International Journal of Humanities and Social Science Invention
ISSN (Online): 2319 – 7722, ISSN (Print): 2319 – 7714
www.ijhssi.org ||Volume 6 Issue 5||May. 2017 || PP.33-42

Vulnerabilityin the Face of Climate Change and Variability: Perceptions and Off-FarmCopping Strategies amongFarm Households in Northern Rural Savannah,Ghana

Ibrahim Abu Abdulai[1], Abdul-Moomin Adams[2], Mu-een Abdulai[3]
[1]*Department of Governance and Development Management, University for Development Studies, Tamale, Ghana.*
[2]*Department of Governance and Development Management, University for Development Studies, Tamale, Ghana.*
[3]*Faculty of Planning and Land Management, University for Development Studies, Tamale, Ghana.*

Abstract*: Rural population in West Africa represents one of the largest vulnerable groups in the world and this vulnerability emanates from the change and variability of the climate over the years. Agriculture in Northern Ghana is rain-fed and the rural population lack adequate resources to adapt to the changing climate. This paper focuses on farm households' perception of their vulnerability to climate change and copping strategies. Four farming communities in the Wa-West District were purposively selected for the study. The study was basically qualitative which employed Participatory Rural Appraisal methods including interview and Focused Group Discussions (FGDs) in the data collection. A total of 20 farmers were interviewed and 8 FGDs were conducted. The data was analyzed through transcription, detailed description and paraphrasing. Results of the study indicates that farmers generally agreed that there is a change in climate marked by increasing temperatures, shortened rainy season, prolonged dry season, erratic rainfall pattern and high incidence of drought. Farmers attribute the occurrence of these climatic conditions to illicit activities such as incessant armed robbery, killing of innocent people, adultery and people having sex in the bush which made the gods and ancestors of the land angry and therefore changes in climatic elements are punishment from the gods and ancestors. Farm households adopted varied copping strategies to reduce their vulnerability to climate change including sale of their casual labour, charcoal making, petty trading, pito brewing, shea nut collection, shea butter extraction and temporary out-migration to seek for "greener pastures". It is recommended that the Ghana Meteorological Service Department should collaborate with the local radio stations to broadcast weather forecast in the local languages targeted at rural farmers so that they could properly plan their farming activities during the rainy season.*

Keywords: *Vulnerability, Climate Change,Perception,Copping Strategies, Wa-West District, Ghana*

I. INTRODUCTION

Ghana like any country in Sub-Sahara Africa is significantly vulnerable to climate change. The vulnerability emanates from the fact that Ghana's economy is largely dependent on agricultural production especially in rural areas where about 90% of the population depends primarily on agricultural related activities for survival. In Northern Ghana, there has been a constant trend of decreasing rainfall (USAID, 2011). Changes in rainfall levels and distribution, rising temperatures and variations in soil fertilitydue to climate change are expected to negatively influence the growing conditions and the potential yields of many crops. The decline in output and yields will in turn aggravate the food security status and poverty incidence of smallholders whose livelihood is solely dependent on agriculture (IPCC, 2007; Amikuzuno *et al.*, 2013).

Climate change is considered to have remarkable effects on the quality of livelihoods of humanity, particularly rural populations of developing economies which are subject to increasing vulnerability (IPCC, 2001, 2007, and 2013). The impact of climate change on the West African Sub-Region is expected to be widespread and geographically variable (Marc *et al.,* 2015; Wakhungu, 2011; Yaro*et al.,* 2010). The changing climate does not only affect agriculture; its impact is also felt in all aspects of the lives of rural people,particularly in West Africa (Yaro&Hesselberg, 2016).

The changing climate and increasing variability amplifies the vulnerability of the region's population to climate stressors such as droughts, flood, heat waves, and changing rainfall patterns. This is projected to increase the cost of food, health, basic infrastructural provision and humanitarian assistance. According to Gornall*et al.* (2010), agriculture which is the main source of livelihood for most rural households is extraordinarily vulnerable to even slight changes in temperature or rainfall pattern, which can have devastating effects on crops, grasslands or forests and livestock.

Agriculture in Northern Ghana is rain-fed and the rural populations lack adequate resources and capability to cope with the vagaries of the changing climate. Therefore, the agricultural sector is predominantly vulnerable(McDowell& Hess, 2012; Hertel&Rosch, 2010; USAID, 2011). Consequently there is the need for all societies to learn to cope with the changes in climate — declining rainfall, warmer temperatures, drier soils, and weather extremes. It is however, important to state that the ability of a people to cope with the predicted changes in climate will predicate on the peoples' perception of their vulnerability to the changes in climate.

The main focus of this paper is to assesshouseholds' perception of their vulnerability to the effects of climate change and copping strategies of farm households.Perception as put forward by Lindsay and Norman (1977)is the process by which an individual or community interpret their experience of the world around them. In other words, it isthe way we organize and interpret our experiences in order to give meaning to the environment. A situation may be the same but the interpretation of that situation by two individuals may be immensely different.Thus, when a person or community is confronted with an environmental situation, the person or community interprets the situation into something meaningful based on previous experiences (Lindsay & Norman, 1977). On the other hand, coping strategies refer primarily to short term actions taken to neutralize the immediate negative consequences of climate change and variability including drought and increased temperature (Campbell *et al.*, 2011; Yohe&Tol, 2002).In view of the fact that rural households heavily depend on agriculture which is influenced by climate change and variability, understanding farmers' perceptions of vulnerability and households' copping strategies is a critical component for motivating policy makers and development practitioners to appropriately intervene to address farmers' vulnerability to the effects of climate change and variability.

