HOUSEHOLD FOOD INSECURITY AND COPING STRATEGIES: THE CASE OF KINDO DIDAYE DISTRICT, WOLAITA ZONE, SOUTHERN ETHIOPIA.

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DECLARATION

I hereby declare that the dissertation entitled "HOUSEHOLD FOOD INSECURITY AND COPING STRATEGIES: THE CASE OF KINDO DIDAYE DISTRICT WOLAITA ZONE, ETHIOPIA submitted by me for the partial fulfillment of the MA in Rural Development to Indira Gandhi National Open University (IGNOU) New Delhi is my own original work and has not been submitted earlier either to IGNOU or to any other institution for the fulfillment of the requirement of any course of study. I also declare that no chapter of this manuscript in whole or in part is lifted and incorporated in this report from any earlier work done by me or others

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CERTIFICATE

This is to certify that Mr. Bereket Demissie student of MA (RD) from Indira Gandhi National Open University, New Delhi was working under my supervision and guidance for his project work for the Course MRDP-001. His project work entitled "HOUSEHOLD FOOD INSECURITY AND COPING STRATEGIES: THE CASE OF KINDO DIDAYE DISTRICT WOLAITA ZONE, ETHIOPIA which he is submitting is his genuine and original work.

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ACRONYMS AND ABBREVIATIONS

AE	Adult Equivalent
CSA	Central Statistic Authority
FAO	Food and Agricultural Organization
FDRE	Federal Democratic
FSS	Food Security Strategy
FFSS	Federal Food Security Strategy
GTP	Growth and Transformation Plan
HH	Household
HHH	Household Head
HA	Hectares
HFS	Household Food Security
Kg	Kilogram
Kcal	Kilo Calorie
MDG	Millennium Development Goal
MoFED	Ministry of Finance and Economic Development
NGO	Non-governmental organization
SNNPR	Southern Nations Nationalities and People Region
PA	Peasant Association
VFI	Variance Inflation Factor
WHO	World Health Organization

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ABSTRACT

A better understanding of factors affecting the status of food security at micro level is required for the organization of technical research, the development of policies and for shaping the direction of action for food security. Consequently, this study is expected to generate ideas that would be useful to reveal the seriousness of the problem and identify the determinants of household food security. To this end, investigation of the demographic and socioeconomic characteristics of food secure and food insecure groups of farmers; identification and examination of major causes of food insecurity and measuring food security status of households; identification as to what kinds of the households are more food insecure or secure; as well as assessment and analysis of the local coping strategies of the households in the district was made in this study. With existence of high annual variability in food production mainly due to unpredictable climatic conditions coupled with expanding human population and the lack of access to off-farm opportunity the household food security status is worsening in the study area. This study was therefore, envisaged to assess the magnitude of food insecurity at household level and to identify local coping strategies practiced in the district.

In order to achieve these objectives demographic and socio-economic data were collected from 160 randomly selected households in Kindo Didaye District of Wolaita Zone SNNPRG. A two-step sampling procedure was used to select 4 PAs. A survey was conducted to collect the primary data from sample respondents. Supplementary, secondary data were collected from various sources. Univariate analysis such as T-test and Chi-square tests were also used to describe characteristics of food secure and food insecure groups. The survey result shows that about 72.9% of sample farmers were food insecure. A logistic regression model was fitted to analyze the potential variables affecting household food insecurity in the study area. Among 14 explanatory variables included in the logistic model, 9 of them were significant at less than 10% probability level. These were family size, number of oxen owned, use of chemical fertilizer, size of cultivated land, farm credit use, total annual income per adult equivalent, food consumption expenditure, livestock owned, and off-farm income per adult equivalent.

1. INTRODUCTION

1.1.Background

Ethiopia is one of the African countries known for structural food insecurity (Greater Horn of Africa Food Security Bulletin/GHAFSB, 2004). Food insecurity is divided into two categories namely chronic and acute. Chronic food insecurity is commonly perceived as a result of overwhelming poverty indicated by a lack of assets. Acute food insecurity is viewed as a more of a transitory phenomenon related to man-made and unusual shocks such as drought (Federal Democratic Republic of Ethiopia/FDRE, 2009).

Food insecurity in Ethiopia derives directly from dependence on undiversified livelihoods based on low-input, low-output rain fed agriculture. The concept of food insecurity incorporates low food intake, variable access to food, and vulnerability–a livelihood strategy that generates adequate food in good times but is not resilient against shocks. People are food insecure not only because their food consumption level is low, but also because their access to food is variable and unpredictable over time; from one year or season to the next (Devereux, 2000).

The problem of food insecurity has continued to persist in the country as many rural households have already lost their means of livelihood due to recurrent drought and crop failures (Ayalneh, 2002). In many parts of Ethiopia most households are only able to meet their food requirements for less than six months of the year. This is particularly true in low land areas where rainfall is generally low and is extremely variable and unpredictable that leads to low yield and frequent crop failures (Kidane, 2003).

According to FDRE (2002), the causal factors of increasing food insecure caseload in the country are the interaction between environment, high population growth, diminishing landholdings, and a lack of on-farm technological innovation which led to a significant decline in productivity per household. These trends have combined with repeated effects of drought over the years.

Poverty eradication in Ethiopia, where smallholder farming is the dominant livelihood activity and source of vulnerability to poverty and food insecurity, is an overriding objective of the Federal Democratic Republic of Ethiopia (FDRE) (FDRE, 1996, 2004, 2012; MoFED, 2006; Brown and Teshome, 2007). To combat this problem, the Government has been trying to launch various policies and strategies to attain rapid economic growth. It has to design appropriate food security policy and strategy within the framework of Ethiopia's Poverty Reduction Strategy and the Growth and Transformation Plan (GTP) which has a medium-term objective of maintaining at least an average real GDP growth rate of 11% and attaining the Millennium Development Goals (MDGs) by 2015. Poverty reduction and enhancing food security situation has been an important component of the MDGs (MoFED, 2010, FDRE, 2012). To this end, the measurement and analysis of poverty and food insecurity is vital for understanding situations of well-being and factors determining food insecurity situations the outcomes of which are useful to inform policy making and in designing interventions and for assessing effectiveness of these policies and strategies. To achieve the objective of reducing the depth and extent of chronic poverty and food insecurity, the Government monitors the progress in poverty reduction and strongly underlines the effect of the on-going reforms and programs (FDRE, 2012).

The major dimensions of food security measured by some indicators usually have limited capacity to capture the extent of food security and hunger. Daily food energy consumption per capita or per adult equivalent and percentage of households that are food energy–deficient are outcome measures of diet quantity (WHO, 1985). Improved diet quality is associated with improved birth weight, child nutritional status and reduced mortality (Ruel, 2002, 2003). It is also recognized that inadequate diet quality rather than insufficient energy consumption is becoming the main dietary constraint facing poor populations. Household's diet diversity, percentage of food energy from staples, and quantities of foods consumed daily are indictors of diet quality of a household. The theoretical and empirical literature on food security as evidenced by Radimer *et al* (1990),Maxwell (1996), FAO (1996, 2007), Hoddinott (1999), Bickel et al (2000), Swindale and Ohri-Vachaspati (2005), Smith and Subandoro (2007), Kennedy *et al* (2011) identifies the ways of measuring food security situation, each measuring different aspects of food security situation at different levels.

Empirical evidences on food security in Ethiopia verify the prevalence of high level of food insecurity with significant idiosyncratic and spatial features. The specific food security studies by Samuel (2004), Berhanu (2004), Freihiwot (2007), Ayalneh and Shimelis (2009), Hadleya *et al* (2011),Zegeye and Hussien (2011), Abebaw *et al* (2011) and Hailu (2012) generally suggest that depth and intensity of food insecurity is high, influenced by poor functioning of marketing systems and other household and socioeconomic factors. However, most of the studies were focused on one aspect of food security situation, specifically the percentage of households facing calorie shortage. It is, therefore, of policy importance to measure both diet quantity and quality aspects of food security in rural Ethiopia. Dietary quality and diversity indicators enable to measure food security situations with limited resources and identify additional dimensions of food security measurement at household level.

Agriculture is considered as a strong option and fundamental instrument for spurring growth and sustainable development, poverty reduction, and enhancing food security in developing countries like Ethiopia. It is also assumed to be a vital development tool for achieving the Millennium Development Goals (MDG), one of which is to halve by 2015 the share of people suffering from extreme poverty and hunger (World Bank, 2008). According to the working definition of FAO (1996), food security is assumed to exist "when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life."

Improving income and food security requires articulation of policies that encourage and support subsistence farmers to produce over and above their own needs and use their natural and human resources for high value crops that can easily be sold in the market. Diversification is the process by which households construct increasingly diverse livelihood portfolios, making use of increasingly diverse combinations of resources and assets. But income diversification is the development by which households widen their income base by adopting new economic activities which includes agricultural diversification; diversification from subsistence into commercial activities; and diversification from agriculture into nonfarm activities (Niehof, 2004). From a

narrow point of view, agricultural diversification implies increasing the variety of agricultural commodities produced at the farm level and is the response of subsistence farmers to reduce risks (Goletti, 1999). A broader point of view is that agricultural diversification is a process accompanying economic growth, characterized by a gradual movement out of subsistence food crops to a diversified market-oriented production system involving

Food security is one of the concepts in the rural development literature with various definitions and hundreds of indicators. For instance, Hoddinott (2001) noted 200 definitions and 450 indicators of food security. Some of the indicators are qualitative while others quantitative. Some indicators are appropriate for monitoring purposes, whereas others are outcome indicators. There is no single and one best food security measure that is universally accepted. It is up to the researcher to select an indicator or a combination of indicators that suits the objective of the study, the level of aggregation and specific circumstances of the study and the study area. Therefore, as it is already reviewed above the selection and use of food security indicators, the type of food security measure depends on the objective of the study, characteristic of households and socioeconomic background of the study area, level of aggregation and specific circumstances of the study. In this study, average annual expenses/AE was used to compute proxy indicators of food security.

It is estimated that the current scenario of food crisis around the globe has increased the number to more than one billion undernourished people in the world. The global demand for food is expected to increase by 60 percent by 2050. Most of the world people consume too little food for a healthy and active life (Tweeten and Donald, 1997).

The causes of food crises in Africa are numerous, and complex. The principal factors which are attributed to food shortage include: 1) climatic hazards; 2) severe degradation of natural resources; 3) rapid population growth outstripping agricultural growth; 4) unstable macroeconomic environment and incompatible government policies in some nations; 5) low purchasing power of the people; 6) absence of food security policies at national or regional levels; 7) lack of storage facilities; 8) limited access to infrastructure and basic services; 9) civil war; 10) insufficient incentives; and 11) low productivity in the agriculture sector (Sijm, 1989; Braun et al., 1990; Tekolla 1990; ECA, 1992; FAO, 1994).

However, empirical investigations attempting to establish causal association between the above listed factors and food shortages have been limited. Similarly Ethiopia has been facing challenging problems. There is frankly speaking gradual improvement in reduction of poverty in the country. The recurrent drought is worsening health problems such as communicable diseases, epidemic prone diseases, micronutrient deficiency, malaria, water and other vector borne diseases. In the past decades, demands for access to productive asset and particularly land became an important issue of those vulnerable and food insecure households (FDRE, 2003).

The extent of food insecurity in Ethiopia has become alarming over the last few years and its coverage in drought periods has reached as high as 45 percent of the population. Although food insecurity is predominantly chronic, it is often aggravated and turns out to be more acute, and an average of over five million people were enlisted for a daily food relief per annum over the last decade, even when the weather and market conditions are relatively good. This condition in Ethiopia leads to a shift between chronic and acute food insecurity expressed by broad and deep crisis, which often is the characteristic of drought prone areas with low and variable rainfall, high population density and low natural resource endowments (FDRE, 2003). The problem of food insecurity has continued to persist in the country; many rural households have already lost their means of livelihood due to recurrent drought and crop failures (Ayalneh, 2002). Currently, millions people are food insecure or live in what is defined as "absolute" poverty in Ethiopia. Hence, there is a pressing and urgent need to assist farmers to be able to achieve food security through rapid increase in food productivity and production on economically and environmentally sustainable basis (Ayele et al., 2003).

In describing the concept of coping strategy terms or phrases like "coping technique" and "survival methods" are often used interchangeably by writers and researchers. In this context, "coping strategy" means coping mechanism "or coping technique" implying mainly at a household and individual levels. The term "response" is also used for individual actions aiming at survival in the face of disaster-induced food crisis or famine. Coping strategy could be defined as a mechanism by which households or community members meet their relief and recovery needs, and adjust to future disaster-related risks by themselves without outside support (Dagnew, 1993). According to Davies (1994), coping strategies are the bundle of poor people's responses to declining food availability and entitlement in abnormal seasons or years.

Kindo Didaye district has three Agro Ecological zones with high land covering 17.4%, intermediate (middle altitude) 59.0%, and low land 26.6%. The District is found at altitude between 700 meters and 2800 meters above sea level. 95% of the populations are farmers. According to the District Agronomic information, the total area of the District is 38,874h/r. Out of this Natural forest land covers 14,267 hectare, Re-forestation area 500 hectare, Arable land 15,471 hectare, Pasture land 3,858 hectare, Unproductive or degraded land 1,462 hectare, Marshland 28 hectare, productive but uncultivated 1,792 hectare, Irrigable land 262 hectare, and others 1,234 hectares. The average household size is five and the dependency ratio is also high. Due to the population pressure, average land holding is 0.25 hectare and which is very small and fragmented. (Wolaita zone Finance and Economic development coordination office annual report, 2012)

1.2. Statement of the Problem

In Ethiopia, the seriousness of food shortage problem varies from one area to another, depending on the state of the natural resources and the extent of development of food shortage (Webb et al., 1992). The land resources, mainly the soils and vegetation, of this part of the country have been highly degraded because of the interplay between environmental and human factors such as relief, climate, population pressure and the resultant over-cultivation of the land, deforestation, and overgrazing, technological and institutional factors aggravated growing problem of food insecurity in Ethiopia. The dry land of Ethiopia comprises of about 70% of the total landmass and 45% of the arable land, which includes arid, dry, semi-arid and part of the sub-moist zones. However, these areas contribute only 10% of the total crop production (Kidane, 1999). This amount of production is not sufficient to sustain the households residing in the area. The situation is aggravated by the fact that productivity in those areas declines at the rate of 3-4 percent per year (Kidane, 1999).

A number of factors aggravated the problem of food insecurity in Ethiopia. Averse climatic change (drought) combined with high human population pressure, natural resources degradation,

technological and institutional factors have led to a decline in the size of per capita land holding and food production (Degefa, 2002)

In spite of the improvement of main macro-economic indicators in recent years, food security remains one of the most important issues in Ethiopia's development agenda Indeed, food insecurity in some vulnerable regions is one of the major obstacles to poverty reduction.

Food security and poverty reduction remains as a top issue and prior agenda as far as rural development is concerned. To ensure this objective governmental and non-governmental organizations are working in the area. However, the analysis of factors affecting food security and the level of coping strategy by the households remain a long-standing challenge. Thus, identifying, analyzing, and understanding demographic and socioeconomic characteristics of the households that are responsible for variation in household food security is the main drive of this study to guide policy decisions, devise appropriate interventions and integrated efforts to combat food insecurity.

The UN office for coordination of Humanitarian Affairs' weekly food security update (April 9, 2012) also reported this case stating the situation,

> *"In SNNPR, near to total failure of the sweet potato harvest has been reported in the major root crop-dependent areas of Kembata, Hadiya and Wolaita zones. In addition to moisture stress suffered by the sweet potato crop, the extended dry conditions have been favorable for pest infestations in some areas, leading to further crop damage. Under normal circumstances, the sweet potato crop comes onto the market in March and is consumed primarily by poor households during the March to May lean season, until the [1]belg harvest begins in June. This year, there is no sweet potato available in the region's markets, indicating a likely increase in food insecurity in affected areas. The preliminary results of the recently concluded joint assessment in SNNPR confirm a need for more relief food for the poorest households due to the failure of the sweet potato harvest and the impact of the delayed belg rains."*

[1]The dry season where rain does rarely rain

This implies that the poor has even no economic access to food in the current scenario. Moreover, currently Kindo Didaye District is also identified as one of the four hot spot districts in Wolaita Zone (Kindo Didaye, Damot Pullassa, Boloso Sore and Boloso Bombe) and one of the *192* total priority one hot spot Districts in Ethiopia, according the multi-agency report of April 2012. Thus it will be pretty significant to the area as it provides further information about the real determinants of the area.

Kindo Didaye district is one of the chronically food insecure and vulnerable area of Wolaita Zone. The district has frequent crop failure and usually is vulnerable to food shortage. In an area where life is challenge, it will be a paramount importance to investigate and analyze, demographic and socioeconomic characteristics of the households and to identify the major causes of food insecurity. Moreover, it assesses the features of the food insecure households as well as their potentials to overcome the problem and analysis of the local coping strategies. Hence, the research will be conducted to examine major causes of food insecurity and coping strategies of households in Kindo Didaye District of Wolaita Zone.

