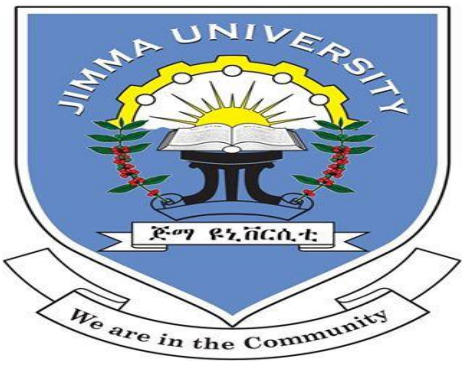

Jimma University

College of Social Sciences and Humanities

School of Graduate Studies

Department of Sociology

Climate Change Discourse and local Perspectives: Farmers Awareness, Perceptions and Adaptation Strategies in Anfillo District of Kellem Wollega Zone

By Kirubel Gezehagn

June 2019

Jimma Ethiopia

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By:

Kirubel Gezehagn

Thesis Submitted to Graduate School of Jimma University for the Partial Fulfillment of the Requirements for Masters of Arts Degree in Sociology, Concentration in Social Policy

Principal Advisor: Mr. Gudina Abashula, Assistant professor, PHD

Co-Advisor: Mr. Hassen Nageso, MA

June, 2019

Jimma Ethiopia

DECLARATION

I, kirubel Gezahagn, hereby declare that this thesis entitled: "**Climate Change Discourse and local Perspectives: Farmers Awareness, Perceptions and Adaptation Strategies in Anfillo District of Kellem Wollega Zone**", submitted to department of sociology Jimma university was a product of my original work. To the best of my knowledge it contains no materials previously published by another person nor material which has been accepted for the ward of any other degree of the University, except where due acknowledgement has been made in the text.

Declared by:

Student Name	Signature	Date
KirubelGezehagn_____	_____	

Certification

This is to certify that this thesis entitled:**,** "**Climate Change Discourse and local Perspectives: Farmers Awareness, Perceptions and Adaptation Strategies in Anfillo District of Kellem Wollega Zone**",prepared bykirubelGezehagn and submitted in partial fulfillment of the requirements for the award of degree of **Master of Arts in Sociology(concentration on social policy)**complies with the regulation of the University and meets the accepted standards with respect to originality and quality.

Approved By Boards of Advisor and Examiners

Advisors' Name	Signature	Date
Principal Advisor: Mr. Gudina Abashula	_____	_____
Co-Advisor: Mr. Hassen Nageso	_____	_____

Internal Examiner	**Signature**	**Date**
Mr. Dereje Tesema	_____	_____
External Examiner	**Signature**	**Date**
Gutema Etana	_____	_____
Chairperson	**Signature**	**Date**
Tadele Duressa	_____	_____

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ACRONYMS AND ABBREVIATIONS

CRGE- Climate Resilient Green Economy

CC- Climate Change

ECFF- Environment &. Coffee Forest Forum

EPA - Environmental Protection Authority

EPCC - Ethiopian Panel on Climate Change ()

GDP- Growth Domestic Product

GHG – Green House Gas Emission

GTP - Growth and transformation plan

GO- Governmental organization

IPCC - Intergovernmental Panel on Climate Change

NGO – Non Governmental organization

SNNPR - Southern Nations, Nationalities and Peoples Region

SPSS - Statistical Package for Social Science

UNDP - United Nations Development program

UNEP - United Nations Environment Program

UNESCO- United Nation Educational, Social and Cultural Organization

UNFCCC United Nations Framework Convention on Climate Change

WHO – World Health Organization

WB - World Bank

ABSTRACT

Problems emanated from climate are negatively affecting a lot both African continents in general and our country Ethiopia in particular. There is variability among peoples and countries about the ways of getting awareness and perceiving the issue. The purpose of this study was to assess farmer's awareness and perception toward climate change, consequences of climate change and available adaptation strategies in Anfillo district of Kellem Wollega zone. The study has employed mixed research method. To select representative sample multi stage sampling procedure for quantitative data and purposive sampling technique for qualitative data was employed. Household Survey with 209 respondents and in depth interview with 19 concerned informants have employed in the study. Both descriptive and inferential statics was employed to analyze quantitative data and thematic analysis method was employ to analyze qualitative data. The finding of this study indicated that most of the sample respondents have awareness about climate change. Farmers have understand or perceive climate change as increase in temperature, increase crop and animal disease, decline and fluctuation of rainfall and early fruiting of coffee plant. Farmers in Anfillo district have attributed climate change to anthropogenic or human factors. There causal perception was determined by level of education and discourse about climate change causation from different organs. Climate change was perceived by the farmers as something risk to their livelihood and environment as result of negative problems facing the framers and scary stories *that they hear from different climate change discourse commentators. Water stress, health problem, and decline in agricultural productivity were the major problems faced by farmers because of climate change. Responses to climate change were on practice at individual, at community and at government levels in Anfillo district. But the level and magnitude of these responses varies from one level to other levels. Climate change adaptation strategies prompted by REDD+ program with idea of carbon compensation is bringing positive result in improving adaptation strategies at each level in the study area. The result of binary logistic regression model depicted that awareness about climate change, level of education, and access to awareness from mass media and government organs; current time risk experience and previous 10 years climate change risk experience are significant independent predictors of individual level climate change adaptation practices. Strategy designed so far has not walked the talk; Strong institution and system that can widen knowledge on climate change hazards and adaptations strategies that take in to account social dimension should be devise. Relevant livelihood diversification measures should be incorporated in to all policy measures of the country for farming community that suffering because of climate change.*

Key Words: Climate change, Discourse, Awareness, Perception, Vulnerability, Adaptation

CHAPTER ONE: INTRODUCTION

1. Background of the study

There is emerging discourses about climate change that has mainly been dominated by scientists, policy makers, politicians and mass media (Reynolds et al. 2010; Robert 2014). Climate change is arguably the major environmental problem of our time (Bhatasara 2015). Climate change is big news and it's becoming bigger news than ever before (Doulton and Brown 2009). There is an enormous debate about climate change in the world which is characterized by a wide variety of alternative perspectives with different actors perceiving and portraying the issue and alternatives for addressing it in contrasting often contradictory ways (Hytten 2013). Discourses of climate change are created within different social groups having different perspectives using different types of language and privileging different concepts(Fleming et al. 2014). As a result, people's understanding of climate change is mediated by the information available to them, the discourses within which it is embedded, and the ways that these discourses construct the issue (Hytten 2013:4).

IPCC (2007) estimated that, by 2020, between 75 million and 250 million people in Africa are projected to be exposed to increased water stress due to climate change. Studies confirm that Africa is one of the most vulnerable continents to climate variability and change because of multiple stresses and low adaptive capacity (UNESCO 2013).In Sub-Saharan Africa, climate change will more likely to distress the agricultural sector the most and will most likely result in suffering especially for those smallholder farmers (Komba and Muchapondbwa 2012). Climate change will cause a wide-ranging decline in most of the crops such as sorghum, maize, millet and groundnuts in several Sub-Saharan Africa countries such as Ethiopia, Eritrea, Sudan, Zambia, Ghana, Sudan and Gambia (Daba 2018).

Climate change is already taking place now in Ethiopia, the temperature in Ethiopia increased at about 0.2° C per decade. As a result of climate change impact, vast numbers of problems are facing the country. Ethiopian agriculture is highly challenged and constrained by many factors, but none is more severe than that caused by its overwhelming dependence on the vagaries of weather and climate (Tesfaye et al. 2015). Ethiopia was identified as one of the most vulnerable countries to climate change problem and the variability of rainfall and the increasing temperature

were a cause for frequent drought and famine, and putting a disastrous impact on the livelihood of the peoples (Amenu, Amamo, and Borko 2017). In addition to the above reality, Simane et al. (2016) further concluded that Climate change-related health problems, like that of mortality and morbidity due to floods and heat waves, vector-borne diseases, water-borne diseases, meningitis, and air pollution-related respiratory diseases are increasing in Ethiopia

There is growing scientific and governmental acknowledgment that human activity and social behaviors are the key drivers of global climate change. However, there is a tendency to underscores the critical role of social science in advancing, understanding, and designing strategies for responding to global climate change (Nagel, Dietz, and Broadbent 2010). (Grundmann et al. 2012 cited in Bhatasara (2015) posited that, whether we want to protect the climate from society (mitigation) or society from climate (adaptation) what is clear is that social conduct alters the natural process and these, in turn, alter social relations. Human activities, such as burning coal, oil, and gas, have led to an increase in greenhouse gases in the atmosphere causing an enhanced greenhouse effect and extra warming(UNESCO 2013:13)

Even though there is a widespread scientific agreement and growing public acceptance that climate change is occurring, however, much uncertainty and confusion remain about climate change (Reynolds et al. 2010). Climate change is a risk to human societies and natural ecosystems, yet public opinion studies indicate that public awareness and concern vary greatly across different countries(Lee et al. 2015). According to Leiserowitz (2008), large numbers of people from developed countries had heard of climate change, while awareness remained quite low in several developing countries. However, despite this fact some people in developing countries may have observed, attempted to explain, and adapt to changes in their local climate, albeit without the conceptual framework and findings of climate change science or the dominant discourse about climate change.

People's perception of climate change is highly personal, local context based, and influenced by a number of factors (Niles and Mueller 2016). Sociological studies indicate that contextual factors and processes can be powerful forces that shape the way individuals and communities engage with the issue of climate change (Lee et al. 2015). Community perceptions of climate change and concern over specific climate-related risks were systematically related to personal

beliefs about climate change (Niles and Mueller 2016). Understanding farmers' perceptions and manifestation and impacts of global climate change, helps to explain why they respond to various stimuli in the way that they do and to device sustainable adaptation strategies (Opiyo et al. 2015, Yayeh and Leal 2017).

Social scientists have concluded that people's risk perceptions about climate change strongly influence the way people respond to hazards (Leiserowitz 2008). The absence of understanding climate change impact lessens our ability to design and implement effective policy measures that aimed at either assisting at-risk households to prevent or mitigate negative impacts in future (Karfakis, Lipper, and Smulders 2012). Identifying valuable farmers' perceptions is also important in order to integrate their perception with scientific knowledge and design a better adaptation strategy rooted in indigenous skill and knowledge, making them more acceptable among the rural population (Yayeh and Leal 2017).

Climate variability can force the farmers to adopt new practices such as shifting sowing time, land preparations, length of growing time, time of harvesting, and control & management of insect pests and diseases (Raghuvanshi 2017). Adaptations to climate change impacts are diverse and place specific (Callo-Concha 2018). As per Komba and Muchapondwa (2012)Climate change impact adaptation actions can be taken by either farmer by themselves or by governments implementing policies aimed at promoting appropriate and effective adaptation measures.

Given the broad scale of climate change driven problems, the resulting impacts affect many aspects of peoples' livelihoods. As a result, there is a need for more place-based studies that highlight the human dimensions of climate change. Considering human dimensions provides to a better understanding of the links between farmers community awareness, perceptions of climate change, determinant factors for this awareness and perceptions, climate change vulnerability context, and available response to climate change induced problems at different level. By focusing on such approaches the study was focus on understanding patterns of the issue from the farmers of *Anfillo* in *Kellem Wollega zone*.

1.2. Statement of the problem

Climate change is a clear example of the dialectical of nature and society; as a result, it's one of the central issues for sociological study (Bhatasara2015). Natural scientists have described

climate change as perhaps the greatest environmental risk confronting the world in the 21st century. Meanwhile, social scientists have found that public risk perceptions strongly influence the way people respond to hazards (Leiserowitz 2008:1). People's perceptions of climate change are known to differ between nations and to have fluctuated over time (Capstick, Whitmarsh, and Poortinga 2015) A review of the literature shows that place, gender, social class, and education as important factors that affect people's awareness about climate change (Alibeli 2009). Thus examining awareness and perception of climate change among farmers could improve understanding of climate change from local farmers' point of view so that we can design better policy and adaptation strategies.

Climate change problems, its impact and adaptive strategies have attracted the interest of some researchers in Ethiopia (Legesse, Ayele and Bewket (2012), Assaye (2016), Yayeh and Leal (2017) Debela et al. (2015),Kassa (2016), Daba (2018), Nega (2018)). As a result, climate change and its associated problems have been the focus of few studies. Yet the amount of researches and the knowledge obtained from those researches may not be sufficient to explain the problem of climate change in different contexts from a sociological point of view.

Legesse, Ayele, and Bewket (2012) studied farmers' perceptions and adaptation to climate variability and change in Doba District, West Hararghe, and Ethiopia. Their study found out that there were nearly unified perceptions of climate variability and change among gender and social groups. The same study has also identified different kind's adaptation strategies employed by farmers in the area. However, their study failed to explore what factors determine the perception of farmers about climate change; they have only focused on the overall perception and adaptation to climate change across different social group and gender. But climate change perception can be determined by other determinant factors like that of discourse about climate change within the community, availability of mass media, age, farm size, literacy level and the like or detailed determinant factors are shown on conceptual framework part of this study on page 32.

Assaye (2016) and Yayeh and Leal (2017) also studied Farmers' Perception to Climate Change in Ethiopia. The studies have identified how farmers perceive climate change and its determinant factors. However both of the aforementioned studies have treated climate change perception as general single variable. Even though climate change perception can be further decomposed in to

further specific concept like that of climate change causal perception and risk perceptions. Thus in opposing to the mentioned studies the present study have classified climate change perception in to general, causal and risk perception. To what factors farmers attribute why climate change has happened (causal perception), whether these farmers perceive climate change as risk or not (risk perception) and their determinant factors was investigated independently in the study.

Debela et al. (2015) have also studied the Perception of climate change and its impact on smallholders in pastoral/agro-pastoral systems of Borana, South Ethiopia. In studying the aforementioned title they had exclusively only employed quantitative research method by only focusing on pastoralist framers. As a result of this fact, the study finding cannot show a clear picture of the issue with regard to other kinds of farmers. Thus in line to this study, their study has a Methodological gap; you cannot exhaustively understand farmer's perception of climate change and adopting strategy without supporting your study by a qualitative method.

Kassa (2016) has conducted research on People's Awareness and Perception Level on the Risks of Climate Change and Constraints of Their Adaptation Strategies in Mekelle City. The study has identified the lower level of awareness and perception on climate change; increased daily temperature; reduced amount and duration of rainfall, increased incidence of disease and finally the study also find out that the most common adaptation strategies in the study setting. Kassa study has explored the most important issues, but still, his study explains the climate change issue from Mekele city point of view which cannot fully explain the rural farmer's case. Thus the present study have investigated the issue from rural area farmers point of view.

Daba (2018)studied Local Community Perceptions on Climate Change and variability and its Effects on Crop Production in Selected Districts of Western Oromia. The study reviled different impacts of climate change on crop production. The researcher only studied this impact and perception in relation to crop production. However, climate change perception and its impact have a social dimension that needs to be investigated accordingly, thus this study was included the social dimension of the climate change problem.

Nega (2018) have studied views, practices, and determinant of climate change adaptation and mitigation strategies among farmers in Konta special woredas, SNNPR Ethiopia. The researcher comes up with tremendous findings. The study revealed how farmers perceive climate change

and its manifestations in the study area; farmers have attributed climate change problem as a curse from God and natural phenomena. The same study also revealed the way farmers are responding to the climate change problem and its determinant factors. The study was deep and very sociological; however, the researcher had not exclusively studied the different consequence of climate change in relation to farmer's livelihood. As result the present study have investigated different negative social, economic and environmental consequences of climate change in the study area.

In general most of the previously conducted researches have content and a methodological gap in line to this study as it was tried to discuss in the above parts with specific to each study. Some of the researchers studied the issue from economics or agricultural science point of view. Moreover, most of these studies could not approach the problem adequately the issue from a sociological point of view. Climate change awareness and perception can be emanated from different discourses about it from a different group. Our world is highly suffering as a result of problems emanated from climate change and at the same time small scale farmers in developing countries are suffering more and more as result of the problem; thus, studying the issue of climate change problem with respect to the given study area is highly important. It is also important to note the absence of empirical works which shows farmers perception about climate change and response to its challenges in the study area *Anfillo* district. As a result, this study has tried to fill the above-mentioned gap of different researchers by studying farmer's awareness and perception about climate change, consequences of climate change and their response to the problem in *Anfillo* district of *Kellem Wollega zone*. The study has tried to answer the following research questions.

- What are awareness and perceptions exist surrounding climate change among farmers?
- What are the determinants of climate change perception?
- What are the consequences of climate change and available adaptation strategies?

1.3. Objective of the study

1.3.1. General objective

To assess farmers awareness and perception toward climate change, consequences of climate change and available adaptation strategies in Anfillo district of Kellem Wollega zone.

1.3.2. Specific objectives

- To assess farmers awareness about climate change and its discourse,
- To assess farmers' perception of climate change,
- To identify factors that determine farmers' perception of climate change,
- To examine the consequence of climate change in relation to farmers livelihood system,
- To assess available climate change adaptation strategies employed in the study area to combat climate change driven problems.

1.4. Significance of the study

Climate change effects have been seen for a long period of time in Ethiopia. The study may have great significance for different organs. The result of this study can be a good input for national policy formulation with regard to climate change-related issue; the output of this study can also add its own contribution for the current academic debate with respect to the human dimension of climate change issue. Furthermore, the finding of this study has paramount importance in understanding the farmer's awareness about climate change, their perception toward the problem, factors determining this perception and potential adaptation strategies employed by farmer's community. Thus the study output can be a good input for different governmental and nongovernmental (NGO) who are working on tackling the problem. Finally, the finding of the study can help different interested researchers as a starting point or as a background for further study.

1.5. Scope of the Study

The study has employed mixed research method or methodological triangulation research approach. Moreover, the study is only going to employee survey and in-depth interview methods to collect data. Issues related to this topic of the study (climate change) are dynamic and multifaceted. However, this study was concentrate on examining and describing farmer's awareness, perception, determinant factors and adaptation strategies in *Anfillo* district particularly in 3 *kebeles* from different ecological zone. The study has generalized finding from aforementioned *kebeles* to the whole *Anfillo* district. The study will be guided by various theories

and frameworks especially social representation theory, social constructionist perspective and discourse theories of environmental problems.

1.6. Limitation of the Study

The study has theoretical, methodological and geographic limitation. The issue of climate change is one of the major challenges in our country. The study was conducted using cross-sectional survey design. But since the human dimension of climate change problem is dynamic over a long period of time, it would have been much better and would have produced much more reach data if the study had employed a longitudinal survey design. Pertinent to this there is an absence of a sociological conceptual framework that can aid the study at hand. The study has only delimited in to three *kebeles* from a total of 25 *kebeles* in *Anfillo* district.

1.7. Conceptualization and operational definition

1.7.1. Conceptual definitions

Climate change is change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods (IPCC 2014).

Global warming refers to "the change in global surface temperature, which can be called earth temperature, caused by an increase of greenhouse effect resulting from greenhouse gas emission" (IPCC 2012)

Climate change adaptation refers to the process of adjustment to actual or expected climate and its effects (IPCC 2012)

1.7.2. Operational definitions of concepts

Climate change awareness: refers to the availabilities of information, news, and discourses about climate change to the farmer community. At the same time, it is also about the awareness of farmers about the happening climate change. Awareness was measured by dichotomies variable as either Yes or No.

Sources of awareness (information) about climate change: this shall mean all about sources of information about the happening of climate change and its discourse. These sources of

information include mass media (radio), agricultural extension workers, social networks (agricultural cooperatives, *ider and ekub),* educated friend and family member and government sectors. This variable was measured as a dichotomous question, either "Yes" or "No'

Climate change perception: shall refer to how the farmer's community locally understands or perceive climate change. This perception includes causal perception and risk perception of climate change among farmers. In order to say a given sample, he/she has a good perception about a given parameter he should score a point equal to or more than mean composite score for a given overall composite score items in a given variable.

Climate change general perception: shall refers to how the farmers perceive or understand climate change from different local indicators. Or it shows how generally farmers are conscious about change in climate from various local indicators.

Perceived causes of climate change (causal perception): refers to what factors do farmer's attribute the happening of climate change. Farmers can have good causal perception or low causal perception. In order to categorize farmers in to mutually exclusive category as having good or low causal perception mean composite score was taken as a cut point. Those farmers who scored point equal to or above mean composite score was said to have good causal perception where as those who score below mean composite score was said to have low causal perception.

Risk perception of climate change: is all about whether farmers perceive climate as risk or not. It is a self-appraisal mechanism which is subjective to measure the extent of the seriousness of climate change.

Previous risk experience: climate change-related hazards faced by farmers in relation to their livelihood in past 10 years and more.

Table 1 Operational definition of concepts

Concepts	Variable	Indicator	Levels of Measurement
Sex	Sex	Sex of head of household	Male/Female Nominal Scale
Age	Age	Age of head of household in complete Year	Age in numbers Interval Scale

Household Size	Household Size	Total Number of family size in the household.	Response in Number Interval/Ratio Scale
Level of Education	Educational level of Household head	The Highest level of education attained by household head	Level of education Ordinal scale
Land Size	House hold land holding size	Total hectares of land owned	Ratio scale
Climate change awareness	Awareness about climate change discourse	Awareness about climate change discourse From different sources	Yes/No Nominal scale
	Awareness about climate change	Awareness about the happening of climate change and the degree of awareness about climate change.	Yes/No, Nominal scale
Perception of climate change	Local perception about climate change	How do people perceive the happening of climate change in their local area/local understanding	Likert scale score Ordinal scale
	Causal perception about climate change	Adheres with the direction of prescription regarding how do they perceive cause for climate change	Likert scale score Ordinal scale
	Risk perception about climate change	Question to measure about weather respondents perceive climate change as a risk or not	Likert scale score Ordinal scale
Consequences of climate change	Negative impacts of climate change on farming activity	Asking respondents previously happened negative impact on farm	Yes/No, Nominal scale
	Negative impacts of climate change to human health	What kinds of health-related problem by farmers as a result of climate change	Yes/No, Nominal scale
	Negative impacts of climate change to the natural environment	The existence of problems on the physical environment that emanated from climate change	Yes/No, Nominal scale
Adaptations to climate change	Response by farmers to the problems of climate change	What kinds of measures are farmers taking in response to the problems of climate change at the individual and community level?	Yes /No Nominal scale
	Response by the government to the problems of climate change	What kinds of measures taken by the government in response to the problems of climate change	Yes/No Nominal scale

Current risk experience: this shall mean any kinds of problems that were facing the farmers because of climate change at current times.

Consequences of climate change: this shall mean identifying different consequences of climate change with respect to farmers' livelihood. The variable was measured; first by asking

respondents the existence of climate change related problems and then by providing different options about consequences of climate change to choose from.

Adaptation strategies: this shall mean that identifying available climate change adaptation strategies that have been practiced in Anfillo district at different levels: at individual, at community level and at government level.

CHAPTER TWO: Review of Related Literature

This review literature section is categorized in to three different parts. The first part deals with global and local facts climate change, and then empirical literature review and finally theoretical literature review.

2.1. Global and regional facts about manifestations, causes and consequences of climate change

This section discusses the general manifestations of climate change starting from global context to Ethiopian context.

2.1.1. Climate change in Global and African context

Ever since the 1980s there has been a growing recognition of the significant risks associated with climate change (Hytten 2013). Between 1980s-1990s Global warming and related climate changes have emerged as crucial issues in the public agenda (Mariotto 2018) The scientific community has concluded that human activity is a major cause of GHG emissions and that these emissions influence climate change. However, there is clearly more than science politics is at play in shaping the public and political debate on climate change (Hoffman 2011).

The global climate change is affecting human life and activities through the increasing amount of natural disasters, global warming and the melting of the icebergs (Azmi et al. 2015). As a result of environmental risk factors cause at least 13 million deaths every year and about one quarter of the global burden of disease. Air pollution alone causes about 6.5 million deaths a year, or one in eight of all deaths, placing it among the top global risks to health.(World Health Organization 2018:1) Climate change or global warming can affect human welfare negatively. Human beings are likely to face severe storms, floods, droughts, and desertification. Agricultural yields are expected to drop in most tropical and sub-tropical regions, and in temperate regions too if the temperature increase is more than a few degrees (UNFCCC 2007). Pertinent to this, as a result of climate change driven problems a range of pests and diseases (such as malaria) may expand. Climate change will most likely endanger ecosystems, leading to a loss of biodiversity through the extinction of numerous plant and animal species (Tuffa et al. 2012).

Africa is considered as the most vulnerable continent to climate change in the world (Awojobi and Jonatan 2017). The glaciers on mount Kilimanjaro in Tanzania are melting fast and are anticipated to have disappeared by 2020(Conway 2009). Climate change is expected to pose a serious threat on environment, agricultural production and food security of most developing countries. Particularly, rural farmers, whose livelihoods depend on the use of natural resources, are likely to bear the brunt of adverse consequences. This is largely because most developing countries experience high poverty incidence and as a result are incapable to adapt to climate change(Acquah and Onumah 2011:1). About 70% of people in sub-Saharan Africa live in rural areas, and their livelihoods is at risk as result of climate change driven problems (Conway 2009). The recent trends of increasing global temperatures and incidences of extreme climate events in Africa is increasing the likelihood of droughts and floods in the continue (Deressa 2014).

In Africa, it has been confirmed that the impacts of climate change are real. Climate change has affected the ecosystem, human health, infrastructure and, food and water. And at the same time it is forcing people to migrate from their homes to other safety parts (Awojobi and Jonatan 2017). Climate change creates a considerable and unique challenge to Africa because so much of its economy depends on a climate-sensitive natural resource base like rain-fed, subsistence agriculture (Deressa 2014). The most common types of climate events in Africa are drought, flooding, desertification and soil degradation (Awojobi and Jonatan 2017).

Majority of African countries are highly dependent on natural resources and their agricultural sector for food, employment, incomes, tax revenue and exports. Changes in climate conditions can damage the agricultural sector and this will thus have a major impact on incomes and livelihoods (Conway 2009). Dependence on such resources exposes the continent to the risks of reduction in agricultural production, municipal water supply for home use and sanitation services, industrial water use and hydroelectric power generation (Deressa 2014). Smallholder's farmers in Africa that depends only on rain-fed agriculture are the most exposed groups to the impacts of climate change (Gemeda and Akalu 2016).

African countries will suffer health consequences due to impacts of climate change. Most of the Populations in African countries are among those most vulnerable to climatic changes in the world (United Nations Economic Commission for Africa 2011). Harsh changes in climate and

rainfall patterns also increase the risk of insect-borne diseases, create conflict over water and grazing resources, and threaten the lives and property of citizens across the continent (Deressa 2014). In addition, there is major concerns water availability in Africa. By 2025, it is projected that around 480 million of people in Africa will face either water scarcity or stress with a subsequent potential increase of water conflicts since almost all of the 50 river basins in Africa are trans-boundary (World Bank 2010).

The voices of Africa's in international climate change negotiations has been very limited and the continent has struggled to pressure global policies to tackle its particular challenges (Deressa 2014). Studies indicate that adaptation is the greatest priority for Africa. However, adaptation has so far received little attention and financing (Tuffa et al. 2012). In dealing with environmental, climate and other determinants of health, WHO promotes a Health in All Policies approach (WHO 2018).

2.1.2. Climate change, manifestations and its impacts in Ethiopian context

The NAPA of Ethiopia indicates that developing countries in general and least developed countries like Ethiopia in particular, are more vulnerable than industrialized countries to the adverse impacts of climate variability and change. This is due to their low adaptive capacity and the high sensitivity of their socio-economic systems to climate variability and change (NMA 2007 Cited in (World Bank 2010). Throughout history, the joint effect of climate change and variability, simultaneously with environmental degradation, has had a strong impact on the disaster situation of the country and on its economic growth(UNDP 2011). Ethiopia's contribution to GHG emissions is very low on a global scale. However, the projected environmental impact of conventional economic development in Ethiopia risks following the pattern observed around the globe. If current practices prevail, GHG emissions in Ethiopia will more than double from 150 Mt CO2e to 400 Mt CO2e in 2030 (Environmental Protection Authority 2011:11)

2.1.2.1. Cause of climate change in Ethiopia

Climate change was resulted from numbers of factors in Ethiopia. According to Environmental Protection Authority (EPA2011), Forestry was one of the main sources of emission; the impact of human activities is a large source of CO2 emissions amounting to almost 55 Mt CO2e in 2010. Forestry emissions are driven by deforestation for agricultural land (50% of all forestry-

related emissions) and forest degradation due to fuel wood consumption (46%) as well as formal and informal logging (4%). Fuel wood accounts for more than 80% of households' energy supply today particularly in rural areas. (EPA 2011:12). Desertification that emanated from human land-use pressures and recurrent drought, has consumed significant land area and continues to threaten arable land (World Bank 2007). Ethiopian farmers poor land management practice is also leading to heavy environmental degradation (Mahoo et al. 2013). In addition, Ethiopia rising urban centers demand for charcoal production is highly contributed to local deforestation (World Bank 2007).

