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Socioeconomic factors influencing farmers' specific adaptive strategies to climate change in Talensi district of the Upper East Region of Ghana

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Abstract

Purpose – Farmers all over the country have been exposed to various adaptation strategies to climate change. The adaptation options however focus too closely on technical skills and technologies and fail to address critical social factors such as culture, beliefs and values that influence the adoption and effective implementation of new adaptation technologies, skills and capacity. This paper aims to assess the socioeconomic factors influencing farmers' specific adaptive strategies to climate change in Pwalugu and Balungu communities in the Talensi district of the Upper East Region of Ghana. This study used purposive sampling technique to select the study communities, whereas simple random sampling technique was used to select a total of 100 respondents from the selected communities. Questionnaires, key informant interviews and focus group discussions were used in collecting data from respondents. This study used detailed statistical test to analyze the data, and the results are presented in the form of figures and tables. This study highlights the legal and institutional context which must be adopted for effective response to climate change impacts in rural communities in Northern Ghana. It also recommends that government and relevant stakeholders should collaborate with financial institutions to ensure that funds are readily available to farmers to enable them to effectively adapt to climate change as well as provide training/workshop programs to farmers to enhance their capacity in planning and implementing effective strategies to climate change.

Design/methodology/approach – This study used the integrated methodological approach where quantitative methods were combined with appropriate qualitative methods. According to Sandelowski (2000), this method ensures reliability (the extents to which results are consistent over time) and validity (the means of which measurements are accurate) of the research. A combination of participatory methods, including key informant interviews, household questionnaire surveys and focus-group discussions were used, allowing local people the opportunity to participate by sharing their experiences and knowledge to outline possible solutions to the problem at hand. Multiple methods (Yeasmin and Rahman, 2012) are good at reducing the inadequacies of a single method. Cross-sectional study was used in designing the research. Variables were measured or determined at the same period in a given population. This method allowed the assessment of practices, attitudes, knowledge and beliefs of a population in relation to a particular event or phenomenon (Olsen and George, 2014).

Findings – The findings of this study revealed farming as the major occupation in the two communities with males being dominant. Diverse livelihood activities such as fishing, animal/poultry rearing, firewood/

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charcoal production, hunting and driving were other activities respondents engaged to earn a living. In terms of institutional arrangements, avoidance of bush burning and tree felling were the norms influencing decision-making in the two communities. Fear of being punished, animals feeding on some of the grasses, trees inducing rainfall as well as benefits respondents get from trees were the reasons these norms were adhered to in the study area. Access to land, gender dynamics and finance were identified as the socioeconomic factors in the study area. High demands by landowners, last minute change of mind by landowners, limited fertile lands, lack of money to acquire lands, behavior of tenants, number of acres required and lands far from water bodies were the challenges associated with acquiring land in the communities. Access to finance influenced respondents' ability to acquire fertile lands, lands closer to water bodies and any number of acres of their choice. Gender however impeded women adaptation strategies to climate change. Women were not allowed to own land and other property in the form of animals simply because they are seen as migrants and they do not know the history of the land.

Originality/value – This is a master's thesis project. This paper shows the socioeconomic factors, which are influencing farmers' specific adaptation to climate change in the Talensi district of Ghana.

Keywords Climate change, Governance, Socio-economic factors, Adaptation, Adaptive strategies to climate change, Norms influencing climate change

Paper type Research paper

1. Introduction

Climate change is considered one of the most challenging global issues. International studies carried out suggest that Africa is particularly vulnerable to climate change and variability (Boko *et al.*, 2007). According to Ghil (2002), climate is seen as a renewable resource, which varies at all-time scales, from year to year, as well as from one decade, century or millennium to the next. Climate change may be defined as the gradual change in the weather pattern of the world over a long period, mainly as a result of human activities with respect to the environment (IPCC, 2007). It has become a developmental issue across the world because of its negative effects on human lives and the future of the world. It is exacerbated by the increase of greenhouse gas emission caused by human behavior (Ford *et al.*, 2011; Fussel, 2009; Parry *et al.*, 2008; Adger *et al.*, 2007).

The most devastating adverse impacts of climate change in most subtropical countries include frequent drought, increased environmental damage, increased infestation of crop by pests and diseases, depletion of household assets, increased rural urban migration and increased biodiversity loss, among others (Abaje and Giwa, 2007; Reilly, 1999). Scientific evidence also suggests that climate change has long-term negative impacts on agricultural productivity globally (Nellemann *et al.*, 2009). The severity of these impacts will ultimately be experienced differently, depending on location (IPCC, 2007). For instance, in the tropics and subtropics, crop yields are likely to fall by 10% to 20% because of increased climate variability (Thornton *et al.*, 2007).

In Ghana, agriculture is primarily small-scale and has been the backbone of the economy. It contributes about 35% of Ghana's GDP, generates about 30%-40% of the foreign exchange earnings and employs about 55% of the population (Ghana Fact Sheet, 2010). Despite its high contribution to the overall economy, this sector is challenged by many climate-related disasters such as prolonged dry spells and floods which are most often severe in Northern Ghana. Individuals, households and communities engage in a number of economic activities to earn a living. Prominent among these livelihood activities and strategies in rural areas is farming which incidentally is the worse hit by climate change.

Extensive research carried out on the impacts of climate change on agriculture revealed episodes of late rains for planting, variability in the pattern and levels of rainfall and intermittent droughts and floods to be the fundamental problems for farmers in Northern Ghana

(Nyantakyi-Frimpong, 2013; Amikuzuno and Donkoh, 2012; Acquah, 2011). This has become a threat to the livelihoods of farmers in this particular zone (Amikuzuno and Donkoh, 2012).