About 98% of the population of the district depends on rain fed agriculture. The population pressure of this area dictates generally very small landholdings (Average land size per farmer being 0.25 hectare) on which farmers grow varied crops using inter cropping in the two production cycles a year. Rainfall dependent mixed farming that combines crop production and animal husbandry predominates as the major economic activity.

Such climatic and topographic attributes of the District emanates from the highly ragged, degraded and the hilly land dominated cultivation with high population pressure and low land holding by farming households. This also ends up farming households with low production of major food items, putting majority of the district population under food insecurity status. The overall performance of crops is poor even in normal seasons because of poor and unseasonal rain, low land size per household, less application of improved agricultural techniques, unavailability of alternative livelihood for the poor, and many other multifaceted socio-economic problems (Kindo Didaye District Rural Development Office 2012 annual report). As the topography of the District is not favorable for agricultural production and exposed to leaching of fertile top soil, the soil is infertile and the natural environment is mostly degraded.

1.3. Objectives of the Study

Major objective of the study

To examine the determinants of food insecurity and identify household coping strategies adopted by the local people during period of food shortage in the study area.

Specific objectives of the study

1. To identify the determinants of food insecurity status of rural households in the study district.

2. To estimate the magnitude of food insecurity in the study area.

3. To assess the strategies adopted by farm households ascoping mechanism to food shortage problems.

1.4. Hypothesis of the study and research questions
i.   Households with larger family size are more prone to food insecurity

ii.   Households engaged in off-farm activities are more likely to experience food security

iii.   Households which produce cash crops are less prone to face food insufficiency than non-cash crop producing households.

Research Questions

1. What is the households' food security status in the study area?
2. What are the household level factors that contribute to food insecurity in the area?
3. How do different socio-economic variables affect household livelihood?
4. What coping mechanisms do the households practice to deal with food shortage?

1.5. Significance of the Study

A studyexploringhousehold level food insecurity and coping strategies is crucial as it provides information as to how effective measures will be made to implement appropriate strategies and enhance food security. Besides, the output of this research will greatly help development practitioners and policy makers to acquire better knowledge to carry out development interventions at the right time and place to decrease vulnerability to food insecurity. The study will also be helpful to identify the different stages of coping strategies in order to make interventions appropriate to the area. Results of the study will be made ready and documented at district level so that it will serve as source material for further research development strategy.

Besides, this study provides necessary information for the regional government commissions of development planning program. Domestic as well as international NGOs interested in promoting rural development in the study area would benefit from the findings of the study. The study gives insight to researchers and students interested in the topic to stimulate further investigations of the problems in other areas.

1.6. Scope and limitation of the Study

The study was undertaken in Kindo Didaye District, Wolaita Zone, Southern Nation Nationalities and Peoples Region (SNNPR). The study covered only four peasant associations namely Zebo, Patata, Mogisa and Zereda out of the nineteen peasant associations of the District from which 160 households were selected. This study is limited in assessing the household food insecurity situation and local copying strategies. It dealt with limited number of households and gives due emphasis on household food insecurity and copying strategies only.

Besides, getting reliable and genuine responses from the respondent households were quite difficult due to the feeling of dependency created by regular food aid distribution in the area. However, the researcher did his level best to capture reliable information by trying tounderstandthe respondents with regard to the purpose of the study and by establishing rapport with them.

2. LITERATURE REVIEW

2.1. The concept of food security

Food security is a concept that has evolved considerably over time. Most definitions of food security vary around that proposed by the World Bank (Maxwell, 1996); wherein, food security defined as access by all people at all times to enough food for an active, healthy life (World Bank, 1986).

The essential elements in this definition are the *availability* (adequate supply of food); *access* through home production, purchase in the market or food transfer; *stability*, when availability and access are guaranteed at all times; and *utilization* which refers to the appropriate biophysical conditions (good health) required to adequately utilize food to meet specific dietary needs and security, as the balance between vulnerability, risk and insurance; and time (Maxwell and Frankenberger, 1992; EC, 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 insecurity, on the other hand, 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 food insecurity means that a household runs a continually high risk of inability to meet the food needs of household members. In contrast, transitory food insecurity occurs when a household faces temporary decline in the security of its entitlement and the risk of failure to meet food needs is of short duration (World Bank, 1986).

In the world of today, food insecurity is a widespread phenomenon despite the fact that food security is considered as a basic human right. As Walter (2000) rightly put it, human rights begin with breakfast. Food insecurity is seen as an evil experienced at an individual level. It is becoming the most critical issue in the developing world and most critical issue of the development agenda (Gezahegn et al., 2003). Food insecurity is a major constraint to the development of many African, Caribbean and Pacific countries.

Food insecurity is the lack of access to sufficient food, either chronically or transitorily, that leads to poor health, reduced energy, and other physical and physiological deterioration. Chronic food insecurity is due to the unavailability of food or lack, of resources to acquire it. Transitory food insecurity is a temporary decline in a household's food supply due to instability in food production, prices or market availability, or household incomes. Food security is sometimes equated with food self-sufficiency, either at household or national levels. In the last two and a half decades, food security has become an important concept in development literature. The roots of the concern with the food security concept in recent years began with the world food crisis during 1972-74. Thus, the food insecurity problem in the 1970s was conceptualized as a supply problem without considering the ability of the population to access the food even if it was available.

The approach to food security dramatically shifted in the 1980s and since then the conceptualization of food security recognizes both the supply as well as, entitlement dimension of the food problem. Sen's concept of entitlement to food (Sen, 1981) contributed for the shift in

the conceptualization of food security in the 1980s. Since the 1970s, the definitions and conceptualization of food security evolved in terms of level of analysis, that is, from the world to nation or from the nation to regions and from regions to households and individuals. With the shift of emphasis from supply to entitlement in the 1980s, Sen's entitlement concept and other studies have demonstrated the ambiguity of global, or national and regional levels of the aggregate measures of food security.

However, lack of generally accepted standard measurements or indicators of food insecurity remain part of the ongoing debates in the food-security literature. There is no single measure of food security. The appropriate measure depends on the level of aggregation at which the problem is analyzed. The food security literature in the 1980s was able to combine the notions of poverty, under- nutrition and vulnerability in the definitions of food security (Maxwell and Franken Berger, 1992). In the context of subsistence farm households, food security refers to the ability to establish access to productive resources such as land, livestock, agricultural inputs and family labor, combined to produce food or cash (Getachew, 1995).

Consistent with this, Bonnard (1999) argues that there are three major components of food security: availability, access and utilization (Haddad, 1997; Kifle and Yoseph, 1999). Food availability refers to the need to produce sufficient food in a way that generates income for small-scale producers while not depleting the natural resource base, and the need to get this food from the market at prices that consumers can afford (Haddad, 1997). According to Kifle and Yoseph (2005), availability is basically the household's capacity to produce the food it needs.

Three definitions of food security that were put forward by Edie (1986), Calkins (1986) and the World Bank (1986) will be briefly reviewed below. According to Edie (1986:223) "Food insecurity is when the viability of the household as a productive and reproductive unit is threatened by food shortage". This definition emphasizes the importance of the household as a productive and reproductive unit, and that its viability can be threatened by food insecurity. On the other hand, Calkins (1986) defines food security as the capacity of a population to produce or to buy enough food, even in the worst years, to satisfy its basic needs. This definition begins with recognition of the capacity of the people as a determinant for food insecurity. The definition

emphasized the need for both production and purchasing capacities of the people to achieve food security.

The most widely used definitions of food security is the one forwarded by the World Bank (1986), which states food security as access by all people at all times to enough food for an active and healthy life. It is a generalized version of Calkin's (1986) definition that the means of accessing food is through the capacity of population to produce or to buy enough food, even in the worst years, to satisfy its basic needs. A household is said to be food insecure when its consumption falls to less than 80% of the daily Minimum Recommended Allowance (MRA) of caloric intake for an individual to be active and healthy. Based on temporal dimension, two types of household food insecurity can be distinguished: chronic and transitory.

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 will be identified as a seasonal food shortage of any magnitude.

Generally, food security signifies the complementarities of the economic and food availability decline because enough food must be available, and households must have the capacity to acquire it. The new concept and definitions of food security has also led to two additional major shifts in thinking; from 'food-first' approach to the 'livelihood' perspective and from objective indicators to subjective perceptions (Maxwell, 1994, cited in Debebe, 1995). The agricultural development policy of Ethiopia encourages farmers to adopt packages of new agricultural technologies as a way to maximize food security of the households (Bezabih, 2000).

Moreover, food security can be achieved through breaking the vicious circle of lack of access to input, information, technology, credit, markets, basic services and limited income generation opportunities and alternatives (FDRE, 2003). At household level, it may be improved by increasing food entitlement. It is achieved particularly when the poor and vulnerable groups get

access to the food they need by enhancing their own production and by diversifying their income sources (Tesfaye, 1995).

There is a consensus in all the definitions of food security to further disaggregate the analysis of food security. However, there are still some differences between scholars who wish to disaggregate the level of analysis to individuals and those who wish to do it at the household level. In contrast, the proponents of household-level aggregation argue that the household is empirically a more appropriate unit of survey since it is the common unit of production and consumption (Frankenberger and Goldstein, 1991; Casley, 1987). Finally, the concept and definition of food security were developed and clearly expanded based on the growing hunger, food insecurity and malnutrition scenarios in developing countries. From the above definitions of food security, slight variations were observed. However, the overall basic principles and definitions of food security, that is, "availability and access" were stressed in the definitions cited above. Therefore, for the purpose of this study, the definition put forward by World Bank (1986) was taken as a working definition of food security and the household level is considered as the key unit of food security analysis.

2.2. Risks of Food Insecurity

Rural households face a variety of risks, which may vary from natural to man-made factors (Debebe, 1995). Drought could be considered as a major cause of famine in Ethiopia??. Hansen (1986) provided a purely scientific, meteorological definition of drought and a definition that relates drought to human activities. Devereux (1993) and Mesfin (1986) argue that one cannot completely ignore climate, by saying "climatic shocks are neither a necessary nor sufficient cause of famine." With widespread crop failures, natural or other disasters as well as the risk of fluctuation in production are some of the risk condition contributing to food entitlement failure. Moreover, variability in food supply, market and price variability, risks in employment and wages, and risks in health and morbidity, and conflict are also an increasingly common of risk to food entitlements (von Braun et al. 1992: 17).

2.3. Food Security: Measurement and Indicators

Hoddinott (1999; 2002) noted the fact that there are approximately 450 indicators of food security and it is difficult to measure food security. In line to Hoddinot`s argument, Maxwell (1995) pointed out that defining and interpreting food security, and measuring it in reliable, valid and cost effective ways, have proven to be stubborn problems facing researchers. According to Maxwell and Frankenberger (1992), food security indicators are generally categorized in to two main categories: „*process*□ and „*outcome*□ indicators. *Process* indicators are divided in to two: indicators that reflect food supply and indicators that reflect food access. *Outcome* indicators are used to measure the status of food security at a given point in time and grouped into direct and indirect indicators. Direct indicators of food consumption include actual food consumption rather than to marketing channel information or medical status. The indirect indicators include storage estimates, subsistence potential ration and nutritional status assessment (Alison and Slack, 1999). However, there is no fixed rule as to which method to employ due to the diversified characteristics of food insecurity and the different level of consideration. The decision to rely on a particular method usually depends on resource and time constraints, objectives of the study, availability of data, type of users and degree of accuracy required (Debebe, 1995). The focus in household food security is on how members of a household produce or acquire food throughout the year (FAO, 2003). At the household level, food security is measured by actual dietary intake of all household members using household income and expenditure surveys (Saad, 1999). However, expenditure is more reliable than income data (Smith et al., 2006; Tassew, 2006). Using a survey data, the minimal standard of living is proxy by the level of consumption expenditure that will enable the household or individual to attain the basic needs. Accordingly, the cost of basic need was calculated based on data of the lowest income quartile in order to measure household food security and to calculate the cutoff point beyond which a household is food secure or not.

Measuring the required food for an active and healthy life and the degree of food security attained is a question to be addressed in a food security study. Given the multiple dimensions of food insecurity, there is no single indicator for measuring it. For this purpose different indicators are needed to capture the various dimensions at the country, household and individual levels. At the national or regional level, food security can be measured in terms of food demand (requirement) and supply indicators. Food security indicators are classified into two main categories: process and outcome indicators. The process indicators provide estimates of food supply and food access situations. The outcome indicators serve as a proxy for food consumption (Frankenberger, 1992). Process indicators are used to measure the changing status of food security. They can also offer the type of information necessary to plan and adjust development efforts. Process indicators are further disaggregated into two groups: supply indicators and access indicators. Process indicators include indicators that reflect food supply. Both process and outcome indicators of food security can be important when assessing food security, but access indicators measure that food access become apparent when governments and development agencies realize existence of household food insecurity and famine conditions are occurring despite the availability of food. In recent years, access indicators have been seen as relatively more valuable in development planning, implementation and monitoring of food security interventions.

Some strategies include short-term dietary changes, reducing or rationing consumption, altering intra-household food distribution, depletion of stores, increased use of credit for consumption purposes, increased reliance on wild food, short term labor migration, pledging, mortgaging and selling of assets, and distress migration (Maxwell 1996). As Eshetu (2000) describes it, indicator (measurement) is not only important, but also necessary at outset to identify the food insecure households, to assess the severity of their food shortfall and to characterize the nature of their insecurity.

Outcome indicators, unlike the supply indicators, can be disaggregated at lower level. They include household budget and expenditure, subsistence potential, food consumption frequency, nutritional status, storage estimate and household perceptions of food insecurity. Some of the problems with outcome indicators like anthropometrics are their results may not exactly indicate the level of food crisis. It is because nutritional intake is affected by a number of factors such as

health and sanitation. Food security at the household level is best measured by direct surveys of dietary intake in comparison with appropriate adequacy norms. However, dietary survey is costly due to the considerable time required for data collection and processing (Mekuanint 2006).

Changes in socio-economic and demographic variables such as real wage rates employment, price ratios, and migration, can serve as proxies to indicate the status of and changes in food security (Hoddinott, 2001). Indicators and their risk patterns need to be continuously measured and interpreted to monitor food security at household level. Recent research on the multi-factorial nature of food security has provided a wealth of analytical insight, but measurement problems remain as a major challenge, not only for research, but also for targeting and program management. However, the search for viable indicators is driven by the lack of a good standard measure for food security. According to Bovis (1993), two approaches have been widely used to evaluate the level of food security.

The first one is the "expenditure technique" used by economists whereby gross household's production and purchases over time are estimated, estimates of the growth or depletion of food stocks held over time are made and the balance is considered as consumed. This approach follows the calorie available to feed members of the household. The second technique is based on caloric intake of individuals in the household. It measures the amount of food consumed by the family members during, usually, 24 hours. It helps generate information necessary to determine the seriousness of undernourishment, malnutrition and under nutrition in terms of money, time and personnel (Maxwell, 1995).

As reviewed by Maxwell et al. (1999), the most common indicators of food security revolve around the measures of food consumption. A good measure of consumption requires data on household food consumption, household size, age and sex of individuals, as well as physical size and activity levels. Even if average size and activity levels are presumed, consumption measures capture only the physiological sufficiency elements of food security. There are also problems with the representatives of consumption measures, particularly when relying on cross-sectional data. However, in practice, measuring caloric intake or the adequacy of household food availability over time continues to be suggested as the main 'benchmark' measure for food security (Chung et al., 1997).

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2.4. Households Strategies of Coping with Food Insecurity

Different studies present a variety of different coping strategies that the households are likely to adopt when faced with food shortage. Households are not passive victims of food insecurity or drought. But, based on their capacity, every household undertakes different activities to cope with crisis and to minimize it. Thus, coping mechanisms used by farm households in rural Ethiopia include livestock sales, agricultural employment, 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 and crop residues, reduction of frequency of food consumption and meal portion, consumption of wild plants, reliance on relief assistance, relying on remittances 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 (Cutler and Stephenson, 1984).However, this depends on and varies with the level of households' entitlement and vulnerability to crisis. Households adopt and develop diversified coping strategies and sequential responses through which people used at times of decline in food availability (Mulugeta, 2002).

Cutler and Stephenson (1984) argue that the pattern of coping is largely determined by the pre-crisis characteristics of individual households that involve a succession of responses to increasingly severe conditions. Webb and von Braun (1994), elaborate that these responses do not signify an overnight awakening to danger, rather a progressive narrowing of options that leads from broad attempts to minimize risk in long-term through actions designed to limit damage caused by a crisis, to extreme measures aimed at saving individual lives, even at the expense of household dissolution.

