



## SOCIO-ECONOMIC STUDY ON THE THREATS AND EFFECTS OF CLIMATE CHANGE ON LOCAL LIVELIHOOD IN SELECTED DISTRICTS OF THE NORTHERN REGION OF GHANA

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### Abstract

*The Northern Sector Action Awareness Centre (NORSAAC), a local NGO in Northern Ghana commissioned a research into the threats and effects of climate change on local livelihoods of the local people, especially women and the youth in four districts of their operational area in the northern region of Ghana. In all, 320 respondents (160 males and 160 females) were selected for interview using the stratified and random sampling techniques. The method of data analysis was basically descriptive. We found that the people's livelihoods basically centre on small-scale agriculture and its related activities such as food processing (using traditional methods) and petty trading, especially for the women. Limited opportunities such as education, off-farm activities and credit as well as irrigation and extension services have meant that they are not able to cope with the negative effects of climate change. Consequently, while a significant percentage of respondents relied on prayers and sacrifices to cope with the effects of climate change, others were simply doing nothing. As intervention measures we propose irrigation and some improved, but affordable equipment for food processing. Also, efforts must be stepped up to increase access to education, credit and extension services in the district, especially for women.*

**Keywords:** Climate change, Livelihoods, NORSAAC, Northern Ghana

### Introduction

Climate change refers to any change in climate overtime, due to natural variability or as a result of human activity (Intergovernmental Panel on Climate Change (IPCC), 2007). Climate change is broader than global warming in the sense that while the latter involves increases in temperature, the former goes beyond that to include floods, storms and erratic rainfall over a long period of time. In this case global warming is part of climate change (Department of Environment Affairs and Tourism (DEAT), 2004; Norwegian Ministry of Environment (NME), 2005). The accumulation of greenhouse gases such as carbon dioxide from different sources in the atmosphere promotes global warming. The main

source of greenhouse gases in the atmosphere is the burning of fossil which IPCC (2007) estimates to be 80%. The remaining 20% is caused by land use and land cover change, especially deforestation and depreciation (Stem, 2007). One of the biggest challenges of the 21<sup>st</sup> Century is climate change (The Climate Change Impacts, Adaptation and Mitigation (CCIAM) Programme, July 2009-June 2014). Even though the contribution to climate change by the least developed countries is generally low it is anticipated that the consequences of climate change will be severer than in the developed countries. Gomme and Petrassi (1996) in the CCIAM Programme, July 2009-June 2014 give a chronology of erratic rainfall patterns in Sub-Saharan Africa between 1960 and

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1993. Also, the Alliance for a Green revolution in Africa (AGRA), (2014) observed that in 2013, the African continent experienced an overall hot year, the second warmest on record behind 2010. For example, on March, 4 that year the temperature in Vioolsdrif, South Africa was 47.3<sup>0</sup> C, the highest March temperature ever measured in Africa. Similarly, in West Africa, Navrongo in Ghana, recorded a temperature of 43<sup>0</sup>C, the highest in Ghana.

Ghana has ratified the Kyoto Protocol and is making some efforts towards the adaptation and mitigation of the climate change impacts. For instance, the Environmental Protection Agency, under the Netherlands Climate Assistance Programme has carried out vulnerability and adaptation assessments showing how vulnerable the country is to climate change. Against this backdrop there has been several project interventions to address the vulnerability challenges of the nation. For instance, there has been the Sustainable Land Management for Mitigating Land Degradation, Enhancing Agricultural Biodiversity and Reducing Poverty (SLaM) Project aimed at contributing to sustainable ecosystem-based integrated land management in areas under threat in Ghana (Gyasi et al, 2011).

Critics however argue that these initiatives are not consistent and coherent and that there has not been adequate consultations amongst the various stakeholders in the country. They stress that there is the need for a concerted effort from all sectors, including the participation of non-governmental organisations to assist in enabling individuals and the nation as a whole to cope with and adapt to the threats and effects of climate change. It has been observed that Ghana needs assistance to support adaptation and mitigation in the context of integrated and systematic national planning, capacity-building, improved technology and funds to reduce the risk of disasters and raise the resilience of communities to the increasing extreme weather events.

