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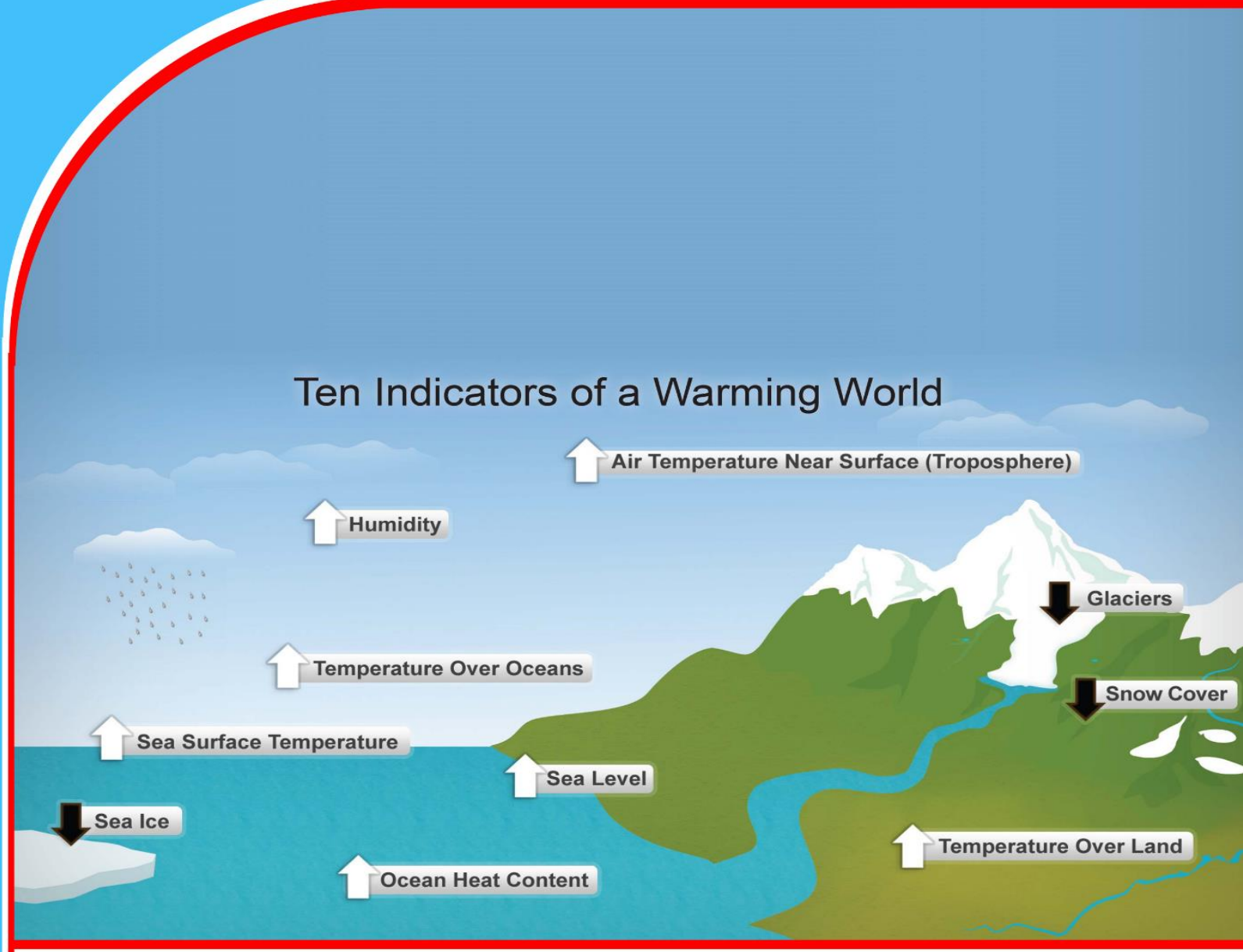

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Bekele Tona Amenu

Wolaita Sodo University, Department of Natural Resources Management
P.O. Box, 01, Tarcha, Ethiopia
E-Mail of the Corresponding Author: bekelet20007@gmail.com or bekele.tona@yahoo.com

Abstract

Purpose: This study aimed to fill this gap by assessing and investigating the perception of farmers' towards climate change and their adaptation responses Essera woreda. The study was conducted in Essera district to achieve the general objective, which is to investigate the perception of farmers' towards climate change and their adaptation responses. Taken as a whole, this study assessed the potential impact of climate change on farmers' socio-economic and the options for adaptations, in order to provide a meaningful insight and contribute to efforts aimed at ensuring sustainable development of farmers.

Methodology: The study involved a combined sampling, i.e. a combination of purposive, stratified, and simple random sampling procedures to select the study area and sample households.

Results: From the sample of 80HH, the result indicates that 79% of the heads of household are male that means 63 male headed 17 female headed households were used. The results revealed that respondents' age, educational status, sex, family size, access to extension services, wealth (farm size, number of farming oxen, cattle, ruminant animals and pack animals), farming experience and exposures to mass media have positive/negative and significant effect on farmers perception on climate change and adaptation. In addition, it indicates that the female-headed households are more likely perceive climate change and take up adaptation methods as they have more affected by climate change. Moreover, farmers living in the lowland areas have perceived climate change as compared to midland and highlands. This is due to the fact that lowland areas are already hotter and a marginal change in temperature could be perceived easily. As observed from the study, farmers live in kola agro-ecological zone are more perceived than farmers in woyina dega. Moreover, access to credit has negative and significant effect on climate change perception and adaptation.

Unique contribution to theory, practice and policy: Governmental institutions like agriculture and natural resources management office, meteorology agency, research institution, universities and NGOs have to facilitate research and extension services to provide adequate extension information services to ensure that farmers receive up-to date information about rainfall and temperature patterns in the forthcoming season so that they can make well informed decisions about their planting dates.

Key words: *Farmers' perception, climate change, adaptation, mitigation and Essera*

1. INTRODUCTION

1.1. Background

Climate change refers to any significant change in the measures of climate lasting for an extended period of time. In other words, climate change includes major changes in temperature, precipitation, or wind patterns, among other effects, that occur over several decades or longer (IPCC, 2007).

Climate change is real and its first effects are already being felt all over the world. Climate change will compound existing poverty and is expected to have serious environmental, economic, and social impacts of Ethiopia particularly rural farmers, whose livelihood depend on the use of natural resources, are likely to bear the brunt of adverse impacts. The extent to which these impacts are felt depends in large part on the extent of adaptation in response to climate change (Glwadys, 2009).

