Migration as an adaptation strategy to climate change: Evidence from Buoku and Bofie-Banda in the Wenchi and Tain Districts of Ghana.

Abstract

Recent concerns about consequences of climate change on human population have fueled the interest in the population mobility and climate-related environmental nexus. This paper examines the extent to which migration has been used as a livelihood strategy in response to climatic changes in the forest-savannah transitional zone of Ghana. Using a mix method approach with data from the CCLONG project and Ghana Meteorological Service Department, the paper employed a multiple classification analysis to examine how migration has been used as a livelihood strategy in response to climate-related events. The results indicate that flood and drought are more likely to trigger migration among people in communities that have savannah characteristics, when other socio-demographic and economic factors are controlled; a similar experience is less likely in communities that have forest characteristics. The paper concludes that climate-related environmental events alone may not trigger migration if it is not linked to other socio-economic issues.

Key words: Climate change, Climate-Related Environmental Event, Migration, Forest-savannah Transitional Zone, Buoku, Bofie-Banda.

Introduction

Population mobility is probably the demographic process that has received the most attention within the field of population-environment studies in recent times (Adamo, 2008). Increasing concerns about consequences of climate variability for human population have further fueled the interest in the subject. The interest has not, however, resolved the debate on exactly what constitutes climate-induced movement, how to explain it, or what the magnitude is.

The impact of climate change on the world has no limits or boundaries. Industrialised countries have better adaptive capacity to climate conditions than developing countries. The United Nations (UN) Conference on Climate Change held in Accra, Ghana from the 21st to 27th August, 2008 focused on adaptive mechanisms to climate variability within the sub-region. Most sub-Saharan African countries are finding it difficult to cope with the existing climate stress and future climate change and variability. The inability of people to cope with environmental stress as a result of climate change could contribute directly to migration by pushing people out of vulnerable environments.

Environmental events such as floods and droughts can serve as an immediate push whilst long-term changes such as desertification can lead to a decline in living standards that increases the cost of staying versus leaving (Adamo, 2003). The frequency of environmental stress however, has compelled people to adapt to the situation by employing all kinds of adaptation measures. As Flannery (2005) puts it, "non-adaptation to climate change is equivalent to genocide and that if we pursue business as usual for the next 50 years the collapse of civilisation due to climate change is inevitable". Today, environmental change, including climate change presents a new threat to human security and a new situation for migration (Adger, 2001). Estimates of number of people who will be displaced due to adverse effect of climate change vary widely. Brown (2008) labels such estimates as little more than ""well-educated guesswork". Despite recent interest in this area, scientist have still not explored and analysed the data that are available. It is therefore, interesting to note that Myers 'prediction of 200 million environmental refugees by 2050 based on data he first used in 1995 publication is often cited by some researchers. The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) described the estimates of numbers of environmental migrants as at best, guesswork, because of a host of intervening factors that influence both climate change impacts, and migration pattern (IPCC, 2007), suggesting the need for extreme caution in the use of such statistics.

There are three basic responses to climate variability. They are: either people will adapt to the climate conditions or migrate to different environments or die. These responses have some consequences but usually migration appears to be the main option in Africa because of limited adaptation strategies to climate change (Henry et. al., 2005). It is, however, generally difficult to tell people's reaction with regard to the type of migration that would be undertaken as a result of climate change. A study by Munshi (2003) in Southwest Mexico found a correlation between declining rainfall and rising migration to the United States, since many rural communities

depend on rain-fed agriculture. However, findings from studies in Burkina Faso (Schoumaker and Beauchemin, 2005) and Mali, (Findley, 1994) revealed that droughts in the 1970s and 1980s were associated with decreases in international, long-distance migration. Short-distance migration to larger agglomerations, however, increased during drought years.

The two study communities are located in the Wenchi and Tain Districts of Ghana respectively in the forest-savanna transitionalal zone. The forest-savanna transitionalal zone of Ghana has been a focus of policy attention with regard to environmental issues. It is characterised by distinct rainfall regimes and as a result support specific crops. The Wenchi District which is located in the southern part of the zone largely comprises dry semi-deciduous forest, while the Tain District which is located in the northern part consists of a mosaic of gallery forests and forest patches in more-or-less wooded savanna grassland. The major occupation of the population in the study communities is farming which is sensitive to climate stress.

Climate-related environmental events will increase rural-urban migration and leave most rural areas with the aged and children who do not have the capacity to go into large scale agriculture, the resultant effect being shortages and high cost of food. Even though, arguments in Tschakert et al (2010) suggest that migration as a result of the impact of climate change may not be that phenomenal, it is important to examine the consequences of migration due to climate change and whether rural population will consider migration as an adaptation option as a result of climate-related environmental event.

