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POVERTY, CLIMATE CHANGE CHALLENGES AND COPING STRATEGIES OF SMALL SCALE FARM HOUSEHOLD

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A B S T R A C T

The main objective of study was to examine poverty level of small scale farmers, climate change challenges they faced and their coping strategies adopting in response to climate change impact. Primary data was collected through interview and group discussion during May 2015 in the Teesta riverine area under Rangpur district of northern Bangladesh. The SPSS (Statistical Package for Social Sciences) was used to determine mean, range, percentage and standard deviation. Multiple regression analysis was done to determine influence household characteristics on the household poverty level. To assess the poverty level, world bank commonly used international poverty line was followed and findings indicated that 41.2 percent farm household lived below extreme poverty level of which 20 percent were subjacent poor. Cross tabulation indicates that, all landless and 64.6% marginal farm household lived below extreme poverty line and the majority (65.6%) of small scale farmers lived out of poverty level. Among five demographic characteristics, only two variables namely education of household head and farm size of household showed significant and positive relationship with their daily income based poverty level. The predictor variable farm size of household recorded the highest regression effect on the level of poverty highlights the various effects climate change has on the availability of food for the teeming populace to ensure food security. The current practice of Agriculture in Bangladesh was taken into consideration, the impact it has on the entire population and the effects climate change has on it. Bangladesh, like most other developing countries, is affected in a very important and critical manner by the adverse effects of environmental crises, most of which are direct influences of climate change and this change in the long run has effect on food security. The study recommended that infrastructural facilities, social interventions in the form of food aid, and crop insurance policies which encourage agricultural initiative should be put in place in rural areas to help reduce the incidence of rural-urban migration and to encourage agricultural production so as to ensure that all the citizens of the country are food secured.

Keywords: Poverty, Climate Change, Coping Strategies, Small Household.

INTRODUCTION

Climate change brings change in rainfall patterns; it increases temperatures and sea level, creates high prevalence of vector-borne diseases and water scarcity and increases natural hazards like floods and droughts. That brings significant changes in agriculture, food security and economic growth (DFID, 2004). Bangladesh is a deltaic country situated between the Himalyan Mountains in the north and the Bay of Bengal in the South. Because of its geographical position, there is no doubt that Bangladesh is likely to be one of the worst affected nations in the face of climate change (Harmeling, 2014). Feeding a rapidly rising global population is taking a heavy toll on farm lands, rangelands, fisheries and forests. Water is becoming scarce in many regions. Climate change could be the additional stress that pushes systems over the edge.

Climate change is defined as a result of temperature variability due to emissions of greenhouse gases produced by human activities (Hope, 2009). According to Hope (2009) human activities such as 'burning of

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fossil fuels, industrial production, cutting down of rainforests change the atmosphere's composition by increasing the amount of greenhouse gases, which, in turn, traps heat in the atmosphere and thereby facilitating climatic changes'. There is linkage between bio-physical and socio-economic impacts of climate change. The environmental degradation caused by bio-physical impacts creates socio-economic impacts. This is mainly on the agricultural sector where areas suitable for agriculture, the length of growing seasons and yield potential, particularly along the margins of semi-arid and arid areas are expected to decrease (Mubaya *et al*., 2010). Consequently, affects small scale subsistence farmers in terms of productivity, food security and family income. However, in middle and higher latitudes areas the impact of climate change is to extend the length of the potential for growing seasons.

Climate change is expected to have a significant impact on the livelihoods of the rural poor in developing countries. Smallholder farmers constitute a significant portion of the world's population, with an estimated 450–500 million smallholder farmers worldwide, representing 85% of the world's farms (Nagayet, 2005). Across the tropics, smallholder farmers already face numerous risks to their agricultural production, including pest and disease outbreaks, extreme weather events and market shocks, among others, which often undermine their household food and income security (O'Brien, 2004; Morton, 2007).

Climate change is expected to disproportionately affect smallholder farmers by further exacerbating the risks that farmers face. Recent studies using regional and global simulation models, for example, indicate that even moderate increases in temperatures will have negative impacts on rice, maize and wheat, which are the main cereal crops of smallholder farmers (Morton, 2007). Climate change is also expected to alter pest and disease outbreaks, increase the frequency and severity of droughts and floods, and increase the likelihood of poor yields, crop failure and livestock mortality (Morton, 2007). As many of the countries that will be the hardest hit by climate change are tropical countries with large populations of poor, smallholder farmers (Hertel & Rosch. 2010), there is an urgent need for the global community to focus its attention on identifying adaptation measures that can help these farmers reduce their vulnerability to climate change and cope with adverse consequences.