Typically, food insecure households employ any of the four types of consumption coping strategy. First, households may change their diet (switching from preferred foods to cheaper, less preferred substitutes). Second, a household can attempt to increase its food supplies using short-

term strategies that are not sustainable over a long period (borrowing, or purchasing on credit; more extreme examples are begging or consuming wild foods, or even seed stocks).Third, households can try to reduce the number of families that they have to feed by sending some of them elsewhere (anything from simply sending the kids to the neighbor's house when they are eating, to more complex medium-term migration strategies). Fourth, and most common, households can attempt to manage the shortfall by rationing the food available to the household i.e. cutting portion size or the number of meals, favoring certain household members over other members and skipping whole days without eating (Maxwell et al., 2003)

A study made in northern part of Ethiopia identified the most common coping practice that is sequentially used during food crisis. It includes reducing number and size of meals, sell of small ruminants and draft oxen, consuming wild food, borrowing of cash and/ or food from better off neighbors and/or relatives. Another less frequently used strategies were postponing wedding, sell of firewood, withdrawing children from school and eating toxic or taboo food (Eshetu, 2000).

Teklu (1992) considers coping strategy as a shift between or within the production, consumption, income, assets and migration paths. The production path is indeed related to risk management that the farm households employ to minimize crop loss through diversification of crop varieties (Hardaker et al., 2004). It could also refer to the coping mechanism through diversification of the income sources as they promptly react to the food scarcity. However, such measures adopted by the households to minimize risks remain effective for only limited periods of time. Webb and von Braun (1994) added that successive years of below average or poorly distributed rainfall have negative effects on production, and hence on income and consumption of the households.

Bezabih (2000) reported that the coping mechanisms are sequentially adopted in a way that the actions taken would, as much as possible, save life today without risking the future food production or entitlement capacity of the household. At early stage, in order to reduce the extent of food insecurity, households adjust their production decisions as well as labor location and commit non-(or less) productive assets.

Coping strategies though vary from place to place and household to household, the most commonly used sequence of responses farm households typically employ as sequential coping mechanisms when faced with a food crisis summarized diagrammatically by numerous authors. These can be grouped in three stages: first stage (insurance mechanism), second stage (disposal of productive assets), and the third stage (stage of destitution) refers to distress migration (Frankenberger, 1992; Debebe, 1995; Bezabih, 2000).

Farm households in different vulnerable areas of the country engage themselves in several activities so as to avoid food insecurity. This holds true for the study area. Ada Berga is one of the vulnerable Woredas where people are affected by drought induced food security. In the face of such adverse conditions, farmers used various coping mechanisms to smooth consumption and escapes severe food crisis.

Farm households respond to the problems caused by seasonal and disaster (mainly drought) related food insecurity in different ways. Various coping mechanisms that are identified by different authors (e.g., Messer, 1989; Dagnew, 1994) can be put under three broad categories. These are production-based responses (expansion of production and improving productivity); market-based responses (food grain purchase through mainly sales of livestock) and nonmarket-based responses (including institutional and societal income transfer systems such as gift and relief food distribution).

All households are not equally vulnerable to food shortages and do not respond to it in the same way. Deprived households are more vulnerable to disasters than relatively better off households. The destitute are often forced to immediately collapse and get engaged in unusual and marginal kinds of economic activities (such as sales of grass, wood, leaves, and eating wild food and at the end migration). Since the country is dependent on agriculture, crop failure usually leads to household food deficit. The absence of off farm income opportunities, and delayed food aid assistance, leads to asset depletion and increasing levels of destitution at household level. As it was discussed before, farm households in different vulnerable areas of the country use different coping mechanisms against food insecurity.

2.5. Food Security Strategy of Ethiopia

Ethiopia's food security strategy highlights the government's plans to address the causes and effects of food insecurity in Ethiopia. The food security strategy has two major approaches towards achieving food security in Ethiopia: 1. Enhancing agricultural productivity 2. Asset building/productive safety net programmes (PSNP). Therefore, the food security strategy places a significant focus on the following issues:

i. **Environmental rehabilitation**: Measures to reverse the level of land degradation and create a source of income generation for food-insecure households through a focus on biological measures, such as re-forestation and land preservation.

ii. **Water projects**: Water harvesting and the introduction of high-value crops, livestock and agro-forestry development.

iii. **Enhancing agricultural productivity:** Agriculture is considered to be the starting point for initiating the structural transformation of the economy. Because of this, agricultural development-led industrialization (ADLI) has been pursued as a major policy framework since 1991. ADLI assists the development of agriculture and helps expand markets for domestic production leading to increased incomes for small holders.

iv. **Controlling population growth**: High population growth rates continue to undermine Ethiopia's ability to be food secure and provide effective education, health and other essential social and economic services. The central elements of the policy focus on a multi-sector approach, improving family planning services and expanding education.

v.   **Prevention and control of HIV/AIDS**: HIV/AIDS is a formidable challenge to the pursuit of food security in Ethiopia as it reduces and debilitates the productive population and society as a whole. The government has put in place a national policy and countrywide programme for the whole population to control and reduce the spread of the disease.

vi.   **Gender**: Women have a substantive productive role in the rural sector, including participation in livestock maintenance and management, crop production, and the marketing of rural produce. Integration of gender perspectives in the design and implementation of economic and social policies, programmes and projects is considered central to the national food security strategy.

vii.   **Environmental sustainability**: This is critical to the pursuit of food security and economic development generally. Development depends on the appropriate and sustainable use of the environment and the management of natural resources. Given the high environmental degradation in drought-prone and pastoral areas, environmental rehabilitation (soil and water conservation) is an essential element.

2.6. Empirical Studies on Food Insecurity

Causes of 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" seasons, when food stocks dwindle and roads become muddy and impassible (Bonnared, 1999).

A study conducted in one of Lesotho's villages found that women and children suffered from lack of food and poor hygiene because women were exhausted to cook and clean at the time of peak agricultural work (Huss-Ashmore, 1984). He also observed that illness of adults at critical times in the production process adversely affected labor efficiency and productivity, which in

turn contributed to food shortage. A study by Ashimogo and Hella (2000) in Iringa, Tanzania revealed that household food security was positively influenced by total household asset disposal and income. On the other, hand the study revealed 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 cause of hunger or food shortage in several African nations. Closely associated with this, Ogbu (1973) noted insufficient farmland; low yields on farmers and high storage losses as the principal causes of food shortage in Nigeria. According to a study by Toulmin (1986), the people of Bambara Village of Kala in Mali faced food shortages that were mainly induced by two principal factors. One of the factors was climatic, specifically low and highly variable rainfall making the people very vulnerable to crop failure. The second class of risk was demographic, consisting of high level of mortality, varying levels of fertility and vulnerability of all producers to sickness and disability (Toulmin, 1986).

Land-use competition between pastoralists and farmer has also become the cause of food shortages in some Sub-Saharan African countries. The situation in Ethiopia is not much different from the conditions in other developing regions. The result shows 'variations between households practicing double cropping system and those relying on a single harvest were the proportion of farmers practicing double cropping who reported to have faced seasonal food deficit was smaller than those engaged in single harvest. Food security at household level is affected by a number of interrelated factors. It is determined by household assets ownership, occupation, demographic factors such as size, gender, and age composition of households, educational level, socio-cultural factors, access to credit and inputs, and climatic factors like variability and shortage of rainfall and drought in general (Andersen, 1997). Some of the general factors that cause household food-insecurity in rural area are poor agricultural growth, unequal distribution of productive resources and income, and rapid population growth.

They result in chronic food-insecurity and poverty, whereas, seasonal rainfall variations, lack of draught oxen, inadequate farm size, and shortage of farm inputs are factors responsible for seasonal shortfall of food. Moreover, additional causal factors for transitory food insecurity in the rural area are outbreaks of human and animal diseases, outbreaks of crop pests, flood hazards

leading to serious harvest failure, drought, sharp grain price increases coupled with sharp decrease in livestock prices, food availability, decline and lack of labor demand during crises situations (Dagnew, 1995). Drought, as noted by Dagnew (1997), was also considered as the major immediate cause of alarming level of food insecurity in many parts of Ethiopia.

Long-term factors, such as the interaction between environments, high population growth, diminishing land-holdings, and a lack of on-farm technological innovation have led to a significant decline in land productivity per household. Ayalneh (2002) describes the food insecure groups of households as those who live on the edge of subsistence often located in remote areas far from markets. According to Hoddinott (2001) household food security issues cannot be seen in isolation from border factors. He viewed these factors as physical, policy and social environment. And he argued that the physical factor plays a larger role in determining the type of activities that can be undertaken by rural households. Therefore, the review made so far is quite useful and relevant to this study. It helps develop clear understanding of variables to be selected; factors determine food security status and major causes of food insecurity. It is also important in assessing and identifying coping strategies.

3. METHODOLOGY

3.1. Descriptions of the study area

The study is undertaken in one of the 12 districts of Wolaita zone, Kindo Didaye in SNNPR. Kindo Didaye is one of the 12 rural and 3 urban administrative districts in Wolaita Zone in the Southern Nations, Nationalities and Peoples Regional State (SNNPR), Ethiopia. It is located at about 90 km to the south-west of Soddo town, the capital of the Wolaita zone, 280 kmfrom the capital city of SNNPR Hawassa and 510 Km from Addis Ababa. The district is situated to the south west of Kindo Koysha district, to the Northeast of Kucha District of Gamo Gofa Zone, to the east of Loma District of Dawro Zone and to the west of Offa District in Wolaita Zone.
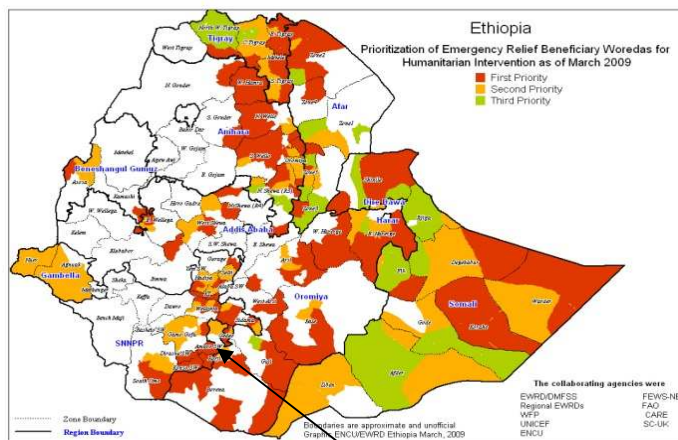
Map of Wolaita zone
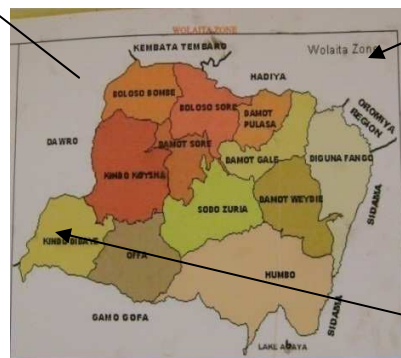
Kindo Didaye district

Agriculture is the mainstay of the economy of the local communities. It is intensively carried out by those who have land and livestock. Some landless are engaged with sharecropping and other non-agricultural income generating activities like daily laboring. Crop production and animal husbandry are major activities under this economic sector. Agricultural products are consumed at home and sold to generate income to meet other household needs, educate children, contribute for social affairs like *ekub[2], edir[3], Debo[4]* etc and to pay taxes. The depth and intricacy of the socio-economic challenges of the area is tremendous and at the same time variable. All livelihood systems of the areas are highly dependent on agricultural production which in turn is fully dependent on rainfall. This high variability of rainfall and natural resources degradation have made livelihood systems in this densely populated areas highly vulnerable to external shocks.

As shown in Table 1, the major livestock managed in the area includes goats, sheep and cattle poultry.

Table 1 Livestock population in Kindo Didaye District

Type of Animal	Number of Livestock
Oxen/bulls	1,682.00
Cow/heifers	2,145.00
Calves	864.00
Sheep	1,870.00
Goat	982.00
Poultry	11,208.00
Total	**18,751.00**

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[2] An informal local cooperative association where people help one another with the money they collect
[3] It is also a social union particularly serving people in some situations like mourning, wedding etc
[4] It is a local unity where people act together in the case of labor shortage

(Kindo Didaye District Rural Development office annual report 2012)

The [i]arable land accounts to 39.8% of the total area of the district (Kindo Didaye Rural Development Office). With regard to the farming system, mixed farming of crop and livestock is a common practice in Kindo Didaye district. The people earn their living mainly by producing crop and by rearing cattle. Maize, teff, sorghum and haricot-bean are crops that grow in the area. Fruits like avocado, banana, mango and pineapple are also cultivated in the district, though at small scale. Maize is the leading crop followed by teff.

3.1.1.. Input Supply

The most important agricultural inputs widely used by farmers in the study district in particular and the zone in general are commercial fertilizer and improved seed (teff, wheat, maize and sorghum). However, the extent of the use of these agricultural inputs is limited as one can see from the amount of fertilizer supplied and distributed to the farmers and the total number of farming households. The proportion of fertilizer supplied to the district and consumed as well as the number of users in 2011/2012 production year were 35.6%, 26.6%, and 26.8% respectively (District Agricultural office). The report indicated that the percentage of fertilizer used by farmers during this year is relatively higher than the average share of other districts.

3.1.2. Soil Type and Farm Land Holding

Farmers in the study district traditionally classify their soils in many different ways. However, most of them identify four dominant soil types, namely red, black, gray and brown soil. According to the Agricultural Development Department of the zone, red soil covers about 38%, black cotton 58%, gray soil 2% and brown soil 2%. Kindo Didaye district is under immense pressure from an expanding human population trying to live on rapidly degrading resources. Soil erosion is severe as cultivation expands increasingly in marginal areas.

The high population pressure in the district resulted in intensified land use to the extent that the rugged surface is plowed. This practice will in turn lead to serious soil erosion and depletion. Upland farming without proper conservation measures are cause of low fertility level of the soils

in the study areas. In the study district land has been cultivated for a long period of time without the use of chemical fertilizers. Such a continuous cultivation of soils leads to widespread depletion of nutrients with a corresponding drastic loss in productivity and exacerbates food security problem.

3.1.3.. Social Infrastructure and Communication services

One of the preconditions for a rapid economic and social development of a given society is the availability of physical infrastructures such as road, water supply, education and health, marketing facilities, telephone and other communication services. These facilities directly or indirectly determine the production efforts to address the livelihood of the society.

3.1.4..Education Services

According to (Wolaita zone Education Sector annual report 2012), Wolaita zone has 334 elementary, 112 junior secondary, 21 senior secondary schools and 1 Agricultural Technique and vocational college, 1 Poly technique college, 1 university and three private colleges. Likewise, in the Kindo Didaye district there are a total of 19 elementary, 4 junior secondary, and 1 senior secondary. According to the same source, the total number of students in elementary, junior secondary and senior secondary schools of the district was 74682, 19876 and 2110 respectively.

3.1.5..Health Services

With regard to the establishment rendering health related services in the zone, in 2012/13, there are 3 referral hospitals, 28 health centers, 224 health posts (Zonal Health Department). Two of the hospitals are located at the distance of 90 km away from the district capital town, Halale and 1 is 123 km away. Each PA under the study has got health posts and one health center in a reasonable distance. The main problems affecting the health status of the people in the district are: lack of safe and adequate water supply, shortage of health professionals, shortage of medical supplies and equipment and shortage of health facilities. The following are the top nine diseases

prevalent in the district: malaria, diarrhea, pulmonary tuberculosis, respiratory infection, sexually transmitted diseases, eye diseases, skin diseases and intestinal parasites (Wolaita zone health Department annual Report 2011).

3.1.5..Water Supply

Water supply coverage is very low in the district. Only the capital of the district, Halale has access to potable water and the rest and all the rest inhabitants including the target area use unprotected stream water. The difficult geology of the study area is the major problem for the development of water supply systems and many NGOs seem to be not attracted to engage in such critical areas of interventions

3.1.6..Communication

The district has 98 km all-weather road that connects to two other districts of the zone. The lack of a network of all-weather roads with in the PAs of the district is hampering trade activities. The mobile network works in 82% of the district and fortunately all the four PAs where the study was conducted access it. The postal service and hydroelectric power is available only in the capital of the district. Lack of social infrastructure coupled with poor and backward marketing facilities, poor road network and communication facilities make Kindo Didaye district relatively the most inaccessible area of Wolaita zone.

3.1.7..Market Places

The markets are mostly located in open rural villages and in small towns with one major market in the district capital, Halale. In addition, some small markets are also found in villages, and are only operational once a week. These markets are traditional in nature and are characterized by inadequate marketing facilities and services, such as good sanitation, product protection, shelter and so on.

They are also constrained by deficient transportation infrastructure. Particularly, feeder roads and roads linking rural areas with urban consumption centers are inadequate. Thus, the majority of the areas are inaccessible by vehicles making it imperative to use pack animals (such as donkeys). Hence, most rural households transport their agricultural produce (surplus over subsistence) to markets and milling places by donkeys and/or on their shoulders. There are over five markets in the district and another two large markets in the neighboring districts namely Gesuba and Belie.