Apart from few studies done by some researchers such as Van de Guest in 2004 and 2008 on North-South migration in Ghana and the role of the environment, there are no empirical studies that assessed the relationship between climate-related environmental events and migration in Ghana. The study therefore examined how migration features in the adaptation strategies at the household level in order to contribute to presenting better adaptation options for communities. It is hoped that if better adaptation strategies to environmental events in rural communities are encouraged, it will help improve the economic livelihood of rural dwellers and eventually reduce rural-urban migration and poverty.

Against this background, this paper seeks to answer the following questions: first, what is the trend in climate variables (rainfall and temperature) in Buoku and Bofie-Banda communities in the Wenchi District; second, what type of environmental events may trigger migration; and third, what is the contribution of climate change to migration in the study communities.

Data and Methods

Data for the study are drawn from both primary and secondary sources. The primary data are collected by members of the Climate Change Collective Learning and Observatory Network Ghana (CCLONG) project and a household survey in the two communities. Secondary sources of data are drawn from the Ghana Meteorological Services Department. The CCLONG Project

collected a range of both qualitative and quantitative data from twelve (12) households in each of the study communities. Selection of households for the study was done by taking into consideration different socio-economic backgrounds of the people in the study communities, including migrants and non-migrants, women and men and old and young people. The aim was to gain a holistic understanding of people's livelihood and how they react to climatic events. They were asked how they perceive their natural environment, how it affects their lives and what they did to maintain themselves during past environmental events like droughts and floods. Also, information on household members and major occupation of households were collected.

The household survey involved questionnaire administration to migrant and non-migrant farmers in the two study communities. In all, 100 questionnaires were administered in 100 households in each of the two study communities. The sample size of 100 households per community was chosen because it represented more than half of the households in the communities. Also, the households in the study communities are homogenous in character with about 98 percent of them being farmers. The sampling of the households was done randomly using a household listing that was done by students of the University for Development Studies in 2008 in the study communities. The main issues in the questionnaire are the background of the respondent, household information, migration patterns and environmental challenges in the communities. The questionnaire was administered to heads of household. There were also participant observations in the communities to find out what people discuss and this involved living with families for about 4 weeks. Analysis of very wet periods, normal periods and dry periods which are used as indicators for examining the climate was done by examining the rainfall and temperature data of the Meteorological Services Department over a period of 45 years.

A mental model technique was used to assess how the people in the communities understand climate change in their own local sense, the causes of climate change and its effects. The technique involves meeting with community members in groups and allowing them to discuss among themselves as to what they understand by climate change, its causes and consequences. Participants are allowed to look at both the positive and negative impact of climate change on people and the environment. Because most of the participants were illiterates, they were allowed to express their views on a piece of paper in the form of a drawing that is understandable to all other participants. This encouraged all the participants to contribute effectively to the discussion.

To examine the influence of climate-related environmental events on the intention to migrate, a Hierarchical Analysis of Variance (ANOVA) and Multiple Classification Analysis (MCA) were employed. The Multiple Classification Analysis is a technique for examining the interrelationship between several predictor variables and one dependent variable in the context of an additive model.

Migration is influenced by socio-demographic and economic factors such as age, level of education, marital status, sex, size of household and income. Climate related environmental events of interest in the study are floods, droughts or experience of both events. It is also important to note that the intention to migrate is also determined considerably by the household perception of future climate related environmental events in the community and the migration status of the household, i.e., whether the household is a migrant household or a non-migrant household. In order to measure the impact of climate change on the intention to migrate, other variables that influence the decision to migrate were considered in the model. The level of significance for interpreting the results is $p<0.05$.

