VULNERABILITY TO FOOD INSECURITY IN THREE AGRO-ECOLOGICAL ZONES IN SAYINT DISTRICT, ETHIOPIA

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ABSTRACT

The objective of this study was to identify and compare the determinants of vulnerability to food insecurity among households in three different agro-ecological zones within the rural district of Sayint in South Wollo, Ethiopia. It also sought to apply the livelihoods framework and examine its robustness in this research context. Findings and analysis indicate that oxen ownership, livestock ownership and access to off-farm employment opportunities are the most significant determinants of a household's vulnerability to food insecurity. All of the sampled households reported major agricultural problems, such as lack of adequate land, financial constraints and lack of oxen and farm implements, but highland households were found to be more vulnerable to food insecurity than lowland and midland households were.

Food security analysis also indicated that 80% of highland households were found to be food insecure. The depth (60%) and severity (41%) of food insecurity were specifically found to be higher among highland households than among lowland and midland households. More detailed vulnerability and livelihood analysis suggest that food insecurity in the highland households is specifically attributed to their limited internal resources endowments and lower access to external assistance.

Keywords: Vulnerability; food insecurity; sustainable livelihood framework; traditional coping and survival strategies; agro-ecological zones.

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Glossary of local terms

Belg:	Short, rainy season which runs from February to May
Birr:	Ethiopian currency unit
Dega:	A highland with an altitude of 2500 – 3000 metres above sea level
Gott	Rural village
Kebele:	The smallest political administrative unit
Kolla:	A lowland with an altitude of less than 1500 metres above sea level
Meher:	Long, rainy season which runs from June to September
Teff:	Ethiopia's traditional staple food
Timad:	A traditional land measurement unit where four timad is approximately equivalent to one hectare
Weinadega:	A midland with an altitude of 1500 - 2500 metres above sea level
Woreda:	An administrative ward equivalent to a district
Zone:	A political administrative unit above a district and below regional state

Abbreviations and Symbols

ABB LZ:	Abay Bashilo Basin Livelihood Zone
ANRS:	Amhara National Regional State
ARARI:	Amhara Regional Agricultural Research Institute
BoFED:	Bureau of Finance and Economic Development
CSA:	Central Statistics Agency
DFID:	Department for International Development
FAD:	Food Availability Decline
FAO:	Food and Agricultural Organization
FDRE:	Federal Democratic Republic of Ethiopia
FED:	Food Entitlement Decline
FEZ:	Food Economy Zone
FFW:	Food for Work
GDP:	Gross Domestic Product
HA:	Hectare
HH:	Household
HHLS:	Household Livelihood Security
IFPRI:	International Food Policy Research Institute
MASL:	Metres above sea level
MT:	Metric Tons
NGO:	Non-governmental Organization
ORDA:	Organization for Rehabilitation and Development in Amhara
PA:	Peasant Association
PRA:	Participatory Rural Appraisal
PSNP:	Productive Safety Net Program
RTE:	Real Time Evaluation
SERA:	Strengthening Emergency Response Abilities
SLF:	Sustainable Livelihoods Framework
SME LZ:	South Wollo Meher Livelihood Zone
TLU:	Tropical Livestock Unit
USAID:	United States Agency for International Development
WFP:	World Food Program
WHO:	World Health Organization

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CHAPTER 1: INTRODUCTION

1.1. BACKGROUND OF THE STUDY

With a population of about 78 million and a physical size of 1.115 million hectares, Ethiopia is one of the largest and most populated countries in Africa. The country is also characterized by a vast physical diversity; altitudes range from about 200 metres below sea level to over 4000 metres above sea level, and there are about 18 major agro-ecological zones (CSA 2005). Several studies show that the country is generally characterized by extreme poverty, a high population growth rate, severe environmental degradation and recurrent drought. As a result, agriculture, from which 85% of the country's population derives its livelihood, has performed so poorly over the last few decades that the country cannot adequately feed its population from domestic production alone. This has manifested in both chronic and transitory food insecurity, which have almost become a structural phenomenon and the way of life for a significant percentage of the population (Tolossa 2002).

According to Berhanu (2004), in the last three decades food production in Ethiopia has been insufficient to render the population food secure. Many Ethiopians live in conditions of chronic hunger, with a low average daily energy supply and a very high prevalence of malnutrition, estimated at about 44% of the total population.

The percentage of people in rural areas who are unable to attain a minimum nutritional requirement is estimated at 52% (Devereux 2000), and the prevalence of child malnutrition is very high. Perhaps the greatest challenge that the country faces is that of ensuring food security. Serious food shortages and high levels of malnutrition continue to affect a large number of people in several parts of Ethiopia (ibid).

Poverty, climate and political and ethnic confrontations make Ethiopia highly vulnerable to food insecurity, and food scarcity emergencies are recurrent. It has been affected regularly by major drought related disasters throughout the last 35 years: in 1973-74, 1984-85, 1999-2000, 2001-2002 and 2005-2006 (USAID 2006).

These successive drought-related disasters have had a disproportionate effect across segments of social groups and food economy zones. Despite widespread risk of food

insecurity in all of the food economy zones[1], in the last decade the Wollo food economy zone has had the most frequent need for food relief.

This food economy zone, which is the focus of the research, comprises of three distinct food economy areas: Wollo Northwest Watershed, Wollo Central Highlands, and Wollo Southern Highlands. As a whole, the region is highly productive when there is enough rainfall, and it exports crops to other regions, such as pulses from the southern and central highlands and teff from the northeast plain. However, erratic rainfall and some catastrophic drought periods over the past 30 years have resulted in this highly populated area producing insufficient food for approximately three years in five, and on three occasions it has been the scene of mass famine in the north and east (SCF-UK 2004).

It is in this context that this study investigates vulnerability to food insecurity among households of Sayint Rural District. The study also compares levels of vulnerability as well as coping and surviving strategies across the three distinct agro-ecology zones.

[1] Food economy zone refers to geographical areas within which people share broadly the same patterns of access to food and income, and have the same access to markets (SCF-UK 2004).

Figure 1: Maps showing location of Ethiopia and its Administrative Regions

Designed by Anne Westoby

1.2. STATEMENT OF THE PROBLEM

Cycles of drought, famine and pestilence have always characterized Ethiopia's past (USAID 2003) and a significant percentage of the country's population has been affected by recurrent chronic and transitory food insecurity. In five of the past seven years, Ethiopia has had large structural deficits in the availability of food supplies as local production and commercial imports have not met needs. This has led to substantial emergency assistance to fill the gap (USAID 2004).

Food production in Ethiopia in the last three decades has not been sufficient to enable the rural population to be food secure. It was estimated that domestic food production in the late 1980s allowed for about 1620 calories per person per day, while total availability, including imports, was about 1770 calories per person per day. This is 16% below the minimum level of 2100 kcal[2] per person per day, equivalent to 225kg of grain per person per year (Nigatu 2004).

Devereux (2000) also noted that the food gap rose from 0.75 million tons in 1979/80 to 5 million tons in 1993/94, falling to 2.6 million tons in 1995/96 despite a record harvest. This clearly shows that over the last 20 years this cycle of food insecurity has repeated itself, and each time the number of people affected gets larger, and the resulting amount of human suffering and disease increases. In turn, social unrest and conflict have followed, despite generous amounts of emergency assistance from the international community (USAID 2004).

On a national level, the average percentage of the population in need of food assistance between 1980/81 to 2000/01 was 10%, and this increased significantly to 22% by the year 2002/03. However, since vulnerability to food insecurity varies depending on agro-climatic and socio-economic factors, the proportion of people requiring food assistance exceeds this in some regions. For example, in the Amhara region, where the research area is located, the percentage of the population requiring food assistance in 2003 increased by 60% from 2002. (DPPC 2004).

The research area, Sayint Rural District, is located in the Amhara region, South Wollo, the heart of what Rahmato (1986) called the Ethiopian 'famine belt'. This region was the most severely affected part of Ethiopia in the well-known famines of 1971-74 and 1983-84 and

[2] 2100 kcal is internationally accepted minimum energy requirement per person per day.

to this day, some households in the area have not fully recovered from the debilitating effects of the 1983-84 crisis (Peter and Negatu 2006).

As in most other drought-affected areas in Ethiopia, food security in South Wollo is precarious due to a high population density, small land holdings per household, a heavy reliance on (erratic) rain and decreasing soil fertility. South Wollo is structurally food deficient, with much of the population chronically dependent on food aid (WHO 2000).

In comparison with other parts of highlands Ethiopia, South Wollo has slightly smaller average land holdings (about 15% smaller), lower incomes, and is less food secure because it depends more on the short (belg) rains than other areas (Peter and Negatu 2006).

The South Wollo zone is considered to be chronically food insecure because of the repeated failure of the belg rains, which results in high livestock mortality and the gradual erosion of livelihoods. Within this zone, Sayint Rural District is considered to be one of the most food insecure woredas, or districts. Even in a normal year, many households are unable to rely on crop production alone (WHO 2000).

Furthermore, the area does not have adequate roads, health services, veterinary services, schools or safe water. Many of the roads are poor and some communities can only be reached on foot or by mule, particularly in the rainy season (ibid, 2000). Basing his study on this area, the researcher set out to discover why this inward spiral cycle of food insecurity has not been broken despite substantial international community assistance and government efforts.

1.3. OBJECTIVES OF THE STUDY

This study aimed to identify and define the determinants of vulnerability to food insecurity using the livelihoods approach. Households in three different agro-ecological zones in Sayint Rural District were examined. The specific objectives of the study were to:

- Identify the determinants of household vulnerability to food insecurity in Sayint Rural District
- Compare determinants of vulnerability to food insecurity across the three different agro-ecological zones

- Apply the sustainable livelihoods approach to food insecurity context within Sayint Rural District

1.4. RESEARCH QUESTIONS

This study sought to provide answers to the following fundamental questions concerning vulnerability to food insecurity, traditional coping mechanisms and household livelihoods:

1. What are the determinants of vulnerability to food insecurity in Sayint Rural District?
2. What kinds of livelihood strategies and activities do households engage in to secure minimum food requirements and sustain future livelihoods?
3. What are the main sources of food and livelihood in Sayint Rural District?
4. What are the main external factors that affect the food security status of households in Sayint Rural District?
5. What coping mechanisms are used among households of Sayint Rural District in response to risks of food insecurity?

1.5. SIGNIFICANCE OF THE STUDY

Food security issues are the primary concern of the Ethiopian government. Despite government efforts and substantial international community assistance, however, the number of people who are food insecure has continued to rise. The magnitude and severity of the problem as well as area it covers has increased as well. According to many good practice reports, the challenge to effective food security intervention lies in the inadequacy of food insecurity assessments and monitoring systems.

Addressing food security issues requires a thorough understanding of vulnerability and food insecurity conditions at a household level. Identifying those who are the most vulnerable, and identifying their coping and survival strategies, will help when designing appropriate relief and development intervention activities. Food insecurity analysis at a local level will also help to identify the most appropriate combinations of interventions. According to the Sphere Project, each intervention must be appropriate to local contexts and exisiting strategies for supporting food security, and will therefore be unique in its objectives and design.

Therefore, this study informs and strengthens understanding about vulnerability to food insecurity. Moreover, by contributing to the robustness of food security monitoring and evaluation methods, it can assist in the design of more appropriate relief and development interventions. Furthermore, insights gained here through the application of the livelihoods framework to household vulnerability and food insecurity indicate the value of further research using this approach.

1.6. ORGANIZATION OF THE STUDY

The research is organised into seven chapters. The first chapter introduces the background of the study, the statement of the problem, the objectives of the study, the research questions and the significance of the study.

The second chapter discusses the conceptual and theoretical frameworks of the study. It includes the concept of food security, vulnerability and the sustainable livelihoods framework; theories of food shortage; contemporary methodologies for the analysis of food insecurity; and a brief food insecurity profile of Ethiopia.

The third chapter presents the background of the study area. It outlines the demographic, socio-economic, and physical characteristics of Amhara National Regional State in general, and Sayint Rural District in particular.

Chapter Four presents the methodology that was used. It includes the process of primary and secondary data collection methods, the method of data consolidation and analysis, and ethical considerations and research constraints.

Chapter Five addresses data presentation and consolidation. It presents the survey findings, which are mainly descriptive statistics concerning demographic characteristics, access to production resources and farming systems, and sources of food, income and expenditure as well as sources of non/off-farm incomes and household assets.

Chapter six provides a food security analysis. It includes the determinants of vulnerability to food insecurity, the food security status of households, and the household's livelihoods and food security status.

The final chapter is the conclusion. This chapter discusses and provides the implications of the study findings and their convergence and divergence with past food security studies. It also provides a critique of the robustness of the sustainable livelihoods framework and future directions for food security research and rural development programmes in Ethiopia. Finally, the chapter concludes by providing a brief overview of the findings of the study.

CHAPTER 2: LITERATURE REVIEW & THEORETICAL FRAMEWORK

This chapter discusses the concepts and theories that are relevant to the issues raised in this study. It includes the concept of food security, vulnerability, theories of famine or food shortage, the livelihoods framework, and contemporary food security methodologies. These theories and concepts are relevant to the issues under consideration.

2.1 DEFINITIONS AND CONCEPTS

2.1.1. INTRODUCTION

The notions of poverty, malnutrition and vulnerability are closely intertwined in definitions of food insecurity, hence, literature on household food security has developed to take account of parallel developments in other fields. According to Maxwell and Smith (1992), this is because, first, the household itself is a problematic concept and individual members of a household will experience different food security risks and often follow different food security strategies. Second, food security is a necessary but not sufficient condition for adequate nutrition. Third, it is misleading to treat food security as a fundamental need, independent of wider livelihood considerations. Fourth, the sensitivity, resilience and sustainability of livelihood systems are crucial to understand levels of food insecurity. Fifth, people's own perceptions of vulnerability and risk predominate in food security strategies. Finally, cultural values are also important in determining the quality of food entitlement, rather than just the quantity. Therefore, a holistic and multi-dimensional understanding of the concepts of food security and related issues is crucial for analysing and explaining a household's vulnerability to food insecurity. Several key concepts underpin this study. These include household food security/insecurity, vulnerability, household livelihoods and the sustainable livelihoods framework. The following section outlines the definitions and concepts of these key words.

2.1.2. FOOD SECURITY

International attention to the concept of food security can be traced back to the Universal Declaration of Human Rights in 1948, which recognised the right to food as a core element of an adequate standard of living. However, a renewed interest in food security followed

the world food crisis of 1972-74. Since then, the meaning of food security and approaches towards achieving it has undergone significant changes (WFP 1998).

Food security was first defined as "access by all people at all times to enough food for an active and healthy life" (World Bank 1986). In this early conceptualization, the essential elements were seen to be the availability of food and the ability to acquire it. This conceptualization of food security also marked a significant shift in the analysis of food security issues from global and national to household and individual levels. Today, it is regarded as more useful to analyse food security in terms of people's access to food than in terms of macro food production or supply. Inclusion of the concept of access to food at the household level marks a clear departure from the previous emphasis on production.

Household food security has three main components: availability, accessibility and utilization. Readily available, stable supplies of food are considered a prerequisite for household food security. However, households must also have physical and economic access to food. In addition, they must have the knowledge to use such food appropriately and have a healthy/sanitary environment that allows for adequate absorption of food by the body (WFP 1998).

Food availability is achieved when sufficient quantities of food are consistently available to all individuals within a country. Such food can be supplied through household production, other domestic output, commercial imports, or food assistance (USAID 1999). However, food availability is a necessary but not sufficient condition for adequate household food consumption as increased reliance on off-farm activities such as petty trade, casual employment and agricultural surplus sales has made households more dependent on purchasing food than producing it (WFP 1998).

Accessibility, however, refers to conditions when households and all individuals within them have adequate resources to obtain appropriate foods for a nutritious diet. Access depends on the income available to the household, the distribution of income within the household, and on the price of food (USAID 1999). The focus on the lack of access to food rather than its inadequate and uncertain supply has helped to explain why famines have occurred in environments of apparent food abundance (Sen 1981).

The utilization concept, on the other hand, adds a qualitative notion to food security in the form of nutritional security. It is no longer enough for a family to have sufficient food

to be food secure; the food must be of adequate nutritional quality, and the household must be able to use it appropriately and have a satisfactory health and sanitation environment for the body to absorb it (WFP 1998). Furthermore, USAID (1999) considered food utilization as the proper biological use of food, requiring a diet providing sufficient energy and essential nutrients, potable water, and adequate sanitation. Effective food utilization depends, in large measure, on knowledge within the household of food storage and processing techniques, basic principles of nutrition and proper childcare, and illness management (ibid).

2.1.3 FOOD INSECURITY

By definition, food insecurity is the lack of physical and/or economic access to sufficient food and can be either chronic or transitory. Chronic food insecurity is a continuously inadequate diet resulting from the lack of resources to produce or acquire food. Transitory food insecurity, however, is a temporary decline in a household's access to enough food. It results from instability in food production and prices or in household incomes. The worst form of transitory food insecurity is famine (Gittinger et al., 1987).

2.1.4 VULNERABILITY

These concepts underline the temporal dimension of food security – a feature that it shares with sustainable livelihoods, which are essential for ensuring household food security and reducing vulnerability to food insecurity. Food insecurity is often due to unavailability of food, insufficient purchasing power, inappropriate distribution or inadequate utilisation at household level. Vulnerability is also seen to be key concept, referring to factors that place people at risk of becoming food insecure or reducing their ability to cope (FAO 2002).

Both concepts of food insecurity and vulnerability have been used in a range of disciplinary contexts, with differing assumptions and theoretical frameworks. For instance, Du Toit and Ziervogel (2004), and Ellis and Kennedy (2002), considered food insecurity to be a form of vulnerability. They argued that 'when the kind of vulnerability that is under consideration is vulnerability to food failure, and then food insecurity is not really distinguishable from vulnerability as a separate concept'. This contrasts with FAO's view that food insecurity is an outcome of vulnerability, and that both are indistinguishable but two distinct points on a timeline. According to FAO (2002), the

difference between food insecure and vulnerable people is one of degree. Vulnerable people have a high probability of becoming food insecure at any time. Food insecure people are vulnerable people who can no longer meet their minimum food needs.

Similarly, there are debates concerning the food security conception of vulnerability among disaster management specialists and food security analysts. According to Burg (2008), the literature on disaster risk defines vulnerability in relation to specific hazards or causes (Vulnerability = Hazard – Coping/ or Vulnerability + Hazard = Risk) whereas food security analysts define it in relation to a general outcome: famine. Therefore, households are vulnerable to hunger, food insecurity, or famine rather than being vulnerable to droughts, floods or market crashes.

For the purposes of this study, the researcher uses WFP's concept of vulnerability to food insecurity that is the probability of an acute decline in food access or consumption often in reference to some critical value that defines minimum levels of human well-being.

2.1.5 HOUSEHOLD LIVELIHOOD SECURITY

A livelihood is the means by which households obtain and maintain access to essential resources to ensure their immediate and long-term survival. Based on this definition of livelihood, livelihood security can be defined in similar terms to food security. Therefore, household livelihood security refers to ensured access to sufficient resources to ensure immediate and long-term survival for all people at all times (Save the Children 2007).

Given the above concepts of food security and vulnerability, it is clear that food security and livelihoods approaches share many common features that point to strong conceptual overlaps. Definitions of both food security and livelihood security emphasise well-being over time, both focus on access to food and income and both demonstrate a concern with risk and vulnerability (Devereux et al., 2004).

A livelihood approach situates food needs within a wider set of needs driving people's actions, and within a set of influences, possibilities and constraints which go beyond the 'food first' mentality of much of the food security literature. Although food security remains a distinctive concern which may need to be differentiated from other concerns, and a focus on poor peoples' access to food should remain central to the analysis, a wider

sustainable livelihoods approach can offer a framework within which to understand food security outcomes and behaviour more comprehensively (Devereux and Maxwell 2001).

These close linkages suggest that livelihoods approaches provide a practical toolkit for linking the analysis of food insecurity with a multi-dimensional and people-centred analysis of poverty – looking beyond income and consumption levels to include an assessment of people's strategies, assets and capabilities. Therefore, the potential for a livelihoods based analytical framework to generate improved approaches to poverty and food security measurement is viewed as very promising (Devereux et al., 2004).

2.1.6 SUSTAINABLE LIVELIHOODS FRAMEWORK

The conceptual framework that guides the research is, therefore, the sustainable livelihoods framework (SLF). The emergence of the sustainable livelihoods approach and its relevance to food security analysis followed Amartya Sen's ground-breaking work regarding the concept of entitlement. Despite the limitations of the entitlement approach, critiques against the approach raised many points which the SL approach has since attempted to address: food insecurity is a complex arrangement of vulnerabilities, not just vulnerability to the trigger of a particular event; deprivation is progressive and its impacts accumulate so that historical patterns of change are important; vulnerability depends not only on a given set of entitlements but also on the perceived risk that these will collapse or prove inadequate; and vulnerable people have agency – they adopt complex and rational strategies to avoid destitution (Swift and Hamilton 2002).

2.2 CONCEPTUAL FRAMEWORK

2.2.1 OVERVIEW

A working definition of sustainable livelihoods is: A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets, while not undermining its natural resource base (Scoones 1998).

According to Devereux and Maxwell (2001), the SL approach is an analytical framework, which seeks to improve our understanding of how people use the resources at their

disposal to construct a livelihood. The key question to be asked in any analysis of sustainable livelihoods is: Given a particular context (of policy settings, politics, history, agro-ecology and socio-economic conditions), what combination of livelihood resources (different types of 'capital') result in the ability to follow what combination of livelihood strategies (agricultural intensification/extensification, livelihood diversification and migration) with what outcomes? Of particular interest in this framework are the institutional processes (embedded in a matrix of formal and informal institutions and organisations) that mediate the ability to carry out such strategies and achieve (or not) such outcomes (Scoones 1998).

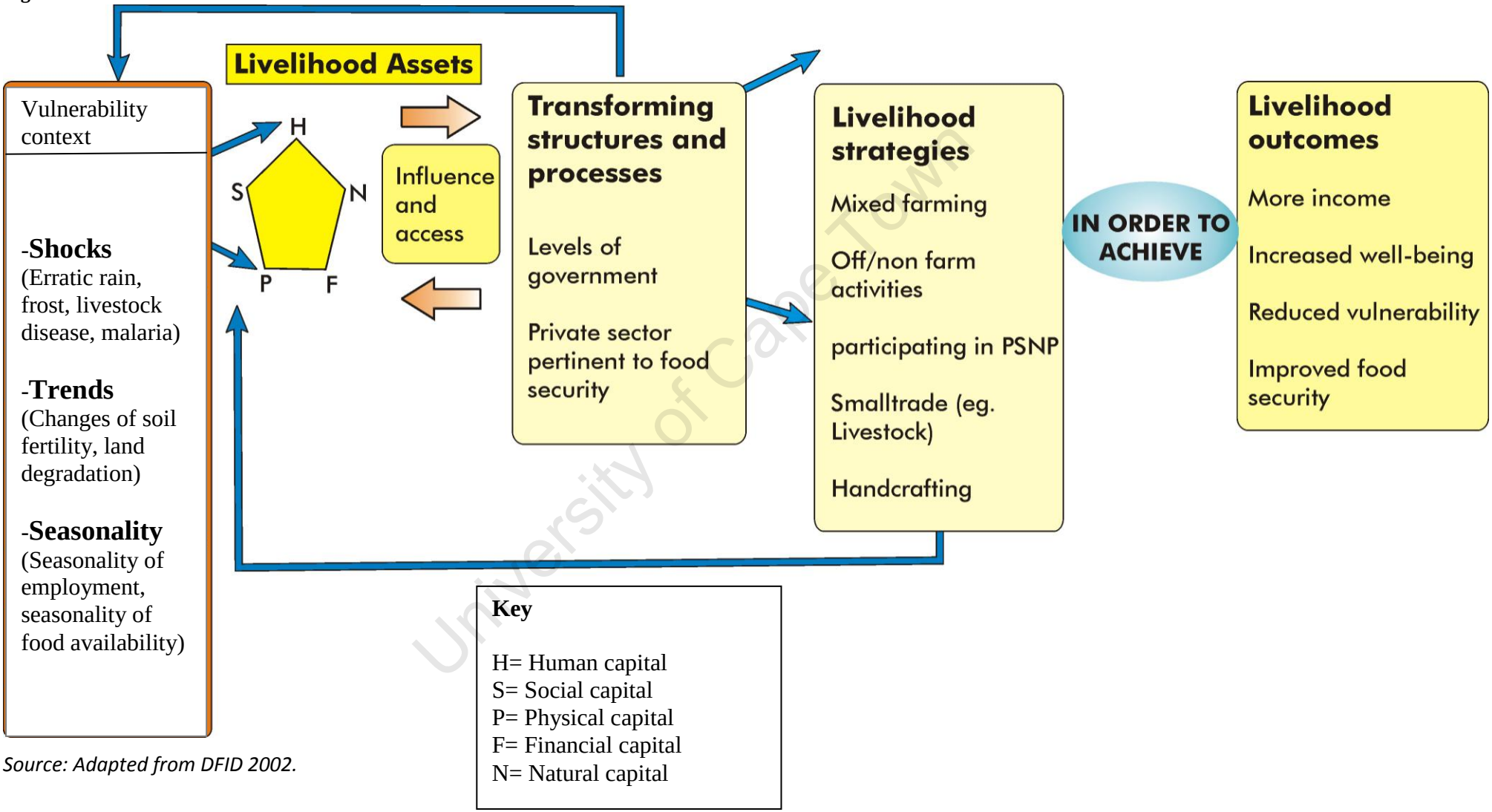
Furthermore, the SL approach is people-centred, designed to be participatory and has an emphasis on sustainability. The approach is positive in that it first identifies what people have rather than focusing on what people do not have. The SL approach recognises diverse livelihood strategies, it can be multi–level, household, community, regional or national, and it can be dynamic (Cahn 2002).

As indicated by Devereux and Maxwell (2001), sustainability is a key quality of successful livelihoods. Sustainability means both the ability of the livelihood system to deal with and recover from shocks and stresses, by means of coping (short-term reversible, responses) or by adaptation (a longer-term change in livelihood strategy), and also the ability of the livelihood system and the natural resources on which it depends to maintain or enhance productivity over time.

This aspect of the livelihoods approach reflects the temporal dimension of food security. Furthermore, a SL approach shows that food security is not just an issue of productivity, or even the sustainability of production, or of entitlements, but depends on how people, especially poor people, gain access to production and exchange capabilities and to food (Devereux and Maxwell 2001).

Figure 2 shows the main components of a livelihoods framework. Devereux and Maxwell (2001) noted that since the diagram is an oversimplification of a complex reality, it should be treated merely as a guide or lens through which to view how poor households make a living.

Figure 2: Sustainable Livelihoods Framework



Source: Adapted from DFID 2002.

While having the above definition and conceptual relevance of the approach, the following section will examine the various elements of the framework. It has five separate but interlinked components, which determine people's livelihood outcomes and choices.

2.2.2 VULNERABILITY CONTEXT

The external dimension of vulnerability is usually known as the 'vulnerability context', a collection of external processes that are a key factor in many of the hardships faced by poor people. The vulnerability context forms the external environment in which people exist and gain importance through direct impacts upon people's asset status (Devereux, 2000). Therefore, the context in which poor households pursue their livelihood strategies is a key determinant of the types of assets available to them and the types of livelihood strategies that they are likely to pursue. It comprises ***trends*** (i.e. demographic trends; resource trends; trends in governance), ***shocks*** (i.e. human, livestock or crop health shocks; natural hazards, like floods or earthquakes; economic shocks; conflicts in form of national or international wars) and ***seasonality*** (i.e. seasonality of prices, products or employment opportunities) and represents the part of the framework that lies furthest outside the stakeholder's control (DFID 1999). Not all trends and seasonalities must be regarded as negative; they can move in favourable directions, too. Trends in new technologies or seasonality of prices could be used as opportunities to secure livelihoods. Such contexts in which livelihoods are constructed are a crucial part of the analysis since these contexts and settings inevitably shape people's livelihood choices (Scoones 1998).

2.2.3 LIVELIHOOD ASSETS

The livelihood approach is concerned primarily with people. Therefore, an accurate and realistic understanding of people's strengths or assets is vital as an antidote to the view of poor people as 'passive' or 'deprived'. Central to the approach is the need to recognise that those who are poor may not have cash or other savings, but they do have other material or non-material assets – their health, their labour, their knowledge and skills, their friends and family, and the natural resources around them. Livelihoods approaches, therefore, require a realistic understanding of these assets in order to identify what opportunities they may offer, or where constraints may lie (Rakodi and Lloyd-Jones 2002).

As indicated by Kollmair and Juli (2001), people require a range of assets to achieve their self-defined goals, whereas no single capital endowment is sufficient to yield the desired

outcomes on its own. Since the importance of the single categories varies in association to the local context, the asset pentagon offers a tool to visualize these settings and to demonstrate dynamic changes over time through the constantly shifting shapes of the pentagon.

The asset pentagon shown in Figure 2 comprises of five forms of capital (human capital, social capital, physical capital, financial capital, and natural capital). These capitals, as explained by Rakodi and Lloyd-Jones (2002), can be stored, accumulated, exchanged or depleted and put to work to generate a flow of income or other benefits.

