EFFECTS OF DROUGHT ON RURAL HOUSEHOLDS AND THEIR COPING MECHANISMS: THE CASE OF KACHA BIRRA WOREDA, KEMBATA TEMBARO ZONE, ETHIOPIA.

MSc THESIS

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EFFECTS OF DROUGHT ON RURAL HOUSEHOLDS AND THEIR COPING MECHANISMS: THE CASE OF KACHA BIRRA WOREDA, KEMBATA TEMBARO ZONE, ETHIOPIA.

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By my signature below, I declare and affirm that this thesis is my genuine work. I have followed all ethical and technical principles of scholarship in the preparation, data collection, data analysis and compilation of this Thesis. Any scholarly matter that is included in the thesis has been given recognition through citation.

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BIOGRAPHICAL SKETCH

The author, Tesfahun Tessema was born on August 27-1982 E.C from his father Tessema Tafesse and his mother Zenebech Dolebo in *Kacha Birra* woreda Kembeta Tembero, Zone, SNNPR. He attended his elementary and junior education at Kacha Birra primary and secondary school and preparatory education at Shinshicho senior secondary and preparatory school. After completion of his preparatory education, he joined Ambo University, College of Agriculture and Department of Plant Science in 2003 E.C and graduated with BSc, degree in Plant Science in June 2005 E.C. Soon after graduation on the Bachelor of Science degree he joined Agriculture and rural development office as extension expert from December 2006 to January 2008 E.C, and he served for two years. After the two years services at Deyogena woreda Youth and sport office vise head service January 2008 to December 2010, he shifted to Kacha Birra woreda as Urban housing and development office head December 2010 to August 2011 E.C then he joined the School of Graduate Studies of Hawassa University in September 2012 E.C to pursue his Masters of science study in Climate Change and Sustainable Agriculture.

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LIST OF ABBREVATION AND ACRONYMS

CSA	Central Statistical Authority
EPA	Environmental Protection Authority
EPE	Environmental Policy of Ethiopia
FAO	Food and Agriculture Organization
FGDs	Focus Group Discussions
GDP	Gross Domestic products
HHs	Household Heads
IFPRI	International Food Policy Research Institute
IPCC	Intergovernmental Panel on Climate Change
KBWARDO	Kacha Birra Woreda Agriculture and Rural Development Office
KBWFEDO	Kacha Birra Woreda Finance and Economic Development Office
MLR	Multiple Linear Regression
MoA	Ministry of Agriculture
NDMC	National Drought Mitigation Center
SNNPR	Southern Nations Nationalities Region
SPSS	Statistical Package for Social Sciences
SSA	Sub -Saharan Africa
UNISDR	United Nations International Strategy for Disaster Reduction
WAI	Weighted Average Index

DESCRIPTION OF LOCAL TERMS

Ojicho The season to same extent overlaps with spring season of northern hemisphere. The season rainfall reaches up to 600 mm and short rainy season that lasts between March and May.

Matto It is typically summer in the northern hemisphere that contributes the longest rainy season and occurs between June and August.

***Kalea (low land*)** an area where the land is at, near, or below the level of the sea and where there are not usually mountains or large hills and altitude of 200-500m above sea level.

Hansawa (highland) a mountainous region or elevated part which is related to low temperature and altitude greater than 1500m above sea level.

Hansawi-kalea(mid land) an area with moderate agro-ecological zone and altitude ranges 500-1500m above sea level.

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ABSTRACT

Drought is one of the most devastating weather phenomena that has negatively affected Ethiopia over the decades. The main objective of this study was to investigate the effects of drought on rural households and their coping mechanisms in Kacha Birra woreda, Kembata Tembero, Zone SNNPR, Ethiopia. Primary data, both of qualitative and quantitative types were collected sample households, focus group discussions (FGDs), and Key informants. A total of 292 sample households were selected from three sample kebles for individual interviews. Secondary data was collected from relevant line offices, the CSA and the woreda Meteorology Office. Descriptive statics, weighted average index, and multiple linear regressions were used to analyze the data .The results indicated that a decline in Crop yield was the most widely reported effects of drought with a weighted average index of 2.16. Among identified drought coping mechanisms, sale of household assets was the most widely reported while cultivating drought-resistant and short-season crops were the least reported ones. The findings from the multiple linear regression model showed that the household's drought coping mechanism is influenced by age, education, farm size, annual household income and access to credit influenced the coping mechanisms of the households in the study area. It is recommended that sustainable adaptation options and involvement of different institutional interventions are crucial to minimize and address the recurrent cycle of drought in the study area.

Keywords: - Climate change, Coping mechanisms, Drought, Livelihoods

CHAPTER ONE: INTRODUCTION

1.1. Background of the Study

Climate change and variability have been a major threat to humankind in recent decades. It is predicted to have adverse consequences on the world's ecosystems, economies, and societies. But, the severity of adverse effects varies across countries, regions, and socio-demographic groups due to differences in exposures, sensitivities and adaptive capacities (Betelhem, 2014). Scientific reports suggest that continuous increment of emissions resulted in to rise in global temperature that promotes sea level rise, change in precipitation over land and other unexpected shocks (IPCC, 2014).

Drought is an extreme climate event that affects the livelihoods of millions of people around the world and is regarded as the most challenging natural disaster in economic, social and environmental terms (Mniki, 2009). It is common in almost all the climatic regions of the world but with varying severity, frequency in high and as well as low rainfall areas and may occur for a short period or a long period. Drought is also related to the timing i.e. the time of occurrence particularly the season in which it occurs, the delay in the start of the rainy season, the occurrence of rains concerning principal crop growth stages and the effectiveness of the rains, Thus every drought year is unique in its climatic characteristics and impacts. Almost all climatic regions and more than 50% of the planet earth are vulnerable to drought each year. Agriculture is the dominant economic activity in developing countries. It is very much sensitive to weather and climate variables like temperature, precipitation, and weather extremes, such as droughts and floods (Abera Birhanu and Manfred Zelle.2012). This indicates that any fluctuation in the variables largely affects agricultural production.

Drought in developing countries is very disastrous causing suffering, population displacement, food shortage, loss of life, land degradation, death of animals, reduction of agricultural output, diminishing of rivers and lakes, deteriorations of water conditions, wildfires and permanent vegetation failure (FAO, 2011).

Ethiopia as one of the sub-Saharan African countries that has been experiencing different degrees of droughts in recent decades. Ethiopia has mainly dry sub-humid, semi-arid and arid regions, all

of which are prone to drought. Moreover, due to climate change and human-induced factors, the areas affected by drought are expanding in Ethiopia.Drought in Ethiopia occurs during the different seasons that occur in different regions in the country and it exists when seasonal rainfall drops below normal by almost 30% to 50% (Getachew Alem, 2018). The severity and persistence of the droughts have produced a wide range of effects across the country because of this, the country is one of the largest humanitarian aid beneficiaries in the world and experiences significant climate-induced drought and water-related stresses on crop and livestock productivity (World food program, 2015). Very recently, the 2015 El-Niño induced drought has caused food insecurity among 10.2 million people, one of the highest on the record (FAO, 2016).

In Kacha Birra Woreda the lack of successive rainy seasons since mid-2015 exerted crushing effects on the worade's agro-economic system. Current drought conditions are affecting the lives and livelihoods of over many rural people in the study area. Meteorological drought or seasonal rainfall failure is largely due to climate variability and its impact results in widespread failure of seasonal crops, pasture and forage and death of livestock in the rural households, and widespread hunger among the affected population.

The coping mechanism consists of household practices used as a reactive response when confronted with immediate and unexpected threats (Thomas *et* al., 2007). Coping mechanisms at the household level in Ethiopia include selling productive assets, selling livestock and agricultural products, reducing current investment and consumption, temporarily or permanently migrating and using intra household transfers and loans, free food distribution (mainly from food aid) and food for work programs (MoFED, 2007).Therefore, coping mechanism is critical for reducing the effects of drought. Coping capacity building is increasingly embraced by governments and other institutions as a means to improve economic and ecological resilience. Therefore, this study was designed to assess the effects of drought on livelihoods of rural households and their coping mechanisms and coping mechanisms in selected Kebeles of *Kacha Birra* Woreda.

1.2. Statement of the Problem

Crop failure will lead to increased food prices, poor health, livestock production losses and a decline in prices of livestock was the most immediate effects of drought for rural households. The coupled effects of drought weaken the income of rural households, results in poor nutrition and decreasing risk coping capacity, thereby increasing the vulnerability of the households. The result has been excessive food insecurity, with households forced to become dependent on food aid and handouts from the government.

Large segments of the population are poor and depend on agricultural income, which is highly sensitive to rainfall variability, most have low access to education, information technology, and basic social and support services, and, as a result, have low coping capacity to deal with the consequences of extreme events, and these make the country to be easily vulnerable to the impacts of drought and influences coping mechanisms to drought.

In Kacha Birra Woreda most of the rural people live in drought-prone areas and are vulnerable to the impacts of drought. To fill this gap, this research has been carried out with a focus on assessing the impacts of drought on crop production, perceptions of rural livelihood in Kacha Birra district of Kembata Tembaro zone implement to overcome the problem. The increase in temperature and decline of precipitation, dependency only on rain-fed agriculture, low level of coping strategies, lack of institutional capacity, and low level of technological improvement made the Woreda more vulnerable to recurrent droughts and this made serious problem on the rural households.

Climate change extremes; namely, selling productive assets, sale of livestock and agricultural products, reducing consumption, temporary or permanent migration, and use of inter-household transfers and loans. Factors affecting drought coping mechanisms not fully identified. Therefore, to fill this gap, this study as the first drought effect assessment study in *Kacha Birra* Woreda will pay due attention to both household and institutional-based coping mechanisms practiced in the study area taking into account the factors affecting drought coping mechanisms.

1.3. Objectives of the Study

General objective

The general objective of this study is to investigate the effects of drought on rural households and their coping mechanisms in Kacha Birra Woreda, Kembata Tembaro Zone, Ethiopia.

Specific objectives

Based on the above general objective, the following specific objectives are formulated. Hence, the specific objectives are to: -

- To assess the effect of drought on the livelihoods of rural households in Kacha Birra Woreda.
- To identify the coping mechanisms adopted by rural households in response to the effects of drought
- To examine the determinant factors that influence coping mechanisms to drought in the study area

1.4. Research Questions

In order to achieve the above Specific objectives of this study, the following fundamental research questions will be addressed.

1. What are the effects of drought on the livelihoods of farm households in the study area?
2. What strategies do farmers design to cope with drought in the study area?
3. What are the major factors that determine drought coping strategies in the study area?

1.5. Significance of the Study

The significance of this study will be used for other researchers, agricultural investors, water resource managers, Environmental resource protection organizations and others in the study area and the results of the study can also be used by researchers and development practitioners as baseline information for further studies in the study area. This study also will be used to understand the effects of drought on rural livelihoods and useful to give information for the people to take possible coping mechanisms. This study is very interesting to use as guideline document for further research in this study area and to the same climatic, socioeconomic and geographical areas. In addition, the findings of this study may be important for all development partners interested in issues of drought such as researchers, extension workers, policy makers, education institutions and NGOs.

1.6. Scope of the Study

The effect of drought is diverse and different from one place to another. But this study is limited to the effects of drought on rural livelihoods especially on crop production and livestock rearing. It also uncovers sections of society that were more vulnerable to drought impacts and major coping mechanisms they use in times of drought. Geographically, this study is confined in three randomly selected kebeles out of twenty two kebeles in *Kacha Birra* Woreda.

1.7 Limitations of the Study

The study has been free from limitations. The challenges were the unwillingness of some officials to be interviewed, unavailability of sufficient data in the office due to poor record and documentation, There was also suspicion in respondents to tell the right information about their socio-economic situations. So by giving guidance to arrange available documents in ordered way for the next work and to change the problems.

1.8. Definition of Key Terms

Climate change: refers any change in climate over time through natural variability or as a result of human activities (IPCC 2007).

Coping mechanism: refers to ways to mitigate the impact of drought after they occur. (Cervigni *et al*, 2006).

Drought- is a phenomenon linked to inadequate rainfall due to a change in the rainfall patterns or a below-normal rainfall (Wilhite, 2011).

Livelihood:-means of living. A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. Agriculture was the main source of livelihood for most households (Pavanello, 2009).

1.9. Organization of the Study

This paper is organized in five chapters. The first chapter deals with the introduction part which includes the background of the study, statement of the problem, objectives, research questions, significance of the study, limitation, and organization of the paper. Chapter two is all about the review of related literature. The third chapter describes the research methodology and description of the study area. Chapter four presents the discussion and findings of the study. And the fifth chapter deals with the conclusion and recommendations forwarded by the investigator.

CHAPTER TWO: LITERATURE REVIEW

2.1. Conceptual Literature Review

2.1.1. Concepts and Definitions of Droughts

Drought is slow onset, spatially extensive events that can affect regions for weeks, months or years. Due to these characteristics droughts are often considered the most complex of all-natural hazards to understand and analyze (Wilhite *et al.*, 2007). Drought is a weather-related natural hazard that may affect vast regions for months or years with protracted impacts on food production, reducing the life expectancy and the economic performance of large regions or entire countries (UNISDR, 2009).

Drought differs from other natural hazards such as cyclone, flood, earthquake, volcano, and tsunami in several ways. First, since the impacts of drought often accumulate slowly over a considerable time and may linger for years after the termination of the events where the onset and end of the drought are difficult to determine. Because of this, drought is often referred to as a creeping phenomenon. Second, drought impacts are non-structural in contrast to the impacts of floods, hurricanes, and most other natural hazards. Its impacts are spread over a larger geographical area than damages that result from other natural hazards (Wilhite *et al.*, 2007). According to Mokhtari (2013), drought is naturally occurring which leads to several damages to human activities and natural resources. Again, drought is perceived as unpredictable Earth`s climate systems which result in significantly lower precipitation availability in comparing with the normal condition.

2.1.2. Types of Droughts

2.1.2.1. Meteorological Drought

Meteorological drought is characterized by a shortage of precipitation and represents a departure of precipitation from its climatological value calculated over some time. It is based solely on departures of rainfall from expected amounts. So, the definition of meteorological drought must be considered as region-specific since the atmospheric conditions that result in deficiencies of precipitation are highly variable from region to region. It also occurs when there is below-average natural precipitation in a given time (Qin *et* al., 2014).

