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Original Research

Farmers' Perception on and Adaptation Strategies to Climate Change: The case of Begi District, West Ethiopia

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Abstract

The study was conducted in West Wollega zone, to understand how farmers perceive climate change and adaptation measures. It involved four villages, with a deliberate sampling method. Key informants, two farmers' group discussions, and 127 sample household respondents were included. Qualitative and quantitative methods were used for data collection and analysis, with ENMA-gridded temperature data from 1983 to 2018 being used. The district experiences a significant increase in annual temperature, with mean temperatures rising at 0.040°C/year, maximum temperatures at 0.054°C/year, and lowest temperatures at 0.026°C/year. The district's rainfall pattern shows a decline of 16.35mm. Climate change impacts include floods, pests, and illnesses, with drought frequency occasionally increasing. Farmers use coping techniques like terracing, afforestation, crop diversification, income diversification, seasonal migration, and livestock management for adaptation. The study found that farmers' opinions on climate change and adaptation are influenced by factors such as age, education, access to extension services, and farming experience. Lowland regions are more aware of climate change due to their warmer climate. Most respondents saw long-term temperature variability and increasing rainfall patterns. Farmers are implementing coping strategies and modifications. The study recommends communities to be aware of new technology through credit services, infrastructure development, training, and climatic information.

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INTRODUCTION

As per the IPCC (2001), climate change is any alteration in the climate over a period of time that could be attributed to either natural fluctuations or human actions. Due to the fact that climate risks are having an increasing influence on both ecosystems and human societies, climate change represents one of the biggest dangers to the realisation of sustainable development in history. The rights of vulnerable people, particularly those who depend on biodiversity and ecosystem services for food, water, and shelter, will be impacted by climate change, as will livelihood assets. This is especially true in times of need or to prepare for emergencies. The world's poor are becoming more susceptible to famine and natural disasters including droughts, floods, and illnesses as a result of climate change's detrimental effects on conventional coping strategies and food security (Pisupati & Warner, 2003).

It has been said that because climate change affects all nations, developed and developing, it has become a crucial topic of discussion in the global development discourse. According to Raghuvanshi et al. (2016), one of the main factors influencing agricultural productivity is the climate. Ethiopia's economy heavily depends on the agricultural sector, which provides 34.9%, 90%, 70%, and 85% of the nation's labour force, GDP, total export earnings, and raw material requirements, respectively. 55.3% of all agricultural shares are accounted for by crop production, with the remaining shares going to forestry (8.8%) and animal farming and hunting (25.6%) (Tilahun & Saron, 2020). Ethiopia is therefore susceptible to the effects of climate change, which could harm the country's cow herds, food and water security, productivity in agriculture, and human health. Low agricultural output in Ethiopia is mostly caused by climate change aspects such drought, floods, and degraded soil (Asrat & Simane, 2017; Yirga, 2007).

Knowledge is shaped not only by perceptions but also by perceptions. Therefore, how farmers view climate change has a significant impact on how they respond to risks and uncertainties brought on by it and adopt certain actions using coping mechanisms to lessen its negative effects on agriculture (Ansari et al., 2018). According to Ansari et al. (2018), researchers found that improving farmers' perceptions is crucial to reducing the negative effects of climate change on agriculture. They also suggested implementing targeted interventions for the farming community and other stakeholders to increase their readiness to handle these effects.

Due to their heavy reliance on climate-sensitive small-scale agriculture, smallholder farmers in the Begi district (the research region) are particularly vulnerable to the effects of climatic variability and change (Asrat & Simane, 2017). Furthermore, as far as agricultural practices are concerned, farmers' attitudes are crucial to the effective application of adaptation techniques to lessen the effects of climate change (Ki et al., 2017). Local perceptions of climate change indicators and factors may differ between smallholder farmers (Leng, et al., 2015). There isn't enough information accessible in this aspect. Thus, it is necessary to investigate the perspectives and adaption tactics of the farmers in the Begi district in order to take appropriate action to lessen the effects of climate change and to provide background information for future research. Thus, the goals of this study were to ascertain farmers' perspectives, Begi district's trend in climate change, and the current adaptation techniques employed by local farmers in reaction to climate variability and change.

Materials and Methods

Study area description: Begi district was one of the 22 districts in Ethiopia's Oromia Regional State's Western Wollega Zone. Geographically, the district has an average elevation of 1650–2000 metres and is situated between 9º 26N' latitude and 34º 32'E longitude. There are 42 rural and 3 urban kebele in the district. Begi Town, the district's headquarters, is situated 662 km to the northwest of Addis Ababa (Figure 1). Begi district shares borders with Qondala district to the east, Gidami district to the south, Benishangul Gumuz Regional State to the west, and Begi district to the east.