### **Problem Statement and Objectives of study**

Northern Ghana is more precarious in terms of the threats and effects of climate change than the south. This is as a result of its geographical location as well as its infrastructural and economic underdevelopment. Lolig et al., (2014) outlined some of the climate change incidences and their impacts in northern Ghana as follows:

In 1999, extreme flooding in northern Ghana destroyed homes, farm-lands, irrigation networks, dams, and livestock, killing not less than five people. The flooding resulted in the contamination of potable water resulting in the rise in water-borne diseases affecting 290,000 people. Also, in 2007, floods following major rains in northern Ghana resulted in 61 deaths with 317,127 people displaced. In addition, 25,923 houses together with 634 drinking water and 39 irrigation facilities were destroyed while 955,050 tons of cereals were rendered unusable by the floods. This resulted in the government spending about 25.1 million dollars as direct emergency funding in the three northern regions. Lastly, in November 2010, 55 communities in the Central Gonja District were affected by floods. About 700,000 people were displaced, 3,234 houses collapsed, and 23,588 acres of farm-lands were destroyed at a cost of 116,340.22 US.

NORSAAC is one of the local NGOs that have, over the years, sought to alleviate some of the sufferings of the people in the north. It is a gender-based advocacy NGO in the northern region of Ghana. In line with its contribution to assisting local communities to cope with and adapt to climate change, NORSAAC commissioned this study to investigate the perceptions with respect to climate change as well as the coping and adaptation strategies of the local people, especially women and the youth in four districts of their operational area,

namely; Sagnerigu, Kumbungu, Savelugu and Central Gonja.

Thus the study is a baseline study to know the situation on the ground before any interventions could be made. Specifically the study sought to:

- Examine the perception of the local people about the changes and severity of major climate factors such as rainfall, floods, storms and drought.
- Determine the perceived short-term and long-term effects of changes and severity of the major climatic factors on livelihood in the study area; and
- Recommend specific advocacy issues to address the identified climate change related threats to local livelihood of the people.

Quite a number of studies have been carried out on climate change, some using primary data (Codjoe et al; 2013; Al-Hassan et al; 2013; Mabe et al; 2012; Lolig et al; 2014; Kusakari et al 2014) and others secondary (Mohan et al; 2014; Amikuzuno and Donkoh; 2012). Essentially, these studies have shown that farmers are, indeed, aware of the fact that there is climate change. While some attribute climate change to some of their farming practices and the felling of trees for lumber and fuel, others attribute it to punishment from the gods/God, as a result of violation of certain traditional laws and norms. The effects of climate change have been identified as destruction of lives, livestock and farm lands and other property. Strategies to cope with these include the adoption of soil and water conservation technologies as well as seed varieties that are of early maturity and are drought resistant. Adaptation strategies also include on-farm and off-farm diversification of activities as well as short-term and long-term migration. Most of these studies are not necessarily gender based, and besides, the focus is mainly on agriculture, without much analysis on the extent to which climate change impacts on the non-agricultural livelihoods. This study is not only gender based, it focuses on socioeconomic activities in general. As we know, women's limited access to farm lands and other agricultural resources has meant that most of them are into off-farm livelihood

activities. A study that focuses only on agriculture therefore automatically cuts off many of the issues that are pertinent to women.

## **Materials and Methods**

### **Study Area and Sampling Techniques**

NORSAAC operates in nineteen districts in the Northern region and three in the Upper East region. Out of these, four districts were purposively selected for the study because these are the districts in which NORSAAC intends to extend its interventions of climate change coping and adaptation strategies. Out of the four districts, stratified sampling was used to select 8 out of 22 operational communities of NORSAAC. The communities are Sangnerigu and Choggu in the Sangnerigu district, Takpaa and Savelugu Naayillifong in the Savelugu district, Gbrima and Kumbungu Nayilifong in the Kumbungu district, and Yarpei and Sankpala in the West Gonja district. The communities selected within the districts have urban, peri urban and rural characteristics. It was also ensured that some of the communities selected were close to a river body. This was to allow comparison of the perceptions as well as the coping and adaptation strategies between communities close to a river body and those away from a river body. Once the communities had been selected both stratified and simple random sampling techniques were employed to select final respondents of 320 based on sex and age. In all, 320 respondents (160 males and 160 females) were randomly selected for the interviews. NORSAAC's target groups are women and the youth but we thought that we should include the men for comparison and a better understanding of the situation of the women.

### **Methods of Data Analysis**

The main methods of data collection used were individual questionnaire administration and a key informant interview. The data was collected by a research team made up of research assistants selected from the University for Development Studies and NORSAAC. The data were coded, entered, cleaned and analyzed using SPSS version 16. After cleaning the data, the number of valid respondents were 314 consisting of 157 females and another 157 for males.

