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Abstract

Climate change and variability continue to adversely impact on the livelihoods of many, especially agriculture-dependent households, in dryland sub-Saharan Africa. Climate vulnerability is shaped by institutions and socioeconomic processes including land tenure arrangements and infrastructural development. This paper employs a participatory mixed-method approach including household questionnaire surveys, key informant interviews, oral narratives and focus group discussions to understand the dynamics of livelihood challenges in 6 dryland farming communities of different vulnerability status in Ghana. Whilst acknowledging the importance of socioeconomic and environmental processes in influencing climate vulnerability in dryland farming systems, this paper demonstrates how the complex land tenure system is implicitly involved in shaping the vulnerability of two groups of farmers – migrant farmers in the Ejura Sekyedumase District and female farmers in the Bongo District – by limiting the adaptation options available to these two groups. Our results suggest that women's rights regarding land ownership should be formalised in land policy in order to reduce cultural discriminations against women. This highlights that opportunities for women to own and formalise land registration titles should be pursued by the Government of Ghana. This will help women to secure property rights over land and use via mechanisms such as collateral to access credit that could be used to implement climate adaptation practices. The rights of migrant workers should also be recognised in Ghana's land policy to provide them with opportunities for adaptation in a similar manner to non-migrants. This paper demonstrates that smallholder farmers' vulnerability to climate variability and change is shaped by various socio-political and environmental factors. It is, therefore, further recommended that climate change adaptation policies should also consider the broader socioeconomic and environmental factors that could hinder the smallholder farmer's ability to implement various adaptation measures.

Key words: land tenure; migrant farmers; gender; Ghana; livelihoods; sub-Saharan Africa; climate change and variability.

1 Introduction

Climate change as a development challenge has a disproportionate effect on climate sensitive sectors such as agriculture with implications for rural livelihoods and food security (IPCC, 2014; Schlenker and Lobell, 2010). Sub-Saharan Africa is particularly vulnerable to the impacts of climate change and variability due to its low adaptive capacity (Boko et al., 2007). Climate change can be defined as shifts in the mean state of the climate that persist over an extended period

(usually decades or longer). It may be due to natural internal changes or to persistent anthropogenic (human induced) changes in the composition of the atmosphere or in land use (IPCC, 2007). Climate variability refers to variations in the mean state of climate on all temporal and spatial scales beyond that of individual weather events (Christensen et al., 2007). Climatic projections suggest that prolonged and more intense droughts are likely to cause West Africa to become drier (Boko et al., 2007; Christensen et al., 2007). The three decades, since the 1970s, have witnessed increased incidence of drought in sub-Saharan Africa due to climate change (Sarr, 2012) and this has often resulted in severe food insecurity (Thornton et al., 2011). This threatens the livelihoods of hundreds of millions of people in this region where between 45 and 55% of the people depend on rain-fed agriculture for their livelihoods (Thornton et al., 2011).

Whilst uncertainties remain on future estimates of rainfall and temperature changes, the general sense is that temperature will increase whilst rainfall decreases in all agro-ecological zones across Ghana (EPA, 2007). Ghana is also projected to experience increased incidences of extreme events such as droughts and floods linked to climate change and variability (Boko et al., 2007; Christensen et al., 2007). Food security will therefore be placed under considerable stress (FAO, 2010). Problems relating to intra-annual rainfall variability and increased temperature are also compounded by a myriad of other political, economic, social and environmental challenges (O'Brien and Leichenko, 2000). This has adverse consequences for Ghana's development and could undermine progress made towards eradicating poverty and hunger.

The need for urgent, practical adaptation strategies to deal with the threat posed by climate change cannot be over-emphasised. Adaptation to climate change is defined as processes and practices undertaken by households to reduce the adverse impacts of climate change on their livelihoods (Smith et al., 2000). The role of adaptation as a practical option in reducing the adverse impacts of climate change and variability has been emphasised by the international community (IPCC, 2014; Ford, 2007; Pielke et al., 2007), nevertheless, the likely implications of land tenure and human land use systems for climate change adaptation have received little research attention.

Studies on climate change and land use systems tend to focus on the possible agricultural impacts of climate change on economic crops of importance (e.g. Wheeler and von Braun, 2013; Parry et al., 2004; Schlenker and Lobell, 2010). Other studies such as Below et al. (2012) and Bryan et al. (2009) have also explored how different socio-economic factors including poverty, education and household sizes as well as environmental factors have shaped the vulnerability of farming households in sub-Saharan Africa. However, land is a critical component of development and, in economic terms, considered one of the key factors of production.

Therefore land tenure arrangements need explicit examination to facilitate climate adaptation planning. This is particularly important especially for West Africa where land is often controlled under complex customary arrangements (Toulmin and Quan, 2000; Fenske, 2011). The importance of formal land tenure to livelihoods has also been strengthened by peri-urbanisation and the increased commoditisation of land, which has led to more intense competition for land (Yaro, 2010). Besides the direct and indirect impacts of climate change and variability on the growth and productivity of agricultural crops (Schlenker and Lobell, 2010), it is projected that climate change will affect food availability in sub-Saharan Africa by reducing the area of crop land suitable for agricultural production (Arnell, 2009).

There is a growing body of work that explores socioeconomic factors contributing to climate vulnerability (defined as the extent to which the livelihoods of households are susceptible to the adverse impacts of climate change and variability (IPCC, 2007)), and how this affects marginalised groups within societies (see Glazerbrook, 2011; Denton, 2002; Antwi-Agyei et al., 2013). However, as yet, little empirical evidence exists on how land tenure arrangements dispose certain social groups (e.g. migrants, women, and the elderly) to vulnerability to climate change in West Africa. This paper forms part of a larger study which seeks to understand the extent of food production systems and livelihood vulnerability to climate change in Ghana (e.g. Antwi-Agyei et al., 2013; Antwi-Agyei et al., 2012). Previous studies have highlighted that within the same agro-ecological setting, different communities and households may experience differential climate vulnerability and adaptive capacity. In particular, they have shown that vulnerable groups are female farmers in north-east Ghana and migrant farmers in central Ghana (see Antwi-Agyei et al., 2013).