2.1.2.2. Agricultural Drought

Agricultural drought is perceived as, "lack of availability of soil water to support crop and forage growth (UNISDR, 2009). A good definition of agricultural drought should be able to account for the variable susceptibility of crops during different stages of crop development, from emergence to maturity. Deficient to topsoil moisture at planting may hinder germination, leading to low plant populations per hectares and reduction of final yields. However, if topsoil moisture is sufficient at this early stage, it may not affect the final yield (Gizachew, 2010).

2.1.2.3. Hydrological Drought

Hydrological drought is perceived as a situation where a hydrological system lacks water which is shown by below-normal stream flow in rivers and below normal levels in lakes, reservoirs, and groundwater. The frequency and severity of the hydrological drought are on a watershed or river basin scale (Van Loon, 2015).

2.1.2.4 Socio-economic Drought

The socioeconomic drought happens when human activities at the individual level are affected by decreased precipitation. This implies that the demand for economic goods exceeds its supply. Specifically, very limited supply of food item, forage, water, hydroelectric power and other that are related to daily activities if the communities lead to socioeconomic drought as they are depends on weather conditions. The existence of socio-economic drought is mainly manifested by affecting the daily activities of the communities due to the creeping characteristics of drought (Wilhite *et* al., 2007).

2.1.3. History of Drought in Ethiopia

Over the coming year all models agree that temperature will be increase in Ethiopia, models predicting precipitation give controversial results of both increasing and decreasing precipitation. Similarly, According to the World Bank (2007) Climate change is projected to reduce yields of the wheat staple crop by 33% in Ethiopia .This amounts to a serious threat to food security and to the achievement of major developmental goals. Hence, there is a strong observable link between climate change variations and overall economic performance. The models predicting future climate change scenario in Ethiopia put conclusion that temperature will increase in the coming decades. However, there is conflicting results concerning the predicted level of precipitation (Tadele et al, nd). There is

constant, 13 decreasing and increasing level of projected precipitation level are generated using different models. According to NMA (2007) indicate that temperature will increase in the range of 1.7 – 2.1C0 by the year 2050 and 2.7 – 3.4C0 by the year 2080 over Ethiopia. The country will experience an increasing level of temperature and precipitation in the coming decades. However, it stated that a small increase in rainfall can be expected. Studies indicate that Ethiopia in the coming year will face a decrease in agricultural production due to the adverse impact of climate change and variability's (Tadele et al, nd). This suggests that agricultural production as an engine of growth and development and vulnerable to climate change and climate variability. While the more pronounced effects on crops and livestock are likely to materialize in later decades, efforts to enhance the resilience to climate shocks of crop yields and livestock production should be improve, this mechanism become increment in agricultural output and lead to achieve the overall objective of Ethiopian growth and transformation plan.

Drought in Ethiopia occurs during the different seasons that occur in different regions in the country and it exists when seasonal rainfall drops below normal by almost 30% to 50%. The history of drought is not a new phenomenon in Ethiopia and the most drought-prone and affected areas of the country are in the northern, eastern and southern parts. Droughts have occurred in different parts of Ethiopia at different times. Its frequency has increased over the past few decades particularly in the lowlands (NMS, 2007). Similarly, Gebrehiwot and his colleagues said that throughout human history,the country is frequentlyexposed to drought and famine (Gebrehiwot et al.,2011).This disaster mainly affects the agricultural production and livelihoods of the farmi ng and pastoral communities.Accordig to available literatures , Ethiopia was attacked by droug ht in 1964-1966,1972/1973,1978/1979,1983/1984,1987/1988,1992,1993/1994,2000,2002/2003, 2007/2008,2015/2016 and 2017 (Getachew Alem,2018).

2.1.4. Effects of Drought on Agriculture

Ethiopian climate is characterized by a history of climatic extremes such as drought, and increase of temperature and a decrease of precipitation. Total failure or shortage of rainfall is often cited as the major cause of the recurring droughts and such a problem or situation is further exacerbated by the social, economic and ecological situations (Mesfin, 2015). Ethiopia is especially vulnerable to climate variability because large segments of the population are poor and depend on agricultural income, which is highly sensitive to rainfall variability (Bishaw, 2013).

2.1.4.1. Effects on crops production

There are several immediate effects of the drought on agricultural production. The Food and Agricultural Organization and United Nations Development Programme note that a decrease in crop production can be viewed as the most immediate and long-lasting consequence of the drought phenomenon as a result of insufficient and poor distribution of rainfall/precipitation. Farmers often harvest fewer crops during drought periods than usual to feed their households and are prompted to sell crops to other members of the community (FAO, 2009). The effects of drought on crop production might be annual and perennial crop losses, damage to crop quality, income loss for farmers due to reduced crop yields, reduced the productivity of cropland, insect infestation, plant disease, increased irrigation costs, cost of new or supplemental water resource development (NDMC, 2010).

According to the FAO 2010, when crops are severely affected by drought, fodder production is reduced, and natural fodders are not less likely to be vulnerable to such dry conditions as compared to crop production and reduced precipitation causes reduced pasture growth and as a result of disturbed crop production residues, a decline in fodder supply may accumulate. Limited amount and uneven distribution of rainfall is the most limiting factor for crop production and livestock management that could finally have consequences on the wellbeing of the rural populations. Ethiopia is vulnerable to climate variability and change since large segments of its population are poor, dependent on income sources that are highly sensitive to the weather, and have low access to education, information, technology, and health services (Oxfam International, 2010).

Ethiopia's economy showed an average of 10% growth over the past decade but contracted by more than 3% in 2012 when the El- Nino occurred. Ethiopian government combated the drought in 2015 by spending 4 billion Birr (\$191 million) for importing of 627,000 metric tons of wheat and 20,000 tons of edible oil. Rainfall shortage from February to May in 2015 production year of the country left more than 10 million people in need of emergency support, and the crisis worsens through September of the 2015 year. Due to drought crop planting in summer and autumn was disrupted where in 10%-30% yield reductions recorded in the central arid area from 710, 000ha. Frequent drought also affected the quality and yield of grazing grassland, which in turn affected the number and quality of livestock (Zenebe *et al*., 2011). Water deficit resulting from drought reduces crop yield because of its negative impacts on plant growth (Karl *et* al.,

2009). Changes in the magnitude and frequency of droughts due to climate change will have severe impacts on agriculture, especially crop production and livestock (Karl *et* al., 2009; Olsen *et* al., 2011).

The food insecurity situation in Ethiopia is highly linked up to severe, recurring food shortage and famine, which are associated with recurrent drought. Currently, there is a growing consensus that food insecurity and poverty problems are closely related to the Ethiopian context. UNICEF (2014) about 10 percent of Ethiopia's citizens are chronically food insecure and this figure rises to more than 15 percent during the frequent drought years. Food insecurity is a critical challenge for rural households in Ethiopia; different studies on different parts of the country indicate that the main sources of food insecurity in the country are drought and weather-related shocks and disasters. According to AFI (2012), the most common causes of food insecurity problems in Ethiopia were; drought and other extreme weather events, pests, livestock diseases, and other agricultural problems, climate change, lack of an emergency.

Rainfall variability and associated droughts have been major causes of food shortage and famine in Ethiopia. At the national scale, the link between drought and crop production is widely known in Ethiopian agriculture (DiFalco *et al,* 2011). Droughts cause low food production (crops and livestock), and particularly in poorer regions, people have less to eat. Food nutrition also is a problem, and that leads to vulnerability, diseases/illness, and deaths (Owen, 2008).

The farmers' perception of drought in Ethiopia is based on the failure of the seasonal rainfall (June to September) and consequently the loss of crops and livestock (elsewhere it is recognized as agricultural drought). The loss of crops and livestock often results in severe household food shortages and psychological stress and insecurity among the affected people. The seasonal rainfall failure (meteorological drought) is largely due to climate variability and its impact results in widespread failure of seasonal crops, pasture and forage and massive death of livestock and widespread hunger among the affected population (Stefan *et al*., 2010 cited in Getachew Alem, 2018). The economic impacts of drought are numerous, ranging from direct losses in the broad agricultural and agriculturally related sectors, including forestry and fishing, to losses in recreation, transportation, banking, and energy. Other economic impacts would include added unemployment, increases in food prices and overall disruption of food supply, the strain on

financial institutions because of farm foreclosures, increased costs of new or supplemental water resource development, and loss of revenue to local, state, and the federal government (NDMC, 2016).As stated by the FAO (2010), once there is serious drought and crops are severely affected, the fodder production is minimized. Lobell *et al*. 2011, estimated that warming since 1981resulted in global level losses of 40 million tons from the production of wheat, maize, and barley due to high temperature. Several villages in Tigray and Southern Nations and Nationality People regional states of Ethiopia experienced severe localized droughts that caused considerable income losses (Dercon *et al*., 2009). Lobell *et al.* 2011 showed that water availability reduction during the growing period could have a significant effect on reducing agricultural productivity.

2.1.4.2. Effects on Livestock production

Livestock plays a very important role by serving as a source of food, income and as the accumulation of wealth and source of traction especially oxen and provision of manure required for soil fertility maintenance (Yirga, 2007). Rising temperatures and declining rainfall will affect livestock in Africa, where two-thirds of domestic livestock are herded through nomadic systems, although significant numbers are also kept under zero-grazing conditions, by reducing the availability of fodder and drinking water, and through increased heat stress. Also, in some areas a significant share of fodder comes from crop residues, hence the declining agriculture will also affect livestock farming in many parts of Africa (Sivakumar *et al*., 2014). Similarly, increased warm conditions favored the increased distribution, incidences and intensity of diseases such as rift valley fever, render pest and tick-borne diseases, which will attack livestock and also reduce suitable rangeland area for nomadic livestock herding (FAO, 2008).

Ethiopia is home to Africa's largest livestock population and is the world's tenth-largest producer of livestock and livestock products, which make up about 10% of the country's foreign currency earnings. Frequent and extensive droughts in the country have a considerable effect on Ethiopia's livestock because decreased rainfall shrinks available water resources and reduces the productivity of grassland and rangeland. In recent years, it became evident that households who use to own hundreds of livestock have now less than one-third of their 30 years herd size. Such loss is primarily through death and secondly by selling out to extremely low prices to thrive through life-threatening moments (IFAD, 2009).

Changes in rainfall and warmer temperatures may also increase the geographical distribution and survival of vectors like flies and mosquitoes that transmit infectious diseases to livestock (IFAD, 2009; Thornton *et* al., 2009). Heat stress and its impact on seasonal water availability have a variety of detrimental effects on livestock, with significant effects on milk production and reproduction in dairy cows, and swine fertility (Nigus, 2011). Drought and delay in the onset of rain led to poor grass regeneration/forage deficit, water shortage and heat stress on livestock, and consequently increased the mortality of the livestock, vulnerability to diseases and physical deterioration due to long-distance travel for water and pastures (Abate, 2009).

2.1.5. Coping Mechanisms to the Effects of Drought

A coping mechanism is defined by different scholars in different contexts. The most common recently used is the definition of a coping mechanism 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. This involves managing resources both during drought and in normal times to withstand the effects of drought risk (Sewnet, 2015). Shiferaw *et* al., 2014, classified drought coping capacity into ex-ante and ex-post. Ex- ante is when exposure to risk is reduced and ex-post when impacts are minimized. Ex-ante strategies include, construction of soil and water conservation structures for crop production, diversification of assets and income and growing of drought-resistant crops and ex-post are designed to prevent shortages in consumption when income drops below normal levels as a result of climate impacts, including enhanced sale of livestock, credits from friends and relatives, reduction of consumption levels, migration, diversification of income, engaging in waged labor, skipping meals, charcoal burning, and consumption of wild fruits and remittances.

Developing countries are struggling to deal with the impacts of drought by the introduction of effective coping strategies to their countries by adjusting the living physical environment. Now day's climate variability, depleted resources, fragile environment, and the growing population pressure have made agriculture less productive, risky and livelihoods more difficult and greatest challenges for developing countries that require planning strategies and policies to minimize impacts and develop resilience from its shocks (Andersson *et al*, 2009).

The most important coping mechanisms widely used in Ethiopia include changes in cropping and planting practices, reduction of consumption level, use of intra-household transfers and loans,

increased petty commodity production, temporary and permanent migration of people and animals, hidden secure grain storage, sale of assets such as livestock and agricultural tools, mortgaging of land/ taking credit from merchants and money lenders, use of early warning systems and appeals for food and other forms of aid (NMSA, 2006 cited in Aklilu and Dereje, 2010).

The Government of Ethiopia also, initiated a Productive Safety Net Program (PSNP) with the objectives of reducing livelihood vulnerability to the impacts of disaster mainly climate variability and recurrent drought, improving livelihood and community resilience to shocks, and breaking the cycle of dependence on food aid. The overarching principle of the Productive Safety Net Program is to facilitate "a gradual shift away from a system dominated by emergency humanitarian aid to productive safety net system resources via multi-year framework". However, this program by itself is limited to certain areas that are historically said to be drought-prone. One of the main departures of this new direction is the provision of relief in ways that will support recovery and long term development through employment generation on development activities such as soil and water conservation, rural road building and other efforts to build community assets; provide employment-based safety net programs and protect household assets to prevent poor households from falling further towards vulnerability to future shocks particularly drought and chronic dependence on external assistance (MoARD ,2009).

2.1.6. Determinants of Drought Coping mechanisms

Ethiopia has low coping mechanisms due to low financial, technological and institutional capacity. However, the existence of these strategies is no guarantee of successful coping in terms of securing basic needs in the face of recurrent drought. When the main activity such as agriculture fails, most people lack the skills, labor or capital necessary to specialize in another activity that can take agriculture's place as a reliable primary income source (Chauhan *et al*, 2014).

Factors influencing Ethiopian farmer's decision to cope up include lack of income, lack of access to extension contact, credit, and lack of weather information, unresponsive and weak government's policy mechanisms, and poor potential for irrigation. Lack of access to appropriate seed, property rights, and market service was also other hard mentioned in Ethiopia. In addition to this, extreme events, lack of effective communication services in the timely delivery of weather

and climate information to enable effective decision making and weak linkage between farmers and agricultural extension service were the major one (Deressa *et al*. 2009).

