

Climate change and internal migration intentions in the forest-savannah transition zone of Ghana

Mumuni Abu · Samuel Nii Ardey Codjoe ·
Jon Sward

Published online: 23 August 2013
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Abstract Migration is at the centre of demographic research on the population–environment nexus. Increasing concerns about the impacts of environmental events on human population are fuelling interest on the relationship between migration and environmental change. Using data from the Climate Change Collective Learning and Observatory Network Ghana project, we employ binary logistic regression to examine migration intentions of households in response to major community stressors including climate-related ones. The results indicate that the type of community stressor that affects households most does not differentiate migration intentions in Ghana’s forest-savannah transition zone: Even though the majority of the respondents mentioned climate-related events as the stressor that affects them the most, such events do not appear to directly explain migration intentions. However, socio-demographic factors such as age, household size and current migration status are significant predictors of migration intentions, with younger household heads, heads of migrant households and heads of smaller households being relatively more likely to have migration intentions than other household heads. We conclude that migration drivers are multifaceted and deserve further research because even in areas with perceived environmental stress, climate-related events may not be the primary motivation for migration intentions.

Keywords Climate-related environmental event · Migration · Forest-savannah · Transition zone · Ghana

M. Abu · S. N. A. Codjoe (✉)
Regional Institute for Population Studies, University of Ghana, P. O. Box LG 96, Legon, Ghana
e-mail: scodjoe@ug.edu.gh

M. Abu
e-mail: abumus2000@yahoo.com

J. Sward
University of Sussex, East Sussex, UK

Introduction

Internal migration is recognized to be an important mechanism through which the spatial distribution of people changes over time (Greenwood 1997). Migration intentions matter in the internal migration literature because intentions are the first step in the actual migration process (Macleod 1996; Van Dalen and Henkens 2008), and intentions have been found to translate into actual migration in most instances (De Jong 2000; Van Dalen et al. 2005). The use of stated preferences such as intentions has been widely used by social demographers, geographers and psychologist as opposed to the revealed preferences approach often used by economists who are interested in the actual movement of people (Borjas 1991; Hatton and Williamson 2004). The focus on internal migration intentions is important because it makes it easy to trace such migrants for follow-up surveys to check whether they have realized their intentions. Studies have shown that intentions are good predictors of actual migration even though some argue that intentions lack credibility (Constant and Massey 2002; Sutton 1998). Recent climate trends and events, and their impacts on communities, are likely to influence people's choices, and migration will be one of numerous options that will be considered.

This study uses migration intentions as a proxy to measure the likelihood of future out-migration in Ghana's forest-savannah transition zone. This method has been chosen because it makes it easy to understand the migration situation in this setting over a period of time. Also, validating the intentions is comparatively easy when the focus is on internal migration rather than international migration. Inferring from the 'new economies of migration' thesis (Lauby and Stark 1988; Stark 1991), households will make migration decisions in environmentally challenged settings based not only on the benefits that households stand to gain from migration but also to minimize risk associated with climate-related events. The means of minimizing risk is easily accessible in developed countries in the form of insurance markets and government programs (Massey et al. 1993), but this is difficult to achieve in some developing countries because of the poor economy or limited governance structures (Mahul and Stutley 2010). A number of developing countries' economies rely heavily on agriculture, but very few of these countries have access to crop insurance (Linnerooth-Bayer and Mechler 2006). Crop losses due to extreme weather events are a common phenomenon in agriculture, including losses in developing countries. An estimated 70–80 % of the losses are attributable either to a lack of rain or to an excess of moisture (either heavy rain or flooding) (Herbold 2010). Risk diversification in the event of climate-related events among poor farmers is very challenging, and migration is usually one of the numerous strategies that are used by households.

In addition, the structural adjustment policies of the mid-1980s and 1990s, such as the removal of subsidies on fertilizer, health care and other social services, have seriously affected development in many parts of Ghana especially in rural communities. Farmers generally were not able to buy fertilizers to increase their yields and therefore decided to move into non-agriculture sectors with migrant farmers being the most affected population (Amanor and Pabi 2007). Also, as a result of the liberalization of land tenure systems and land reforms in 1990s, there

has been increasing land tenure insecurity for women, migrant farmers and young people (Awumbila and Tsikata 2010). In some cases, the longer a settler stays in the community, the more he or she is viewed as a community member and the less restriction that may be imposed on his/her agricultural land use rights (Kasanga and Kotey 2001). However, because of population growth in the transition zone and the high demand for land for agriculture, it is usually difficult for non-indigenes to have less restriction on land use. Indigenes impose rules on share-cropping that typically restrict non-indigenes from cultivating economic plants such as cocoa and palm trees on their land since that takes a longer time to mature and also brings about complications when the indigene wants to take the land away from the non-indigene (Adjei-Nsiah 2006).

Overall, internal migration trends in sub-Saharan Africa are significant. Rural–urban migration accounted for roughly half of urban growth in Africa between the 1960s and 1990s (Zachariah and Conde 1981; Kelley 1991; Lall and Shalizi 2006). It is estimated that 36 % of sub-Saharan Africa's population lives in urban areas (World Urbanization Prospects: The 2011 Revision). An estimated 50–80 % of rural households in sub-Saharan Africa have at least one migrant member (DFID 2004). Considerable demographic literature on internal migration in sub-Saharan Africa discusses the characteristics of people who are more likely to move (Ghana Statistical Service (GSS) 2005; Byass et al. 2003; Gibson and Gurmu 2012). However, these findings may not extend to the relationship between climate-related events and the intention to migrate. The impact of climate-related events could bring about varying results at the household level. This is an issue that affects everyone and receives very complex responses from both poor and rich households based on the resources available to them and the type of climate event that is being experienced (Foresight 2011). Increasing concerns about the impact of climate-related environmental events on human population further fuel the interest on how to explain the relationship between environmental change and migration (UNFPA 2009; Van der Geest 2011).