Agriculture is the main sector of the Ethiopian economy. It contributes about 52% of the GDP, generates more than 85% of the foreign exchange earnings, and employs about 80% of the population. Despite its high contribution to the overall economy, this sector is challenged by many factors, of which climate-related disasters like drought and flood (often causing famine), are the major ones. Knowledge of the adaptation methods and factors affecting farmers' choices enhances policies directed toward tackling the challenges that climate change is imposing on Ethiopian farmers. Climate change refers any change in climate over time through natural variability or as a result of human activities (IPCC, 2007a).

Studies indicate that Africa's agriculture is negatively affected by climate change. Adaptation is one of the policy options for reducing the negative impact of climate change. Adaptation to climate change refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (Adger, W Neil, Nigel W Arnell, and Emma L Tompkins, 2005). Societies, organizations and individuals have adjusted their behavior in response to past climatic changes, and many are now contemplating adapting to altered future climatic conditions. Much of this adaptation is reactive, in the sense that it is triggered past or current events, but it is also anticipatory in the sense that it is based on some assessment of conditions in the future (Adger *et al*., 2005).

1.2. Statement of the problem

Food insecurity and undernourishment is the most acute challenge in Sub-Saharan Africa. These challenges have been compounded by effects of climate change that result either in heavy flooding or drought that destroy farm produce and causes crop failure respectively (Negatu, 2016).

Agricultural productivity is highly dependent on weather, climate and water availability, and is adversely affected by weather and climate related disasters. Failure of rains and occurrence of natural disasters such as floods and droughts could lead to crop failures, food insecurity, famine, loss of property and life, mass migration, and negative national economic growth (Sivakumar, 2005).Crop failure and food shortage can result from what appears to be a minor and much localized decrease in annual precipitation (Hassan, 2002). Among the many challenges

constraining Ethiopian agriculture, none is more severe than that caused by its overwhelming dependence on weather and climate (EPCC, 2015).

Farmers are the most susceptible to climate change that it affects directly or indirectly their productivity especially precipitation and temperature. They have direct impact on agricultural productivity and indirect impact through by pests on crops, reducing water availability and increasing natural resources degradation. Agriculture-based livelihood systems that are already vulnerable to food insecurity face immediate risk of increased crop failure, new patterns of pests and diseases, lack of appropriate seeds and planting material, and loss of livestock.

According to (WFP, 2009), it will also affect all four dimensions of food security: food availability, food accessibility, food utilization and food systems stability. Food insecurity is a condition that put impact on population that usually experience food shortage. It must be analyzed in the context of climate variability, climate change and uncertainty in order to minimize its future impact.

Climate variability has an impact on human health, livelihood assets, food production and distribution channels, as well as changing purchasing power and market flows. Its impacts can be categorized in to both short term, resulting from more frequent and more intense extreme weather events, and long term, caused by changing temperatures and precipitation patterns. People who are already vulnerable and food insecure are likely to be the first affected (WFP, 2009).

As different reports the problem of food insecurity has been challenging the livelihoods of the rural households in the study area whose existence is largely dependent on agriculture. Taking this in to consideration, this study aimed to fill this gap by assessing and investigating the perception of farmers' towards climate change and their adaptation responses Essera woreda.

1.3 Objectives of the study

1.3.1 General objective

The general objective of this study was to investigate the perception of farmers' towards climate change and their adaptation responses.

1.3.2. Specific objectives

1. To evaluate the perception of farmers towards climate change
2. To identify the impacts of climate change in the study area
3. To identify the adaptation practices implemented in the study area

2. LITERATURE REVIEW

2.1. Concepts of climate change

Climate changes refer to a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decade or more (IPCC, 2007). Climate change may be due to internal processes and/or external influences such as changes in solar radiation and volcanism that occur naturally and contribute to the natural variability of the climate system. External influences that are caused by human activity are the change in the composition of the atmosphere that began with the industrial revolution. Nowadays, there is strong scientific evidence that the average temperature of the Earth's surface is increasing due to greenhouse gas emissions. For instance, the average global temperature has increased by about 6 ^{0}C since the late 19th Century. Also the IPCC (Intergovernmental Panel on Climate Change) scenarios project a temperature rise of 4–5 ^{0}C and an average sea level rise of 10 cm by 2100. Warming, however, is expected to vary considerably in the space and time dimension and may affect many climatic and meteorological variables such as precipitation, temperature, humidity, wind speed, evaporation and evapotranspiration. Moreover, each variable can be described by its frequency distribution and its distribution over space and time and thus may be affected differently (Negash and Niehof, 2004).

2.2. Impacts of climate change

2.2.1 Social impacts of climate change

Climate change affects food production across the globe. Food production is a crucial centerpiece of each culture and it is badly threatened due to increasing levels of carbon dioxide entering the atmosphere. Additionally, farmers also have to deal with increased incidence of extreme weather events and higher temperatures. This has affected the overall health of people, especially those living in third world countries. There has been an increase in cases of malnutrition or death as well as injury and diseases due to extreme weather events like storms. This will cause the migration of both humans and also animals. In some instances, it may result in social conflicts and war as communities fight for food or clean water (Daniel, 2013).

Some environmental stressors related to climate change have both immediate and lasting impact on the physical and psychological health of urban residents. Chief among these stressors are severe weather events, extreme heat and disease transmission. The structures of cities have the potential to exacerbate these climate-related health risks. For example, urban form results in increased air temperature due to the urban heat island effect, more intense precipitation and thunderstorms, and in some cases reduced natural drainage (Rebecca, 2010)

Impacts such as rising temperatures and increased frequency of extreme weather events put severe pressure on food availability, stability, access and use. Availability of agricultural products is affected by climate change directly through impacts on crop yields, crop pests, diseases, soil fertility and soil water-holding properties. There is a well-accepted prediction that climate change

will and already has caused severe regional water shortages. As water stress increases, we will likely experience much more unstable global food production along with decreased biodiversity, and damaged ecosystems. Record droughts in recent years in places like China, Australia, Brazil, and Kenya as well as floods in Pakistan, Australia, and Columbia, have already made drastic imprints on food production and in turn, global food prices. This, consequently, is expected to create both internal and external social conflicts around the globe due to a limited supply, and increased competition over water resources *(http://climateactionnetwork.ca/).*

2.2.2 Economic impacts of climate change

The effects of gradual climate changes and extreme weather events in the recent past have undermined progress in the alleviation of poverty and food insecurity, while also having a negative effect on overall development efforts. Economic sectors that largely depend on weather conditions either directly or indirectly most notably agriculture and fisheries are increasingly subject to the impacts of climate change. Moreover, the depletion of natural resources, as a result of increased environmental and demographic pressures, tends to aggravate the severity of climate change impacts. All in all, there are increasing concerns about the rising threats to current income and consumption patterns of households and individuals that earn their livelihoods from these sectors (Collier *et al*., 2008).

