Climate Change resilience experienced by Agro-Pastoralist households: A case study of Tuli Guled District, Somali Regional State, Ethiopia

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ABSTRACT

Climate change resilience experienced by Agro-pastoralist household study was conducted in Tuli Guled District, Somali regional state, Ethiopia with the objective of assessing perception of agro-pastoral households on climate change and its impact. The study was conducted in four kebeles (lowest administrative division), with mixed research design. Purposive sampling was used to select 153 respondents. In addition to this, two interviews and Focus Group Discussions were undertaken which 8 participants in each group. According to 15 year maximum and minimum Temperature data collected of 15 years from Jijiga meteorology station (2002-2016) and Jigjiga station data of (1983-2020) was used to investigate the temperature and rainfall trend. The agro-pastoral households in the study area were very vulnerable and due to their vulnerability, they face recurrent droughts, clan conflicts over scarce resources, outbreaks diseases, less crop production, desert locust and accidental floods. Descriptive results were indicated that the respondents were applying the most common resilience strategies 30.1% livestock diversification and use of drought-tolerant species, 27.6% adjust of planting date/ adoption of early maturing drought tolerant crop varieties, 21.8% herd mobility to search for water and better pasture, 14% and 6.4% off/non-farm activities and rainwater harvesting respectively.

Key words: Agro-pastoralist, Climate, Climate Change, Households, Somali regional state.

Introduction:

Over the last several decades, it has become increasingly clear that human activities such as fossil fuel combustion and deforestation are changing the Earth's climate (IPCC 2013). Climate change includes major changes in temperature, precipitation, or wind patterns, among other effects, that occur over several decades or longer (US EPA, 2016). Several empirical studies showed that negative effects of climate change on African agriculture can be significantly reduced through a better knowledge about the change in climate indicators, its impacts and adaptation (Benhin, 2006; IPCC, 2007; Zampaligre et al., 2013). In the past couple of decades climate change has become increasingly apparent that it is already happened, happening, and will continue to happen, bringing with its local impacts on people's livelihoods (Parry et al., 2007). Ellis (2010) argued that, the increased carbon dioxide concentrations in the atmosphere are a key element of climate change that could affect food security. There is a worldwide consensus that global warming is a real, rapidly advancing and widespread threat facing humanity this century. Evidence is now overwhelmingly convincing that climate change is unequivocal and happening at an unprecedented rate (IPCC 2013; Adhikari et al. 2015,2016).). The Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report of 2007 gives convincing evidence that climate change is increasingly recognized as a serious challenge to environmental health, human well-being and future development (IPCC, 2007).

The horn of African countries are the most vulnerable people to climate change, because of the low adaptive capacity of the African population. This low adaptive capacity is owing to the extreme poverty situation of various Africans, recurrent natural disasters such as floods, droughts, and agriculture, which are critically dependent on rainfall. If agricultural production in the low-income developing countries of sub-Saharan Africa like Ethiopia is adversely affected by climate change, the livelihoods of large numbers of the rural poor will be put at risk and their vulnerability to food insecurity increases (Abebe, 2013). Pastoralists are particularly vulnerable groups to predicted changes in climate for several reasons: (1) they tend to be economically impoverished and heavily dependent on natural resources e.g. for firewood and medicine, (2) they generally occupy less productive lands which are often poorly developed and suffer historical political and economic marginalization and (3) they are faced with continued severe environmental degradation, shrinking resource bases and reduced transhumance mobility routes (Fekadu, 2013).Newer strategies such as increased crop cultivation and adjustment of herd composition (Robinson etal.,2013) have also been reported.

In Ethiopia, it is assumed that the temperature has been increasing annually at the rate of 0.2°C over the past five decades. This has already led to a decline in agricultural production, and cereal production is expected to decline still further (by 12%) under moderate global warming (Ringer, 2008). Climate, in turn, has many obvious implications on landforms and morpho dynamic evolution of natural landscapes as much as on the living conditions of local people, in a country whose economy is heavily dependent on rain-fed agriculture (Hadgu et al., 2013).