2.1.2.2. Impact of climate change on Ethiopian agriculture and Economy

Ethiopia's vulnerability to climate change risks has its root in various factors, including its geographic location and social and economic structure(UNDP 2011). Ethiopian economy is largely dependent on agriculture which is largely a "low-input and low-output" subsistence production system (Tesfaye et al. 2015). Climate change generates a range of risks for Ethiopia that would affect all sectors in the country. Preliminary projections suggest that climate change can have a sizeable impact that ranges in the order of 7-8% of GDP loss per year, with stronger impacts in later decades and on the poor (UNDP 2011:1). The economy of Ethiopia is based on agriculture, which accounts for half of gross domestic product (GDP), 83.9% of exports, and 85% of total employment(UNDP 2011). Furthermore 43% of countries GDP come from crop production. However studies have indicated that climate change will negatively affect this crop production at national and household economy (Tesfaye et al. 2015). Almost all annual economic growth patterns have a one to one correlation with the unfavorable weather conditions in Ethiopia(UNDP 2011).

The threat of global warming and its consequence of changing climate patterns are already happening in Ethiopia (Mahoo et al. 2013). Agriculture, water supply, hydropower production, economic and social infrastructure, health, household income and biodiversity are the sector primarily affected by climate change driven problems (UNDP 2011; World Bank 2010). Climate change places more pressure on the food security of millions by reducing crop yields, increasing land degradation, and lowering water availability. (Tesfaye et al. 2015:27) An increase in temperature will reduce agricultural and crop productivity (Gebreegziabher et al. 2014).Ethiopia's agriculture is overwhelmingly rainfall-dependent and it suffers greatly from the

risks emanated from high rainfall variability. Long- term records indicate that there have been severe and repeated rainfall failures resulting in severe food/feed insecurity, including famines, on the Ethiopian population due to significant loss of crops and livestock (Tesfaye et al. 2015:3). Crop production in is highly correlated to the rainfall patterns. The major impacts of climate change on crop production variability in regular crop planting times, length of growing season and shift in crop type(Mahoo et al. 2013). Furthermore climate change is reducing agricultural output, increases agricultural prices, alters the trade mix, and profoundly affects households' welfare(Yalew et al. 2017).

2.1.2.3. Climate change related hazards in Ethiopia

Even though, Ethiopia has experienced a number of climatic and environmental shocks during the past several thousands of years. The most recent climatic hazards are connected with the current global warming-induced changes in the earth's climate system (Mahoo et al. 2013). Drought and famine, flood, malaria, land degradation, livestock disease, insect pests, and earthquakes have been the main sources of risk and vulnerability in most parts of Ethiopia. Recurrent droughts, famines, and recently floods are the main problems that affect millions of people in the country (World Bank 2010:7).Climate variability and extreme events (drought and heavy rains) are causing significant damage to life, property, natural resources and economy in Ethiopia (Tesfaye et al. 2015). In addition to this Ethiopian Water Resource has highly reduced because of climate change problem (World Bank 2007)

Ethiopia is known to be highly vulnerable to drought, which is the single most important climate-related natural hazard impacting the country from time to time. Major droughts in Ethiopia in recent times were in the late 1950s (in northern parts), in 1972/73 (northeastern in Tigray and Wollo), in 1984/85 (in major parts of the country), 1994 (in the low land pastoral areas), in 2000 (in the southern lowland pastoral areas), in 2002/3 (in major parts of the country), and in 2007/8 (in many areas in the highland and lowlands) (World Bank 2010:7). Climate change is also creating health related problems, like that of mortality and morbidity due to floods and heat waves, vector-borne diseases, water-borne diseases, meningitis, and air pollution-related respiratory diseases are increasing in Ethiopia (Simane et al 2016).

2.2. Previous Studies conducted on climate change

In this section of literature review, the researcher is going to present empirical based literatures about farmer's climate change awareness, perception, and impact and adaptation strategies. The review will include empirical literature from the world perspective, African perspective and then to Ethiopian perspective.

2.2.1. Awareness about climate change

People's awareness and knowledge on climate change constitute essential background to deal with climate change and related problems(Said, Buloshi, and Ramadan 2015). In addition, Climate change and its related problems need publicity in order to help public to make informed decisions in its adaptation and mitigation measures (Ochieng and Koske 2013). Climate change awareness and risk perception were unevenly distributed around the world (Lee et al. 2015) The highest levels of awareness (over 90%) were reported in the developed world, including North America, Europe and Japan. But in contrast the, majority in developing countries from Africa to the Middle East and Asia reported that they had never heard of climate change (Lee et al. 2015:1015) . A survey in USA by Reynolds et al. (2010) reviled that laypeople's today know more about climate change causes, processes and people have able to integrate new information into coherent and scientifically accurate internal representations of how climate change works. In contrast to this, study in India by (Tripathi and Mishra 2017) concluded that even though farmers aware of climate change as rainfall and temperature change, they are unable to identify these changes as climate change.

Different studies about climate change awareness in Africa and Ethiopia also reviled diversified level of awareness among farmers. A study in Marondera, Zimbabwe about the Role of Public Awareness in Climate Change Mitigation and Adaptation reviled that people were aware climate change however; their knowledge of climate was rather general and limited. Their interpretation was more inclined to changes in weather patterns and is in contrast to talk on the political and scientific arena about climate change (Madobi 2014). In opposing the above fact some studies in Nigeria concluded that low level of climate change awareness or their knowledge of climate change as either inadequate or very inadequate. (Oruonye 2011;(Ohwo 2015)

The higher the level of awareness and perception of the people the better level of adaptation measures and the lesser the risks of climate changes impacts (Kassa 2016). A study in Ethiopia by Kassa (2016) to assess Awareness and Perception Level on the Risks of Climate Change Constraints of Their Adaptation Strategies in Mekelle City, identified that there is lower level of awareness and perception on climate change.

2.2.2. Perception about climate change

Understanding public perceptions of climate is critical for developing an effective strategy to mitigate the effects of human activity on the natural environment and reduce human vulnerability to the impacts of climate change (Ruddell et al. 2012:1).

As per result of survey in Australia (2014) respondent of the survey perceive and understand climate change principally in terms of extreme weather events and natural disaster manifestations and consequences (Reser, Bradley, and Ellul 2014:4). People, whose survival of livelihood is based on the direct consumption of natural resources are most affected by climate change and have different but accurate perceptions of climate change than those people following modern lifestyles (Aryal, Tn, and Cockfield 2014). One hundred and forty five transhumant herders were interviewed from three Village Development Committees (VDCs) namely Khumjung in Solukhumbu, Kalinchok in Dolakha and Majhigaun in Bajhang; representing Eastern, Central and far-Western mountainous areas of Nepal respectively to explore their perceptions about climate change and other observed changes in biophysical indicators. About 80% of the herders perceived increasing summer temperature, 92% decreasing winter rainfall and more than 93% noticed decreasing snowfall. Majority of the herders agreed that there was fast melting of snow in the rangelands, rainfall events were becoming more and more unpredictable, drought events increased, there was early induce in greenery and maturity of grasses in the rangelands and appearance of new livestock diseases (Aryal et al. 2014).

The extent of climate change impacts on agriculture can be ameliorated by the perception and level of adaptation of farmers. Studies have shown that African perception and understanding of climate change are poor (Acquah and Onumah 2011:1). According to study conducted in Ghana (2011) majority of the farmers perceived climate change as increase in temperature and decrease in rainfall pattern (Acquah and Onumah 2011).

Perception of climate change is a necessary condition for farmers to investment in appropriate adaptation strategies to reduce the impact of climate change (Assaye 2016). Seyoum (2017) studied Farmers and policy makers' perceptions of climate change in Ethiopia; his Findings revealed that farmers obviously perceived climate risks based on their experience and knowledge of their local environment. The commonly cited indicators of change include high temperature, rainfall, seasonal shifts and incidence of certain diseases. He further concluded that Farmers also identified specific indicators such as change in wind direction, disappearance of plant (crop and tree) species, growing hitherto unfamiliar crops and emergence of new parasites and weeds(Seyoum 2017:1). Another study in Ethiopia by Saguye (2017) reveled related finding with that of (Seyoum 2017) study. According to the findings of the study, large number of farmers has good perception level about the changing temperature volume and heat intensity, rainfall amount, distribution, onset and offset increased frequency and intensity of weather and climatic extreme events and others (Saguye 2017:7)

2.2.2.1. Risk perception about climate change

Social scientists have found that public risk perceptions strongly influence the way people respond to hazards. What the public perceives as a risk, why they perceive it that way, and how they will subsequently behave are thus vital questions for policy makers attempting to address global climate change (Leiserowitz 2008:1)

The survey in Australia(2014) questioned respondents “What do you think will be the most serious problem facing the world in the future if nothing is done to stop it?” The most frequent serious problem mentioned by respondents was climate change or the environment, with this problem category being given three times as often (39% of respondents) as the next most frequently mentioned problem, overpopulation (13%), followed by poverty and hunger (11%) and the economy/unemployment (6%) (Reser et al. 2014) other survey findings in 2011also fully confirmed strong levels of belief and acceptance that climate change is both a very real threat and is already taking place in Australia (Reser et al. 2014).

According to a study in India, Farmers are aware of risks generated by climate variability and extreme climatic events. However, farmers are not taking concrete steps in dealing with perceived climatic changes (Aryal e

al. 2014). Other study in India also confirms that farmers perceive impacts of climate change, particularly in terms of declining crop productivity, increasing the cost of cultivation, and livelihood insecurity (Tripathi and Mishra 2017).

Debela et al. (2015) studied Perception of climate change and its impact by smallholders in pastoral/agropastoral systems of Borana, South Ethiopia. Their study Results suggest that most participants perceived climatic change and its negative impact on agricultural and considered climate change as a salient risk to their future livelihoods and economic development.

2.2.2.2. Causal Perception about climate change

To squarely address causal understandings of climate change, study by (Reser et al. 2014) in Australia asked respondents to answer "Thinking about the causes of climate change?" The great majority of respondents (83%) thought that both natural and human causes were contributing to climate change (Reser et al. 2014). Study in Yenagoa ,Bayelsa State , Nigeria revealed that 55.3% of the respondents are not aware that carbon dioxide (CO2) is the major greenhouse gas contributing about 55% to global warming. Similarly, 48.7% of the respondents believed that one of the major natural causes of climate change is divine providence (act of God) (Ohwo 2015:9)

Some studies have also conducted in Ethiopia in order to identify how peoples perceive or understand causes for climate change and come up with diversified findings. Zerga and Gebeyehu (2015) study concluded that Causes/drivers of climate change in the country are divided in to two as major and minor. Deforestation and forest degradation, land use change, and agriculture are considered as major drivers while transport, power, industry, and buildings are minor ones (Zerga and Gebeyehu 2015:80). According seyoum (2017) Farmers perceptions of causes of climate change are mixed: deforestation, God's wrath, human activities, and weakened indigenous practices and values. On the other hand, participants from policy-making community espoused views shared by scientific discourse such as deforestation, global warming and CO2emissions. (Seyoum 2017:1). Like many traditional communities in sub-Saharan Africa, a significant proportion of Boran smallholders consider that humanity is cursed and supernatural forces are the primary cause of climate change. Disobedience and unfaithfulness to God's rules, failure to glorify him and divergence from the age-old Boran tradition have led to divine punishment, especially drought events (Debela et al. 2015:10).

2.2.3. Determinant of climate change awareness and perception

Individual's perception about climate change is linked to whether individuals support climate policies and whether they alter their own climate-related behaviors, yet climate perceptions may be influenced by many factors beyond local shifts in weather. Likewise, perceptions may be influenced by personal beliefs about climate change and whether it is human-induced or not (Niles and Mueller 2016). Worldwide, educational attainment is the single strongest determinants of climate change awareness. On the other hand perception of local temperature change is the strongest determinants in many African and Asian countries(Lee et al. 2015).

In the USA, the most important predictors of climate change awareness are civic engagement, communication access and education. Residents with higher levels of civic engagement are almost always aware of climate change, whereas those with lower levels of civic engagement and communication access tend to be unaware. In contrast, the key predictors of climate change awareness in China are education, geographic location (urban/rural) and household income. Lower-income residents who are poorly educated and living in a rural area or on a farm are the least aware, whereas those who are highly educated and urban are the most aware of climate change (Lee et al. 2015:1016). In contrast to this in Germany, gender, experience of extreme weather events and trust in external aid are important determinants of climate change risk perception (Menny et al. 2011).

Socio-economic endowments, social interactions and exposure to and source of information may shape significant differences in climate change perceptions farmer(s) (Javed, Kishwar, and Iqbal 2015).In India farming experience, print media contributes are pointed out as significantly determinant of such perception (Tripathi and Mishra 2017).

Different researchers have concluded diversified determinants of climate change awareness and perception in Africa. Pastoralists in northwestern Kenya perceive climate changes because of access to extension services; because extension services provide information and create awareness (Opiyo et al. 2015). On the other hand Farmers in the Lake Basin Region of Kenya has different determinant for climate change perception. For them perceptions of climate change are intimately linked to their farming and food provisioning practices. Crop failures and food shortage, conceptions of stressors or hazards are considered prominent determinant of climate

change perception (Robert 2014:140). According to Manyani et al. (2017) in Chirumhanzu, Zimbabwe; climate change perception of climate change is determined by cultural issues, religious issue and human induced which varies according to age, number of years stayed in the area and the level of education.

In Ethiopia different types of climate change awareness and perception determinants was identified by different researchers. As per Asrat and Simane (2018), educational attainment, the age of the head of the household, the number of crop failures in the past, changes in temperature and precipitation significantly influenced farmers' perception of climate change in wet lowland parts of the study area. In dry lowland condition, farming experience, climate information, duration of food shortage, and the number of crop failures experienced determined farmers' perception of climate change(Asrat and Simane 2018:1). Debela et al. (2015) on the other hand concluded that Age, education level, livestock holding, access to climate information and extension services significantly affected perception levels.

Study in conducted in Nile basin of Ethiopia reveled that farmers' perception of climate change was significantly related to the age of the head of the household, wealth, knowledge of climate change, social capital and agro-ecological settings (Deressa, Hassan, and Ringler 2011). In a slit contrast to this study, a study conducted in GezeGofa District, Southern Ethiopia identified that access to awareness raising campaign by some NGOs, educated family members and extension workers, access to indigenous early warning information, farmer's location in terms of agro-ecology, closeness to market, educational level, and age of household heads are among major determinants of climate change perceptions (Saguye 2017:7).

2.2.4. Impacts (consequences) of climate change on farmer's livelihood

Climate change causes wide-ranging effects on the environment, socio-economic and related sectors, including water resources, agriculture and food security, human health, terrestrial ecosystems and biodiversity (Zerga and Gebeyehu 2015). Agriculture which provides food, raw materials, and livelihoods is under significant threat from climate change (Tripathi and Mishra 2017). The livelihoods of households in Kenya are most hit by climate change as falling harvest and poor performance of the livestock sub sector undermine household and national food security (Taiy et al. 2015).

Climate change is posing a serious environmental, economic, and social impacts on Ethiopia(Assaye 2016). The country during those periods (1951 to 2005) has experienced both dry and wet years over the last 54 years. These changes in the physical environment are expected to have an adverse effect on agricultural production, environment, and the overall livelihood. (Zerga and Gebeyehu 2015:80). Ethiopia has lost a cumulative level of over 13 percent of its current agricultural output between 1991 and 2008 as result of climate change impact. If the current rate of decline in the average annual level of rainfall continues over the medium term, Ethiopia will forgo, on average, more than six percent of each year's agricultural output. The poverty impact of rainfall variability is enormous(Asaminew 2013).

2.2.5. Adaptations strategies to climate change

The world has responded to climate change phenomenon through two broad response mechanisms (mitigation and adaptation strategies) with the aim of moderating the adverse effects of climate change and/or to exploit any arising beneficial opportunities (Elum, Modise, and Marr 2017:1). Both the United States and the rest of the world are currently considering policy responses to the issue of climate change that would entail costs and expenditures amounting to trillions of dollars(Reynolds et al. 2010).

Australians are clearly adapting to the threat and perceived environmental impacts of climate change by way of changes in thinking, feelings, risk perceptions and appraisals, motivations, and other psychological and behavioral responses to climate change (Reser et al. 2014:6). A study in India concluded that, despite perceiving climate change, farmers are not responding to it. But they are changing their agricultural and farming practices to deal with socioeconomic changes, and some of these changes such as changing sowing and harvesting timing, cultivation of crops of short-duration, inter-cropping, changing cropping pattern, investment in irrigation, agro forestry help in adapting agriculture to climate change (Tripathi and Mishra 2017:206)

The Ethiopian Government has already put in place a number of policies, strategies and programs aimed at enhancing the adaptive capacity and reducing the vulnerability of the country to climate variability and change(Zerga and Gebeyehu 2015). A study conducted in Western Amhara Region, Ethiopia identified that, The major adaptation strategies employed by the majority of small holder farmers included enhancing traditional irrigation, use of drought tolerant

and early maturing varieties, converting farm land to tree growing and relay cropping immediately after harvesting. Whereas on the other hand The coping strategies to climate variability are largely related to migrating to urban areas, engaging in daily work, selling of fuel wood and asset while mitigation measures have focused on ecosystem rehabilitation. Institutional support to farmers' efforts to adapt to climate change is generally weak (Ayalew 2016).

2.2.6. Factors determining adaptation towards climate change

A study in Ghana reveled that access to water, high cost of adaptation, lack of information, lack of knowledge on adaptation, insecure property rights, insufficient access to inputs and lack of credits were identified as the major barriers to adaptation (Acquah and Onumah 2011).

Gedefaw et al. (2018) by studding Farmer's Perceptions and Adaptation Strategies to Climate Change, Its Determinants and Impacts in Ethiopia they identified lack of knowledge, lack of capital, lack of sufficient land, lack of information and unobserved climatic related problems as major determinants that affecting the adaptation strategy of smallholder farmers. on the other hand study by Asrat and Simane(2018) identified Farmers' adaptation decision is influenced(determined) by household size, the gender of household head, cultivated land size, education, farm experience, non-farm income, income from livestock, climate information, extension advice, farm-home distance and number of parcels. Ayalew(2016) also concluded that Gender, education, off farm activity, farm size, ownership of oxen, farmer to farmer extension, access to credit and information on climate change are determinants of adaptation to climate change and variability.

2.3. Theoretical Framework

The study focus on assessing farmer's awareness, perception and adaptation strategies; in doing so the study will be guided by Social representations theory, social constructionist perspective and discourse analysis perspective.

2.3.1. Social representations theory

The theory of social representations, first formulated by Serge Moscovici (Höijer 2017). The theory has rooted in the sociological tradition of social psychology and has been developing since the sixties as a useful theoretical and practical multidisciplinary social research tool (Eréndira and Oswald 2013). There is a link between the concept of social representations and

Durkheim's concept "collective representations" which refers to common ways of conceiving, thinking about and evaluate social reality (Höijer 2017:4). Social representations are social products derived from interaction and their nature is relational (Eréndira and Oswald 2013). According to (Höijer (2017) Social representations are about processes of collective meaning-making resulting in common cognitions which produce social bonds uniting societies, organisations and groups. It sets focus on phenomena that becomes subjected to debate, strong feelings, conflicts and ideological struggle, and changes the collective thinking in society (2017:4). Moscovici define social representation theory as:

> Social representations […] concern the contents of everyday thinking and the stock of ideas that give coherence to our religious beliefs, political ideas and the connections we create as spontaneously as we breathe. They make it possible for us to classify persons and objects, to compare and explain behaviors and to objectify them as part of our social setting. While representations are often to be located in the minds of men and women, they can just as often be found "in the world", and as such examined separately (Moscovici 1988: 214 cited in Höijer 2017:4).

Social representations refer to cognitions stamping the collective thinking of society. Of special interest are phenomena that in different ways diverge from traditional views, create tensions in society and challenge everyday life of citizens, groups and institutions. Such phenomena are especially well suited for studying how old ideas are modified and transformed and new social representations are produced by public debate. We easily find examples in today's society, which go through many quick changes related to, for example, new communication technology, biotechnology, environmental risks, global market, terrorism and violence (Höijer 2017:6). Social representations further, embedded in communicative practices, such as dialogues, debates, media discourses and scientific discourses (Marková 2003).

So in relation to this study we can take climate change as new social representation in the society. Society may interact through different ways about climate change and its intensity. Different segment of society like that of politician, scientists, mass media and the like may communicate climate change as a discourse with in the society.

The theory proclaim two basic socio-cognitive communicative mechanisms that generate social representations; that are anchoring and objectifying (Höijer 2017).

1. **Anchoring**: it is all about makes the unknown known by bringing it into a well-known sphere of earlier social representations so that we may compare and interpret it; or its about understanding of the unfamiliar phenomenon it is essential to name it and to attribute characteristics which allow the phenomenon to be communicated and talked about (Wagner et al. 1999; Höijer 2017). We may have different anchoring mechanisms: naming and emotional anchoring.

Naming anchoring: A most common way of giving the foreign or unknown phenomenon a more well-known face is to name it. the complex scientific phenomenon climate change may shortly be labeled as the weather, and so on (Höijer 2017).These acts of naming's build the abstract issue of climate change into recognizable frames of references, or locate it in the identity matrix of our culture(Ibd).

In line to this study, when people gate the awareness of climate change from different source for the first time about the thing they know in a common sense i.e. when society hear new name given for the change in a weather in their environment as climate change or global warming they will start to develop different perception of climate change.

Emotional anchoring: refers to a communicative process by which a new phenomenon is fastened to well-known emotions. That mean the unknown gets recognizable as, for example, a threat or a danger to fear, something to worry for, or as something nice and pleasurable.\ (Höijer 2017:9). Climate change has found to be anchored by the media in a mixture of well- known emotions of fear, hope, guilt, compassion and nostalgia. By this is the scientific phenomenon of climate change turned into a social representation we can compare with other current social phenomena attached to similar emotions such as terrorism or a number of environmental risks. Media further invites us to feel compassion for endangered species and nostalgia for the idyllic past we are about to lose" (Höijer 2017:9).

In relation to this study this concept can help in studying how the Emotional anchoring can create perception of climate change in general and risk perception in the society in particular. As a result of mass media, politician and scientists driven emotionalizing and awareness of climate

change as something fearful and dangerous, perception of climate change starts to develop within the society. As result of this phenomena community will start to take adaptation activities.

2. **Objectification**: it is a mechanism by which socially represented knowledge attains its specific form. It means to construct an icon, metaphor or trope which comes to stand for the new phenomenon or idea (Wagner et al. 1999:5). It is the way in which a new object, through communication about it, will be rapidly simplified, imaged, and diagrammed (Eréndira and Oswald 2013).Objectifying, makes the unknown known by transforming it into something concrete we may perceive and touch and thus control. When, for example, the media attach specific storms, heat waves or floods to climate change the abstract phenomenon is objectified (Höijer 2017).

Here again this concept of objectification can assist this study in studying how the community will start to develop objective reality about climate change as result of discourse created by different groups in objectifying climate change through showing different kind of climate change driven environmental hazard in order to initiate the community to take action or adaptation measures.

2.4.2. Social Constructivism perspective to environmental problem

Perhaps one of the most fundamental concepts within environmental sociology is the idea that 'the environment' is socially constructed (Hannigan 1995). This concept does not refer to the transformation of 'pristine' nature by humans into 'artificial' or 'built' environments, but to the ways in which our understandings of nature, the environment, and environmental problems are shaped by intrinsically social processes of knowledge generation and communication. This requires us to recognize that the terms we use to describe our environments do not refer to universally applicable objective features of those environments but to socially valued categories and understandings that are liable to change across space, time and social groups (Hannigan 2006:29-33). Constructivists also offer a constitutive model of international relations in which global environmental 'culture' gradually envelopes more and more states in a world institutional structure. These global common values created a social system that includes the traditional international political world. As result global network of scientists and International

Nongovernmental Organizations (INGOs) disseminate their global environ- mental ideas and values (Parks and Roberts 2010:38).

Thus, this concept of social constructivism concept of environmental problem can assist the present study, on how the concept of climate change is constructed through the interaction of different country, institutions, organizations and individuals within the community. Help in studying how concept of climate change is constructed and perceived as a problem or not in the community.

2.4.3. Environmental discourse

In recent years, discourse analysis has emerged as an increasingly influential method for analyzing the production, reception and strategic deployment of environmental texts, images and ideas. Discourse is defined as 'a specific ensemble of ideas, concepts and categorizations that is produced, reproduced and transformed in a particular set of practices and through which meaning is given to physical and social realities' Hajer (1995: 264 cited in Hannigan 2006) . According to Hannigan (2006) within environmental studies, discourse has been visualized in a variety of ways. One basic attempt to organize the analysis of environmental discourse comes from Herndl and Brown (1996). Their 'rhetorical model for environmental discourse' takes the shape of three circles, each of which is located at the tips of a triangle. At the top of the triangle is what they call **regulatory discourse**– disseminated by powerful institutions that make decisions and set environmental policy. Nature here is treated as a resource. At bottom right of the triangle is the **scientific discourse** where nature is regarded as an object of knowledge constructed via the scientific method. Policy-makers routinely ground their decisions here, relying in particular on technical data and expert testimony. Finally, directly opposite this on the bottom left is **poetic discourse** that is based on narratives of nature that emphasize its beauty, spirituality and emotional power (Hannigan 2006:37).

International regulatory bodies and institutions like NGOs, On the other hand, local NGOs, but also government related bodies are often highly informed by discourses that shape global environmental politics, and hence, are part and parcel of similar discursive and political realms. pertinent to this, there are also local media, traditional rulers, religious leaders and farmers who can also be seen as interlocutors in the global chain of climate change discourses(Wit 2011).

The concept environmental discourse can help study by being triangulated in social representation theory (theoretical triangulation) in studying how climate change discourse is constructed and shaping people's awareness and perception about climate change.

2.5. International community response to climate change

Increasing awareness by international organizations and nation-states of changes in the ecosystems and the destruction of natural resources initiated the attempts to address environmental concerns on a global scale. As a result, the 1972 United Nation conference on human environment enabled the United Nations Environment Programme (UNEP). In addition to this, The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 by the UNEP and the climate change; the environmental, economic, and social impacts of climate change; and the possible response strategies (Tuffa et al. 2012:11).

United Nations Framework Convention on Climate Change (UNFCCC) was signed by more than 150 countries in New York on May 9, 1992.Then after that in June 1992 Rio de Janeiro summit was held, which is considered as largest ever gathering of Heads of States on climate change and ratified Rio Declaration. In addition, Starting from December 1–11 1997 meeting by world country head was held and adopted the Kyoto Protocol. The Kyoto Protocol is a legally binding agreement under which industrialized countries are committed to reduce their collective emissions of six GHGs. Furthermore, In December 2009 in Copenhagen the fifteenth United Nations Conference on Climate Change was held. The key objectives of the conference were establishing a binding agreement in which each country - according to the "polluter pays principle" and would take its responsibility by reducing greenhouse gas emissions. In the same vain transfer of technology and financial assistance to the developing countries was on the agenda for helping the poor in vulnerable regions to mitigate, and to adapt to the negative consequences of climate change (Wit 2011, Tuffa et al. 2012).

On 12 December 2015, in Paris the UNFCCC held meting and reached on landmark agreement. This agreement included, strengthen global response to climate change threat; increase the ability of countries to deal with the impacts of climate change and at making financial flows consistent with a low GHG emission and climate resilient pathway. To reach these ambitious goals, provision of financial resource, a new technology framework and enhanced capacity building

and then supporting actions by developing countries and most vulnerable countries (UNFCCC 2015). Thus different developed and developing countries, international institutions and organizations are responding to the problem of climate changes.

2.6. Ethiopian policy and strategic response to climate change

The government of Ethiopia recognized the implications of climate change impact on social and economic development for the country. It has, therefore, formulated a policy and strategy document to combat such threat(Tesfaye et al. 2015).

2.3.1.1. Ethiopian Environmental policy

By proclamation No. 9/1995 the Ethiopian Environmental Protection Authority (EPA) has created an environmental policy. The overall objective of the policy was "improve and enhance the health and quality of life of all Ethiopians and to promote sustainable social and economic development through the sound management and use of natural, human-made and cultural resources and the environment as a whole so as to meet the needs of the present generation without compromising the ability of future generations to meet their own needs" The NEP outlines policy objectives that pertain to climate change, including a focus on climate monitoring, control of greenhouse gases and use of renewable energy.

