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Climate Change and Its Causes: Perception of Rural Community in Benshangul Gumuze Regional State (Western Ethiopia)

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Abstract
The scientific evidences witnessed that the earth's climate is changing mainly as a result of the increasing concentration of greenhouse gases in the atmosphere as an end result emission from various human activities (IPCC, 2001). This study was therefore aimed to assess perception of community about this climate change and its causes in the State of Benshangul Gumuze Region. In order to have relevant information for the study field survey, structured interview and focus group discussion were employed. An awareness test and attitude scale were developed and administered to investigate perception and attitude. More than 371householdheads were involved in the survey from different climate zones. Encouraging level of awareness was observed among the rural communities on the change and causes of climate change. The result of human actions/misuse of environment/ had been considered as most important causes of climate change. Analysis of meteorological data reveals similar result with the perception of the community.
Keywords: Climate change, cause and community perception

1. Introduction

A large part of Ethiopia is dry sub-humid, semi-arid and arid, which is prone to desertification and drought. The country has also fragile highland ecosystems that are currently under stress due to population pressure and associated socio-economic practices. Ethiopia's history is associated, more often than not, with major natural and man-made hazards that have been affecting the population from time to time (Pankhurst, 1985). Drought and famine, flood, malaria, land degradation, livestock disease, and insect pests have been the main sources of risk and vulnerability in most parts of the country. Especially, recurrent drought, famine and, recently, flood are the main problems that affect millions of people in the country, almost every year (Pankhurst, 1992). While the causes of most disasters are climate related, the deterioration of the natural environment due to unchecked human activities and poverty has further exacerbated the situation in Ethiopia (NAPA, 2007).

Current climate predictions indicate that crop production in the Ethiopia would be extremely vulnerable as a result; food security of the country will be at risk unless effective adaptation and mitigation mechanisms are put in place (Karim et al., 1996). In effect, ongoing national development efforts that are aimed at increasing food production through the expansion of small scale irrigation, water shade management, and application and transformation of modern agricultural technologies to achieve food self-reliance will be at risk. Therefore, scientific investigations and applied researches on climate variability and its economic impact on the production levels and productivity of agriculture is critical to develop effective and locally adaptive agricultural production systems in the appearance of the increasing climate change and variability (Karim et. al., 1994). As a result, this study was conducted in Benishangul Gumuz Regional State to identify challenges and opportunities responding to climate change.

The western part of Ethiopia, where this study was conducted is evidently the hardest hit region of the country in terms of drought (Bezabih et. al; 2010). However, growing climate and land use changes as a result of the increasing climate variability such as rising temperature, erratic rainfall and the resultant water shortage coupled with the continued deforestation and improper use of woodlands and other land resources has led to the substantial decline in agricultural productivity and rising food insecurity. However, in-depth analysis and well-established scientific evidences on the perception of community on the nature and cause of climate change of the rural poor area was virtually lacked. Since knowing to what extent the rural people sense about climate change could have substantial implication for policy makers, conducting this study was therefore indispensable.

2. Research Methodology

2.1. Research Method

In order to achieve the general and objective of the study Sequential explanatory method was employed. Sequential explanatory method is an expansive and creative form of research, not a limiting form of research (Creswell, 2003). It is inclusive, pluralistic, and complementary, and it suggests that researchers take an eclectic approach to method selection and the thinking about and conduct of research (Johnson and Onwuegbuzie, 2004, pp. 17–18). As well, Morgan (1998) suggested that the sequential explanatory design is the most frequently used mixed methods approach.

For this research cross sectional survey was the main design preferred. Survey is data gathering at a particular point in time with the intention of describing the nature of existing conditions, or identifying standards against

which existing conditions can be compared, or determining the relationships that exist between specific events (Mitchell et al, 2004). Classically cross-sectional survey method is used to scan wide information from people with different experience and back ground on the same issue in order to measure or describe any generalized features (Marczyk et al, 2005).

2.2. Sampling Design and Sampling Size

In order to collect the raw data needed to achieve the objectives of the research, stratified random sampling (SRS) was employed. In the first stage, the Woreda was purposely selected and classified into three strata of high land (Dega), Midland (woyna-dega) and Lowland (kola) agro-ecological zones. The selection of woreda was based on different cultural background to respond to climate change due to divers ethnic group in the region. Accordingly, in 'dega' climatic zone 'Wonbera' woreda (residence of shinasha and Gumuze people) and Tongo woreda(residence of Mao and Komo people); in woinadega climate Assosa wereda(residence of Berta people) and Bullen Woreda(residence of Shinasha and Gumuze people) ; and in 'kola' climate kemashi (residence of Gumuze people) and Komosha woreda(residence of Berta people) were sample woredas. The woreda sampling was believed to be representative because it considers different agro climatic zones and five indigenous ethnic groups in the region. The consideration of ethnic group was due to the assumption that there would be different sensing by different ethnic group to climate changes in different climatic zones.