With fluctuations in the rainfall pattern and corresponding changes in food availability, farmers in Northern Ghana have developed intricate strategies to adapt to climate change. For instance, some farmers use traditional methods of weather forecast such as behavior of plants and animals to predict weather conditions and decide when to prepare lands and sow seeds (Gyampoh and Asante, 2011; Newsham and Thomas, 2011; Roncoli *et al.*, 2002). This indigenous knowledge makes it possible for farmers to adequately prepare in advance for any climatic catastrophe. Some farmers in the Talensi district have adopted the dry season farming along the White Volta as a major farming approach to address the rainfall issues (Gyampoh and Asante, 2011). Crop diversification is also practiced by some farmers as a viable strategy to resist shocks, decrease the risk of crop failure and, in so doing, reduce their vulnerability of livelihood to climate change (Thornton and Lipper, 2013). This therefore means that adaptation to climate change is not new to farming households and communities (Dixon *et al.*, 2014). Certain factors, however, limit the extent to which these adaptation strategies are fully applied.

Farmers in the Talensi district in the Upper East Region have been exposed to various adaptation strategies. Research carried out by Gyampoh and Asante (2011) showed that farmers have recently adopted the dry season farming along the White Volta as a major approach to address rainfall variability. Studies have also revealed that farmers' response to climate change through adaptation, however, appears to be weak. There appears to be a gap between the full range of adaptation options available to farmers, which have been made available through their own experiences and those that have been disseminated to them by Ministry of Food and Agriculture and other responsible organizations such as non governmental organizations (NGOs). These adaptation strategies help to improve their resilience and reduce the vulnerability of farmers to the impacts of climate change.

Farmers' adaptive response to climate change is weak because adaptation options available to farmers are influenced by a number of socio-economic factors (Nyanga *et al.*, 2011). Adaptation options however focus too closely on technical skills and technologies and fail to address critical social factors (culture, beliefs and values) that influence the adoption and effective implementation of new adaptation technologies, skills and capacity. For instance, land access, culture, beliefs and values as well as associated decision-making processes, among other factors influence farmers' ability to adopt specific strategies to climate change (Nyanga *et al.*, 2011; Smit and Skinner, 2002). Also, the top–down mode of planned adaptation support commonly provided by NGOs and governments with little attention given to building local agency and innovation could influence farmers' ability to adopt specific strategies to climate change (Smit and Skinner, 2002; Ludi *et al.*, 2012) .

However, several studies on the subject have only concentrated on the adaptation strategies of farmers to climate change and have actually reported a wide range of options adapted by farmers. These studies have not actually researched into the factors that influence the decision of a farmer to adapt a specific adaptation strategy, especially with regard to the socioeconomic background of farmers. The willingness of farmers to adapt a particular strategy is largely backed by their capacity, which is influenced directly by their socioeconomic factors and other institutional arrangements and support. This paper therefore seeks to bridge the gap in literature regarding the factors influencing the adoption of specific adaptation strategies by farmers in the Talensi district.

The overall aim of the study is to explore the socioeconomic factors influencing farmers' specific adaptive strategies to climate change. Specifically, the study aims to identify

institutional arrangements and socioeconomic factors influencing decision-making on specific adaptation strategies to climate change.

2. Study area

2.1 Location and demographic characteristics of the study area

Balungu and Pwalugu are the two communities in the Talensi district, which were used for the study from March 2017 to July, 2017. Talensi district came into existence after the Nabdam district was created out of the then Talensi-Nabdam district in 2012 (Establishment instrument 2012) (Ghana Statistical Service, 2010). It is located in the Upper East Region and has Tongo as its capital. It is bordered to the north by the Bolgatanga Municipal, south by the West and East Mamprusi districts (both in the Northern Region), Kassena-Nankana district to the west and Nabdam district to the east. The district lies between latitude 10° 15' and 10° 60' north of the equator and longitude 0° 31' and 1° 05' and west of the Greenwich meridian. It has a total land area of 838.4 km^2. The population of Talensi district as indicated by the 2000 population and housing census was 77,007 made up of 38,658 male and 38,349 females representing 50.20% male and 49.80% female respectively (Ghana Statistical Service, 2010).

2.2 District economy

Agriculture plays the major role in the local economy of Talensi. It employs about 2/3rd of the labor force and accounts for about 75% of the local gross domestic product. All economic activities are also dependent on it. Other activities undertaken by the people are livestock rearing, poultry production, fuel wood extraction, food processing, tourism and mining. Economic trees such as Shea and Dawadawa are extensively distributed in the wild. The harvesting and processing of the shea nuts and dawadawa fruits are dominated by women. The agro-processing industry includes the production of groundnut oil, shea butter, dawadawa (food additive or ingredient), pito as well as parboiling and milling of local paddy rice (Ghana Statistical Service, 2010). Industrial activity in the district is generally low. There are two main extractive activities in the district, namely, gold mining and quarrying. There is one commercial quarry in the district operated by Granites and Marbles Company Limited. The quarry produces cut rocks for export. The gold mining industry is not very developed. Lately, small-scale gold mining activity, popularly known as – galamsey (gather and sell) or – alakpiri|| has become rampant in the district. This gives an indication that there is substantial gold mineral deposit in the district (Ghana Statistical Service, 2010).

2.3 Vegetation and climate

The vegetation is Guinea Savannah woodland consisting of sparse short deciduous trees and a ground flora of grass. The most common economic trees are sheanuts, dawadawa, baobab and acacia (Ghana Statistical Service, 2010). The climate is tropical with two distinct seasons: a rainy season, which is erratic and runs from May to October and a dry season that stretches from October to April. The mean annual rainfall for the district is 95 mm and ranges between 88 mm and 110mm. The area experiences a maximum temperature of 45°C in March and April and a minimum of 12°C in December (Ghana Statistical Service, 2010).

