Community Perception on Environment, Health and Socio-Economic Impact of Climate Change in Arbaminch Town South Ethiopia

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Abstract

Climate change has been disrupting the lives of households' in Arbaminch town which is the most devastating environmental, economic, social and health threats in the current century. This paper has aim to organize the effect of climate change in social, economic environmental and health of households in Arbaminch town southern Ethiopia. Primary data was collected via survey research strategy through structured questionnaire. A cross-sectional survey was conducted in Arbaminch town. A pre-tested questionnaire was used in data collection to evaluate group differences for dichotomous variables. Logistic regression and chi-square test was also used to determine the strength of the association between factors. The survey result shows that 73.2%,72%,59.1% of respondents perceived shortage of rainfall, drought, water and air pollution and unexpected rainfall are climate change related environmental impact in the town. The study result indicates that respondent's perception about climate change impact on social life (conflict) is significant association with occupation x^2 =37.3, p < 0.001, and education level x^2=17.1, p=0.002 at the 5 % significant level. The logistic regression model indicated that the respondents increasing level of education and occupation is significant relation with climate change impact on economy p =0.005 and p = 0.1, Negelkerk R^2 =0.192.due to climate change human and livestock death is high in the town. Therefore, policies and intervention programs aimed at establishing interventions to reduce climate change related impact by providing different alternatives.

Keywords: Climate change; Economic; Environmental; Health; Social; Impact; Perception

Introduction

Climatic change is not new to our planet. Over the last few billion years the earth has witnessed tropical forests spread across entire continents, dinosaurs roam the landscape, ice sheets covering most of the Northern Hemisphere, and sea levels decrease by 100 meters. These processes are part of the planet's natural climatic variability. Unfortunately, many ecosystems and organisms suffer as these changes take place, while others thrive in the new environment [1]. Over the last 450,000 years, the earth has gone through several ice ages (global cooling) followed by warming periods (global warming) [2]. These climatic changes have shaped the ecosystems that we see today. Animals and plants that live on the earth at present have evolved over a long period of time under pressures from their surrounding environment. While climates and habitats have always changed, the problem today for these organisms is that the changes are occurring faster than ever [1]. Africa is particularly vulnerable to climate change and climate variability. This vulnerability has been attributed to the continent's high poverty levels, low adaptive capacity, its dependence on rain-fed agriculture as well as its limited economic and institutional capacity [3]. Kofi Annan in his opening address to the said that "climate change is

happening, and it is happening now. We can no longer consider it as a threat that is yet to hit us; all over the world we see its impact) [4].

Developing countries in general and least developed countries like Ethiopia in particular are more vulnerable to the adverse impacts of climate variability and change. This is due to their low adaptive capacity and high sensitivity of their socio-economic systems to climate variability and change [5]. Severe weather events such as droughts and floods have historically imposed heavy costs in Ethiopia the projected impacts of climate change may affect the consequences of these events and could potentially hinder advancements in key development areas such as food security, water resources management, health, and economic growth.

Climate related hazards in Ethiopia include drought, floods, heavy rains, strong winds, frost, heat waves (high temperatures), etc. 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 [5]. These climate related hazards results environmental, social and economic impacts in the world particularly in the developing countries including Ethiopia. For example, 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 [6]. The main objectives of the study therefore, were to identify climate change impact and the adaptation options practiced in Arbaminch town southern Region of Ethiopia

Methods and Material

Study area

The study area is located approximately between 370 28' 54''E to 370 36' 45''E and 50 55'16''N to 60 05' 14''N in South Nations, Nationalities, and peoples' Regional State (SNNPRS).