Farmers' adaptive capacity is determined by wealth, human capital, material resources and infrastructure, information and technology. Institutional adjustment in production technology (planting date shifting, new resistance crop variety, crop rotation, rainwater harvesting), government policy, insurance schemes and international trade are the good adaptation options in agriculture (Lotze-campen & Schellnhuber, 2009). Coping includes the use of existing resources to attain different desired goals during and immediately after unusual and adverse situation of a hazardous event. The strengthening of coping capacities including preventive measures is a crucial aspect of adaptation and resilience to a natural hazard (Agrawal, 2008).

Climate change also promises new and unprecedented challenges, and demands new and urgent efforts to meet these. Adaptation is the actions and adjustments in order to maintain the capacity in dealing with stresses of current and future external changes (Agrawal, 2008; Alland, 1975), whereas adaptive capacities are the preconditions that enable actions and adjustments of the adaptation process (Agrawal, 2008). The vulnerability and adaptive capacity of particular individuals rely on the cognitive factors (e.g. ability to perceive the risks posed or unwillingness to accept the need to act in response) and normative factors (e.g. social or cultural norms or belief that may limit adaptation) (Hamilton and Kasser, 2009; Grothmann & Patt 2005; Ortrom, 1990).

Teesta is one of the major trans-boundary rivers in northern Bangladesh originated from the Himalayas glaciers lake known as Pauhunri. Agro-climatic variation e.g. rainfall, temperature, humidity, evaporation, evapotranspiration etc (Sarker *et al.*, 2011) has led temporal distribution of water resources into two extremes such as dry season from December to May and wet season from June to October (Rahman, 2013, p.9). According to IPCC (2007) rainfall in this region has fallen in the past 100 years and future projection shows that rainfall in dry season will decrease slightly within the 21st century (Rahman, 2013, p.2). The river floodplain area situation becomes quite opposite to the scenario observed during the rainy season. This is because of heavy rainfall in the upper catchments **of** rivers create overflow of water during the rainy season. In addition, the current trend of glacial melting of Himalayas due to rising global temperature has increased the risk of flash flood. Both precipitation in rainy season and glacial

melts would generate additional volume of water runoff causing river bank erosion (NIRAPAD, 2011).

Mitigation measures are obviously critical to contain the damage and changing agricultural and land use practices have a major role to play. A recent study by the International Food Policy Research Institute, titled 'Climate change: Impact on agriculture and costs of adaptation', highlighted some of the anticipated costs of climate change:

- 25 million more children will be malnourished in 2050 due to climate change without serious mitigation efforts or adaptation expenditures.
- Irrigated wheat yields in 2050 will be reduced by around 30% and irrigated rice yields by 15% in developing countries.
- Climate change will increase prices in 2050 by 90% for wheat, 12% for rice and 35% for maize, on top of already higher prices.
- At least US$7 billion a year are necessary to improve agricultural productivity to prevent adverse effects on children.

Adaptation can greatly reduce vulnerability to climate change by making rural communities better able to adjust to climate change and variability, moderating potential damages, and helping them cope with adverse consequences (IPCC, 2001). The objective of the study is to examine poverty level of small scale farmers, climate change challenges they faced and to establish or identify adaptation strategies employed by rural small-scale farmers to achieve household food security in the midst of the effects of climate change.

MATERIALS AND METHODS

Site and Sample Selection: The research study was carried out in Laxmitari Union of Gangachara Upazila under Rangpur district of northern Bangladesh. There are 9 villages in Laxmitari union from which One village "West Ichli" was selected as a locale of the research. About 80 households were selected from this village through stratified random sampling. The village is situated on the bank of Teesta River and very remote and vulnerable to climate change and disaster. The total household of West Ichli was 485 containing of 1939 people (Anonymous, 2015).