Furthermore, the ability to pursue different livelihood strategies is dependent on the basic material and social, tangible and intangible assets that people have in their possession (Scoones 1998). It is based on these forms of capital that people's livelihoods can be constructed. As indicated by Devereux and Maxwell (2001), the constituents of the asset pentagon are described as follows:

- Natural capital, or natural resources including the stocks and flows and environmental services available in particular agro-ecological settings
- Financial or economic capital, including savings and access to credit
- Physical capital, including infrastructure and transport
- Human capital, including demographic and gender structures, a body of education, the skills, knowledge and good health needed to produce effectively
- Social capital, including social networks, claims, associations and social relationships, including consensual norms and relationships of legitimate authority

2.2.4 POLICIES, INSTITUTIONS AND PROCESSES

Having the above livelihood resources rose, which combine to allow various strategies to pursue, and different outcomes to be realised? Questions such as: how is this process bound together, and what structures and processes mediate the complex and highly differentiated process of achieving a sustainable livelihood, are crucial in the analysis of household's livelihood.

According to Scoones (1998), one of the key questions raised in the analysis of a household's livelihood concerns 'accesses' - different people clearly have different access to different livelihood resources. This access depends on institutional arrangements,

organisational issues, power and politics. A socially differentiated view to analysing livelihoods is therefore critical, one that disaggregates the chosen unit of analysis – whether community, village or household – and looks at individuals or groups and their relationships in relation to the range of relevant dimensions of difference (wealth, gender, age and so on) and the distribution of control over resources.

According to Shankland (2000) and Keeley (2001), cited by Kollmair and Juli (2001), institutions, organisations, policies and legislation transform the structures and processes that shape livelihoods. They are of central importance as they operate at all levels and effectively determine access to and terms of exchange between different types of capital, and returns to any given livelihood strategy.

Institutions relevant to shaping livelihoods and food security include gender, as institutionalised norms of masculine and feminine behaviour significantly determine the options available to men and women in formulating livelihood strategies (Devereux and Maxwell 2001).

Furthermore, the transforming structures and processes occupy a central position in the framework. They directly feed back to the vulnerability context, while influencing and determining ecological or economical trends through political structures, while mitigating or enforcing effects of shocks or keeping seasonality under control through working market structures; or they can restrict people's choice of livelihood strategies (e.g. caste system) and may thus be a direct impact on livelihood outcomes (Kollmair and Juli 2001).

2.2.5 LIVELIHOOD STRATEGIES AND OUTCOMES

Livelihood strategies comprise the range and combination of activities and choices that people undertake in order to achieve their livelihood goals. They have to be understood as a dynamic process in which people combine activities to meet their various needs at different times and on different geographical or economical levels, and they may even differ within a household (Kollmair and Juli 2001).

As explained by Scoones (1998), the combination of activities that are pursued can be seen as a 'livelihood portfolio'. Some such portfolios may be highly specialised with a concentration on one or a limited range of activities; others may be quite diverse. Different livelihood pathways are evident over different time scales.

According to Scoones (1998) in a rural context households may construct four main categories of livelihood strategy:

- Livelihood intensification, where the value of output per hectare of land or animal is increased by the application of more labour, capital or technology
- Livelihood extensification, where more land or animals are brought in to production at the same levels of labour, capital or technology
- Livelihood diversification, where households diversify their economic activities away from reliance on the primary enterprise (livestock or cropping), typically seeking a wider range of on- and off-farm sources of income
- Migration, where people move away from their initial source of livelihood, and seek a living in another livelihood system

Although conceptually it helps to distinguish these strategies from each other, typically households pursue a combination of strategies together or sequentially. Different individuals or social groups may use similar strategies for different reasons. Households may use particular strategies to meet minimum consumption needs in the present, or to achieve ongoing accumulation, corresponding to a distinction between subsistence strategies and livelihood strategies (Devereux and Maxwell 2001).

2.3 THEORIES OF FAMINE/FOOD SHORTAGE

2.3.1 OVERVIEW

In the past 30 years, there has been a significant shift in both conceptual and theoretical explanations of the cause of famine or food shortage. Several attempts have also made to create an adequate definition of famine. In the Malthusian or neo-Malthusian view, famine is the question of an excess of population over the means of subsistence. It is an instance where population growth has outstripped food production. Massive starvation almost inevitably follows until the balance is restored (Edkins 2002).

Subsequently, theories of famine have shifted from an emphasis on environmental and demographic causes to economic and socio-political causes. Since Malthus, many scholars have employed different theoretical explanations of famine and food shortage. Famine theories therefore vary across disciplinary context, author interest and underlying assumptions. According to Devereux (1993), who assessed competing explanations of famine and food shortage, there is no single school of thought or hypothesis that can provide a comprehensive framework for analysing famine. In this section, the following major theoretical explanations and approaches will be discussed: Food Availability Decline (FAD) or Malthusian approach, Food Entitlement Decline (FED) or Sen's Entitlement Approach and Household Livelihood Security Approach (HHLS).

2.3.2 FOOD AVAILABILITY DECLINE (FAD) APPROACH

The 'Food Availability Decline' (FAD) approach has been labelled and analysed by Sen (1981). It explains that famine or food shortage occurs when there is an aggregate decline in food supply in a given geographical area. According to Sen, this traditional approach to famine looks for a decline in food availability: "a sudden, sharp reduction in the food supply in any particular geographic locale has usually resulted in widespread hunger and famine". Proponents of the FAD approach argue that anything that disrupts food production or supply can reduce food consumption, resulting in a subsistence crisis. Examples of events that can trigger a subsistence crisis are drought, war and rapid population growth. A drought, for instance, causes crop failure and livestock deaths, reducing the availability of food in the affected region. Similarly, war disrupts food production and storage as well as distribution (Devereux and Naeraa 1996).

Furthermore, proponents of the FAD approach argue that crop failure due to natural calamities often results in high food prices because of supply shortages, an increased demand to deal with uncertainty, and the sale of possessions to obtain food. Ultimately, the poor and those who are negatively affected by bad weather become famine victims because of reduced purchasing power. Therefore, since crop failures initiate the chain of effects, the proponents of this approach argue that the best way to understand famine is to look at what happened to food availability (Lin and Yang 2000).

The demographic set of the FAD approach, Malthus (1798), also explains famine or food shortage thus: population growth has led to a constantly increasing demand for food which agriculture, given the fact that there is strictly limited land and other natural resources, would eventually be unable to satisfy. Malthus could not foresee the agricultural, industrial and transport revolutions, of course, so to him famine was seen as an inevitable result – nature's way of restoring the balance between food demand and food supply (Devereux and Naeraa 1996).

2.3.3 FOOD ENTITLEMENT DECLINE (FED) APPROACH

The FAD approach was challenged by Amartya Sen. He argued that a decline in what he called 'food availability' was not necessary for a famine to occur. The total food supply per head in any area did not matter; what was crucial was whether particular individuals or households had access to sufficient food. In the famous opening words of *Poverty and Famines*, Sen argues: 'Starvation is the characteristics of some people not having enough food to eat; it is not the characteristic of there not being enough food to eat' (Sen 1981). Starvation was not about food as a commodity, but about the relationship of people to that commodity.

According to the Food Entitlement Theory (FED), food availability at a global or national level cannot bring food security at a household level. Thus, the FED approach has contributed significantly to the shift of emphasis to a household and individual level of analysis. A household may suffer from food shortage in a country where adequate food is available. Thus, food shortage becomes a matter of lack of access, that is, either inability to produce or being unable to purchase food. Households become food insecure because of failure in entitlement.

Furthermore, proponents of the FED approach argue that a growth in domestic production does not necessarily prevent famine or hunger because what is produced is not equally distributed and the entitlement system that determines access to food is not changed. Sen argues that one is entitled to food through four possible sources of entitlement. It could be through trade, through production, through the application of one's labour or through gift and transfer. The ability of a person to command food is therefore determined by what he/she owns (endowment) and the bundles of alternatives that can be obtained through exchange entitlement.

As explained by Devereux and Naeraa (1996), a person's entitlement is defined as the set of alternative commodity bundles (including food) that can be acquired through the various legal channels of acquisition. In the context of a private ownership market economy, Sen identifies four broad categories of entitlement:

1. Production-based entitlement: one is entitled to own what one produces with one's own or hired resources;
2. Trade-based entitlement: one is entitled to own what one obtains by trading;
3. Own-labour entitlement: one is entitled to all trade-based and production-based entitlements related to the 'sale' of one's own labour power; and
4. Inheritance and transfer entitlement: one is entitled to own what is willingly given to one by others (e.g. remittances), as well as transfer from the state (e.g. food aid).

2.3.4 THE HOUSEHOLD LIVELIHOOD SECURITY (HHLS) APPROACH

In contrast to the previous approaches, Household Livelihood Security (HHLS) refers to an adequate and sustainable access to income and resources to meet basic needs (including food, potable water, health facilities, educational opportunities, housing, involvement in policymaking, and time for community participation and social integration). Livelihoods include a range of on-farm and off-farm activities that together provide a variety of procurement strategies to make a living. Thus, each household can have several possible sources of entitlement, which constitute its livelihood. These entitlements are based on the household's endowments and its position in the legal, political and social fabric of society (Baro and Deubel 2006).

Baro and Deubel also explained that the risk of livelihood failure determines the level of vulnerability of a household to income, food, health and nutritional insecurity. The

greater the share of resources devoted to the acquisition of food and health services, the higher the vulnerability of the household to food and nutritional insecurity.

Furthermore, livelihoods are viewed as secure when households have secure ownership of, or access to, resources (both tangible and intangible) and income earning activities, including reserves and assets, to offset risks, ease shocks, and meet contingencies. Households have secure livelihoods when they can acquire, protect, develop, utilize, exchange, and benefit from assets and resources (Frankenberger 2003).

2.3.5 HOUSEHOLD ECONOMY APPROACH (HEA)

According to Save the Children (2007), the Household Economy Approach (HEA) is a livelihoods-based framework for analysing the way people obtain access to the things they need to survive and prosper. It helps determine people's food and non-food needs and identify appropriate means of assistance, whether it is short-term emergency assistance or longer-term development programmes or policy changes. It was developed in the early 1990s by Save the Children UK in order to improve the ability to predict short-term changes in access to food. Its inception was in response to a demand for an approach that could quantify the problem and allow for comparisons as well as provide reliable results for large populations and point to appropriate responses (Save the Children 2007).

After the works of Amartya Sen, which suggested that famine occurs not from an absolute lack of food, but from systematic inequalities that keep some people from obtaining access to that food, the HEA remains a key analytical framework relevant to food and livelihood security analysis.

The HEA is not a data collection research method but is rather an analytical framework that helps to define the information that needs to be gathered and specifies the way in which it should be analysed. The HEA starts with an understanding of how households normally live and then incorporates the impact of a shock and how people might be able to cope. In general, the HEA includes two major components: HEA Baseline Analysis and HEA Outcome Analysis. The former includes the first three steps of the process of HEA (livelihood zoning, wealth breakdown, livelihood strategies) and the later includes another three steps of HEA process (problem specification, analysis of coping capacity, projected outcome) (Save the Children 2007).

Furthermore, while the HEA was developed prior to and independently of the sustainable livelihoods framework (SLF), both share many common elements. The HEA explicitly describes livelihood strategies and livelihood outcomes through the presentation of sources of food and income and expenditure patterns. The wealth breakdown in the HEA incorporates a particular formulation of the assets available to the households, which can be expressed in terms of the five types of assets or capitals in the SLF. However, given their respective roots, with the HEA originally designed as a tool for emergency needs assessment, and the SLF conceived for more development-oriented planning, the HEA has focused more on livelihood strategies and outcomes, while SLF assessments tend to focus more on understanding the factors underlying those strategies and outcomes (Save the Children, 2007).

2.4 CONTEMPORARY METHODOLOGIES FOR THE ANALYSIS OF FOOD INSECURITY

2.4.1 OVERVIEW OF FOOD SECURITY METHODOLOGIES

Several attempts have been made to develop methodologies for food security analysis. The focus of these methodologies has, over time, shifted from a mere analysis of national food supply to individual and household access to entitlement bundles; from objective indicators to subjective perceptions; and the most recent methodologies incorporate livelihoods and vulnerability elements into food security analysis.

However, there are several methodological challenges in food security related research. For instance Maxwell (1998) explained that collecting data for a complete analysis of food security can be a virtually impossible task in a situation where household composition is variable and the "household" itself is subject to varying interpretations; where there may be multiple income sources among adult members of a household who have strong incentives not to reveal to each other the full extent of their individual earning power or assets; where responsibility for the production and/or purchase of food may be shared among these adults; and where subsistence production is harvested piecemeal and is neither measured nor recorded. Households in both urban and rural areas may fulfil each of these criteria for making the collection of valid and reliable food security data a difficult understanding.

Despite the common methodological challenges of food security and vulnerability measurements with respect to geographic coverage, recall and measurement error, intra-household distribution issues, topic coverage, analytical capacity, and time dimension, the following section outlines existing and contemporary methods used in food security and vulnerability analysis, including methods that are not covered in this study.

2.4.2 MEASURING NUTRITIONAL DIMENSIONS OF HOUSEHOLD FOOD SECURITY

Although this method was not employed in this study, this section describes its relevance to food security. Nutritional assessments are measurements of body size, body composition, or body function intended to diagnose single or multiple nutrient deficiencies. Sometimes nutritional assessments consist of highly controlled technical measurements, while in other circumstances they may be conducted in a participatory manner that fosters community involvement and ownership of the project as a whole. Findings may be interpreted at the level of the individual, but are commonly aggregated over a community, district, or sub-national region (Hoddinott 2002).

Hoddinott also explained that the basic principle of anthropometry (measurement of body size and gross body composition) is that prolonged or severe nutrient depletion eventually leads to retardation of linear (skeletal) growth in children and to loss of, or failure to accumulate, muscle mass and fat in both children and adults. These problems can be detected by measuring body dimensions, such as standing height or upper-arm circumference or total body mass (weight). All of these measures are expected to vary by the age and sex of the person measured, so that there is a need for the measurements to be standardized for age and sex before they can be interpreted.

Furthermore, it is becoming increasingly clear that food availability is a necessary condition for food accessibility but not a sufficient condition; and food accessibility is a necessary condition for adequate utilization but not a sufficient condition. Therefore, developing a methodologically robust assessment and the monitoring of household food security and nutritional status is fundamental to generating adequate information for food and nutrition planning and policymaking (Suresh and Quinn 1994).

2.4.3 CHOOSING OUTCOME INDICATORS OF HOUSEHOLD FOOD SECURITY

The concept of food security has evolved considerably over time, as have food security indicators. There are approximately 200 definitions and 450 indicators of food security. With this abundance of indicators, an important methodological problem for development practitioners is to determine which indicators are appropriate, given the project being proposed (Hoddinott 2002).

However, attempts have been made to classify a cluster of indicators as 'process indicators,' which describe food supply and food access, and 'outcome indicators,' which describe food consumption. There are four major ways of measuring household food security outcome: (1) individual intakes, (2) household caloric acquisition, (3) dietary diversity and (4) indices of household coping strategies. In each case, there is a brief explanation of what this indicator measures, how data can be collected, and how indicators of food security can be calculated (Hoddinott 2002).

2.4.4 RAPID APPRAISAL TECHNIQUES FOR FOOD SECURITY ASSESSMENTS.

Participatory appraisal techniques (PRA) are 'a family of approaches and methods to enable rural people to share, enhance, and analyse their knowledge of life and conditions, to plan and to act' Chambers (1994). These include the mapping of activities, transect walks, seasonal calendars, wealth ranking and analytical diagramming. Unlike traditional, more extractive data-gathering methods, PRAs are premised on the notion that local people have an enormous amount of local knowledge. Rather than merely appropriating this information, in PRA local people dominate the agenda, and decide how to express and analyse information and evaluate it (Hoddinott 2002).

According to Hoddinott (2002), PRA methods have distinct advantages over survey-based research methods. They generally involve low costs; are highly adaptable to different situations; and tend to facilitate rapport with local communities, allowing investigators to explore topics not easily studied otherwise or to bring out qualitative aspects that would be missed by surveys. They also favour on the spot analysis with local people, enabling verification of findings and enhancing the local relevance of results. However, PRA methods present important disadvantages over more conventional methods, including a limited ability to generalise findings, a lack of clear validation procedures, and a

susceptibility to manipulation by informants. In addition, the quality of the information collected depends to a high degree on the skills of the field personnel.

Some of the major PRA methods relevant in the context of food security are concept definition; community mapping; household food security ratings; seasonal time lines; conceptual mapping of threats to food security; and the evaluation of interventions (Hoddinott 2002).

2.4.5 HOUSEHOLD SURVEYS

Since there is no single golden methodology, household surveys (whether they are donor-funded HH-surveys, nationally owned HH-surveys or specialist surveys) differ depending on geographic coverage, recall and measurement error, intra-household distribution issues, topic coverage, analytical capacity and time dimension (Devereux et al., 2004).

According Devereux et al., household surveys are under-exploited resources in food insecurity and vulnerability analysis. He noted that along with qualitative surveys and participatory assessments, household surveys are very diverse. However, most donor-funded and nationally-owned household surveys have sample sizes that do not allow for detailed geographic disaggregation, and do not allow intra-year and intra-household issues to be addressed satisfactorily.

On the other hand, they are relatively cost efficient and timely instruments that allow one to make precise statements about certain variables (such as income, expenditure and other indicators of living standards) for the population represented by their sampling frames. Only in a few cases (usually involving specialist panel surveys) is there sufficient time-depth to undertake a direct examination of vulnerability at the household level. Food security analysts must therefore exercise a good deal of judgment concerning what should, and what should not, be done with any given household survey (Baulch 2002).

Furthermore, Baulch (2002) also examined recent developments in the analysis of household surveys. These include analysing the distributional impact of price changes using non-parametric densities, combining household survey and Census data to produce poverty and vulnerability maps, estimating household vulnerability to poverty, and identifying proxy indicators of poverty and food insecurity.

2.4.6 INTEGRATED QUALITATIVE AND QUANTITATIVE METHODS

Research methods are a variety of techniques that people use when studying a given phenomenon. They are planned, scientific and value-neutral. There are two different but complementary research techniques: qualitative and quantitative research approaches. In social science research, both methods have long been separate spheres with little overlap. However, recent innovations have highlighted the complementary nature of qualitative and quantitative approaches (Maxwell 1998). Steckler (1992) also noted that both the qualitative and quantitative paradigms have weaknesses that, to a certain extent, are compensated for by the strengths of the other. The strengths of quantitative methods are that they produce factual, reliable outcome data that can usually be generalized to some larger population. The strengths of qualitative methods are that they generate rich, detailed, valid process data that usually leaves the study participants' perspectives intact.

According to Madey (1982), quantitative methods can be used to draw statistical inference — that is, empirical conclusions about an entire population can be drawn from a sample. However, qualitative methods cannot be used to draw statistical or empirical inference but can be used to draw logical or analytical inference. This set of definitions alone begins to suggest some of the ways in which qualitative and quantitative methods complement each other.

In this study, the researcher tried to exploit the benefits of an integrated qualitative and quantitative approach in both the data collection and analysis phases. The integration of quantitative and qualitative methods within a single study has synergistic effects in the three major phases of design, data collection and analysis (Madey 1982). Despite several limitations in each approach, it is important to note some of the benefits of the integrated approach in the context of food security issues.

Firstly, Wolfe and Frongillo (2000) noted that existing measures of regional or even local food availability are often inadequate for project-level decision making, since availability is only one component of household food security. Other components, such as access to food and certainty of the food supply, are also important. One way to develop direct measures that include these components and can complement existing measures is to base them on an in-depth understanding of the experience of food insecurity at the household level. To this end, a number of simple tools and techniques for assessing problems and situations at the community level have been developed as part of Rapid Rural

Appraisal (RRA). These often involve focus groups and in-depth interviews. Information gathered through these qualitative techniques can be used to understand the food security situation and to help develop quantitative measures.

Secondly, in conducting intervention evaluations related to food security, quantitative methods are best suited to measuring levels and changes in impacts and to drawing inferences from observed statistical relations between those impacts and other co-variates. They are less effective, however, in understanding process, and they can be crucial to *understanding* impact, as opposed to simply *measuring* it (Madey 1982). This limitation of quantitative methods can be redressed by qualitative methods which are particularly effective in deep explorations into issues of process; a careful mix of qualitative and quantitative methods can therefore help provide a more comprehensive evaluation of an intervention related to food security.

Thirdly, qualitative methods provide depth to some of the causes behind the changes (or lack thereof) observed when using quantitative methods. Qualitative methods, however, sharpen the focus on and provide additional explanations of the observed relationships (Madey 1982). It is, therefore, possible to study a wide depth of natural and socio-economic causes of food insecurity using qualitative techniques and it is possible to provide empirical explanations of relationships and the relative importance of causes of food security using a quantitative approach.

Fourth, Maxwell (1998) developed a method for assessing household food security indirectly through food-related coping strategies, that is, the actions people take when they do not have enough food or money to buy food. In-depth interviews with a focus group, a qualitative technique, can be used to identify coping strategies, and their relative severity and importance can be rated by a household questionnaire.

In conclusion, most development research and program evaluations employ integrated qualitative and quantitative approaches, and provide insights that neither approach would produce on its own (Michael and Rao 2002). Therefore, both approaches have been employed here in order to investigate the vulnerability to food insecurity and coping and survival strategies of the households under study.

2.5 FOOD INSECURITY PROFILE IN ETHIOPIA

Meeting the food requirements of the growing population is one of the major development policy concerns and challenges in contemporary Ethiopia. Despite efforts made to improve food production through the increased use of chemical fertilizers and improved seeds, food production in Ethiopia in the last three decades has not been sufficient to enable the rural population to be food secure (Adenew 2004).

It was estimated that domestic food production in the late 1980s provided about 1,620 calories per person per day, while total availability, including imports, was about 1770 calories per person per day, which is 16% below the minimal level (2100 calories per person per day, equivalent to 225kg of grain per person per year) (FDRE 1996). Cereal (the core of the Ethiopian diet) production in Ethiopia has been steadily declining on a per capita basis for more than 45 years (1951-1992), while population continues to grow at a high rate without a commensurate growth rate in food (cereal) crop production. The production of cereals dropped from about 200kg per capita in the early 1950s to less than 150kg in 1992 (FDRE 1996).

Food insecurity is a chronic problem for about five million people in Ethiopia (about 6.4% of the total population). The most recent food crisis occurred in 2002/03, and the country has not yet recovered from it. About 22% of Ethiopians were in need of food aid at this time. The other periods of critical food crisis were 1971/74, 1984/85, 1991/92, 1993/94, and 1999/2000. On average about 10% of the population of the country faces food shortages every year (Negatu 2004).

Negatu also explains that the country's dependency on food aid is because both smallholder highland mixed farming and lowland agro-pastoral/pastoral systems are not efficient and productive enough to ensure farm household food security through on-farm production (availability) and/or purchasing capability (access). According to Clay et al. (1999) for example, the annual volume of cereal food aid has ranged from 200 000 metric tons to about 1.2 million metric tons or between 3.5 and 26% as a percentage of total domestic food grain production over the 1985–96 period. Even in average years, the volume of cereal food aid in a given region can account for 25% or more of the total marketed supply of grain, and up to 50% in drought years.

Furthermore, the number of drought-affected people who require foreign food aid is a major indicator of Ethiopia's national and household level food security crises. Based on the data obtained from DPPC's food security profile, which was documented over many years, Adenew (2004) explained that the drought-affected population during the last 28 years rose from slightly over 8% in 1975 to 16% of the total population in 2003. During this period there has never been a year in which some portion of the population was not affected. The annual growth rate of the share of population affected by drought was 2.6% until 1991, and increased to 4.6% per annum thereafter. As a result, food aid requirements to mitigate the impact of drought and famine reached their highest level of 1.4 million MT in 2003, from a level of only 0.4 MT in 1990 (Adenew 2004).

However, despite the paramount role of drought in triggering a food crisis, the difference in household consumption status between good year and bad year is not so significant as to be able to claim that drought is the central cause of famine/food insecurity. This implies that there are structural and other factors underlying the food insecurity/poverty problem. In this regard, one can claim that inadequate technological progress and institutional changes are the underlying causal factors of food insecurity and poverty (Negatu 2004).

The high prevalence of food insecurity in Ethiopia is manifested by the high prevalence of malnutrition. Under-nourishment is severe, and 47.3% of the population is affected. Similarly, malnutrition in children under five years of age is very high (47% under weight and 51% stunted) ((Negatu 2004).

2.6. SUMMARY

Food security is defined as secure access by all people at all times to a sufficient quantity and quality of food for an active and healthy life. Livelihood security can be defined in similar terms: ensured access to sufficient resources to ensure immediate and long-term survival for all people at all times. These conventional definitions of food and livelihood security incorporate the different dimensions of food security. These are the availability, accessibility and utilization of food. These dimensions of food security underlie the basic difference among theories of food shortage. For example, the food availability decline (FAD) theory emphasises the role of availability of food in explaining food shortage. It states that people starve because of the decline in food availability below the minimum

requirement for survival in a given area. Whereas the food entitlement decline (FED) theory emphasises the accessibility and utilization of food in explaining the occurrence of food shortage. Food shortage is a lack of ability to command and obtain food rather than a decline in general availability.

On the other hand, the concept of vulnerability helps to capture the temporal dimension of food security and associated risks. Analysis of vulnerability to food insecurity, therefore, requires a holistic and forward-looking approach to explain the detailed aspects of food security and vulnerability. In this regard, the livelihoods framework helps to understand issues that affect people's livelihoods such as policies and institutions, and the vulnerability context (trends, shocks and seasonality) on which the livelihood is constructed. The livelihood approach is people-centred, designed to be participatory and has an emphasis on sustainability.

Since food insecurity is a chronic problem in Ethiopia, holistic approaches and wide range of food security analytical tools are required to understand the root causes of food insecurity at national, regional and household levels.

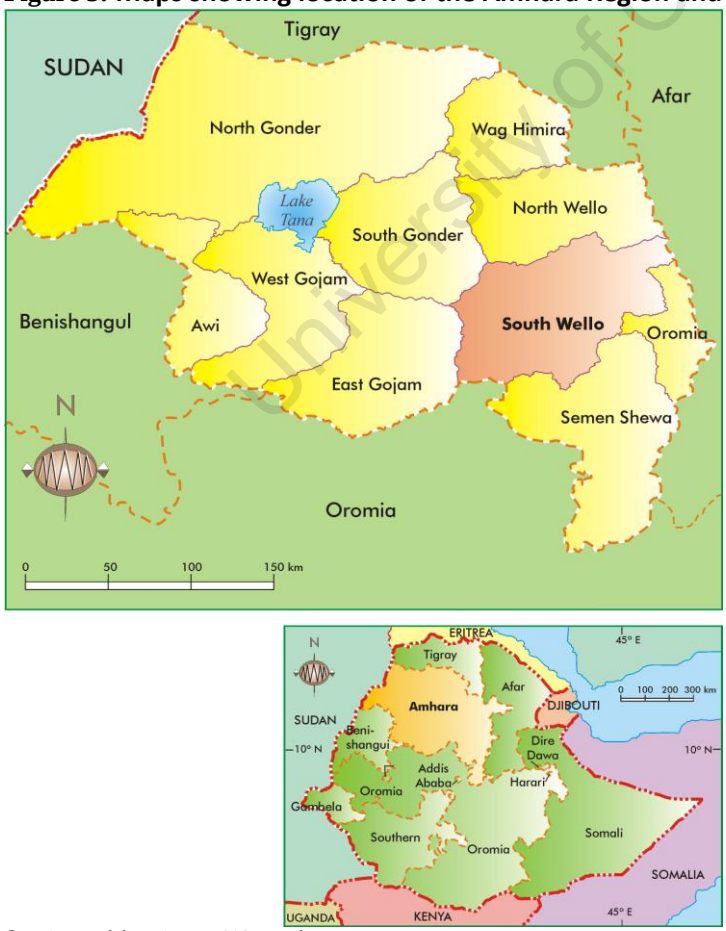
CHAPTER 3: BACKGROUND OF THE STUDY AREA

3.1 AMHARA NATIONAL REGIONAL STATE (ANRS)

3.1.1 INTRODUCTION

This chapter outlines the demographic, socio-economic, physical and environmental geographical features of the Amhara region in general and Sayint Rural District in particular. The Amhara National Regional State (ANRS) is one of the nine regional states of the Federal Democratic Republic of Ethiopia (FDRE). In geographic terms, the ANRS is located between $9^{0}\ 21'$ to $14^{0}\ 0'$ North latitude and $36^{0}\ 20'$ and $40^{0}\ 20'$ East longitude. The total area of the Amhara region is estimated to be 170,752 square kilometres. The region shares its borders with the Tigray region in the north, the Afar and Oromia regions in the east, the Oromia region in the south, and the Benishangul region and the Sudan Republic in the west. The region is divided in to 11 administrative zones, including Bahir Dar special administration and 114 woredas or districts (ARARI 2004).

Figure 3: Maps showing location of the Amhara Region and its Administrative Zones



Designed by Anne Westoby

The Amhara region has ample water resources. It has three main river basins, the Blue Nile, Awash, and Tekeze. The Blue Nile and Tekeze river basins cover approximately 199,812 sq.kms and 88,800 sq.kms respectively. Moreover, there are many lakes found in the region, including Lake Tana, the largest body of inland water (3,620 sq.km) in the country. These huge water resources have a major potential for fishery and irrigation development (ARARI 2004).