Results and Discussions

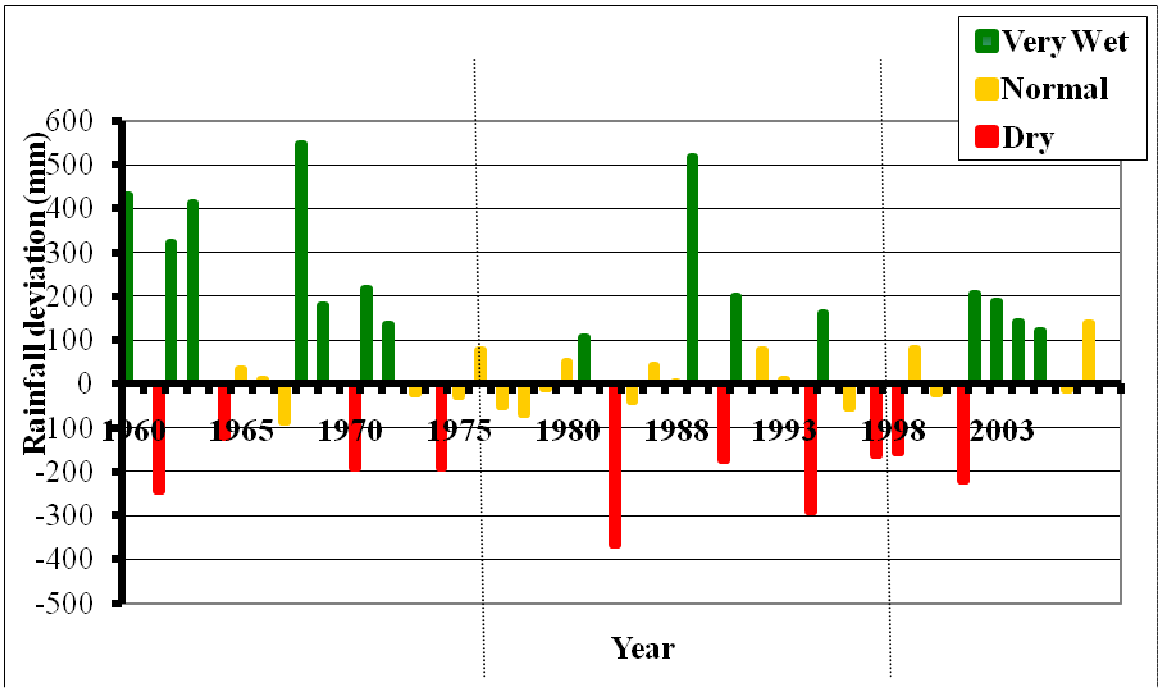
The Wenchi District is one of the largest maize producing districts in Ghana whiles the Tain district is well noted for the cultivation of Yam. Ecologically, the Wenchi district largely comprises dry semi-deciduous forest, while the Tain district consists of a mosaic of gallery forests and forest patches in more-or-less wooded savanna grassland. An interview with the Assembly Member for Bofie-Banda community in July 2009 revealed that most of the farmers in the community have stopped cultivating maize because of the irregular rainfall pattern in the area during the past decade. Also, an interview with the chief of Buoku in July 2009 revealed that the community had been experiencing shorter periods of rainfall and the temperature in the community has been increasing over the past decade. This has affected the economic status of the people since revenue earned from the cultivation of maize had reduced drastically as a result of changes in rainfall pattern. Household income was also seriously affected and this has had a negative impact on the education of children and health status of households.

Temperatures are relatively high with monthly mean of about 30^{o}C in both districts. Rainfall starts in April and ends in November with a short dry spell in August. The rainy season is followed by a long dry season from November to April.

Modeling of Rainfall Pattern for the forest savanna transitional zone - 1960 to 2004

The forest savanna transitional zone is one of the food production baskets of Ghana. Agriculture in the forest-savanna transitional zone relies solely on rainfall and it is the main source of livelihood for the people in the transitional zone. Modeling of rainfall pattern in the forest savanna transitional zone for a period of 47 years indicates that the pattern of rainfall in the transitional zone has been changing over the years. Figure 1 shows that when the graph is divided into three parts, the events experienced in each of the parts vary from one period to the other. There were more very wet periods in the first 15 year period compared to the other two later periods. The figure also indicates that whilst the highest very wet year was experienced in the first period - 1969, the driest year was experienced in the second period – 1983. The figure further shows that whilst there were very wet years following one another in the first period, there was nothing of that in the second period. There were, however, several normal rainfalls in the second period. The third period shown in the graph experienced more dry periods during the 47 year period and there was a continuous dry period in 1998 and 1999. It also indicates that the period experienced continuous wet years from 2002 to 2005.

Figure 2.9: Pattern of rainfall variation in the forest savanna transitional zone – 1960-2007



Source: Computed from rainfall data from GMSD for the savanna transitional zone

The implication is that over the last 15 years, there has been an experience of more dry years as well as very wet periods and this makes it very difficult for farmers to plan. It is also revealing from Figure 1 that even though there were continuous dry periods in 1998 and 1999, the event that was easily recollected by most of the people in the communities was the 1983 drought. The last period presented in Figure 1 also indicates a drastic decline in the intensity of the wet years compared to the first and second periods. However, the same thing cannot be said of the dry years. The graph indicates that there have been very significant dry years in the last period. Apart from 1983, 1995 was the second driest year in the 47-year period. Generally, the trend of annual rainfall in the last period is an indication that yearly prediction of rainfall pattern is becoming more difficult. The last seven years in the graph assumed a different trend all together where very wet years are experienced more often. This is usually not good for farmers because farming activities rather do well under normal rainfall conditions. Further, very wet periods could result in floods and this will have serious implications for the well-being of the people.