2.3.1.2. Ethiopia's Climate- Resilient Green Economy Strategy

Climate Resilient Green Economy (CRGE) strategy document prepared in 2011 and consists of two important elements, i.e. strategy for climate resilience (CR) and strategy for green economy (GE) (EPA, 2011). The CRGE Vision outlines Ethiopia's ambition to build a climate resilient green economy by 2025. The strategy claimed that Ethiopia is committed to building a climate-resilient green economy. Its plan to do so comprises actions to reduce greenhouse gas emissions while safeguarding economic growth ("green economy") as well as adaptation in silience") (EPA 2011).

Ethiopia is planning to develop the green economy strategy based on four pillars:

● improving crop and livestock production practices to increase food yields, hence food security and farmer income, while reducing emissions

● Protecting and re-establishing forests for their economic and ecosystem services, including as carbon stocks

● Expanding electric power generation from renewable sources of energy fivefold over the next five years for markets at home and in neighboring countries

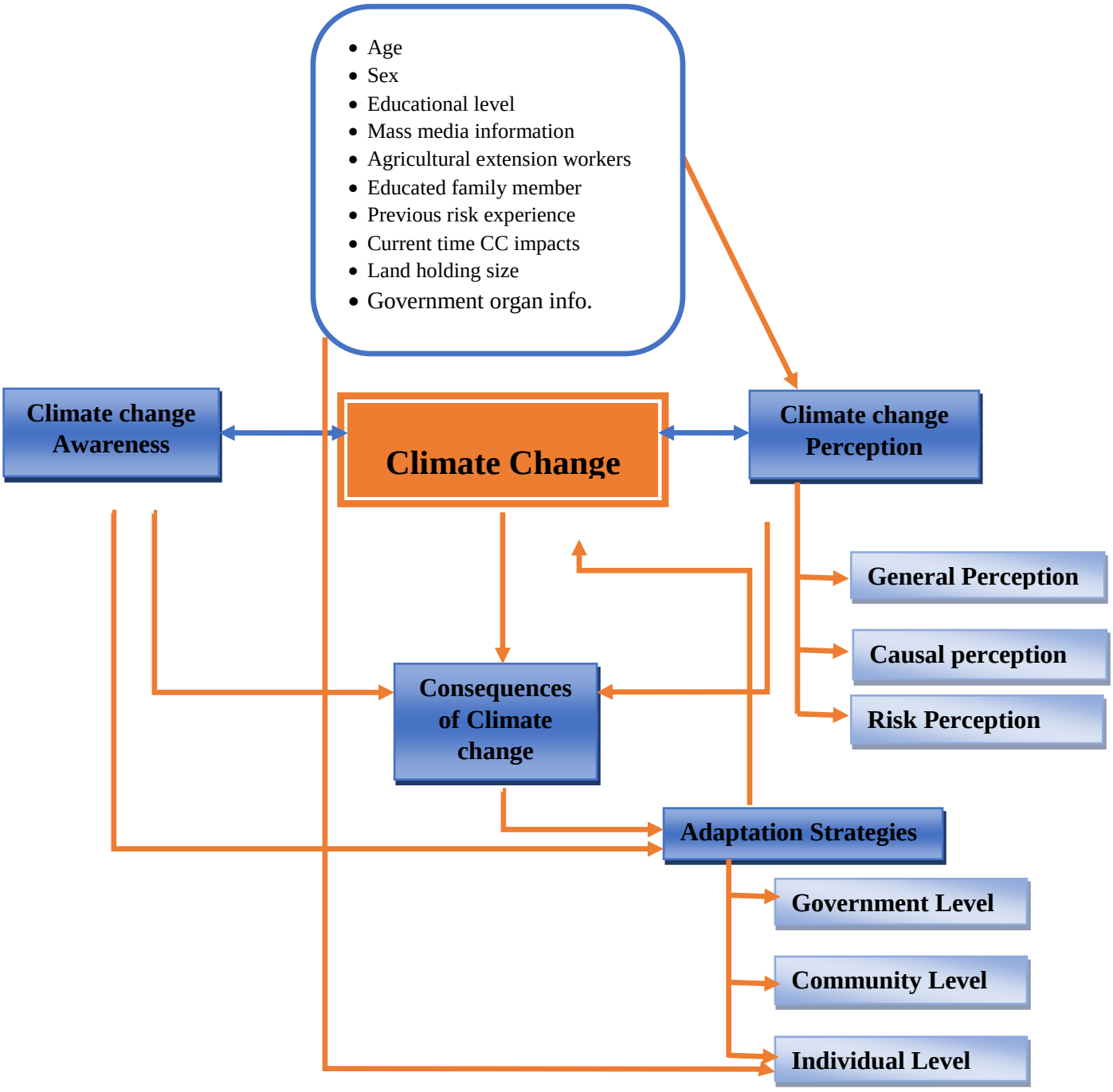
● Leapfrogging to modern and energy-efficient technologies in transport, industry, and buildings (EPA 2011:9).

2.3.1.3. The Growth and transformation plan (GTP)

Both GTP1 and GTP2 have also addresses climate change as a crosscutting issue under the strategic priority of 'environment and climate change'. It outlines 'building a climate resilient green economy' as a strategic priority as a way to counter development losses caused by climate change (figure 1).

2.7. Conceptual framework

The conceptual framework of the study includes five important components. These are: (1)awareness about climate change (2) perception about climate change, this perceptions includes general perception, causal perception and risk perceptions; (3)factors that determines this perception (this includes: age, sex, educational level, awareness from agricultural extension workers, awareness from mass media, awareness from government organ, previous risk experiences, current time climate change driven problems experience, information from educated family members, and social network and land size or ownership of cultivable land (this concepts are independent variables)); (4) different negative consequences of climate change(health, economic, social and environmental impacts) and finally(5) different adaptation strategies employed at different level; that means at government, community and individual levels. Climate change perception and individual level climate change adaptation practices are dependent variables. The happening of climate change will be perceived by farmers in different ways at the same time farmers may have different awareness about climate change and its discourse. Climate change has different kinds of negative consequences that will leads different adaptation strategies at different levels. The existence of adaptation strategies will minimize the problems related to climate change.



Source: own construct (2019)

CHAPTER THREE: Research Methods

The research method section of the study was discussed in detail the research approaches, description of the area, study design, study population, methods and instruments of data collection, sampling technique, sources of data, method of data analysis, data quality assurances plan, and ethical considerations.

3.1. Description of the Study Area

The study was conducted in *Anfillo* District of *Kellem Wollega* Zone, Oromia Region. Anfillo is bordered on the southwest by the *Gambella* Region, on the north by *Jimma Horo* and *Gidami* district, on the northeast by *Hawa Walel*, and on the east by Sayo districts. The major town in Anfillo is Mugi.

The 2007 national census reported that the total population for this district was 77,156, of whom 39,486 were men and 37,670 were women; 7,853 or 10.18% of its population were urban dwellers. The three largest ethnic groups reported in Anfillo were the Oromo (89.66%), the Amhara (4.6%), and the Mao people (4.46%). Afan Oromo was spoken as a first language by 95.41%, 2.92% Amharic, and 0.64% speak Mao, one of the northern group of Omotic languages; the remaining 1.03% spoke other languages. The majority of the inhabitants were Protestants, with 63.74% reporting that as their religion, while 26.52% observed Orthodox Christianity, and 8.84% observed Islam. In the district, about 99% of the coffee is produced by small scale farmers, which include forest coffee, semi-forest coffee, semi-plantation coffee and garden coffee which accounts for 15%, 40%, 20% & 25% respectively. The district consists of diverse indigenous groups and settlers who come from other parts of Ethiopia

Of the 10 districts in Kellem Wollega Zone, Anfillo is known as predominantly coffee growing district and is situated about 42 km to the south west of Dambi Dollo town. It is located at 8030"E and an elevation range from 500 to 2200m above sea level. The mean minimum and maximum temperature of the area is 120 Centigrade and 270Centigrade respectively. The average annual rain fall is 1200-2320mm. The district is generally divided in to three agro-climatic zones from which 28% is high land, 8% is mid altitude and 64% is low land (source: Anfillo district agricultural and rural development office). Coffee is the major cash crop of the

district and the site is considered as one of the major coffee cultivating areas, with various annual crops like maize, wheat, sorghum, etc, and livestock production.

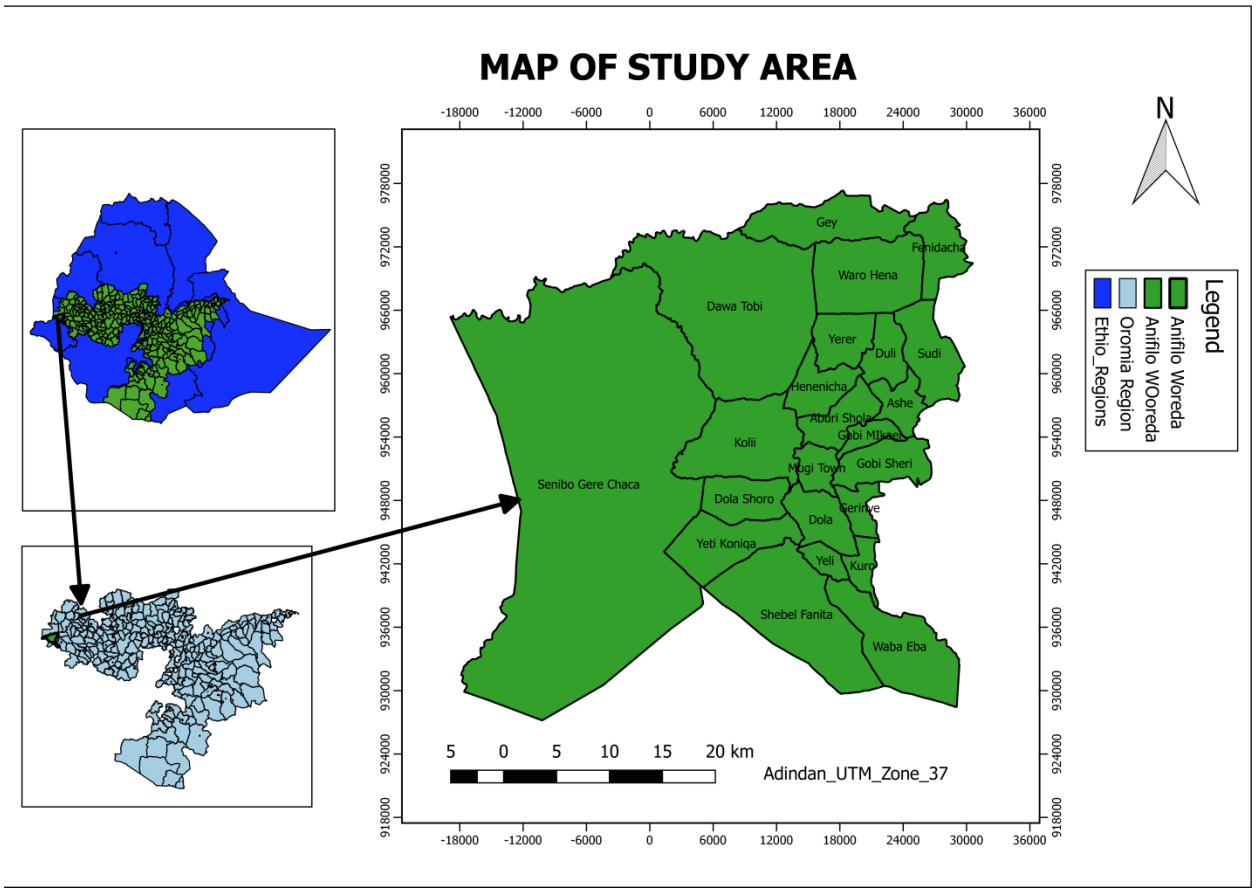


Figure 1Map of the study area

3.1.1. Justification for Study Area Selection

The area is known for coffee production and people are highly dependent on it for their livelihood and at the same time the district produces more coffee production compared to other districts in the zone; pertinent to this the district is reach in natural forest coverage which is under threat because of climate change. Thus the fact that global climate change discourse claims that, the change in climate will make such kind of area more vulnerable to its impact initiated the researcher to conduct an empirical study to verify the reality. At the same time as far as the literature review by the researcher is concerned, there is no empirical study on the issue at aforementioned area. Additionally, the familiarity of the researcher about the study area is also another motivation.

3.2. Research Approach

The study employed mixed research approach; it included both quantitative and qualitative research approaches. By employing this approach a researcher collects both quantitative and qualitative data sequentially. Mixed research approach tries to overcome the limitations of the quantitative and qualitative research by reducing the reductionist nature of the quantitative approach and representativeness of the sample of qualitative approach (Creswell 2009).

3.3. Study Design

A research design is a plan that describes how the research will be conducted; it expresses the procedures for collecting, analyzing, interpreting and reporting data in research studies (Creswell 2003). Thus, the present study employed a cross-sectional research design where the data collection process is conducted at a point in time from samples selected in the study population. A cross-sectional design was an appropriate design to assess farmer's awareness, perception and adaptation strategies about the issue of climate change.

3.4. Source Population

The source population for this particular study was all the farmer communities and stakeholders (both governmental and nongovernmental) that are found in Anfillo district. Almost all of these communities are farmers or they are in one way or another engage in farming activities. The study had also included some key informants that are stakeholders for the problem under investigation. These stakeholders include experts of the relevant government office that are working on the issue of climate change, nongovernmental organizations (NGOs) that are working on the issue, model farmers, older farmers and finally with health professionals. These aforementioned study participants had more detailed knowledge about the issue at hand.

3.5. Study Population

The study population for this study was the farmer communities that are found in Suddi, Ubur Sholla, and Shebel kebeles. The study population has also comprised key informants that are stakeholders for the problem under investigation, including experts of the relevant government office that are working on the issue of climate change, nongovernmental organizations (NGOs) that are working on the issue, model farmers, older farmers and finally with Health professionals. These aforementioned study participants had more detailed knowledge about the issue at hand.

3.6. Sampling Procedure and Sample Size

3.6.1. Sampling for Qualitative Data

For the qualitative part of the study, the sampling procedure was made through purposive sampling method and final sample have determined by data saturation point or theoretical sampling. Detailed qualitative data were collected from agricultural extension workers, experts on climate change issue, model farmers, older farmers and Health professionals. These segments of the study participants had better knowledge on the present and past manifestations of climate change, different kinds of climate change impact and how the farming community is responding (adapting) to the problems emanated from climate change. The data that were obtained from this aforementioned study participant was more detailed and enable the researcher to triangulate the data with the quantitative one.

3.6.2. Sampling for Quantitative Data

For the quantitative part, a multistage sampling technique was employed to select respondents in accordance with a subgroup's proportion in the overall population and simple random sample is drawn within each subgroup. The primary sampling units were *kebeles*. There are twenty-five (25) kebeles in *Anfillo* district; first, those *kebeles* were stratified to three different agro-climatic zones. That means high land, mid-altitude and low land; in high land agro-climatic zone there are eight (8) kebeles, in mid-altitude agro-climatic zone there are seven (7) kebeles and in low land agro-climatic zone there are ten (10) kebeles.

After stratifying to different agro-climatic zones, sample kebeles were selected from each agro-climatic zone to represent each Zone through the lottery method. The fact that the numbers of *kebeles (Ganda)* in each agro-ecological zone is small had enabled the lottery method to practicable. Then *3 kebeles*, one from each stratum were selected; so, *kebele Suddii*(High altitude), *Ubur shollaa* (mid-altitude) and *Shebel* (low altitude) selected through lottery method for each agro-climatic zones respectively.

From each selected each representative kebeles household head were selected as the final study unit through Systematic Sampling methods. Specific procedure used for the aforementioned technique was; firs the researcher have divided the total numbers of household in the selected representative kebele to final sample size, the by using the optioned value the researcher have

selected every K th house in the given kebele. The optioned number were 15, then by taking kebele administration office as starting point every 15^{th} house in each direction was selected until the required sample was optioned.

The sample size was calculated using OpenEpi software version 3.03 (Dean AG, et al, 2016) as indicated below:

Sample size $n = [Np (1 -p)]/ [(d2/Z_{21-\alpha/2}*(N-1) + p*(1-p)]$

Where n is the estimated sample size:

DEFF- Design effect (for cluster surveys-*DEFF*) =2

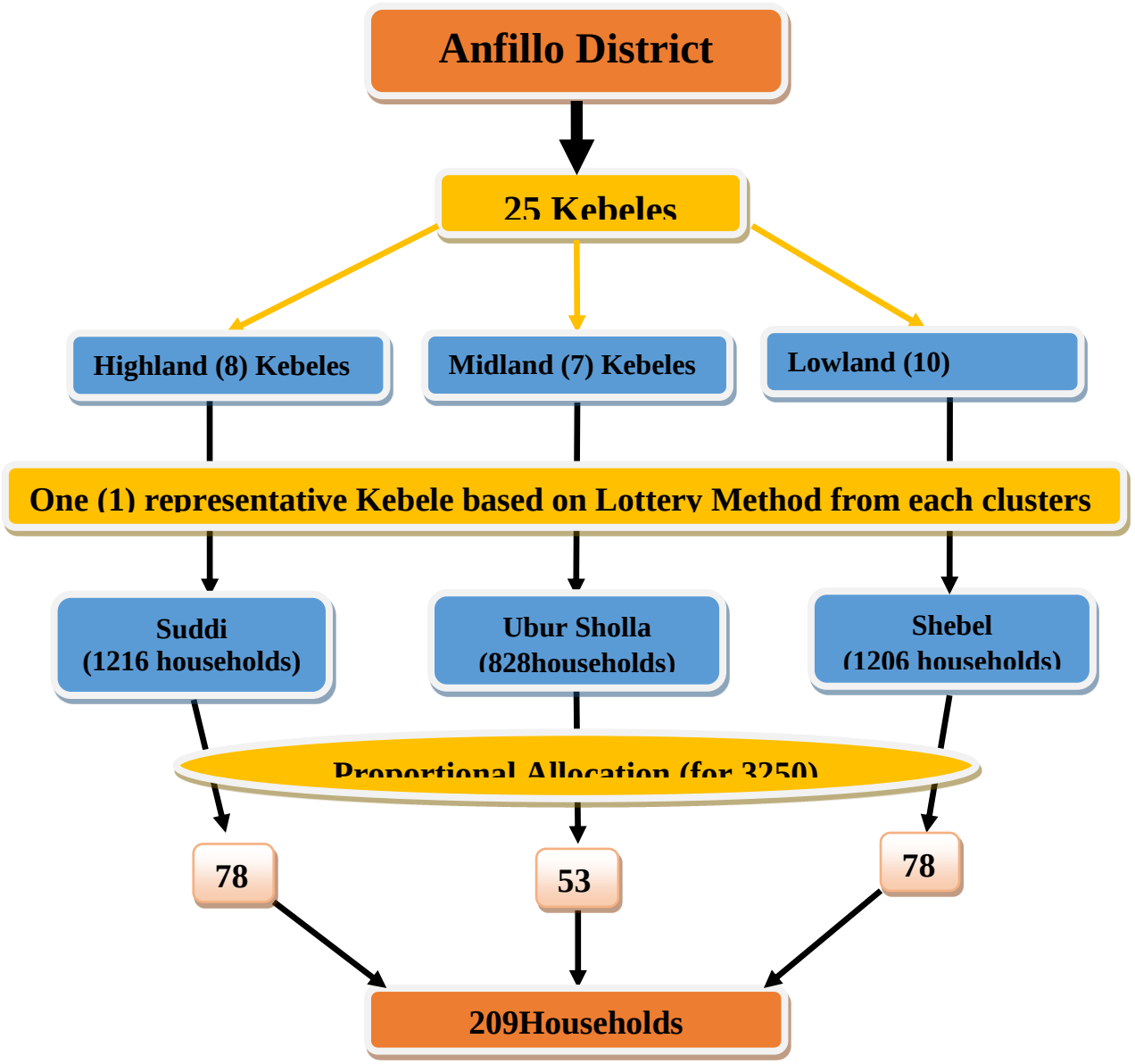
Np -is the Population size (for finite population correction factor or fpc) (N) = 6650

p- Is the hypothesized % frequency of outcome in the population=

($Z_{1-\alpha/2}$ = the $100(1-\alpha/2)$ the percentile of the normal (or Gaussian) distribution. For the commonly used two-sided 95% confidence interval, $Z_{1-\alpha/2} = 1.96$

d = the margin of error = 0.10

Accordingly, considering population size of 6650, frequency of outcome in the population, and assuming the proportion of participants having awareness towards climate change to be 50%, with 95% confidence level and 10% margin of error, and an also a design effect of 2 (accounting for multistage sampling), the sample size calculated would be 190. Finally, adding 10% (19) for the non-response rate, the sample size required for the study was 209. The procedure for sample selection was shown in the following figure.



3.7. Methods and Instruments of Data Collection

Quantitative data was gathered through a survey questionnaire that contains both close-ended and open-ended questions and Qualitative techniques were also used to collect relevant data regarding community awareness, perception and adaptation strategies. To this end in-depth interview was conducted.

3.7.1. Household Survey

A survey is a method of obtaining large amounts of data, usually in a statistical form, from a large number of people in a relatively short time (Creswell 2003). Therefore, this study has

employed household survey which was the major tool to collect facts and information in the study. Household survey was carried out, using a semi-structured questionnaire which administered to collect information from randomly selected study participants. Five (5) data collectors have been given training about the survey instrument and have participated on data collection to assist the researcher. Some of the survey items were adopted from Nega (2018) modified to the context of this study.

3.7.1.2. Survey instrument

Household interviews were carried out, using a pre-test semi-structured questionnaire (to give respondents the opportunity to include concept related to the study) was administered to collect information from randomly selected households. The questionnaire was administered for the head of a household; who has the most decision making power in the family in the absences of the head of household. The questionnaire was administered in local language (Afan Oromo) to ease the interview processes. The survey instrument have five parts, the first parts deal with Socio-demographic and socio-economic profiles of respondents, the second parts deals with awareness of respondents about climate change, procedures of awareness and the extent of their knowledge about climate change. The third consists of scale items that intend to measure or know perceptions of respondents about climate change. The Likert scale measurement questions, in which 1 mean "strongly disagree" and 5 means "strongly agree" were used to better discriminate among the responses of respondents. This particular climate change perception Likert scale items have 3(three) subparts. The first part deals with the general perception of respondents about the happening of climate change by providing them a total of nine (9) statements which includes local indicators of climate change. The second part has consisted of nine (9) items that consists of statements about the causes of climate change. And finally, the third part consists of eleven (11) statement which talks about the risks associated with climate change in order to determine whether the respondents have perceived climate change as risk or not.

The forth part of the survey instrument consists of questions related to climate change impacts or negative consequences in the study area. A bunch of multiple response climate change related negative impacts items were provided for respondents to choose from. The final part of the

survey instrument has included different climate change adaptation strategies at the community level, at individual level and at government level. The existence of climate change adaption practice at each level was prepared. Response options were (0 = No, 1 = Yes). There is also a 'skip code' next to each "No" response option. Because respondents who responded 'No' to each level practices will not respond to specific items provided under each strategy.

3.7.1. In-depth Interviews

In-depth interviews are best for collecting data on individuals' personal histories, perspectives, and experiences (Creswell 2003). The in-depth interview enables the researcher to explore issues in detail with the interviewee, using probes, prompts, and flexible questioning styles (Henne et.al.2006). For the purpose of the study at hand structured in-depth interview was made with some purposively selected study participants. This group of study participant was included agricultural extension workers, experts on climate change issue, model farmers, older farmers, health professionals, concerned Go's an Ngo's officials and final sample size for each group have determined by data saturation point. There were a total of 19 informants that have totally participated on the study which have comprised from different sects discussed above. Accordingly, 11 informants were from farmers, including 4 old farmers, 3 model farmers and 4 ordinary farmers. Pertinent to this there were also a total of eight (8) informants from different government sectors that have take part in this study.

3.8. Sources of Data

Both primary and secondary data source was employed in the study.

3.8.1. Primary Source of Data

Primary data are those which are collected afresh and for the first time, and thus happen to be original in character. Accordingly, the researcher has gathered primary data through survey, in-depth interviews. Survey instrument was prepared in English, and then the survey instrument was translated into Afan Oromo so that the researcher can collect his data smoothly. Interview guide was prepared to collect qualitative data.

3.8.2. Secondary Source of Data

Secondary data are those which have already been collected by someone else. Intensive review of related literature was crucial source of secondary data that have back the research. Books,

articles, other research work, and published and unpublished materials were utilized to conduct the research and to get deep understating about the subject of the study, draw the gap in the existing literature and derive useful concepts and methods.

3.9. Methodological Triangulation

Triangulation avoids the dichotomy differences and limitation of quantitative and qualitative approaches and helps to develop the type of mixed methods as a holistic approach that enable the researcher to overcome the limitation of one approach by the strength of the other approach (Yeraswork 2010). Therefore in the study, both qualitative and quantitative data that was gathered in one phase of data collection and incorporate into the interpretation of the overall results. Converging concurrent methodological triangulation or simultaneous analysis in themes to synthesise qualitative and quantitative data was employed.

Table 2Methodological Triangulation Table

Objectives	**Unit of analysis (information on study of what?)**	**Observation unit/data source (data from whom)**	**Methods of data collection (how to collect data)**
To assess farmers awareness about climate change and its discourse	Awareness level of farmers about climate change	Sample farmer household Development agent worker (DA)	A. Household Survey B. Key informant interview
To assess farmers perceptions towards climate change.	Understanding farmers perception, causal perception and risk perception about climate change	Sample farmer household Model farmer Older farmers	A. Household Survey B. In-depth interview C. Key informant interview
To identify factors that determine farmer's perception about climate change.	Determinants of farmers awareness and perception toward climate change	Sample farmer household Development agent worker (DA)	A. Household Survey B. In-depth interview
To examine the consequence of climate change in relation to farmers livelihood system.	Studying impacts of climate change on farmers livelihood	Sample farmer household Older farmers Model farmer	A. Key –informant interview B. In-depth interview

		Development agent worker (DA) Health professionals Climate change and environmental conservation office	C. Household Survey
To explore Adoptive strategies employed by farmers to combat climate change driven problems.	Identifying available adoptive strategies towards climate change	Sample farmer household Development agent worker (DA) Climate change and environmental conservation office	D. Household Survey E. Key –informant interview

3.10. Methods of Data Analysis

The raw data in itself has cannot convey meaning in itself unless it is arranged and analyzed properly. Both quantitative and qualitative data in the study was analyzed carefully. First, the quantitative data was cleaned, coded and entered into SPSS software version 24.0 for analysis. Descriptive statistics were employed to summarize the sample characteristics. Descriptive statistics particularly percentage and tables were used to describe socio-demographic characteristics of the respondents, awareness about climate change, consequences of climate change in the study area and available climate change adaptation strategies. Likert scale items were described in terms of mean score of the parameter and also with an overall composite score for items. Additionally, an inferential statistical test, including Chi-square test and binary logistic regression analysis was employed to identify determinant factors for farmer's perception about climate change and individual level climate change adaptation practices. Each outcome variable was then investigated and 95% confidence interval was assumed. Results were considered significant at the $p <= 0.05$ significant level.

Qualitative data was analyzed through thematic analysis method. After the collection of the data, the researchers has transcribed the tape recorded data and immersed with raw data by listening tape records. Then by reading the transcripts, the transcript was coded, and then categorizing the code, all of the key issues, concepts and themes were identified and the raw data were rearranged

according to the appropriate part of the thematic framework to which they relate. Subsequently, based on the similarity of the themes, was triangulated with the quantitative ones (methodological triangulation for both kinds of data will be conducted).

3.11. Data Quality Assurance

Reliability of research is all about the degree to which a method gives the same results each time it is used, assuming that the underlying thing being studies does not change (Yeraswork 2010:12). The instrument was piloted with 5% respondents' before the actual data collection is conducted and the reliability was checked to estimate the internal reliability of the survey item. Pertinent to this to assure the reliability of Likert scale item, calculation of Cronbach's coefficient alpha have made in order to check internal consistency reliability among items. from the three independent Likert scale items two of them have good alpha value ($r > 0.70$) while only the item used to measure causal perception about climate change scored alpha value ($r < 0.70$)

In addition to this, the validity of findings or data is understood as the correctness or precision of research findings. In relation to the validity of the quantitative data, the instrument, concept-wise, content-wise arrangement was checked. In order to determine the content validity of the instrument, the initial version of the questionnaire about farmer's community awareness, perception of climate change and available coping strategies (English version) was translated into local language Afan Oromo and it was checked by professional from Jimma University Afan Oromo and sociology department. Pertinent to this in order to ensure the construct validity of the study, the tools for data collection was deduced from the empirical literature, theoretical constructs and the conceptual frame work of the study.