2.2. Empirical Literature Review

A lot of studies globally have been undertaken and have confirmed that drought has adverse effects on agriculture. According to the FAO 2010, when crops are severely affected by drought, fodder production is reduced, and natural fodders are not less likely to be vulnerable to such dry conditions as compared to crop production and reduced precipitation causes reduced pasture growth and as a result of disturbed crop production residues, a decline in fodder supply may accumulate.

Vilane *et* al., 2015, in their study on drought coping strategies at Lonhlupheko community, rural area in Swaziland, divided drought coping strategies into two based on the source of the strategies. The first strategies were those employed by the household themselves. These methods include marketing and selling, preparing and selling traditional brew, providing labor for food and money, dressmaking, selling second-hand clothes, carpentry, cutting and selling of building timber. The second strategy were those received from external and institutional support such as receiving food rations and food farming inputs from NGOs, receiving crop seeds and fertilizer, forming cooperatives, subsidized tractor service and benefiting from extensional services. The authors also indicated the drought coping strategies proposed by the respondents like the provision of water for irrigation, construction of dams and structures for rainwater harvesting, a revival of agricultural extension services, and access to loans for small and medium enterprises and promotion of drought-tolerant crops.

Yaffa 2013 has also conducted research in the Gambia on drought coping strategies collecting data from a questionnaire survey of 373 households, 60 focus group discussions and six expert interviews. In his findings, he identified the drought coping strategies like rely on support from other people, rely on support from organizations, earn extra income to buy food, migration of household members, reliance on social networks, sell assets (livestock) to buy food, reduce food consumption and reduce expenses (school fees). Mentioning that these strategies were not enough to offset the negative impacts of the drought, he said that more should be done by the government and NGOs to help people at the time of drought event.

Another study by MoFED 2007, on the ability of farmers to cope with shocks, revealed that the main coping strategies include the sale of animals, loans from relatives, sale of crop outputs) and own cash, Sale of agricultural tools and other assets are identified as a coping mechanism in Ethiopia.

Similarly, Anteneh 2013 has researched an assessment of coping strategies for drought-induced food shortages in Fedis District; East Hararghe Zone, Ethiopia collecting data from field observation, household survey, key informant interview and focus group discussions. In his findings, he identified coping strategies were borrowing, eating wild foods, migration to surrounding urban areas, selling fuel wood and charcoal, and petty trading. Another study conducted by Negatu 2011, in southern Ethiopia, found that a range of coping mechanisms used by respondents which include: minimizing the number of meals and amount of food consumption; diversifying their livelihood; cultivating more crops, wage labor, seasonal migration to neighboring community during peak season; and intercropping are some of the mechanisms used by households.

In line with this, a lot of studies globally have been undertaken on the determinants of drought coping mechanisms. The study, by Trisna Mardy *et* al., 2018, studied the Coping Strategies in Response to Drought: A Micro-Level Study in the North-West Region of Bangladesh. The findings were analyzed using descriptive statistics, coefficient of correlation, multiple linear and stepwise regressions. The findings from multiple regression showed that age, education, farm size, annual family income, extension media contact, and organization participation were significantly associated with the choice of coping mechanisms that the farmers employed.

The study by John *et* al., 2011 on effects of socio-economic characteristics of food crop farmers on the selection of coping strategies against drought in Borno State, Nigeria showed that farm experience, farm income, and farm size had an impact on drought coping mechanisms while age, education level, and extension did not affect. Ajao and Ogunniyi 2011, studied Farmers' strategies for adapting to climate change in the Ogbomoso agricultural zone of Oyo state found influence of age, farm size, access to extension, gender and non-farm income on the choice of drought coping mechanisms.

The study by Nti 2008 on Climate Change Vulnerability and Coping Mechanisms among

Farming Communities in Northern Ghana observed that literacy level, membership with a farmer organization, household income, and location of households had positive and significant impacts on adaptation to drought. Deressa *et* al., 2008 observed that wealth (on-farm income, off-farm income, and livestock ownership) and household characteristics, such as level of education, age of household head and household size, increased the probability of adaptation to drought.

MG Debesai *et* al., 2019, studied Drought Coping Mechanisms in Smallholder Farm Households: Evidence from Dry Lands of Eritrea. The findings of this research indicate that the choice of household's drought coping mechanism is influenced by livestock ownership, current asset holding, its level of food insecurity, access to credit and age of household head.

Temesgen Tadesse Deressa 2010, studied Factors Affecting the Choices of Coping Strategies for Climate Extremes: The case of Farmers in the Nile Basin of Ethiopia. This study adopted the multinomial Logit model to analyze factors affecting the choice of coping strategies in response to climate extreme events. Results from the multinomial Logit model show that different socioeconomic and environmental factors affect coping with climate extreme events. Factors that positively influence coping include education of the head of household, gender of the household head being male, farm income, livestock ownership, access to an extension on crop and livestock production, farmer-to-farmer extension, temperature, ownership of radio, and better-quality house.

2.3. Conceptual framework

Currently, drought is a serious climatic hazard; it is manifested through a different process, such as an increase in temperature, a decrease in Precipitation and dryness of agricultural land, etc. It harms the human being directly or indirectly. To reduce the adverse effect of drought, a coping strategy is an important choice. The farmers' choice decisions of coping strategies to drought effects are determined by numerous factors. Many of these factors influence farmers' drought coping strategies. These factors include the household demographic characteristics (age, family size, farming experience, and education status), institutional factors (extension service, access to weather information and credit) and Economic factors (annual farm income, farm size and access to irrigation). These are the most important variables identified by many kinds of literature in determining a household to take coping strategies used to cope with the impact of drought. As indicated in figure 1 the conceptual framework of this study is based on the

assumption that coping mechanism to drought effect depends on the coping capacity of farmers, which is determined by different demographic, economic and institutional factors.

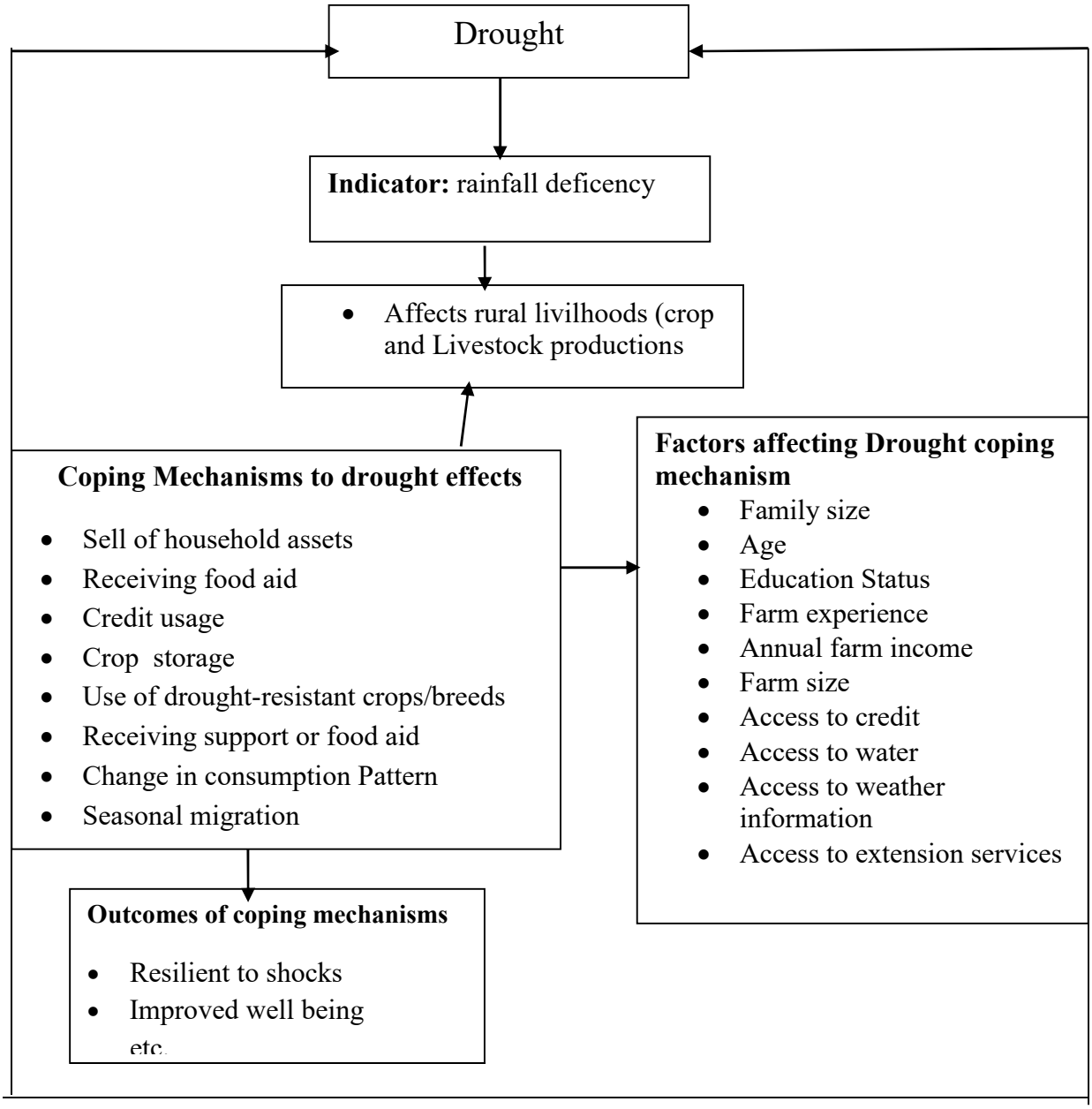

Figure 1.Conceptual framework

Source: Own illustration, 2021

CHAPTER THREE: RESEARCH METHODOLOGY

3.1. Description of the Study Area

The study will be conducted in Kacha Birra Woreda Kembata Tembaro Zone, South Nations Nationalities and Peoples Regional States (SNNPRS). The woreda lies between 07°10'30" - 07°17'0" N latitude and 37°30'0"– 38°0'0"E longitude. Kacha Birra woreda is bordered on the south by Wolyita Zone on the west by Hadaro Tunto Zuria woreda on the north by Doyogena and Angecha woreda and on the east by Kidida Gameia and Mirab Badewacho woreda. The woreda with a total land area of 25,944 hectare is further sub-divided in to 20 rural kebeles and 2 semi-urban keels (CSA, 2005). The minimum and maximum rainfall of the Woreda is 531.1mm to 1200mm while the minimum and maximum temperature of the study area is 15^0C to 28.2^0C (KBWARDO, 2019). The capital town of the Woreda is Shinshicho which is about 327 Km away from the country capital Addis Ababa and 136 km away from the regional capital, Hawassa.

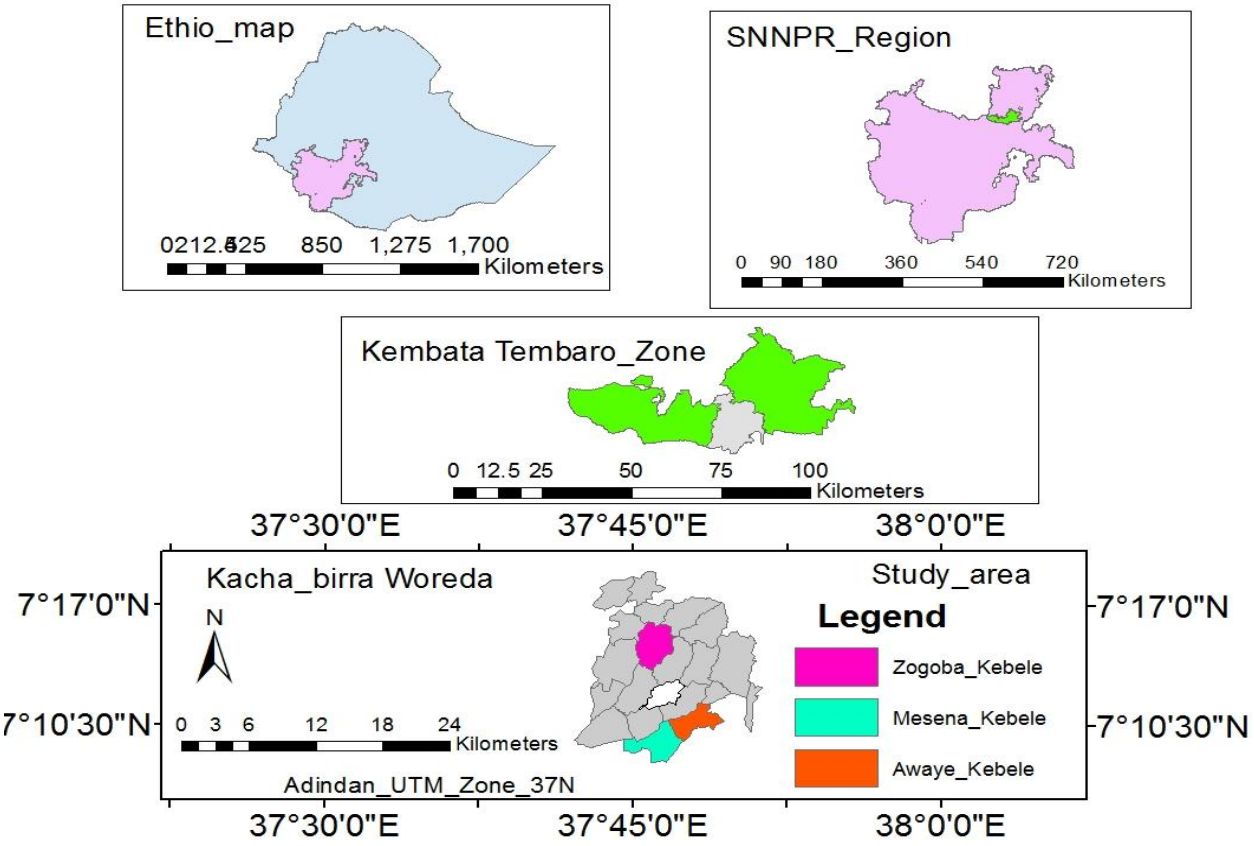

Figure 2. Location Map of the Study area

Source: Own illustration, 2021

3.1.2. Topography and Soil

The topographic feature of Kacha Birra Woreda is characterized by flat plains, moderately gentle slopes and steep slopes in certain areas. The altitude of the Woreda ranges from 1382 to 2600 meters above sea level. There are 22 kebeles within Kacha Birra Woreda. Of which, the most part is situated along low land contains 6 kebeles, highland contains 6 kebeles and the rest 10 kebeles are situated within mid land agro-ecological zone .The major soil type in the woreda is Sandy, Clay, and Silt-Loam soils in terms of texture. Sandy soils are easy to work but do not retain soil moisture, clay soils are poorly drained and difficult in terms of workability and silt-loam soils are the most preferable soil type and suitable for agricultural purposes. Most parts of Kacha Birra woreda are covered by sandy soils thus usually lacks water retaining quality where as some parts are dominated by poorly drained clay soils (KBWARDO, 2019).