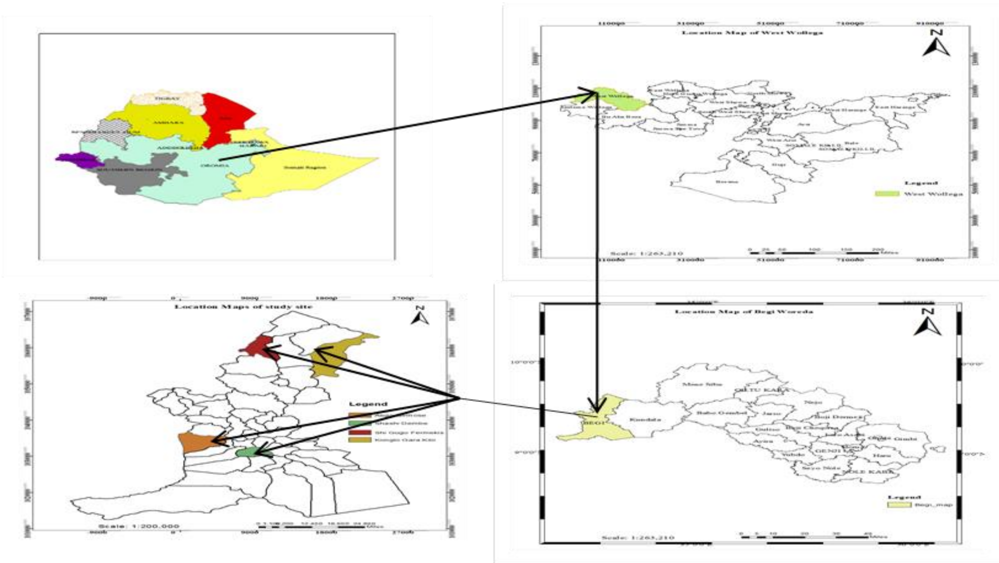

Figure 1. *Location Map of Study Area*

Population: According to the Central Statistical Agency (CSA) of Ethiopia's 2007 national census, there are 142581 people living in the district, with 70599 men and 71982 women. Thus, of the 62659 males and 63656 females in rural Keble, 126,315 live there overall, while 7940 males and 8326 females, or 16266 total, live in urban Keble. There are an estimated 18,772 households in the district, with 17950 male households and 822 female homes.

Climate and Agricultural Activities: About 15% of the district is lowland, 38% is midland, and 23% is highland. Additionally, it receives 1676 mm of rainfall on average, with a range of 771 mm to 1700 mm. Maize, sorghum, and teff are the three main crops grown in the region; most of them are produced for domestic use. The main economic methods are crop cultivation plus the raising of sheep, cattle, and horses along with coffee and conversation (BDANRO, 2019; unpublished).

Land use: The Begi district has 92,140.67 hectares of land overall. 5477 hectares are covered by forest cover, 7509 hectares by grazing land, 1320 hectares by dwellings, 16421.67 hectares by permanent plantations, and 1663 hectares by barren land (BDANRO, 2019). Of this, 59,750 hectares are exploited for crop cultivation.

Type and Source of Data: The pertinent data covered four kebeles in the district (Shash Dembi Guda Teki, Ego Girmos, Kongilo Gara Kelo, and Shigigo Fermikisi) and were both qualitative and quantitative data types (a mixed method approach) collected from primary and secondary data sources to complement each of the approaches (Creswell, 2009). Key informants, focus group discussions, and household surveys were the sources of primary data. Additionally, the district's government offices provided secondary data, as did the Central Statistical Agency (CSA), the National Meteorological Agency (NMA), and a number of published and unpublished literary sources. Trends for different seasons and annual averages from 1983 to 2019 were computed with the aid of secondary data on climate variables. These gridded station meteorological data were compared with the perceived responses of the farmers about the climatic factors in order to investigate the farmers' perceptions of climate change and variability.

Methods of Data Collection

The study employed two methods to gather qualitative data: key informant interviews with eight respondents and focus group talks with eight participants (two focus groups per kebele). Data collected from 668 households was supplemented with information from Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs). To learn more about how farmers view climate change and variability as well as the adoption of adaptation measures by the respondents, a household survey was carried out.

A questionnaire that was distributed to households was used to gather quantitative data. The dataset included views of extreme events (temperature and precipitation variations); options for adaptation or response plans; farm attributes (landholding, livestock ownership, agricultural practices, land tenure, land use, income sources); and institutional attributes (access to climate information and weather forecasts; availability of credit services; availability of extension services). The survey also included information on biophysical variables like access to the early warning system, the frequency of droughts, and the experiences of households with crop failure as a result of climate change and variability. Demographic and socioeconomic characteristics of the households were also covered. These included age, education, gender, marital status, and family size. Utilising the characteristics of the data gathered, perceptions of changes in several climate factors during the last 30 years were gathered. Regarding adaption tactics, the participants were questioned regarding the scope of their activities.

The National Meteorological Agency (NMA) of Ethiopia's meteorological station provided the rainfall and temperature data for the observation station closest to the study area. The data included monthly precipitation, monthly mean maximum temperatures (derived from the maximum temperatures observed each day), and monthly mean minimum temperatures (derived from the minimum temperatures observed each day).

Sampling Procedures: To choose the kebeles and families, the study used a combination of probability and non-probability sampling techniques (purposive and simple random sampling). Begi district was specifically chosen in the first phase of primary data collecting. This was motivated by the dearth of research in the region, which has unique geographical characteristics and a history of being vulnerable to climate-related issues. From a total of 45 kebeles, four were chosen at random for the second stage based on their coverage by productive potential and methods for adapting to climate change and unpredictability. Due to the large size of the territory and the challenge of conducting a survey in every kebele, four kebeles were chosen at random. The survey team used simple random sampling (SRS) in the third stage to select respondents over 45 years old who were 29, 35, 31, 32, and from 152, 185, 164, and 167 households (Shash Dembi Guda Teki, Ego Girmos, Kongilo Gara Kelo, and Shigigo Fermikisi, respectively). The PPS sampling technique was used to determine the sample size. A team of trained data collectors was assigned a day in each kebele to finish the household listing. Upon completion of the household listing, each listed household was assigned a unique identification number. Next, a systematic random selection technique was used to randomly choose households.

