux 1988, 270). The model demonstrates the situation of subsistence farmers, such as the

farmers under investigation, and reveals how a failure of production during one growing season would lead to food shortage. Nevertheless, the model is criticized because it overemphasizes food supply and undermines the demand for available food. This criticism over FAD ended up in the alternative model of 'Entitlement' proposed by the economist Amartya Sen in 1981.

2.2.2. The food entitlement decline (FED) approach

Amartya Sen's influential book 'poverty and Famine' (1981) decisively shifted the focus of famine analysis from supply side to the demand side. The entitlement approach emphasizes access to food, or people's relationship to the food, rather than the availability of food (Devereux and Maxwell, 2003). The main argument of this model is the mere presence of food in the economy or in the market does not entitle a person to consume it and thus starvation can set in without any obvious aggregate available fall (Getachew, 1995).

Some of the catastrophic famines have occurred without FAD. For example, the Bengal famine of 1943, the Ethiopian famine of 1973 and 1984, and the Bangladesh famine of 1974 occurred due to lack of entitlement rather than due to lack of availability short fall (Fasil, 2005). Among many positive features of the FED approach over FAD, the following are very important (Devereux and Maxwell, 2003):

- First it has emphasized upon demand rather than supply.
- Second, it allows vulnerable groups to be identified.
- Finally, it suggests more appropriate policy intervention.

Although this approach has the above mentioned strength upon FAD, it has also its own limitations. Generally, food security signifies the combination of the above two approaches and food utilization because enough food must be available, and households must have the capabilities to acquire it (Degafa, 2002).

The framework of the study is describes by mixes the premises of the `general explanations to famine' and the famine models briefly highlighted above. It consists of five major variables adversely affecting the farmers' food production, which in turn determines the situation of the households' food security. These are environmental crises, population pressure, poor asset base, social (cultural) issues, and poor rural infrastructure.

- **Environmental crises**: comprise two elements, i.e., climatic hazards (drought, flood, hailstorm, frost, etc.), and land degradation through soil erosion, loss of nutrients, deforestation and overgrazing.

- **Population pressure**: rapid growth of human and livestock population resulting in diminishing holding size and fragmentation of farmland and absence or shortage of fallow periods.

- **Poor asset base**: involve aspects such as lack of investable surplus cash, lack of farm oxen, absence of off-farm employment opportunities and inability to purchase modern farm inputs.

- **Social (cultural issues**): poor rationing of grain produced at home because farmers utilize a considerable proportion of their annual production for various ceremonies and celebrations immediately in post-harvest periods. Low level of educational background among the people in the area under study can also be the other variable.

- **Poor rural infrastructure:** inaccessibility to roads, absence of rural credit, lack of irrigation practices, lack of agricultural extension services, poor health facilities, poor storage and unfavorable market for agricultural produce.

2.3. Coping Mechanisms

Coping mechanisms used by farm households in rural Ethiopia include livestock sales, agricultural employment, and certain types of off-farm employment and migration to other areas, requesting grain loans, sale of wood or charcoal, small scale trading, selling cow dung (in central Ethiopia) and crop residues, reduction of food consumption, consumption of meat from their livestock, consumption of wild plants, reliance on relief assistance, relying on remittance from relatives, selling of clothes, and dismantling of parts of their houses for sale. Some of them are likely to be implemented only after the possibilities of certain other options have been pursued. In addition, households who have diversified source of income are often able to cope with crisis than others (FFP 2003, Yared 1999, Dessalegn 1991).

Households that spend a high portion of their income on food (i.e., more than 70 percent) are very likely to be food insecure. Thus, the percent of total household expenditure spent on food is used to show household vulnerability. To the extent that households rely on market purchases as an important source of food, cash incomes (or expenditure levels) are likely to be a more or less important indicator of their food security status (USAID2003, Smith 2002).

Food aid, today, is mainly considered as an instrument in addressing for both transitory and chronic types of food insecurity in low-income country.

It is noted that the humanitarian agencies, or donors, implement food aid programs in these countries in order to give immediate response to the needy people, to increase income sustainability, to improve agricultural productivity, and improvement in health and nutrition among the residents. Moreover it leads to improvement in the availability of food supplies at the national or regional level, or to increase access to food at household levels through higher home production of food crops, market purchase and/or other means or to make more effective utilization of food at the individual level to meet human biological needs(USAID 1999).

According to some literatures (Habtewold 2001, WFP 1991) food aid can be classified based on its target or purpose. Even if there is no clear difference in the definition between the different types of food aid, however it is traditionally classified into three broad types. These are **emergency food aid**, **project food aid**, and **program food aid**. The emergency food aid is a response to sudden natural and manmade disasters while the second type; i.e. project food aid, is aiming at transferring income to the poor or satisfying their nutritional requirements in normal years through development oriented works. The third type; i.e. program food aid, is providing to the government for balance of payment and budgetary support (ibid 2001).

In general, food aid is an important development resource, supporting programs with a wide range of development objectives. For example, investments in soil and water conservation efforts supported by food-for-work programs have potential long-term implications for increased agricultural productivity and crop income, while school feeding programs are typically intended to improve student attendance and performance, factors which ultimately lead to enhanced labor productivity and higher wage earnings.

Improved health and nutrition achieved through food-assisted maternal and child health programs or food-for-work efforts at improved water and sanitation have immediate implications for individual health and well-being and also promote productivity and income-earning potential over the long-term. As it is mentioned above, it is believed that food aid has tremendous contribution in improving food insecurity problems of individuals, households, and regions of the developing countries.

On the other hand, numerous researchers (Barrett 2006, Barrett and Maxwell 2005, Barrett and Hoddinott 2005, Barrett 2000, Maxwell 1991) have constructed a list of disincentive scenarios of food aid that could be mentioned as follows:

- Household-Level Effects of Food Aid (both cash and kind) according to some research it discourages them from working something to generate income. Moreover, food for work programs are relatively more attractive than work on own farms/businesses either because it pays immediately or because the

Household considers the payoffs to be higher than the returns from own labor.
In addition, poor timing and FFW wages that are above prevailing market rates can cause negative dependency by diverting labor from local private uses.

- In addition food aid can discourage household-level production. It is so because if food aid lowers local food prices, that may decrease the relative payoffs to investing in one's own production. In this case, both recipients of food aid and non-recipients of food aid discouraging from own production.

- Changed Consumption Patterns: the rationale for food aid partly has long been export promotion that entails some efforts to change consumers' preferences to introduce them to new foods and thereby endogenously stimulate demand for foods with which they were previously unfamiliar or which had formerly represented only a minor share of their diet.

In general when we see the last 30 years there is no year passes without receiving food aid from donors. With this, all amount of continuous food aid from the donors, in this time has become a debating agenda and NGOs and others do numerous evaluation studies on the impact of food aid on food security program. There is a debate about incentive and disincentive effect of food aid as labor disincentive production, change consumption pattern, natural resource over exploitation, price effect, community level moral hazard, disrupting international market, real exchange rate, discourage policy reform.

2.4. Empirical review of causes and determinants of food insecurity

The empirical review for this study is organized under three sections. The first section presents some cases of seasonal food insecurity documented in some countries of Africa, Latin America and Asia. The second part summarizes the findings of certain previous studies concerning seasonal food shortages and famines experienced in Ethiopia over the recent past decades. The third part presents and generalizes the findings of certain previous studies concerning the determinants of food insecurity, coping mechanism and empirical evidences as well.

2.5. Causes of food insecurity

2.5.1. Causes of seasonal food shortage in other countries

Causes of seasonal food insecurity facing farm households in various developing regions, particularly Africa, Latin America and Asia, have been documented in some literature. Much of the Sub-Saharan African population, particularly in rural areas, experiences some degree of hunger over the rainy, or "hungry" season, when food stocks dwindle and roads become muddy and impassable (Bonnard 1999, 3).

A study by Fortes (cited in Messer 1989) among the Tallensi reveals grain was short during the planting season and the problem was largely attributed to poor allocation of resources and poor rationing. In somewhat similar way, Sharman's (1970) observation in Uganda indicates that it is not household supply but the care and skill with which

Mothers rationed or distributed food that determined which household's children were seasonally malnourished. Migration of male labor is also recognized as a cause of seasonal hunger.

A study conducted in a Lesotho village found that women and children suffered from lack of food and poor hygiene because women were too exhausted to cook and clean at times of peak agricultural work (Huss- Ashmore 1984).

Haswell (1953) observes that growing cash crops at the expense of subsistence crops has largely contributed to seasonal food deficit among the Gernieri in Gambia. He also observes that illness of adults at critical times in the production process adversely affects labor efficiency and productivity, which in turn contributes to seasonal food shortage. Likewise, a recent study by Ashimogo and Hella (2000) in Iringa,

Tanzania reveals that the transition to commercial agriculture has had negative influence on food security. Deterioration in the ecological conditions of production has also been seen as a cause of seasonal hunger in several African nations.

Closely associated with this, Ogbu (1973) notes insufficient farmland, low yields on farms and high storage losses of staples were the principal causes of seasonal food shortage in Nigeria.

Nurse's (1975) findings in central Malawi are contrary to the findings in the Lesotho village (Huss-Ashmore 1984), because in the former men normally do not work in local subsistence production. Thus, the seasonal food shortage is blamed on inadequate storage facilities. Nurse (1975) states that wicker granaries allowed a large proportion of the grain to rot during the rainy season and fall prey to rats and mice during the dry season.

According to a study by Toulmin (1986), the people of Bambara Village of Kala in Mali face seasonal food shortages that are mainly induced by two principal factors. One of the factors is climatic, specifically low and highly variable rainfall making the people very vulnerable to crop failure.

The second class of risk is demographic, consisting of high level of mortality, varying levels of fertility and vulnerability of all producers to sickness and disability (Toulmin 1986, 58). Land-use competition between pastoralists and farmers has also become the cause of seasonal food shortages in some Sub-Saharan African countries. Regarding this, Longhurst (1986, 68) observes "the pastoralists of central Niger are probably typical of many others in losing land to agriculturists, being increasingly forced to sell off their young cattle and heard cattle owned by non-pastoralists for low wages, and holding herds whose numbers and composition are no longer viable". As a result, they become less able to cope with bad years and more vulnerable to regular stress.

Regarding seasonal food insecurity among poor farmers in Asia, Hartman and Boyce (1983) mention that hunger occurs principally before the major rice harvests, when food supplies of land-poor households are exhausted, wage labor is scarce, and food prices peak. In Mexico, peasants complain about Sepi-hambre (hunger September), the lean month when the maize from the previous harvest is exhausted, and the new maize not yet harvested. People seek to minimize the suffering with seasonal crafts and other occupational diversification (Warman 1980).

2.5.2. Causes of seasonal food shortage/insecurity in Ethiopia

Literature regarding Ethiopian catastrophic famines such as the 1973 and 1984/85 seems to be voluminous. Nevertheless, proper "transitory/seasonal food insecurity" has received little attention, despite its prevalence even in what we call "normal years" as well as in the so-called "high potential" and "surplus areas".

Although investigations concerning farm households' transitory food shortage have been limited, the situation in Ethiopia does not deviate much from the condition in other developing regions. Mesfin's (1991) investigation in North central Ethiopia indicates that most farmers could not produce enough to meet the annual requirements, from both the farmers' annual requirement perceptions and the ENI's (1990) estimates.

The empirical research (Degefa 1996) in Arssi, a zone considered to be a surplus producer at an aggregate level, examines seasonal food shortage among farm households and assesses variations between households practicing double cropping (during meher and belg seasons) and those relying on a single harvest (meher). The study found out that 40% of the households (out of 220 sampled households) faced seasonal food shortage. The proportion of farmers practicing double cropping who reported to have faced seasonal food deficit was 29%, while the proportion among single harvesters was 52%. An assessment of the causes of transitory food insecurity identified various physical and socioeconomic constraints to subsistence production.

There were insufficient farmlands for 99% of the households, lack of cash income to purchase farm inputs for 79% of the households, poor quality of their farmland for 67% of the households, reliance on single harvest for 55% of the households, and shortage of pulling power for 33.7% of the households.

The study reveals that the pre-harvest periods as the time for food shortage, and that 69.7% of the households encountered food deficit before meher harvest and about 23.6% of the households before belg harvest (Degefa 1996). Another research finding by Markos (1997) shows that "household's average cereal production during normal harvest years is persistently lower than annual food requirements and hence many households feed themselves from their farm outputs only for less than three-fourth of the year." Martha's (2000) study in Meket, Habru and Gubalafto woredas of North Wello Zone found out that 30%, 21% and 40% of the sample households, respectively, were unable to satisfy the food demand of their family for more than five months in

a year. Based on an empirical study in Northern Shewa, Yared (1999) argues that the seasonality of agriculture introduces fluctuations in the income, expenditure and nutritional patterns of peasant households. He further states, "The coincidence of diminishing grain supplies and increasing grain prices is a liability for the economic status and food security of households" (Yared 1999, 123).

Sen (1981) argues that famine can occur in a region when certain groups of people lack the ability to command enough food. Mesfin (1984) comes out with an interesting model that demonstrates the responsible factors for farm households' vulnerability to famine.

He states that vulnerability to famine is a product of a system, that is, a subsistence production system, which consists of three components: the peasant world, the natural forces (physical environment) and the socio-economic forces.

Regarding the relationship between these factors, Mesfin (1984) argues that an agricultural population must first be made vulnerable to famine by socio- conomic and political forces before any adverse natural factor initiates the process of food shortage that leads to famine.

In their study on Ethiopian famine, Webb et al. (1992) found strong positive correlation between famine and poverty.

Accordingly, they have identified a number of interrelated factors that contribute to famine.

These are:

- proneness to climatic-driven production fluctuations,
- lack of employment opportunities,
- limited asset bases,
- isolation from major market,
- low level of technology,
- constraints to improvements in human capital and
- Poor health and sanitation environments.

The other quite remarkable observation made by the study is that famine does not happen suddenly famine builds on high levels of food insecurity that the present households cannot withstand and that the government is not prepared for (Webb et al. 1992, 133-140). Similarly, Getachew (1995, 342) concludes, "Households' risk of food insecurity and famines were greatly increased by long-term secular decline in resource endowment, combined with unfavorable food policy intervention." Emphasizing on subsistence farmers' food insecurity situation, he

underlines that the prevailing inability of Ethiopia's small-scale agriculture to feed its population is mainly generated by the neglect of the policy and the decline in access to productive resources upon which most of the livelihoods are built.

In general many of the natural and human-induced factors that made Ethiopia a food-insecure country at the national level over the last few decades are cited in a paper by Kifle and Yosef (1999) including fragile natural resource base, inadequate and variable rainfall, improper farming practices, inaccessibility to productive resources (rural credit), diminishing land holdings and tenure insecurity, poor development of human resources, poor storage technology, inaccessibility to transport infrastructure, heavy work load on women, poor health status, lower productivity of livestock, high level of unemployment, inappropriate use and non-integrated free distribution of food aid, socio-cultural barriers, and lack of baseline information.

2.6. Determinants of household food insecurity

Much of the literature on seasonal food insecurity analyzed factors that influence seasonal food insecurity of rural farm households using appropriate regression models. Wilma *et al* (2003) used a logistic regression model to predict seasonal household food insecurity.

According to their findings, the probability of a household being seasonally food insecure decreased, when the household has a vehicle, has many types of appliances, their toilet facility is water-sealed, has more bed rooms, the mother is employed and the educational attainment of the mother is high.
Causes of food insecurity facing farm households in various developing regions, particularly Africa, Latin America and Asia, have been documented in some literature.

The productivity of Ethiopian agriculture is among the lowest in the world - around 1.2 tons per hectare (World Bank 1999). Although higher yields are possible through agricultural intensification, the evidence suggests that “average land holdings would be insufficient to feed a family of five (5) even if production could be successfully increased three times with the use of improved technology” (Masefield 2000).

A study conducted in Uganda on the main cause of seasonal food insecurity revealed a data associated with weather related problems (little or too much rain) followed by pests and disease. Factors that contribute to such insecurity were inadequate labor, inadequate land, not growing enough food during the seasons and soil infertility, poor health, lack of planting materials, lack of oxen for plaguing and so on. The farmers coping strategies include donations from relatives and neighbors, reducing the number of meals or ration, sale of livestock and exchange of labor for food. The study also shows that female headed households were more food insecure than male-headed households.

The study in Nigeria using Tobit model found that sex of head, educational level, dependency ratio, network, farm size, input usage, commercialization extent, being a member of cooperative, food expenditure, remittance have negative influence on food insecurity, whereas age of head, household size, positively influences the problem and all the variables are significant (IKPI et al 2004).

Study by Alarcon et al (1993) for smallholder farm households in west highland of Guatemala found that lack of access to credit and cash crop production displace food crops and household consumption of own production is reduced. Thus the household's vulnerability to food insecurity tends to increase. However another study in Malawi by Diagne .A. (1998) found that formal credit has marginally beneficial effects on household annual income. However, these effects are very small and do not cause any significant difference between the per capita incomes, food security, and nutritional status of credit program members and non-current members.

Similarly, in Ethiopia the number of studies made use of various methodologies to identify determinants of food security in different parts of Ethiopia. According to studies conducted by Shiferaw*et al.* (2003) and Webb *et al.* (1992); livestock ownership, farmland size, family labor, farm implements, employment opportunities, market access, level of technology application, level of education, health status, weather conditions, crop disease, rainfall, oxen ownership and family size were identified as major determinants of farm households' food security in Ethiopia.

The Case of Oromia National Regional State using the data carried out by Centre for Studies of African Economies (CSAE 2003) in collaboration with Addis Ababa University. This study also used logit model regression to identify the determinants of food security in the selected area. The empirical evidence revealed those farmers' access to fertilizer or educational level of household heads or farmers' access to land or farmers' access to family planning improve the probability of food security in the study area. Barret and Clay (2008) also find that in rural Ethiopia food aid may change in a consumption pattern and shift the production pattern of agricultural system.