3. Methods

3.1 Study approach and design

The study used the integrated methodological approach where quantitative methods were combined with appropriate qualitative methods. According to Sandelowski (2000), this method ensures reliability (the extents to which results are consistent over time) and validity

(the means by which measurements are accurate) of the research. A combination of participatory methods, including key informant interviews, household questionnaire surveys and focus-group discussions were used, allowing local people the opportunity to participate by sharing their experiences and knowledge to outline possible solutions to the problem at hand. Multiple methods (Yeasmin and Rahman, 2012) are good at reducing the inadequacies of a single method.

Cross-sectional study was used in designing the research. Variables were measured or determined at the same period in a given population. This method allowed the assessment of practices, attitudes, knowledge and beliefs of a population in relation to a particular event or phenomenon (Olsen and George, 2004).

3.2 Data collection instruments and techniques

Before the data collection, a reconnaissance survey was carried out to gain an insight into the nature of the study area. This helped to establish necessary contacts with opinion leaders. According to Burns and Grove (1999), data collection is a process of gathering information using questionnaires, interviews or observation. For the purpose of this research, a semi-structured questionnaire was used as the primary research instrument. The questionnaires were prepared in English but translated into local languages for non-English speaking respondents. The validated and pre-tested questionnaires were administered to farmers by face-to-face interactions.

Key informants' interviews and focus-group discussions were also used in the collection of data. These activities were carried out in each community aimed at generating conversations that uncover individual opinions. Key informants were selected based on their long farming experience (between 50 and 60 years). Each focus group composed of a minimum of eight to ten participants. Two separate focus group discussions, one for male and the other for females were conducted in each community resulting in four focus-group discussions for the two communities. Selection of these participants was random with the help of community leaders. The questionnaires were then distributed to respondents in the two communities excluding key informants and those who took part in the focus-group discussions. The completed questionnaires were then sorted and analyzed. A total of 100 questionnaires were administered to the farmers in the two communities.

3.2.1 Selection of communities and sampling techniques. Talensi district was used as the study area. Farmers in this area were actively involved in crop production during both the rainy and dry seasons. The communities in this district were purposely selected based on the following criteria: communities highly vulnerable to the impacts of climate change because of the unimodal rainfall pattern and communities whose major sources of livelihoods are highly climate dependent and communities very close to the White Volta. Two communities, namely, Pwalugu and Balungu were therefore purposively selected for the study.

This study also used simple random sampling technique to select the respondents in the two communities, as a complete list of active farmers in each community was obtained. Numbers were assigned to the names of the farmers and the numbers, which were randomly selected were the respondents that the questionnaires were administered to. The total respondents in each community was determined using Yamane table (1967). A sample size of 100 and 50 from each community was used for the study which was proportional to the size of their populations (Balungu total population = 754, Pwalugu total population = 1,001) (Ghana Statistical Service, 2010).

3.2.2 Data analysis and presentation. The data obtained from the respondents were coded in Statistical Package for Social Sciences version 20 to enable appropriate statistical

analysis to be made. Descriptive statistics such as frequencies and means were used in making analysis. Chi-square tests were also performed at 5% level on all the variables to determine significant differences between the male and female respondents in each community as well as between the two communities.

4. Results

4.1 Sociodemographic information of respondents

4.1.1 Distribution of respondents by community, sex and age class. The distribution of respondents in both Balungu and Pwalugu communities according to their sex and age class is shown in Table 1. The majority of respondents in Balungu (42%) were within 41-50 years with the least age class being above 71 years (representing 2%) of the total population. Chi-square analysis revealed no significant difference (p-value = 0.094, df = 5, χ^2 = 9.405) in age class between men and women in Balungu.

Age class of 31-40 years constituted the majority in Pwalugu community with the least age class been 61-70 years and above 71 years. There was significant difference (p-value = 0.011, df = 5, χ^2 = 14.919) in the age class of men and women in Pwalugu. The majority of men fall between 31-50 years and 41-50 years representing 18%, whereas majority of women representing 16% fall within the age class of 51-60 years. This implies that women in Pwalugu were relatively older than their men counterparts.

Also, when the two communities were compared, there was significant difference (p-value = 0.000, df = 5, χ^2 = 22.358) in the age class of men and women.

4.2 Institutional arrangements and socioeconomic factors influencing decision-making on specific adaptation strategies to climate change

4.2.1 Influence of communal norms on adaptation to climate change. Avoidance of bush burning and tree falling, especially fruit trees, are the most important norms in these two communities. In Balungu, 98% respondents admitted that these norms are adhered to. In Pwalugu, 78% of respondents agreed that these norms were obeyed by community members, whereas 22% said these norms were not obeyed.

Community	Sex	Age class (years) 31-40	41-50	51-60	61-70	above 71	Total
		N (%)	*N* (%)	*N* (%)	*N* (%)	*N* (%)	*N* (%)
Balungu	Male	6 (12.0)	14 (28.0)	2 (4.0)	4 (8.0)	1 (2.0)	29 (58.0)
N = 50	Female	6 (12.0)	7 (14.0)	7 (14.0)	0 (0.0)	0 (0.0)	21 (42.0)
	Total	12 (24.0)	21 (42.0)	9 (18.0)	4 (8.0)	1 (2.0)	50 (100.0)
	p-value						0.094
Pwalugu	Male	9 (18.0)	9 (18.0)	4 (8.0)	3 (6.0)	3 (6.0)	36 (72.0)
N = 50	Female	4 (8.0)	2 (4.0)	8 (16.0)	0 (0.0)	0 (0.0)	14 (28.0)
	Total	13 (26.0)	11 (22.0)	12 (24.0)	3 (6.0)	3 (6.0)	50 (100.0)
	p-value						0.011*
Total	Male	15 (15.0)	23 (23.0)	6 (6.0)	7 (7.0)	4 (4.0)	65 (65.0)
N = 100	Female	10 (10.0)	9 (9.0)	15 (15.0)	0 (0.0)	0 (0.0)	35 (35.0)
	Total	25 (25.0)	32 (32.0)	21 (21.0)	7 (7.0)	4 (4.0)	100 (100.0)
	p-value						0.000***