II. LITERATURE REVIEW

The Concept of Vulnerability

The study of the vulnerability of human and natural systems to climate change and variability, and of their ability to adapt to changes in climate hazards, is a relatively new field of research and there are different definitions of the term depending on the background of the researcher (USAID, 2011). For the purpose of this paper,vulnerability implies the degree to which a community or household is predisposedto, or unable to cope with adverse effects of climate change, including climate variability and extremes (IPCC, 2001). The condition of the susceptibility of a system is predicated on its weakness, exposure, character, magnitude, and the rate of climate variation to which a system is exposed, its sensitivity, and adaptive capacity (Campbell, 1997). Vulnerability has two sides: an external side of risks, shocks, damage and stress to which an individual or household is subjected to by climate related events (Jones & Boer, 2003; Younus, 2014) and an internal side which is defenselessness, meaning as a state that exists within a system before it encounters a hazard (Chambers,1998; Allen, 2003;Wilbanks, *et al.*, 2007). In other words, systems [communities or households] that are sensitive to climate conditions and less able to adapt to changes in climatic elements are generally considered to be vulnerable to climate change (Aandahi& O'Brien, 2001; Wilbanks*et al.*, 2007).

Vulnerability perspective considers how communities or households are exposed to dangers, the ways in which they are easily harmed, and the protection and capacity that they lack (Brauch, 2002).Vulnerability is not simply a function of exposure, but also of people's capacity to adapt to change. If the people's capacity to adapt to change remains unchanged, increased exposure will lead to increased vulnerability. Furthermore, vulnerability is influenced by both physical and socio-economic characteristics, which are not static. This implies that vulnerability is specific in relation to context, place, time and the perspective of those assessing it (Adger, 1996; Aandahi& O'Brien, 2001).

Individual perceptions about climate change, vulnerability, and risks are created within the social and spatial context in which they occur (Shakeela*et al.*, 2013). A research on smallholder farmers' vulnerability to agriculture risk and climate change in Madagascar show that farmers live in precarious conditions and are inherently vulnerable to any shock that affect their farming system. Agriculture is the most important occupation of farmers serving as the main source of food and income to households.Therefore, the fate of farmers is intrinsically linked to farming (Harvey *et al.*, 2014).

Dimensions of Vulnerability

Exposure as used here refers to the extent to which households come into direct contact with drought, increased temperature and erratic rainfall in a locality. This implies that the greater the exposure, the higher the sensitivity of households to climate change and variability. For example, dry land farming is exposed to variability in precipitation amount,drought and timing in a way that irrigation-based farming is not.Exposure to climate change is chiefly a function of geography (IPPC, 2001; IPCC, 2007;World Bank, 2009).According to Brooks (2003), the extent to which a population is exposed to a hazard very much depend on where they choose to live, and how they construct their settlements, communities and livelihoods. Environmental variables will show a discrepancy in response to human activity, as populations utilize resources and manage the environment

for their benefit in the short or long term (Brooks, 2003). Thus, geography of an area exposes residents to certain conditions that make them vulnerable. For example,Harvey *et al.* (2014) found that cyclones are a common feature of Madagascar's climate and have devastating impact on smallholder farmers because the peak of the cyclones occur during the lean season when farmers are experiencing food shortages.

Another dimension of vulnerability is sensitivity which refers to the degree to which households aredirectly or indirectly affected by changes in climatic conditions [temperature and precipitation] or specific climate change effects [change in crop yields, increased temperature, damage caused by flooding].If a household is likely to be affected as a result of projected climate change, it should be considered sensitive to climate change (IPCC, 2001; IPCC, 2007). For example, a community or household dependent on rain-fed agriculture is to a great extent sensitive to changing rainfall patterns than one where mining is the dominant livelihood. Likewise, a fragile, arid or semi-arid ecosystem will be more sensitive than a tropical one to a decrease in rainfall due to the subsequent impact on water flows (IPCC, 2001;World Bank, 2009).According to Harvey et al., (2014) farmers in Madagascar are consistently subjected to extreme weather events which result in livestock and food crop losses as well as damage to agriculture systems.

According to IPCC (2001),adaptive capacity is the ability of a system [community or household] to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with external stress. In other words adaptive capacity describes the ability or capacity of a system to modify or change its characteristics or behavior so as to cope better with existing or anticipated climatic event (IPCC, 2001; Burton *et al.*, 2002; Adger*et al.*, 2003). A cardinalfactordetermining the adaptive capacity of individuals, households and communities is their access to and control over natural, human, social, physical, and financial resources (IPCC, 2007; World Bank, 2009).Brooks (2003) argued that the direct effect of adaptation is to reduce vulnerability. He further states that whether or not adaptation translates into a reduction in vulnerability will depend on the nature of the climatic event. Furthermore, adaptation decisions are shaped by the perceptions of risk held by individual or community that is confronted with the risk and in this case climate change and variability (Adger*et al.*, 2009).Bawakyillenuo*et al.* (2014) in their exploration of autonomous adaptation strategies by farmers in selected villages in northern Ghana found that there is a shift from solely depending on agricultural related activities to non-farm jobs as a measure to cope with climate change. These include trading,processing of groundnuts, shea butter and rice for sale, carpentry, masonry, mechanics etc.