Ethiopia is vulnerable to climate variability and change because large segments of its population are poor, dependent on income opportunities that are highly sensitive to the weather, and have low access to education, information, technology, and health services. They have low adaptive capacity to deal with the consequences of climate variability and change. The country is one of the poorest countries in the world, where 77.5% of the people live on less than two dollars a day and 46% of the total population is undernourished (World Bank, 2010). According to IPCC (2014) Fifth Assessment Report of Famine Early Warning Systems Network (FEWS NET) there has been an increase in seasonal mean temperature in many areas of Ethiopia.

Somali Regional State is one of the permanently pastoral and agro-pastoral areas in Ethiopia. The production system of the region is divided into three categories: large nomadic pastoralism, agro-pastoralist and agriculturally based system. About 80% of the population in the region depends on the first two production systems while the remaining 20% depends on crop-based livestock production (ERA, 2003). Agro-pastoralists and farmers highly depend on rain-fed agriculture and pasture which makes them particularly vulnerable to drought, livestock disease and crop pests (SC UK, 2007).

The local community of Tuli Guled Woreda of Somali region are agro-pastoralists that involved in mixed farming and livestock production. If there is stress, they migrate for their livestock to find good pasture and water. The working age and strong family members move to the wells, dams, streams during dry and drought seasons. The major livestock they rear are cattle, sheep, goats and few camels. The source of food during travel is own source and purchase (SRS, 2010). The agro-pastoralists in Tuli Guleddistrict were both engaged agriculture and pastoral, although availability and accessibility of water is the most difficult challenges for fetching animals, families and irrigation. This research was conducted to identify the perception of agro-pastoral households on climate change in the study area and to assess the major experienced resilience strategies of climate change by agro-pastoral households' in the study area of Tuli Guled of Somali Regional State, Ethiopia.

2. Materials and Methods

Tuli Guled district lies between 90°2'0" N to 90°42'0" N and 420°29'00" E to 420°13'00" E. The district is found in Jigjiga (Fafan) zone of the Somali Regional State, Ethiopia. The mixed research design was applied in this study. The researcher selected 153 sample respondents from four different kebeles (kebele means smallest administrative division) of Tuli guled district. Probability proportional to size sampling technique was used in order to draw 153 sample respondents from the agro-pastoral selected sample kebeles in the study area**.** The required data for this research was collected with the help of self-administered Questionnaire, key informants Interview and focus group discussions. And also, Temperature and Rain fall data was collected and analyzed. The quantitative data was analyzed through descriptive statistics.

