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ADDIS ABABA UNIVERSITY
COLLEGE OF DEVELOPMENT STUDIES
CENTRE FOR FOOD SECURITY STUDIES

**DETERMINANTS OF AGRO-PASTORAL HOUSEHOLDS' FOOD
SECURITY AND COPING MECHANISM IN ITANG SPECIAL WOREDA,
GAMBELLA REGION, ETHIOPIA**

BY
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October, 2021
ADDIS ABABA, ETHIOPIA

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DECLARATION

I declare that this research is my own original work and it has not been submitted to any other institution for the purpose of earning any degree.

Name of Student

Signatures

____/____/____

Date

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TABLE OF CONTENTS

Contents	Page
ACKNOWLEDGEMENTS	I
LIST OF FIGURES.....	IV
LIST OF TABALES	V
LIST OF APENDICS.....	VI
LIST OF ABBREVIATIONS	VII
<i>ABSTRACT</i>	viii
CHAPTER ONE: INTRODUCTION	1
1.1 Backgrounds of the Study	1
1.2 Statement of the Problem	2
1.3. Objectives of the Study	4
1.3.1. General objective.....	4
1.3.2. Specific objective	4
1.4. Research questions	4
1.5. Scope and Limitation of the Study	4
1.6 Validity and Reliability of Data and Techniques	5
1.7 Ethical Considerations.....	5
1.8 Significant of the study.....	5
1.9 Organization of the Study.....	5
CHAPTER TWO: REVIEW OF RELATED LITERATURE	7
2. Food Security Concept and Theoretical Literature Review	7
2.1. Concepts and Definitions of Food Security.....	7
2.2. Theoretical Literature Review	12
2.3 Coping Mechanisms	13
2.4. Causes and Effects of flooding on household food security status	14
2.5. Empirical Reviews on Determinants of Household Food Security	16
2.6. Conceptual Framework	19
CHAPTER THREE: DECRISPTION OF THE STUDY AREA AND METHODOLOGY OF THE STUDY	22
3.1 Description of the Study Area	22
3.2 Methodology of the Study	24
3.2.1 Research sources and approach.....	24
3.2.2. Sampling techniques and Sample size determination.....	24
3.3 Tools of Data Collection	26
4.1 Description of the study households.....	33
4.1.1. Characteristics of the sampled household	33

4.2. Crop Production, Income Sources and Expenditures	38
4.2.1. Crop types produced in the study area	38
4.2.2. Purpose of crop production	39
4.2.3. Income source of sample households	40
4.2.4. Household food consumption expenditures	41
4.3. Household food insecurity in the study area	42
4.3.1. Household food insecurity analysis.....	42
4.3.2. Season of food shortages in the study area.....	44
4.3.3 Causes of food insecurity in the study area	45
4.4. Determinants of food security in the study area	46
4.5. Coping mechanisms used by household during food shortage.....	48
CHAPTER FIVE: CONCLUSION AND RECOMMENDATION	49
5.1. Conclusion.....	49
5.2. Recommendations	50
REFERENCES	52
APPENDICES	58

LIST OF FIGURES

FIGURE 2.1 CONCEPTUAL FRAMEWORK OF THE STUDY AREA	21
FIGURE 3.1 MAP OF THE STUDY AREA	23
FIGURE 4.1: CROP TYPES PRODUCED IN THE STUDY AREA.....	39
FIGURE 4.2: PURPOSE OF CROP PRODUCTION IN THE STUDY AREA	40
FIGURE 4. 3: SOURCE OF HOUSEHOLD INCOME IN THE STUDY AREA	41
FIGURE 4. 4: HOUSEHOLD EXPENDITURES BASE ON SOURCE OF FOOD CONSUMPTION.....	42
FIGURE 4. 5: SEASONAL FOOD SHORTAGE IN THE STUDY AREA.....	45
FIGURE 4. 6: CAUSES OF FOOD INSECURITY IN THE STUDY AREA	45
FIGURE 4. 7: HOUSEHOLD COPING MECHANISM IN THE STUDY AREA	48

LIST OF TABALES

TABLE 3.1: DESCRIPTION EXPLANATORY AND ITS EXPECTED SIGN.....	32
TABLE 4.1: DEMOGRAPHICS CHARATESTIC OF HOUSEHOLD	34
TABLE 4.1: DEMOGRAPHICS CHARATESTIC OF HOUSEHOL.....	36
Table 4.3: Summary of the household food security status-----	43
TABLE 4.4: HOUSEHOLD’S FOOD SECURITY STATUS BY HOUSEHOLD FOOD INSECURITY ACCESS SCALE.....	44
TABLE 4. 5: BINARY LOGISTIC REGRESSION MODEL FOR DETERMINANT OF FOOD SECURITY STATU	47

LIST OF APENDICS

APPENDIX 1: CONVERSATION FACTOR USED TO COMPUTE TROPICAL LIVESTOCK UNIT (TLU).....	58
APPENDIX 2: SUMMARY OF THE FREQUENCY OF THE RESPONSES TO THE HFIAS QUESTIONS.....	58
APPENDIX 3: STATA RESULT FOR HFIAS AND SAMPLED HOUSEHOLDS	59
APPENDIX 4: VARIANCE INFLATOR FACTOR FOR CONTINUOUS VARIABLES	59
APPENDIX 5: CORRELATION FOR DUMMY VARIABLES.....	59
APPENDIX 6: STATA RESULT OF ORDINAL LOGISTIC REGRESSION MODEL FOR DETERMINANTS FOOD SECURITY STATUS	59
APPENDIX 7: SOME OF OFF/ON-FARM INCOME USED BY HOUSEHOLD AS COPING MECHANISM	74

LIST OF ABBREVIATIONS

CPEG	Centre For Poverty, Employment and Growth
CSA	Central Statistical Agency of Ethiopia
DRR/LRP	Disaster Risk Reduction and Livelihood Recovery Program
EHNRI	Ethiopian Health and Nutrition Research Institution
FDRE	Food Democracy Republic for Ethiopia
FEWSN	Famine Early Warning Systems Network.
FGD	Focus Group Discussion
FAO	Food and Agricultural Organization
GDP	Growth Domestic Product
HS	Household survey
HSRC	Human Sciences Research Council
KII	Key Informal Interviews
MDG	Millennium Development Goals
MEDAC	Minister of Economic Development and Cooperation
NGO	Non-Government Organization
OPHI	Oxford Poverty and Human Development Initiative
SPSS	Statistic Package for Social Sciences
SSA	Sub-Saharan Africa
TLU	Tropical Livestock Unit
UNDP	United Nations Development Program
USAID	United State Agent for International Development
USD	United State Dollar
WFP	World Food Program

ABSTRACT

This study investigated the households' food security status and indigenous coping strategies adopted to overcome food shortage in Itang special woreda. Data for this study was collected through survey from 260 randomly selected sampled households. The study also, conducted key informant interview and, focus group discussion with discussants and personal field observation. Descriptive statistics and regression models were used to identify determinants of households' food security. In addition, food security analysis techniques were used to analyze the food security status and coping strategies of the households. The results of household food insecurity access scale revealed that 13.46% of households were food secure and 86.54% of households were food insecure. Binary logistic regression model was used to identify determinants of households' food security status. The result showed that among the variables included in the model, family size, educational level, livestock ownership and distance from the market were statistically significant in affecting the dependent variable. Family size and distance from the market affected households' food security negatively whereas education level and livestock ownership affected the extent of food security positively. Moreover, the study identified that selling livestock, reducing meal size, consume seed from stock and prepare local wine were the top four main coping mechanisms adopted to cope up the food shortage in the study area. Finally, the study suggested that awareness of family planning; educated people to catch up with model technology; modeling livestock rearing and saving institutional environment were recommended.

Keywords: *Agro-pastoral, Food security, Coping mechanism, Itang special woreda, Gambella*

CHAPTER ONE: INTRODUCTION

1.1 Backgrounds of the Study

Food insecurity is a growing concern worldwide. It is a state or a condition in which people experienced at nation, household and individual level that has neither physical nor economic access to the nourishment they need (Hendrik, 2015). Food security, on the other hand, explain as adequate availability and access to food at an individual, household, national and global level to meet the minimum energy requirements as recommended for an active and healthy life, (FAO, 2003). According to FAO *et al.*, (2019) report highlights that after decades of steady declines, world hunger prevalence remains unchanged whilst the actual numbers of people suffering from hunger are increasing. It seems like the indication which current global downturn due to the COVID-19 pandemic highlights the importance of policies and plans to counteract the adverse effects of such shocks (Barrett, 2020). The last four years have seen a reversal in decades of progress towards eradicating food insecurity. The latest estimates of global food insecurity put forward that over 821 million people experience food shortage matched to 785 million in 2015 (FAO *et al.*, 2019). At the same time, emergency food assistance needs increased for the fourth consecutive year: in the year of 2020. Around 88 million people in 46 countries are estimated to require emergency food aid—suggesting an increase of 87 per cent compared to 2015 (FEWS NET, 2019). This negative tendency is predominantly the result of prolonged conflicts and increased magnitude of extreme weather events (FAO *et al.*, 2019).

According to UNDP (2015) report, Africa faces a number of critical challenges. Environmental deterioration, increased social and economic inequality and globalization is widespread across the environmental disasters such as recurrent drought and flood have serious devastating socio-economic and ecological impacts in Africa as whole and left Africa suffering.

A report of the FAO shows that the number of malnourished in Africa still leftovers high at more than 250 million or 19.1 percent of total population in 2019 (FAO *et al.*, 2020). This results in a significant decline in agricultural production and increase in undernourishment around the world (UNDP, 2015).

Despite prominent progress in economic development and welfare progress in developing countries over the last decades, food safety has not been achieved in most developing countries. Particularly, food insecurity continues to form a deep seated problematic in several Sub-Saharan African countries.

In addition to other sub-Saharan African countries, Ethiopia faces difficulty to achieve food security at individual, household and national level for an active and healthy life. In the year of 1990s about 30 million people were estimated to be malnourished in Ethiopia (Frehiwot *et al.*, 2007). Amongst malnourished people, large numbers of them were living in rural part of the country. A number of people who have incapable for accomplishing their least food requisite is reported to be 52% of the rural inhabitants (MEDAC, 2009). Though, Ethiopia has prepared growth improvements over the last two decades (WFP *et al.*, 2020), 27 percent of the population are still living below the poverty line (USD 1.90 a day). Over 70 percent of rural Ethiopians are severely poor according to the Multidimensional Poverty Index (OPHI, 2019)

Food insecurity condition in Ethiopia is increasing due to a combination factors include: interaction of environmental degradation, high population growth, diminishing land holding, outbreak plant and livestock disease, chronic shortage cash income, poor social and infrastructure facility, instability and arm conflicts, pre and post-harvest crop loss and lack off/on farm income led to a significant decline in the productivity per households and causes of food insecurity and starvation (Mohamed *et al.*, 2017). These trends have combine with repeated effects of famine over years, to considerably erode the productive possessions of rural households (WFP, 2020).

The lowland of Gambella region, located in the south west of the country are further exposed to flood, climate related shocks, livestock and human disease and other parts of the region, particular Itang special woreda. These impacts directly influence rural household food security. On the top of that, about half of the households in the area faces flooding that damaged the existing reserves of grains, and exacerbated local food scarcity (Buom, 2013). It is expected that the use of such a multi-faced method will afford additional improvement and helpful on analysis of the status and determinants of food security at household in agro-pastoral area, Itang special woreda in Gambella.

1.2 Statement of the Problem

Despite the fact that Ethiopia has abundant natural resources, most of its socio-economic indicators are extremely low and discouraging. Ethiopia is most food-insecure and famine faced country. A large number of populations in Ethiopia have been affected by chronic and transitory food insecurity (Gebre, 2012). More than 80 percent of population lives in the rural areas and are serious depend on Agricultures; this make them enormously exposed to change in weather events (Anderson *et al.*, 2011).

Food insecurity condition in Ethiopia increasing due to a combination factors include: interaction of environmental degradation, high population growth, diminishing land holding, outbreak plant and livestock disease, chronic shortage cash income, poor social and infrastructure facility, instability and arm conflicts, pre and post-harvest crop loss and lack off/on farm income led to a significant decline in the productivity per households and causes of food insecurity and starvation (Mohamed *et al.*, 2017). These trends have combine with repeated effects of famine over years, to considerably erode the productive possessions of rural households.

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On the top of that, about half of the households in the area faces flooding that damaged the existing reserves of grains, and exacerbated local food scarcity. Agro-pastoral areas of Gambella region in general and Itang special woreda in particular are among the most flood prone areas. Baro River creates favorable conditions for crop cultivation and livestock keeping, but in the case of an extreme flood due to overflow of the river, it threatens the lives and livelihoods of the people (Dika, 2018).

Various researches conducted on agro-pastoral in Gambella region found that people in the area use alternative coping mechanism to cope with food shortage; these includes sale of more livestock usual, borrowing of food, reduce size of meal, sale firewood and charcoal, seasonal migration, seeking alternative or additional job, rely on less preferred and less expensive food, seeking relief assistance, becoming temporary trader, households splitting, consume wild food, remittance, participating in cash basis project work (Buom, 2013).

Therefore, this study assessed the status of food security and coping mechanism at household level in Itang woreda, Gambella with aim of identifying specific factors that contribute to the households' food insecurity. Moreover, it identified the way households cope up the food shortage problem. Additionally, the research could contribute to the literature gap, policymakers, development practitioners and future researchers.

1.3. Objectives of the Study

1.3.1. General objective

The general objective of this study was to investigate the agro-pastoral households' food insecurity status and coping mechanisms in Itang woreda of Gambella region.

1.3.2. Specific objective

The specific objectives of the study are

- To measure the households' food security status in the study area;
- To identify determinants of households' food insecurity in the study area, and
- To examine indigenous coping strategies adopted by households to overcome food shortage in the study area.

1.4. Research questions

1. What is the food security status of agro-pastoral households in the study area?
2. What are the causes of food insecurity in the study area?
3. What are the coping mechanisms used by agro-pastoral households during food shortage?

1.5. Scope and Limitation of the Study

This study focuses on assessing the food security status of agro-pastoral households in Itang woreda, Gambella National Regional State. The study also identified coping strategies used by agro-pastoral households against food insecurity. The study covers only Itang special Woreda, considering three selected kebeles, of Gambella regional state where the flash flood is regularly disturbing the communities. The work focused on the agro-pastoral households, in the study area and it does not include pastoral households in the study area. A total of 260 households were selected randomly, since households were the unit of analysis in the study. The scope of the study was limited due to limited resources, time, data availability, budget and other material limitations. Moreover, the major limitations of the study come from the fact that the study is based on data drawn from one cross sectional survey at particular period, where households were asked a series of questions. Besides this, the respondents scattered in different sites, some difficulties were faced in giving orientations, following up respondents and collecting responses.

1.6 Validity and Reliability of Data and Techniques

Validity defines as its level in which a data test from where the researcher is actually wished to achieve. In order to promote the validity of the research, the researchers were undertaking the following consideration; Data were collected using developed questionnaire from different papers with slightly adjustment with the existing situation of the study. The questionnaire were distributed and collected by the researcher himself. Reliability deals with research, in which researcher has to do with the accuracy and precision of the data procedures. The questionnaire were pre-tested to test the validity of the data and also check the structure, word ambiguity, clarity, length, and their suggestion are incorporated before the final distribution of the question.