Simplified formula provided by Yamane (1967) was used to determine the required sample size at 95% confidence level, 5% degree of variability and 8% level of precision. This value is acceptable since it is less than 10%. $n = N/[1 + N (e)^2]$

Where **n** is the sample size, **N** the population (total household) size and **e** is the level of precision. $n = 668/1+ 668*0.0064 = 668/5.2752 = 127$

Method of data analysis

Qualitative analysis and descriptive statistics were combined to analyse the data. Descriptive statistics were used to analyse quantitative data on the socioeconomic and demographic traits of the homes. The results were summarised and presented using graphs, tables, frequency, and percentages. The gathered data were input into a computer programme called Microsoft Excel 2007, examined using SPSS Version 20, and reported using descriptive statistics for several factors. On the other hand, transcription, categorization, and interpretation were done on the qualitative data that was gathered through focus groups, observational notes, and key informant interviews.

Ultimately, categories and cause-and-effect linkages were used to construct relationships. Data analysis techniques included descriptive statistics, the multinomial logistic regression model (Equ. 2), and the simple linear regression model (Equ. 1). The model is also used to pinpoint the key factors that affect farmers' attitudes towards climate change.

For cases where participants are categorised according to the values of a collection of predictor variables, multinomial logistic regression is helpful. Although this kind of regression resembles logistic regression, it is more inclusive because the dependent variable isn't limited to only two groups.

$$Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i. \quad (1)$$

$$Y = \beta0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_p X_p + \varepsilon \ (2)$$

Where Y and X represent the scores for individual on the criterion and predictor variable respectively.

i. *The parameters β_0 and β_1 are constants describing the functional relationship in the population.*
ii. *The value of β_1 identifies the change along the Y scale expected for every unit changed in fixed values of X (represents the slope or degree of steepness).*
iii. *The values of $\beta 0$ identify an adjustment constant due to scale differences in measuring X and Y (the intercept or the place on the Y axis through which the straight line passes. It is the value of Y when X = 0).*

iv. *∑(Epsilon) represents an error component for each individual. The portion of Y score that cannot be accounted for by its systematic relationship with values of X.*

v. *The other parameters, β_1, β_2, ..., β_p in the multiple regression equation are sometimes called partial slopes.*

Results and Discussion

Demographic and socio-economic characteristics of the respondents

Three (2.4%) female-headed and 124 (97.6%) male-headed homes made up the total number of household heads included in the sampling (Table 1). Age group classification, according to Santrock (2011), comprises youths aged 20 to 40, adults aged 41 to 60, and seniors aged 60 and beyond. The age distribution of the respondents in this study was 45–78 years old, with a mean age of 57 (Table 2). Nonetheless, the ages of 69% of the responders were below average. The respondents' households varied in size from 4 to 17 family members, with 7 being the average. 52 (41%), 65 (51.1%), and 10 (7.9%) of the families surveyed reported being Orthodox, Muslim, or Protestant, respectively, in terms of religious affiliation.

Table 1

Distribution of Sample Households by Kebele and Gender in four kebeles of Begi district, 2020.

Gender	Kebele				Total	%
	Shash Dembi Guda Teki	Ego Girmos	Kongilo Gara Kelo	Shigogo Fermikisi		
Male HHs	28	34	31	31	124	97.6
Female HHs	1	1	0	1	3	2.4
Total	29	35	31	32	127	100

While 21% of respondents had completed basic school, 40% of household heads were illiterate and had never received formal education, while more than 39% of respondents claimed to be able to read and write. Figure 2 shows that, overall, 60% and 40% of the respondents were literate and illiterate, respectively. In addition, roughly 18% of respondents had 0.5 hectares of farmland, 23% had more than 2.1 hectares, and 59% of respondents had between 0.51 and 2 hectares. Table 3 shows that 47.4% of the respondents have less than 1ha of cropland overall.

Table 2

Distribution of sample households by age group in four kebeles of Begi district, 2020.

Age	Total					
	Frequency			Percenta		
	Male	Female	Total	Male	Female	Total
45-60	82	3	85	65	2	67
>60	42	0	42	33	0	33

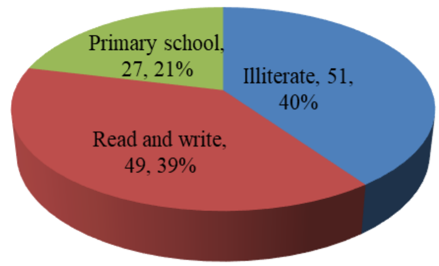

Figure 2. *Distribution of sample households by educational status*

Climate data analysis

Begi district temperature: The maximum and minimum daily, monthly, and yearly temperatures were noted. Figure 3 thus depicts the area's annual maximum, lowest, and average temperatures from 1983 to 2019. As a result, the results indicated that 1990 represented the highest range of average temperatures, while 2005 represented the lowest average temperatures. It seems like the temperature was rising a little bit.

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Table 3.

Distribution of sample households by land holding size in four kebeles of Begi district, 2020.

Kebele	Sex	Size of Farmland in ha			
		0.5	0.51-2	>2.1	Total
Shash Dembi Guda Teki	Male	4	15	9	28
	Female	1	0	0	1
Ego Girmos	Male	10	16	8	34
	Female	0	1	0	1
Konglo Gara Kelo	Male	5	19	7	31
	Female	0	0	0	0
Shigogo Fermikisi	Male	3	23	5	31
	Female	0	1	0	1
Total		23	75	29	127

Climate data analysis

Begi district temperature: The maximum and minimum daily, monthly, and yearly temperatures were noted. Figure 3 thus depicts the area's annual maximum, lowest, and average temperatures from 1983 to 2019. As a result, the results indicated that 1990 represented the highest range of average temperatures, while 2005 represented the lowest average temperatures. It seems like the temperature was rising a little.