Analysis of the temperature data collected from the meteorological services presents an overall increase in temperature from 1960 to 2004. The highest temperature within the 1960-2004 period was recorded in the last decade as 32.3^{o}C in 1998.

The Impact of Climate Change on Migration

Table 1 presents the results of the hierarchical analysis of variance of the intention to migrate by household members in Bouku, with household perception of current coping strategies in the future and migration status as covariates and the other variables as explanatory variables. The hierarchical analysis of variance show which of the independent variables are significant predictors in explaining the differences in the dependent variable. It indicates that the age of the

household head explains a significant variation in the intention of a household member to migrate. It seems that climate related environmental events are also an important predictor explaining differences in the intention to migrate by a household member. The analysis reveals that household size and sex of head of household are significant predictors of intention to migrate at the household level whilst income of household, level of education of the head of household and his/her marital status are not important predictors in explaining the variations in the intention to migrate at the household level.

Table 1: Analysis of variance of the effects of climate-related environmental events and other explanatory variables on the inclination to migrate, Bouku

	Hierarchical Method				
Source of Variation	**Sum of Squares**	**DF**	**Mean Square**	**F**	**Significance of F**
Main Effects					
(Combined)	8.475	12	0.706	3.754	0.000
climate related environmental events	1.847	2	0.923	4.909	0.010
age of household head	2.963	2	1.482	7.876	0.001
size of household	1.216	2	0.608	3.232	0.044
income of household	0.590	1	0.590	3.139	0.080
level of education head of household	0.105	1	0.105	0.557	0.457
sex of household head	0.775	1	0.775	4.120	0.045
marital status of head of household	0.067	1	0.067	0.354	0.554
Covariates					
perception of current coping strategy in the future	0.527	1	0.527	2.799	0.098
migration status	0.385	1	0.385	2.048	0.156
Model	8.475	12	0.706	3.754	0.000
Residual	16.365	87	0.188		
Total	24.840	99	0.251		

Source: Computed from CCLONG, 2009

The MCA results for Buoku community in Table 2 indicates that about 30 percent of the variation in the intention to migrate is explained by the additive effects of climate related environmental events, income of household, age of head of household, level of education, marital status, sex of head of household and the size of the household. However, 34 percent of the variation in the intention to migrate is explained by the additive effect of all factors and covariates. It further shows that the effect of climate related environmental events on the intention to migrate is reflected by the fact that households that have been exposed to only flood or drought have a negative mean deviation of -0.017 and -0.035 respectively after controlling for the effects of income, age of household head, level of education of household head, marital

status of household head, sex of household head, size of household and the covariates (perception of current coping strategy in the future and migration status).

Table 2: Relationship between climate related environmental events and other explanatory variables and the inclination to migrate, Buoku

	Deviation from the Grand Mean		
Variable + Category	**Unadjusted**	**Adjusted for independents**	**Adjusted for independents and covariates**
Climate related environmental events:			
Flood	-0.222	-0.117	-0.017
Drought	-0.064	-0.019	-0.035
Flood and Drought	0.109	0.052	0.019
(Eta and beta)	-0.273	-0.137	-0.046
Income:			
< 2,000	-0.217	-0.094	-0.053
2,000+	0.098	0.042	0.024
(Eta and beta)	-0.292	-0.127	-0.071
Age of head of household:			
20-34	-0.214	-0.147	-0.15
35-49	0.229	0.145	0.18
50+	0.06	0.075	-0.006
(Eta and beta)	-0.412	-0.277	-0.304
Level of education of head of household:			
Primary/lower	0.011	-0.031	0.007
JHS/Higher	-0.011	0.029	-0.006
(Eta and beta)	-0.022	-0.06	-0.013
Marital status of head of household:			
Married/cohabiting	0.155	0.043	0.034
Not in union	-0.223	-0.062	-0.049
(Eta and beta)	-0.373	-0.104	-0.175
Sex of household head:			
Male	0.06	0.055	0.064
Female	-0.111	-0.102	-0.119
(Eta and beta)	-0.164	-0.15	-0.175
Size of household:			

< 3	-0.299	-0.114	-0.149
3 - 5	0.094	0.103	0.111
6+	0.16	-0.031	-0.008
(Eta and beta)	-0.387	-0.184	-0.215
Multiple R	_	0.547	0.584
R^2	_	0.299	0.341

Source: Computed from CCONG, 2009

On the other hand, households that have been exposed to both floods and droughts have a positive deviation (+0.019) after controlling for other explanatory variables and covariates. As the results indicate, households that have been exposed to both floods and droughts are those who may have the intention to migrate among people who live in an environment that is typical of forest vegetation. Thus, in such an environment, exposure to only floods or droughts will not trigger people to migrate because there will always be some other alternative ways of adjusting to the situation.