It is located about 500km away from Addis Ababa, the capital city of Ethiopia. The study site is bordered with Lake Abaya in the East, Lake Chamo in South-East and the ridge of the Great African Rift in the West. It is also bounded in between River Sile in South and River Harre in North. River Kulfo crosses the town at the northern side and flow South-East direction into Lake Chamo. The Great East African Rift Valley and the two lakes basins (Abaya and Chamo) are dominant physical features of the study area. The elevation varies from 1108m at Lake Chamo up to 1800m above sea level on Genta-Zigiti Ridge. The agro-climatic zone of the study area is characterized by dry Kola with its average annual temperature of 280C and 895mm of average annual rainfall. The major economic activity in the town is trade. Tropical fruit plantations and cotton production, reliant on irrigation from the nearby lakes and rivers are also common in the region. Traditional fishing is also a major livelihood of the Arba Minch residents (Figure 1).
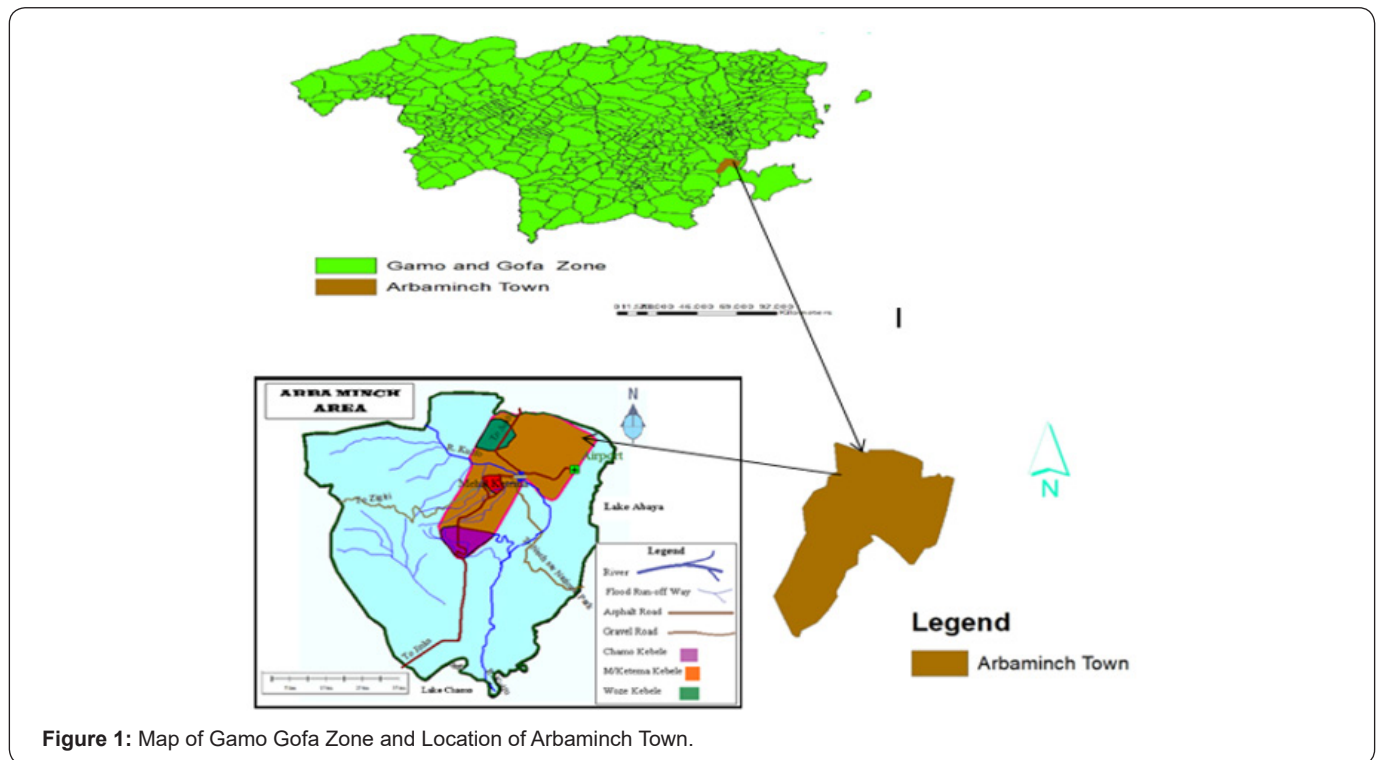

Figure 1: Map of Gamo Gofa Zone and Location of Arbaminch Town.