Careful consideration was taken in order to assure quality of qualitative data. A good rapport was built between the researcher and the study participants, the study participant were encouraged to be frank with the researcher about the research, approaching study participant friendly, explaining the objectives of the research to the study participants and the like measures were employed. In addition, iterative questioning like that of using probes to elicit detailed data was employed.

3.12. Ethical Consideration

Relevant and appropriate ethical consideration was taken thought the entire process of the study. Maximum effort was exercised to safeguard the rights of all research participants; by keeping their confidentiality, respecting each of them and acknowledging their values, norms and government laws in the whole process of carrying out this study. The researcher has present supportive letters, written in Amharic language from Jimma University sociology department. The letter was given firstly for Anfillo District administration so that, the District administration office write a letter of cooperation for other concerned selected government sectors and *Kebeles*. During data collection, the necessary supportive letter was present for all of the study participants along with open communication of the study objectives. Study participants were also kindly requested to have freedom from asking questions, including the identity (address) of the researcher and refusing to participate at any stage of data collection. Consent of each participant was obtained to participate in the study by the researcher.

3.13. Limitations of the Study

The first limitation of the study is with regard to sampling; the researcher determined sample size for the total number of households from three selected *kebeles (suddi, ubur shola and shebel)* and administered proportionate to size of *kebeles* that would not fully represent the study Anfillo *District* due to resource and time constraints. The sample size would have been large and more representative if additional *kebeles* were *included* in the study. Focus group discussion (FGD) data collection method were prepared to collect necessary qualitative data; however because of 'state of emergency' that was declared in the study area, it was unable to perform. The state of emergency forbids any kinds of gathering, at the same farmers have also afraid of the military and again most of them are unwilling to take part in the FGD.

3.13.1. Field Challenges and Experiences

The data for the study was collected from March 20 to 15th of April 2019. One of the major field challenge faced by the researcher is the problem of security. During the data collection period, the study area were under 'state of emergency or command post' because of ongoing conflict and war between Ethiopian government military force and Oromo liberation front (OLF) fighters. As result going to the rural area were very much difficult for the researcher and his assistant. As result of this fact there some household head who have refused to participate in the study because

of suspicion of the researcher and his assistant as if they go there for another spying purpose. Every day security check and measures from both government and OLF force were very difficult for the researcher and his assistant.

CHAPTER FOUR: Data Presentation

This chapter presents the major findings of the study, based on the data obtained through household survey and in-depth interviews. The data are presented and organized in sequential order in line with the specific objectives that stated under the first chapter of the thesis. The results of the survey instrument were presented in the table form; while the in-depth interviews data were transcribed and presented thematically and triangulations were made one after the other.

4.1. Socio-demographic and socio-economic profiles of respondents

The socio-demographic and socio-economic profiles of respondents consisting of their sex composition, age group, ethnic group, marital status, highest educational level of head of the households, respondents' sources of income, ownership of cultivable farmland, dominant types of agricultural activities and forms of agricultural practice, are depicted in table 4.1.

4.1.1. Sex, age, ethnic, religious composition and marital status of the respondents

This study involved 209 respondents, representing head of the household of the total respondents, 83.3% of them were male and the remaining 16.7% were female. Table 4.1, shows that the majority of respondents (49.8%) were in the age group 36-50, followed by age groups 18-35 and 51-64 years which comprises 33% and 12.9% respectively. The significant majority (82.8%) of the respondents belonged to the productive age group, between 18 and 50 years. Age groups were formed based on the supposition of youth, young adult, and adult and old age groups' classifications. Concerning their ethnic compositions, the significant majority (86.1 %) of the respondents were Oromo, 9.6 % were from Amhara. The Mao ethnic group accounted for a small portion (4.3%) of respondents. With regard to marital status, 83.3% of the respondents were married.

Table 4.1. Socio-demographic and socio-economic profiles of respondents

Characteristics		Frequency (N=209)	Percentage (%)
Sex	Female	35	16.7
	Male	174	83.3
	Total	**209**	**100**
Age group	18-35	69	33
	36-50	104	49.8
	51-64	27	12.9
	65 and Above	9	4.3
	Total	**209**	**100**
Ethnicity	Oromo	180	86.1
	Amhara	20	9.6
	Mao	9	4.3
	Total	209	100
Marital Status	Never Married	25	12
	Married	174	83.3
	Divorced	4	1.9
	Widowed	6	2.9
	Total	**209**	**100**
Highest Educational Level of Head	Can't Read and Write	32	15.3
	Can Read and write	36	17.2
	Primary Education (1-8)	55	26.3
	Secondary Education(7-12)	64	30.6
	Vocational Training	13	6.2
	Tertiary Education	9	4.3
	Total	**209**	**100**
Sources of income	Agricultural activities	197	94.3
	Commercial Activities	6	2.9
	Daily Laborer	4	1.9
	Total	**209**	**100**
Ownership of Cultivable Farm Land	Do not Have Farm Land	12	5.7
	Less than 1 Hectare	107	51.2
	1.1-2 hectare	55	26.3
	2.1-3 hectare	24	11.5
	Above 3 hectare	11	5.3
	Total	**209**	**100**
Dominant types of agricultural activities	Crop farming	33	15.8
	Livestock Raising	5	2.4
	Coffee farming	169	80.9
	Total	**207**	**99**
	Missing	**2**	**1**
Forms of Agricultural	Rain Fed	193	92.3

practice	Irrigation based farming	2	1
	Mixed	12	5.8
	Total	**207**	**99**
	Missing	**2**	**1**

Source: Sample survey, 2019

4.1.2. Educational Level of the Respondents

As it was shown in table 4.1, (30.6 %) of respondents attended high school (grade 9-12), while 26.3% of the respondents had attended elementary education, 17.2 % of respondents can read and write, whereas 15.3 % cannot read and write. Of the total respondents, 6.2% and 4.3% was attended Vocational Training and Tertiary education respectively. The majority (67.5%) of these respondents has attended primary education and some of them have attended more than primary education.

4.1.3. Income sources of the respondents

Respondents were asked about their major sources of income; according to table 4, the majorities (94.3%) of the respondents were engaging in farming activity as the main source of income, the remaining small amount of respondents 2.9 % and 1.9 % engaged in commercial activities and daily laborer as major sources of income respectively. Of all the respondents, the vast majority of them were engaging in the practice of farming as major sources of income.

4.1.4. Respondents' ownership of Cultivable Farm Land

As depicted in Table 4.1, the majority of the respondents have less than one hectare (51.2%) followed by 1.1-2 hectare (26.3) of land. Among the respondents, 11.5% of households have 2.1- 3 hectares cultivable farmland and 5.3% of household head respondents have 3 hectares and more land. And finally, only a small portion or 5.7% of these respondents did not have farmland.

4.1.5. Dominant types and forms of agricultural activities

As per table 4.1, large majorities (80.9%) of respondents were engaging in coffee farming, followed by crop farming (15.8%) and only small portion (2.4%) of them engaged in livestock raising. This finding shows that most of the farmers were engaging in coffee farming.

Regarding forms of agriculture, 92.3% of the farmers were practicing farming that depended on rain or rain feed agriculture. Were as only 1% of the respondent is practicing irrigation based

farming and 5.2% of these respondents are practicing mixed farming or farming practice that depended on rain and irrigation. As a result majorities of these farmers are practicing rain feed agriculture.

4.2. Awareness about climate change

People's awareness and knowledge on climate change constitute an essential background to deal with climate change and related problems(Said, Buloshi, and Ramadan 2015). In order to have a clear picture of farmers' awareness about climate change, the sampled respondents were asked about whether they have heard about climate change or not. Accordingly, among the total of them, most 184(88%) of the respondents have heard about climate change while the remaining 25(12%) of the respondents have never heard about climate change.

Table 4.2. Sample respondent source of climate change awareness

Source of information about climate change(N184)(*multiple responses*[1])

Items	Responses		Percent of Cases
	N	Percent	
Government organ	117	18.3%	63.6%
Mass media	163	25.5%	88.6%
From Friends	53	8.3%	28.8%
From my educated family members	57	8.9%	31.0%
Local agricultural extension worker	124	19.4%	67.4%
From our peasant association(farmers union)	37	5.8%	20.1%
From our religious institution	39	6.1%	21.2%
From social network (like that of Iddir ,Ekub, Debo, and One to five network)	50	7.8%	27.2%
Total	**640**	**100.0%**	**347.8%**

Source: Sample survey, 2019

Those respondents who have responded that they have heard about climate change before were further asked about from which sources they have got information or awareness about climate change by providing them with options to choose from. Accordingly, table 4.2, presents the sources of information about climate change. Most 88.6% of respondents have got information

[1] **Multiple responses:** When respondents are provided with a list of possible items in a survey question, answers do not necessarily fall into one of several mutually exclusive categories; question may allows participants to choose one or more responses from a list to get all information available and to avoid missing of information. The **Percent**

from mass media such as radio and television. The majority of the respondents have also heard about climate change from local agricultural extension workers (67.4%) and different government organs (63.6%) like that of climate change monitoring and forest agency office. Furthermore, 31% and 28.8% of the respondents have heard about climate change from their educated family members and from their friends respectively. The remaining 27.2%, 21.2%, and 20.1% have accessed awareness from traditional social networks such as *Iddir, Ekub, Debo*[2], and one to five network, religious institution, and farmers agricultural union respectively.

The result from the in-depth interview also revealed that the informants have been getting awareness about climate change from governmental and nongovernmental organs.

One of my informants (male, age- 56) stated that:

> *I heard about climate change from different sources, most of the time in the morning my radio talk about the issue, it talks about how it has become dangerous; in addition, government officials and our kebele agricultural extension workers have been telling us about the cause and impact of climate change. They have taught us not to destroy the natural forest and that we should protect our environments in order to prevent it; Moreover, they also gave us information the fluctuation in time and amount of rainfall we have been experiencing itself is due to climate change* (Male, 56 years old in-depth interview informant).

In addition to this, another male informant elaborated these issues:

> *We heard about the new problem, climate change, from many sources. The government's workers, the radio, church leaders tell us many things about it. Church leaders have been advising us to plant trees in our environment in order to prevent the problem; our agricultural cooperative union also informed us that our coffee production and quality have been decreasing from time to time as a result of this new problem, climate change and have advised us, to take different measures* (Male, 42 years old in-depth interview informant)..

However, some of the informants argued in a little bit different way from the above ones. They say that people have of course in one way or another heard about climate change from different sources, but still many of them do not have enough knowledge and awareness about climate change. One of my informants' model farmers described the issue as follows:

[2] Are the names of traditional social institution or social networks in Ethiopia that do have different functions.

*Farmers might have or might have not heard about climate change; sometimes we hear about it from mass media, some agricultural extension workers come sometimes with other government officials to give training about the issue, but as they(government officials)often try to politicize the issue; then people do not listen to them with attention '***Namoonni jecha jijjiirama qilleensaa jedhu ni dhaga'an malee maal jechuu akka ta'e hubannoo ga'aa hin qaban***' *meaning that most people have just heard the word climate change without proper understanding of what it is. (Model farmer)*

Experts interviewed revealed that as a result of an imminent increase in the climate change problem in the country in general and in *Anfillo* district in particular, awareness has been created for the farmers. There is a climate change committee established at the woredas level for this purpose. The committee is composed of 4 different district sect -oral level office; these sectors include health sector, climate change and environmental conservation sector, forestry agency, and *Anfillo* district agricultural office. Awareness creation was made at least 3 times in a year for all *kebeles* in the district. The climate change committee members aware the community about climate change (its causes, problems emanated from it and methods of adapting to it) according to their respective knowledge and expertise. Likewise, the climate change and environmental conservation officer of the district described that attempts have been made to aware the community about climate change; however, the awareness could not reach the stage it is expected to reach. He described the reason as:

*Of course, we have been creating awareness for the community about climate change by coordinating different task force from different sectors in the previous year; We had created awareness for the farmers at different times and in addition to this, we provided training for different segments of the community and the community representative like church leaders, Iddir leaders and rural kebele leaders to aware the rest of the farmers more. But this year we are not functioning well because of the current political instability in our district (*The district climate change office and environmental protection officer, key informant).

In addition to the above climate change monitoring office experts, an agricultural extension worker of the district also argued that he has been raising awareness for farmers about climate change, its causes, its impact on their farming activities and method of adapting to the problem. He stated that:

Because of the fluctuation of rainfall, agricultural productivity in the district is decreasing from time to time; we explained this fact to the farmers that this has been happening because of climate change. Thus, we are advising them to diversify their means of livelihood and use different natural recourses efficiently and effectively in order to prevent the problem. We have also informed them about the necessary measures they should take in order to adapt and mitigate the problem (Agricultural extension worker, Key informant).

4.2.1. The extent and procedures of climate change awareness creation

In order to know to what extent the respondents learned about climate change from the sources they mentioned above, respondents were asked how much they have learned about climate change. As shown table 4.3; 85(46.2%) of the respondents responded that they have learned a little about climate change while 81(44%) the respondents revealed that they have learned a lot about climate change from these sources. On the other hand, 16 (8.7%) the respondent responded that they have learned not very much about climate change. Furthermore, the remaining small portion of the respondents 2(1.1%) claimed that they have not learned anything at all.

Table 4.3. The extent and procedures of climate change awareness creation

Extent and procedures of climate change awareness	Scale (Rating) Frequency(N 184)	Percent
How much have you learned about climate change from these sources you have chosen?		
1. A lot	81	44%
2. A little	85	46.2
3. Not very	16	8.7
4. Not at all	2	1.1
Total	**184**	**100**
How much would you trust information about climate change from these different sources above?		
1. A lot	102	55.4
2. A little	64	34.8
3. Not very	16	7.7
4. Not at all	2	1.1
Total	**184**	**100**
Does the above organ aware you the happening of climate change as something new or it's the thing that you have already know?		
1. Yes as something new	103	56
2. No, as something that I had already aware of	81	44
Total	**184**	**100**

If it is something you already know, how did they aware you (how do they conceptualize it)?		
	Frequency(N 81[3])	**Percent**
1. They give it new name and explanations	10	12.3
2. They conceptualize it as I have already understudied it.	50	61.7
3. They give a new name that I have never heard of, but to the fact, I know in different terms in the local environment	21	25.9
Total	**81**	**100**

If it is something new, how did they conceptualize it or how do they present it to you?		
	Frequency(N 103[4])	**Percent**
1. As something normal	8	8.5
2. They present it as issue that is less concern for me	10	9.4
3. As something that is dangerous	45	43.5
4. As something that is very worrying	40	36.7
Total	**103**	**100**

Source: Sample survey, 2019

In the in-depth interview, informants were asked about the extent or depth of their knowledge about climate changes from the sources they mentioned. These informants say that the knowledge they got about climate change is not that much adequate. One of my informants (male age 52) argued as:

> *Government workers tried to aware us about the happening of this climate change, even though they tried their best, the awareness that they provided for farmers is not that much deep and adequate. Of course, the radio always talks about the issue, but people do not give attention to the message and also does not take the issue seriously (*52 years old, in-depth interview informant).

Another model farmer in-depth interview informant also argued that:

> *Farmers have a small fraction of awareness about climate change, Other than hearing about it from different sources; they don't have enough knowledge about its causes, impacts and adaptation strategies. The awareness that has been created by governments and the*

[3] This particular item will only be responded by those respondents who responded that 'No, it's something that I had already aware of' in former question

[4] This particular item will only be responded by those respondents who responded that 'Yes as something new' in the former question

peoples from REED+ NGO[5] *are not that much enough and consistent. Farmers might have heard a lot about climate change but they only know a little about it. Because most of the time farmers think that the people from the government offices speak is just politically motivated* (Model farmer in-depth interview informant).

But despite this argument, there are some informants who said that they have learned a lot about climate change especially from Read plus NGO operating in the district and government agricultural extension workers. They argued that they have learned about the new environmental problem and its social consequences. An expert from climate change and environmental protection office also strengthened this idea by indicating that:

> *Even though we can't say that all the farmers have equal awareness and knowledge, there are some farmers who have good knowledge and understanding of climate change. We are creating awareness for farmers at different times by establishing a committee from four governmental sectors Anfillo district health sector, agricultural sector, forestry agency and climate change monitoring offices sector by including technical and financial support from REDD+ Ngo program. As a result of our awareness-raising activities, some of the farmers have now a good knowledge about the causes of climate change and its impacts. Farmers have also now started to conduct different forms adaptation practices to climate change as a result of better knowledge about future impacts of climate change and economic value of carbon compensation concepts* (The district climate change officer, key informant).

The respondents were also further asked how much would they trust information about climate change from these different sources; As it was depicted on table 4.3, 102(55.4%) these respondents responded that they trust these information lot, were as 64(34.8%) of this respondents trust this information a little. The remaining 16(8.7%) and 2(1.1%) the respondents said that they do not trust this information and they do not trust at all the information from these sources respectively.

In the in-depth interviews, many farmers have described that they trust the information they got on climate change from the sources. They further explained that they believe the information

[5]Reducing Emissions from Deforestation and Degradation (REDD+) is a part of United Nation (UN) program which is working on creating a financial value for the carbon stored in the trees. REDD+ will allow polluters to purchase cheap carbon offsets from countries in the south instead of reducing their own greenhouse gas emission at source.

they got from the various sources because they have been observing climate change and the consequences associate with it in their local environment. However, there are still some farmers who argue that they did not observe climate change and its consequences yet. Hence, they do not trust and believe in the information from different sources on the issue. There are farmers who see the awareness on climate change as just targeted for political purpose.

> *The government cadres often talk lie about so many things to deceive us; I think what they have been saying about climate change is part of those lies and political propaganda. They always command us to plant tree and practice terracing just for political purpose to waste our energy. It is just a means they make us busy and trap us for their political agendas. They just create this fake story about climate just in order to exploit our energy. (Laughed….). They are just politicizing this fake issue, look our environment is good and nothing has changed thanks to God.(*(Male, 35 years old in-depth interview informant).

There are also other farmers who think that the government and media are talking about climate change just in order to initiate people plant a tree and so that government can receive a financial benefit from foreign countries through carbon compensation. Few of the farmers think that since their local environment is green, they think that there is no climate change and the issue is not their concern.

In table 4.3 respondents were also asked about whether these sources of climate change awareness aware the farmers about the happening of climate change as something new or as something that they have already known. Accordingly, 103(56%) the respondent responded that 'Yes' this sources present or aware us about climate change as if it's something new. While the remaining 81(44%) the respondents responded that, these sources aware them the happening of climate change as it was something they know or have an awareness before.

Those respondents who have responded that these sources have aware the happening of climate as something that is new were further asked the way or how this sources of climate change awareness did conceptualize it or how did they present the happening of climate change for them. As indicated in table 4.3, 45(43.5%) of the respondents responded that these sources present the happening of climate change as something that is dangerous, while 40(36.7%) this farmers responded that they conceptualize or aware them as something that is very worrying for the future. On the other hand, 10(9.4%) responded that these sources present it as something that

fewer concerns and while the remaining small portion of the respondents 8(8.5%) say that these sources have conceptualized about the happening of climate change as something normal.

As per the data from the in-depth interview, most the informants described that they have noticed the change in weather in their local environment, but they haven't considered this change in climate, happened all over the world.

> *We have noticed the change in the weather condition since the past few years, but we have not considered it as that much big issue. The radio and people from the government most of the time keep saying (……**jijjiirama qilleensaa, jijjiirama qilleensaa**, meaning that keep saying climate change and climate change again and again). Most of the time media talk news about bad things happened in a foreign country because of climate change. Especially those people from the government offices scared and warned us that the same may encounter us if we continue destroying the forest and not take measures of environmental conservation.* (Male, 57 years old in-depth interview informant)

Experts participated in the interviews conducted for this study also describe the concerted efforts to aware the farmers about the general fact. In order to demonstrate and motivate farmers to take adaptation measure, they use stores of climate change related to accidents that happened in both foreign and within the country. They also use facts from the community related to a decrease in productivity and increase in temperature in Anfillo district as a result of climate change.

On the other hand, those 81 respondents who responded that these sources have conceptualized the happening of climate change as something they know or have awareness before were again asked how do these sources conceptualize or present the happening of climate change. As it was indicated in table 4.3; the majority 50(61.7%) of these respondents responded that these sources conceptualize the happening of climate change to the same understanding that they already have; while 21(25.9%) of the respondents responded that these sources have presented the happening of climate by giving it new name that they did not hear or practically know it before. Finally, the remaining small portion of the respondents 10(12.3%) say that these sources have conceptualized about the happening of climate change by giving it new name and explanations.

4.2.2. Chi-square test between climate change awareness and explanatory variables

Chi-square was calculated in order to investigate the association between the respondents' awareness about climate change and different explanatory variables. 10 explanatory variables

that were depicted in the conceptual framework of this study was employed for this particular purpose Accordingly the result that showed significant association will be presented in the following section (*See Appendix II)*

The crosstab or chi-square result depicted that (χ^2=16.344, df 5, P=0.006) there is positive and significant association between household head education level and climate change awareness. The trend in the association also indicated that as level household education level increase, their level of climate change awareness also increases. The test result showed that government agencies awareness creation activity is statistically significantly associated with climate change awareness (χ^2=36.113, df 1, P=0.001). And this shows that there is a positive and significant association between the two variables.

The analysis result between climate change awareness and mass media information shows (χ^2=100.623, df 1, P=0.001), which indicated significant statistical association between the two variables. Furthermore, the analysis result between accesses to awareness from local agricultural extension worker and climate change awareness indicate that there is a significant association between the two variables (χ^2=41.426, df 1, P=0.001). The analysis result between previous risk (climate change negative impact) experience in previous 10 years and climate change awareness depict that (χ^2=3,519, df 1, P=0.0061). There is statistically marginal association between the two variables. Those respondents who have experienced climate change driven hazards in past 10 years have relatively batter awareness about climate change as compared to those who did not experienced. On the other hand the analysis result between social network and climate change awareness show that (χ^2=8.93, df 1, P=0.003) which indicated significant association between the two variables. Significant association was also observed between experiencing climate change driven problems at current time and climate change awareness was (χ^2=12.063, df 1, P=0.001) this indicate that there is significant association between the two variables. Farmers who are currently experiencing climate change driven problems have more climate change awareness compared to those who are not experiencing climate change driven hazards. There is no significant association between climate change awareness and size of cultivable land, sex of responded and age of the respondent.

Though the effects are not tasted between the above significantly associated variables, most of the variables are significantly and positively associated. Thus from this significant associations we can understand that the existence of different source of information for the farmers increases their awareness level about climate change. At the same time vulnerability to different kinds of climate change hazards will also enable the farmers to have awareness about climate change. These facts are also confirmed by qualitative data in this study. The farmers have reported that as result awareness creation activities by aforementioned organ and because of livelihood challenge facing them as result of climate change they have able to have awareness or come to know about climate change.

4.3.Climate change perceptions

People's perception of climate change is highly personal, local context based, and influenced by a number of factors (Niles and Mueller 2016). Understanding farmers' perceptions and manifestation and impacts of global climate change, helps to explain why they respond to various stimuli in the way that they do and to device sustainable adaptation strategies (Opiyo et al. 2015, Yayeh and Leal 2017). For this reason, in this study attempt was made to understand the farmers' perception about climate change. To this end, a Likert scale item questions were provided for respondents to understand their feeling by choosing from strongly disagree (1) to strongly agree (5). This climate change perception items have categorized into three major parts. The first part deals the general perceptions of the respondent about climate change, the second one deals with causal perception and finally, the third one deals with risk perception about climate change.

4.3.1. General local perception of climate change

In order to determine respondents' general local perception of climate change, nine (9) items or statements scale item was provided. A five-item Likert scales question were provided for the respondents. Respondents were provided with options that range from strongly disagree (1) to strongly agree (5). The following table 4.4 summarizes the results of each item.

For all the items provided in order to measure the general perception of respondents about local climate change indicators, most of them have agreed or strongly agreed for the items. The overall mean score for the climate change general local perception items were 4.67. In order to describe

the overall general climate change perceptions of respondents so as to label them as those with favorable or unfavorable perception towards indicators of happenings of climate change, a composite score was calculated. In order to describe the result with a single score, those responses with agreed and strongly agree have been merged together to have a value of 2 point, neutral was assigned 1 point value and disagree and strongly disagree have been merged together to have 0 point score value.

Table 4.4. General local perception of climate change

Items related to general local perception	Scale					Mean Score
	Str Agree (5)	**Agree (4)**	**Neutral (3)**	**Disagree (2)**	**Str Disagre (1)**	
I recognize that the increase in temperature of atmosphere from time to time in our local environment is due to climate change.	144 (68.9%)	62 (29.7%)	_____	2 (1%)	1 (0.5%)	4.65
I believe the fact that there are widespread animal and plant diseases from time to time due to climate change	136(65.1)	64(30.6)	4(1.9)	2(1%)	3(1.4%)	4.56
I assume that crop pests become widespread from time to time due to climate change	117(56%)	75(35.9)	8(3.8)	6(2.9)	3(1.4%	4.42
The fact that there is a delay in the coming of rainfall season is due to climate change	147(70.3)	55(26.3)	3(1.4%)	2(1%)	2(1%)	4.64
I perceive that climate is changed because annual seasons have become more and more unpredictable from time to time due to climate change	150(71.8%)	51(24.4%)	4(1.9%)	3(1.4%)	____	4.86
I imagine that the length of rainy season is decreasing from time to time as a result of climate change	132(63.2%)	61(29.2%)	10(4.8%)	3(1.4%)	3(1.4)	4.92
I recognized that climate is changing because of the existence of powerful sun light hit in our local environment	132(63.2%)	71(34%)	3(1.4)	2(1%)	1(0.5%)	4.58
I perceived that climate is changing as a result of Unusual heavy rainfall every summer session in our local environment	129(61.7%)	63(30.1%)	10(4.8)	4(1.9%)	3(1.4%)	4.48

Early fruiting of our coffee results from climate change	156(74.7)	47(22.5%)	2(1%)	3(1.4%)	1(0.5%)	4.94
					Overall mean score	4.67
					Cronbach alpha value	0.789

Source: Sample survey, 2019

The maximum possible score is 18 and the minimum is 0 (zero). In order to determine whether the respondents have good perception or low perception, mean composite score is set as a cut point because the mean score is one form of central tendency measurement. Respondents having a composite score below the mean composite score were defined to have low perception. Accordingly, the survey result shows that mean composite score for general local perception item was 17.4. Whereas the minimum score is 6 and the maximum is 18 with the standard deviation of 1.57. The study found out that 85.2 % of the respondents have scored mean score of 17.4 and above. The remaining 14.8% respondents have scored a score less than the mean score. This indicates that most of the respondents have strong general perception of local climate change indicators. Likewise, the Cronbach alpha value for these items describing farmers risk perception about climate change was α=0.789 indicating that there is good internal consistency and reliability among the items.

In the in-depth interviews, session key informants were asked to picture and explain how they perceive climate change according to their local environment indicator. Most of the informants have mentioned the facts and indicators consistent with the findings in table 4.4 above. The following quotations are pieces of evidence to be mentioned.

> *Climate change is obvious in our community. The climate condition of our environment is completely different from the one before 15 years or 20 years. Before 15 and 20 years, it had been raining throughout the year and it stopped to rain only for a maximum of 3 months in a year, but nowadays there is no rain for most of the months in a year. ('**Arfaasaa'** (summer), the beginning of rain-season which is very important for the farming practice, used to start from the month of April but nowadays it might or might not starts to rain at the end of **Caamsaa/Ginbot** (May). Seasons are now completely changed from the previous months to others and the months categorized in a specific season in the past 15 or 20 years ago are no more categorized to that specific season,* (Male, 56 years old in-depth interview informant).

Another informant also described his climate change perception as:

> *I have been a farmer for more than 20 years, the rain used to rain on time but now it is not and this lead to a decrease in coffee production. I have been harvesting more than 100 quintals of coffee before 15 years. But now I barely collect 40 quintals of coffee. Things have changed now, I think this has just happened because of climate change. (52 years old, male in-depth interview informant).*

Furthermore, other informant (model farmer age 42) has also described his observation about local climate change as:

> *In previous years in* ***kollii, Dawo and Mugi*** *(name of the local kebeles)* the spring rain starts at the same time *across these three different kebeles without variation. But now there is variation in the time and amount of rain even within the same kebele. If it raining in one kebele, there is no rain in another kebele and it is sunny. I think that such variation is because of climate change in our area. On the other hand, in previous years if you take maize or coffee, these crops reach for harvesting time slowly and normally. But nowadays, the crops reached for harvesting very soon before proper harvesting time and production also decreased. I assume that this happened because of climate change* (Male, 42 years old in-depth interview informant).