Off-farm employment opportunities in rural Ethiopia are limited in both availability and income-generating potential. Only 44% of rural households surveyed by the Ministry of Labor in 1996 reported any non-agricultural sources of income, and these contributed only for 10% to household income (Befekadu and Berhanu 2000). Another survey in Hararghe Region confirmed that off-farm activities generated only petty incomes: women collect and sell firewood and forage, men and women seek irregular, low-paid work as farm laborers, and some men migrate seasonally (ICRA et al. 1996).

Ramakrishna *et al* (2002) made an assessment on food insecurity situation in North Wello Zone of Ethiopia. A food balance sheet was constructed and food security causation was examined using a binary logistic regression model. Accordingly, cereal production, educational status of the household head, fertilizer, consumption, household size, land size, and livestock were found to be the most determining factors of household food security. Along with food availability and entitlement factors, the study suggested that attitudinal variables also influence food insecurity Ramakrishna *et al* (2002).

A study by Haile *et al.* (2005) conducted in Koredegaga Peasant Association, Oromia Zone, identified that farmland size, per capita aggregate production, fertilizer application, household size, ox ownership, and educational attainment of farm households heads had a significant influence on food security. The computed partial effects at sample means using results from the logistic regression model indicated that a unit change in farmers' access to fertilizer or educational level of household heads or farmer's access to land or access to family planning

improve the probability of food security in the study area.

2.7. Generalizations of the causes and determinants of food insecurity

From the theoretical and empirical causes and determinants of food insecurity, it can be generalized that food insecurity is a function of environmental crises, rapid population growth, poor assets basis, socio-cultural related issues, and poor access to market and infrastructure. Hence, in this sub-topic it is attempted to review relevant literatures particularly conducted in Ethiopia.

2.7.1. Environmental factors

The combined effect of land based resources degradation like deforestation, soil erosion, flooding, and loss of agricultural and pasture land leads to production decline (Getachew, 1995).Rapid population growth and recurrent drought are causing serious resource degradation.

Markos (1997) and Fitsum*et al*. (2002) described that the seriousness of shortage of productive (fertile) land in the highland areas, coupled with population pressure, have forced the cultivation of the steep and moderate slopes which are highly degraded because of soil erosion. Climate is one of the important elements of the natural environment that positively or negatively affects the food security status of rural households.

Many studies indicated that inadequate and erratic rainfall is one of the environmental phenomena, causing food crises in many rain fed farming and drought prone areas across the world. In Ethiopia more than 95% of food grain production is from rain fed subsistence farm (Osman, 2005: cited in Adane, 2008). A study conducted in Ethiopia by Devereux (2002) revealed that a 10% decline in rainfall below its long term average reduces national food production by 4.4%.

2.7.2. Demographic factors

The population of Ethiopia is rising from time to time. Currently the Ethiopian population is about 74 million which grows by 2.6 % (CSA, 2008). According to CSA (2008) the average household size is also large when compared with other Sub-Saharan countries. At the micro level, household size is one of the factors expected to have influence on food security status of households. The majority of farm households in Ethiopia are small scale semi-subsistence producers with limited participation in non-agricultural activities since land holding size and financial capital to purchase agricultural inputs is very limited.

Kidane (2005) in his work found that family size tends to exert more pressure on consumption than the labor it contributes to production. Another demographic factor that strongly influences household food security is *sex* of the household head. Studies by Degafa (2002), Ramarkrisha*et al.* (2002) and
Kidane*et al.* (2005) independently conducted in different parts of rural Ethiopia came out with common conclusion that the livelihood of female headed households was disadvantaged when compared with their male counterparts. This is due to the fact that, the researchers justify, female household heads have limited access to livelihood assets like land, education, saving, labor force and oxen (drought power), livestock and credit services.

2.7.3. Poor asset base of the rural households

In countries like Ethiopia where agricultural sector employed 85% of the labor force and contributed 41% of GDP and 80 % of export earnings (EEP, 2012), land is an indispensable resource. Given the level of agricultural technology, certain minimum land holding size is required to produce sufficient production.

Yared (1999) in his study in Wagda concluded that household land holdings play the most fundamental role in determining grain and animal production in the rural economy. He added that in Wagda, access to drought power and labor participation are influenced by the size of the land people owned. Farm equipments and basic infrastructure are among the physical capitals that influence the day to day activities of rural households as producers and consumers. Dulla

(2007) stated that ownership of machinery and equipment enables households to raise labor and land productivity and is especially helpful for households with relatively high opportunity costs for labor, such as those pursuing off-farm employments.

Fertilizer use is used by most studies as a proxy for technology. Literatures on roles of fertilizer in agricultural productivity found that fertilization of farmland can boost agricultural production and Influence the food security status of a household.

Study by Kidane*et al.* (2005) concluded that the shift from non-fertilizer user to fertilizer user increased the probability of food security from 33.8% to 44.3 %, but in the country those who apply fertilizer are insignificant due to their limited purchasing power.

2.7.4. Socio-cultural factors

Education has a tremendous influence on the food security status of households. Educational attainment by the household head could lead to awareness of the possible advantages of modernizing agriculture by means of technological inputs; enable them to read instructions on fertilizer packs and diversification of household incomes which, in turn, would enhance household's food supply (Kidane*et al.*, 2005). Socio-cultural events such as eating habit and food preference, cultural ceremonies and festivals also influence the food security status of the given communities and way of saving or expenditure, also directly or indirectly affects the food security situation of that particular community.

2.7.5. War or conflict

Different literatures revealed that the present day famine in Africa are largely the result of military conflict that arises due to oppressive, unaccountable, and non-participatory governments. The experience of Sudan, Liberia, Ethiopia, Chad, Rwanda, Burundi, and Somalia depicted how war disrupts the normal functioning of the economy, social and political situations (Salih, 1994; Fasil, 2005). According to Getachew (1995), in Ethiopia and in Sudan alone 10 million people were affected by the civil war and estimates prevailed that more than 5 million people died. Regarding resource misallocation, before 1991, in Ethiopia more than 50% of GDP

was spent on the war effort while food security and other economic and social development agendas were neglected (MoFED, 2000; Adane, 2008).

2.7.6. Access to infrastructure

Access to infrastructure such as market center and roads promote livelihood diversification and agriculture intensification. Adequate infrastructure, especially main and feeder roads that improve access to necessary input-fertilizer, seed, pesticide chemicals and other agricultural implements are very indispensable (Osman, 2003).

Although, the current government has made a significant progress particularly in road development, the sector is still weak even compared with the African average. World Bank (2007) reported that due to lack of proper and on time transportation facilities post harvest total production loss reached up to 30%.

2.7.7. Comments on the reviewed literatures

Much of the reviewed literature on household food insecurity concentrated on describing qualitatively and quantitatively the extent of household food insecurity and examining their implications.

Almost all reviewed studies applied logistic regression in modeling relationships between variables. However, the central task of regression analysis: the parameter estimation techniques and variable selection methods were not addressed.

Most of the reviewed model did not check model adequacy, detection and treatment of outliers, influence diagnostics and multicollinearity. Almost all reviewed studies did not examine the effect of factors in discriminating food secure households from food insecure households.

Hence, in this study in addition to the prediction, a model that can identify discrimination factors and coping mechanism on rural households based on the discriminate factors will be used, taking into account the limitations described in the reviewed literature.

CHAPTER THREE: DESCRIPTION OF STUDY AREA,

3.1. Biophysical features

Gambella People's National Regional State (GPNRS) is located at south west Ethiopia between the Geographical coordinates $6^0$28'38" to $8^0$34' North Latitude and 33^0 to $35^0$11'11" East Longitude, which covers an area of about 29,782.82 km^2 about 3% of the nation.

The Region is bounded to the North, North East and East by Oromiya National Regional State, to the South and South east by the Southern Nations and Nationalities People's Regional State and to the Southwest, West and Northwest by the Republic of South Sudan.

The regional capital city is Gambella which is about 767km from Addis Ababa, the capital city of Ethiopia. The region is divided into 3 Ethnic zones (i.e. Nuer Zone, Anywuak Zone and mejenger zone) and 13 administrative Districts that include one special district with 5 indigenous ethnic Groups and many highlanders.

Topography is an integral part of the land surface. It influences soil formation, drainage, runoff, erosion, exposure, accessibility etc. The topography of the Region is divided in to two broad classes, i.e. the Lower Piedmonts between 500 to 1900 masl and the Flood Plains of below 500m contours.

3.2. Demographic & socio –economy

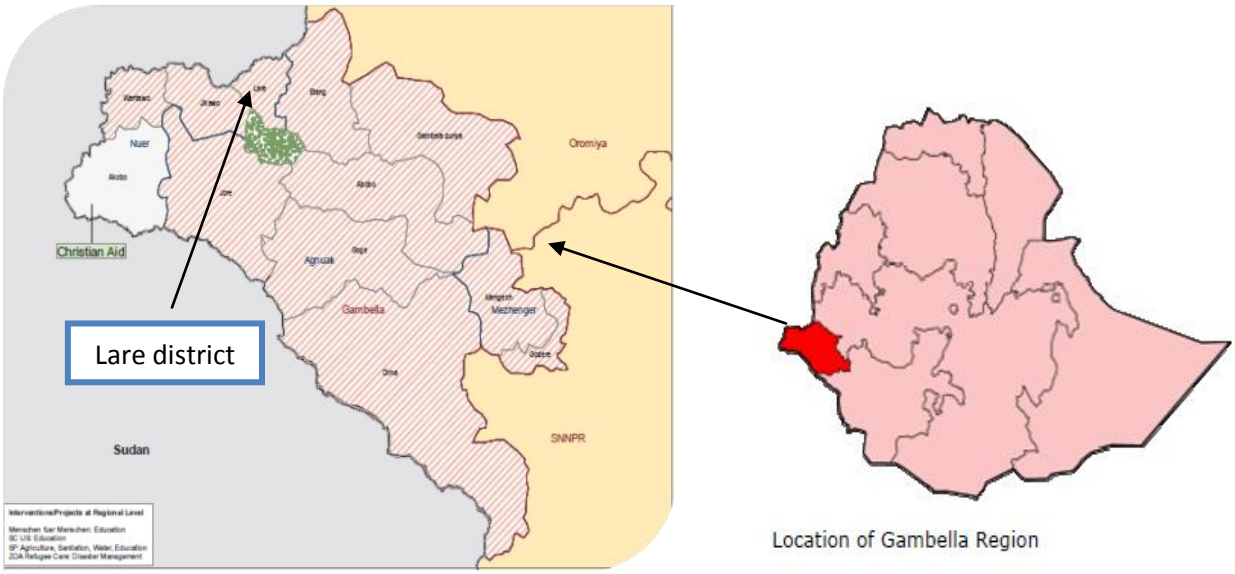
2007 Census showed that the Region has total population of 306,916, consisting of 159,679 men and 147,237 women; urban inhabitants number 77,878 or 25.37% of the population. With an estimated area of 29,782.82 square kilometers, the region has an estimated density of 9.57 people per square kilometer. The average HH of the region is estimated to be 5. The main ethnicities of the region are the Nuer (46.65%), the Anywuak (21.17%), Amhara (8.42%), Kafficho (5%), Oromo (4.83%), Kambaata (1.44%), Mejenger (4%), Shakacho (2.27%), Tigrean (1.32%) and other ethnic groups predominantly from southern Ethiopia were 4.9%

According to CSA (2007), among the population aged 10 years and over, 34.4% are economically inactive and 64.4% were economically active. Based on the distribution of the age, among the male, 73.3% were economically active, while in case of female it is 55.1%.

In all zones, the percent economically active males were higher than females. This is true mainly because housewives are mostly engaged in activities that are not considered economic. As observed from the census data, in rural areas of Gambella region, more active persons were recorded as compared to urban.

In all age groups, the activity rates for rural is higher than urban. Specifically in the age group 10-14 years, the difference was much wider, where the activity rate was 5.9% for urban areas while it is 37.7% for rural areas. The major reasons for such variation was that in the rural areas young children rather than going to school at an early stage, get usually engaged in farm activities such as herding cattle and helping parents in weeding and harvesting.

Figure 1: Map of Gambella region and Administrative Districts



3.3. The climate of the region

The climate of the Region is formed under the influence of the tropical monsoon from the Indian Ocean, which are characterized with high rainfall in the wet period from May to October and has little rainfall during the dry period from November to April. Temperature and rainfall are

important factors in soil formation and range of crops that can grow in a particular environment. For instance, the Godere district has enormous variation in terms of soils, vegetation and crops, because of variations in temperature and rainfall from the rest of the districts of the Region.
The mean annual temperature of the Region varies from 17.30C to 28.30C and annual monthly temperature varies throughout the year from 270C to 330C.

The absolute maximum temperature occurs in mid-March and is about 450C and the absolute minimum temperature occurs in December and is 10.30C. The annual rainfall of the Region in the lower altitudes varies from 900-1,500mm. At higher altitudes it ranges from 1,900-2,100mm. The annual evapo-transpiration in the Gambella reaches about 1,612mm and the maximum value occurs in March and is about 212mm.

3.4. Natural resource base

The region endowed with a vast marginal land which is suitable for agriculture and other economic activities. The existing land cover (vegetation) types of the region are identified as cultivated land, forest land, wood land, bush land, shrub land, grass land, bamboo, wet (marsh land), etc.

The major rivers within Gambella region are the Baro, Alwero, Gilo and Akobo with their tributaries originating from the highlands which have immense potential for diversified seas. The eastern foothills that lie below the main escarpment are between 1,300 and 600mask and the plains to the west of the foothills between 450 to 600masl. Rainfall generally increases with altitude, from 850 mm in the west to over 2,000 mm at the highest parts of the escarpment. Temperature is inversely related to altitude, with mean annual temperatures of 220C to 270C.

Four major soil types are found in the region. Fertile but poorly drained Vertisols covering 47 percent of the Region are found on the low-lying alluvial plains. On the interfluves between the plains are relatively infertile well-drained orthic Acrisols on 14 percent of the area. On the gently sloping foothills below the escarpment are relatively fertile eutric Fluvisols, occasionally with high water tables, with 27 percent of the area. On the escarpment with 11 percent of the area are deep well drained dystric Nitosols of moderate fertility. The natural (i.e. undisturbed) vegetation

patterns are closely related to patterns of rainfall and temperature, with local variations due to soil and drainage factors. In the upper parts of the foothills a mixed broadleaf montane forest occurs, with increasing species diversity to the west. Between 600 and 450masl a lowland forest occurs which has affinities with the Guinea-Congo plant realm. Between about 1,300 and 600 masl a transitional type of forest occurs with species of both the highland and lowland forest types. The woodlands can be divided into the Acacia-Commiphora woodlands in the drier southern lowlands and broadleaf Combretum-Terminalia woodland found in the wetter areas of the western lowlands. The western part of the Region is covered by vast areas of permanent and seasonal swamps.

3.5. Livelihood system of the region (zone)

3.5.1. Mixed agriculture livelihood zone (GMALZ)

Gambella Mixed Agriculture (GMA) livelihood zone is found in Gambella regional state, which is located in the lower and central part of the region. It encompasses districts of Dimma, Gog, Abobo, Itang and Gambella. This livelihood zone economy is based on mixed agriculture (crops and livestock) with some fishing, mining and wild food collection. The topography of area is dominated by flat plain land.

The agro ecology of the area is *kolla*/ lowland. April to October is the rainy season having annual average rain fall 1500-2000 mm and temperature in the range of 24- 44^{o} C. Gold, forest, wild food, game animals and construction stone are natural resources available in the LZ. Maize, sorghum, rice and sweet potato are crops grown for consumption and maize, sorghum and sesame grown for sale. Cattle, goats and sheep are the main livestock reared in the LZ. All households get most of their annual food requirements from their fields. Fish and wild foods make important contributions to food intake, dietary diversity and income. Drought, flood, crop pests and livestock disease are chronic hazards that affect the LZ.

3.5.2. Coffee, Honey and Cereal livelihood zone (GCHLZ)

Gambella, Coffee, Honey and Cereal (GCHC) LZ is one of the livelihood zones located in Gambella region that found in the south west part of region. Godere and Mengeshi- Mejenger are districts located in the LZ. The LZ is isolated from main roads and Mengeshi District is inaccessible during the rainy season and its population density is moderate.

Mixed agriculture is the mainstay dominated by coffee production particularly for settlers but the natives are more involved in honey production in the forests and followed by livestock production. The major economic activities LZ are cultivation of maize, sorghum and enset for consumption and coffee and honey for cash. The GCH LZ is well known for coffee and honey production. Own crop, purchase and wild roots/ fruits are source of foods in the order of importance. The significant annual incomes for all wealth groups come from own crop sale followed by livestock and its product sale and wild fruits which increase across the wealth groups. Its rain fed agriculture and highly potential nature of the area coupled with fertile soil the LZ is a self-sufficient and there is an instance when it is labeled as surplus producing LZ.

3.5.3. Agro -pastoral livelihood zone (GAPLZ)

Gambella Agro- Pastoral livelihood zone (GAPLZ) is located in the western part of the region. It encompasses Itang, Lare, Akobo, and Jikaw, Wanthoa and Jor districts. This agro-pastoral livelihood zone is a low lying plain, and an agro-ecology described as Bereha/extremely hot. The main category of the Livelihood zone agro-pastoral (livestock and crop production), fishing, hunting and wild food collection in which the livelihood of the community depends on. The major economic activities are livestock rearing mainly cattle, goats and sheep, respectively. Crop production (maize and sorghum) both rain fed and recessional cultivation is important.

The main food sources are own crops, purchase and livestock product supplemented by wild fruits, fish, and game meat. Flood (water logging), erratic rainfall and pest infestation are chronic hazards affecting production of the Livelihood zone. Flooding affects livestock grazing land result in movement from river side to upland

The main economic activities in the region are subsistence agriculture, pastoralism and fishing. Recession agriculture is common, particularly maize and sorghum production along the Baro, Gilo and Akobo rivers. As the region is not cereal sufficient, alternative income sources such as fishing are important sources of food. Along the Ethio-Sudanese border, where it is too dry for rain-fed agriculture, livestock constitutes the primary source of income (Sewonet, 2003).