Notes: *N* = sample size, % = sample percentage; *= significant at 0.01; **= significant at 0.001; ***= significant at 0.0001

Table 1. Distribution of respondents by community, sex and age class

Focus-group discussions and key informant interviews from both communities also revealed that, these norms have been adhered to. There is the presence of tree felling and bush burning committees in both communities that ensure that these norms are adhered to. Figure 1 gives the reasons why these norms were adhered to in both communities. Benefits they get from trees when they are left on farms was the major reason respondents adhered to the norms constituting (66%) in Balungu and (40%) in Pwalugu. This reason (benefits they get from trees when they are left on farms) was significantly different (p-value = 0.009, df = 1, $\chi^2 = 6.784$) between the male and female respondents in the two communities.

4.3 Associations within the community that influence respondents ability to adapt to climate change

The presence of groups/associations within the community can influence farmers' ability to adapt to climate change. This influence could be in terms of support or training received either by government or NGO. In Balungu community, 34% of the respondents received training on how to adapt to climate change, whereas the remaining 66% did not. In Pwalugu community, 28% of the respondents received training, whereas 72% did not receive any training on adaptation to climate change.

Planting or sowing in lines was identified as the major training received by respondents in both communities (34% in Balungu and 24% in Pwalugu). The least training received in Balungu was fertilizer application (constituting 6%), whereas storage skills (representing 2%) was cited as the least adaptive training received by respondents in Pwalugu.

There was no statistical difference (planting or sowing in lines; p-value = 0.271, df = 1, $\chi^2 = 1.214$, preparation of farm beds; p-value = 0.749, df = 1, $x^2 = 0.102$ and how to build animals/keep animals; p-value = 0.564, df = 1, $\chi^2 = 0.332$, among others) in the type of training received by the male and female respondents in the two communities. Table 2 shows the type of training received by respondents in adapting to climate change in the two communities.

The training received by respondents impacted positively on them. Majority of the respondents in both communities (34% in Balungu and 32% in Pwalugu) outlined increased in total crop output as a significant impact of the training on them. Efficient use of fertilizer (16%) as well as strong and healthy crops (16%) were the second most important impacts of the training on respondents in Balungu, whereas improved storage skills (10.0%) was identified as the second important impact of the training on respondents in Pwalugu. Improved storage skills (p-value= 0.022, df = 1, $\chi^2 = 5.263$) through chi-square test was statistically significant between the male and female respondents in the two communities. Table 3 gives a summary of how the training has improved the adaptation ability of respondents in both communities.

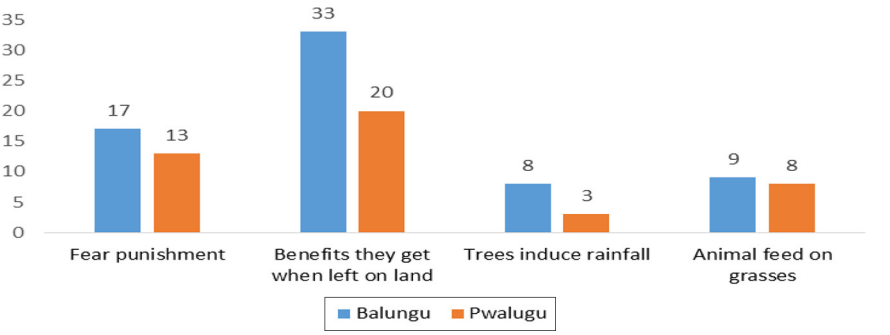

Figure 1.
Reasons why these norms are adhered to in both communities

4.4 Socioeconomic factors

A lot of socio economic factors influence how farmers adapt to climate change. These include access to land, gender and finance among others.

4.4.1 Access to land. Access to land was found to be a major factor impeding on the specific adaptation strategies of farmers in both communities. Behavior of tenants (52%) and lands far from water bodies (10%) were the major and least challenges associated with acquiring land in the two communities. Challenges and access to land are influenced by a number of factors as shown in Table 4.

Not all lands are suitable for farming. Respondents' choice of land for farming is influenced by a number of factors. Fertility of the land (representing 76%) and presence of trees on land (representing 19%) were the major and least factors influencing the choice of land for farming in the two communities. Land, which is free from intruders (p-value = 0.000, df = 1, χ^2 = 32.667), was identified to be statistically significant between the male and female respondents in the two communities through chi-square test. The various factors influencing respondents' choice of land for farming are outlined in Table 5.

4.4.2 Finance. Financial resources is another factor that influences how farmers adapt to climate change. Their access to finance makes it easy to acquire lands and farm materials. Figure 2 shows how access to finance influences their ability to acquire lands. Respondents cited fertile lands (78% in Balungu and 61% in Pwalugu) as the major financial factor influencing their adaptation to climate change. There was significant difference (p-value = 0.000, df = 1, χ^2 = 12.148) in fertile lands of male and female respondents in the two communities whereas,

Type of training received by respondents	Balungu $N = 50$	Pwalugu $N = 50$	Total $N = 100$	p-value
	N (%)	N (%)	N (%)	
Planting or sowing in lines	17 (34.0)	12 (24.0)	29 (29.0)	0.271
Preparation of farm beds	6 (12.0)	5 (10.0)	11 (11.0)	0.749
How to build animal houses/keep animals	8 (16.0)	6 (12.0)	14 (14.0)	0.564
Storage skills	4 (8.0)	1 (2.0)	5 (5.0)	0.169
Fertilizer application	3 (6.0)	3 (6.0)	6 (6.0)	1.000
Spacing in between crops	6 (12.0)	8 (16.0)	14 (14.0)	0.564