Moreover, another informant has described her opinion concerning climate change with surprise as follows.

"……O my God, the weather has become so hot, the temperature is increasing, each day there is powerful sunlight that is melting our head. As the temperature has been increasing from time to time, nowadays we do not wear heavy clothes like a blanket. In addition, the weather condition has been highly fluctuating; there is no stable weather condition throughout the year; sometimes it gets a bit colder and sometimes it becomes too much hotter within the same day". (Thirty seven (37) years old Female in-depth interview informant).

4.3.2. Climate change causal perception

In order to describe farmer's causal perception about climate change, farmer respondents were provided with nine (9) statements. Respondents were provided with options that range from strongly disagree (1) to strongly agree (5). However, from the following nine items 3 of them are

wrong statements with regards to climate change causation. And that wrongness was determined based on the available literature.

Table 4.5 Climate change causal perception

Items related to causal Perception	Scale					Mean Score
	StrAgree 5	**Agree 4**	**Neutral 3**	**Disagree 2**	**StrDisagree(1)**	
Climate change is just normal fluctuation of earth's temperature	51(24.4%)	48(23%)	23(11%)	45(23.4)	42(20.1%)	**3.1**
Climate change is caused by supernatural force or God	31(14.8%)	41(19.6%)	38(18.2%)	49(23.4%)	50(23.9%)	2.77
Climate change is caused because of increase in the amount pollutant gases from factories	103(49.3%)	61(29.2)	17(8.1%)	21(10%)	7(3.3%)	4.11
Increasing population size is responsible for climate change	89(42.6%)	50(23.9%)	20(9.6%)	29(13.9%)	21(10%)	3.75
Garbage/ waste disposed to the natural environments causes climate change	83(39.5%)	80(38.1%)	11(5.3%)	23(11%)	12(5.7%)	3.95
Smoking cigarette causes climate change	76(36.4%)	72(34.4%)	20(9.6%)	22(10.5%)	19(9.1)	3.78
Deforestation of natural forest by human being causes climate change	159(76.1%)	45(21.5%)	_____	5(2.4%)	_____	4.95
Rich countries industries are responsible for our local environment climate change	116(55.5%)	59(28.2%)	10(4.8.9%)	19(9.1%)	5(2.4%)	4.23
Lumber and charcoal production by individuals cause climate change	151(72.2%)	47(22.5%)	5(2.4%)	5(2.4)		4.63
					Over all mean score	3.91
					Cronbach alpha value	0.558

Source: Sample survey, 2019

As shown in table 4.5 above, most of the respondents, responded that deforestation of natural forest by human being is the cause for climate change (97.6%, mean score 4.95), lumber and charcoal production by individuals cause climate change (94.7% mean score 4.63) and again majority of the respondents have attributed climate change to pollutant gases from industries, increase in population size and west disposed to the environment. The overall mean score for the

climate change causal perception items was 3.91. This means the majorities of the respondents' perception inclined towards agree or strongly agree of the items included in the survey for this purpose. Furthermore, causal perception items were described by a composite score. In order to describe the result with a single score, those responses with agreed and strongly agree have been merged together to have a value of 2 point, neutral was assigned 1 point value and disagree and strongly disagree have been merged together to have 0 point score value. Mean composite score is set as a cut point because the mean score is one form of central tendency measurement. The maximum possible score is 18 and the minimum is 0(zero), in order to determine whether the respondents have high perception or low perception, mean composite score is taken as a cut point. Respondents having a composite score below the mean composite score were defined to have low causal perception. The composite mean score for the causal perception item were 12.65which means 60.3% of the respondents have scored a point equal to or above mean composite score. This shows that more than half of the respondents have good causal perception about climate change. The 95% confidence interval calculation was made. The researcher is 95% confident that the mean is between (7.53, 17.77). The Cronbach alpha value for these items describing farmers causal perception about climate change was α=0.658.

In the in-depth interviews, informants have shared their views for the happening of climate change. Most of the informants attributed the happening of climate change for human factors. On the first level, they put deforestation as a cause for climate change. There are also informants who had put poverty and unemployment, urbanization as a cause for climate change. The following are some the evidence they provide for this.

> *.....Most of the lands in Anfillo district have covered with natural forest, but now people have destroying it in order to expand their farmland. I think the climate is changing as a result of this. Coffee is not giving enough products and at the same time, its price is cheap. Cost of living is getting higher and higher. Massive poverty and unemployment problem in our area is increasing from time to time. As a solution, most of the people deforest forest and produce charcoal and lumber to make living and this lead to massive deforestation of the forest resource. I think this intern driving us into problems of climate change. (57 years old male farmer)*

Other informant has also shared his perception and feeling about the cause of climate change as:

A large number of peoples now a day's migrates from rural areas to nearby urban centers., since there is little/no job or employment opportunity in urban centers, they make living by selling firewood and charcoal. There is also a higher demand in urban centers for these products. This, in turn, leads to alarming destruction of forest and eventually contributes to climate change. (Model farmer)

There are also informants who do not exactly know the real cause and those who attribute the cause of climate change the act of God.

"(…..laughing)……I don't know whether this change in climate is because of God or not. 'You yourself tell me as you are the one who is more educated' than me she said by replaying the question to me. I am just a poor woman I don't know much about it.(female farmer age 53)"

4.3.3. Climate change risk perception

In this section, the respondents were asked both quantitative and qualitative questions whether they perceive and view climate change as a risk to their life, livelihood and their environments or not. Social scientists have concluded that people's risk perceptions about climate change strongly influence the way people respond to hazards (Leiserowitz 2008). Farmers may perceive the happening of climate change in different ways and this perception includes perceiving the happening climate change either as risk or not.

According to data from in-depth interviews, most of my informants perceive climate change as a serious risk for their livelihood. As a result of climate change, they have lost many things in their local environment. Due to this, farmers perceive climate change as a risk for them. Furthermore, informants have also asked why they perceive it that way. When they described why they perceive climate change as risk, they depict that they perceived climate change as risk because of the already happened different negative impacts that emanated from climate change so far to their livelihood and also they also motioned that the terrifying stories and news about the negative impacts of climate change from mass media, government organs and other people who migrated to the area as a result of climate change driven problems. As one of the informants put it:

This thing what they call climate change worry us so much; even now in itself we have already suffered a lot because of it and I don't know what will happen to our life if things continue like this. Look 10 or 15 years ago, thanks to God I have been collecting enough amount of harvesting from my farm every year and the living condition at the time was also

*good and everything was cheap. As a result, we used to live a prosperous life, but now things have become changed. Our coffee needs to stay at least for three or four years to give enough products once now. It has stopped to produce every year as it used to do. (**isayyuu amma wanti hundumtuu ibidda** meaning that living cost has become more expensive now than before due to decrease in production and an increase in demand). If we also take maize farm, it has become unproductive and even the worse thing is that it is being affected by worms. Now everything is getting difficult and difficult from time to time and I am frightened that famine will kill our children may be one day in the near future. (68 years male farmer)*

Another informant also shared the above concern about climate change, he described the issue as:

*(……..**Jijjiiramni qilleensaa gara fulduraatti waan baayyee sodaachisaa dha;** meaning that climate change worries everybody in the future). We have heard a lot of trifling story about climate change from the radio., I heard a lot of scaring news like a lot of people were displaced, died and properties were damaged in this and that country due to a heavy storm, rain and over flooding caused by climate change. … ……. And surprisingly this problem has been affecting both developing and developed countries like the USA. At the same time, people from the government have also told and warned us that the like problem may happen in our local environment if we don't protect our environment I often imagine the damage and worry about what would happen if such accident happens to people in our country, In this poor country, definitely, we are going to die or suffer a lot. (Model farmer)*

The survey respondents also explained their concern (risk perception) about climate change by mentioning almost all of the items that were provided for this purpose as depicted in table 4.6 below. Pertinent to this, the in-depth interview participants also mentioned the real situation of the *Harar* Oromo community displaced from their homeland and resettled in Anfillo district as a result of drought-induced displacement by climate change as evidence for the risk perception.

Likert scale is also employed so as to determine whether the respondents have perceived the happening of climate change as a risk to their livelihood and environment or not. To this end, the respondents were asked whether they agree to the particular eleven statements stated to gauge their risk perception of climate change or not. For the items provided to measure the risk perception of respondents about climate change, most of them have agreed or strongly agreed for the items. The overall mean score for the climate change risk perception items was 4.50.

Table 4.6. Climate change risk perception

Items related to risk Perception	Scale					Mean Score
	StrAgree 5	**Agree 4**	**Neutral 3**	**Disagree 2**	**StrDisagr 1**	
I believe that climate change has risk to me, my family and to our community	151(72.2 %)	50(23.9 %)	2(1%)	2(1%)	4(1.9%)	4.63
The decrease in the number of various species of plants in our surrounding from time to time is due to climate change	129(61.7 %)	70(33.5)	2(1%	5(2.4%)	3(1.4%)	4.51
The decrease in the number of various species of animals in our surrounding from time to time due to climate change	122(58.4)	58(27.8 %)	10(4.8%)	15(7.2%)	4(1.9%)	4.33
I assume that the fact that we are not getting adequate amount of rain from time to time due to climate change	150(71.8 %)	55(26.3 %)	_____	3(1.4%)	1(0.5%)	4.67
Low agricultural productivity in our farming community results from climate changing	146(69.9 %)	52(24.9 %)	_____	6(2.9%)	4(1.9%)	4.57
Extreme decrease of river volume in autumn session and overflowing of the river in summer session resulted from climate change.	120(57.4 %)	58(27.8 %)	13(6.2%)	16(7.7%)	2(1%)	4.33
Heavy flood hazards in summer session that emanated from heavy rain during summer resulted from climate change problems.	124(59.6 %)	58(27.8 %)	9(4.3%)	14(6.7%)	3(1.4%)	4.37
Climate change will lead us to the condition of food shortage	135(64.6 %)	56(26.8 %)	6(2.9%)	9(4.3%)	3(1.4%)	4.48
Climate change is affecting human health	138(66%)	56(26.8 %)	8(3.8%)	6(2.9%)	1(0.5%)	4.55
As result of Climate change our family income will decrease	137(65.6 %)	64(30.5 %)	5(2.5%)	2(1%)	1(0.5%)	4.59
Soil erosion in this area is because of climate change	143(68.4 %)	53(25.4 %)	5(2.4%)	5(2.4%)	3(1.4%)	4.56
					Over all mean score	4.50
					Cronbach alpha value	0.82

Source: Sample survey, 2019

In order to describe the result with a single score, those responses with agreed and strongly agree have been merged together to have a value of 2 point, neutral was assigned 1 point value and disagree and strongly disagree have been merged together to have 0 point score value. Mean composite score is set as a cut point because the mean score is one form of central tendency

measurement. The maximum possible score is 22 and the minimum is 0(zero). Respondents having a composite score below the mean composite score were defined to have low risk perception of climate change. Accordingly, the composite mean score for the risk perception item was found to be 20.63; whereas the minimum score is 4 and the maximum is 22 with the standard deviation of 2.6. In another word, 70.3% of the respondents have scored a point equal to or above the mean composite score. This means the survey result revealed that the majority of the respondents perceive that climate change is a risk to their livelihood and their life. The Cronbach alpha value for these items describing farmers risk perception about climate change was α=0.82, this show that there is good internal consistency and reliability among the items used to understand the perception of the respondents.

4.4. Consequences of climate change

Climate change is expected to pose a serious threat to the environment, agricultural production and food security of most developing countries. Particularly, rural farmers, whose livelihoods depend on the use of natural resources, are likely to bear the brunt of adverse consequences. This is largely because most developing countries experience high poverty incidence and as a result are incapable to adapt to climate change (Acquah and Onumah 2011:1).

Respondents were asked to mention whether they have previously experienced any climate change related problems or negative impacts in the past ten (10) years., Concerning this, the majority 164(78.5%) of the respondents responded that they have experienced a climate change-related hazards impacts while on the other hand 45(21.5%) of the respondents responded that they have never experienced any climate change-related impacts.

Respondents were further asked about whether they are experiencing any forms of climate change related problems currently in their living environment., Accordingly, 194(92.8%) of the respondents responded that they are experiencing one or other forms of climate change related problems. While the remaining small portion 15(7.2%) of the respondent responded that they are not experiencing or observing any forms of climate change impacts or problems. Those 194(92.8) respondents who argued that they had observed or experienced problems related to climate change were further asked to mention the specific kinds of problems that they are currently experiencing. Table 4.7 presents detail information about this.

As it is seen from the table, most (97.9%) of the respondents have mentioned that they have experienced an increase in temperature; at the same time (89.2%) of them have experienced a decrease in the amount of agricultural production as a result of climate change. Larger proportions of these respondents i.e., 87.7%, 83.1%, 81.5 and 81% of the farmers have claimed that they have observed unpredictable fluctuations of seasons and rain; climate change is affecting human health; and observed widespread of crop pests and increase of animals' disease respectively in their environment as result of climate change.

Table 4.7. Negative consequences of climate change in Anfillo district

Negative Consequences of climate change(N194) *(Multiple response* **)**	Responses		Percent of Cases
	N	Percent	
Increase in temperature	191	9.6%	97.9%
Unpredictable fluctuations of seasons and rain	171	8.6%	87.7%
Shortage of rain and water	153	7.7%	78.5%
Widespread of animals disease	159	8.0%	81%
Climate change is affecting human health	162	8.1%	83.1%
Widespread of crop pests	159	8.0%	81.5%
Decrease in production	174	8.7%	89.2%
Food shortage	148	7.4%	75.9%
Over folding and heavy storm sometimes	100	5.0%	51.3%
Shortage of grass for cattle	130	6.5%	66.7%
Crop failure sometimes	103	5.2%	52.8%
Recurrent drought sometimes	91	4.6%	46.7%
Heavy rainfall that destroys property	113	5.7%	57.9%
Heavy powerful sun light	141	7.1%	72.3%
Total	1995	100.0%	1023.1%

Source: Sample survey, 2019

N.B: * The total number in table 4.7 is greater than the actual 209 sampled households because the respondents have given more than one response for this specific question. Similarly, the corresponding percentage to each response is calculated out of the 194(because this items were provided for those respondent who have yes in prior question) households interviewed for this study and its summation is greater than 100% due to the fact that more than one response given by respondents for the specific question.

In addition, 78.5%, 75.9%, and 72.3% of the respondents have also mentioned that they experienced problems like shortage of rain, water, and food as well as an increase in temperature

in their local environment as a result of climate change respectively. Furthermore, 57.9%, 52.2% and 51% of the respondents indicated that they have experienced climate change induced problems like that of heavy rainfall that destroy property, crop failure and over flooding and heavy storm sometimes respectively. The remaining 46.7 % of the farmers mentioned that they have experienced recurrent drought sometimes

Informants were also asked in the in-depth interview part to share their individual experiences about the negative consequences of climate change happened to them. Most of my informants mentioned that they experienced a lot of negative consequences. The following narrations quoted from excerpts are mentioned as evidence.

A widowed Woman (aged 42) expressed the negative impacts of climate change as:

> *"**Jijjiiramni qilleensaa kun miidhaa guddaa jireenya maatii koo irraan gahaa jira"** meaning that climate change is bringing a lot of problems to my family life. I used to give my children's and family enough food and water in those old good days. But nowadays the climate is changed, our agricultural production has been decreasing from time to time, our water stream has been drying. My children walk for more than one hour to just to find clean water for our drinking. I worry a lot about how to feed and survive my children in such circumstance.*

Another male farmer age 67 also further described his experience as:

> *Look, my son, our environment was, green, blessed, attractive and productive in the past. However, things have been changed recently. The weather is getting hotter and hotter every year and our coffee production has been declined in a alarming amount from year to year. I used to harvest fifty (50) quintals of coffee from just one hectare of land but now I barely harvest a maximum of eight (8) quintals from the same coffee farm. Even to get this small amount of harvest, we should wait for 4 (four) years as the coffee plant became unable to bear fruit every year. Moreover, our cattle are dying as there is no enough grass and water for them. The agricultural land has become unproductive, most people have nothing to eat and many families in our kebele are now having food only once a day. I don't know why God is doing this to us (70* years old, male in-depth interview informant).

In addition to the above problems, informants have also mentioned many more climate change driven problems. They have motioned about the increase in temperature, extreme decrease in water volume and drain of some water streams, especially during the summer season. Furthermore, they have also frequently mentioned about the increase in cattle disease and a decrease in animal production.

In addition to farmers informants, Key informant or concerned experts have also mentioned a number of the negative consequences of climate change that is occurred in the study area so far. They said that a lot of sever problems happened in Anfillo district because of climate change. The key informants mentioned that agricultural productivity has decreased, tremendously, fluctuation of rain time, the increase in soil acidity, increase in plant and cattle disease have been taking place at an alarming rate. The following are quoted from their narrations about this.

> *Anfillo district has been facing many problems, for instance, in terms of agriculture. Agricultural productivity has massively deceased because most of the agricultural activities practiced in the district are dominantly traditional and dependent on rain. Because of frequent fluctuation in the time of raining and its amount, agriculture is facing many problems. These days, rain comes out of the proper time it used to do so and disappear soon. This causes coffee to start flowering at inappropriate time and become scourge by high temperature comes soon after the disappearance of the rain which in turn results in limiting the coffee to bear beans and consequently its production decreases. The other problem is related to the delay in raining time for '**Arfaasaa'** (spring session) farming which leads to delay in harvesting into the extreme rainy season. Moreover, the increase in temperature due to climate change has created favorable conditions for the widespread of crop pests like fall armyworms which destroy crops and decrease production. These are some of the major problems facing Anfilo district due to climate change to mention a few* (agricultural extension worker key informant);

Furthermore, an expert from food security and disaster risk management office described the negative consequences that are facing *Anfillo* district as a result of climate change as:

> *So far in our district even though there is no that much frequent savior climate change driven problem that we can mention as we see on the news, there are of course some problems that the community has faced since the past ten years. In the year 2013 G.C,*

*there was landslide accident that was happened in **Yarer** kebele which have destroyed many properties. Again in 2017 G C., there was also heavy rain with strong storm rained in 6 kebeles.; As a result of this accident, crop and coffee farm was destroyed, many cattle's died and floods destroyed some houses. Nowadays as a result of climate change driven problem, every year farmers are suffering from heavy excessive rain during harvesting and of course an insect which is called 'fall armyworm' or American Gerry (*Food security and disaster risk management officer key informant).

In terms of human health, the community has been also facing water born disease like diarrhea, skin disease because of inaccessibility to clean drinking water and frequent exposure to malaria and most of all malnutrition. In terms of malnutrition, the district is categorized under the red category which means it is under chronic malnutrition area as per the national standard as described by key informants. In addition it was also motioned by the key inform about the problems facing coffee farmers. One of the key informants further elaborated the problem as follows.

According to our research center, the problems that we have identified so far in Anfillo district as a result of climate change includes, erosion of soil is increasing from time to time so does soil acidity and impact of over rain and the high sun hit on coffee test which is becoming a massive problem for farmers. Especially unpredictable fluctuation in rainfall highly impacts the normal pattern of coffee production into a very devastating condition for farmer's production and livelihood (senior plant science researcher at Jimma agricultural research center in Mugi sub-district).

4.5. Available climate change adaptation strategies

The world has responded to climate change phenomenon through two broad response mechanisms (mitigation and adaptation strategies) with the aim of moderating the adverse effects of climate change and/or to exploit any arising beneficial opportunities (Elum, Modise, and Marr 2017:1). Assuming that the ever increasing climate change related problems is important to take action at a various level at an individual, at the community level, and at government level. Having this in a mind, this study tried to investigate the existence of each level adaptation practices in Anfillo district. The findings are discussed in the following sections.

4.5.1. Community-level climate change adaptation practices

Respondents were asked about whether they are practicing any climate change adaptation practice at the community level or not. Among all respondents, only small portion 63 (30.1%) of them have responded that they are practicing one or more of climate change adaptation strategies at the community level. While the remaining majority 146(69.9%) of the respondents responded that they are not practicing any forms of climate change adaptation practices at community level.

Table 4.8. Community level climate change adaptation practices in Anfillo district

Community level climate change adaptation practices (N63) (*multiple response*)	**Frequency**		
	Responses		**Percent of Cases**
	N	**Percent**	
We (the farmer community) have established social norms (bylaws) to mitigate human activities contributed to climate change	59	13.5%	93.7%
We have limited human activities on the environment by our social norm(byelaw)	59	13.7%	93.7%
We have limited the amount of natural resources human being withdraw from the environment by our social norm(byelaw)	59	13.7%	93.7%
We have avoided indiscriminate destruction of plant species by our social norm(byelaw)	56	13.0%	88.9%
We have limited the amount of pollutants released to the environment(garbage like plastic) by our social norm(byelaw)	49	11.4%	77.8%
We have been engaging in off-farm activities to reduce the impact of farming on the environment	45	10.4%	71.4%
We have identified natural forests to be protected from human and animal intervention	54	12.5%	85.7%
We have afforested degraded areas	51	11.8%	81.0%
Total	**431**	**100.0%**	**684.1%**

Source: Sample survey, 2019

N.B: * The total number in table 4.8 is greater than the actual 209 sampled households because the respondents have given more than one response for the specific question. Similarly, the corresponding percentage to each response is calculated out of the 63 households interviewed for

this study who responded 'Yes' for prior question and its summation is greater than 100% due to the fact that more than one response given by respondents for the specific question.

In the in-depth interviews, the study participants were also asked about climate change adaptation strategies practiced in the district. Accordingly, many of my informants argued that the community level climate change adaptation practices were not that much practiced in the area. They said that there is no that much initiation among the community to do so. Among my informants (68 years old) farmers explained the issue as:

> *Even though it's so important to protect our natural environment by collaborating together, the adaptation strategies are not that much practiced in most of the kebeles in our district. Most of the time peoples think that protecting and conserving the natural environment are the duties and responsibility of the government. There are various socio-economic problems like poverty in the district. Most of the residents are busier struggling with how to fulfill daily survival needs than practicing climate change adaptation strategies.*

Another key informant also strengthens the above informant argument by arguing that:

> *First of all some farmers community have no exhaustive awareness and knowledge about the problem of climate change, its associated problems, and adaptive strategies. Farmers may hear about climate change, but this does not mean that they have adequate knowledge of about its adaptive mechanisms. In addition to this, the government has not played the required role in organizing and mobilizing the society to take different actions in order to solve the problems (**Akkan ani yaadutti mootummaan uummata sirriitti miidhaawwan jijjiirama qilleensaan walqabatee ummata miidhu danda'an barsiisuudhan,akka rakkoo kana furuuf shoora mataa isaa taphachuu qaba.** Meaning that, I think the government should clearly aware the communities about all the likely impacts of climate change related problems and at the same time organize the community to take action together). (Model farmer age 42)*

In addition to this, other in-depth interview informants have mentioned why the farming communities are not taking action collectively. They argued that there was some beginning by the community to conserve the environment in previous years , however, the efforts were unable

to succeed as expected as a result of political instability in most of the areas of the district and the weakness of the government sectors to follow up and supports,

Those respondents, who have responded that they have climate change adaptation strategies at the community level, were further asked about the specific kinds of practices they have done so far and multiple response items among which they had to choose were provided for them. According to table 4.8, most of the respondents 59 (93.7%) have indicated that the farming community have established informal community byelaws to preserve and protect their environment; by applying this byelaws most of this farmers claimed that they have limited the pressure of human activities on environment, limited the amount of natural resources human being withdraw from the environment and avoided indiscriminate destruction of plant species by using this social norm (byelaws). Furthermore, 85.7% and 81.0% of them responded that they have identified natural forests to be protected from human and animal intervention and afforested degraded areas. Finally, 77.8% and 71.4% of these respondents who have practiced climate change adaptation strategies at community responded that they have reduced the amount of pollutants garbage that released to the environment and have been engaging in off-farm activities to reduce the impact of farming on the environment.

Some of this community-based climate change adaptation and environmental protection activities were most of the time has been practiced in highland kebeles of Anfillo districts. In-depth interview part, informants were asked to describe the activities that they have practiced so far. Even though there is no that much action that was taken by collaborating farmers' community together, there are some remarkable actions that were taken so far in some kebeles.

One of my informant narrated for me what they have so far in their kebele as:

> *After the agricultural extension worker and those people from REDD+ NGO gave us awareness on climate change and associated problems, we have learned a lot. They thought us to plant trees and to protect the natural forest in our environment so that we can able to receive a financial benefit in the future. After that, we have been teaching each other about the issue during Iddir meetings and organize our self in one to five networks to protect our environment. We had formulated bylaws that can help us to control one another; we have been punishing those individuals who engage on deforestation.* (Former rural kebele leader)

Other older key informant (older farmer) also motioned a lot of issue about the methods that the community has been practicing so far to protect its environment. He narrated the practice as:

> *We Oromo people have our own norm and value system that we have been practicing to protect our environment. ("**Nuti aadaa mataa keenyaa kan abbootii keenya irraa dhaalle ni qabna".** mean that we have learned these values and norms from our ancestors.) There are kinds of tree variety that no one is allowed to cut. For example it's not allowed to cut indigenous trees like that of **Qilxuu** (*ficus vasta), ***Butujjii, Qawwoo**, **Lawwoo and Dambii** for simple reasons. In addition to this, one cannot cut a tree from the top of the mountain. Furthermore, there are certain days on which the community members are prohibited not to cut down trees because trees cannot rejuvenate if cut on such days. These days are Called "'**cagginoo'** meaning rejuvenation inhibiting days. Because if people cut a tree on this day, that tree cannot regenerate and at the same time the plant you plant on such days may not grow. So by using this norm, we have been protecting our environment, but nowadays these norms and values are disappearing, because most of the young generation failed to learn and practice such values and norms.*

Experts from climate change and environmental office and agricultural office also explained different forms of climate change adaptation practices that been conducted so far by the community in some kebeles of the district. When describing the specific action that was practiced so far by the community:

> *In five kebeles which are called Suddi, Ubur sholla, Gobi ijarrii and Garjjeedda kebeles farmers have identified a natural forest in their area and they have engaged in protecting and conserving the identified forest. Three years ago with the help of technical and financial support from REED+ NGO, we have organized the farmer's community in to program called participatory forest management (PFM); after identifying natural forests in such kebeles, farmers will form byelaws on how to conserve and protect this forests, then by classifying this forest in to different cluster and block the responsibility of conservation will be given for those farmers who are living surrounding the classified block. This environmental conservation activity has its own committee, rules, and regulations. Farmers will plant new tree varieties and protect*

natural forest which was already there; farmers will control each other not to harm the identified area by cutting trees from there and herding cattle there. By practicing these, farmers have entitled to short term and long term benefits. As short term they can hang traditional honey bee equipment, they are also entitled to use a tree that will collapse naturally or by the wind in the area and in the long term the REDD+ Ngo have promised them that it will transfer financial benefit as a form of carbon compensation for the community. Most of all as a result of taking this measure the farmers can adapt to the problem that emanated from climate change.

4.5.2. Individual-level climate change adaptation practices

The respondents were asked about whether they are practicing any forms of climate change adaptation practice at an individual level or not. Accordingly most 162(77.5%) of them responded that they are practicing climate change adaptation activities; whereas the remaining 47(22.5%) respondents responded that they are not taking any actions.

Table 4.9. Individual-level climate change adaptation strategies in *Anfillo* district

Individual level climate change adaptation practices(N162) *(multiple response)*			
	Responses		**Percent**
	N	**Percent**	**of Cases**
I do not cut down tree/plants every day for various purposes simply(deforestation)	151	21.7%	93.2%
I plant and grow at least one tree before I cut down a single tree	109	15.7%	67.3%
I use less air pollutant and renewable energy sources	13	1.9%	8.0%
I maintained trees and vegetation from damage	134	19.3%	82.7%
I am applying Mixed cropping and Mixed farming technique on my farm	136	19.6%	84.0%
I am Praying to God to protect our environment	152	21.9%	93.8%
Total	695	100.0%	429.0%

Source: Sample survey, 2019

Those respondents 162(77.5%) who responded that they are practicing climate change adaptation practices at the individual level were further asked to mention specific practices that they have been performing so far. Accordingly, most of (93.2%) the respondents have claimed that they do not cut down a tree or engage on deforestation every day and pray to God so that it can protect their environment. Furthermore, majority 84.0%, 82.7% and 67.3% of these respondents

indicated that they applying mixed cropping and Mixed farming technique on their farm, maintained trees and vegetation from damage and plant and grow at least one tree before they cut down a single tree respectively.

