

# Climate Change Impact on Agriculture in Talensi District of Ghana: A Case Study of Baare and Datuku Communities

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**Abstract:** A survey research was conducted in the Talensi district of Ghana in December 2013, using Baare and Datuku communities as case study. The objectives were to assess the effect of climate change on Agriculture production, socio-economic livelihood and other natural resources, and to identify the vulnerable groups and livelihoods affected by climate change, and ascertain the effectiveness of mitigation measures respondents adapt. Three hundred and twenty (320) respondents were target in this study. A case study research strategy was adopted, using structured questionnaire; interview and observation methods. The result showed that respondents engaged in more than one economic/livelihood activity, with crops and Livestock production as the major activities. Loss of economic trees, difficulty in land cultivation, decrease yield, the emergence of new pests and disease, higher mortality and decreased in fecundity were the major effects of climate change on their crops and livestock production. The study revealed that rural communities have their own strategies in coping with natural disasters due to climate change. However, these strategies are not sufficient and clearly have a negative impact on the growth, productivity and health of women and children who are usually the most vulnerable groups.

**Keywords:** Climate change, food security, Mitigation, vulnerability.

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## 1. INTRODUCTION

Climate change/global warming is a statistically significant change in measures of climate (temperature, precipitation or wind) due to natural variability or as a result of human interventions usually lasting for an extended period, decade or longer (Sharma, 2010 and Dahal, 2011). This results in the buildup of greenhouse gases (carbon dioxide, methane, nitrous oxide, ozone and CFCs). The greenhouse gases emit naturally to warm the planet to an ideal temperature suitable for living organisms. However, human activities such as burning natural gas, coal and oil, poor farming practices and land-use changes, production of long-lasting industrial gases from factories, deforestation, population growth and the use of chlorofluorocarbons (CFCs) distort and accelerate the natural processes by creating more greenhouse gases in the atmosphere than are necessary (Dahal, 2007; Anonymous, 2001). Signs such as increased temperatures, acid rain, desertification, and pollution of both water and air, all associated with climate change (IPCC, 2007). According to the FAO (2004), Agriculture contributes about 50% of household food requirements and up to 50% of household incomes in Africa. In Ghana, Agricultural land use is concerned mainly with food production, and about 67% of Ghanaians depend on Agriculture as a source of livelihood; most of who live in the rural communities. Women constitute 52% of the agriculture labor force and Men 48%; with women contributing about 46% to the total GDP (MOFA-WIAD, 2002). However, agriculture and agro-ecological systems in general are most vulnerable to climate change. Mainly due to the use of slash and burn method, and deforestation as land preparation methods for Agriculture activities. According to IPCC, (2007) temperature rise beyond 2°C are likely to result in reduced crop yields in most tropical, sub-tropical, and mid-latitude regions and some ecosystems will be irreversibly damaged or lost. It will result in much more flooding in low-lying areas with decline in food production, an increase in disease, and the extinction of plants, animals, and entire

ecosystems. Also, Oxfam international (2009) reported that extended drought in many parts of the globe has destroyed massive forest due to land degradation and wildfires. The health impacts of climate change pose a double jeopardy for the livelihoods of poor people. The main productive members of the household is lost and the cost of health care is expensive and time consuming (Sharma, 2010). These factors lead to the worsening of food insecurity and increase in the number of people at risk from hunger (UNFCCC, 2007; Sharma, 2010). According to Eldis, (2010) although about 57% of the total land area of Ghana is suitable for agriculture and other productive economic livelihood activities especially by rural communities, its utilization in recent times has been limited and negatively affected by climate change effects. It is therefore explicit that Climate change is depleting the natural resource base that rural livelihoods depend upon, especially food production.