Nearly 87% of the region's population lives in the rural areas, with livelihoods mainly depending on agriculture and related activities. Owing to various biophysical and socioeconomic challenges, the region is one of the poorest in the country. The regional head count index (number of people living below the absolute poverty line) is estimated to be 54%. This figure exceeds the national average by 8% and the Sub-Saharan Africa (SSA) average by 15% (ARARI 2004).

According to the Amhara Regional Agricultural Research Institute, the causes and the intensity of poverty in the region can easily be attributed to the low performance of agriculture, the sector that defines and leads the regional economic structure. The low return from agriculture on its part is attributed to erratic rainfall, the prevalence of pests and diseases, the scarcity of farmland, soil erosion and degradation, a lack of improved technologies, a lack of support services, and a poor socioeconomic infrastructure.

3.1.2 DEMOGRAPHIC CHARACTERISTICS

Ethiopia is the second most populous country in sub-Saharan Africa (after Nigeria) with an annual growth rate of 2.9%. The total population of the country as of 2002 is estimated to be 67.7 million. The population of the Amhara region reached 17.7 million as of 2002. This accounts for roughly 27% of the total population of the country, while in terms of area the region is only 15.4% of the country. Hence, if the current trend in population growth continues unabated, the population size of the region will double within less than 30 years (BoFED 2003).

According to the Amhara Regional Agricultural Research Institute (ARARI 2004), the percentage of the population under the age of 15 years is 43.1%. On the other hand, the percentage of population aged 65 and above is only 3.9% while the percentage of the active labour force (16 – 64 years) is 53%.

The dominant ethnic groups in the region are the Amhara, Oromo, Agew and Tigre. Orthodox Christianity and Islam are the dominant religions. The fertility and mortality rates in the region are found to be relatively high, and the average number of children a woman bears during her reproductive lifetime is about six. The average life expectancy at birth is roughly 50 years. However, due to the prevalence of the HIV/AIDS pandemic and other communicable diseases, life expectancy can be even shorter. In addition, the infant mortality rate /IMR is relatively high i.e. 112/1000 live births. In other words, at least one child out of ten live births will die before celebrating his or her first birthday (BoFED 2004).

Regarding the settlement pattern, the overwhelming majority, i.e. nearly 87% of the population, resides in rural areas and is engaged mainly in agriculture. In addition, population distribution is uneven among zones and districts (woredas). For example, North Gondar stands first in terms of population size, followed by South Wollo and West Gojjam, while Oromia and Wag Hamera are relatively small. In terms of population density, West Gojjam is relatively densely populated while North Gondar is sparsely populated. Generally, the highlands are more densely populated than the lowlands (BoFED 2004).

3.1.3 SOCIOECONOMIC CHARACTERISTICS

According to the BoFED (2004) report, the region has insufficient health services. The health service to population ratio in the region is one hospital for 1.3 million people, one health station for 337,400 people and one clinic for 28,500 people. This has resulted in a high prevalence of diseases such as malaria, respiratory diseases, tuberculosis and HIV/AIDS. Currently, there are about 15 hospitals, 78 health centres, 517 clinics, and 385 health posts providing healthcare services. However, considering the WHO standard, the health institution to population ratio at all levels is found to be below the national average. The same applies to the health personnel to population ratio (BoFED 2004).

According to the Amhara Bureau of Finance and Economic Development (BoFED), primary healthcare service coverage in the region was roughly 41.5% in 2002 and 40.1% in 2003, which shows a declining trend. Besides this, 62% of the rural population is forced to travel more than 5km in order to reach to the nearest health institution. This suggests that many people are still under-served by existing health institutions. In addition, the lack of an adequate number of health personnel is a critical problem.

In terms of education, the Amhara region has a low level of enrolment ratio when compared to the national level. The gross enrolment ratio for primary schools is 64.2%. Enrolment in the first cycle of secondary school is only 13.4%, and in secondary education as a whole only 6.3%. There are about 179 kindergartens, 2 996 primary schools (for ages 1-8), 88 first cycle secondary schools, 24 preparatory secondary schools and 20 technical and vocational schools. The number of teachers and students in primary schools are 29 089 and 2 023 113 respectively. This shows that the gross enrolment ratio in primary education is 55.4% as opposed to 61.6% at the national level. This indicates a relatively low level of primary education in the region (BoFED 2004).

In addition, the region's Bureau of Finance and Economic Development report indicates that dropout and repetition rates are significant in primary education. For example, in 2003 the dropout rate was found to be 6.5%. Distance is a contributing factor. For example, out of the total rural population, nearly 35% reside in more than 5km away from the nearest primary school. Besides this, the need for labour by the family and traditional and cultural practices such as marriage contribute significantly to female dropout rate.

In terms of access to transportation infrastructure almost all of the districts but two are connected to the national road network. The total road network of the region is about 6 159km, which makes the regional road density to be 38.1km per 1000 km2 (BoFED 2004). This suggests that a number of people, especially in rural areas, are still travelling long distances to reach the main roads to get transportation services. In addition, farmers are unable to get inputs timely and sell their products to better markets. Because of the lack of road networks, the construction of new schools, health centres, agricultural input stores and the supply of relief aid etc is difficult in remote and inaccessible areas.

Agriculture remains the dominant economic sector in the region. Structurally, it accounts for 63.1% of the regional GDP and nearly 90% of the population derives its livelihood from agriculture and allied activities. It is the predominating source of food, raw materials for local industries, and export earnings. Crop production and animal husbandry are the major agricultural activities undertaken. Cereals, pulses, oil seeds, fibres and root crops are grown in different parts of the region. In addition, different types of perennials can be grown in both the highlands and lowlands (BoFED 2004).

However, agriculture is constrained by land degradation and recurrent drought. Erratic rainfall, particularly in the eastern part of the region, has made crop production difficult.

Besides this, agriculture is practiced mainly for subsistence and methods are for the most part archaic. The absence of relevant agricultural technologies combined with a low level of extension services have lead to a low level of productivity and production. For example, the total land covered by major crops is estimated to be 3.2 million ha while the total average production was 32.8 million quintals for the year 2002/2003. Thus, the average productivity of all crops combined hardly exceeds 10 quintals per hectare (BoFED 2004).

Furthermore, low agricultural productivity and production is correlated with a low level of calorie intake. For example, the daily average per capita calorie intake is around 1564 calories (i.e. 465 gm/1.70 quintals available per annum), which is well below the standard 2200 calories (i.e. 650 gm) recommended by World Health Organization (WHO). Thus, own production (self-sufficiency ratio) from major crops is sufficient only to meet 77.2% and 69.9% of the standard requirements respectively (BoFED, 2004).

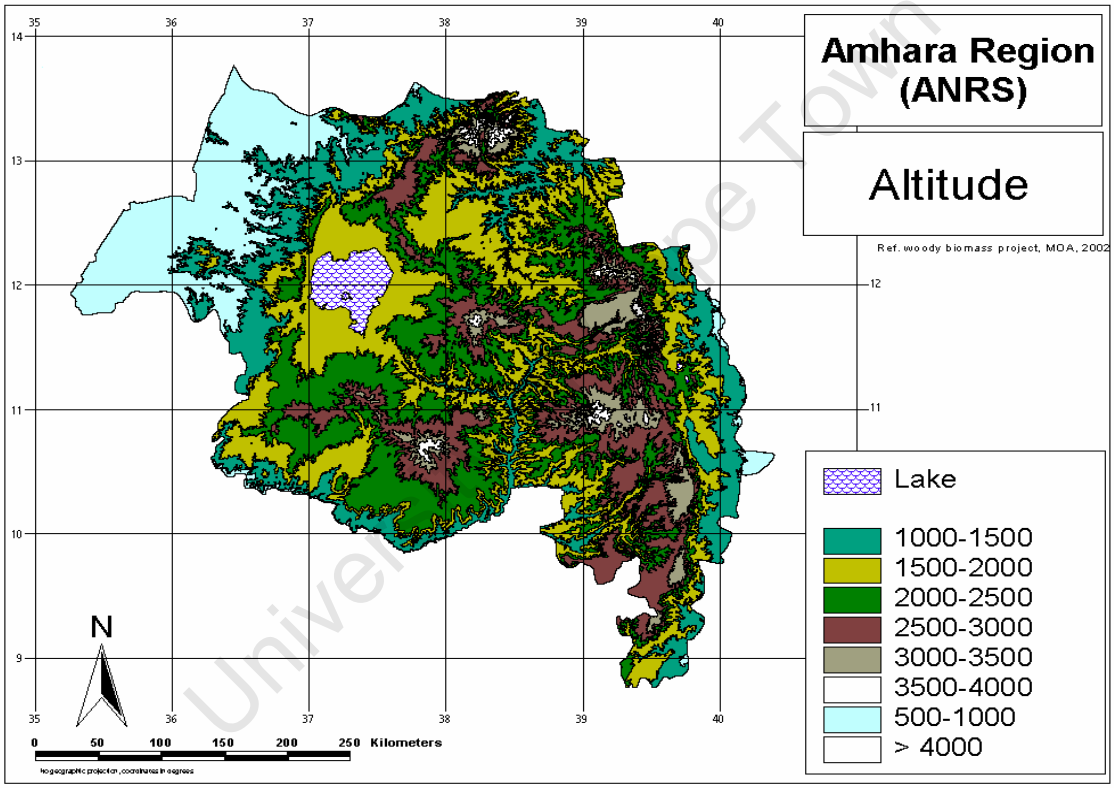
Apart from crop production, livestock is the other principal source of income for farmers. The livestock population in the region constitutes 29.4% of the country. In this regard, cattle, shoats, and equines are the most important sources of traction power, meat, milk and hides. Cattle constitute the largest percentage (85.2%) of the total Tropical Livestock Unit (TLU) and when compared with the available grazing land, there is a high level of livestock pressure on the existing grazing land. For example, the per capita TLU for rural households is about 0.53 against 0.23 hectare of cultivated land (BoFED, 2004).

3.1.4 PHYSICAL CHARACTERISTICS

The Amhara region has a diverse topography. Lowland, midland and highland plains, mountains, rugged lands, undulating landforms and chains of plateaus are common land features. The lowlands (500-1500 metres above sea level) cover mainly the northwestern part of the region, bordering the Sudan, and the eastern parts bordering the Afar region. These areas are largely plains and constitute big part of the northern and eastern part of the region. The highland areas are rugged and mountainous with peaks rising up to 4620 masl at Rasdashen (the highest peak in Ethiopia). In terms of the traditional agro-ecologic classification, the region is composed of hyper arid 3% (below 500 masl), lowland 22% (500-1500 masl), 44% midland (1500-2300 masl), 27% highland (2300-3000 masl), 3.6% cold highland (3000-3700 masl) and 0.4% afro alpine (above 3700 masl) (ARARI 2004).

The recorded annual mean temperature of the region ranges from 12.4 degree centigrade in Mehal Meda (Dega) to 27.8 degree centigrade in Metema (Arid Kolla) (CSA, 1996). The mean annual rainfall recorded in the region is in the range of 598.3 mm (Lalibela) and 1692 mm (Chagni) (3-25 years average). The northwestern and northeastern parts of the region, along the boundary with the Sudan, Tigray and Afar regions, receive the lowest amount of rainfall, less than 700 mm. The region receives the highest percentage (80%) of the total rainfall in the country. The highest rainfall occurs in "Meher" season, which starts in mid-June and ends in early September (ARARI 200.

Figure 4: Altitudinal Map of the Amhara Region showing elevation in metres



Source: (ARARI 2004)

The region's Agricultural Institute report also indicates that the land use pattern of the region is 28.2% arable land, 30% pastoral land, 2.1% forest land, 12.6% bush land, 7.2% settlement, 3.8% water bodies and 16.2% unusable land. The region is rich in rivers and water bodies. It is the source of the famous Blue Nile and has some other 49 perennial rivers. Despite the presence of such enormous water wealth, rain-fed and subsistence

farming characterize the region. In addition, the population is highly vulnerable to drought.

3.1.5 ENVIRONMENTAL CHARACTERISTICS

Environmental problems are broad and are often reflections of the level of development found in a country. Environmental problems in less- developed countries like Ethiopia are manifested in the form of deforestation, soil erosion, and the depletion of biodiversity. Due to centuries of cultivation, a rapid population growth rate, and abuse of natural resources, environmental degradation in the region is considerable.

A significant portion of the region is affected by soil erosion, and about 29% of the total area is categorized as being under a high erosion hazard. As a result, 51 to 200 tons of soil are eroded from each hectare of land every year. The highest rate (>200 tons) occurs on 10% of the total area. In general, soil erosion in the region is a critical problem. About 58% of the soil eroded in the country is from the Amhara region (BoFED 2004).

Furthermore, it was estimated that about 9,725 tons of grain were lost by the year 2000 due to soil erosion hazards, especially on topsoil up to a depth of 50cm. Therefore, in the absence of preventive measures, the annual crop loss will undoubtedly be escalated to a level of 205,973 tons per annum by the year 2025. The annual loss of cultivated land is estimated to be about 6,365 ha in the year 2000 and is projected to reach 62,716 ha by the year 2025 (BoFED 2004).

In addition, the region's Bureau of Finance and Economic Development report indicates that the annual per capita fuel wood consumption in many rural and urban areas of the region are found to be 652 kgs/1.09M^3, which is well below the national average (i.e. 700 kgs/1.12M^3) per capita. In the region, assuming that the per capita rates of consumption and supply patterns remain the same, the amount of woody biomass will decrease to 66% by 2010 (BoFED 2004). However, fuel consumption estimates do not include forest and woodland removal for expansion of agriculture. This undoubtedly would aggravate the situation and make it worse.

3.1.6 FOOD SECURITY

The Amhara region suffers from recurrent droughts and pest invasions. According to the ANRS Food Security Research Assessment Report, of the 105 districts in the region more than half of them are drought prone and chronically food insecure. The problem of food insecurity is more pronounced among poor farmers and farmers in marginal areas. In recent years, vulnerability to drought and famine has tended to be worse in rural areas. In the region, so far 52 districts are categorized as chronically food insecure (see Table 1). In these districts, nearly three million people have faced chronic food insecurity problems, making the situation more critical than ever before. The following table depicts the number of drought prone districts and drought vulnerable people in the region.

Table 1: Number of drought prone woredas & drought vulnerable people

Zone /Woreda	Number of woredas affected	Number of kebeles affected	Number of people affected	Affected percentage	Six years average vulnerability from total population (%)
North Gondar	8	230	296,184	12	26
North Wollo	8	268	571,000	23.2	40
Wag Himra	3	112	169,150	6.9	52
South Wollo	16	460	667,589	27.1	29
Oromiya	4	88	126,300	5.1	25
North Shoa	5	97	174,900	7.1	37
East Gojjam	3	85	50,000	2.0	14
SouthGondar	5	150	403,029	16.6	42.4
Total	52	1340	2,458,152	100	32.7

Source: ARARI 2004

Given the above, the regional government has attempted to reverse the situation by launching an integrated food security programme, with the objective of ensuring food security at a household level within 3—5 years. In order to realize this objective, various interventions have been designed, and include voluntary resettlement, the enhancement of agricultural productivity through integrated package development, natural resource management, the promotion of non-agricultural income generating activities and the implementation of water harvesting techniques (BoFED 2004).

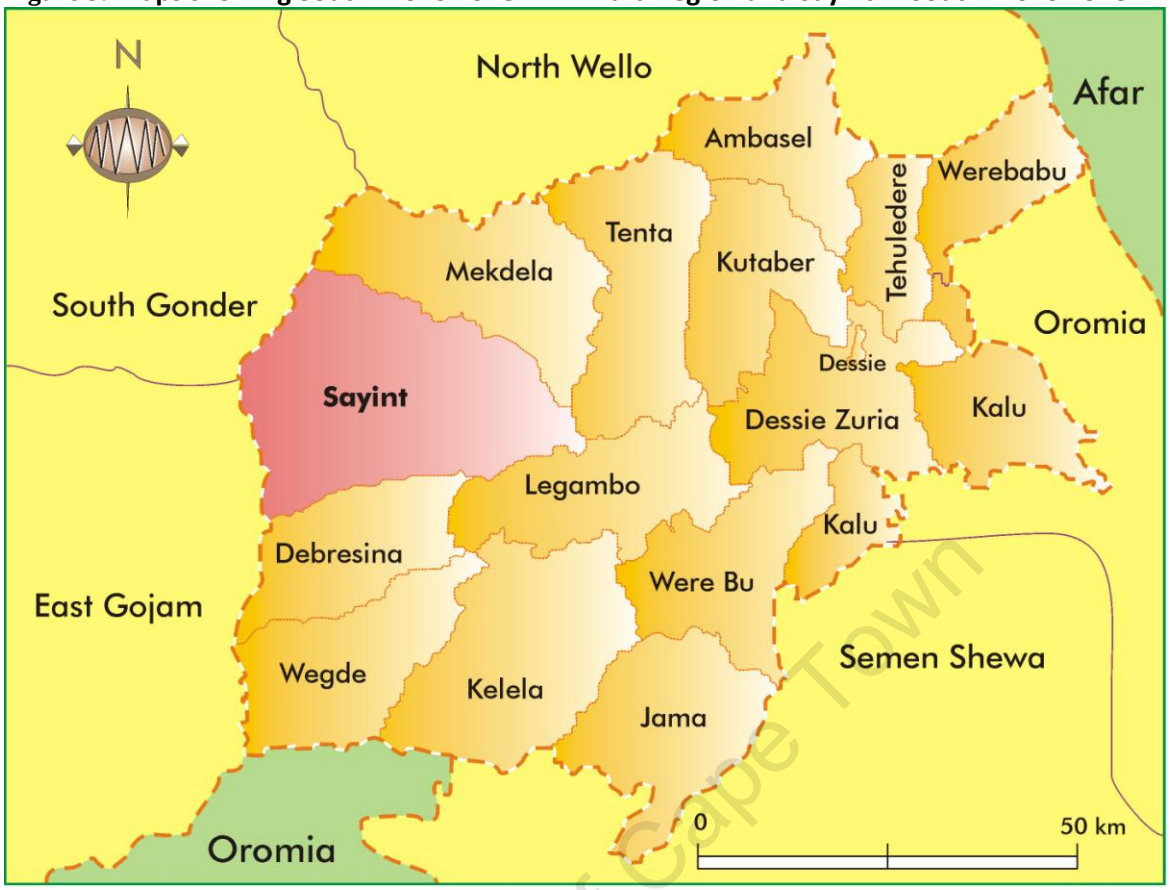
3.2 SAYINT DISTRICT PROFILE

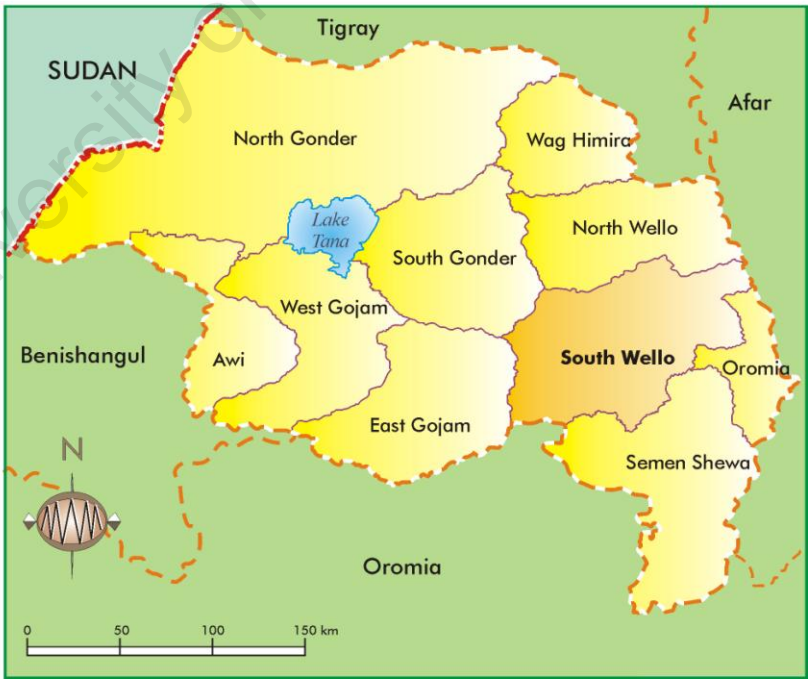
Sayint Rural District falls within two major livelihood zones: South Wollo Meher livelihood zone (SME) and Abay Bashilo Basin livelihood zone (ABB). The main economy of the SME livelihood zone is crop production supplemented by livestock rearing (sheep and cattle). It is a chronically food deficit area and is historically known as a drought stricken area. Wheat, teff, red sorghum, barley and pulses are the main crops grown in the area. Furthermore, the main sources of cash for the middle and better-off are from the sale of crops, livestock and eucalyptus trees. Migrant labour, the sale of eucalyptus trees and local and urban labour are the major economic activities for the poor and very poor. The Productive Safety Net Program (PSNP) and household credit packages are also available in the area.

Similarly, the ABB livelihood zone is a food insecure area with a very long history of requiring relief assistance. However, communities residing in this zone suffer from chronic food insecurity due to a combination of various factors, including erratic rains, small landholdings, highly degraded farm lands, infertile soil, pest infestation, livestock disease and malaria. Poor physical infrastructure is also a serious problem. Trade interaction across the river valleys is minimal during the dry season and totally impossible during the rainy season. Furthermore, the middle and better-off can barely produce much more than their annual food needs, so livestock are an important source of income for this group. In contrast the poor and very poor are dependent on local labour, PSNP and sales of firewood.

Much of Sayint Rural District is part of the “South Wollo Woina Dega (mid-land) Meher Food Economy Zone”. Generally, the district is characterised by a moderate population density, a meher cropping season, and a small size of land per household.

Figure 5: Maps showing South Wollo Zone in Amhara Region and Sayint in South Wollo Zone





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3.2.1 RELIEF AND CLIMATE

Sayint Rural District is one of 17 districts in the South Wollo zone of the Amhara region. Sayint Ajbar, the capital of the district, is located 189km from Dessie, the capital of South Wollo zone to the west, 659km from Bahirdar, capital of the region, and 589km from Addis Ababa to the north.

The district has a very diverse topography constituted of mountains, river valleys and scattered plains separated by deep-cut gorges and steep slopes. Valley relief features characterize a large percentage of the district (70%). Plains and mountain relief features constitute 17% and 13% respectively. The altitude of the district ranges from <1500 m.a.s.l. at Meka administrative area to 4247 m.a.s.l. at the top of the Tabor Mountain. In the lowest parts of the area, the climate is tropical (Kolla) while in the higher parts, a temperate (Dega) climate prevails. At the intermediate altitude, the climate is subtropical (Woyna Dega). Thus, the climatic zones of the district are classified into Dega (above 2500m.a.s.sl) that refers to highlands, Woyna Dega (1500-2500m.a.s.l.) that refers to the intermediate and Kolla (below 1500m.a.s.l.) that refers to the lowlands. The Kolla agro-climatic zone constitutes 34.6% of the total area of the district while Woyna Dega and Dega agro-climatic zones constitute 22.6% and 42.8% respectively (Rural Development and Agriculture Office Report).

Sayint Rural District has mean annual temperature of 22°C. Areas in the middle altitude range have favourable weather, while the high and lowland climates are characterized by extreme weather conditions. The main rainy season is between early June and the end of September, when agriculture is predominantly depend on. There is a high concentration of rainfall in July and August. The amount of rainfall generally varies with altitude, and the highland portion of the area receives the highest rainfall. Small rains occur between early February and the end of April.

3.2.2 POPULATION AND SOCIOECONOMIC ACTIVITIES

- **POPULATION**

The 1994 Population and Housing Census revealed that the total population of Sayint Rural District was 149,812, with more males (50.7%) than females (49.3%). Out of the total population, 97.9% were rural and the remaining 2.1% urban. Most of the population (63.2%) is aged between 15 and 60 years, while the young population (less than 15 years of age) constitutes 28.2%. However, the old age people constitute less than 9%. The overall dependency ratio is about 1.73 i.e. there are 173 dependents for every 100 working-age people. The sex ratio is about 103. The household sizes in the district range from between three and seven people.

About 98% of the population lives in rural areas where mixed farming is the main activity. The population growth rate is about 2%. In addition, the Census showed that the crude population density of the district is 104 persons per/km^2. Approximately 46%, 37% and 17% of the population, respectively, resides in the highland, midland, and lowland agro-climatic zones of the district. Furthermore, almost all residents in the district belong to the Amhara ethnic group and 96.8% of the population follow the Orthodox religion. A small percentage (3.2%) of the population is Muslim.

- **ECONOMIC ACTIVITIES**

Most farmers in the Ethiopian highlands depend on rain-fed agriculture. Some areas have the favourable situation of having two rainy seasons, Belg (February-May) and the long rainy season Kiremt (June-October), which is the case in some parts of Sayint Rural District. Agriculture is the single most dominant means of livelihood in the district, and 65% of the population depend on it. Despite the prevalence of agriculture, both crop cultivation and livestock rearing are the overall dominant economic activities, and about 26% of the population are engaged in business activities and in handicrafts. Two percent of the population are daily labourers.

According to the District Rural Development and Agriculture Office, the main crops grown here are wheat, barley, teff, maize, beans, chickpeas, sorghum and lentils. The type and pattern of crop cultivation is affected by altitude. Barley, wheat, beans and peas are the major crops in the highlands while sorghum, maize and haricot beans are widely cultivated in the lowland *kebeles*.

At every altitude, households try to plant all of the crops considered suitable for the area. Both men and women carry out all farming activities except for plowing and sowing, which is done by the men. Women typically process and prepare the crops into food. Rearing livestock is the other important economic activity performed in combination with crop production. According to the District Rural Development and Agriculture Office, the district had 87,209 cattle, 72,740 sheep, 47,524 goats, 47,523 poultry and 7,152 traditional beehives in 2004.

- **SOCIAL SERVICES**

There is no safe and adequate water supply to most of the rural communities in the study area. In the highland *kebeles*, springs serve as a source of drinking water while the lowland *kebeles* use seasonal streams and rivers. According to the District Rural Development and Agriculture Office, there are 128 springs and 32 hand-dug wells, which account for 51% of the potable water in the district.

According to the Education Office Report 2007, there are 78 primary schools and one secondary school in the district. On average, there is one teacher for every 55 students, and the average class-student ratio and student-books ratio is 1:55 and 1:5 respectively. There is also only one private clinic in the town, meaning the health service coverage in the district is very limited. There are 17 health posts and two health centres in the entire district; in general, the health service in the district is inadequate. The major diseases in the area are respiratory diseases, skin rashes, malaria, intestinal parasites and sexually transmitted diseases including HIV/AIDS (District Health Office Report 2007). Furthermore, transport is very limited. There is only 385km of all-weather roads, which account for 20% of the total road coverage of the district. There is no banking service, so people have to go to Dessie, capital of South Wollo zone, 189km away.

3.2.3 SOIL, AND WATER RESOURCES

- **SOILS**

The wide diversity in climate, topography and vegetation in the area has given rise to marked variations in soils, even within relatively small areas. No detailed soil surveys have been carried out in Sayint, but the red-to-red-brown clay soils common on the high, rolling plateaus seem to be relatively fertile, with a higher organic matter content and lower susceptibility to erosion than other soils. However, many years of continuous cultivation,

the limited application of nutrients and the removal of all crop residues have depleted the soil of nutrients.

Farmers in the area have their own way of describing and characterising soils in their fields, and this is based on levels of fertility and physical properties such as colour, depth, workability, susceptibility to erosion, and drainage and water holding capacity. According to the Rural Development and Agriculture Office, black, red, brown and grey soils cover 12%, 18%, 50% and 20%, respectively, of the total soil coverage in the district. The management of soil fertility and other agronomic practices vary according to each soil type (Elias and Fantaye 2000). Hence, two types of soil dominate all the agro-ecological zones: *walka* and *keyate*. *Walka* is a relatively fertile black cotton soil, but it has physical limitations similar to vertisols, cracking when dry and becoming waterlogged and difficult to work when wet. The red-brown *keyate*, which has similar properties to nitisols, is highly susceptible to erosion and therefore likely to become shallow, infertile and unproductive.

- **WATER RESOURCES**

The district is endowed with many perennial springs, rivers and seasonal streams. There are five main rivers, called Gunda, Chilaga, Gedami, Tela, and Betemuja. According to the District Rural Development and Agricultural Office, there are 1,549 spring water and two pond water sources, which are available for water supply in the district. All rivers and streams in the highland and lowland catchments drain into the Blue Nile River. The Blue Nile River is a natural border separating this district from South Gondar Administrative Zone. Most lowland *kebeles* are found within the Blue Nile River Valley.

3.3. SUMMARY

The above brief description provides a snapshot of the region's physical, demographic, and socioeconomic characteristics in general, and Sayint Rural District in particular. Despite the region's abundant natural resources favourable for agricultural production, a considerable number of the population remains food insecure. The region has very diverse agro-ecological zones and abundant water resources, which allows for a wide range of crops to be grown using effective irrigation systems. However, efforts to exploit this potential are minimal.