According to information from the in-depth interview part, most the farmers are doing most of the activities that are listed in table 4.9 as individual level practicing it. However, they are doing so just in order to improve their agricultural productivity, not with the intention of preventing climate change-related problems.

> *Coffee plantation needs a lot of tree as a shed in order to be productive, so we do not cut down trees; we rather plant different kinds of trees in it. Furthermore, after our local agricultural extension worker teaches us to plant avocado, coffee, and ginger together in order to save space, prevent soil erosion and increase productivity some farmers are trying to practice it on their farm even though it was not that much effective. (Model farmer)*

However, because of the poverty situation in the area, most of the people are making living by using forest products and also those farmers who plant trees most of the time plant *eucalypts* tree.

> *In our kebele, most of the farmer's plan eucalypts tree because it grows fast and has good economic value. However, after the farmers get education about the negative impacts of this plant that drain groundwater; there are some farmers who quit planting a large amount of eucalypts especially around their farm. Pertinent to this after the agricultural extension workers and people from the government teach the farmers about the future economic benefit of planting trees like that* ***tid , spatuala and shuwashuwe*** *(names of tree verities) as means of carbon compensation. Some farmers have started to plant different kinds of tree varieties little by little. However, there is a shortage of seed of such plants.*

An expert from climate change and environmental protection, and forest agency was also asked about the practices of farmers. They responded that, after gating awareness about the benefits of planting trees, some farmers have started planting a tree, vetiver grass in order to prevent soil erosion. An expert from climate change office describes the issue as:

> *After massive awareness creation made for the farmers about the problem that emanated from climate change and at the same the economic and environmental benefits of*

conservation practices; some farmers started to take action. Most of all there was one good success story about tree plantation in our district, there was a privet investor whose name is called Mr. Dagnew Gebremichael; by his own initiation he started to plant different kinds of tree varieties in the year 2002 G.C and on the present day he has an asset of tree which covers more 218.12 hectors of land. This plantation come up with a magnificent improvement, the area has been little bit desert but after this plantation, the weather condition of the area was improved; peoples cattle's have started to live longer than ever before; even this plantation have improved the weather condition of the hottest neighboring region Gambella. At the same time the investor is getting different kinds of benefits, he was been paid millions of money as carbon compensation, the area is also serving as a tourism destination and generating income for the investor; once again the investor is getting a large amount of money by selling some his forest product and he had received different kinds of regional and national awards for his achievement. Thus as a result of this great successes story of this investor, some of farmers and investors have initiated and started to follow the path of this investor. Peoples are planting trees individually and by different small enterprises to earn financial benefit from the forest as a form of carbon compensation. Awareness was made for the farmer that they will be paid equivalent compensation for their effort of planting trees. But so far no one has being received financial payment as a form of carbon compensation other than that successful investor. As a result, laggardness of Oromia forest agency and REDD+ Ngo to deliver their promise of carbon compensation payment for peoples, it is decreasing people's motivations.

According to table 4.9, small portions 8% of these respondents have mentioned that they are using energy sources that is less air pollutant and renewable. In an in-depth interview session, the informants were asked why people do not use clean energy sources. Their response was, people do not know what clean energy source means and most of all they responded that the government was not expanded infrastructures that can enable the people to use clean energy sources. Of my informants one model farm says:

The agricultural extension worker advises people to use biogas as their energy source and they teach farmers as if this source of energy was clean and environmentally friendly. But the problem is in order to build this biogas it needs a huge amount of money

which can be beyond the capacity of farmers. In addition to this most of the cattle are dying because of different kinds of disease and as a result there is a shortage of urine which serves as an input for the biogas.

Concerned experts have also said that the activities to transfer farmers energy source into clean energy source or biogas was on very infant level in the district; Because of financial and technical constraint to run the project. They also mentioned that even though there is a problem in the distribution of electricity in rural areas, some of the farmers have now days started to use solar energy source for lightning their house and church their mobile.

4.5.3. Climate change adaptation practices at government level

Respondents were also asked about whether the government has introduced any climate change adaptation strategies in the local community. The majority, 131 (62.7%) of the respondents have responded that the government is practicing climate change adaptation and mitigation practices. while the remaining 78(37.3%) of the respondents have responded that the government has not introduced any climate change adaptation and mitigation practices in the study setting.

Those respondents 131 (62.7%) who have responded that, the government is practicing climate change adaptation and mitigation activities, were further asked to mention the specific activities that they observed from government practices. Multiple response items were provided for the respondents to indicate government practices. As it was shown in table 4.10, the majority 82.4 %, 74.8 %, 74% and 73% of these respondents have mentioned that the government had to expand agro forestry (planting avocado, coffee and mango together) to prevent deforestation in search for agricultural land in their district by teaching farmers, enhancing forest management, afforestation/ reforestation (planting trees on communal and degraded areas) and increased use of soil and water conservation (terracing and water harvesting) technologies in their districts respectively. In addition, to this more than half of these respondents 59.5%, 58% 57.3% and 51.9 of them have indicated that the government has conducted different awareness raising and community mobilization activities on how to adapt and mitigate the problem of climate change. To this end, it introduced drought tolerant and early maturing crop varieties, distributing drought-resistant coffee varieties and Control and punishing individuals who engaged on the destruction of natural resource like that of forests illegally respectively. Only small portions (28.2 % and 21.4%) of these respondents have mentioned that the government has expanded of farm

income activity in order to reduce the impact of farming on the environment and increased the use of small scale irrigation in district respectively. The following table shows respondents response with regards to climate change adaptation strategies being introduced by the government.

Table 4.10. Government level climate change adaptation practices in Anfillo district

Government level climate change adaptation practices(N131) (*multiple response*)			
	Responses		**Percent**
	N	**Percent**	**of Cases**
Increased use of small scale irrigation	28	3.7%	21.4%
Introduction of drought tolerant and early maturing crop varieties	76	10.0%	58.0%
Introduced drought resistant coffee varieties	75	9.9%	57.3%
Increased use of soil and water conservation (terracing and water harvesting) technologies	97	12.7%	74.0%
Expanding agro forestry (planting avocado, coffee, and mango together) to prevent deforestation in search for agricultural land by teaching farmers	108	14.2%	82.4%
Enhancing forest management	98	12.9%	74.8%
Afforestation/ reforestation (planting trees on communal land and degraded areas)	96	12.6%	73.3%
Conducted different awareness raising and community mobilization on how to adapt and mitigate the problem of climate change	78	10.2%	59.5%
Control and punishing individuals who engaged on destruction of natural resource like that of forests illegally through charcoal and lumber production	68	8.9%	51.9%
Diversification of farm income activity (trade and daily labor) for community to reduce the impact of farming on the environment	37	4.9%	28.2%
Total	761	100.0%	580.9%

Source: Sample survey, 2019

The in-depth interview informants were asked to share their views and observation regarding government adaptation practices taken so far. Accordingly, some of the informants responded that the government is taking some measures even though it is inadequate. Informants described that there are attempts made by the government and NGO called REDD+ in order to combat and adapt to the problem of climate change. However, these attempts made by the aforementioned

organs are inconsistent and intended for political consumption. Of my informants, a model farmer described the situation as:

> *Five (5) years ago, the government officials were coming to our village to teach us about climate change. They told us that the world climate condition is changing from time to time and this change will have negative impacts on our environment, agriculture, and livelihood. They also taught us in a campaign form the adaptation measures that we should take to combat soil erosion by planting different kinds of trees in our area. But the teaching and mobilization were stopped after a while and most of the trees planted during the campaign could not be grown because of lack of protection.*

Furthermore, other informants have acknowledged attempts made by the government to conserve the environment by mobilizing the community. He argued that a remarkable change which will have positive implications for environmental conservation was observed with attempts done so far. But he also motioned that the measures started could not continue and most of the attempt made was to get political support from the community and not based on people's free will a As a result, people have shown the feeling of fatigue and the conservation action have more or less quitted after sometimes. Some Informants also view the government adaptation advises as a means to trap people under its political control and easily follow up their political intentions and actions.

> *The government could have done more in order to fight this problem but always what they do is politicizing things. There is no government expert who truly aware and work with the farmer about this climate change adaptation, they just do thing on paper, not on the ground. As one session campaign, they start some works here and there but without following, protecting and conserving what they have done. The other thing problem of infeasibility about experts practices and advises with regard to farmer's capacity and local environmental factor. They advise you about many things, the method of farming that we should follow, the types of crop and coffee variety that we should farm, however, most of what they advise are not practicable because economic problem that is facing farmers. The other thing is once up on time the government expert have been forcing us to dig hole so as to harvest rainwater, but they have never provided us plastic that can prevent the collected rainwater from drowning. This act rather than helping us it exposed*

*us to different problems, our cattle's have died by falling into the dig hole and malaria has been affecting our community. Most of all we have a big river, if they really think for us they can construct irrigation canal from (**Camo,** the name of local river**)** River (35 years old male farmer).*

Concerning the government level climate change adaptation practice the researcher has come up with more data. According to data obtained from most the informants, all what the government has been doing was raising some awareness about climate change and its methods of adaptation. There are also some practical interventions by the government by mobilizing the farmer's community especially with help of REDD+ NGO. However, most of these practices have problem of sustainability as they were more of campaign practices. In addition, in the recent year most this adaptation and conservation actions have faced obstacle due to political instability in the area. Furthermore, most of these adaptation strategies practiced or propagated by both government and REDD+ NGO were mainly focused on bringing physical change to the environment rather than the social ones, for instance, the attitude of the community. According to my informants, the government has not tried to provide some sort of support so far for the vulnerable farmers who are in chronic poverty and food security problem as result of decrease in agricultural productivity or crop failure due to natural hazardous related to climate change. Moreover, the government has not provided support for the community to solve the problem of water shortage resulted from climate change.

In addition to the farmer's informants, the concerned government experts have also interviewed to share their practices and achievement with regard to climate change adaptation in Anfillo district. Accordingly, the key informants have confirmed the above-mentioned views of the respondents and in-depth interview participants. Concerning this, an expert from Anfillo district climate change and environmental conservation office said:

Every year we have been undertaking environmental conservation by mobilizing the community. Through mobilizing the community we have engaged on reforestation and afforestation. We have also undertaken soil and water conservation practices. Through the Anfillo district climate change committee we have been giving awareness about methods of adaptation to climate change. The government is also facilitating and preparing conditions in order to benefit farmers through carbon compensation by making collaboration with

REDD+ NGO. Different tree varieties are being prepared and distributed to the community. But because of the existence of political instability in the area, most of the works have stopped.

Furthermore, other expertise from Anfillo district agricultural sector have also mentioned that, in order to overcome a problems of rain shortage the government is trying to expand few small scale irrigation in some more vulnerable area with help of agricultural growth program AGP[6], tried to diversify livelihood of some farmers especially by supporting to take part in other form(like that of pastoralism , vegetable and fruit farming) agriculture, providing farmers with technical capacity about better methods of farming activity that are climate change resilient and finally they have also mentioned that they provide farmers chemical when 'American Fall Armyworm ' have destroyed crop in district as pandemic.

At last other key informant experts (expert from health sector and forest agency) who have take part in the in-depth interview section have also mentioned explained some of their practices. As per expert from health sector, with regard to health sector even there are some health problems that is happening in the district a as result of climate change, but responses made so far and adaptation practices made by health sector was poor and inadequate. Even though the district health sector have reported the problem that is facing the district for concerned higher body no response have been made so far and they claimed that these problems cannot be addressed by capacity of the district health sector. Pertinent to this an expert from Anfillo district forest agency have also reviled that they are working highly on conserving and protecting forest resource in the area and working on sensitizing carbon compensation business. He also mentioned about the delay in payment of carbon compensation because the bureaucratic process at a higher level. With regard to question provided in relation punishing an individual who are destroying forest my informant described the issue as:

Through collaborative action from kebele to district level some guilt individuals because of such act have brought to justice and face charges. But the problem is there is inconsistence between Oromia regional state law and Federal level law which is creating problem. Those people who have guilt of such act will be sentenced to punishment up 15 years imprisonment;

[6]The Program Development Objective is "to increase agricultural productivity and commercialization of small holder farmers targeted by the Program and also contributes to dietary diversity and consumption at HH level."

but at federal level people will on sentenced punishment that ranges from 1 to 3 years only. As result of this vacuum peoples who have sentenced guilt at district level will take their appeal to federal level and reduces their sentence charge. As result of this vacuum individuals do not feel fear to destroy forest because of shallowness of punishment (officer from Anfillo district forest agency)

4.6. Determinant of climate change perception and individual level climate change adaptation strategies

In order to verify the determinants of climate change perception and individual level climate change adaptation strategies, 10 explanatory or independent variables were selected and different statistical test was conducted. These explanatory variables were depicted in the conceptual frame work of this study. Cross tab and binary logistic regression were calculated. Accordingly, the test statistic that has shown significant association in both tests was presented in the following part.

4.6.1. Chi Square analysis between explanatory variables and climate change causal perceptions

To identify the factors that determine farmer's perception about climate change; the previously aforementioned 10 explanatory variables in conceptual model was used for the analysis. In the present study, climate change perception was subdivided into three parts, this general local climate change perception, causal perception and risk perception. Cross tabulation test was made with these three dependent variables and the independent explanatory variables. The result depicted that only causal perception was explained by the explanatory variables, while the remaining two dependent variables were not explained by the independent variables.

The Chi-square test between climate change causal perception and the explanatory variable result was presented in the following section (*Appendix 2*). The test result showed that climate change causal perception is statistically significantly associated with climate change awareness (χ^2=9.742, df 1, p=0.002). Those respondents who have awareness about climate change from different sources tend to have good causal perception (53.3%) compared to those respondents' who have no awareness (20%). The chi square test between climate change causal perception and household head education level was (X^2=27.07, df 1, P=0.001). There is statistically significant association between the two variables.

Significant association was also observed between climate change causal perception and government agencies awareness creation (χ^2=6.776, df 1, p=0.009). This shows that there is statistical significant association between the two variables. Those respondents who have access to awareness about climate change from government tend to have good causal perception 57.3% as compared to those who do not have access to awareness 39.1%. The chi square test between farmers household head climate change causal perception and mass media information shows (χ^2=4.961, df 1, P=0.026). The test result has shown a statistical significant association between the two variables. Those respondents who have access to awareness from mass media about climate change tend to have good causal perception (53.4%) compared to those who do not have access to awareness from mass media (34.8%). The chi square test result between climate change causal perception and local agricultural extension worker awareness creation about climate change was (χ^2=4.939, df 1, p=0.026). This result has indicated that there is statistical significant association between the two variables.

Binary logistic regression analysis was employed to estimate odds ratios (OR) of the factors influencing causal perceptions of farmer's about climate change. As it was depicted on table 4.11, Education level, having awareness about climate change, access to information from mass media and having access to education or awareness from government organs and local agricultural extension worker about climate change were significant predictors of climate change causal perception. For the interpretation purpose, the 'No' category was used as base category to interpret the OR.

Farmer's household head those completed secondary education were 5.211 times more likely to have good causal perception about climate change than farmers who have no formal education or who can't read and write (p-< 0.001). As depicted in table 4.11, farmer's household head with tertiary education level education were approximately eight times (OR = 7.7, p = 0.022) more likely to have good causal perception about climate change than those farmers who can't read and write. Those respondents who can read and write or had primary education were not significantly different from those who had no formal education (can't read and write) in having good causal perception about climate change (p > 0.05). From this, we can infer that as educational level of household head increase, so does climate change causal perception.

Conversely, being able to read and write or having primary level of education may not guarantee to have good casual perception about climate change.

Keeping other variables constant in the model, respondents who responded that they were accessing awareness about climate change from government were more likely to have good climate change causal perception than those who have no access to awareness about climate change from government sources (OR = 2.084; p 0.010). As it was shown in table 4.11, respondents who have access to awareness about climate change from mass media are 2.146 times more likely to have good climate change causal perception than those who do not have access to awareness from mass media (p – value 0.028). While on the other hand, farmers who are accessing climate change awareness from local agricultural extension worker were about two times (OR = 1.882; p- 0.027).times more likely to have good climate change causal perception than those who are not gating access

Table 4.11: Results of Binary Logistic Regression Models indicating significant determinants of Causal perception and Individual CC adaptation practice

Parameters	**Causal perception (Model 1)**		**Individual CC adaptation practice (Model 2)**	
	OR (95% CI)	***p* –value**	**OR (95% CI)**	***p* –value**
Education status		.000		
Can't read and write	1		-	-
Can Read and Write	0.846(.29-2.40)	.754	-	-
Primary Education	1.58 (0.69 – 3.97)	.329	-	-
Secondary Educ.	5.21(2.08-13.07)	0.00	-	-
Tertiary Education	7.70 (1.35 – 43.88)	0.022	-	-
Previous 10 years risk experience				

No	1	-	-	-
Yes	1.28 (0.66 – 2.49)	0 .46	4.64(2.26-9.54)	0.000
Current time risk experience				
No	1	-	-	-
Yes	1.50(0.51-4.38)	0.46	12.07(3.63-40.04)	0.000
Awareness of climate change				
No	1	-	-	-
Yes	4.56(1.64-12.66)	0.04	5.82(2.43-13.97)	0.000
Government organs				
No	1	-	-	-
Yes	2.08(1.19-.38)	0 .010	2.53(1.29 -4.94)	0.006
Mass media				
No	1	-	-	-
Yes	2.15(1.087-4.238)	0.028	5.060(2.467-10.379)	0.000
Local extension worker				
No	1	-	-	-
Yes	1.882(1.07-5.295)	0.27	1.383 (7.19-2.660)	.332

4.6.2. Chi-square test between explanatory variables and individual level climate change adaptation

Chi-square test was calculated in order to investigate the association between the respondents' sex and their willingness to practice individual level climate change adaptation practices. The result showed that there is statistically significant association between male and female respondents with respect to willing to practice individual level climate change adaptation practices. (χ^2=7.964, df 1, p = 0.007).

Statistically significant association was also observed between climate change awareness and practice of individual-level climate change adaptation (χ^2=18.296, df 1, p=0.001). This shows that there is statistical significant association between the two variables. The willingness to practice individual level climate change adaptation was higher among farmers who have awareness about climate change as compared to those who have no awareness about climate change. The chi square test result between climate change awareness from government organ and

individual level climate change adaptation was (χ^2=7.964, df 1, p=0.006). There is statistical significant association between the two variables. The crosstab test result between climate change awareness from mass media and individual level climate change adaptation was (χ^2=21.724, df 1, p=0.001). The finding indicates that there is statistical significant association between mass media and individual level climate change adaptation practice. From this, we can understand that farmers who have access to awareness about climate change from different sources will tend to practice individual level climate change adaptation as compared to those who have no access to awareness.

The chi-square test result between farmers previous 10 years climate change driven negative impacts experience and individual level climate change adaptation was (χ^2=19.223, df 1, p=0.001). There is statistically significant association between the two variables. Those farmers who have experienced any climate change driven problems in past 10 years tends to practice individual level climate change adaptation strategies as compared to those who do not experience negative climate change driven impact in the past 10 years. The chi square test result between experiencing climate change driven problems at the present time and individual level climate change adaptation was (χ^2=23.967, df 1, p=0.001) which indicates statistically significant association between the two variables. Those farmers who responded that they are currently experiencing climate change driven negative impacts tends to practice individual level climate change adaptation strategies (81.4%) as compared to those who are not experiencing climate change driven problems currently (26.7%).

Access to information or education from mass media, government organization and local agricultural extension worker; current experience of climate change impact, risk experience in past 10 years and having awareness about climate change was significantly associated with individual level climate change adaptation practices. In order to determine the magnitude of these associations in terms of number or to quantify it, binary logistic regression analysis was performed. The result of the test statistic was presented in the following part.

Respondents who have reported that they have awareness or heard about climate change are more likely to practice individual level climate change adaptation strategies than those who have no awareness with odd ratio of 5.824 with $p < 0.001$. On other hand, household heads who have access to awareness, educations and training about climate change from government organ are

approximately three times (OR = 2.52, p value = 0.006) more likely to practice individual level climate change adaptation strategies than those who have no access to awareness from government organ.

Keeping all the other variables constant, respondents who had access to awareness about climate change from mass media were about five times (OR = 5.06, p value < 0.001) more likely to apply individual level climate change adaptation strategies than those who have no access to awareness from mass media. Respondents that are currently experiencing climate change driven negative problems were about twelve times (OR = 12.065, p value < 0.000) more likely to practice individual level climate change adaptation practices than those who are not currently experiencing climate change driven negative problems. Respondents who have experienced climate change driven risk in the past ten years were also about five times (OR = 4.644, p value = 0.000) more likely to practice individual level climate change adaptation strategies than those have not experienced climate change driven risk in the past ten years.

CHAPTER FIVE

5. Discussion, conclusion, and Implication

5.1. Discussion of the major findings

The ultimate goal of this study was to examine and assess farmer's awareness and perception toward climate change, consequences of climate change and available adaptation strategies in *Anfillo* district of *Kellem Wollega* zone.

In order to address the objectives of the study clearly, mixed research approach was used to collect data from 209 respondents (83.3% male and 16.7% female) through household survey and in-depth depth interview with 19 key informants constitute from different target group, which include model farmer, ordinary farmers, old age farmers, and different concerned experts. Accordingly, primary data were collected from the aforementioned respondents and informants to address the objectives of the study. Pertinent to this, secondary data sources were also employed in order to strength and cross-check finding of the study.

According to the data obtained from the survey, socio-demographically, most respondents were males because the study is household-based survey and mainly males are the head of the households who are responsible for public activities in rural area. As far as the age of the household was concerned, the significant majority (82.8%) respondents were belonged to the productive age group, between 18 and 50 years. In terms of their ethnic composition, the larger proportions (82.8%) of respondents were Oromo and 83.3% were married in terms of their marital status. The majorities (67.5%) of the respondents have attended primary and secondary education. Most (94.3%) of the respondent were engaged in the farming activity as a major source of income. More than half (51.2) of study participants have one or less than one-hectare cultivable farmland. Vast majorities (80.9%) of respondents were engaged in coffee farming and 92.3% of the farmers were practicing farming that depended on rain or rain feed agriculture.

5.2. Climate change awareness in Anfillo district

Climate change awareness and risk perception were unevenly distributed around the world (Lee et al. 2015) The highest levels of awareness (over 90%) were reported in the developed world, including North America, Europe, and Japan. In contrast, the majority in developing countries from Africa to the Middle East and Asia reported that they had never heard of climate change

(Lee et al. 2015:1015). In a similar vein study in Nigeria concluded that low level of climate change awareness or their knowledge of climate change as either inadequate or very inadequate (Oruonye 2011;Ohwo 2015). In supporting prior research finding conducted in Nigeria, a study conducted in Ethiopia also found that there lower level of climate change awareness among its study participants (Kassa 2016).

Unlike the above study findings, this study has revealed that most of the respondents (88%) have awareness about climate change. The study has confirmed that most respondents have heard or received awareness about climate change in the study area dominantly from mass media specifically from radio, from government organs, and from agricultural extension worker. The discrepancy in awareness of climate change in the study area and the other areas mentioned above was happened because of massive awareness creation campaign in the study area by the government sector and mass media that was made for farmers so far.

In *Anfillo* district there is task force or committee that was established by bringing different government sectoral offices in order to create awareness for the farmers and the general community on its cases and its different manifestations (consequences). This committee was formed by collaborating experts from four different governmental sectors in Anfillo district namely the health sector, agricultural sector, forestry agency, and climate change and environmental protection sector by including technical and financial support from REDD+ Ngo program. In supporting this fact, the data from REDD+ self-assessment report (2017) indicated that the program is creating awareness about climate change and method of adaptation throughout Ethiopia by using different means of communication channel. The means of communication indicated in the report includes awareness creation materials using print media, continuous radio, TV and print media advertisement made on various occasions (National Redd+ Secretariat 2017). The present study has also confirmed that most farmer households have getting awareness about climate change because of awareness creation campaign that was performed by REED+ programs.

A study in Marondera, Zimbabwe about the Role of Public Awareness in Climate Change Mitigation and Adaptation revealed that people were aware of climate change however; their knowledge of climate was rather general and limited. Their interpretation was more inclined to changes in weather patterns and is in contrast to the discourse on the political and scientific arena

about climate change (Madobi 2014). This study has also found that somewhat similar finding with the above study in Marondera, Zimbabwe. More than half of the respondents, who participated in the study, have argued that they have learned a little or not that much about climate change from their source of information. Some of the data from the in-depth interview also indicated that, even though farmers have heard or received awareness about climate change, but their knowledge about the issue was limited, general and not exhaustive.

According to Höijer (2017), Social representations are about processes of collective meaning-making resulting in common cognitions which produce social bonds uniting societies, organizations and groups. It sets focus on phenomena that become subject to debate, strong feelings, conflicts, and ideological struggle, and changes the collective thinking in society (2017:4).[7]

The finding of the study discloses that the majority (56%) of the respondents have been aware of climate change as something which is a new event that has happened all over the world in general and in *Anfillo* district in particular. This finding confirms that the basic assumption of social representation theory about the way new social reality was communicated for the public. Furthermore, a significant number of the respondent and most informants have confirmed that the happening climate change event was being presented for them as something which is dangerous and worrying by those sources of information. The study has also revealed that the majority of the respondents believes or trusts the awareness that being created for them by various sources. The data from the in-depth interview also confirm that most of the farming community trust the awareness created for them as result of the existence of local indicator about what being said and terrifying stories that have happened some were else.

5.3. Climate change perception

A study conducted in Australia by Reser, Bradley, and Ellul (2014), concluded that the respondents of the survey perceive and understand climate change principally in terms of

[7]*Climate change has become new social representation in the society. Different segment of society, politician, scientists, mass media and Ngo's communicating climate change as new event or discourse within the society. Society may interact through different ways about climate change and its intensity.*

extreme weather events and natural disaster manifestations and consequences. A study conducted in Ghana (2011) concluded that the majority of the farmers perceived climate change as an increase in temperature and decrease in rainfall pattern (Acquah and Onumah 2011).

On the other hand, studies conducted in Ethiopia also identified deferent perceptions of farmers about climate change. Seyoum (2017) studied farmers and policymakers' perceptions of climate change in Ethiopia; his findings revealed that farmers obviously perceived climate change based on their experience and knowledge of their local environment. The commonly cited indicators of change include high temperature, rainfall, seasonal shifts and incidence of certain diseases. (Seyoum 2017:1). Gedefaw et al. (2018) their study revealed that 90% of the respondents perceived that there is a change in climate parameters overtime. Temperature and rainfall variation are the dominant climatic variables in the study area. According the findings of this study, the most commonly climate change indicators observed by smallholder farmers were high temperature (90%), high rainfall (87%), and high wind (65%). 92% of the respondents perceived that the agricultural production dramatically decreased due to excess rainfall at harvesting time and less rainfall at its growing time.

From these, it is understood that this study has come up with similar findings from other sources discussed above. This study has revealed that farmers in the study area perceive climate change on different local indicators they observed in their surroundings. Some of the major indicators for farmers perception about climate change in *Anfillo* district includes, early fruiting of coffee without its proper time, decreasing in length of rainy season is from time to time, unpredictable on annual seasons from time to time, increase in temperature, delay in the coming of rain, increase in sun hit and increase in crop pests and animals diseases as a result of climate change. Because of these factors informants have indicated that their agricultural productivity was decreasing from time to time. Similar to this perceptions of farmers about this days rainfall pattern, it has also stated and confirmed that strong variability within Ethiopia's annual and decadal rainfall which even make it difficult to detect long term trends, and that there is no statistically significant trend in observed mean rainfall in any season for which climate data is available (1960–2006) (ECFF 2017).

5.3.1. Causal perception about climate change

Most of the time causal perceptions of farmers in most developing courtiers are diversified and so do most of the studies conducted about causes of climate change. Some studies have concluded that farmers attributed climate change to human factors while other attributes it to supernatural factors.