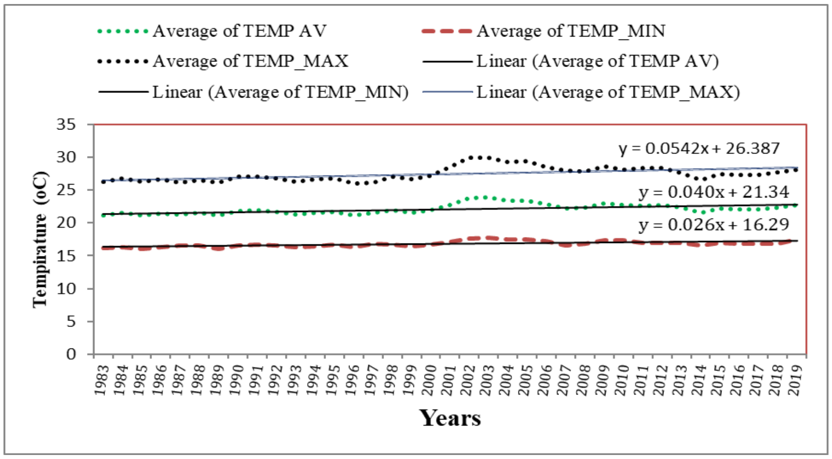

Figure 3. *Temperature trend of study Area, four kebeles of Begi district (1983-2019).* Source: ENMA (2020)

The average yearly temperature is rising at a rate of 0.040 °C/year, the maximum temperature is rising at a rate of 0.054 °C/year, and the lowest temperature is rising at a rate of 0.026 °C/year, according to the trend (Figure 3). The district under consideration has an average temperature between 21.08 ºC and 23.83 ºC, and an average maximum temperature between 25.99 ºC and 29.96 ºC, according to data from ENMA (2020). As a result, for over thirty years, the district's annual lowest temperature has fluctuated between 16.01 ºC and 17.69 ºC (Figure 3).

Trend and Distribution of Rainfall in Begi District

For the previous 36 years, the annual rainfall in the Begi district has varied from a minimum of 771 mm in 2002 to a maximum of 2294.57 mm. The results of the data analysis indicate that, over the previous 36 years, yearly rainfall has decreased at a rate of 13.8 mm/year, peaking in 1996. Between 1983 and 2018, there was an annual variation in the amount of rainfall. Over the previous 36 years, the district has received 1492.5 mm of rain on average. With the exception of 1990, 1991, 1992, 2000–2013, the inter-annual patterns of rainfall distribution revealed that yearly rainfall quantities were above normal in the majority of years (Figure 4 & 5).

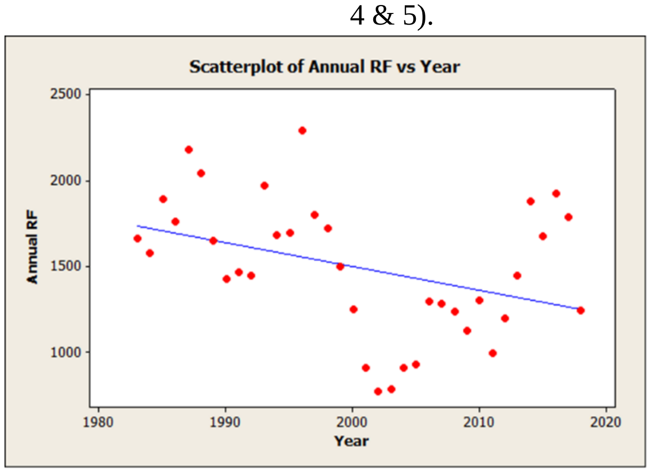

Figure 4. *Trend of annual rainfall in Begi District (from 1983-2018).*
Source: ENMSA (2020), grid data

As in most parts of western Ethiopia, Begi district's rainy months are June, July, August, and September, while November, December, and January are the lowest rainy months. Thus, the monthly distribution and variability show the wettest month is August, while the driest month is February, with an average rainfall of 29.90 mm. On the other hand, the wettest season is summer, while the driest season is winter. Relatively speaking, spring is the second rainy season in the district (Figure 5).

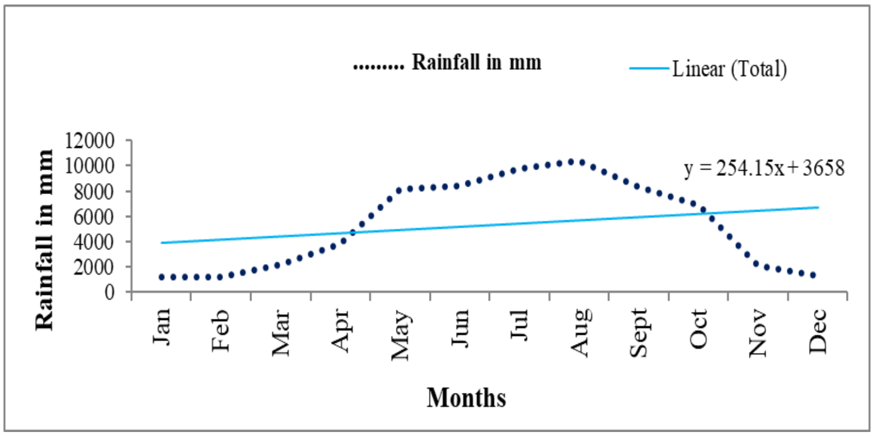

Figure 5. *Overall average monthly rainfall distribution of Begi district, western Ethiopia (1983 to 2018).*

Trends in seasonal rainfall variability

The rainy months in Begi district are June, July, August, and September, while the least rainy months are November, December, and January, similar to rest of western Ethiopia. With an average rainfall of 29.90 mm, February is the driest month, while August is the wettest according to the monthly distribution and variability. In contrast, winter is the driest season and summer is the wettest. In the district, spring is essentially the second rainy season (Figure 5).