Study design and period

A quantitative cross-sectional study design has been used in this research. A quantitative research is generally associated with the positivist/post positivist paradigm. It usually involves collecting and converting data into numerical form so that statistical calculations can be made, and conclusions drawn. In quantitative research a hypothesis which predicts relationships and associations between the things to be investigating (variables) should be conducted. Based on this approach we have developed a hypothesis regarding the association between demographic characteristics with the perception of residents. The study was conducted from November-December 2016.

Source and study population

All households at Arbaminch were the source population of this study. The study populations were all selected households included in those kebeles which were purposely selected as areas where urban agricultural practice was common.

Sample size and sampling procedure

The study followed multistage sampling procedures with respondents as the ultimate sampling unit to acquire primary data. From the total number of kebeles, three kebeles which practice urban agriculture were selected using purposive sampling. The sample size for the households'/respondent's

survey was determined using single proportion formula (Kothari,2004). The following formula was used to determine the size of the sample.

$$n = \frac{z^2 . p . q . N}{e^2(N-1) + Z^2 . P . q}$$

$$\frac{(1.82)^2(0.5)(0.5)5409}{(0.07)^2(5409-1)+(1.82)^2(0.5)(0.5)}$$

Where n = desired sample size when target population is less than 10,000; N= total number of households in three kebeles, z = Value of standard variation, e= Acceptable error, p= the proportion of the target population estimated to have characteristics being measured (50% is taken or 0.5), d= level of statistical significance, and q= 1-p. Then p= 0.5, q = 0.5 considering 95% level of confidence, the related standard normal deviate is z= 1.82 and the desired accuracy is at 0.07 level.

Then the sample size is; $= \frac{4479}{27.3273} = 164$

Data collection

Primary data at the household level was collected through a household survey using structured questionnaire. Primary data was collected through questionnaires containing close ended questions. After preparing the questionnaires in English language, it was translated into the local language Amharic. A pre- test was collected in other kebeles before the actual data collection was conducted. The investigator checked the collected pre-test data to maintain its accuracy, completeness, clarity and consistency. Any error, related to clarity, ambiguity, incompleteness, or misunderstanding were solved before beginning actual data collection activities. To make the subjects respond freely, the data collection process was conducted confidentially, and the duration of data collection was as short as possible.

Data processing and analysis

The collected data were coded and entered using Statistical Package for Social Sciences (SPSS) software version 20.0. Data were cleaned accordingly for further analysis. The frequency distribution of dependent and independent variables was computed. Descriptive statistics including frequency and percentage were calculated and presented in tables, graphs and charts. The Chi-square test of independence was used to evaluate group differences for dichotomous variables .Logistic regression was also used to determine the strength of the association between factors, in this study, for example, if age group could be used to predict the awareness of the respondents regarding climate change (1 = ''Yes'', 0 = ''No'').

Results and Discussion

Results

Table 1: Distribution of Sampled Household by Kebeles.

Kebele	Total Numiber of HH in each Kebele	Proportion	Sample Size from Each Kebele
Woze	2655	$\frac{2655}{5409} \times 164$	81
Mehal ketema	1214	$\frac{1214}{5409} \times 164$	37
Chamo	1540	$\frac{1540}{5409} \times 164$	46
Total	4479		164

Demographic characteristics of respondents: Demographic data provides the readers with a picture of the demographic and socio-economic composition of the respondents (Table 1). Accordingly, demographic data in this study comprises age, gender, educational status, occupation and monthly income level of the sample households in the town. The demographic and socio-economic characteristic of the sample households is described in (Table 2). Most of the respondents were males 105 (64%) and the rest 59 (36%) were females. Among the total respondents 59 (35%) of the respondents had no education, while 31(18.9%) and 44 (26.8%) attained primary and secondary education respectively. The mean age of respondents in the study was found to be 30.29 years with standard deviation of .917; the younger age of the respondent was 18 whereas the older age is 64 years. 11.6% and 9.1% of they obtained college diploma and degree. Regarding the occupation category as illustrated in (Table 2) that majority of respondents were Merchant (31%) followed by farmers (29.3%). Government employees consisted only 18.3% the rest 20.7% of them were engaged in other activities.