Seasonal migration is another adaptive strategy being employed by farm households to cope with the effects of climate change. Generally, it is the young men and women who migrate to other areas to work to earn income for household consumption (Laube*et al.*, 2012; Bawakyillenuo, *et al.*, 2014). Seasonal migration is principally motivated by climate change, but consideration is also given to the opportunity to find informal job opportunities. While the majority of men still migrate to rural locations as farm hands, the majority of women migrate to urban areas as head porters, shop assistants and house helps (Bawakyillenuo *et al.*, 2014). Copping strategies help farm household to mitigate impacts of climate change.The fact that many household suffer from food shortage show that copping strategies are inadequate. Moreover, there are limits to which copping strategies can be used. For example, off-farm employments are limited and temporary, therefore, they cannot be relied upon for long term measure to cope with climate change (Harvey *et al.*, 2014). Livestock are heavily relied on in years of poor farm harvests as they are often sold for household food stock and farm inputs (Bawakyillenuo *et al.*, 2014).

III. METHODOLOGY

The study was conducted in four communities in the Wa-West District. The Wa-West District is located in the western part of the Upper West Region, approximately between longitudes 9º 40′ N and 10º 10′ N and latitudes 2º20′ W and 2º 50′ W. It shares boarders to the south with Northern Region, North-West by Nadowli District, East by Wa Municipal and to the West by Burkina Faso. The total land mass of the District is approximately 1,492 km^2, representing 10% of the total land mass of the Upper West Region.The District is largely rural and has two marked seasons namely, the wet and dry seasons. The rainfall pattern is erratic and thus affects cropyields. The vegetation is the Guinea Savannah grassland type made up of short trees and shrubs of varying heights and luxuriance. Over 90% of households in the district are engage in agriculture with particular interest in crop farming (Ghana Statistical Service, 2014).

The study communities include *LassiaTuolu, Dornye, Dorimon* and *Zanko* as indicated in Figure 1.These communities were selected purposively based on the fact that *LassiaTuolu* and *Dornye*are settler farming communities in theWa-West district while *Dorimon and Zanko* are indigenous communities. A total of twenty(20) farmers were selected for in-depth interviews in order to understand their perspective on the subject, while 8 Focus Group Discussions (FGDs) were held so as to enable the researchers access a broad range of views on perceptions of vulnerability and household level copping strategies to climate change. Membership of

each Focused Group ranged between 6-12. In each selected community, 5 in-depth interviews and 2 FGDs were conducted with farmers aged 45years and above, chief and elders, and the earth priest. This category of persons were selected on the basis that they would have had a better appreciation of climate events since climate change is a gradual process and its impact is hardly palpable (IPCC, 2014). The interviews and FGDs were conducted in the local language and analyzed through transcription, detail description and paraphrasing.

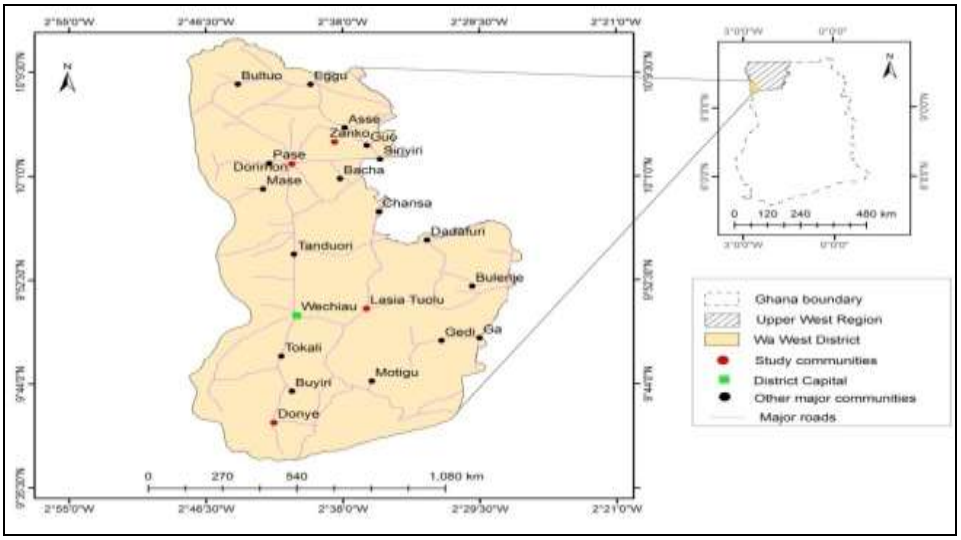

Figure 1: Map of Wa-West District Showing the Study Communities

Source: Adapted from Ghana Statistical Service, 2014.