The region's level of basic infrastructure and socioeconomic development is very low. Access to education and primary health care services are extremely limited in some inaccessible areas of the region like Sayint Rural District. The study area lacks basic infrastructure such as roads, electricity, and communication facilities. Hence, farmers are unable to get inputs in a timely fashion or sell their products to better markets. In the absence of road networks, the construction of new schools, health centres, agricultural input stores and the supply of relief aid is difficult.

Therefore, it is hard to address the objectives of food security related programmes without developing the basic infrastructure and social services first. In addition, appropriate natural resource management and irrigation schemes should be in place to augment agricultural production in the region.

CHAPTER 4: METHODOLOGY

4.1 INTRODUCTION

In order to provide comprehensive information on vulnerability to food insecurity, a wide range of methods have been used when collecting data from both primary and secondary data sources. The research was undertaken as a comparative analysis to define and determine the determinants of vulnerability to food insecurity in three agro-ecological zones of Sayint Rural District, South Wollo. Therefore, the methods sought to obtain information on who was vulnerable, where they lived, and what factors were highly associated with their vulnerability to food insecurity.

This chapter describes the types and processes of data collection methods that were employed in this study. Household questionnaires, key informant interviews and community group discussions were utilized to collect data relevant to household vulnerability, food security, and livelihoods.

Primary and secondary data sources, researched using both quantitative and qualitative methods, were used to compile information about the following: general household profile; land ownership; sources of food, income, and expenditure; off/non-farm activities; risks to food security; household coping strategies; famine experiences.

The chapter continues with detail on the methods used to consolidate, present and analyse data collected.

4.2 SECONDARY DATA COLLECTION

Secondary materials such as published books, articles, journals, maps and bulletins about the research topic were collected from relevant organizations and institutions, mainly the University of Cape Town and Bahir Dar University. Numerous annual reports and policy documents from Ethiopian government sources were also obtained. These included recent policy documents about agricultural development and food security as well as relevant district-level reports on education, health, agriculture, and rural development. Publications related to food security were also obtained from Food Policy and

Development Journal, from the websites of the Food and Agriculture Organization of the United Nations (FAO) and from other organizations.

4.3 PRIMARY DATA COLLECTION

Most of the data required to answer the research questions were collected from primary data sources, using quantitative and qualitative methods.

Quantitative methods were employed to collect data that could be measured or examined, and household questionnaires were the main data collection tools used to gather information concerning different variables pertinent to vulnerability to food and livelihood insecurity.

However, since household surveys in poor rural economies often contain large measurement errors and it is difficult to use quantitative methods to measure some dimensions of vulnerability to food insecurity, the researcher employed qualitative methods such as community group discussions and key informant interviews to collect data that could not be not quantitatively measured or examined.

4.3.1 DESIGN AND PROCESS OF HOUSEHOLD QUESTIONNAIRE

The household questionnaire was guided by three existing documents pertinent to food security and vulnerability. These were the Amhara National Regional State District Vulnerability Profile, Ethiopia's Livelihood Integration Unit documents, and the National Agricultural Household Survey. Key content areas addressed by the questionnaire included:

- demographic characteristics (structure of household, age, gender)
- health variables (household member deaths)
- institutional variables (market, gender, land tenure, fertilizer and other agricultural input providers)
- labour market (education, employment status, on/off farm labour income)
- production variables (livestock and crop production)
- other economic variables (assets, land, investment, credit)
- expenditure variables (food consumption, non-food consumption, durables)
- food variables (type and amount of food consumed, number of meals per day)

The questionnaire also included the household's perception of hazards/risks, the types and frequency of the coping strategies used, and experience of famine as well as suggestions on how to mitigate the risk of food deficit.

The structured household interviews were undertaken with the assistance of experienced local development agents and supervisors. The purpose of the questionnaire and how best to approach potential interviewees and conduct the interviews were discussed with all co-researchers in the three research sites. The questionnaire interviews took place from 11- 28 December, 2008.

Questions were structured, pre-coded and quantitative in nature and administered to the heads of the household or any available member of the household who had knowledge of household's food security and vulnerability situations in all agro-ecological zones of the study area.

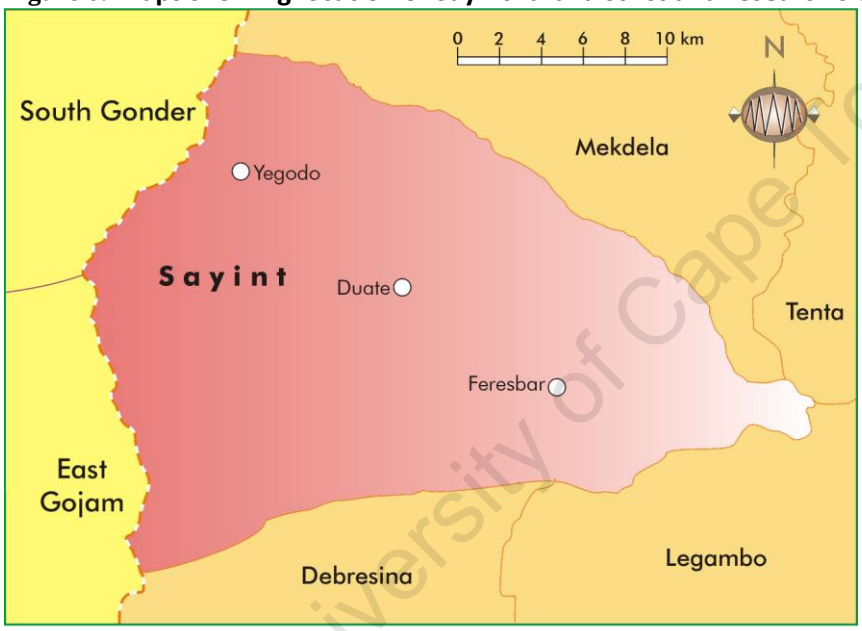
4.3.2 SITE SELECTION AND SAMPLING

Selection of the specific research sites for the study (Peasant Associations or Pas) was undertaken jointly with development agents in the district Rural Development and Agriculture office; The PAs were the smallest sampling unit next to households. The most important selection criteria were agro-climatic zone, severity of food shortage problem, and accessibility. Based on the above purposive sampling criteria, three PAs were selected from each agro-ecological zone. These were Feresbar, Duat, and Yogodo peasant associations representing highland, midland and lowland, respectively. The total number of valid samples from the purposely-selected PAs was 89 households. The number of sample households from each PA was determined proportional to the size of each PA by using the stratified sampling technique: **[**nj =(Nj/N)n; where, nj=number of households to be taken from each PAs, Nj=total number of households in each PAs, N=total number of households in all selected PAs, and n=sample size determined by the researcher i.e. 90.**]**. Households were randomly selected for questionnaire interviews.

Table 2: Structure and size of random sample

Sampling unit	Procedure	Number in FEZ	Total number in sample
Kebele (PA) (primary sampling unit)	Purposive random sample	1 in ABB, 2 in SME	3
Gott (secondary sampling unit)	Random sample (lottery) 3 per kebele	3 in ABB, 6 in SME	9
Household (final sampling unit)	Random sample (systematic)10 per gott	30 in ABB, 60 in SEM	90

Figure 6: Maps showing location of Sayint rural district and research sites



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Using the above sampling techniques, the table below represents the research sites, their sample size and the type of agro-ecology.

Table 3: Sample size and research sites

Agro-ecology	Name of PA	Sample size
Highland	Feresbar	25
Midland	Duat	36
Lowland	Yogodo	28
Total		89

4.3.3 KEY INFORMANT INTERVIEWS

Key informant interviews were made at national, regional, district and village levels. At each level, the researcher conducted a key informant interview with two or three people. Key informant group interviewees include national and regional food security and rural development officials, district agricultural extension officers, traders, village leaders and knowledgeable residents who had participated in the mapping of households. The main purpose of this was to establish background information for community group discussions and household questionnaire interviews. This was a qualitative interview to collect information about conditions of food and livelihood insecurity at national, regional and district levels; demographic and socio-economic aspects; conditions of access to markets and services; and other specific and relevant information (such as average land holding sizes, crops grown and farm production levels).

4.3.4 COMMUNITY GROUP DISCUSSION

As a qualitative approach, community group discussions were conducted with a maximum of six knowledgeable people, including local residents and local agricultural development officers and supervisors in the three research sites of the study. After a brief discussion with the key informants, six people were chosen to conduct discussions concerning the temporal aspects of major agricultural activities, the risks associated with food security, and each household's coping and survival strategies during a time of food crisis. The following table represents the people involved.

Table 4: The number of community group discussion members per agro-ecology and PA

Agro-ecology	PAs	Local agricultural development officers	Supervisors	Knowledgeable community members
Highland	Feresbar	4	1	1
Midland	Duat	3	2	1
Lowland	Yogodo	3	2	1
Total		10	5	3

4.3.5 FIELD OBSERVATION

Observations of physical and socio-economic infrastructures (lifestyles, community resources, geographic features) as well as patterns of land use and the conditions of houses and farmlands and other key assets were made in order to understand the general situations (vulnerability context) external to households. In this study, therefore, a transect walk was made to carefully observe the above attributes.

4.4 DATA CONSOLIDATION AND METHOD OF DATA ANALYSIS

4.4.1 DATA CONSOLIDATION

Just as data collection methods determine the validity and reliability of the data collected, methods of data presentation and consolidation determine the quality of the research findings. This section describes the presentation and consolidation of the raw data collected through various qualitative and quantitative techniques.

Data obtained through household questionnaires were captured and analyzed using Microsoft Excel and STATISTICA 8 programmes. Contingent tables, bar graphs, and other descriptive statistical techniques were used to present and consolidate the data.

To complement this, qualitative data from field observation community group discussion, and key informant interviews were also consolidated. These data provided valuable insights on background information of the study area including household vulnerability, livelihoods, and major disaster risks faced by households of the study area.

4.4.2 METHOD OF DATA ANALYSIS

Three major analytic frameworks and/or tools were used in this study. These were Food Security and Livelihood Analysis, Multi-livelihoods Criterion, and non-parametric statistics (Chi-square Test). The following section outlines the relevance of each analytic tool to the study.

4.4.2.1 FOOD AND LIVELIHOOD SECURITY ANALYSIS

- OVERVIEW

Given that the definition of food security is access to sufficient food for all people at all times, food security and livelihood analysis should reflect this basic definition i.e., the analysis focused on ***accessibility*** (what determines differences in access) and ***availability*** (quantified measures and thresholds) of food and resources as well as ***seasonality*** (what causes changes in access) of shocks and stresses (Save the Children, 2007).

For instance, a household's food *availability* was analysed based on the internationally accepted minimum energy requirement of 2100kcal/person/day. This minimum required energy threshold was used to determine the food security status of households.

However, the household's *accessibility* to food was analysed after the different physical (geography) and socio-economic factors that determine differences in access to food were identified.

Seasonal calendars were also used to graphically analyse the seasonality of livelihood opportunities and activities, hazards and the other factors that cause changes in access to food.

- DETAILED FOOD INSECURITY ANALYSIS

In order to capture a more detailed dimension of food security, three food insecurity measures were employed. These were *Head Count Method*, *Food Insecurity Gap*, and *Squared Food Insecurity Gap*. Adopted from Khatri-Chhetri (2006), the measures are described below.

The *Head Count Method*, in this study, is defined as the ratio between the number of food insecure and the total number of households under study. It provides the proportion of sample households that are food insecure. In other words, the method provides the percentage of households who consumed less than the minimum calorie requirement (2100 kcal/person/day) in the 12 months preceding the survey. Hence, it is possible to determine incidence of food insecurity in the study area.

$IFI=FIH/TH \times 100$ ....*i*

Where, *IFI* = Incidence of Food Insecurity
FIH = No of Food Insecure Households
TH = Total Households under study

However, the method does not provide detailed information about the food insecure households. On the other hand, *Food Insecurity Gap (FIG)* and *Squared Foot Insecurity Gap (SFIG)* measurements provide the depth and severity of food insecurity among the food insecure households. The Food Insecurity Gap is the average measurement of the gaps between the calories consumed by the food insecure households and the minimum energy requirement (2100 kcal/person/day). The equation to calculate FIG is given below.

$FIGi=TCRi - TCCi/TCRi$ ii

Where, *FIGi* = Food Insecurity Gap of i^{th} food insecure household
TCRi = Total Calorie Requirement for i^{th} food insecure household
TCCi = Total Calorie Consumption by i^{th} food insecure household

Therefore, total food insecurity gap is:
$TFIG=\Sigma TCRi - TCCi/TCRi\ /FIH$ iii

Where, TFIG = *Total Food Insecurity Gap*, which indicates the *depth of food insecurity* among the food insecure households
n = No. of food insecure households

Furthermore, the *Squared Foot Insecurity Gap (SFIG)* is the squared average measurement of the gaps between calories consumed by the food insecure households and the minimum energy requirement. This measurement gives more weight to the chronically food insecure

households, which shows the inequality in terms of consumption distribution among the food insecure households. The equation to calculate SFIG is given below.

$SFIG = \sum(FIGi)^2 / FIH$.....iv

Where, *SFIG= Squared Food Insecurity Gap*, which indicates *severity of food insecurity* among the food insecure households.

4.4.2.2 MULTI-LIVELIHOODS CRITERION

The other analytic tool employed was the Multi-livelihoods Criterion. This analytic tool was adopted from the work of Bahry (2007). The analysis was undertaken through the development and application of a multi-criteria ranking table indicating a household's livelihood. This involved the identification of 15 key household livelihood factors pertinent to food security and vulnerability. The factors were grouped into three categories and assigned numeric values of 0, 1 or 2 respectively - "less fragile", "fragile" and "more fragile" livelihoods. Households achieving scores across 15 factors of between 5-9 were subsequently defined as "more fragile", while those who scored values of 10-14 were "fragile" and 15-20 clustered as "less fragile".

Farmland size, oxen ownership, livestock ownership, household size and percentage share of household's expenditure on agricultural inputs are some of the major factors identified to measure the robustness of household's livelihood. Each variable was assigned the value of 0, 1 and 2 based on a given criteria set for each variable. For example, households who owned <=0.5 hectares were considered as 'more fragile' and those who owned between 0.5 hectare and 2 hectares, and those who owned >hectares were respectively considered as 'fragile' and 'less fragile'.

In terms of oxen ownership, households who have one ox and no ox were considered as 'more fragile'. Households who owned a pair of oxen and more than two oxen were classified as 'fragile' and 'less fragile' respectively. Similarly, the share of household's expenditure on agricultural inputs was categorized into households who invest less than 25%, between 25% and 50%, and >50% of their expenditure on agricultural inputs and are subsequently considered to be 'more fragile', 'fragile' and 'less fragile'. (See Appendix VI for the details). The total score of variables for each household determined the level of the household's livelihood security (more fragile, fragile and less fragile). Therefore,

comparisons were possible among households and agro-ecological areas. It was also possible to analyse the relation between livelihood security and the food security status of households.

4.4.2.3 NON-PARAMETRIC TEST STATISTICS

The third analytic tool used was a Chi-square Test, a non-parametric statistic that helps to analyse the significance of differences between variables. A chi-square test statistic was made to analyse the significance of the difference between households in their livelihood security and food security status. The hypothesis to be tested was as follows:

H_0 = Household's food security status and livelihood profile are statistically independent i.e. there is no relationship/association between food security status and livelihood profile.

H_1 = Household's food security status and livelihood profile are associated i.e. there is a relationship/association between food security status and livelihood profile.

Furthermore, understanding the different forms of capital/assets as well as sources of food, income, and expenditure and consumption patterns including livelihood strategies are units of analysis of the research. In addition, how the vulnerability context of the research and transforming structures and processes determine the food security status of households was also the focus of the analysis.

4.5 ETHICAL CONSIDERATIONS

During the interviews, the researcher recognized the sensitivity that is required when conducting food security research among households with severely constrained livelihood options. Confidentiality was maintained by referencing the informants according to their positions, rather than by names. In addition, permission was sought from all participating households before proceeding with interviews.

4.6 RESEARCH CONSTRAINTS AND LIMITATIONS

Several difficulties were encountered during the research process. First, as there were limited transport services to the rural communities, it was difficult to reach remote villages. Second, associated with the lack of transport services was the problem of time constraints. Walking on foot from one village to other was not only a difficult task but also time-consuming. However, the researcher managed to collect the required data from each research site. Third, as most of the existing survey data available is based on administrative zones and districts, it was difficult to obtain demographic, socio-economic and other relevant information related to food security differentiated by agro-ecological zones. Finally, yet most importantly, since the sample size is small, it is difficult to generalise the findings of study to the general population of the district or beyond.

4.7 SUMMARY

Both quantitative and qualitative methods were used to collect data pertinent to vulnerability and food security. In this study, household questionnaire was the most important data-collecting tool. Community group discussion, field observation and key informant interviews were also used to establish background information of the study area, particularly, household's vulnerability, livelihoods, and disaster risk context.

Data drawn from these data collecting tools were presented and consolidated using excels and STATISTICA 8 programmes.

Three major analytical tools were used. These were livelihoods and food security analysis, food insecurity gap measurements, and multi-livelihoods criterion. Non-parametric test statistics (Chi-square test) was also used to determine the relationship between household's food security status and robustness of their livelihoods.

Purposive and random sampling techniques were used to identify research sites and sample households. During the process of data collection, several difficulties were encountered. However, the researcher managed to collect the required data

CHAPTER 5: DATA PRESENTATION AND CONSOLIDATION

5.1 INTRODUCTION

This chapter is organized into five major sections. The first three sections present the demographic and social characteristics of the households under study, their access to production resources and farming systems, and sources of food, income and expenditure. The fourth section outlines their access to non/off-farm income generating activities and household assets. The final section of this chapter presents the households' risk perceptions and coping strategies.

5.2 DEMOGRAPHIC CHARACTERISTICS

This section briefly highlights the demographic and social characteristics of the households in the study area. The issues treated here would be those that have a direct or indirect relation to food availability and consumption, including family size, age and sex composition, the education and marital status of the household heads, and settlement patterns.

The demographic characteristics of households determine the demand and supply of food, while family size and dependency ratios determine the availability of labour, efficiency of labour use, and the burden on productive members of the household. Moreover, demographic information such as age, sex, education and marital status of household heads provide an insight into the socio-economic characteristics of the household.

5.2.1 POPULATION SIZE AND STRUCTURE

The size of a household is a factor expected to influence food security status. The majority of farms owned by households in Ethiopia are small. To make matters worse, semi-subsistence producers have limited participation in non-agricultural activities. Since land and the capital to purchase agricultural inputs are limited, an increase in family size, according to Paddy (2003), tends to exert more pressure on consumption than the labour it contributes to production. Thus, a negative correlation between household size and food security is expected as food requirements increase in relation to the number of people in a household.

As discussed before, the total population of Sayint Rural District was 149,812 with more males (50.7%) than females (49.3%). Out of the total population, 98% were rural and the remaining 2% were urban during the same year. The age structure indicated that most of the population (63.2%) are aged between 15 and 60 years, while the young population (less than 15 years of age) constitutes 28.2%. However, the old age people constitute less than 9%. The overall dependency ratio is about 1.73 i.e. there are 173 dependents for every 100 working-age people. The sex ratio is found to be about 103 (see Table 5).

About 98% of the population lives in rural areas where mixed farming is the main activity of the people. Population growth rate of the *woreda* was found to be 2%. In addition, the Census showed that the crude population density of the *woreda* is 104 persons per/km^2. Household size ranges between three and seven.

Table 5: Demographic characteristics of Sayint Rural District

Residence & sex	Age group (percent)				
	0-4	5-14	15-60	60+	Total
Total	15.5	12.7	63.2	8.6	100
Male	7.9	6.4	32	4.4	50.7
Female	7.6	6.3	31.2	4.2	49.3
Urban total	0.33	0.27	1.32	0.21	2.13
Male	0.14	0.12	0.57	0.09	0.92
Female	0.18	0.15	0.75	0.12	1.2
Rural total	15.28	12.54	62.01	8.04	97.87
Male	7.75	6.34	31.46	4.36	49.91
Female	7.53	6.20	30.55	3.67	47.95

Source: CSA 1994

According to the survey, a significant percentage of the households (54%) have a household size ranges between 6 and 10 people. The remaining 46% have a household size of less than five. On average, there were six people per household. As depicted in Table 6, about 80% of the household heads are between 20 and 50 years of age, while those aged between 50 and 80 years account for only 20%. The least share (7%) goes for household heads between the ages of 61-80.

Table 6: Age of Household-heads

Age category	count	percentage
20 -30	14	15.7
31 -40	30	33.7
41 -50	27	30.3
51 -60	12	13.5
61 -70	5	5.6
71 -80	1	1.1

Source: survey December 2008

5.2.2 EDUCATION

In recent years, attention has been paid to the need to strengthening links between economic growth and human development in order to counter poverty traps. Improving the capabilities of people must be the focus of this process if real development is to result. Therefore, education is should be a priority, particularly primary education, and educating girls should be considered to be important. The realization of agricultural-led development industrialization would also be possible through improved education (BoFED 2004).

If farmers are provided with the opportunity to get a basic education, they can adopt agricultural technologies, keep their environment sanitary and manage their household income properly.

Levels of illiteracy therefore contribute greatly to the vulnerability of households and communities in the areas under study. The educational status of household heads is therefore expected to influence the food security status of a household. Of the household heads questioned, nearly one-third could neither read nor write and over half had never gone to school. With respect to the highest grade completed, about 20% had gone above a primary school education. Levels of literacy varied across the agro-ecological zones. Reportedly, 24% of highland household heads, 27.8% of lowland household heads and 32.1% of midland household heads could neither read nor write. With respect to the highest grade completed, there is no significant variation. About 20%, 19.5% and 21.4% percent of

the highland, lowland and midland household heads, respectively, reported that they had gone above primary education (see Table 7).

Table 7: Literacy status of household heads, by agro-ecology

Literacy status	Highland	Lowland	Midland	Total
Illiterate	24.00	27.78	32.14	28.09
Can read	20.00	22.22	32.14	24.72
Church education	4.00	5.56	0.00	3.37
Primary	32.00	25.00	14.29	23.60
Lower secondary	20.00	11.11	10.71	13.48
Secondary	0.00	5.56	10.71	5.62
Higher secondary	0.00	2.78	0.00	1.12

SOURCE: Field survey, December 2008

5.2.3 MARITAL STATUS

The marital status of the household heads is expected to influence the households' food security status. Married household heads can be more stable, better in managing the household economy and can benefit from the labour of household members. Divorced household heads have problems regarding asset ownership; they tend to have less assets due to divisions after divorce.

The survey data indicated that a large percentage (88.8%) of the sample household heads were married, while less than 5% were reported to be single. Divorced/separated household heads accounted for small percentage (6.7%). (See Table 8).

There is an insignificant variation in marital status of the sample household heads across agro-ecology. As shown in Table 8, no household heads were found to be single (never married) in the highlands, while about 2.8% and 3.6% of household heads in the lowlands and the midlands, respectively, were reported to be single. The percentage of widowers in the highlands and the midlands accounted for 4% and 3.6%, respectively, and there were no widowers in the lowlands.

Table 8: Percentage distribution of household heads, by marital status and agro-ecology

Marital status	Highland	Lowland	Midland	All HH-heads
Married	96.00	80.56	92.86	88.76
Single (never married)	0.00	2.78	3.57	2.25
Divorced/separated	0.00	16.67	0.00	6.74
Widowed	4.00	0.00	3.57	2.25

SOURCE: Field survey, December 2008

5.3 ACCESS TO PRODUCTION RESOURCES AND FARMING SYSTEMS

Food security literature indicates that access to production resources and modern farming methods influence a household's food security status. Land is one of the basic economic factors of production. The other factors are labour, capital, and management. In the context of a smallholder subsistence farming system, cultivable land size is the key determinant of agricultural output.

In the northern areas of Ethiopia, where the study area is located, agricultural land is highly degraded due to high population pressure and over-cultivation. Moreover, due to the continuous division of land to support an ever-increasing number of households, the average size of a landholding has become very small and fragmented. Government statistics estimate that the average size of landholding in the study area is approximately 0.74 hectares per household, which is smaller than the national average (0.95 ha) and that of regional average (0.97 ha). This section describes production resources, particularly of land and its different features such as land use patterns, the prevailing tenure system, ways of getting access to land and holding size as well as the fertility and fragmentation of the holdings. In addition, this section describes the households' access to assistance to improve crop and livestock production.

5.3.1 LAND-USE PATTERNS

Table 9 presents the land-use pattern of the study area. Less than 20% of the land in the study area was found to be cultivated. This is due to unsuitable topography and poor soil fertility. Almost all the cultivated land is under annual crops and no land is lying fallow due to the shortage of cultivated land.

Table 9: Land-use patterns in Sayint Rural District (1998/99)

Land-use	Area (ha)	Share (percent)
Total land under cultivation	27183.8	18.85
Annual crops	27170.45	18.84
Perennial crops	13.35	0.009
Land lying fallow	-	-
Grazing land	19801.04	13.73
Non-productive land	41043.96	28.46
Land under bushes and forests	48104.92	33.35
Land under other uses	8296.23	5.75
Total	144240.96	100

Source: District Agriculture office

A significant percentage of the land (28.4%) is non-productive. In addition, bushes and forests cover 33.4% of the land and about 13.7% is used for livestock grazing. (For more information concerning land-use patterns, see Appendix IV).

5.3.2 LANDHOLDING SIZE

Most studies have shown that landholding size determines the type of crops grown and the amount of crops harvested. About 80% of the increase in agricultural output in Africa has been attained through the expansion of cultivated land (Tolessa 1999). Therefore, landholding size is expected to influence the food security status of households who engaged in subsistence agriculture.

The average holding size of the sample households was found to be 1.22 hectares, which is relatively larger than the district average (0.74 hectares). The survey data reveals that holding sizes vary greatly from 0.25 hectares to 3 hectares. About half of the households

had a holding size of 0.5 – 1.92 hectares, and 75% had a holding size of less than 1.92 ha. Only 25% of households have less than a starvation plot (0.5 hectare). In addition, only 10% of the sample households had a farm size greater than 2.5 ha (see Table 10).

Table 10: Landholding size distribution

Farm size category (ha)	NHH	Percent	Cumulative percent
0 – 0.5	15.00	16.85	16.85
0.51 – 1	37.00	41.57	58.43
1.01 – 1.5	21.00	23.60	82.02
1.51 – 2	7.00	7.87	89.89
2.01 – 2.50	1.00	1.12	91.01
2.51 – 3	8.00	8.99	100.00
Total	89	100	

SOURCE: Field survey, December 2008

Table 11 presents six categories of holding sizes, the percentage of farmers that fall under each group, and the total land occupied by the respective groups. The variation in mean landholding was not significant among agro-ecological zones of the study area, with a range between 1.1 ha in lowland (*Kolla*) and 1.3 ha in highland (*Dega)*. However, as shown in Table 12, the coefficient of the variation indicates that there is higher variation in holding size among lowland (*Kolla*) households, and there is a low variation in holding size in the midland (*W/dega*) households.

Table 11: Percentage distribution of households, by farm size category and agro-ecology

Agro-ecology	No. HH	Farm holding size					
		0 - 0.5	0.51 – 1	1.01 - 1.50	1.51 - 2	2.01 - 2.50	2.51 - 3
Dega	25	6.74%	8.99%	6.74%	1.12%	0.00%	4.49%
Kolla	36	8.99%	21.35%	3.37%	2.25%	0.00%	4.49%
W/dega	28	1.12%	11.24%	13.48%	4.49%	1.12%	0.00%
Total	89	16.85%	41.57%	23.60%	7.87%	1.12%	8.99%

Table 12: Mean, Maximum and Minimum landholding size, by agro-ecology

Agro-ecology	Mean	Minimum	Maximum	St. Dev.	C.V
Dega	1.30	0.50	3.00	0.86	65.8
Kolla	1.10	0.25	3.00	0.77	70.31
W/dega	1.29	0.50	2.50	0.42	32.6
Total	**1.22**	**0.25**	**3.00**	**0.71**	**58.25**

SOURCE: Field survey, December 2008

Note: St.Dev. = standard deviation; C.V. = coefficient of variation

Households were asked to identify the general topography and fertility status of their farm plots. The responses presented in Table 13 show that most of the farmlands are situated in valleys and steep topographies, as a large percentage of the study area (70%) is valley. About 38.1% of households rated their plots as fertile and large percentage of households rated their plots as moderate and poor fertility (see Table 13).

Table 13: Household's responses on the fertility status and topography of their farm plots

Topography	Highland		Midland		Lowland		Total	
	NP	%	NP	%	NP	%	NP	%
Plain	20	37.04	16	25.39	48	58.54	84	42.21
Moderate	32	59.26	15	23.81	13	15.85	60	30.15
Steep	2	3.70	32	50.79	21	25.61	55	27.64
Total	54	100	63	100	82	100	199	100
Fertility status								
Fertile	4	7.41	13	20.63	59	71.95	76	38.19
Moderate	27	50	32	50.79	17	20.73	76	38.19
Poor	23	42.59	18	28.57	6	7.32	47	23.62
Total	54	100	63	100	82	100	199	100

SOURCE: Field survey, March 2008

Note: NP refers to the number of plots

5.3.3 LAND FRAGMENTATION

Households were also asked whether their holdings were in one parcel or not. A significant percentage (64%) responded that their holdings were not. Among those farmers who reside in the midlands, about 75% responded that their holdings were not in one parcel.