1.7 Ethical Considerations

The study design should be explain to the Officials of Agriculture department and Administrative of Itang Special Woreda for their permission and support. Furthermore, the nature of the study would be fully explained to respondents to obtain consent. No false promise such as remuneration and or per diem, food and financial aids would be given. Information's were collected after securing consent from study participant. Therefore, data obtained from each study participant would kept confident, or acknowledgement.

1.8 Significant of the study

These assess he determinants of food security status and coping mechanisms in Itang special woreda of Gambella and it expected to contribute to knowledge of rural household from area specific, local context in the study area and the region in general. Furthermore, it will possibly play a role in policy and practices that are dedicated in alleviating food security and it coping mechanism and improving the overall standard living of rural households.

1.9 Organization of the Study

The study was organized into five chapters. Chapter one deals with the introduction, background of the study, statement of problem, objectives of the study, significance of the study and scope and limitation of the study. Second part of paper was about the theoretical and empirical literature includes basic conceptual and measurement issues related to subject study availability in Ethiopia and other countries.

The third part discussed on description of the study area and methodological issues employed. The interpretations of the finding and analysis are presented under chapter four. The final section draws conclusion and possible policy and program implication.

CHAPTER TWO: REVIEW OF RELATED LITERATURE

2. Food Security Concept and Theoretical Literature Review

2.1. Concepts and Definitions of Food Security

Food security is a dynamic concept, which has continuously integrated new dimensions and levels of analysis over the years; this reflects the wider recognition of its complexities in research and public policy issues. According to 1996 World Food Summit Food security exists “when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life”. Based on this definition (FAO, 2008) developed four main dimensions of food security which are food availability, food accessibility, food utilization and stability. Examining the dimensions of food security provides a more comprehensive picture, and can also help in targeting and prioritizing food security and nutrition policies and programme.

Early definition of food security focused on aggregate food supplies at national and global levels and analysts advocated production self-sufficiency as a strategy for nations to achieve food security (Devereux, 2006). According to developmental tendencies of food security which is going ups and downs gained prominence at the World Food Conference of 1974, linked with the food self-sufficiency of individual countries (USAID, 2009).

Across the review of thousands of literatures, it was realize that a clear understanding the concept of food security is paramount step to further repair the underlying particles and to extent of food security. According to Anderson (1990), food security is a concept that can generally be addressed at individual, community, sub-national, national, regional, and global.

According to the World Food Summit plan of action of 1996, food security is generally defined as all people, at all times, have physical and economic access to sufficient, safe and nutritious food for a healthy and active life. Food insecurity is therefore the inverse of food security: a condition in which a population does not have access to sufficient, safe and nutritious food over a given period to meet dietary needs and preferences for an active life. Possible causes are insufficient food availability, accessibility, and inadequate food utilization. Food security has three major components: availability, access and utilization (Kifle and Yoseph, 1999).

Food availability refers to the need to produce sufficient food in a way that generates income for small-scale producers without depleting the natural resource base, and need to get this food into market for sale at prices that consumers can afford (Haddad, 1997).

According to Kifle and Yoseph (1999), availability is basically the household capacity to produce the food it needs. The second component relates to people ability to get economic access to this food. Economic access is typically constrained by income. If household cannot generate sufficient income to purchase food, they lack an attainment to food. The third component concerns an individual ability and use food for growth, nutrition and health. Environment lacking clear water, sanitation, child care and health facilities, the ability to use food to promote health and nutrition will be impaired (Haddad, 1997).

On the other hand, when we come to household food security, literature by Anderson (1990) sees it fit to distinguish between food security at national and household level. This distinction is crucial since the approach to assess food security in those levels are not the same. Food security at national level refers to the condition whereby the nation is able to manufacture, import, retain and sustain food needed to support its population with minimum per capita nutritional standards.

At community level food security is defined as the condition whereby the residents in a community can obtain safe, culturally accepted, nutritionally adequate diets through a sustainable system that maximizes community self-reliance. At household level food security refers to the availability of food in one's home which has accessibility. In this case, a household is regarded as food secure when the members of the family do not live in hunger or fear of starvation (Anderson, 1990).

According to literature review conducted by FAO (2006), as well as the Centre for Poverty, Employment and Growth (CPEG) of the Human Sciences Research Council (HSRC) in the united nation acknowledged that food security has three dimensions namely food availability, accessibility and utilization. Food availability in the definition implies that a country must have sufficient quantities of food available on a consistent basis at both national and household level. Food accessibility also implies the ability of a nation and its households to acquire sufficient food on a sustainable basis. Food utilization refers to the appropriate use based on knowledge of basic nutrition and care, as well as adequate water and sanitation (FAO, 2006). It is evidenced by scholars that, not only food availability (adequate supply of food) but also food access through home production, purchase in the market or food transfer.

Global food production does not sufficiently grantee a given nation, household or individual to be food self-sufficiency because accessibility and purchasing power entitlements are other factors those could curtail households from getting the available food (HHFSO, 2007).

Food availability: refers to the presence of food at global, national, household and individual level, example when “sufficient quantities of appropriate, necessary types of food from domestic production, commercial imports, commercial aid programs, or food stocks are consistently available to individuals or nations.” Hence, food availability is largely a function of macroeconomic factors (Ranum et al., 2014). The food availability indicators capture not only the quantity but also the quality and diversity of food. For assessing food availability, adequacy of dietary energy supply, share of calories derived from cereals, roots and tubers, average protein supply, and average value of food production should be analyzed.

Food access: refers to the resources that households have to obtain foods, either through own production or through purchase. So, individuals need to have assets or incomes to produce, purchase in order to obtain foods needed to maintain their consumption. Hence, food access is largely related to household income and own production (Devereux et al., 2015). food access depend on; income available to the household, the distribution of income within the household, the price of food in the market and other factors worth mentioning are individual’s access to the market, social and institutional rights.

Food utilization: refers to the nutritional benefits derived from food consumption which is related to proper food processing, storage techniques, adequate knowledge of nutrition; and adequate health and sanitation services exist. Hence food utilization is largely related to nutrition, health and sanitation (Shetty et al., 2015). The same to this Bublitz et la.,(2019) define food utilization as ‘proper biological use of food, requiring a diet that contains sufficient energy and essential nutrients as well as knowledge of food storage, processing, basic nutrition, child care, and illness management’.

Food stability: refers to the stability of all other dimensions of food security over time. Even if your food intake is adequate today, you are still considered to be food insecure if you have inadequate access to food on a periodic basis, risking a deterioration of their nutritional status.

Adverse weather conditions, political instability, or economic factors (unemployment, rising food prices) may have an impact on your food security status (FAO, 2003). Therefore, food security to be insured at global, regional, national, household, and individual level food stability should be maintained.

On the other hand, Food insecurity is a situation that exists when people lack food secure access to sufficient amounts of safe and nutritious food required for normal growth and development for an active and healthy life. It may be caused by the unavailability of food, insufficient purchase power, inappropriate distribution, or inadequate use of food at the household level. Food insecurity it is poor condition of health and sanitation, inappropriate care and feeding practices are the major causes of poor nutritional status. Food insecurity may be chronic, seasonal or transitory (WFP, 2004).

Household food insecurity can be traced as inadequate and unsustainable access to income and resources to meet basic needs. These needs include adequate food, health, and shelter, minimal levels of income, basic education and community participation (Devereux *et al.*, 2004). Household livelihoods are insecure when they lack ownership security, or access to resources and income earning activities, including reserves and assets, to off-set risks, ease shocks, and meet contingencies. More narrowly, livelihood strategies are undertaken essentially to facilitate food security. People enjoy food security when they have access to sufficient, nutritious food for an active and healthy life. Food insecurity exists if one or more of these conditions are not fulfilled. Further, different levels of household asset building must be considered if the underlying causes are to be effectively understood (Drimie *et al.*, 2006).

Food insecurity is a situation which occurs at individuals, households or nation level that has neither physical nor economical access to the nourishment they need. Household is said to be food insecure when its consumption falls to less than 80 percent of the daily minimum recommended allowance of caloric intake for an individual to be active and healthy. In particular, food insecurity includes low food intake, variable access to food, and vulnerability- livelihood strategy that generates adequate food in good times but is not resilient against shocks. These outcomes correspond broadly to chronic, cyclical or seasonal, and transitory food insecurity, and all are endemic in Ethiopia (Devereux 2000).

Chronic food insecurity: is long-term or persistent in that it can be considered to be an almost continuous state of affairs. It is a continuously inadequate diet caused by the inability to acquire food. It affects households that persistently lack the ability either to buy enough food or to produce food by their own food production system (Berlie et al., 2013).

Seasonal or cyclical food insecurity may be evident when there is a recurring pattern of inadequate access to food such as prior to the harvest period (the „hungry season“) when household and national food supplies are scarce or the prices higher than during the initial post-harvest period (Mohamed et al., 2017). It is generally considered to be more easily predicted than temporary food insecurity as it is a known and regular occurrence.

Transitory food insecurity: on the other hand, is usually sudden in onset, short-term or temporary and refers to short periods of extreme scarcity of food availability and access (Tim et al., 2009). Such situations can be brought about by climatic shocks, natural disasters, economic crises or conflict. Experiences of transitory food insecurity may arise through smaller shocks at the household level, for example, loss of income and crop failure while not the normal state of affairs shocks can be severe and unpredictable.

Coping strategy is defined by different scholars in different contexts. The most common recently used is the definition of coping strategy as a mechanism by which household or community members used to meet their relief and recovery needs and adjust to future disaster related risks and shocks by themselves without depending on any external support (Klein et al., 2019).

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

Vulnerability: is defined as: “the household’s susceptibility to shocks and stresses that affect the household’s ability to generate sufficient income to earn a livelihood and achieve a threshold level of nutritional requirements for a healthy life both now and in the future.”

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

2.2. Theoretical Literature Review

There are two economic approaches for explaining food insecurity such as Food Entitlement Decline and Market failure. The FED model is pioneered by Amartya (1981) as an alternative method to FAD. His theory has brought about a shift in famine analysis, from seeking explanation for the short supply to identify of symptom of the failure in demand. It suggests that food availability in the economic or market failure does not enable person to consume, or famine can occur without aggregate availability decline. Sen presents a range evident for his argument: the Bengal famine of 1943, the Ethiopia famine of 1973 and 1984 and Bangladesh famine of 1974. He believe that it is access to food that plays a crucial role in securing command over food, which in turn is determined by sources of entitlement to food. The four possible source of entitlement are production based, trade based (exchange), own labour, and inheritance and transfer. An issue related to access at individual level resulted in the formulation of new definition for food security: access by all place at all time to enough food for an active, health life (World Bank, 1986).

One of the strong points of the FED approaches, which separated it from FAD counterpart, is potential capacity to identify which group of people will be affected by various threats of availability or access to food, differentiation depending on the degree vulnerability (Maxwell and Smith, 1992). However the model has certain weakness to be addressed before directly applying it as a framework to a study of food security. The main limitation of the FED model includes: failure to take into consideration intra-household distribution of food, exclusion of relief entitlement (food aid), a source that can be mobilized when conventional source fail, concentration of proximate cause of famine, such as market price, rather than addressing underlying causes; heavy focus on food shortage and presumption that famine mortality induce by hunger, remove all non- legal transfer of resources, hence the role of violent and social disorder leading to entitlement collapse, failure to give attention to significant of the cultural preferences and taste in determining voluntary under-consumption when entitlement is adequate, and no temporal dimension and analysis is a historical and cannot account for changing vulnerability to the entitle failure (Maxwell and Smith, 1992; Devereux, 1993).

According to Devereux (1993) also present another possible economic explanation for food insecurity. This specifically related to market failure which can happen in two ways; demand (pull failure) and supply (response failure). Pull failure refer to people lack of purchasing power which is caused by poverty and can therefore explained in term of lack or collapse of exchange of entitlement to food.

In contrast response failure can happen when market fail effectively to meet people demand. This very important input because of some intent, the ideas reconcile one of many conflicts between proponents of FED and FAD.

2.3 Coping Mechanisms

In elaborating the concept of coping strategy/mechanism, common terms or phrases like coping technique, and survival methods are often used interchangeably by writers and researchers. In this context, coping strategy means coping mechanism or coping technique, is implying mainly at a household and individual levels. Coping strategy means coping mechanism or coping technique, is indicating mostly at a household and individual levels. The extent reply is also used for individual activities pointing at endurance in the aspect of disaster-induced food Devastation or food crisis. Coping strategy could be defined as a tool by which household meet their respite and retrieval desire and adapt to imminent disaster- related threats by themselves without external provision (Bedeke *et al.*, 2012).

According to Degnew (2000) studied that coping strategies as mechanism by which household or community members meet their relief and recovery needs and adjust to future disaster related risk by themselves without extra support. In any stage of food insecurity (initial or severe), agro-pastoral household practice different coping strategies but with low frequency. The less frequently practiced coping strategies were becoming temporary traders, by making mortar from trees and selling in main towns inside the country or outside as well, by working as daily labour in nearby towns or areas, by participating in the food for work programme and by eating wild foods were found (Gulled, 2006).

Coping mechanism offerings by agro-pastoral households in Ethiopia include; livestock selling, farming service, convinced type of off-farm service and moving to other part of area, ask for grain credits, selling of wood or charcoal, using small scale market, selling manure and harvest remainders, eating wild food, reliance on relief assistance, depend on help from their neighbor, sale of clothes and taking some parts of their house for selling (Yared, 2001; Buom, 2013).

Incapability to manage, or susceptibility, is usually correlated to possessions, mainly physical possessions such as land, exertion and prosperity (Elizabeth, 2004). Household's intake using different incomes to manages when a food catastrophe hits them.

Their coping strategies are improved subject on how bad the catastrophe are and what is obtainable to support them accomplish their condition. Some trade their possessions, appearance for share time work, fit to their social linkage, undertaking into income producing accomplishments, involve in food for effort accomplishments and others get nourishment respite from NGOs and the administration (Chlembo, 2004).

According to review from Eshetu (2000) more shown that the furthest corporate coping rehearsal that are successively used in food catastrophe forcing decreasing number and minimize meals size, auction of small ruminants and some other oxen, using wild food as food and asking neighbor for cash and food. Another fewer often used approaches included delaying wedding ceremony, selling fire wood with sketching kids from school and eating contaminated taboo diet.

2.4. Causes and Effects of flooding on household food security status

The daily event of extreme hydrologic proceedings such as flood and drought over the last couple of decades showed a basic climate change and variability in many parts of the world. The effects of these extreme occurrences vary from region to region. The sub-Saharan part of Africa has been pretentious by determined flood and drought that exposed millions of urban and rural lives. Estimated effects of climate change show that the Eastern African part of the region will be pretentious by more common flooding, increased poverty of small-scale farmers and changing rainy season will make agriculture more difficult, e.g. changed sowing dates due to later or earlier start of wet season etc. (Kundzewicz *et al.*, 2014).

In this research, Sidi (2012) conducted on the effect of the 2012 floods on farming and nourishment safety in Nigeria using GIS and his outcomes indicate that flooding pretentious an extensive percentage of areas which yield the three leading tuber nourishment harvests (sweet potatoes, cassava and yam) in Nigeria. The concludes that 17.2% of sweet potato making areas; 21.6% of cassava making areas and 27.9% of yam making areas are pretentious.