Migration has a long-standing tradition in Ghana. Every ethnic group in Ghana claims to have migrated from somewhere else within the region to its current location (Anarfi et al., 2003). It is estimated that about 25 % of migratory moves in Ghana are rural–urban (Ghana Statistical Service (GSS) 2008). The reasons behind most of these migrations are usually to join a family, to find a better environment and also for economic activities (Songsore 2009; Van der Geest 2011). In West Africa, there are well-established patterns of seasonal migration from the northern regions of countries such as Ghana, Togo, Mali and Burkina Faso to destinations in the south such as cocoa farms (Sharp et al., 2003). These seasonal migrations are influenced by the differences in the ecological zones, as the north is usually dry for most of the year while the southern regions typically experience a substantial wet period throughout the year. As a result, the southern part of Ghana tends to be a net receiver of migrants, and the northern part is known as a net supplier of migrants (GSS 2005). The decision to migrate in some instance is partly the result of the goods, or capital return migrants are able to bring home, which motivate others from their communities to migrate (Kwankye et al. 2009). Females from northern parts of Ghana for instance embark on migration in order to acquire the basic things that will

enable them to get married (Opare 2003). Also, one study on north–south migration in Ghana concludes that migration decisions were not ascribed to sudden onset of environmental stress and that environmental pull of more easily accessible arable land in the south appears to be at least as important as environmental push (Van der Geest 2011). Overall, current research suggests that socio-demographic and economic factors are the dominant drivers of internal migration.

In recent times, internal migration has been used as a livelihood strategy in environmentally vulnerable rural communities in Ghana (Kwankye et al. 2009). The relationship between environmental events and migration has been established empirically in other contexts—although the relationship is not a linear one—and varies according to other migration ‘push’ and ‘pull’ factors. In southwest Mexico, declining rainfall has been associated with rising migration to the United States, since many rural communities depend on rain-fed agriculture (Munshi 2003); however, a second study in the drought-prone Mexican states of Zacatecas and Durango found the opposite: that decreasing rainfall correlated with lower rates of international migration (Kniveton et al. 2008). Findings from studies in Burkina Faso (Beauchemin and Schoumaker 2005) and Mali (Findley 1994) revealed that droughts in the 1970s and 1980s were associated with decreases in international, long-distance migration, while short-distance migration to larger agglomerations increased during drought years. However, climate-related stressors are just one of the stressors people in the West Africa region experience. There are no studies on how climate-related stressors as part of the general stressors of a community affect migration intentions. Examining climate-related stressors as part of the general stressors will help policy makers to understand the contribution of climate-related stressors to internal migration and to develop policies that will address the challenges of climate-related stressors.

This paper examines internal migration intentions of respondents in two rural agricultural communities (Bouko and Bofie-Banda) in the forest-savannah transition zone of Ghana where their source of livelihood is affected by environmental stress. In this paper, we address three research questions: (1) Do household heads in the forest-savannah transition zone perceive climate-related events as a major community stressor? (2) Do household heads in the forest-savannah transition zone perceive climate-related events as the stressor of greatest concern? (3) Are household heads who perceive climate-related events as the stressor of greatest concern more likely to intend to migrate than household heads that do not? The two communities provide different environmental contexts in which to study migration intentions. Bouko is located in a dry, semi-deciduous forest, while Bofie-Banda is located in a wooded savannah grassland (Fig. 1). The Bouko community has in recent times experienced the establishment of stone quarry companies in the community, which serve as an alternative source of livelihood for local people while there is no such development in Bofie-Banda. Bouko is also located on the main Sunyani-Wenchi highway, which makes it possible for farmers to sell their produce to the travelling public. Bofie-Banda on the other hand is located about 17 km from the Wenchi-Sampa road but has currently seen a lot of vehicular movements because of the construction of the Bui power dam which is about 22 km from the community. In terms of marketing of farm produce, people in Bofie-Banda transport their produce to either Nsawkaw or Wenchi for sale.