3.6. Pattern of local climate (temperature and precipitation)

The agro- climate of Gambella is fall under Arid, Semi-arid and humid conditions. This region is divided in to two distinct climatic zones including mid altitude and low land areas. The minimum temperature of the low land area is about 15.5oc where as in the eastern highlands is 10 ^{o}c and the extreme maximum temperature in the low land area is about 44.5 ^{o}c whereas in the mid altitude is 23 oc. the mean annual temperature of the low Land area is about 27^{o}c and the annual temperature in the high land areas is about 21^{o}c.

The rainfall is also very variable and is becoming increasingly unpredictable and this trained affect the livelihoods of traditional farmers and agro- pastoralists. The occurrence of rainfall was highly erratic and uneven in its distribution in time and space. The total amount of rain varies greatly from year to year resulting droughts in some years and change of cropping seasons. Moreover, temperatures are high throughout the region and in most of the months in the year (BoARD, 2009).

Rainfall of the region ranges from 800mm-1200mm in low land area. The annual total rain fall recorded about 1200mm-1800mm at mid altitude. Near the equator, location and the altitude varying from 390m to more than 2500 meters above sea level influence a rich variety of local climates, ranging from tropical climate along the Republic of South Sudan boarder to warm temperate and high plateaus on the mountain peaks from the Eastern part of the region

3.6.1. LAND AND WET LAND DEGRADATION

According to BISPP (2001), the main types of land degradation in the region are soil erosion by water in the high land and mild altitude part of the region. Physical degradation of soil involves

leaching of important nutrient (nitrogen and phosphorus). The region is relatively free of soil erosion when compared with Northern Ethiopia and other regions of the country due to the low ling topographic feature of the region.

High temperature and erratic rain fall (flood and drought hazards) causes negative impact on wet land ecosystem of the region. Flood affects wetland by transporting suspended soil particles from the highland areas and silted on the lowland wetlands since the slops of most wetlands nearly flat. This results on reducing in both size and volume of wetland areas. Drought (increasing temperature) is another impact of climate change affecting the wetland areas through evapo-transpiration from the surface of the wetland. This resulted in
Reducing and disturbs the wetland ecosystem.

In all the grass land of the region, forage vegetative growth is seasonal. During the rainy season there is lash and palatable forage almost everywhere in the region. However; during the dry season the abundance, succulence and palatability of the grass species will be reduced except the land closer to banks of rivers and swamps. This leads to reduce the existing quantity and quality of the grass. Fire occurrence, over grazing of green pasture
Around the water body, bush encroachment which reduced grass quality and quantity; in addition it increases contamination and transmission of animal diseases.

3.6.2. WATER STRESS

Water is becoming a scarce resource in most regions in the country because of increased expectations and the rising demand for water due to increasing in temperature. Water demand for both domestic water supply and irrigation is rising at an ever-increasing rate, therefore; both surface and groundwater resources should get increased attention.

In many cases climate change is expected to increase current water stress. The rural and urban water supply coverage in the region is not match with the increased demand. In rural areas, water supply scheme condition is mal-distributed and the non-functional water points exceed the functional water points. According to the water status assessment made in 2000, 56.47% are non-functional while 41.7% are functional from the existing water point (Yeshi- Ber Consult .2003).

3.6.3. ECONOMICS OF THE REGION

Animal husbandry is one of the main economic activities of the western Woreda in the region and also subsistence agricultural farming, traditional fishing, hunting, gathering of wild animals and plants are used as source of living in the rural parts of the region (GRDPPA, 2006).

3.6.4. AGRICULTURE SECTORS

Gambella region is a flood-prone region with the wide range of ecological and socio-economic diversities which influence agriculture. The region used sedentary farming system with erratic rainfall pattern, high incidence of diseases, pests and weeds and flood hazards which causes food insecurity in the region

The agricultural activity of the local farmers was highly depending on rain fed and recession crop production which made the region's economy extremely vulnerable to the effects of weather and climate, which are highly variable both temporally and spatially. Most of the rural population depends on subsistence agriculture for their livelihood and if the rain stops for one season farmers unable to satisfy their needs.

Climate variability and change is likely to intensify the desertification of arable areas. It's also predicted that the humid agro-climatic zones are likely to shift south east ward, rendering areas of the west increasingly unsuitable for agriculture. Crop production is predicted to decline substantially specially for both maize and sorghum rain fed crops, due to increasing temperature and variable rainfall. This climate variability cause shifting of seasonal rain fall and reduce the length of a growing period for both endogenous and adapted crops, which leads to crop growth and yield reduction.

The main environmental issue in the region is land degradation mainly due to soil erosion and deforestation (Merid, no year stated!). Overgrazing is an environmental issue in the livestock dependent areas of the region and as the matter fact that the western part of the region is register

as seasonal food insecure due cattle raiding from cross border south Sudan and some internal conflict that leave them into vulnerable life which drive them to seasonal migrate.

Lare district is one of the 13 districts of Gambella region of Ethiopia. It is located in the western part of the region, It's 85 km from Gambella city, Eastern part of Nuer Zone & jekow district, South-east and Southern part of Itang special district, and at its north is the Republic of South Sudan. Based on figures published by the Central Statistical Agency in 2007, this district has an estimated total population of 32,241 with an estimated area of 685.17 square kilometer. According to estimation made in 2012 by the Central Statistical Agency the district has the total population of 38,985, which shows the rapid growth of population in the district..

Lare district is found in the Agro-pastoral livelihood zone (GAPLZ). This Agro-pastoral livelihood zone is a low lying plain and its agro-ecology is described as **extremely hot (bereha**). The main category of the Agro-pastoral livelihood zone in which the livelihood of community defends on is livestock, crop production, fishing, hunting, and wild food collection.

The major economics activities are livestock rearing mainly cattle, goats and sheep. And also crop production mainly maize and sorghum. The main food sources are own production, purchase and livestock product supplemented by wild fruits, fish and game meat (hunted meat).
Flooding affects livestock grazing land and result in movement from river side to upland
Flood (water logging), recurrent flash flood, erratic rainfall and pest infestation are chronic hazard affecting production of Agro-pastoral livelihood zone in general and lare district in particular.

The district is believed to be one of the chronically and seasonally food insecure areas in the Region. It has been repeatedly exposed to recurrent flash flood hazard, recurrent erratic rainfall, drought and famine and was in fact labeled as the epicenter of the flash flood hazard in the region. The total production is persistently inadequate to cover food requirement of the population. This is mainly due to high population growth, poorly developed infrastructure, flash recurrent flood hazard and drought. Due to such reasons, it has long been a food deficit district with widespread and deepening seasonal food insecurity situation.

CHAPTER FOUR: RESEARCH METHODOLOGY

4.1. Data sources

This study uses both primary and secondary data. The primary data were collected from a sample of rural households head through a structured questionnaire prepared for the study with closed ended and open-ended questions. Information pertaining to the respondents' household demographic, education, off-farm income, farm land size, owned land, livestock ownership, food consumption and expenditure, own milking cows, food aid and the coping mechanisms were collected through self administered structured questionnaires.

Secondary data were extracted from publications, seasonal and annual reports of district disaster prevention and food security agency, District agricultural office and Gambella people's national regional state disaster prevention and food security agency, Regional Disaster Risk Reduction and livelihood recovery program (DRR/LR) coordination office, regional finance and economic development bureau and WFP.

4.2. Sampling Technique and Sample Size

In this study, two stage random sampling procedure was used. At the first stage, 6 kebeles out of 28 kebeles were randomly selected. In the second stage, probability proportional to size sampling technique was employed to draw 120 sampled households from the selected sampled kebeles. A structured survey questionnaire was designed and pre-tested to collect the data. For the purpose, Four enumerators who have diploma of which two have their diploma in Natural resource, one in animal science and one in small scale irrigation and working in the rural area as development agents were selected and trained for two days before the pre-test.

Though the household head is the main respondent, a person who is responsible to prepare meal to the household was also equally important to provide information on the total amount of grains that was consumed as food by their households during cropping season of 2012/13.

The questionnaire tried to encompass information on demographic characteristics, Socio-Economic variable such as, plowing system, uses improved seed, irrigation system, farm land size, , cultivated own land, livestock holding, owning milking cow(s), and coping mechanism used by the households during time of food shortage.

4.3. Methodology and Techniques of data analysis

4.3.1. Methodology

Food security at the household level is best measured by direct survey of income, expenditure, and consumption and comparing it with the minimum subsistence requirement (Von Braun et al, 1992). The government of Ethiopia has set the minimum acceptable weighted average food requirement per adult per day at 2200 kcal (FDRE, 2010/11; cited MOFED March, 2012), which is estimated to be 225kg of food (grain equivalent) per person per year (Aschalew F.2006). But for the study area since 84.2% cultivated two times a year, 14.6% cultivated three times a year and only 2% cultivated one year with special consideration of difference health problem, the estimation were considered to be half of years per person as 112.5kg (grain equivalent). Consequently, a threshold level is set by computing the value of this amount of cereal by the existing local grain stock available for consumption from their own harvest and local market price of grain and the real per capita consumption expenditure is obtained by dividing consumption expenditure by family size instead of adult equivalent (an interim report on poverty analysis study 2010/11 p6 tab 1, cited by MOFED .March, 2012).

The researcher proposed 2200 kcal per adult equivalent (AE) per day to be a cutoff between food-secured and food-insecure households.

The dependent variable which is dichotomous variable which takes value one if household is food secure and zero otherwise, will be measured as follows. Firstly, cereal availability from own production and net transactions will be calculated and will be used to determine calorie availability for each household. Secondly, the medically recommended levels of calories per adult equivalent will be use to determine calorie demand for each household. Thirdly, the difference between calorie availability and calorie demand for households will be use to determine the household's food security status.

Households whose per capita available calories greater than their per capita calorie demand will be regard as food secure and will be assigned a value of 1, while households that will experiences a calorie deficit will be regards as food insecure and will be a assigned a value of 0.

Once the groups are categorized as food-insecure and food-secure, the next step is to identify the demographic and socio-economic factors that are correlated with food-insecurity. It is hypothesized that some farm and household characteristics such as family size, farm land size,

plowing system, on-farm income, non-farm income, having of livestock, number of milking cows, use of improving seed, use of fertilizer, age of household head, number of Family members actively involved etc., have got relative importance in determining whether the households are food secured or not

4.3.2. Techniques of data analysis

Data was analysis by using SPSS version 19,econometrics model and descriptive statistic such as mean, standard deviation, frequency distribution, tables, figure , percentage and chi-square, t-test, odds ratio, likelihood ratio, contingency coefiicience and binary logistic were used to present the result. Econometric model was used to identify determinants of seasonal food insecurity in rural area at household level and copping mechanism used by sampled households.

4.3.3. Econometrics model

Following the modeling of production and consumption behaviors of rural household by Strauss (1983), Barnum and Squire (1979) and Yotopoulos (1983) (cited in Shiferaw, Kilmer and Gladwin, 2003), the extent of household food security found in this study is modeled within the framework of consumer demand and production theories.

Households derive utility from the consumption of foods through the satisfaction found in a set of taste characteristics as well as the health effects of the nutrients consumed.

The model that will be use in this study to determine factors affecting seasonal food insecurity is given below

$$\phi i = E\left(yi = \frac{1}{Xi}\right) = \frac{1}{1+e^{-(\beta 1+\sum_i^k \beta ixi)}} \quad \text{..... (1)}$$

Where: ϕi stand for the probability of household i, being food secure, yi is the observed food security status of household *i*, x_{ij} are factors determining the food security status for household ***i***, and βj stands for parameters to be estimated.

Denoting $\beta + \sum_{j=1}^{k=n} \beta ij$ as z equation 1 can be written to give the probability of household i can be calculated as:

$$\phi i = E\left(yi = \frac{1}{Xi}\right) = \frac{1}{1 + e^{-Zi}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots . (2$$

From equation 2, the probability of a household being food insecure is given by $(1 - \phi i)$ which gives equation 3 which can be written as

$$(1 - \phi i) = \frac{1}{1 + e^{Zi}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Therefore the odd ratio i. e., $\phi i/(1 - \phi i)$ is given by equation 4 as

$$\left(\frac{\phi i}{1-\phi i}\right) = \frac{1+e^{Zi}}{1+e^{-Zi}} = e^{Zi} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

The natural logarithm of equation 4 gives rise to equation 5

$$\ln\left(\frac{\phi i}{1-\phi i}\right) = \beta + \sum_{j=1}^{k=n} \beta ij + \varepsilon i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Rearranging equation 5, with the dependent variable (food security) in log odds, the logistic regression can be manipulated to calculate the conditional probabilities as

$$\phi i = \frac{e^{(\overline{\beta o} + \sum_{i=1}^{k=n} \overline{\beta} jxij)}}{1+e^{(\overline{\beta o} + \sum_{i=1}^{k=n} \overline{\beta} jxij)}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

Once the conditional probabilities are calculated for each sample household the " partial" effect for continuous individual variables on household food security can be calculated by the expression

$$\frac{\partial \phi i}{\partial xij} = \phi i(1 - \phi i)\beta j \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots . (7)$$

The "partial "effects of the discrete variables are calculated by taking the difference of the probabilities estimated when value of the variable is set to 1 and o ($x_i = 0$, $x_i = 1$) respectively

Prior to the estimation of the logistic regression model, the explanatory variables will be checked for the existence of multicolinearity. Variance Inflation Factor (VIF) will be used to measure the degree of linear relationships among the continuous explanatory variables and contingency coefficient will be used to check multicollinearity among discrete variables. Following Gujarati (2004), VIF is defined as:

$$\textbf{VIF (Xj)} = \left(\frac{1}{1-Rj^2}\right) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(8)}$$

Where: Xj = the jth quantitative explanatory variable regressed on the other quantitative explanatory variables; R2j = the coefficient of determination when the variable Xj regressed on the remaining explanatory variables.

If the VIF of a variable exceeds 10, that variable is said to be highly collinear and it can be concluded that multicolinearity is a problem (Gujarati, 2004). The contingency coefficients are computed as follows

$$\mathbf{C} = \sqrt{\frac{x^2}{n+x^2}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(9)}$$

Where, C= coefficient of contingency, x2 = a Chi-square random variable and n = total sample

To estimate head count ratio, food insecurity gap and to assess the severity of household food insecurity the Foster, Greer and Thorbeck (FGT) index is employed. This model is recently used by IFPRI for the analysis of household food insecurity (Hoddinot, 2001).

Several researchers used the FGT model to determine the incidence and severity of poverty and food insecurity (Edilegnaw, 1997; Ayalneh, 2002; MoFED, 2002; Abebaw, 2003; Aschalew, 2006)

The FGT model can be expressed as follows (poverty manual JH, 2005.p68)

$$P(\alpha) = 1/n \quad \sum_{i=0}^{q} [m - yi/m]^{\alpha} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(10)}$$

Where: n is the number of sample households

Yi is the measure per adult equivalent food calorie intake of the i^{th} household

m represent the cutoff between food security and insecurity (expressed in calorie requirement)

q is the number of food insecure households?

α is the weight attached to the severity of food in security.

In equation (10) m - $y_{i=0}$ if yi > m

As far as the weight to α is concerned, Hoddinot (2001) further explained that giving no weight To severity of food insecurity is equivalent to assuming that α = 0. So then, the formula collapse To p (0) = q/n, this is called the head count ratio.

Giving equal weight to the severity of food insecurity among all food insecure households is equivalent to assuming that α = 1. Summing the numerator gives the food insecurity gap; dividing this by m express this figure as a ratio. This index p(1) will provide the possibility to estimate resources required to eliminate food insecurity through proper targeting. That is the product (n*m*p1) gives the total calorie commitment required to bring the food insecure household to given daily calorie requirement level.

Further giving weight to the severity of food insecurity among the most food insecure household is equivalent to assuming that α = 1. The most common approach in poverty literature is to set α = 2 yielding

P (2) =1/n $\sum_{i=0}^{q}[m - yi/m]^2$ ……(11)

Hence p (0) is percentage of food insecure households

P (1) is food insecurity gap

P (2) is the severity of food insecurity.

Moreover, based on the survey data result socio economic characteristic of sampled households were described with respect to food status by employing some descriptive statistics.

4.4. Definitions of variables and working hypothesis

After the analytical procedures are clearly delineated, it had been necessary to identify the potential explanatory variables that would influence household's seasonal food insecurity. Review of literatures, past research findings, experts and author's knowledge of the food insecurity situation were used to identify the potential determinants of household's seasonal food insecurity. Therefore, assigning the household's food insecurity as the dependent variable, some of the common explanatory variables that were expected to influence rural household's seasonal food insecurity in the study area were be categorized into Demographic and socio-Economic variables.

The main socio-economic and demographic characteristics hypothesized to differentiate or discriminate between foods secure and food insecure household in the study area were:

Household Food Insecurity (FODINS): is a dichotomous dependent variable in the model which takes 1 if the household is seasonal food secure, 0 otherwise. Food security status of household is identified by comparing total kilocalorie consumed in the household per adult equivalent per day with daily minimum requirement of 2200 kcal (FDRE, 2010/11. MOFED March, 2012) and those getting 2200kcal and above is food secured and food insecure otherwise.

Independent variables are capture as follow

The following explanatory variables were recognized as the main ones in discriminating between food secured and food insecure.

X_1- Age of household head (AGEHHH) : It was hypothesized to influence food security status positively in that households acquire experience and knowledge in farming and accumulate wealth through time which enable households to be food secured than younger household heads and was defined as the period from his/her birth to time of his/her interview and was measured in years.

X_2–Sex of household heads (SXHHH): Is a dummy variable which take 1 if household head is male, 0 if female. Households headed by males are expected to have better access to maintain Household's seasonal food security than households headed by female.