Table 14: Percentage distribution of the number of plots, by agro-ecologies

Agro-ecology	N	Min	Max	X	Farmers with plots of				
					1	2	3	4	5
Highland	25	1	4	2.08	13.48	3.37	6.74	4.49	0.00
Lowland	36	1	5	2.39	15.73	4.49	10.11	8.99	1.12
Midland	28	1	5	2.54	6.74	6.74	13.48	3.37	1.12
Total	**89**	**1**	**5**	**2.35**	**35.96**	**14.61**	**30.34**	**16.85**	**2.25**

SOURCE: Field survey, December 2008

Note: N= number of households; Min= minimum number of plots and X= mean

As shown in Table 14, there is a substantial variation in the number of plots belonging to the sample households. They ranged between 1 and 5, the overall average was 2.35, and a valid cumulative percentage indicates that there is a high degree of land fragmentation. The variation among agro-ecologies seems slight as the mean number of plots ranges between 2.08 in the highlands and 2.54 in the midlands. Relatively speaking, there is lower degree of land fragmentation in the highlands. This is mainly because most of the farmlands are situated on valleys and gorges.

5.3.4 FARMING SYSTEM

More than 85% of the population of Ethiopia lives in rural areas and depends entirely on agriculture. About 6 million hectares of cultivated land and over 70% of livestock production come from the midlands and the highlands. This area includes about 90.5% of cultivated land in the country, and supplies food to approximately 90% of the population. The remainder of the country, of which only 9.5% is cultivated, comprises of arid or semi-arid zones which receive insufficient rainfall to sustain cropping without irrigation, and so are only suited to nomadic pastoral use (Haile 1995).

The highlands support a mixed farming system that combines both cereal and livestock production. Rain-fed cereals such as teff, barley, wheat, maize and sorghum are dominant, and pulses, oil seeds and some root crops are cultivated. Cropping systems are complex, with farmers growing a wide range of crops to guard against crop failure.

A typical cropping system in the mid-altitude highlands might include teff for home consumption and sale; maize or sorghum as the basic staple and as a source of building materials, livestock feed and fuel; a small plot of oil seeds or pulses for lame

consumption, and a variety of horticultural crops. These complex systems usually include livestock. These integrated crop-livestock production activities have coexisted for centuries, with livestock providing draught power for tillage, farmyard manure, fuel, dietary supplements and security against famine; and crop production providing food for the household and the market (Haile 1995).

- **CROP PRODUCTION**

Crop production and animal husbandry are the major agricultural activities undertaken in the rural district of Sayint. Cereals, pulses, oil crops and other field crops dominate the agriculture of the study area. The households were asked about the amount of crops they produced during the 2007 harvesting season, and a large percentage (99.5%) of the total production is reported to be cereals and pulses. Cereals accounted for 64.6% of the total production.

As shown in Table 15, the sample households produced about 90,168.5 kilograms of crops in the reference year (2007). Cereal accounted for 58,240kg, pulses for 31,480kg, and oilseeds for 448.5kg. When taking the cereal equivalent of all crops, the average food available was found to be 1,016.3 kilograms per household. Hence, the mean daily per capita food available is 1,624.22 kcal, which makes up about 77.3% of the minimum energy requirement (2100 kcal).

Table 15: Production and yields of major crops, by agro-ecologies, in 2007

Crop type	Highland		Lowland		Midland		Total	
	Pr.	Y	Pr.	Y	Pr.	Y	Pr.	Y
Cereals	13,400	412.31	18,240	460.26	26,600	738.89	58,240	538.49
Pulses	8,410	258.77	11,920	300.78	11,150	309.72	31,480	291.06
Oilseeds	90	2.77	103.5	2.61	255	7.08	448.5	4.15
Total	21,900	673.85	30,263.5	763.65	38,005	1,055.69	90,168.5	833.70

SOURCE: Field survey, December 2008

Note: Pr= production (output) in Kg; Y= yield of crop in Kg per hectare

- **LIVESTOCK AND FARM OXEN POSSESSION**

Apart from crop production, livestock is the other principal source of livelihood in the study area. Livestock play a pivotal role in providing draught power for tillage, farmyard manure, fuel, dietary supplements and security against famine (Ezra 1997). In this regard, livestock includes cattle, shoats, equines, and chickens. These are important assets; according to the community group discussions, livestock ownership is the major determinant of wealth ranking among sample households in all agro-ecologies.

The survey data revealed that the sample households owned 327.04 tropical livestock units (TLU). Cattle constituted the largest percentage (77%) of the total tropical livestock unit owned by the sample households, while shoats and equines together accounted for 22.91 percent (see Table 16). In addition, the households reported that they owned 363 poultry. As shown in Table 16, on average the households owned 2.86, 0.51, and 0.34 TLU of cattle, shoats, and equines, respectively. When compared with the available grazing land, there is high intensity of livestock pressure on the existing grazing land. For example, the per capita TLU for sample households is about 0.62 against 0.20 hectares of cultivated land. This explicitly shows that there is severe shortage of animal feed in the study area.

Table 16: Total livestock population of the study area, March 2008

Livestock type	Number	TLU	Per capita TLU	% share of TLU
Cattle	265	251.92	2.86 (0.48)	77.09
Shoats	534	45.17	0.51 (0.08)	13.75
Equines	63	29.95	0.34 (0.06)	9.16
Poultry	363	-	-	-
Total	1225	327.04	3.71 (0.62)	100

SOURCE: Field survey, December 2008

However, livestock ownership varies across agro-ecology. For example, the midland households have the highest level of livestock ownership. The midland households owned 130.76 TLUs, while the highland and the lowland households owned 94.08 and 102.20 TLUs respectively. On average, the highland, the midland and the lowland households, respectively, owned 3.76, 4.67, and 2.92 TLUs per household. Despite average TLUs seem small in the lowland, due to large sample households; they have better livestock ownership than the highland households. This is mainly because lowland households have traditionally lived a nomadic way of life (See Table 17).

Table 17: Distribution of livestock population, by the type and agro-ecology

Agro ecology	Livestock type								No. Per HH	TLU per HH
	Cattle		Shoats		Equines		Total			
	No.	TLU	No.	TLU	No.	TLU	No.	TLU		
Highland	77	71.72	138	12.21	15	10.15	230	94.08	9.20	3.76
Lowland	80	79.37	169	14.03	22	8.8	271	102.2	7.74	2.92
Midland	108	100.83	227	18.93	26	11	361	130.76	12.9	4.67
Total	265	251.92	534	45.17	63	29.95	862	327.04	9.80	3.72

Source: Field survey, December 2008

Note: Tropical livestock unit (TLU) is equivalent to a livestock weight of 250 Kg, and the conversion factors vary according to the type of livestock. Accordingly, an ox = 1.12 TLU, other cattle = 0.7979 TLU, a sheep = 0.0892 TLU, a horse = 1.3 TLU, a goat = 0.07 TLU, a mule = 0.9 TLU, a donkey = 0.35 TLU, a camel = 1 TLU.

Previous studies on food security underline the important role played by ownership of farm oxen. Therefore, this factor was expected to influence the food security status of sample households. Therefore, information concerning households' oxen ownership was collected separately from other livestock types. According to SERA (2002), shortage of oxen is one of the reasons that force households to lease out their land. It also leads to late land preparation and planting as they can only get oxen under rental arrangements after the owners complete their own ploughing, or through labour-sharing arrangements where the oxen- less households provide labour.

The survey data (Table 18) indicate that 43.1% of sample households own one or no oxen. 56.8% of sample households reportedly own more than two oxen. On average, they own 1.47 numbers of oxen. This explicitly indicates that there is shortage of oxen in the study area.

Ownership farm oxen also varied across agro-ecology. For example, households in midland agro-ecologies had more oxen per household than their counterparts in other agro-ecological zones. The highland households reported the lowest number of oxen.

Table 18: Distribution of farm oxen ownership, by agro-ecology

Agro-ecology	Total farm oxen	Mean	Percentage of farmers with					Total number of HH
			0	1	2	3	4	
Highland	33	1.32	16	40	40	4	0	25
Lowland	49	1.40	20	28.57	45.71	2.86	2.86	35
Midland	47	1.68	7.14	17.86	75	0	0	28
Total	129	1.47	14.77	28.41	53.41	2.27	1.14	88

Source: Field survey, December 2008

5.4 SOURCES OF FOOD, INCOME AND EXPENDITURE

This section presents relative sources of food and income, as well as, expenditure. As cannot be assumed that households obtained food from only one source, six potential food sources were identified and utilized. Recognising that various food sources contribute differently to household food needs, the potential food sources were clustered into six categories. These were 'own crop', 'own livestock', 'exchange', 'relief', 'wild food', and 'productive safety net programs (PSNP)'.

With respect to sources of income, this section presents the kinds of activities that households engage in and the amounts of money that are earned. The main sources of income available are crop sales, livestock and livestock product sales, labour sales, remittance, trade and aid. The income earned from these sources is presented in Ethiopian birr, and the exchange rate at the time was birr 9.62 to one dollar. Finally, this section concludes by presenting essential and non-essential household expenditure items, and the amount of money spent on each.

5.4.1 SOURCES OF FOOD

Rural households try to ensure access to food from various sources. It is recognised by the Household Economy Approach (HEA) that households with a limited range of food sources have a high risk of food insecurity in times of shocks and stresses unlike households with wide range of food sources. This is mainly because of the disproportional effect of shocks and stresses on various food sources. Therefore, it is necessary to determine the relative importance of food sources to meet household food needs.

As depicted in Figure 19, a household's own production contributes significantly to meeting food needs. Reportedly, more than three-quarters of households responded that their own crop production makes a high contribution to their food needs. Both relief and PSNP have a relatively high contribution, rather than own livestock and exchange. Surprisingly, nearly all of the households responded that wild food has low or no contribution to their food needs.

Despite the high contribution of household crop production to meet internal food requirements, research findings indicated diversify in the relative contribution of different food sources in the three agro-ecological zones. As shown in Table 17, own crop production contributed more to meeting food needs in lowland households. In contrast, own livestock production contributed more to food needs in the highland and midland households. Only 4.5% and 6.7% of midland and highland households respectively responded that their own livestock production has a low or no contribution to meet food needs. Conversely, 25.8% of lowland households responded that their own livestock production has a low or no contribution to meet food needs. This might be because of the severe decline in crop production in highlands and midlands; the contribution of own livestock production is increasing as a result. There is high tendency to use own livestock as the major income source rather than as a food source among the lowland households.

The contribution of wild food, which includes non-farmed vegetables such as roots, tubers, fruits, leaves and other seeds, was found to contribute minimally to household food needs in all agro-ecologies. Relatively, relief and productive safety net programs (PSNP) have higher contribution to food needs in the lowlands compared with their counterparts.

Table 19: Percentage distribution of contribution of food sources, by agro-ecology

Sources of food	Highland			Lowland			Midland		
	Degree of contribution			Degree of contribution			Degree of contribution		
	high	Medium	Low/no	High	medium	Low/no	High	medium	Low/no
Own crop	21.35	4.49	2.25	35.96	4.49	0.00	20.22	5.62	5.62
Own livestock	4.49	16.85	6.74	1.12	13.48	25.84	0.00	26.97	4.49
Exchange	0.00	3.37	24.72	6.74	16.85	16.85	6.74	10.11	14.61
Relief	4.49	8.99	14.6	13.48	4.49	22.47	1.12	12.36	17.98
Wild food	0.00	0.00	28.09	0.00	1.12	39.33	1.12	1.12	29.21
PSNP	3.37	2.25	22.47	10.11	6.74	23.59	5.62	7.87	17.98

Source: Field survey, December 2008

5.4.2 SOURCES OF INCOME

The income of the sample households was estimated by using the total cash income the households received from a variety of income sources. Major income sources were own crop and livestock sales, labour sales, small trade, remittance and external aid. Table 20 presents the total income received from each source. The amount is very small; the annual average income was Birr 3063.62 across all income sources. More than 80% of the total income was obtained from only three major sources. These were livestock sales, crop sales, and external aid, which accounted for 34.9%, 25% and 20.9% of total income respectively. The remaining 20% of the total income was reportedly obtained by combining four income sources (livestock product sales, labour sales, remittance and small trade).

The contributions of income sources also varied across agro-ecology. For example, livestock sales account for 35.9% of the total income of highland households, 25.2% for lowland households, and 39.7% for midland households. External aid contributing more for highland and lowland households than midland households do. 36.6% of the income of the lowland households was obtained from external aid.

Table 20: Total and average income earned by income sources, and by agro-ecology

Income source	Highland		Lowland		Midland		Total	
	Total	Average	Total	Average	Total	Average	Total	Average
Crop sales	18,500	740	14,743	421.23	34,300	1,225	67,543	767.53
Livestock sales	22,126	885.04	17,720	506.29	54,383	1,942.25	94,229	1,070.78
Livestock product sales	2,230	89.2	970	27.71	3,407	121.68	6,607	75.08
Labour sales	1,800	72	6,450	184.29	22,300	796.43	30,550	347.16
Remittance	0	0	200	5.71	300	10.71	500	5.68
Trade	2,735	109.4	4,500	128.57	6,500	232.14	13,735	156.08
Aid	14,770	590.8	25,695	734.14	15,970	570.36	56,435	641.31
Total	**62,161**	**2,486.44**	**70278**	**2,007.94**	**137,160**	**4,898.57**	**269,599**	**3,063.62**

Source: Field survey, December 2008

Note: one US Dollar is equal to ETB 9.62 for the reference year

5.4.3 EXPENDITURE

Households were asked to indicate the allocation of their cash earnings in order to examine issues of vulnerability in the study area. The amount of expenditure on farm inputs or other valuable assets and on food grains to supplement the household's food requirements was anticipated to indicate the level of household's vulnerability in the study area. The higher the household's expenditure on food grains to buy food as opposed to expenditure on farm inputs/valuable assets, the more vulnerable the household would be.

Table 21 presents the major expenditure items and the share of total expenditure spent. The share of total expenditure on food grains is found to be larger than the share of total expenditure on agricultural inputs. Sample households spent about 35.8% of their total expenditure on staple and non-staple food while they spent 18.7% percent of their total expenditure on agricultural inputs. Since there is a low investment on agriculture, the households are likely to remain food insufficient. They have to spend their limited income

on food grains to supplement their food deficit, and remain more vulnerable to price fluctuations.

Table 21: Percentage share of total expenditure spent on items, by agro-ecology

Expenditure items	Highland	Lowland	Midland	Total
Staple food	34.27	23.82	32.26	30.62
Non-staple food	7.85	0.00	6.36	5.12
Household items	25.61	31.72	10.73	15.21
Water	0.00	0.86	1.92	1.15
Agricultural inputs	7.30	15.14	16.82	18.67
Cloths	18.66	22.43	18.19	19.40
Tax	1.75	1.94	1.21	1.54
Gifts	0.00	0.61	0.78	0.53
Social services	4.56	3.37	7.83	5.84
Other	0.00	0.11	3.89	1.92
Total	**100.00**	**100.00**	**100.00**	**100.00**

Source: Field survey, December 2008

Note: one US Dollar is equal to ETB 9.62 for the reference year

However, the share of expenditure on food grains and agricultural inputs varies across agro-ecology. For example, the share of expenditure on agricultural inputs is very low in the highlands (7.3%). Relatively speaking, midland households spend the most on agricultural inputs. Expenditure on water, taxes and gifts is reportedly very low in all agro-ecologies.

5.5 NON/OFF-FARM INCOMES AND HOUSEHOLD ASSETS

In the context of smallholder subsistence farming, access to various sources of income has great deal of significance in times of shocks and stresses. Given the persistent trend of declining agricultural production in Ethiopia, access to supplementary sources of income is becoming a necessity. This is mainly because fundamental livelihood sources (farming and livestock) are not sufficiently stable to sustain rural households.

According to the community group discussion conducted in March 2008, off-farm and non-farm income sources, which are considered supplementary income sources, result from seasonal employment in the commercial farms of Metema and Humera, which are located

in North Gondar. Employment for short periods in construction and other works in the surrounding towns also provides some opportunity for a few individuals.

Within the villages, wealthy farmers employ people to work on their fields but this is very limited in scope. For example, the survey data revealed that only 23.9% of households are engaged in off-farm activities. Among those households, 61.9%% work in their own village, 33.3% in other villages and 4.8% in a neighbouring woreda.

As shown in Table 22, the households' total off-farm income was 50,700 Ethiopian *Birr* during the last 12 months prior the survey. On average, households earned 576.14 Birr from off-farm activities. The survey data also reveals that there is high variation of off-farm income earned; it ranges between *Birr* 240 and *Birr* 10,000.

Table 22: Mean, Maximum and Minimum off-farm income, by agro-ecology

Agro-ecology	Total	Mean	Max	Min	St.Dev.	C.V
Dega	22,060	882.40	10,000	0	2,155.82	244.31
Kolla	11,750	335.71	5,500	0	1,148.50	342.11
W/dega	16,890	603.21	6,000	0	1,536.26	254.68
Total	**50,700**	**576.14**	**10,000**	**0**	**1,606.38**	**278.82**

SOURCE: Field survey, December 2008

Note: St.Dev. = standard deviation; C.V. = coefficient of variation

Concerning access to non-farm income generating activities, only 31.8% of households had engaged in non-agricultural activities in the 12 months preceding the survey. The remaining 68.1% have reported no access to non-farm income generating activities. Among those households who engaged in non-farm income generating activities, 14.2%, 35.7% and 50% , respectively, reside in the highlands, lowlands and midlands. The overall average non-farm income earned by the sample households was found to be Birr 622.56. The survey data also revealed that, per capita, non-farm income is very small at Birr 103.76 per person in the 12 months preceding the survey.

In addition, survey data revealed that the households' non-farm income range between Birr 0 and Birr 12,900. Furthermore, there is a high variation in household's non-farm income among sample households of different agro-ecologies. As shown in Table 23, the coefficient of variation indicates that there is higher non-farm income variation among households of the highlands and midlands than with lowland households.

Table 23: Mean, Maximum and Minimum non-farm income, by agro-ecology

Agro-ecology	Total	Mean	Max	Min	St.Dev.	C.V
Dega	5,285	211.4	2,000	0	552.23	261.22
Kolla	17,400	497.14	3,200	0	889.97	179.02
W/dega	32,100	1,146.43	12,900	0	2627.42	229.18
Total	54,785	622.56	12,900	0		

SOURCE: Field survey, December 2008

Note: St.Dev. = standard deviation; C.V. = coefficient of variation

5.6 HOUSEHOLDS' RISK PERCEPTIONS AND COPING STRATEGIES

5.6.1 INTRODUCTION

This section presents the households' experience of food insecurity and the strategies they adopt in order to withstand the impact of food shortage. Based on previous research on indigenous knowledge, the research assumes that the households who have faced food insecurity problems have a better understanding of the causes of food insecurity and the nature of coping strategies adopted. All of the sample households have identified at least one of the causes listed in the questionnaire. These include natural causes (not enough rain, too much rain, and insects/pests); physical causes (poor quality of land, steep land, and not enough land); and technological and socio-economic causes (inappropriate land management practice, use of traditional farm implements, market inaccessibility, and lack of fertilizers and improved seeds). The households' perceptions concerning major agricultural problems were also sought in order to understand the risks associated with crop and livestock production. Furthermore, this section outlines the consequences of the agricultural problems, and the households' suggestions concerning solutions to alleviate food insecurity.

5.6.2 RISK PERCEPTIONS

The households were asked about their experience of food insecurity in the past 10 years, a significant percentage (64.8%) reported that they have faced food insecurity problems. The highland, lowland and midland households accounted for 23.9%, 22.7%, and 18.1% respectively. Given the causes of food insecurity as sources of risk of crop production, households were asked to identify causes of food insecurity as they have perceived them in the last 10 years. As shown in Table 24, a shortage of rainfall and land, and the use of

traditional farm implements were reported as the major causes of food insecurity. However, households' perceptions on causes of food insecurity varied considerably across agro-ecologies. For example, in the highlands a shortage of rain was reported as the major cause of food insecurity, followed by use of traditional farm implements and poor quality of land. In contrast, in the lowlands, the majority reported a shortage of rainfall followed by a shortage of land and poor quality of land. However, the midland households reported a wide range of causes of food insecurity, yet the use of traditional farm implements was found to be the major driver of food insecurity rather than shortage of rain.

Table 24: Percentage distribution of HHs by perception on the causes of food insecurity

	Highland		Lowland		Midland		Total	
Causes of food insecurity	Count	percent	count	percent	Count	Percent	count	Percent
No enough rain	23	45.10	16	41.03	12	19.35	51	33.55
Too much rain	-	-	1	2.56	6	9.68	7	4.61
Insects/pests	-	-	2	5.13	2	3.23	4	2.63
Poor quality land	8	15.69	3	7.69	2	3.23	13	8.55
Land is too steep	-	-	1	2.56	4	6.45	5	3.29
Not enough land for households	7	13.73	11	28.21	7	11.29	25	16.45
Inappropriate land management practice	2	3.92	3	7.69	8	12.90	13	8.55
Use of traditional farm implements	8	15.69	1	2.56	14	22.58	23	15.13
Market inaccessibility	-	-	1	2.56	-	-	1	0.66
Lack of fertilizers inputs (fertilizer, improved seed	3	5.88	-	-	7	11.29	10	6.58
Total	**51**	**100**	**39**	**100**	**62**	**100**	**152**	**100**

SOURCE: Field survey, December 2008

Households were also asked to identify the major agricultural problems they faced during the last 5 years that contribute sources of risk to food security. These were reported to be a lack of adequate land, financial constraints, a lack of oxen and a lack of farm implements. As the result 39.2% reported that, they had been exposed to famine/food

shortages, 32% to poverty, and 15.2% to epidemics/mortality. About 13.6% of the households reported that they have faced no problems (Table 25 & Table 26).

Suggestions concerning solutions to alleviate the problems of food insecurity, acquiring additional land; changing traditional land management practices; and availability of improved seeds/fertilizers were identified as the preferred responses to the problem of food insecurity. Although responses varied across agro-ecologies, about 37% suggested the increased availability of improved seeds and fertilizers, 36.1% suggested changing the traditional land management and 26.8% suggested the acquisition of additional land.

Table 25: Consequences of the agricultural problems

	Highland		Lowland		Midland		Total	
Consequences	Count	percent	count	percent	count	Percent	count	percent
Famine/food insecurity	20	51.28	19	40.43	10	25.64	49	39.20
Epidemics/mortality	-	-	14	29.79	5	12.82	19	15.20
Poverty	14	35.90	12	25.53	14	35.90	40	32.00
No problem	5	12.82	2	4.26	10	25.64	17	13.60
Total	**39**	**100**	**47**	**100**	**39**	**100**	**125**	**100**

SOURCE: Field survey, December 2008

Table 26: Solutions suggested by sample households to alleviate the problem of food shortage

	Highland		Lowland		Midland		Total	
Suggested solution	Count	percent	count	percent	count	percent	count	percent
Getting additional land	8	25.00	10	27.78	11	27.50	29	26.85
Changing the traditional land management	8	25.00	14	38.89	17	42.50	39	36.11
Availability of improved seeds/fertilizers	16	50.00	12	33.33	12	30.00	40	37.04
Total	32	100	36	100	40	100	108	100

SOURCE: Field survey, December 2008

Households were also asked to identify the most severe and frequently occurring problems. About 31.8% and 35.2% of households, respectively, reported famine and poverty as severe problems faced in the last five years. In terms of frequency, however, famine was found to be more frequent. However, responses concerning severity and frequency of problems vary across agro-ecology. For example, among those households who reported famine as frequently occurring problem, about 50% were in the highlands, 34.4% in the lowlands and 15.6% in the midlands.

5.6.3 COPING STRATEGIES

Extensive literature on food insecurity gives particular emphasis to the issues of coping strategies in times of duress. These strategies generally refer to ex-ante and ex-post responses to a stressful situation. According to Ellis (2000), coping strategies are defined as the sequence of survival responses to crisis or disaster. In the context of this study, coping strategies refer to ex ante and ex post responses to manage household food deficits.

The ex ante measures help to improve food availability and access to food through own production and income diversification. On the other hand, when households are faced with the decline of food availability, they can adjust their food deficit through ex post responses like borrowing food, collection of wild foods, sale of agriculture and livestock products etc. (Khatri-Chhetri 2006). This section, particularly, focuses on ex post strategies adopted by households faced by food insecurity.

Coping strategies vary both spatially and temporarily. The types of strategies employed also vary depending on the severity and duration of the disruptive conditions. Given the temporal and spatial variation in the use of coping strategies, the percentage of households that have adopted one or more coping strategies in a community indicates the prevalence of food insecurity (SERA 2002).

In this study, large percentage of households (76.1%) reported that they did not produce enough food to meet their food demand. They were forced to adopt a wide range of coping strategies to cope with risks associated with food security, based on available resources and external assistance.

Sample households were asked if they had adopted a set of coping mechanisms during the last 12 months prior to the survey. Nearly all reported having adopted at least one coping mechanism. The most prevalent mechanisms for coping with food insecurity were reducing the number of meals per day (adopted by 59%); reducing the quantity of meals (adopted by 52.3%); and eating less preferred foods (adopted by 52.3%). The other prevalent coping mechanisms were participation in food-for-work and employment generation schemes, and selling livestock (Table 27).

Table 27: Percentage distribution of household head by coping mechanisms, by agro-ecology

Coping mechanisms	Highland	Lowland	Midland	All households
Reducing number of meals	72	45.71	64.29	59.09
Reducing quantity of meals	32	57.14	64.29	52.27
Eating less preferred foods	28	57.14	67.86	52.27
Household members seeking work within/outside PA	-	5.71	60.71	21.59
Borrowing food/grain or cash to buy food	8	20	50	26.14
Migration (to find work/food etc.)	4	2.86	39.29	14.78
Selling livestock	16	40	71.43	43.19
Participating in FFW/EGS	32	45.71	64.29	47.73
Withdrawing children from school	8	2.86	21.43	10.23

SOURCE: Field survey, December 2008

However, the prevalence of coping strategies varied across agro-ecological zones. For example, in the highlands the most prevalent coping strategy was found to be reducing the number of meals. In contrast, most of the lowland households reportedly adopted reducing the quantity of meals and eating less preferred foods.

The type and prevalence of coping strategies in the midland is, however, different. Large proportion of the midland households reported having adopted selling livestock to cope with food deficit situation. Livestock selling and seeking work are both ex ante and ex post coping strategies. These strategies were largely adopted by the midland households because there is a better availability of labour and more livestock ownership in the midlands.

5.7 SUMMARY

Data collected using both qualitative and quantitative methods were consolidated and presented based on five key areas. These were demographic characteristics; access to production resources; sources of food, income, and expenditure; non/off-farm incomes and household assets; and household risk perceptions and coping strategies.

Percentages, proportions, averages and other descriptive statistics were used to present data obtained from the above key areas.

CHAPTER 6: FOOD SECURITY ANALYSIS

6.1 INTRODUCTION

Following several of international summits since the World Food Conference in 1974 and after work spanning several decades, the definition of food security is today generally agreed upon (Lovendal and Knowles 2006). The World Food Summit in 1996 built on earlier work by adopting this definition: *"Food security exists 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"* (FAO, 1996). This definition integrates stability, access to food, availability of nutritionally adequate food and the biological utilization of food. Despite the fact that the definition of food security has been agreed upon, a range of different approaches have been employed in the analysis of food security. This is mainly because of the different emphasis paid to components of the definition of food security (sufficiency, access and entitlement, security, and temporal aspects) as a unit of analysis. These can be grouped into two. The first approach in food security analysis is the 'Food First' approach, which predominated in the earlier food security literature. For example, Handy (1985) and Hopkins (1986) placed food at the top of a hierarchy of needs rather than placing it as one part of livelihood needs. This approach also assumed that access to food is the primary objective of food security rather than livelihood security and sustainability.

The second approach, focused on sustainable livelihood, assumes food security as one element of the broader concept of livelihood security. It also prioritizes livelihood security and sustainability as the primary objective of food security analysis. In recent years, this approach has incorporated the notions of risk and vulnerability. The importance of a livelihood approach in food security analysis is illustrated by several scholars such as De Waal (1989), Corbett (1988), Frankenberger and Goldstein (1990) and Riely (1991) .

Thus, this study applied the sustainable livelihood framework to analyse household's vulnerability to food insecurity in the rural district of Sayint.

Since the concept of vulnerability is central to this study, this chapter discusses the key determinants of vulnerability to food insecurity. Vulnerability refers (Pelling, 2003), to exposure to risk that arises from a lack of defense against hazards and a difficulty in coping with them. Hence, in this chapter, vulnerability has two components. The first is external vulnerability, which refers to the exposure to hazards that negatively influence

access to food. The second is internal vulnerability, which refers to the degree of defenselessness against hazards.

This chapter also discusses a household food security status based on aggregate household calorie consumption in which consumption below the internationally accepted minimum calorie requirement (2100 kcal/person/day) signaled household food insecurity condition. It also discusses the relationship between a household's livelihood and its food security status. The chapter also examines the robustness of sustainable livelihood framework in explaining the vulnerability to food insecurity in the context of Sayint Rural District; and concludes by suggesting possible solutions to the problem of food insecurity in the study area.