3.2.Research Design and sampling technique

A cross-sectional household level survey was employed to see the magnitude of food insecurity and some of coping mechanisms that farm households use in time of food shortage in the study area.

The data used in this research were collected mainly from rural households located in four Peasant Associations (PAs) in Kindo Didaye district of Wolaita Zone. A two stage sampling procedure was used. In the first stage, four PAs from a total of nineteen PAs were randomly selected. Consequently, two PAs from a highland and mid-altitude and 2 PAs from lowland were selected. In the second stage, one hundred sixty representative farm households were randomly selected for interview. During this process, the list of household heads in each peasant association was used to make random selection of the farmers. A structured survey questionnaire was designed and pre-tested to collect the primary data.

For enumeration, two youths who completed two years college training that live in the area and close to the people under study were recruited and trained on the techniques of data collection, including how to approach farmers, how to conduct the interview, and how to convince the respondent to get relevant information on sensitive economic and social issues. After they were made aware of the objective of the study and content of the questionnaire, pre-test was conducted under the supervision of the researcher. Some adjustments were made to the questionnaire and the final data used in the research were collected under continuous supervision of the researcher.

As a means of verifying the data collected by the enumerators from the farmers, personal observation was made using rapid appraisal methods. Secondary data were also collected from

published and unpublished sources and used for this study. Such data were collected from the district Bureau of Agriculture, NGOs operating in Wolaita Zone, Finance and Economic Development Department of the district, Publications of CSA, etc. Moreover, documents of SNNPR Food Security Coordination Office were intensively reviewed to consider pertinent information. The table below shows how the PAs were selected for the study.

Table 2. Number of household per peasant association and samples to be drawn

S.No	Peasant Association	Population	Sub Village within PA	No of HHs	Sample from each sub village	Percent
1	Zebo	7948	1	370	14	8.75
			2	392	15	9.34
			3	342	13	8.13
			4	338	13	8.13
			Total 1	**1442**	**55**	**34.4**
2	Patata	7693	1	258	10	6.25
			2	236	9	5.63
			3	250	10	6.25
			Total 2	**744**	**29**	**18.13**
3	Mogisa	7423	1	274	11	6.87
			2	272	11	6.87
			3	284	11	6.87
			4	310	12	7.5
			Total 3	**1140**	**45**	**28.07**
4	Zereda	5745	1	250	10	6.25
			2	285	11	6.87
			3	270	11	6.87
			Total 4	**805**	**31**	**19.9**

Sampling procedure


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          ┌─────────────────────────────┐
          │      Kindo Didaye district   │
          │                              │
          │    19 Peasant Associations   │
          └─────────────────────────────┘
                         │
                         ▼
          ┌─────────────────────────────┐
          │                              │
          │      4 Peasant Associations  │
          │                              │
          └─────────────────────────────┘
                         │
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```

Proportional Simple Random Sampling

| PA-1 Zebo (55 HHs) | Patata (29 HHs)PA-2 | Mogisa (45 HHs)PA-3 | Zereda (31 HHs)PA-4 |

160 HHs
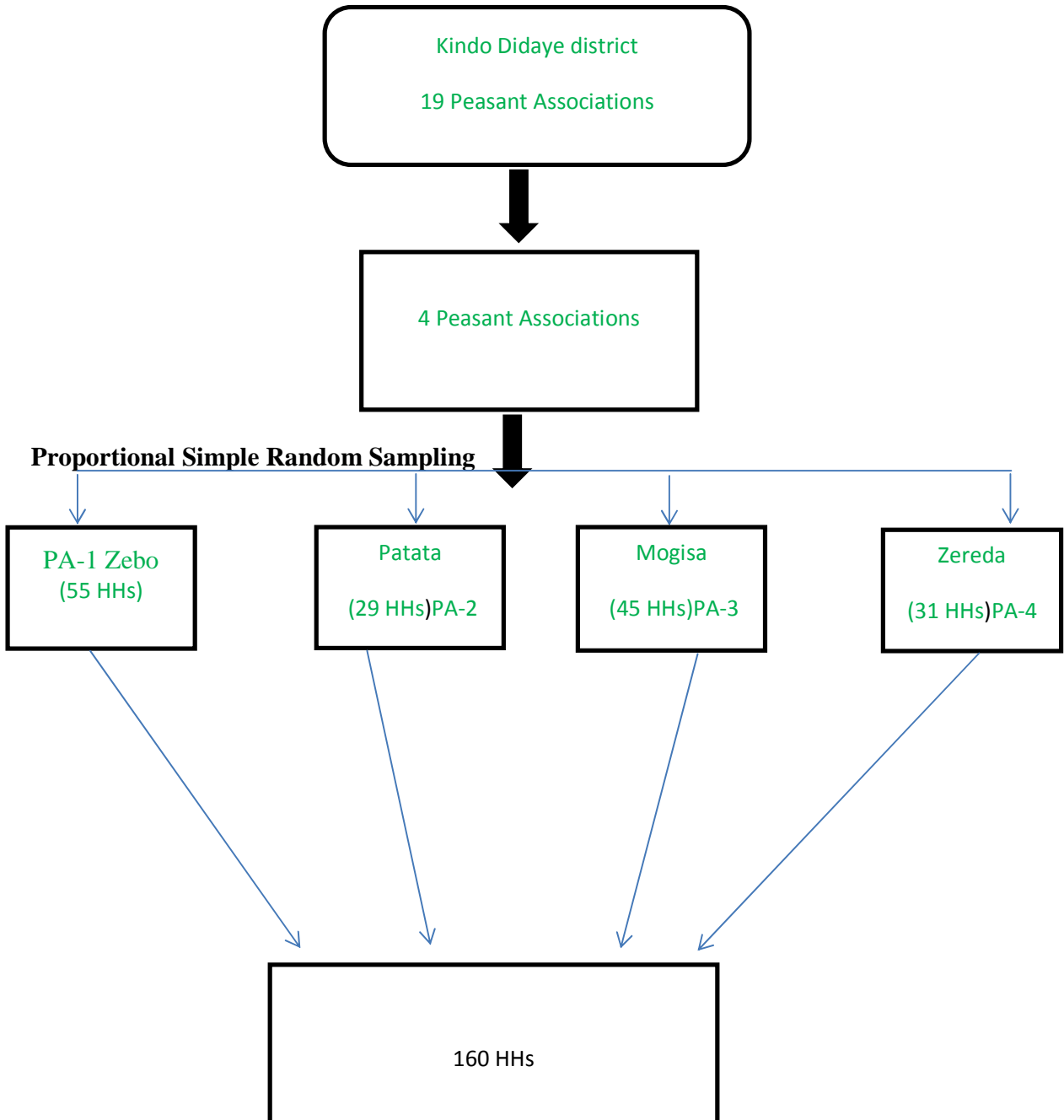
3.3. Sources of data

Both qualitative and quantitative data were collected from primary and secondary sources to identify important independent variables that affect household food security. Quantitative primary data were collected using household survey, in which the household heads and their spouses were asked about food security and related issues separately since the way women and men understood food security may differ . Qualitative primary data were collected using key informants where elderly and knowledgeable people about the area were asked on various issues relevant to the study. On the other hand, secondary data were obtained from published and unpublished sources. The main data that were collected for this study include household demographic characteristics, asset possession, off-farm/non-farm income, livestock and oxen ownership, soil conservation activities, and types and amount of food eaten by the household in a specific period. The coping strategies practiced by households werealso collected at different levels. Other additional data were also collected including resource endowment, institutional factors such as access to credit and training, accessibility of farm inputs and extension service, problems in crop and animal production, pest infestation, productive resources and biophysical factors.

The data collected from diverse sources included those ranging from descriptive to interpretive ones such as feeling and emotions of informants. As the research also employed qualitative approach, the theories referred to will be used to interpret the data. In addition, the data collected will be subjected to descriptive analysis (providing narrative accounts) of the study problem.
Data compilation and coding was done before the analysis and interpretation of the outputs. The primary and secondary data obtained using the structured questionnaires were edited, coded and analyzed using the SPSS version 16 analytical tool, while the others will be subjected to descriptive statistics such as mean, variance, standard deviation and percentages.

3.4. Analytical model

The farm household data were analyzed using both descriptive and econometric procedures of data processing. Descriptive statistics like mean, variance, standard deviations, frequency distributions, ratios, percentage, graphical and tabular analysis were used to examine and

understand the socio economic situations of the respondents. Evidently, the core aim of this investigation was to identify the major causes of food insecurity among the farm households in Kindo Didaye. Statistical models can be fitted to establish the relationship between the household characteristics and food insecurity in such a way that food security/insecurity is a function of a series of household characteristics and other variables. Linear regression analysis is widely used in most economic and social investigation (Aldrich and Nelson, 2002, cited in Getachew, 2009). This is because it has some desirable properties for specific type of data, and is easy to compute and interpret. However, the same source further stated that while estimates derived from linear regression analysis may be robust in the face of errors in some assumptions, other assumptions are critical, and their failure will lead to quite unreasonable estimates (Aldrich and Nelson, 2002). To examine the association between food security/insecurity (dependent variable) and the relative importance of independent variables, food security/insecurity will be treated as dichotomous dependent variable. Food security/insecurity is, therefore, a non-continuous dependent variable that does not satisfy the key assumptions in the linear regression analysis. The most widely used qualitative response models are the logit and probit models (Amemiya, 2000). The statistical similarities between the two models make the choice between them difficult. However, Maddala (1989) and Kementa (1986) reported that many authors tend to agree on the use of logistic model since the commutative normal functions are very close to the mid-range but the logistic function has slightly heavier tails than the cumulative normal functions.

Feder et al. (1985) have recommended probit model for functional forms with limited dependent variables that are continuous between 0 and 1, and logit models for discrete dependent variables. But, logit and probit models produce similar parameter estimation, a commutative logistic regression model is preferred (Agresti, 1990); it is advantageous over others in the analysis of dichotomous outcome variable in that it is extremely flexible and simple model from computational point of view and meaningful interpretation (Hosmer and Lemeshew, 1989). The logistic function is therefore, selected for this study. The cumulative logistic probability is econometrically specified as follows (Pindyck and Rubinfeld, 1981).

3.4.1..Definition of model variables

The dependent variable

Food security at household level is best measured by direct surveys of income, expenditure, consumption, and comparing it with the adequacy norm (minimum subsistence requirement). Specifically, average income and expenses are commonly used to compute proxy indicators of food security. In this study, the total household expenditure per adult equivalent was taken to compute proxy indicator of food security. The selection of this indicator as dependent variable in this study was due to the fact that theoretical arguments support it since consumers normally understate their incomes than their total expenditure.

As it may be recalled from the theoretical framework of economic theory, traditionally a consumer maximizes his utility subject to his budget constraint, i.e., his total expenditure; so if expenditures are assumed to be made direct for consumption, they contribute directly to utility while income contributed indirectly. The actual household expenditure in this study is considered as the sum of the total annual expenditure incurred by the household for consumption (including own produce) as well as non-consumption.

The explanatory variables and working hypothesis

Once the food insecure groups of household are identified the next step is to identify characteristics that are correlated with food insecurity and that can be used for targeting interventions. Such important household characteristics, which potentially affect the level of household food security, would be identified using probabilistic models. In other words, the likelihood that the given household characteristics threaten the food security of the household would be analyzed. It was hypothesized that there are some specific farm household characteristics associated with food production or acquisition and procurement strategies responsible for determining the state of security at household level. In order to test the above hypothesis, a multiple logistic regression was specified with food security as a function of a

series of socio-economic, biophysical and farm household characteristics as explanatory variables.

After the analytical procedures are clearly delineated, it is necessary to identify the potential explanatory variables that would influence households' food security status based on preliminary identification of potential causes of household food insecurity, research findings, literatures review, author's and experts assessment of the situation of the study area. The household food security status which was taken as the dependent variable for the logit analysis had a dichotomous value representing the status of household food security. It was represented in the model by a value of 1 if a given household belongs to food secure and 0 for food insecure households. The independent variables, which are expected to have associations with food security status, were identified as demographic, biophysical and socioeconomic factors that are relevant and feasible in the farming systems of the study area and Wolaita Zone and defined as follows.

1. **Family size**: The expectation is that the household with large number of children or economically dependent family members will face food insecurity because of high dependency burden. The existence of large number of children under age of 15 and old age of 60 and above in the family could affect the food security status of the household. That means, the working age population (i.e., 15-60 years) supports not only themselves, but also additional dependent persons in the family. Thus, it is hypothesized that the family with relatively large number of dependent family members (high dependency ratio) negatively affects household food security status.

2. **Age of the household head**: Rural households mostly devote their lifetime or base their livelihoods on agriculture. It is anticipated that as the age of the household head increases the farmer acquires more knowledge and experiences with possible positive effect on food security. In other ways, it was expected that younger farmers are more likely to be food insecure than the older farmers that the older ones due to better possession of resources accumulation. In light of this, it is hypothesized that ages of the household heads and food insecurity are negatively correlated.

3. **Size of cultivated land**: Total cultivated land owned by household is important resource for food production. Hence, it is expected to be associated with food security status. It was hypothesized that farmers who have larger farm landholding would have less probability to be food insecure.

4. **Livestock owned**: The livestock holding of the household was measured in terms of livestock units. Livestock are the farmers' important sources of wealth as farmers accumulate wealth in the form of livestock. Households who possess large livestock size are expected to be less vulnerable to food insecurity. Since households with larger livestock size produce more milk, milk products and meat for direct consumption owners could be more food secured. Besides, the contribution of livestock to food security includes the draft power, manure and income from sales of livestock and livestock products, which are often used for purchase of food grains during times of food shortage.

5. **Number of oxen owned**: Oxen are the most important means of land cultivation and basic factor of production. Households who own more oxen have better chance to escape food shortages since the possession of oxen allows effective utilization of the land and labor resources of the household. The number of oxen available to the household was therefore, hypothesized to increase the probability of the household being food secure.

6. **Chemical fertilizer uses**: It is dummy variable taking value 1, if the farmers used chemical fertilizers and 0 otherwise. The use of fertilizer has been perceived as improving yield per unit area. Hence, it was hypothesized that the households using fertilizer are expected to be more food secure than the non-users. In the group discussions with farmers indicated that fertilizer application is economical in increasing crop yield.

7. **Off-farm income**: When crop production and income earned from sales of livestock and livestock products become inadequate to subsist the farming households of the study area they often depend on external or other source of income to purchase food and farm inputs. So income earned from off farm activities is an important variable, which determines household food security in the study area. In this regard, households engaged

in off-farm activities are better endowed with additional income and less likely to be food insecure. Therefore, off-farm income per Adult Equivalent (AE) is expected to positively contribute to household's food security status.

8. **Total income**: Income determines the household's access to food. It is an important variable distinguishing the food secure and food insecure households in that those who have earned relatively larger income per AE could be more food secure. It is expected that the total annual income per AE and food insecurity are negatively related.

9. **Use of improved seed**: This is also a dummy variable taking value of 1, if the farmers used improved seeds and 0 otherwise. Moisture stress resistant varieties contribute one of the modern agricultural inputs that can withstand drought and erratic rain distribution. It augments agricultural productivity by boosting overall production, which in turn contributes to attaining households' food security. In the study area the household who used improved seeds have a chance of getting high production as a result they become food secure than the non-user group. Hence, it was hypothesized that using improved seeds and food security are positively related. There is also risk involved in use of improved technologies under areas such as Kindo Didaye district due to limited supply and high prices.

10. **Insect and pest infestation**: It is a dummy variable in the model taking the value 1, if the households faced insect and pest infestation and 0 otherwise. It is an important biological factor limiting crop production and causing food shortage in study area. It was assumed that farmers with problem of pest infestation are more likely to be food insecure than those who do not have this problem. Thus, pests and insects' infestation is negatively correlated with food security status.

11. **Soil fertility problem**: It is a dummy variable taking value 1, if the farm household faces problem of soil fertility and 0 otherwise. Soil fertility problem is one of the physical factors affecting crop production. It is hypothesized that farm households who faced soil

fertility problem are more likely to be food insecure than those who do not have the problem.

12. **Pattern of food consumption**: The pattern of consumption of food includes own production consumed, which forms the major part of family's consumption, Therefore, it is hypothesized that the proportion of household expenditure equivalent on own food is positively correlated with the household food security status.

13. **Farm credit received**: It is a dummy variable in the model taking value 1, if farmers got farm credit and 0 otherwise. Credit is an important source of earning future income. Those households who received farm credit have possibility to invest in farming activities, which is important component in small farm development programs. In the study area, farm households who have easy access to credit at times of peak season of cultivation avail it and increase their production. Hence, it was expected that credit in general have a positive impact on food security status.