3.1.3. Climate and Drainage

The Woreda is the typical three agro-ecological zones, lowlands highlands and mid land.The rainfall and temperature data collected by the Ethiopian Meteorological Service Agency (NMA) from Station were used to describe the climate of the study area. Based on this data, the minimum and maximum rainfall of the Woreda is 531.1mm to 1261.4mm while the minimum and maximum temperature of the study area is 15^0C to 28.2^0C (NMA, 2019). The study area experiences bi-modal rainfall distributions. Hence, there are two rainy seasons which are in local launguage **Ojicho** and **Matto. Ojicho** is the short rainy season that lasts between March and May. **Matto** is the longest rainy season and occurs between June and August. This is the main season for the production of teff, wheat and vegetables in the study area; On the other hand, the short **Ojicho** rain occurs between March and May, food crops like maize, sorghum, and haricot bean were grown in this season in the study area (KBWAO, 2019).

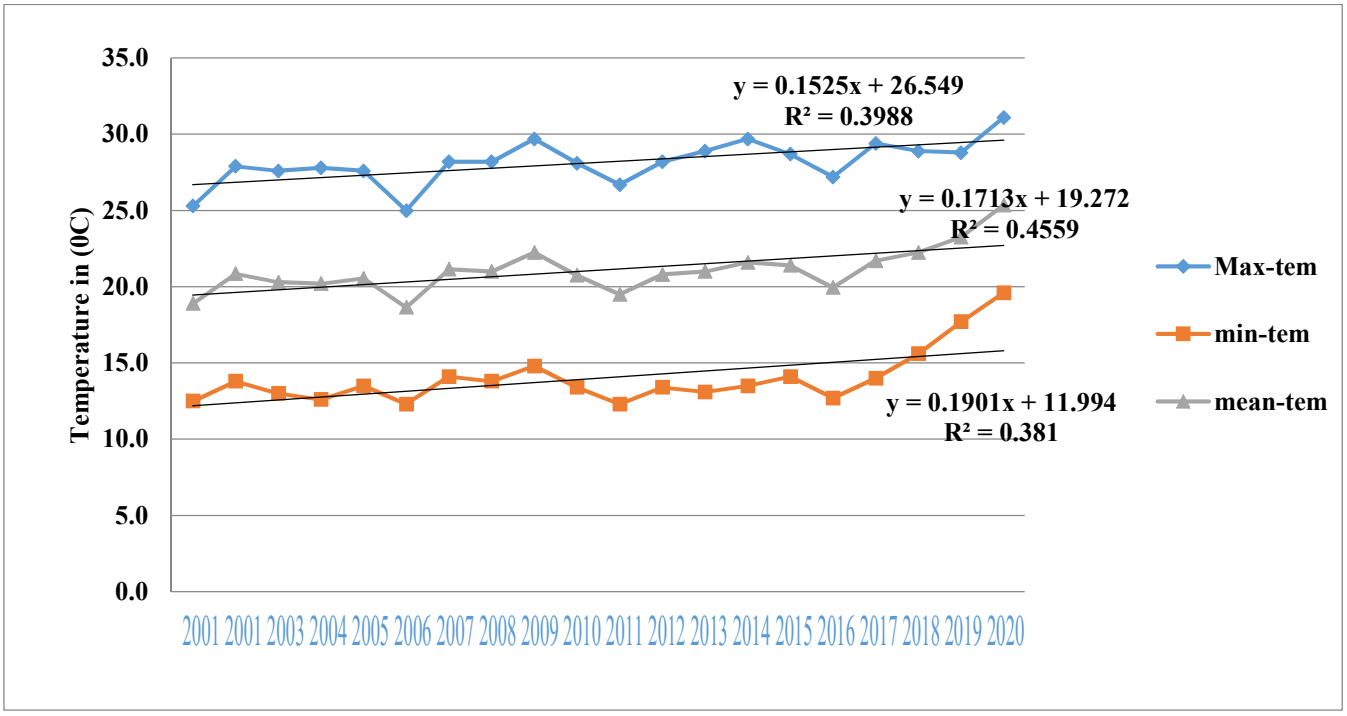

Figure 3. Annual Max, Mean and Min Temperature of the study area from year (2001-2020)

Source: NMA 2021

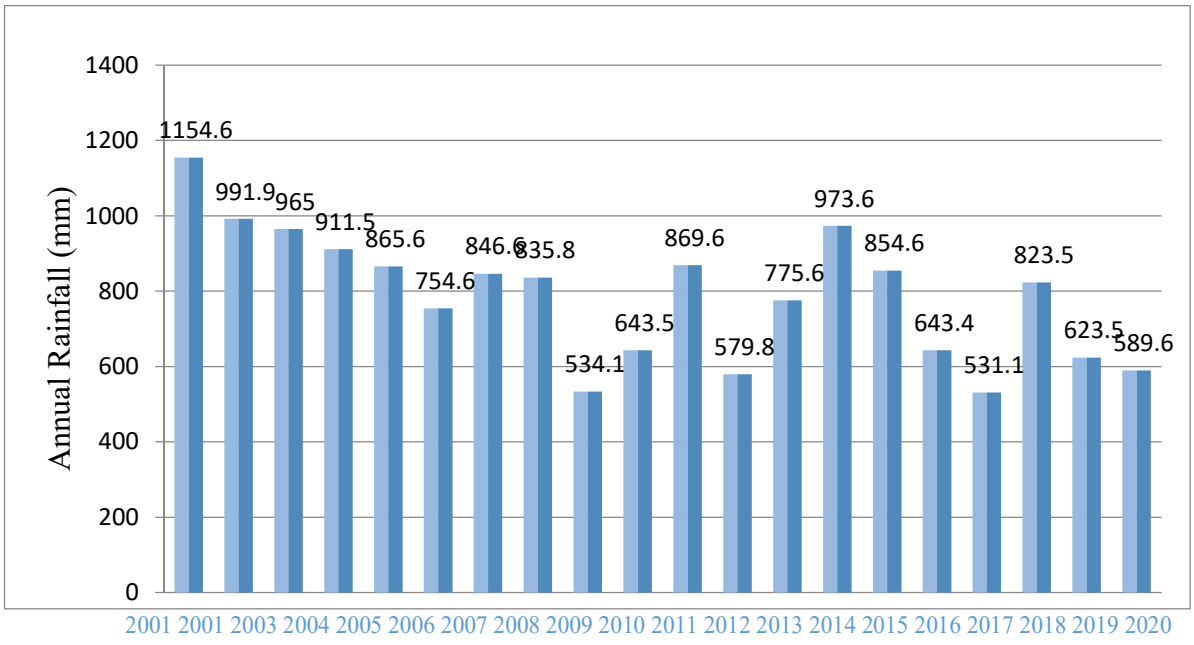

Figure 4. Average rainfall distributions from year (2001-2020)

Source: Computed based on raw data of NMA 2021

3.1.4. Demographic characteristics

According to KBWFEDO (2019) report, the population of Kacha Birra woreda is 115,579 out of which 58,778 are female (i.e. 50.86 %) and 56801 are male (i.e. 49.14%). Zonal population growth rate is 3%. The total number of households in the woreda is 25,780, with an average of 6 family members per household. The average population density is 551 people per km2. About 52% of the total population is economically active (CSA, 2007). In Kacha Birra Woreda. the most part is situated along low land (**Kalea)** contains 31%, highland (**Hansawa)** 29% and 40% are situated within mid land (**Hansawi-kalea)** agro-ecological zone

3.1.5. Socio-economic Situation

The livelihood of the people in the Woreda depends mainly on mixed farming (crop and livestock production). Dominantly growing crops in the study area include maize, teff, harcot bean and sorghum.Traditional oxen plow and hoe culture subsistence agricultural practices are common in the study area. The lowland agro-ecology is characterized by large land holding size when compared to the midland agro-ecology and mostly dependent on cereal crops such as maize, teff, wheat and sorghum while midland agro-ecology relatively diverse in terms of crops grown as they grow cereals, tubers like enset fruit trees like avocados. Coffee is the main cash crop for this agro-ecology. Livestock production is important in both agro-climatic zones as one type of mixed farming. Animals are used for traction and power for halving and threshing. It is the main source of income for periods of distress time when crop failure happened due to erratic nature or seasonal drought occurred in rural areas. Economically, agriculture serves as the main economic foot and means of livelihood to the majority of the people and characterized by traditional mixed farming as it includes both crop and livestock production. More of it is rain-fed with gradual prevalence of drought and crop failures (KBWARDO, 2019).

3.2. Research Design

The cross-sectional research design was used because this method is believed to be more appropriate to investigate the topic under discussion and provides reliable and valid research outcomes. Because cross-sectional designs generally use survey techniques to gather data, they are relatively inexpensive and take up little time to conduct. This design helped to gather the

quantitative and qualitative data at the same time and it is preferred over others due to its merits to confirm findings within a single study.

3.3. Types and Sources of Data

As per the objectives of the study both qualitative and quantitative data were collected from both primary and secondary sources. The Primary data were collected from the household survey, Key Informants and Focus Group Discussion (FGD).On the other hand, the secondary data were obtained through reviewing different relevant literature from books, research works, journals, published and unpublished documents, and different activity reports of government and non-government institutions. Qualitative data were collected from FGDs, KI and was employed to inquire deep understanding into the research problem under the study which is difficult to quantify. Quantitative data were collected from the questionnaire survey and used to assess demographic characteristics such as age and education level of the respondents and economic asset endowments such as the amount of income gained, land size, and other information that require quantification.

3.4. Sampling Techniques and Sample Size Determination

Kacha Birra woreda was selected purposively because it is one of the most affected by climate change factors like drought and variable nature of rainfall. The target group of this study is the rural households found in the Kacha Birra woreda. The woreda has a total of 22 kebeles. To select the respondents for this study, a multi-stage sampling technique was employed. Three rural kebeles were selected out of 22 kebeles in the woreda purposively based on agro-ecological zone and the intensity of the impact of drought with the assistance of staff from woreda Agriculture and Rural Development Office by using random sampling. Then, a systematic sampling method was employed to select households from each of the three kebeles proportionally. In this case, the lists of the households were collected first from the each Kebeles. An element of randomness is usually introduced in a systematic sampling method by using random numbers to pick up the unit with which to start. This sampling procedure is useful when the sampling frame is available in the form of a list. In such a design, the selection process starts by picking some random point in the list and then every n^{th} element was selected until the desired number is secured. Systematic sampling can be taken as an improvement over a simple random sampling and it can spread more evenly over the entire population, easier to draw, execute, less costly and can be

conveniently used even in the case of a large population (Kothari, 2011). Household heads in Mesena Kebele, 398, Household heads in Awaye 403 and Zogoba 414. These three rural kebeles has a total household head of 1215. Therefore, this study applied a simplified formula provided by (Yemane, 1967) provides a simplified formula to calculate sample size.

$n = N/1+N (e)^2$ Given: N=1215

Where, n=sample e=10% 10×1/100=0.1

N=total population/household required: n=?

e=level of precision/sample error Solution: $n=N/1+N (e)^2$

$=1215/1+ 1215 (0.1)^2$

$=1215/1+1215\times0.01=1215/4.16=292$

Therefore, 292 respondents were selected. The sample household heads were selected randomly at an interval based on the following formula K=N/n where K is sampling frame, N is the total number of households in the three kebeles and n is a sample size. For this study sample size, n is 292 and N is 1215 and sampling frame K =1215/292=4. Hence, the sample interval k is 4 and the fifth household from the source list of each kebeles was systematically selected.

Table 1.Distribution of sample households

Kebele	Total HHs	Sample HHs		Total Sampled HHs
		Male	Female	
Zogoba	414	91	8	99
Awaye	403	90	7	97
Mesena	398	89	7	96
Total	**1215**	**270**	**22**	**292**

Source: own survey, 2021

3.5. Methods of Data Collection

A. Survey Questionnaire

The investigator used questionnaires for all the respondents of the sample and collected data from the sample household heads through the use of open-ended and close-ended questionnaires. Furthermore, the investigator used a pilot survey by administering 6 household heads that were out of the respective sample Kebeles' to check the validity and reliability of the questions. After the necessary amendment following the feedback from the pilot survey, the final version of questionnaires was prepared in English and translated into *Kembatisa* language and distributed to predetermined 292 respondents to collect quantitative and qualitative data. It was handled by six development agents; two from each kebele after taking appropriate training. The preference to use DAs to collect data was based on the fact that: they do have a list of households of each category that could be included in the survey; They are more familiar with the community hence communication and getting reliable data would be easier; they do have knowledge and experience on the subject matter and can easily understand the questionnaires and; they have training background in area of agriculture.

The survey questionnaire covered a wide range of information which includes household demographic and socio-economic characteristics, perception of farmers on drought and its effects and drought coping mechanisms. The investigator has used this instrument because it was easy to administer and provided wide coverage of data.

B. Key Informant Interview

The interview method was particularly suitable for intensive investigation. The investigator interviewed knowledgeable and experience-rich experts from the woreda's agricultural and rural development office, DAs, woreda Disaster prevention and preparedness office, Women, Child and Youth office and Forest and Environment protection offices interviewed male 21 female 18 totally 39. The interviews and discussion with informants found to be more valuable in providing context at a general level and gave the researcher a wealth of knowledge about the community and an in-depth understanding. The purpose of conducting an interview was to triangulate the household survey. Major drought effects on rural households, coping mechanisms, major factors that hinder coping mechanisms, the effort

made by local institutions (government, NGOs, and civil society) in reducing the risk of drought on the community to make lives sustainable and generally the socio-economic realities of households were discussed during the time of interview. The interview of key informants was conducted by the investigator itself. The interviewees gave the needed information verbally in face to face situations.