IV. RESULTS AND DISCUSSIONS

Farm Households' Perception of Climate Change and its Causes

In an attempt to deal with the subject matter of perception of vulnerability of farm households to climate change over the last 30 years, the researchers wanted to know from the farmers whether there has been a change in the climate over the last 30 years. Analysis of data shows that there is a perceived change in climate over the last 30 years. A 45year old farmer from *Zanko* community summarized his perception of climate change as follows: *In the past, there were big trees which brought about rainfall and the lands were fertile for crops but now the trees are gone and the rains are not coming too. We cannot predict the on-set of the rains, draught is now common and the weather is usually hot and I believe that the climate has changed.*

According to the farmers, in the past, rainfall pattern was predictable and the duration of the rainy season was much longer than it is in the present times and this revelation is supported by the findings of Maddison (2007) who reported that in six out of ten countries in West Africa which he studied, majority of farmers believed that rainfall levels had decreased whilst a sizable majority believed they had witnessed a change in the timing of the rains. According to discussants and interviewees,in the past [30 years ago] the average duration for rainfall was 8 months; it used to start from April to November and it was well distributed. However, now the climate has change due to the fact that rainfall pattern has become unpredictable and the duration of the rainy season has reduceddrastically and distribution is also poor in recent times. Discussants indicated that the rainy season now starts in June and ends in September and consequently ends farming activities. With the short period of rainfall, drought takes about two months which implies farmers have approximately two months to cultivate their food crops.

Drought here refers to the protracted absence of rainfall in the rainy season which affects the cultivation of food crops and livestock. Farmersreported that there has always been drought [*Wari*] but the regularity and intensity is what has changed. In the past,droughtduration was not more than 8 days in the farming season and this finding corroborates the findings of Jarawura (2014) who found that farmers perceive that expected drought no longer occurs at the time it used to; which compromise their ability to properly plan their farming activities.According to the farmers,in the past, drought helped in the production of food crops by giving opportunity for farmers to weed on their farms to allowfood crops the needed sunshine and air in the soil that ensured proper growth and maturity. Discussants however reported that in recent times it is difficult to predict drought, but it could extend for about 1–2 months. This phenomenon couple with the short wet season affects crop yields negatively.

In *Dornye* community the Traditional Earth Priest described his perception of the change in climate when he said that:*In the past, in the month of January you could find fresh grasses in the low lying areas and you could not walk there because the areas were still muddy.You also could find Wormdischarge ("Saberisis") and it tells you that when you put anything there you would have bumper harvest.All of these were because there was enough moisture in the soil. The worms feed on muddy soil and so because the rainfall was good. You could find them everywhere. However,for the past 20 years I have not seen those things ["saberisis"]. Now you cannot find fresh grasses in the low lying areas by the middle of December*.

With regards to perception of changes in temperature, farmers were of the view that temperature has increased which is manifested in the warm seasons just before the on-set of the rains. According to the farmers, in the past the duration of the warm seasonwas about one month [usually in March] before the on-set of the rains [usually in April] but in recent times the warm season could extend to about three months. The data indicate that across the four communities studied, a significant number of farmers believed average temperatures have increased. This finding corroborates the finding ofMaddison(2007) when he reported that generally famers in West and East Africa believed that there is change in the timing of rains, frequency of drought and increased in temperature.

Thechange in climate is caused by physical, social, cultural and spiritual factors. Some of the farmers indicated that climate change is as a result of the cutting down of trees [deforestation] which hitherto brought about rainfall and prevented the sun rays from direct contact with human and crops. According to the farmers, in the past, the presence of trees made rainfall predictable. However, all the trees have literally been cut down for fuel wood and charcoal burning for domestic and commercial consumption. This has led to the current situation of unpredictable and declining rainfall, severe drought and high temperature. This finding corroborates that ofJarawura (2014) as he reported thatthe perception of farmers about the causes of drought is deforestation which reduces the amount of moisture in the atmosphere that brings rain. Also, deforestation is said to expose the top soil to the sun which destroys its moisture holding capacity and makes it possible for drought to easily set in when the rains stop for some time. Also, farmers' explanations of the causes of climate change generally had a strong leaning on social, spiritual and religious connotations(Jarawura, 2014). Most farmers also attribute the current climatic conditions to incessant armed robbery, killing of innocent people, adultery and people having sex in the bush.According to the farmers, these illicit activities make the gods and ancestors of the land angry.Therefore, erratic rainfall, pronounced draught and high temperature are punishment from the gods and ancestors. Thisfinding is also corroborated by Golo andYaro (2013) when they reported that the Gods and deities may bring drought upon the people for several reasons, including immoral conduct. Finally, farmers attributed the current climatic conditions to the neglect of tradition and culture. Farmers reported that in the past when the rains stopped in the farming season, elders of the community would gather at the village square and offer sacrifices to the gods to appease them of any crime that might have been committed knowingly and unknowingly.The rain will usually fall on the same day the sacrifice is offered. However, in recent times, the tradition has been considered barbaric and neglected due to modernization and the influence of Christianity and Islam; hence the gods have decided to punish the community with the current climatic conditions. During a FGD with women in *Zanko* community, a 60year old woman narrated her experience as follows:*I remember in the past whenever we had challenges with rainfall, elders of the community would gather at the village square to offer sacrifices to the gods and ancestors in appeasement for rainfall. The women of the village would fetch ash and pour it on the most elderly person in the community while singing traditional songs and chants.As children, we joined in the singing of the traditional songs. It usually worked out because by the close of the day of the sacrifice, it would rain till we want no more. Now we have left all these practices claiming they are barbaric and unacceptable to God.Meanwhile, we are committing more crimes now than ever*.