14. **Food aid**: The study area frequently faces food shortage and its productive resources particularly, land is less productive. Therefore, the frequency of food aid distribution and its amount obtained by farm households is one indicator of food insecurity. Hence, since Kindo Didaye is one of the drought affected district, it is expected that farm households who have been receiving food aid more likely cope with food insecurity.

15. **Distance from market center**: Access to market and other public infrastructure may create opportunities of more income by providing non-farm employment and access to transportation facilities. It is hypothesized, that households who have good accessibility to market center have better chance to improve farm household food security status than who do not have a proximity to market centers. Hence, distance from market center is negatively related to food security.

4. RESULTS AND DISCUSSIONS

In this chapter, the food security status of the household is measured and findings from descriptive and econometric analyses are presented and discussed. The descriptive analyses are made in terms of mean, percentage and standard deviation. Econometric analysis was employed to identify the major causes of food insecurity that affect the food security status of the household.

4.1. Current Food Security Status of Households

In this study detailed information on households' food security status was discussed based on World Bank's (1986) definition of food security, which is "access by all people at all times to enough food for active and healthy life". This concept consists of a number of components including resources, production, income, consumption and nutrition. Specifically, food consumption as a component or indicator of food can be measured by expenditure technique and the gross production and purchases of household over definite period of time, usually a year, is estimated. It was further described that food security is best measured by comparing expenditure with adequacy norm appropriate to the household. In this study, food security is defined as the extent to which a total household expenditure per AE meets its subsistence requirement. The total consumption expenditure in this study is defined as total expenditure incurred by the household or any of its members and includes expenditure on food and nonfood items. Total expenditure consists of expenditures including own produce, stimulants, clothing and footwear, household equipment, social obligation and various services. The reason why the total expenditure/AE was used in this study is consumption expenditure is typically preferred over income as the consumption expenditure /AE better reflects households' ability to meet their basics. Moreover, the reliability of income data in subsistence farming where record keeping is limited is always questionable (Tesfaye, 2003). Of course, it cannot be denied that measuring food security in terms of income is consistent with objectives of many rural development interventions aimed at raising the level of income of rural households. However, the correlation between income and food security status of household is not always strong (Haddinott, 2001). In addition, the level of income estimated as adequate to acquire the recommended minimum

calories by different studies does not converge. Consumption expenditure also reflects a household's access to credit and its savings at times when their income is too low. Hence, consumption expenditure is better used to measure household's food security (CSA, 2002). In a survey of this kind, the income statistics reported by the households usually tends to under estimate the actual income level of households due to various reasons. Since the income of the household is not known with certainty, household expenditure is usually taken as a proxy of income (CSA, 2002).

Based on the above argument, and conceptual framework of this study, the total household food expenditure for the year 2012/2013 was used as the best measure of food security. In this study, food security is defined as the extent to which a total household expenditure per Adult Equivalent (AE) meets its subsistence requirement. Accordingly, a food poverty line, a threshold level of consumption expenditure below which an individual is considered to be food insecure was established. The minimum expenditure for food items basically consumed by the lowest income quartile in the study area was found to be 415 Birr per AE and that of nonfood component was Birr 112 per AE which gives a threshold of 527 Birr beyond which the household is food secure. The proportion of households with an average total expenditure per AE, which is less than the minimum level, is 72.9% Average expenses, which at least met or required per adult equivalent was computed as a threshold for food security status. To analyze the major causes of household food insecurity, the household expenditure per AE was compared with the minimum expense required to cover the minimum subsistence requirement per AE per annum that can be used as a yardstick for measuring food security. Accordingly, the extent to which farm households' income covers the minimum expense level needed for subsistence can be used to assess the extent to which the sample farm households are food secure/insecure.

The data collected from diverse sources included those ranging from descriptive to interpretive ones such as feeling and emotions of informants. As the research also employed qualitative approach, the theories referred to will be used to interpret the data. In addition, the data collected will be subjected to descriptive analysis (providing narrative accounts) of the study problem.
Data compilation and coding was done before the analysis and interpretation of the outputs. The primary and secondary data obtained using the structured questionnaires were edited, coded and

analyzed using the SPSS 16 version analytical tool, while the others will be subjected to descriptive statistics such as mean, variance, standard deviation and percentages.

4.2. Data presentation

The data obtained from primary and secondary sources were analyzed, interpreted and statistically presented with tabulations, percentages, pie chart??, and graphs?? maps and pictures. In addition, the information obtained from the target people as well as researcher's reflections on the field work were presented in narrative accounts

4.2.1. Age and sex composition

The average age of the respondents was 55 years. The age ranged from 21 to 86 years. Out of 160 respondents, less than 7% were younger than 30 years. However, about 17% were older than 60 years. The majority of the farmers (75.9%) were found in the age range between 31 and 60 years. It was argued that as the age of the household head increases, he/she would be less prone to be food insecure since he/she acquires more knowledge and experiences. In other words, it was expected that younger farmers are more likely to be food insecure than older farmers, that the older farmers due to better possession in terms of resources accumulation compared to that of younger farmers. Statistically, there was no significant difference between the food secure and insecure groups.

The total number of members of the households was 1109 of which 52.9 and 47.1% were male and female respectively. The proportion of children less than 15 years was 34 percent. The economically active age members (15-60), constituted 55.5 percent of the total family size. Thus, the remaining 11% of the sample household members were above 60 years. The children (0-14years) and youth (15-25) constituted 75.2 % of the total sample household members. The ratio between percent of young age group (0-14) and the old age group > 60 to the labor force (age15-60) indicates the dependency ratio, i.e., the economically non-active person to the economically active person within the family. This was found to be 122% and 8% respectively. Hence, the overall dependency ratio in the study area is 130%. This means, every 100 persons within the

economically active population groups support not only themselves, but also supporting additional 30 dependent household members with all basic necessities. This clearly shows a high dependency rate in the study area. The distribution of sample household members by age group and sex is given below.

Table 3 Distribution of the household heads by age groups (%)

Age group	Food Secure (N=52)	Food Insecure (N=108)	Total (N=160)	X^2
18-30	5	9.2	7.1	0.91
31-40	18	21.8	19.9	0.87
41-60	58	54	56	0.75
>60	19	15	17	0.4

Source: Own Survey (2013)

4.2.2. Marital status

The majority of the respondents (85%) were married, while 1% was single, (1%) divorced and (13%) were widows. Of those married, about 14% were polygamous; while most of them (86%) reported having only one wife.
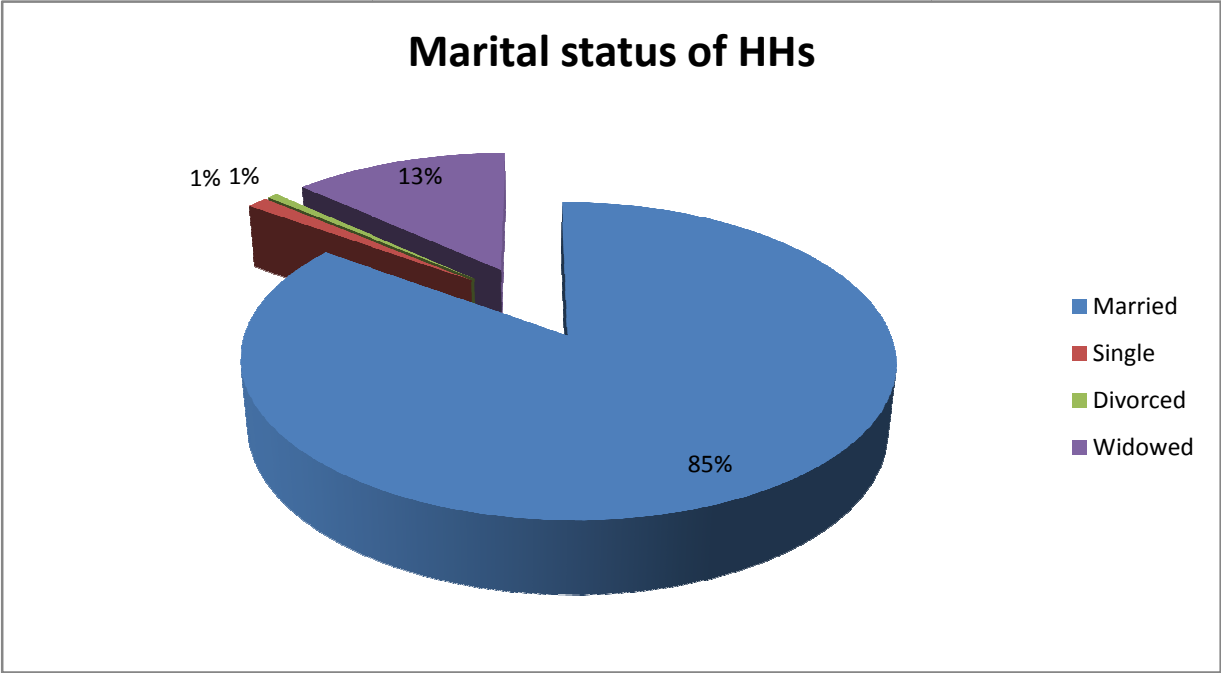
Figure 1. Marital status of sample household heads Source: Own Survey (2013)

4.2.3..Family size and dependency ratio

The average family size of the sample households was 6.3 with a range from 1 to 12 persons and standard deviation of 2.5. The majority of the farmers (89%) had more than 4 members. About 11% of them had less than 5 members, while about one third (33.3%) had more than 9. With respect to the specific characteristics of food secure and food insecure households, family size was hypothesized to have a negative impact on the state of food security, in such a way that households with large family size tend to be food insecure than those with small numbers. In light of this, the statistical analysis showed significant difference (at 1%) in mean family size between food secure and food insecure farmers,. Moreover, the mean household size expressed as AE exhibited significant difference at less than one percent probability level between the food secure and food insecure households.. Higher the adult equivalent would not necessarily mean that a household has sufficient adults to perform economic activities and escape from food insecurity. Rather, the higher the

family sizes in AE, the larger the amount of food is required. This is depicted in the survey result

Table 4 Distribution of Households by family size in %

Family size range	Food Secured (52)	Food Insecure (108)	Total (160)	X^2
≤3	21.4	6.5	10.7	0.4
3.00-3.50	52.4	41.7	44.7	0.11
5.51-7.50	23.8	39.8	35.3	0.009***
≥7.50	2.4	12.0	9.3	0.008***

*= significant at 10% level of significance, **= significant at 5% level of significance, and ***=significant at 1% level of significance.

Source: Own Survey (2013)

4.2.4..Educational Level

The educational status of household heads was very low. Out of 160 respondents, 54.6% were illiterate, and about 19.4% were either illiterate or could only read and write without formal schooling. Most of the farmers have learnt only through non-formal education. About 38.6% of the food secure households and 28% of food insecure households had formal education of grade 1-7, respectively.
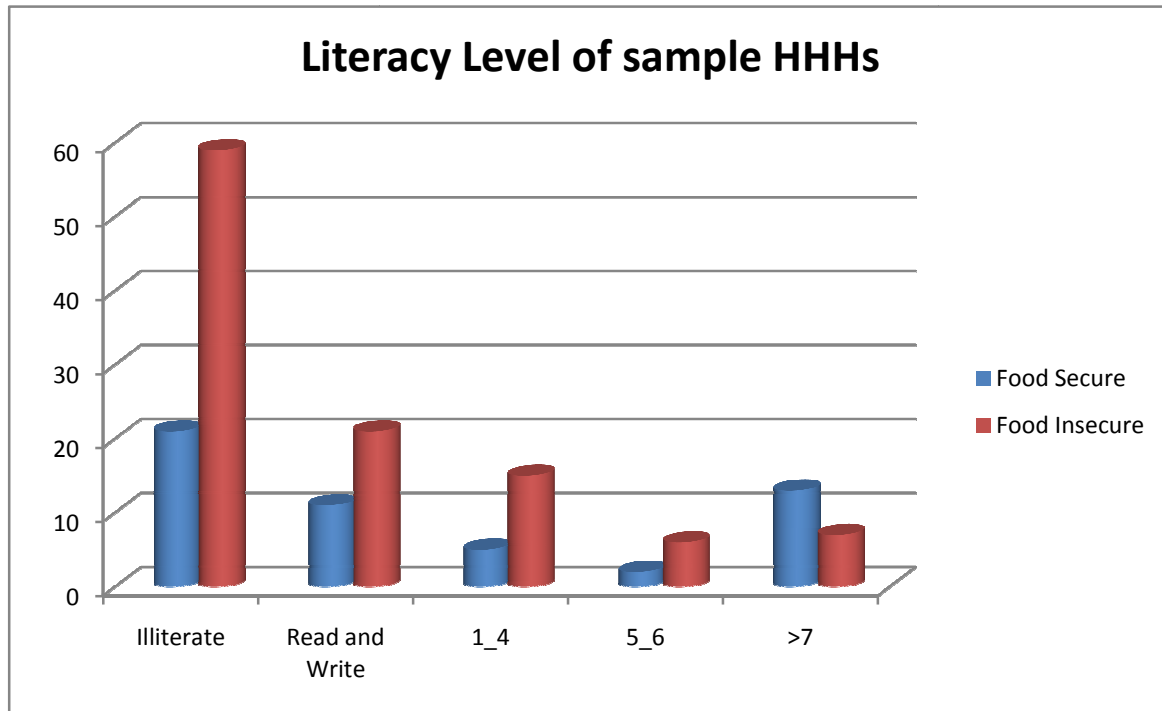
Figure 2: Literacy level of households

Source own survey (2013)

4.2.5..Landholding and its Physical Features

Land size is considered as a critical production factor that determines the type of crops grown and the amount of crop harvest. About 80% of the growth in the agricultural outputs in Africa has been attained through the expansion of cultivated land (Degefa, 2002). Moreover, the availability of pastureland is an important factor for livestock rearing. Therefore, under subsistence agriculture, landholding size is expected to play a significant role in influencing farm households' food security. Thus, the discussion of one of the basic resources particularly farmland, farming and its contribution to household food security is given below.

The landholding of the farmers ranged from 0.25 to 5.0 ha with an average of 1.2 ha. Sizes of holdings also show variation between the sample peasant associations. Relatively the scarcity of land holding is observed in mid highland agro ecology zones of the study area/district. This

could be due to heavy population pressure in mid-highland area. The survey results show that about 57.3% of the respondents have a land size of 1 hectare or less while 30% had relatively higher size, which ranged between 1 and 2 ha. On the other hand, only 14.7% of sample farmers hold more than 2 ha of land. It was observed that 66.6%, of the food secure households and 51% of food insecure households hold 0.5 to1 ha of land.

Table5. Distribution of households by landholding size (%)

Land area (ha)	Food secure (N=52)	Food insecure (N=108)	Total (N=160)	X^2
≤ 0.5	9.5	13	12	0.09*
0.5-1.0	57.1	38	43.3	0.07*
1.01-2.0	19.1	34.3	30	0.07*
≥ 2.01	14.3	14.8	14.7	0.08*

*= significant at 10% level of significance, **= significant at 5% level of significance, and ***=significant at 1% level of significance.

Source: Own Survey (2013)

4.3. Crop Production (major crops)

Even though many types of crops grow in the study area, the most commonly grown ones are maize (48.6.8%), teff (39.3%) and wheat (11.03%). These crops are grown as staple and cash crops in the zone. The average maize and teff farm size operated by respondents is 0.58 and 0.47 ha with maximum size of 2.76 and 1.8 ha respectively. These two types of crops are the major crops grown for cash and consumption in the study area.

Table 6: Major crops produced in the area

Farm Size (ha)	Food Secure (N=52)			Food Insecure (N=108)		
	Maize	Teff	wheat	Maize	Teff	wheat
0.13-0.5	61.5	58.6	18.1	47.7	44.6	12
0.5-1.0	42.5	50.2	20	48.3	52.4	10.9
>1.0	52	41.8	16	14.7	36.8	10.2

Source: Own Survey (2013)

4.4. Livestock Holding

Animal husbandry forms another important source of livelihood for the rural households. Livestock contributes to household's economy in different ways i.e., as a source of draught power, source of cash income, source of nutrition and means of transport. Besides, livestock are considered as a means of saving and means of coping mechanism during crop failure and other calamities. The types of animals reared in Kindo Didaye district include cattle, sheep, goats and poultry. Small ruminates and chickens are reared for home consumption and for sale. Moreover, they are the first to be sold to purchase food when farmers face food shortage.

Food secured households own relatively larger number of cows. The former have relatively larger number of oxen than those of the food insecure. In general, the food secure group of households own larger average size of livestock in terms of total TLU/AE as compared to for food insecure group.