### 1.1 Some Climate Change Mitigation Strategies:

Climate change will have both positive and negative effects, but the adverse effects will predominate with greater rates of climate change, and all countries are vulnerable with the poorest countries and the poorest people within them being the most vulnerable (IPCC, 2001). Pettengell (2010) and Feenstra *et al.* (1998) define climate change adaptation/mitigation as how farmers chose to react or not react to the changes in climate and their behavior to sustain their crop and living standard, comprising all those responses to climate changes that may be used to reduce vulnerability. According to Chaudhary and Aryal (2009) there is the need for government, civil societies, NGO's to be involved for the high quality of outcome in the field of climate change and environment management. Extra farm activities such as charcoal burning, brick making, fishing, casual laboring depending on the geographical locations and seasons are been adopted by some people in rural communities to maximize their survival due to repeated crops failure caused by climate change. Pastoralist would distribute livestock and/or shifting herd to safer places to reduce drought risk (Paavola, 2003). Farmers would grow traditionally drought-resistant crops and intercropping with the aim of maximizing harvest is becoming common. It is common to find more than two different crops being grown in a piece of land in a drought-prone areas while others water their crops in the absence of rainfall. The use of fuel conserving stoves and some communities growing their own fuel wood is now common among some rural communities (Mwingira *et al.*, 2011).

### 1.2 Research Questions:

This research aims to seek answers to the following: 1. what is the current impact of climate change on food security and general economic livelihood of the people living in Baare and Datuku in the Talensi district of Ghana? 2. Which category of people are the most vulnerable and affected by the influence of climate change in Baare and Datuku communities? 3. What measures are currently been adapted locally to mitigate the effect of climate change in these two communities? This research therefore had the objectives: 1. to assess the effect of climate change on Agriculture production, socio-economic livelihood and other natural resources of respondents in Baare and Datuku communities. 2. To identify the vulnerable groups and livelihoods affected by climate change, and ascertain the effectiveness of mitigation measures respondents adapt

### 1.3 Problem statement and Justification of Study:

Baare and Datuku are among the two economically viable farming communities in the Talensi district of Ghana. The district is characterized by a dry savannah climate and vegetation, poor soils, irregular rainfall patterns leading to poor yields and low levels of production (Talensi-Nabdan District Assembly Report 2010). Natural processes such as adverse climatic conditions, drought, etc. have been identified as major causes of environmental and resource depletion. However, human activities such as indiscriminate grazing, small-scale mining, sand and stone quarrying, periodic bush burning and firewood harvesting, a characteristic of these communities, have played an increasingly important role in driving the ecosystems far beyond their carrying capacity, causing unprecedented degradation and depletion of the natural resources (William, 1998). According to FAO, (2004), agriculture and agro-ecological systems in general are most vulnerable to climate change, especially in Africa. About 67% of Ghanaians: 52 % women and 48 % men, depend on Agriculture as a source of livelihood; most of who live in the rural communities (MOFA-WIAD, 2002). The impact of climate change can be much greater for the poor, indigenous and Dalit communities who rely most directly on their immediate environments for subsistence and livelihood often living in the more remote and ecologically delicate zone (UNFCCC, 2004). Despite NGOs working in the Talensi district on farmers' regeneration programs, assistance to the poor on other economic livelihood, the challenges of climate change faced by these communities are still prevalent. According to Aryal and Choudhary, (2009) the scarcity of adequate information flow on climate change trends slow down the task of effective

policy formulation regarding adaptation and mitigation. Also, most local people find it difficult to cope with climate change using modern technologies like high input agriculture and biotechnology and have relied on their indigenous skills. However, most of these local coping strategies could only be applicable in a short term and/or less severe impacts. Their strategies are likely to leave populations vulnerable to both climate change and the associated poverty in the longer term (Orindi and Murray, 2005). These challenges provided the impetus for this study on the extend of climate change impact on Agriculture production and other economic livelihood in the Talensi district, considering the depth of information in the district on the topic.

## 2. RESEARCH METHODOLOGY

### 2.1 Study Area:

Baare and Datuku are among the two major farming and economic communities in the Talensi district. The district lies between latitude 10<sup>0</sup> 15' North and 10<sup>0</sup> 60' North of the equator and Longitude 0<sup>0</sup> 31' West and 1<sup>0</sup> 0.5' west of the Greenwich meridian. The district has a land area of 912 sq. km with a total population size of 115,020 with 57,318 as females and 57,702 as males (GSS, 2010). It has a mean rainfall of 88-110mm with temperature of 12 °C – 45°C as min and max respectively (Talensi-Nabdan District Assembly. 2010). Agriculture is the main source of economic livelihood with about 90 % engaged in crops production (millet, maize, Guinea corn, groundnut etc). High population growth has also reduced the size of household land available for productive cultivation (World vision report, 2013).