Furthermore, Ajaero (2017) revealed the effect of flood on nourishment safety of male-ruled and female-ruled flood-induced traveling family unit in Anambra State by defining the earlier- and later-the 2012 flood nourishment safety prestige of the two types of households and his effects indicated flood to have pretentious nourishment safety, since the 89% of the FHHs described to have been nourishment safe beforehand the flood decreased to 22% afterward the flood while the 84% of MHHs that are food security reduced to 34%. However, founded on the accessible literature, the effect of climate variation on nourishment safety is well recognized while the impact of floods on nourishment safety is quiet slight. If climate variation has an adverse effect on food security as Syaukat (2011) and Emaziye *et al.* (2013) argued, then flooding which arises from extreme weather events as one of the manifestations of climate variability is also expected to affect food security.

According to Ramakrishna *et al.*, (2014) found out that floods have positive impact on household nourishment uncertainty in Khammam (India) and Niger correspondingly, there is essential to examine the impacts of flooding on nourishment safety in other flood susceptible areas. Therefore, the leading thrust of this study is look at the level to which flooding can impacts nourishment safety in the agrarian societies which are susceptible to flooding in south eastern region of Nigeria.

Moreover, the several logistic regressions was assumed to indicate the link between flooding and household food security beside other socio-economic and demographic issues since the previous is nominal variable with two standards variable (food secure and food insecure). Furthermore, the ordinal logistic regression was used to indicate the link between flooding and nourishment safety. The research is relevant because there is scarcity of technical works viewing the relations between floods and nourishment safety in the south eastern region of Nigeria.

In Ethiopia, mainstream of natural rivers and flush flood initiate from the highland area and marches through defiles until they hint the low land plain zones. The extremely steep slope and related topographical arrangements convey adequate energy against flow resistance so that the attentiveness time for flood water is reduced.

It floods massive area within short period of time so that related life and property damage become substantial. Moreover, the outbreak of widespread waterborne diseases laid the health condition of urban and rural community at threat. It also causes physical hurts to people, mental health problems, and undernourishment as outcome of reduced crop production. The flood is one of the major events in terms of its impact on lives and livelihoods in the Itang Woreda.

Extremely rainfall amount in the neighboring region (Oromia) of Gambella has led to increased flash floods in the Itang woreda. Heavy rainfall within Itang also contributed to the increased flood severity since the flat land of the study area did not allow rapid removed of the rain water. Therefore, the foremost impartial of this review is to provide observed sign livelihood loss in Itang woreda by floods impacts as a result of household level incapability to fully cope or adapt to impacts (Hancock *et al.*, 1995).

2.5. Empirical Reviews on Determinants of Household Food Security

Empirical review lead by numerous authors recognized several issues persuading household food safety. Climate change is trendy and already disturbing food security in Africa. Ethiopia is vulnerable to climate change since our economies mostly depend on climate-sensitive agricultural production. Environmental changes, such as changes in rainfall variability, drought, flood, warmer or cooler temperature (lead to change in growing seasons or livestock survival) and land cover change have increased concerns about achieving food security. Climate change impacts on agriculture and livestock is depending on changes in temperature, precipitation and climate variability (such as erratic rainfall, floods and droughts) (Alemu *et al.*, 2019). Subsistence economy is the standard for rural farmers of the Itang woreda. The main factors of food security problem in the study area are inadequate rainfall or irregular distributed of rainfall that may cause soil erosion during rain time as well as communal conflict which is actually cause of insecurity in the study area resulting for restricted of free movement or rural household to access their livelihood services. Rural households are rain fed cultivated practice in which without rainfall, people would not cultivate and even there will be shortage of water for their livestock, however, heavy rain fall result into flash flooding since they are on the riverbank, therefore, all factors expose rural households agro-pastoral to poverty and food deficit in the Itang woreda (H/Miriam *et.al.*, 2012). Various researches have been conducted on cause of food insecurity as well as climate change and food security.

Endalew *et al.* (2015) studied sustenance safety condition in Ethiopia and foundations of sustenance uncertainty, and get that about 10% of Ethiopia's people are constantly sustenance uncertain and this figure increases toward extra number of 15% throughout common water scarcity existences.

According to the researchers, the decline of sustenance safety condition in Ethiopia is began by multifactor, which comprise as are; over population, water scarcity, lack of land cultivated, absence of livestock farming, decline of sustenance making ability, outburst of plant and animal disease, deprived soil productivity, lack of cash income, deprived undeveloped skills, lack of access services, unlimited work expenditure, deprived community and substructure service and pre-and post-harvest crop damage. In order to address sustenance safety concern in the country, Researchers proposed that household heads and household's member would involve in diverse profits works for achieving food security situation. Therefore, Ethiopian government would investigate different study result to project plans that can approach sustenance safety.

By means of empirical examination, Beyene and Muche (2010) studied determinants of household food security among rural household in the Ada Berga district in Central Ethiopia. Household calorie achievement was examined to test the standard of household food security. Researcher's assessed the logit model to find variables that would significantly influence household food security in the study area. So, the researcher acquire that variables like farm household skill, off-farm and non-farm earning, land and livestock holding, as well as soil and water conservation practices obviously influence household food security. Moreover, variance in manure use has a progressive influence on sustenance safety, in which food security was developed as the intensively of manure use increases.

Outcome of the review additionally shown that progress involvements focusing at income variation, developed fertilizer source; increasing land and livestock output extremely add to the achievement of food safety in the research area. The study conducted on sustenance uncertainty in rural areas of Eastern Ethiopia likewise showed that socio-economic aspects can influence food insecurity (Bogale and Shimelis, 2009).

According to Bogale and Shimelis (2009), socio-economic variables like family size, annual income, and amount of credit received, access to irrigation, age of household head, farm size, and livestock owned have major effect on food security in rural areas of Dire Dawa, Eastern Ethiopia. Their results indicate that progress in food safety condition in the study area needs building household possessions, refining the effective of rural financial markets and improving family plan.

Warner and Hatch (2017) study that the prediction using climate variation models of progressively penetrating and recurrent floods for New England (United States) are now being manipulated frequently by rural household groups that have been facing the related undesirable penalties such as flood, erosion, natural habitat devastation, and property destruction, which always distress food security.

Ludi *et al.* (2007) showed the influences of climate variation on agrarian manufacture and recognized that over the following century, there will be undesirable results on crop productivity, particularly in developing region where every individual are now at threatening. According to FAO (2008b) report that these variations in agrarian productivity patterns will interrupt food security status in two ways; by influencing food distribution at both local and global levels; and by influencing livelihoods and skill to food availability.

In the similar way, Schlenker and Roberts (2009) predicted that temperature effects on crops in the United States, and Muller *et al.* (2011) expected temperature effects on crops in Africa, and both resolved that climate variation will have undesirable influences on crop productivity. They did these forecasts by establishing the effects on temperature developments and projected intensify in the likelihood of excesses during the cropping period.

Furthermore, in concerning the effect of Climate Variation to food productivity and food security, Syaikat (2011) rummage-sale climate documents of 36 years (1971 to 2006) and with assistance of a reproduction, he highlighted that Indonesia agrarian manufacture is more subtle to temperature rising rather than precipitation reduction. His study also indicated that the mixture of precipitation and temperature will have major influence on Indonesia's food stability by 2050 with projected shortage of 90 million tons of husked rice by 2050. Moreover, Emaziye *et al.* (2013) concentrated on the relationship between climate variation and food safety of countryside households in Cross River State, Nigeria by smearing the nourishment safety index calculation used by Hoddinott (2001) and Feleke and Gladwin (2003).

They recognized that Cross River State is abstemiously nourishment uncertain with nourishment safety having statistically important link with the climate variation aspects, with 67.07% losses of yearly earnings. Floods have been defined as the natural tragedies with greatest penalties on agriculture; hindering food safety particularly in less developed nations (Pacetti *et al.*, 2017) where people are mainly reliant on rain fed agriculture.

To verify this in his study, Pacetti *et al.* (2017) the remote sensing data has been used to shown the evidence, joint with water footmark files and agrarian data to measure the impacts of flood proceedings on food source (food accessibility) with orientation to the floods damage proceedings in Pakistan (2010) and Bangladesh (2007) as research conducted. They assessed flood compensations on agrarian areas by approximating crop losses and changing it into absent calories and water footmark as balancing pointers, and their effects showed a flood-induced decrease of nourishment source between 8 percent and 5 percent in Pakistan and Bangladesh correspondingly.

On the other hand, Ramakrishna *et al.* (2014) studied the effect of flood on nourishment safety and incomes of Internally Displaced Person (IDP) households using binary logit model. They decided that floods have an undesirable effect on nourishment safety by decreasing the net earnings and buying control, subsequent in lack of food among rural households in Khammam region of India. In the similar manner, Zakari *et al.* (2014) also decided that floods have negative and major result on household nourishment safety in Niger Republic using logit model and Oluoko-Odingo (2006) conclude that an adverse linkage between flooding and household nourishment crop manufacture in Nyando district of Kenya.

2.6. Conceptual Framework

Natural or Environmental factors includes climate variation which determines the flood, hence, rural households to cope with extremely floods is limited, and floods tends to have long-term negative effect on local food security status but farmers can do little to protect crops when the water level is rising, so an extremely flood may result in a completely failed crop production. Moreover, farmers are generally, not able to sow new crops soon after the flood, since the soils are too wet. They have to delay the sowing, which means the crop season extends into the dry season, resulting in a lack of water during crop's maturity stage, therefore, the introduction of small scale irrigation can help to prevent crop failure (Connolly *et al.*, 2016).

Physical factors include access to infrastructures such as distance to market and road improvement, agricultural productivity, resulting in positive effects on local food security status in the study area. Therefore, adequate infrastructure, especially main and feeder roads that promote access to necessary input- fertilizer, seed, and pesticides chemical and other agricultural implementation are very crucial (Adepoju and Salman, 2013).

Economic factors include size of cultivated land, livestock ownership, remittance and income earned from off/on-farm activities affected household food security status. Household with large cultivated land, large number of livestock, remittance from their relatives and more incomes from off/on-farm income have more probability to be food secure than others. This section explores the factors influencing household food accessibility and hence determinant of household food security status. According to conceptual framework presented (Figure 2.1) shows that age household head, sex of household head, household family size, dependency ratio influence the household food security status positively whereas sex of household head, access to credit and educational level influence household food security status negatively. Household with large family are more likely to be food insecure than others. In similar ways household with high dependency ratio have high risk for food insecurity. Therefore, age of household head and food insecurity have positive relationship which mean as the age of the household head increase, the household is unable to work hard for survival of his/her family members. In other hand variable such as educational level is an important demographic factor affects household food security status negatively that mean if the educational level of household head increase, household food security decline. Moreover, variable like access to credit is important institutional factors affects household food security status negatively whereas distance to nearest market affects household food security status positively.

Independent variables

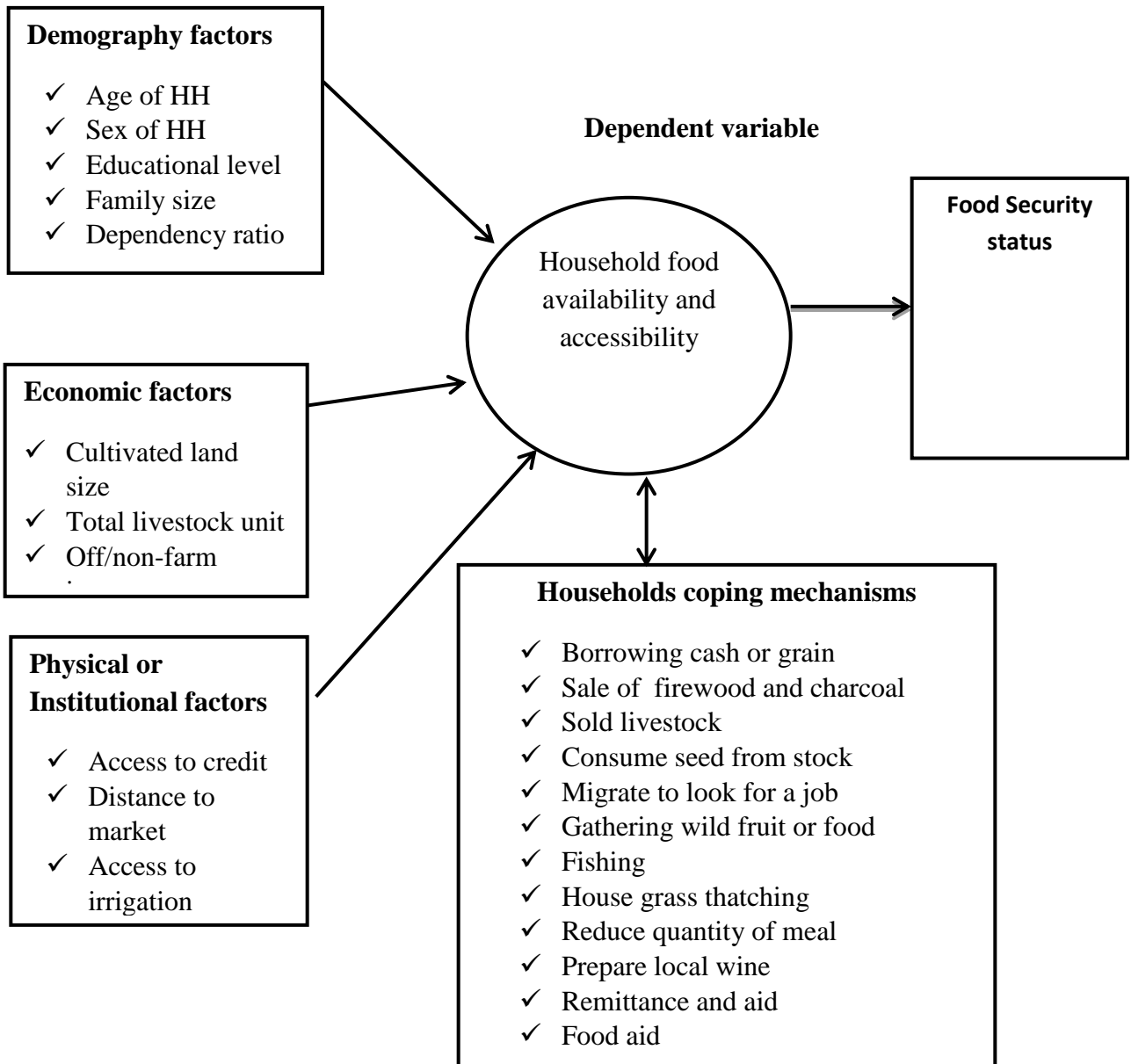


Figure 2.1 Conceptual framework of the study

CHAPTER THREE: DESCRIPTION OF THE STUDY AREA AND METHODOLOGY OF THE STUDY

3.1 Description of the Study Area

Location, Topography, Climate and Land feature

Itang Special woreda is found in the Gambella Region, Western parts of the region (Figure 3.1). The main town is called Itang, is situated about 42km away from Gambella town. Since Itang is not part of any Zone in the Gambella Region, it is considered as a Special woreda. This woreda consists of 23 kebeles, of which 95% lies in the floodplain of the Baro river basin; only 5% are living far away with semi-nomadic way of life. Itang town and most of other villages are found on the shore of the Baro river, which is important for ecology of the area and sources of livelihoods to the people reside there (Tamiru *et al.*, 2014).