Exposure of Household Assets

In the context of this paper, exposure refers to the extent to whichclimatic elements [rainfall, drought and temperature]directly affect household assets. Farmers in all the four study communities reported that erratic rainfall in recent years is detrimental to the cultivation of food crops and rearing of livestock. Farmers are of the opinion that basically their agriculture activities and livelihoods in general depend on rainfall and therefore the unpredictability and reduction in the amount of rainfall received, the increased prevalence of drought and increased temperaturein the last 30 years affected their agriculture production and productivity. This finding is in consonance with that of Molua (2002) when he contend that agricultural production in sub-Saharan Africa depends on climate variables such as temperature, precipitation and light. Farm households' ability to grow enough food to feed themselves and their animals is determined to a large extent by the weather(Molua, 2002).

Another important climate factor which farmer households' assets are exposed to is the hash drought conditions that characterized the climate of the study area in the last 30 years. According to the farmers, drought has always been an integral part of climate in the area but the intensity and duration has changed significantly

over the period.According to Müller *et al.,* (2011), inclimate dependent communities, households' assets such as land, livestock, crops and livelihoods in general are consistently exposed to drought.

According to the farmers, in the past, there were a lot of big trees in and around the communities under study and in that instance the sun rays could not directly hit humans and animals and therefore the temperature felt was not as severe as it is in recent times. The farmers explained that the absence of trees has exposed their farmlands, crops and livestock to the direct sun rays.

Box 1: General Perceptions of Farmers about Exposure

- *We are helpless. We are unable to do anything about the nature of the rainfall that has come to characterize our area. All that we do depend on the rainfall and when it does not fall as expected we are in trouble. Our lands are bad now, when you sow a crop it does not do well because of the rains and the infertility of the lands [50year old Earth Priest from LassiaTuolu community].*
- *In the past, it was not difficult to get termites to feed the chicken and fowls, you could just cut the top of their mould and the termites would be flowing like water and you could just remove the mould and take it home to feed the fowls. But now you may dig for about 30 cm deep into the ground and yet you would not get the termites. It has created a big challenge for us in rearing our fowls. The least said about cattle, sheep and goats the better.They [livestock] do not get the fresh grasses to feed on and thereby making them look lean. Some even die as a result of that. Our animals are suffering. We cannot boast of fowls in recent times because all the cattle, sheep and goats are gone [50year old farmer from Dornye community].*
- *Our farmlands are dead now; anything you plant on it fails to bear fruits for your labour. In the last two years, I have cultivated soybean, maize and millet but I do not get more than one bag of each on three arches of land. All my fowls are dead and I have nothing now to depend on. All we do here are directly exposed to the hash climatic conditions we experience in recent times [56 year old female farmer from Zanko community].*

Sensitivity of Household Assets

Sensitivity here refers to the reduction in crop yields and livestock as a results of erratic rainfall, increased temperature and intensive drought over the last 30 or more years(Antwi-Agyei*et al.*, 2012). Farmlands are an important asset and a source of livelihood for farm household in the study communities. The farmers contend that the ability of the land to support plant growth and other agricultural activities depends largely on the amount of rainfall received and distributed during the farming season. Without adequate and regular rainfall,farmlands cannot support food crop and livestock production.According to O'Brien *et al.* (2004), Morton (2007), Gitz and Meybeck (2012), climatic events affecting yields of main staple crops are particularly important for smallholders who tend to consume a large part of their own production.

The farmers explained that moisture creates conducive soil conditions that help to keep the soil cool andsupportactivities ofmicro-organismsthat support the growth and maturity of crops and fodder for livestock. However, the erratic nature of rainfall in contemporary times coupled with severe drought and increased temperature kills micro-organisms and drain the soil of major soil nutrients that could support cultivation of crops and fodder for livestock and any meaningful agriculture related activity. Farmers further explained that farmlands are sensitive to prolong absence of rainfall and its accompanying high temperature.It drains the soil of its moisture content and other nutrients which results in the withering of crops.This implies that farmers have to remove the dead crops and replant when the rains reset-in. Replanting is sometimes difficult for some farmers because they do not have the financial resources to purchase seeds to replant. Another challenge that is associated with drought is that when the rains re-set-in, its duration is not long enough to support maturity of crops. A 45year old male farmer paints the picture in *Zanko* community when he said among other thingsthat:*The land has become infertile because we donot get enough at the end of the farming season. In the past, we could cultivate a small piece of land and harvest enough that could feed the entire family throughout the year and we could afford to give out some of the farm produce to our relatives and friends and still had enough to feed ourselves. Today, we cultivate large Parcells of land and yet we harvest very little that cannot feed us for three months. That is how bad the lands have become due to the unpredictability and declining rainfall received over the years.*