The method of data analysis was basically descriptive and the results presented using frequencies and percentages in the form of tables.

## Results

### Respondents' Perceptions of climate change

The first objective of the research was to investigate respondents' perceptions on changes in climate variables such as the onset of rainfall and the frequency of drought, floods and storms. In the case of rainfall, respondents were asked to indicate whether the onset of rains had become more unpredictable (A), the same (B) or predictable (C). From the results, majority thought that the onset of rains in their communities had become more unpredictable (80.8%), while 12.3% thought it had been predictable and 6.9% said there had been no change. In terms of gender, the percentage of males who thought that the onset of rains had become more unpredictable (84.9%) was higher than that of the females (76.7%). Earlier, we had noted that more males were into crop farming than females.

Agriculture is more susceptible to climate change than the other socioeconomic activities. It is not surprising therefore that more males perceived changes in the onset of rains than females. Across the districts, Central Gonja recorded the lowest percentage of respondents who said the rains were more unpredictable. This is perhaps, as a result of its proximity to the Yapei River which makes dry season farming possible. Also, proximity to the river makes fishing possible, which means a reduction on the reliance of rainfall. In the case of drought, respondents were asked to indicate whether the frequency of drought now had increased (A), decreased (C) or are the same (B). Similarly, the results show that the majority indicated that drought was more frequent in their communities. However, while 16.5% thought the frequency was the same, 13.5% said it had reduced.

Unlike, drought, perceptions about flood and storms were favourable, the majority (72.9%) opined that floods had rather been reducing. This is consistent with the earlier perception that the frequency of rains had reduced. Farming communities in Northern Region are generally said to be more drought prone, while those in Wa are flood prone (Kusakari et al, 2014). In terms of gender, more females (74.7%) than males (71.1%) thought that floods had reduced. Across the districts, Central Gonja recorded the highest percentage of respondents who said that floods had reduced, followed by Savelugu (79.6%), Sagnerigu (70.4%) and Kunbungu (59.2%).

The percentages with respect to the favourable perceptions of storms were generally lower; on average, 43.7% of the respondents said storm disasters had reduced. The figures for females and males were 46.0% and 41.5% respectively. The district level figures were Central Gonja (51.8%), Savelugu (50%), Sagnerigu (46.8%) and Kumbungu (26.4%).

### Perception of changing severity of climate change on socioeconomic activities

Apart from the changing frequency of climate change variables, respondents' perception on the severity of climate change variables on their socioeconomic activities was sought. This section discusses the extent to which climate change affects the socioeconomic activities of respondents. The next section then considers the specific effects of climate change on such activities.

From Table 1 we observe that on average the effect of temperature changes on the socioeconomic activities of respondents was severe (65.2%). However, while 21.9% said the effect was not severe, 12.9% indicated it was severer. It is clear from the table that the percentage of females who said the effect was severe (66.5%) was slightly above that of the males (63.8%). Similarly, while 25.2% of females said the effect was not severe, only 18.6% of the males indicated same. Lastly, the percentage of males who said the effect was severer (17.6%) was more than twice that of the females (8.3%). Contrary

to our expectations, this shows that males experience severer impacts from temperature changes than females. In terms of the districts, Savelugu recorded the highest percentage of respondents whose effects are severer (18.1%), followed by Sagnerigu (14.8%), Central Gonja (13.5%), and Kumbungu (5.4%). Thus, only 11.1% said the effect was not severe in Kumbungu while Sagnerigu (31.5%) and Central Gonja (31.3%) recorded high percentages of

respondents who said the effect of temperature was not severe.

In terms of statistical significance, we observe from Table 1 that the overall chi square value of 6.15 is significant at 5% level, implying that there is a significant difference in terms of gender perception of the severity of temperature across the five districts. The gender perceptions in the individual districts however are not statistically different.