Data collection and analysis: Data were collected from the sampled units through maintaining personal interview during May 2015. The SPSS (Statistical Package for Social Sciences) was used to determine mean, range and percentage and standard deviation. Multiple regression analysis was done to determine influence household characteristics on the household poverty level. At least five percent (0.05) level of probability was used to reject the null hypothesis. In multiple linear regressions, a linear model was developed between the mean of a dependent variable (Yi) and independent variables (Xi). Each independent variable (Xi) has a partial regression coefficient (βi). The partial regression coefficient determines the influence of the concerning independent variable on dependent variables while the influence other independent variables are kept constant. The regression model (Thas, 2013) has given as follows:

$Yi=\mu+\beta 1X1i+\beta 2X2i+€i \quad i=1,\ldots\ldots,n,$

Where,

$€i \sim N(0, \sigma 2)$ is the error term

Yi= Dependent variable

X1i and X2i are the two regressors

μ is the intercept parameter

β is the regression coefficient or slope parameter

$Yi=\mu+\beta 1X1i+\beta 2X2i$, is the regression line

The assumptions were fulfilled to develop the regression model such as a) Normality of the error terms was checked whether the residuals (errors) are approximately normally distributed or not. This was assessed by means of a normal P-P plot of the residuals; b) Linearity of the covariate effect was assessed by means of a scatter plot in order to assume a linear association between an independent variable and a dependent variable (Thas, 2013). The 3rd assumption was multicollinearity in order to assess how two or more independent variables are highly correlated with each other. This produces big standard deviations of the regression coefficients and decreases the model validity (Gujarati & Porter, 1999). It was done with correlation matrix or Collinearity statistics and when the correlations $|r| \geq 0.9$, then one or both independent variables assume to leave out of the model (Ottoy *et al*., 2013); and d) Independence of observations or independence of residuals was checked by Durbin-Watson statistic to assess how the effect of independent variables significantly correlated with the outcome variable**.** The determination coefficient (R2) indicates how much variances in the dependent variable can be explained by independent variables. It also indicates the 'goodness-of-fit' of the model. The R2 equal to 1 indicates the perfect model and equal to 0 mean there is no linear correlation. F-test indicates

whether the regression model is significant or not. If the p-value ($P<0.05$), the regression model is significant rejecting the null hypothesis. It means that there is a significant linear association between dependent variable and one or more independent variables(Ottoy *et al*., 2013).

RESULTS AND DISCUSSION

Demographic characteristics: Agricultural farming was the main occupation of the household head in the study area. About 45% of the households earning source was agriculture farm followed by 16.3 % daily wage labour and 21.2% households was depended on both agriculture and daily wage labor. Very few households relied on small business or others occupations like rickshaw pulling or easy bike driving for their livelihoods (Table 1).

Table 1. Salient features of the demographic information (n=80).

Demographics	Range		Description in Categories	Proportion(%)	Mean	SD
	Possible	Observed				
Occupation	-	-	Farming	45.0	-	-
			Wage labour	16.3		
			Farming and wage labour	21.2		
			Small business or others	17.5		
Age (year)	unknown	19-65	Young (< 30)	18.8	38.74	9.13
			Middle aged (31-45)	63.7		
			Old (>45)	17.5		
Education of household head (year of schooling)	unknown	0-12	Illiterate (0)	16.3	3.12	3.82
			Can sign only (0.5)	40.0		
			Primary (1-5)	22.5		
			Secondary (6-10)	10.0		
			Above secondary (>10)	11.2		
Farm size of Household (Ha)	unknown	0.2-0.81	Landless	13.8	0.19	0.20
			Marginal	52.5		
			Small	33.7		
Training received (day of attend)	unknown	0-4	No training	51.3	1.18	1.52
			Training received	48.7		

Majorities (63.7%) of the household head were middle aged, and highest portion (40%) of them could sign only. Near to 50%of household head received training on climate change impact and adaptation technologies provided by different Non-government organizations. In this study, household farm size is the total farming area including homestead, contract or share land. Farm size was categorized into five such as landless (≥0.02 ha), marginal (0.021–0.2 ha), small (0.21–1 ha), medium (1–3 ha) and large (above 3 ha) farmers following the farm categorization system of DAE (1999). The average household farm size was 0.19 ha and no medium and large farm household found in the study area (Table 1). The result has similarity with Roy (2014).