It is also observed from Table 2 that the betas decreased from 0.273 to 0.137 after controlling for other explanatory variables and further to 0.048 after controlling for other explanatory variables and covariates. A focus group discussion with elders in the community to discuss slow changes in the climate on July 4th, 2009, indicates that members in the community are able to deal easily with just one climate related environmental event like either flood or drought. It was realised that climate related environmental events become difficult to address when communities are not able to predict its occurrence. A 57-year old maize farmer in the community noted:

> "We experience at least one climate-related environmental event in this community after every five years some four decades ago. What happened was that when we experience flood in a particular year, then we expect to experience drought in the next five years after that. This trend of events made it possible for us to plan the type of crops to cultivate. The situation has been different over the past decade where floods and droughts occurred in this community unexpectedly. This is really making farming a very difficult business".

The results also show a very interesting relation between income and the intention to migrate and again between age of the head of the household and the intention to migrate. Households with annual income of less than GH¢2,000 had a negative mean deviation (-0.053) while households with annual income of GH¢2,000 and above had a positive mean deviation (+0.024). This implies that migration is not just embarked upon by those who are poor but those who have the means to support themselves for the first few weeks at place of destination. Even though most of those in the lower income bracket will be willing to migrate, they cannot do so easily because they need some money to take care of themselves for the first few days at place of destination before probably getting a job. Households with heads aged 20-34 have a negative mean deviation (-0.150) whilst households with heads who are 35-49 years old have a positive mean deviation (+0.180) after controlling for other explanatory variables and covariates. Most of those in the age category 20-34 are single households and as a result may not feel the difficulty of the economic challenges that may have come about as a result of climate related environmental events in the

community because they have fewer or no family members to cater for. Those in the age group 35-49 years old are either married or ever been in a union and so will be faced with the responsibility of large household sizes. In such situations, the temptation may be that, the household head will encourage members to migrate to other places first; to reduce the number of mouths to feed in the household and also to work and send some remittances to the family back home.

Other significant explanatory variables such as sex of the head of the household and the size of the household also have varying effects on the intention to migrate. In terms of sex, males have a positive mean deviation (+0.064) whilst females have a negative mean deviation (-0.119). A focus group discussion with elders in the community indicated that the community encourages male migration more than that of females. An elderly woman noted:

> "Women are very fragile and they cannot just sleep at any place when they move out of this community without actually knowing who they are going to live with. Men are able to do hard work like construction works when they get to the city and they are able to support families here".

Results on size of household indicate that households with a size of less than three have a negative mean deviation (-0.149); households with a size of 3-5 have a positive mean deviation (+0.111) compared to households with a household size of six and above which has a negative mean deviation (-0.008). Thus, households with a size of less than three will not be encouraged to migrate because the economic burden of having to cater for the family may be less than household with more than three members. Households with large sizes might not migrate because it will be difficult to move all members. However, households with a size of 3-5 members may migrate because such numbers are manageable than larger ones.

Table 3 presents the results of the hierarchical analysis of variance of the intention to migrate by household members in Bofie-Banda, with household perception of current coping strategy in the future and migration status as covariates and the other variables as explanatory variables. Similar to what pertained in Buoku, the results from Table 3 indicate that the age of the head of the household explains a statistically significant variation in the intention to migrate by a household member. Also, climate related environmental event is a significant predictor explaining the differences in the intention to migrate by a household member.

Table 3 further indicates that the level of education of the head of the household, income, size of the household, sex of the head of household, intention and marital status of the head of the household were not significant predictors on the intention to migrate at the household level. Further, whilst household size, the sex of head of household and income of the household are significant predictors of the intention to migrate in Buoku community, they were not significant predictors of the intention to migrate at the household level in Bofie-Banda.