**Table 1: perception of changing severity of temperature on socioeconomic activities**

District	Female			Male			Average			Chi Sq. test	
	C	B	A	C	B	A	C	B	A	Value	Sig
Sagnarigu	35.3	55.9	8.8	27.6	51.7	20.7	31.5	53.8	14.8	1.886	0.39
Kumbungu	16.7	83.3	0.0	5.4	83.8	10.8	11.1	83.6	5.4	4.472	0.107
Savulgu	17.4	69.6	13.0	10.3	66.7	23.1	13.9	68.2	18.1	1.341	0.511
Central Gonja	31.4	57.1	11.4	31.2	53.1	15.6	31.3	55.1	13.5	0.268	0.875
Average	25.2	66.5	8.3	18.6	63.8	17.6	21.9	65.2	12.9	6.15**	0.046

A=Severer; B=Severe; C=Not Severe

Significant at 10%; \*\* Significant at 5%; \*\*\*Significant at 1%

**Perception of changing severity of drought on socioeconomic activities**

The effect of drought on the socioeconomic activities of the respondents was severer than that of temperature. On average, 51.5% of the respondents opined that drought was severe (Table 2). On the other hand, while 34.6% said it was severer, 13.9% indicated that it was less severe. The males however were harder hit (44.4%) than the females (24.8%). As indicated earlier, the males were more into on-farm activities than the females who were more into processing and petty trading. Naturally, the former

would feel the impact of drought more than the latter. Among the communities, Sagnarigu recorded the highest percentage of respondents who indicated that the effect was severer (48.5%), followed by Central Gonja (35.4%) and Savelugu (33.8%). Kumbungu recorded the lowest percentage (20.7%). Like perceptions on temperature, there is a significant gender difference with respect to the perceptions on the severity of drought across the districts. In terms of specific districts the results show that the gender perceptions also differ in Sagnerigu and Kumbungu.

**Table 2: perception of changing severity of drought on socioeconomic activities**

District	Female			Male			Average			Chi Sq. test	
	C	B	A	C	B	A	C	B	A	Value	Sig
Sagnarigu	29.7	37.8	32.4	12.9	22.6	64.5	21.3	30.2	48.5	7.13**	0.03
Kumbungu	18.2	69.7	12.1	4.9	65.9	29.3	11.6	67.8	20.7	5.52*	0.06
Savulgu	10.0	63.3	26.7	4.5	54.5	40.9	7.3	58.9	33.8	2.05	0.36
Central Gonja	19.4	52.8	27.8	11.4	45.7	42.9	15.4	49.3	35.4	2.06	0.36

Average	19.3	55.9	24.8	8.4	47.2	44.4	13.9	51.5	34.6	14.74***	0.00
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- A=Severer; B=Severe; C=Not Severe
- Significant at 10%; \*\* Significant at 5%; \*\*\*Significant at 1%

### Perception of changing severity of flood on socioeconomic activities

The effect of flood is generally less severe in the study area. This was the opinion of 31% of the respondents across the district (Table 3). Only 20.6% said it was severer, while 48.5% also said it was severe. Flood is not very common in these parts of the northern region compared with certain areas in the Upper West region. Across districts, the highest percentage of respondents who said the effect was severer was recorded in Sagnarigu (34.5%), Central Gonja (33.4%), Kumbungu (11.8%) and Savulgu (2.7%). Again, generally, males (27%) were harder hit than females (14.1%). However, generally there was no significant difference in gender perceptions in the study area apart from in Central Gonja.

**Table 3: perception of changing severity of flood on socioeconomic activities**

District	Female			Male			Average			Chi Sq. test	
	C	B	A	C	B	A	C	B	A	Value	Sig
Sagnarigu	32.1	35.7	32.1	29.6	33.3	37.0	30.9	34.5	34.6	0.15	0.93
Kumbungu	7.7	84.6	7.7	31.6	52.6	15.8	19.7	68.6	11.8	3.62	0.16
Savulgu	53.3	46.7	0.0	31.6	63.2	5.3	42.5	55.0	2.7	2.16	0.34
Central Gonja	30.0	53.3	16.7	31.8	18.2	50.0	30.9	35.8	33.4	8.68**	0.01
Average	30.8	55.1	14.1	31.2	41.8	27.0	31.0	48.5	20.6	3.52	0.17

A=Severer; B=Severe; C=Not Severe

- Significant at 10%; \*\* Significant at 5%; \*\*\*Significant at 1%

### Perception of changing severity of storm on socioeconomic activities

Generally, storms are severer than floods in the study areas. On average, 55.3% indicated that storms were severe. The percentage of females who said it was severe (56.5%) was more than that of males (54.2%). In terms of the districts figures, Kumbungu recorded the highest percentages of respondents who were less affected (20.5%), followed by Savelugu (26.1%), Kunbungu (31.7%) and Central Gonja (36.5%). Unlike the other climate change variables there was no significant difference between the sexes with respect to the perceptions on the severity of storms in all the districts.