Assessment of poverty level: Poverty level based on income could be counted by following World Bank commonly used international poverty line (Norton *et al.*, 2015) such as poverty line (daily income below or equal to US$ 1.25 in 2005 purchasing power parity) and out of poverty line (daily income above US$ 1.25). But, the target of Millennium Development Goals (MDGs) was to halve the proportion of people living in extreme poverty and hunger by 2015 and the MDGs characterize the extremely poor as those living on less than a dollar a day.

Here the households firstly categorized into extreme poverty (below 1.0 $ a day) and out of poverty (equal or above 1.0 $ a day). Secondly, the households facing extreme poverty again disaggregated into three groups according to their location below the dollar-a-day poverty line such as subjacent poor (living on between 75 cents and a dollar a day), medial poor (living on between 50 cents and 75 cents a day), and ultra poor (living on less than 50 cents a day) (IFPRI, 2009. pp100).

Table 2. Categorization of the poverty level based on daily income.

	Range		Description in Categories	Proportion (%)	Mean	SD
	Possible	Observed				
Household poverty level (based on daily income)	unknown	0.42-4.21	1. Faced extreme poverty (< 1$)	41.2	1.33	0.76
			a) Ultra poor (below 0.5$)	7.5		
			b) Medial poor (0.5-0.74$)	13.8		
			c) Subjacent poor (0.75-0.99$)	20.0		
			2. Out of poverty (≥1.0 $)	58.8		

About 41.2% % households in the study area lived in below poverty line of 1.0 US dollar a day, followed by 205 subjacent, 13.8% medial and 7.5% ultra poor (Table 2). The reason was that farm size was comparatively very lower causing dependent on wage labor. Another reason, this community of the study area was more flood and erosion vulnerable because of nearby stands on the Teesta river bank causing agricultural yield loss.

Table 3. Cross tabulation between household poverty level and occupation of household head.

		Occupation of household head (%)				Total
		Farming	Wage labour	Farming and wage labour	Small business or others	
Household poverty	Faced poverty	43.8	20.8	29.2	6.2	100
	Out of poverty	46.9	9.4	9.4	34.4	100
Total		45.0	16.3	21.2	17.5	100

According to the data depicted in Table 3, it was recorded that majority of the household having occupation crop farming, wage labour or both faced the extreme poverty line. Again, all landless and 64.6% marginal farm household lived below extreme poverty line and the majority (65.6%) of small scale farmers lived out of poverty level (Table 4). It could be said that landless or marginal farm household depending on daily wage labour and crop faring had extreme poverty level. Moreover according the data mentioned in Table 4, Majority (59.4%) household having training of the family head on climate change and disaster management exceeded the extreme poverty level, but most of the household (58.3%) having no training the extreme poverty level. Data in this regard is mentioned in (Table 5).

Table 4. Cross tabulation between household poverty level and farm size.

		Household farm size (%)			Total
		Landless	Marginal	Small	
Household poverty	Faced poverty	22.9	64.6	12.5	100
	Out of poverty	0	34.4	65.6	100
Total		13.8	52.5	33.7	100

Table 5. Cross tabulation between household poverty level and training of household head.

Saleem		Training of household head (%)		Total
		No training	Training received	
House hold poverty	Faced poverty	58.3	41.7	100
	Out of poverty	40.6	59.4	100
Total		51.2	48.8	100

Determinants affecting poverty level: Poverty level based on daily income (Y)was considered as dependent variable and other 5 variables namely occupation of household head (X1), age of household head (X2), education of household head(X3), farm size of household (X4), and training received on disaster management (X5), were taken as independent variables in this study. The coefficient of correlation (r) between the demographic characteristics of the household heads and their poverty level based on daily income has been presented in Table 6. Among five demographic characteristics, only two variables like

education of household head (X3) and Farm size of household (X4) showed significant and positive relationship with their daily income based poverty level. It could be said that these two characteristics influenced the household to a great extent in exhibiting poverty level. The other characteristics such as occupation, age and training skill of household heads had no influence on their poverty level.

Table 6. Correlation Co-efficient between poverty level (Y) and rest 5 independent variables.