The total area of the woreda is 2,188 km². The indigenous host community ethnic groups are Nuer, Aynuak, and Upo in the woreda and other ethnic groups live there as well. The Itang area covers 2,188 km² in 2007 national census. The indigenous ethnic groups are Nuer, Anyuak, and Upo in the woreda and other ethnic groups live there as well. The livelihood service of study area is categorized into two major group, semi-nomadic or agro-pastoralist which consisted of seven (7) kebeles, inhabited by mostly Nuer ethnic group and the rest sixteen (16) are agro-fisheries and agro-hunting of wildlife (mixed farming), which are dominated by Anuak and Upo respectively, according to CSA 2007, cited in Frew (2019).

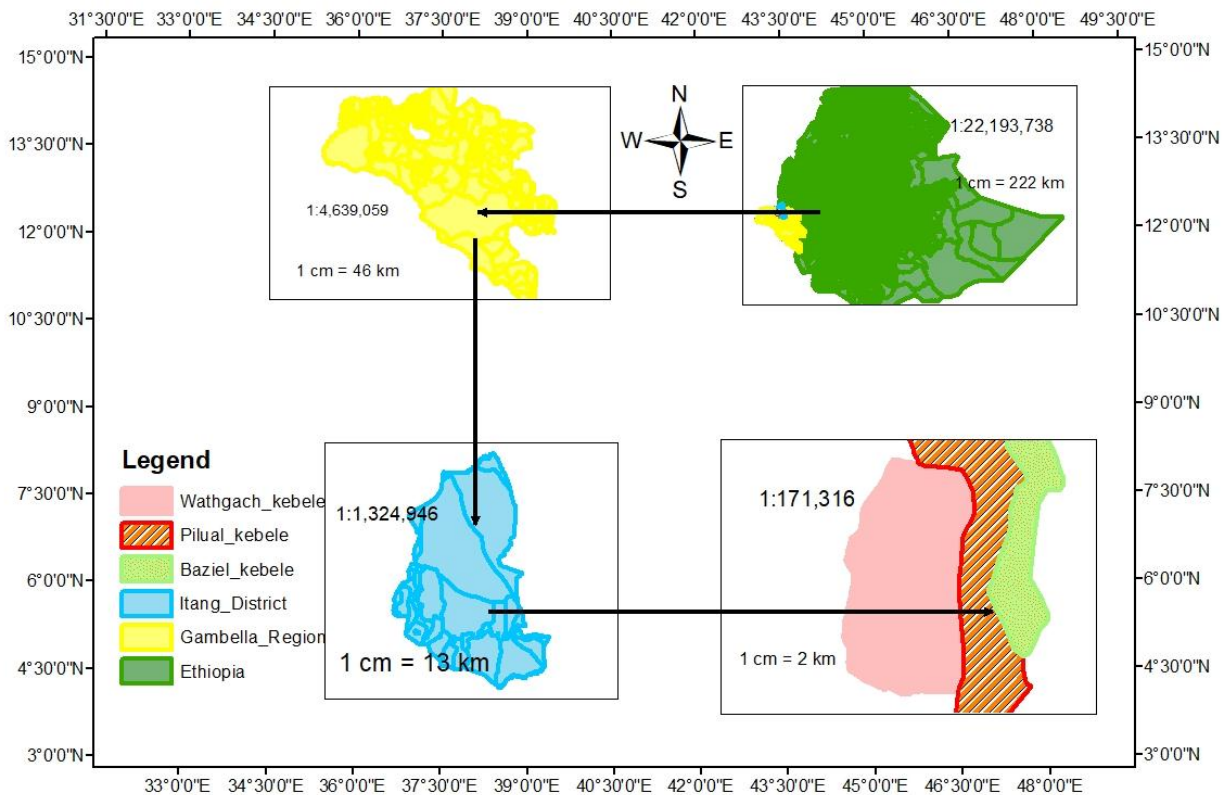


Figure 3.1 Map of the study area

Source: ArcGIS v-10.3, (2020)

Socio-Economic, Population and Administrative structure

This agro-pastoral area is dependent on livestock and crop production as well as fishing. The major crops grown both for consumption and sale are maize and sorghum. Tobacco is also cultivated as a cash crop. Livestock reared in Woreda are Cattle, goats and sheep. Livestock and crop production are the main livelihood strategies. Agro-pastoral population moves from area to area in search of pasture while the mixed agriculture population lived on a permanent settlement (MoARD, 2010).

The livelihood of the area is categories into two major group, semi-nomadic or agro-pastoralist which consisted of seven (7) kebeles, inhabited by mostly Nuer ethnic group and the rest sixteen (16) are agro-fisheries and agro-hunting of wildlife (mixed farming), which are dominated by Anyuak and Upo respectively (CSA 2007, cited in Frew, 2019).

The livelihood of the study area in which rural communities depend on are divide into different categories such as livestock and crop production (agro-pastoral), fishing, hunting or wild food collection. The main economic activities in the study area are livestock rearing particular cattle, goat and sheep and crop production such as maize and sorghum are both rain fed or seasonal cultivation are significant. The major sources of food production include own crops, purchase and livestock product exchange with meat, fish, wild fruit and meat (Mfunda *et al.*, 2010). Based on the 2007 national census of Ethiopia, the total population of Itang woreda was about 35,686, of which 17,731 female and 17,955 male.

3.2 Methodology of the Study

3.2.1 Research sources and approach

This study has a cross sectional research source. It employed mixed research approach, in which both qualitative and quantitative data gathered from primary and secondary sources. Primary data were gathered from respondents through field surveys while secondary data were collected from journals, reports, government statistics, book and internet.

3.2.2. Sampling techniques and Sample size determination

An essential choice that has to be made while picking a sampling method is about the size of the sample. A suitable sample size depends on several factors linking to the issue under study like the cost aspect, the time aspect, and degree of accuracy desired (Gupta, 2002). According to sampling size determination techniques that if sample size is too large, it can waste resource. But if it is too small, researcher may fail to achieve the objectives of the analyses. So that proper sample size has to be selected in order to get good representative data. It is also relevant when a researcher desires to use cases that have the essential information with respect to the objectives of study.

In the method of choosing the sample, two-stage sampling procedures were employed to select the sample households in the study area. At the first stage, Itang special woreda was purposely identified from a list of 13 administrative woreda in Gambella region which is most regular affected flash flood area. Itang special woreda holds 23 kebeles of which 7 kebeles are agro-pastoral and 16 kebeles are pure pastoral. At the second stage, the 7 agro-pastoral kebeles of Itang special woreda were stratified into three agro-ecologies, and 3 kebeles namely Wathgach, Pilual and Baziel were randomly selected due to their exposure to food insecurity since Wathgach, Pilual and Baziel kebeles are water stress areas and nearest to the river bank (Baro) which overflow during rainy season and result always in crop failure and livestock disease (Nigatu *et al.*, 2018).

According to, the information obtains from Itang administration woreda, Wathgach kebeles has rural household's population of 2979, Pilual kebeles has rural household's population of 3673, and Baziel kebeles has rural household's population of 3367 which make 10,019 rural household in the three kebeles was stratified to determine food insecure households. Base on the sample size selection, statistics were calculated with formula given by Kothari (2004) with 95% confidence level and 0.5 probability level of precision.

$$n = \frac{Z^2 \cdot p \cdot q \cdot N}{e^2(N-1) + Z^2 \cdot P \cdot q} \text{-----} 1$$

Where: n = number of sample size

Z^2 = abscissa of the normal curve that cuts off area α at the tails (1- α) equal the desire confident level.

The value for Z is found in statistical tables which contain the area under the normal curve. e.g., $Z=1.96$ at 95% confidence level; and $Z^2=3.841$). N= the population size (10,019) P= the population proportion (assumed to be 0.5 since this would provide the maximum sample size), $q = 1-p$, e = is the desired level of precision or margin of error (6% error or 0.06).

Thus;

$$n = \frac{3.841 \cdot 0.5 \cdot (1-0.5) \cdot 10019}{(0.062(10019-1)) + (3.841 \cdot 0.5 \cdot (1-0.5))} = 260$$

3.3 Tools of Data Collection

The study employed both qualitative and quantitative methods of data collection. In addition, it utilizes both primary and secondary data. Therefore, the study uses the following tools of data collection.

Focus Group Discussion (FGD)

Focus Group Discussion on the selected discussion theme such as general welfare condition, vulnerabilities to food shortage and coping mechanism of the study household was conducted. Two FGD was conducted per *kebele* communities members, representing both men and women of the community and various age who are active participation in socioeconomic and development affairs of the study area were major target of the focus group discussion. The FGD consist of group of 12 people were selected from each economic group and meeting held for one hour and half to ensure flexibility.

Focus Group Discussions were employed to collected information from food security and coping mechanism of households. Others questions that were posed to both categories of households were factors that make a given household to become food secure, existing opportunities and resources, demographics, food in/secure, coping mechanism, and diversity perception in the study woreda.

Key Informants Interview (KII)

A key informant's interview was carried out with intention of capturing divers' welfare status; and was selected in all proposed study three kebeles with support of kebeles leaders and development agents. Thorough interview was made with both Development agents and experts of Agriculture and Rural Development office. The checklist was preparing to guide and facilitate the interview, and KII used semi-structured checklist so as to generate relevant data from sample households.

Semi-structured questionnaire was directed to key officials of relevant government offices at all level of the study area. Besides informant interview meeting were carried out with woreda official to discuss efforts made so far to food security at local level.

Personal field observation

It is data collection tool where researchers participate in many activities such as participating in the daily lives of the people in the area and view the survival of rural household practices in the field.

However, because of time, the research could use only notes in the field observation during visits to the study area and see the real living situation of rural household in the area. This provides input for the study by providing the visible information and description of the study area as well as the concerned unit of the study that otherwise might not be achieved through interviews. This technique did not need any response from the informants whereas the researcher was responsible to make his/her own direct observation and interpretation (Kothari 2004).

Household surveys (HS)

In order to generate information at household level, household survey was undertaken using structured questionnaires⁷. Before, conducting survey, questionnaires revision was made and finalized, and then, two enumerators were employed to collect data. Well-structured questionnaire was used to collect data on food security and coping mechanism of household.

A. Descriptive statistics

Descriptive statistics like mean, standard deviation and percentages, maximum, minimum and others were used to define the causes and determinants of food insecurity status in the study area based on the environmental, economic, institutional, physical factors and demographic situations and also the comparison between food security and food insecurity status in the study area link with environmental, physical, economic, demography and institution factor could be tested by statistic test in particular t-test and chi-square test.

B. Household Food Insecurity Status analysis using HFIAS

The collected data were edited to detect and omitted unnecessary data and thereby after analysis was done by using STATA Version 13. Then, the data analyzed using qualitative and quantitative data methods. Qualitative data was analyzed using Household Food insecurity Access Scale (HFIAS). The study used descriptive and Binary Logit regression model for analyzing the data to address the predefined objectives. The former method was for analyzing the qualitative data while the latter for the quantitative.

HFIAS was used to analyze food insecurity status of household. The studies used HFIAS nine items food insecurity scale that was developed by the FANTA projects which measures anxiety about food supply, followed by questions about food quality, questions on food quantity, and finally, questions on going to sleep hungry or going all day and night without eating (Deitchler *et al.*, 2010). The HFIAS score is then calculated as a continuous measure of the degree of food insecurity access in the

households in the past four weeks (30 days). Using HFIAS, household have been categories as food secure, moderately food insecure, middle food insecure and severe food insecure. The response variable has four values as:

$$Y = \begin{cases} 1 = \text{if food secure} \\ 2 = \text{if moderately food insecure} \\ 3 = \text{if middle food insecure} \\ 4 = \text{if severe food insecure} \end{cases}$$

C. Determinants of Households' food insecurity

The study used Binary logit model to examine the relationship between the household characteristic and food insecurity status. Typically, According to Gujarati (1995), the functional form of logistic is represented as follows:

$$P_i = F(z_i) = \frac{1}{1 + e^{-(\alpha + \sum \beta_i x_i)}} \quad \text{-----} \quad 1$$

Where P_i = is probability that household is being food insecure given x_i

X_i = represents the i^{th} explanatory variable

α and β = are regression parameter to be estimated

e = is the base of the natural logarithm

Definitions of variables and working hypothesis

The following explanatory variable is recognized as the major factors describing the different between food security and food insecurity. The following are explained below:

Dependent variable definition

Household Food Insecurity Access Scale (HFIAS), which generate the dependent variable, Households food security status, for the logit analysis (Binary logistic model) that is a dummy variable which take 1 for food security, 0 for food insecure. The HFIAS was a categorical variable that took 1 for food secured, 2 for moderately food insecure, 3 for middle food insecure and 4 for severe foods insecure.

Household food security status was determinant through HFIAS nine item food insecurity scale questions that was developed by the FANTA projects which measures anxiety about food supply, food quality and finally, food quantity.

Definition of Independent or explanatory

Demographic characteristic of household

Sex of households head (SHH): its dummy variable in which take value 1 for sex of household head is male, 0 for sex of household is female. Several study found that female household head can find difficult than men to gain access to valuable resource in order for them to improve production and gain more income (Baten and Khan 2010). This in turn that female heading have more probability to be food insecure than male heading. Thus, in this study, it is expected to affect extent of households to food security negatively.

Age of household head (AHH): it is continuous variable measurement in years, many studies found that young households head are stronger and energetic than elderly households head as they are expected to cultivated large farm and obtain high yield (Abafita and Kim, 2014); Babatunde, 2007). Hence, in this study, age of the household head is expected to affect extent of food security negatively.

Household's family size (HFS): it is continuous variable which refer to number of family members of the households. Many studies found that large family size tends to exert more pressure on households consumption than the labour it contribute on the production (Stephen and Samuel, 2013; Mulce *et al*, 2014). Therefore, in this study, large family size is expected to affect extents of food security positively.

Educational level of households head (EHH): it is level of educational attainment of the household head measured in two categories: in which 1 for literate and 0 for illiterate. Household with good educational level have chance to improve their living standard than uneducated household in the rural household (Romeo *et al.*, 2016). Thus, education level is expected to have positive effect on rural household food security.

Dependency Ratio (HDR): it is continuous variable measured in number of adult with in household member and also proportion of economically inactive labour force (less than 15 and above 65years old) to the active labour force (between 15 and 65years old, Velasco, 2003).

Due to scarcity of resources, higher dependency ratio impose burden on the active member of household to fulfill their immediate food demand (Mulche *et al.*, 2014). Besides, the higher dependency ratio showed that the small labour force have constraints on household's per capita income and consumptions, which also influences the well-being of household's members (Negusse *et*

al., 2013). In this study, it is expected that active member of household affect extents of food security positively.

Household's economic characteristic

Household cultivated land size (HLS): Refer to the cultivated land size (hectare) in the last year period and this variable found as the continuous variable. The household cultivated large land size have more probability to be food secure than household cultivated small land size (Mitiku *et al.*, 2012). Therefore, higher production and increasing availability grains produce helps to ensure food security status of households (Asmelash, 2015). Thus, the size of cultivated land is expected to affect extent of food security negatively.

Household livestock ownership (HLO): It is main sources of food and income for agro-pastoral household that mean household owned large number of livestock have more probability to produce more milk, and meat for consumption.