6.2 DETERMINANTS OF VULNERABILITY TO FOOD INSECURITY

6.2.1 OVERVIEW OF KEY FACTORS OF FOOD SECURITY IN ETHIOPIA

A number of studies have made use of various methodologies to identify determinants of food security in different parts of Ethiopia. For example, Shiferaw, et al (2003); Yared, et al (1999); and Webb, et al (1992) have identified the following as major determinants of food security: ownership of livestock, farmland size, family labour, farm implements, employment opportunities, market access, levels of technology application, levels of education, health, weather conditions, crop diseases, rainfall, oxen ownership, and family size. These are categorized in to three groups within the framework of the general definition of food security mentioned in Chapter Two, i.e. food availability, food access, and utilization. For example, food availability may be constrained by inappropriate agricultural knowledge, technology, policies, inadequate agricultural inputs, family size, etc. On the other hand, access to food and its utilization could be constrained by economic growth, lack of job opportunities, lack of credit, inadequate training, inadequate knowledge, etc. Hoddinott (1999). Despite the fact that a dependence on unreliable and low-productivity rain-fed agriculture may well be the primary determinant of household food insecurity in Ethiopia Devereux (2000), in this study, determinants of food security are categorized as either internal or external vulnerabilities.

6.2.2 INTERNAL VULNERABILITY TO FOOD INSECURITY

This dimension of vulnerability refers to 'defencelessness' to external shocks and stresses (Chamber 1989). Internal vulnerability is explained by demographic and socio-economic conditions that could possibly influence either food availability or accessibility.

In this study the specific variables contributing to internal vulnerability were household size, oxen ownership, farmland size, livestock ownership, educational status of household heads, access to off/non-farm activities, and the level of investment on agricultural inputs. The average and percentage values of each variable determine the food security status of households. The research found that the percentage of food secure and food insecure households was 24.7% and 75.3%, respectively. Table 28 represents the average and percentage values calculated for each variable (elements of internal vulnerability to food insecurity) across a household's food security status.

As shown in Table 28, the percentages and average results of farmland size, oxen ownership, access to off/non-farm activities, expenditure on agricultural inputs, and livestock ownership were found to be higher in food secure households than that of food insecure households. On the other hand, average household sizes and the percentage of households with infertile land are higher among food insecure households than among food secure households. However, average land fragmentation and the percentage of households with illiterate heads were higher among food secure households than among food insecure households.

Therefore, except in the case of land fragmentation and the educational status of household heads, the results converges with previous literature on the relationship between the major determinants of food security and a household's food security status.

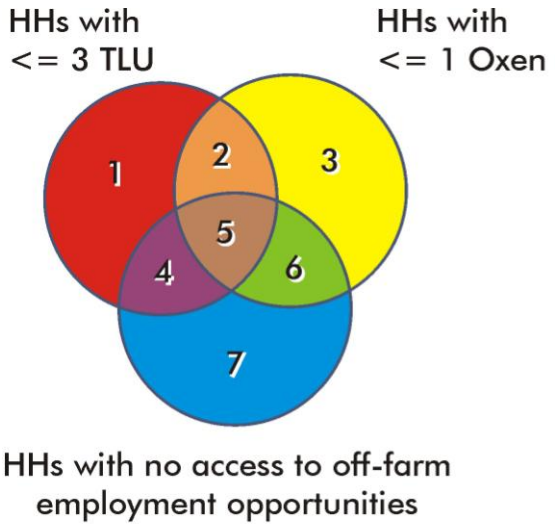
Table 28: Household food security rates for major determinants of vulnerability to food insecurity

Variables	Food insecure	Food secure	All households
Average farm land size (ha)	1.16	1.40	1.22
Average ox ownership	1.29	2.00	1.47
Average household size	5.79	4.86	5.67
Average livestock ownership (TLU)	3.33	4.73	3.67
Average land fragmentation	2.21	2.77	2.35
Infertile land (%)	20.90	13.64	19.10
Illiterate (%)	26.87	31.82	28.09
Primary education (%)	25.37	18.18	23.60
Engaged in off-farm activities (%)	19.70	36.36	23.86
Engaged in non-farm activities (%)	28.79	40.91	31.82
Average share of expenditure on agricultural inputs (%)	14.05	23.84	18.67

Source: survey data, December, 2008

Furthermore, internal vulnerability to food insecurity can also be indicated by examining the relationship between selected determinants of food insecurity and the percentage of food insecure households . Households who have limited ownership of oxen and livestock as well as no access to off-farm employment opportunities are found to be food insecure, as shown by Figure 7, which represents the percentage of food insecure households with limited oxen and livestock ownership as well as limited access to off-farm employment opportunities. There are considerable proportions of food insecure households in all sections of the diagram. For example, among those households who own less than or equal to three TLU, 86.1% of them are food insecure. Similarly, there are 92.1% of food insecure households among those who own less than or equal to one ox. This suggested that oxen and livestock ownership as well as access to off-farm employment opportunities were the three most important determinants of a household's vulnerability to food insecurity in the rural districts of Sayint.

Figure 7: The Percentage of Food Insecure Households, by Determinants of Food Insecurity



KEY
% of food insecure households

1	86.11 %
2	90.32 %
3	92.10 %
4	86.67 %
5	89.29 %
6	91.18 %
7	79.10 %

6.2.3 EXTERNAL VULNERABILITY TO FOOD INSECURITY

This dimension of vulnerability, however, refers to the risks, shocks and stresses to which an individual or household is subject (Chambers 1989). In this study, external vulnerability was examined by investigating household's perceptions of food deficit risks and major agricultural problems, as well as their responses in the last five years prior to the survey.

The findings indicate that a significant percentage of the respondents (64.8%) reported that they have faced food insecurity problems in the previous ten years. Given the causes of food insecurity as sources of risk of crop production, households were asked to identify causes of food insecurity, as they perceived them. Shortage of rainfall, a shortage of land, and use of traditional farm implements were reported as the major causes of food insecurity. Since vulnerability is location specific, the causes of food insecurity vary across agro-ecology. For example, in the highlands and the lowlands a shortage of rainfall was reportedly perceived as the major cause of food insecurity, while the use of traditional farm implements was found to be the major cause of food insecurity in the midlands.

Households were also faced with major agricultural problems during the last 5 years as sources of risk. Lack of adequate land, financial constraints, lack of oxen and a lack of farm implements were reportedly the major agricultural problems. As the result of these

problems, about 39.2% of households reported that they have been exposed to food shortage, 32% to poverty, and 15.2% to epidemics.

In addition, 31.8% and 35.2% of households, respectively, reported famine and poverty to be severe problems faced in the last five years. However, responses concerning severity and frequency of problems vary across agro-ecology. For example, among those households who reported famine as a frequently- occurring problem, about 50% were in the highlands, 34.3% in the lowlands and 15.6% in the midlands.

6.2.4 TEMPORAL DIMENSION OF VULNERABILITY TO FOOD INSECURITY

As the conventional definition of food security incorporates the concept of time together with secure access to enough food at all times, it has become predicable to draw a distinction between chronic and transitory food insecurity. On one hand, chronic food insecurity refers to a situation whereby a household is continuously unable to meet the food requirements of all its members. Transitory food insecurity occurs when a household faces a temporary decline in the security of its entitlement, and runs the risk of failing to meet the food requirements of its members in the short run (UNICEF 1992).

The rationale underlying transitory food insecurity is that it can be further divided into cyclical and temporary food insecurity. According to UNICEF (1992), while temporary food insecurity occurs for a limited time period due to unforeseen and unpredictable circumstances, cyclical (seasonal) food insecurity occurs as a result of a regular pattern in the periodicity of inadequate access to food.

The latter category of transitory food insecurity has mainly characterized drought-prone areas of Ethiopia. Similarly, sample households in Sayint Rural District have been suffering from recurrent seasonal food insecurity for the past ten years. During this period, some sample households felt severe food shortages, and more than 90% consumed less than or equal to two meals per day. Households were also asked whether their current food stocks were sufficient to meet their day-to-day food requirements. In response, 72.4% of the sample households responded that they had insufficient levels of current food stocks to meet the food needs of all household members.

Furthermore, a seasonal calendar was made during community group discussion in December 2008. Tables 29 and 30 represent the seasonal calendar regarding major

agricultural activities, off-farm labour opportunities and hungry seasons faced by the sample households. In particular, Table 29 represents a seasonal calendar for highland and midland agro-ecologies, which demonstrate similar seasonal patterns. This is because both sample agro-ecologies occupy a similar livelihood zone, which is the South Wollo *meher* (long rainy season) livelihood zone (SME LZ). As discussed in Chapter Three, the main economy of the SME livelihood zone is crop production supplemented by livestock rearing (sheep and cattle). This zone is also characterized by *meher* harvest season, and lasts from June to September.

In this livelihood zone, as illustrated by Table 29, the consumption year runs from November to October. There is one significant harvest, *meher*, which is planted using the long *kiremt* rains. The planting occurs in June and July, and harvesting extends from November to January. Livestock, particularly shoats (sheep and goats), are sold in big numbers in public holidays; New Year (Enkutatash) in September, Christmas (Gena) in December, Easter (Fasika) in April, and Idd Alfeter (Idd Aladha) in May and August, respectively.

Local agricultural labour is linked to the calendar of weeding and harvesting. Labour migrates from November to March, as well as from August to September. Households start to purchase food in May, at the time when households start to exhaust their own harvests and continue until the beginning of the main harvest. The productive safety net program is available in the study area between January and June (LIU 2007).

Table 29: Seasonal Calendar for the Highland and Midland Sample Areas

	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Seasons	Rainy season				Harvest season			Dry season				
Land preparation												
Wheat			Weeding			Harvest						
Teff			Weeding				Harvest					
Livestock sales (cattle)												
Livestock sales (shoats)												
Local labour												
Labour migration												
Food purchase												
Productive safety net												
Hungry season												

Source: Field survey December 2008

Above all other agricultural activities, land preparation (March to June) and weeding (July to September) are the most challenging and time-consuming activities in the study area. Agriculture is entirely dependent on *kiremt* rains that last from June to September. While maize is harvested green from September to October, the other two main food crops, sorghum and teff, are harvested in November. Shoats and cattle are sold on the market in December and January. Other types of livestock are sold throughout the year within specific periods. While shoats are sold around the major Christian festivals (New Year, Christmas and Easter), cattle are sold in the months when they are not utilized for agricultural activities. Even if migratory labour is not common, some people do travel to Tapi, Metema, Wollega and Humera in search of job opportunities. Local employment opportunities are available for a relatively longer periods starting from weeding in July to harvesting in November. The hunger season, and the period for the highest dependence on the market for food supply, lasts from September to October

Table 30: Seasonal calendar for the lowland sample area

	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Rainy seasons	Rainy season				Dry season				Short rain			dry
Land preparation												
Maize			weeding			harvest						
Teff			weeding			harvest						
Livestock sales (cattle)												
Livestock sales (shoats)												
Local labour												
Labour migration												
Food purchase												
PSNP												
Malaria												
Hungry season												

Source: Field survey December 2008

6.3 FOOD SECURITY STATUS OF HOUSEHOLDS

In order to determine the food security status of households, aggregate household calorie consumptions were computed (see appendix vii). Food security analysis is based on the minimum energy requirement i.e. 2100 kcal/person/day. Hence, households whose available per capita calories were found to be greater than their demand were regarded as food secure; on the other hand, those households who have been experiencing a calorie deficit during the last 12 months before the survey were regarded as food insecure.

The head count method of food insecurity analysis indicates that large percentage of households (75.2%) were found to be food insecure and they were not even capable of managing household food demand through a wide range of available coping strategies. In food security research, it is a conventional practice to categorize a household's food security status into chronically food insecure (less than six months food secure), potentially food insecure (more than six and less than 12 months food secure) and year round food secure (12 months and more food secure) (Lovendal 2006).

According to Lovendal's criterion, Table 31 shows the percentage of sample households that fall under each category of food security status.

Table 31: Food security status of sample households (in percent)

Food security status	Agro ecology			All households
	Highland	Lowland	Midland	
Chronic food insecure	52	22	21	30
Potentially food insecure	28	57	46	45
Year round food secure	20	22	32	25

Source: Survey data, December 2008

The sample households have experienced severe food insecurity problems. A large percentage (75.2%) are chronically or potentially food insecure. However, food security conditions vary across agro-ecology. More than half of the highland households were found to be chronically food insecure and were not able to meet household food needs for more than 50% of the time in a year. However, the number of potentially food insecure households is higher in the lowlands and the midlands than in the highlands. There are more food secure households in the midlands (32.1%) than its counterparts (See Table 31).

The highlands were also found to be more vulnerable to food insecurity due to poor internal resource endowments and access to external assistance.

In order to explain the more detailed aspects of food insecurity at household level, Table 32 represents the incidence, depth, and severity of food insecurity among sampled households. Incidence of food insecurity refers to the proportion of food insecure households in the study area. Table 32 indicates that there is high incidence of food insecurity in the highlands; this is mainly because highland households have limited resource endowments. For example, significant determinants of food insecurity in the study area, such as oxen ownership, livestock ownership, and off-farm employment opportunities, are reportedly limited in the highlands.

However, incidences of food insecurity do not show how insecure the households are. Hence, the average number of calories consumed by the food insecure below the minimum energy requirement is used to explain the depth of food insecurity among food insecure households of the study area. The average depth of food insecurity is higher among highland households than among other agro ecology. This was indicated by a 60%, 38%, and 40% food insecurity gap, respectively, among highland, lowland, and midland households. (See Table 32). Although incidence of food insecurity was higher in the lowlands than in the midlands, there was a relatively lower depth of food insecurity in the lowlands than in the midlands. This is mainly because significant percentages of the lowland households (55.6%) are potentially food insecure. Furthermore, the depth of food insecurity is higher among households with small farm sizes and households with limited oxen and livestock ownership than among households of any category.

Table 32: Incidence, depth, and severity of food insecurity, by agro-ecology and socio-economic characteristics

Variables	Incidence of food insecurity	Depth of Food insecurity	Severity of food insecurity
Agro ecology	Percent		
Highland	80.00	0.60	0.41
Lowland	77.78	0.38	0.18
Midland	67.86	0.40	0.20
Farm land size			
Small (<=0.5 ha)	86.67	0.59	0.39
Medium (0.5 to 2 ha)	73.85	0.42	0.23
Large (>2 ha)	66.67	0.51	0.32
Oxen ownership			
<=1 ox	92.11	0.57	0.38
2 oxen	65.96	0.34	0.15
>2 oxen	0.00	0.00	0.00
Livestock ownership			
<=3 TLU	86.11	0.55	0.35
3 - 6 TLU	71.79	0.36	0.17
>6 TLU	57.14	0.48	0.30
Household size			
0 - 2	61.54	0.40	0.21
3 - 5	81.63	0.49	0.30
6 - 10	78.57	0.46	0.25
Share of expenditure on agri. Inputs (%)			
>=25 percent	81.67	0.47	0.27
25 - 50 percent	59.09	0.36	0.21
>=50 percent	66.67	0.67	0.52
Access to off/non*-farm activities			
Yes	61.90	0.50	0.30
Yes*	67.86	0.41	0.19
No	79.10	0.45	0.26
No*	78.33	0.48	0.30

By squaring the food insecurity gap, more weight was given to the food insecure households that fall well below the food insecurity line (2100 kcal/person/day). The squared food insecurity gap, therefore, refers to the severity of food insecurity among the food insecure households. As shown in Table 32, severity of food insecurity is higher among highland households and small farm holders, oxen and livestock holders. However, the findings indicate that higher level of incidence of food insecurity is not necessarily related to higher depth and severity of food insecurity.

6.4 HOUSEHOLD'S LIVELIHOODS AND FOOD SECURITY STATUS

Research carried out in the late 1980s and early 1990s indicated that food security is but one subset of objectives for vulnerable households; food is only one of a whole range of factors that determine the decision-making and risk-spreading behaviours of vulnerable rural households. People may choose to go hungry to preserve their assets and future livelihoods. It is misleading to treat food security as a fundamental need, independent of wider livelihood considerations (Berthe et al., 2005). The following section compares a household's food security status along with vulnerability/fragility of livelihoods in order to understand how different livelihood portfolios affect food security at household levels.

According to Scoones (1998) "A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks maintain or enhance its capabilities and assets, while not undermining the natural resource base." Given this definition of a livelihood, the sustainable livelihoods framework (e.g. Chambers & Conway 1991; Scoones 1998) attempts to provide a broad analytic framework for household livelihood strategies within which both the dimension of external threat and internal resilience and capacity for coping can be understood. On the other hand, as discussed in Chapter Two, the definition of food security underlines the importance of addressing vulnerability and the centrality of secure and sustainable livelihoods to underpin food security (Hussein 2002).

Therefore, in this study, ensuring food security is considered to be one part of the broader livelihood strategies employed by a household. Hence, a multi-livelihoods criterion ranking method is employed to understand the vulnerability/fragility of livelihoods and their ability to ensure food security. The multi-livelihoods criterion ranking table (see Appendix

VI) comprises of a set of 16 relevant livelihood portfolios pertinent to food security. These can be grouped into five asset components of the sustainable livelihoods framework. These are: human capital (education status of household heads and household labour); physical capital (farmland, oxen and livestock ownership, and total cereal production); financial capital (total income and expenditure on agricultural inputs); social capital (transfers/remittances); and natural capital (fertility and slope of farmland). Moreover, the livelihoods ranking table incorporates the role of institutional structures and processes which influence a household's food and livelihood security. Hence, access to government assistance to improve crop and livestock production, health, credit and a weekly market, as well as access to off-farm and non-farm employment opportunities, are considered key determinants of household livelihoods.

Table 33: Percentage of households by livelihood profile, and agro-ecology

Livelihood profile	Agro ecology			All households
	Highland	Lowland	Midland	
More fragile	40	8.3	3.6	15.7
Fragile	32	58.3	64.3	52.8
Less fragile	28	33.3	32.1	31.5

Source: Survey December 2008

Note: All the percentages are column percentages.

Table 33 represents the livelihood profiles of the sample households in all agro ecologies. The table indicates that there are more households with more fragile livelihoods in the highlands than in the lowlands and the midlands. In addition, the percentage of households with less fragile livelihood is lower in the highlands. Hence, the findings indicate that the relative vulnerability/fragility of household livelihoods have considerably determined the food security conditions of the households. For example, the following table depicts the relationship between household livelihood profile and food security status. Table 34 illustrates this by indicating that a large percentage of households (78.6%) who have a more fragile livelihood profile are chronically food insecure. Similarly, 57.1% of households with less fragile livelihoods are found to be food secure. Therefore, the more fragile the household's livelihood, the more food insecure the household will be.

Table 34: Percentage of households by livelihood profile and food security status

Food security status	Livelihood profile		
	More fragile	Fragile	Less fragile
Chronically food insecure	78.57	31.91	3.57
Potentially food insecure	14.29	57.45	39.29
Food secure	7.14	10.64	57.14

Source: survey December 2008

Note: all the percentages are column percentages.

In order to test the degree of association between a household's food security status and livelihood profile, a chi-square test statistic was used to determine the significant difference between the two variables. According to the test statistics, the value of Pearson Chi-squared, degree of freedom, and p-value were found to be 39.58, 4, and 0.00. Hence, at 0.05 level of significance, it is possible to conclude that household's food security status and livelihood profile are significantly associated, and even at statistically highly significant levels of rejection (p=0.001), food security status and livelihood profile are associated.

6.5 APPLICATION OF THE LIVELIHOOD FRAMEWORK

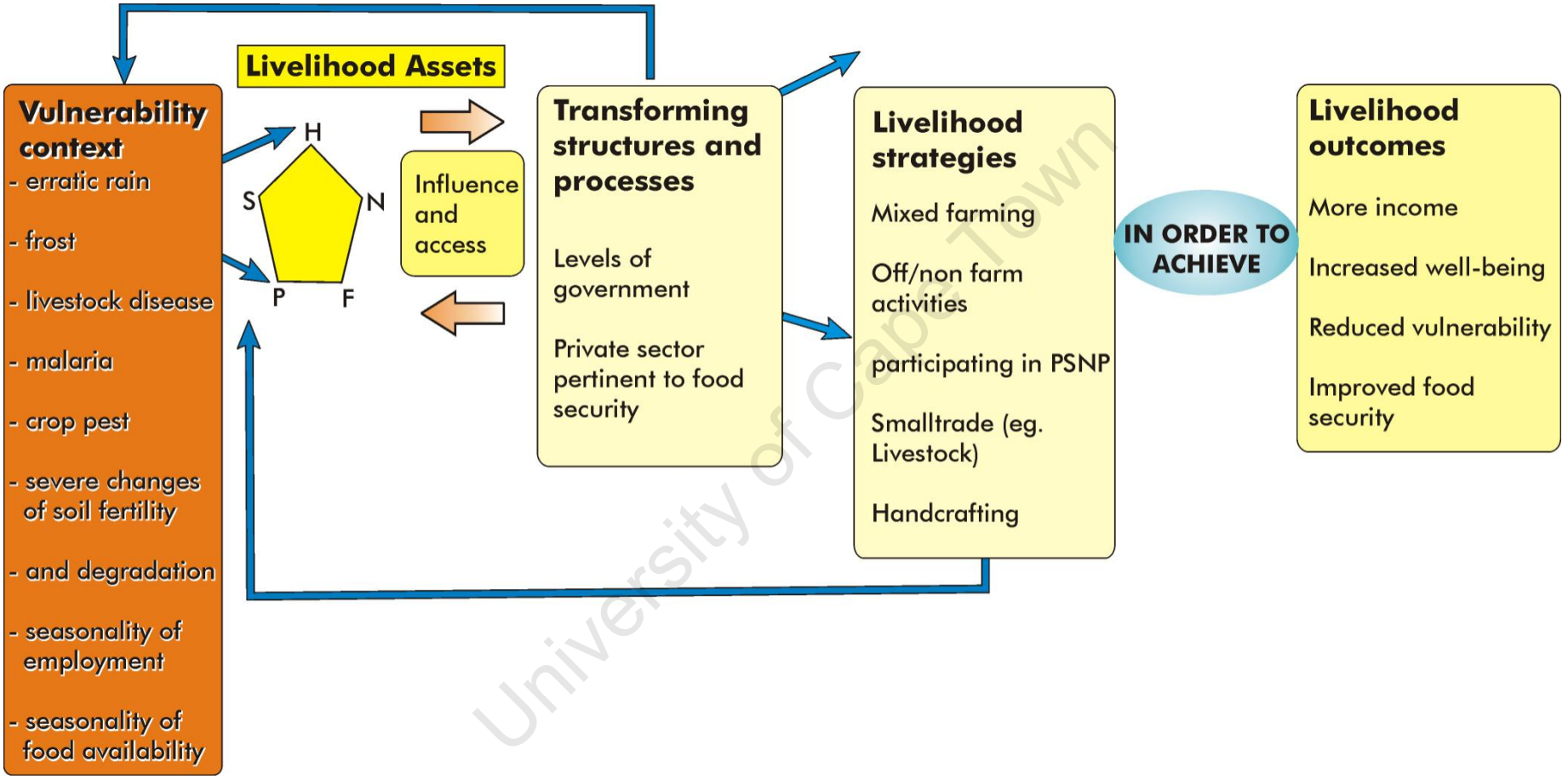
Research carried out in the late 1980s and early 1990s indicated that food security is but one subset of objectives of vulnerable households. Food is only one of a whole range of factors that determine the decision-making and risk spreading behaviour of vulnerable rural households. People may choose to go hungry to preserve their assets and future livelihood. It is misleading to treat food security as a fundamental need; independent of wider livelihood considerations (Berthe et al., 2005).

As discussed in Chapter Two, the working definition of food security is closely linked to livelihoods concepts. Livelihoods approaches, therefore, provide a practical tool to tie together the concepts of food insecurity, hunger and poverty - providing the link between a multidimensional and people-centered view of poverty with an analytical framework based on people's strategies, assets and capacities (Hussein 2002).

This analytical framework informs data collection and analysis methods related to vulnerability and food security conditions of drought prone areas of Sayint rural district. In

light of the framework, the following figure depicts the vulnerability context, assets, livelihood strategies and outcomes in the area under study.

Figure 8: Sustainable Livelihoods Framework as Applied to the Study Area (Sayint)



Source: Adapted from DFID 2002

- **VULNERABILITY CONTEXT**

The vulnerability context frames the external environment in which people exist. People's livelihoods and the wider availability of assets are fundamentally affected by critical ***trends*** as well as by ***shocks*** and ***seasonality*** over which they have limited or no control. In this study, the vulnerability context varied across agro-ecology. For example, in the lowland, ***shocks*** such as erratic rains, crop pests, livestock disease (Anthrax and Black Legs), Malaria (endemic and highly prevalent especially in September and October, the months immediately after the rainy seasons), and weeds are major problems that have an adverse effect on the health and agricultural activities of households.

However, the highland and midland agro-ecological zones, which both belong to South Wollo Meher Livelihood Zone (SME LZ), have faced major shocks such as frost (especially in the highlands), erratic rain, hailstorm, and livestock disease.

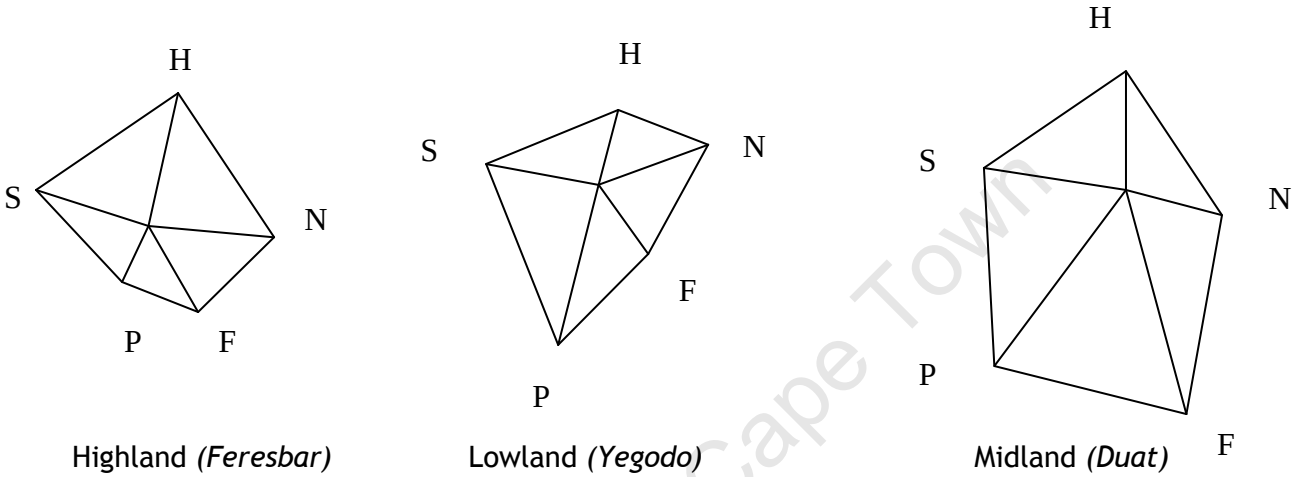
In terms of ***trends***, continuous changes of soil fertility, land degradation, and decline of crop production are recurring problems in the study area. For example, 60.7% of the sample households have perceived changes of soil fertility as medium and severe declines in the last ten years. Furthermore the ***seasonality*** of off/non farm employment opportunities (available during weeding and harvesting months only), food availability (September and October are hungry months before the harvest season), and price fluctuations are most enduring sources of hardship for the sample households.

- **LIVELIHOOD ASSETS**

People require a range of assets to achieve their self-defined goals, and no single capital endowment is sufficient to yield the desired outcomes on its own (Kollmair and Juli 2001). Since the importance of assets varies in association to the local context, Figure 9 below represents the shapes of the asset pentagons in the three agro-ecological zones. The shape of the pentagon can be used to show schematically the variation in people's access to assets. The idea is that the centre point of the pentagon, where the lines meet, represents zero access to assets while the outer perimeter represents maximum access to assets (DFID 1999). On this basis, different shaped pentagons can be drawn for three research sites of the study area. Human capital (H) represents the percentage of households who had gone beyond primary education; Natural capital (N) represents the availability of rivers and other water bodies; Financial capital (F) represents a household's

annual average income; Physical capital (P) represents level of oxen ownership; and Social capital (S) represents assistance from relatives. According to the asset pentagons shown below, the midland households had the most extended access to assets and particularly to physical and financial capitals. Despite the highland households having access to extended human capital, they had a generally less robust asset pentagon than midland and lowland households.

Figure 9: The Shape of Asset Pentagon for the three Research Sites



Highland *(Feresbar)* Lowland *(Yegodo)* Midland *(Duat)*

These forms of capitals can be stored, accumulated, exchanged or depleted, and this section describes the types of assets and their associated risks.