Climate change brings about a variation in net world product, which could be minus or plus 5 percent. However, even the smallest changes can result in comparatively huge variations in the national economies. One industry that is normally affected by such changes is the widely held insurance industry. In fact, a report done in 2004 by British Insurers discovered that the changing climate systems increase the risks for property and households by about 5% per annum (Madison, 2006).

Furthermore, claims for flood and tornado compensations in Britain had also increased twofold during the period of the report. Consequently, insurance premiums are so costly such that in certain places it is almost impossible for people to afford storm and flood insurance. Agriculture, transportation and food are also affected adversely by global warming. This results in an overall slowing down of development in most countries. Temperature variations cause damage to roads, railway lines, pipelines, water mains and airport runways and so on. Hence, additional efforts and money are needed to renew and maintain the entire system. Areas that experience permafrost are unfavorably affected resulting in badly damaged airport runways and crumpled roads(Davies, 2015).

2.2.3 Ecological impacts of climate change

Life on Earth is profoundly affected by the planet's climate. Animals, plants, and other living beings are moving, adapting, and in some cases dying as a result of climate change, affecting not only individual species but the ecosystems on which humans depend. At the request of the United States Geological Survey, the National Research Council convened an expert committee to identify examples of ecological impacts of climate change to serve as the basis for an educational booklet

for a public audience. This booklet explains, in lay terms, basic scientific concepts about climate change, ecological changes that have already been observed or are anticipated to occur in the near future, and how humans may influence the effects of climate change on ecosystems *(http://dels.nas.edu/Report/Ecological-Impacts-Climate-Change/).*

2.3. Climate change mitigation and adaptation

2.3.1. Climate change mitigation

'Mitigation' in the climate change regime refers to the regulation of greenhouse gases (GHGs) in the atmosphere. Forests contribute to mitigation by three avenues: (i) reducing emissions by avoiding deforestation and forest degradation; (ii) protecting the existing forests; and (iii) increasing the sink effect of forests by land use, land-use change and forestry activities (LULUCF). As mitigation regarding LULUCF is protection of existing forests and, simultaneously, reducing emissions from deforestation and forest degradation is a key concern of climate change. In the Kyoto Protocol, protection and enhancement of forests, promotion of sustainable forest management practices and afforestation and reforestation are listed among possible policies and measures for achieving emission limitation and reduction commitments. As the protocol countries also have an obligation to account for the outcome of afforrestation, reforestation and deforestation activities when reporting about the achievement of their commitments. Furthermore, countries can on a voluntary basis include in the national accounting system additional human-induced activities that have taken place since 1990, including effects of forest management. Finally, afforestation and reforestation (AR) are eligible activities within the CDM (Simula, 2008).

Managing forest resources has become one of the most important agenda in climate negotiations, which has resulted in proliferation of financial mechanisms such as Clean Development Mechanism (CDM) and Reducing Emissions from Deforestation and Forest Degradation (REDD). The CDM was proposed by the Kyoto protocol as an instrument to reduce emissions with particular purpose of enhancing cooperation between developed and developing countries in mitigating climate change. The CDM assists developed countries implementing their emission reduction at low cost; and developing countries receive capital for environmentally acceptable and economically viable forest investments that contribute to sustainable development. Similarly, REDD opens an opportunity for the development of sustainable forest management and utilization in developing countries which have historically experienced high rates of deforestation and forest degradation due to financial and technical constraints(Yitebitu, 2010).

Sustainable forest management contributes significantly to mitigation of harmful effectsof greenhouse gasses. In general, the term mitigation refers to all activities aimed at reducing green-house gas emissions and / or removal of CO2 from the atmosphere with the aim of stabilizing CO2 concentrations. Actions which can be taken in the forest sector to promote mitigation include:

1. Managing forests with high carbon uptake potential,
2. Expanding such forests through reforestation and afforestation,
3. Reducing deforestation and reversing the loss of forest cover,

4. Providing an enabling environment for investments and market access to sustainable forest-based products, and
5. Increasing the use of forest-based products such as bio-energy and durable wood products, and substituting these for less eco-efficient materials.

Forest-related mitigation activities often have a cost advantage over other mitigation strategies. They can also be designed to support other national development and poverty alleviation priorities because of the multiple benefits forests provide. The Intergovernmental Panel for Climate Change (IPCC) estimates that about 65% of the total mitigation potential in the forest sector is located in the tropics and about 50% of this total could be achieved by reducing deforestation. In other words, because tropical forests have the greatest potential for carbon uptake and storage, the most cost effective way of reducing carbon concentrations in the atmosphere, is to reduce deforestation of tropical forests and allow for forest cover expansion.
Modern bio-energy can also contribute substantially to mitigation by providing an alternate source of renewable energy. Using fuels such as bio-diesel made from wood products is carbon neutral because trees harvested for use as fuel are continually replanted. In addition, forestation and bio-energy plantations can lead to restoration of land that has been degraded by over-extensive agriculture, manage water runoff, retain soil carbon and benefit rural economies by providing employment and income. However, if such plantations are not designed properly, they do have the potential to compete with land for food production and may be negative for biodiversity (Patosaari, 2007).

2.4. Historical Climate Related Hazards in Ethiopia

Climate related hazards in Ethiopia include drought, floods, heavy rains, strong winds, frost, heat waves (high temperatures), etc. Though the historical social and economic impacts of all of these hazards are not systematically well documented, the impacts of the most important ones; namely droughts and floods are discussed (NAPA, 2007). Ethiopia is highly vulnerable to drought. Drought is the single most important climate related natural hazard impacting the country from time to time. Drought occurs any wherein the world but its damage is not as severe as in Africa in general and in Ethiopia in particular. Recurrent drought events in the past have resulted in huge loss of life and property as well as migration of people (NAPA, 2007). Droughts and floods are the most frequent climate related hazards facing Ethiopia. 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). Droughts have been chronic events in some areas of the country for many years, as evidenced by harvest failures, especially in areas where food aid and recent productive safety net programs have been implemented over the years. Drought and, subsequently, famine, have had serious impacts on human life and property in the country(EACC, 2010).