There was significant annual rainfall fluctuation, according to rainfall data spanning more than three decades (Figure 6). Over the last three decades, the average annual rainfall has been 1492.5 mm, with a standard deviation of roughly 1183.66 mm. However, the amount of rainfall over the previous three decades has varied from the mean by 70.612%, or a significant amount. Nonetheless, there is a noticeable increase in rainfall unpredictability, and the total amount is gradually declining (Figure 4; Figure 6).

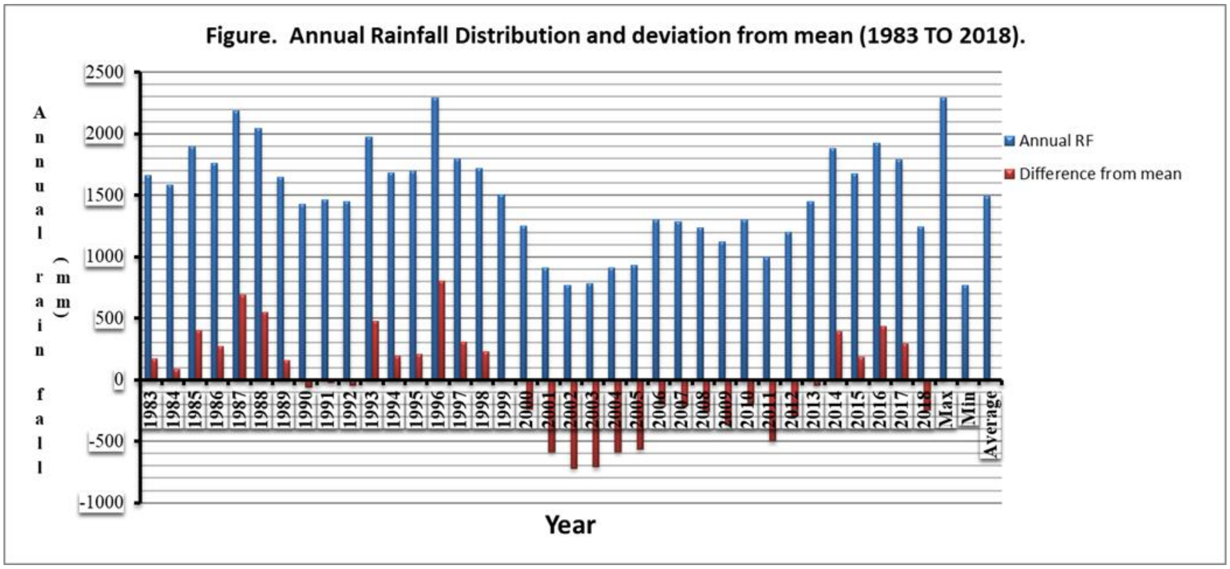

Figure 6. *Annual Rainfall Distribution and its deviation from the mean (from 1983 to 2018). Source: ENMA (2020) gridded data, 2020*

Farmers' perceptions of rainfall variability in Begi District

There has been variability in the amount, timing, and distribution of rainfall in the research area during the past 30 years, according to more than 91% of key informant interviewers and participants in farmers group discussions (FGDs).

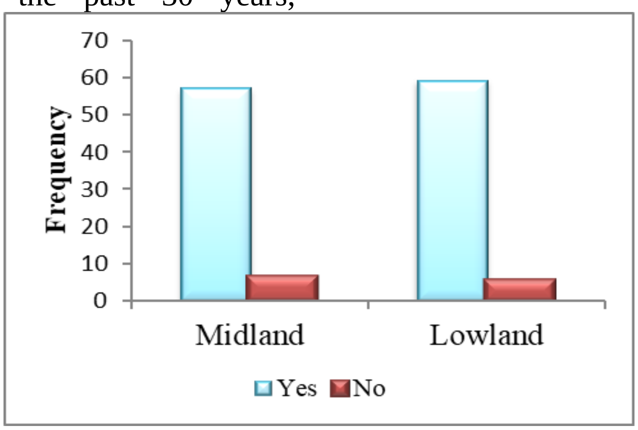

Figure 7. *Farmer's perception of rainfall variability by agro ecology*

Every agroecology has a different way of seeing them. The findings of the field survey revealed that only 72% of respondents from midland areas saw a change in rainfall, compared to roughly 94% of respondents in lowland areas who recognised a change in rainfall (an increase or decrease). This demonstrates that when there are already climate-related issues, the effects of climate change are more noticeable (Figure 7). According to the survey results, all of the household heads who participated in the study felt that there was long-term unpredictability in the volume and distribution of rainfall. Few respondents stated that the amount of rainfall in Begi district had increased over the past 30 years, while the majority of household heads indicated that it had varied and showed a decreasing tendency.