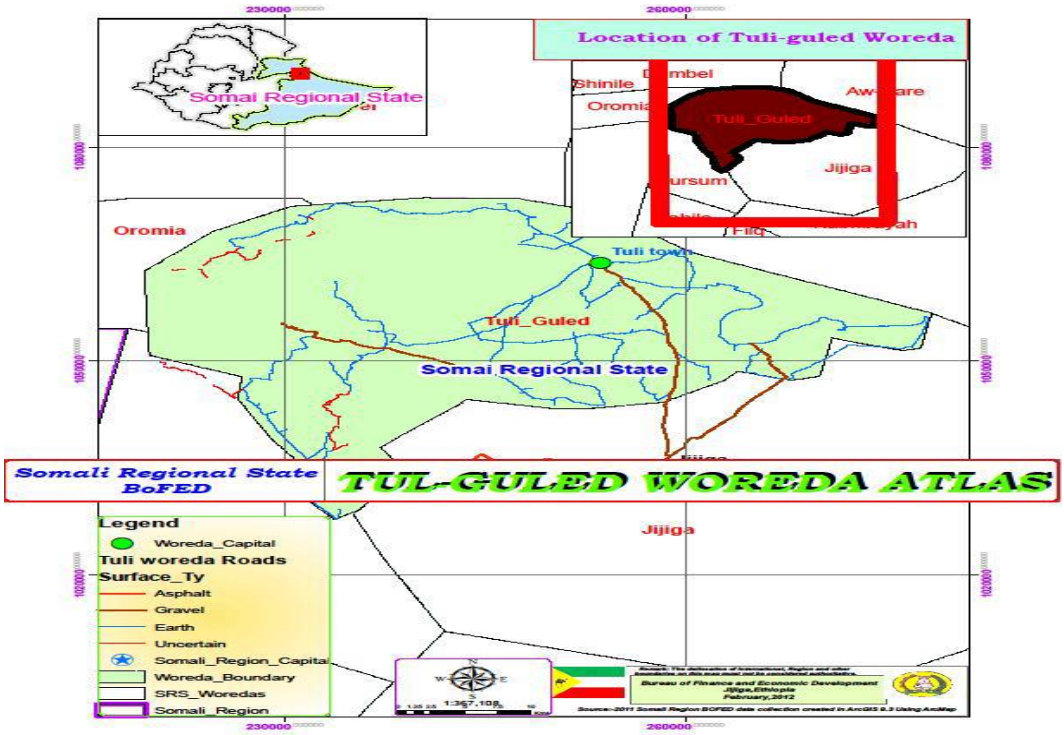

Figure: 1. Study area map

Source: Somali regional Bureau of Finance and economic development (2021)

3. Results and Discussion

Climate Change Data Analysis

Temperature

According to Abebe, (2013) rainfall and temperature are important meteorological variables that determine water availability and production of crops and livestock rearing or food production processes in countries where agriculture is more dependent on rainfall. According to (Bureau of Agriculture, 2011) and (NMA, 2007) reported that temperature is increasing over the country.

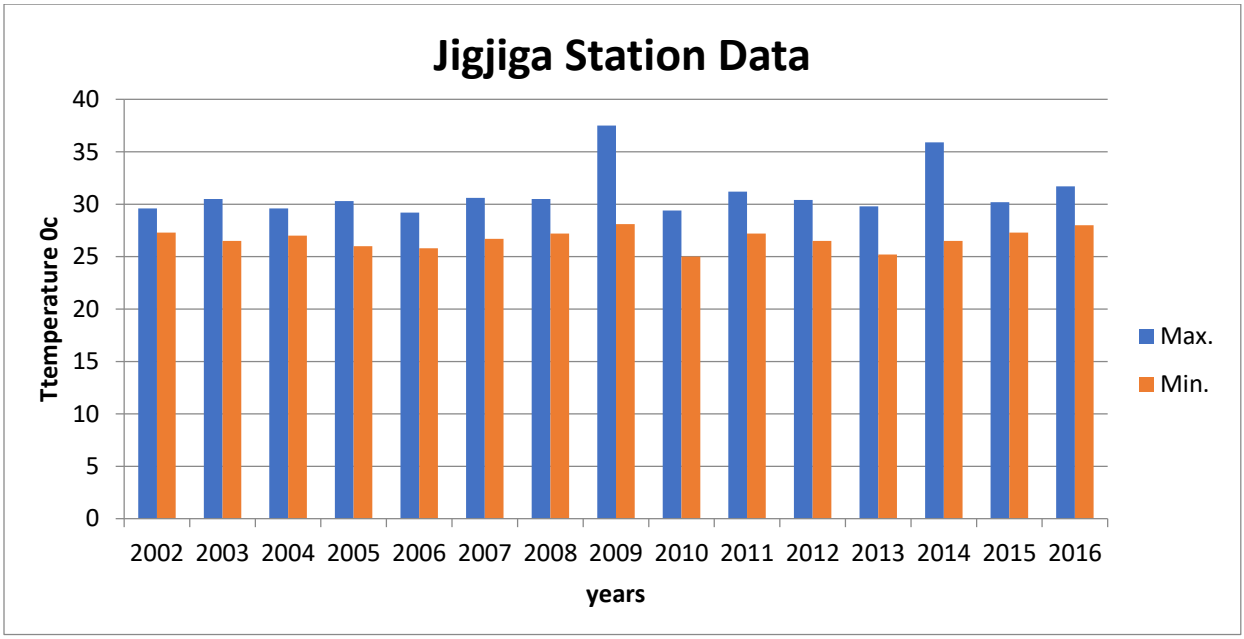

Figure: 1 Yearly maximum and minimum Temperature data collected of 15 years from Jigjiga meteorology station (2002-2016). Source: - Somali region and Neighborhood Regions Meteorology Service Center (2020)

According to the Jigjiga station data the yearly maximum temperature observed was 35.9 C°, while the minimum temperature observed was 25 C°. As depicted on the above figure the maximum was observed during these years 2009, 2014 and 2016.