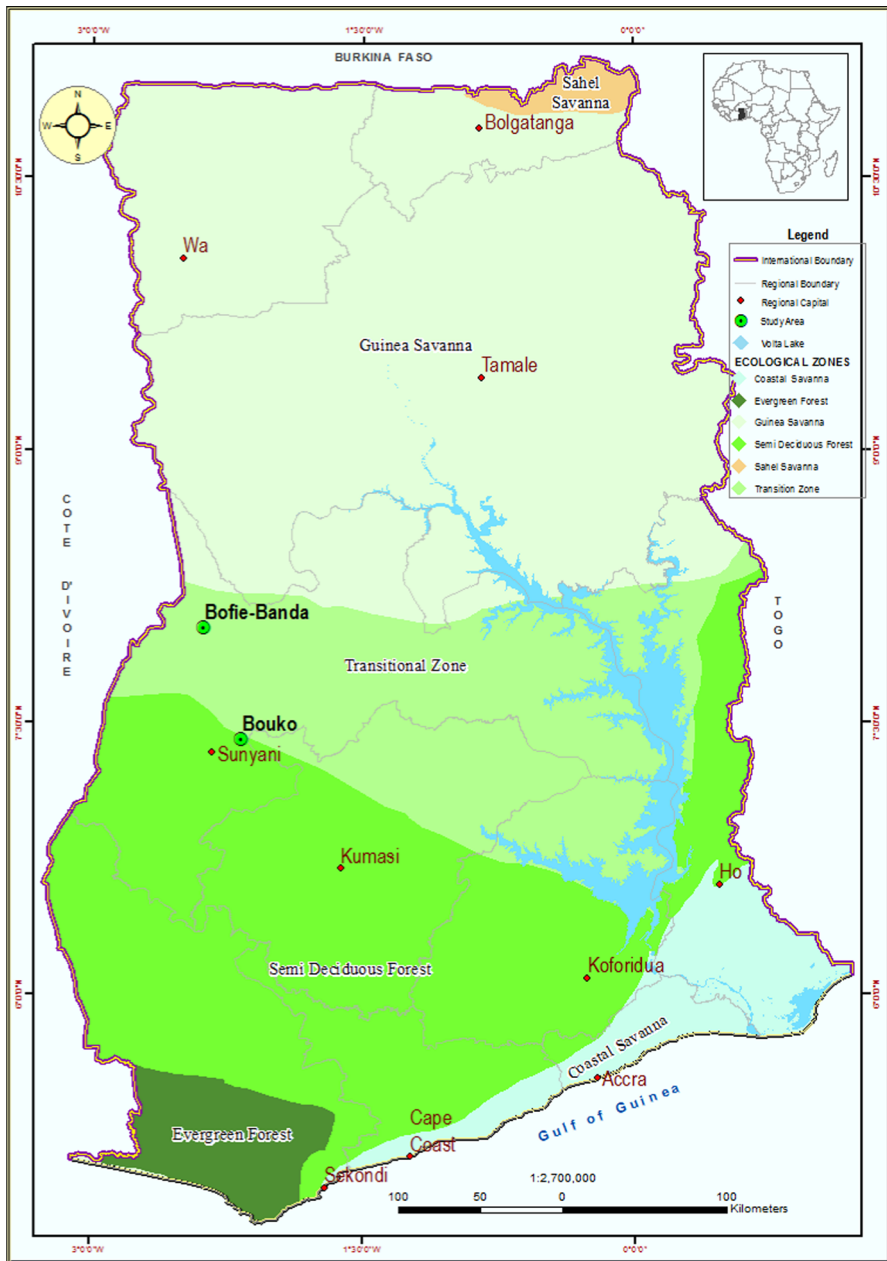


Fig. 1 Map of Ghana showing the study communities

Why focus on the forest-savannah transition zone?

In terms of agriculture, Ghana has five distinct agroecological zones, namely rainforest, forest-savannah transition, guinea savannah, Sudan savannah and coastal

savannah. These zones are characterized by distinct rainfall regimes and as a result support specific crops. The forest-savannah transition zone in Ghana has been the focus of policies addressing environmental issues over the past two decades because it is particularly vulnerable to climate-related environmental events that negatively impact agriculture (Afikorah-Danquah 2009). The forest-savannah transition zone is one of the food baskets of Ghana and has been a major destination for migrants from the comparatively arid Sudan savannah regions of Ghana (GSS 2005). There are two different vegetation characteristics in the transition zone, and so communities in the region experience different types of environmental conditions.

Ecologically, the southern part of the transition zone largely comprises dry semi-deciduous forest, while the northern part consists of a mosaic of gallery forests and forest patches in more-or-less wooded savannah grassland. The soils in the forest-savannah transition zone are generally sandy in texture and have low effective water retention capacity, and nutrients leach easily if not well managed (Adjei-Nsiah 2006). This has resulted in soil impoverishments in some parts of the region, particularly where the soils are light textured surface horizons with clay pans appearing in shallow depths (MOFA 1998). Against these challenges, a recent study in the region has shown widespread presence of highly fertile anthropogenic dark earth soils, similar to Amazonian terra preta, yet subject to continuing production and use (Leach et al. 2012). The little known practice of soil enrichment, though largely absent from common narratives of land degradation in the transition zone, points to a long history of relatively sophisticated indigenous farming practices.

However, the population in the transition zone has grown over the years, and this has equally had an impact on the land. According to the 2000 population census, the transition zone had a population density of 46 people per square kilometre, which is the third lowest in Ghana in terms of regions. However, population densities are unevenly distributed within the transition zone, with a much higher population density of 109 people per square kilometre in the forest portion of the area and a thin population density of 22 people per square kilometre in the savannah portion (GSS 2005). This presupposes that there is widely available land in the savannah portion to migrant farmers from the northern part of Ghana at relatively cheap terms but in a difficult environment to succeed (Amanor and Pabi 2007). Farmers, especially in the forest portion of the transition zone, could no longer practice bush-fallow system of farming because of limited land (Codjoe and Bilsborrow 2011). This condition presents farmers in the transition zone with limited arable lands for their farming activities, which has serious implications for food security in Ghana as a whole.

Environmental trends are exacerbating the already challenging economic, social and health issues confronting the populations in the forest-savannah transition zone and are obstacles to achieving the Millennium Development Goal (MDG) target of reducing poverty by half by the year 2015 (Adjei-Nsiah 2006). According to the Ghana Environmental Protection Agency's (EPA) report on *Climate Change Impacts, Vulnerability and Adaptation Assessment* in 2008, cocoa production will be seriously affected by the impact of climatic events and the ramification of this on the social and economic life of individuals, communities and Ghana as a whole will be very significant. Cocoa is a major cash crop in

Ghana and a significant contributor to its Gross National Product (GSS 2008). Initial qualitative study in Buoku indicates that farmers in the community used to cultivate cocoa on a larger scale four decades ago but because of the irregular rainfall and rampant bush fires, few of the farmers currently have cocoa plantation. The irregular trend of rainfall in the area does not support cocoa production, which was formerly a major cash crop for the people.

Today, environmental change, including climate-related events, presents a new threat to human survival and a new situation for migration (Adger et al. 2001). However, there is still little understanding of how climate-related environmental events will contribute to migration, net of the traditional determinants of migration. Ghana continues to experience significant rural–urban migration (GSS 2005), although the rate of migration has declined over the years, and it is also lower compared to many African countries. Environmental events could be spurring the increase in rural–urban migration, at least in part, as members of agricultural communities are moving into non-agricultural settings in search of alternative sources of livelihood (Marchetta 2008; Van der Geest 2011).

Climate-related events and internal migration intentions

The relationship between climate-related events and migration intentions is complex. It is difficult to distinguish individuals for whom environmental factors are the sole motivation for migration. In other words, the fact that people are migrating in most cases cannot be solely attributed to environmental factors. Thus, it is important to consider the general stressors people go through in a place and to find out whether the type of stressor experienced differentiates migration intentions. Despite these complexities, Myers (2002) predicts that there will be more than 200 million environmental refugees by 2050. His article was cited by a number of subsequent publications as the best estimate of the number of people who will be displaced due to the adverse effects of climate-related events (Friends of the Earth 2007; Christian Aid 2007; Stern 2007; Global Humanitarian Forum 2009). However, this estimate has been criticized as ‘guesswork’ owing to the assumptions of its methodology (Castles 2002, 2011; Brown 2008; Gemenne 2011; Foresight 2011). There are several factors that drive migration, and climatic events are just one of these. Also, because climatic events are linked to the environmental, economic and socio-political factors that also drive migration, it is difficult to identify individuals for whom climatic factors are the sole reason for migrating. It is important to take into account other factors when investigating whether people in low-income countries will migrate as a result of climate-related events.