Whilst acknowledging the role played by environmental and socio-political factors in exacerbating climate vulnerability of smallholder farmers, the aim of this paper is to demonstrate how land tenure affects the vulnerability of two marginalised groups – migrant farmers in the Ejura Sekyedumase district of the Ashanti region and female farmers in the Bongo district of the Upper East region of Ghana. The study adopts a mixed method approach to:

(i) explore the linkages between land tenure arrangements and land management practices in the Ejura Sekyedumase district (located in central Ghana) and Bongo district (located in north-eastern Ghana);

(ii) understand possible impacts of land tenure on climate change adaptation and vulnerability in six study communities, and;

(iii) assess differential impacts of land tenure arrangements on different social groups across these six study communities.

The study contributes to existing literature on land tenure and livelihoods opportunities (e.g. Yaro, 2012; Quan and Dyer, 2008; Tsikata and Yaro, 2013) and agricultural development (e.g. Barry and Danso, 2014; Owusu, 2008). Importantly, the paper offers significant recommendations that could help Ghana's government's efforts and policies aimed at reducing the vulnerability of agriculture-dependent households and communities to climate change.

2 Land tenure arrangements in Ghana and the study districts

Land tenure defines access to land resources and considers the ways in which land is held, accessed or transacted (Kasanga, 1988; Bugri, 2008). In Ghana, like in most parts of Africa, land resources are controlled under complex customary systems, which are managed by a set of social norms and cultural rules (Yaro, 2010; Obeng-Odoom, 2014). Two types of land ownership – state (or public) and customary (or private) – are recognised in Ghana (Larbi, 1996). Hence, the 1992 Constitution of the Republic of Ghana recognises two forms of tenure– public and customary. The Government of Ghana may compulsorily acquire public lands through the invocation of appropriate legislation according to the Lands Commission Act, 2008 (Act 767) and The State Lands Act, 1962 (Act 125) and invested in the President of the Republic in trust for the people of Ghana (Republic of Ghana, 1999; Obeng-Odoom, 2014; Larbi et al., 2004). Such lands are used for public interests. Customary land is held and administered by the traditional or spiritual head of the family with state agencies such as the Land Commission of Ghana, providing services for land transactions (Yaro, 2010).

It is estimated that 78% of all land in Ghana is held under the customary system. Of the remaining 22%, 20% is held for the government for developmental projects whilst 2% is held in a dual ownership between the government and customary owners (Republic of Ghana, 2003). Under customary land tenure, land is considered to belong to a social group and not an individual. Hence, the rights and ownership of land is vested in a clan or family, and members of this social group enjoy unrestricted rights of usage (Yaro, 2010; Owusu, 2008).

Customary land tenure systems are recognised and observed as an institution governed by customary law (Gough and Yankson, 2000). As has been demonstrated in other parts of sub-Saharan Africa (Chimhowu and Woodhouse, 2006; Ali et al., 2014; Becker, 2013), in Ghana, land acquisition and access for farming and other developmental projects by individuals and groups is mainly through the traditional customary system (Kasanga, 2001; Owusu, 2008). Members of a particular clan or community can acquire land preceded with the presentation of customary gifts to the traditional or spiritual leader (Kasanga, 2001). However, people from outside the community do not have rights to communal land, even though they may acquire land

for farming by entering into a contractual agreement with the chief or the traditional head for a period of time (Kasanga et al., 1996). Acquiring land for farming and other development projects through the customary system may involve several intermediaries (Owusu, 2008).

In the past, land in Ghana was regarded as plentiful, with enough for every citizen, with the customary system guaranteeing tenure security to individuals and groups (Yaro, 2010). Population growth and increased land commoditisation has led to greater demand for land resources and to land disputes (Obeng-Odoom, 2014). Since 2003, Ghana's government through the Ghana Land Administration Projects (LAP I and II) has been working to improve the security of tenure of vulnerable groups, notably for women, the youth and migrants. The LAP is aimed at transforming land administration. The fragmentation of public sector institutions that administer land was identified by the National Land Policy (Republic of Ghana, 1999) as one of the main impediments to efficient and effective land administration. The aim of the LAP I was to undertake legal and institutional reforms aimed at ensuring transparent and secure access to land that would stimulate national development (Anaafo, 2015; Republic of Ghana, 2011). The LAP II seeks to strengthen land administration in order to engender transparency in land transactions by consolidating the gains made under the LAP I through deepening of various reforms that will make land sector agencies more responsive to client needs (Republic of Ghana, 2011). Customary Land Secretariats (CLSs) have been established in various land owning traditional areas, with the view to improving the general land governance of these areas by providing support for the operations of customary tenure systems (Republic of Ghana, 2011). For instance, the establishment of the CLSs in the Upper West region has ensured peace and harmony in their operational areas whilst promoting sustainable land use and management practices (Nara et al., 2014).

Ownership of customary land differs across the two study districts. In most of southern Ghana, particularly in the Akan speaking communities where the Ejura Sekyedumase district is located, both male and female members of a particular family (*abusua*) or clan can access and own land for farming and other economic activities. In the Bongo district (and the Upper East in general), it is the *tendana* (the earth priest) who customarily is the owner of the allodial interest in land and is entitled, under the customary system, to grant rights to families and individuals within the community (Bugri et al., 2008; Bugri, 2008; Yaro, 2010). The *tendana* is usually a patrilineal descendent of the original family that first settled in the community but occasionally, may be chosen by a soothsayer. The belief underpinning the customary land system is that land is an ancestral trust and should be utilised judiciously in order not to jeopardise the chances of the generations unborn to use such resources (Gough and Yankson, 2000; Bugri et al., 2007). This

study investigates both land tenure arrangements and their implications for climate change adaptation efforts by farming households with varying degrees of climate vulnerability in the Bongo and Ejura Sekyedumase districts.