Variables	'r' value (Pearson)
Occupation of household head (X1)	0.194
Age of household head X2)	-0.012
Education household head X3)	0.248*
Farm size of household (X4)	0.652**
Training received on disaster management (X5)	0.209

Note: *, ** Correlation is significant at 5% and 1% level of significance, respectively

Possible assumptions were fulfilled in order to run the step wise multiple regression analysis. The normal P-P plot showed that there was no significant deviation from the straight line and could be said that the residuals were normally distributed. As the observations (80>30), normality of residuals could be fulfilled based on Central Limit Theorem (CLT). It could be assumed from the scatter plot that there was linear association between at least one independent variable and the dependent variable. Durbin-Watson value (1.707) was proved the independence of observations or independence of residuals that means the effect of independent variables are significantly and positively correlated with the outcome variable (Table 7). The VIF (Variance Influence Factor) were less than 10 which indicated that independent variables had no multi-collinearity effect or they were not highly correlated (Table 8). The Pearson correlation values of the independent variables were less than 0.9 that indicated no multi-collinearity (Table 6).

Table 7. ANOVA.

Model		Sum of Squares	df	Mean Square	F	Sig.	Durbin- Watson
1	Regression	19.909	4	4.977	14.625	0.000b	1.707
	Residual	25.525	75	0.340			
	Total	45.434	79				

From the linear model summary, the value of R2 (R Square) is 0.438. It means that 43.8% of the variance of adopting local adaptation options could be explained by its relation to the predictors or independent variables. The F-statistics of ANOVA indicated that the model was highly significant (P <0.05) that indicated the regression model significantly predicted the outcome or dependent variable (Table 7).

Table 8. Multiple regression analysis of the poverty level (Y) with the independent variables (X).

Variables	Unstandardized Co-efficient		Standardized Co-efficient		VIF
	B	Standard error	Beta (β)	't' value	
Adoption (Y) Constant	1.177	0.295		3.998	
Age of household (X2)	-0.008	0.007	-0.094	-1.056	1.064
Education of household head (X3)	0.000	0.021	-0.002	-0.019	1.513
Farm size of household (X4)	2.508	0.358	0.692	7.005**	1.302
Training received (X5)	-0.032	0.054	-0.063	-0.585	1.550

Note: *, ** significant at 5% and 1% level of significance, respectively, R^2 =0.438.

In the table 7, the P value of intercept was 0.00 (<0.05) which meant the intercept was significant and the dependent variable poverty level (based on daily income) was affected by at least one of the independent variables. The predictor variable farm size of household (X4) recorded highest regression effect on the level of poverty having the β value of 0.692 (Table 8).Thus it had significant and positive effect on the household poverty

level. It meant that 1.0 ha increases household farm size (X4) increases 2.508$ of daily household income and reduces poverty level assuming other variables constant.

Perception of the effects of climate change and variability: During focus group discussion, majority of the respondents agreed that their region was very vulnerable to flood and drought in the last three decades. They often affected by flood due to heavy rainfall or sudden flash water in rainy season (June-September) and claimed flash flood was more dangerous to human lives and property than rain flood. The reason behind that flash flood was occurred very suddenly and rapidly. It was mainly controlled by the upstream Gojaldoba barrage of India and Dalia Teesta barrage of Bangladesh. Sometimes, especially at night, they were not early informed to flash flood. It seemed difficult to move safe shelter at night carrying households' materials as well as children, disorder or older people.

Flash flood standing was varied three days to a week causing damage of infrastructures, crops, and livestock, even death of people. Another second hand impact of flood was the river bank erosion. Last two decades, each year drought occurred during November-April and drought was more harmful than flood. Because drought affected the region for long period of times causing loss of crop yields. Sometimes, they could not harvest a minimum yield of production cost due to water scarcity. The respondents claimed that they usually used to apply underground water during dry period, but since last 10 years, they were unable to withdraw underground water because of downward falling of water table. Some other natural events like storm, winter cold, heat stress, and earthquakes that often affected their livelihood. The seasonal storms are locally known as "Kal Baishaki Johr" occurred suddenly and rapidly causing damage to trees, shelters and standing crops. Cold winter, temperature around 100C, caused poor and old people often death due to lack of warm cloth. In addition, heat stress in summer created uncomfortable livelihood since the last three decades. The earth quake was very uncommon event in the previous few years. But now they are afraid of regular appearance of earth quake. During Nepal earth quake tragedy-2015, the earth quake was also felt 4 to 5 times in Bangladesh including the study region.