Another household asset that is lost as a result of climate change is livestock. According to the farmers, the livestock depends on the rainfall for fresh fodder and water. Irregularity of rainfall, drought and increased temperature has affected the rearing of livestock. According to the farmers, when the rainfall is well distributed and the appropriate amount of moisture is received, farmers do not hustle to feed their livestock. The animals are able to find their own food and water. However, the irregularity of the rainfall have led to the absence of pasture for the livestock and the loss of worms that fowls feed on. Farmers indicated that they have lost a lot of

livestock during periods of poor rainfall.This means farmers have nothing to fall on to support the households in terms of purchasing food, pay medical bills, funeral expenses in the event of crop failure. It is a general consensus among farmers in the study communities that many farm households lost a lot of their animals in the last decade as a result of drought, high temperatures and irregular rainfall. A 57 year old male farmer in*Zanko* community described the situation as follows:*When the "weather" is good, you [farmers] donot have to look for food for animals, they could go and get their own food and get water to drink without any challenge. The sheep, goats, cattle and pigs can get grasses and other feed and water in nearby streams to drink.But now, it is difficult for the animals. Fowls feed on millipedes and other organisms. However, during periods of drought and irregular rainfall, they have to be fed by the farmer which in most cases is difficult for the farmers because their households themselves are unable to depend solely on their farm harvest for survival throughout the year. I lost a lot of fowls in the last two farming seasons and as I speak, I have only two goats which cannot help me and my family in the event of massive crop failure.*

Household Vulnerability

In the context of this paper, vulnerability is the extent of defenselessness of farm households or inability of farm households to respond to changes in climatic elements such as rainfall, drought and temperature as a result of lack of alternative sources of food and income. The research revealed that farm households are at the mercy of the weather for their source of livelihoods. According to the farmers, theirmainstay is agriculture and its related activities. Therefore, any disturbances in the farming activities affect their livelihoods and survival. This finding is consistent with the view that farm households in West Africa depend unswervingly on agriculture for their livelihoods and have inadequate resources and capability to cope with shocks. Therefore, any reduction to agriculture production will further expose them to the vagaries of changing climate (McDowell & Hess, 2012; Hertel&Rosch, 2010;Molua, 2002).According to the farmers, they depend hugely on the farmland inherited from their parents for the cultivation of crops and raring of animals for household consumption and sale of excess harvest to support household expenditure. The continues decline in soil fertility and associated poor harvest have tremendous effect on the life of farm households in the study communities as evidenced in the fact that farmers' livelihoods revolve around agriculture and its related activities. The farmers indicated that the poor nature of the farmlands is affecting households' food crops production negatively in recent times and that has led to untold hardship on them. Farmers reported that there is no irrigation infrastructure in the study communities and therefore agriculture is mainly rain-fed. Their over dependence on the erratic rainfalland shortened wet season have being a major challenge in recent times. This make farmers unable to depend on their farm produce for more than three months after harvesting. Male farmers have to resort to other non-existing non-farm activities in othertowns(e.g. the regional capital) for survival.A male farmer in*Zanko* community asserted that:"The *land is the farmer and the farmer is the land" and anything that happens to the land affects the farmer and the reverse is true. The land is the most valuable asset that we have in this community. Without land we are nothing and that is why we are suffering as a result of the deteriorating fertility of the land. The erratic rainfall, drought and high temperatures are killing the land for us and we are suffering*.

According to farmers, households are vulnerable to loss of livestock as a result of erratic rainfall, drought and increased temperatures. When everything else fails, they rely on their livestock for survival. They sell their animals to buy household food, foot medical bills of household members, pay funeral expenses and meet basic educational needs of the children. The loss of household livestock means farmers have to rely on the mercy of God for survival.During an FGD session in *Dornye*community, a female farmer vividly described the situation as follows:*It is the animals that are our last resort when there is nothing left for us after the failure of our crops. It is the animals you can easily convert into cash to deal with emergency situations such as paying medical bills of household members, school fees, funeral expenditure, household foodstuffand other household expenditure. When you lose livestock in the midst of crop failure, then you are finished. Three years ago, our crops did not do well and my husband also lost all his animals.It was really difficult for us to feed our children and we had to rely on friends and relatives for food*.

Households' Copping Strategies

In the midst of the vulnerability of farm households, several and varied copping strategies have been adopted to reduce vulnerability to the changing climate and its associated challenges. Copping strategies are short term measures employed by farm households and communities to withstand the occurrence of extreme climatic events (Campbell *et al*., 2011). The copping strategies adopted by the farm households include causal labour, charcoal making, petty trading, temporal migration, shea nut picking and butter extraction, and *pito* brewing.

Sale of causal labour is one of the copping strategies adopted by farm households to be able to earn income to meet food requirement and other household expenditure. Male and female alike engage in off-farm activities such as provision of causal labour at construction sites in the various communities, regional capital and its environs in order to earn income to support household food requirement and other expenditures. The engagement of men and women particularly in *Zanko* and *Dorimon* in causal labour is as a result of their proximity tothe regional capital (Wa) where a lot of development of physical infrastructure is taking place. Farmers in the other communities are also engaged by people undertaking construction activities around their communities.

Another copping strategy employed by members of farm households to weather the storm is the felling of trees for fuel wood and charcoal making. This activity is the commonest copping strategy in all the study communities. Almost all farm households cut down trees for fuelwood and charcoal for sale to the urban dwellers in order to earn income. Farmers admitted that the felling of trees adversely affects climatic conditions such as rainfall, drought and temperature and subsequently their entire livelihoods. Farmers however, stated that there is no alternative source of income to depend on for survival and hence farmers' continues engagement in the felling of the trees for fuel wood and charcoal for sale to support household expenditure and foodstuff requirement.The irony of this copping strategy however, is that economic trees such as the shea tree is the common victim of demand for fuel wood and charcoal to satisfy domestic and commercial energy needs. The indiscriminate felling of shea trees for example has led to their disappearance across the study communities and that has affected their ability to earn a living from the shea tree.