X_3 –Household size (HHSZ): In the study area, where there is persistent seasonal food insecurity, the expectation is that households with larger number of members will face food insecurity because of high dependency burden. Thus, large family size affects Household's food security situation negatively.

X4-Marital status of household head (MRTSTHHH): Marriage is biological and social engagement to support each other both socially and economically. Marriage is established with a view of helping each other and married people pool their resources and also reduce cost that would have been spent separately. Moreover, married households put aside some of resources for unforeseen circumstances to smoothen their life. In this study marriage and food insecurity are hypothesized to be related negatively.

X_5 – Dependence ratio (DEPRATIO): Household members aged below 15 and above 64 are considered as dependent and dividing it by household members whose age is between 15-64 resulted in dependency ratio. These groups are economically inactive and burden to the other member of household. It is hypothesized that dependence ratio and food insecurity Status of household are positively related.

X_6-Number of family members actively involved (NUMFAMOP) - Number of family member actively involved in farm operation influences the food security status in that households would have enough labor to farm actively to operate timely and sufficiently. Thus, large number of active family member affects household's food security situation positively.

X7- Education level (EDULEVEL): Education is a dummy variable taking a value of 1 if household Head is literate and 0 otherwise. Households with better education level are believed to have a chance to diversify household's income sources and better manage their farm and agricultural. It is hypothesized that Educational level of household head and food insecurity are expected to be related negatively.

X8- Farm land size of a household (FLSZ) : Farm land size is the total land cultivated by household measured in hectares; according to Haile et at.(2010) and babatunde et al (2011) and

other literatures, food production can be increased extensively through expansion of areas under cultivation. It is thus hypothesized that household with larger farm land size are more likely to be food secure than those with smaller farm land size. The expected effect of farm land size on HFS is positive.

X9- Livestock ownership (TLU): Livestock ownership was measured by the number of TLU owned by the household during the study time excluding milking cows. Conversion factors were used in order to change each livestock of a household to its equivalent TLU. Thus it is hypothesized that household with more number of livestock have a chance to cope with food insecurity.

X10- Number of milking cow (NUMLKCOW): livestock as a source of income in the study areas in general are assumed to play big role because of recurrent seasonal food insecurity. In similar manner animal product like milk and butter are also assumed to be a good source of income. Thus, it is hypothesized that household with one and / or more milking cow to have better food security status than without milking cow.

X11 - Use of improved seed (IMPSEED): Improved genetic resource of seeds is essential to increase Agricultural production. A high quality of seeds of improved or indigenous crops adjusting with the ecological and environmental conditions boosts the overall crop production. Use of improved seed is expected to have a positive effect on Household food security.

X12-On-farm income (ONFARMIN): Proceeds from crops in a particular year in birr. Households who are able to generate higher on farm income are supposed to have better food security status than with less on farm income.

X13 - Non-farm income (NONFARMIN): Non-farm and off-income in Birr. Income generated from Non-farm and Off-farm activities individually are treated for different purpose in this document, however, income from both activities by the household members in total are assumed to back household's up to be in a better food security status than from the single activity of income. For this reason amount of income generated from activities other than crop and livestock production, income from own business like; petty trading, home-made drinks, handicraft (weaving, blacksmith etc.) and off-farm like; food- for work, daily laborer etc. are treated in lump-sum incomes from these additional sources.

X14 –Cultivating own land (CULTOWNLAND) : It is hypothesized that those households who cultivate their own land rather than renting out or sharecropping are expected to have better chance of food security status . X16 = 1 if he/she cultivates own land, and 0 otherwise.

X15 – plowing system (PLSYS): It is hypothesized that households who cultivated their land using oxen are food secure than those household using hoe. X19 = 1 if household using oxen and zero if he /she using hoe.

X-16- Irrigation (IRGN): It is a dummy variable in the model taking value 1 if the household uses irrigation, 0 otherwise. Therefore, since irrigation is the key technology to boost the production of the households, many agencies are trying to upgrade the existing traditional irrigation technology. As a result, many households keep on improving their production. With this justification it is hypothesized that irrigation and food insecurity are negatively related in the study area.

Table 1. Demographic variables

Variables	Description	values
AGE HHH (X1)	Age of household head	Years (continuous variable)
SXHHH(X2)	Gender of household head	Dummy variable (0 = female, 1= male)
HHSZE (X3)	Household size	Number (continuous variable)
MRTSTHH (x4)	Marital status of household head	Dummy (1, if married ; 0 otherwise)
DEPRATIO (X5)	dependence ratio	Number (continuous variable)
NUMFAMOF (X6)	Number of Family members actively involved in activities	Number (continuous variable)

Table 2. Socio – Economic Variable

Variables	Description	values
EDUCLEVEL(X7)	Educational level of	Dummy variable (1 = literate , 0 = illiterate)

	household head	
FLSZ (X8)	Farm land size of household	Hectare (continuous variable)
TLU (X9)	Livestock holding (excluding milking cows)	TLU (continuous variable)
NUMLKCOW (X10)	Number of milking cow	Number(continuous variable)
IMPSEED (X 11)	Use of improved Seeds	Dummy variable (1 = yes , 0 = No)
ONFMIN(X12)	On-farm income	Quintal/ KG or Birr (continuous)
NONFMIN (X13)	Non-farm income	Birr (continuous)
CULTOWN(X14)	Cultivating own land	Dummy variable (1= cultivating own land 0 otherwise)
PLSYS (X15)	Plowing system	Dummy variable (1= oxen, 0= hoe)
Irrigation (x16)	Irrigation system	Dummy variable(1=yes, 0=no)

CHAPTER FIVE: RESULTS AND DISCUSION

The survey results are presented in two categories as a descriptive and econometrics model analysis of the survey data. Descriptive statistic such as, mean, standard deviation, tables, figures percentage, frequency distribution and chi- square were used and binary logistic, econometric model was used to identify determinants of seasonal food insecurity at household level and copping mechanism used by sampled household .

5.1. Demographic and Socio Economic Characteristic

Demographic and Socio- economic characteristic of sampled households by sex, age, household size, education level, marital status, farm land size, livestock holding, number of milking owning, use of improved seed, on farm income, off-farm income, cultivating own land and irrigation system are summarized in relation to the food security status at household level.

Possible explanation on factors supposed to have contribution on household seasonal food insecurity is also presented from analysis of model output.

5.1.1. Sex and Age composition of sampled household

The summary of basic household characteristics for the 120 sampled household indicated a total size of household members of 906 peoples, where females accounted for about 517(57%) and male account for about 389(42.9%). The percentage of male and female in each category followed similar pattern where age group of 8 - 14 are found to be the largest as compared to other age groups. Age group of sampled households showed children age 0-14 consisted 40.1 percent, age group 15- 64, 54.9 percent and old age above 64 years of age amount to 5.0 percent. Over all dependency ratio, defined as the ratio of people age from 0-14 and above 64 divided by those people aged 15-64 (Table 3)

Table 3. Characteristic of household by Sex and Age

Sex	**Frequency**			**Percent**
Male	389			42.9
Female	517			57.1
Total	**906**			**100.0**
Age Group	**male**	**female**	**Frequency**	**Percent**
0-7	34	74	108	11.9
8-14	119	136	255	28.2
15-25	93	145	238	26.3
26-45	109	88	197	21.7
46-64	21	42	63	6.9
Above 64	13	32	45	5.0
Total	**389**	**517**	**906**	**100.0**

Source: survey result in 2013

5.1.2. Characteristic of sampled household by headship

Female as household head comprise 42.5 percent of sampled households while, the majority that is 57.5 percent were male head household. The sampled household head whose age group is below 29 comprise 9.2 percent; sampled household head whose age group is between 30-64 are 85.8 percent and old age above 64 years account for 5 percent. Mean number of household size, age of household heads in years and dependency ratio of sampled household were found to be 5.6, 42.38 and 0.82 respectively.

Mean family size of sampled household were found to be higher in male headed households whereas mean household head age and dependency ratio were higher in female headed sample households. 48.3 percent of male headed households had household size number below eleven and above two while 36.6 percent of female headed household had the same size of household. 7.4 percent of male headed household had more than eleven members of household and less than sixteen where as female headed households had only 5.9 percent in that range. 1.7 percent of male headed household had family size above sixteen where as no female headed household had that range.

Therefore male headed households in each group had greater percentage of family size (Table 4). This may be due to the fact that people in study area practice polygamy or married two or more wives, this may be the reason why male head household had more family size than female headed households.

Table 4. Descriptive characteristics of households by headship

Characteristics	**Male headed household**	**Female headed household**	**All households**
Mean household size	5.8	5.4	5.6
Mean age of head	42.27	42.49	42.38
Dependency ratio	0.74	0.88	0.82
HH size group	male	female	Total
1-2 person(s)	0(0.00%)	0(0.00%)	0(0.00%)
3 - 4 persons	6(5%)	4(3.3%)	10(8.3%)
5 - 6 persons	22(18.3%)	19(15.83%)	41(34.2%)
7 - 8 persons	24(20%)	17(14.2)	41(34.2%)
9 - 10 persons	6(5%)	4(3.3%)	10(8.3%)
11 - 12persons	7(5.8%)	3(2.5%)	10(8.3%)
13 – 14 persons	1(0.8%)	2(1.7%)	3(2.5%)
15 – 16 persons	1(0.8%)	2(1.7%)	3(2.5%)
More than 16	2(1.7%)	0(0.00%)	2(1.7%)
Total	**69(57.4%)**	**51(42.6%)**	**120(100.0%)**

Source: survey result in 2013 NB: Numbers in bracket are percentages

5.1.3. Household food security status and household size

It was hypothesized that family size has positive relationship with seasonal food insecurity status of household. The survey result revealed that 16 percent of food secure households have family size of 1-4 whereas 6.3 percent of food insecure households have the same family size. 72.6 percent of food insecure and 52 percent of food secure households have family size of 5-8 persons.

Household with large family size are more likely to be at risk of becoming food insecure. The survey result indicated that there is significant difference in mean family size at less than one

percent probability level between food secure and food insecure in sampled households. The mean household size for food insecure and food secure households was found to be 1.05 and 4 respectively. The minimum and maximum family size of sampled households is 3 to 23 persons (Table 5)

Table 5. Household food security status by household size

Family size group	**Seasonal Food secure(N=23)**	**Seasonal food insecure(N=97)**	**Total (N=120)**
	percent	percent	percent
1-4	17.4	6.3	8.3
5-8	52.0	72.6	68.3
9-12	32.0	12.6	16.7
13-18	0.00	7.4	5.8
≥ 19	0.00	1.1	0.8
Total	**100.0**	**100.0**	**100.0**
Mean	4	1.05	0.83
Minimum			**3**
maximum			**23**
p-value	**0.00**		

* Significance at less than 1 percent probability level

Source: survey result

5.1.4. Household food security status and sex of household head

Sex of household head was hypothesized to be one of the variables that make a difference on the level of food security. Female headed households accounted for about 42.5 percent of the sampled households while male headed household head accounted for 57.5 percent in sampled household. The survey result indicated that 49.5 percent of food insecure households were female headed whereas, the corresponding figure for male headed households was 50.5 percent. Male headed households comprise 84.0 percent of food secure and remaining 16 percent food secure are female headed households.

The survey result showed no significant difference (p>0.10) on food security status of household in term of household head sex (table 6).

Table 6. Household food security by sex of household head

Household head	Food secure(N=23)	Food insecure(N=97)	Total (N=120)	χ^2
	percent	percent	percent	
Male	84.0	50.5	57.5	1.229[a]
Female	16.0	49.5	42.5	
Total	**100.0**	**100.0**	**100.0**	
p.value = 0.873		df =4		

Source: survey result in 2013

5.1.5. Household food security status and marital status

Marital status of sampled household heads indicated that married, divorced and widowed household head accounted for about 75, 1.7 and 23.3 percent respectively. 88.0, 4.0 and 8.0 percent of married , divorced and widowed were found to be food secure whereas, food insecure household consisted of married (71.6%) , divorced (1.1%) and widowed (27.3%)The result of the survey showed significant relationship at one percent probability level among the marital status with respect to household food security status (Table 7).

Table 7. Household Food security by marital status of household head

Marital status	Food secure (N=23)	Food insecure(N=97)	Total(N=120)	χ^2
	percent	percent	percent	
Married	**88.0**	**71.6**	**75.0**	**46.116[a]**
Divorced	**4.0**	**1.1**	**1.7**	
widowed	**8.0**	**27.3**	**23.3**	
Total	**100.0**	**100.0**	**100.0**	
p.vale = 0.00	**df = 6**			

Source: survey result

5.1.6. Household food security status and education of household head

It was hypothesis that household food insecurity and education of household head has negative relationship. Categorization of household head as literate and illiterate exhibited that 23.3 percent of household heads were literate and 76.7 percent of household heads were illiterate. Among literate household heads 20.0 percent were found to be food secure and out of 92 illiterate household heads 75.8 percent were food insecure. The survey result showed insignificant relationship between educational level of household head and household seasonal food security status (Table 8). This may because illiterate people put their entire life on looking for cattle and cultivate their own land whereas literate people engage partially on all these.

Table 8. Household food security by educational status of household head

Education	Food secure (N=23)	Food insecure (N=97)	Total (N=120)	χ^2
	Percent	Percent	Percent	2.025[a]
Literate	20.0	24.2	23.3	
Illiterate	80.0	75.8	76.7	
Total	**100.0**	**100.0**	**100.0**	
	p.value = 0.567	**df = 3**		

Source: survey result (2013)

5.1.7. Household food security status by household members actively participant in activities

It was hypothesized that the large number of household members actively involved in activities affects the food security status of household positively. The survey result indicated that 20 percent of foods secure households have family size of 1-2 persons who actively participant in activities and 24.2 percent of food insecure where as the household who have 3 – 4 persons actively participated in activities have 32 percent food secure households and 41 percent food insecure households. The higher percent of food secure household is 36 percent which is 5 – 6 persons in household who actively involved in activities. The survey result showed that as the number persons who make work done increase the household will be more food secure. The result of the survey showed a significant difference among household members actively participant in activities and food security status at 5 percent probability level (table 9).

Table 9. Household food security status by household members actively participant in activities

HH member actively participant in activities	**Food secure(N=23)**	**Food insecure(N=97)**	**Total (N=120)**	**$\chi 2$**
	percent	percent	percent	43.564[a]
1-2	20.0	24.2	23.3	
3-4	32.0	41.1	39.2	
5-6	36.0	24.2	26.7	
7-8	8.0	7.4	7.5	
10-11	4.0	12.0	3.3	
>11	0.00	0.00	0.00	
Total	**100.0**	**100.0**	**100.0**	
	p.value = 0.023	**df = 27**		

Source: survey result

5.1.8. Household food security status & farm land size and cultivated size by sampled household in 2012/13 cropping season.

Crop production requires primarily the availability of suitable cultivable land. Table 8 presents the distribution of the farm land size. The total farm land size of sampled household ranged from 0.5 to 1ha. The average land size of the sampled household is 0.75ha with standard deviation of 0.87ha. This average farm land size had small different with average cultivated land size, this is due to shifting of two persons from the land size of 0.75 ha to cultivates land size of 0.5ha. The reason may be due to health problem. Both farm land size and cultivated land size are below the national recommended average land size per household which is 1.53 (Yilma M. 2005), which is said to be sufficient to produce household food requirement.

The mean comparison of farm land size is 0.75and mean cultivated land size is 0.75 but the different is shifting cultivation of some households from large land size to cultivated small land size. The survey result showed that 52.2 percent of food security household owning land size of 0.75ha and 30.4 percent of food secure household own land size less than 1ha. Comparing food security and food insecurity, the households having land size equal to 0.75ha and greater than 1ha is less likely to food insecure than household having land size less or equal to 0.5 ha. This result support the hypothesis that farmers who have larger cultivated land size are more likely to be food secure than those who cultivated smaller land size due to the fact that there is high possibility to produce more food. The survey result revealed that there was significant relationship among household food security status and farm land size and cultivated land size at 5 percent probability level (Table 10)

Table 10. Household food security status by farm land size & cultivated size sampled household head in 2012/13 cropping season

Farm land size in hectare	**Food secure(N=23)**		**Food insecure(N=97)**		**Total (N=120)**	**$\chi 2$**
	frequency	percent	frequency	percent	percent	17.029
≤ 0.5 ha	4	17.4	39	40.2	43.0	
0.75ha	12	52.2	41	42.3	53.0	
≥1ha	7	30.4	17	17.5	24.0	
Total	**23**	**100.0**	**97**	**100.0**	**100.0**	
Cultivated land size in ha				**P .value=0.035**	**df=9**	**$\chi 2$**
≤ 0.5 ha	**4**	17.4	**41**	42.3	37.5	**16.101**
0.75ha	**12**	52.2	**41**	42.3	44.2	
≥ 1ha	**7**	30.4	**15**	15.4	18.3	
Total	**23**	**100.0**	**97**	**100.0**	**100.0**	
Mean = 0.75				**p.value = 0.041**	**df = 8**	
St. deviation = 0.87						

**** Significant at less than 5% probability level**

Source: survey result

5.1.9. Household food security status, ownership of livestock and respective share among the sampled households.

Livestock production plays an important role in household economics in difference ways, e.g. as a source of cash income and as a source of supplementary food. Beside, livestock are considered as a mean of food security and means of coping mechanism during crop failure. Livestock provide milk, meat, fuel and manure. 81.7 percent of sampled household own livestock and 18.3 percent of sampled household didn't owned livestock. Livestock that are owned by 81.7 percent of sampled household include cattle, sheep, goat and chickens are 2,769 in number. Out of this, 51.8 percent, 14.7 percent, 13.5 percent and 20.0 percent were cattle, goats, sheep and chickens respectively. The percent share of cattle is larger than any of the other types of livestock among the sample households.