Human capital – this refers to the skills, knowledge, and ability to perform labour and the good health vital to the ability to pursue different livelihood strategies (DFID 1999). The role of this form of capital, in the study area, is considerably undermined by lack of health posts, lack of health related programs and poor education services. The health service coverage in the district is very limited. There are 17 health posts and 2 health centers in the entire district. In general, the health service in the district is of low quality and inadequate. The major diseases in the study area which undermine the role of this form of capital are respiratory diseases, skin rash, malaria, intestinal parasites and sexually transmitted diseases including HIV/AIDS (District health office report 2007). On the other hand, According to Education Office report 2007, there are 78 primary schools and 1 secondary school in the district. On average, one teacher is for 55 students, and average class-student ratio and student-books ratio are 1:55 and 1:5 respectively. Educational attainment of households can affect the significance of this form of capital. The survey result indicated that over half of sample household heads have never gone to

school and about 20 percent of sample household heads have gone above primary education.

Physical capital — this refers to the basic infrastructure (transport, shelter, water, energy and communications) and the production equipment and means that enable people to pursue livelihoods (DFID 1999). This form of capital is very limited in the study area; poor physical infrastructure and the remote location of the study area are the major factors that restrict trade with neighbouring districts as well as between different markets within the district. There are only 385 km of all-weather roads, which accounts 20 % of the total road coverage of the district. There is no banking service in the district so that people must travel to Dessie, capital of South Wollo zone, 189 km away. The most important physical capital, farm land appears to be small, degraded and fragmented resulting in low productivity over time. Approximately, 75 percent of sample households had holding sizes of less than 1.92 ha with average 2.35 numbers of plots. Furthermore, sample households had limited oxen and livestock ownership. For example, the research findings indicated that the per capita tropical livestock unit for sample households was 0.62 and on average households owned 1.47 numbers of oxen. This indicates significantly constrained livestock ownership and shortage of oxen in the study area.

Financial or economic capital — according to DFID (1999), this form of capital refers to the financial resources which are available to people (whether savings, supplies of credit or regular remittances or pensions), and which can provide them with different livelihood options. This form of capital can be explained by a household's access to credit services and off/non-farm employment opportunities, which are important supplementary sources of income to use as a buffer against shocks and stresses. This form of capital is also limited in the study area. For example, the survey data reveals that 35.6% of sample households had no access to credit services and more than 90% of households did not receive any financial assistance from relatives in the past 12 months before the survey. In addition, the findings indicated that 76.1% and 68.2% of households had no off-farm and non-farm income generating activities, respectively.

Social capital — this refers to the social resources (networks, membership of groups, relationships of trust, access to wider institutions of society) upon which people draw in pursuit of livelihoods (DFID 1999). It was evident during the community group discussion that households in the study area help each other in times of severe food shortage. In

addition, there were some reciprocal arrangements such as ox pairing with others, exchanging labor for oxen, and leasing land for crop sharing.

Natural capital — this refers to the natural resource stocks from which resource flows useful for livelihoods are derived (e.g. land, water, wild life, biodiversity, environmental resources) (DFID 1999). The district is endowed with many perennial springs, rivers and seasonal streams. There are five main rivers called Gunda, Chilaga, Gedami, Tela, and Betemuja. According to the District Rural Development and Agricultural Office, there are 1549 spring water and two pond water sources, which are available for water supply in the district.A significant percentage of the land (28.5%) in the study area is non-productive, however. In addition, bushes and forests cover a large percentage of land (33.4%). About 13.7% of the land is used for livestock grazing.

- **POLICIES, INSTITUTIONS, AND PROCESSES**

The institutions and policies of the transforming structures and processes have a profound influence on access to assets (DFID 1999). The process of land redistribution and current land tenure system resulted in limited ownership of land in Ethiopia in general and the study area in particular. Several studies have indicated that given the absence of any contractual or lease agreement with the government and the general belief that land redistribution will take place at any time, tenure insecurity is often high. This often results in minimal incentives to invest in land improvement. For example, in the study area farmland appears to be small, degraded and fragmented resulting in low productivity over time. About 75 percent of sample households operated holding size of less than 1.92 ha. Such small farms are fragmented on average into 2.35 plots. Furthermore, poor institutional services and credit availability limit access to various forms of capital. For example, 17.2% of households had no access to credit due to high interest rates.

- **LIVELIHOOD STRATEGIES AND OUTCOMES**

Households with more assets tend to have a greater range of options and the ability to switch between multiple strategies to secure their livelihoods (DFID 1999). In order to meet food needs, the sample households pursue a range of strategies. These were farming (crop and livestock), off/non-farm activities, small trade (livestock sale), handcrafting, and participating in Productive Safety Net Programmes (PSNP). Given that food security is a fundamental livelihood outcome in the context of agricultural communities,

considerable percentages (75.3%) of the households remain food insecure and 30.3% are chronically food insecure; the remaining 44.9% are potentially food insecure. However, the livelihood outcomes also varied across agro-ecological zones due to the different vulnerability contexts and level of access to assets. . Eighty percent of highland households, 77.8% of lowland households, and 67.9% percent of midland households were found to be food insecure. The percentage of chronically food insecure households was highest among highlands households, at 52%.

6.6 SUMMARY

The analysis of vulnerability to food insecurity requires a thorough understanding of detailed dimensions of food security and vulnerability. This study covers internal and external dimensions of vulnerability to food insecurity as well as the temporal aspects. Internal vulnerability is examined by investigating demographic and socio-economic conditions of households that could possibly influence either household's food availability or accessibility. Whereas external vulnerability is examined by investigating household's perceptions of food deficit risks and major agricultural problems. In addition, since vulnerability and food security status of household's vary over time, it is essential to capture the seasonality of agricultural production and other livelihood activities. Therefore, to explain detailed aspects of vulnerability to food insecurity, several analytic tools such as head count method, food insecurity gap measurements and multi-livelihoods criterion were employed.

In this study, Sustainable livelihoods framework was also applied to explain and analyse issues related to vulnerability and food insecurity, particularly nuanced aspects of food security. Despite the fact that the sustainable livelihoods framework was not limiting by itself, it required a number of analytical tools for best use. The framework was found to be robust enough to explain the households' vulnerability to food insecurity in the areas under study, however.

CHAPTER 7: DISCUSSION AND CONCLUSION

7.1 INTRODUCTION

This chapter discusses and provides implications of the study findings and their convergence and divergence with past food security studies. It also suggests critiques of the robustness of the sustainable livelihoods framework and future directions for food security research and rural development programmes in Ethiopia. The chapter concludes by providing a brief overview of the findings of the study.

7.2 IMPLICATIONS OF STUDY FINDINGS: CONVERGENCE AND DIVERGENCE WITH PAST STUDIES

The objective of this study is to identify and compare the determinants of vulnerability to food insecurity among the households of the different agro-ecologies. Although the findings of the study are consistent with existing literature in terms of the major determinants of food insecurity, the study differs in terms of the methodology used and the vulnerability context considered. This study identifies and compares determinants of food insecurity based on levels of vulnerability, livelihood fragility, and the incidence, depth, and severity of food insecurity contexts. The following sections discuss the convergence and divergence of the study findings with previous studies of food security.

7.2.1 FOCUS ON STUDY FINDINGS

A number of studies identify determinants of food security in different parts of Ethiopia. For example, Shiferaw et al. (2003); Yared, et al. (1999); and Webb, et al. (1992) have identified ownership of livestock, farmland size, family labour, farm implements, employment opportunities, market access, levels of technology application, and levels of education, health, weather conditions, crop diseases, rainfall, oxen ownership, and family size as major determinants of food security. The results of the survey are consistent with the findings of the literature regarding the major determinants of food security. However, none of the studies employed the sustainable livelihoods framework and food insecurity gap measurements to identify and determine the significance of food insecurity determinants. Food insecurity gap measurements are useful as they capture detailed aspects of food insecurity. Thus, unlike in past studies, it has been possible to determine

the relative importance of the determinants among the varied incidences, depths and severity of food insecurity contexts.

Despite the relative importance of the determinants that vary across agro-ecological zones, oxen ownership, livestock ownership and access to off-farm employment opportunities were found to be the most significant determinants of the households' vulnerability to food insecurity. However, this vulnerability should be examined over time to capture the causal factors of food insecurity. This suggests that the significance of food insecurity determinants largely depends on the nature of livelihoods and vulnerability contexts.

7.2.2 FOCUS ON METHODOLOGY

The difference in results between this study and previous research is in part explained by both the vulnerability context and the methods used. With specific respect to the methods applied in this research, the sustainable livelihoods framework and food insecurity gap measurements were used to determine the major determinants of vulnerability to food insecurity. Thus, it was possible to determine the relative importance of the determinants among varied incidence, depth and severity of food insecurity contexts. This contrasts with previous studies, which used econometric models to identify and determine the significance of food insecurity determinants in Ethiopia. Econometric models tend to overlook the role of livelihood and vulnerability contexts. they give much emphasis to the variables (determinants of food insecurity) rather than the overlaps and dynamic nature of determinants of vulnerability to food insecurity. However, the sustainable livelihoods framework, associated with other food insecurity gap measurements, helps to capture the dynamic and holistic nature of vulnerability to food insecurity.

7.2.3 FOCUS ON LIVELIHOOD AND VULNERABILITY CONTEXT

A further source of difference between past studies on food insecurity in Ethiopia and this research is reflected in the differences in livelihood and vulnerability contexts. Vulnerability to food insecurity is often location-specific, so local vulnerability and livelihood contexts have considerably determined the type and significance of determinants of food insecurity. For example, in the highland, oxen ownership, access to off-farm employment opportunities, and level of education of household heads were found to be key determinants of vulnerability to food insecurity. However, in the lowlands, oxen

ownership and level of investment on agricultural inputs were the two significant factors that affect household's food security status. Furthermore, the findings indicate that higher level of incidence of food insecurity is not necessarily related to higher depth and severity of food insecurity. This is mainly because the depth and severity of household's food insecurity varied depending on the household's vulnerability and livelihood security conditions. Therefore, it should be noted that in food security research, local livelihood and vulnerability contexts should be examined overtime to capture detailed aspects of household food insecurity.

7.3 CRITIQUE OF ROBUSTNESS OF THE SUSTAINABLE LIVELIHOODS FRAMEWORK

Despite the fact that the framework was found to be robust enough to explain vulnerability to food insecurity, some limitations were observed during analysis of the findings. These limitations resulted from from the holistic nature of the framework and the complexity of vulnerability and food security concepts. First, the framework seeks to understand changing combinations of modes of livelihood in a dynamic and historical context where it requires a number of other analytical tools. For example, in conjunction with the framework, analyzing vulnerability to food insecurity requires analytical tools such as the total food insecurity gap and the squared food insecurity gap measurements, as well as the multi-livelihood ranking system and the vulnerability analysis. Second, it is extremely challenging to quantify the impacts of agricultural problems on different capital assets to affect food security status of households. Hence, the approach is best used in conjunction with other tools. Third, the concept of vulnerability to food insecurity requires a thorough understanding of household's asset ownership and associated risks over time. Therefore, a detailed trend analysis is required in order to capture the temporal dimensions of vulnerability and food insecurity. Finally, most livelihoods information is redundant, so it requires a careful categorization and aggregation of data.

Sustainable livelihoods framework is a conceptual framework for understanding how different elements interact to determine livelihoods outcomes. There is no single analytical method for assessments based on the livelihoods framework, and a range of tools can be used to collect the information required to do an analysis based on the framework (Save the Children 2007). These limitations were addressed in the study by including the analytical tools relevant to food insecurity, poverty, and vulnerability. Therefore, the sustainable livelihoods framework is not necessarily limiting; instead, it

must be used in conjunction with concepts drawn from other conceptual frameworks or fields of study.

7.4 FUTURE DIRECTION FOR FOOD SECURITY RESEARCH AND RURAL DEVELOPMENT PROGRAMMES

Based on the findings and concerns raised in the course of the study, this section provides future direction for further food security research and rural development programmes undertaken in the study area.

7.4.1 FOOD SECURITY RESEARCH

The major determinants of food insecurity that are identified in this study should be considered as a starting point in the search for a more comprehensive indicator of a household's vulnerability to food insecurity. Future research should certainly explore different variables in an attempt to capture the detailed dimensions of vulnerability to food insecurity. In addition, the use of different methods of aggregation should be further investigated in order to understand the dynamic and holistic nature of vulnerability to food insecurity. Future research, using the sustainable livelihoods framework, should also incorporate more absolute food security analytical tools to understand the role of key assets and livelihood strategies on livelihood outcomes. Furthermore, it should be noted that this study examined only current vulnerability to food insecurity across agro-ecological zones. Thus, since vulnerability can be thought of as a continuum, it is important that future research should consider examining a household's vulnerability to food insecurity over time.

7.4.2 RURAL DEVELOPMENT PROGRAM: POLICY IMPLICATION

The study highlights the six main areas of intervention for rural development programmes in the study area. These include:

- Improving agricultural production
- Promoting income diversification and creating income-generating opportunities
- Promoting irrigation
- Improving agricultural extension and social services
- Providing credit services and government support
- Promoting coordination between stakeholders

- **Improving agricultural production**

Efforts should be made to improve agricultural production. Since almost all of the households depend on agricultural production for household food consumption, crop diversification, the selection of an appropriate variety of crops (drought and disease resistant, early maturing, and high yielding), and the improvement of methods of cultivation should be primary objectives of rural development programmes.

- **Promoting income diversification and creating income-generating opportunities**

Promoting income diversification and creating income-generating opportunities should be critical areas of concern to mitigate household's vulnerability to food insecurity. In the context of smallholder subsistence farming, access to various sources of income has great deal of significance in times of shocks and stresses. Given the high frequency and severity of agricultural problems as a source of risk of food insecurity in the study area, access to supplementary sources of income is very essential to use as a buffer against food deficit risks and associated shocks and stresses. It is therefore important to make income-generating activities accessible to households in order to increase household's income and further widens their coping strategies.

- **Promoting irrigation**

Promoting irrigation in the study area is critical to reduce the risk of unviable, low return, rain-fed agriculture. There are rivers and small streams in the study area suitable for irrigation. Therefore, great attention should be given in this respect to augment agricultural production and further improve food security conditions of households in the study area.

- **Improving agricultural extension and social services**

Improving agricultural extension and social services is also critical areas to mitigate household's vulnerability to food insecurity in the study area. Appropriate extension services have to be expanded and farmers in the study area should be introduced to

improved seeds and farm implements. Particular emphasis should also be given to market extension and social services (the improvement of schools, clinics, road transport, and marketing and distribution facilities) to positively affect the food security conditions of households in the study area.

- **Providing credit services and government support**

Credit services and government support are necessary conditions in order to improve farming practices, i.e. the use of improved seeds, fertilizers, pesticides and farm implements. Therefore, there should be appropriate government support and credit institutions that are based on the contexts of local situations and the interests of the community to improve household's food security in the study area. Furthermore, the price for agricultural inputs is often not affordable for the poorer households; therefore, there should be government support in subsidizing agricultural inputs.

- **Promoting coordination between stakeholders**

Above all, promoting coordination between stakeholders is both a necessary and sufficient condition to take households out of the vicious circle of poverty and food insecurity. A household's vulnerability to food insecurity is not only a failure of the agricultural sector. It is the consequence of the complex interaction of biophysical and socioeconomic factors. Therefore, solid integration and coordination between the agricultural sector and other sectors of the economy central to rural development should be made. In general, well-coordinated stakeholders with holistic and forward-looking approaches, in dealing with the problem of food insecurity, can mitigate a household's vulnerability to food insecurity in the rural district of Sayint.

7.5 CONCLUSION

The objective of this study was to identify and compare the determinants of vulnerability to food insecurity among households of different agro-ecologies. The key determinants of a household's vulnerability to food insecurity include farm size, land fertility, household size, level of investment on agricultural inputs, oxen and livestock ownership, and access to off/non-farm employment opportunities. However, the relative significance of determinants varies across agro-ecology. For example, in the highlands, oxen ownership, access to off-farm employment opportunities, and level of education of household heads are found to be key determinants. In the lowlands, oxen ownership and level of investment on agricultural inputs are the two significant factors. There is no one significant factor that will determine a household's vulnerability to food insecurity in the midlands, but land fertility, livestock ownership, and level of investment on agricultural inputs have relatively determined a household's vulnerability to food insecurity. Given major agricultural problems such as lack of adequate land, financial constraints, a lack of oxen and a lack of farm implements, highland households are found to be the most vulnerable to food insecurity. This is mainly because they have limited internal resource endowments and external assistance.

Food security analysis based on the internationally accepted minimum calorie consumption at household level indicates that majority of the households (75.3%) are food insecure. Incidence of food insecurity varies across agro-ecology, and large percentages of highland households (80%) are found to be food insecure. Similarly, there are more chronically food insecure households (52%), who consume less than 50% of total calorie requirements in the highlands than in the lowlands (22.2%) and in the midlands (21.4%).

Based on total food insecurity gap and squared food insecurity gap measurements, both depth and severity of food insecurity are highest among highland households; the severity is twice as much as it is among lowland and midland households. Furthermore, average incidence and the depth and severity of food insecurity are higher among households with small farm sizes and limited oxen and livestock ownership than any other category. In addition, the findings indicate that a higher level of incidence of food insecurity is not necessarily related to a higher depth and severity of food insecurity.

A multi livelihoods criterion-ranking table was made to explain the vulnerability and fragility of the households' livelihoods in relation to their food security status. According

to the multi livelihoods criterion ranking result, considerable percentages of highland households (40%) have more fragile livelihood profiles. The findings also indicate that the level of vulnerability/fragility of the household livelihoods has considerably determined the food security conditions of households in the study area. A large percentage of households (78.6%) that have a more fragile livelihood profile are chronically food insecure. Similarly, 57.1% of households with less fragile livelihoods are found to be food secure. Therefore, the more fragile household's livelihood, the more food insecure the household will be.

The Sustainable Livelihoods Framework was found to be robust enough to explain a household's vulnerability to food insecurity in the area under study. However, some limitations were observed during analysis that emanated from the holistic nature of the framework and the complex concepts of vulnerability and food insecurity. Although the framework was not limiting by itself, it requires a range of analytical tools to capture different dimensions of vulnerability and food insecurity.

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Appendix I: Household Survey Questionnaire

A. General Information

1. Please tell us information about each and every person in this household

Name	sex	Age	Language	Relationship with head of household	Education (years of school Completed)	Marital status	Contribution to the household
				Head of household			

Contribution: 0=dependent, 1= student (in school), 2=watch after animals, 3=housewife, 4=farming, 5=hired labourer, 6=off-farm activity

Relation to household head: 1=wife, 2=child, 3=grandchild, 4=brother, 5=sister, 6=hired labour, 7=other, specify----------

Marital Status: 1=Single, 2=Married, 3=widowed, 4=Divorced

B. Land resources and means of farming

1. Does your household (or any member of your household) own any land?

   Yes ☐ No ☐

2. If yes, what is the total size of your land holding? Please give details (in timad)

owned	Rented out	Rented in/share cropped	Given out	Received as a loan, gift	Total amount

3. Do you cultivate your entire holding?

   ☐ Yes

   ☐ No

4. If no, what is the total size of your cultivated land this past year?

	timad

5. How do you use the other part of your holding?

For grazing (timad)	For fallow land (timad)	Other (specify)

6. How did you obtain the land?

   ☐ Through inheritance

   ☐ During land reform

   ☐ During redistribution

- Other (specify)……..

7. Is your landholding all in one parcel?

   - Yes
   - No

8. If no, how many plots do you have and what is the size, fertility and slope of each plot?

   Number of plots…….

	Size (timad)	Fertility (lem, lem-teuf, teuf	Slope(medda, dagthama, geddel
Plot 1			
Plot 2			
Plot 3			
Plot 4			

9. Do you practice crop rotation on your main plot?

   - Yes
   - No

10. How do you view the level of erosion on your main plot since you started farming?

    - Very severe
    - Severe
    - Minor
    - No problem
    - Not certain

11. Have you observed a decrease in soil depth?

    - Yes
    - No

12. If yes what is the extent of stoniness on your main plot?

    - Very high
    - High
    - Average
    - Few
    - None
    - Not certain

13. How do you view the changes in soil fertility on your farm main plot, since you started farming?

    - Very severe decline
    - Severe decline

- Medium
- Minor decline
- No problem
- Improved fertility
- No certain
- NA

14. Have you ever received advice/assistance on how to prevent soil erosion?
    - Yes
    - No
15. Did you face water logging on your land?
    - Yes
    - No
16. Does the household have access to grazing land?
    - Yes
    - No
17. If yes, where is your main grazing area?
    - On highland slope
    - In a valley
    - On a plateau
    - In and around crop lands
    - Other (specify)……..
18. Is the grazing area:
    - Your own plot
    - Owned by PA
    - Other (specify)……..
19. Do you face shortage of grazing land?
    - Yes
    - No
20. If yes, during which season?
    - Rainy season
    - Dry season

- Both rainy and dry season

21. How do you plough your plots?
    - Using my own oxen
    - Using ox pairing with other(s)
    - Using human labour
    - Exchanging labour for oxen
    - Leasing land for crop sharing
    - Other (specify)----------

C. Sources of food and income and expenditures

1. **What is the main source of food to your household? (put in order of relative contribution to the household food needs)**

Sources of food	X
own crop production	
own livestock products	
purchase or exchange	
Relief, gifts and loans	
Wild foods, fish and game	
Payment in food/food for work	

10 how much was produced in the last harvest?

Types of crops	Quantity in kg.	Consumed (kg)	Sold out (kg)	Given away (kg)
Sorghum				
Teff				
Pulses				
Maize				
Honey				
Horse beans				
lentils				
Wheat				

11 How many shoats, cattle and other livestock do you own?

Livestock type	Number owned	If sold, how much did you receive from the sale? BIRR	Remark
Bulls/oxen			
Young bulls			
Cows			
Sheep			
Goats			
Horses			
Camels			
Donkeys/mules			
Chicken			

12. What is your main source of income?

Income sources	Sales in ETH *birr*	Remark
Crop sales		
Livestock sales		
Livestock prod. Sales		
Sale of Labour		
Remittances		
Self-employment		

Small business and trade		
Other (eg. Prod. safety nets)		

13 Expenditure

Expenditure item	ETH *birr*	Remark
Staple food		
Non-staple food		
Household items		
Water		
Inputs		
Clothes		
Tax		
Gifts		
Social services		
Other		

D. Non/off farm incomes and household assets

1. Do you own the following assets?

Asset	X	Asset	X
Hoe (doma)		Plough (maresha)	
Hammer (martelo)		Saw (megaz)	
Weaving equipment		Saddle (korcha)	
Spring bed		Table	
Chairs		Radio	
Wrist watch		Kerosine stove	
Fanos		Gold/jewelry	
Gun			

2. Is your house characterised by:

   - ☐ Tin roof
   - ☐ Hidmo
   - ☐ Thatched
   - ☐ Tent
   - ☐ Other (specify) ----------

3. During the last 12 months, did you or any other members of the household work out of the household's land either on some one else's land or in some other agriculture related activity, against payment in cash or in kind?

   Yes ☐ no ☐

4. If yes, where was the work done?

   - ☐ In the village/PA
   - ☐ Other village/PA
   - ☐ This woreda
   - ☐ Neighbouring woreda
   - ☐ Town
   - ☐ Other (specify) ----------

5. **How much has the household earned from the activity?**

Amount in birr	
Amount in kind	

6. **Was the income from the activity used for:**

   - **Purchase of food grains**
   - **Purchase of clothes and other household items**
   - **Expenditure for children (schooling, health, etc.)**
   - **Payment of taxes, loans, iddirs, etc.**
   - **Saved**
   - **Purchase of ox/livestock**
   - **Other (specify) ----------**

7. **If no, to Question no. 3, is it because of:**

   - **No employment opportunities**
   - **Needed for own farm activity**
   - **Jobs too far away**
   - **Wages too low for kind of work**
   - **Other (specify) ----------**

8. **Have you or other members of your household been involved in any non agricultural activities in the last 12 months?**

   - **Yes**
   - **No**

9. **If yes, please give details:**

Activity	Household member responsible	How much has the household earned
		Amount in birr amount in kind
Weaving/spinning		
Milling		
Handicraft, incl. pottery		
Trade in grain/general trade		
Trade in livestock		
Trad. healer/religious teacher		
Transport (by pack animals)		
Sale of local drinks		
Other (specify)		

10. **Has the household received any other income (such as remittance, gifts or other transfers) in the last 12 months**

- **Yes**
- **No**

11. If yes, how much has the household received in the last 12 months

Amount in birr	
Amount in kind	

E. perception of Hazards and risks and coping strategies

1. What are the major problems that you face in the last 12 months?
   - Lack of farm implements
   - Lack of adequate land
   - No farm land at all
   - Labour constraints
   - Lack of time
   - Lack of credit facilities
   - Financial constraints
   - Lack of ox
   - Others, non agricultural (specify)……..
   - Others, agricultural (specify)……
2. What are the major undesirable consequences that your household has encountered in the last 5 years?
   - Famine
   - Epidemic/mortality
   - Forced migration/displacement
   - Insecurity
   - Exploitation
   - Conflict/violence
   - Poverty
   - No problem
   - Others (specify)…….
3. Of these, which is the most frequently occurring?.....
4. Of those major risks which ones are the most severe?.....
5. Did your household experience food insecurity/food shortage in the past 10 years?
   - Yes
   - No
6. If yes, when was that (were these)?.....
7. What do you think are the causes of that food shortage/insecurity in the household?
   - No enough rain (for major grains)
   - Too much rain
   - Insects/pests
   - Poor quality land
   - Land is too steep
   - Not enough land for households
   - Inappropriate land management practice
   - Use traditional farm implements
   - Market inaccessibility
   - Lack of fertilizers inputs (fertilizer, improved seed)
   - Others (specify)……
8. What do you think are the solutions for this problem of food insecurity?
   - Getting additional land
   - Changing the traditional land management
   - Availability of improved seeds, fertilizers

- Others (specify)……..

9. Here is a list of household coping strategy and food stress responses. Which of the strategies does the household use with increasing severity of the problem? (put in order of application by the household starting from the first coping strategy mentioned to the last)

Coping strategies	Frequency experienced in the last 10 years - Frequently - Rarely - Never	Was this used during the last 12 months? - Yes - no	When did you use this strategy? - When the problem starts - Around the middle - When it is severe
1. Reducing number of meals			
2. Reducing quantity of meals			
3. Eating toxic, taboo, foul tasting wild food			
4. Eating less preferred foods			
5. HH members seeking work within PA			
6. HH member seeking work outside PA			
7. Borrowing food/grain or cash to buy food			
8. Migration (to find work/food, etc.)			
9. Selling livestock			
10. Sale of productive assets (except livestock)			
11. Sale of personal household effects			
12. Sale of fire wood/dung/charcoal			
13. Participating in FFW/EGS program			
Skipping eating (not eating for whole day			
Withdrawing children from school			

14. Thinking of right now, how adequate or sufficient is the stock of food items in your household until the next harvest?
    - Sufficient
    - Insufficient
    - Out of stocks
    - Other (specify)……
15. If insufficient, how many more months will it last?
    - Number of months……..
16. In your opinion, is the current annual household income or production sufficient to make the family's needs meet?
    - Much
    - Too small
    - Barely sufficient
    - Sufficient
    - Other (specify)…….
17. If not sufficient, for how month is your annual household income or production sufficient to make the family's needs meet?
    - ……..months
18. Did your household member experience epidemics in the past 5 years?

- Yes
- No

19. What types of epidemic diseases were those?
    - Malaria
    - Diarrhea
    - Meningitis
    - Typhus fever
    - Measles
    - Hepatitis
    - Typhoid
    - Other, specify……..
20. What do you think are the causes of these epidemics?
    - Lack of safe drinking water
    - Poor sanitation
    - Lack of health facilities
    - Lack of knowledge to protect one self from diseases
    - Lack of disease control programs (eg. Malaria control program in the community)
    - Other, specify…….

F. Service provision

1. Has your household received any type of assistance to improve your crop or livestock production from any government or non-government organization in the last 5 years?
    - Yes
    - No
    - NA
2. What organization(s) provide the assistance for crop or livestock production?
    1. ……
    2. ……
    3. ……
3. What type of assistance have your household members received from these organizations?
    - Improved seeds
    - Fertilizer
    - Pesticide, herbicide
    - Animals, poultry
    - Farm equipment
    - Veterinary service
    - Agricultural/animal information/education
    - Other (specify)……
4. If you didn't receive, why not?
    - No need to take
    - No institute which provide such services

- Other (specify)……..

5. Has your household received any type of credit or loan to improve your crop or livestock production from any GO or NGO in the last five years?

   - Yes
   - No
   - NA

6. What organizations provide the creditor loan for the crop or livestock?

   a. ……

   b. ……

   c. ……

7. What type of credit or loan has your household members received from the organization?

   - Improved seeds
   - Fertilizer
   - Pesticide, herbicide
   - Animals, poultry
   - Farm equipment
   - Veterinary service
   - Other (specify)……

8. If you didn't receive, why not?

   - No need to take
   - No institute which provide such services
   - Other (specify)……

9. Has your household ever received any type of assistance or services to improve the health of household member or prevent/address epidemics from any GO or NGO in the last 5 years?

   - Yes
   - No
   - NA

10. What organization(s) provided the assistance to improve health or prevent epidemic?

    a. ……..

    b. ……..

    c. ……..

11. What type of assistance or services has your household received from the organization?

- Medical examination and treatment
- Vaccination/immunization
- Birth delivery assistance
- Medicines/drugs
- Health information/education
- Other (specify)……

12. Which schools does your village have for children?
    - Nursery school
    - Kindergarten
    - Primary school
    - Junior high school
13. Are your children attending school now?