Thus, environmental factors cannot be easily disentangled from the rest of the social, economic and political factors and processes leading to out-migration (Lonergan 1998). With the exception of sudden environmental disasters, migration is just one among several possible responses and adaptations to environmental changes (Adger et al. 2007). People’s subjective view and perception of climate hazards and their own vulnerability to climate variability are other factors related to migration decisions (Izazola et al. 1998; Hunter 2005). It is, however, difficult to tell

whether such decisions are made based on climate-related stressors or the social and economic challenges that people have to grapple with. Psychologically, people who have experienced a particular event over a long period of time may perceive it as a ‘normal’ event and thus may not turn to migration as a response (Kasperson and Kasperson 2005). In other words, people may develop a psychological thinking that enables them to cope with environmental hardships. The intention to migrate is more likely to arise as a result of the social and economic difficulties that are exacerbated by climate-related environmental events. Therefore, it is important to examine these other stressors together with climate-related stressors to see whether they yield different effects on migration intentions.

Environmental events such as floods and droughts can serve as an immediate push while long-term changes such as desertification can lead to a decline in living standards that increases the cost of staying versus leaving (Adamo 2003). In sum, the severity of environmental stresses can force people to adapt to adverse situations by employing many kinds of adaptation measures (Codjoe et al. 2012 and Codjoe and Owusu 2011). Internal migration is a livelihood strategy for many households in rural Ghana as a result of poor agricultural yields (GSS 2005). For example, rural families often encourage young men and women to migrate to the urban centres in order to send remittances home and to reduce household size (Van der Geest 2004). In other cases, rural farmers migrate from the north of the country to the transitional zone, where arable land is less scarce (Van der Geest 2011). We suspect that climate-related environmental events will increase migration from affected environments by those who have the ambition or resources to move and as a result may leave most of these areas with particularly vulnerable (or ‘trapped’) populations.

The risk of being affected by environmental impacts is the interaction between climate-related events and the underlying social vulnerability of the population. Social vulnerability in this sense is viewed as the socio-demographic characteristics of households such as age, household size and migration status that make them relatively vulnerable to climate-change-related events. Also, migration decisions in response to climatic impacts are likely to be influenced by community stressors. To better understand these associations, this study focuses on salient stressors of households including climate-related ones and how these differently influence migration intentions in rural agricultural communities in the forest-savannah transition zone of Ghana.

Data and method

The data for the study are part of series of data collected by members of the Climate Change Collective Learning and Observatory Network Ghana (CCLONG) project in the two communities in the transition zone from 2007 to 2009. Two of the authors were part of the CCLONG project team.¹ The CCLONG Project had four main objectives: (1) to assess perceptions of climate change and other threats among

¹ Abu and Codjoe are members of the CCLONG team.

farmers, extension agents, researchers and policy makers as well as determinants of adaptive capacity and decision-making for adaptation; (2) adjust climate forecasts, carbon measurements and modelling to place-specific needs; (3) encourage social learning and risk communication for adaptation and resilience; and (4) identify land use and management practices, socio-economic strategies and institutional arrangements that enhance carbon uptake and storage (mitigation) and contribute to more resilient livelihoods and ecosystems (adaptation).

The CCLONG team conducted a household survey in the two selected communities (Bouko and Bofie-Banda) in 2009. The communities were selected because they both fall in the forest-savannah transition zone but have different environmental histories that have over the years influenced the type of crops that are cultivated by farmers. Both communities used to have forest vegetation with the majority of farmers cultivating cocoa, maize and rice. However, changes in rainfall trends over the past four decades, coupled with droughts causing bush fires, have influenced agricultural activities in the transition zone. For example, farmers in Bofie-Banda have stopped producing maize, which is generally a staple food and a major cash crop in the transition zone, because the pattern of rainfall in the area did not support maize cultivation anymore. Additionally, the CCLONG team had in-depth information of the communities because they had been collecting qualitative data in the communities for over 2 years. Survey respondents were randomly selected using a household listing completed by students of the University for Development Studies (Tamale, Ghana) in 2008. A total of 200 households representing more than 50 % of households in the communities were selected and visited for the study. All the 200 selected households participated in the study. Approximately 100 households were interviewed in each of the communities. Also, the households in the study communities are homogenous in character with about 98 % of them being farmers. However, the establishment of stone quarry companies in Bouko in 2010 could serve as alternative source of livelihood to the people.

The questionnaire was administered to heads of household. Household heads were chosen because of the role they play in decision-making in the study settings. They typically have the final say in major household decisions. There were instances in some of the qualitative studies in the communities where household heads did not practically contribute anything to household income but were recognized by household members as the ones responsible for making household financial decisions. Household heads are thus held in high esteem, and issues confronting families are usually discussed at that level before it is taken to higher levels like the chief palace in instances where there is no compromise among the parties. With regard to migration decision-making processes, individual household members who have the intent to migrate typically need the approval of the head of the household to be able to embark on a good journey. Further, in order to measure the social vulnerability of households to environmental events, a combination of household head characteristics and general household information was used. These included the household head's age, sex, educational level, marital status, as well as the present migration status of household, household size and household income. These factors are influential in amplifying or reducing overall vulnerability to hazards (Blaikie 1994; Hewitt 1997).