Table 3: Analysis of variance of the effects of climate related environmental events and other explanatory variables on the inclination to migrate, Bofie-Banda

	Hierarchical Method				
Source of Variation	**Sum of Squares**	**DF**	**Mean Square**	**F**	**Significance of F**
Main Effects					
(Combined)	9.364	12	0.780	4.639	0.000
climate related environmental event	2.159	2	1.080	6.417	0.003
age of household head	4.458	2	2.229	13.250	0.000
size of household	0.324	2	0.162	0.964	0.385
income of household	0.166	1	0.166	0.985	0.324
level of education head of household	0.634	1	0.634	3.771	0.055
sex of household head	0.423	1	0.423	2.517	0.116
marital status of head of household	0.058	1	0.058	0.346	0.558
Covariates					
perception of current coping strategy in the future	0.074	1	0.074	0.438	0.510
migration status	1.067	1	1.067	6.345	0.014
Model	9.364	12	0.780	4.639	0.000
Residual	14.636	87	0.168		
Total	24.000	99	0.242		

Source: CCLONG Survey data, 2009

The proportion of the variation in the intention to migrate explained by the additive effects of climate related environmental events, income of household, age of head of household, level of education, marital status and sex of head of household, and size of household is 0.343. However, climate related environmental events together with the other explanatory variables explain 39 percent of the variance in the intention to migrate from Bofie-Banda as shown in Table 4.

Table 4 further indicates that households in Bofie-Banda that have experienced flood have a positive mean deviation (+0.017) just as households that experienced drought (+0.071) after controlling for the effects of income, age of household head, level of education, marital status of household head and sex of household head, size of household and the covariates (perception of current coping strategy in the future and migration status). This is contrary to what pertained in Buoku where exposure to only flood or drought recorded a negative mean deviation. Generally, the weather conditions in the savanna zone are at the extreme and so exposure to any climate-related environmental event is more likely to trigger households to have the intention to migrate. On the other hand, households exposed to both floods and droughts have negative mean deviation (-0.069) after controlling for other explanatory variables and covariates. This is true because the ability to live within one extreme environmental event in the savanna zone strengthens households to deal with subsequent issues that may come up and so will not consider migration as an immediate solution. This scenario is also contrary to what pertained in Buoku where exposure to both flood and drought is more likely to trigger households to have the intention to migrate. The two communities fall into different ecological zones and so respond to

climate-related environmental events differently. While climate-related environmental events are common phenomena in the savanna zone, it is not the same in the forest zone. As a result, any household that is able to stand the pressure of one climate-related environmental event in the savanna zone may be in a better position to address other future climate related-environmental events and so may not migrate.

Table 4: Relationship between climate related environmental events and other explanatory variables and the inclination to migrate, Bofie-Banda

	Deviation from the Grand Mean		
Variable + Category	**Unadjusted**	**Adjusted for independents**	**Adjusted for independents and covariates**
Climate related environmental events:			
Flood	0.096	0.065	0.017
Drought	-0.2	-0.059	0.071
Flood and Drought	0.114	0.013	-0.069
(Eta and beta)	-0.3	-0.097	-0.126
Income:			
< 2,000	0.046	0.051	0.038
2,000+	-0.086	-0.094	-0.071
(Eta and beta)	-0.128	-0.141	-0.107
Age of head of household:			
20-34	-0.358	-0.331	-0.308
35-49	0.167	0.17	0.147
50+	0.184	0.157	0.155
(Eta and beta)	-0.512	-0.474	-0.441
Level of education of head of household:			
Primary/lower	0.02	-0.053	-0.043
JHS/Higher	-0.1	0.188	0.045
(Eta and beta)	-0.108	-0.203	-0.167
Marital status of head of household:			
Married/cohabiting	0.095	0.024	-0.043
Not in union	-0.137	-0.035	0.154
(Eta and beta)	-0.232	-0.06	-0.167
Sex of household head:			
Male	-0.108	-0.062	-0.056
Female	0.169	0.097	0.087

(Eta and beta)	-0.276	-0.159	-0.143
Size of household:			
< 3	-0.29	-0.042	-0.042
3 - 5	0.114	0.06	0.065
6+	0.121	-0.011	-0.014
(Eta and beta)	-0.378	-0.081	-0.086
Multiple R	_	0.585	0.625
R^2	_	0.343	0.39

Source: CCLONG Survey data, 2009

Age of household head also plays a very important role in the decision to migrate by a household member. Table 4 indicates that household heads of age 20-34 have negative mean deviation (-0.308) after controlling for other explanatory variables and covariates. Household heads aged 35-49 years have positive mean deviation (+0.147) just as household heads aged 50 years and above (+0.155).

Further, Table 4 shows that level of education of head of household has a positive effect on the intention to migrate. Household heads with primary or lower education have negative mean deviation (-0.043) whilst their counterparts with Junior High School or higher education have positive mean deviation (+0.154) when exposed to either flood or drought or both. This is so because education gives people the skill to explore other environments for alternative job opportunities whilst households with lower education will have to rely on the only available opportunity within their environment. A focus group discussion among the youth in the community revealed that migration among young girls who have just completed Junior High School is on the increase in the community because of a perception in the community that educated female migrants easily get jobs when they get to the city.