Moreover, household with more livestock have more likely to earn more income and livestock products which assist them to purchase stable food during food shortage and invest of purchasing of farm input that increase food production, and ensure households food security (Mitiku *et al.*, 2012; Gemechu *et al.*, 2015). Livestock ownership mitigates vulnerability of households during crop failures and others disaster (Abafita and Kim., 2014). Therefore, this study hypothesizes that owner more TLU of livestock is expected to have positive effect on the extent of household food security.

Household off-farm income (HOFI): it is dummy variable, 1 for off/non-farm income, 0 otherwise. it refer to the total monetary value of all off/non-farm income implements household owns. This variable related directly to food security status. According to Beyene and Mulche, (2010) finding, higher farm income earning enables rural households to purchase different nutrition food items to satisfy their family food demand. Therefore, in this study, rural household's income is expected to affect extent of food security negatively.

Physical or Institutional factors of household characteristic

Household access to credit service (HACS): This variable is dummy in which take value 1 as household access credit, 0 otherwise. It is an important source of investment. According to Alemayehu *et al.* (2003), credit helps farmers for purpose of consumption or purchasing agricultural input such as seed, fertilizers, and chemicals. However, the amount of credit received has direct

relationship with the improvement of the income level. Therefore, it is expected that access to credit have positive relationship with household's food security status.

Distance to market (HDM): it is continuous variable measured by kilometer (km). Nearest market may create opportunity of more income by providing off/non-farm employment opportunity, which identify income level of rural households. Besides, the closer, the rural households to the market have more probability to get enough information, purchase agricultural input and finally products require for family consumption, therefore, it is expected to affect extent of households food security positively.

Household access to irrigation (HSSI): this variable found as dummy variable in which take value 1 if household have access irrigation, 0 otherwise, hence the household using irrigation have more probability to be food secure than household with lack of access Irrigation. According to the results, many households keep improving their production. It is expected that irrigation and food security have positive relation in the rural household.

Coping mechanism of household characteristic

Household remittance (HR): it is continuous variables which measured in birr, in which many household in the study area get their remittance from their relatives to backup one another in the Nuer culture. According to Gulled (2006) in his study showed that remittance and food security status in the study area are inversely relation. Therefore, in this study, it is expected to affect extent of household's food security negatively.

Household food aid (HFA): it is dummy variable in which take value 1 if household have receive food aid, 0 if household have not receive food aid. Furthermore, food aid plays an importance role to lessen household from being vulnerable to sever food insecurity but it can develops behaviors amongst rural households that can change their motivation toward self-independency. It is expected that food aid has negative relationship toward household food security.

According to Mulugeta, (2002), Abebaw and Ayalew (2003) found that food aid has positive relationship to household food security.

Table 3. 1: Description explanatory and its expected sign

Variable	Description	Types	Measurement	Expected Sign
SHH	Sex of household head	Dummy	1 = if male, 0 = female	+/-
AHH	Age of household head	Continuous	Years	+/-
HFS	Household family size	Continuous	Number	+
EHH	Educational level of HH	Category	1 = if literate, 0 = if illiterate	+
HDR	Household dependency ratio	Continuous	Number	-
HLS	Household cultivated land size	Continuous	Hectare	-
HLO	Livestock ownership	Continuous	TLU	-
HOFI	Household off/on farm income	Dummy	1 = if access to off/non-farm income, 0 = otherwise	-
HACS	Household access credit service	Dummy	1 = if access to credit, 0 = otherwise	-
HDM	Household access to market	continuous	KM	+/-
HAI	Household access to irrigation	Dummy	1=if access to irrigation 0= otherwise	+/-
HR	Household remittance	Continuous	Birr	-
HFA	Household food aid	Dummy	1 = if household receive food aid, 0= otherwise	+/-

CHAPTER FOUR: RESULTS AND DISCUSSION

The survey results are presented into two categories: these are descriptive statistic and ordinal logistic analysis. Moreover, descriptive statistics include; frequency distribution, percentage, mean, chi-square and t-test were used and ordinal logistic analysis was also used to determine food security problem at agro-pastoral sampled households.

4.1 Description of the study households

4.1.1. Characteristics of the sampled household

Sex of household head

According to descriptive analysis presented with regarding the sex of sampled household, the result shows that male household head account for about 80 percent of the sampled household while Female household headed account for about 20 percent of the sampled household. The survey results show that 82.9 percent of food security household was Male household head whereas 17.1 percent were Female household head. The male household headed was about 79.6 percent of food insecure while 20.4 percent of sampled household food insecure was female household headed. Therefore, this figure indicates that male household headed was owner's major livelihood household assets in the study area. There is no statistically significant relationship between sex of household and household food security status (Table 4.1). This result is consistent with the finding of (Sharaunga *et al.*, 2016).

Household educational level

Concerning the educational level of sampled household, the results (Table 4.1) revealed that 77.3 per cent of household head were illiterate whereas 22.7 percent of household were literate. Among categories shown that, 91.2 per cent of household foods secure were illiterate while 75.1 per cent of household foods insecure were illiterate and then 8.6 percent of household foods secure were literate whereas 24.9 percent of household foods insecure were literate. Therefore, the survey result revealed that no statistically significant relationship between household food security status and education level of household. Because illiterate households are looking for cattle and cultivated land with their entire life while literate people participate in partially way on the above livelihood assets. This result is in agreement with finding of (Romeo *et al.*, 2016).

Household access to irrigation

The survey result indicated that 4.2 percent of household response that they have access to use irrigation whereas 95.8 of household shown their response that they have not access to used irrigation (Table 4.1). To compare two categories, 8.6 percent of household food secure said that they were using irrigation whereas, 3.6 percent of household food insecure were using irrigation. While in the corresponding, 91.4 percent of household food secure said that they were not using irrigation and also 96.4 percent of household food insecure was not using irrigation. Therefore, difference was observed between categories, the irrigation survey that agro-pastoral household were using its hand irrigation system which is more traditional in which they were collected from difference water source where there is water in that area. This finding is consistent with result of other studies (Han et al.,2021). The chi-square result shows that there is no statistically significant relationship between food security status and household irrigation access.

Table 4.1: Characteristics of the sampled household

Name of Variables	Category	Food secure (N = 35)		Food insecure (N = 225)		Total value (N= 260)		X ²
		frequency	%	frequency	%	Frequency	%	
Sex of HH	Male	29	82.9	179	79.6	208	80.0	.206 ^a
	Female	6	17.1	46	20.4	52	20.0	
Educational level HH	Literate	32	91.4	56	24.9	59	22.7	4.597 ^a
	Illiterate	3	8.6	169	75.1	201	77.3	
Access to irrigation	Yes	3	8.6	8	3.6	11	4.2	1.881 ^a
	No	32	91.4	217	96.4	249	95.8	
Off-farm income	Yes	33	94.3	179	79.6	212	81.5	.000 ^{***}
	No	2	5.7	46	20.4	48	18.5	
Access to credit	Yes	18	51.4	164	72.9	182	70	0.21 ^a
	No	17	48.6	61	27.1	78	30	
Food aid	Yes	25	71.4	187	83.4	212	81.5	2.746 ^a
	No	10	28.6	38	16.6	48	18.5	

Source: Own survey result, 2021

Household off-farm incomes

The survey results revealed that 81.5 percent of household response that they received off-farm income while 18.5 percent of household said that they do not received any off/on-income (Table 4.1). Comparing the food security status and household off-farm income, 94.3 percent of household off-farm income are food secure whereas 79.6 percent of household off-farm income are food insecure and 5.7 percent of household off-farm income are food secure while 20.4 percent of foods insecure of households have off-farm income, therefore, it expected that affect food security status positively. Moreover, the mean of household having more income is more likely to be food secure than the one with less income (Beyene *et al.*, 2010).

Household access to credit

Access to credit represent physical characteristic of endowment of sampled households, therefore, survey result (Table 4.1) shown that 70 percent of household have access credit whereas 30 percent of household have lack of access credit. According to studies of Ngema *et al.*, 2018, low level of financial resource among sampled households could bring change to household food security status. Therefore, there is no statistically significant relationship between food security status and household access credit.

Household food aid

According to descriptive analysis presented (Table 4.1) result shown that 81.5 percent of household have received food aid whereas 18.5 percent of sampled households said that they do not received food aid. Hence, the survey results indicate that there is no great disparity of food shortage due to food aid difference among the household. Food aid plays a major role to reduce the household vulnerability to food security problem. According to study of Sani *et al.*, 2019, it was hypothesize that household who received more food assistance can be more probability to be food secure than the household who have not. Therefore, the means amount of food aid received by sampled household shown that there is no statistically significant relationship between food security status and household food aid.

Age of household head

Age is one of the vital important demographic characteristic of household expected to bring change in food security status differently with in agro-pastoral household, and so age may influence food security status of the households. This finding is consistent with the result of other studies (Teka *et al.*, 2019). However, the mean age of sample household of food secure was 39.942 whereas the mean age of household food insecure was 43.702 (Table 4.2).

Therefore, the average mean for age of sampled household was 41.822. There is no statistically significant mean between household food security status and household age.

Household family size

According to family size of sampled household, the survey result (Table 4.2) shown that the mean for sampled household family size of food secure was 15.31 while the mean for sampled household family size of food insecure was 10.85. Therefore, the average mean of household family size was 13.08. Hence, there is statistically significant mean between household food security status and household family size at 1% probability level. Moreover, household with large number of family size is more likely to be food insecure than the household with small number of family size, therefore, increase family size within limited resource would increase household vulnerability to food shortage. This result is in agreement with the finding of other studies (Dube et al.,2018).

Table 4.2: Characteristics of the sampled household

Name of variables	Food secure (N= 35)	Food insecure (N= 225)	Total value	T-value	P -value
	Mean	Mean	Mean		
Age of household head	39.94	43.702	41.822	-1.720	.091
Family size	15.31	10.853	13.083	5.003	.000
Dependency ratio	2.46	3.008	2.733	-1.878	.062
Cultivated land size	1.32	1.315	1.322	.132	.895
Tropical livestock unit	3.61	8.41	6.016	-3.065	.002
Remittent	3600.09	4064.44	3832.26	-2.104	.036
Distant to market	1.8286	1.7644	1.7965	.519	.606

Source: own survey result, 2021

Household dependency ratio

Dependency ratio is hypothesis as having negative relationship with household food security status in the agro-pastoral household with large dependency ratio is more likely food insecure than household with less dependency ratio. This finding is consistent with the result of other studies (Sirajea et al.,2013).

Therefore, the survey results show that the mean of household dependency ratio of food secure was 2.46 whereas the mean of household dependency ratio of household of food insecure was 3.008 (Table 4.2). However, the average mean household dependency ratio was 2.733 Therefore; there is no statistically significant mean between food security status and household dependency ratio.

Household cultivated land size

The survey result (Table 4.2) indicated that the mean of household cultivated land size of food secure was 1.32 while the mean of household cultivated land size of food insecure was 1.315. However, the average mean value of household cultivated land size was 1.322. Therefore, the result support hypotheses that the household cultivated large land sizes have more probability to be food secure than household cultivated small land size, beside that there is high probability to produce more food. This result is in agreement with the finding of other studies (Bogale et al., 2009). The result shows that there is no statistically significant mean between food security status and household cultivated land size.

Household livestock ownership

The survey result shown that mean of livestock holding of sampled household food security were 3.61 and 8.414 for food secure and food insecure tropical livestock unit respectively (Table 4.2). However, the average mean values of sampled household livestock holding was 6.016, therefore, The t-test for equality of the means in livestock holding between food secure and food insecure household revealed that there is statistically significant mean at less than 1% probability level.

Livestock production plays an important role in rural household economic in various ways which include source of cash income and source of supplementary income and can also be as the mean of food security and also mean of coping mechanism in the time of crop failure. Livestock can provide milk, meat, manure and fuel. This result is consistent with the finding of other studies (Beyene et al., 2010).

Household Remittent

According to survey results presented (Table 4.2) indicated that the mean of household remittent of food secure was 3600.08 whereas the mean of household remittent of food insecure was 4064.44.

However, the average mean values of sampled household remittent was 3832.26, therefore, there is no statistically significant mean between household food security status and household remittent. Cash income is form of financial asset that provide access regular inflow of money on which household may rely on for pursuing their means to sustain life. The main contributors of income to the household were household relatives abroad and children through social support grants attached to them in this study. This finding is in agreement with the result of other studies (Le et al., 2020).

Household distant to market

The survey result (Table 4.2) shown that the mean of distant to market for household food secure was 1.82 while the mean of distant to market for household food insecure was 1.764, however, the average mean values of household distant to market was 1.796. Therefore, there is no statistically significant mean between household food security status and household distant to market. A good infrastructure is important for food sufficiency by improving market efficiency for rural household in order to exchange information among farmers and traders for transforming the agricultural system. This result is consistent with the finding of other studies (Boratynska et al., 2017).

4.2. Crop Production, Income Sources and Expenditures

4.2.1. Crop types produced in the study area

According to the survey results (Figure 4.1) shown that 37.7 percent of household planted maize, 34.2 percent of household planted sorghum, 8.5 percent of household planted pumpkin, 6.2 percent of household planted okra, 8.1 percent of household planted vegetable, 4.2 percent of household planted fruit, and 1.2 percent of sampled households planted bean.

Comparing food security status of sampled household and crop types shown that most of sampled household said that they used maize and sorghum this could be due to fact that as the type of crops varies the amount of calories gain increases as difference crops have difference calorie content. This finding consistent with result of these studies (Agidew et al., 2018).

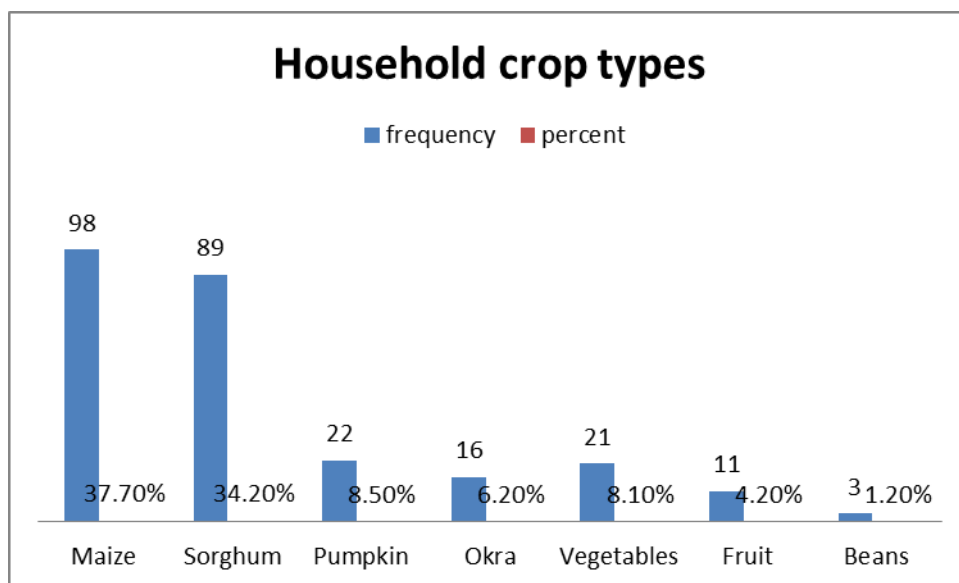


Figure 4.1: Crop types Produced in the study area.