**Table 3: Perception of severity of Storm on socioeconomic activities**

District	Female			Male			Average			Chi Sq. test	
	C	B	A	C	B	A	C	B	A	Value	Sig
Sagnarigu	36.4	36.4	27.3	26.9	50.0	23.1	31.7	43.2	25.2	0.93	0.63
Kumbungu	22.2	70.4	7.4	18.8	68.8	12.5	20.5	69.6	10.0	0.57	0.78
Savulgu	35.0	55.0	10.0	17.1	57.1	25.8	26.1	56.1	17.9	3.46	0.38
Central Gonja	32.0	64.0	4.0	40.9	40.9	18.2	36.5	52.5	11.1	3.64	0.16
Average	31.4	56.5	12.2	25.9	54.2	19.9	28.7	55.3	16.0	3.5	0.33

A=Severer; B=Severe; C=Not severe

- Significant at 10%; \*\* Significant at 5%; \*\*\*Significant at 1%

**Respondents’ Perceptions of climate change effects on their socioeconomic activities**

Respondents were also asked to indicate the effects of climate change on their socioeconomic activities. Tables 5-8 show the various responses given. In periods of drought and high temperatures, the following are some of the effects on crop production: crops are destroyed through wilting or drying, there is poor plant growth and an increase in the incidence of pests and diseases. In periods of floods and storms, crops get rotten; there is poor plant growth, logging of crops and loss of nutrients, all leading to low yields.

With respect to animal production, there is generally, scarcity of feed during drought and high temperatures. The animals fall sick and sometimes die. In periods of flood and storm, the commonest problem is drowning and restrictions in the movement of animals and human beings. Sometimes

also, the animals become infested with pest and diseases. The main effect of drought and high temperatures on food processing is that there is inadequate raw material, which means that prices shoot up leading to high cost of processing, and for that matter, low sales and profit. One positive effect however, is that there is enough sunshine to dry the grains and nuts. Smoking and drying of fish are also facilitated during these periods. However, during flood and storms, the opposite ensues, in that there is not enough sunshine to dry these foods, the grains are therefore not of good quality and this affects sales and profits. Like the processors, petty traders also do not get enough wares to sell during the dry season. This reduces sales and for that matter profit. Otherwise, the period is normally the lean season where sales are supposed to boom. On the contrary, the period of flood is when there is abundant supply of river fish which means that fish mongers can buy more and store against the lean season.

**Table 5: Effects of climate change on Crop production**

Climate change factor	Effect
Drought	Crops are destroyed
	Wilting/drying up of crops
	Low yield
	Poor plant growth
	Incidence of pests and diseases
	Witch weed attack
	Heat retards work on farm
Temperature	Crops are destroyed
	Wilting/drying up of crops
	Low yield
	Poor plant growth
	Heat retards work on farm
Flood	Crops are destroyed
	Crops get Rotten/wilt
	Low yield
	Loss of nutrients
Storms	Difficulty in weeding/working
	Crops are destroyed/crops fail
	Low yield
	Poor plant growth
	Reduces grain quality
	Pest and disease attack
	Logging of crops/destroys shea trees/building

**Table 6: Effects of climate change on Animal production**

Climate change factor	Effect
Drought	Animals fall sick/death
	Scarcity of feed
	Stress/loss of weight
Temperature	Inadequate feed for animals
	Restricts movement on human beings-can't work for a long distance.
Flood	Loss of animals
	Restricts movement on human beings and animals
Storms	Death of animals
	Restricts movement on human beings and animals
	Pest and disease attack

**Table 7: Effects of climate change on Food processing**

Climate change factor	Effect
Drought	Sales profit reduces
	Low standard of living
	High cost of raw materials
	Inadequate raw materials
	Less/no water to work with
	Facilitates processing
Temperature	Reduced or inadequate stock
	Facilitates processing/drying of grains/nuts/smoking of fish
	Reduced or inadequate stock
Flood	Difficulty in drying grains and nuts
	Increase poverty
	Low profit
Storms	Reduces grain quality

**Table 8: Effects of climate change on Petty trading**

Climate change factor	Effect
Drought	Sales profit reduces
	Low standard of living
	High cost of products
	Gets less fish to buy
	Scarcity of food
	Sales profit reduces
Temperature	Sales become normal
Flood	By more fish to store
	Low profit