3 Research design and methods

This research integrates a range of qualitative and quantitative approaches in an interdisciplinary manner to understand the implications of prevailing land tenure arrangements and climate change vulnerability for different social groups in two study districts.

3.1 Selection and description of study sites

The Ejura Sekyedumase District of Ashanti region and Bongo District of the Upper East region were identified as the most resilient and vulnerable districts respectively, based on previous quantitative vulnerability assessments (Antwi-Agyei et al., 2012). Within these districts, 6 specific farming communities with different socioeconomic characteristics (3 in each district) were selected for this study. Within the resilient district (Ejura Sekyedumase), Aframso, Babaso and Nyamebekyere were identified as resilient communities, while Adaboya, Ayelbia and Vea located in the Bongo District, were identified as the vulnerable case study communities. These 2 districts and 6 communities provided opportunity to explore climate change related livelihood problems as they represent a range of different agro-ecological characteristics in the two different land tenure systems outlined above.

The Ejura Sekyedumase District is located within the transitional agro-ecological zone. It experiences bi-modal rainfall patterns that permit two growing seasons (Figure 1). The Ejura Sekyedumase District is a high rainfall area, recording average annual rainfall ranging from 1200–1500 mm, with minimum and maximum temperatures of 20°C and 32°C respectively (EPA, 2003). The transitional zone is characterised by potential evapo-transpiration of about 1430 mm per annum and relative humidity of 75% (EPA, 2003). The Bongo District is located within the Sudan savannah agro-ecological zone (Figure 1) with average annual rainfall from 800–1000 mm, and maximum temperatures of 35°C and mean monthly minimum temperatures of 21°C (EPA, 2003).

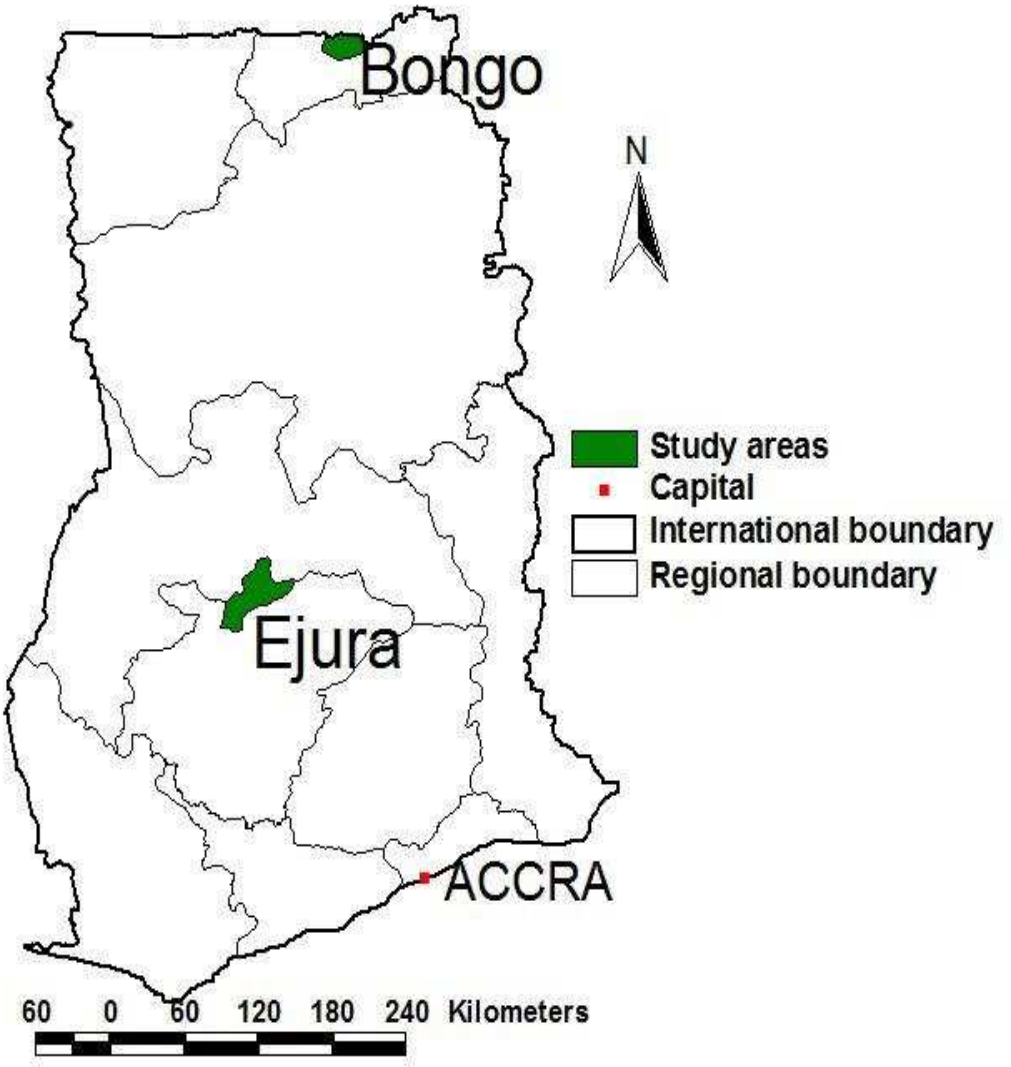

Figure 1: Ghana showing selected study districts (source: Authors, 2014)

3.2 Research methods

This paper uses a mixed-method approach to understand how land tenure influences the vulnerability of certain social groups to climate change and variability. The data used in this paper were collected from June – August, 2011 and in March, 2012, and involved a total of 270 households in 6 farming communities. Forty-five (45) household questionnaire surveys were conducted in each community, representing about 30-40% of total households. Households were stratified into different socioeconomic groups, based on age, gender and wealth status (based on local perceptions of wealth), and a random sample from each group was then surveyed. We interviewed the household heads where possible and when the head was not available we interviewed his or her representative.