This signifies the importance of cattle in that particular are of study for purpose of milk and other products , apart the culture of that particular community admit having more cattle than others livestock as a mean of storing wealth and as protection mechanism of any risk or control of food shortage during time of stress. The survey results reveal a significance difference among ownership of livestock and food security status of household at 5 percent probability level. (Table 11)

Table 11. Household food security status, ownership of livestock and respective shares among sampled household

Owner ship of livestock	**frequency**	**percent**	**Food secure(N=23)**	**Food insecure (N=97)**
			percent	**percent**
Yes	98	81.7	87.0	81.7
No	22	18.3	13.0	18.3
Total	**120**	**100.0**	**100.0**	**100.0**
Livestock type	**frequency**	**percent**	**p.value = 0.028**	**$\chi 2$ = 6.695**
Cattle	1435	51.8		
goat	408	14.7		df = 3
sheep	373	13.5		
chicken	553	20.0		
Total	**2,769**	**100.0**		

Source: -Survey result

5.1.10. Household food security status and ownership of milking cows by household.

Milking cows as source of income in daily based, it was believed that household with one and / or more milking cows were better food secure than those without milking cows. The survey result showed that 27.5 percent of sampled households have 1 – 2 milking cows, 19.2 percent of sampled households have 3- 4 milking cows, 16.7 percent of sampled households have 5 – 6 milking cows, 5 percent of sampled households have 9 – 12 milking cows, 2.5 percent of sampled households have 20 – 30 milking cows and 0.8 percent of sampled households have 31

– 50 milking. In term of wealth, household with more milking cows were more wealthier than others, but since food secure is measure in term stock harvest from field and based entirely on consumption from own harvest of sampled households.

The more wealthy households' consumption were categories on purchase of grains as a result they are consider as food insecure. The survey result revealed that 26.1 percents of food secure in sampled household owned 1-2 milking cows whereas 27.8 percents of food insecure in sampled household owned similar milking cows, 26.1 percent of food secure of sampled households owned 3 – 4 milking cows whereas 17.5 percent of food insecure sampled households owned the same, 21.7 percent of food secure household owned 5 – 6 milking cows, likewise 15.5percent of food insecure sampled households own the same and 8.7 percent of food secure sampled households owned 9-12 milking cows likewise 4.1 percent of food insecure sampled households owned the same. The survey showed that there is significant relationship between owned milking cows and food security status of household at 1 percent probability level (Table 12)

Table 12. Household food security status by ownership of milking cows by household.

Ownership of milking cows by hhh in 2012			**Food secure(N=23)**	**Food insecure(N=97)**	**Total (N=120)**	**$\chi 2$**
	frequency	**percent**	percent	percent	percent	45.596
1 - 2	33	27.5	26.1	27.8	27.5	
3 - 4	23	19.2	26.1	17.5	19.2	
5 - 6	20	16.7	21.7	15.5	16.7	
7 - 8	0	0.0	0	0.00	0.00	
9 - 12	6	5.0	8.7	4.1	5.0	
13 - 19	0	0.00	0	0.00	0.00	
20 - 30	3	2.5	4.3	2.1	2.5	
31 - 50	1	0.8	0.00	1.0	0.8	
No response	34	28.3	13.0	32.0	28.3	
Total	**120**	**100.0**	**100.0**	**100.0**	**100.0**	
			p.value = 0.005	**df = 24**		

Source: survey result (2013)

5.1.11. Household food security status and use of improved seed by sampled household

The survey result showed that 30 percent in sampled households used improved seed whereas 70 percent of sampled households didn't used improved seed. Comparing two groups from food secure and food insecure status, 13 percent of food secure sampled households used improved seed whereas 34 percent of food insecure sampled households used improved seed, 87 percent of food secure sampled household did not used improved seed on farm whereas 66 percent of food insecure sampled household did not used improved seed. The chi- square shows insignificance relationship between used of improved seed and food security status of household (Table 13)

Table 13. Household food security status by use of improved seed by household.

Improved seed			**Food secure(N=23)**	**Food insecure(N=97)**	**Total (N=120)**	**χ2**
	frequency	**percent**	percent	percent	percent	5.091[a]
Yes	36	30.0	13.0	34.0	30.0	
No	84	70.0	87.0	66.0	70.0	
Total	**120**	**100.0**	**100.0**	**100.0**	**100.0**	
			p.value = 0.165	**df = 3**		

Source: survey result (2013)

5.1.12. Household food security status and expenditure per household in 2012/13 cropping season.

The survey result revealed that 23.3 percent of sampled households consumed 300kg -400 kg per household per six months, in term of birr is 1800 to 2400 birr, 54.2 percents of sampled households consumed 500kg – 600kg per household per six months, in birr is 3000 to 3600 birr and 22.5 percent of sampled household consumed 700kg – 800kg per household per a six month, in birr is 4200 to 4800 birr. 8.7 percents of food secured households consumed 300kg – 400kg per household per six months whereas 26.8 percent of food insecure sampled households consumed the same amount. 56.5percents of food secure sampled households consumed 500kg – 600kg per household per a year likewise 53.6 percent of food insecure sampled households consumed the same amount per household per six months and 34.8 percents of food secure sampled households consumed 700kg – 800kg per household per six months likewise 19.5

percent of food insecure sampled households consumed the same amount per household per six months. The survey result revealed significance relationship between household expenditure and food security status at 5 percent probability level (Table 14).

Table 14. Household food security status by Expenditure per household in 2012.

Expenditure per household in 2012			**Food secure(N=23)**	**Food insecure(N=97)**	**Total (N=120)**	**χ2**
	frequency	**percent**	percent	percent	percent	13.270
300kg – 400kg	28	23.3	8.7	26.8	23.3	
500kg – 600kg	65	54.2	56.5	53.6	54.2	
700kg – 800kg	27	22.5	34.8	19.6	22.5	
Total	**120**	**100.0**	**100.0**	**100.0**	**100.0**	
			p.value =0.039	**df = 6**		

Source: survey result (2013)

NB: 100kg =1quintal, 1quintal = 600birr therefore, 3quintal = 1, 800birr, 4 quintal = 2,400birr. Hence the minimum & maximum expenditure on food are 1,800 and 4800 birr per year per household

5.1.13. Household food security status and irrigation

The table below showed the distribution of sampled households' status by use of irrigation. In the survey it was observed that 15.8 percent of sampled households said that they were used irrigation whereas 83.4 in sampled households said that were not used irrigation. To compare the two sampled groups, 16.5 percent of food insecure household said that they were used irrigation while 82.5 of food insecure households said that they were not used irrigation.

Whereas in the corresponding food secure households 13 percent said that they were used irrigation and 87 percent of food secure households said that they were not used irrigation. Though such difference was observed between the groups, but the irrigation system that they were used was hand irrigation system, which is more traditional and they were practiced in water reserve area where part of the land is wet. The survey result exhibited no significant statistically.

The result of survey showed that there is no systematic relationship between food insecurity and use of irrigation (table 15).

Table 15. Household food security status and irrigation used by sampled household.

Uses irrigation			**Food secure(N=23)**	**Food insecure(N=97)**	**Total (N=120)**	**χ2**
	frequency	**percent**	percent	percent	percent	3.041
Yes	19	15.8	13.0	16.5	15.8	
No	100	83.4	87	82.5	83.4	
No response	1	0.8	0.0	1.0	0.8	
Total	**120**	**100.0**	**100.0**	**100.0**	**100.0**	
			p.value = 0.804	**df = 6**		

Source: survey result (2013)

5.1.14. Household food security status and Frequency of planting per a year and crop types planted by sampled household in 2012 cropping season.

The survey result showed that 1.7 percent of sampled households said that they planted one a year, 84.2 percents of sampled households said that they planted two times a year and 14.1 percent of sampled household said that they planted three times a year. Comparing food security status of sampled households with frequency of planting, we can see that 2.1 percent of food insecure of sampled households planted one time a year whereas 82.6 percent of food secures sampled households and 84.5 percents of food insecure sampled households planted two times a year. 14.1 percent of food secures sampled household and 13.4 percent of food insecure of sampled households planted three times.

The survey result on crops types planted indicated that 82.5 percents of sampled households planted maize,3.3 percent of sampled households planted maize, pumpkins and bean, 5 percent of sampled households planted maize ,bean and sweet potatoes whereas 9.2 percent of sampled households planted only maize and sorghum.

Comparing food security status of sampled households with the crops types planted. The survey result showed that 65.2 percents of food secure sampled household and 86.6 percent of food

insecure of sampled households planted only maize, 4.4 percent of food secure sample household and 3.1 percents of food insecure of sampled households planted maize pumpkin and bean, 8.7 percents of food secure and 4.1 percent of food insecure of sampled households planted maize, bean and sweet potatoes whereas 21.7 percent of food secure and 6.2 percent of food insecure sampled households planted only maize and sorghum. The survey result reveal that there is significant relationship among households who planted three times a year and planted difference variety of crops with food security status of sampled household, but chi- square showed insignificants relationship among them (table 16)

Table 16. Household food security by frequency of planted per a year and crop types planted by sampled household in 2012 cropping season

Planting per a year			**Food secure(N=23)**	**Food insecure(N=97)**	**Total (N=120)**	**$\chi 2$**
	frequency	**percent**	percent	percent	percent	1.360
One time	2	1.7	0.00	2.1	1.7	
Two times	101	84.2	82.6	84.5	84.2	
Three times	17	14.1	17.4	13.4	14.1	
Total	**120**	**100.0**	**100.0**	**100.0**	**100.0**	
Crops types planted in 2012				**p.value =0.968**	**df=6**	
Maize	99	82.5	65.2	86.6	82.5	12.144
Maize, pumpkin & bean	4	3.3	4.4	3.1	3.3	P=0.205
Maize bean & sweet potatoes	6	5.0	8.7	4.1	5.0	Df=9
Maize & sorghum	11	9.2	21.7	6.2	9.2	
Total	**120**	**100.0**	**100.0**	**100.0**	**100.0**	

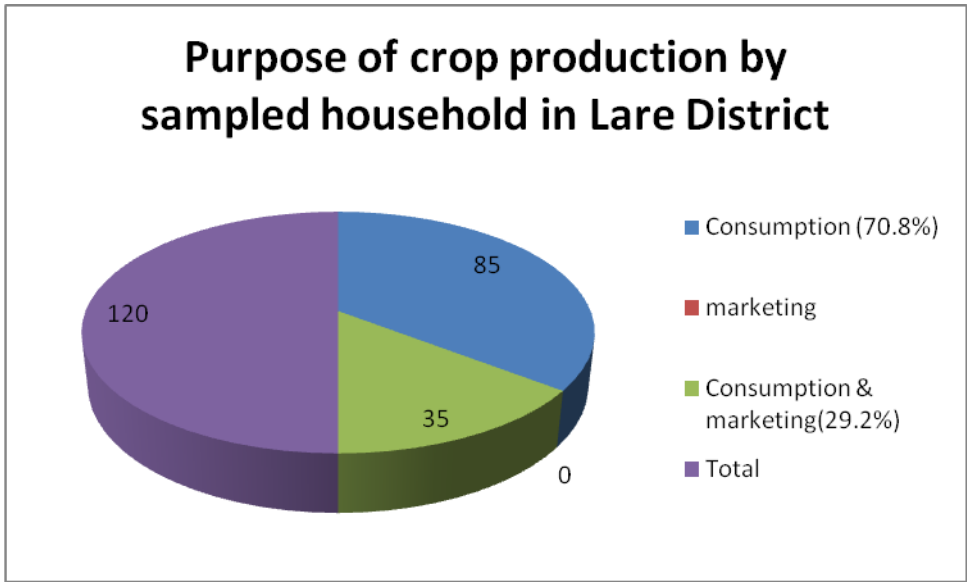
Source: survey result 2013

5.1.15. Purpose of crop production

As shown in the figure 2, 70.8 percent of sampled households said that they produce crops for consumptions whereas 29.2 percent of sampled household said they produce crops for both consumption and marketing. The survey result revealed that most of sampled households

cultivated for consumption. This may be due to large family size for those who cultivated crop for consumption and lack of awareness of market availability. The possible explanation is that most households in sampled households' uses subsistence cropping system which mean they produce crop simply to consume and no serving, this made them vulnerable to seasonal food insecurity.

Figure 2. Purpose of crop production by sample household



NB: the series apart is "sources of total sampled household income" point total value 120(50%).

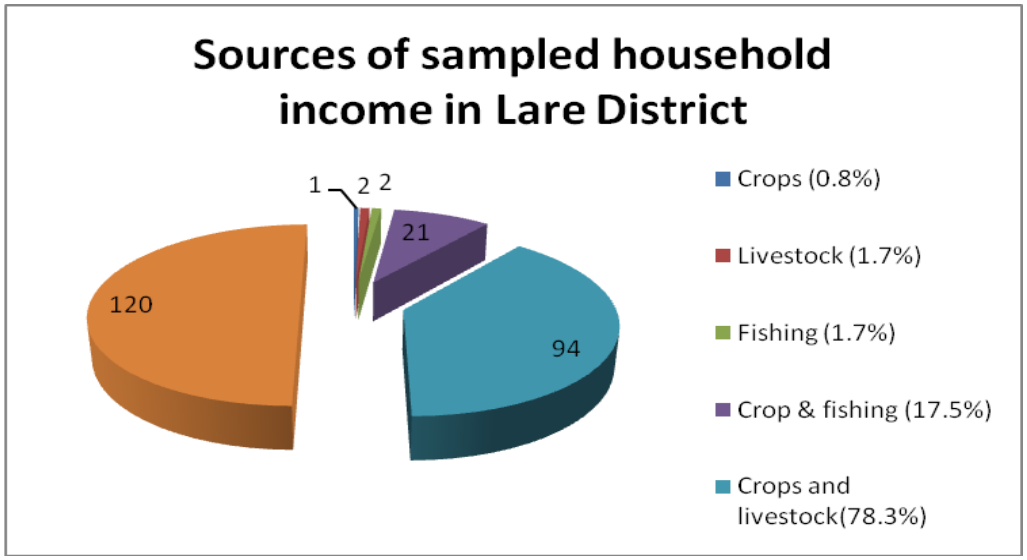
5.1.16. Sources income of sampled household

Figure 3 Showed that 0.8 percent of sampled households said that they got their income from crop, 1.7 percent of sampled household said that they got their income from livestock, 1.7 percent of sampled households said that they got their income from fishing, 17.5 percent of sampled household said that they got their income from both crop and fishing and 78.3 percent of sampled households said that they got their from both crops and livestock. This figure demonstrated that the highest number of sampled households said that they got their income from both crops and livestock whereas the second highest number of sampled households said that they got their income from both crop and fishing.

The reason why many respondents said that they got their income from both crops and livestock may be because the most important household asset and mean of livelihoods for most people in the study area is livestock. Livestock are main source of cash income, food as well as foundation

of prestige and power in the study area. The reason why second large groups of peoples said that they got their income from both crops and fishing may be because the sampled population dwell along river bank (baro) for their entire life, hence in absent of having livestock they prepared fishing instead. The survey result on the figure below demonstrated that largest number of people in sampled household had their sources of income from crops production and livestock rearing.

Figure 3. Source of income



NB: the series apart is "sources of total sampled household income" point total value 120(50%).

5.1.17. Expenditure of sampled households' based on sources of income in lare district in 2012 cropping season.

Household income has a paramount importance in achieving household food security especially in rural area where people depend entirely on agriculture production rather than monthly/daily earning like people in urban areas. Households in rural areas usually allocated their harvested grain/ crop produced to meet food needs of their family. The sampled households were asked on the quantity and value of food they consumed for last year from their own harvest/crop produced, from purchase, from food aid and gift and also food they consumed from both owned harvest/ crop produced and purchase, food they consumed from own harvest, purchase and gifts/ food aid. However the results of respondents were demonstrated in the table 16.

The survey result revealed that 19.2 percent of sampled households said that they consumed from their own harvest/ crop they produced for whole year, 1.7 percent of sampled households

consumed said that they consumed from purchase only, 1.7 percent of sampled households said that they consumed from food aid, remittance/gifts, 66.6 percents of sampled households said that they consumed from own harvest and purchase whereas 10.8 percent of sampled household said that they consumed from own harvest/ crop they produced, purchase and food aid, remittance/ gifts.

Comparing the food security status of sampled household and expenditure per households per six months, this showed that 100 percent of food secure sampled households consumed their own harvest/crop produced in their field per household per six months, 1.7 percent of food insecure household consumed from purchase, 1.7 percent of food insecure sampled households consumed from food aid, remittance/gifts, 66.6 percent of food insecure sampled households consumed from both own harvest and purchase whereas 10.8 percent of food insecure sampled household consumed from own harvest, purchase, and food aid, remittance/gifts. The survey result exhibit that there is significant relationship between food security status of household and expenditure of household at 5% significant level (table 17)

Table 17. Expenditure of sampled households based on sources of income in Lare District in 2012 cropping season.

Expenditure based on sources of income in 2012		**Food secure (N=23)**	**Food insecure (N=97)**	**Total (N=120)**
	Frequency	**percent**	**percent**	**percent**
Food consumed from own harvest	23	100.0	0.00	19.2
Food consumed from purchase	2	0.00	1.7	1.7
Food consumed from food aid & gift	2	0.00	1.7	1.7
Food consumed from own harvest and purchase	80	0.00	66.6	66.6
Food consumed from own harvest , purchase & gift	13	0.00	10.8	10.8
Total	**120**	**100.0**	**100.0**	**100.0**
p.value = 0.039 df=6				**$\chi 2$ =13.270**

Source: survey result (2013)

5.1.18. Duration of food from own harvest, Food from own harvest in kg and expenditure per year in kg.

The survey result in table 16 below, compare food duration from own harvest and food consumed from own harvest with the expenditure of household per six months. As demonstrated in the table 16, 33 percent of sampled households said that they consumed food from their own harvest for 2-3 months, 44.2 percent of sampled households said that they consumed food from their own harvest for 4-5 months, 19.2 percent of sampled household said that they consume food from their own harvest/production for six months and above whereas 3.3 percent of sampled household give no respond.