Notes: N = sample size; % = sample percentage; *= significant at 0.01; **= significant at 0.001; ***= significant at 0.0001

Table 2. Type of training received on adaptation to climate change by respondents

Impact of training on respondents	Balungu $N = 50$	Pwalugu $N = 50$	Total $N = 100$	p-value
	N (%)	N (%)	N (%)	
Increase in total output	17 (34.0)	16 (32.0)	33 (33.0)	0.832
Spraying becomes easy	6 (12.0)	4 (8.0)	10 (10.0)	0.505
Efficient use of fertilizer	8 (16.0)	4 (8.0)	12 (12.0)	0.218
Improved storage skills	0 (0.0)	5 (10.0)	5 (5.0)	0.022*
Strong and healthy crops	8 (16.0)	3 (6.0)	11 (11.0)	0.110
Animals free from diseases	2 (4.0)	0 (0.0)	2 (2.0)	0.153

Notes: N = sample size; % = sample percentage; *= significant at 0.01; **= significant at 0.001; ***= significant at 0.0001

Table 3. Impacts of training on adaptation to climate change on respondents

lands closer to water source (p-value = 0.221, df = 1, χ^2 = 1.500) and any number of acres you want (p-value = 0.102, df = 1, χ^2 = 2.667) were not significantly different between the male and female respondents in the two communities.

4.4.3 Gender. Gender is another factor that influences farmers' adaptation strategies to climate change. In both, Balungu and Pwalugu communities, gender was found to be impeding farmers' adaptation strategies to climate change. Women especially were not allowed to own lands and hence created a cultural barrier on how effectively they can adapt to climate change. Focus-group discussions highlighted that as a result of this cultural barrier, women cannot cultivate crops of their own choice as they do not have access to their own land. This negatively

Table 4. Challenges associated with land acquisition in study area

Challenges associated in acquiring land for farming	Balungu $N = 50$	Pwalugu $N = 50$	Total $N = 100$	χ^2 p-value
	N (%)	N (%)	N (%)	
High demands by landowners	13 (26.0)	9 (18.0)	22 (22.0)	0.334
Last minute change of mind by landowners	4 (8.0)	8 (16.0)	12 (12.0)	0.218
Limited fertile lands	24 (48.0)	16 (32.0)	40 (40.0)	0.102
Lack of money to acquire lands	21 (42.0)	23 (46.0)	44 (44.0)	0.753
Behavior of tenants	27 (54.0)	25 (50.0)	52 (52.0)	0.689
Number of acres required	6 (12.0)	7 (14.0)	13 (13.0)	0.766
Lands far from water bodies	1 (2.0)	9 (18.0)	10 (10.0)	0.008**

Notes: *= significant at 0.01; ** = significant at 0.001; *** = significant at 0.0001

Table 5. Factors that influence respondents' choice of land for farming in both communities

Factors influencing choice of land for farming by respondents	Balungu $N = 50$	Pwalugu $N = 50$	Total $N = 100$	p-value
	N (%)	N (%)	N (%)	
Fertility of the land	39 (78.0)	37 (74.0)	76 (76.0)	0.640
Types of crops to grow	30 (60.0)	25 (50.0)	55 (55.0)	0.315
Presence of trees on land	8 (16.0)	11 (22.0)	19 (19.0)	0.444
Evenness of land	15 (30.0)	12 (24.0)	27 (27.0)	0.499
Proximity to water source	11 (22.0)	15 (30.0)	26 (26.0)	0.362
Land free from intruders	6 (12.0)	34 (68.0)	40 (40.0)	0.000***

Notes: *= significant at 0.01; **= significant at 0.001; ***= significant at 0.0001

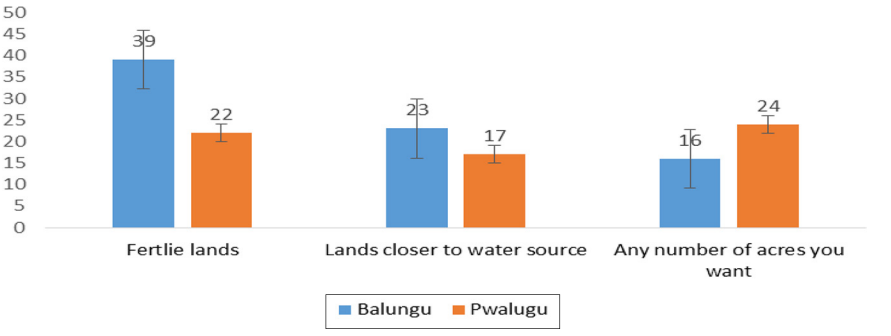

Figure 2. Influence of finance on ability of respondents to adapt to climate change

affects their adaptive capacity to climate change. Among respondents interviewed, 98% admitted that women are not allowed to own lands whereas 2% were uncertain. Key informant interviews and focus-group discussions also unveiled that women whether migrants or natives are not eligible to own lands. Traditionally, ownership of land rests entirely on only men, who are the heads of the families in the communities.

Figure 3 presents the reasons why women are not allowed to own land in those communities. Women being migrants was the major reason (68% in Balungu and 42% in Pwalugu) why women are not allowed to own lands in the communities. Also, women not knowing the history of the land (26%) and lands belonging to the family (32%) were the least reasons given by respondents in Balungu and Pwalugu, respectively.

There was significant difference (p-value = 0.009, df = 1, χ^2 = 6.828) in women being migrants of the male and female respondents in the two communities. However, women not knowing the history of the land (p-value = 0.509, df = 1, χ^2 = 0.437) and lands belonging to the family (p-value = 0.834, df = 1, χ^2 = 0.044) were not statistically significant between the male and female respondents in the two communities.