The validity of these variables is tested in the study, but they are assumed to be relevant to this study for the reasons outlined below. Firstly, the age of household head determines the security of younger household members in times of climate-related hazards. Older household heads may not migrate in most instances because of the attachments they have to their communities as compared to younger household heads. Thus, older household heads preserve the traditions of the household and help in the upbringing of children even if some members are going to migrate. Younger household heads may in most instances migrate with the entire family as compared to older household heads who may select some members of the household to migrate. Also, because of the land tenure system in the area and the power that is given to male household heads, female-headed households may not have access to alternative sources of livelihood in a community where men control most of the resources. Individual members in female-headed households are therefore more likely to suffer as a result of climate-related events compared to households headed by males. In addition, the educational level of the head of the household plays an important role in the welfare of the household and also determines the level of information available to the household and their capacity to prepare towards climate-related events. All things being equal, household heads with higher level of education are expected to be more knowledgeable than household heads with lower level of education in times of climate-related events because education provides people with a lot of options in times of difficulties.

Secondly, the marital status of the household head also helps to determine the level of vulnerability of the household. People who are married tend to have more extended relations coming to their aid in times of climate-related events than those who are not married and so may be limited to just their immediate family. Those who are not married on the other hand could easily migrate without having to worry about kin relations like those who are married. Thus, unmarried people are able to take quick decisions in times of climate-related hazards in comparison with married people. The size of the household also determines how the household will be able to manage in times of climate-related events. The larger the household size, the more vulnerable they may be compared to smaller household size in times of a disaster because the needs of a larger household will be difficult to provide for compared to a smaller one where just a few people have to be attended to. On the other hand, larger households might be able to more easily diversify their income by sending one of their members elsewhere for cash labour without losing essential household labour. Finally, the current migration status of the household head determines how attached the household is to the community and the resources that the household could enjoy in the community. All things being equal, non-migrant households have greater access to land and kin relations than migrant households and so may be less affected by climate-related events compared to migrant households. However, when a migrant is married to an indigenous person, he or she stands to benefit from the properties owned by the partner. There are also instances where the length of stay of a migrant in a community could give him/her similar privileges similar to those of non-migrants. Also, income plays a major role in the migration decision process. In an environmentally challenged setting, household income may help facilitate the migration process in a household. Households that have the financial resources will

be able to sponsor members to embark on migration while those who do not have the financial resources may resort to other ways of coping with the situation.

Dependent variable

The dependent variable in the study was migration intentions. Household heads were asked, ‘Do you intend to move from this community in the next 5 years?’ The question sought to identify household heads who intended to migrate from the community and stay in their new location continuously for 6 months and beyond. Households that indicated ‘yes’ were those who have the intention to migrate while those who said otherwise were classified as those who have no migration intentions.

Independent variable

The independent variable used in the model was the stressor that household heads indicated affected them most in the study communities. First, household heads with assistance from other members of the household listed all the major stressors that affect them in the community. All respondents were prompted once with regard to this particular question. Second, still with inputs from other household members, the stressors in an order of how they should be addressed were ranked. Third, household heads scored the severity of the stressor. The study used cowpea seeds for the severity score because some of the respondents were illiterate. Participants scored each stressor with the seeds bearing in mind that the number of seeds placed on a particular stressor is a measure of the severity of that stressor. The scoring ranged from zero to five. A score of zero is an indication that that particular stressor in the community has no impact on the respondents’ household while a score of five is an indication that it is a stressor that affects them most. Thus, lower scores relate to no or mild impacts, and higher scores relate to severe impacts on households. The severity of each major community stressor as scored in the household was used in the regression model as the main independent variables. We treated the stressors in the model independently but discussed the stressors as climate-related or non-climate-related. Thus, irregular rainfall and bush fire were considered as climate-related stressors. This is because our prior focus group discussions in the communities revealed that individuals in the area perceive irregular rainfall and bush fires as climate-related events.²

Control variables

We controlled for household size, household income, age, sex, marital status, migration status and level of education of household head, which are known to influence internal migration intentions (Anarfi et al. 2003; Kwankye et al. 2009). Age

² Bush fires are specifically linked to drought in the study area. Major drought events in the area have been reported in 1983, 1988 and 1995, which was also the period that widespread bush fire destroyed farms and displaced a lot of households. The impact of the harmattan weather in parts of the year which brings about temporary drought has been associated with bush fires in the transition zone.

is categorized into four groups in conformity with the classification of youth in rural Ghana as those aged 18 years and above but less than 30 years. Those aged 30–39 and 40–49 years are classified as those in their middle age, while those aged 50 years and above are classified as the elderly in the communities. Marital status is categorized into those married/cohabiting and those not in unions. Education is categorized as those with primary or lower education and those with junior high or higher certificate. There were very few respondents with a secondary or higher education, and so these were combined with those with junior high education. The size of the household was equally categorized into three groupings. We combined single individual households with households with two members because the two may not be very different in how they are affected by climate-related events. We therefore grouped household size into those with: (1) less than three members; (2) three to five member households; and (3) households with six or more members. We classified households of six members as larger households because the current average household size for rural forest in Ghana is approximately five members (GSS 2008).

Household income was classified into two groups: those who earn an annual household income of GH¢ 2,000, which is approximately equivalent to the annual minimum wage in Ghana, and those who earn above GH¢ 2,000. We grouped household income into two categories because most of the household had an annual income of just a little over GH¢ 1,000 and the maximum household income that was reported was about GH¢ 2,500. Income levels in the study area are low, and there is little variation in income among households. However, migrant households typically have higher income than non-migrant households because they put the piece of land available to them into maximum use by applying fertilizer and other chemicals on their crops to ensure that they get enough harvest to be able to achieve their migration objectives. With regard to sex, we distinguished between households that had females as their head and those that had males as their head because of some cultural privileges that individuals enjoy in the transition zone based on their gender. Finally, we classified current migration status of households into those who are currently migrants in the community and those who are not. We took into consideration respondents' place of birth and whether they are natives of the community or not. Generally, non-migrants or indigenous people of the community have access to agriculture lands that can only be acquired by migrants through leasing, marriage or a long period of stay in the community (Adjei-Nsiah 2006).