Also, some farmers indicated that women especially engage in petty trading to generate income for their households. They engage in the sale of household groceries in the community or other market centers in the Wa-West district to enable them earn income to support their household expenditure requirement. It was also reported that some men also engage in trading in livestock at various market centers in their quest to also support household expenditure. However, petty trading requires some amount of capital to start with and only a few farm households are able to engage in it.

Besides, in the midst of the poor rainfall received, intense drought and high temperatures couple with crop failure, young male farmers and girls have to temporary migrate to other communities within and outside the region to engage in illegal mining ["*galamsey*"], head porting ["*kayayie*"]and other menial jobs to earn income to support themselves and their families. It was reported that young persons between the ages 16-35 years usually leave in search of alternative source of livelihood. However, most of the girls return home with either children or pregnancies that they cannot identify the fathers of their children.

Again, some women in the study communities engaged in the brewing and sale of *pito* [a local beer] to supplement household income. During a FDGs session with women in *LassiaTuolu* community, they reported that some women usually buy Guinea corn on credit to start the*pito* brewing business; and as they sell, they pay back and keep the profit. Some women however, reported that the brewing business is unsustainable within their context because sometimes the working capital is eventually used to purchase foodstuff for household consumption.

Another copping strategy adopted by women to support their households is the picking of shea nuts andbutter extraction for sale in market centers within and outside the district to earn income. It was however, reported that in recent times it is difficult to obtain raw sheanuts due to the indiscriminate felling of shea trees for fuel wood and charcoal making.

It is evident from the above that farm households resort to off-farm activities to cope with the consequences of climate change such as poor farm yields, loss of livestock etc. as sources of their livelihoods. This finding collaborates that of Bawakyillenuo*et al.* (2014)who explored autonomous adaptation strategies to climate change andclimate variability in selected villagesin the rural northern savannah zone ofGhana. It was found thatthere is a shift from solely depending on agricultural related activities to non-farm jobs as a measure to cope with climate change. These include trading, processing of groundnuts, shea butter and rice for sale, carpentry, masonry, mechanics etc.Besides, Laube*et al.* (2012), Bawakyillenuo*et al.* (2014) reported seasonal migration as an adaptation strategy to the effect of climate change among farm households in Northern Ghana.

V. CONCLUSION AND POLICY RECOMMENDATIONS

It is evident from the discussions that farm households in the study communities are extremely vulnerable to climate change. The mainstay of thelocal economy is agriculture and its related activities. Household assets such as land, livestock are exposed and sensitive to extreme climatic events. The amount of rainfall received has declined, drought has become more pronounced and temperature has also increased; making farm households unable to predict climatic elements and thus unable to plan agricultural activities. Crop yields have reduced and livestock have been lost which constraint farmers' ability to produce enough for household consumption and for local market.

There were varying views on the causes of climate change. While some research participants attributed the phenomena to spiritual and social factors, others attributed it to physical factors.

Based on the findings of the study, the following recommendations are made for consideration:

1. The District Assembly in collaboration with Non-Governmental Organizations (NGOs) should train rural farm household especially, household heads and women on alternative sources of livelihood. Women should be trained on alternative livelihood activities such as soap making, batik tie and dye, extraction and packaging of shea butter for both local and international markets. The training should also be accompanied by financial support for the women to start their businesses. Without the support,the training alone will not make any meaningful impact because the rural women are already constrained by their inability to generate income for business start-ups. This strategy could assist rural farm households cope with extreme weather events and its associated consequences.
2. Farmers do not have reliable source of weather information. They rely on their local knowledge to plant crops. The local knowledge of farmers on the weather is no more trustworthy. Therefore, the Ghana Meteorological Service should collaborate with the local radiostations to broadcast weather forecast in the local languages targeted at rural farmers so that farmers could properly plan their farming activities during the rainy season.
3. In recent times, the amount of rainfall received in the study area is said to have reduced and therefore farmers have to plan farming activities to coincide with the little amount rainfall received. Besides, none of the study communities hasan irrigation infrastructure to enable farmers engage in dry season farming. Therefore, the District Assembly in collaboration with Ghana Irrigation Development Authority and NGOs in agriculture should take advantage of the proposed "one village, one dam" policy of the government to provide the communities with irrigation infrastructure. This would reduce their vulnerability and exposure to the occurrence of extreme climatic events; enhance the productivity of the farmers and improved farm households' income.

REFERENCES

[1]. Allen, K. (2003). Vulnerability reduction and the community-based approach. In:Pelling, M. (ed.).Natural Disasters and Development in a Globalising World, 170-184

[2]. Adger, W. N., Dessai, S., Goulden, M., Hulme, M., Lorenzoni, I., Nelson, D. R.&Wreford, A. (2009). Are there social limits to adaptation to climate change? Climatic Change, 93(3–4), 335–354. https://doi.org/10.1007/s10584-008-9520-z

[3]. Amikuzuno, J. &Harthie, I. (2013). Climate Change Impact on Smallholder Farmers in the White Volta Basin of the Upper East Region of Ghana. In 2013 AAAE Fourth International Conference, September 22-25, 2013, Hammamet, Tunisia. African Association of Agricultural Economists (AAAE). Retrieved from http://ageconsearch.umn.edu/bitstream/160478/2/Climate%20Change%20Impact%20on%20Smallholder%20Farmers%20in.pdf

[4]. Aandahi, G. & O'Brien, K. (2001). Vulnerability to climate changes and economic changes in India agriculture. Paper presented at the biannual Conference of the Nordic Association for South Asian Studies - Waters of hope: The role of water in South Asian development, Voss, Norway, 20-22 September 2001.