The other climate-related hazard that affects Ethiopia is flood. Major floods caused loss of life and property in different parts of the country in 1988, 1993, 1994, 1995, 1996, and2006. Flash and

seasonal river floods have affected areas in the Afar Region along the Awash River, in the Somali Region along the WabiShebele River and in the Gambela Region along the Baro-Akobo River, in the Southern Nations, Nationalities and Peoples Region along the Oomo-Gibe River, and Bahir-Dar Zuria and Fogera areas along theAbbay River in the Amhara Region (Endalkachew et. al., 2004 quoted in NAPA p. 37).For instance, recently in the 2006 main rainy season (June–September), flood caused disasters in many locations. More than 250 people died, about 250 people were unaccounted for and more than 10,000 people became homeless due to the flood that occurred in Dire-Dawa town located in eastern Ethiopia. More than 364 people died, and more than 6000 people were displaced due to flooding of about 14 villages in South Omo zone in place called Dasenech located in Kuraz woreda. More than 16,000 people were displaced in Southwest Shoa, at 50 km west of Addis Ababa due to heavy flood disaster inflected by the overflow of the Awash River. Similar situations also occurred in Afar,Western Tigray, in Gambella and the low lying areas of Lake Tana in Amhara region.The Ethiopia country study looked at what these costs imply for individual countries. Ethiopia is heavily dependent on rainfed agriculture. Historically the country has been prone to extreme weather variability. Rainfall is erratic and since the early 1980s, the country has suffered seven major droughts, five of which have led to famines. Its geographic location and topography make it highly vulnerable to the impacts of climate change.

2.5. Causes of Vulnerability to Climate Conditions in Ethiopia

Causes for vulnerability of Ethiopia to climate variability and change include very high dependence on rain-fed agriculture which is very sensitive to climate variability and change, under-development of water resources, low health service coverage, high population growth rate, low economic development level, low adaptive capacity, inadequate road infrastructure in drought prone areas, weak institutions, lack of awareness, etc (NAPA, 2007). Vulnerability assessment based on existing information and rapid assessments carried out under NAPA has indicated that the most vulnerable sectors to climate variability and change are Agriculture, Water and Human health. In terms of livelihood approach smallholder rain-fed farmers pastoralists are found to be the most vulnerable. The arid, semiarid and the dry sub-humid parts of the country are affected most by drought (NAPA, 2007). Baseline climate was developed using historical data of temperature and precipitation from 1971–2000 for selected stations. The analysis provides the year-to-year variation of rain fall over the country expressed in terms of normalized rainfall anomaly averaged for42 stations. The data shows that the country has experienced both dry and wet years over the last 55 years. The trend analysis of annual rainfall shows that rainfall remained more or less constant when averaged over the whole country. Similarly, temperature variability and trend was analyzed (NAPA 2007, p. 33).

2.6. Coping Mechanisms to Climate Variability

Traditional and contemporary coping mechanisms to climate variability and extremes in Ethiopia include changes in cropping and planting practices, reduction of consumption levels, collection of wild foods, use of inter-household transfers and loans, increased petty commodity production, temporary and permanent migration in search of employment, grain storage, sale of assets such as

livestock and agricultural tools, mortgaging of land, credit from merchants and money lenders, use of early warning system, food appeal/aid (Deressa *et al*., 2009).In countries like Ethiopia, more than 85% of the people depend mainly on agriculture fortheir livelihoods, rendering them very vulnerable to climate variability and change. Accordingly, in recent times, a significant number of people in Ethiopia are being affected chronically by drought and/or flooding, leading to deaths and loss of assets and to an appeal for international support (Yahannes, 2009).

3. MATERIALS AND METHODS

3.1. Study Area Description

Location

This study was carried out in Essera Woreda of Dawuro zone, which is located between 6.7-7.02^0 latitude and 36-37.1^0 longitudes. Essera Woreda with its capital at Bale town is situated 575 km south of the capital Addis Ababa. The capital of *Esera* is Bale. It is situated in the omo basin located 323 km and 670 km far from Hawassa and Addis Ababa which are capital cities of the Southern Peoples Region and Ethiopia, respectively. The *woreda* shares boundary with *Marekaworeda* in the east, *Tocha* woreda in north, *Konta* special *woreda* in the west, *Loma woreda* south east and Gamu Gofa zone in the south.

Climate and agro ecology

The district has a total area of 1043 km^2 and is divided in to 29 kebeles. The altitude of the district ranges from 501-2500 meters above the deal level. The area receives an average a new rainfall of about 1600.5mm and has an average annual temperature ranging from 17.6 to 27.5^{0}c mixed farming system is main economic action practiced and regarding the Agro-Ecology, 47% was tropical, 32% was Subtropical and 21% was temperate as Essera Woredsa Agricultural and Natural Resource Management Development office (EWARDO, 2017).

Population

According to 2007 population and housing census population of the district had an estimated population of 82,218 of which 41,762 male and 40,456 female. The district has 29 *kebeles*. The area is topographically rugged.

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Land use and forest/vegetation cover

Table 1 Land use characteristics of Essera District

Component	Area in hectare	Percent
Annual crop land	20354.43	18.5
Perennial crop land	8250.35	7.5
High forest land	22994.7	20.9
Woodland and bush land	5501.3	5
Plantation forest	10010.6	9.1
Pasture land	11001.4	10
Land for investment	22003.6	20
Others	9901.62	9
Total	110018	100

Source, Esserawereda Agriculture and Natural Resource Management Office (EWANRMO, 2018)

Livelihood and socio-economic characteristics

According to the land utilization data of the area, 38.4% is cultivated land, 13.39% grazing land, 16.81% forest bushes and shrub land, 17.09 % cultivable and 14.31 is covered by others. The livestock resource of the woreda was estimated to be 313,094 cattle, 113,554 sheep, 45,703 goats, 7,081 horses, 1,934 mules, 5,064 donkey, and 157,996 chicken and 28,557 traditional hives (CSA, 2006).