Analytic approach

To examine what type of climate-related environmental events may trigger internal migration intentions, a binary logistic regression was employed to handle the dichotomous dependent variable. Two models were run for the study. The first model examined the relationship between stressors and migration intentions in the transition zone. The second model examined how households who scored climate-related stressors as the most severe differ in migration intentions from those who scored other stressors highest controlling for covariates. The level of significance for interpreting the results is $p < 0.05$.

Results

Descriptive statistics

Table 1 shows the distribution of major community stressors in the forest-savannah transition zone in 2009. The results indicate that household heads in the forest-savannah transition zone are experiencing quite a number of challenges. Climate-related events (irregular rainfall and bush fire) are among the major stressors mentioned by household heads. Of the 200 sampled households, more than two-thirds (70 %) of the respondents indicated that irregular rainfall is a major stressor in the transition zone. In addition, 26 % out of the 200 sampled households mentioned poverty as a major stressor, while 13 and 20 % mentioned poor health services and unemployment, respectively. With regard to education, respondents were concerned about poor formal educational attainment in the community. Other stressors mentioned, such as land disputes, teenage pregnancy, stealing and gross disrespect of elders by the youth, are not shown in Table 1.

In terms of ranking of the community stressors, more than half (51 %) of households ranked irregular rainfall as the most concerned stressor followed by unemployment (22 %) and then poverty (16 %). The least ranked community stressor among the seven is poor health services. In scoring the stressors in terms of severity, irregular rainfall had the highest average severity score of 3.7, followed by bush fire (3.4) and poor soil fertility (3.2). Even though unemployment was the second highest ranked stressor in the communities, its severity score is lower than bush fire and poor soil fertility, which were ranked fifth and sixth, respectively. We argue that it is the severity of the stressors that creates problems for households and the climate-related variables (irregular rainfall and bush fire) received higher severity scores.

Table 1 Percentage distribution of listing, ranking and scoring of major stressors in the transition zone ($N = 200$)

Community stressor	Listing	Percentage of respondents ($N = 200$)	Ranking	Percent	Average severity score
Irregular rainfall	139	69.5	1	50.5	3.7
Unemployment	100	50.0	2	21.5	3.1
Poverty	130	65.0	3	15.5	2.8
Lack of formal education	18	9.0	4	6.0	2.8
Bush fire	25	12.5	5	3.0	3.4
Poor soil fertility	9	4.5	6	2.0	3.2
Poor health services	68	34.0	7	3.0	1.5
Other	18	9.0	–	–	–

Source: Field Survey, 2009

The intention to migrate from the communities in the next 5 years came up strongly among the respondents. Table 2 shows that more than half (54 %) of the respondents had intention to migrate in the next 5 years. Household heads in the study communities (where the average age was 41.4 years) are, on average, younger than the national average age (46.3 years) for rural Ghana (GSS 2008). There are more male household heads than female household heads in the transition zone, and this is consistent with national statistics where about 71 % of household heads are males (GSS 2008). There are very low levels of education in the study communities. A little over half (51 %) of the respondents had attained junior high school or senior high school education with the remaining having attained primary or lower education. These low levels of education will make respondents less competitive in the formal sector of the economy, and so they may be limited to the informal sector, which does not provide much security for households' well-being in times of climate-related hazards. As expected, nearly two-thirds (64 %) of household heads were married or cohabiting, while the remaining were not part of a union. Household heads are supposed to lead a responsible life and are expected in most rural settings in Ghana to be individuals who are married and command some respect in the community.

In addition, on average, households have approximately five members, which is higher than the national average of 4.1 for rural forest areas but a little lower than the national average of 5.4 members for rural savannah zones (GSS 2008). Generally, income levels are low in the transition zone. Nearly half (48 %) of the respondents in the communities had an annual income below the national minimum wage. Poverty is pronounced in rural Ghana, and about a quarter (25 %) of the population of Ghana lives below the poverty line (GSS 2005). In addition, the current migration status of the household often determines how decisions regarding migration are made. For current migrant households, they could have migration intentions when their expectations at place of destination are not met. This is because, currently, migrant household heads may not have so much attachment to the community compared to those who are non-migrants. That said currently migrant households are challenged in terms of finance to accomplish such migration intentions. Table 2 indicates that a little over half (52 %) of the respondents are currently non-migrants while the remaining are migrants.

Association between climate-related events and internal migration intentions

The bivariate association between the major community stressors as mentioned by household heads and the intention to migrate is examined in Table 3. The results indicate that more than half of the respondents who mentioned some of the community stressors as a concern to them did not have the intention to migrate. Also, on average, over two-fifth of the respondents who did not mention any of the community stressors as a concern to them indicated that they have the intention to migrate. The decision to migrate therefore depends on several factors, and it is difficult to say that people are migrating from a particular community as a result of a single factor. The analysis shows that even in a very diverse environmental setting like the forest-savannah transition zone, where the impact of climate-related events

Table 2 Percentage distribution of intention to migrate and control variables

Variable	N	Percent
Intention to migrate	108	54.0
<i>Age of head of household (years)</i>		
> 30	43	21.5
30–39	60	30.0
40–49	45	22.5
50+	52	26.0
Mean age (years)	41.4	
<i>Sex of head of household</i>		
Male	126	63.0
Female	74	37.0
<i>Level of education of head of household</i>		
Primary education or lower	127	49.0
Junior high school or higher	73	51.0
<i>Marital status of head of household</i>		
Married/cohabiting	118	63.5
Not in union	82	36.5
<i>Household size</i>		
<3	58	29.0
3–5	69	34.5
6+	73	36.5
Mean household size	5.2	
<i>Household income</i>		
<2,000 Ghana Cedis	96	48.0
2,000 Ghana Cedis and above	104	52.0
<i>Current migration status of head of household</i>		
Migrant	97	48.5
Non-migrant	103	51.5
Total	200	100

Source: Field Survey, 2009

1 US Dollars was equivalent to 1.49 Ghana Cedis at the time of survey

is known to be impacting on people's livelihood (Afikorah-Danquah 2009), quite a number of household heads do not have the intention to migrate. Apart from bush fire, which has a statistical association with migration intentions in the forest-savannah transition zone, none of the other major stressors mentioned by the respondents have statistical association with intention to migrate. Thus, one of the climate-related variables (bush fire) was statistically associated with migration intention at the bivariate level, while irregular rainfall was not. With regard to other explanatory variables, age, marital status, household size and migration status were statistically associated with migration intentions, while sex, level of education and income were not statistically associated with migration intentions. Even though most of the major community stressors were not associated with migration intentions, we sought to find out at the multivariate level whether there is a relationship between most severe stressors and intentions to migrate in the transition zone.