C. Focus Group Discussion

It is a method of gathering information in a short time. It helps to generate data on group dynamics and allows a small group of respondents guided by a skilled moderator, to focus on the key issue of the research topic and conducted in the three kebeles of the study area. In each Kebele one Focus Group, male 20 female 5 totally 25, the discussion had been conducted. FGDs were selected randomly based on the age groups and socioeconomic status, who were believed to have a better knowledge of the issue and different from an interview. During the focus group discussion, understanding of drought, perception of farmers about drought, drought coping mechanisms being undertaken by households to the existing drought effects and the major challenges of the society to cope up were given emphasis. The main advantages of focus groups are: they are useful to obtain detailed information about personal and group feelings, perceptions, and opinions. They can save time and money compared to individual interviews. They can provide a broader range of information.

Table 2. Participants of Focus Group Discusions

Kebeles	Number of FGDs	Sex compositions		Number of participants
		Male	Female	
Zogoba	1	6	2	8
Awaye	1	7	1	8
Mesena	1	7	2	9
Total	**3**	**20**	**5**	**25**

Source: Field survey 2021

3.6. Methods of Data Analysis

The specific objectives of the study were addressed by employing appropriate methods of data analysis for each of them. The first objective of the study concerning the effects of drought on the livelihoods of the agricultural community was analyzed by using a four-point scale rating. Various types of Likert types consist of a four-point Likert type, five-point Likert type, seven-point Likert type, etc. Even though five and seven-point Likert types better indicate the perceptions, the items could take a longer time to complete. Four-Point Likert formats are easier for respondents to complete. It is also easier to administer and easier to score (Dolnicar and Grun, 2007). Because of its simplicity to administer and complete, the four-point Likert type was used to assess the perceived effects of drought. Accordingly, households were asked to rate the effects of drought on their livelihoods using high, medium, low and none with a corresponding score of 0-3 scale. The ranking was carried out and given priority for the states where the effects of drought were high. The ranking was calculated using a weighted average index formula (Trisna Mardy *et* al., 2018).

$$WAI = \frac{Fh\times3+Fm\times2+Fl\times1+Fn\times0}{N}$$ Where

WAI = weighted average index, F_h = frequency of responses with high effect, F_m = frequency of responses with moderate effect, F_l = frequency of responses with low effect, F_n = frequency of responses with no effect, and N = total number of responses.

The second objective of the study which focused on drought coping strategies were analyzed by using descriptive statistics such as, frequency, percentage, and table. Descriptive statistics such as frequencies and percentages were used to summarize different categories of drought coping strategies. Accordingly, eight drought coping mechanisms were identified during questionnaire survey data collection time and the third objective requires a multiple linear regression analysis.

Multiple regression analysis was used to analyze factors affecting drought coping strategies. This model was selected for its simplicity and practical applicability to show a linear relationship between several independent (explanatory) variables and the dependent (response) variable (Greene, 2003). The MLR equation, given n observations, is given by:

$y_i=\beta0+\beta1X_1+\beta2X_2+\beta3X_3+\beta4X_4+\beta5X_{5\ldots\ldots}+xK\beta K+€$ ……(3)

Where

yi = The dependent variable(coping mechanisms of drought in this study)

β0 = Constant,

X1 to xk= number of independent variables

β1to βk =standardized multiple regression coefficients for independent variables (each regression coefficient represents the change in the dependent variable relative to a unit change in the respective independent variable), and the term €is Error term (Giordani 2012; Kovdienko *et* al. 2010). In this study, Drought coping mechanism (Yi) was considered as dependent variable and others 10 variables namely age of household head (x1) education of household head (x2), family size of household head (x3), Farm size of household head (x4), Annual family income of household head (x5), access to water for irrigation(x6), availability of credit access to household head(x7), access to weather information(x8), frequency of extension visit(x9) and Farming experiences of household head(x10) were taken as independent variables.

The multiple linear regression models were estimated using the ENTER method and F-test computed to observe the significance of the models. Diagnostic tests were also carried out to check for multicollinearity of the variables included in the model. Multicollinearity was checked using correlation coefficients and variance inflation factor (VIF). According to (Ottoy *et* al., 2013), the value of VIF greater than or equal to 10 is an indicator of the existence of a serious problem of multi-colinearity and when the correlations $|r| \geq 0.9$, then one or both independent variables assume to leave out of the model. The determination coefficient (R2) indicates how much variances in the dependent variable can be explained by independent variables.If the p-value ($P<0.05$),the regression model is significant rejecti ng the null hypothesis.It means that there is a significant linear association between depend ent and independent variables .

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1. Demographic and Socio-Economic Characteristics of the Respondents

To support this finding, some studies (Temesgen et al., 2008) for example, reported that education increases the probability of coping strategies to weather extremes. This is because education is an indispensable tool to easily understand climate extreme information to adjust and develop a coping capacity for drought.

Table 3.Demographic and socio-economic characteristics of respondents

Variables	Categories	Frequency	Percentage
Age	20-30	29	10
	31-45	137	47
	46-65	113	38.6
	Above 65	13	4.4
Education level	Unable to read and write	123	42.3
	1-8	110	37.7
	9-10	50	17
	Above grade 10	9	3
Family size	1-3	55	18.8
	4-6	105	36
	7-10	110	37.7
	>10	22	7.5
Farm size(hectare)	<0.5.ha	44	15
	0.5-1.ha	71	24.3
	1.25-2.ha	88	30.1
	2.25.ha -3.ha	61	21
	>3.ha	28	9.6
Annual income(ETB)	<5000	32	11
	5000-10000	110	37.7
	10001-15000	115	39.3
	>15000	35	12

Source: field survey, 2021 NB: Total Respondents=292

According to information in the Table 3, 47% of participants were between 31 and 45 years of age, 38.6% of respondents were found between 46 and 65, 10% of respondents were found between 20 and 30 while those aged above 65 years were 4.4%. All farmers are within the active

working-age group and have relatively long years of farming experience to notice environmental changes.

In terms of educational status, the majority of the sample household heads 42.3%, were unable to read and write, 37.7% attended grade 1-8 school level,17% attended grade 9-10 and only 3% attended above grade 10. This investigator concluded that there is a high illiteracy rate among local people of the woreda especially the aged people. Uneducated people might be less able to understand and use new technology that could improve their means of production and; this can increase their vulnerability to drought.

As indicated in Table 3, 37.7% of the respondents have 7-9 family members, and 36% of respondents have 4-6 family members and, 11.8% of respondents have 1-3 family members and also 7.5% of respondents have above 10 family members. Family size determines the level of sensitivity to drought in rural areas whose source of livelihood is predominantly agriculture. Big households can have both merits and demerits. During drought, they are more vulnerable to drought. On a positive note, if all household members can provide labor, then that will benefit the household (Belle. J, et al., 2017). Generally, the study area has a big average size of households.

The landholding of farmers in the study area is very small. Land is one of the most important factors of agricultural production (Habtamu, 2011).Therefore, farmers' coping capacity also differs from average landholding their own. According to the survey data, the size of the land is very fragmented and it differs among individual farmers. As shown in Table 3, (15%) of households have less than (0.5 ha), households have landholding size of (0.5-1.0ha), which is (24.3%), households have landholding size of (1.25-2. ha) which is 30.1% respectively, households have landholding size of (2.25-3.ha) which is (21%). Only 9.6% of households owned greater than 3.ha of agricultural lands. Because of rapid population growth farmland size per household has decreased to less than one hectare which makes the newly formed households landless thus, forcing them to plow marginal areas. This in turn has increased pressure on the land resources, accelerating land degradation which further aggravates the effects of drought in the study area. Similarly, Agriculture is the major source of income for households and the annual total income of households was found by adding their incomes from selling farm products. Based on this, the majority of the rural household heads responded that the amount of annual income in the study area range between 10000 to 15000ETB (39.5%), 5001-10000ETB (37.6%), greater than 15000ETB (15.1%) and less than 5000ETB (7.6%) respectively in the study area. Families

with more annual farm income have more capacity to adapt to climate extremes. This could be obvious because adaptation to climate extremes is capital intensive and hence increased income will encourage the investment capacity on adaptation options (Temesgen et al., 2008).

Table 4.Access of households to institutional services in the study area

Institutional supports	Frequency	Percent
Extension services		
No	150	51.4
Yes	142	48.6
Total	292	100 %
Credit usage		
No	183	62.7
Yes	109	37.3
Total	292	100 %
Utilization of irrigation		
No	290	99.3
Yes	2	0.7
Total	292	100

Source: field survey, 2021

It is necessary to provide information and enhance the knowledge and skills of farmers through extension. Better access to extension services seems to have a strong positive influence on the probability of employing coping mechanisms (Aymone, 2009; Temesgen et al., 2009). Aymone (2009), argues that farmers who have access to extension services are more likely to be aware of changing climatic conditions and to have knowledge of the various management practices and accelerates farmer's decision to take up measures to climate extremes. About 51.4% of respondents have no access to extension services and 48.6% of them had access to extension services in the study area (Table, 4).

Credit is important to improve the ability of households at critical times of the year to buy necessary goods, and to diversify income sources. Borrowing to smooth seasonal fluctuation in agricultural income is normal and regular activities in rural areas. During a period of distress, such as drought, reliance on borrowing tends to increase. It also reduces their vulnerability by enabling them to overcome the shortage of consumption. According to Table 4, only about 37.3% of respondents reported that they had access to credit and 62.7% of respondents had no

access to credit in the study area. Credit increases the financial resource of the farmer they able to cope with the problem they face. Based on the result of the survey data, most of the households about 62.7% of the total do not use credit, according to the information obtained from focus group dicussions the reason for this is that they fear its interest, assuming that they cannot able to pay back it to the institutions within the time limit and they have low confidence in its profitability.

Similarly, access to water for irrigation is important in that it enhances the capacity of farmers to produce more than once a year using a nearby water source and it avoids dependence on rain. Only 0.7% of the respondents have access to irrigation in the study area (Table, 4). From this one can able to understand in the study area almost all households are dependent on rain-fed agriculture which is sensitive to climate change and variability. As a result of this, they suffer a lot by the impacts of drought; this decreases their coping capacity and makes them more vulnerable.

4.1.1. Means of Livelihood among the sample households in the Study Area

The target populations in this study were farmer's whose livelihood directly or indirectly depends on land resources. The livelihood of the people in the Woreda depends mainly on mixed farming (crop and livestock production).Agriculture is the major economic activity of the household heads in the study area. The farmers in the study area uses crop particularly maize and livestock farming system.

Table 5.Major food Crops is grown in the study area

Major food Crops	Number of HHs (N=291)	Percentage (%)
Maize	198	77.1%
Teff	49	16.9%
Haricot bean	20	6.8%
Sorghum	7	5.3%
Wheat	1	2.9%
Total	292	100%

Source: field survey, 2021

The activity of farmers of Kacha Birra woreda is tied to rain-fed agriculture. For majority of sample house holdheads, their source of income is crop and livestock production. According to

KBWARDO (2019), the major staple food and cash crops are grown in the study area are maize, teff, sorghum, Haricot bean, wheat and enset. As shown in table 6, 77.1% of households grow maize followed by 16.8% teff. And a few (5.3%) grow sorghum. It was observed that maize is a staple food in the study area. Economically, agriculture serves as the main economic foot and means of livelihood to the majority of the people and characterized by traditional mixed farming as it includes both crop and livestock production. Most of the sample respondents reported that the production of crops is declining from year to year as a result of bad weather conditions. Most of the sample respondents also reported that the production of crops is declining from year to year as a result of bad weather conditions. As the woreda report of 2019, sweet potato was totally destroyed by the pest and drought.

Table 6.Data that shows crop productivity Q/hectare in study area from 2008-2020

Year	Maize	Teff	Harcot bean	Sorghum
2008	40	12	21	30
2009	34	7	19	27
2010	48	13	17	28
2011	37	11	13	23
2012	37	12	14	19
2013	39	11	10	17
2014	41	9	11	12
2015	28	9	8	15
2016	21	8	7	16
2017	23	7	7	13
2018	26	9	6	14
2019	24	7	5	13
2020	21	7	4	12

Source: Kacha Bira woreda Agriculture and Rural Development office, 2021

This crop is very crucial by filling crop gap during food insecure and hunger months as it mainly harvested between April and June in the woreda. Even in normal years yield from their fields may not feed a household all year round. The crop productivity in study area decreases from year to year quintal per hectare, this shows the study area livelihood is affected. Insignificant amount, and distribution of rainfall results in low agricultural performances and productivity in the study area.

Livestock production is the other economic activity in the study area. Oxen, cows, horses, donkeys, sheep, goats, hens and bee hives are the important in Kacha Birra woreda. It is important in both agro ecological zones as one type of mixed farming. Livestock provide foods such as meat, milk and milk products, non-food products such as hide and skin. It is also a main source of income for periods of distress time when crop failure happened due to erratic nature or when seasonal climate variation and drought occurred in rural areas.

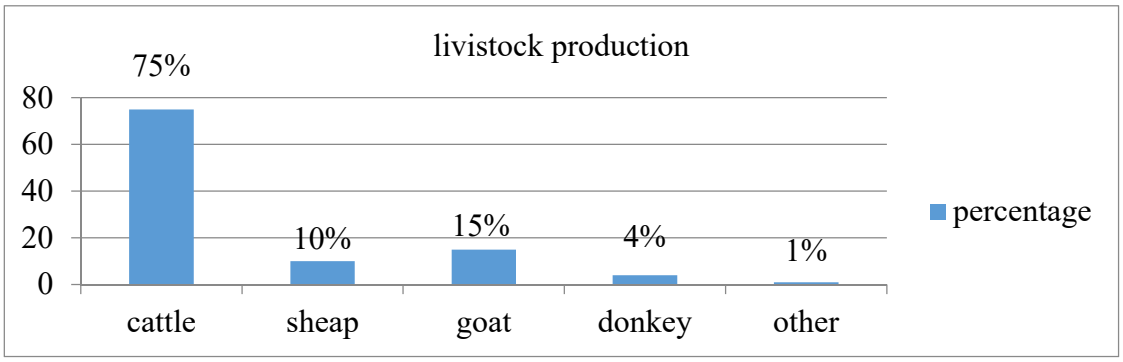

Figure 5.livestock production in the study area

Source: field survey, 2021

As indicated in Figure 5 above, 75% of respondents keep cattle, 15% of respondents keep a goat, 10% have sheep, 4 of respondents keep donkeys and 1% others. This information shows that the larger part of the community owns types of livestock. A large number of households own cattle, which have a higher value and it follows that cattle have a positive effect on family livelihoods. Livestock plays a very important role by serving as a source of food, income and as the accumulation of wealth and source of traction especially oxen and provision of manure required for soil fertility maintenance (Yirga, 2007).