Rainfall

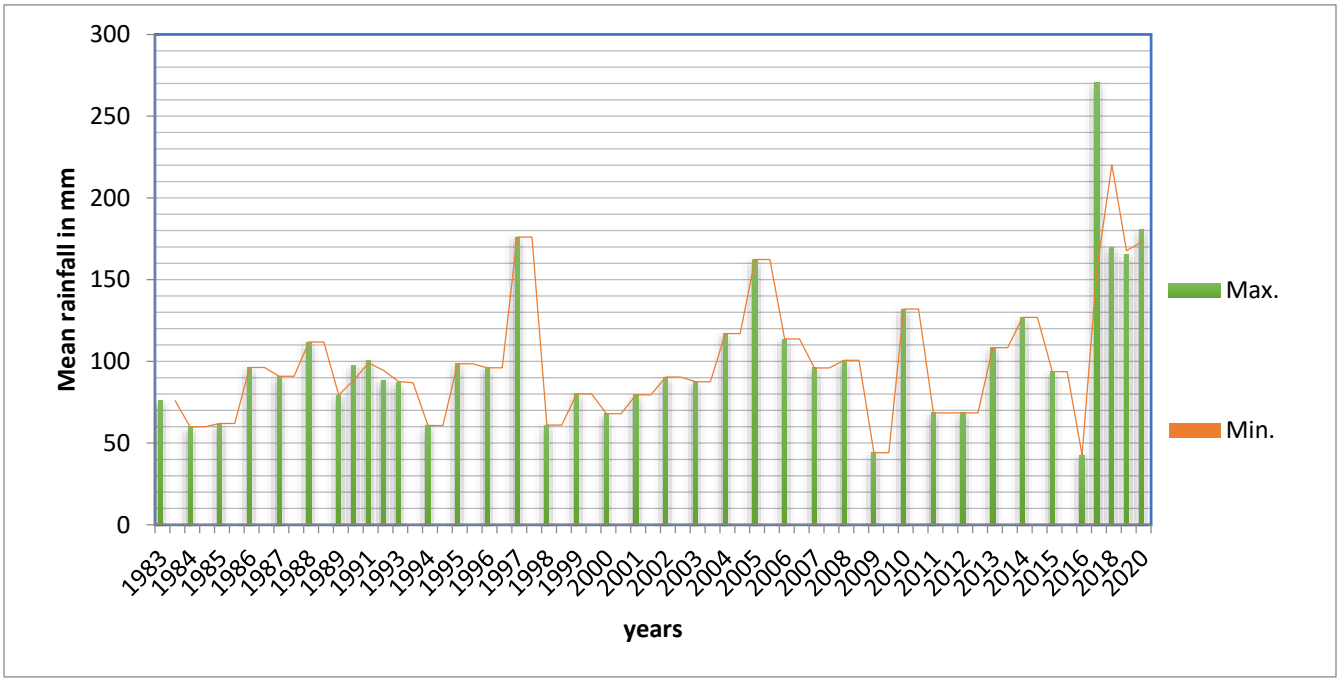

Figure: 2 Jigjiga station data of (1983-2020) was used to investigate the trend rainfall

Source: - Somali and Neighborhood Regions Meteorology Service Center (2020)

According to field researches conducted in Africa suggested that there are gaps between the information needed by farmers and that provided by the meteorological service (Stigter et al., 2005). Therefore, this data obtained from Somali and Neighborhood Regions Meteorology Service Center might be vary from people's perception due to two reasons. First, Somali and Neighborhood Regions Meteorology Service Center is not established in woreda level. Second, the study area is away from the center about 31.726 km. On the other hand, the minimum rainfall received yearly is not indicated on the chart as it is zero, which means all the minimum is on the origin of the chart.

Regarding to the Jigjiga station data the yearly maximum rainfall received in the study area was 270.4 mm and the yearly minimum rainfall received was 52 mm for the past 37 years. Thus, the survey result indicated that rainfall has a variability trend in the past 37 years.