Table 3 Percentage distribution of major community stressor and control variables by intention to migrate ($N = 200$)

	Intention to migrate	
	<i>N</i>	Percent
<i>Community stressor</i>		
Poor health services	68	30.2
Unemployment	100	55.8
Lack of formal education	18	7.0
Irregular rainfall	139	68.6
Bush fire**	25	17.4
Poverty	130	62.8
Poor soil fertility	9	7.0
Other stressors	18	11.6
<i>Control variable</i>		
<i>Age***</i>		
<30 years	43	38.4
30–39	60	36.0
40–49	45	9.3
50+	52	16.3
<i>Sex</i>		
Male	126	66.3
Female	74	33.7
<i>Level of education</i>		
Primary or lower	127	59.3
JHS/higher education	73	40.7
<i>Marital status***</i>		
Married/cohabiting	118	41.9
Not in union	82	58.1
<i>Household size***</i>		
<3	58	48.8
3–5	69	26.7
6+	73	24.4
<i>Income</i>		
<2,000	96	51.2
2,000+	104	48.8
<i>Migration status***</i>		
Migrant	97	62.8
Non-migrant	103	37.2

A χ^2 test of the statistical association between the independent variable and the dependent variable

Source: Field Survey, 2009

** $p < 0.01$; *** $p < 0.001$

Turning to multivariate analyses, the results in Model 1 in Table 4 indicate that the most concerned community stressors only explain about 6 % of the variations in the intention to migrate in the transition zone. In Model 2, however, when the socio-demographic factors are controlled, the model explains about 41 % of the variations in the intention to migrate in the transition zone. This is an indication of the strong role socio-demographic factors play in intentions to migrate in the transition zone.

This is not different from other studies on migration where socio-demographic factors played important role in the migration decision process and the type of people who finally migrate (De Jong 2000; Anarfi et al. 2003). Climate-related events are tied to socio-demographic factors in the migration decision process with a higher influence on the intention to migrate emanating from socio-demographic indicators. Also, household heads who mentioned bush fire as the stressor that affects them most in the transition zone are significantly more likely to report

Table 4 Standardized coefficients of the relationship between major community stressors, control variables and migration intentions in the forest-savannah transition zone of Ghana ($N = 200$)

Variable	Intention to migrate			
	Model 1		Model 2	
	β	SE	β	SE
<i>Community stressor</i>				
Poor health services	-0.095	0.162	-0.098	0.199
Unemployment	0.213	0.147	0.380*	0.204
Lack of formal education	-0.195	0.279	0.066	0.325
Irregular rains	0.032	0.123	0.056	0.154
Bush fire	0.382*	0.190	0.279	0.222
Poverty	-0.089	0.133	0.210	0.182
Poor soil fertility	0.468	0.372	0.776	0.457
<i>Control variable</i>				
Age of household head (RC ≥ 30 years)				
30–39 years			1.519*	0.711
40–49 years			0.894*	0.542
50+ years			-0.797	0.620
Sex (RC = male)				
Female			-0.129	0.438
Level of education (RC = primary/lower)				
JHS/higher			0.225	0.467
Size of household (RC ≤ 3)				
3–5			0.876	0.735
6+			-0.493	0.480
Marital status (RC = married/cohabiting)				
Not in union			0.387	0.523
Income (RC $\leq 2,000$)				
2,000+			0.031	0.438
Migration status (RC = migrant)				
Non-migrant			-1.592***	0.457
Constant	-1.219	0.962	-4.043**	1.504
Nagelkerke R^2	0.063		0.412	

SE standard error

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

migration intentions (Model 1). This implies that a unit increase in household's perceived severity score of bush fire will lead to an increase in migration intentions in the household by 0.032. Bush fire is associated with drought in the transition zone, and the gradual changes in the seasonal nature of agriculture in the transition zone as a result of the occurrence of some of these events may render respondents unemployed for some period of the year. Household heads affected by bush fire are more likely to migrate to other places where they can have some employment. The association between bush fire as a stressor that affects households most and migration intentions does not hold after controlling for household heads' socio-demographic factors (Model 2).

Model 2 includes socio-demographic characteristics to ascertain whether the associations in Model 1 are robust. Once socio-demographic factors are controlled, there is no significant association between any of the climate-related stressors that affect household heads most and the intention to migrate in the forest-savannah transition zone. Unemployment as a most concerned stressor in the forest-savannah transition zone predicts migration intentions at this point. The results indicate that a unit increase in household heads' perceived severity score of unemployment will result in an increase in migration intentions by 0.380. Non-migrant households are significantly less likely to report migration intentions compared to migrant households. Household heads who are aged 40–49 years are significantly more likely to have migration intentions in their household compared to those aged 20–29 years (Model 2).

Conclusions

Migration intentions are influenced by social, economic, demographic and environmental factors. In this study, rainfall is essential for the livelihood of the study populations, which depend on rain-fed agriculture. Environmental events challenge people's livelihoods, which are directly linked to their social and economic well-being. The complex nature of these relationships demands a thorough investigation of the environmental, socio-demographic and economic factors that trigger migration intentions. To understand how community stressors including climate-related stressors predict migration intentions, we considered stressors that affect respondents most in the study communities, the socio-demographic and economic situation of the people, and the agroecological area in which they are located.