Table 2: Socio Demographic Characteristics of Respondents.

Variable		Frequency	Percentage
Gender	Male	105	64
	Female	59	36
Educational Level	Illiterate	55	33.5
	Elementary School	31	18.9
	High School	44	26.8
	College diploma	19	11.6
	Degree	15	9.1
Occupation	Government	30	18.3
	Merchant	52	31.7
	Farmer	48	29.3
	Others	34	20.7
Age	18-30	46	28
	31-40	63	38.4
	41-60	42	25.6
	Above 61	13	7.9

Environmental impact of climate change in the town: As a result of increased population Environmental problem is widely recognized as a major Climate Hazard and a key development and Environmental challenges in the town. As indicated in (Figure 2,3) below over 73% of respondents believed that major climate change related Environmental problem in the town is Shortage of rainfall. 72 % of respondents felt Drought and water or Air Pollution as Climate change related environmental problem in the town.59.1%, 36.6%, 34.1% and 28.7% of respondent's mentioned Un expected rainfall, Seasonal Fluctuation of rainfall, Land degradation and Heat wave as major Climate Change related Environmental challenge in the town. Most of the respondents were males 105 (64%) and the rest 59 (36%) were females. Among the total respondents 59 (35%) of the respondents had no education, while 31(18.9%) and 44 (26.8%) attained primary and secondary education respectively. The mean age of respondents in the study was found to be 30.29 years with standard deviation of 917; the younger age of the respondent was 18 whereas the older age is 64 years. 11.6% and 9.1% of they obtained college diploma and degree. Regarding the occupation category as illustrated in (Table 2) that majority of respondents were Merchant (31%) followed by farmers (29.3%). Government employees consisted only 18.3% the rest 20.7% of them were engaged in other activities.
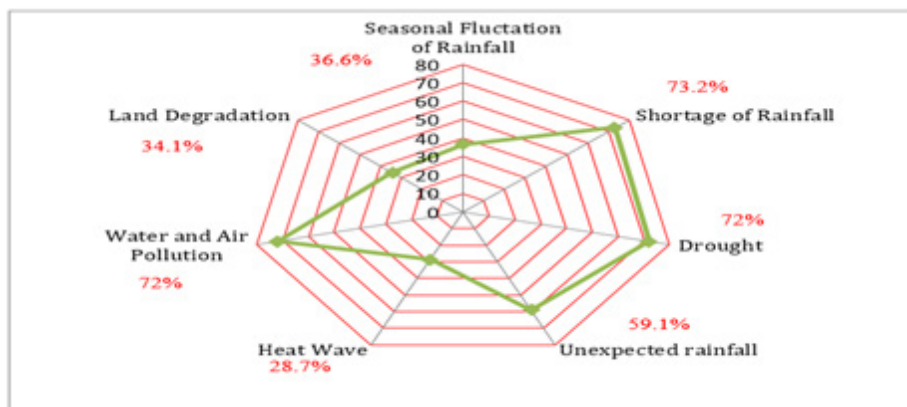