### 2.2 Sampling technique and procedure:

Three hundred and twenty (320) respondents were targeted in this study. Structured questionnaire, interview and observation methods were used. The use of Questionnaires were the Primary source of information. Interviews with community leaders and focus groups with specific economic activities such as crops production, livestock rearing, commerce etc. were used where necessary. Key informants were also targeted during questionnaires administration. Reports and related websites served as a secondary source of information. A case study research strategy used by Bryman, (2008) was adopted where an exploratory questions, ‘‘what’’ and ‘‘how’’, and inductive research are most appropriate and helps to harness detailed and valuable insights and understanding of the topic which could not be achieved by a survey (Rialp and Rialp, 2006; Yin, 2003).

## 3. RESULT

### 3.1 Demographic Characteristics:

Majority of the respondents were within the age range of 50-59 years (27.8%) and 40-49 years (25.6 %) in Baare and Datuku respectively. In both communities, the highest number of respondents were males. In Baare community, 34.1% had a household size of 5-7 whiles 41.9% of respondents in Datuku had 2-4 as household size; representing the highest in both communities (Table 1a and 1b).

Most of the respondents had formal education from primary to tertiary. Baare community had Senior High School (SHS) being the highest educational level of respondents (26.9%) while Datuku respondents had Junior High School representing the highest. 31.1% had non-formal education in Datuku compared to 25.9 % in Baare (Figure 1).

**Table 1 (a) Age, Sex and Household size distribution of respondents in Baare community**

Age	Frequency (F)	Percent (%)	Sex	Frequency (F)	Percent (%)	House hold Size	Frequency (F)	Percent (%)
<20	29	9.1	Males	204	63.8	< 2	21	6.6
20-29	47	14.7				2-4	90	28.1
30-39	52	16.3				5-7	109	34.1
40-49	71	22.1				8-10	67	20.9
50-59	89	27.8				<10	33	10.3
>60	32	10	Females	116	36.2			
<b>Total</b>	<b>320</b>	<b>100</b>	<b>Total</b>	<b>320</b>	<b>100</b>	<b>Total</b>	<b>320</b>	<b>100</b>

Table 1(b): Age, Sex and Household size distribution of respondents in Datuku community

Age	Frequency (F)	Percent (%)	Sex	Frequency (F)	Percent (%)	House hold Size	Frequency (F)	Percent (%)
<20	22	6.9	Males	197	61.6	< 2	19	5.9
20-29	31	9.7				2-4	134	41.9
30-39	67	20.9				5-7	71	22.2
40-49	82	25.6				8-10	55	17.2
50-59	77	24.1				<10	41	12.8
>60	41	12.8	Females	123	38.4			
<b>Total</b>	<b>320</b>	<b>100</b>	<b>Total</b>	<b>320</b>	<b>100</b>	<b>Total</b>	<b>320</b>	<b>100</b>