Focus group discussions (FGDs) were held in each community with between 5-10 farmers with different socioeconomic characteristics (such as age, gender and social standings (see Kitchin and Tate, 2000; Hopkins, 2007)). Participants in FGDs were selected based on their local knowledge of land tenure, climate vulnerability and food security issues. Using FGDs provided an opportunity to triangulate some of the key issues that emerged from the household questionnaire survey. In all, 9 FGDs were conducted with farmers in the 6 communities – one in each community - but on three occasions (in the vulnerable communities located in the Bongo District) separate FGDs were held with female farmers and women groups to explore differential impacts between male and female farmers. This enabled an understanding of power relations within the study communities and assessment of how this affects households' vulnerability to climate variability. Cultural factors constrained women in the vulnerable communities from expressing themselves in a mixed gender setting. FGDs focused on issues relating to capital assets, dynamics of land tenure, access to land and the changing power and land tenure of various social groups within the communities. Discussions at focus groups were recorded with the consent of participants and analysed to draw out themes and patterns. FGDs were followed up with transects walks (Pretty, 1995) to have a better appreciation of the issues discussed in each community.

Qualitative interviews were also held with individual key informants, including chiefs, assembly members (i.e. representatives of the local community at the district assembly), youth leaders, chief farmers, and other opinion leaders. Each key informant interview lasted between 40 and 60 minutes. In addition, interviews were held with experts and stakeholders including those at the Lands Commission, and the Ministry of Lands and Natural Resources. These interviews provided expert opinion on issues relating to land tenure and the climate vulnerability of farmers in the study areas.

To reconstruct livelihood profiles and explore linkages between social relations and tenure systems, oral narratives (Powell, 2008) were obtained from both migrant famers and female farmers as the marginalised groups under direct investigation in this study. These oral narratives provided an in-depth understanding of the livelihood problems encountered by migrant and female farmers with regards to land tenure and climate change adaptations. Finally, content analysis (Forbes, 2000) of Ghana's land policy and climate change policy were conducted to examine how women's rights to land tenure are covered in these policy documents.

3.3 Data analysis

Quantitative data from the household questionnaire surveys were coded for analysis using Microsoft Excel (Version 2010). Qualitative data from interviews and focus groups were coded and indexed through intensive content analysis in order to identify major themes and dominant narratives (Forbes, 2000). Structuring dominant narratives permitted the categorisation of the responses and provided opportunity to identify those that diverge from the common narratives emerging from the questionnaire surveys, focus group discussions and key informant interviews.

4 Results

The findings are discussed in the following sections structured based on the study objectives.

4.1 Land tenure arrangements and land management practices

Two categories of farmers can be identified in the study communities: indigenous farmers and migrant farmers (see Table 1). According to Owusu (2008, p.178), indigenous farmers are defined as natives of the land "…(sons of the soil) linked by shared identities related to clan, tribe, language, kinship system and so on". Indigenous farmers are natives of these communities. These were born in the study community and inherited their farmlands from their forefathers. The indigenous farmers have greater tenure security compared with poor migrant farmers. In contrast, migrants farmers are considered 'outsiders' or 'strangers', that have no such shared identity related to the land or soil (Owusu, 2008). Migrant farmers are those who migrated from different parts of the country (and sometimes from other countries) to settle and engage in farming activities because of the attractive agricultural conditions. Table 1 shows that the majority of migrant farmers were based in the Ejura Sekyedumase District compared to the Bongo District.

Table 1: Characterising the nature of farming households in the study area

Type of farmer	**Within Ejura Sekyedumase district**			**Within Bongo district**		
	Aframso	Babaso	Nyamebekyere	Adaboya	Ayelbia	Vea
Indigenous*	32	35	26	45	45	45
Migrants	13	10	19	0	0	0
Total	45	45	45	45	45	45

*Refers to farmers who are natives of the respective districts

Results from household questionnaire surveys and FGDs suggest that the majority of farmers renting their farmlands (i.e. tenant farmers) were using short-term soil conservation practices such as mulching and application of inorganic fertilizers to boost productivity, whilst farmers who have inherited their farmlands (i.e. owned lands) used both long-term conservation practices and adaptation strategies such as agro-forestry. During qualitative interviews, farmers who were renting farmlands claimed that the customary tenure system prohibits them from planting trees that could last longer than annual food crops and there are no immediate returns on such plantation crops to non-owner farmers. This has implications for adaptation to climate variability because land tenure arrangements constrain migrant (tenant) farmers' efforts to implement appropriate adaptation strategies that can mitigate the adverse effects of drought on their livelihood. This is illustrated by the following characteristic remarks:

> *We [migrant farmers] do not have any incentives to employ long term land management practices such as planting trees. We are mindful of the fact that the farmland has been rented out to us for just a short period. Thus, we mainly resort to short term land management practices that may not entail huge financial commitments* [Migrant farmer, Qualitative interview, Nyamebekyere, June, 2011].

> *I moved to this village 18 years ago. I do not own land in this village and therefore rent my farmland as a migrant. I pay money to my land owner at the end of the farming season. In terms of land management, I use mulching and leguminous crops such as beans* [Migrant farmer, Focus group participant, Babaso, June, 2011].

These quotes highlight that land management practices are influenced by the land tenure arrangement. It shows migrant farmers engage in short term land management practices that may compromise the sustainability of land management in the longer term.