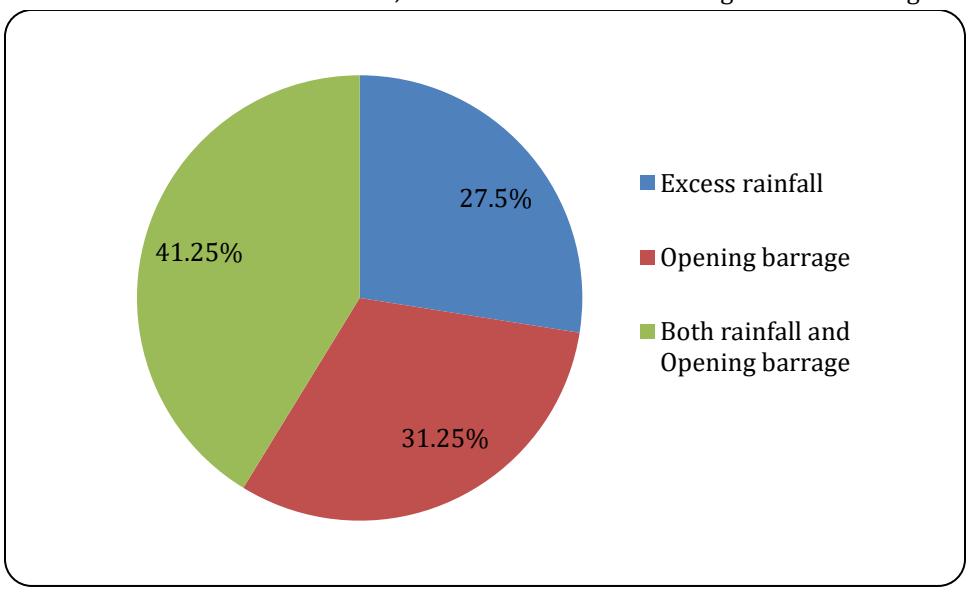

Figure 1. Pie graph showing perceived causes of flood.

The respondents were also asked to provide their perceived opinion regarding the possible reasons of flood and drought. Majority (41.25%) of the respondents stated that both rainfall and upstream barrage opening was main reason for seasonal and flash flood, while 27.5 % mentioned that excessive rainfall was the major reason for seasonal flood and 31.25% reported that opening the upstream barrage in Dalia (Bangladesh) and Gojaldoba (India) was important cause for flash flood (Figure 1). On the contrary, majority of the respondents (48.75%) stated that no or less rainfall was the major reason for seasonal drought followed by 12.5-23.1% switching off upstream barrage in dry season and 13.3-25.0% high temperature in March-April (Figure 2).

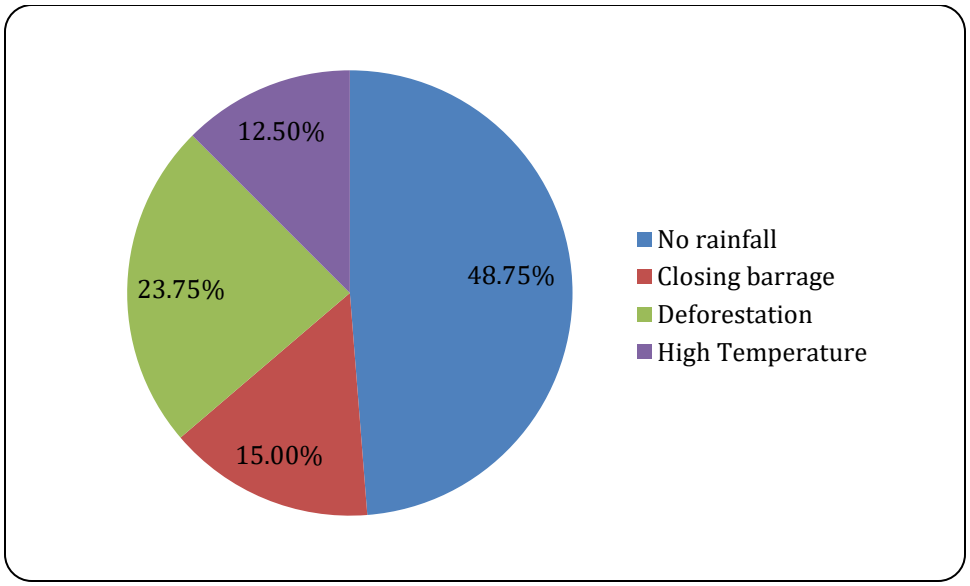

Figure 2. Pie graph showing perceived causes of drought.