On consumption habit from own harvest/production 3.17 percent of sampled household said that they consumed 100kg – 200kg, 41.7 percent of sampled households said that they consumed 300kg- 400kg, 18.3 percent of sampled household said that they consumed 500kg – 600kg and 5.8 percent of sampled households said that they consumed 700kg -800kg.

As indicated in expenditure per household per six months.15 percent of sampled households said that they consumed 300kg -400kg per household per six months, 62.5 percent of sampled household said that they consumed 500kg – 600kg and 22.5 percent of sampled households said that they consumed 700kg – 800kg per household per six months.

Comparing yearly expenditure and consumption from their own harvest/production, we can conclude that those households who produce 100kg – 200kg from their own harvest/ production are food insecure because when we compare their six month expenditure and their income no household whose yearly expenditure fall between 100kg to 200kg. 8.7 percent of food secured sampled households and 26.8 percent of food insecure sampled household their expenditure per household per six months fall between 300kg – 400kg. 60.9percent of food secure of sampled household and 52.6 percent food insecure of sample households their expenditure per household per six months fall between 500kg – 6ookg, whereas 30.4 percent of food secure sampled household and 20.6 percent of food insecure sampled households their expenditure per household per six months fall between 700kg – 800kg. the survey result showed that those who produced/harvested more crops on their field are more food secure than those who harvested less(Table 18).

Table 18. Food duration from own harvest/ production, amount of food from own harvest in kg and expenditure per household per six months.

Food duration from own harvest in 2012	**Frequency**	**percent**		
2 - 3 months	**40**	**33.3**		
4 – 5 months	53	44.2		
Six months and above	23	19.2		
No response	4	3.3		
Total	**120**	**100.0**		
		Total percent (N=120)	**Food secure(N=23)**	**Food insecure(N=97)**
Food consumed from own harvest in 2012			**percent**	**percent**
100kg – 200kg	38	31.7	0.00	39.2
300kg – 400kg	50	41.7	8.7	49.5
5ookg – 600kg	22	18.3	56.5	9.3
700kg – 800 kg	7	5.8	30.4	0.00
No response	**3**	**2.5**	**4.4**	**2.1**
Total	**120**	**100.0**	**100.0**	**100.0**
Expenditure per household per a year.				
300kg – 400kg	**28**	**23.3**	**8.7**	**26.8**
500kg – 600kg	**65**	**54.2**	**60.9**	**52.6**
700kg – 800kg	**27**	**22.5**	**30.4**	**20.6**
Total	**120**	**100.0**	**100.0**	**100.0**

Source: survey result (2013)

5.1.19. Seasonal food insecurity for last five years.

The survey result revealed that, 89.2 percent of sampled households said there was seasonal food insecurity for last five years whereas 13 percent of sample households said that there was no seasonal food insecurity for last five years on their household bases.

Comparing two groups in term of frequency and percent, we can reason out that seasonal food insecurity prevails in this particular area for last five years. The report from regional disaster prevention and food security agency indicated that WFP provided food aid to Lare distric for

last consecutive five years as well as others districts in the region taking into consideration the months rural communities face the food shortage.

According to report, Lare district was given regular food aid on months of food shortage since 2008 upto present time. The provision was given was 685quintals of maize to 475 households in 2008, 618 quintal of wheat to 518 households in 2009, and 1620 quintals of maize to 445 households in 2010, 765 quintal of maize to 253 households in 2011 and 1187 quintal of maize to 748 households in 2012. They reported that in 2012 they give food to 245 households in 11 kebeles, which were affected and lost their property by flash flood during September of 2012. The survey result showed that rural communities in lare district are vulnerable to seasonal food insecurity (table 19).

Table 19. Seasonal food insecurity status in study area.

Seasonal food insecurity for last 5 years	**Frequency**	**percent**
Yes	107	89.2
No	13	10.8
Total	**120**	**100.0**

Source: survey result (2013)

5.1.20. Major reason for food insecurity by gender of household head in 2012 cropping season

To understand the context of food insecurity in the study area, the respondents were asked to list the major causes of food shortage at household level. See table 18 below. Based on this.42% of male headed household said that food insecurity was cause by flood hazard in 2012 where as 49% of female headed household said the same, 26.1 % of male headed household said that food insecurity was caused by erratic rainfall in 2012 likewise 29.4% female headed household said the same , 10.8 % of male headed household said that food insecurity was caused by both flood and erratic rainfall whereas 7.8% female headed household said the same, 4.4% of male headed household said that food insecurity was caused by pests and weeds whereas 2% of female headed households said the same, 1.5% of male headed households said the food insecurity causes due to their health problem whereas 2% of female headed household said the same and

4.4% of male headed household give no response where 5.9% of female headed household fall to give response.

The survey result showed that female headed households (49%) were more seriously affected by flood hazard than male headed households (42%), similarly female headed households (29%) were as well affected by erratic rain than male headed households (26.1%). This analysis indicated those women headed households were much affected by both flood hazard and erratic rainfall in 2012 cropping season, that mean the female headed households were vulnerable to food insecurity (table 20)

Table 20. Major reasons for food insecurity by gender of households in 2012 cropping season

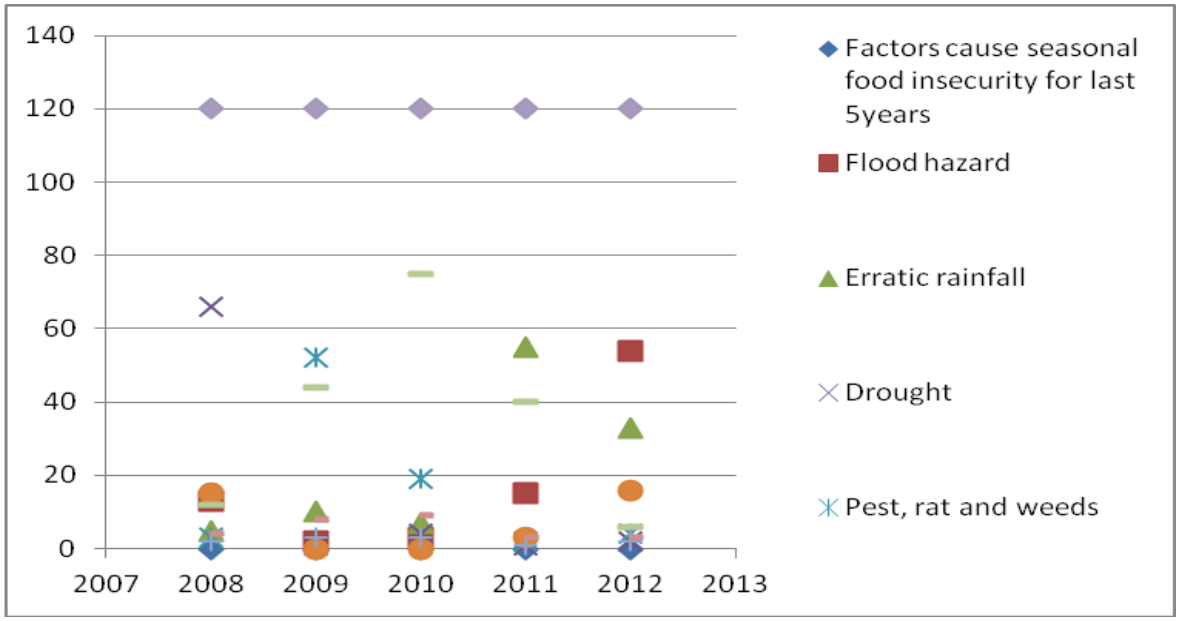
Causes of food insecurity	**Gender(sex)**				**Total**	
	male		**female**			
	frequency	%	frequency	%	frequency	%
Flood hazard	29	42.0	25	49.0	54	45.0
Erratic rainfall	18	26.1	15	29.4	33	27.5
Flood & erratic rainfall	12	10.3	4	7.8	16	13.3
drought	0	0.00	2	3.9	2	1.7
Pest & weeds	3	4.4	1	2.0	4	3.3
Exhausted land	3	4.4	0	0.0	3	2.5
Health problem	1	1.5	1	2.0	2	1.7
No response	3	4.4	3	5.9	6	5
Total	**69**	**100.0**	**51**	**100.0**	**120**	**100.0**

Source: survey result (2013)

5.1.21. Factors that causes seasonal food insecurity for last five years

The figure 4 , showed that 55% of sampled household said that the causes of food insecurity in 2008 was drought, 43.3 % of sampled household said that the causes of food insecurity in 2009 was , pests, rat and weeds,15% of sampled household said that the causes of food insecurity in 2010 was the same as those factor of 2009 which pests, rat and weeds,45% of sampled households said that the cause of food insecurity in 2011 was erratic rainfall and 45% of sampled households said that the cause of food insecurity in 2012 was flood hazard. Comparing the response given by sampled households we can reason out that food insecurity is more vulnerable to the people in study area with different dimension of factors that affected them.

Figure 4*. Factors that causes seasonal food insecurity for last five years in Lare District*



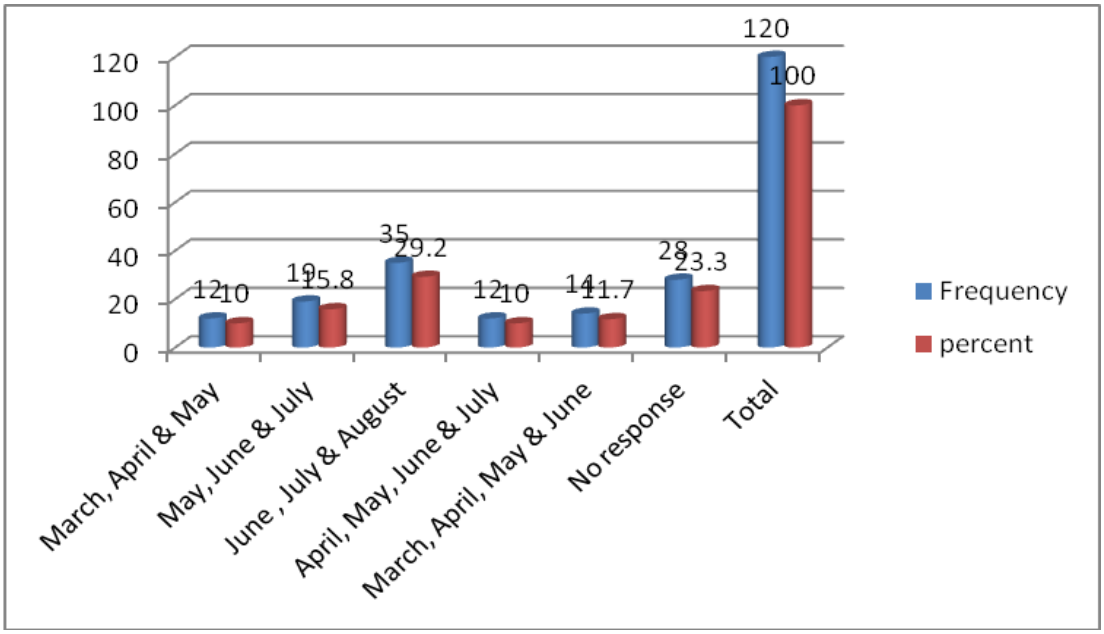
5.1.22. Months of food shortage in Lare District

The survey result showed that 10% of sampled households said that the month of food shortages were match, april and may , 15% of sample households said that the month of food shortage were may, june and july, 29% of sampled household said that the months of food shortages were June, July and August, 10% of sampled household respondent that the months of food shortage were april, may ,june and july, 11.7 % of sampled household respondent that the

month of food shortage were march , april, may and june whereas 23.3% of sampled household give no respond.

Comparing the respond of respondents we can point out that high number of respondents mention June, July and august follow by no responses. The possible explanation is that some household did not give due attention to situation of food shortage as to be tackled while other household who give no response find it seriously that they have already copy with food shortage situation and they give it solution in their household bases. This may be because some of sampled household may lack saving and communal culture, which allow them to share their properties (figure 5).

Figure 5. Months of food shortage in Lare District



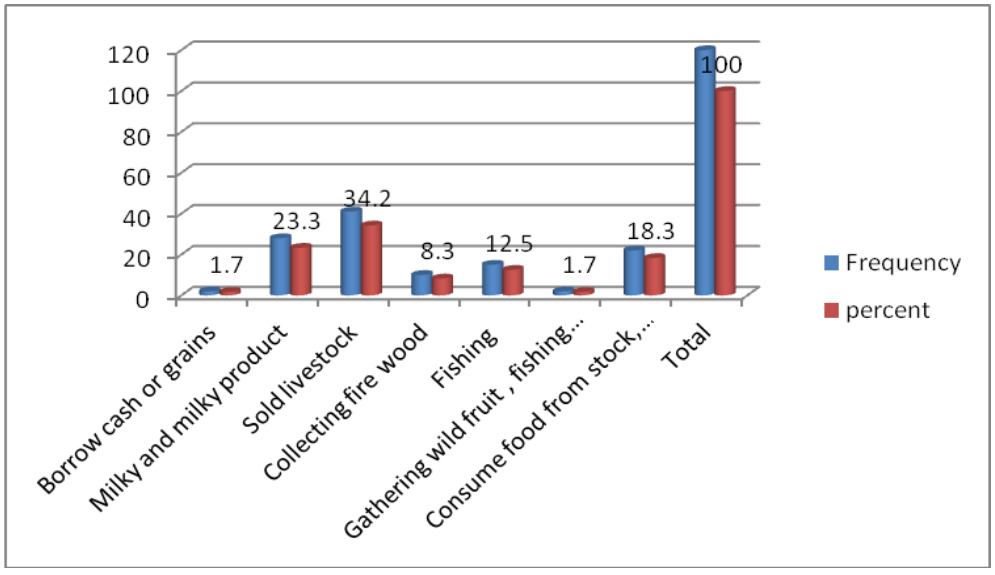
5.1.23. Coping mechanism used by sampled household during food shortage.

The figure 6 below showed that 1.7% of sampled households said that they used to borrow cash/grain as a mean of their coping mechanism, may be these peoples they total dependent on crops and other means, 23.3% of sampled households said that they used milky & milky product as mean of their coping mechanism, these people may be probably due that they have large numbers of milking cows, 34.2%t of sampled households said that they used to sell livestock as a

mean of their coping mechanism these peoples may be they have many livestock, 8.3% of sampled households said that they used to collect fire wood as mean of their coping mechanism, 12.5 % of sampled household said that they used fishing as mean of their coping mechanism, 1.7%t of sampled household said that they gathering wild fruit & fishing as mean of their coping mechanism where as 18.3% t of sampled households said that they consumed food from stock as mean of their coping mechanism.

Comparing the responses given by sampled households we can see that most of sampled households said that they used to sell livestock as a mean of their coping mechanism followed by sampled household which said that they used milk and milk product as a mean of their coping mechanism. This may show that most household in study area are livestock holding peoples.

Figure 6*. Copping mechanism used by sampled household during food shortage*



5.2. Determinants of food insecurity

An econometric model, logistic regression was employed to identify the determinants of seasonal food insecurity. The variables included in the model were tested for existence of multicollinearity, if any. Contingency coefficient and variance inflation factor were used for the multicollinearity test of dummy and continuous variables respectively.

Table 21. Contingency coefficient value for dummy variables

Variables	SEXHHH	MRTSHHH	EDUCHHH	IRGN	IMPSEED	PLSYS	CULTOWNLAND
SEXHHH	1						
MRTSHHH	0.463	1					
EDUCHHH	0.367	0.330	1				
IRGN	0.151	0.179	0.167	1			
IMPSEED	0.337	0.167	0.273	0.100	1		
PLSYS	0.33	0.152	0.621	0.222		1	
CULTOWNLAND	0.251	0.162	0.372	0.185	0.336	0.322	1

Source: survey result (2013)

Contingency coefficient value ranges between 0 and 1, and as a rule of thumb variable with contingency coefficient below 0.75 shows weak association and value above it indicates strong association of variables. The contingency coefficient for the dummy variables included in the model was less than 0.75 that didn't suggest multicollinearity serous to be a serious concern as depicted on table 18.

As a rule of thumb continuous variable having variance inflation factor less than 10 are believed to have multicollinearity and those with VIF of above 10 are suggested to be subjected to the problem and should be excluded from the model. The computational results of the variance inflation factor on table 22 below confirmed the non- existence of association between the variables that were included in the model.

Table 22. Variance inflation factors of continuous variables

Variables	R2	VIF
SIZEHHH	0.003	1.00
DEPNDRTO	0.055	1.05
CLSZ	0.116	1.13
NUMMC	0.076	1.08
NONFMIN	0.125	1.02
ONFMIN	0.004	1.00
TLU	0.155	1.05
AGEHHH	0.067	1.13
NUMFMWORK	0.087	1.09

Source: survey result (2013)

In total, sixteen independent variables were used for estimation to identify determinants of seasonal food insecurity, among hypothesized explanatory variables that were expected to influence seasonal food insecurity on rural households in Lare district, binary logit model was estimated using a statistical package for social science known as SPSS version 19. Types, codes and definition of the variables and estimates of logit model are presented in Table 23 and Table 24 respectively

Table 23. Types, codes and definition of variables in the model

Types	Codes	definitions
Dummy	SXHHH	1,if hhh is male;0 otherwise
Dummy	EDUCSHHH	1, if hh is literate; 0 otherwise
Dummy	MRSTHHH	1, if married; 0 otherwise
Dummy	IMPSEED	1, yes; 0 otherwise
Dummy	IRRIGSYS	1, if hh use irrigation; 0 otherwise
Dummy	PLSYS	1, if household say yes; 0 otherwise
Dummy	CULTOWNLAND	1, if hhh say yes; 0 other wise
Continuous	AGEHHH	Age of household head
Continuous	HSZE	Household size in number
Continuous	DEPRATIO	Dependent ratio
Continuous	NUMFMMWORK	Number of family members actively work
Continuous	ONFMIN	On farm income
Continuous	NONFMIN	Non-farm income
Continuous	NUMLKCOW	Number of milking cows
Continuous	FLZS	Farm land size
continuous	TLU	Livestock (tropical livestock unit)

Sources: survey result (2013)

NB: SXHHH means sex of household heads, EDUCSHHH= educational status of household head, MRSTHHH= marital status of household head, IMPSEED= improved seed, IRRSYS= irrigation system, CULTOWNLAND= cultivated owned land, PLSYS= plowing system, AGEHHH= age of household head, HHSZE= household size, etc.