4.2. Perceived Effects of Drought on Livelihoods

4.2.1 Farmers perception about drought

It is important to understand farmers' perception about drought; this gives an insight into their previous drought experiences, level of understanding and awareness about drought. The perception of people stems from their observations and experiences of oscillations in temperature and rainfall regimes of their respective localities.

Table 7.Farmers perceptions about a drought in the study area

Farmers' perception of of drought	Respondents(n=291)	Percentage (%)
Failure of the seasonal rainfall	253	86.6
Food scarcity and less agricultural employment	132	45.2
Temperature increase	104	35.6
Previous drought experience		
Yes	287	98.6
No	4	1.4
Total	100	1oo%
Drought frequency		
More frequent	145	49.8
No difference	54	18.6
Less frequent	89	30.6
Don't know	3	1.0
Total	292	100%

Source: Field Survey, 2021

Drought has a different meaning to agriculture based on their physical environment, type and degree of involvement in agricultural activities, and level of impact on their financial wellbeing. Participants of this survey were asked to guide their understanding and 87% of respondent explained drought as failure of the seasonal rainfall resulting in water scarcity for various uses mainly for drinking and agriculture (87%) 45.2 % of respondents explained drought as food scarcity and less agricultural employment and 35.6% of respondents have also perceived drought as an increased atmospheric temperature. Moreover, 98.6% of the respondents had experienced drought and 1.4% not. About 49.8% of the study participants indicated that droughts occurred more frequently than expected. According to Stefan et al., 2010, the farmers' perception of drought in Ethiopia is based on the failure of the seasonal rainfall and the consequence is loss of crops and livestock.

Participants in one focus group were all in consensus with the following statement: We lived here in Kacha Birra Woreda for about 45 and 65 years. We have been experiencing many droughts than it used to be before. Before droughts used to occur after 10 years but these days moderate droughts have become very common and take more months than those which used to occur in the past. A key informant had a similar observation that drought occurrence has shortened and had this to say: " Previously, drought came every 10 years but now especially, since 2000 E.C(Ethiopian Calendar) the drought occurs within a shorter interval, that is 2 to 3 years. This means the frequency of drought is increasing.

4.2.2. Effects of drought on Livelihoods of the study area

Drought as one of the threats seen in recent years affects rural livelihoods. The effects of drought are based on frequency, severity, degree and on the vulnerability of the region and sectors. According to climate projections, the impacts of climate change across the world are likely to vary, colder regions may benefit from warmer temperatures while warmer regions may suffer from increased heat and drought. So in most household livelihood is affected year to year in the study. Drought as one of the threats seen in recent years affects rural livelihood (NDMC, 2010).

Table 8.With drought affected household data in study area from year 2006-2020

Year	Study area (Kebele)		
	Awaye	Mesena	Zogoba
2006	187	173	146
2007	187	173	146
2008	187	173	146
2009	187	173	146
2010	187	173	146
2011	296	289	271
2012	296	289	271
2013	296	289	271
2014	296	289	271
2015	296	289	271
2016	383	378	359
2017	383	378	359
2018	383	378	359
2019	383	378	359
2020	383	378	359

Source: Kacha Birra Woreda Productive Safety Nate Progam, 2020

Drought affects the production and productivity which lead rural households to famine. During drought and late in the onset of rain, land becomes dry and difficult to plough and

lack/absence of precipitation hinders seed cultivation and germination of cultivated seeds. Even weeks delay in the onset of rain found to have significant difference on the harvest and has deprivation of household's livelihoods. As shown in the above table 8, increase number of drought affected households, which shows drought affects livelihoods of rural households.

Table 9.Perceived effects of drought in the study area

Indictors	N	Fh	Fm	Fl	WAI	rank
The decline crop yield	125	96	64	6	2.16	1
Food shortage	105	108	78	-	2.09	2
Lower income	85	143	63	-	2.07	3
Increase cost of production	68	173	45	5	2.04	4
Decrease livestock production	96	103	74	18	1.95	5
Forage deficit	70	130	63	28	1.83	6
Increase livestock death and disease	46	97	143	5	1.63	7

Source: Field Survey, 2021

As shown in the above table 9, a decline in Crop yield was perceived as the first impact of drought with a WAI of 2.16, due to inadequate and poorly distributed rainfall. In the study area, drought is linked to crop failure and a sharp decline in rainfall plays an overriding role in crop production. These culminate in poor crop development and low yields. Therefore, this finding has coincided with the findings of (Karl et al., 2009 and Olsen et al., 2011), which states that water deficit resulting from drought reduces crop yield because of its negative impacts on plant growth.

The food shortage (WAI 2.05) was perceived as the second impact of drought in the study area. The food insecurity situation in study area is highly linked up to severe, recurring food shortage and famine, which are associated with recurrent drought (MoARD, 2009). Rainfall variability and associated droughts have been major causes of food shortage and famine in Ethiopia. At the national scale, the link between drought and crop production is widely known in Ethiopian agriculture (DiFalco et al., 2011). Concerning the staple food crops of the study area, maize and teff are the principal ones. All people like, or aspire, to eat teff and maize. However, during drought years, majority of the households shift to other food crops. For most of them, the shift was from maize to sorghum and Enset products. The reason for this was that the price was higher

than the others. This means that they follow the rational principle of selling a few amounts and buying a high amount to consume the available resources for a longer time. Even in normal years yield from their fields may not feed a household all year round. A study conducted by Kebede (2016) states that in Kacha Birra woreda, on-farm crop production contributes only up to a maximum of 50% of the annual food requirements of the population, even in good years. Nevertheless, in drought years the months of self-subsistence from its yield are drastically reduced.

As shown in the above Table 9, Lower-income (WAI 2.07) was perceived as the third effects of drought in the study area. Small scale agriculture is the major source of income for households in the study area. The nature of agriculture primarily rain-fed means that production is sensitive to fluctuations in rainfall. Limited amount and uneven distribution of rainfall is the most limiting factor for crop production and livestock management that could finally have consequences on the wellbeing of the rural populations. Based on this, rainfall fluctuation creates a credible threat to agriculture. It has a huge influence on production loss. This reduces the income level of households in the study area. This finding is consistent with the NDMC (2016) report which indicates that drought usually causes economic and financial challenges for agricultural production and also that if it persists for some years it can cause huge and devastating agro-economic problems as well as serious economic hardships for agricultural production and businesses that are agriculturally-based in rural communities.

Decrease Livestock Production (WAI 1.95) was also another perceived effects of drought by respondents in the study area. Focus group discussion participants pointed out that in kola kebeles, the delayed precipitation is resulted in a shortage of water and fodder for livestock and increases heat spells that result in loss of livestock and decreases the quality of livestock. Strategies used by local communities to save their cattle involved selling some of the cattle which are old and weak but cannot substitute them with other livestock, because these cattles are sold at a low price. Therefore, the number and types of cattles are decreasing from year to year. Forage deficit was also another drought effect reported by the respondents, with a WAI of 1.83. This finding is consistent with the finding of Abate (2009) which states that drought and delay in the onset of rainfall led to poor grass regeneration/forage deficit and consequently increased the mortality of the livestock, vulnerability to diseases and physical deterioration due to long-distance travel for water and pastures. Increase livestock death and disease were also one of the effects of drought reported by the respondents, with a WAI of 1.63. In the study area, on-farm

grazing is completely absent and livestock is usually still-fed with crop residues and fodder. But during drought years, fodder, as well as grain would be scarce. Members of FGD respondents noted that during drought years grasses do not grow well, livestock was underfed and subjected to high mortality.

Table 10 .Major impacted crops in the study area (multiple response possible)

Major crops	Frequency	%	Rank
Maize	154	52.7	1st
Teff	98	33.5	3rd
Haricot bean	117	40	2nd
others	65	22.2	4th

Source: field survey, 2021

There are different types of agricultural production which are familiar with and mostly affected by recurrent drought in the study area. As shown in the above table 10, the most victims of crops in the study area are maize 52.7%, Haricot bean 40% %, teff 33.5%, and others 22.2 % and respectively. Maize is the most affected crop type during drought years in the study area. Because it is not drought-resistant crop, and so an overdependence on maize makes the community vulnerable to drought. What is encouraging though, is that the third most popular crops grown are small grains such as sorghum. It is noted that small grains adapt much better in drought-prone areas, compared to most food crops. As the woreda report of 2016, sweet potato was totally destroyed by pests and drought. This crop is very crucial by filling crop gap during food insecure and hunger months as it mainly harvested between April and June in the woreda.

“One of key informant from Woreda Rural Development and Agricultural office said that agricultural production is decreasing from time to time in the woreda due to the variability of the rain fall and bad climatic condition. Also the amount of the income from agricultural production is decreasing and the ways of rural livelihood in this woreda is affected by recurrent drought.

4.3. Coping Mechanisms to Drought Effects

Coping mechanism involves managing resources both during drought and in normal times to withstand the effects of drought risk (Sewnet, 2015). Developing effective coping mechanisms for drought depends on the level of understanding of the issue and its impacts in different levels, the degree of impact and technological capacity of farmers to coping mechanisms needs proper plan, policy and strategies to create adequate coping structure in the country level. Therefore, respondents in the study areas have developed various coping mechanisms to cope with problems of drought. The higher dependence on agriculture and poor economic condition forces farmers to take different coping mechanisms just to face immediate losses. For this study, eight coping mechanisms, which were important according to the participants and most widely adopted by them, were separated for further statistical analysis

Table 11. Drought coping mechanisms used by households

Coping mechanisms	Frequency	Percentage (%)
Selling household assets (livestock and crops)	165	56.5
Change in consumption pattern	137	47
Credit/Borrowing	122	41.7
Receiving supports or food aid	116	39.7
Off-farm activities	95	32.5
Store crop harvest	85	29.1
Seasonal migration	21	7.2
Planting drought-resistant and short-season crops	12	4.1

Source: Field Survey, 2021

Households in the study area employ a range of drought coping mechanisms. The most used drought coping mechanism was the selling household assets (56.5%), and the least used was Planting drought-resistant and short-season crops (4.1%) followed by Seasonal migration (7.2%), store crop harvest (29.1%), off-farm activities (32.5%), receiving support or food aid (39.7%) ,Accessing credit (41.7%) and change in consumption pattern (47%). The striking point here is that selling household assets as a drought coping mechanism rather than more reliance on mechanisms like change in consumption pattern and accessing credit would exacerbate the loss of productive assets.

Selling of Assets

During the time of crisis and shocks, farmers in the study area employed different coping mechanisms (Table, 11). At the aggregate level, selling of assets were the dominant coping mechanisms of rural households in the study area. According to the farm households, it is difficult to rear large numbers of livestock even under normal weather conditions due to problems associated with a lack of grazing land and pasture. Hence, they only keep a few numbers of

livestock to sell them during adversity. During drought years households sell their livestock to purchase food grains to keep their families alive, first sheep and goats, and then cows and finally oxen. Interviews indicate that the number of livestock was sold at throwaway prices of one-third or less of normal rates. All most all of the respondents have livestock and it was the primary means of coping with the effects of the drought. A study conducted by Tadege, 2007), suggested that Sale of livestock and other assets are identified as a coping mechanism in Ethiopia. Farmers may sell some of their resources in the market, and this can be an important extra income, and can also function as a coping mechanism. These studies support the findings of this study.

Change in consumption pattern

The finding also shows that Change in consumption patterns was another dominant coping mechanism in the study area next to the selling of assets (Table 11). A large proportion of farmers reported a change in consumption patterns, which include reducing frequency and meals, eating less preferred food items and reducing socialization so on. A study conducted by Nigatu 2011, in Southern Ethiopia confirms this finding. According to him, minimizing the number of meals and the amount of food consumption during peak season are some of the mechanisms used by households.

Accessing credit

Accessing credit was also one of the major coping mechanisms in the study area. Borrowing to smooth seasonal fluctuations in agricultural income is a normal and regular activity in rural areas. Borrowing may be in both cash and kind. During periods of distress such as drought, reliance on borrowing tends to increase and Farmers borrowed mainly cash or food crops. Survey data indicated that 41.7% of respondents used credit from merchants and other relatives as coping mechanisms. Accessing credit helps farmers to diversify and increase incomes and provide long term solutions for farmers. Similar outcome have been found and explained by Anteneh ,2013.

Receiving Supports or Food aid

As shown in table 11, (39.7%) of respondents in the study area indicated that food aid was the best strategy in coping with drought. majority of the income-poor households relied on food-aid and safety-net programs in the study area. 10% of surveyed households were beneficiaries of PSNP, the major food security program of the government by the time of fieldwork for this study.

They receive birr 140.0 per month per household member. The PSNP operates such that beneficiaries get food or cash assistance for five years, after which they are expected to graduate and become food secure by themselves. Even though some of the PSNP beneficiaries are already meeting their food needs for the twelve months and can withstand modest shocks after they graduated, more than half of the beneficiaries do not feel ready and want more time and additional support before leaving the program.

Off-farm diversification

One other mechanism that households use to cope with drought in the study area is engagement in small businesses. The household survey and FGDs indicated that most of the sample respondents in the study area often practiced off-farm activities. These off-farm activities included petty trade (selling different products like, clothes, crops, salts, local drinks, coffee,), handicrafts, and daily wage labor in nearly urban and rural areas. These incomes surely reduce their vulnerability as they are relatively diverse as alternative sources of income. Off-farm activity help households to retain or to withstand drought crisis. Poor and landless also make earning from daily labor on better-off farmers 'land, construction activities, and small scale businesses in the study area. To support this finding, Aymone (2009), suggested that expanding smallholder farmers' access to off-farm sources of income increases the probability that they will invest in farming activities.

Seasonal Migration

Seasonal migration is a form of return migration. It is driven by seasonal peaks in labor demand, mostly in agriculture. The study revealed that nearly 7.2% of respondents migrated to other places to search for jobs. Those moved to urban centers to seek for other livelihood opportunities to better their livelihood outcomes. This finding tend to support assertion by Anteneh (2013) who opined that migration is a form of coping mechanisms within a broader set of potential adaptive responses that individuals and households undertake to minimize their vulnerabilities.