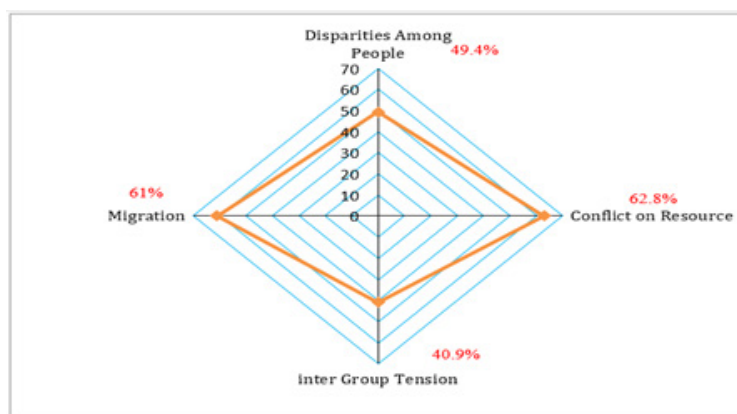**Figure 2:** Perceived Environmental Challenges of Climate Change in Arbaminch Town.

Figure 3: Perceived Social Challenges of Climate Change in Arbaminch Town.

Climate Change has negative Impact on physical, financial and Natural asset of communities. The descriptive statistics of the study revealed in (Figure 4) that the majority 98.2% of respondents responded that due to climate change food price is raised and had high impact on the economy of the community.86% of respondents perceived that due to climate change they have paying for either for construction of ditches, construction of Embankment and dislocating out of flood area.

70.7%, 54.3% and 29.3% of respondents perceived that climate change lead to water cost, Health cost and cost for lost crop. Due to aggregate economic impact of climate change drought persists human and livestock death toll increases compounded by poor sanitation and deteriorating natural environment. In many parts of the town, the effects of drought on ecosystems have begun to compromise the traditional livelihoods and lifestyles of indigenous peoples who depend on them.
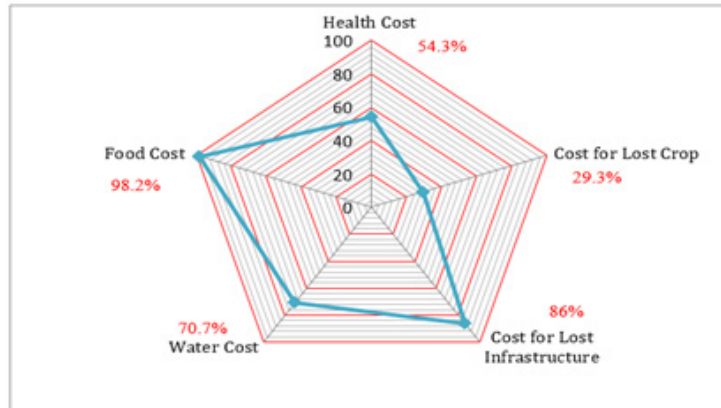

Figure 4: Perceived Economic Impact of Climate Change in Arbaminch Town.

Table 3: Chi-Square Test of Independence Regarding Perception of Respondents on the Social Impact of Climate Change.

Category	Conflict		X^2(p-value)	Intergroup Tension		X^2(p-value)	Migration		X^2(p-value)
	Yes	No		Yes	No		Yes	No	
Gender									
Male	35	70	1.86(0.116)	56	49	4.08(0.031)	42	63	0.12(0.432)
Female	26	33		41	18		22	37	
Age									
Young	21	25	4.21(0.240)	27	19	2.63(0.451)	17	29	1.48(0.685)
Adult	22	41		39	24		22	41	
Old	16	26		26	16		19	23	
Very old	2	11		5	8		6	7	
Education									
Illiterate	19	36	17.1(0.002)	29	26	17.9(0.001)	25	30	4.39(0.356)
Primary	15	16		19	12		10	21	
Secondary	23	21		36	8		17	27	
Diploma	4	15		9	10		9	10	
Degree	0	15		4	11		3	12	
Occupation									
Employed	7	23	37.3(.0.000)	15	15	36.1(0.000)	8	22	3.66(0.299)
Farmer	4	44		14	34		17	31	
Merchant	33	19		45	7		24	28	
Other	17	17		23	11		15	19	
Income									
<600	4	7	6.00(0.112)	5	6	7.52(0.057)	4	7	1.62(0.654)
600-1200	1	13		4	10		6	8	
1201-2000	19	29		29	19		22	26	
>2001	37	54		59	32		32	59	