Conclusion and policy recommendation

The study examined climate related vulnerability and how this triggers the intention to migrate in the forest-savanna transitional zone with specific reference to Buoku and Bofie-Banda communities in the Wenchi and Tain Districts in the Brong Ahafo Region of Ghana. The forest-savanna transitional zone is experiencing drastic changes in the area of rainfall, temperature and vegetation. The bi-modal pattern of rainfall that used to exist in the entire forest-savanna transitional zone is gradually giving way to a uni-modal pattern of rainfall especially in communities that are located close to the savanna belt of the Wenchi and Tain Districts. Analysis of the trend of rainfall in Buoku and Bofie-Banda showed that there has not been any significant change in the amount of annual rainfall in the two communities from 1960 to 2004. It was, however, evident in the data that there was a significant reduction in the number of rain days from 1960 to 2004. Rainfalls are more erratic in the two communities in recent times and this is reflected in the frequent experience of very wet years in the last 15 years in the forest-savanna transitional zone.

Climate change is a development issue that needs the attention of all stakeholders. The impact of climate change will exacerbate the already challenging economic, social and health issues confronting the people in the forest-savanna transitional zone and make it difficult for government to achieve the Millennium Development Goal (MDG) target of reducing poverty by half by the year 2015. According to the Ghana Environmental Protection Agency (EPA) report on Climate Change Impacts, Vulnerability and Adaptation Assessment in 2008, cocoa production will be seriously affected by the impact of climate change and the ramification of this on the social and economic life of individuals, communities and Ghana as a whole will be very significant.

The projection of future scenarios of rainfall in the forest-savanna transitional zone indicates that the current rainfall will increase substantially by about 14 percent (CCLONG, 2009). This has its own advantages and disadvantages depending on how the population of an area is able to prepare itself for such events. Bofie-Banda is already experiencing out-migration of young females and the experience of flood in the community has a positive deviation (0.017) on the people in the community to migrate. Future increase in rainfall will therefore, increase the flow of migration from the Bofie-Banda community into other communities and urban settlements. The future composition of most households in the community will be the aged and children and this will have serious implications on the economic activities of the household. Migration is, however, a survival strategy and the contribution of migrants to the development of their communities have been very significant. Families benefit from the remittances migrants send home and communities benefit from the small and medium-scale enterprises that some migrants set up in their communities. The future movement of people from Bofie-Banda as a result of increased rainfall in the community could equally be beneficial to the community when migrants begin to send remittances home.

There is the need to educate farmers on issues of climate change and how it manifests itself within any geographical location. In many instances, farmers are confused with regard to distinguishing between weather, climate and climate change. Educating farmers on the causes of climate change will enable them to adopt more friendly environmental ways of cultivating their crops thereby, contributing in their own small ways to reducing green house gasses in the atmosphere. Information on climate change is also paramount to farmers and there is the need to ensure proper collaboration between the Meteorological Services Department and agricultural extension officers to ensure that seasonal weather forecasts are made available and also explained to farmers to enable them to plan the timing of their farming activities.

In addition, there is the need for agricultural extension officers in the study communities to educate farmers in the area to begin to cultivate water loving crops such as rice because projections of future rainfall in the area indicate higher rainfall pattern which will not be conducive for crops that do not need much water. It is also important to educate farmers to cultivate their crops on uplands and create water ways within their farms to ensure easy passage of water.

Further, government needs to commit funds to support the construction of drainage systems in the study communities to ensure easy passage of water and also protect the buildings in the

communities from collapsing as a result of heavy rainfall events in the future. In addition, efforts should be made at helping people in rural communities to embrace small-scale mechanised agriculture since the current method of farming will not be sustainable in the future where the impact of climate change will be most felt.

It is also important to embrace climate change as a development issue and all sectors should be brought on board in addressing it. The population issues in climate change such as its impact on migration, the aged, women and children should be given priority by government. It will be prudent to integrate climate change issues into all aspects of the development process and this could be made possible if all sectors of the economy are brought on board.

Adaptation to climate change is a major concern that the government has to consider in addressing the issue of climate change in rural agricultural communities in Ghana. Being a developing country, there is usually a major challenge with regard to adaptive capacity mostly as a result of low level of development, inadequate resources, and inadequate scientific and technical capacity. However, adaptation in the form of better education, training and awareness of climate change and more technical measures like promotion of water loving crops, diversification of livelihood options and community-based natural resource management to prevent over-exploitation of marginal lands and replanting depleted forests could be done with support from industrialised countries.