Yes	No

If no why ----------

14. Is there any household member who dropout of school in the last 12 months?

Yes	No

If yes why----------

15. Does your village have healthcare institution?

Yes	No

16. What is the major material used for construction of walls of main dwelling unit?
    - Mud and wood
    - Wood and thatch
    - Stone and mud
    - Bamboo and thatch
    - Other (specify)……
17. Major material used for construction of the roof of main dwelling unit?
    - Thatch
    - Corrugated iron
    - Other (specify)……..
18. Are their any windows in the house?
    - Yes
    - no

19. What is mainly used to light the house at night?

- Electricity
- Propane gas
- Kerosene lamp
- Candles
- Firewood
- Other (specify)…….

20. What main types of fuel do you use for cooking purposes?

- Fire wood
- Leaves
- Dung
- Charcoal
- Electricity
- Gas
- Kerosene
- Other (specify)……

21. What is your main source of drinking water during the dry season?

- Piped
- Pumped
- Protected well
- Unprotected well
- Protected spring
- Unprotected spring
- Lake, river, pond
- Other (specify)……

22. How far is from your house to water source?.....

23. What type of toilet facilities does your household use regularly?

- None
- Pit latrine
- Flush
- Other (specify)……

G. vulnerability and household responses

Now we would like to ask you some questions about the household's drought and food shortage experience in the previous 10 or 15 years.

1. At the worst time of the most recent famine, how many meals did you eat each day?

	times

2. Did you eat wild foods collected from out in the fields at that time (not usually eaten in normal years such as roots, leaves, etc.
   - ☐ Yes
   - ☐ no
3. Did you sell any of your most valued possessions in the worst year (for example, jewellery, furniture, saddles, etc.)
   - ☐ Yes
   - ☐ no
4. Did you receive food aid during the most recent famine (not in feeding camp and not in food-for-work)?
   - ☐ Yes
   - ☐ No
5. Did any member of your household move to feeding camps during the most recent famine?
   - ☐ Yes
   - ☐ No
6. Has any member of your household died during the most recent famine?
   - ☐ Yes
   - ☐ No
7. Did any member of your household migrate to other places as a result of the most recent famine?
   - ☐ Yes ☐ No
8. If yes, where and for how long?

   Where……. For how long……..
9. Do you feel that for your household, there is more risk or less risk of famine in the future than there was 10 years ago?
   - ☐ More
   - ☐ Less
   - ☐ Same
10. Why/why not? Describe:

    ……
11. How did households with more children compare with households having less children in terms of coping?
    - ☐ Suffered more

- Suffered less
- Same

12. How many children below 10 years of age did you have during the most recent famine?

……..

13. Who suffered most in the household?

- Children
- Adult women
- Old people
- Adult men

14. Do you think families helped each other more or less during the worst famine period?

- Helped each other more
- Helped each other less
- Not at all

15. From your experience about drought and famine in the last 10 to 15 years, do you know now the early signs of drought and food shortages?

- Yes
- No

16. If yes, what are they?

……
……
……
…….

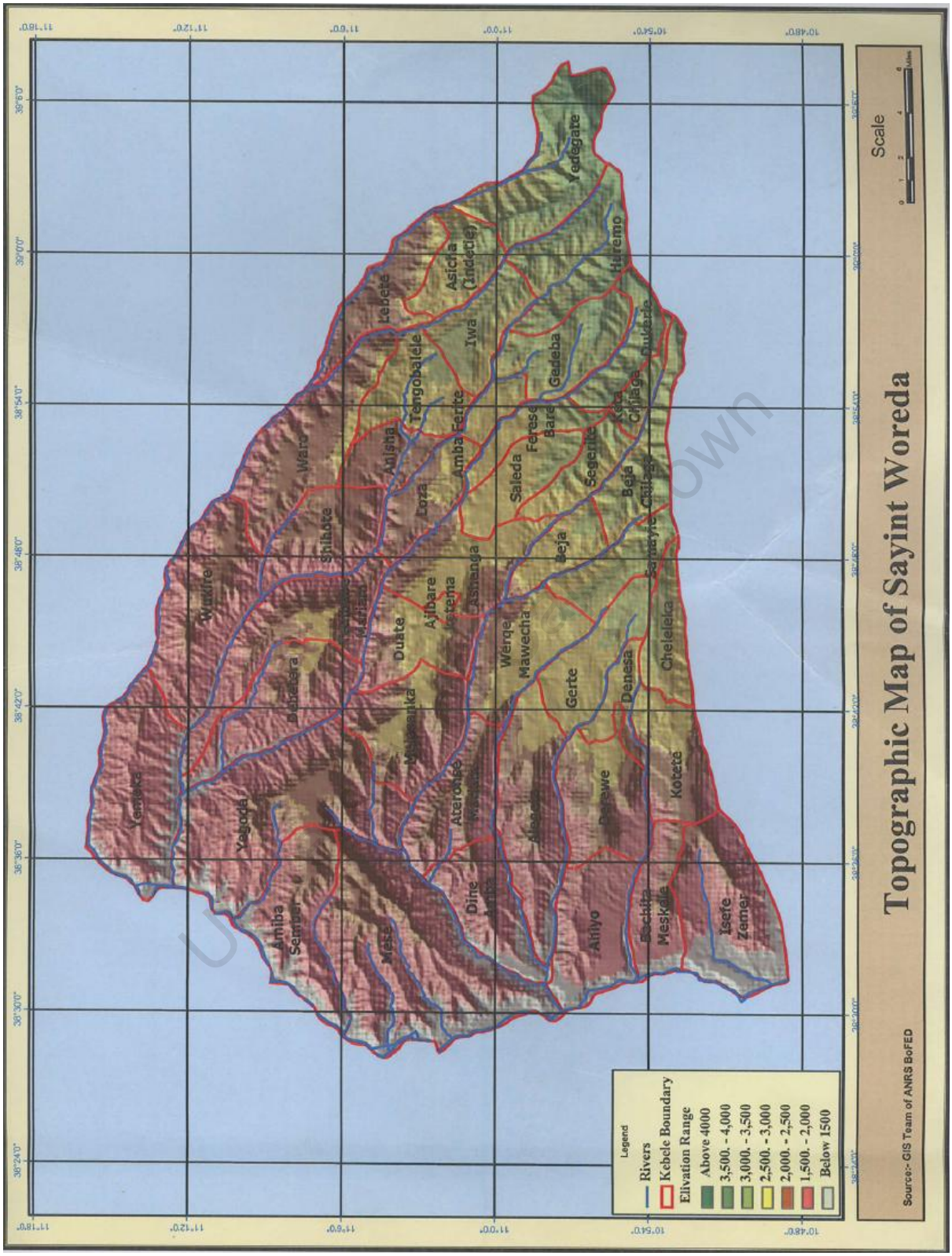
17. If you know drought and famine is ahead what preparatory steps do you take?

……
……
……
…….

18. What do you think are the causes of drought?

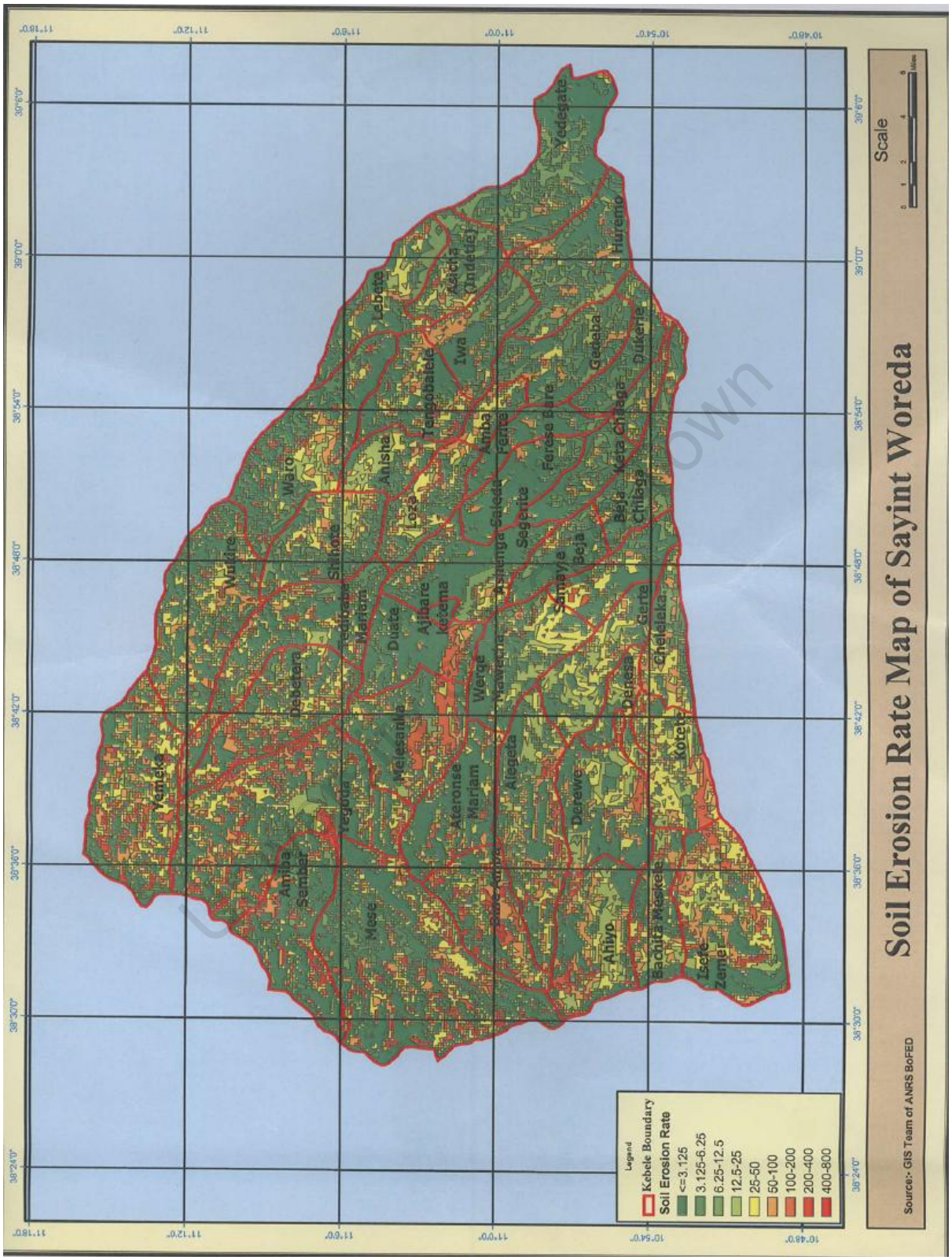
- Failure of rains
- Deforestation
- Soil erosion
- God's order
- Other (specify)……

Appendix II: Topographic Map of Sayint Woreda



Designed by Amhara region GIS team

Appendix III: Soil Erosion Rate Map of Sayint Woreda

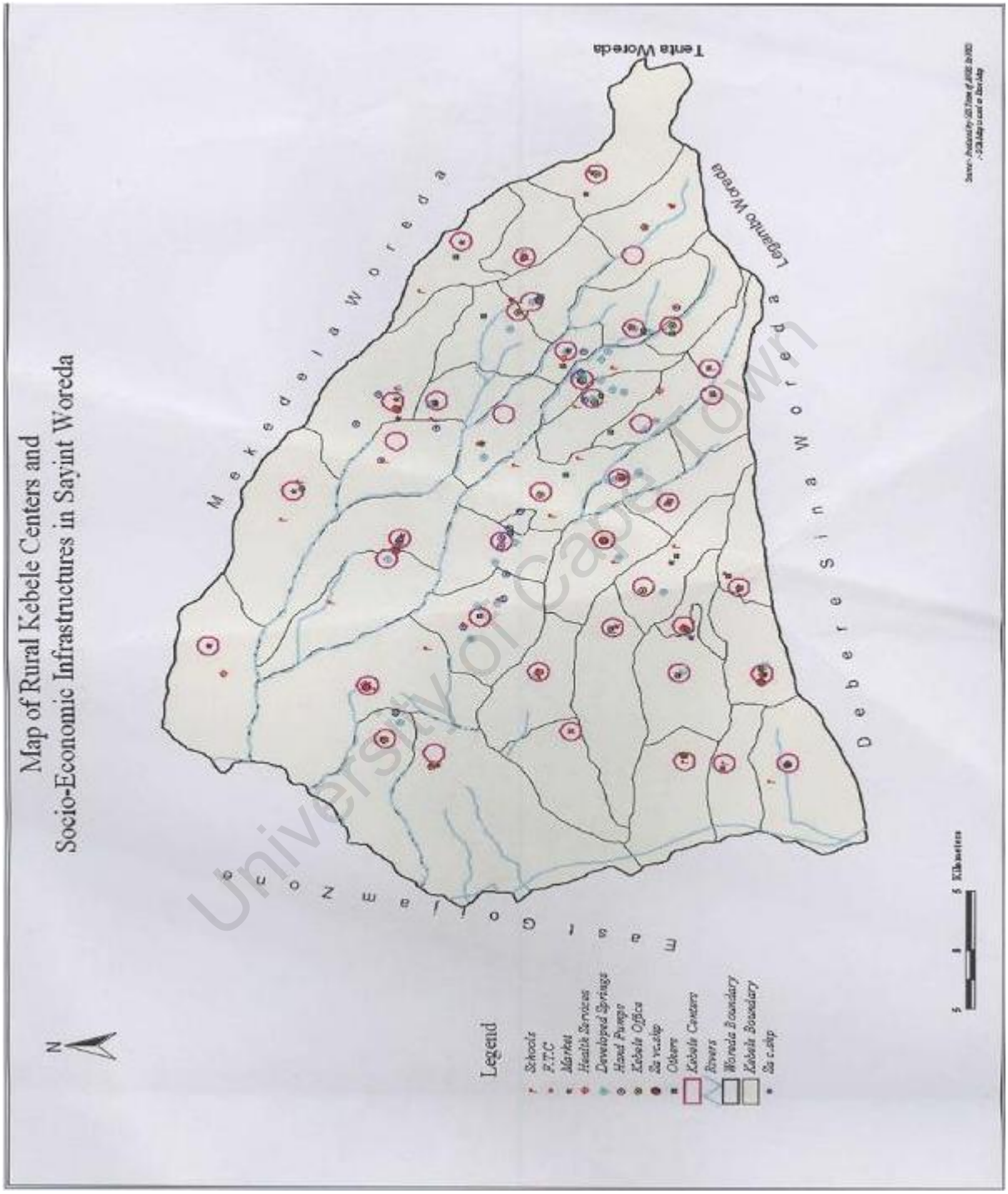


Designed by Amhara region GIS team

Appendix IV: Landuse/Landcover Map of Sayint Woreda

Designed by Amhara region GIS team

Appendix V: Map of rural Kebele Centres & Socio-Economic Infrastructures in Sayint Woreda



Designed by Amhara region GIS team

Appendix VI: Household's Multi Criteria Livelihood Profile Table

Agroe	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	R
Dega	1	0	0	0	1	0	0	0	0	1	1	1	1	0	1	1	8
Dega	1	1	0	1	2	1	1	0	0	1	1	1	1	1	0	1	13
Dega	1	1	1	1	2	0	0	1	0	1	1	0	1	1	1	1	14
Dega	1	1	1	0	2	0	1	1	0	1	1	1	1	0	1	1	15
Dega	1	1	1	2	2	0	0	0	0	1	0	1	1	0	1	2	14
Dega	2	1	1	1	2	0	1	0	1	1	1	1	1	0	1	1	17
Dega	1	0	0	0	2	0	0	0	0	1	1	1	1	0	0	2	9
Dega	0	1	0	0	2	0	0	0	0	1	1	1	1	0	1	0	8
Dega	0	1	0	0	2	0	0	0	0	0	1	0	1	0	0	1	6
Dega	1	0	1	1	1	1	0	0	0	1	0	1	1	0	1	2	12
Dega	2	1	1	1	2	2	1	0	0	0	0	1	1	0	1	2	17
Dega	1	0	0	0	2	0	0	0	0	0	1	1	1	0	1	1	8
Dega	1	0	1	1	2	0	0	0	0					0	0	0	7
Dega	1	1	1	2	2	1	1	0	0	1	1	1	0	0	1	1	14
Dega	1	1	0	2	1	2	0	0	0	1	1	1	1	0	1	2	14
Dega	0	1	0	1	2	0	0	0	0	0	1	0	1	1	1	1	10
Dega	0	1	0	0	1	0	0	0	0	1	1	1	1	0	1	1	8
Dega	1	0	1	1	2	0	1	1	0	1	1	1	1	1	1	2	16
Dega	1	0	2	2	2	1	0	0	0	1	1	1	1	0	1	2	17
Dega	0	0	0	0	2	2	0	0	0	0	0	0	1	1	0	1	7
Dega	2	0	0	0	2	1	0	0	0	1	1	1	2	0	1	2	13
Dega	0	1	0	1	2	0	0	0	0	0	0	1	1	1	0	1	8
Dega	2	0	0	0	0	0	0	0	0	1	1	1	1	0	1	1	8
Dega	1	1	0	0	2	2	1	1	0	1	1	1	0	1	1	1	15
Dega	1	1	1	2	1	2	1	0	0	1	1	1	1	1	1	1	17
Kola	0	1	0	0	2	0	0	0	0	0	0	1	2	0	1	1	8
Kola	0	1	0	0	2	0	0	0	0	0	0	1	2	1	0	1	10
Kola	0	1	1	0	2	1	0	1	0	1	1	1	2	1	0	1	15
Kola	1	1	1	1	2	1	1	0	0	1	0	1	2	1	0	1	16
Kola	2	2	0	0	2	1	1	0	0	1	1	1	2	1	1	2	18
Kola	1	1	0	0	2	1	0	1	0	1	0	1	1	1	1	1	13
Kola	0	1	0	0	2	0	0	0	0	0	0	1	2	1	0	1	9
Kola	1	0	1	1	2	1	0	1	0	0	0	1	2	0	0	2	13
Kola	1	0	1	1	1	1	0	1	0	0	0	1	2	0	1	2	13
Kola	1	0	1	2	2	1	0	0	0	1	0	1	2	0	1	1	15
Kola	1	1		0	2										0	1	5
Kola	1	1	1	1	2	0	0	1	0	0	0	1	2	0	1	1	13
Kola	1	1	0	0	2	0	0	0	0	0	0	1	2	1	1	1	11
Kola	1	1	0	0	2	0	0	0	0	0	0	1	2	1	0	1	11
Kola	1	2	1	1	2	1	0	1	0	0	0	1	2	0	1	2	17

Agroe	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	R
Kola	1	2	0	0	2	0	0	1	0	1	1	1	2	1	0	2	15
Kola	1	2	0	0	2	1	0	1	0	0	1	1	2	0	1	1	14
Kola	1	2	1	1	1	0	0	0	0	1	0	1	1	1	1	1	13
Kola	1	2	1	1	2	0	0	0	0	1	0	1	2	1	1	2	16
Kola	1	2	0	1	2	0	0	0	0	1	1	1	1	1	0	2	14
Kola	1	2	2	1	2	1	1	1	0	1	0	1	1	0	1	2	19
Kola	0	2	0	0	2	0	0	0	0	1	0	1	2	1	1	1	12
Kola	1	2	2	1	1	0	0	0	0	1	1	1	2	1	1	2	18
Kola	1	2	1	0	2	0	0	0	0	1	1	1	0	1	1	2	14
Kola	1	1	1	1	2	0	0	0	0	1	1	1	0	0	1	1	11
Kola	2	0	0	0	1	0	0	0	0	1	1	0	1	1	1	2	10
Kola	1	1	1	1	2	0	0	0	0	0	1	1	1	1	1	2	14
Kola	2	1	0	0	1	0	0	0	0	1	1	0	1	1	1	1	10
Kola	2	2	1	1	2	0	0	0	0	1	0	1	2	1	1	2	17
Kola	1	2	0	1	1	0	0	1	0	1	0	1	1	1	1	1	12
Kola	1	2	1	1	2	1	0	0	0	1	0	1	1	1	1	2	16
Kola	0	2	0	0	1	0	0	0	0	1	1	1	2	1	1	2	12
Kola	0	2	0	0	1	0	0	0	0	1	1	1	2	1	0	2	12
Kola	0	1	0	0	1	0	1	0	0	1	0	1	2	1	1	1	10
Kola	1	2	1	1	2	0	0	0	0	1	1	1	2	1	1	2	17
Kola	1	1	1	1	2	0	0	0	0	1	0	1	2	1	1	1	14
Wdega	2	1	1	2	2	0	0	1	1	1	1	1	1	0	1	1	18
Wdega	1	1	1	1	2	0	0	0	0	1	1	1	0	0	1	1	13
Wdega	1	1	1	1	2	0	0	1	0	1	1	1	1	1	0	1	14
Wdega	1	1	0	0	2	0	0	1	0	1	1	1	1	1	1	1	12
Wdega	1	1	1	2	2	0	0	1	0	1	1	1	1	0	1	1	14
Wdega	1	2	1	2	2	2	0	1	0	1	1	1	1	1	1	1	20
Wdega	1	1	1	1	0	0	0	1	0	1	1	1	1	1	1	1	13
Wdega	1	1	1	1	1	0	0	1	0	1	1	1	1	0	1	1	14
Wdega	1	1	0	1	2	0	0	1	0	1	0	1	1	0	1	1	12
Wdega	1	2	0	0	1	0	0	0	0	1	1	1	2	0	0	1	11
Wdega	1	1	1	2	1	1	0	0	1	1	1	1	1	0	1	1	15
Wdega	1	2	1	1	1	1	0	0	0	1	1	1	1	0	1	1	14
Wdega	1	1	1	1	1	0	1	0	0	1	1	1	1	1	1	1	14
Wdega	1	1	1	0	1	0	1	0	0	1	1	1	1	1	0	1	11
Wdega	1	1	0	0	2	0	0	1	0	1	1	1	0	1	1	2	13
Wdega	1	1	1	1	2	0	1	0	0	1	1	1	1	1	1	1	14
Wdega	1	1	1	1	2	1	1	0	0	0	1	1	1	1	1	2	17
Wdega	1	1	1	2	2	0	1	0	0	1	0	1	1	0	1	2	16
Wdega	1	0	0	0	2	0	0	1	0	1	1	1	1	1	0	2	12
Wdega	1	0	1	2	0	1	1	1	0	1	1	1	1	1	1	2	15
Wdega	1	1	1	2	2	0	1	1	1	1	1	1	1	0	1	1	17
Wdega	1	1	1	1	2	1	0	1	0	1	1	1	1	1	0	0	15

Agroe	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	R
Wdega	0	2	0	0	0	0	0	0	0	1	1	1	0	1	0	1	8
Wdega	1	1	1	1	2	0	0	0	0	1	0	1	0	0	0	1	10
Wdega	1	1	1	1	2	0	1	0	0	1	1	1	1	1	1	1	14
Wdega	1	0	1	1	2	0	0	0	0	1	1	0	2	1	0	0	11
Wdega	1	1	0	0	2	0	0	0	0	1	0	1	2	1	0	2	13
Wdega	1	1	1	2	1	1	1	1	0	1	0	1	1	0	1	0	15

Key

A = Family size
B = Soil fertility
C = Oxen ownership
D = Livestock ownership
E = Number of dependent household members
F = Household's expenditure on agricultural inputs
G = Access to off farm activities
H = Access to non-farm activities
I = Total household income
J = Access to crop assistance
K =Access to credit
L = Access to health assistance
M = Access to market
N = Access to transfer/remittance
O = Educational status
P = Location of farm lands
R = Rank
Agroe = agro ecological zones

IF:

R= 5 – 9 More fragile livelihood

R= 10 – 14 Fragile livelihood

R= 15 – 20 Less fragile livelihood

Appendix VII Households Kilocalorie Consumption and Food security status

HH	Cereal consumed (kg)	Observed kcalpppd	% share of minimum calorie requirement	Food Secure	Potentially Food Insecure	Chronically Food Insecure
1	-	-	-			-
2	100	191.7808219	9.132420091			✓
3	1300	1385.083714	65.95636733		✓	
4	1400	3356.164384	159.8173516	✓		
5	1150	1378.424658	65.63926941		✓	
6	2300	2756.849315	131.2785388	✓		
7	100	319.6347032	15.22070015			✓
8	550	659.2465753	31.39269406			✓
9	150	287.6712329	13.69863014			✓
10	1300	1780.821918	84.80104371		✓	
11	2200	3515.981735	167.4277017	✓		
12	540	863.0136986	41.09589041			✓
13	600	2876.712329	136.9863014	✓		
14	700	839.0410959	39.9543379			✓
15	-	-	-	-	-	-
16	800	1095.890411	52.18525766		✓	
17	250	399.543379	19.02587519			✓
18	900	1232.876712	58.70841487		✓	
19	1600	3068.493151	146.1187215	✓		
20	100	319.6347032	15.22070015			✓
21	250	479.4520548	22.83105023			✓
22	270	517.8082192	24.65753425			✓
23	400	958.9041096	45.66210046			✓
24	700	1118.721461	53.27245053		✓	
25	1100	1318.493151	62.78538813		✓	
26	200	958.9041096	45.66210046			✓
27	250	2397.260274	114.1552511	✓		
28	400	3835.616438	182.6484018	✓		
29	1250	2996.575342	142.6940639	✓		
30	650	2077.625571	98.93455099		✓	
31	550	1054.794521	50.2283105		✓	
32	350	1118.721461	53.27245053		✓	

33	550	1757.990868	83.71385084		✓	
34	1050	1678.082192	79.9086758		✓	
35	900	2157.534247	102.739726	✓		
36	750	1027.39726	48.92367906			✓
37	950	1518.26484	72.29832572		✓	
38	410	1965.753425	93.60730594		✓	
39	450	2157.534247	102.739726	✓		
40	750	3595.890411	171.2328767	✓		
41	330	1054.794521	50.2283105		✓	
42	700	1342.465753	63.92694064		✓	
43	1200	1278.538813	60.88280061		✓	
44	800	1095.890411	52.18525766		✓	
45	950	1518.26484	72.29832572		✓	
46	1750	3356.164384	159.8173516	✓		
47	450	1438.356164	68.49315068		✓	
48	1500	2397.260274	114.1552511	✓		
49	1100	1506.849315	71.75472929		✓	
50	300	958.9041096	45.66210046			✓
51	781.5	936.7294521	44.60616438			✓
52	1381.5	1892.465753	90.11741683		✓	
53	400	547.9452055	26.09262883			✓
54	900	1232.876712	58.70841487		✓	
55	500	958.9041096	45.66210046			✓
56	650	1558.219178	74.20091324		✓	
57	550	753.4246575	35.87736464			✓
58	550	1318.493151	62.78538813		✓	
59	450	863.0136986	41.09589041			✓
60	1300	1780.821918	84.80104371		✓	
61	905.705	1240.691781	59.08056099		✓	
62	2900	2780.821918	132.4200913	✓		
63	1380	2646.575342	126.0273973	✓		
64	900	1726.027397	82.19178082		✓	
65	370.375	591.923516	28.18683409			✓
66	940.75	1002.321157	47.72957889			✓
67	1100	2636.986301	125.5707763	✓		
68	940.75	1288.69863	61.36660144		✓	
69	1650	2636.986301	125.5707763	✓		
70	800	1278.538813	60.88280061		✓	
71	500	1198.630137	57.07762557		✓	
72	1950	2077.625571	98.93455099		✓	
73	1250	1712.328767	81.5394651		✓	
74	782.6	1876.09589	89.33789954		✓	

75	400	639.2694064	30.4414003			✓
76	600	1150.684932	54.79452055		✓	
77	448.9	717.4200913	34.16286149			✓
78	1700	2328.767123	110.8936725	✓		
79	2914.1	3991.917808	190.0913242	✓		
80	600	1150.684932	54.79452055		✓	
81	700	839.0410959	39.9543379			✓
82	800	1278.538813	60.88280061		✓	
83	1850	2534.246575	120.6784083	✓		
84	700	1342.465753	63.92694064		✓	
85	1400	1917.808219	91.32420091		✓	
86	716.3	763.1811263	36.3419584			✓
87	600	1438.356164	68.49315068		✓	
88	550	2636.986301	125.5707763	✓		
89	2450	2610.350076	124.3023846	✓		

Note:
The food security status of households was based on Lovendal's criterion, i.e. households who consumed less than 50%, 50% -100%, >100% of the minimum calorie requirement are subsequently categorized as chronically food insecure, potentially food insecure, and food secure respectively.

Households of the study area consumed different types of crops, which provide different kilocalories, however to ease the calculation they have been converted into their cereal equivalent. The technique used to change kilograms of cereal into kilocalories is shown below.

EXAMPLE.
Three sacks of sorghum = 270 kg.
One kg of sorghum provides 3550 kcals. (Converted in to its cereal equivalent)
Three sacks of sorghum provide 270 x 3550 kcals = 958,500 kcals.
- To find the amount of kcal/person/day [assume a household size of 6]
958,500 ÷ 6 people = 159,750 per person per year
159,750 ÷ 365 days = 438 kcals per person per day
-Finally, we can calculate the percentage of total kilocalorie consumed by a household as per the minimum energy requirement
438 ÷ 2100 x 100 = 21% of 2100 kcals = this hypothetical household is therefore chronically food insecure.