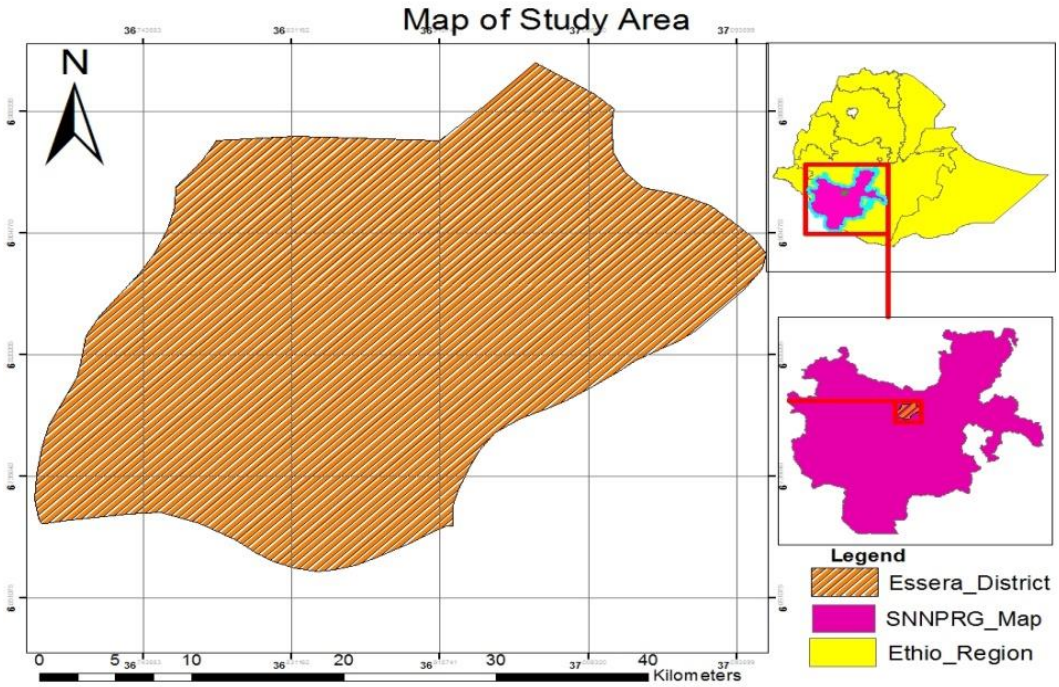

Figure 1. Map of study area

3.2.Sampling techniques and sample size

The study involved a multistage sampling, i.e. a combination of purposive, stratified, and simple random sampling procedures to select the study area and sample households. The strategy used to identify the study area and sampling procedures involved the following steps.

First, the Woreda/ Essera was purposefully selected because, its good forest resource. Then, the sampling frame of the target population was developed and the sample size was determined. To draw the sampled households, the households in the study area was stratified into two categories proportionally male and female households based on the population size of male and female-headed households to avoid the bias in generating sided information.

The sample size was decided based on sample size determination formula, which is given a care to have the sample size of the study to be as representative as possible and in accordance with the time and budget billed. Having this into consideration, out of total households in the watershed, the sample size was determined using the following formula adapted from Israel (1992) was used.

n=N/1+N (e) 2 where;

N= the total population that had been studied
n= the required sample size
e= the precision level which is = (±5%) Precision Levels
Where Confidence Level is 95%.

Researcher decided to use sample size determination formula because the study population is huge and impossible to undergo total enumeration.

3.3. Data Sources and Collection

The data for this study was generated from both secondary and primary sources of data focusing on both qualitative and quantitative natures.

a. Secondary sources: The secondary sources of information including, research journals and articles, internet sources, different agriculture and rural development office reports, and document reviewed at different levels of government organizations were used.

b. Primary sources: the primary sources of the thematic issues was focused on the status of forest resource and its role on climate change mitigation of Essera district; challenges of forest management and its opportunities; and societies' attitude toward forest. The sources of the information were local community, kebele agriculture extension workers, woreda natural resource management experts and observation.

a. Key Informant Interviews (KII)

Key informant interviews were conducted with different individuals at different levels. At the kebele level, one KA chairperson, one kebele manager and three development agents were interviewed. Furthermore, at the Woreda level, experts and staffs of the Woreda Agricultural and Rural Development Office and Forest offices were interviewed.

b. Focus Group Discussions (FGDs)

Two focus group discussions were carried out within the study area, one at kebele and the other at Woreda level teams. Each group was involved concerning individuals. The discussions were focus on the perception of farmers towards climate change adaptation and mitigation.

c. Field Observations and Photographs

During field surveys, three transect walks down the watershed was carried out with the guidance of the Kebele chairperson and community leaders. The natural resource distribution (trees, forest, rivers, etc.), and the settlement patterns was observed as part of the data collection process. In so

doing, notes were taken on specific observation in advance. During the observation period, information was gathered from different members of the community.

d. Household Surveys

The household survey using the semi-structured questionnaire was the major data collection process of the study. The questionnaire was involves both open and closed-ended questions. It was prepared in English and translated into local language of the study area. Before, collection of data, the questionnaire was pretested with few individuals who are not members of the sampled households. The data was collected by enumerators who were trained before data collection commenced.

3.4. Data Analysis and Presentation

Combinations of qualitative and quantitative methods were employed for data analysis. Quantitative analysis was employed Statistical Package for Social Science (SPSS) or Excel. The data was edited and coded before entering into the cells of SPSS or Excel. The qualitative data, which was generated from different sources, was be analyzed qualitatively, and the results of the key findings were displayed in the form of narrations, graphs, diagrams, tables, and pictures to provide evidence and to support the qualitative information.

4. RESULT AND DISCUSSION

4.0. INTRODUCTION

This chapter held findings of this study starting from demographic characteristics of the respondents.

4.1. Descriptive Analysis

This chapter presents the survey data and interpretation of the analytical findings. Of the 80 sample respondents 55 reported that they have participated in meeting concerning climate change in woreda and kebele level. However, the degree of adoption differs widely between households.

4.2. Demographic Characteristics

Sex of Respondents

From the sample of 80 HH, the result indicates that 79% of the heads of household are male that means 63 male headed 17 female headed households were used. These household heads include a wide range of people, village elders, decision makers (local administration), younger people, older people, poor farmers and rich farmers. Out of the total sample households in the study area, 21% of the household heads are women, who are single, widowed or divorced.