Table 24. The maximum likelihood estimates of the logit model

Variables	Coefficient	Wald - statistic	Odds ratio
HSZE	0.413	15.528***	1.512
SXHHH	1.797	4.572	6.033
MRTSTHHH	-1.472	3.327***	0.229
EDUCLHHH	-1.161	5.992	0.313
DEPRATIO	-0.147	0.262***	0.863
IMPSEED	-0.008	0.527	0.992
IRRIGSYS	-0.018	18.625	0.226
PLSYS	-0.862	0.622	0.422
CULTOWNLAND	-0.296	4.327**	0.233
AGEHHH	-0.125	3.653	0.855
FLZS	-0.156	3.337**	0.744
TLU	-0.067	3.672**	0.863
NUMFMMWORK	-0.125	0.652**	0.373
ONFMIN	-0.036	6.22**	0.863
NONFMIN	-0.067	4.356	0.992
NUMLKCOW	-0.862	0.329***	0.226
Constant	0.563		
Pearson chi-square	66.673 ***		
-2log likelihood	206.653		
Sensitivity	69.8		
Specificity	78.9		
Percent correctly predicted (count R^2)	75		
Sample size	120		

Source: model output (2013)

NB: *** Significant at less than 1% probability level

** Significant at less than 5% probability level

* Significant at less than 10% probability level

The likelihood ratio has a chi-square distribution and it is used for assessing the significance of logistic regression. Model chi-square provides the usual significance test for logistic model. i.e. it test the null hypothesis that is none of the independents are linearly related to the log odds ratio of the dependent. It is overall model test which doesn't assure every independent is significant. The result is significant at less than one percent probability level revealing that the null hypothesis than none of the independent is linearly related to the log odd of the dependent is rejected.

Additionally, goodness of fit in logistic regression analysis is measured by count R^2 which works on the principle that if the predicted probability of the event is greater than 0.50 the event will occur otherwise the event will not occur. The model result shows that the correctly predicted percent of sampled household is 75 percent which is greater than 0.50. The sensitivity, correctly predicted food insecure is 19.2 percent and that of specificity, correctly predicted food secure is 80.8 percent. This indicates that the model has estimated the food insecure and food secure correctly.

5.3. Discussion of significant of independent variables

Sixteen independent variables that were hypothesized to have influence on household food insecurity in the study area were included in the model, of which nine were found to be statistically significant even though the level of statistical significance for independent variables included in the model was different for individual or groups of variables and the sign of the significant parameters were as expected.

The model output revealed that household size (HHSZE), marital status of household head (MRSTHHH), dependency ratio (DEPRATIO) and owned milking cows (NUMILKCOW) were significant at less than one percent probability level. Onfarm income (ONFMIN), farm land size (FLSZ), livestock (TLU), number family actively involved in work (NUMFAWORK) and cultivated own land (CULTOWNLAND), household were found to be significant at 5 percent probability level.), where as Sex of head (SXHHH), Education of household head (EDUCHHH), nonfarm income (NONFMIN), use of improved seed (IMPSEED), Irrigation (IRRGN) and plowing system (PLSTS), were found to be statistically insignificant.

In light of the above summarized model results, possible explanations for each significant independent variable are given consecutively as follows:

Household size (HHSZE): Given the strong positive relationship between household size and food insecurity already noted in the descriptive part. It is not surprising that the estimated parameters are positive and highly significant. This positive relationship shows that the odds ratio in favor of the probability of being food insecure increase with increase in household size. The odds ratio in favor of food insecurity increases by a factor 1.512 as household size increases by one keeping other variables constant. The possible reason is that with existing culture norm of polygamy. Most couples married many wives, because this the household size increase rapidly that mean the number mouths which need feeding will increases and income will decrease that lead the household to become food insecure.

Marital status of household head (MRSTHHH): the result of the model depicted that marital status of household head and food insecurity are related negatively in the study area. The negative relation indicated that the odds ratio in favor of food insecurity decreases by a factor of 0.229 as household head becomes married.

The possible explanation is related to the economics scale of consumption items purchase and pooling available resources in one way or another and possibly, married households reduce expenditure that would been spent separately. The results of marital status and sex of household seems to contradictory but headship is not only gifted to male as observed from sampled households. There were female household heads in the presence of male (husband) either due to economic reason or absent of male household head in the area for any reason.

In general, being married by itself is not an assurance to escape the risk of food insecurity. Rather it is mainly because of the fact that household size, level of income and other factors of household affect food security status in relation to married status. The result of the survey confirms prior hypothesis of the study.

***Dependent ratio (DEPRATIO*)**: The survey result showed a negative relation between dependent ratio and food insecurity and the coefficient is highly significant at less than one percent probability level. Holding other variable constant, the odds ratio in favor of food insecurity increases by a factor of 0.863 as the dependent ratio increase by one person. The result

corresponds with increment of household size. Therefore, household head whose dependents ratio increases from time to time is more likely to become food insecure than low dependants ratio households.

Number of milking cows (NUMLKCOW): livestock as a source of income for study area in general are assumed to play big role because of recurrent flood hazard, recurrent erratic rainfall & drought. In similar manner animal product like milk and butter are also assume to be good source of income. Thus, it was believed that household with one and/or more milking cow(s) to have better food security status than household without milking cow(s). The relationship between owned milking cow(s) and seasonal food insecurity turn out to be negative and the coefficient is highly significant at less than one percent probability level. The odds ratio in favor of seasonal food insecurity, holding other variable constant, decrease by a factor of 0.226 as number of milking cow(s) increases by one. The possible explanation is that milking cows have daily income, households with many milking cow(s) have highly daily income and are less likely to become food insecure than household with few or don't have any milking cow(s).

***Cultivated own land (CULTOWNLAND)*:** the relationship between cultivating own land and seasonal food insecurity is negative and the coefficient is significant at 5 percent probability level. holding other variable constant, the odds ratio in favor of seasonal food insecurity decrease by a factor of 0.233 as household manage to cultivated his land properly and increased it by one unit . The possible explanation is that household head who did manage to cultivate their farm lands had relatively better chance of being foods secure than household head that didn't.

***Number of household members actively works (NUMHHMWORK)*:** The number of family members actively involved in work was hypothesis that it affects food security status of household positively, as we may know that many hands make work easy. Household with many member participants in activities are food secure than households with less member on works. The survey result revealed a negative relation between number of household actively work and food insecurity and the coefficient is significant at less than five percent probability level. Holding other variable constant, the odd ratio in favor of food insecurity decreases by a factor of 0.363 as number of household actively participant in work increases by one person.

***On farm income (ONFMIN*)**: Income is explained in term of household income on their farm this is because rural households in Ethiopia and in study area in particular dependent on agriculture as a source of their income as a result, the rural household dependent of agriculture as a sources of their income for their entire life. The survey result exhibit negative relation between on farm income and food insecurity and the coefficient is significant at less than five percent probability level. *Under ceterius paribus condition*, the odds ratio in favor of food insecurity decrease by a factor of 0.863 as proportion of household income increases by one. As proportion of income increase the expenditure increases, access to food by household also increases to the amount needed for household consumption. In circumstances where some covariant shocks happen, for instance rise in price of food commodity, this changes the habit of consumption of household and uses other alternative mean of serving their income.

***Farm land size (FLSZ*)**: The result of the survey revealed that the variable under consideration is negatively related and significant at less than 5 percent probability level with food insecurity. Holding other variable constant, the odd ratio in favor of food insecurity decreases by a factor of 0.863 as household have access of land. The possible explanation is that access to land by household gives an opportunity to escape from risk of food insecurity.

***Livestock holding (TLU*)**: The relationship between the amount of livestock holding in tropical livestock unit and seasonal food insecurity turned out to be negative and significant. The relationship is statistically significant at 5 percent probability level. This is an indication that ownership of livestock acts as a hedge against food insecurity in the study area. The possible explanation for the negative relationship is that livestock besides its contribution to the subsistence need and nutritional requirement, it also serves as accumulations of wealth so that disposed during times of need, especially when food stock in the household deteriorate. The odds ratio in favor of food insecurity decrease by factor of 0.863 when the amount of livestock in the household rises by one TLU. This result is supported by Getachew (1993) & Abebaw (2003).

5.4. Incidence of seasonal food insecurity and household characteristics

The incidence of seasonal food insecurity with some household characteristics is depicted on table 22. Food insecurity is more than three times less prevalent with households of less than or equal to four members as compared to those households with more than eight members. On other hand, household with family size ranging from 9 to 12 have almost twice more incidence of food insecurity as compared to those having less or equal to four family members. The prevalence of seasonal food insecurity decrease as household head had more livestock which showed that household with more livestock had lower incidence of being food insecure than household with few livestock.

The negative relation of seasonal food insecurity and owning milking cows revealed higher incidence for households with no milking cows and no other sources of livestock's that they are vulnerable to food insecurity while household with milk cow is less likely to be food insecure. The result showed that 32% of sampled households who said that they didn't milking cows, they were vulnerable of being food insecure than household with milking cows (Table 22)

Table 25. Incidence of seasonal food insecurity and households characteristics

Characteristic	Household grouping	Number of food insecure	Total household	Food insecurity incident
Family size	1 - 4	6	10	60
	5 - 8	69	82	84.2
	9 - 12	16	20	80
	13 - 18	7	7	100
	≥19	1	1	100
	Overall	**97**	**120**	**80.8**
Owning livestock	Yes	78	98	79.6
	No	19	22	86.4
	Overall	97	120	80.8
Owning milking cows	yes	66	86	76.7
	no	31	34	91.2
	Overall	**97**	**120**	**80.8**

Source: Survey result (2013)

5.5. Summary of Key Finding

Based on the survey data, an attempt was made to describe the socio- economic characteristic of the food insecure and food secure sampled household groups, i.e., whether there exists mean difference between two groups with respect to the different of socioeconomic attributes.

Accordingly, the survey result revealed that there were significance difference with respect to mean of family size and food insecurity. It is not surprising that the estimated parameters are positive and highly significant. On the other hand, marital status of household head shows the negative relationship with food insecure; this negative relationship indicated that the odds ratio in favor of food insecurity to decrease by a factor of 0.229 as household head becomes married. The average family size among the sampled household is 5.6 persons per household and is regard as high and is demographic factors contributing to the prevalence of food insecurity at large. Moreover with regard to dependents ratio, it was defined that as the ratio of people of age group from 0 -14 above 64 divided by those people with age group of 15 – 64 which is 1.2. There is also significant relationship between marital status and food insecurity at less than 1% probability level.

Binary logit econometric model was estimated using the survey data to identify the determinants of food insecurity among the rural households in the study area. Accordingly, the estimated coefficient revealed a mixed impression. On the one hand, household size, marital status of household head, dependent ratio, owned milking cow, owned livestock, members of household participant in activities, farm land size, cultivated own land, on farm income showed theoretically consistent and statistically significant effect while education of household head, age of household head, sex of household head, improved seed, irrigation , non-farm income and plowing system were found not to be statistically significant in determining food insecurity.

A closer look at the model result revealed that the variables household size (HHSZ) influenced the households' food insecurity positively and significantly. This means the probability for the householh becoming food insecure increases as the household size increases. On farm income (ONFMIN) on the other hand, as the prior expectations has negative and significant coefficient in the estimated model result. This means increasing

the household's total annual income affects the household food insecurity negatively. This because households who have better income from any source would have a better chance and potential to be more food secures.

Age of household head (AGEHHH) and Educational status of household head (EDUCSHHH) also exhibited negative and insignificant. This means the two variables are inversely not related with food insecurity in this particular contact. Whereas farm land size and cultivated owned land were another significant variable came out to be negatively and significantly related with food insecurity.

The other importance variable is livestock holding, this variable in agreement with the prior expectation came out to be negatively and significantly related with food insecurity. This is due to the fact that livestock holding had both direct and indirect contribution to the household's energy requirement and income. However number of milking cows owned had the prior expectation that turn out to be negative and significant at less than 1% probability level in related to food insecurity. The possible reason might be household's owned milking cows had twice income a day, this point out the benefit gain by households with milking cow on daily bases.

The survey data where further used to estimate the extend of food insecurity in household level. Accordingly, 97% of sampled households were food insecure whereas incidence of seasonal food insecurity and household characteristics was as high as 84% as the household increases from 5 to 8 persons per household and as higher as 100% as household size increases from 18 to 19 persons per household.

CHAPTER SIX: CONCLUSION AND POLICY RECOMMENDATIONS

6.1. Conclusion

The study was conducted with the specific objective of examining seasonal food insecurity situation, estimating the seasonal food insecurity gap and severity and identifying the determinants of seasonal food insecurity and copping mechanism at household level in rural households in Lare District of Nuer Zone in Gambella region. The research objective was realized through conducting household survey in six kebeles of the study area. Household

demographics, education status, on farm income, farm land size and other data deemed to be relevant were collected, organized, analyzed and interpreted to come with possible results.

The analysis employed both descriptive statistics and econometric methods. Descriptive statistics were employed to describe household characteristics with seasonal food status. Binary logistic model was employed to specified and estimated to identify determinants of seasonal food insecurity whereas copping mechanism was treated as an optional solution reflected from sampled households on time shocks.

The sampled households were classified into food secure and food insecure groups based on kilocalorie or grain that was harvested for consumption by the households during last year 2012 cropping season. The total amount of food that were consumed by household from their own production/ harvested and total amount of food that they were consumed per household per six months were compared, if the total amount of food that was consumed from their owned production/ harvest less than total amount of food that they were consumed per six months such households were considered as food insecure, but if the total amount of food that they were consumed from their own production/ harvest was equal total amount of food that was consumed by household per six months, then such a household were considered as food secure but the next step, their grain that they consumed were converted into equivalent daily kilocalories per adult equivalent (AE) and then compared with recommended daily kcal per AE. Then, if the total daily food energy per adult equivalent of household was equal to 2200kcal per adult per a day (225kg grain equivalent per adult per a year) , then such a household was considered as seasonal food secure , otherwise seasonal food insecure.

The descriptive statistics showed the existence of a significant mean difference in expenditure and household seasonal food insecurity status at less than 5 percent probability level between food secure and food insecure households.

As a conclusion, since 80.8% of sampled household were food insecure and only 19.2% of sampled households were food secure, it may be concluded that 81% of the population in the study area always suffered with seasonal food insecurity.

6.2. Policy Recommendations

Based on the finding of this study, the possible policy recommendations that can be me from this study are as follows:

1. As family size and food insecurity are positively related, serious attention has to be given to limit the increasing population in the study area. This can be achieved by creating sufficient awareness about family planning in the rural households. Even thought every individual has a natural right to multiply himself with his willing partner. This right should be exercise with the ability to furnish his descendents with all the necessary or basic needs. So, along with creation of effective family planning through effective extension services some methods of incentive, such as material reward for those households accepting a given number of children by the end of productive age.

2. As on farm income and food insecurity are negatively related on the model results, searching and providing productive technical skill that can make rural community competitive on saving and avoid communal culture that affect their saving on their production.

3. Although the education of household head show insignificant on household food insecurity, we need to focused much on education for betterment of living condition. The more the household head is educated, the higher will be the probability of educating family members and familiar with modern life style or technology. This should done by strengthening both formal and informal or adult education and vocational and skill training to rural household to reduce food insecurity status.

4. Productive resources especially farm land size is importance, even if the model result showed that farm land size and food insecurity have inverse relationship, tackling the problem of food insecurity through increasing farm land size is mandatory. Land as a especial resources should be utilize in term of using it.

5. Sustainable food security intervention must not exclude the improvement of production and productivity of agriculture sectors through use of irrigation. Although the finding of the showed that irrigation and food insecurity are negatively related and insignificant. Therefore development strategies, or any intervention related with food security through agricultural

production should not neglect the paramount importance of irrigation. Therefore we can tackle this by encouraged farmers who have irrigable farm land by provided them with input such as fertilizer, improved seed, and pesticide through effective extension services and credit facilities.

6. Rural household in the study area, used only hand tool for cultivation which is traditional mean of cultivation, hence for these peoples' to change their life style, they need to be aware of model plowing system such as using oxen and other new technology that can change their traditional way of farming system. This can be done through giving them a training, sharing experience with others and introduced them with model cropping system.

7. Sticking to the finding of this study, livestock subsector plays a great role in the struggle to eliminate food insecurity. Its contribution to the household food energy requirement and total income is significant. Hence necessary effort should be made to improve the production and productivity of the sector. This can be done through the provision of adequate veterinary service, introduction of timely and effective artificial insemination service to up- grade the already existing breeds, launching sustainable and effective forage development program, provision of training for the livestock holders on how to improve their production and productivity, improving the market conditions.

8. Rural households in the study area have very limited room for generation of income. Hence for these household to enhance their welfare in general and food security in particular, they must have diversified access to income alternatives, in fact they lack saving due to communal culture, creating enable be economic and provision of saving institution in form giving credit to build the capacity of farmer to invest in the agricultural sector, such as purchase of fertilizer, pesticides, improved seed, live and productive animals and invite their local product to big markets.

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APPENDICS

Appendix 1. Summary of survey questionnaire

Questionnaires for determinants of seasonal food insecurity and coping mechanism in rural household in Lare District of Nuer Zone of Gambella, Ethiopia

GENERAL INFORMATION

Zone:……..
District:…….
Peasant association (kebele)..... …….
Date of interview:……..
Name of household head…….....
Name of the interviewer:…….