	Short supply of food
Storms	Low sales
	High prices of commodities

### Coping and adaptation measures

Some of the coping and adaptation measures taken by the respondents in the study area are listed in Table 9

**Table 9 Respondents' coping and adaptation measures**

Socioeconomic activity	Action taken
Crop production	Pray to God/appeal to the gods
	Early planting and replanting
	Plant drought resistant/early maturing varieties;
	Adoption of soil and water conservation;
	Mixed cropping
	Off-farm employments;
	Irrigation.
	Stop selling;
	Proper timing/delay planting/delay weeding.
	Dispose off- some assets
	Borrow/depend on family
	Migration;
	Dispose off some assets
	Borrow/depend on family members
Do nothing	
Animal production	Off-farm diversification;
	Use of Alternative Feeding Materials (Maize Bran, Yam Peels Etc.)
	Medication/
	Diversification.
Food processing	Pray to god
	Reduce quantity of raw materials/ fish purchased
	Panic buying
	Store produce/ store raw
	Search for water elsewhere
	Dispose off- some assets
	Borrow/depend on family members.
Petty trading	Pray to god
	Panic buying
	Reduce quantity purchased
	Travel far to buy or sell
	Store produce/stop selling
	Dispose off some assets
	Increase price of fish

**Table 10: Respondents long-term adaptation measures**

Climatic factor	Action taken
Drought and High temperatures	Afforestation/planting trees
	Staking;
	Practicing mixed farming
	Avoid bush fires
	Change planting date;
	Go to farm early;
	Grow resistant or tolerant varieties
	Adoption of soil and water conservation (SWC) technologies
	Pray to god;
	Diversification
	Reduce purchases;
	Create ventilation/sleep in the open
	Increase quantity of products;
	Dispose of personal assets.
Flood and storms	Avoid planting and building at flood prone areas; plants; maintenance of good drainage system; report to NADMO; diversification.
	Avoid planting and building at flood prone areas;
	Change planting dates;
	Grow water resistant crops
	Grow early maturing plants;
	Maintenance of good drainage system
	Report to NADMO;
Diversification.	

**Discussion**

The findings show a young adult population who can be engaged in meaningful employment and whose human resources can be tapped for community, and for that matter national development. There is the popular adage that “life begins at forty”. The average age of the respondents in this current study was 38.6 years, which means that meaningful life could begin if the necessary support is given them. Unfortunately, like it is nationally, majority of the respondents, especially the females, had little or no formal education. This has negative implications on accessing well-paid jobs, and also, even with respect to agriculture which many of them were engaged in, the adoption of modern technologies and practices for increased productivity. In a similar study by Donkoh and Awuni (2011) a large majority (67.1%

and 85% for adult males and adult females respectively) had not had any formal education.

The Ghana Statistical Service (2007) noted that 50% of the Ghanaian population never attended school or completed basic school. There is also a gender gap in education in the sense that almost twice as many females as males never attended school. The situation is worse for the three northern regions; while the population who had never been to school in the three northern regions ranged between 44.5% in Upper East and 54.9% in the northern region, in other regions it ranged between 10.1% in the nation’s capital region to 26.4% in Brong Ahafo (Ghana Statistical Service, 2010).

The United Nations Children Fund/New York Headquarters (UNICEF/NYHQ), (2007) underscored the importance of education, noting that education empowers people with the necessary knowledge and skills needed to create or access jobs for themselves. In this case they are able to increase production and income to reduce hunger and poverty. Similarly, education equips people with knowledge, skills, values and behaviour needed for taking good care of the environment.

As the findings show, majority of the respondents, especially the males, were engaged in agriculture, with limited adoption of modern inputs. The few off-farm activities, which were mainly patronised by the females, were petty trading and food processing, also involving no modern technologies. This is not different from the national situation where the Ghana Statistical Service (2007) disclosed that 55.8% of the working population is employed in agricultural activities and only 15.2% and 10.9% are into trading and manufacturing respectively. Also, whereas 21.6% of the females were engaged in trading, only 8.4% of their male counterparts are into the profession.

Not only does agriculture in the study areas lack the adoption of modern technologies, it is mainly rain-fed, with very limited dry season farming, which further limits the opportunities of the farmers to engage themselves all-year round. Also, access to extension services is limited, especially for women farmers. Furthermore, access to credit is limited, but this is faced by not only farmers but also non-farm patrons such as processors as well as petty traders. Membership of socioeconomic groupings, especially farmer-based organizations, is an important source of mutual assistance, in terms of labour, credit and business advice, yet most of the respondents in this present study do not belong to any socioeconomic group. This also has negative repercussions on the socioeconomic lives of the people.