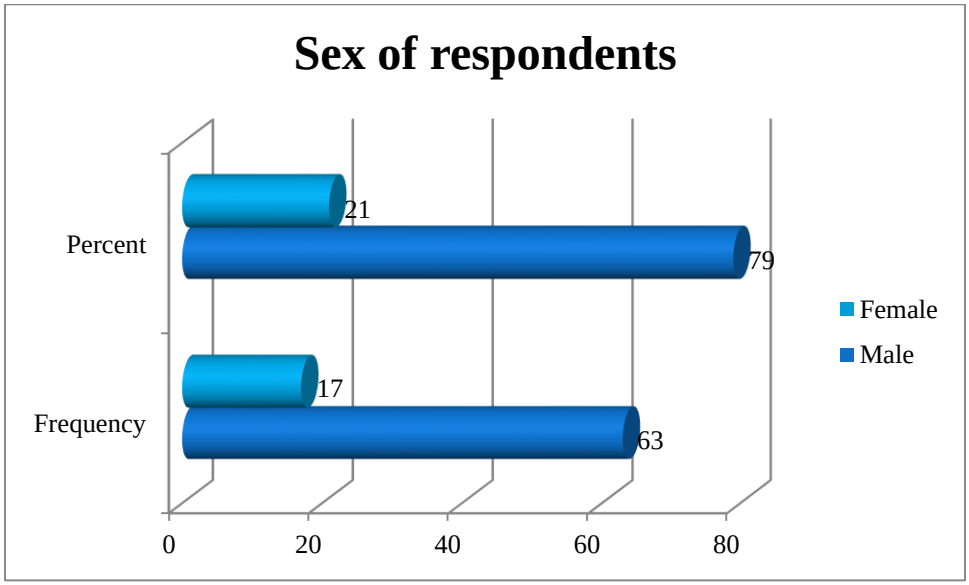

Figure 2. Sex of respondents

4.3. Education Status of Household

Table 2: Educational status of household heads

Educational status	Frequency	Percent
Illiterate	22	28.0%
Write and read	13	17.0%
Primary school	40	50.0%
Secondary school	5	7.0%
Total	80	100.0%

Sources: Field survey (2018)

From the survey results, better-educated households have more realistic perceptions about climate change, the way to mitigate and adapt it. From discussion with key informants, with respect to educational status of households educated farmers have positive attitude in planting trees to mitigate climate change in study area.

4.4. Age Status of Households

Three age groups of family members were identified as it can be seen from table and figure

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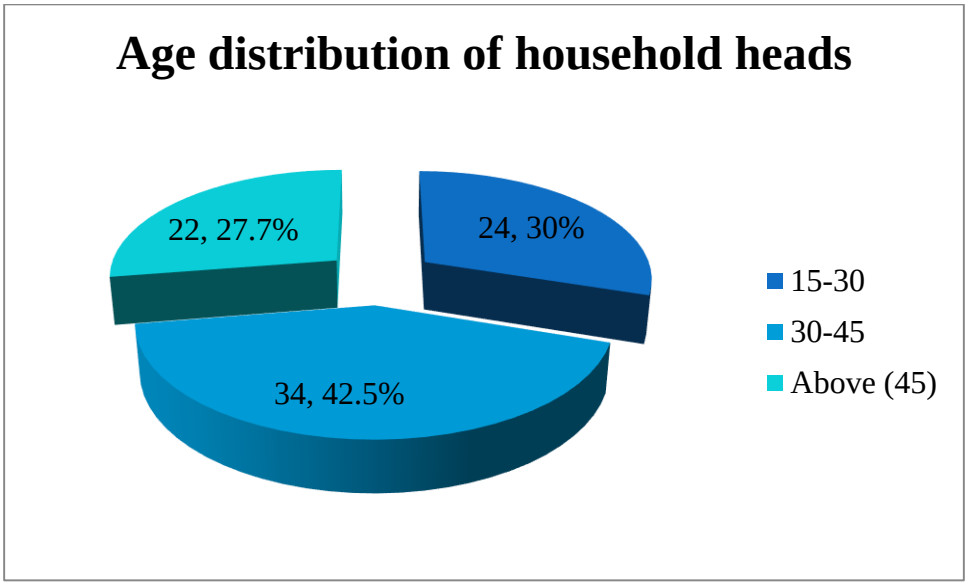

Figure 3. Age group of respondents

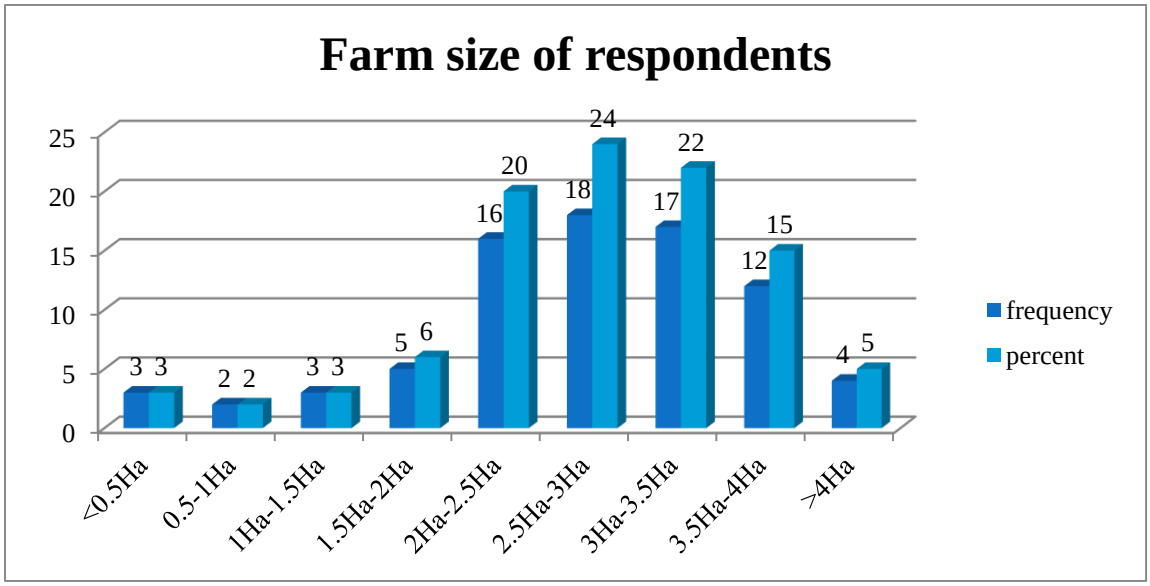

Figure 4. Farm Size of Respondents

4.5. Factors Affecting Farmers' Perceptions to Climate Change

The results of analysis examining the factors influencing the farmers' perceptions of climate change are age, educational status, sex, family size, access to extension services, wealth (farm size, number of farming oxen, cattle, ruminant animals and pack animals), farming experience and exposures to mass media have significant relationship with farmers' perception to climate change.

According to discussion with focus group and key informants interview, the influence of age on perception of climate change and adaptation to change of climate are of mixed nature. Some of them concluded that age had no influence on perception of climate change and adaptation, while others found that age is significantly and negatively related to perception of climate change. According to the result of this study, the age has positive and significant effect on the perception of farmers in the study area toward rainfall change, drought, and frequency of drought and crop failure due to shortage of rainfall. Thus, increasing the age of household head by one unit increases the probability of perceiving change in climate by 7%, whereas increasing farm income by one unit increases perception by 17.92%. For example, the perception of aged (>50yr old) farmers toward rainfall in their local area is higher than the farmers of others age of group. All sample farmers aged above 50 understand about the increment or decrement of rainfall and occurrences of drought in the past three decades. They also feel there is an increment of temperature in the past 15 years.