Oxen ownership is an important variable for farmers of Kindo Didaye district, that almost entirely rely on traditional farming methods. Thus, farm oxen possession would be a critical

production factor. Due to the high shortage of drinking water and grazing land and animal feed in the study area, the respondents underlined the problem of raising livestock. As a result, oxen supply for crop cultivation is a principal constraint to farming that limited the capacity of farmers to cope with the problem of crop failure. The study findings on farm oxen ownership showed that the food secure households have an average of 1.9 oxen and the insecure ones 1.1. However, about 14% the food secure and 26% of the food insecure did not have any oxen. The possession of was significant factor that distinguishes food secured from food insecure households. The result revealed that there was significant difference between the two groups in terms of the number of oxen owned which is statistically significant at 10% probability level.

Table 7. Average number of livestock holding by households

Animal type	Food secure (52)	Food Insecure (108)	Total cases (160)	X^2
Cows	1.8	1.16	1.72	0.1
Oxen	1.9	1.13	1.71	0.085*
Calves	0.4	0.09	0.24	0.4
Sheep	0.28	0.21	0.23	0.5
Goats	0.36	0.26	0.28	0.15
Donkey	0.58	0.62	0.59	0.23

*= significant at 10% level of significance, **= significant at 5% level of significance, and ***=significant at 1% level of significance.

Source

4.5. Food Aid

For more than two decades, annual distribution of hundreds of thousands of metric tons of food aid have been channeled into safety net programs designed to alleviate the impact of food shortages in Ethiopia. Accordingly, food aid plays a role in giving relief to those households who are perceived to be most at risk of severe food insecurity. In the study area, the mean amount of

food aid received by sample farm households who are grouped as food secured was Birr 384.50 whereas that of the food insecure group was Birr 472.70. The mean amount of food aid received by the two groups of sample households was not different significantly. The fact that households in both groups received food aid indicates that the grouping is based on the relative level of vulnerability although all of them to a certain degree face food shortage. Moreover, about 24.1 and 42 percent of the food secured and insecure farm households received less than Birr 200 respectively. On the other hand, about 55.9 and 58 percent of food secure and food insecure sample households received more than Birr 350 respectively.

Table 8. Distribution of households by amount of food aid received (%)

Food aid received		Food Insecure	
Birr/Year	Food secure (52)	(108)	Total cases (160)
<200	21	25.6	24
200-350	23.1	16.4	18.7
351-400	19	10	12.7
401-550	8	13	11.3
>550	28.9	35	33.3

Own Survey (2013)

4.6. Agricultural Inputs and Extension Services

Various studies in Ethiopia have proven that appropriate application of modern farm inputs such as chemical fertilizers, improved seeds and herbicides increase crop yield and productivity (Degefa, 2002). Because of this fact, Ethiopian farmers have been encouraged to adopt utilization of modern farm inputs. The importance of inputs becomes more significant in highly eroded soils and fragile environments such as in Kindo Didaye district to improve land productivity and to boost overall production. Therefore, utilization of modern farm inputs are expected to enhance farm households' food security. The sample farmers were asked whether

they use modern farm inputs to increase yields of their crops. As shown in Table 16, the proportion of farm households using improved inputs is low.

4.6.1. Chemical fertilizers

About 69 % of the sample farmers reported that they used chemical fertilizers. The difference between the food secure and food insecure farmers in terms of using chemical fertilizer is significant at 1% probability level as, the chi-square analysis showed the association between food security and fertilizer use. Therefore, the hypothesis that food security and fertilizer use is positively associated is maintained.

4.6.2 Improved seeds

The introduction of improved seeds that can withstand the problem of erratic rain distribution seems an important issue to the district under investigation. The field survey showed that only 69% of the sample farmers adopted the improved seeds. The main constraints against utilization of this input among the farmers were limited supply and high prices. Regarding, this the difference between the two groups of respondents were found to be statistically significant at less than 5% probability level.
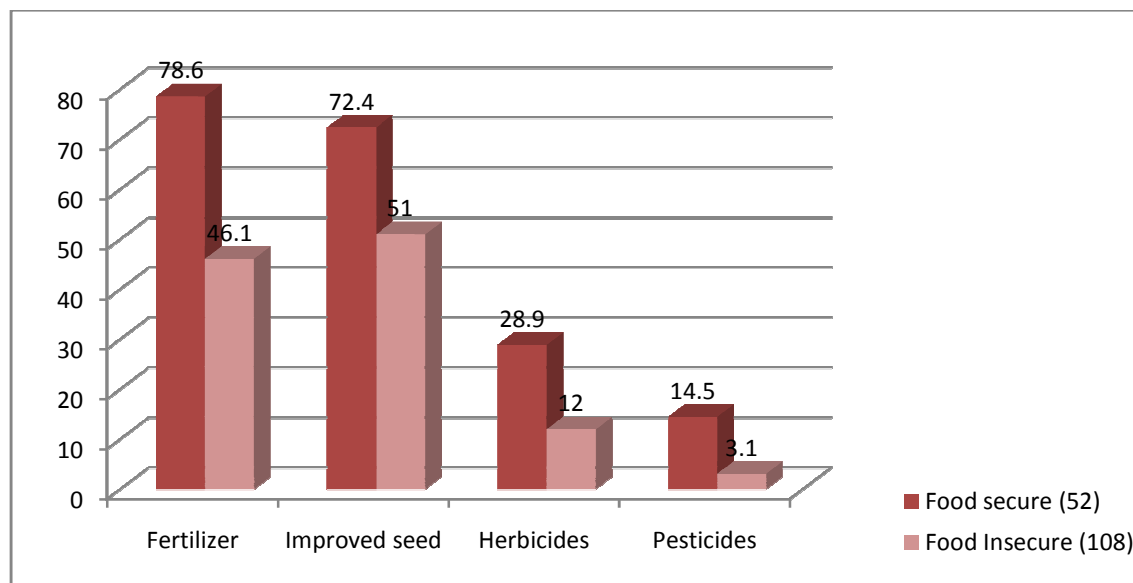
Graph 2: Distribution of Households that used farm inputs

Figure 3 Own Survey (2013)

4.6.3 Herbicides

Utilization of herbicides by the sample farmers in Kindo Didaye District was found to be low with only 25% reporting to have used them. A large number of farmers used hand weeding to remove weeds from maize and other field crops. Farmers have shown their concern that the herbicides were not effective to kill weeds growing under maize as well as good quality herbicides were not available in the market. The figure seems very low compared to other inputs. The difference between the two groups was found to be statistically significant at less than 1 % probability level. Moreover, weeds are considered as an important source of feed for livestock, contributing to overcoming shortage of pasture. As a result, the farmers are reluctant to use chemicals.

4.7. Income Analysis

The major income sources for the households in the study area include crops, livestock and their products and off-farm activities. Income earned by the households from different sources was computed per AE. This would help to relate the income earned to the subsistence requirement. Analysis of the mean difference between the food source and income groups with regard to the main source of income shows that the food secure and insecure groups differ only in off-farm income. It was observed from the survey that crop production is the most important source of income in the study area followed by livestock production and off-farm activities, respectively.

Table 9. Mean income by sources of income in 2012/2013 (Birr per AE per Year)

Source of income	Food Secure (N=52)	Food Insecure (N=108)
Income from crop	1,110.00	560.00
Income from livestock	460.00	265.00
Off-farm income	980.00	350.00
Total income	2,550.00	1,175.00

Source: Own Survey (2013)

The cash income of the farmers comes from sales of crops, animal and animal products and off-farm activities. It was observed that some of the farm households did not sell any type of product during the production year, whereas other respondents received a total income of more than Birr 1352/AE.

4.8. Agricultural Constraints

As responded and perceived by farmers, there were different reasons given concerning the declining trend of production in the study area. The responses of sample farmers on the major reasons for the declining trend of crop production showed that 62% of them reported poor soil fertility or poor quality of land. Soil fertility problem is one of the physical and important factors affecting crop production. Soil fertility has negative impact on crop production performance, and caused food shortage in the household. Shortages of oxen, seed and insect and pest problems were found to be other important factors as mentioned by 28.4% and 8.6% of the farmers, respectively.

4.9. Causes of household food shortage

Farmers and consumers have lacked awareness and information on the alternative ways of producing crops through organic farming other than the conventional ways so as to become food secure and keep the environment safe. As opposed to this reality, the small scale farmers' over dependence on external inputs has made them fall deeper into debts and progressive poverty levels because majority cannot cope with the ever rising prices of the farm inputs. On top of that, drought and poor utilization of the resources at hand are the main factors that have exacerbated the problem of food production, distribution and access. High rates of population growth have also played a part, within an already difficult environment of fragile ecosystems. Increases in population have undoubtedly disturbed the equilibrium between people and natural resources. In addition, productive group does not withstand any of the challenges and soon migrate to the

neighboring urban and semi-urban areas in search of job and the land continues to remain uncared-for and infertile.

No fallowing is practiced to allow the land to recover it and no effective watershed management techniques including physical and biological SWC methods that include constructing physical structures as well as planting seedlings and grasses is employed. In addition to these, the saving habit of the community is very poor as once they earn money they use it extravagantly and their financial as well as harvest management system is wretched.

In order to identify the major perceived causes of food shortages, the farmers were asked to respond to each question set for this purpose by rating as first, second and third causes of food deficit. Regardless of the differences in perceived magnitude of their influence, in the different ecologies, the farmers rated erratic rainfall patterns (90%) as the most influential of all factors under consideration. In general, the traditional farming practice and poor performance that have greatly affected the sustainability of production and productivity coupled with the shortage and erratic rainfall have made the study area more vulnerable and food insecure. Insect and pest infestation is another important biological factor that has been negatively affecting and limiting agricultural production in the study area.

As a result, it was concluded that farm households with problem of insect and pest attack are more likely to be food insecure than those who do not face the problem. Regarding this, the chi-square analysis showed that absence of rainfall and insect and pest incidence were systematically associated with the state of food security at probability level less than 1%. The proportion of farm households with problem of insect and pest incidence is lower among the food secure than the food insecure groups of farm households. Accordingly, 61% of food secure farm households and 76% of food insecure farm households reported to have insect and pest infestation incidence problem.

Table 10. The proportion of farmers with major causes of food insecurity (%)

Type of response given	Food Secure (N=52)	Food Insecure (N=108)	All Cases (N=160)
Shortage of rain fall	72.9	96.3	90.3
Poor quality of land/soil	19.5	29	26
Shortage of cultivated land	35.7	40.7	39.3
Insect and Pests	57	78.7	72.7
Plant diseases	7.1	13.9	12
Too much rain	16.7	7.4	10
Shortage of oxen	4.8	4.6	4.7
Poor Health Situation	2.4	1.9	2
Low farm inputs	31	20.4	23.3

Source: Own Survey (2013)

As it was stated in the previous sections, the largest portion (61%) of the study area were located in the low altitude of agro-ecologic zone. This determines the type and level of production. The low land area is usually characterized by low amount and erratic distribution of rainfall and vulnerable to drought. Furthermore, the lowland part has usually one cropping season contrary to mid and high altitude.

4.10. Coping Strategies

Farm households in a vulnerable area like Kindo Didaye engage in several activities in order to cope with their food insecurity challenges . In the literature, several coping strategies to maintain normal consumption have been identified (Frankenberger, 1992; Teklu, 1992; Debebe, 1995). These include adjustments farmers would make to cope with food supply pattern, labor

(including migration) in search for employment opportunities, sales of productive assets and stocks, depending on loans/credit or donations and shifts between quantities and ingredients of consumption. In the following section, several coping strategies to smooth consumption were identified. Farmers were asked about how they manage food shortage and how they can cope with food insecurity. This section describes the results of the interview and relates the response to the farmers' actual activities.

The local coping strategies, which have been practiced during food crisis by groups of sample farmers in Kindo Didaye, are presented below. The principal strategies used by the respondents to mitigate food supply shortage include purchasing of grain, diversification of crop production into various crop varieties such as potato, haricot been and others during short and erratic rainy seasons to meet their subsistence needs. They produce wheat to meet their needs for cash. About 52% of all respondents and 43% of food secure and 56% of food insecure households engaged in off-farm jobs. Even though, there was limited access to off-farm work opportunity in the district, resource poor farmers work in farms of better off farmers for wage earned in kind or cash. Another important coping mechanism considered first by farmers was borrowing cash or grain from others. This was practiced by 48% of food secure and 60% of the food insecure households. Livestock, besides their complimentary relationship with crop production, provide hedging against risk of food insecurity. As a result, when food produced is fully consumed and or no cash reserve is available to purchase more of it, animal products and live animals are sold as ways of getting access to cash income and to buy food for the household. Accordingly, about 47% of all households, 48% of the food secure and 46% of the food insecure households were involved in the sales of animals (mostly small ruminants) to acquire food whenever there is shortfall in food supply. Sales of animals were common for the two groups and this shows that the farm households keep animals as principal assets to manage the shortage. This mechanism is ranked as the third most important coping practice, followed by involvement in off-farm and/or non-farm job. Sales of animals to purchase food grains during supply shortage have considerable effects on farmers' economy mainly because of sharp decline in livestock prices. The proportion of food secure and food insecure households who practiced purchasing grains/food items during food supply shortage were 26% and 43%, respectively. Reduction of consumption in terms of both the number of meals per day and amount of food per meal was identified as means of

coping for the largest proportion (40%) of the respondents, 7% of the food secure and 53% of the food insecure sample households during short supply. About 23% of all cases, 7% of the food secure and 30% of the food insecure households reported that they overcome food shortage problems by receiving relief food freely from government and non-government organizations.

Table 11 Coping strategies practiced by farmers in Kindo Didaye district

S.No	Strategies Practiced by Farmers	Food Secure (N=52)	Food Insecure (N=108)	All Cases (N=160)
1	Purchasing grains	21	48	38
2	Borrowing cash or grains from others	48	60	56
3	Sales of animals to meet purchase of grain	48	46	47
4	Reducing number and size of meal	12	64	40
5	Receiving relief food aid	7	30	23
6	Involve in off-farm and on farm job	43	56	32
7	Sales of fire wood and charcoal	6	28	19
8	Temporary migration to other area	2	8	5
9	Sales of key productive assets	2	2	2
10	Receiving gifts and remittances	2	5	4
11	Rent out land	7	16	13
12	Changing planting and cropping pattern	0	6	5

Source Own Survey (2013)

The survey results further revealed that food insecure households in the study area practiced sales of fire wood, cow dung and charcoal; rented out farm land; received gifts and remittances; changed cropping and planting pattern, sold productive assets as coping strategies. These categories were reported and practiced as a last resort by fewer sample respondents. The analyses of the coping mechanism of the sample farmers have shown that, coping mechanisms have different patterns. All farmers were not equally vulnerable to drought or food insecurity; they

responded in different ways. Some households implement some coping strategies after all other options have been pursued and exhausted. As the food crisis persist, households are increasingly forced into a greater commitment of resources, just as the household exhaust the strategies that are available in the early stages of food crisis, they begin to dispose key productive assets such as draft oxen and rent out land. Other households (especially those who are easily vulnerable) often collapse immediately and thus engage in unusual activities such sales fuel wood and cow dung. Accordingly, among the sample households 2% of them (2% food secured and 2% of food insecure households) sold key productive assets as coping mechanism for food insecurity.

On the other hand, about 7% of the food secure and 16% of the food insecure sample households rented out their land as a coping mechanism in the study area. As drought and crisis persist in the area finally they decide to out migrate to cope with food supply shortfall. About 5% of all cases, 2% of the food secure and 8% of the food insecure sample households reported migration within their own areas to their relatives (particularly during months of July and August). With respect to the period of severe food shortage that the farm households practice these coping mechanisms, more than 82% of the households encountered severe food shortages during the months of March, April and May. In the study area almost all households face severe food shortage during April. As observed through group discussions, the farm households in the lowland ecological zone face severe food shortage more frequently than those in the mid highlands. With increasing vulnerability, farmers shift to the consumption of the cheapest and less quality of food. November, December and January, are the months when the majority of the respondents households do not face any kind of food shortage.

In general, the proportion of households with local coping strategies implies the extent to which most of the Kindo Didaye district's farmers are vulnerable and how food insecurity is serious. Hence, factors like poor marketing infrastructure lack of off-farm job opportunities, and lack of credit facilities aggravated food insecurity and made households more vulnerable.

4.11. Parameter estimates of the econometric model

As it was discussed above in this thesis, a logit model was estimated to identify the major determinants of food insecurity of households. The variables described above were used to estimate the logistic regression model. However, before fitting the logit model, it was important to check whether serious problem of multicolinearity or associations exist among the potential explanatory variables. For this purpose, Variance Inflation Factor (VIF) and contingency coefficient were computed for the continuous and discrete variables respectively. The value of VIF greater or equal 10 is an indicator of a serious multicolinearity problem and it is important to omit such variables from the model. In this analysis the value of VIF of continuous variables were found to be less than 10. Hence, there were no as such serious problems of multicolinearity and all the ten explanatory variables were entered into logistic analysis. In the same way, the contingency coefficients were calculated for the discrete variables. The x^2 was computed to check the degree of association among the discrete variables. The contingency coefficient ranges between 0 and 1 where the value of 0 indicates no association between the variables and the value closer to 1 indicates strong association. Accordingly, the results of contingency coefficient computation revealed that there were no as such serious problems of association among the explanatory variables. Hence, all the four discrete variables were entered into logistic analysis.