Finally, there is the need to incorporate climate-related environmental events into census questionnaire and other national representative surveys like the Ghana Living Standards Survey and also improve on migration data collection. This will make it possible to use census data to undertake comprehensive studies with respect to the impact of climate related environmental events on migration within any geographical region in the country. This is very important for national planning as it would help improve on the mechanisms for effective allocation of resources to regions that are mostly affected by climate related environmental events thereby, providing alternative economic opportunities to affected populations instead of consigning them to migration as the only available option that is open to them.

References

Adamo, S. 2008. Addressing Environmentally Induced Population Displacement**:** A Delicate Task. Background Paper for the Population-Environment Research Network Cyberseminar on "Environmentally Induced Population Displacements" 18-29 August 2008. www.populationenvironmentresearch.org

Adamo, S. 2003. "Vulnerable people in fragile lands: migration and desertification in the drylands of Argentina. The case of the Department of Jáchal." PhD Dissertation. Austin: University of Texas.

Adger, W. N.; Kelly, P. M.; Nguyen, H. N. 2001: Environment, society and precipitous change. In: Adger, W. N.; Kelly, P. M.; Nguyen, H. N. (Eds): Living with Environmental Change: Social Vulnerability, adaptation and resilience in Vietnam. Routledge, London.

Anarfi, J., Kwankye, S., Ababio, O.M., and Tiemoko, R., 2003, *Migration From and To Ghana: A Background Paper*, Working Paper C4, Development Research Center on Migration, Globalisation, and Poverty, University of Sussex.

Asiamah, R.D., Adjei-Gyapong., T., Yeboah, E., Fening, J.O., Ampontuah E.O., and Gaisie, E., 2000. Report on Soil Characterization and Evaluation at four Primary Cassava Multiplication Sites (Mampong, Wenchi, Asuansi and Kpeve) in Ghana. Technical Report No. 200, Soil Research Institute, Kumasi, 91pp.

Brown, O (2008). "The numbers game", *Forced Migration Review vol 31,* pages 8-9.

Findley, S.E. 1994. 'Does Drought Increase Migration? A Study of Migration from Rural Mali during the 1983-1985 Drought'. In: International Migration Review 25 (3): 539-553.

Ghana Statistical Service 2000. Ghana Living Standards Survey 4 (1998) Ghana Statistical Service, Accra.

Ghana Statistical Service. 2002. 2000 Population and Housing Census, summary report of final results. Accra, Ghana: Ghana Statistical Service.

Ghana Statistical Service. 2005. Ghana 2003 Core Welfare Indicators Questionnaire

Ghana Statistical Service. 2005. Population Data Analysis Report Vol. I. Socio-Economic and Demographic Trend Analysis.

Government of Ghana 2003. Ghana Poverty Reduction Strategy, An Agenda for Growth and Prosperity Vol. 1. National Development Planning Commission, Accra.

Henry, S., B. Schoumaker, and C. Beauchemin 2004 "The impact of rainfall on the first out-migration: A multi-level event-history analysis in Burkina Faso, *Population and Environment*, Vol. 25, No. 5, pp. 423-460.

Henry, S., P. Boyle and E. Lambin. 2003. "Modelling inter-provincial migration in Burkina Faso, West Africa: the role of socio-demographic and environmental factors." *Applied Geography* 23:115-136.

Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2007: The Physical Science Basis. Summary for Policymakers* (Geneva: World Meteorological Organization (WMO) and UN Environment Programme (UNEP) IPCC, 2007), June 1, 2007.

ISSER, 2004. The state of the Ghanaian Economy in 2003. Institute for Statistical, Social and Economic Research (ISSER), University of Ghana.

Munshi, K. 2003. 'Networks in the Modern Economy: Mexican Migrants in the U.S. Labour Market'. In: Quarterly Journal of Economics 118(2): 549-599.

Myers, N. 2002: Environmental refugees: a growing phenomenon of the 21st century. In:*Philosophical Transactions of The Royal Society B*. vol. 357, pp. 609-613.

Myers, N. 2005. Environmental Refugees: *An Emergent Security Issue.* Paper presented at the 13th Economic Forum, Prague, 23-27 May.

Myers, N and J Kent (1995), *Environmental Exodus: an Emergent crisis in the Global Arena*, Climate Institute, Washington DC.

Tschakert, P., Sagoe, R., Ofori-Darko, G. and S. N. Codjoe (2010). Floods in the Sahel: An Analysis of Anomalies, Memory and Anticipatory Learning. Climate change, Vol. 103: 471-502.

Van der Geest K. 2004. *"We are managing!" Climate Change and Livelihood Vulnerability in Northwest Ghana*. Leiden: Afrika-Studie Centrum.