A Study conducted in Nigeria revealed that 55.3% of the respondents have not aware that carbon dioxide (CO2) is the major greenhouse gas contributing about 55% to global warming. Similarly, 48.7% of the respondents believed that one of the major natural causes of climate change is divine providence (act of God) (Ohwo 2015:9). Some of the study conducted in Ethiopia revealed different finding of climate change causes. According to seyoum (2017) farmers perceptions of causes of climate change are mixed: deforestation, God's wrath, human activities, and weakened indigenous practices and values. A study conducted among Borana pastoralist has confirmed that like many traditional communities in sub-Saharan Africa, a significant proportion of *Borana* smallholders consider that humanity is cursed and supernatural forces are the primary cause of climate change. Disobedience and unfaithfulness to God's rules, failure to glorify him and divergence from the age-old *Borana* tradition have led to divine punishment, especially drought events (Debela et al. 2015:10). Other study conducted in Ethiopia by Nega (2018) confirmed that substantial amount (46.6%) of the farmers perceive climate change as a curse from God and natural phenomenon than attributing climate change to human activities. Unlike these findings discussed in the above part, this study confirmed that the farmers respondents perceive or attribute the causes of climate change to a human factor rather than supernatural force (God) or other factors. This difference has happened because of extensive awareness creation made by different organs on the causes and manifestations of climate change in the study area.

Most of the respondents have attributed the cause of climate change in the study area to; deforestation of natural forest by human being, lumber and charcoal production by people by destroying forest and furthermore majority of the respondents have also attributed climate change to pollutant gases from industries, increase in population size and west disposed to the environment. Data from in-depth interview informants also confirmed that informants attributed the happening of climate change to human factors. Pertinent to this, the study has also revealed

that because of the existence of massive poverty that emanated from low agricultural productivity and which was further exacerbated by cheap price for an agricultural product(mainly coffee) and because of booming in cost of living most of the farmers making living by selling forest product. Furthermore, because of massive urbanization, people from a rural area (dominantly farmers) migrated to nearby urban centers in search for better living conditions in cities and to escape from worst living conditions in a rural area. However, because limited job opportunity that fits with farmer's ability in the urban centers, most of these migrants engage on selling firewood and charcoal(in order to make living) which was further fueled by high demand in the urban area for such products.

5.3.2. Risk perception about climate change

Social scientists have concluded that people's risk perceptions about climate change strongly influence the way people respond to hazards(Leiserowitz 2008). Farmers may perceive the happening climate change in different ways and this perception includes perceiving the happening climate change either as risk or not.

A study conducted in Kenya by Fiona (2016) Kenyan farmers' perceptions of and adaptations to climate change before and after a radio program intervention. The study concluded that farmers viewed climate change as a risk that threatened their livelihoods, with some reporting that they had suffered negative impacts such as reduced crop yields as a result of the severe weather events (such as droughts and floods) they reported to have experienced. Consequently, many (87%) reported that their exposure to the impacts of climate change weighed negatively on their emotions, with some reporting to feel despair (23%), irritated (17%), confused (16%) and angry (13%). Other studies in Ethiopia also concluded that most pastoral/ agro-pastoral study participants perceived climatic change and its negative impact on agricultural and considered climate change as a salient risk to their future livelihoods and economic development (Debela et al. 2015).

The finding of this study consists with other studies that have discussed in the above part. A significant number of farmer household head participated in the study have confirmed that they perceive climate change as a risk to their life. This study has revealed that most of the respondent

perceived climate change as it has a risk for their self, family and community. Data from key informant interview also confirmed that farmer households are perceiving climate change as a risk to their livelihood. As a result of the already happened and happening climate change problem in their local environment farmers have perceived the change in climate condition as a risk for them. Most of them have mentioned that the problem of decrease in agricultural productivity, decline in productivity was further gate into worst conditions because of economic hardship (inflation). The study participants explained that they perceive climate change as risk as a result of scary stories they hear about it from different sources; this reality, on the other hand, confirms the ideas that was found in social representation theory about the concept of **emotional anchoring**. When they described why they perceive climate change as a risk, they depict that they perceived climate change as a risk because of the already happened different negative impacts that emanated from climate change so far to their livelihood. In addition because of the terrifying stories and news about the negative impacts of climate change (especially stories related to climate change driven hazards) from mass media, government organs and other people who migrated[8] to the area as a result of climate change driven problems.

One basic assumption of social representation theory is about **Emotional anchoring**: which refers to a communicative process by which a new phenomenon is fastened to well-known emotions. That means the unknown gets recognizable as, for example, a threat or a danger to fear, something to worry for, or as something nice and pleasurable (Höijer 2017:9). Climate change has found to be anchored by the media in a mixture of well- known emotions of fear, hope, guilt, compassion, and nostalgia. By this is the scientific phenomenon of climate change turned into a social representation we can compare with other current social phenomena attached to similar emotions such as terrorism or a number of environmental risks. Media further invites us to feel compassion for endangered species and nostalgia for the idyllic past we are about to lose" (Höijer 2017:9).

The finding of this study especially those from qualitative part clearly supports the assumption of social representation theory about emotional anchoring. Because of the way media is reporting

[8]*There thousands of Harar Oromo people who have resettled in kellem wollega zone in general and in Anfillo district in particular starting from the year 2005 G.C. this people have resettled there because of drought and famine problem that have faced them back there at their previous living home.*

and narrating climate change related news (specifically in line to climate change-related hazards) people have developed risk perception about climate change.

5.4. Consequences of climate change in *Anfillo* district

Ethiopia's vulnerability to climate change risks has its root in various factors, including its geographic location and social and economic structure; Climate change generates a range of risks for Ethiopia that would affect all sectors in the country (UNDP 2011). The most vulnerable sectors to climate variability and change in the country are agriculture, water and human health (Gashaw et al. 2017)

This study confirmed that majority of the respondents experienced change related problems or negative impacts in the past ten (10) years. Furthermore, when respondents asked their experience of climate change driven negative problems in current time, most of the respondents have confirmed that they are experiencing one or other forms of climate change related problems. As per the finding of this study, the specific climate change driven problem that are being experienced by *Anfillo* district farmers are various. The major once include: increase in temperature, decrease in the amount of agricultural production, unpredictable fluctuations of seasons and rainfall, human health problem, increase in crop pests and animals disease, shortage of rain, water and food in the area as a result of climate change. Moreover, the study has also reviled the existence of climate change driven accidents or hazards sometimes. These accidents mentioned by a substantial majority of the respondents include heavy rainfall that destroys property in the summertime, crop failure and over flooding and a heavy storm that is facing the farmers in *Anfillo* district as a result of climate change.

The data from key informant interviews also substantiate most of the above realities. Most of the stories of farmers are very worrying and sad. The problem that was frequently mentioned was a problem of a decrease in the amount of agricultural productivity that was being fueled by a shortage of water and unpredictable fluctuations of rainfall. It was also confirmed by the study the increase human health problem, like that of water born disease like diarrhea, skin disease because of inaccessibility to clean drinking water and frequent exposure to malaria and most of all malnutrition.

The finding of this study corroborate to other studies; for instance study in Kenya confirms that livelihoods of households in Kenya are most hit by climate change as falling harvest and poor performance of the livestock sub-sector undermine household and national food security (Taiy et al. 2015). Most of the studies conducted in Ethiopia have also confirmed; changes in the physical environment are increasing an adverse effect on agricultural production, environment, and the overall livelihood; lost in cumulative level of over 13 percent of its current agricultural output between 1991 and 2008 as result of climate change impact and because of decline in the average annual level of rainfall (Zerga and Gebeyehu 2015:80,Asaminew 2013). A study by ECFF (2017) in Ethiopia also concluded that climate change is posing negative impacts coffee farming communities and on coffee production. They have also concluded that if the current climate change continues over the coming decades; many areas that are suitable for coffee growing in the present day will become less suitable in the future, and in some cases unsuitable.

5.5. Climate change adaptation strategies in *Anfillo* district

Climate change adaptation strategies have widely researched and theorized in different literature. A study conducted in Tanzania concludes that the farmers have generally used short season crops, drought-resistant crops, irrigation, planting dates and tree planting to adapt to the potential negative impacts of climate change on their agricultural yields (Komba and Muchapondwa 2012). Likewise, a study conducted in Western Amhara Region, Ethiopia identified that the major adaptation strategies employed by the majority of smallholder farmers included enhancing traditional irrigation, use of drought tolerant and early maturing varieties, converting farmland to tree growing and relay cropping immediately after harvesting. Whereas on the other hand the coping strategies to climate variability are largely related to migrating to urban areas, engaging in daily work, selling of fuelwood and asset while mitigation measures have focused on ecosystem rehabilitation. Institutional support to farmers' efforts to adapt to climate change is generally weak (Ayalew 2016). Nega (2018) concluded that *Farmers* were found to practice mitigation strategies such as afforestation, agroforestry and agricultural intensification as adaptation strategies and of course more than adaptation strategies.

The finding of this study has also confirmed most of the climate change adaptation strategies mentioned in other studies discussed in the above part. But unlike these studies, the present study has tried to investigate climate change adaptation strategies by classifying them into three

different levels; at the community, at an individual and at government level. From both qualitative and quantitative part the study has found out the following different types of adaptations strategies are used at the individual, community and government level.

5.5.1. Climate change adaptation practices at community level

The study has revealed that only small portion (30.1) of respondents are practicing community-level adaptation to climate change problem; where it was indicated that the majority of respondents have not practiced climate change adaptation practices at a community level. The segment of the farming community that has responded that they are practicing climate change adaptation practices at community level revealed that the farming community established informal community byelaws to preserve and protect their environment.

The data from key informant have further revealed that this community based environmental conservation and adaptation practice was initially initiated by REED+ program to protect natural forest. REDD has an idea of creating an international framework to halt deforestation. In addition, the mechanism could help fight poverty while conserving biodiversity and sustaining vital ecosystem services. Currently, Ethiopia as one of the REDD+ program implementation countries has been implementing REDD+ Program. *Anfillo* district was one the of REDD+ project implementation area specifically in five kebeles. As a result of awareness creation by the REED+ program, the farmer's community found in five *kebeles of Anfillo* district organized them self in to the program called participatory forest management (PFM). The model of the program organizes the community into community-based organizations (CBOs). These comprise villagers, recognized by all as forest stakeholders, who voluntarily enroll as members, develop internal bylaws to govern relations of their members with the forest, elect managers of their organization and formally register with the appropriate government agencies. The legalized CBO enters into a Forest Management Agreement with the relevant government body, specifying roles, responsibilities and rights of both parties (Lemenih, Allan, and Biot 2015). By establishing administrative committee and bylaws some farmers in the community have engaged on such practices. The study have also confirmed that this practice will entitle those farmers that are taking part in the program to financial benefit as a form of carbon compensation and most of all create a better climate resilient environment in the future. The study have also revealed the existence of traditional Oromo people norm and value system that been have practiced in the

study area to protect and conserve environment; however it was not being practiced effectively in present day because of weakening of this traditional institution.

Even though such a like climate change adaptation practices is a relevant approach to fight the impact of climate change, it is also revealed in this study that such strategies have only practiced in few areas and by a small proportion of the community in *Anfillo* district. As explained by most of the informants, this is due to the fact that many people think that environmental conservation is the duty of the government.; Furthermore, some of them mentioned that some people in the community have inadequate awareness about climate change and adaptation strategies or the government could not expanded the initiation evenly to most areas in the district.

5.5.2. Individual-level climate change adaptation practices

The study has also revealed that the majority (77.5) of the farmer's respondents were practicing climate change adaptation measures at individual level. It has been confirmed in the study that most of farmers are practicing individual level adaptation practice like that of protecting natural forest by abstaining from engaging on frequent deforestation activity and planting trees. Pertinent to this data from in-depth interview also revealed that some people have engaged in tree planting for one thing in order to make shed for their coffee farm as means of preventing powerful sun/warming that damages their coffee at the same time engaged in intercropping of different crops like avocado, ginger and coffee plant together on a single farmland in order to increase their productivity and adapt to climate change.

Most of them have also confirmed in this study that some individual engaged in forest planting as a new form of business or investment through the program of carbon compensation by REDD+. Because of the program and concept of carbon compensation, farmers individually or by organizing themselves by enterprise they engage on forestation investment. Those individuals who have engaged on this business were inspired as successful investor. In *Anfillo* district, there is individual who had planted more than 261 hectares of forest that benefited the society and him a lot. However, because of inability of the REDD+ and Oromia forest agency to deliver its promise (payment of carbon compensation) for the community on time, the motivation and willingness of the individuals is declining from time to time. The present study has also revealed that most of the farmers are not using clean energy source like that of biogas because of technical and financial constraint to build the necessary infrastructure.

5.5.3. Government level climate change adaptation strategies

The study has also revealed that the majority of respondents (62.7%) observed that the government is practicing climate change adaptation and mitigation practices. The major climate change adaptation strategies activities practiced by government as confirmed by the study participants includes: teaching the farming community about expanding enter cropping (planting, coffee avocado, ginger and mango together so that prevent deforestation in search for agricultural land; enhancing forest management, afforestation/ reforestation (planting trees on communal and degraded areas) and increased use of soil and water conservation (terracing and water harvesting) through mobilization of farmers community in Anfillo districts. Furthermore, the household survey showed even though the scale of its practice is not big, it is also reviled by this study that government have engaged on awareness rising about strategies to adapt to climate change driven problems, in addition, the government is attempting to introduce early maturing drought-resistant crop verities and control and punishing individuals who engaged on destruction of natural resource like that of forests illegally. As per the finding of this study the least mentioned climate change adaptation practices mentioned by the study participant in survey were the failure of the government to diversify the livelihood strategies through expanded of farm income activity to the farmers in order to reduce the impact of farming on environment and expanding the small scale irrigation infrastructure in Anfillo district.

On the other hand data from the in-depth interview also revealed that most government climate change adaptation strategies were based on community mobilization. However, as the approach used by the government is mainly based on obligation and intended for political purpose, the community felt fatigue and became slow in fully implementing the adaptation practices. Furthermore, the problem of sustainability about these strategies was also emphasized by the study participants. Most of the started practices have stopped because they are mainly single time campaign, lack close follow up because of the weakening of government sectors as result of political instability in the area. These made the sustainability of the program in question for the time being. The study has also come up with fact that adaptation strategies advised by the government was viewed by the farmers as if it was abstract and ineffective to practice as per the financial and technical ability of the farmers. The experts interviewed have also revealed that some beginning was made by the government even though they are not adequate. For instance an

attempt made to control fall armyworm through chemical has become more or less effective; however activities made in order to solve health problems in the district was become unsuccessful because of the absence of response from higher body; once again it has also confirmed that there is a problem with regard to punishing individual who are destroying forest, problem was created because of inconsistency between Oromia regional state law and Federal level law; while the former say 15 years of prison for the act the latter only say 3 years. As a result peoples take appeal to federal level and reduce their sentence.

5.6. Discussion of determinant factors for causal perception and individual level adaptation strategies.

5.6.1. Determinants of climate change causal perceptions

The result of binary logistic regression to identify predictor variables of causal perception has revealed different magnified of the determining factors. Causal perception of farmers was determined by education level of household farmer especially tertiary and secondary level education. Tertiary education had higher impact on causal perception compared to secondary education. From this, we can infer that, as level of farmer's education increases to higher education status, their causal perception about climate change will also increase. Whereas there was no significant difference between those have no formal education and those who can read write or attended primary education. In agreement with our finding, different studies conducted in other parts of Ethiopia reported that household education level determines perception about climate change (Debela et al. 2015, Assaye 2016, Nega 2018). Unlike these studies, most previous studies treated the level of education as those educated and those who do not. But the present study has measured the impact of each level education on causal perception. Furthermore, none of previous studies have treated causal perception about climate change as single independent variable; rather, they just treated this perception as climate change perception. However, this study has treated climate change perception into three different major parts.

Access to awareness about climate change from government organs, mass media, and local agricultural extension worker have determinants of good causal perception holding a different degree of determining capacity as it was shown in data presentation part. The result of this study also confirmed the finding study conducted in Nigeria which revealed that there were significant

variations in respondents' perception of the causes. The variations were attributable to differences in educational status and sources of information on climate change by respondents (Ohwo 2015). We can conclude that different discourses about climate change from various sources can determine climate change causal perception.

5.6.2. Determinants of individual level climate change adaptation strategies.

It was revealed in this study that, currently experiencing different climate change driven problems will significantly determine farmers to practice individual level climate change adaptation strategies. The other significant determinant of individual-level climate change adaptation includes awareness or education from government organ or from mass media. Pertinent to this, it was also revealed in this study that experiencing climate change in past 10 years has also determined individual level climate change adaptation practices.

Studies conducted in different parts of Ethiopia theorized different determinants of farm level climate change adaptation practices. For instance, a study by Asrat and Simane (2018) identified Farmers' adaptation decision is influenced(determined) by household size, the gender of household head, cultivated land size, education, farm experience, non-farm income, income from livestock, climate information, extension advice, farm-home distance and number of parcels. Ayalew (2016) also concluded that Gender, education, off farm activity, farm size, ownership of oxen, farmer to farmer extension, access to credit and information on climate change are determinants of adaptation to climate change and variability.

As it was depicted in this study, all of them have mentioned that access to information significantly determines climate change adaptation strategies. Like prior mentioned study in the above part, the finding of this study have also revealed that access to information or awareness about climate change significantly determine individual level climate change adaptation practices. However unlike other studies, this study has not just treated information's or awareness from different sources as a single variable, rather this study have treated each sources awareness as an independent predictor by their own so that which information source will determine more about individual-level climate change adaptation practices. Thus, as it was depicted in this study this sources of awareness have their own significant power to determine the adaptation strategies. As far as the major information source is concerned, it was confirmed

by the study that information from mass media was the major on as compared to the others. Unlike to those other studies discussed in the above part household heads education level, sex, age and size of cultivable was not found as a significant determinant of climate change adaptation strategies in this study. On the other hand as per the result of this study current time and past 10 years' experience of climate change driven problem are found to determine individual level climate change adaptation strategies. As far as the literature review of the researcher was concerned these factors have not been mentioned in other related studies as a predictor variable. The major reason why these two factors have determined individual level climate change adaptation in *Anfillo* district can be because of the existence of different kinds of climate change driven problems in the district that was experienced by farmers which are forcing them to take actions. From this, we can understand that the more climate change driven problems faced by the farmer, the more he/she is going to practice individual level climate adaptation practices in order to solve problems facing him/her.

5.7. Conclusion

The study attempted to understand farmer's awareness, perception consequences of climate change and its adaptation strategies. The farmers in *Anfillo* district have heard about climate change. Various awareness creation platforms through mass media, government organizations and REDD+ program have contributed for their awareness. Despite this, all farmers have no equal level of awareness about climate change. For some of them, awareness about climate change is just a tiny one which is very general and limited. The procedures or the means used to aware farmers have contributed positive impact on farmer's level of awareness and trust about climate change. Stories and local indicators that have been used by climate change awareness creators have triggered farmer's awareness about climate change.

Farmers have also got their own collective consciousness about climate change from local symptoms and indicators. They perceive that there is climate change because there is an increase in temperature, increase crop and animal disease, decrease and fluctuation of rainfall season, diminish in agricultural productivity and early fruiting of the coffee plant in the area. However, there is no universal right and identical way of perceiving climate change. Thus, despite the indicators of climate change that being propagated by climate change discourse commentators

(mass media, scientists and politicians) farmers in *Anfillo* district has their own ways of understanding or perceiving the happening of climate change from local indicators. For instance, most of the time global climate change discourse commentators presents indicators like fast melting's of ice berg, increase in sea level, wild fire and accident like storms and hurricane as indicators of climate change. Trough such social constriction of reality by this aforementioned group, people perception of climate change may be been constructed through such way. Nevertheless, the farmers in the study area never experienced exactly the same events mentioned above by other communities elsewhere. But still, some elements of these discourses have able to shape the way farmers in *Anfillo* district view or perceive climate change in a general sense.

It is difficult to find a universally identical way of understanding about climate change causation. In conforming to global scientific discourse about climate change, most farmers in Anfillo district have attributed the happening of climate change to anthropogenic or human factors. Even though most of the studies conducted in developing countries including Ethiopia have theorized that most farmers attribute climate change to supernatural power (act of God) most of the farmers in *Anfillo* district have attributed the causes of climate change to human factors like that of deforestation. Mainly deforestation was identified by most of the farmers and experts as cause of climate change. Such kind of causal perception was developed by these farmers because of enormous awareness creation that was conducted by different organs. The study further confirmed that poverty and unemployment is forcing farmers to engage in such acts as a means of alternative livelihood.

Problems emanated from incidence of climate change, at the same time social pressures and discourse from different groups (mass media, government) is shaping farmers risk perceptions of climate change. Farmers in the district have clearly perceived climate change as a risk for their livelihood and environment. This is because there are chronic climate change driven problems that are facing the farming community especially in relation to a decline in agricultural productivity; climate change was being perceived as a risk. For one thing because of the feeling of pessimism about the future, because of limited capacity to adapt or coping to climate change driven problems and current worst livelihood challenges faced by farmers, climate change was being perceived by farmers as something risky. In addition, to these, climate change related

discourses, stories and the negative consequences of climate change that is occurring in different parts of the world is also triggering climate change risk perception among these farmers.

Because of the nature of their job, obviously farming, which is vulnerable to climate change effects, most of the farmers have fully aware of the impacts of climate change that was manifested in their livelihood and environment. Many of climate change driven problems that are facing most of the farmers all over the world are also facing farmers in Anfillo district. Social, economic and environmental challenges have being faced by these farmers as a result of climate change driven problems. The major problem that was faced by the farmer in the district as a result of climate change includes water shortage, health problem, increase in temperature and decline in agricultural productivity mainly coffee production. The area is mainly known for its cash crop production (coffee production) and the livelihood of most farmers depended on this cash crop. However, because of the enormous decline in its productivity as a result of fluctuation in climate, farmer's livelihood is getting into a devastating situation if things continue like this. In view of the fact, coffee production is the base for the livelihood of the farming community in the study area, the lowering of its production from time to time exacerbating other socio-economic problems. This will have even a negative implication for the economy of the country as well. Since Ethiopia's source of foreign currency depends largely on agriculture especially on coffee export, things will be complicated more and more if appropriate and timely measures are not taken to reduce the negative impacts of climate change on coffee production. Similarly, the decrease in other agricultural production which expose some farmers to poverty and farmers to engage in deforestation and the selling of forest products like charcoal triggers or reinforce the already happening climate change. Thus, from this we can understand the vicious circle of climate change driven problems.

In *Anfillo* district attempts to respond to climate change driven problems at individual, community and government level are to some extent have been showing remarkable results even though it is still far away from effective and adequate. The program initiated by the REDD+ program about the idea of carbon compensation is bringing positive result in practicing adaptation strategies to climate change driven problem. The idea of carbon compensation through selling forest has inspired many farmers either in private or by joining together to participate in forest development which is one means of adaptation practice. Present forest

plantation as a new form of investment through carbon compensation has many positive implication for the general society as it makes them feel optimism about future benefit from carbon composition and encourage them to practice the adaptation strategy. As a result of the decrease in agricultural productivity, some farmers are forced to take different adaptation measures in order to solve their problems.

The climate change adaptation practices implemented by the government in Anfillo district was more or less based on community mobilization. However, this adaptation strategies practiced by the government are more or less focused on physical environment rather than social or changing the attitude of the community and improving the livelihoods of the destitute farmers. The adaptation strategies undertaken by government so far did not make efforts to support the livelihood of the highly vulnerable farmers which are suffering from climate change driven negative problems. Other than mobilizing the community to engage in environmental conservations (soil and water conservation), there is no that much concert practices performed by the government so far. Climate change responses so far performed by the government at the district are not systematically designed to address the problems of the farmers that are poor, most vulnerable and environmental challenged. In general, most of this adaptation taken at each level are more of toward physical environment and have not included the social dimensions or other options to tackle the problems. If things continue like this there is a possibility for the study area to face critical food shortage created by climate change.

5.8. Implications of the study for research and policy

The finding of this study have revealed some important finding about climate change, based on this finding the researcher would like to discuss the policy and research implications of this study.

5.8.1. Policy implication

First of all the researcher would like to recommend about problems related to implementations of polices. As once up on a time quoted by former US president Barak Obama (2012), “Climate change is no longer some far-off problem, it is happening here, it’s happening now”. Thus responding to climate change driven problems at every level is very important and mandatory if we need to adapt to the problems. As usual, Ethiopia has no problem of policy but the problem is

implementation, for instance, the climate resilient green economy of Ethiopia claims that [The CRGE Vision outlines Ethiopia's ambition to build a climate resilient green economy by 2025. The strategy claimed that Ethiopia is committed to building a climate-resilient green economy. Its plan to do so comprises actions to reduce greenhouse gas emissions while safeguarding economic growth ("green economy") as well as adaptation in silence")]. But the problem is that this CRGE strategy has not walked the talk. As it was confirmed by this study most strategies claimed to be practiced was unpracticed in the study area. Rather than always formulating ambitious policy and strategies, it is better if policies formulated in a feasible manner. Furthermore, policies and adaptations strategies that designed to deal with climate change issue should take in to account local farmer's perceptions and understanding of climate change.

As it was revealed in this study because of inconsistence between Oromia regional state law and Federal government to punish individuals found guilty because of deforestation it has become to deter people from such acts. The former sentences prison up to 15 years whereas the latter only sentence punishment from 1 to 3 years. As a result of this vacuum peoples who have sentenced guilt at district level will take their appeal to the federal level and reduces their sentence charge. Thus punishment is not playing its deterrence role as a result of this fact. Thus the law should be revisited and revised so that consistent sentence for the same act of offenses so that deforestation can be prevented.

As it was revealed by this study some sort of farming community is practicing community-level climate change adaptation practices at the community level. However the work done so far in terms of adaptation was never been adequate thus, national policies should support local climate change adaptation strategies. Strong institution and system that can widen knowledge on climate change hazards and knowledge on adaptations strategies in which works towards integrating adaptation and the country's economic development strategies. For the reason that the biggest challenge for the countries growth is problems emanated from climate change, the time to take action is now and only now.

Climate change adaptation strategies have only focused on physical adaptation to climate change. However, emphasis should also give for social dimension. Measures should be taken in order to support the vulnerable group of farming community like that women's and resource-poor farmers. In addition to this, as it has been reviled by this study the farmer's livelihood is

getting into devastating conditions because of the decline in agricultural productivity that emanated from climate change driven problems. It is also revealed in this study that farmers engaged in deforestation because of the rise in the cost of living. Thus relevant livelihood diversification measures should be incorporated into policy measures for farming community that area suffering because of climate change. Climate change adaptation and economic development should be seen as two sides of the single coin in different policy and strategies of Ethiopian if the country really needs to realize the economic development she always clime to happen in near future.

5.8.2. Research implication

The finding presented in this paper still leaves a number of unanswered questions for which more research is called for. In this study, the REDD+ program was the most effective strategy in dealing with climate change driven problems. Because of the program, most farmers were able to get awareness about climate change. Most of all farmers planting tree massively either individually or by collaborating together because of optimism about carbon compensation. Thus further research is more important to investigate about this program independently. The role, impact, and possible associated problem; the associated problem may be about benefit sharing from carbon selling can be studied, Further other researchers can investigate about this climate change issue by using the sociological theory of functionalism by relating the functional aspect of climate change. For instance massive afforestation practices do have number socioeconomic functions. Further study can also be conducted by including social exchange theory to better explain the relationship between climate change adaptation program and society. Because such kind of climate change adaptation practices not only saving planate earth, but we can make more money for development on the process. Thus more studies that can connect the like dots are required.

This study has not exhaustively studied each specific forms of climate change with regard to climate change negative impacts especially in line to social impact with regarding assessing magnitude of climate change impact across different farming community. More research can be conducted on this issue by applying Ulrich becks risk society thesis especially by applying the concept of the boomerang effect of modernity. Finally, further study should be conducted about the concept of ***Cagino,*** which have been helping the community to conserve the natural

environment as it was indicated in this study. Independent study can be conducted on such concept about how to integrate this practice into policy measure.

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Appendix II. Instruments of data collection

Jimma University

College of Social Sciences and humanities

Department of Sociology

Information sheet

Climate change Discourse and local perspectives: Farmers Awareness, perceptions and Adaptation Strategies in Anfillo District of Kellem Wollega Zone

Dear respondent!

The aim of this questionnaire is to collect data for the study entitled **Climate change Discourse and local perspectives: Farmers Awareness, perceptions and Adaptation Strategies in Anfillo District of Kellem Wollega Zone.** The study will be conducted for the requirements for the completion of Masters of Arts degree in Sociology (concentration on social policy) at Jimma **University.** Your response to the survey items will highly contributes to the success of the study. To this end, your participation and genuine response to the questions is invaluable to the success of the study. Trust that the information you provide will be kept strictly confidential and serve for academic purpose only. No need of writing your name or any personal identification. Thus, I kindly ask your cooperation in filling this questionnaire truthfully.

Thank you for your cooperation!!