Perception of respondents onTemperature trend for the last 15 years

The study of Asrat and Simane (2017) and Deressa et al. (2011) revealed that farmers living in the dry lowland area perceived more change in climate than farmers in the wet lowland. The perception of agro-pastoralist on temperature is a crucial as they are the source of information and have knowledge and experience about their environment. According to the sampled respondents about 96.2% of the respondents perceived increasing trend of temperature and 3.2% of the respondents perceived that there is no change of temperature. Thus, this shows that there is a change in temperature in the last 15 years which is indication of climate variability and change. In short, it could be concluded that there was increasing trend of temperature in the study area.

During the interview with selected respondents explained that there is increasing trend of temperature for the last 15 years, while the Focus Group Discussion participants indicates increasing temperature trend even for the last 30years. Some studies which were conducted on the Fafan zone, Somali region and its surrounding districts indicated that the temperature is increasing gradually.

"*Furthermore, one of the Focus Group Discussionmember who was aged 85 years old, stated that there was increasing of temperature for the last 36 years which brought crop failure, loss of livestock production, shortage of water points, migration of wild animals and conflict over resources"*

Perception of the Agro-pastoral Households on Rainfall trend

Rainfall is the one factor that determines climate variability and change in a specified area. According to the survey results, 90.4% of the respondents perceived decreased trend of rainfall, while 8.3% of respondents shows the same trend of rainfall and the rest of 1.3% of respondents perceived increasing trend of rainfall in the study area. This infers that majority of the respondents recognized that decreasing rainfall trend was observed.

During Focus group discussion with selected members stated that they observe rainfall variability which is rain comes late and goes early. This implies that loss of crop and animal production. On the other hand, the key informative interview members revealed that they observe impact of climate change including decreasing trend of rainfall.

Perception of agro-pastoral households on climate change and its impact, source of information and type of climate change impact faced

Rising community awareness about climate change and its impact can play a crucial role in the climate change. The field survey results indicated that about 94.2% of the respondents have awareness about the climate change and its impacts and 5.8% of the respondents have no awareness about climate change and its impacts in the study area. On the other hand, Source of information is an important to update the Agro-pastoral households about the climate change. As per the field survey results, about 41.7% of the respondents indicated that the major source of information on climate change is sharing information, 28.8% of the respondents suggested source of information is practical observation, 19.2% of the respondents shown that the source of information is on radio, 4.5% of the respondents revealed that the source of information is other and 0.6% of the respondent said that source of information is on TV.

The survey analysis indicated that droughts, clan conflicts, outbreak diseases, low of crop productions, desert locust and flash floods are major type of climate changes faced as reported by agro-pastoral community. As per the field survey results about 40.4% of the respondents reported that they face droughts, 20.5% of the respondents indicated that they face clan conflicts,17.9% of the respondents revealed that they face diseases outbreak, 12.2% of the respondents mentioned that they face low crop production, 6.4% of the respondents indicated that they face desert locust and 2.6% of the respondents revealed that they faced floods.

According to prospect of key informative interview members droughts, clan conflicts, failure of crop production and outbreak diseases are the major climate change related impacts, whereas focus group discussion members suggested that most of the time droughts and failure of crop production are the major climate change impacts affected by the local community of the study area.

The pastoralists have knowledge and experience about their livestock in order to determine the extent of the impacts that caused by climate change. According to the field survey result, about 71.2% of the respondents indicated that climate change affects their livestock as high, 28.2% and 0.6% of the respondents revealed that climate change affects their livestock as medium and as low respectively.

Women and children are the most vulnerable group to climate related hazards due to their triple responsibilities in the family and inability of their physical respectively. As per the survey results, about 57.7% of the respondents stated that women are more affected due to their gendered and their triple responsibilities on the family, 30.1% of the stated that children are more affected by hazards because of their inability, 11.5% of the respondents recognized that men are more affected by hazards due to their engagement during occurrence of the hazards and 0.6% of the respondents stated there is no difference between the all.

According to the focus group discussion members and key informative interview participants indicated that the hazards (particularly droughts and floods) were becoming more worse when compared to the last 15 years with the period before and stated that their expectation about the climate related hazards will increase in the future.