Our results indicate that the majority of household heads in the forest-savannah transition zone perceive climate-related events as their most pressing stressor. This is so because agriculture, which is the main livelihood of the people, depends on rainfall. Irregular rainfall and bush fires will therefore make it difficult for them to harvest enough from their farming activities. This is consistent with other studies in the transition zone that indicate a dramatic change in the rainfall pattern in the area (Asiamah et al. 2000; Adjei-Nsiah 2006). Also, household heads in the transition zone perceive climate-related events as the most salient stressors confronting them. More than half (56.5 %) of the respondents mentioned climate-related events as the

stressor that affects them most. We equally found that more than half of the respondents in the transition zone had the intention to migrate which could potentially impact food production in the region—although the present study did not probe where migrants planned to move (which could include, for example, other rural areas within the region, urban centres or returning to their communities of origin in northern Ghana). The transition zone has some of the major food markets in Ghana because of high food production in the area. The Techiman food market for instance is patronized by people from neighbouring countries such as Burkina Faso and Cote d'Ivoire. Also, food produced in the transition zone, especially yam and maize, is transported to other parts of Ghana by market women. This has helped us to address food shortage situations in some parts of northern Ghana, especially during the dry periods in the north when food production is very low. Thus, the migration of farmers from the transition zone will have major consequences for food security and requires some urgent attention from policy makers to address what is driving these people to have such intentions.

However, apart from unemployment in our study, the other type of stressors that affect people most, including climate-related events, does not differentiate migration intentions in the transition zone after controlling for socio-demographic and economic factors that influence migration decisions. In fact, socio-demographic factors were found to be the main predictors of intentions to migrate in the forest-savannah transition zone. Thus, older household heads in the transition zone significantly report lower migration intentions compared to younger household heads. This is consistent with the migration literature where people in younger age groups are most likely to embark on migration compared to those in older age groups (Hughes and McCormick 1985; Lam 2006; GSS 2008; White and Subedi 2008).

In addition, non-migrant household heads in the study area are significantly less likely to report migration intentions than migrant household heads because of the attachment non-migrants have to their community and the resources available to them. In the forest-savannah transition zone for instance, non-migrants are the custodians of the farmland, and so they rent the land to migrant households based on share-cropping arrangements (Amanor 2002; Adjei-Nsiah 2006). The share-cropping practice in this setting is in two forms—*Abusa* and *Abunu*. *Abusa* was formerly the dominant share arrangement, which was based on division into thirds. Under this arrangement, one could be employed to weed and manage an already established farm or plantation in exchange for a third of the yield. Also, an *abusa* tenant can gain access to land and in return provide the landlord a third of the yield. This system has been replaced with the half share system (*abunu*) in which a landlord commands a half share as land has become scarcer. The landlords, who are mostly the indigenous people, enter into share contracts with settler farmers in order to make maximum benefit from their resources and also to have control over the land. In this regard, non-migrant households do not go through so much difficulty because they rely on what migrant households will harvest at the end of the farming season (World Bank 2003). Migrants on the other hand exert a lot of pressure on the land in order to have good harvest under the share-cropping system, and if they are not able to harvest much, they are likely to migrate to a different place (Amanor

1993; Codjoe and Bilisborrow 2012). It is also important to mention that migrants are typically less tied to their communities of residence and thus can more easily decide to embark on migration than non-migrants (Nogle 1996; Levitt 2004).

Unemployment is the only community stressor that predicts migration intentions because of the limited options in employment in the study communities. The other salient community stressors mentioned by household heads, including climate-related events, do not differentiate migration intentions probably as a result of people's perceptions about the efficacy of coping resources that they may be using to address these challenges, which have not been explored in this study. As already mentioned, the share-cropping system in the transition zone may be a valuable resource to non-migrants in times of climate-related events but may make year-on-year livelihood outcomes for migrant households difficult. The resources available to non-migrants may help them cope with the situation while migrants are most likely to migrate because of inadequate resources. Also, the growth of the population in the forest portion of the transition zone means that individual households may not have large land tracts to rent some out to migrant households. In this regard, if farmers will have to cultivate different types of crops on a piece of land because of the unpredictable nature of the rains, then migrant households will be limited in their options because they will not have access to enough land to do this. The practice of multicropping generally has been used in some parts of Ghana as a strategy to diversify risk and also overcome land constraints. However, migrants typically do not practice multicropping because the strategy requires more than one growing season and it is difficult to pursue under the share-cropping rules.

In conclusion, this study demonstrates that migrant households are more likely to have migration intentions than non-migrant households in Ghana's forest-savannah transition zone. The contribution of migrants to their host communities is, however, very significant. In the agricultural sector for instance, migrants play a crucial role in providing farm labour (Fisher et al. 2004) and also contribute significantly to food production. With the system of land tenure in Africa coupled with recent climatic impacts, the contribution of migrants to the agricultural sector could be negatively affected. Migrants may not have enough land to undertake farming, and their productivity could also be low because of the impact of climate change on crops. In this sense, the direction of migrants may be towards urban places where they could get alternative jobs that are different from agriculture. On the other hand, our study suggests established indigenous people are more likely to stay because of their attachment to the community and the resources they have. However, the extent to which these people will be committed to stay in the community has not been rigorously tested in this study, and this is an area that needs to be examined in future studies. For instance, when there is high demand on the same family land from the youngest generation of household members, it will be difficult for everybody to receive a fair share. In such situations, will some members consider migrating? And, if so, what will be the implications for food production in the transition zone? These are critical issues that need research attention.

The forest-savannah transition zone has high rates of in-migrants and out-migrants. The study also reveals high migration intentions in the area. It is, however, not clear whether this trend of migration intentions pertains specifically to the

communities examined or whether this is symptomatic of wider trends within the transition zone more broadly. It is also unclear from the current study whether members of established households other than the household head are engaging in migration—another issue that deserves further research and could potentially impact the livelihoods of household members who stay behind. In short, our study finding that socio-demographic factors are greater predictors of migration intentions than whether households report being affected by climate-related events supports existing research that suggests that climate change's impact on migration trends will be influenced by existing drivers of migration, including economic and social ones (Foresight 2011).

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