The increased drought risks to agriculture, property, infrastructure, and ecosystems are likely to have negative effects on health by impeding access to safe water and sufficient food in the town. Regarding perception of respondents on social impact of climate change The result of a Chi-square test of independence suggested a significant association between respondents occupation and awareness about climate change related conflict X2= 37.3, p <0.001 and education level with awareness about climate change related conflict X2= 17.1, p = 0.002 were statistically significant at 5 % level of significance The result of a Chi-square test of independence suggested a significant association between respondents occupation and climate change related inter group tension X2= 36.1, p <0.001 and education level with awareness about climate change related inter group tension X2= 17.9, p = 0.001 were statistically significant at 5 % level of significance. The hypotheses that differences in perception regarding climate change impact and association with migration related to differences in independent

variable are not supported even at the 5 % significant level (Table 3). Similarly, the result of a Chi-square test of independence which tested the association between respondents' demographic characteristics with their perception regarding climate change related impact on the respondents Economy. The result of a Chi-square test of independence suggested a significant association between respondents occupation and awareness about climate change related impact on crop loss X2= 38.7, p <0.001, the association of climate change related impact on crop loss with respondents age X2= 17.1, p = 0.001, the association of climate change related impact on crop loss with education level X2= 36.1, p = 0.001 were statistically significant at 5 % level of significance. The hypotheses that differences in perception regarding climate change impact and association with water and infrastructure cost related to different in independent variable were not statistically significant even at the 5 % significant level (Table 4).

Table 4: Chi-Square Test of Independence Regarding Perception of Respondents on the Economic Impact of Climate Change.

Category	Crop Loss		X²(P-Value)	Water Cost		X²(P-Value)	Infrastructure Cost		X²(P-Value)
	Yes	No		Yes	No		Yes	No	
Gender									
Male	45	60	0.97(0.205)	14	91	0.11(0.452)	76	29	0.38(0.32)
Female	30	29		9	50		40	19	
Age									
Young	31	15	17.1(0.001)	9	37	6.5(0.088)	32	14	0.76(0.85)
Adult	29	34		11	52		46	17	
Old	10	32		1	41		28	14	
Very old	5	8		2	11		10	3	
Education									
Illiterate	15	40	18.1(0.001)	5	50	4.56(0.33)	36	19	3.77(0.43)
Primary	12	19		6	25		24	7	
Secondary	24	20		9	35		31	13	
Diploma	13	6		1	18		12	7	
Degree	11	4		2	13		13	2	
Occupation									
Employed	19	11	38.7(0.000)	5	25	0.49(0.92)	26	4	4.66(0.19)
Farmer	4	44		6	42		33	15	
Merchant	30	22		8	44		35	17	
Other	22	12		4	30		22	12	
Income									
<600	2	9	7.98(0.046)	1	10	1.32(0.72)	7	4	0.68(0.87)
600-1200	3	11		1	13		9	5	
1201-2000	25	23		6	42		35	13	
>2001	45	46		15	76		65	26	

Logistic regression was used to determine the odds that a ''Yes'' response to participants perception about Economic impact of climate change and a function of a set of demographic

characteristics, including gender, age, education level, income level and occupation (Table 5). displays the findings concerning the perception of respondents about climate change impact on

economy as function of predictors. The model shows a positive relation between respondents' educational level and occupation with their perception about climate change impact on economy. The model indicates that respondents with diploma and above had more awareness compared to illiterate respondents and respondents who possessed primary and secondary level education (p=0.005). It was also observed that, government employees had better awareness about perception about climate change impact on economy compared to farmers, merchants and others (p =0.100).

Table 5: Summary of Logistic Regression Analysis for Variables Predicting Perception of Respondents About Economic Impact of Climate Change.