Cultivating Drought Resistance and Short-Season Crop

Cultivating drought resistance and short-season crops is one of the coping mechanisms practiced in the study area. In the study area, whenever drought occurs, the effect on crop production was severing and the consequence is yield reduction. The household survey result shows that of the total sample households, 4.1% of respondents used drought resistant and short-season crops as drought coping mechanisms. Similarly, reports of FGDs indicated that drought resistance crops

and short-season crops cultivated during the dry season with the low amount of rainfall of the years in the study area. Enset, or false banana, is a relative drought-resistant plant and it is a highly valuable plant.

Table 12. Level of drought coping capacity in the study area

No.	Practice of drought coping mechanism	No.	Percentage
1	High	11	3.8%
2	Medium	85	29.1%
3	Low	196	67.1%
	Total	292	100%

Source: field survey 2021

As shown in above table 12, the level of drought coping capacity was low (67.1%), medium (29.1%) and a few farmers reported a high level of drought coping mechanisms in the study area (3.8%). From this one can able to understand in the study area level of drought coping capacity was low as a result of this, they suffer a lot by the impacts of drought and makes them more vulnerable. Coping mechanisms desired by the households are not without constraints. Chauhan et al, 2014, confirmed this finding. He said that Ethiopia has low coping mechanisms due to low financial, technological and institutional capacity. The existed strategies are no guarantee of successful coping in terms of securing basic needs in the face of recurrent drought.

4.4. Factors that Determines Drought Coping Mechanisms

The factors affecting drought coping mechanisms are explored by employing multiple linear regression models. Before fitting the multiple linear regression model,it was important to check whether or not the serious problem of multi-collinearity exists between explanatory variables. Two measures are often suggested to test the presence of multi-collinearity. In this study, both correlation coefficients and Variance Inflation Factor (VIF) was used to verify multicollinearity. The value of VIF greater than or equal to 10 is an indicator of the existence of a serious problem of multi-collinearity and when the correlations $|r| \geq 0.9$, then one or both independent variables

assume to leave out of the model (Ottoy et al., 2013). Therefore, in this study multicollinearity diagnosis result obtained from the model, shows no multicollinearity problem (table, 13 and 14). Therefore, the multiple linear regression model was used to see the determinants of drought coping mechanisms in this study.

Table 13. Correlation between Socioeconomic characteristics and coping mechanisms

Socio-economic characteristics	Correlation Coefficient (r)
Age	.276**
Education	.191**
Family size	-.010
Farm size	.220**
Income	.216**
Access to water	.048
Access to credit	.153**
Access to weather	.101
Extension contact	-.074
Farm experience	.029
Note: *, ** Correlation is significant at 5% and 1% level of significance (2-tailed).	

Source: Computed from the field survey data, 2021

Correlation is a technique that describes the degree of relationship between two variables. Pearson's correlation coefficient was used to assess the relationship between them in the study area. Simply, the Pearson correlation coefficient tells how much one variable tends to change when the other one does. The results were shown that among ten socio-economic characteristics reported by household heads, only five variables like age (x1), education(x2), farm size(x4), annual family income(x5) and credit(x7) had a positive and significant association with the drought coping mechanisms.

Table 14.Multiple linear regression results on variables influencing drought coping mechanisms

Explanatory variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics
	B	Std. Error	Beta			VIF
(Constant)	2.401	.307		7.828	.000	
Age	1.802	.184	.960	9.780	.000	4.12
Education	.826	.103	.677	8.020	.000	3.05
Family size	.084	.144	.039	.585	.559	1.93
Farm size	.426	.091	.369	4.665	.000	2.68
Income	.317	.108	.246	2.944	.004	2.99
Access to water	.398	.410	.053	.971	.332	1.27
Access to credit	.255	.122	.115	2.097	.037	1.30
Access to weather info	-.058	.113	-.027	-.514	.607	1.15
Extension contact	-.166	.170	-.060	-.977	.330	1.64
Farm experience	.027	.080	.018	.344	.731	1.15

Dependent Variable: Coping mechanisms, Adjusted $R^2 = 0.322$; F = 14.79; Significant if $p < 0.05$, Significance Level, 95%.

Source: Computed from the Field Survey Data, 2021

The regression output indicates that certain household-level variables are affecting the magnitude of coping mechanisms used by the households in the study area. Among the variables entered into the multiple regression analysis, five out of ten explanatory variables were significant with an F- value of 14.79 and an adjusted R^2 value of = 0.322. Therefore, the results imply that 32.2 percent of the variation in the drought coping strategies practiced by the farmers could be explained by the combined effects of explanatory variables.

The age was positive and had significant effect on the practice of drought coping mechanisms. It represented a farming experience of household age this is because as the age of farmer's increases, the farming experience of household age increases and the farmer is likely to acquire more experience in weather forecasting. Experienced farmers are more likely to have more information and knowledge in Climatic conditions and crop and livestock management. This result was consistent with the finding of Ajao and Ogunniyi 2011; Gunn et al., 2012 and Deressa et al., 2008, but contradicts the finding reported by those of (John et al.2011),who reported that age did not affect drought coping mechanisms.

Education was positive and significant at ($p<0.05$) for the practice of drought coping mechanisms with a standardized regression coefficient of 0.677. This implies that a higher education level increases knowledge to practice drought coping mechanisms. This is because educated people easily understand climate extreme information to adjust and develop the coping capacity to drought. Educated farmers have greater knowledge to understand and develop the ability to cope with adverse effects. This result is consistent with studies conducted by (Temesgen et al, 2008; John et al.,) which states that education increases the probability of coping mechanisms to weather extremes. Farm size has a significant and positive effect on drought coping mechanisms with a standardized regression coefficient of 0.369. This implies households with large farm sizes have a better opportunity for diversification of their crop and livestock enterprises, and it can help to distribute risks associated with unpredictable weather. The land is the major determinant factor for applying coping strategies because some crop-based coping mechanisms require a larger farm size. A study conducted by Trisna Mardy et al., 2018, found that land area has a positive and significant influence on drought coping mechanisms.

Annual family income was positive and significant for the practice of drought coping mechanisms with a standardized regression coefficient of 0.55. This implies that household with more income increases the coping capacity to drought and reiterates that farmers avoid risks that are associated with the adoption of new technology. This could be obvious because coping with climate extremes is capital intensive and hence increased income will encourage the investment capacity on adaptation options. This finding is consistent with the findings of Temesgen et al, 2008.

Similarly, access to credit was positive and significant for the practice of drought coping mechanisms with a standardized regression coefficient of 0.126. It is considered that the provision of saving and credit service is essential in enhancing the coping capacity of farmers through saving and accumulating wealth. Credit is important to improve the ability of households at critical times of the year to buy necessary goods, and to diversify income sources. As credit increases financial resource of the farmer they able to cope with the problem they face. Access to affordable credit increases the financial resources of farmers and their ability to meet transaction costs. In the drought-prone areas where crop production is highly affected by the amount and temporal distribution of rainfall, access to credit fills food gaps of households and helps households to diversify their livelihood options. Similar outcomes have been found and explained by (MG Debesai et al., 2019).

CHAPTER FIVE: SUMMARY, CONCLUSION, AND RECOMMENDATIONS

This chapter has two sections. The first section presents the summary and conclusion of the study which briefly reflects the overall summary and conclusion of the finding and the last section forward recommendation emanated from the finding of the study.

5.1. Summary

Drought is causing the greatest environmental, social and economic threats to all of mankind and across borders in many nations. The main objective of this study was to investigate the effects of drought on the livelihoods of rural households and their coping mechanisms in Kacha Birra woreda Kembata Tembaro Zone, SNNPR. The study was conducted in three rural kebeles of Kacha Birra woreda. The study relied on both quantitative and qualitative methods of data collection and analysis. The primary data were collected by using questionnaires, interviews and Focus group discussion. The sample kebeles were selected based on their agro-ecological setting both from lowland and midland agro-ecological zones. A total of 292 sample respondents were selected from the three sampled kebeles based on a multi-stage cluster sampling approach. The study area was one of the pre-dominant rain-fed agricultural productions with farmers undertaking both crop and livestock production. The analysis was done using a four-point rating scale, descriptive statistics (frequency and percentage,), and Multiple linear models.

In the study area, there was an impact of drought which affected most of the crops and livestock products. For the impact, the most common coping strategies designed and applied by the sample household heads include: sale of household assets, credit from merchants or money lenders, inter household transfer and loans, changing growing and harvesting time, growing short maturing and drought-resistant crops, diversifying agricultural production and particularly took aids from different stakeholders. The coping strategies desired by the households are not without constraints in the study area. However, several socio-economic challenges have been hindering farmers' effort to undertake various coping mechanisms in response to the existing drought effects on their livelihoods. Lack of available water (for irrigation), Lack of access to timely weather information, Low level of education, Shortage of land, and inadequate cash income and capital were some of the responses responded by respondents. Finally, conclusions and recommendations were made based on the findings of the study.

5.2. Conclusion

The study shows that Kacha Birra woreda is a drought prone and ravaged area. What exacerbates the problem is that the livelihood of the community is anchored on farming. Sufficient and regular rainfall would improve the livelihoods of the members of the community. However, the research findings are that perennial rain shortage is the root cause of drought in the area. Lack of irrigation water, and a generally low level of education expose community members to drought. In addition, the community's overdependence on maize, which is very susceptible to drought, also increase the level of drought risk in the study area.

Drought effects on farmer's livelihood in the study area among others include,crop failure, low er income, food shortage/food insecurity,increase cost of production, decrease livestock production, forage deficit, increase livestock death and disease. The decline in Crop yield was perceived as the first impact of drought with a WAI of 2.16. In trying to cope with the above-listed effects of drought and others in the study area, the following coping mechanisms were identified by respondents: sell of household assets, food aid or food appeal, credit from merchants or money lenders, use of drought-resistant crops and storing crop were some of the coping mechanisms in the study area.

Households believed that the coping mechanisms they employed are not enough to reduce the impact of the current drought. Their actual coping mechanisms were not the same as their perceived adaptations due to various constraints. The study identified lack of weather information, forage and feed scarcity, lack of agricultural technologies and inputs and ineffectiveness of an option, etc., as major constraints of coping mechanisms.

Multiple Linear regression analysis identified age, education level, farm size, annual income and access to credit significant factors for drought coping mechanisms. Therefore, necessary initiatives focusing on these factors could increase the coping capacity of the farmers.

5.3. Recommendations

Depending on the nature of the data, the finding obtained and the conclusion drawn from the study, the following recommendations are suggested to minimize drought effects on the livelihoods of rural communities and to improve coping mechanisms in the study area.

- The rural household heads and productive aged groups of the local community should participate and motivate in different activities and diversify the livelihood strategies that help them to reduce drought effects.
- In the study area problem of food insecurity is widespread especially when crop failure due to drought and little rainfalls. Therefore, effort and strengthen the farmers coping capacity to drought effect through providing early maturing, and drought-tolerant crop varieties to farmers have an important mechanism.
- To increase households' coping capacity, improving their knowledge and skills through supporting them financially (credit) to increase their involvement in small scale irrigation and water harvesting, improved agricultural inputs should be disseminated timely to farmers to increase their income from crop and livestock production.
- Households should be encouraged to store food grain and hay at all times, protect vegetation cover, trained and educated on certain farming ethics with regards to drought as well as rational use of water.
- Finally, further studies that could address the adaptation and coping mechanisms, and the existing challenges in various agro-ecological conditions should be conducted to provide more options to policy formulation and enhance the sustainability of the livelihood of a rural households in the face of changing the environment.

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APPENDICES

Appendix I: Survey Questionnaire

Questionnaires to be completed by Sample Household Heads

Introduction

My name is Tesfahun Tessema. I am writing a thesis entitled "Effects of drought on livelihoods of rural communities and their Coping mechanisms in Kacha Birra Woreda, Kembata Tembaro Zone, Ethiopia". The general objective of this study is to investigate the effects of drought on livelihoods of rural community and their coping mechanisms and specific objectives are: to assess the effect of drought on the livelihoods of farm household, to identify the coping mechanisms taken by farm households in response to the effects of drought and to examine the determinant factors that determine drought coping mechanisms in the study area. Confidently, this research has a significant contribution to reducing the impacts of drought on rural communities of this study area. Therefore, your valid contribution by giving accurate information is highly valuable in achieving the objectives of this research. I assure you that the information to be shared by you will be used only for academic purposes and kept confidential. Thus, please feel free to convey the required information honestly.

Thank you in advance for your cooperation!

General characteristics of respondents

1. General

   1.1.Name of the Kebele ----------Date of interview ----------

   1.2.Enumerator's name ----------signature----------

   Checked by ----------signature ----------

2. Socio-economic and demographic characteristics

   1. Age of the household head ____

   2. Sex of the household head_____

   3. Marital status_____

   4. Family size_____

   5. Educational status of the household head_____

6. Monthly income_____

7. Size of the farm land you have (owned)?_____

8. Do you have agricultural extension services in your area? 1. Yes, 2. No

9. Do you have access to information media? A. Yes B. No.

If your answer is yes, which medium do you possess? A. Radio B. TV C .journal/newspaper D. extension agents E. Others (specify)

10. Do you have access to credit? A. Yes B. No

11. Do you have market access nearby? A. Yes B. No

12. If your answer is yes, how far is it? _____km (approximately)

10. What is your means of livelihood or how do you get your livelihood? (Multiple response)

A. Livestock rearing C. crop production

B. Mixed farming D. working as a daily laborer,

E. petty trade F. Other (specify) _____

11. Do you think crop production is enough to feed the family year and above?

A. Yes B. No

12. If no, for how money months it is sufficient? ----------

13. Do your households get sufficient water in the whole year? A. Yes B.No

15. What was the main source of feed for your livestock before10 years?

A. grazing pasture B. steam of Enset plant C. Crop residues D. others

16. What is your main source of animal feed at the present time?

Appendix II

A. Farmers perceptions about drought

1. What did you understand about drought? ----------

2. Have you ever experienced any droughts? (Yes/No)

If yes, do you think droughts are becoming more or less frequent in last year's?