Source: Filed study, 2013

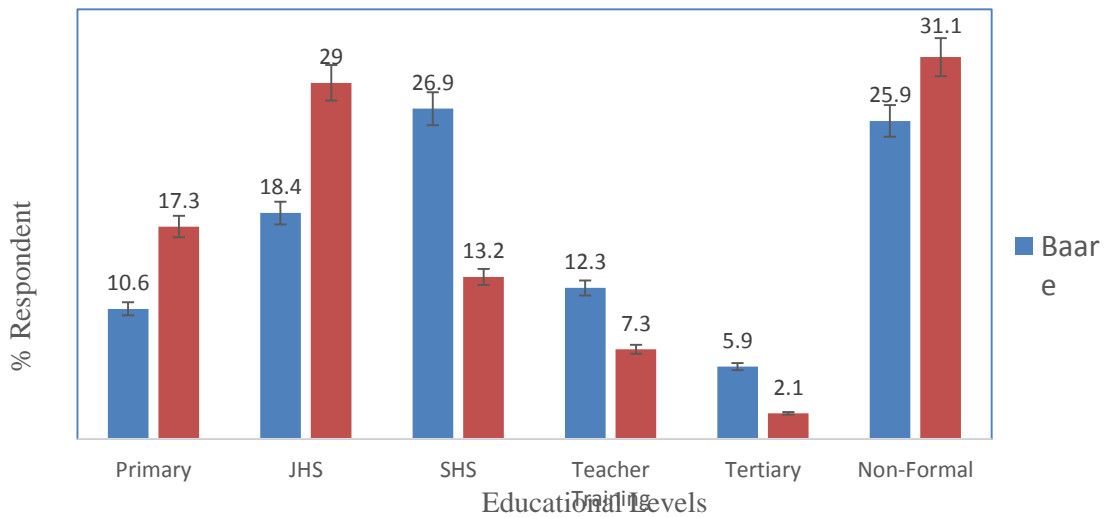


Figure 1: Educational Levels and distribution of respondents

3.2 Effect of Climate Change on Livelihood and Economic activities:

Majority of the respondents in both communities engaged in crops production and livestock rearing as their main source of livelihood, 32.2% in Baare and 41.6 % in Datuku. Sole crop production representing 26.3 % in Baare and 18.2% in Datuku, was the second economic source of livelihood in both communities (Figure 2).

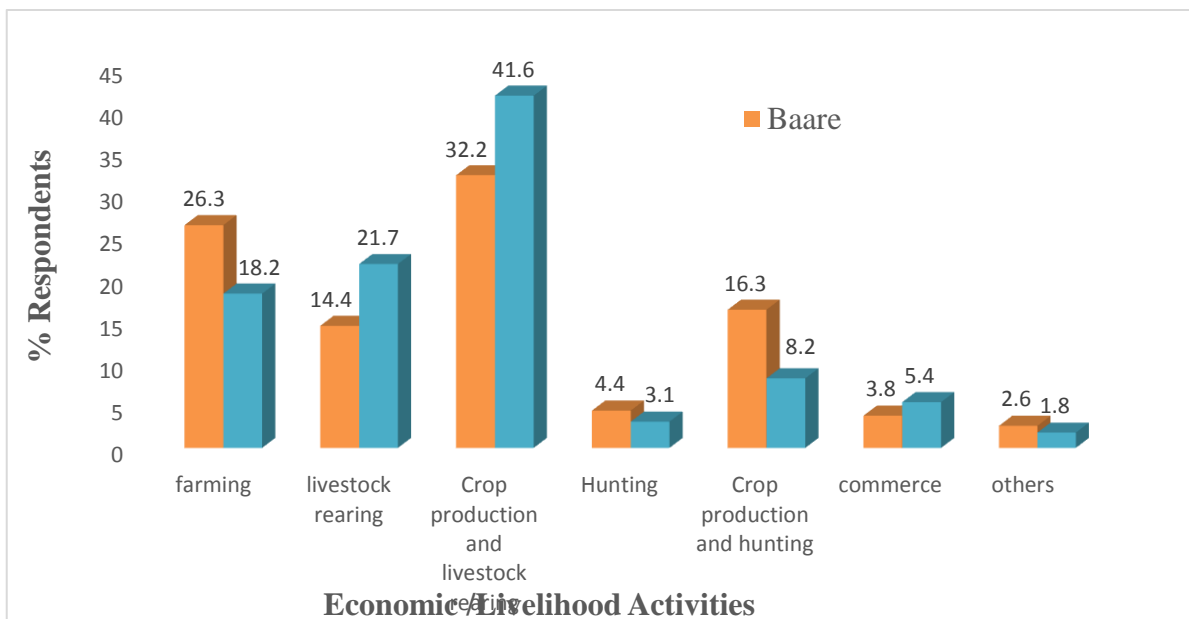


Figure 2 Major economic and Livelihood activities

On respondents opinions about changes in crops and livestock production, 31.6 % and 41.3% mentioned difficulty in Land cultivation and Loss of economic trees as the major changes in crop production in the past 5 to 15 years in Baare and Datuku respectively. Also, 24.4 % mentioned decreased in fecundity as a major change in livestock production in Baare, with 25.3 % indicating the presences of new pest and disease in Datuku (Table 2).