Variables	Estimated Coefficient	Standard Error	Wald	Sig.
Gender	-0.329	0.528	0.388	0.533
Age	0.116	0.394	0.087	0.768
Educational Level	1.023	0.368	7.727	0.005
Occupation	0.519	0.316	2.702	0.1
Income	-0.313	0.284	1.214	0.271
Constant	-0.337	2.186	0.024	0.877

The logistic regression regarding respondents' r perception about climate change impact on social life of respondents' function of predictors is presented (Table 6). The model revealed that a positive relation between respondents' educational level with perception about Social impact of climate change. The model indicates that respondents with diploma and above had more awareness compared to illiterate respondents and respondents who possessed primary and secondary level education (p=0.003).

Table 6: Summary of Logistic Regression Analysis for Variables Predicting Perception of Respondents About the Social Impact of Climate Change.

Variables	Estimated Coefficient	Standard Error	Wald	Sig.
Gender	-0.344	0.429	0.644	0.422
Age	0.2	0.331	0.367	0.545
Educational Level	0.883	0.298	8.797	0.003
Occupation	-0.137	0.234	0.343	0.558
Income	-0.287	0.23	1.559	0.212
Constant	0.656	1.81	0.131	0.717

Discussion

The majority of world's peoples and governments believe that a climate change poses a high-level threat to human beings and to the natural environment. Successive scientific reports, notably from the Intergovernmental Panel on Climate Changes [7], suggest that "there is a high level influence of human beings on the world environment" and this high level influence cause an overall degradation of the natural environment and to the rising of world atmospheric temperature. The present study result also indicates that Climate change has high impact on environment in Arbaminch town. Shortage of rainfall, Drought, water and air pollution, land degradation, unexpected rainfall and heat wave are major environmental impact in Arbaminch town (Figure 2) this study is similar with Studies undertaken by [8], the major environmental problem currently faces Africa are erosion, deforestation, desertification, drought, water shortages resulting from the dry season, hot springs and active volcanoes found to the extreme east of the rift valley. According to Reuveny R [9], global climate change is also likely to have an effect on intergroup relations. Diminishing resources set the stage for intergroup conflict, either when two groups directly compete for the remaining natural resources or when ecological degradation forces one group to migrate out of its own territory and become an immigrant into another group's territory. In line with [9], this study indicated in (Table 3) that climate change has social impact in Arbaminch town. There for the study result confirmed that Conflict, intergroup tension, migration are indicated climate change social impact in the town.

As expected, the logit model shows there is positive association between respondents' perception about climate change impact on economic sector). It was also observed that that respondents with diploma and above had more awareness compared to illiterate respondents and respondents who possessed primary and secondary level education (p=0.005) and government employees had better awareness about perception about climate change impact on economy compared to farmers, merchants and others (p= 0.100). Studies also reported that 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 [6], Studies by Alemu [10], on socioeconomic impact of flooding in Dire Dawa shows that the 2006, flood has inflicted severe direct and indirect damages on social; infrastructure and economic sectors of Dire Dawa according to this study

Arbaminch has faced similar economic impact of climate change. Therefore, the respondents' perception cannot merely depend on the actual climate conditions and a change in the climate parameters. Instead, it can be observed a number of social, economic, environmental, and health factors.

Conclusion and Recommendation

This study has analyzed perception of respondents about environmental, social, and economic impact of climate change in Arbaminch town. This study shows that perception of respondents about climate impact in environment, economy and social life is different from individual to individual and is affected by age, sex, income level and educational level and occupation of the sample respondents. The major climate change impact in the town are t, shortage of rainfall, seasonal fluctuation of rainfall, drought and heavy rainfall which affects socio economy of the town and environment by flooding, shortage of water, heat waves, soil and land degradation and water and air pollution in the study area. The local community and government intervention is needed to reduce climate change impact on environmental and socio economic and health of community by providing and developing local adaptation strategies to reduce climate change impacts and to build resilience to climate change impact.

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