4.2 Land tenure and climate change adaptation in study communities

Secure land tenure is critical for investment in land and water related climate change adaptations (Ngigi, 2009). Though related broadly to agricultural development, secure land tenure was described by 36% (n = 98) of respondents from across the resilient and vulnerable communities as acting as a barrier to climate adaptation (Table 2). The results also suggest marked differences between the number of farmers in the resilient and vulnerable communities in relation to the percentage of respondents citing complex land tenure system and gender issues as a climate

adaptation barrier. For instance, the results reveal that whilst few respondents (27%; n = 37) in the resilient communities believed land tenure was hindering climate adaptation strategies, almost half of the respondents (45%; n = 61) in the vulnerable communities described the complex land tenure system as a barrier.

Table 2: Number of famers reporting complex land tenure as a barrier for climate change adaptation

Location of farmer		**Land tenure as a barrier to climate change adaptation**		
			Yes	No
Within Ejura Sekyedumase district	Indigenous	Male	1	55
		Female	4	33
	Migrant	Male	15	7
		Female	17	3
Within Bongo district	Indigenous	Male	7	65
		Female	54	9
	Migrant	Male	0	0
		Female	0	0
Total			**98**	**172**

4.3 Differential impacts of land tenure arrangements on social groups

The analysis reveals that gender of the farmer may affect the perception of the complex tenure system as a barrier to climate adaptation. For example, of the 45% of farmers that cited the complex tenure system as barrier to climate adaptation in the vulnerable communities, only 11% were male, compared to a large majority of females (89%) (Table 2). Similar trends were observed in the resilient communities, where fewer males compared with females described the complex tenure system as a barrier. This is summarised by participants from women's focus group discussions:

> *Sometimes, women in this village are disadvantaged when it comes to accessing the most fertile land for farming. We rely mostly on our husbands for land and this can sometimes be problematic* (Female farmer, Adaboya, July, 2011).

> *I have no property rights over land in this community. I depend on my husband for farmland. I have access to the land but do not own the farmland* [FGD participant, Ayelbia, August, 2011].

Key informant interviews also suggest that migrant farmers are hindered in the pursuit of feasible adaptation practices closely linked to complex land tenure systems in the study area. One migrant worker stated:

> *As a migrant farmer working on a rented farmland, I am constrained in terms of what I could plant on this land. Tenure arrangements prohibit the planting of trees. This is because most trees and tree crops take longer to mature compared to annual crops and land owners may not want you to plant such trees. This is a serious disincentive for migrant farmers in this community* (Migrant farmer, Aframso, July, 2011).

Another migrant farmer complained during a key informant qualitative interview.

> *We do not have the same land rights as the native farmers. Most of the native farmers inherited their farmlands from their parents and therefore are not accountable to anybody. But migrant famers on the other hand need to observe the strict conditions that may be attached to a particular piece of land. All these can reduce agricultural productivity and make migrant farmers more vulnerable than native farmers* (Migrant farmer, Nyamebekyere, June, 2011).

The lack of tenure security was also captured during the expert interviews. An expert on land tenure issues at the National Lands Commission remarked:

> *There is the need to reform land tenure systems to make land more accessible for agricultural production and to implement adaptation measures. This is particularly important for female farmers in northern Ghana* [Expert, Lands Commission, Accra, March, 2012].

The analysis of the qualitative interview data suggest that migrant farmers in the Ejura Sekyedumase district and female farmers in the Bongo district were most constrained by land tenure arrangements. Boxes 1, 2 and 3 present a series of oral narratives provided by members of these social groups providing insights on the nature of land tenure problems. The oral narratives indicate that migrant farmers have less tenure security. This prohibits them from implementing certain adaptation strategies including agro-forestry (see Box 1). It also shows that the lack of tenure security reduces the ability of female famers and migrant farmers to use their lands as collateral to secure credit to implement adaptation practices (see Box 3). This may further exacerbate the vulnerability of these groups of farmers.

Box 1* – *Migrant farmer, – Mr Seidu at Aframso, Ejura Sekyedumase District*

Mr Seidu is a migrant farmer with four children – two daughters and two sons – and lives in a two bedroom house in Aframso. Mr Seidu was born in Walewale in the Northern region of Ghana but could not complete primary education. He is a 58 year old who migrated to Aframso in 1990s because of the conducive environmental and farming conditions there. He said: *I moved to Aframso with my family because life was very hard for us in the north. We are farmers but the environmental conditions in the north are quite difficult so we decided to move here*. Mr Seidu started life in Aframso by tending to somebody's cocoa farm, where he was given a share of the proceeds from the sale of the cocoa at the end of the farming season. With time, he started moving into producing maize, yam and rice. Mr Seidu rented his farmland and indicated that as a migrant he does not own land. He stated: *When I moved here land was easily available. You just had to see the chief and he would allocate part of the land to you for farming. But recently, demand for land has significantly increased for farming and non-farming purposes so land is scare in this village.* He continued: *People are coming from the cities with good money to purchase the land and this has placed a premium on the most fertile farmlands in the village.* Mr Seidu cultivates about 5 acres of land and harvests about 15 bags of maize per year. In terms of land tenure, he argued that he is prohibited from planting tree crops that may last longer than two years to be harvested. He indicated: *With regards to changing weather patterns [climate changes] some of us [migrants] cannot take advantage of planting tree crops because of the tenure arrangements*. He usually pays a bag of maize as rent for every acre of land after the farming season.