Using the household food security status as a dependent variable whereby a value of 1 is given to households belonging to food secure group and 0 otherwise, and using the above 14 explanatory variables (10 continuous and 4 discrete), the model was estimated by following the maximum likelihood estimation procedure. The measurement of goodness of-fit of the model shows that the model fit the data well. The likelihood ratio test statistic exceeds the chi-square critical value with 14 degree of freedom at 5% significance level. So the hypothesis that all coefficients except the intercept are equal to zero is rejected. The value of Pearson chi-square test shows an overall goodness of fit at less than 10% probability level. Moreover, the logistic regression model correctly predicted 92% of the total sample farm households, 81% food secure and 96% food insecure households. Hence the model parameter estimates best fitted.

The result of the logistic regression model estimate indicates that out of the 14 factors included, 9 variables were found to have a significant influence on the probability of being food secure at less than 10% level. The variables considered were family size, number of oxen, fertilizer use, and cultivated land size, the use of farm credit, total annual income per adult equivalent, food consumption expenditure, number of livestock owned and off-farm income per adult equivalent. Whereas, the remaining 5 of the 14 explanatory variables were found to have no significant influence on the probability of being food secure. The significant explanatory variables, which have effect on food security status of the farm households, are discussed below.

Table 12. Parameters of the logit model

Variables	Estimate Coefficient	Odds ratio	Significance level
Constant	-0.7444		0.4230
Age	0.0227	1.0229	0.1030
Family size	-0.5905	0.5540	0.0060[***]
Number of oxen owned	0.7862	2.1950	0.0731[**]
Fertility problem	0.7280	2.0709	0.1160
Cultivated land size	0.7766	2.1741	0.0590[*]
Total annual income	0.0029	1.0029	0.0190[**]
Insect and pest problem	-0.5679	0.5667	0.2402
Livestock size	0.2963	1.3445	0.0013[***]
Fertilizer use	0.9660	2.6270	0.0280[**]
Distance to market	-0.1566	0.855	0.0025[***]
Off-farm income	0.0019	1.0019	0.071[*]

Food consumption pattern	0.0349	1.0356	0.0075***

*= significant at 10% level of significance, **= significant at 5% level of significance, and ***=significant at 1% level of significance.

Source: Own computation 2013

Family Size: among the important demographic variables, family size is to be highly significant in determining the probability of farm household's food security status in Kindo Didaye district. This variable is negatively associated with the food security status and significant at probability level of 1%. This negative relationship indicates that odds ratio in favor of the probability of being food secure decreases as family size increases. If all other things are held constant, the odds ratio of 0.55 for family size implies that, the odds ratio in favor of being food secure decreased by a factor of 0.55 as family size increase by one person. The farm households with large family size, having children of non-productive age, could face the probability of food insecurity because of high dependency ratio than farm households with small family size. Therefore, the hypothesis that family size with high dependency ratio negatively affectsthe probability of households to be food insecure is confirmed.

Number of Oxen Owned: Oxen are among the most important factors of production and hence determine household food security status. This variable is significant at a probability of 10% and has positive association with household food security. As hypothesized, this variable affects households food security. The more the number of oxen available to households the larger is the probability of being food secure. The positive sign of this variable indicates the contribution of this resource towards ensuring food security. The interpretation of the result shows that if other things are held constant, the odds ratio in favor of the probability of food security increases by a factor of 2.19 as the farm household's oxen holding increases by one. Size of Cultivated Land: Size of cultivated land, which is significant at 10% probability level, has positive influence on the probability of farm household's food security in the study area. It implies that the probability of being food secure increases with cultivated farm size. This agrees with the hypothesis that farmers who have larger farm land holding would be less food insecure than those with smaller land size, due to the fact that, larger farmers are associated with higher possibility to produce more food. With greater wealth and income which increases availability of capital that could

increase the probability of investment in purchase of farm inputs which increases food production and hence ensuring food security of farm households. The odds ratio of 2.17 for the total cultivated farm size implies that other things kept constant, the odds ratio in favor of being food secure increases by a factor of 2.17 as the total cultivated farm size increases by one hectare.

Livestock Size: Livestock are important source of income, food and draft power for crop cultivation. Livestock size is positively and significantly associated with the probability of being food secure in the study area. This indicates that households with more livestock produce more milk, milk products and meat for direct consumption and owners could be more food secured. Besides, this enables the farm households to have better chance to earn more income from livestock production which enables them by increasing purchasing power of food during food shortage and could invest in purchasing of farm inputs that increase food production, and able in ensuring household food security. Hence, this empirical finding support that larger livestock holding is important source of income in explaining the probability of being food secure in the Kindo Didaye district. The result indicates that, other things held constant, the odds ratio in favor of being food secure increases by a factor of 1.3 as the total livestock holding increase by one TLU.

Farm Credit Use: Credit is important source of investment on activities that generate income for farm households. The households can purchase agricultural inputs (improved seed, fertilizer, etc.) and livestock for resale after fattening. In Kindo Didaye district, farm households who have access to credit could increase their production to escape food shortage. The logit model analysis revealed that credit has a significant positive association with food security status (at a probability level of 1%). This is in agreement with the prior expectations about the impact of the differential access to credit service. This is because farm households who have the opportunity of accessing farm credit would build their capacity to produce more through purchasing of agricultural inputs. The households with more access to farm credit have possibility to reduce the probability of being vulnerable to food insecurity. The odds ratio in favor of food security increases; other things remain constant, by a factor of 1.66 as farm households get access to farm credit.

Total Income per AE: This variable is found to have positive influence on the food security status at probability level of 1%. The finding of this study supports that larger income per AE enhances the household's ability to secure food. Thus, the possible explanation is that, in Kindo Didaye district farm households who have earned more or relatively large income per AE could be food secure than those who had not. The interpretation of the odds ratio implies that, other things are held constant; the odds ratio in favor of the probability of being food secure increases by a factor of 1.00 as farmers earn Birr per 1 AE.

Use of Chemical Fertilizer: This variable has positive influence on the probability of food security situation, which is significant at 5% level. This means that those farmers who have access to fertilizer use are more likely to be food secure than those who have no access to fertilizer use. The result indicates that, other factor kept constant, the odds ratio in favor of being food secure increases by a factor of 2.63 as a farm households fertilizer use increases by one unit.

Food Consumption Pattern: This variable indicates the households' pattern of consumption, which is expressed in terms of own production consumed. It represents the major parts of family's consumption defined in terms of value of food produced in the total expenditure. This variable has positive sign of influence on the probability of being food secure and highly significant (at 1% probability level). The odds ratio in favor of the probability of food secure increases by a factor of 1.04 as the value of own food increases by one Birr.

Off-Farm Income per AE: This variable represents the amount of income earned in cash or in kind, during the year. In the areas like Kindo Didaye district, where the farmers face crop failure and sales of livestock and livestock product is inadequate, income earned from off-farm activities is an important means of acquiring food. Accordingly, in the study area, the success of farm households and their family members in coping with food insecurity is highly determined by their ability to get access to off-farm job opportunities. The result suggests that households engaged in off-farm activities are endowed with additional income and less likely to be food insecure. Consistent with the hypothesis, off-farm income is positively and significantly associated with farm households' food security status (at probability level of 10%). The probabilities of farm households to be food secure increases by a factor of 1.00 as the farm

households obtain one more unit of off-farm income per adult equivalent. The econometric result gives important clues regarding variables, which should be considered and given emphasis during interventions in order to overcome the problem of food insecurity in the study area.

5. SUMMARY AND RECOMMENDATIONS

5.1. Summary

This study demonstrates that household food security in the study area is determined by many key socio-economic variables as discussed earlier. The researcher, however, believes this is not a complete study to come up with solid recommendations to address the food security situation in the area under the study. The reasons for not arriving at solid recommendations are that the causes of food insecurity are so complex and interrelated to each other at different levels, considering all these causes at all levels was beyond the scope of the present study. Food security depends on potential resources available to a country, access to technology, and the quality of human resources at all levels. Moreover, Political, economic, cultural, and social factors affect the utilization of these potential resources and how they are translated into resources for food security have not been studied and these are an area for further research. The researcher had to limit his study only to the immediate determinants of household food-security, which in turn were influenced by three underlying determinants manifesting themselves at the household level

5.2. Recommendations

➢ Large family size was found significant among the major factors that lead households more vulnerable to food insecurity. Most related studies indicate that the level of food and agricultural production could not often meet the growing demand of farming community. The rate of food and agricultural production often grows slowly compared to the rate of growth in population. In this regard proper attention should be given to limit the rapid population growth in the study area. Activities that lead to boost agricultural production on one hand and limiting the fast growing population on the other hand are crucial to meet the demand of food. Government and non-government organizations working in the area are supposed to focus on intensive agriculture, integrated health and education services, and family planning to equate food supply and demand equation in the long term.

➢ Off-farm and non-farm incomes are among the major socio economic variables that influence the state of household food security. Promoting and expanding non-farm activities are essential especially for those who have little or no land for cultivation. Indigenous skills associated with wood-work, metal-work, pottery, etc. should be given prior attention in the study area. Trainings and credit facilities should be geared towards raising their skills so as to meet increased farm income and improved food security. People of similar interest and skill can be organized into cooperatives to enhance access to trainings and credit facilities. In this regard the role of NGOs working in the area will be of paramount importance.

➢ This study vividly showed that livestock sub sector plays a great role in the struggle to eliminate food insecurity. Its contribution to the household food security 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 services, improved water supply points, introduction of timely and effective artificial insemination services 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 marketing conditions, etc..

➢ Rural households in the study area have very limited room for generation of income. Hence, for these households to enhance their welfare in general and food security in particular, they must have diversified access to income alternatives. In the face of this, provision of credit must be taken as a measure, though not the only one, to build the capacity of farmers to invest in the agricultural sector, such as purchase of fertilizer, pesticides, improved seed, live and productive animals. Moreover, development strategies should be able to identify income alternatives other than agriculture. In light of this, non-governmental organizations that are focusing only on agriculture should also channel their scarce resources to creation of income generating activities, trading, crafting, etc. which would greatly help in strengthening off-farm activities which would enable the households to secure their food through purchase.

➢ Sustainable food security intervention must not exclude the improvement of production and productivity of agricultural sector through use of irrigation. As the findings of this study assured, irrigation and food insecurity are negatively and significantly related in the study area. Therefore, development strategies, programmes, or any intervention related with food security through agricultural production should not neglect the paramount importance of irrigation. Hence, the already launched irrigation development programmes should be further strengthened.

➢ Productive resources especially land is very limiting and highly binding resource in the study area. And hence, even if the model result showed farm size and food insecurity have inverse relationship, tackling the problem of food insecurity through increasing farm size would not bring any sustainable improvement. So a medium and longer-term food insecurity strategy through increased food production must be introduced. In a medium or shorter term, distribution and allocation of cultivable land, which was not under cultivation, thereby increasing output should be made. This would give short period relief from the problem, otherwise the amount of return from such a strategy would not be by any means sufficient and sustainable to up-root the problem from the present setting. As a result, strong effort should be made to improve the production and productivity in the agricultural sector in the longer term. The possible measures that can be undertaken to achieve this strategy include crop diversity, runoff and flood harvesting, timely and low cost supply of inputs like fertilizer, improved seed and agrochemicals.

➢ Some of the coping strategies that involve sale of livestock and productive assets as well as marketing of wood/charcoal can in turn aggravate the problem of food insecurity. Protection of these productive assets and natural resources is crucial as the detrimental effect is costly. Thus intervention should be carried out so as to reduce vulnerability of food insecure through economically feasible alternatives. The diversification of activities has long been an important coping strategy for the most vulnerable households. Therefore, measures including diversifying cropping and livestock activities, promoting the use of community funds to stimulate off-farm and asset building activities, improving infrastructure and strengthening timely response mechanisms to food stress should be

given emphasis. In brief, promoting environmental awareness among the people of the study areas highly contributes to land resource conservation. Enhancing farmers for better management of their land and investment on land improvement measures, which could help improving the productivity of land in the short run. These efforts should aim at increasing the range and quantity of food crops production and productivity. Regarding this, soil and water conservation intervention, which helps sustain and increase crop production through improved land management practice, should be implemented. This may help in solving food insecurity and ensure food security in the short run as well as in the long run.

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6. REFERENCES

Abebaw Shimeles, 2003. Dimensions and determinants of food security among rural households in Dire Dawa, Eastern Ethiopia. An M. Sc. Thesis presented to the School of Graduate Studies of Alemaya University, Alemaya. 152p.

Amdissa T (2006). Challenges of Implementing the Productive Safety Net Programme (PSNP) Paper Presented at the 4rd International Conference on the Ethiopian Economy United Nations Conference Centre, Addis Ababa.

Ayalew Yimer, 2003. Identification and intensity of food insecurity and coping strategies of rural households in North Shoa: the case of Lalomama. An M. Sc. Thesis presented to the School of Graduate Studies of Alemaya University, Alemaya. 221p.

Alamgir, M., and P. Arora, 1991. Providing Food Security for all. Published for the International Fund for Agricultural Development by IT Publishers, Great Britain.

Anderson, 1997. 2020 Vision for Food, Agriculture, and the Environment in South

Africa. In: Lawrence Haddad (ed.). Achieving Food Security in South Africa New Challenges, New Opportunities, IFPRI. Washington D.C

Ayalneh Bogale, 2002. Land Degradation, Impoverishment and Livelihood Strategies of Rural Households in Ethiopia: Farmers' perceptions and policy Implication. Vol.8. Shaker Verlage, Germany.

Ashimogo, G., and J. Hella, 2000. Deagrarinisation, household level food Security and Environment: The case of Iringa Region. A paper presented for the first RLDS International policy Research Workshop, Addis Ababa, 14-15 April 2000.

Berhanu A (2004). The Food Security Role of Agriculture in Ethiopia. Agricultural and Development Economics Division (ESA) electronic. J. Agric. Dev. Econ., 1(1): 138-153.

Berhanu G (2001). Food Insecurity in Ethiopia: the Impact of Socio-political Forces Institute for history, international and social studies.

Bazabih Emana, 2000. The Role of New Varieties and Chemical Fertilizer under Risk: The Case of Small holders in Eastern SNNPR, Ethiopia. Ph.D dissertation. University of Hanover,Shaker Verlug, Germany.

Bonnard, P., 1999. Increasing the Nutritional Impacts of Agricultural Interventions. A paper presented at the Horn of Africa workshop on Agricultural policy, Resource Access and Human Nutrition, Addis Ababa, 3-5 November 1999.

Bouis, H., 1993. Food Consumption Surveys. How random are measurement errors? In: Von

Braun, J.& Puetz,D. (year??) (eds.). Data Needs for Food Policy in Developing Countries. International Food Policy Research Institute, Washington, D.C.

Casley D.J., and D.A. Lary, 1987. Data Collection in Developing Countries, Clarendon Press, Oxford.

Chung, K., Haddad, L., Ramakrishna, J., and F. Eiely, 1997. Identifying the Food Insurance: The Application of Mixed method Approaches in India. Washington D.C.: International Food Policy Research Institute.

Corbett, J., 1988. "Famine and Household Coping Strategies." World development 16(9):1009.

Central Static Authority (CSA). The 2007 Population and housing census of Ethiopia result for SNNPR, abridged Statistical report.

Cutler, P., and R. Stephenson, 1984. The State food Emergency Preparedness in Ethiopia. Mimeo, International Distastar Institute. London, UK.

Debebe Habtewold, 1995. Food security: A Brief Review of Concepts and Indicators. In Mulat

Davies, S., 1994. "Are Coping Strategies a cop out?" Nutrition paper of the Month, NewYork, UNICEF.

Dagenew Eshete, 1993. Food Shortages and Households Coping Strategies by Income Groups; A Case Study of Wolaita district in Southern Ethiopia.

Dagnew Eshete, 1994. Food Grain Marketing, distribution Mechanisms and problems inWollo and Adjacent Administrative Zones: Implications for Household Food Security and policy. A research report prepared for save the children (UK) in Ethiopia, Addis Ababa, and October 1994.

Dagnew Eshete, 1995. Seasonal and Exceptional Food shortage. Their Causes and Socio-Economic Consequences: A case Study of Wolaita District in Southern Ethiopia,

Dagnew Eshete, 1997. Training programme on food security and Vulnerability. CRDA,Prepared and conducted by: International Development consulting firm (IDCOF) Dessie,Ethiopia.

Degefa Tolosa, 1996. Belg crop production as a strategy of households' food security: A Comparative Study of belg grower and non- belg grower farmers in Munessa Wereda, Arssi Region. Unpublished M.A thesis.