From each Woreda, target kebeles were selected in such a way that the kebeles represent the Woreda in biophysical, agricultural and socio-economic aspects. Most importantly, the kebeles were selected in the condition that they represent the main farming practices, crop varieties, socio-economic status, climate problems and disasters, besides topographic features.

Table1. Sample Woredas, Kebles and sample size

No	Sample Woreda	Sample Keble	Estimated House hold population	Sample size
1.	Wonbera	Sankie	659	49
		Manasibu	629	46
2	Bullen	Maxa	670	50
		Emaji	552	40
3	kemashi	Daguba	451	33
		Dobi Badesa	502	37
4	Assossa	Abrhamo	451	33
		Selga	322	24
5	Komosha	Tereselam	231	17
		Asura	190	14
6	Tongo	Tajagesi	150	11
		Wanga gitan	236	17
Total	6	12	5043	**371**

By the formula n = $N/1+N(e)^2$ where n =the sample size; N =total population size; e =level of precision (Yamane T. (1967).

Then, total sample size "n" was: $5043/1+5043(0.05)^2 = 5043/13.6075 =$ **371**

In order to distribute sample size proportionately in 12 kebles stratified sampling was applied as indicated in table1.

2.3. Data Source and Collection Method

Three sets of primary data namely: climate data (temperature and precipitation), socio-economic and factors exacerbating impacts of climate change and data on traditional climate change adaptation mechanisms was collected. The first group of data (climate data) was obtained from the National and Regional Metrology Agency. The second group of data (socio-economic and climate adaptation) was collected from household survey via questionnaire, and field observation.

2.3.1. Climate Data

The observed data on climate variables mainly temperature and rainfall, from 1981-2013, of the study area was collected from the National and Regional Metrology Agency of Ethiopia. Accordingly, monthly rainfall and temperature data was collected from the National and Regional Metrological Station.

2.3.2. Socio-economic Data

An in-depth household survey by using a semi-structured questionnaire was conducted to collect both the detailed socio-economic data and the customary climate change adaptation mechanism of the households. Farm households' cross-sectional data was obtained from a household survey. Prior to conducting the household survey, key informants and community leaders were identified for focus group discussions with the help of the Woreda agricultural bureau and local development agents.

3. Discussion and Results

3.1. Perception on Indicators and the Causes of Climate Change

Table 2 shows distribution of the respondents' perception towards indicators of climate change. The result indicates that about 68percent of the respondents strongly believed that there was change in rainfall distribution period and amount had decreased. Meanwhile, there was an increase in daily temperature. This infers that in the region indicators of climate variability and change in fluctuation of rainy period and increases in daily temperature amount is perceived by the rural community.

Table 2. Indicators of Climate Change

Rainfall and temperature	Perceived	
	FERQ	%
Increase in daily temperature	200	54
Decrease in rainfall amount	252	68
Decrease in number of rainy days	33	9
Decrease in number of cold days	45	12
Rainfall amount is remain the same	59	16

Source: field survey 2015

Regarding .temporal distribution pattern of rainfall, about 79 percent of the respondents responded that rain period starts too late and stops very early. Hence, they strongly agreed that there was a climate variability and change. Meanwhile, 31percent and 56percent of the respondents reported that the rainfall distribution pattern was unpredictable, long dry period in a year (absence of rainfall for long period) respectively.

Climate variability is a clear, sustained changes (over decades or longer) in the components of climate such as temperature, precipitation, atmospheric pressure or winds either due to natural variability or as a result of human activity. Therefore, the responses (see Table 2) of the study area had understanding and awareness as to the unseasonal distribution of rainfall is the result of climate variability and change.

Table 3 . Perception on Annual Rainfall as an Indicator of Climate Variability and Change

Annual Rainfall distribution pattern	Perceived	
	FERQ	%
Rain come too late and stops very early	292	78.8
Difficult to predict time of rainy season	115	31
Long dry and hot months increased in a year	208	56
Normal rainfall distribution	22	6

Source ;field survey (2016)

Climate changes intensify the global hydrological cycle and have major impacts on regional water resources. A change in the water volume and distribution of water would have effect on ground and surface water supply for different uses. Table 3 shows distribution of the respondents' perception on annual surface water cycle and water volume. The change of marshy/swampy areas to dry land, the extinctions of springs had existed for long time exhibited. This implies that the rural communities had awareness and perception on river streams and wetlands adversely affected by climate change.