A. More B. No difference C Less D. Don't know

3. What are contributing factors of drought in your kebele?

A. Climate change C. Land degradation

B. Shortage of precipitation D. El None E. others_____

3. What is the Extent of drought effects on the livelihoods of agricultural communities in your area? (Multiple responses possible)

No	Statements	Degree of problems			
		High	Moderate	Low	No effect
1	Lower Income				
2	The decline in crop yield				
3	Food Shortage				
4	Increase the Cost of Production				
5	Decrease Livestock production				
6	forage deficit				
7	Water scarcity				
8	Increase livestock death and disease				
9	Others				

4. Why do you think, you are more vulnerable to the effects of drought

A. Lack of information on climate and weather variability B. Poverty to cope the shocks easily C. weak social capital D. Poor administration E. Others

B. Coping Mechanisms to Drought Effects

1. How do you prepare during the normal year to cope with drought?(multiple response)

A. Do nothing B. Store crop harvest C. Store crop residues for livestock

D. Save money, E. Migration for employment F. Sell some livestock

G. Seek an alternative source of income H. Use less water consuming crops

I. Early sowing J. Others----------

2. Do you think that is it possible to avert or adapt to the impact of drought by action in your locality? A Yes B. No

3. What actions/coping do you think and possible in your capacity? (It is possible to give opinion more than one actions)_____

4. Level of drought coping capacity in the study area
   A. High B .Moderate C. Low

5. Is there any effort made by institutions (government, NGOs and civil societies) to your Kebele to overcome the impacts of drought before, during and after the events?

   A. Yes B. No

6. If your answer is yes Q 4 How_____

7. What are the major constraints that hinder coping strategies in your Kebele?

8. In time of famine caused by drought, who helps you best?

   A. Relatives B. friends C.NGOs D. The government E. Cooperatives

9. Is there any government program targeted in your Kebele to cope effects of drought?

   A. Yes, B. No

10. Do you think that the program fairly targeted to each individual in your Kebele?

   A. Yes B. No

11. If your answer is yes Q9, what improvements are developed from the targeted program?

   _____

Appendix III

Guiding Questions for Focus Group discussions (FGDs)

1. What is your understanding of drought?

2. How often has drought occurred in the past?

3. What are the impacts of drought on the community's health, food security, livestock, and agricultural production?

4. Do you get governmental and or non-governmental aid when drought occurs?

5. Discuss the major drought coping strategies adopted by the household in particular and the society in general during drought occurrences?

6. What are the main challenges that hinder drought coping mechanisms?

Appendix IV

A Checklist for Key informant Interviews

1. Based on your experience, what look like its implication and trend on crop output in the Woreda? _____

2. Is there a food insecurity problem in the area? _____

3. What indigenous and learned strategies might be used to support these vulnerable people?

4. What are the impacts of drought on the livelihoods of agricultural community?

5. What are the ways of strategies used by the agricultural community to reduce the risk of drought in the woreda? ----------

6. To what extent (percent) these responses and coping strategies alleviate the problem? Was it for short term? Or For long term

7. Is there any effort made by local institutions (government, NGOs, and civil society) in reducing the risk of drought on the community in order to make their lives sustainable? A. Yes B. No, if you say yes, how? ----------

8. What are major challenges in the alleviation of the problem and what should be done?

Appendix .v

Table2**.** National Meteorology Agency, Ethiopia (MAE) Rain fall Data from 2001-2020

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001	12	0	56.5	182	222.5	123.5	221.4	200.8	124.6	11.3	0	0
2002	0	0	15.4	180.9	76.3	145.5	136	145.8	160.6	64.9	21	45.5
2003	4.8	10.1	86.9	94.6	105.7	201.8	151.9	178.4	98.6	22	4.7	5.5
2004	12	23.5	45.8	67.8	78.9	112.6	219.1	139.1	121.4	2.8	46	42.5
2005	35.8	58.9	58.4	49.7	103.4	108.3	145.7	176.9	102.5	11.7	14.3	0
2006	56.4	15.6	7.9	9.3	89.2	123.4	158.7	112.8	109.8	40.2	17.3	14
2007	31.5	18.8	144.4	62.1	97.2	64.6	100	98.9	123.7	37.7	67.7	0
2008	28.9	13.9	70	78.9	98.4	124	100.9	183.6	88.2	15.8	6	27.2
2009	0	0	19.4	50.5	61.2	80	123.6	100.4	83.9	15.1	0	0
2010	0	1.2	3.5	64.3	56.7	150.6	128.5	150..9	139.3	20.7	78.2	0.5
2011	34.5	4.8	36.9	25.6	78.6	122.7	146.9	258.3	98.5	57.1	5.1	0.6
2012	11.8	3.4	35.2	54.3	43.7	100.8	103	145	54.9	8.9	9.3	9.5
2013	15.5	11.2	98.7	102.7	116.8	95.6	108.8	100.4	76.7	0	49.2	0
2014	0	0	67.4	58.3	102.5	150.9	233.1	255.9	100.7	1.4	2.4	1
2015	15	17.4	87.4	97.4	67	182.2	100.8	152	98.6	36.4	0.4	0
2016	17.5	32.6	43,	44.9	54.6	124.4	156.2	111.4	54.6	0	47.2	0
2017	12.7	24.5	25.7	74.5	75.3	117.2	75.8	62.5	58.3	4.6	0	0
2018	11.8	18.8	75.6	50	75.8	49.9	121	256.6	132	10.9	21	0.1
2019	12.7	25.7	78.9	99.4	99.1	67.8	69.8	65.8	47.5	56.8	0	0
2020	5.8	18.8	75.6	50	99.4	43.7	90.3	118.8	58.2	7.9	21	0.1

Table 2. National MAE Maximum and Minimum Temperature Data from 2001-2020

Year	Min And Max °c	Jan	Feb	Mar	Ap	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001	Mx	27.7	30.8	29.8	27.9	26.5	23.8	23.3	24.7	26.6	28.2	29.0	29.5
	Mi	14.0	13.5	14.2	14.6	14.9	14.8	14.4	14.1	13.9	10.4	10.0	11.1
2002	Mx	29.5	30.1	31.1	27.2	28.1	27.0	24.6	24.7	28.2	27.4	27.5	29.2
	Mi	13.2	12.8	14.9	14.8	13.6	13.3	14.3	14.5	13.6	14.2	14.0	12.4
2003	Mx	28.0	29.9	29.1	29.9	28.6	25.7	23.6	24.0	25.9	26.3	28.7	30.9
	Mi	15.3	15.8	15.3	15.0	15.3	14.7	15.1	15.1	14.6	14.6	10.3	10.0
2004	Mx	31.0	32.1	28.5	30.3	28.1	26.5	23.5	25.1	26.4	25.0	27.9	29.1
	Mi	11.7	11.9	13.7	12.9	13.0	13.3	13.7	13.0	12.3	13.9	10.3	11.8
2005	Mi	12.3	12.8	13.5	15.0	13.9	13.5	13.9	13.9	13.6	14.0	13.0	12.0
	Mx	30.0	30.7	31.7	30.2	27.0	25.3	24.4	24.6	25.1	26.1	27.8	28.7
2006	Mi	12.6	13.2	14.6	14.3	14.2	14.4	14.3	14.6	13.2	13.2	11.8	12.3
	Mx	29.0	31.0	27.4	28.6	27.0	25.3	24.1	24.7	25.6	27.3	28.8	29.7
2007	Mi	14.4	13.3	14.9	14.4	15.1	14.8	14.5	14.5	13.8	12.0	12.8	14.9
	Mx	28.5	30.4	28.9	29.2	28.1	26.2	26.3	25.2	27.2	29.2	30.4	28.6
2008	Mi	13.0	13.6	14.9	15.1	15.5	14.7	14.5	14.6	14.0	11.5	12.4	11.9
	Mx	28.7	31.6	30.1	28.3	29.6	26.5	24.4	25.0	28.1	29.2	28.7	28.7
2009	Mx	29.6	30.2	31.1	27.8	28.7	26.4	24.7	24.8	26.7	28.0	29.9	30.0
	Mi	13.6	13.1	14.0	14.9	13.4	13.7	13.5	14.2	13.6	11.9	11.4	12.6
2010	Mi	12.7	13.6	15.1	14.8	15.1	14.7	14.0	14.6	13.9	12.0	10.5	10.2
	Mx	29.6	32.0	30.3	29.5	26.4	25.9	24.3	25.3	25.9	28.6	29.2	29.7
2011	Mx	30.7	31.4	29.1	27.3	27.9	26.3	23.7	24.2	26.8	28.7	30.0	29.5
	Mi	13.0	14.0	14.7	14.4	13.9	13.9	14.8	14.5	14.0	14.0	11.8	14.3
2012	Mx	30.3	29.9	31.5	29.2	28.6	24.7	24.9	24.8	26.3	28.4	30.0	29.9
	Mi	14.3	14.8	12.9	13.6	14.4	14.6	14.1	14.5	14.0	11.0	11.5	10.9
2013	Mx	31.7	31.4	33.2	31.1	28.3	25.9	24.1	25.4	27.4	29.1	28.5	30.3
	Mi	12.7	13.2	12.1	13.9	14.5	14.0	14.1	14.2	13.9	12.1	11.3	10.9
2014	Mx	30.6	31.7	33.4	30.5	30.4	29.2	25.7	26.7	28.9	29.1	31.1	29.3
	Mi	12.2	13.0	13.9	14.3	13.8	13.8	14.3	14.3	14.0	12.6	11.2	15.0
2015	Mx	30.0	29.2	29.8	29.3	28.0	27.1	25.1	25.6	26.9	30.6	31.5	30.7
	Mi	13.2	15.6	14.2	15.3	16.1	14.7	15.0	14.8	14.4	12.1	11.2	12.2
2016	Mx	31.0	31.9	31.4	32.0	28.4	26.0	25.6	25.5	27.3	30.3	29.6	29.7
	Mi	12.9	13.4	14.9	14.7	15.2	14.9	14.3	14.6	14.3	12.3	13.4	11.3
2017	Mx	31.2	32.3	32.9	28.4	30.8	27.2	24.7	25.3	27.1	30.3	31.7	31.0
	Mi	12.2	12.3	14.0	15.3	14.7	14.7	14.7	14.4	14.1	11.8	12.0	12.5
2018	Mx	31.6	33.0	31.7	29.9	28.0	26.1	24.6	24.9	28.2	29.0	30.0	30.3
	Mi	13.2	13.8	15.5	15.1	14.6	15.4	16.6	17.6	17.4	16.7	16.3	14.6
2019	Mx	31.7	30.4	32.1	30.8	28.6	27.9	25.7	26.2	27.1	27.1	29.3	28.6
	Min	18.2	17.3	17.0	18.3	18.0	19.2	19.3	19.6	16.2	16.4	16.6	16.6
2020	Mx	31.5	33.7	34.1	33.4	30.3	28.1	28.2	28.7	29.6	32.6	31.8	31.1
	Min	18.3	18.3	18.1	19.5	20.1	20.2	20.9	21.1	20.4	19.8	20.6	17.9

Table 3. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.588[a]	.346	.322	.881

ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	114.768	11	11.477	14.794	.000
	Residual	217.211	280	.776		
	Total	331.979	291			

a. Dependent Variable: COPING mechanisms

Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.401	.307		7.828	.000
Age	1.802	.184	.960	9.780	.000
Edu	.826	.103	.677	8.020	.000
Family size	.084	.144	.039	.585	.559
Farm size	.426	.091	.369	4.665	.000
Income	.317	.108	.246	2.944	.004
Acc water	.398	.410	.053	.971	.332
Acc credit	-.255	.122	-.115	-2.097	.037
Acc weather	-.058	.113	-.027	-.514	.607
Extension cont	-.166	.170	-.060	-.977	.330
Farm exp	.027	.080	.018	.344	.731

a. Dependent Variable: COPING mechanisms

Appendix VI

Figure 1.Standardized precipitation index graph (SPI)

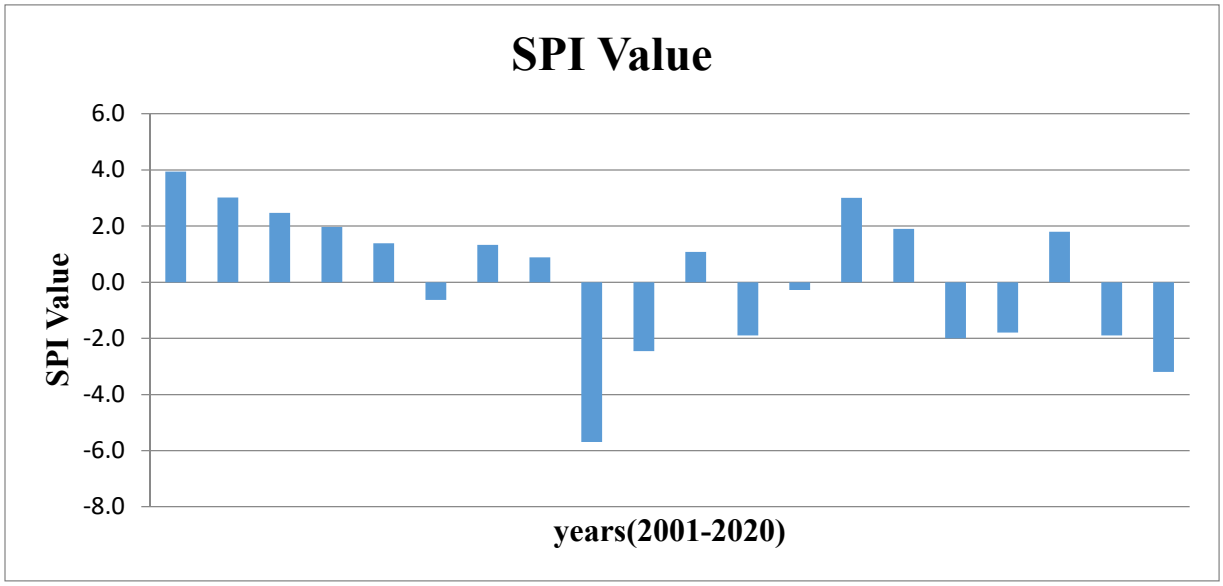

Table 4. Drought Categories

No	SPI values	Drought categories
1	2.0 +	extremely wet
2	1.5 to 1.99	very wet
3	1.0 to 1.49	moderately wet
4	-0.99 to 0.99	near normal
5	-1.0 to -1.49	moderately dry
6	-1.5 to -1.99	severity dry
7	-2 and less	extremely dry