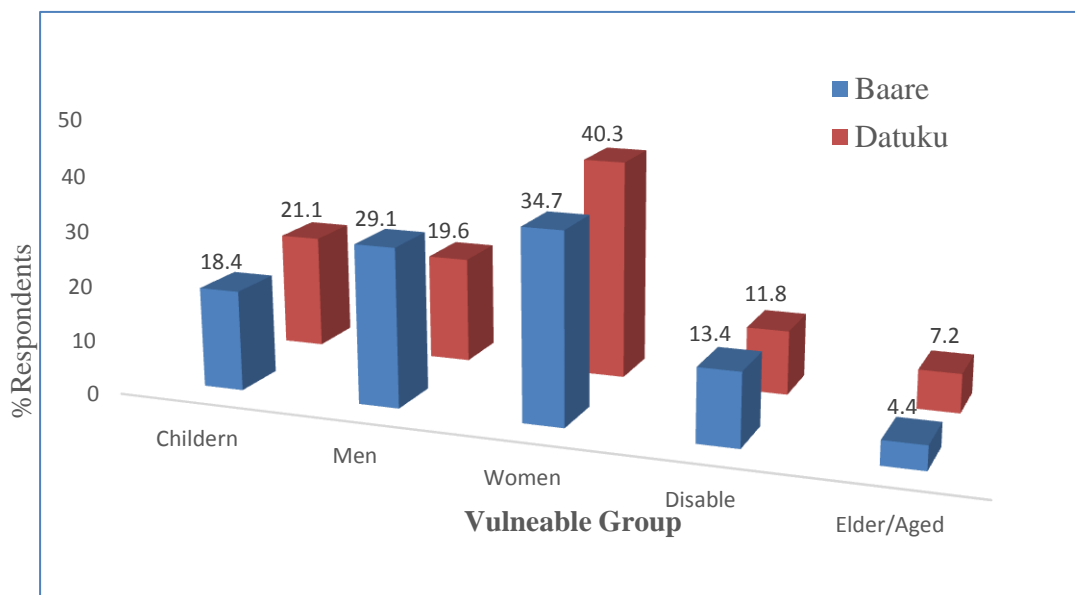
**Table 2: Respondents perception on Changes in crops and livestock production in the past 5 to 15 years**

Crops production	Baare		Datuku		Livestock Rearing	Baare		Datuku	
	F	%	F	%		F	%	F	%
Emergence of wild weed species	21	6.6	19	5.9	High Mortality	74	23.1	51	15.9
Increase crop yield	17	5.3	11	3.4	No change/impact	12	3.8	17	5.3
Decrease crop yield	39	12.2	47	14.7	Increase in Disease /pest	54	16.9	73	22.8
No change in crop yield	15	4.7	8	2.5	Decrease in Disease/pest	19	5.9	13	4.2
Difficulty in land cultivation/Drought	101	31.6	94	29.4	Increase in Fecundity	6	1.9	11	3.4
Loss of some economic trees	108	33.7	132	41.3	Decrease in Fecundity	78	24.4	66	20.6
No Idea	19	5.9	9	2.8	No Idea	10	3.1	08	2.5
					Presence of new pest/Disease	67	20.9	81	25.3
<b>Total</b>	<b>320</b>	<b>100</b>	<b>320</b>	<b>100</b>	<b>Total</b>	<b>320</b>	<b>100</b>	<b>320</b>	<b>100</b>

Source: Filed study, 2013

### 3.3 Climate Change Vulnerability and mitigation measures:

Respondents in both communities mentioned women as the most vulnerable to the adverse of climate change, about 40.3 % in Datuku and 34.7 % in Baare. Children were the next affected whilst the Elderly/Aged were considered the least vulnerable group (Figure 3). In addition, growing early maturing varieties was the most common adaptation strategy practiced by respondents in both communities (30.9% in Baare and 31.9% in Datuku) (Table 3).



**Figure 3: Vulnerable groups during natural disasters caused by climate change**

Table 3 Respondents' coping strategies to climate change

Coping strategy	Baare		Datuku	
	Frequency	Percentage	Frequency	Percentage
Migration	13	4.1	09	2.8
Diversification to other off-farm activities	52	16.2	69	21.6
Saving	20	6.3	14	4.4
Hunting	19	5.9	12	3.8
Reduce frequency of cooking	68	21.3	45	14.1
Growing early maturing varieties	99	30.9	102	31.9
Mixed/ inter cropping	37	11.6	51	15.9
Food aid	12	3.7	18	5.6
<b>Total</b>	<b>320</b>	<b>100</b>	<b>320</b>	<b>100</b>