Interviewer‘s name: _____ Signature: _____
Date: _____

Section 1: General Information

Questionnaire ID Number: _____

Name of the Kebele: _____

Agro ecology (*HL, MA, LL)* _____

Section 2: Socio-demographic and socio-economic profiles of respondents

Instruction: Please choose the appropriate answer that reflect your opinion and put the number of your choice in the box provided or circle the number of your choice which best represent your

1	Sex (Male=1,Female=2)	
2	Age of the respondent (18- 35=1, 36- 50=2, 51- 64=3, 65 and above =4)	
3	What is your ethnicity? (Oromo=1, Amhara=2, Mao=3 Others=4_____.	
4	Marital Status (Not Married = 1, Married = 2, Divorced =3, Widowed = 4)	
5	Highest Educational Level of Head of the Household attained (Illiterate =1, reading and writing =2, primary education (Grade 1-6)=3 , secondary education (Grade 7-12) =4, vocational training=5, tertiary education=6)_____	
6	What is your main source of income (Farming = 1, Commercial Activity = 2, Daily Labor =3, other= 4 _____	
7	Ownership of Cultivable Farmland (Do not have Farmland= 1, One Hectare and less =2, 1.1-2 Hectare=3, 2.1-3 Hectare=4, Above 3 Hectare =5)	
8	What kinds of agricultural activities you are dominantly practicing on your farm? (multiple answer is possible) Crop farming=1, Livestock raising=2, Coffee farming=3, both crop and coffee farming=4, other=5_____	
9	What types of agriculture you practice? Rain fed=1, Irrigation farming=2, Mixed=3, other specify=4_____	

Section 3. AWARNESS AND ITS DISCOURSE

1	Have you ever heard about climate change? Yes=1, No=2	
2	If you say 'Yes' for the above question number 1, from where have you heard about climate change? indicate your response by putting **"✓"** from the following options	

No	**Climate change induced problems**	**Yes**	**No**
1	Government organ		

		2	The mass media(radio, television, local men media,)		
		3	From friends		
		4	From my educated family members		
		5	Local agricultural extension worker		
		6	From our peasant association(farmers union)		
		7	From our religious institution		
		9	From social network (like that of Iddir ,Ekub, Debo, and One to five network)		
		10	If other please specify_____		
4	How much have you learned about climate change from these sources of your choice? 1. A lot 2. A little 3. Not very 4. Not at all				
5	Does the above organ aware you the happening of climate change as something new or it's the thing that you have already know? 3. Yes as something new 4. No, its something that I had already aware of				
6	If it is something you already know, how did they name it (how do they conceptualized it)? 4. They give it new name 5. They name it to the concept that I already have 6. They give new name that I have never heard of, but to the fact I know in different terms 7. If other please specify_____				
7	If it is something new, how did they conceptualize it or how do they present it to you? 1. They present it as something normal phenomena 2. They present it as issue that is less concern for me 3. As something that is fear full (risk full) 4. As something that is worrying 5. If other please specify it_____				
8	How much would you trust information about climate change from these different sources above? 5. A lot 6. A little 7. Not very 8. Not at all				

4 Farmers perception about climate change

1. How did you perceive the happening of climate change, its cause and extents of its risks in your local environment? The following statements are provided in order to know how you perceive climate change in this area. Please tell us your levels of agreement by choosing from (1.Strongly Disagree, 2. Disagree, 3. Neutral, 4. Agree to 5 Strongly Agree) that best describe your feeling.

No	**Statements**	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
2	I recognize that the increase in temperature of atmosphere from time to time in our local environment is due to climate change	5	4	3	2	1
3	I believe the fact that there is a widespread of animals and plant diseases from time to time due to climate change	5	4	3	2	1
4	I assume that crop pests become widespread from time to time due to climate change	5	4	3	2	1
5	The fact that there is delay in the coming of rain season is due to climate change	5	4	3	2	1
6	I perceive that climate is changed because of annual seasons have become more and more unpredictable from time to time due to climate change	5	4	3	2	1
7	I imagine that the length of rainy season is decreasing from time to time as result of climate change	5	4	3	2	1
8	I recognized that climate is changing because of the existence of powerful sun light hit in our local environment	5	4	3	2	1
9	I perceived that climate is changing as result of Unusual heavy rainfall every summer session in our local environment	5	4	3	2	1
10	Early fruiting of our coffee results from climate change	5	4	3	2	1
	Causal perception					
11	Climate change is just normal fluctuation of earth's temperature	5	4	3	2	1
12	Climate change is caused by supernatural force or God	5	4	3	2	1
13	Climate change is caused because increase in the amount pollutant gases from factories	5	4	3	2	1
14	Population size increase is responsible for climate change	5	4	3	2	1
15	Garbage/ waste disposed to the natural environments causes climate change	5	4	3	2	1
16	Smoking cigarette causes climate change	5	4	3	2	1
17	Deforestation of natural forest by human being causes climate change	5	4	3	2	1
18	Rich countries industries are responsible for our local environment climate change	5	4	3	2	1
19	Lumber production by individuals cause climate change	5	4	3	2	1
	Risk perception					

20	I believe that climate change has risk to me, my family and to our community	5	4	3	2	1
21	The decrease in the number of various species of plants in our surrounding from time to time due to climate change	5	4	3	2	1
22	The decrease in the number of various species of animals in our surrounding from time to time due to climate change	5	4	3	2	1
23	I assume that the fact that we are not getting adequate amount of rain from time to time due to climate change	5	4	3	2	1
24	Low agricultural productivity in our farming community results from climate changing	5	4	3	2	1
25	Extreme decrease of river volume in autumn session and overflowing of river in summer session was resulted from climate change.	5	4	3	2	1
26	Heavy flood hazards in summer session that emanated from heavy rain during summer were resulted from climate change problems.	5	4	3	2	1
27	Climate change will lead us to the condition of food shortage	5	4	3	2	1
28	Climate change is affecting human health	5	4	3	2	1
29	As result of Climate change our family income will decrease	5	4	3	2	1
30	Soil erosion in this area is because of climate change	5	4	3	2	1

Section 5. Climate change and its consequences

1. Have you ever experienced any climate change effects in the past 10 years? 1. Yes 2. No		
2. Are there climate change induced serious negative impacts in this area? 1. Yes 2. No		
3. If your answer for the above question number 2 is "Yes", which of the following effects of climate change have you ever experienced? It is possible to give more than one answer.	**Yes**	**No**
1. Increase in temperature		
2. Unpredictable fluctuations of seasons		
3. Shortage of rain/water		
4. Drying of steams and river		
5. Widespread of animals and plants disease		
6. Climate change is affecting human health		
7. Widespread of crop pests		
8. Decrease in production		
9. Food shortage		
10. Over folding and recurrent drought		
11. Shortage of grass for cattle		
12. Crop failure		
13. Recurrent drought		
14. Heavy rainfall that destroy property		
15. Heavy powerful sun light		

16. If others please specify,_____	

Section 6. Adaptation to climate change

	6.1. Adaptation to climate change at community level		
1	Do you have any Climate change adaptation/mitigation practices at community level (social response)? 1. Yes 2. No		
2	If you say yes for the above questions No 1 (please choose either Yes or No to best describe your practices		
	Statements	Yes	No
3	We (the farmer community) have established social norms (byelaws) to mitigate human activities contributed to climate change		
4	We have limited human activities on environment by our social norm(byelaw)		
5	We have limited the amount of natural resources human being withdraw from the environment by our social norm(byelaw)		
6	We have limited the frequency of natural resources utilization by our social norm(byelaw)		
7	We have avoided indiscriminate destruction of plant species by our social norm(byelaw)		
8	We have limited the amount of pollutants released to the environment by our social norm(byelaw)		
9	We have been engaging in off-farm activities to reduce the impact of farming on environment		
10	We have identified natural forests to be protected from human and animal intervention		
11	We have afforested degraded areas		

	6.2. Adaptation to climate change at individual level		
12	Did you practice any Climate change adaptation/mitigation practices at individual? 1.Yes 2. No		
13	If you say yes for the above questions (please choose either Yes or No to best describe your practices		
	Statements	Yes(practiced)	No(don't practiced)
14	I do not cut down tree/plants every day for various purposes		
15	I plant and grow at least one tree before I cut down a single tree		
16	I use less air pollutant energy sources		
17	I maintained trees and vegetation from damage		
18	I am applying Mixed cropping and Mixed farming technique on my farm		
19	I am Praying to God to protect our environment		

	6.3.Adaptation to climate change at government level		
20	Does the government introduced any climate change adaptation strategies in your local environment ? 1. Yes 2, No		
	If you say yes for the above questions (please choose either Yes or No to best describe government practices		
	Statements	Yes	No
21	Increased use of small scale irrigation		
22	Introduction of drought tolerant and early maturing crop varieties		
23	Introduced drought resistant coffee varieties		
24	Increased use of soil and water conservation (terracing and water harvesting) technologies		
25	Expanding agro forestry (avocado, coffee, mango,		
26	Enhancing forest management		
27	Afforestation/ reforestation (planting trees on communal and farm land)		
28	Conducted different awareness rising and community mobilization on how to adopt and mitigate the problem of climate change		

Interview guide Questions for key informant interview (elder farmers and model farmers)

1. Have you heard about climate change before? If yes from where have you heard?
2. Are you aware of the changing climate? If yes how do you become aware of?
3. Does any governmental and nongovernmental organ that helped you to get awareness about climate change? (probing: if yes who are they?)
4. Does the awareness you received from this organ a new thing or something you have already aware of it? Or Something you know already? Is there any practical indicator in your local environment for this awareness you get?
5. In the past 10 have you ever noticed more unusual weather in this area ? if yes, can you explain it for me?
6. Did you really believe the happening of climate change?
7. How do you perceive the happening climate change? Can you picture it for me?

8. What factors enable you to realize the happening of climate change? Or what are the indicators?
9. What do you think causes climate change in this area?
10. Did you think that climate change can be risk for peoples life in this area? If Yes how ? if NO why?
11. When do you expect the effects of climate change to take place?
12. Does the happening of climate affected peoples livelihood negatively so far in this area? If yes how?
13. What are the major impacts that happened to you livelihood and your local environment so far? (probe: economic, social, productivity, cattle health and human health impacts)
14. Has climate change ever affected the health of any of your family or friends?
15. How well can you picture these consequences of climate change?
16. Have you or anyone you know taken any actions to adapt/cope to climate change?
17. What have you done already to adapt to/deal with/cope with climate change?
18. Have the government taking any measures to tackle the problem of climate change? If yes, explain it?
19. Did you see this intervention as effective? If Yes how? if No why
20. Do you have any informal mechanisms of adaptation to climate change that you are implementing in this area to tackle the problem of climate change? If yes explain it? If No why (what factor preventing you not to do so)?
21. What did you recommend to tackle or prevent the problem of climate change?

Interview guide questions for key informant experts (health professionals, agricultural extension workers and experts from climate change prevention sectors)

1. Do you think climate change is happening in this area? If yes when did you started to realize it?
2. What are the indicators for the happening of climate change in this area?
3. Have you aware this happening of climate change for the farmers? (do the farmers know the happening of climate change?)
4. How did you think the farmers picture or perceive the happening of climate change in this area?

5. What are the determinant factors that shape this awareness and perception of farmers as per your understanding?
6. Did you think that climate change can negatively affect the livelihood of community in general and farmers in particular in this area?
7. If you say that climate change is affecting the community; how it is doing so in this area?
8. How does climate change is negatively affecting the community economically, socially, in terms of peoples and their cattle health, farming productivity and finally Anfillo area physical environments?)
9. Did you think that the farmers is perceiving the happening of climate change as a risk or not?
10. Is there any intervention masseur (adaptation or mitigation measures) for climate change that is taken so far by different concerned body to tackle the problem?
11. If yes by who do the measure was taken? And what are those measures?
12. Is there any knowledge transfer for the farmers by government to tackle the climate change problems? If yes, do the farmers adopted it?
13. Does the Ethiopia's Climate-Resilient Green Economy Strategy has implemented in this area so far? If yes can you explain it for me?
14. Is there any traditional community bylaw or any strategies that is practiced by local community that did you know? If yes can you explain it for me?
15. What is your recommendation that you suggest in order to tackle this problem of climate change that is expected from governments, NGO's and farmers community?

Appendix II: Association Between Explanatory variables

Have you ever heard about climate change? * Government organ

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	**36.113[a]**	**1**	**.000**
Continuity Correction[b]	**33.579**	**1**	**.000**
Likelihood Ratio	**45.419**	**1**	**.000**
Linear-by-Linear Association	**35.940**	**1**	**.000**
N of Valid Cases	**209**		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 11.00.
b. Computed only for a 2x2 table

Crosstab

			Government organ		
			No	Yes	Total
Have you ever heard about climate change?	No	Count	25	0	25
		% within Have you ever heard about climate change?	100.0%	0.0%	100.0%
	Yes	Count	67	117	184
		% within Have you ever heard about climate change?	36.4%	63.6%	100.0%
Total		Count	92	117	209
		% within Have you ever heard about climate change?	44.0%	56.0%	100.0%

Have you ever heard about climate change? * Mass media

Chi-Square Tests

	Value	**df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	**100.623a**	**1**	**.000**
Continuity Correctionb	**95.529**	**1**	**.000**
Likelihood Ratio	**89.634**	**1**	**.000**
Linear-by-Linear Association	**100.142**	**1**	**.000**
N of Valid Cases	**209**		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.50

b.

			Mass media		
			No	**Yes**	**Total**
Have you ever heard about climate change?	**No**	**Count**	**25**	**0**	**25**
		% within Have you ever heard about climate change?	**100.0%**	**0.0%**	**100.0%**
	Yes	**Count**	**21**	**163**	**184**
		% within Have you ever heard about climate change?	**11.4%**	**88.6%**	**100.0%**
Total		**Count**	**46**	**163**	**209**
		% within Have you ever heard about climate change?	**22.0%**	**78.0%**	**100.0%**

Have you ever heard about climate change? * Local agricultural extension worker

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	**41.426**[a]	**1**	**.000**		
Continuity Correction[b]	**38.680**	**1**	**.000**		
Likelihood Ratio	**50.070**	**1**	**.000**		
Fisher's Exact Test				**.000**	**.000**
Linear-by-Linear Association	**41.228**	**1**	**.000**		
N of Valid Cases	**209**				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.17.

CC awareness * Highest Educational Level of Head of the Household attained

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	**16.349**[a]	**5**	**.006**
Likelihood Ratio	**15.764**	**5**	**.008**
Linear-by-Linear Association	**10.547**	**1**	**.001**
N of Valid Cases	**209**		

a. 4 cells (33.3%) have expected count less than 5. The minimum expected count is 1.08.

Have you ever heard about climate change? * Highest Educational Level of Head of the Household attained Crosstabulation

			Highest Educational Level of Head of the Household attained						
			can't reading and writing	reading and writing	primary education	secondary education	vocational training	tertiary education	Total
Have you ever heard about climate change?	No	Count	10	4	7	3	0	1	
		% within Have you ever heard about climate change?	40.0%	16.0%	28.0%	12.0%	0.0%	4.0%	
	Yes	Count	22	32	48	61	13	8	
		% within Have you ever heard about climate change?	12.0%	17.4%	26.1%	33.2%	7.1%	4.3%	
Total		Count	32	36	55	64	13	9	
		% within Have you ever heard about climate change?	15.3%	17.2%	26.3%	30.6%	6.2%	4.3%	

Crosstab

			Local agricultural extension worker		
			No	Yes	Total
Have you ever heard about climate change?	No	Count	**25**	**0**	**25**
		% within Have you ever heard about climate change?	**100.0%**	**0.0%**	**100.0%**
	Yes	Count	**60**	**124**	**184**
		% within Have you ever heard about climate change?	**32.6%**	**67.4%**	**100.0%**
Total		Count	**85**	**124**	**209**
		% within Have you ever heard about climate change?	**40.7%**	**59.3%**	**100.0%**

Have you ever heard about climate change? * Have you ever experienced any climate change effects in the past 10 years?

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	**3.519**[a]	**1**	**.061**
Continuity Correction[b]	**2.613**	**1**	**.106**
Likelihood Ratio	**3.161**	**1**	**.075**
Linear-by-Linear Association	**3.502**	**1**	**.061**
N of Valid Cases	**209**		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.38.

Crosstab

			Have you ever experienced any climate change effects in the past 10 years?		
			No	Yes	Total
Have you ever heard about climate change?	No	Count	**9**	**16**	**25**
		% within Have you ever heard about climate change?	**36.0%**	**64.0%**	**100.0%**
	Yes	Count	**36**	**148**	**184**
		% within Have you ever heard about climate change?	**19.6%**	**80.4%**	**100.0%**
Total		Count	**45**	**164**	**209**
		% within Have you ever heard about climate change?	**21.5%**	**78.5%**	**100.0%**

Have you ever heard about climate change? * Are there climate change induced serious negative impacts in this area?

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	**12.063**[a]	**1**	**.001**
Continuity Correction[b]	**9.366**	**1**	**.002**
Likelihood Ratio	**8.500**	**1**	**.004**
Linear-by-Linear Association	**12.006**	**1**	**.001**
N of Valid Cases	**209**		

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 1.79.

Crosstab

			Are there climate change induced serious negative impacts in this area?		
			No	Yes	Total
Have you ever heard about climate change?	No	Count	**6**	**19**	**25**
		% within Have you ever heard about climate change?	**24.0%**	**76.0%**	**100.0%**
	Yes	Count	**9**	**175**	**184**
		% within Have you ever heard about climate change?	**4.9%**	**95.1%**	**100.0%**
Total		Count	**15**	**194**	**209**
		% within Have you ever heard about climate change?	**7.2%**	**92.8%**	**100.0%**

Have you ever heard about climate change? * From social network (like that of Iddir ,Ekub, Debo, and One to five network)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	**8.930**[a]	**1**	**.003**
Continuity Correction[b]	**7.499**	**1**	**.006**
Likelihood Ratio	**14.709**	**1**	**.000**
Linear-by-Linear Association	**8.887**	**1**	**.003**
N of Valid Cases	**209**		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.98.

b. Computed only for a 2x2 table

Crosstab

			From social network (like that of Iddir ,Ekub, Debo, and One to five network)		
			No	Yes	Total
Have you ever heard about climate change?	No	Count	**25**	**0**	**25**
		% within Have you ever heard about climate change?	**100.0%**	**0.0%**	**100.0%**
	Yes	Count	**134**	**50**	**184**
		% within Have you ever heard about climate change?	**72.8%**	**27.2%**	**100.0%**
Total		Count	**159**	**50**	**209**
		% within Have you ever heard about climate change?	**76.1%**	**23.9%**	**100.0%**

Causal perception * Mass media

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	**4.961**[a]	**1**	**.026**
Continuity Correction[b]	**4.245**	**1**	**.039**
Likelihood Ratio	**5.029**	**1**	**.025**
Linear-by-Linear Association	**4.937**	**1**	**.026**
N of Valid Cases	**209**		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 22.67.

Crosstab

			Mass media		
			No	Yes	Total
causal_score	low causal perception	Count	**30**	**76**	**106**
		% within causal_score	**28.3%**	**71.7%**	**100.0%**
	good causal perception	Count	**16**	**87**	**103**
		% within causal_score	**15.5%**	**84.5%**	**100.0%**
Total		Count	**46**	**163**	**209**
		% within causal_score	**22.0%**	**78.0%**	**100.0%**

Causal perception * Highest Educational Level of Head of the Household attained

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	**27.079**[a]	**5**	**.000**
Likelihood Ratio	**27.929**	**5**	**.000**
Linear-by-Linear Association	**21.069**	**1**	**.000**
N of Valid Cases	**209**		

a. 2 cells (16.7%) have expected count less than 5. The minimum expected count is 4.44.

		causal score				Total	
		low causal perception		good causal perception			
		Count	% within causal score	Count	% within causal score	Count	% within causal score
Highest Educational Level of Head of the Household attained	can't reading and writing	22	20.8%	10	9.7%	32	15.3%
	reading and writing	26	24.5%	10	9.7%	36	17.2%
	primary education	32	30.2%	23	22.3%	55	26.3%
	secondary education	19	17.9%	45	43.7%	64	30.6%
	vocational training	5	4.7%	8	7.8%	13	6.2%
	tertiary education	2	1.9%	7	6.8%	9	4.3%
Total		106	100.0%	103	100.0%	209	100.0%

Causal perception * Government organ

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	**6.776**[a]	**1**	**.009**
Continuity Correction[b]	**6.070**	**1**	**.014**
Likelihood Ratio	**6.819**	**1**	**.009**
Linear-by-Linear Association	**6.744**	**1**	**.009**
N of Valid Cases	**209**		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 45.34.

Crosstab

			Government organ		
			No	Yes	Total
causal_score	low causal perception	Count	**56**	**50**	**106**
		% within causal_score	**52.8%**	**47.2%**	**100.0%**
	good causal perception	Count	**36**	**67**	**103**
		% within causal_score	**35.0%**	**65.0%**	**100.0%**
Total		Count	**92**	**117**	**209**
		% within causal_score	**44.0%**	**56.0%**	**100.0%**

causal_score * Local agricultural extension worker

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	**4.939**[a]	**1**	**.026**
Continuity Correction[b]	**4.332**	**1**	**.037**
Likelihood Ratio	**4.964**	**1**	**.026**
Linear-by-Linear Association	**4.915**	**1**	**.027**
N of Valid Cases	**209**		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 41.89.

Crosstab

	Local agricultural extension worker		Total
	No	Yes	

causal_score	low causal perception	Count	**51**	**55**	**106**
		% within causal_score	**48.1%**	**51.9%**	**100.0%**
	good causal perception	Count	**34**	**69**	**103**
		% within causal_score	**33.0%**	**67.0%**	**100.0%**
Total		Count	**85**	**124**	**209**
		% within causal_score	**40.7%**	**59.3%**	**100.0%**

Causal perception * climate change awarness

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	**9.742**[a]	**1**	**.002**		
Continuity Correction[b]	**8.456**	**1**	**.004**		
Likelihood Ratio	**10.377**	**1**	**.001**		
Fisher's Exact Test				**.002**	**.001**
Linear-by-Linear Association	**9.695**	**1**	**.002**		
N of Valid Cases	**209**				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 12.32.

causal score * Have you ever heard about climate change? Cross tabulation

			Have you ever heard about climate change? No	Yes	Total
causal score	low causal perception	Count	**20**	**86**	**106**
		% within causal score	**18.9%**	**81.1%**	**100.0%**
	good causal perception	Count	**5**	**98**	**103**
		% within causal score	**4.9%**	**95.1%**	**100.0%**
Total		Count	**25**	**184**	**209**
		% within causal score	**12.0%**	**88.0%**	**100.0%**

Climate change adaptation practices at individual * Sex

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	**7.396**[a]	**1**	**.007**
Continuity Correction[b]	**6.239**	**1**	**.012**
Likelihood Ratio	**6.658**	**1**	**.010**
Linear-by-Linear Association	**7.361**	**1**	**.007**
N of Valid Cases	**209**		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.87.

b. Computed only for a 2x2 table

Crosstab

			Sex Male	Female	Total
Did you practice any Climate change adaptation/mitigation practices at individual?	No	Count	**33**	**14**	**47**
		% within Did you practice any Climate change adaptation/mitigation practices at individual?	**70.2%**	**29.8%**	**100.0%**
	Yes	Count	**141**	**21**	**162**
		% within Did you practice any Climate change adaptation/mitigation practices at individual?	**87.0%**	**13.0%**	**100.0%**
Total		Count	**174**	**35**	**209**

	% within Did you practice any Climate change adaptation/mitigation practices at individual?	**83.3%**	**16.7%**	**100.0%**

Climate change adaptation practices at individual * Government organ

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	**7.694**[a]	**1**	**.006**
Continuity Correction[b]	**6.796**	**1**	**.009**
Likelihood Ratio	**7.668**	**1**	**.006**
Linear-by-Linear Association	**7.657**	**1**	**.006**
N of Valid Cases	**209**		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 20.69.

Crosstab

			Government organ		
			No	Yes	Total
Did you practice any Climate change adaptation/mitigation practices at individual?	No	Count	**29**	**18**	**47**
		% within Did you practice any Climate change adaptation/mitigation practices at individual?	**61.7%**	**38.3%**	**100.0%**
	Yes	Count	**63**	**99**	**162**
		% within Did you practice any Climate change adaptation/mitigation practices at individual?	**38.9%**	**61.1%**	**100.0%**
Total		Count	**92**	**117**	**209**
		% within Did you practice any Climate change adaptation/mitigation practices at individual?	**44.0%**	**56.0%**	**100.0%**

Climate change adaptation practices at individual *mass media

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	**21.724**[a]	**1**	**.000**		
Continuity Correction[b]	**19.900**	**1**	**.000**		
Likelihood Ratio	**19.421**	**1**	**.000**		
Fisher's Exact Test				**.000**	**.000**
Linear-by-Linear Association	**21.620**	**1**	**.000**		
N of Valid Cases	**209**				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.34.

Crosstab

			Mass media		
			No	Yes	Total
Did you practice any Climate change adaptation/mitigation practices at individual?	No	Count	**22**	**25**	**47**
		% within Did you practice any Climate change adaptation/mitigation practices at individual?	**46.8%**	**53.2%**	**100.0%**
	Yes	Count	**24**	**138**	**162**
		% within Did you practice any Climate change adaptation/mitigation practices at individual?	**14.8%**	**85.2%**	**100.0%**
Total		Count	**46**	**163**	**209**
		% within Did you practice any Climate change adaptation/mitigation practices at individual?	**22.0%**	**78.0%**	**100.0%**

Climate change adaptation practices at individual? * Previous 10 risk experience

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)

Pearson Chi-Square	**19.233**[a]	**1**	**.000**		
Continuity Correction[b]	**17.506**	**1**	**.000**		
Likelihood Ratio	**17.204**	**1**	**.000**		
Fisher's Exact Test				**.000**	**.000**
Linear-by-Linear Association	**19.141**	**1**	**.000**		
N of Valid Cases	**209**				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.12.

b. Computed only for a 2x2 table

Crosstab

			Have you ever experienced any climate change effects in the past 10 years?		
			No	Yes	Total
Did you practice any Climate change adaptation/mitigation practices at individual?	No	Count	**21**	**26**	**47**
		% within Did you practice any Climate change adaptation/mitigation practices at individual?	**44.7%**	**55.3%**	**100.0%**
	Yes	Count	**24**	**138**	**162**
		% within Did you practice any Climate change adaptation/mitigation practices at individual?	**14.8%**	**85.2%**	**100.0%**
Total		Count	**45**	**164**	**209**
		% within Did you practice any Climate change adaptation/mitigation practices at individual?	**21.5%**	**78.5%**	**100.0%**

Climate change adaptation practices at individual? * current time risk experience

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	**23.967**[a]	**1**	**.000**
Continuity Correction[b]	**20.928**	**1**	**.000**
Likelihood Ratio	**19.268**	**1**	**.000**
Linear-by-Linear Association	**23.853**	**1**	**.000**
N of Valid Cases	**209**		

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 3.37.

b. Computed only for a 2x2 table

Crosstab

			Are there climate change induced serious negative impacts in this area?		
			No	Yes	Total
Did you practice any Climate change adaptation/mitigation practices at individual?	No	Count	**11**	**36**	**47**
		% within Did you practice any Climate change adaptation/mitigation practices at individual?	**23.4%**	**76.6%**	**100.0%**
	Yes	Count	**4**	**158**	**162**
		% within Did you practice any Climate change adaptation/mitigation practices at individual?	**2.5%**	**97.5%**	**100.0%**
Total		Count	**15**	**194**	**209**
		% within Did you practice any Climate change adaptation/mitigation practices at individual?	**7.2%**	**92.8%**	**100.0%**

Climate change adaptation practices at individual? * Have you ever heard about climate change?

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	**18.296**[a]	**1**	**.000**

Continuity Correction[b]	**16.177**	**1**	**.000**
Likelihood Ratio	**15.396**	**1**	**.000**
Linear-by-Linear Association	**18.208**	**1**	**.000**
N of Valid Cases	**209**		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.62.

b. Computed only for a 2x2 table

Crosstab

			Have you ever heard about climate change?		
			No	Yes	Total
Did you practice any Climate change adaptation/mitigation practices at individual?	No	Count	**14**	**33**	**47**
		% within Did you practice any Climate change adaptation/mitigation practices at individual?	**29.8%**	**70.2%**	**100.0%**
	Yes	Count	**11**	**151**	**162**
		% within Did you practice any Climate change adaptation/mitigation practices at individual?	**6.8%**	**93.2%**	**100.0%**
Total		Count	**25**	**184**	**209**
		% within Did you practice any Climate change adaptation/mitigation practices at individual?	**12.0%**	**88.0%**	**100.0%**