Source: own survey result 2021

4.2.2. Purpose of crop production

According to survey result (Figure 2.2) shown that 91 percent of household produced crop for home consumption while 9 percent of household produced crop for consumption and marketing. Moreover, the results indicated that most rural household produce crop for consumption which mean many household have not aware of family planning and market accessibility which in turn of large family size and market failure respectively. Therefore, most household uses crop for subsistence which make crop easy to consume or use without saving and make them more vulnerable to food shortage (William,. 2016).

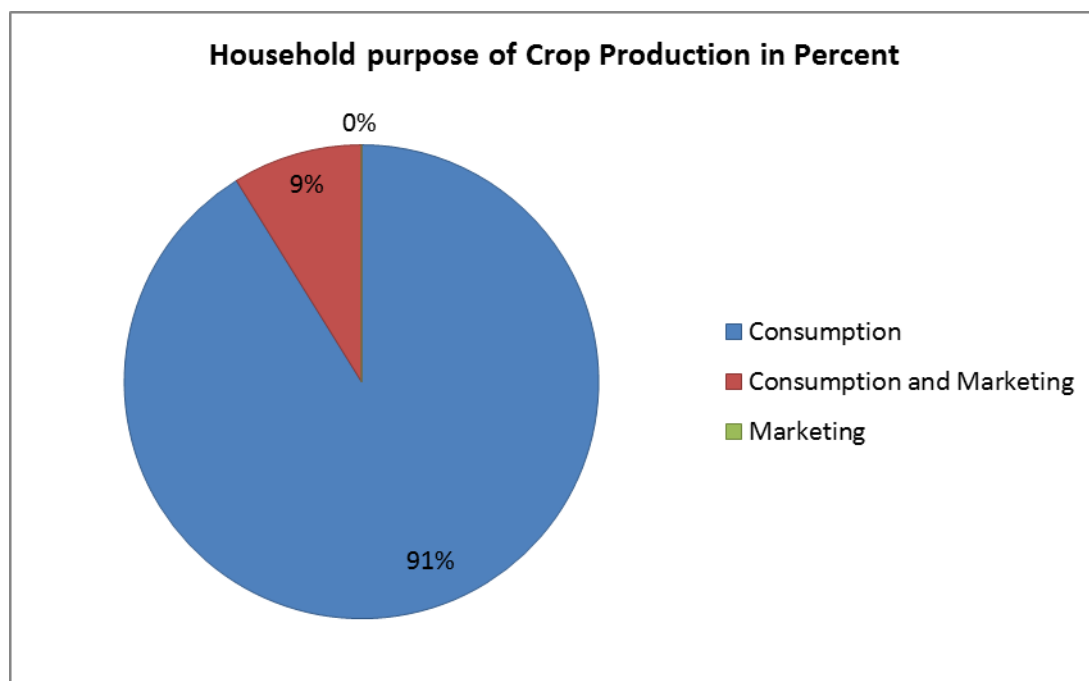


Figure 2.2: Purpose of crop production in the study area

Source: own survey result, 2021

4.2.3. Income source of sample households

The survey result (Figure 4.3) revealed that 22 percent of household received their income from livestock production only while 20 percent of household received their income from crop production only and 10 percent of household received their income from fish and crop production. Finally, 48 percent of household received their income from livestock and crop production. The result display that largest number of people got their income from livestock and crop production whereas second large number, next to livestock and crop production is livestock production. Therefore, the purpose for household to select livestock and crop production as the sources of income is that most household used livestock and crop production as the mean and livelihood asset because the area occupy by agro-pastoral communities.

Livestock are the main source of household's income, food as well as foundation of food security status and power in the study area. The reason why fish and crop production to be selected as the selected for many people because the sampled population live along the river bank for their entire life, therefore in the absent of livestock they prepare fishing and crop production instead going somewhere (Beyene et al., 2010).

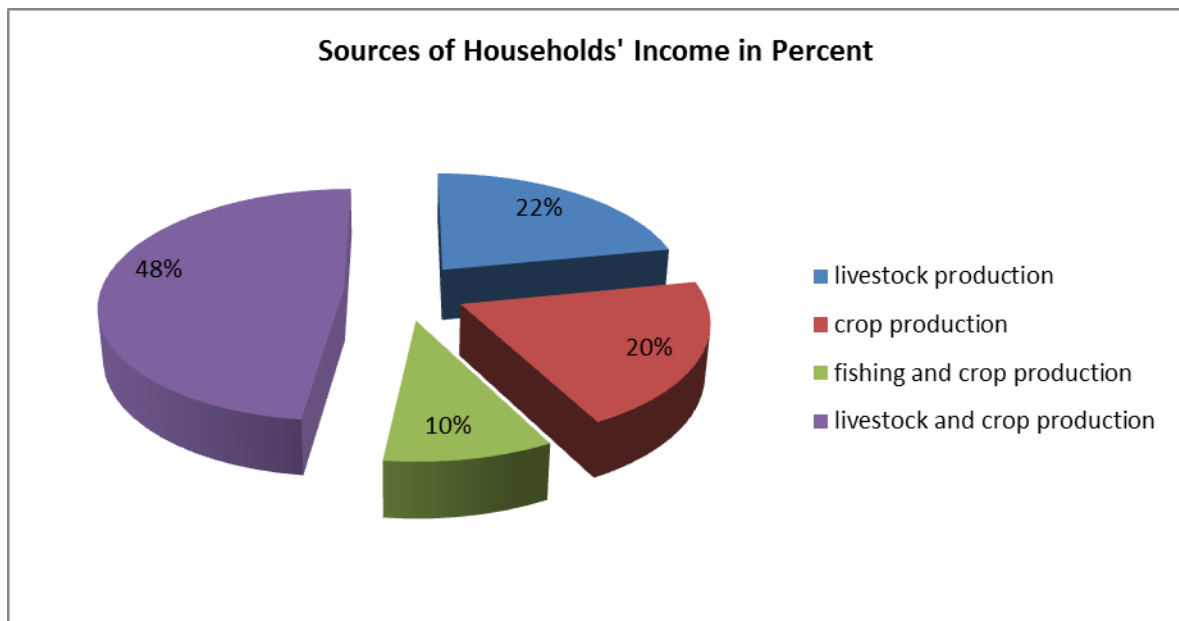


Figure 4. 3: Source of household income in the study area

Source: own survey result, 2021

4.2.4. Household food consumption expenditures

Figure 4.4 shown that 14.6 percent of household said that they consume their own harvested for a year while 3.5 percent of household said that they consume purchase only, and 1.5 percent of household said that they consume food aid only whereas 69.6 percent of household said that they consume their own harvest and purchase and then 10.8 percent of household said that they consume own harvest, purchase and gift. Therefore, survey results indicate that there is no statistically significant relationship between food security status and household expenditures.

Income is most status lead in achieving households' food security status in agro-pastoral area in which household rely their entirely life on agricultural activities rather than monthly/daily earning like people living in urban areas. Household in rural area are usually allocated their harvested grain and livestock products to meet food need of their family. This finding consistent with the result of other studies (Mota *et al.*,2019).

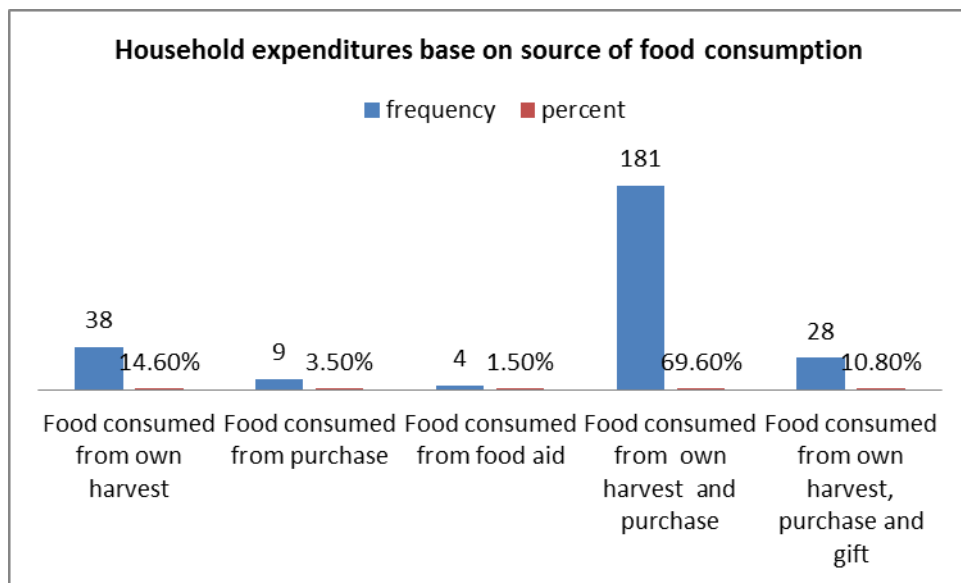


Figure 4. 4: Household expenditures base on source of food consumption

Source: own survey result 2021

4.3. Household food insecurity in the study area

4.3.1. Household food insecurity analysis

HFIAS is food security measurement which used to investigate household food security status based on the response of sampled household about their access to food include never, rarely, sometimes and often (Regassa *et al.*, 2012). Hence, household food insecurity access scale analyses were used to investigate using access related, condition and prevalence. The nine generic questions of HFIAS were also designed to represent varying level of food insecurity and reflect the domains to categorized food security status. These domains are never, rarely, some times and often as indicated in below.

Table 4.3: Summary of the household food security status

HFIAS Questionnaire		Number and households percentage by frequency				Total	HH experience condition
		Never	Rarely	Some times	Often		
Worried about food?	N	43	112	77	28	260	217
	%	16.5	43.1	29.6	10.8	100	10.8
Unable to eat preferred food	N	48	107	80	25	260	212
	%	18.5	41.2	30.8	9.6	100	10.6
Eat a few kinds of foods	N	37	127	73	23	260	223
	%	14.2	48.8	28.1	8.8	100	11.1
Eat food they really do not want eat	N	30	147	70	13	260	230
	%	11.5	56.5	26.9	5.0	100	11.4
Eat small meal than they felt	N	49	127	68	16	260	211
	%	18.8	48.8	26.2	6.2	100	10.5
Eat a few meal in a day	N	21	137	89	13	260	239
	%	8.1	52.7	34.2	5.0	100	11.9
No food or any kind in the house	N	20	140	94	6	260	240
	%	7.7	53.8	36.2	2.3	100	11.9
Slept hungry	N	24	149	69	18	260	236
	%	9.2	57.3	26.5	6.9	100	11.7
Whole and night without food	N	39	125	76	20	260	201
	%	15.0	48.1	29.2	7.7	100	10.0
	No	311	1,171	696	162	2340	2,009(100)

Source: own survey result, 2021

Households' food insecurity access prevalence is classification for the indicator of household vulnerability to food shortage that revealed its seriousness. It classify household in to four scale of food insecurity severe by using formula given by scholar (Maxwell *et al.*, 2014) as food secure, mildly food insecure, moderately food insecure and severity food insecure.

The survey result (Table 4.3) indicate that 13.46 percent of household were food secure, 50.38 percent of household were moderate food insecure, 29.23 percent of household were mildly food insecure and finally, 6.92 percent of household were severe food insecure. Therefore, this finding results closely similar to the result (Yien, 2018) which found that 82.39 percent of household was food insecure.

Table 4.4: Household’s food security status by household food insecurity access scale

Household food insecurity access scale	Freq.	Percent
Food Secured	35	13.46
Moderately Food Insecure	131	50.38
Mildly Food Insecure	76	29.23
Severe Food Secure	18	6.92
Total	260	100.00

Source: own survey result, 2021

4.3.2. Season of food shortages in the study area

The survey result (Figure 4.5) shown that 72.7 percent of household said that monthly food insecure were at May, June and July, 6.2 percent of household said that monthly food insecure were at Aug, Sept and Oct, 0.4 percent of household said that monthly food insecure were at Nov, December and January, 20.8 percent of household said that monthly food insecure were at Feb, Mar and April according to study area. Comparing food security status and household monthly food shortage we can point out that high number of sampled household mentioned May, June & July follow by February, March and April (Ahmed *et al.*, 2013). This implies that most household in the seasonal of study area planted in month of June and November in a year while harvest their crop in the month of September and February respectively, therefore, because some household may lack saving for the future or could have communal culture, which allows them to shares their grains with others and becoming food shortage in a shortage period of time, this is communal culture influential to the resource utilization (Bell *et al.*, 2017).

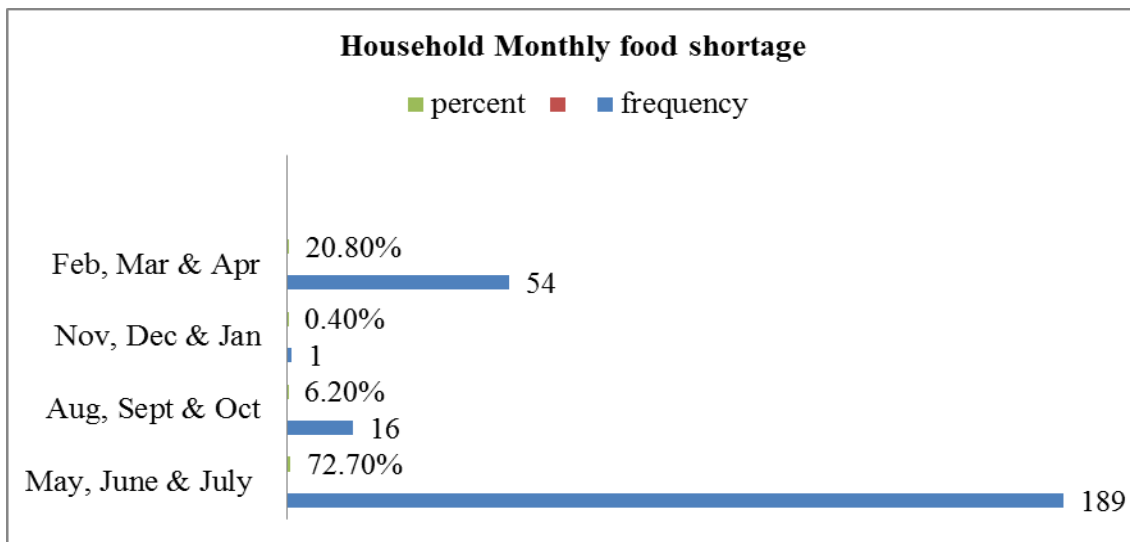


Figure 4. 5: Seasonal food shortage in the study area

Source: own survey result 2021

4.3.3 Causes of food insecurity in the study area

The sampled households were asked to list the major cause of food insecurity at household level. The survey result (Figure 4.6) shown that 85 percent of sampled households said that the major cause of food insecurity is flood hazard whereas 11.5 percent of sampled household said that the major cause of food insecurity is traditional farming system. 3.5 percent of sampled households said that major cause of food insecurity is crop and animal diseases. To compare household cause of food insecurity, the researcher rely that household in the study area faced food security problem in difference ways.