Box 2* – *Migrant farmer – Ms Safiatu at Nyamebekyere, Ejura Sekyedumase District*

Ms Safiatu, a 55 year old farmer at Nyamebekyere, lives with three daughters in a two bedroom aluminium roofed house. She has no formal education. She is a widow who moved to Nyamebekyere in the late 1980s. Ms Safiatu hailed from the Upper West region of Ghana but decided to migrate to the Ejura Sekyedumase district because of the attractive environmental conditions for farming. According to her, when she arrived at this village, she accessed fertile farmland without much difficulty. Sometimes, she and her then husband only needed to present some traditional drinks to the chief to be granted access to land. She remarked: *When we moved here in the 1980s, we presented drinks to the chief of the village and he showed us portion of land where we farmed. Even though we did not own this piece of land we had access to it and could grow our crops.* However, she asserted that things have now changed since the late 1990s and early 2000. She stated: *We have been renting farmland for growing our crops. Even with that things have changed. When we started renting land, we used to pay a token [small fee] for every acre of land annually. It was not any big money and many of the migrant farmers did not struggle to pay this.* Ms Safiatu posited that nowadays, there are changing tenure arrangements and negotiations for farmland in the village. She argued: *These days migrant farmers are asked to pay a bag of maize [estimated at about GHS200.00] for every acre of land rented after harvest.* What is even more worrying according to Ms Safiatu is the fact that even when one rents the farmland there are strict conditions that one must adhere to. She said: *As a migrant farmer renting land you cannot even grow plantation crops on rented lands. This prevents many of us from growing tree crops and other plantation crops that have the potential to regulate the micro environment and improve the environmental conditions. Land tenure arrangements are not favourable to migrant farmers and land is increasingly becoming a scarce resource.*

Box 3* – *Female farmer – Ms Baabata at Adaboya, Bongo District*

A lady who was born and grew up in this village, Ms Baabata lives with five children in a two bedroom house at Adaboya. She has no formal education and grows annual crops such as sorghum, millet and groundnuts to feed her family. Ms Baabata is one of two wives of the husband. She argues that according to tradition and customs, she could not own land and relies on her husband for her farmland. She reported: *Our tradition in this part of Ghana does not permit females to own lands. The land tenure system in this village is a bit unfavourable [discriminatory] to women because it does not allow women to own land. Women depend on their husbands for farmlands. Things become difficult for women when their husbands die or when there is divorce*. Ms Baabata argues that such situation does not augur well for their livelihoods which are principally agriculture based. She continued: *Land is fundamental for our livelihood and household food security and, therefore, anything that makes access to land difficult becomes a hindrance to the survival of the female farmer in these villages*. Further, Ms Baabata was of the opinion that land tenure could indirectly influence her ability to implement climate change adaptation measures. She argued: *I cannot use my farmland as collateral to secure credit from banks or any other financial institution to implement climate change coping measures such as venturing into non-agriculture-based livelihoods that may be less vulnerable to the adverse impacts of rainfall variability that are less directly linked to the changing weather patterns [climate change]*.

* For ethical reasons the real names of farmers have not been used

5 Discussion

5.1 Gender, climate change and land tenure arrangements

Our results suggest that land tenure is a potential constraint to the implementation of livelihood adaptation strategies to the adverse impacts of climate change in the study communities. Qualitative interview data suggest that two groups of farmers – migrant farmers in the resilient communities (located in the Ejura Sekyedumase District) and female farmers in the vulnerable communities (located in the Bongo District) – are especially disadvantaged by the current tenure system. Female farmers, especially those in the vulnerable communities, were more concerned with lack of tenure security as a result of social-cultural discrimination against women regarding distribution and ownership of farmland (see Box 3). Access to, and ownership of, farmland remains one of the greatest challenges in implementing appropriate climate adaptation strategies. Gender inequalities in access to land in many parts of Africa are well-documented (Place, 2009; Quan et al., 2004; Hilhorst, 2000). In Ghana, especially northern Ghana, women have weak tenure rights compared to their male counterparts (Whitehead and Tsikata, 2003). It should be stressed that efforts via the Land Administration Projects I and II are aimed at improving tenure security for vulnerable and the marginalised in society including females, elderly and migrant farmers.

That female farmers have less tenure security is worrying as it has serious implications for climate adaptation, food security and agricultural development more widely in Ghana. Women play a significant role in ensuring livelihood resilience at the household level (Ibnouf, 2011). For instance, it is estimated that in Africa, women contribute to over 70% of food production and over 85% of food distribution (Glazerbrook, 2011). In Ghana, a report by the Social Watch Coalition in 2010 indicates that women contribute about 87% of food production (Glazerbrook, 2011). Culturally, in rural Ghana, women share the greater household management burden and hence are supposed to obtain food for the household (Pickbourn, 2011). Despite this, women in sub-Saharan Africa in general and Ghana in particular are constrained by tenure insecurity that restricts their ability to implement certain adaptation measures to reduce their vulnerability to the adverse impacts of climate change and variability.

5.2 Migrant famers, access to land and land management practices in the study area

The results of this study suggest that the majority of farmers (86%, n = 37; Table 2) in the resilient communities that claimed complex land tenure system constituted a barrier to climate adaptations were mainly migrant farmers who were renting their farmlands (see Box 1). Most of

these migrant farmers have come from northern Ghana in search of better farming conditions. It is important to note that there were no migrant farmers in the vulnerable communities (i.e. Bongo District). A plausible explanation for this could be that generally there are limited environmental and economic opportunities compared to the resilient communities. Lack of economic opportunities and under-development in the Bongo district and the Upper East region could be attributed to colonial and past governmental policies that have often tended to neglect socioeconomic and infrastructural development of northern Ghana (Plange, 1979).

Migrant farmers have no communal rights to communal land and may acquire land for farming by entering into a contractual agreement with the chief (*odikro*) or the family head (*abusuapanyi*n) for a specific period of time (see Goldstein and Udry, 2008; Kasanga et al., 1996). Migrant farmers can also access land through share cropping arrangements, popularly known as *abanu* where the migrant worker gets land and farm inputs including seeds and fertilizers from a land owner and the crop harvests are shared equally between the land owner and the migrant worker (Antwi-Agyei, 2012).