In terms of climate change, majority of the respondents attested to the fact that there is climate change in their communities. That is to say that not

only had there been unfavourable changes in the patterns of the climatic factors, they are severer than they used to be. On the whole, the men perceived climate change to be severer than the women. In terms of districts also, climate change was perceived to be severest in Sagnerigu, followed by Central Gonja, Savelugu and Kumbungu. In the study by Kusakari et al (2014) majority of the farmers had noticed changing climate trends as follows: unpredictability of rainfall (90.7%), decreasing rainfall amount (85.3%), and increasing drought frequency (84.8%) as well as severity (83.7%).

The effects of climate change were not far-fetched; the main one being poor crop yields which leads to inadequate food and raw materials for the processors. Inadequate supply of raw materials also means high prices, and for that matter high cost of production and low profit, the end result being poverty or low standards of living. Thus, most of the socioeconomic activities being agriculture related means that when the people fail in agriculture, they fail in the other areas as well, further exacerbating their plight. These findings are consistent with that of Kusakari et al (2014), where farming was the livelihood activity most severely affected by droughts (83.7%) and floods (87.0%), which led to the destruction or loss of crops, low yield, and low agricultural productivity. One of the few positive effects of drought, however, was that it facilitated the drying of the agricultural produce.

Turning to the coping and adaptation strategies, the fact that a number of the respondents were adopting some agronomic as well as soil and water conservation practices means that an intervention can come from that angle. In Lolig et al (2014) also the coping strategies during drought were as follows: offer sacrifices to the gods; depend on wild fruits and plants; depend on extension information; plant late; engage in petty trading; depend on dry season gardening; and buy food from the market to supplement the home-produced food. The coping strategies during flood included feeding on wild fruits and plants, depending on extension services, cropping on mounts and upland areas, planting early,

petty trading and buying food to supplement farm produce.

However, a significant percentage of them were relying on religion to take them out of the climate change menace. As we know, traditional African religion used to play a significant role in the socioeconomic lives of the rural communities. The rural folks used to observe certain practices (such as praying and sacrificing to the gods) which they believed brought rains and abundant food. In recent times however, the introduction of Christianity and Islam has meant that people are gradually losing faith in the traditional religion and are failing to observe the tenets. At the same time commitment to the foreign religions has not been strong enough to gain much, in terms of favourable weather conditions and abundant harvest. The net effect is that the African is left hanging in the balance-having rejected his traditional religion, but at the same time not being committed enough to the foreign ones to benefit adequately from them. A high percentage of the respondents relying on religion for answers to their climate variability is quite worrying and needs to be addressed appropriately. Lolig et al (2014) also found that in all the communities, households thought drought was related to the deity and their belief that the deity had the power to cause and to deny rains. As a coping strategy, therefore, they consulted and offered sacrifices to the “rain gods” in request for rains in times of drought. Such sacrifices were made from community contributions. They appeased the gods as a community and not on an individual household basis.

The more worrying situation though was the fact that an equally significant percentage of them said they were doing nothing by way of coping or adapting to climate change; and understandably so, because when you are not well educated, have no good job and are relying on rain-fed agriculture using traditional tools with limited or no access to credit, extension services and off-farm activities there is virtually nothing you can do to mitigate the effects of climate change.

## **Implications of findings for policy recommendations**

The following are the policy implications of the findings.

### **Dry season farming**

As a matter of urgency, there is the need to support dry season farming in the study area. As the findings show, dry season farming is being practised by only the communities in the Central Gonja District that are close to the White Volta in Yapei. In the other communities where there are no rivers, it is important that dams are constructed and small irrigation pumps sold at affordable prices to the farmers. Needless to say, the multiplier effects cannot be over-estimated. First farming can go on all-year round, food and raw material supply would increase, and there would be more employment opportunities, resulting in a higher standard of living for the people. The study did not directly look at access to land by gender. However, as we know, women are often marginalized when it comes to the issue of land. In fact, it could partly explain why a relatively small percentage of women were into crop farming. NORSAAC can advocate for an affirmative action to be taken in favour of women with respect to access to land. Otherwise, women would have very little to gain from agricultural development.