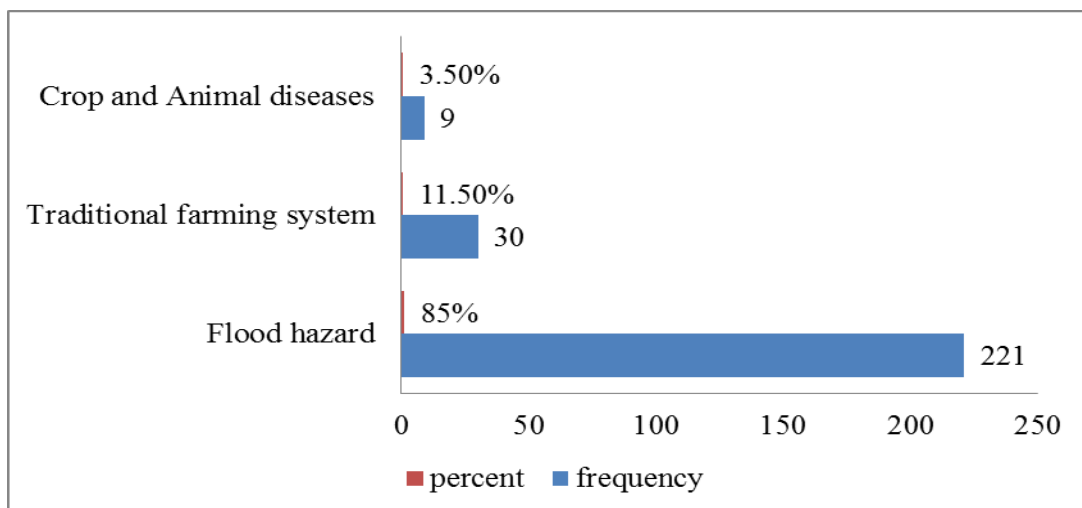


Figure 4.6: Causes of food insecurity in the study area

Source: own survey result 2021

4.4. Determinants of food security in the study area

As specified in the methodology part of the study, the analysis used the Binary logistic regression model since the researcher used HFIAS for measuring food insecurity access in the study area which take the Binary logistic regression model because it has natural order. This model was used to see relatively check the influence of Demographic, socioeconomic, physical or institutional factors on the food security status of household. The use for description statistics is not enough to stimulate policy action unless the relative influence each factor is known for priority based intervention. Before, the discussing about the econometrics model result, the model specification and data fitting should be used. The present of multicollinearity among explanatory was tested used **VIF** for all continuous variables and coefficient value contingency for Dummy variables as indicated in **appendix 4 and 5**.

In the study, logit analysis was made using the household demographic, socioeconomic, and institutional factors hypothesized to determine the food security status of agro-pastoral households. According to Asenso-O *et al.*, 2013, a logit model estimation was used to figures out factors with a certain sort of relationship to the food security status of the study in agro-pastoral households. The logit equation (Table 4.4) indicated that four significant variable were found toward food security status in the study area.

These variables are family size, educational level are statistic significant at 1% probability level whereas livestock ownership and market access are statistic significant at 5% probability level respectively.

Table 4. 5: Binary logistic Regression model for determinant of food security status

HFIAS	Coef.	St.Err.	t-value	p-value	Sig
SEXHHH	0.308	0.293	1.05	0.292	
AGEHHH	0.008	0.008	0.99	0.320	
FMSHHH	-0.073	0.025	-2.92	0.003	***
DEPRT	-0.038	0.079	-0.48	0.628	
EDUHHH	0.890	0.316	2.81	0.005	***
LNDSEHH	0.091	0.210	0.44	0.664	
IRRIGATION	0.034	0.940	0.04	0.971	
LVSTLU	0.030	0.014	2.17	0.030	**
OFFFRM	-0.268	0.298	-0.90	0.370	
REMI	0.000	0.000	1.54	0.124	

CRESER	0.105	0.272	0.39	0.698	
MARDIS	-0.368	0.161	-2.29	0.022	**
FOODAID	-0.082	0.315	-0.26	0.795	
Pseudo r-squared		0.060	Number of obs		260.000
Chi-square		30.862	Prob > chi2		0.004

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: own survey result, 2021

Household family size: it is continuous variable where the survey result found that there is statistically significant relationship with household food security status at 1% probability level. The result shown that household family size has negative relationship with household's food security status that mean large family size could face food shortage. Moreover, household with large number of family size is more likely to be food insecure than the household with small number of family size, therefore, increase family size within limited resource would increase household vulnerability to food shortage (Dube *et al.*, 2018).

Educational level: Education is household head indicate that educational level of household head is significant (at 1% probability level) in determining household food security.

Household educational level have positive relationship with food security status which mean that the more household head is educated, the higher will likely be to educate family member and aware of modern technology, particular family planning and agricultural technology such as awareness on use of irrigation in the study area. This implies that mean the more household head educated, the more family member would be familiar to modern life style and adapt the new modern life specially, agricultural technology to improve their agricultural productivity (Romeo *et al.*, 2016).

Livestock holding: it is continuous variable and found as statistically significant at 5% probability level with positive relationship of household food security status. The result implies that households with livestock holding have most likely food secure than the one who have not because it contribute to subsistence need and nutritional requirement. Similarly, livestock contribute to sustenance and dietary requirement, and also as accumulation of wealth so that disposed during the time of need, especially when food stock in the household decline (Gecho *et al.*, 2014).

Distant to Market: According to result shown that distant to market was found statistically significant (at 5% probability level) and have positive impact on household food security status in the study area. Nearest market may create opportunity of more income by providing off/on-farm employment opportunity than the far distant to market with significant level. This mean the probability of household of being food insecure increase if household is far away from the market. This result reliable that the more the distant from the market, the households probability to be food insecure and more likely to expose to food shortage (Tamiru *et al.*, 2017).

4.5. Coping mechanisms used by household during food shortage

The survey result (Figure 4.7) show that 7.7 percent of sampled household said that they used to borrowing cash or grain whereas 8.1 percent of household use firewood whereas 22.3 percent of household use to sale livestock during food shortage and 15 percent of household use to consume seed from stock while 7.7 percent of household to migrate to look for job during food shortage. About 6.2 percent of household used to gathering wild fruit or food, 5.4 percent of household use fishing whereas 5.8 percent of household use grass thatching during crop and 11.5 percent of household use to reduce the quantity of meal per day while 0.4 percent of household use to prepare local wine. Comparing household food security status and coping mechanisms shown that most rural household in the study area were used livestock as the mean coping mechanisms followed by consume seed from stock. Therefore, result shown that household in the study area is agro-pastoralist.

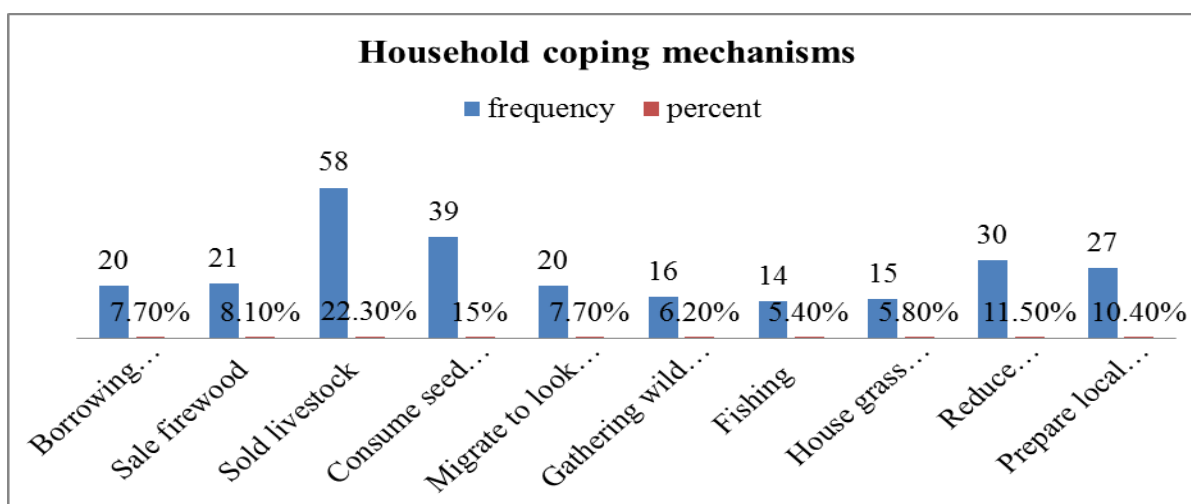


Figure 4. 7: Household coping mechanism in the study area

Source: own survey result 2021

CHAPTER FIVE: CONCLUSION AND RECOMMENDATION

5.1. Conclusion

This study was conducted in Itang special woreda of Gambella region with the objectives to measure the food security status of agro-pastoral households, to determine the causes and factors of household's food insecurity and to identify indigenous coping strategies adopted to overcome food shortages. In order to achieve research objectives, the study collected data depend more on primary and secondary data through rural household survey within randomly selected sampled size of 260 from selected three kebeles in the woreda.

Demographics, socioeconomic and institutional characteristics of the sampled households were estimated in order to collect, organized, analyzed and interpreted to come up with results.

The survey results from food security analysis using HFIAS food security techniques shown that 13.46% and 86.54% of sampled households were food secure and food insecure, respectively.

Descriptive statistic indicated that there are statistically significant relationships between food security status and agro-pastoral households at less than 1% probability level.

According to survey result, the coping strategies practiced by most of the agro-pastoral households in the study area were selling livestock than usual 22.3%, Consume seed from stock 15%, Reduce quantity of meal 11.5% and Prepare local wine 10.4%.

Ordinal logistic model was employed to test relationship between the characteristic of sampled households and food security status. The model outcome showed that four variables out of thirteen variables were found statistically significant. Among these significant variables were livestock owned and educational level were positively related with food security status whereas the remaining significant variables such as family size and distant to market were negatively related with food security status in the study area. Moreover, the research finding shows that, 86.54% of sampled households were food insecure and only 13.46% of sampled households were food secure, it may be concluded that 87% of population in the study area always suffered with food insecurity.

Therefore, it could be concluded that livestock productivity can be improved by applying veterinary services and awareness created on effective family planning and the impact of large family size on

ensuring food security and this can be done if agro-pastoral household have access to education in the study area. Opportunities for access to market and road infrastructures help to linked agro-pastoral communities to the market and so that it can include all activities involved in supply of farm inputs to the farmers and movement of agricultural products from the farms to the consumers.

5.2. Recommendations

Based on the findings of the study, policy recommendations toward reducing or eliminating household agro-pastoral food insecurity in the study area are as follows:

- ✓ Family size has negative relationship with household's food security that mean household with large family size could face food insecurity problems than the household with small number of family size. To improve such an impact, the government or non-governmental organization need to create awareness for rural households to use family planning and capability building to ensure availability and to disseminated accurate information to the sampled households.
- ✓ Educational level is one of influential factor on household food security status. Household with good educational level have chance to improve their living standard than uneducated household in the study area, that mean high educated household head, the more family member would be educated and easy to adopt modern technology. This can be promoted by government or other supported non-governmental organization to strength both formal and informal education for household to achieve food security.
- ✓ Livestock ownership is main sources of food and income from agro-pastoral household that mean household owned large number of livestock have more probability to earn more incomes. Livestock development packages can be introduce in order to improve livestock productivity which includes sustainable forage program, providing access water supply, and veterinary services by government or other supported non-governmental organization.
- ✓ Agro-pastoral household is imposed by long distance to the market, the survey result prove that most of agro-pastoral households have lack of access market and mostly depends on own production, therefore, researcher encourage government or other supported non-government organization to improve road or rehabilitate for household to ease access input and output market for achieving food security.

In generally, as the policy suggestion the government should exhaustedly work on promoting educational level of rural household in order for household to adapt agriculture technology, give

awareness for family planning and improving road access for agricultural input, and subsidized the agro-pastoral households to overcome problem of food shortage and promote households coping capability to food insecurity.

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APPENDICES

Appendix 1: Conversation factor used to compute Tropical livestock unit (TLU)

Animal category	Conservation factors	Total population	Tropical livestock unit (TLU)
Oxen	1.00		1.00
Cows	1.00		1.00
Heifer	0.75		0.75
Calf	0.125		0.25
Donkey (Adult)	0.70		487.20
Donkey (young)	0.35		0.35
Sheep and Goat (Adult)	0.13		0.13
Sheep and Goat (young)	0.06		0.06
Chicken	0.013		0.013

Source: storck, et la, (1991).

Appendix 2: Summary of the frequency of the responses to the HFIAS questions

NO	HFIAS Questionnaire		Number and households percentage by frequency				Total	HH experience condition
			Never	Rarely	Some times	Often		
. 1	Worried about food?	No	43	112	77	28	260	217
		%	16.5	43.1	29.6	10.8	100	10.8
. 2	Unable to eat preferred food	No	48	107	80	25	260	212
		%	18.5	41.2	30.8	9.6	100	10.6
. 3	Eat a few kinds of foods	No	37	127	73	23	260	223
		%	14.2	48.8	28.1	8.8	100	11.1
. 4	Eat food they really do not want eat	No	30	147	70	13	260	230
		%	11.5	56.5	26.9	5.0	100	11.4
. 5	Eat small meal than they felt	No	49	127	68	16	260	211
		%	18.8	48.8	26.2	6.2	100	10.5
. 6	Eat a few meal in a day	No	21	137	89	13	260	239
		%	8.1	52.7	34.2	5.0	100	11.9
. 7	No food or any kind in the house	No	20	140	94	6	260	240
		%	7.7	53.8	36.2	2.3	100	11.9
. 8	Slept hungry	No	24	149	69	18	260	236
		%	9.2	57.3	26.5	6.9	100	11.7
. 9	Whole and night without food	No	39	125	76	20	260	201
		%	15.0	48.1	29.2	7.7	100	10.0
Total score = 260*9 =2340		No	311	1,171	696	162	2340	2,009(100)

Appendix 3: STATA result for HFIAS and Sampled households

household food insecurity access scale	Freq.	Percent
food secure	35	13.46
moderately food insecure	131	50.38
mildly food insecure	76	29.23
severe food secure	18	6.92
Total	260	100.00

Source: own survey result, 2021

Appendix 4: Variance inflator factor for continuous variables

Name variable	VIF	1/VIF
HFS	1.239	.807
HLS	1.143	.875
HR	1.134	.882
AHH	1.108	.903
HLO	1.084	.922
HDR	1.06	.944
HDM	1.03	.971
Mean VIF	1.114	.

Source: own survey result, 2021

Appendix 5: Correlation for Dummy variables

Variable	SHH	EHH	HR	HOFI	HACS	HF
SHH	1.000					
EHH	0.090	1.000				
HR	-0.098	0.098	1.000			
HOFI	-0.019	-0.110	-0.065	1.000		
HACS	-0.062	-0.220	0.052	0.046	1.000	
HF	0.026	0.086	-0.003	0.028	-0.099	1.000

Source: own survey result, 2021

Appendix 6: STATA result of ordinal logistic regression model for determinants food security status

HFIAS	Coef.	St.Err.	t-value	p-value	Sig
SEXHHH	0.308	0.293	1.05	0.292	
AGEHHH	0.008	0.008	0.99	0.320	
FMSHHH	-0.073	0.025	-2.92	0.003	***
DEPRT	-0.038	0.079	-0.48	0.628	
EDUHHH	0.890	0.316	2.81	0.005	***
LNSZEHH	0.091	0.210	0.44	0.664	
IRRIGATION	0.034	0.940	0.04	0.971	
LVSTLU	0.030	0.014	2.17	0.030	**
OFFFRM	-0.268	0.298	-0.90	0.370	
REMI	0.000	0.000	1.54	0.124	
CRESER	0.105	0.272	0.39	0.698	
MARDIS	-0.368	0.161	-2.29	0.022	**
FOODAID	-0.082	0.315	-0.26	0.795	
Pseudo r-squared		0.060	Number of obs		260.000
Chi-square		30.862	Prob > chi2		0.004

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: own survey result, 2021

INTERVIEW SCHEDULE FOR HOUSEHOLD SURVEY

Consensus message

Hello Sir/ Madam,

My name is **Kache Taliat Puoch**, I am student from Addis Ababa university, my purpose to come here is for academic as a researcher and the research topic is to investigated how agro-pastoral household food security and coping mechanisms in Itang special woreda, and I purposely select this community as my target group to feed me with information which fit with their living condition economically, physical, socially and environmentally in order to better be informed with what is going on and you have been identified as a key respondent and I wish, with your permission, to interview you. No personal information about you (such as your name) will be used in the final report to link you with what you said unless authorized. All information from the entire study will be put together to compile a joint report. Your participation in this study is very important and I will rely on you to provide me with accurate information that will aid a future rural food security in this area.