Table 4. Water volume and water cycle fluctuation

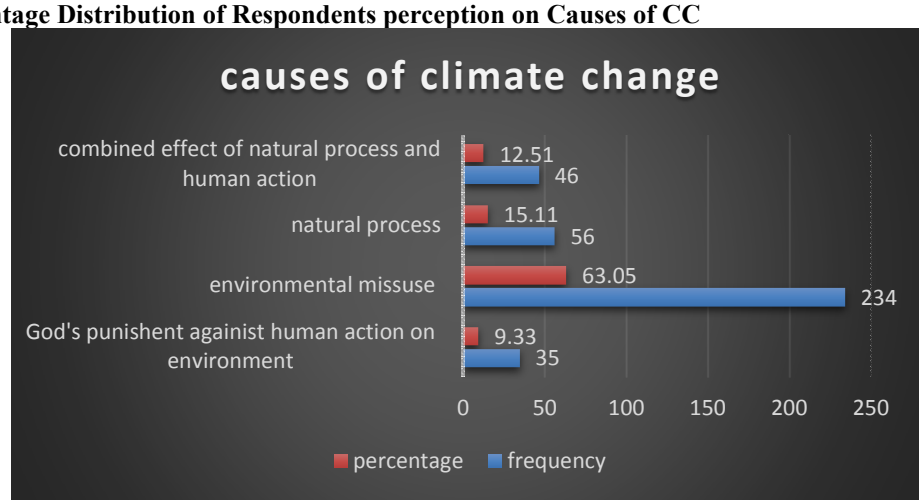
Indicators of CC	Perceived	
	FERQ	%
Wet lands are changing to dry	267	72
Rapid evaporation of ground water	115	31
Variation of water volume in streams and rivers	93	25

Source: field survey (2016)

3.2 Causes of Climate Change

Graph 1 shows respondents' perception of the causes for climate change. The result indicates the respondents had perceived that human interaction with natural surroundings had been the causes of climate variability. The majority of the farmers, (64.0percent) strongly believed that climate change was a mere result of environmental misuse. Meanwhile, 15.1percent responded climate change was a natural phenomenon that might occur once in human life span because of overpopulation.

Graph 1: Percentage Distribution of Respondents perception on Causes of CC



Source field survey (2014/15)

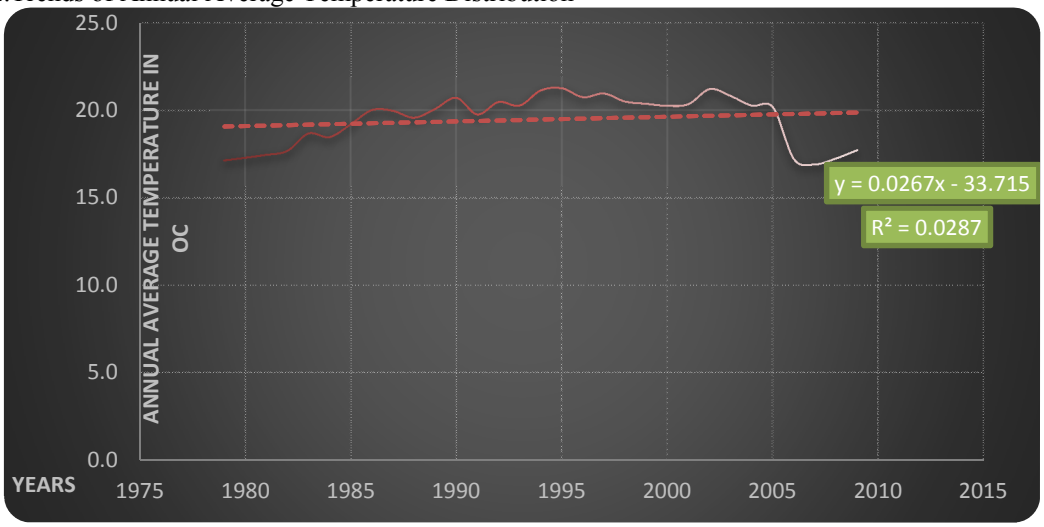
3.3. Perception on Climate Change versus Meteorological Data

To Assess communities' views of climate variability and change, analyses was made on how the climate data recorded at meteorological station evolved (trends and variability).Tests were undertaken for linear trend in annual and seasonal means of temperature, total annual and seasonal rainfall both at the district level. Descriptive statistics based on summary counts of the questionnaire structure used to provide insights into respondents' perceptions of climate variability and change. In the literature, several studies have undergone the same type of analysis.