Despite providing access to members of a particular clan (*abusua*) to carve out their livelihoods, the customary land tenure system may prohibit migrant farmers, from planting tree crops and trees that last longer than annual food crops. This means that such migrant farmers may not be able to implement certain climate adaptation strategies such as agro-forestry, thus limiting the ability to control their own decision making and ability to enact climate adaptation strategies. Indigenes of a particular community may also be prohibited from planting tree crops because under the customary land arrangement, members of the land owning family/clan are required to use the land, and to leave it to other members when they are no longer available to use it. Planting tree crops and trees that last longer than annual food crops may therefore deny other indigenes the right to use the land.

The importance of agro-forestry practices as a climate adaptation and mitigation strategy has been widely emphasised in many parts of the world (Kebebew and Urgessa, 2011; Albrecht and Kandji, 2003; Mbow et al., 2014). For instance, the integration of agricultural systems with trees on the same piece of land can ensure the complementary use of environmental resources that can enhance productivity (Altieri and Nicholls, 2005). Agro-forestry systems provide mitigation through carbon sequestration and adaptation measures (Verchot et al., 2007; Albrecht and Kandji, 2003). Sales of timber from agro-forestry bring financial resources that can be used to implement certain climate adaptation practices, thereby enhancing the adaptive capacity of vulnerable households (Kalame et al., 2011). Within the context of the existing Ghana's timber and forestry laws and regulations, land owners are required to pay a fee to the Ghana Forestry

Commission when harvesting trees planted on their farmlands. In effect, the trees are partly owned by the state. The fee covers the processing of permit to enable the landowners harvest and sell such trees. In drought prone regions, agro-forestry practices have the potential to improve the microclimate through the modification of temperature which consequently reduces heat stress and evapo-transpiration and can yield positive benefits for food production (Jose et al., 2004).

Whist highlighting the importance of tree planting and agro-forestry practices to reduce the vulnerability of farming households in the study communities to climate change, it is also critical to acknowledge the fact that, agronomically, there are practically many other farming practices including mulching, planting of leguminous crops, planting resistant varieties of crops and rain harvesting (Antwi-Agyei et al., 2014; Fosu-Mensah et al., 2012; Zinyengere et al., 2014) that smallholder farmers in semi-arid conditions could adopt to reduce their overall vulnerability to climate change and variability. For example, farming management practice such as mulching, has been found to reduce evaporation and able to retain soil moisture by increasing the organic matter content of the soil; thereby increasing water holding capacity of the soil (Ngugi et al., 2015), although different mulching materials have been found to have varying degree of success in reducing drying of the soil (Zribi et al., 2015). Other studies have demonstrated that farming households could adapt to climate change through the choice of cropping system and sowing date (Waha et al., 2012), planting resistant crops such as cassava (Jarvis et al., 2012) and appropriate use of climate change information in supporting adaptation ((Ziervogel et al., 2010). Besides implementing agronomic practices, the possession of local agro-ecological indigenous knowledge has been found to be critical in shaping adaptation efforts in dryland farming systems (e.g. Nyantakyi-Frimpong, 2013; Kalanda-Joshua et al., 2011; Speranza et al., 2010; Codjoe et al., 2014).

Poor soil fertility management and cropping practices that lead to low agricultural productivity in most parts of Africa have been partly attributed to a lack of land tenure security (Damnyag et al., 2012; Besley, 1995). For instance, migrant farmers have often resorted to unsustainable cropping practices that tend to reduce soil fertility, partly due to tenure insecurity, and this sometimes creates mistrust between natives and migrant farmers (Damnyag et al., 2012). It is argued that farmers will have a strong incentive to invest in land improvement and conservation practices when they have better land rights (Deininger and Jin, 2006; Besley, 1995). This finding confirms studies suggesting that insecure land tenure systems may hinder farmers in practising long-term soil conservation techniques (Damnyag et al., 2012; Toulmin and Quan, 2000; Fraser, 2004). On the contrary, migrant farmers may have valuable experience in managing

highly variable environments that may be useful in managing challenges associated with climate change (Isaac et al., 2014). Hence, singling out and drawing a direct causal effect between land tenure insecurity and a lack of investment in soil fertility that result in poor agricultural productivity in sub-Saharan Africa has been contested (Bugri, 2008). Non-tenure related factors such as inadequate and unreliable rainfall, bush burning, and lack of finance may also be attributed to the low agricultural productivity in sub-Saharan Africa (Bugri, 2008).

5.3 Socioeconomic and environmental factors constraining adaptation

Whilst acknowledging the potential for land tenure arrangements and gender in limiting the adaptation options available to migrant and female farmers in the study communities, it is equally important to place the discussion within the wider socioeconomic and environmental contexts that constrain adaptations and livelihood options available to small-holder farmers. While climate change is certainly an important factor that influences livelihoods in the study communities, socioeconomic factors including population growth and commercialisation of lands have also had major impacts on farmer's livelihoods and access to land. The commoditisation of land in Ghana due to peri-urban development and increasing commercialisation of land due to large-scale biofuel plantations (see Cotula et al., 2009; World Bank, 2010; German et al., 2011; Lund, 2008) has placed undue pressure on land ownership and access both in the rural and urban centres across parts of sub-Saharan Africa. In some cases, this has resulted in indigenous farmers having shrinking opportunities to access land to implement livelihood activities and adaptation strategies such as tree planting and agro-forestry systems. This is especially the case in situations where indigenous farmers who lack opportunities for non-farm income sources are unable to access adequate fertile farmlands because of either senior members of the family (including chiefs and clan leaders) selling portions of family land to investors or increased population growth leading to larger family size that reduces the size of land available to each member of the family.