Farmers' perceptions of the determinants of Begi district's rainfall variability

Participants in the study were asked to consider the indicators they had been utilising to gauge rainfall variability. According to the people's responses, farmers used a few indicators to identify the occurrence of climate variability: 72% of respondents cited the loss of livestock and plant species; 78% mentioned an increase in temperature; and 78% mentioned a decrease in rainfall and the spread of animal and human diseases; 83% mentioned a shortening of the growing season; 90% mentioned rainfall that arrives late and leaves early; 97% mentioned a decline in agricultural yield; and 100% mentioned a decrease in water availability.

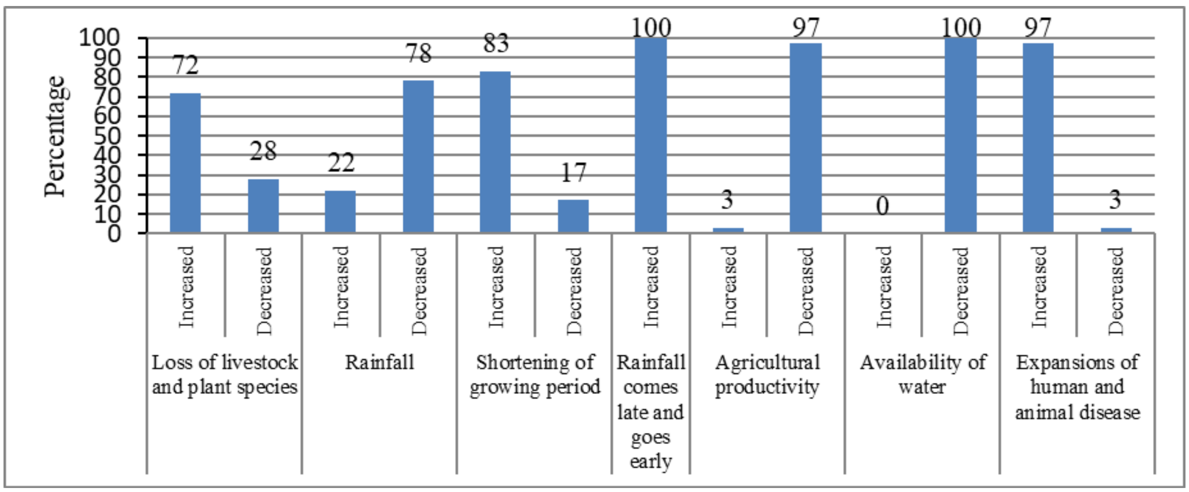

Figure 8. *Farmers' perception on rainfall variability indicators*

Farmers' perception on temperature variability and its indicators in Begi District

The survey result revealed that out of the total household heads, all of them perceived that there has been long- term variability in temperature in study area over the past 30 years and showed an increasing trend. Thus, in lowland and midland area, 100% and 97.7% of the respondents perceived that temperature was increasing year to year, respectively, while 2.3% of the midland kebele respondents felt that there was no change in temperature (Figure 9). Respondents were also asked to identify some of the variability in temperature they have observed in their surroundings over the past decades. Accordingly, they responded that the occurrence of newly introduced human and animal disease (58%), drying up of rivers and streams (94%), and damage to crops caused by pests (75%), were some of the indicators in the surroundings reported by the respondents as a result of variability in temperature and disturbance of rainfall over time. FGD and key informant interview participants also added a decrease in water availability, a loss of biodiversity, and land degradation as indicators of increasing temperature in the area.

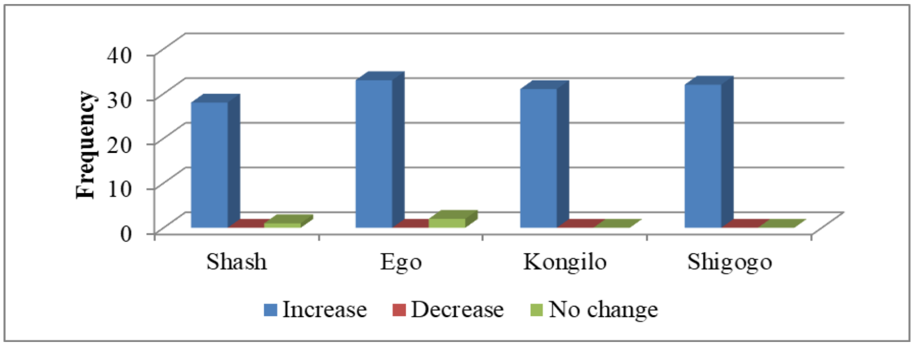

Figure 9. *Farmers' Perception on Temperature Variability in Begi district*

Farmers' perceptions of climate change in Begi district, Ethiopia

According to the survey results, every household head who responded felt that the study area's temperature had fluctuated during the previous 30 years and that this trend had been growing. As a result, 2.3% of respondents in the midland kebele believed that there had been no change in temperature, whereas 100% of respondents in the lowland and 97.7% of respondents in the midland area felt that the temperature was rising annually (Figure 9). In addition, the respondents were asked to list some of the temperature variations they had noticed during the last few decades in their immediate environment. As a result, they responded that some of the indicators in the environment reported by the respondents as a result of temperature variability and rainfall disturbance over time included the occurrence of recently introduced human and animal disease (58%), drying up of rivers and streams (94%), and damage to crops caused by pests (75%). Participants in focus group discussions and key informant interviews also mentioned land degradation, a decline in biodiversity, and a reduction in water supply as signs of rising temperatures in the region.