Higher level of education is believed to be associated with access to information on improved technologies and productivity consequences. Evidence from past sources indicates that there is a positive relationship between the education level of the household head and the adoption of improved technologies and adaptation to climate change (Maddison, 2006). As observed from the study, a unit increase in the education of the head of the household will have the impact of raising the probability of perceiving to climate change by 6.6%. Similarly, education has positive and significant impact on the analyzing of drought occurrences and frequency, and crop damage due to drought. Therefore, farmers with higher levels of education are more likely to better perceive to climate change.

We can see the influence of household size on use of adaptation methods from two sides. The first assumption is that households with large family members may be forced to divert part of the labor force to off-farm activities in an attempt to earn income in order to ease the consumption pressure imposed by a large family size as discussion with Essera woreda Agriculture and Forest office experts indicate. The second assumption is that large family size is normally associated with a higher labor endowment, which would enable a household to accomplish various agricultural tasks. However, this study shows that there is negative relationship between family size and climate change adaptation and mitigation.

According to the household survey result indicated in this study, family size has positive impact on perceiving drought, drought frequency and encountering of crop failure, while has negative and insignificant impact on having awareness of climate change. As observed from focus group discussion and key informants, families that have large family members forced part of the labor force to off-farm activities. In general, household with large family size has positive and significant effect on the awareness of rainfall change, drought and drought frequency and damage of crop due to climate change.

As key informant interview indicates Male-headed households are often considered to be more likely to get information about new technologies and take risky businesses than female-headed

households. Females in the study area are more affected by climate change as observed from focus group discussion.

According to this study, farm size has negative effect on climate perception as well as adaptation even in most cases it has insignificant impact on the farmers' perception of drought, increasing of temperature as well as drought frequency. It is due to that farmers with large farm land have an alternative of diversifying their livelihood.
Moreover, farmers living in lowland areas are perceived climate change as compared to midland and highlands. This is due to the fact that lowlands are already hotter and a marginal change in temperature could be perceived easily. As observed from the study, farmers living in kola have better perception than farmers of woyina dega.

As observed from focus group discussion and key informant discussion the frequency of drought increase from decade to decade, i.e. in the beginning there was drought for every ten years, next every five years at the end every two years there was drought that affect crop cultivation. Due to this, farmers do not have confidence on rainfall and there is lag of agricultural inputs such as fertilizer and improved seeds use. Woreda agricultural development office data indicates, only 25% of the farmers applied these inputs. This shows that the woreda is the lowest in using these new technologies in Essera district (EWANRMO, 2017).

Therefore, farmers perception analyses to climate change indicates that most of the farmers in the study area are aware of the fact that temperature is increasing, while on the level of precipitation, it is both way.

4.6. Farmers Perception towards climate change

Change of climate was well perceived by farmers of the study area as most of them have been observing changes in temperature, precipitation and timings of rainfall and related frequent drought. Particularly, perceptions on temperature and precipitation change of farmers of the study area. The result indicates that most respondents, about 85%, perceive that there is change in climate, while 15% of respondents perceived that there is no change in climate or they did not know about climate change. Similarly, 97.5% of respondents feel that temperature of Essera was increasing in the last three decades, whereas 2.5% of them noticed that they were not aware of temperature change or they did not feel change in temperature. Furthermore, 69.4% of the respondents observed increase in rainfall amount in the last three decades in the area, while 29.4% have noticed a decrease in the amount of rainfall.

Generally, about 98.8% of the respondents observed the change in rainfall in the past three decades, whether there is decrease or increase in rainfall. As observed from key informants and group discussion, there is a change not only in the total amount of rainfall but in the timing of the rains, with rain coming either earlier or later than expected and with rain withdraws before the normal time. About 71.3% of the respondents observed the late starting of rainfall from normal date and 91.3% of the respondents approved the early termination of rainy season from normal date.

Table. 2. Farmers' perception of climate change based on the past 10 years experiences

No		Number of Respondents					Percentage			
	Perception	Respondents	Yes, very much	Yes	No, there is no	I do not know	Yes, very much	Yes	No, there is no	I do not know
	Do you think that there is climate change in your local area?	80	14	57	3	6	17.5	71.25	3.75	7.5
	Is there change in amount of rainfall during main rain season?	80	0	69	1	10	0	86.25	1.25	12.5
	Has the timing of the onset of rain in the main season shifted?	80	12	52	10	6	15	65	12.5	7.5
	Has rain started late than normal?	80	8	65	4	3	10	65	5	3.75
	Is rain of main season early withdrawn than normal?	80	0	71	3	6	0	88.75	3.75	7.5
	Do you feel temperature of the area is changing?	80	7	54	9	10	8.75	67.5	11.25	12.5
	Do you feel temperature is increasing?	80	8	65	2	5	10	81.25	2.5	6.25

Source: Survey, 2018

Agro-ecologically, farmers of kola area (96.3%) are more aware on climate change than farmers of woyna dega (73.4%). This is mostly related to a unit change in climate results the hotter the area of kola because it is already environmentally fragile and hazard prone.
In general, about 85% of the respondents in both climatic zones are aware of climate change, while 15% of respondents perceive either there is no or do not have the knowledge of climate change. About 96.2% of the respondents in kola area recognized the change (the increase or decrease) of rainfall amount, while only 41.8% of respondents of woyna dega perceived rainfall change. This shows that climate change is more pronounced in areas already have climatic problem. From the sample households, about 81.2% are well recognized the existence of drought in kola region, while 58.2% of sample farmers of woyna dega are perceived drought existence. On the other hand, the increment of the frequency of drought is more perceived by kola sample respondents (88.9%) than woyna dega sample respondents (59.5%). From this one can conclude that climate change is not the problem of the woyna dega area of the woreda understudy.

4.3.2. Climate Change Impact

About 84.4% of the respondents have well observed about the increasing of drought frequency especially in kola part of study district such as Yucha kebele and Hageli 01 kebel. Problems of livestock and human health, crop failures and their frequencies and extreme temperature events are visible for the majority of the sample households. About 67.5% of households have encountered at least one time complete crop failure in the last three decades. An increase in the problem of livestock and human health related to climate change are perceived by 41.9% and 59.4% by sample households, respectively. Malaria infestation area expanded from the kola area to woynadega area where it was uncommon before. It was only common in kola area, but now it covers almost the lower woyna dega area (up to 2200masl). Due to climate change there was

shortage of food and uncommon child diseases like diarrhea and malnourished have emerged as the most common problems of the society of the study area in kola and Weyna dega agro-ecology.