PART I. HOUSEHOLD INFORMATION AND DEMOGRAPHICS

1.1. Name of household head: _____
  1.1.1. Sex 1. Male ☐ 2. Female ☐
  1.1.2. Age: 1. below29 2. 30 – 64 3. 64 and above
1.2. Size of household members_____

s/no	Names of HH members	sex	age	education	relationship	occupation
1						
2						
3						
4						
5						
6						
7						
8						

1.3. Marital status: 1. Married ☐ 2. Divorce ☐ 3.Window ☐
1.4. Education level: 1. Literate ☐ 2. illiterate ☐
1.5. Religion of HHH: 1. Christian ☐ 2. Muslim ☐ Others_____
1.6. Contribution of children in household activities
  1. Participating in home activities 2. Herding cattle 3. Engaging in agriculture activities
  4. Engage in business
1.7. Number of family members actively involved in household activities
  1. Children less than 18 years
  2. Young's above 18 yrs and below 25 years
  3. Household head

PART II. LAND RESOURCES

2.1. Do you have your own land? _____1. Yes, 2. No
2.1.1. If No, where do you get the land for cultivation?
1. Rented 2.for free 3. Share land with others
4. Others_____
2.1.2. If yes, what is the total size of your land? _____ (in hectare).
2.2. What is the total area of land did you cultivated during last harvesting season in year 2012? _____ (in hectare).
2.3. Do you think that your piece of land is enough to support your family? 1. Yes 2.No
2.3.1. If No, state your reason.
1. Small size of land 2. Exhausted land 3. Lack of agricultural inputs to increase productivity 4. Large family size 5. Others _____
2.4. How many times do you plant a year?
a) One time b) two times c) three times d) others (specify) _____
2.5. List the type of crops you cultivated and their average production for 2012.

Type of crop	Year 2012		
	Area(in hectare) or local unit	Total production (in quintal Qt) or in kg	Value in Birr
Semiannual crops			
1.			
2.			
3			
4			
5			
Annual crops			
1			
2			
3			
4			
5			
Others			

2.6. What is your purpose for crop production?
1. Consumption 2. Marketing 3. Consumption and marketing 4. Others
2.6.1. If your answer is consumption and market, quantify the grain for consumption and for the market in year 2012 in Quintal (Qt).

S/No	Types of crops	Consumption (kg)	Marketing (kg)	total (kg)
1	maize			
2	sorghum			
3	Sweet potatoes			
4	pumpkin			
5	bean			
6	others			

2.6.2. If **No**, how long did your grains last? _____# Months.
2.7. Did you use intercropping during the last cropping season in the year 2012?
1. Yes 2. No
2.7.1. If **yes**, what are the types of crop you were intercropping in your farm land?
1. Maize and bean 2. Maize and sweet potatoes 3. Maize and pumpkin 4. Maize, bean and pumpkin 5. Maize, pumpkin and sweet potatoes 6. Maize, bean, pumpkin and sweet potatoes.
2.8. What do you use to plough your land?
1. Hand tools (hoe) 2. Oxen 3. Rented tractor 4. Others
2.9. What are the problems related to farming system in your area in year 2012?
1. Shortage of seeds 2. Lack of fertilizer 3. Disease and insect pest 4. Weeds.

5. Lack of land 6. Shortage of oxen/tractor 7. Others specify_____

2.10. Do you use irrigation system? 1. Yes 2. No

2.10.1. If yes, what type of irrigation did you used?

1. Drip 2. Aerial 3. Channel 4. Hand

2.11. What types of crops do you plant using irrigation?

s/no	Types of crops	Area (in hectare)	production (Qt)	amount consumed	amount sold
1					
2					
3					

PART III. <u>USE OF MODERN AGRICULTURAL INPUT</u>

3.1. Do you use chemical fertilizer? _____ 1. Yes 2. No

3.1.1. If No, state your reason

1. Not heard about it 2. Not available 3. Not necessary for crop cultivation 4. Too expensive
5. Lack of credit 7. Others (if any) _____

3.1.2. If yes, indicate the amount of fertilizer you used in year 2012/13

Types of crops	Year 2012/13	
	Fertilizer (Qt)	Area in hectare
1		
2		
3		

3.2. Do you use improved seed in your farm? _____ 1. Yes 2. No

3.2.1. If No, state your reason

1. Not heard about it 2. Not available 3. No yield difference 4. Too expensive
5. Others…….

3.2.2. If yes, where did you get the seed from/seed source?

1. Agricultural Bureau 2. Gambella Agricultural Research Institute, 3. NGos. 4. Relatives, 5 others_____

3.3. What were the factors affecting your crop production in 2012 cropping season

1. Disease 2. Pests 3. Weeds 4. Flood 5. Erratic rain fall 6. Drought
7. Others _____

3.4. Any lost you have encountered in 2012 cropping season? 1. Yes 2. No

3.4.1. If yes, indicate the cause of lost and extent of lost

s/no	Types of crops	Causes of lost	Area(in hectare)	Amount lost(Qt)
1				
2				
3				

PART IV. <u>AGRICULTURAL EXTENSION SERVICES</u>

4.1. Have your household receive any agricultural extension services from any Government/NGOs in 2012 cropping season?

1. Yes 2. No

4.1.1. If yes, what are the extension services? 1. Training 2. Crop protection 3. Agronomic practice 4. Others_____

4.2. Have you ever participate in the new agricultural extension package program?

1. Yes 2.No

4.1.2.. If yes, what type of package program?

1. Crop production, 2. Animal production 3.Honey bee production 4. Fishing production

PART (V). LIVESTOCK PRODUCTION

5.1. Do you have livestock? 1. Yes 2. No

5.1.1. If yes, Can you tell us about your herd of livestock at present?

S/no	Types of livestock	Number owned & present in your farm	Number not owned but cared for	Number owned but away	During last six months how many were born?	During last six months how many died or got lost?
1	Young bulls/Oxen					
2	Cows					
3	Milky cows					
4	Heifer(young cow)					
5	Calves					
6	Sheep					
7	Goats					
8	Horses					
9	Donkey					
10	Mules					
11	Camels					
12	Chickens					
13	Others					

5.2. Do you have milking cow in your farm? 1. Yes 2. No

5.2.1. If yes, how many milking cow do you have?

1. One 2. Two 3. Three 4.Four 5. Five and above

5.3. What are the factors affecting your animal production in year 2012?

1. Animal disease, 2.Insect pest (Tsetse fly) 3. Flood hazard, 4. Shortage of grazing land

PART VI: HOUSEHOLD INCOME

6.1. Do you or do any member of your family have off-farm (non-farm) job?

1. Yes 2. No

6.1.1. If yes, indicate the type of work and monthly earned in that work.

Name of Family members with job	Type of jobs	Monthly earned(birr)
1		
2		
3		

6.2. If the payment is made in kind, convert them to birr by considering the material in prevailing price. 1. Fishing 2. Sell of fire wood 3. Sale of wild fruits 4. Weaving/spinning 5.milling 6. Fetching for water 7. Handcraft (pottery, metal work) 8. Sale of local drinks (wine) 9. Livestock trade 10. Pity trade (grain, vegetables, fruits) 11. Others y)……

6.3. Have your household received any other income (such as remittance, gifts, aid or other transfer) last year in 2012? ___1. Yes 2. No

6.4. I f yes, tell us the type of materials your household have received from others?

Types of receipt	Amount in kind	Amount received (birr)	sources
1.grain			
2.money			
3.cattle			
4.others			

6.5. What were the Sources of your household income in year 2012?

Sources of income	unit	quantity	Total sale (birr)
1. Crop buy by types			
Maize			
Sorghum			
Wheat			
Others			
2. Animal sales by types			
cattle			
Sheep or goat			
Chickens (chicken eggs)			
Others			
3. Sales of animal products			
milk			
Milk product			
4. Honey			
5. Fish			
6. Others			

PART VII: HOUSEHOLD EXPENDITURE

7.1. Please can you tell us the amount of expenditures of your family for last 3 - 6 months before harvesting season of year 2012?

Food type consumed	Food consumed from own harvest		Food consumed from purchase		Food consumed from food aid		Food consumed from gift/ remittance		Total food consumed per household per six month	
	Amount (kg)	Value (birr)	Amount (kg)	Value (birr)	Amount (kg)	Value (birr)	Amount (kg)	Value (birr)	Amount (kg)	Value (in birr)
Cereals crops										
Maize										
Sorghum										
Wheats										
others										
Purses										
Common bean (local)										
sesame										
(ground nug)										
Vegetables										
potato										
tomatoes										
carrot										
fruits										
Mango										
Banana										
Orange										
papaya										
Okra(kenkes)										
Animal sources										
Milk										
Milk product										
Meat										
Chicken										
Eggs										
others										

7.2. Have your household purchased any prepared foods, or eaten elsewhere against payment in last 3- 6 months? 1. Yes 2. No_____
7.2.1. If yes, tell us the total expenditure for that particular time (in Birr)_____

PART VIII: <u>FOOD CONSUMPTION HABIT (FOOD SECURITY)</u>
<u>PART VIII A: Food availability, access and coping mechanism</u>
8.1. Have your household had ever face any seasonal food insecurity in this area for last five years? 1. Yes 2. No
8.1.1. If yes, what were the main causes of that seasonal food insecurity?
1. Erratic rainfall 2. Flood hazard 3. Poor quality of seed.
4. Shortage of cultivated land 5. Health problem 6. Traditional farming system. 7. Crop and Animal disease 8.Exhausted land 9. Others (if any) _____
8.2. Which months in a year is the food shortage severs? Choose according to their severity level by ticking the box below.

1. January ☐	5. May ☐	9. September ☐
2. February ☐	6. June ☐	10. October ☐
3. March ☐	7. July ☐	11. November ☐
4. April ☐	8. August ☐	12. December ☐

8.3. Please indicate the months in which your household had enough food for consumption during last year 2012? by ticking the box below

1. January ☐	5. May ☐	9. September ☐
2. February ☐	6. June ☐	10. October ☐
3. March ☐	7. July ☐	11. November ☐
4. April ☐	8. August ☐	12. December ☐

8.4. For how many months during last year 2012 did your household have enough food for consumption? _____ .
1. two months 2. Three months 3. Four months 4. Greater than five months
8.5. Did your household used seeds from grains on own reserve during last farming season of 2012?_____
8.6. How many harvest/grain did your household harvested in your field during last year 2012 cropping season? ____ (in kg)

Name of crops (grain)	Quantity (in kg)	Value (ETB)
1. maize		
2. sorghum		
3. bean		
4. sweet potatoes		
5. okra		
6. others		

8.7. Please can you indicate the number of meal per days during normal, medium and deficit period of food availability among the members of the households?

Household categories	Normal (availability of food) meal per a day	Medium (a little availability of food) meal per a day	Deficit (shortage of food) meal per a day
Children below age of 5yrs			
Children below age of 18			
Young adults from age of 18 yrs to 29yrs			
Adult from age of 30 yrs and above			

PART IX: SHOCKS AND COPING MENCHANISM

9.1 What coping mechanism do you use when you have food shortage at your home to have enough food? Rank the given option according to how you prioritize them.

S/No	**Coping mechanism**	
1	Borrowed cash or grain	
2	Sold firewood	
3	Sold livestock	
4	Consume seed from stock	
5	Migrated to look for job	
6	Gathering wild fruit/food	
7	Eat fewer meals per day /Reduced quantity of food per meal	
8	Fishing	
9	Sell milk and milk product	
10	Sell grass	
11	Prepare local wine	
12	Others----------	

9.2 Did you receive any food aid in year 2012? 1. Yes 2. No

9.2.1. If **yes**, specify the types of food aid, 1. Cereal grain 2.Oil. 3. Other

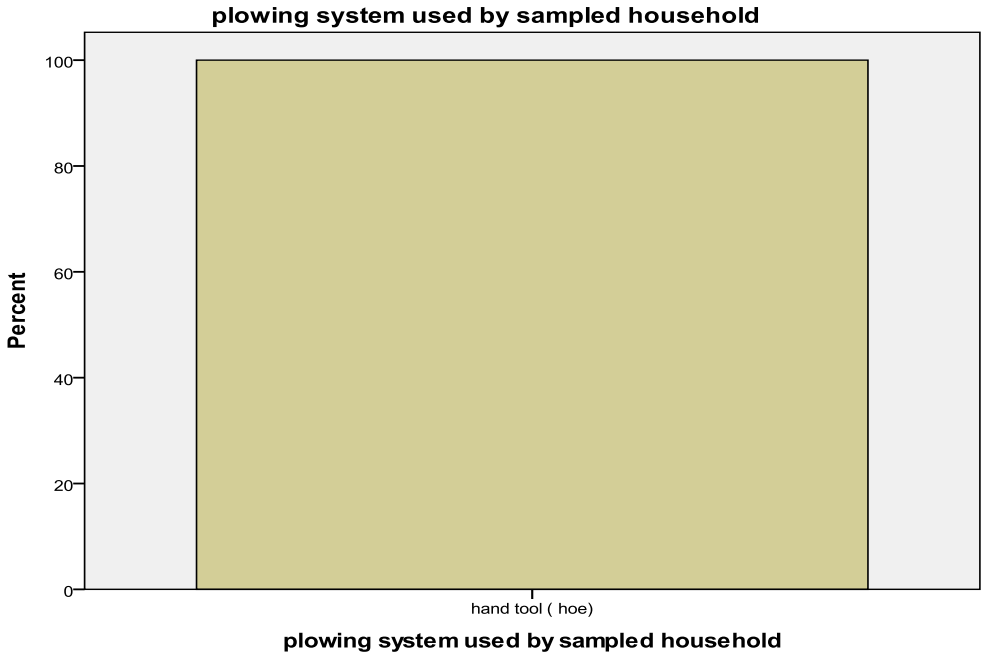
9.2.2. If yes, what is amount of food supply per household is provided (Quintal/ Kg)

s/no	Crop	Amount/unit	
		kg	liter
1.	maize		
2.	wheat		
3.	oil		

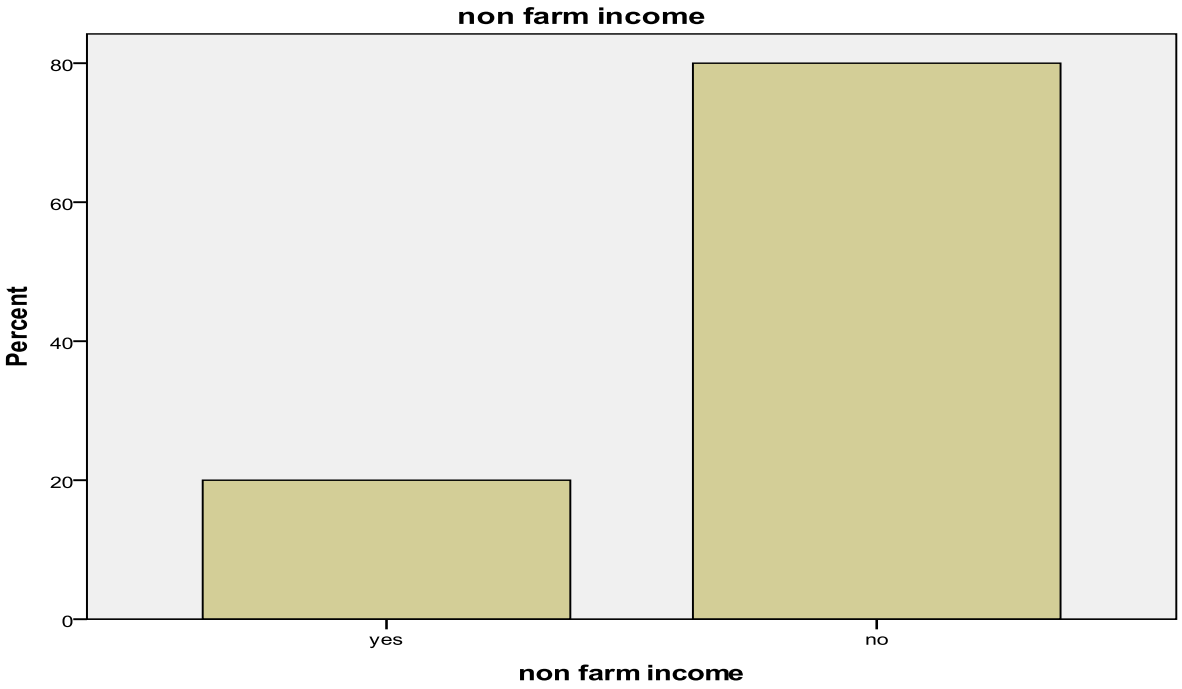
Comment or suggestion

THANK YOU!!!

Appendix 2. Plowing system used by sampled households, 100% of sampled household said that they used hand Tool for cultivation.



Appendix 3. Nonfarm income



Appendix 4. Calorie value of food items consumed by sampled households

Food item	Unit	Kcall
Teff	kg	3589
Wheat	Kg	3623
Sorghum	Kg	3805
Maize	Kg	3751
Barley	Kg	3723
Oat	Kg	3599
Peas	Kg	3553
Lentils	Kg	3522
Fenugreek	Kg	3824
Irish potato	Kg	1037
Sweet potato	kg	1360
Onion	Kg	713
Meat	kg	1148
Milk	Lt	737
Egg	Each	61
Butter	kg	7364
Edible oil	Lt	8964
coffee	kg	1103
Sugar	kg	3850
Spaghetti/macaroni	Kg	3550

Source: Ethiopia Health and Nutrition Research Institute food consumption table, 1998

Appendix 5. Conversion factor used to calculate adult equivalent

Age category(Years)	Male	Female
Less than 10 years	0.60	0.60
10 - 13	0.90	0.80
14 – 16	1.00	0.75
17 - 50	1.00	0.75
Greater than 50		0.75

Source: Institute pan African pour le development (1981); cited in stock et al.1991

Appendix 6.Local irrigation system

Appendix 6. Cont…

Appendix 7. Local unit of measurement




Appendix 8. Some of Copping mechanism used such milk, local wine, grass for sell and fishing