Table 4

Farmers' perception on climate

Questions		Frequency			Percentage %		
		Male	Female	Total	Male	Female	Total
Table 4 continues...							
Do you think that there is climate Change in your local area?	Yes	164	23	187	96	55	88
	No	6	19	25	4	45	12
Have you heard of the word Climate variability before?	Yes	120	25	145	70	60	68
	No	52	17	69	30	40	32
From which source you heard about climate variability?	Radio	92	24	116	50	75	54
	DAs	83	5	88	46	16	41
	NGO	7	3	10	4	9	5

Perception on agro-ecology and sex of HHHs

According to several reports, farmers in low-lying areas were more aware of climate change because the environment there is already hotter and easier to sense (Deressa et al., 2008). This finding also demonstrated that farmers in lowland areas (92.7% of sample respondents) have a greater awareness of climate change than do farmers in the midlands (79.5% of respondents). As a result, homes headed by women are seen less favourably since they have less access to mobility, information, and technology. On the other hand, because they are mobile, make decisions, and are involved in local organisations, male-headed farmers have access to knowledge. In general, 86.1% of respondents in both climatic zones said they were aware of climate change, whereas 13.9% said they were either unaware of it or did not think it existed (Figure 10).

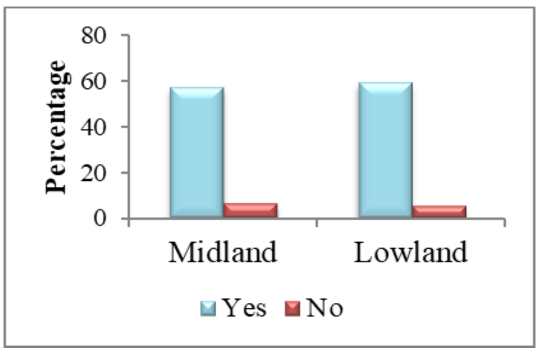

Figure 10. *Farmers Perception on climate change by agro--ecology and sex.*

Perception by age group and educational status

Amadou et al. (2015) claim that seasoned farmers are more aware of climate change. Accordingly, 88% and 93% of study participants who were classified as adults under the age of 45–60 and older participants beyond the age of 60, respectively, acknowledged the existence of climate variability (Table 5). Furthermore, although adults were thought to recognise climate change because they had access to education and knowledge, the majority of adults in this research were illiterate; as a result, older people perceived the issue more accurately because of their experience than their education (Deressa et al., 2008).

Table 5

Participant's Perception of Climate change by Age and Educational Status

No	Is there CC in your locality?	Age category (N=127)				Educational status (N=127)					
		45-60		>60		Illiterate		Read and write		Primary school	
1	Yes, there is	75	88	39	93	35	27	38	30	26	20
2	No, there isn't	10	12	3	7	16	13	11	9	1	1
Total		85	100	42	100	51	40	49	39	27	21

Of the 51 participants who were illiterate, 70% acknowledged the presence of climatic fluctuation. According to Table 5, 78% and 96% of participants who have completed primary school and can read and write, respectively, believed that there is climate variability. The findings indicate that the bulk of respondents (30%) who did not believe that climate variability exists are illiterate, followed by read-and-write respondents (23%) and primary school graduates (4%), respectively. Farmers' perceptions of climate fluctuation are directly correlated with their educational attainment. Educated farmers can obtain information from educational institutions, environmental organisations, and other information sources. Higher educated farmers, then, perceive things more favourably than farmers with lower education levels (Table 5).

Approximately 93.2% of the sample households are aware that there is a drought in the lowland region, but 67.3% of respondents in the midland believe there is a drought (Figure 11). Conversely, respondents from the lowland sample (89.9%) felt that the frequency of drought was increasing higher than those from the midland group (61.5%).

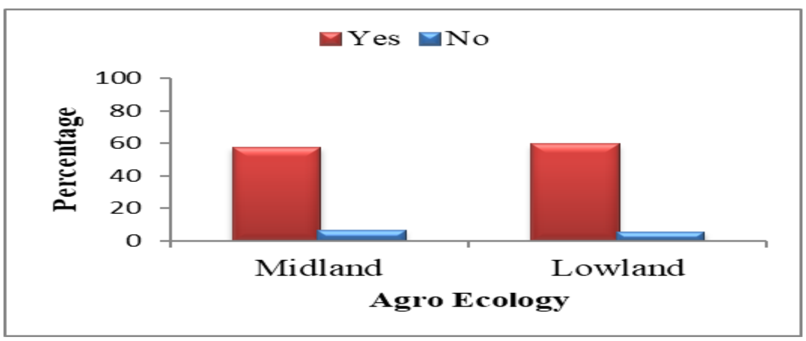

Figure 11. *Perception on the existence of drought by agro ecology*

Farmers' perception on impacts of climate change

Pests and diseases, temperature fluctuations, and variations in precipitation are enduring issues affecting agricultural practices and public health in the study region. In Begi district, climate variability affects crop productivity, livestock, and human health. As a result, the livelihood of the local population is impacted, leading to famine (due to reduced production), diseases, shortages of animal feed, and livestock losses (Figure 12). Begi district households are generally seeing a downward trend in crop and animal output due to rising and variable temperatures, pests, illnesses, and rainfall variability. Consequently, a sizeable percentage of the families experienced a decrease in food crops and an increase in disease. They added that things had gotten worse over time. The primary cause of their livestock decrease is a lack of fodder, and according to the majority of respondents, they also sell their animals because they are unable to repay the money they have borrowed from family and financial institutions.