Table 3. Climate Impacts on Farmers in the past ten years

No.	Impacts	Respondents	Yes, very much	Yes	No, there is no	I do not know	Percentage			
							Yes, very much	Yes	No, there is no	I do not know
1	Is there drought?	80	7	61	12	0	8.75	76.25	15	0
2	Is there an increment of drought frequency or occurrences of drought?	80	4	68	1	7	5	85	1.25	8.75
3	Did you encounter complete crop failure?	80	11	50	9	10	13.75	62.5	11.25	12.5
4	Is there an increase of livestock health problem due to climate change?	80	0	47	30	3	0	58.75	37.5	3.75
5	Is there an increase of human health problem due to climate change?	80	9	40	31	0	11.25	50	38.75	0

Source: Survey, 2018

5. CONCLUSION AND RECOMMENDATION

5.1. Conclusion

1. Because of low agricultural productivity, due to low rainfall, high rainfall variability and increased temperature, farmers of the woreda has been practicing different adaptation methods.
2. Farmers of the area rely on rainfed agriculture taking into consideration risky of climatic condition. Farming experience, access to extension and access to education were found to enhance positively attributed to adaptation. This implies that education improves awareness of the potential benefits of adaptation could be an important policy measure.
3. This study focused on the analysis of farmers' perception on climate change impact and adaptation focusing on the farmers' decisions in response to seasonal variations in climatic and related factors. These decisions are influenced by a number of socio-economic factors that include household wealth (land size and ownership of livestock), access to information of seasonal and long term climate changes, availability of institutions like access to credit and health institutions (human and livestock).
4. Age, sex, educational status, access to extension, farming experience and extra income has positive and significant impact on adaptation to climate change.

5.2. Recommendation

The study recommends the following adaptation strategies to counteract the harmful impacts of climate:

1. Promote use of improved crop and early maturing seeds that can resist the impact of climate change;
2. Improve the quality of meteorological data and increase the number and their spatial distribution.
3. Facilitate research and extension services to provide adequate extension information services to ensure that farmers receive up-to date information about rainfall and temperature patterns in the forthcoming season so that they can make well informed decisions about their planting dates,
4. Introduce irrigation technologies to reduce the dependency of rainfed agriculture and to secure availability of food.
5. Promoting mixed agriculture through improved crop and livestock to diversify livelihood of the farmers in order to resist climate change risk.

REFERENCES

Adger, W Neil, Nigel W Arnell, and Emma L Tompkins. 2005. "Successful Adaptation to Climate Change across Scales." 15: 77–86.

Collier, Paul, Gordon Conway, and Tony Venables. 2008. "Climate Change and Africa." 24(2): 337–53.

Danie H., 2013. Securing the Data Revolution in Africa

DAVID, S., THOMAS G., TWYMAN C., OSBAHR H. & HEWITSON B. (2007). Adaptation to climate change and variability: farmer responses to intra-seasonal precipitation trends in South Africa. Climatic change 83, 301-322.

Davies, R., 2015. The Indonesia-Australia Forest Carbon Partnership: A Murder Mystery, In: (CGD), C.f.G.D. (Ed.). CGD Policy Paper 060 April 2015.

Deressa T.T, R.M. Hassan C. Ringler, T. Alemu and M. Yesuf (2009). Determinants of farmers' choice of adaptation methods to climate change in the Nile Basin of Ethiopia. Global Environmental Change 19 (2009).

EACC, 2010, Economics Adaptation to Climate change Synthesis Report, 2010,

EPCC (2015), *First Assessment Report, Working Group II Agriculture and Food Security, Published by the Ethiopian Academy of Sciences*

Essera District Agriculture and Natural Resource Management Office, (2017).

Glwadys A.G. (2009) Understanding Farmers' Perceptions and Adaptations to Climate Change and Variability. IFPRI Discussion Paper 00849.

Hassan (2002). A Framework for the Design of Ware house Layout Facility.

http://climate.nasa.gov/effects. 8/01/2018

http://dels.nas.edu/Report/Ecological-Impacts-Climate-Change /6/02/2018.

IPCC. 2007a. Impacts, Adaptation and Vulnerability Working Group II Contribution tothe Intergovernmental Panel on Climate Change Fourth Assessment Report.Summary for policymakers, Brussels.

Madison, D., 2006. The perception of and adaptation to climate change in Africa. CEEPA Discussion Paper No. 10. Centre for Environmental Economics and Policy in Africa, University of Pretoria.

Mr. PekkaPatosaari, Director, UN Forum on Forests Secretariat (2007). To the 60th Annual DPI /NGO Conference "Climate Change: How it Impacts Us All" Roundtable on Coping with Climate Change: Best Land Use PracticesUnited Nations, New York, 6 September 2007.

NAPA 2007, Climate Change National Adaptation Program of Action, Ethiopia, Addis Ababa, 2007,

Negash and Nielof (2004). Adaptation of agricultural innovations by small holder farmers.

Negatu, W., &Musahara, H. (2016).Innovations in Achieving Sustainable Food Security in Eastern and Southern Africa.

PanagiotisKarfakis, 2013. The assessment of the socio-economic impacts of climate change at household level and policy implications.

Rebecca Gaster, 2010. Social and economic impacts of climate change on the urban environment.

Simula, M. (2008). Financing Flows and Needs to implement theNon-Legally Binding Instrument on all Types of Forests. Prepared for: Advisory Group on Finance of the Collaborative Partnership on Forests and Program on Forests (PROFOR) of the World Bank October, 2008. 89 p.

Smit B, Skinner MW (2002) Adaptation options in agriculture to climate change: A typology. Mitigation and Adaptation Strategies for Global Change 7: 85-114.

Susmita Dasgupta, Benoit Laplante, Craig Meisner, David Wheeler, and Jianping Yan (2007) The Impact of Sea Level Rise on Developing Countries: A Comparative Analysis. World Bank Policy Research Working Paper 4136, February 2007.

The United Framework Convention on Climate Change (UNFCCC). 1992

World Bank. 2010. "Costing Adaptation through Local Institution. Village survey results – Ethiopia." March 2010. Draft Report. Washington, DC: World Bank.

World food programe (WFP, 2009) annual report

Yitebitu Moges[1], Zewdu Eshetu[1]and Sisay Nune[2] (2010). Literature ReviewPrepared For the Ethiopian Climate Research and Networkingand the United Nations Development Programme (UNDP) Addis Ababa, October 2010.

Yohannes Gebre Michael, Addis Ababa University, and Mebratu Kifle, PFE, (2009), Local innovation in climate-change adaptation by Ethiopian pastoralists.