3.3.1. Temperature changes

About 94.24 percent of the rural communities interviewed perceived long-term changes in temperature. Only 3.6 percent noticed the contrary-a decrease in temperature and 1.44 percent, of them had not noticed any changes in the temperature. The national meteorology service agency statistical record of temperature of the region between 1979 and 2013 shows that slight increasing trend temperature with an increase mostly in the autumn and winter. In the last 30 years, the temperature has risen by about 1 degree Celsius. An analysis at the provincial level showed the same general trend of increasing temperature.

Graph 2.Trends of Annual Average Temperature Distribution



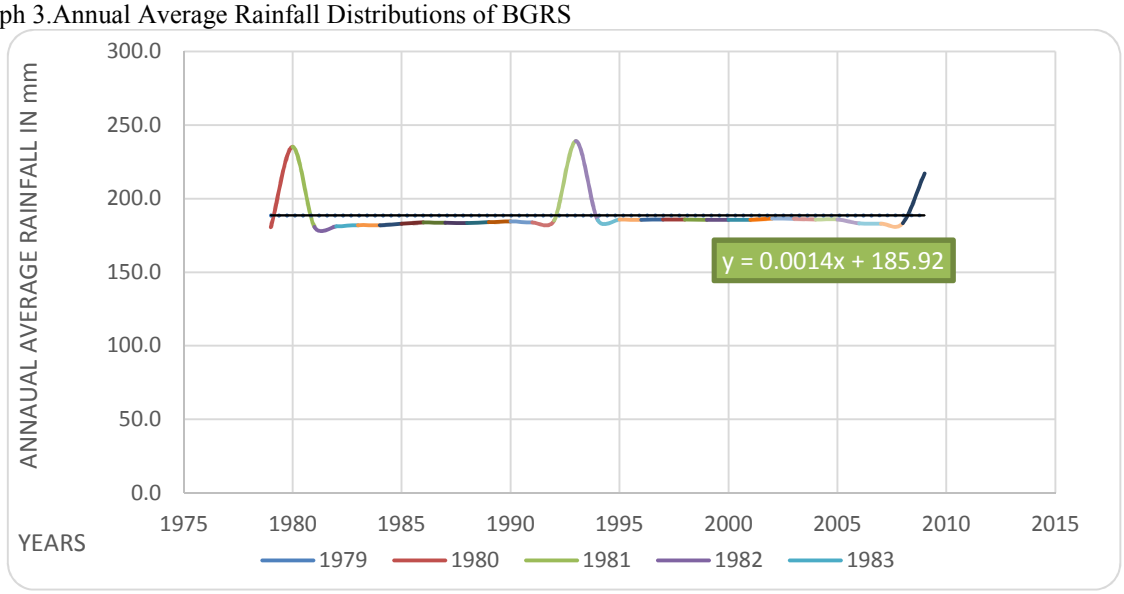
Source: computed from NMAS data (1979-2013) BGRS annual average temperature.

3.3.2. Changes in Precipitation

In total, all of the respondents observed changes in rainfall patterns over the past two decades. And 92 percent noticed a change not only in the total amount of rainfall but also in the timing of the rains, with rains coming either earlier or in advance than expected where as about 15.11 percent noted that decrease in the amount of rainfall or a shorter rainy season. Almost 5 percent of the informants noticed a no change in the total amount of rainfall.

Many respondents observed that the main rainfall season of a year, i.e. summer "kiremti", was coming late lasting shorter. A change in the timing of rainfall was mentioned by national meteorological service agency. However, based on the calculated meteorological data the amount of annual rainfall is almost similar for the last one decade.

Graph 3.Annual Average Rainfall Distributions of BGRS



Source: Computed from NMAS data (1979-2013)

4. Conclusion

The study shows that the communities of rural awareness about change in rainfall distribution period and amount has decreased. Meanwhile they perceive also an increase in daily temperature. This implies in the region there are indicators of climate variability and change. The communities in the study area have understood that unseasonal distribution of rainfall was the result of climate variability and change. The causes for this climate change /climate variability/ as the communities perceived was that human interaction with natural surroundings i.e. climate change was a mere result of environmental misuse.

The national meteorology service agency statistical record of temperature of the region between 1979 and 2013 shows that slight increasing of temperature with an increase mostly in the autumn and winter. In the last 30 years, the temperature had risen by about 1 degree Celsius. A change in the timing of rainfall was mentioned by national meteorological service agency. However, based on the calculated meteorological data the amount of annual rainfall was almost similar for the last one decade.

To sum up, since the rural people are conscious with climate change and its causes, the policy makers should use the local people in policy preparation and implementation about the mitigation and adaptation of climate change because it may not take time in bringing anticipated change compared with running alone.

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