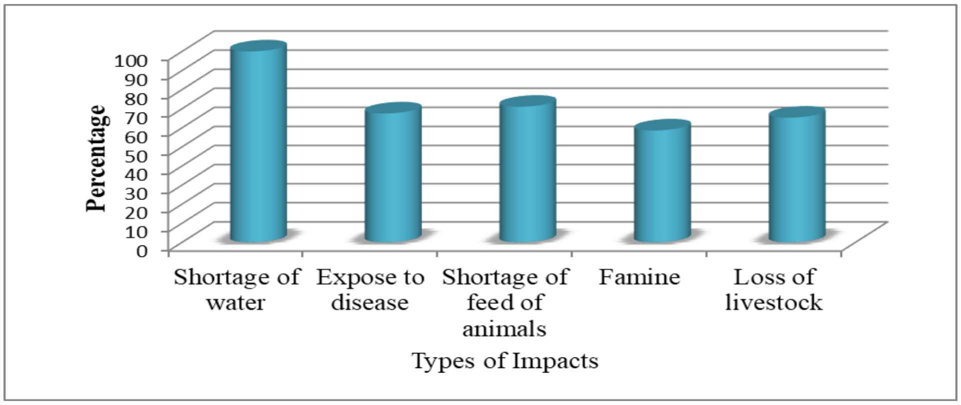

Figure 12. *Most commonly mentioned impacts of climate change*

Impacts of climate change on natural resources and the environment

According to the household evaluation of the area's environmental resources, 96% and 100% of the study area's respondent households, respectively, said that the availability of water and the amount of forest cover had declined over time (Table 6). Approximately 92% of the participants noted an increase in soil erosion issues in the Begi district. In general, 84% of respondents indicated that land degradation is a significant issue facing society today (Table 6). Certain plant species, such as Acacia, Ficus, and Cordia Africana, have significantly declined in number, and certain populations of wild animals have declined from the research region, as confirmed by FGDs and KII participants.

Table 6

Household's Assessment of the state of Environmental Resources

Natural resources		Frequency	Percentage
Change in forest cover	Increased	5	4
	Decreased	122	96
	No change	0	0
Soil erosion over time	Increased	117	92
	Decreased	10	8
	No change	0	0
Water availability	Increased	0	0
	Decreased	127	100
	No change	0	0
Land degradation	Increased	107	84
	Decreased	16	13
	No change	4	3

Responses to Climate Change

Community's adaptation strategies

These days, there are many coping and adaptation strategies available due to the widespread recognition of the effects of climate change. According to this poll, the study area's residents implemented a variety of reaction strategies to mitigate the effects of extreme weather brought on by climate change. The findings showed that, correspondingly, 73.8%, 64.5%, 79.3%, and 74% of the respondents planted trees, cultivated short-maturing crops, and varied their sources of income (Figure 13).

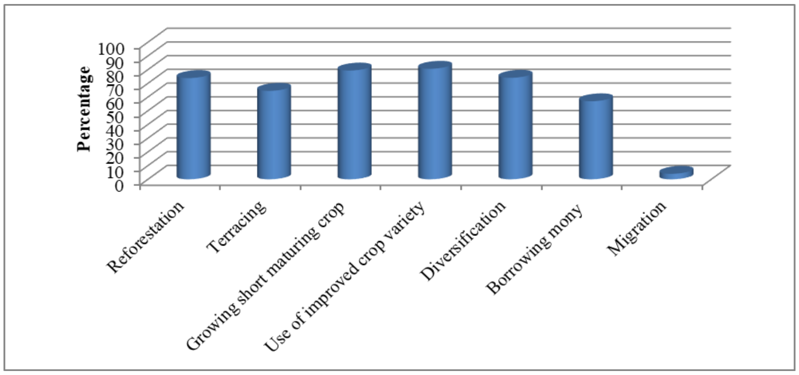

Figure 13. *Farmers Adaptation Options to climate change in Begi district, Ethiopia.*

Releasing funds from family members and credit institutions accounted for 56.7 percent of the respondents' adaptation options, with relocation making up the remaining 4%. In addition, farmers sold charcoal and firewood and decreased the size and frequency of their mills during times of food scarcity.

CONCLUSIONS

The study's conclusions demonstrated that over the previous three decades, the Begi district's temperature and precipitation varied. The highest and lowest temperatures have both somewhat increased and fluctuated; the amount of rainfall in the winter and autumn has decreased and fluctuated, while the amount of rainfall in the year has varied across seasons and years. In addition, local farmers believed that threats brought on by climatic variability included drought, land degradation, deforestation, floods, pests, and disease; variations in rainfall had an impact on the environment and their means of subsistence. Therefore, the most popular adaptation techniques used in the region to deal with the effects of the climate were terracing, reforestation, planting crops with short maturities, diversifying sources of income, and managing animals. As a coping strategy, people also use seasonal migration, cutting back on meal size and frequency, and selling firewood. For many people in the research area, however, the main obstacles to adapting were poverty, water scarcity, farmland scarcity, lack of knowledge about weather and climate variability, lack of available financing, and lack of access to extension. The study's findings showed that farmers' perceptions of climate change are generally positive. Additionally, a farmer's age, educational level, access to extension, prior farming experience and additional income, sex, the size of their farm, loan availability, information availability, and market accessibility all had a substantial impact on their opinion of climate change and its adjustments. Those who were poor, landless, women, children, and the elderly were found to be some of the most vulnerable social categories. Thus, in order to enhance farmers' perspective and capacity for adaptation, suitable policy mechanisms and programme execution are needed for more environmentally friendly and sustainable agriculture.

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DECLARATION

The authors declare that there is no competing interest regarding the research.

DATA AVAILABILITY

The necessary data are available within the article.

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