Also, growing income inequalities has placed livelihoods of poor marginalised farmers in the study communities and Ghana more widely under considerable stress. Although this study suggests that poor female and migrant farmers generally lack formal access to land, it is important to highlight that the increasing commoditization of land (Yaro, 2012; World Bank, 2010) means that one's economic background (ability to pay) becomes a critical factor shaping access to land. Yet, the majority of women in the vulnerable communities who may have no financial capacity to acquire land can therefore only access land through marriage or sometimes by borrowing or begging (Yaro, 2010). Land inheritance in the vulnerable communities (located

in the Bongo District of the Upper East region) is through the male heir, and female right of usufruct is not recognised under the customary law (Yaro, 2010). Should the man and woman be divorced, the poor, marginalised woman would lose such land. Widows can access farmland only if they had male children with their husbands. Unmarried women have limited access to land and those who may have access tend to be given the most unproductive farmlands. The lack of secure property rights including access to tenure security by women may reduce the accessibility to sources of credit (see Box 3) (Quan and Dyer, 2008). This may subsequently affect the ability of such households to implement climate adaptation strategies. This is because most of the livelihood adaptation to climate change involves financial commitment (see Antwi-Agyei et al., 2014). Hence, any constraint that impinges on the ability of the farming household in dryland Africa farming systems to source credit can have a dire consequence for such households' climate change adaptation efforts.

In discussing the broader contextual factors that could influence vulnerability of farmers within these two districts (Ejura Sekyeduase and Bongo Districts), it is important to stress the good environmental conditions including high levels of rainfall and favourable soil conditions in the Ejura Sekyedumase district (EPA, 2003) may also have played a critical role in reducing the vulnerability of female farmers in the resilient communities. Other studies such as Yaro et al. (2014) and Berman et al. (2012) have also explored how local institutions can play critical role in helping local farmers in adapting to the adverse impacts of climate change in dryland farming systems. Again, socio-political processes at the local and national levels have been found to influence the adaptation options implemented by smallholders across Africa (Eriksen and Lind, 2009). For example, Ericksen and Lind (2000) reported that national economies and political structures affect local adaptation practices in Kenya.

6 Conclusions and land policy implications

The key finding from this paper is that land tenure arrangements, within the broader socioeconomic, environmental and political contexts, are implicitly involved in shaping the vulnerability of poor female and migrant farmers in Ghana. Our findings suggest that: (i) analysis of the key policy documents related to land tenure reveals that women's rights regarding land ownership are not comprehensively covered in current national land policy. There is the need to institute appropriate measures to reduce or eliminate these cultural discriminations against women by restructuring the land tenure system to ensure the rights of poor women on land ownership are fully recognised and granted. This will require intensive education programmes to sensitise chiefs, *tendana*s and other opinion leaders who are custodians of farmlands, on the need

to recognise women in decision-making relating to land tenure arrangements; (ii) it is important that public sector institutions such as the Lands Commission, the Survey Department, Ministry of Lands and Natural Resources that deal with land transactions in Ghana are supported by the Government of Ghana through institutional capacity building and the provision of good working conditions in order to strengthen their capacity to function effectively; (iii) opportunities for women in the Bongo district (and the Upper East in general) to own and formalise land registration titles should vigorously be pursued by the Government of Ghana. This may potentially help female farmers to secure property rights over land and use land as collateral to access credit that could be used to implement climate adaptation practices. Nevertheless, it needs to be stressed that Abdulai (2010) has questioned the commonly-held view that land rights which emanate from formal registration of land are associated with several benefits including increased investments and economic growth, and reduction in land disputes and conflicts, and; (iv) the Government of Ghana could encourage block farming, whereby the government rents a vast area of farmland and distributes this to various households to produce various agricultural crops. Households may be provided with farm inputs such as seeds and fertilizers. This will afford vulnerable households, which otherwise would not be able to access such farmlands and inputs, the opportunity to improve their livelihoods. This will be particularly a policy intervention for marginalised female farmers who are culturally discriminated by land ownership and acquisition practices in the vulnerable communities. Climate vulnerability is shaped by various socio-political and environmental factors. Therefore, it is further recommended that climate change adaptation policies in Ghana and more widely sub-Saharan Africa) should consider the broader socioeconomic, political and environmental contexts that could hinder the smallholder farmer's ability to implement adaptation measures. In this case, a bottom-up approach to land reforms should be encouraged in order to bring land administration closer to the people. The recommendations from this paper are very timely. The Government of Ghana, under the Land Administration Project (Phase II), is currently drafting a new Lands Bill for the consideration of Ghana's Parliament for passing into a Lands Act. These recommendations could feed directly into these national policy documents aimed at improving land administration and governance in Ghana.

Using a participatory mixed-method approach, this study adds to empirical work on land tenure by providing a nuanced understanding of the dynamics of land tenure and its implications for climate vulnerability among different social groups in Ghana. The paper shows that land tenure arrangements affect land management practices of different social groups of famers. It has demonstrated that migrant farmers who may have insecure tenure are more likely to engage

in short-term land and soil management practices. On the contrary, the results highlight that indigenous farmers are more inclined to engage in long-term land management and climate adaptation practices that have the potential to reduce their vulnerability to the adverse impacts of climate change. The paper also shows that farmers with less secure tenure (such as migrant workers) may lack property rights and could be disadvantaged with regards to sourcing credit because they cannot use such lands as collateral. Furthermore, the study has shed light on the possible impacts of land tenure arrangements on the adaptation choices available to the different farmers in the study communities. This paper has demonstrated that land tenure is importantly involved in disposing two groups of farmers – migrant farmers in the resilient communities (located in the Ejura Sekyedumase District) and female farmers in the vulnerable communities (located in the Bongo District) – as vulnerable by limiting the access of these two groups of farmers to land. This paper contributes to the academic discourse on climate change adaptation by providing empirical evidence to deepen our understanding of how land tenure could inhibit adaptation efforts by small-scale farmers, in rural Ghana and sub-Saharan Africa, in their attempt to implement appropriate adaptation and coping strategies to manage the impacts of climate change.

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