Source: Filed study, 2013

## 4. DISCUSSION

### 4.1 Demographic Characteristics and Socio-Economic Livelihood activities as influenced by climate change:

There was a positive correlation between the educational levels of respondents and their level of climate change awareness. Majority of the respondents had formal education from primary to tertiary (Figure 1). This could have accounted for 70 % of respondents in both communities responding YES to being aware of the issues of climate change. Norris and Batie, (1987) reported that a higher levels of education is believed to be associated with access to information on improved technologies and higher productivity. This research envisage that a higher education at the household level could trigger better access to information on climate change awareness and management at both community and policy implementation level. However, this was in contrast with Thornton *et al.* (2006) who reported that the level of information and knowledge on climate change impacts in several sectors of East-Africa is exceedingly patchy, generally poor to moderate only. In both communities, the major economic activity was crop production and livestock rearing (Figure 2). Crop production and livestock rearing were the major victims of the impact of climate change in both communities; this has the predisposition to degenerate the food insecurity situation in the district since both are Agrarian communities. This conforms to Senbete (2009) who reported that climate change affects us because our life is totally intertwined with livestock and crop production, they are our life. In terms of crop production; the loss of economic trees, difficulty in land cultivation, decrease yield, and the emergence of new pests and disease (Table 2), could be attributed to the fact that the Talensi district is part of the drier regions of Ghana. Therefore, any impact of climate change in terms of prolonged drought, high temperature and less precipitation could have exacerbated the already Savanna conditions.

Bhandari, (2008) reported decreased in crop production due to abnormal climatic conditions in two agro-ecological zones (Hills and Terai); this is consistent with the findings in this study. Also, in Africa over 90% of the food supply comes from rain fed subsistent agriculture and rainfall failure means loss of major livelihood source that always accentuate food deficit (Adgolign, 2006). Sharma, (2010) and Pettengel, (2010) reported that due to climate change there will be reduced productivity, fertility and death of livestock as a result of heat stress and increased water requirement. The above finding agrees with the result in this study since majority of respondents in Baare and Datuku reported higher mortality, the presence of new pest/disease, decreased in fecundity as the major impact of climate change on their livestock rearing. We infer that since the Talensi district is rocky and drier, low precipitation and higher temperatures due to climate change could have compelled animals to move to further distances in search of pasture, resulting in reduced fertility, productivity, weight and even death under extreme conditions. Also, Animals rummaging on contaminated waste, water or moving to distance places in search of pasture could have acquired new pest and diseases that previously did not exist in these communities (Baare and Datuku).

### 4.2 Climate change impact on vulnerable groups, Livelihood, and their Adaptation strategies:

All societies are vulnerable to climate shock, and vulnerability is more acute on the poor, landless and unemployed, children, women, livestock tenders and large sized households (Senbete, 2009). The result from the study also showed that the most vulnerable group of people were women followed by men (Figure 3). This could be attributed to the role women play, in the Northern sector of Ghana, as the main home caretakers and food providers to children. In addition,

much of the farming activities at the farm level are usually performed by Women who are also the final point of call by children in accessing food in Northern Ghana (Talensi district). This further concurs the finding in Ethiopia by Senbete, (2009) who suggested that women (10%) are more vulnerable to climate change compared to men (3%).

Growing early maturing varieties of crops, reducing frequency of cooking and diversifying to off-farm activities used to mitigate the impact of climate change in both Baare and Datuku shows that respondents can no longer depend on a single strategy in combating food insecurity and this could explain why respondents engage in more than one economic activity. According to Feenstra *et al.* (1998), Humans may change their behavior to cope with a different climate change impact. This also harmonizes the findings of Resurrection *et al.* (2008) who reported that climate change adoption by local communities include alteration in the agriculture sector, labor migration, diversification of livelihood source, credit and borrowing, and moderating consumption behavior

## 5. CONCLUSION

This research showed the level of impact of climate change on the livelihood /economic activities of most rural communities in Ghana, which in recent times have become a global phenomenon, using Baare and Datuku communities in the Talensi districts as a case study. Crops and livestock production were the major economic /livelihood activities in the district. Loss of some economic trees, difficulty in land cultivation/drought, decrease in livestock fecundity, and the presence of new pests and disease constituted the main effects of climate change on their livelihood activities. The study revealed that rural communities have their own strategies in coping with natural disasters due to climate change. However, these strategies are not sufficient and clearly have a negative impact on the growth, productivity and health of women and children who are usually the most vulnerable groups. Thus, confirming the alternate hypothesis that rural livelihood / economic activities are affected by the impact of climate change.

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