### **Backward and Forward Linkages**

Agricultural development is made possible by effective backward and forward linkages. Backward linkages are simply the activities that feed the agricultural industry; for example, the supply of agricultural machinery or implements and agrochemicals. Farmers need credit and extension services to be able to access these inputs. Similarly, they need effective FBOs to be able to access these inputs creditably and also to have a strong bargaining power for their produce. Forward linkages are the activities that make use of agricultural produce, such as food and raw materials for agro-industries. Without an effective market for the produce, the farmers cannot break-even, let alone make profit. NORSAAC can collaborate with the Association of Ghana Industries (AGI) and the School Feeding

Programme for the purchase of farmers' produce. Also, they can collaborate with warehousing companies to help store the farmers' produce against the lean season for better prices.

### **Processing**

A more sustainable way for absorbing the farmers' products, however, is when they are processed at the community level. In this case the multiplier effects take place in the communities; it is a win-win situation for both farmers and processors. Fortunately, this is what the women are into. As the findings indicate, there is processing of shea nut and almost all the major farm products, namely, rice, maize and groundnut. The major problem with this industry however, besides credit, is lack of efficient processing machinery. This is where NORSAAC can again link up with engineering institutions like Kwame Nkrumah University of Science and Technology (KNUST), Ghana Regional Appropriate Technology Industrial Research (GRATIS) and blacksmith associations to manufacture simple machines for the processing of these farm products.

### **Livestock farming**

Livestock farming is one thing that has been looked down upon for a long time. Like crop farming, livestock farming is more or less undertaken as a way of life, rather than as a business. This is evidenced by the limited care that is given to the animals, and yet it is one area that can be a great source of wealth to the farmers. Intensive system of farming is almost non-existent in the communities. Largely, the animals are left to fend for themselves without shelter, even in the rainy season, not to talk of medication. And yet the animals are the ones the owners run to when they are cash trapped. Livestock production must be taken up as a business, like it is done in the poultry industry. Over the years, there have been some interventions in the livestock industry with respect to training in caring, feeding and medication. NORSAAC may again link up with the Ministry of Food and Agriculture (MoFA) to offer training to the farmers.

### **Education**

Many of the problems we have with the rural folks and the urban poor have to do with lack of education, both formal and informal levels. As indicated earlier, lack of formal education has meant that our people are not gainfully employed, they lack the capacity to understand the application of some modern technologies and they live in superstition. With the present generation, there is not much we can do by way of formal education. However, informal education with respect to some of their own practices exacerbating climate change impacts and how they can minimize the impacts can be offered. Again, informal education and sensitization can go a long way to de-programme their minds on some of the superstitions they hold while at the same time upholding and helping to 'refine' some of their indigenous knowledge and practices with scientific underpinnings. In the case of the young and unborn generations we cannot afford to allow them tread on the same path of 'ignorance' that their parents are treading now. All hands must be on deck to put them into the classroom to the highest possible levels. The onus lies on NORSAAC to team up with educational organizations like Ibis to contribute its quota in the study areas.

### **Integrated climate Risk Management**

Important as the above measures are, they do not exhaust the list in terms of the measures taken to reduce the negative impacts of climate change. Warner et al (2013) noted that risk sharing and transfer instruments, such as insurance are very vital in reducing climate change impacts. They stressed that climate risk management practices, in general, do not only provide liquidity for the insured when the risk occurs but they help people to take measures to prevent or reduce the impacts of risk occurrence. As a complementary measure, to the above, it is important that NORSAAC collaborates with other civil society and governmental organizations to mobilise and support the people in the study area to participate in some of these risk management practices. For instance, the Innovation for poverty Action and Christian Aid are piloting crop insurance in some communities in Northern Ghana. The

Meteorological Department of Ghana can also be collaborated with to give some weather information to the people in a sustainable manner.

### Conclusion

Agriculture continues to be the backbone of the Ghanaian economy. Like the present study areas, the majority of Ghanaians depend on agriculture and its related activities. Climate change simply implies that the weather cannot be predictable. Agriculture depending on natural factors implies therefore that as a country, our development cannot be predicted-we cannot be sure about our fate as a country. It is for this reason that we need, as a country, to gradually move away from depending on these natural factors like the developed countries. The surest ways are to irrigate and to process our raw materials for greater value addition, but above all, both formal and informal education is necessary to build our human capital and capacity since this remains the most important factor of production that can ensure a more efficient use of our natural and man-made resources.

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