Coping strategies adopted by the household in response to the challenges of climate change: During flash flood shelter loss or damage is the most common challenges faced by the respondents. They mitigate it by moving shelter to safe place. Dead of poultry-livestock, Standing crop damage, Short-term food crisis and various other problems also occurred during climate change hazards (Table 9).

Table 9. Coping strategies adopted by household in response to the challenges faced.

Climate impact	Challenges faced	Coping strategies	% Response
Flood	1. Standing crop damage	a) Flood tolerance crop variety	65.0
		b) Early or late planting crop	52.0
		c) Floating vegetable gardens	41.0
	2. Loss of aquaculture	Protecting by net	43.0
	3. Dead of poultry-livestock	Shifting to safe place	81.0
	4. Shelter loss or damage	Shelter to safe place	93.7
	5. Cooking problem	Stable cooking stove	68.8
	6. Pure water problem	Preservation of water	81.2
	7. Short-term food crisis	Storage of dry food	88.7
	8. River bank erosion	a) Pile with sand bag	78.0
		b) Shifting homestead	63.8
	9. Social insecurity	Aware of the issues	45.0
Drought	10. Crop yield loss due to water scarcity	a) Drought tolerance crop	65.0
		b) Changing cropping pattern	53.0
		c) Mulches and ashes	71.0
		d) Deep water irrigation	76.0
		e) Rain water harvesting	28.0
	11.Pest and disease attack	a) Bio-pesticides	15.0
		b) Indigenous techniques	74.0
	12. Aquaculture problem	a) Deep water collection	35.0
		b) Rain water harvesting	12.0
	13. Causing infertility of soil	Vermicompost or manure	82.0
Flood and Drought	14. Unemployment and Long term food insecurity	a) Off-farm activities	17.5
		b) Migration to city	63.5

Data presented in Table 9 revealed that the highest (93.7 percent) coping strategy adopted by household in response to the challenges faced was found on 'shelter to safe place'. The result might be due to that during any kind of climate change challenges firstly one have to secure his/her life.

'Storage of dry food' was found as the second highest (88.7 percent) adaptation measures taken by the households. It is very essential to store food materials during natural disaster like flood, drought and others.

The least (12 percent) mitigation measures taken by the respondents was 'rain water harvesting'. The result might be due to that rainwater harvesting instruments are not available in our country. So people are not well interested about this technology.

CONCLUSIONS AND RECOMMENDATIONS

Climate change possesses definitely harmful impacts on agricultural systems. The systems and the natural resources that support them are already under severe stress from over- exploitation of the current climate, as well as multiple other stresses. The big proportion (41.2 percent) of the farmers faced extreme poverty level of which majority of them were landless and marginalized categorized farm household. It meant that poverty level was influenced by land holding size of the farmers. Many people in developing countries face a very real and direct threat to their food security and livelihoods as climate change unfolds. Yet we have at our disposal a wealth of knowledge that, if turned into action, would allow these same people to build resilient livelihoods and prosper in spite of variable and uncertain weather. All of the farm household indicated that flood and drought were the major climate change impact causing several challenges to them. Among the coping strategies shelter to safe place was highest coping strategies practiced by the households due to climate change problems. Mainly the coping strategies on climate change depend on the indigenous practices. Although there is also included some modern innovation such as resistance crop from flood and drought but still there lack of insurance scheme. Most of the household had no training on coping mechanism of climate change. So, effective policy will be crucial in the coming years as we address the climate change threat. But policy is complex and multilayered, and we will need to better understand the interactions and the real impacts of policies to be successful. Government should take adequate steps in collaboration with non-government organizations to mitigate climate change hazards and to reduce the vulnerability of the peoples livelihood.

Authors' contributions: This work was carried out in collaboration between all authors. Author MRK designed the study, wrote the protocol and designed the conceptual framework. Both Authors MRK and NM collect the review of literature, conducted field survey, perform statistical analysis and write the draft manuscript. The following authors extensively edited this article. All authors read and approved the final manuscript.

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