5. Discussion

5.1 Sociodemographic characteristics of respondents

All the respondents were farmers. There was however a higher percentage of male farmers than female farmers in both communities. This observation is consistent with the 2014 report by the Ghana Statistical Service, which stated that more males are engaged in agriculture in the Talensi district than females. Apart from farming, other important sources of livelihood activities of the respondents include trading, animal/poultry rearing and firewood/charcoal production, among others with trading being the second most important activity undertaken by them. This means that respondents have diverse livelihood activities. According to Lansigan *et al.* (2000), having diverse livelihood options helps farmers to adapt to climate change when food production becomes more risky. Khan *et al.* (2009) explains that these livelihood opportunities are essential as an insurance mechanism. From the focus-group discussion, it was revealed that majority of the women were into fruit collection, especially black berries, wild grapes and shea nuts. This supports the findings by Carette *et al.* (2009) that rural women in Northern Ghana are into shea nuts collection. It also agrees with findings by Schreckenberg (2004) that women in West Africa are responsible for the collection and processing of *Vitellaria paradoxa* (shea nut) in parklands.

To maximize output in agriculture, the most important factor is age. According to Gbegeh and Akubuilo (2012), farmers' age can have either a positive or negative influence on their decisions to adopt new technologies. From the results, the majority age class differed in both

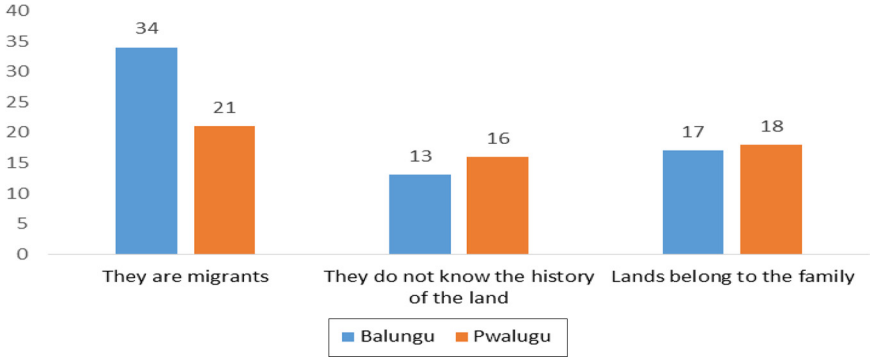

Figure 3.
Reasons women do not own land in study communities

communities. In Balungu, the majority age class was within 41-50 years, whereas in Pwalugu, it was 31-40 years with the males been dominant. These age classes suggest that majority of the respondents were young and have farming experience and will be in a better position to identify the governance and socioeconomic issues influencing their adaptation measures against climate change. According to Osewa *et al.* (2012), young and active individuals are more productive than too old and weak people.

5.2 Institutional arrangements and socioeconomic factors influencing decision-making on specific adaptation strategies to climate change

All adaptation practices depend for their success on specific institutional arrangements. According to Lusthaus (2002), institutions are defined as the formal and informal rules by which system actors interact. They involve a range of areas such as normative structures, culture, legal frameworks, policies and trends. Studies by Smit and Skinner (2002) revealed that, the institutional context within which a farmer acts can restrict a farmer's adaptive capacity directly through rules and regulations or increase capacity by providing support for adopting certain adaptation strategies.

5.2.1 Influence of communal norms on adaptation to climate change. Both Balungu and Pwalugu communities are endowed with several norms, values and practices. However, some of these communal norms influence respondents' adaptation to climate change positively. The two most important communal norms influencing adaptation to climate change were: avoidance of bush burning and tree felling, especially felling of trees such as the shea (*Vitellaria paradoxa*) and dawadawa (*Parkia biglobosa*). This is consistent with study by Stafford-Smith *et al.* (2011), who explained that, cultural norms and values influence individuals' responses to climate change. In Pwalugu, bush burning, especially burning before the "Tigaani" festival is strictly forbidden. Sweeping of the chief's palace, fines and to some extent imprisonment are some of the punishments associated with violating these communal norms. It was realized that these norms were more adhered to in Balungu than in Pwalugu. This is attributed to the effectiveness of the bush burning and tree-felling committees in Balungu. Apart from the punishments associated with violating these norms, respondents outlined several reasons for adhering to these communal norms. According to respondents, avoidance of bush burning ensures the availability of grasses (fodder) where their animals can feed on. This buttresses the point made by Akudugu *et al.* (2012) that, increasing bushfires is another indirect effect of climate change on food and nutrition security in Northern Ghana. Also, the benefits from trees such as shade, fruits and inducement of rainfall, among others were some of the reasons respondent adhered to the communal norms.

From the focus-group discussions, it was observed that, fruit collection is traditionally the role of women. This means that men are not allowed to gather or collect fruits such as shea nut, berries and dawadawa, among others. This actually impedes the capacity of men who want to go into shea butter and shea pomade production as an adaptation strategy.

Women are not allowed to go out for fruit collection before 4:00 a.m.. This communal norm facilitates adequate adaptation to climate change in the community. This goes a long way to help prevent problems with women collecting fruits on lands, which do not belong to them. This norm therefore allows all women a fair access to their fruits on their lands, which becomes a safety net for them in terms of negative impacts of climate change.

Women in both communities are allowed to plant trees as against other communities, where it is prohibited. This observation deviates from the findings by Chavangi (1994), where communal norms inhibit women from planting trees in Kenya. It was revealed that Ghana Social Opportunities Project are deeply involving women in planting trees and rehabilitating degraded forests within the communities. This initiative increases the capacity of women in adapting to

climate change, as it exposes them to various livelihood activities. This is consistent with the report by Ipara (1993), who observed that 25% of women planted trees in western Kenya.