[5]. Antwi-Agyei, P., Fraser, E. D. G., Dougill, A. J., Stringer, L. C.& Simelton, E. (2012). Mapping the vulnerability of crop production to drought in Ghana using rainfall, yield and socioeconomic data. Applied Geography, 32(2), 324–334. https://doi.org/10.1016/j.apgeog.2011.06.010

[6]. Bawakyillenuo, S., Yaro, J. A.& Teye, J. (2014). Exploring the autonomous adaptation strategies to climate change and climate variability in selected villages in the rural northern savannah zone of Ghana. Local Environment: The International Journal of Justice and Sustainability, 21(3): 361-382. https://doi.org/10.1080/13549839.2014.965671

[7]. Brooks, N. (2003). Vulnerability, risk and adaptation: A conceptual framework, Tyndall Centre Working Paper 38

[8]. Brauch, H.G. (2002). Vulnerabilities due to environmental degradation: a human security perspective on disaster reduction. Symposium on Disaster Reduction and Global Environmental Change, Berlin, 20 June 2002.

[9]. Burton, I., Huq, S., Lim, B., Pilifosova, O. &Schipper, E.L. (2002). From impacts assessment to adaptation priorities: the shaping of adaptation policy. Climate Policy, 2(2): 145-159.

[10]. Campbell, D., Barker, D. &Mcgregor, D. (2011).Dealing with drought: Small farmers and environmental hazards in southern St. Elizabeth, Jamaica. Applied Geography, 31(1): 146-158.

[11]. Mack, N., Woodsong, C., Macqueen, K. M., Guest, G. &Namey, E. (2005). Qualitative Research Methods: A Data Collector's Field Guide. USA: Family Health International.

[12]. Golo, B. K. &Yaro, J. A. (2013). Reclaiming Stewardship in Ghana: Religion and Climate Change. Nature and Culture, 8 (3): 282-300.

[13]. Hertel, T.W. &Rosch, S.D. (2010). Climate Change, Agriculture and Poverty. Policy Working Paper 5468.Washington DC: World Bank

[14]. IPCC (2001). Third Assessment Report (TAR). Geneva: IPCC.

[15]. IPCC (2007).Climate Change 2007: Synthesis Report. Geneva: IPCC.

[16]. IPCC (2013).Climate Change 2013: The Physical Science Basis, Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.Cambridge: Cambridge University Press.

[17]. IPCC (2014). Climate change 2014: synthesis report. Contribution of Working Groups I, II, and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R. K. &Meyer, L. A. (eds.)]. IPCC, Geneva, Switzerland, pp.151.

[18]. Jarawura, F. X. (2014). Perceptions of drought among rural farmers in the Savelugu district in the northern Savannah of Ghana. Ghana Journal of Geography, 6(1), 102–120.

[19]. Laube, W., Schraven, B.&Awo, M. (2012). Smallholder Adaptation to Climate Change: Dynamics and Limits in Northern Ghana. Climate Change111(3-4):753–774. DOI: 10.1007/s10584-011-0199-1
[20]. McDowell, J.Z.& Hess, J.J. (2012). Accessing Adaptation: Multiple Stressors on Livelihoods in the Bolivian Highlands under a changing climate. Glob. Environ. Change, 22 342-352
[21]. Maddison, D. J. (2007). The perception of and adaptation to climate change in Africa. World Bank Policy Research Working Paper, (4308). Retrieved from http://papers.ssrn.com/sol3/Papers.cfm?abstract_id=1005547
[22]. Molua, E. L. (2002). Climate variability, vulnerability and effectiveness of farm-level adaptation options: the challenges and implications for food security in Southwestern Cameroon. Environment and Development Economics, 7(3). https://doi.org/10.1017/S1355770X02000311
[23]. Müller, C., Cramer, W., Hare, W. L., & Lotze-Campen, H. (2011). Climate change risks for African agriculture. Proceedings of the National Academy of Sciences, 108(11), 4313–4315.
[24]. Wilbanks, T., Lankao, P.R., Bao, M., Berkhout, F. & Cairncross, S. (2007). Industry, settlement and society. In: Parry, M. (ed.). Climate change 2007: Impacts, adaptation and vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 357-390). New York & Cambridge: Cambridge University Press
[25]. Yaro, J. A.& Hesselberg, J. (eds.) (2016). Adaptation to Climate Change and Variability in Rural West Africa. Cham: Springer International Publishing. Retrieved from http://link.springer.com/10.1007/978-3-319-31499-0
[26]. Yohe, G. &Tol, R.S.J. (2002). Indicators for social and economic coping capacity: moving toward a working definition of adaptive capacity. Global Environmental Change, 12(1): 25-40.
[27]. Younus, M. A. F. (2014). Vulnerability and Adaptation to Climate Change in Bangladesh. Dordrecht: Springer Netherlands. Retrieved from http://link.springer.com/10.1007/978-94-007-5494-2