Devereux, S., 1993. Goats before Ploughs: Dilemmas of Household Response Sequencing during Food Shortages. IDS Bulletin 24(4): PP 52-59.

Devereux S (2010). Food insecurity in Ethiopia. Department For International Development (DFID): http://www.nesglobal.org/node/129. Ethiopian Health and Nutrition Research

Kindo DidayeDistrict Agricultural Development Office, 2004. Annual report. PP. 9-12 (unpublished)

Edie, W.B., G.Holmoe- ottesen, A. Oshaug, D. perea, S. Tilakaratna and M. Wandel, 1986. "Introducing Nutritional Considerations into Rural Development programs with focus on Agriculture. Towards Practice." Development of Methodology for Evaluation of Nutritional Impact of Development programs, Institute for Nutritional Research. Report No. 2 University of Oslo, Norway.

Eshetu Bekele, 2000. The underlying causes of Household food Security and Coping Strategies: The case of Legambo Wereda, South Wollo Zone, Amhara Region, North Estern Ethiopia. M.Sc.Thesis, Addis Ababa University, Ethiopia.

FAO/WFP., 2001. Crop and Food Supply Assessment to Ethiopia: FAO Global Information and Early Warning System on Food and Agricultural: World Food Program, 9th January.

Federal Democratic Republic of Ethiopia (FDRE), 2003. The New Coalition for Food Security Program. Zero Draft. Volume 1. Addis Ababa, Ethiopia.

Frankenberger, T., 1996. Measuring Household Livelihood Security: an approach for Reducing Absolute Poverty. Food Forum 34 (November-December. Food Aid Management, Washington, DC, PP 1-6.

Frankenberger, T.R., and D.M. Goldstein, 1991. Linking Household Food security with Environmental Sustainability Through an Analysis of Coping Strategies. In Growing Our Future. K. Smith, ed. New Yourk: Kumarian Press.

Frankenberger, T.R., 1992. Indicators and Data Collection Methods for Assessing Household Food Security. In: Maxwell, S. and T. R. Frankenberger (eds.). Measuring Food insecurity: The Frequency and severity of Coping Strategies. IFPRI, Washington, D.C.

Getachew Diriba, 1995. Economy at the crossroad: Famine and Food Security in Rural Ethiopia. Printed by Commercial Printing Enterprise, Addis Ababa Ethiopia.

Gezahegn Ayele, W. O., Steven and Eleni Gabre-Madhin, 2003. The State of Food Security and Agricultural Marketing. Proceeding of a policy Forum of The Ethiopian Development Research Institute (EDRI) and The East African Food Policy Network of the International Food Policy Research Institute (IFPRI). 15-16, May (2003), Addis-Ababa, Ethiopia.

Haddad, L., 1997. Human Nutrition in the Developing World. Ithaca, New York. U.S.A. Hoddinott, J. (ed)., 2001. Method for Rural Development Projects. Food Security in practice, Vol., 1., IFPRI, Washington D.C.

Haswell, M., 1953. Econometrics of agriculture in savannah village. Colonial Research Study,no.

Huss- Ashomore, R., 1984. Seasonality in rural household Lesotho: Method and policy. In a report on regional workshop on seasonal variations in the provisions, nutrition, and health of ruralfamilies Ford Foundation.

Kidane Georgis, 1999. Agronomic Technique foe Higher and Sustainable Crop Production in the Dry Land Area of Ethiopia Food Security prospective, In: Taye Asefa (eds.): Food Security Through Sustainable Land use Proceedings of the First National Workshop of NOVIN, Addis Ababa.

Kifle Lemma and Yosef Gebrehiwot, 1999. The Food Security Situation in Ethiopia. Concepts, Status and Trends. In: Taye Assefa (ed.): Food Security through Sustainable Land use. Proceeding of the first National Workshop of NOVIN Partners. Forum on Sustainable land use. NOVIN, Addis Ababa.

Maxwell, D., Ahiadeke, C., Levin, Armar. Klemesu, M., Zakariah, S. and Lamptey, C.M., 1999. Alternative Food Security Indicators: Revisiting the Frequency and Severity of coping Strategies: Food Policy 24, 411-429.

Markos Ezera, 1997. Demographic responses to ecological degradation and food insecurity: Drought Prone areas in Northern Ethiopia. Amsterdam: Thesis Publisher Ph.D. Dissertation.

Maxwell D (1995). Measuring food insecurity: The Frequency and severity of coping strategies. International Food Policy Research Institute, USA, Washington, D.C

Maxwell D, Watkins B, Wheeler R, Sheikh D (2002). The coping strategy index: A tool for rapidly measuring food security and the impact of food and programs in emergencies; Field methods manual, World Food Program.

Maxwell S (1996). Food Security: A Post-Modern Perspective. Food Policy, p. 21.

Maxwell S, Frankenberger F (1992). Household Food Security: Conceptual indicators and measurements; A technical review. UNICEF, New York and IFAD, Rome..

Mesfin Woldemariam, 1986. Rural vulnerability to famine in Ethiopia, 1958-1977. New Dheli: Vikas Publishing House.

Messr, E., 1989. Seasonality in food system: An anthropological prospective on household food security. In seasonal vulnerability in Third World agriculture: The consequence for food security, edited by D. Sahan. Baltimore: Johns Hopkins.

Ogbu, J., 1973. Seasonal hunger in Tropical Africa as a cultural Phenomenon. Africa, no. SNNPR Bureau of Finance and Economic Development, 2002. Annual report. PP. 25-35. (Unpublished report)

Reutlinger, S., 1987. Food security and poverty in developing countries. In policy: Integrating supply, distribution and consumption, edited by J. Gittinger and Baltimore: Johns Hopkins.

Sen, A., 1981. Poverty and famine: An essay on entitlement and deprivation. Claredon Press, Oxford.

Sharman, A., 1970. Social and economic aspects of Nutrition in Padhold Duk di District,Uganda. Ph.D. dissertation, University of Landon.

Tassew W (2006). Measuring and Monitoring Poverty in Ethiopia: Department of Economics Addis Ababa University, Ethiopia.

Tassew W (2008). Correlates of poverty in Rural and Urban Ethiopia: Department of Economics Addis Ababa University, Ethiopia, Eth. J. of Agric. Econ., 7(1): 49-81.

Tesfaye Zegeye and Debebe Habtewold, 1995. Food Security: A Situation Analysis. In: Mulat, D.; Wolday, A.; Ehui, S. and Tesfaye, Z. (ed.): Food Security, Nutrition and Poverty Alleviation in Ethiopia: Problems and Prospects. Proceedings of the Inaugural and First Annual Conference of the Agricultural Economics Society of Ethiopia, Addis Ababa, Ethiopia.

Tekolla, Y., 1990. The African food Crisis. Food Crisis in Africa: Policy and management issues, edited by Eshtu Chole. New Delhi: African Association for Public Administration and Management.

Tesfaye Kumbi, 2005. Household Food Insecurity in Dodota-Sire district, Arsi zone: Coping strategies and policy options

Tesfaye Lemma, 2003. Livelihood Strategies in Context of Population Pressure. A case study in Hararghe Highlands, East Ethiopia. Ph. D. dissertation. University of Pretoria

Tweeten and Donald, 1997. Promoting Third-World Development and Food security. Green wood publishing Group. United States of America.

Toulmin, C., 1986. Access to food, dry season Strategies and household Size amongst theBambara of Central Mali. IDS Bulletin 17, no. 3: 58-66.

Webb, P.; Braun, J. and Yohannos, 1990. Famine in Ethiopia: Policy Implication Coping Failure at National and Household Levels. Washington D.C. International Food PolicyResearch Institute.

World Bank, 1986. Poverty and Hunger: Issues and Options in Developing Countries. A World Bank Policy Study, Washington D.C.

World Bank, 1992. Development and the Environment. World Development Report, World Development Indicators.

Yared Amare, 1999. Household Resources, Strategies and food security in Ethiopia. A Study of Amhara households in Wogda, Northern Showa. The Department of Sociology and social Administration, AAU Press, Ethiopia.

APPENDICES

Appendix III Survey questionnaire distributed to development agents

Part I. General Information

1. Zone_____2. district___

3. Peasant Association (PA) _____

4. Selection Number of the Household_____

5. Name of the Household_____ 6.Enumerator's name_____ 7. Date interview___

8. Signature_____

Part II. Demographic, Economic and Social Characteristic of the Household

1. Household Information

1	2	3	4	5	6	7	8
	Name of the Household members	Marital Status	Relationship to the household head	Sex M=1 F=2	Age	Education Level	Main Occupation Activity

For codes 03= 1) unmarried 2) Married 3) Divorced 4) Widowed 5) below marriage age

For codes 04= 1) Husband 2) Wife 3) Daughter 4) Son 5) Relatives 6) Others

For codes 07= 0) Illiterate W&R) Read & write 3) If attending School, write the grade

4) Leave blank for children below 8 years

For codes 08= 1) Farming 2) Merchant 3) House hold work 4) Schooling 5) Other specify

2. Since the last five years, how is the change in your household size? (Circle) 1) Increased 2) Decreased 3) Not changed.

3. If there is change, describe the reasons. 1) Increased birth rate 2) Relatives returned from other places 3) Marriage and extended family 4) Labor migration 5) others

4. Has any member of your family ever migrated out during food crises? 1) Yes 2) No

5. If yes, 1 who? 1) HHH 2) Son 3) Spouse 4) Daughter 5) Other, specify_____

2. Where 1) Halale 2) Other bigger towns 3) In the village 4) Other specify

3. Which year?_____ 4. Which season of the year_____

5. For how long _____

6. If children, aged 6 years and above, are not attending school, why?

1) School too far 2) No money 3) disabled 4) Needed for work/labor 5) Lack of interest 6) others, specify _____

7. Labor force status (for those ten years and above): Have you engaged in productive work in most of the last 12 months? 1) Yes 2) No

8. If no what are the reason? _____

1) Disabled 2) Didn't want 3) No job/No one employs me/No employment

4) Scarcity of agricultural and 5) Sick 6) Old 7) others (specify)___

Part III. Land Use Information

1. Land holding in ha

	Cultivable land	Land left fallow	Grazing land	Garden land	Degraded land
Own Land					
Rented					

2. Do you have your own land? 1) Yes 2) No

3. Allocation of the total area of land to different crops in 2012 in ha?

Type of Crop	Owned	Rented	Share Cropped
1			
2			
3			

4. Do you think, that your cultivated land is enough to support your family 1) Yes 2) No

5. If no, state your reasons _____

1) Infertility of land 2) Small size of land

3) Lack of agricultural inputs to increase productivity 4) Large family size

5) Crop pests 6) Crop diseases, 7) Drought 8) Others

6. What proportion of your cultivated land is allotted to? In ha

1) Annual crops _____ 2) Perennials _____

7. List type of crops you cultivate and their average production (including garden crops) for the last two years.

Type of Crop grown	2011				2012			
	Area (ha)	Produced			Area (ha)	Produced		
		Sold in (Qt)	Value in (Birr)	Consumed (Qt)		Sold in (Qt)	Value in (Birr)	Consumed (Qt)
1								
2								
3								
4								

8   Inputs used during 2012

Type of Crop grown	Area (ha)	seed kg	Labor (Man day)				Fertilizer KG			Chemical KG	
		(qt)	Ploughing	cultivation	Trashing	Harvesting	Urea	DAP	Manure	Pesticides	Insecticides
1											
2											
3											
4											

9. Cost of input used during 2012/2013 (Birr): 1) Labor if hired _____ 2) Dap _____

3) Urea_____ 4) herbicide _____ 5) Animal medicine ____ 6) Animal feed_____

7) Pesticide _____ 8) Seed _____

10. If no chemicals are used on your farm? _____

1) Does not help 2) No problem of weed or pest 3) Too expensive

4) Not available 5) Not heard about it 6) others (Specify)

Part IV. Use of Modern Agricultural Inputs

1. Do you use chemical fertilizers? 1) Yes 2) No

2. If no state your reasons _____

1) Not necessary for cultivated crops 2) Too expensive 3) Harmful to the soil

4) Land is fertile 5) Not available 6) other specify

3. If yes for how many years have you been using fertilizer? _____ Years.

4. Do you use improved seed on your farm? _____ 1) Yes 2) No

5. If no state your reasons: _____

1) Not heard about it 2) Not available (no supply) _____

3) Too expensive 4) other reasons (specify)

6. Was what you produced last year enough for your family? 1) Yes 2) No

7. If yes what amount of grain stock was transferred to this year? ___ Qts. based on previous table

8. If no, for how long could it last? ___ Months.

9. What do you think are the main causes of food deficit in order of importance?

1) Absence of adequate rainfall___ 2) Insect or pest infestation _____ 3) Shortage of cultivated land _____ 4) Poor quality of land_____

5) To much of rain_____ 6) Animal disease _____

7) Poor health situation of the farmers'__ 8) Plant diseases____ 9) Flood ____

10) Others (specify) _____

10. During which months is food shortage severe? _____ Month (s)

11. How did you cover (cope) with the deficit?_____

1) Sale of animals 2) Cash reserve 3) Food aid

4) Borrow from neighbors 5) Income from off-farm works in the locality

6) Received gifts or remittance 7) Eating wild Food 8) Migration to others areas _

12. If relief food is a means to fill the deficit for how long have you been getting food aid?

1) ___ Years 2) ___ months per year

13. Indicate the amount of food aid your household received in the past two years? If any

Type of food Unit 2012 2013

1) _____ _____ _____ _____

2) _____ _____ _____ _____

14. Describe the problems you encountered in your farm operation in order of importance

1) Shortage of oxen 2) Shortage of seed 3) Shortage of labor 4) Shortage of livestock feed

5) Shortage of fertilizer 6) in adequate shortage of facilities 7) Poor transportation

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8) Weeds and pest problem 9) Shortage of rain 10) Land shortage 11) Poor soil fertility

12) Low price of produce 13) Distance to market 14) Shortage

Of farm Implements _____

15. Where there any damage to your crop during the last year? 1) Yes 2) No

16. If yes, to question number 15 specify the type of crops lost along with extent lost?

Information on agricultural production in relation to climate change

2.1 What is the annual average crop production income?

☐ <5quintal ☐ 5-10quintal ☐ 10-15quintal ☐ 15&above

2.2 Do you use irrigation? ☐ Yes ☐ No

2.3 If your answers for question number 2.2 is yes, then mention the conditions when do you use

_____

_____

2.4 When you compare the production of agriculture along with climate change trends, what happens year after year? ☐ Decreasing ☐ ncreasing ☐ same

2.5. State your possible reason/s for your answer to question 2.4

_____

_____

_____

2.6. Do you use intercropping system? ☐ Yes ☐ NO

2.7. If you answer for question 2.6 is yes, mention the reason to use it.

_____

_____

_____

2.8, How many hectare of land do you have? ☐ Less than 1 ha ☐ 1-4ha ☐ above 4 ha

2.9. Do you use similar crop species for the last 10 years? ☐ Yes ☐ No

2.10. Mention the reason for the selected answer of question 2.9

_____

_____

_____

2. 11. How many cattle do you have? ☐ No ☐ 1-4 ☐ above 4

2.12 Do you observe any climate change within the last 10 years? ☐ Yes ☐ No

2.13 If your answer is YES for question 2.12 mention the changes occurred.

_____

_____

_____

2.15 Is there conflict among children in your house? ☐ Yes   ☐ No, I have no children

2.16 If your answer for question 2.15 is yes, mention the reason/s

_____

_____

_____

2. 17. Is there any change in family food security in the last 10 years?

☐ Yes increased   ☐ yes decreased   ☐ No

2.18 If your answer for question number 2.17 is yes, explain the reason

_____

_____

_____

2.19 How many wives do you have? ☐ One   ☐ two   ☐ three   ☐ more than three

2.20 Explain the reason for the selected answer of question number 2.19

_____

_____

_____

2.21 Have you ever changed or modified your agricultural systems in response to the change in climatic conditions? ☐ Yes ☐ No

2.22 If your answer for question 2.21 is "yes", which adaptive strategies from the mentioned below are best? (Put '' ✓ ''and then rank)

No	Coping strategies	Put '' ✓ ''	rank
1	Purchasing grains		
2	Borrowing cash or grains from others		
3	Sales of animals to meet purchase of grain		
4	Reducing number and size of meal		
5	Receiving relief food aid		
6	Involve in off-farm and on farm job		
7	Sales of fire wood and charcoal		
8	Temporary migration to other area		
9	Sales of key productive assets		
10	Receiving gifts and remittances		
11	Rent out land		
12	Changing planting and cropping pattern		
13	Mulching		
14	Introduction of flood control measures		
15	Increasing number of animals		
16	Start trading		
17	Working as part time casual labor in towns		
18	Selling homemade handcrafts		
19	Limiting family size		

Rank: 0=no contribution; 1=low; 2=high; 3=highest contributor