5.3 Associations within the community that influence respondents' ability to adapt to climate change

Very few respondents (34% in Balungu and 28% in Pwalugu) benefitted from associations within the community in adapting to climate change. It was realized that, being a member of an association within the communities aids in receiving support from either government or NGO. With regard to the benefits received by respondents in adapting to climate change, the results were consistent with Vidal (2009) who observed that government support that would help poor farmers in most developing countries to adapt to climate change is very limited. There was a higher number of beneficiaries in Balungu than in Pwalugu. This training/support received from the benefactors impacted positively on them in diverse ways. Majority of the respondents mentioned improvement in total output as a positive impact. They narrated that planting in lines, spacing in between plants, preparation of farms and dip fertilizer application resulted in increased output. Also, spraying becomes easier when planted in lines. Some even explained that dip fertilizer application results in efficient use of fertilizer and reduced the amount of money spent in purchasing fertilizers. Those who received training on proper storage also unearthed their views on how it has reduced rodents spoiling their produce. Respondents who received training on how to build and keep their animals cited that, creating small holes within the animal houses allow for ventilation especially in the dry/warmth season. Also, proper spacing of animals in their rooms minimizes disease outbreak. This shows that the training given by either government or NGO to respondents has positive impacts on them and hence being a member of this association will actually improve your adaptive capacity. This supports the findings by Antle and Capalbo (2010) that, institutional support and social networks are among the factors influencing farmers' adaptive capacity to climate change.

However, majority of the respondents in both communities did not receive any training or support. Lack of training on adaptive strategies to climate change has hindered farmers in developing specific adaptation strategies to climate change. This has impacted negatively on the ability of farmers to cope with the adverse impacts of climate change. According to Batterbury (2004), farmers have developed their own traditional methods and techniques of adapting to climate change at the farm level as a result of the inadequate support from government. Findings by Nkonya *et al.* (2008), Yesuf *et al.* (2008), Mariara and Karanja (2007) as well as Stafford-Smith *et al.* (2011) explained that, farmers are more likely to adjust their farming practices in response to climate change if adequate training is given to them. In addition, farmers with access to extension services are likely to perceive changes in the climate because they have information about climate and weather changes (Gbetibouo, 2009).

5.4 Socioeconomic factors

Socioeconomic factors to adaptation can be related to the different ways in which people experience, interpret and respond to climate change. Moser and Ekstrom (2010) reported that, social barriers to agricultural adaptation broadly arise from the socio-institutional context within which the farmer acts.

5.4.1 Access to land. Access to land is a serious factor affecting the adaptation of specific adaptive strategies by respondents. Lands in these communities are owned by chiefs and families. Acquiring lands for farming is therefore not easy. The study therefore looked at the challenges influencing land acquisition for farming in the two communities. From the results, behavior of tenants was identified as the major factor. According to landowners, some tenants will come for the land in the name of farming and later sell it to other tenants at

higher prices without their consent. Other tenants also refused to plant the crops specified by the landowners. Instead, they go about planting trees on the land, which later occupies the entire space on the farm and violating the contract.

Lack of money was also identified by respondents as a challenge to land acquisition in both communities. Renting or acquiring land for farming involves paying the landowner, which is not a small amount. Landowners who do not take money require you to plough their lands for them. After satisfying the requirement of the landowners, there will be little or no money left to purchase farm materials for farming, especially if you are practicing irrigation.

Limited fertile lands were also identified as a challenge to proper adaptation to climate change. According to respondents, most of the lands landowners rent out are not fertile and are very far from water sources. Farming on such lands therefore become difficult and is capital intensive.

Farmers also take into consideration certain factors when searching for lands to farm. It was realized that the choice of land for farming differed in the two communities. In Balungu, fertility of the land was the most important choice respondents considered followed by the types of crops to grow. Access to fertile land, among others, is a factor identified by Bryan *et al.* (2009) to influence adaptation strategies at the farm level.

In Pwalugu, however, types of crops to grow was the first and foremost choice by respondents followed by presence of trees on land. The difference in the choice of land for farming may be attributed to the intensive dry season farming taking place in Pwalugu. Certain soils support certain crops. Most respondents who were into calabash production narrated that it does not require fertile land and can virtually survive in every soil. Also, farmers who cultivate crops around the riverbank planted water-loving crops such as rice, as the floods could come at any time and the presence of trees will reduce the impact of the water on the land hence, their reason for looking out for trees on suitable lands.

5.4.2 Access to finance (credit). Access to credit has a positive influence on the decision to adopt a climate change adaptation practice. From the results, respondents' ability to purchase lands for farming was influenced by access to finance. This assertion is supported by Bryan *et al.* (2009) who noticed that, farmers are more likely to adapt if they had access to credit. When respondents were asked how access to finance influenced land acquisition, majority of the respondents in both communities said access to finance will aid in getting fertile lands. Getting fertile lands depends on the amount of money you can pay for it. The higher you pay, the more fertile land you get from landowners. Also, lands closer to water source and the number of acres you desire can easily be obtained as long as you can pay for the land. This observation is emphasized by Gbetibouo (2009), Daressa *et al.* (2009) and Benhin (2006), who said access to credit influences farmers' financial resources thereby enabling them to purchase fertile lands and other inputs such as drought-tolerant varieties. This also confirms the findings by Smit and Skinner (2002) that, lack of adequate financial resources is an important factor constraining farmers' use of adaptation measures.