Impacts on Crop Production

As per the survey results, about 39.1% of the respondents reported that crop production and its productivity was decreasing due to lack of improved seeds, 37.8% of the respondents stated due to shortage of rain during raining season, 13% and 9.6% of the respondents indicated that droughts and fertilizers are major causes decreasing crop production and its productivity. In addition to this, the key informative interview made with Development Agents reported that they observed decline of crop production and productivities caused by climate change for the recent years, whereas focus group discussion members stated that they observe climate change impact on agriculture.

Climate Change Impacts on Livestock Production

Animals such as goats, sheep, cows and camels are the major domestic animals that are reared by local communities of the study area. As they indicated in field survey about 98.1% of the respondents stated they rear livestock, while 1.9% of the respondents mentioned that did not rear livestock but they engaged agriculture. Thus, this implies that majority of the respondents rear livestock especially the animals that could resist adverse condition of climate change. In addition to this, the respondents were asked to indicate the reason if the pasture trend increasing or decreasing and they replied the pasture was increasing due to shortage of livestock and low agricultural lands, while the decrease of pasture was because of recurrent droughts and locust desert.

Agro-Pastoral Households Resilience Strategy on Climate Change

Farmers are more likely to select less risky crops with less return, even when intercrop interactions are considered (Bezabih et al, 2011). As per the survey results about 30.1% of the respondents were indicated that the first most commonly used resilience strategy among different options is livestock diversification and use of drought-tolerant species. it means rearing animals and diversifying their composition and also rearing livestock that are drought friendly which have capacity of water holding and require less pasture, specially camels and goats are the best examples of these group of animals, 27.6% of the respondents recognized. The second most commonly used resilience strategy is adjust of planting date/ adoption of early maturing drought tolerant crop varieties, the reason behind to use this resilience strategy is to avoid crop failure and to avoid more vulnerable crops if rain comes late and leaves early, 21.8% of the respondents stated that the third most commonly used resilience strategy is herd mobility to search for water and better pasture it indicates that mobility of animals for searching where water and good pasture are abundant. And 14.1% of the respondents revealed that the fourth most commonly used resilience strategy is off/non-farm activities which is migration of working age to the towns such as Jigjiga, Togwajale, neighboring countries like Djibouti, Somali land and 6.4% of the respondents indicated that the fifty most commonly used resilience strategy is water harvesting to fetch their family and animals.

Key informative interview participants reported that livestock diversification and use of drought-tolerant species and herd mobility to search for water are the most commonly used strategies to overcome climate change impacts. Some of them stated that these resilience strategies are the best to resist and sustain the livelihood of the communities because this study area is appropriate both agriculture and pastoralist. Whereas focus group discussion members realized that adjust of planting date/ adoption of early maturing drought tolerant

crop varieties and off/non-farm activities are the major resilience strategies that could be used to overcome climate change effects in the study area.

In addition to this, the focus group discussion participants were asked to indicate the way they share knowledge and skills about resilience strategies. And also how they stated that knowledge and skills were obtained from generation to generation and shared from the previous elders and events that their resilience strategy faced during at that time. They were also asked to state the benefit gained using the resilience strategy and the satisfaction in using the resilience strategy and they indicated that their livestock diversification and drought tolerant species are other resilience strategies. These are helpful to avoid the negative consequences of climate change effects, experienced are obtained, protection and increase of the livelihood and they forwarded that the they have more satisfaction because the resilience strategy is owned and created by themselves and they are the source of information about their environment.

According the key informative interview participants they indicated the challenges in using the climate change resilience mechanism, provided suggestion to cope up this challenge and possible strategies to improve the existing problems and they stated/recognized such challenges. The local community are the heart and major source of knowledge and skills about their environment and they have traditional knowledge. But they are not well supported about their needs and development rather they are given relief which made them beggars/relief receivers, policy and decision making are not established bottom up approach, good seeds are not supported adequately. Animal vaccination are not matched their livestock number, non-farm activities are not created locally rather it requires migration these and other challenges are existing in the study area. Accepting the traditional knowledge of the local community, supporting developmental issues, participating the local community in the policy and decision making, provision of good and quality seeds, awareness rising of the community about the climate change, establishing opportunities rather than agro-pastoral activities, keeping and protecting drought affected people these mentioned and others are suggested strategies and to improve the existing problems.

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