This interview is planned to last within 1 hour and half. I would like to record this discussion so that I can be able to accurately capture what we discuss. If you agree it will be my pleasure. Do I have your permission to proceed with the interview? _____

Questionnaire for agro-pastoral household food security and coping mechanism in Itang Special woreda, Gambella Region, Ethiopia

GENERAL INFORMATION

Name of Woreda: _____

Name of Kebeles: _____

Name of household head: _____

Name of the interviewer: _____

Date of interview: _____ Signature: _____

Part one: Household Demography

1.1 Name of household head : _____ (optional coded)

1.1.1 Sex household head: _____ 1. Male |___|, 2. Female |___|,

1.1.2. Age of household head: 1. below 29|___|, 2. between 30 – 64 |___|, 3. 64 and above |___|

1.2. Family Size: 1. >5 |___|, 2. 5-10|___|, 3. >10|___|

1.4 Please, tell us the number of members in the household according to the following?

Age category	Sex		Educational status			
	Male	Female	Illiterate	Read	Write	Literate
Number of family members 0-14 years						
Number of family members 15-64 years						
Number of family members 65 years						

Part Two. Land Resources

2.1. Do you have your own land? _____ 1. Yes, 2. No

2.1.1. If yes, what is the total size of your land? _____ (in hectare).

2.1.2. If No, where do you get the land for cultivation? _____

1. Rented|____|, 2.for free|____|, 3. Share land with others|____|, 4. Others _____

2.2. What is the total area of land did you cultivated during last harvesting season in year 2020? _____ (in hectare).

2.3. Do you think that your piece of land is enough to support your family? 1. Yes|____| 2.No|____|

2.3.1. If No, state your reason. 1. Small size of land|____| 2. Exhausted land|____| 3.Lack of agricultural inputs to increase productivity |____| 4.Large family size |____| 5. Others: _____

2.4. How many times do you plant a year? a) One time b) two times c) three times d) others (specify) _____

2.5. List the type of crops you cultivated and their average production for 2020.

Type of crop	Year 2020		
	Area(in hectare) or local unit	Total production (in quintal Qt) or in kg	Value in Birr
Semi-annual crops			
Annual crops			
Others			

2.6. What is your purpose for crop production?

1. Consumption |____| 2. Marketing |____| 3. Consumption and marketing |____| 4. Others |____|

2.6.1. If your answer is consumption and market, quantify the grain for consumption and for the market in year 2020 in Quintal (Qt).

S/No	Types of Crops	Consumption(kg)	Marketing(kg)	Total(kg)
	maize			
	Sorghum			
	Sweet			
	Potatoes			
	Pumpkin			
	Bean			
	Others			

2.6.2. If No, how long did your grains last? _____Months.

2.7. Did you use intercropping during the last cropping season in the year 2020?

1. Yes |___| 2. No |___|

2.7.1. If yes, what are the types of crop you were intercropping in your farm land?

1. Maize and bean |___| 2. Maize and sweet potatoes |___| 3. Maize and pumpkin |___| 4. Maize, bean and pumpkin |___| 5. Maize, pumpkin and sweet potatoes |___| 6. Maize, bean, pumpkin and sweet potatoes|___|.

2.8. What do you use to plough your land? 1. Hand tools (hoe) |___| 2. Oxen |___| 3.Rented tractor |___| 4. Others |___|

2.9. What are the problems related to farming system in your area in year 2020?

1. Shortage of seeds |___| 2. Lack of fertilizer |___| 3. Disease and insect pest|___| 4. Weeds.|___| 5.Lack of land |___| 6.Shortage of oxen/tractor |___| 7. Others specify|___|

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

2.10.1. If yes, what type of irrigation did you used? 1. Drip|___| 2. Aerial |___| 3. Channel|___| 4. Hand |___|

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

S/No	Types of Crops	Area (in hectare)	Production(Qt)	Consumption(kg)	Amount sold

PART Three. Livestock production

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

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

S/N	Types of livestock	Number owned	Weight	TLU
	Young bulls/Oxen			
	Cows			
	Heifer(young cow)			
	Calves			
	Sheep			
	Goats			
	Horses			
	Donkey/mule			
	Camels			
	Chickens			

3.2 What are the factors affecting your animal production in year 2020?

1. Animal disease 2. Insect pest (Tsetse fly) 3. Flood hazard 4. Shortage of grazing land 5. Others: _____

Part Four: Non-Farm Income and Remittance

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

1. Yes 2. No

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

ID code of Family members with job	Type of jobs	Monthly earned(birr)

* ID code: 01- Head 02- Wife 3- Son 4- Daughter 5- Relative 06- Raised 07- Other, specify ** A = Sale of fire wood B = Traditional equipment (like DutkieKoy Collection) C = Others, specify DutkieKoy – means traditional Nuer house construction material

4.2. Do your household receive any other income (such as remittance, gifts, aid or other transfer) last year in 2020? 1. Yes 2. No

4.3. If yes, tell us the type of materials your household have received from others?

Types of receipt	Amount in kind	Amount received (birr)	Sources
grain			
money			
cattle			
others			

4.4. What were the Sources of your household income in year 2020?

Sources of income	Unit	Quantity	Total sale (birr)
1. Crop buy by types			
Maize			
Sorghum			
Wheat			
Others			
Animal sales by types			
Cattle			
Sheep or goat			
Chickens (chicken or eggs			
others			
Sales of animal product			
Milk			
Milk product			
Honey			
Fish			
Others			

Part Five: Credit Services

5.1 Do you receive any type of credit for the last couple of years?

1) Yes 2) No

5.2 If yes, from where do you get the credit? _____

1) Local money lender 2) friends and relatives 3) NGOs 4) Commercial bank of Ethiopia 5) Micro finance institute 6) Other, specify _____

5.3. Does the household received remittance in this year? Yes No

5.4. If yes, the amount in birr/ year: _____

Part Six: Market Access

6.1 Is there any market (s) does your household use? Yes No

6.2 What is average market distance you traveled to nearest market from your home, measured in hours of walk? 1) ½hr |___|, 2) 1hr |___|,3) 1 ½hr |___|, 4) 2hr |___|,5) 2 ½hr |___|,6) 3hr |___|,7) 3 ½hr |___|,8) 4hr |___|,9) 4 ½hr 10) > 4 ½hr |___|

6.3 If yes, what means of transportation do you use to take your produce to the market?

1) Pack animals|___| 2) Vehicles|___| 3) Human|___| 4) Other, specify _____

6.4 Amount of food grain purchased and sold by the household during last three months.

S/N	Types of grain	Purchase in		Sold out	
		Itang	Birr	Itang	Birr
1.					
2.					
3.					
4.					
5.					

Part Seven: Food access information (HFIAS)

No	Questions	Response	Code
1.	In the past four weeks, did you worry that your household would not have enough food?	0=No(skip to Qt2) 1=Yes	
1.a	How often did this happen?	1= rarely(once or twice in the past four weeks) 2= sometimes(three to ten times in the past four weeks) 3=often(more than ten times in the past four weeks).	
2.	In the past four weeks, were you or any household member not able to eat the kind of food you prefer because of a lack of resource?	0=No(skip to Qt3) 1=Yes	
2.a	How often did this happen?	1= rarely(once or twice in the past four weeks) 2= sometimes (three to ten times in the past four weeks) 3=often (more than ten times in the past four weeks).	
3.	In the past four weeks, did you or any household member have to eat a limited variety of foods due to lack of resource?	0=No(skip to Qt4) 1=Yes	
3.a	How often did this happen?	1= rarely(once or twice in the past four weeks) 2= sometimes (three to ten times in the past four weeks) 3=often (more than ten times in the past four weeks).	
4.	In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resource?	0=No(skip to Qt5) 1=Yes	
4.a	How often did this happen?	1= rarely(once or twice in the past four weeks)	

		2= sometimes (three to ten times in the past four weeks) 3=often (more than ten times in the past four weeks).	
5.	In the past four weeks, did you or any household member have to eat smaller meal than you felt you needed because there was no enough food?	0=No(skip to Qt6) 1=Yes	
5.a	How often did this happen?	1= rarely(once or twice in the past four weeks) 2= sometimes (three to ten times in the past four weeks) 3=often (more than ten times in the past four weeks).	
6.	In the past four weeks, did you or any household member have to eat fewer meals in a day because there was no enough food?	0=No(skip to Qt7) 1=Yes	
6.a	How often did this happen?	1= rarely(once or twice in the past four weeks) 2= sometimes (three to ten times in the past four weeks) 3=often (more than ten times in the past four weeks).	
7.	In the past four weeks, was there even no food to eat of any kind in your household because of a lack of resource to get food?	0=No(skip to Qt8) 1=Yes	
7.a	How often did this happen?	1= rarely(once or twice in the past four weeks) 2= sometimes (three to ten times in the past four weeks) 3=often (more than ten times in the past four weeks).	
8.	In the past four weeks, did you or any household member go to sleep at night hungry because there was no enough food?	0=No(skip to Qt9) 1=Yes	
8.a	How often did this happen?	1= rarely(once or twice in the past four weeks) 2= sometimes (three to ten times in the past four weeks) 3=often (more than ten times in the past four weeks).	
9.	In the past four weeks, did you or any household member go a whole day and night without eating anything because there was no enough food?	0=No(questionnaire is finished) 1=Yes	
9.a	How often did this happen?	1= rarely(once or twice in the past four weeks) 2= sometimes (three to ten times in the past four weeks) 3=often (more than ten times in the past four weeks).	

Part Eight: Food Consumption Practice (Food security)

8.1. Do your household have ever face any food shortage in this area for last five years?

Yes No

8.1.1. If yes, what were the main causes of that food insecurity?

1. Erratic rainfall	
2. Flood hazard	
3. Poor quality of seed	
4. Shortage of cultivated land	
5. Health problem	
6. Traditional farming system	
7. Crop and animal diseases	
8. Others (if any)	

8.2. Which months in a year is the food shortage sever? Choose according to their severity in months by ticking the box below.

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

8.3. Please indicate the months in which your household had enough food for consumption during last year 2020? By ticking the box below

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

8.4. For how many months during last year 2020 did your household have enough food for consumption? _____ 1. two months 2. Three months 3. Four months 4. Greater than five months

8.5. Did your household used seeds from grains on own reserve during last farming season of 2020? Yes No

8.6 If yes, what types of crop seeds household used to reserves during last season of 2020? By ticking the respective box below

1. Maize 2. Sorghum 3. Bean 4. Sweet 5. potatoes 6. okra 7. Others: _____

8.7. How many harvest/grain did your household harvested in your field during last year 2020 cropping season? _____ (in kg)

Name of crops (grain)	Quantity (in kg)	Value (ETB)
maize		
sorghum		
bean		
sweet		
potatoes		
okra		
others		

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

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

Part Nine: Coping Mechanisms during food insecurity

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

S/N	Coping mechanism	
1.	Borrowed cash or grain	
2.	Sold firewood	
3.	Sold livestock	
4.	Consume seed from stock	
5.	Migrated to look for job	
6.	Gathering wild fruit/food	
7.	Eat fewer meals per day /Reduced quantity of food per meal	
8.	Fishing	
9.	Sell milk and milk product	
10.	Sell grass	
11.	Prepare local wine	
12	Others:	

9.2 Did you receive any food aid in year 2020? 1. Yes|___| 2. No |___|

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

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

9.2.3.

S/N	Crop	Amount/unit	
		Kg	Liter
	Maize		
	Wheat		
	Oil		

APPENDIX II, FOCUS GROUP DISCUSSIONS

Focus Group Discussion Guides

Kebeles Name _____ Date ____|____|2021

Name of the group member _____

Type of the Groups (farmers groups or others) _____

Main role in the group or community _____

Characteristics of focus group participants	Categories (Mark X in front of each rows)
Sex	
Male	
Female	
Age	
20-40	
41-60	
61 and above	
Position in the household	
Father	
Mother	
Adult members	

1 checklist for focus group (land, livestock and crops linked with their practice)

A. Land for crops

1. What type of crops do you practice in this area? What drives you to select one or some crop from the other?
2. What are the sources of land for farming in your area? How do you access the land in your area? How much do you pay in cash or kind for land?
3. What are the inputs required for farming and their sources? How do you access those inputs service for your crop cultivation?
4. Is there any crop failure shock in your area? What are the factors for exposure to crop failure shocks?
5. What measures do you take to manage the risks associated with crop failure?

B. Livestock pasture spacing

1. What type of livestock rearing in your area? What is the reason for selection of some livestock among the others?
2. What are the sources of pasture for livestock in your area? How do you access the pasture land in your area? What are the problem those prevent you from access to those pastures?
3. How do you solve the problem related to those spacing of livestock grazing?

C. Access to market

1. How do you explain the situation of market shocks that you have been exposed so far?
2. What do you think are the reasons for your exposure to market shocks in your local area?
3. What measure do you take to manage market failure in your local area?

APPENDIX III. FOR KEY INFORMANT INTERVIEW

Key Informants Interview Guides for staffs and elder in the woreda

A. Interviews with agricultural experts (Development agent)

Checklist for crops and livestock practice

1. What are the major crops grown in the woreda?
2. What are the challenges of crop production in the woreda?
3. How do you see the natural resource degradation status in the woreda/locality?
4. How do you see the soil and water conservation practices in the locality?
5. What are the main livestock reared by households in the study area?
6. What are the challenges of livestock production in the study area?
7. How do you explain the resettlement program occur in the woreda?
8. What do you think is/are positive or negative impacts on both crops and livestock?

B. Interviews with elders

Checklist for living styles of the villages

1. Do you live in one village during year around or move to others area for temporary time?
2. Who move in the family (a) young, b) parents, c) all family)?
3. Why do people move from the village to other rural village in the woreda?
4. Before ten years back how do you think the living condition look like?
5. In these two years what are the new farming activities do you practice on your farm?
6. Where do you get the material for houses and huts for your cattle before ten years?
7. Now if you need construct the house where do you get the construction materials?

APPENDIX III Personal observation Guide (at local area)

Name of Observer _____

Name of kebeles _____ **Date** _____ | _____ | **2021**

Checklist for observation

- ✓ Living and working environment of casual on/off farm income
- ✓ crop farming practices in the area
- ✓ Types of Livestock rearing in the area
- ✓ Agro-climate condition of the area
- ✓ Land use and cover in the area
- ✓ Available social services and infrastructure
- ✓ Coping mechanism in the area
- ✓ Temporary mobility of the host community

(Seeing and recording tangible things)

Comment or suggestion -----

Appendix 7: Some of off/non-farm income used by household as coping mechanism