5.4.3 Gender. Gender was found to be a major socioeconomic factor influencing respondents' adaptation to climate change. The effect of gender on adopting strategies to climate change is location specific (Gbetibouo, 2009). From the study, it was realized that women in both communities are not allowed to own land. This was justified by majority of the respondents who said women are seen as migrants and hence cannot own land. Even women who are natives are not entitled to own any land of their own. Land ownership in these communities rests solely on men, as they are seen as the heads of the families. This observation agrees with Place (1994) that, the land tenure systems in many parts of Africa have granted male adults the rights to own and dispose of land. Women are only allowed to own their own land when their husbands are dead. This observation is similar to the study carried out by Tenge *et al.* (2004), who found that females have less access to land and other

resources because of traditional social barriers, which negatively influenced adoption of technologies. It is also consistent with studies in Uganda, where access and control over land and complementary factors of production is lower in female-headed households compared to male-headed households (Koru and Holden, 2008; Blackden and Wodon, 2006; Doss and Morris, 2001). This creates a cultural barrier for women who want to make good use of the land in adapting to climate change. This is because women cannot cultivate crops of their own choice, as they do not have access to their own land. They therefore cannot adapt suitable specific adaptation strategies to overcome the adverse effects of climate change. This ultimately results in reduced capacity of women to adapt to climate change. Maddison (2006) and Gbetibouo (2009) explained that, this barrier undermines women's capacity to embrace labor-intensive agricultural innovations of adoption. This results in women having fewer capabilities and resources than men (Gbegeh and Akubuilo, 2012; Marenya and Barrett, 2007). This therefore goes a long way to affect their access to land for farming hence making them more vulnerable to the impacts of climate change. The findings by Jones and Boyd (2011) do not deviate from this observation. According to them, societal norms and values act as a major barrier to successful climate adaptation in western Nepal.

Women not knowing the history of the land was another reason cited by respondents why they cannot own land. According to them, adequate knowledge about the origin of their lands counts a lot. It involves pouring libation to appease the gods at the beginning and ending of the farming season. As women cannot perform this task, they are not eligible to own lands. This assertion is consistent with studies by Carr (2008) and Kuruppu (2009), who concluded that gender, religion and ethnic identity play a significant role in climate change adaptation.

The head of every family is always a male and so a woman cannot be the head of the family. This was also a reason given by respondents why women cannot own land. Studies in Uganda by the Ministry of Finance, Planning and Economic Development has revealed that climate change has negative implications on females who have inadequate access to ownership of land (Ministry of Finance, Planning and Economic Development [MFPED], 2002). This is supported by Chowdhury *et al.* (1993), who highlighted how cultural norms in a number of south Asian nations increases female vulnerability to flooding.

From the focus-group discussion, it was revealed that property in the form of animals such as cattle, sheep, goats and fowls in the family were predominantly owned by men. Studies done by Daressa *et al.* (2009) asserted that, livestock ownership plays a critical role when adapting to climate change. Women in the two communities have limited access to these animals. This acts as a barrier and inhibits their adaptation to climate change. This finding supports the observation by Gbegeh and Akubuilo (2012) that, women in many parts of Africa are often deprived of property rights because of social barriers. It also agrees with Blackden and Wodon (2006) that, women who own fewer working animals are less likely to adapt good strategies to climate change.

Several studies on gender has therefore revealed that, unequal distribution of assets between men and women in rural households may either favor or constrain their adaptive capacities (Meinzen-Dick *et al.*, 2010; IFPRI, 2001).

6. Conclusion and recommendation

The findings of the study revealed farming as the major occupation in the two communities with males being dominant. Diverse livelihood activities such as fishing, animal/poultry rearing, firewood/charcoal production, hunting and commercial driving were other activities respondents engaged in to earn a living.

In terms of institutional arrangements, avoidance of bush burning and tree felling were the norms influencing decision-making in the two communities. Fear of being punished, animals

feeding on some of the grasses, trees inducing rainfall as well as benefits respondents get from trees were the reasons these norms were adhered to in the study area.

Access to land, gender dynamics and finance were identified as the socioeconomic factors in the study area. High demands by landowners, last minute change of mind by landowners, limited fertile lands, lack of money to acquire lands, behavior of tenants, number of acres required and lands far from water bodies were the challenges associated with acquiring land in the communities. Access to finance influenced respondents' ability to acquire fertile lands, lands closer to water bodies and any number of acres of their choice. Gender however impeded women adaptation strategies to climate change. Women were not allowed to own land and other property in the form of animals simply because they are seen as migrants and they do not know the history of the land.

Since lack of financial assistance was the most important challenge affecting farmers' adaptation strategies to climate change in the two communities, thus, it is recommended that government and relevant stakeholders should collaborate with financial institutions to ensure that funds are readily available to farmers to enable them to effectively adapt to climate change. These funds could be in the form of credit where beneficiaries will payback subsequently. There should also be concentered efforts by government to include financial packages to the climate change adaptive policies and programmes it introduces to farmers. This gives the farmers the capacity to adapt the strategies without much challenge.

Access to education and training is vital in developing specific adaptive strategies to climate change. Very few respondents received training on how to adapt to climate change. Government through the department of agriculture should provide training/workshop programmes to farmers to enhance their capacity in planning and implementing effective mitigation and adaptation strategies to climate change. The adaptation strategies could include adjustment in planting time, crop diversification, irrigation, change method of crop/animal production, migration and trading, among others. Moreover, there should be emphasis on the importance of forming social groups/cooperatives within the communities.

Government should establish a legal and an institutional arrangement framework that will ensure that women within the two communities have access to properties such as land and animals as well as avoid felling of trees purposely for charcoal production as mitigation strategies. This will go a long way to improve their adaptive capacity to climate change.

It is also recommended that the farmer based organizations (FBOs) in the two communities should initiate steps to personally train their members on some novel adaptation strategies using local resources to boost the adoption of these strategies. The farmers in FBOs are also encouraged to embark on group projects in respect to the adoption of some strategies such as tree planting. The group dynamics encourages participation, learning and pooling of resources together.

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