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Swedish University of Agricultural Sciences

Faculty of Natural Resources and
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How to Live and Cope with Climate Change

- Coping Strategies of Small-Scale Farmers in Upper East Region, Ghana

Gabriel Antwi- Boasiako

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Ghana

Gabriel Antwi-Boasiako

Supervisor: Örjan Bartholdson, Department of Urban and Rural Development, SLU

Examiner: Kjell Hansen, Department of Urban and Rural Development, SLU

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Abstract

In Ghana, the Upper East Region (UER) is considered as one of the poorest regions of the country. It consists of a poor subsistence agricultural region, where the population suffers from low levels of education and poor development of infrastructure and other forms of state investments.

The threat of climate change, such as enhanced average temperatures and weather variability risk making the people more vulnerable than before, especially, the small-scale farmers, whose livelihoods are directly dependent on the climate conditions.

This research study explores how climate change affects livelihoods, with extensive discussions on the social situation of rural small-scale farmers, including gender relations, and tried to demonstrate how they have coped with some of these challenges. The role the state (Ghana) is specifically emphasized.

Key words: Climate Change, Coping Strategies, Ghana, Upper East Region, Small-scale farmers

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List of Abbreviations

CEPA- Centre for Policy Analysis

COP- Conferences of Parties

GoG-Government of Ghana

NFEA- Non-Farm Economic Activities

ODI- Oversea Development Institute

PRA-Participatory Rural Appraisal

SADA- Savannah Accelerated Development Authority

UER-Upper East Region

UNDP-United Nation Development Program

The paragraphs which follow, reveals a description of events surrounding climate change at the global level including the African continent. Furthermore, challenges which hinder the progress and development of Ghana, especially, among small-scale farmers with respect to climate change are discussed. It provides a general overview of the recognition of challenges posed by climate change by the state (Ghana) and some activities which are under implementation to ameliorate the effects. The section concludes with some of the gaps raised by researchers which inhibit the process and the need to target and develop climate change policies at the local level.

I. Introduction

The ongoing climate change and the interconnected climate fluctuations have become an issue of grave concern all over the globe, especially for many developing countries, which are mostly dependent on agriculture (IPCC, 2007). The beginning of the early 1990s, with the introduction of the Earth summit in Rio de Janeiro and recently the Conference of Parties (COP)¹ 15, 16 and 17 conferences in Copenhagen, Cancun and Durban have all addressed this issue with utmost priority. Research reveals that many poor countries, a majority of which are found in Africa, risk being badly affected by the ongoing global warming and its interconnected consequences. Many of the inhabitants of Sub-saharan Africa do not have adequate capacities to mitigate the negative impacts of global warming (Ifejika Speranza, 2010). Furthermore, Sivakumar

¹ The governing body of the convention on Climate Change through which it advances the implementation of the convention through the decisions it takes at its periodic meetings.

et al (2005), believes that the mean annual temperatures of Africa will increase approximately from 0.2 C to 0.5 C per decade and this will cause enormous challenges for small-scale farming.

During the past decades, the economic progress of Ghana has experience a rapid increase mainly as a result of growth in sectors of the economy such as agricultural, mining, forestry etc (Shepherd and Gyimah-Boadi, 2004). However, the stability in the economic development chalked over the period risk being badly affected by the ongoing climate changes and hazards, with small-scale agricultural identified as one of the potential activity (Wurtenberger et al 2011). A majority of Ghanaians are small-scale farmers and depend on natural resources such as forest, water and coastal resources, which are threatened by fluctuations and variations of the climate (Yaro, 2006).

The plight of small-scale farmers in Ghana and mostly in the Upper East Region (UER) is badly affected by climate change fluctuations. These fluctuations which are mostly determined by irregularities in rainfall and higher temperatures ensure that the activities of the farmers are hampered and altered, making it highly unproductive (Van der Geest, 2004). A majority of small-scale farmers' activities are rain-fed and fluctuations in the climate make them more vulnerable (Yaro, 2006). Some of these climate hazards that have worsened the plight of the farmers in UER include floods, long dry spells, erratic rainfall patterns etc. These ongoing climate change fluctuations and hazards have both short and long term negative effects on the livelihood security of farmers in Ghana and UER as a whole. It is therefore important that the state of Ghana develop and implement policies aimed at tackling some of these challenges to improve farmers' livelihood standards.

1.1 Research Study Justification

The Upper East Region (UER) of Ghana is one of the poorest in the country, characterized by extreme poverty as a result of low level of development in infrastructure, lack of job opportunities etc. Small-scale agriculture, which is mainly rain-fed, is the major occupation of many of the people. The climate of the area is very susceptible to the climate fluctuations, due to its location and geography, closer to the Sahel region which is mostly dry.

Recent changes and fluctuations in the weather, reveals changes in the climate, which according to many scholars and research institutions, has a negative effect on

agricultural activities, and risk reducing the livelihood opportunities and furthermore, endanger the living standards of the people.

The UER lags behind in terms of economic opportunities and living standard compared to the southern part of Ghana (GSS, 2000). Climate change has a major tendency to increase these inequalities such as reduced agriculture harvests, making small-scale agriculture more non-productive and unprofitable (Yaro, 2006). Inadequate economic resources, the lack of a political will over the years and weak institutions at the national and local levels, have contributed to the aggravation of climate change effects on the small-scale farmers.

1.2 Research Problems and Questions

The aim of this research study is to explore the coping strategies and practices used by small-scale farmers to mitigate the effects of climate fluctuations in Upper East Region (UER) of Ghana. The study focuses specifically on the household level and also tries to discern how the aforementioned strategies affect gender relations. The intension is also to analyze the authorities' policies, strategies and actions on climate fluctuations in UER which is currently under implementation. This research study is expected to answer the following questions:

- What (if any) are the main strategies and practices used by small-scale farmers in UER (Ghana) to cope with climate change fluctuations and how are these strategies and practices mediated by gender?
- How do the authorities (Ghana and other institutions) in UER relate to climate changes which risk affect the small-scale farmers of the region?

1.3 Research study outline

The study is divided into 6 sections. The first section consists of the introduction of the research study, including the problems and questions. In section II the focus is on the methodology of the study.

Section III describes the economic and social situation of small-scale farmers in UER. The low living standard and the livelihood situation and strategies of the farmers are discussed.

Section IV describes the gender situation of climate change in UER.

In section V, the state's policies and actions concerning climate change are discussed.

The last section consists of a concluding discussion of the results and findings of the study.

II.METHODS

The research study is based on:

- A review of available qualitative and quantitative secondary data on poverty, economic and social vulnerability and other economic and social aspects, which risk being affected by climate change hazards in Upper East Region (UER), Ghana.
- Personal experience of the author based on experience from the area. The experiences of the author compliment the literature which includes the inheritance systems of the people, gender relations, livelihood strategies and practices and other activities that are important for the study.

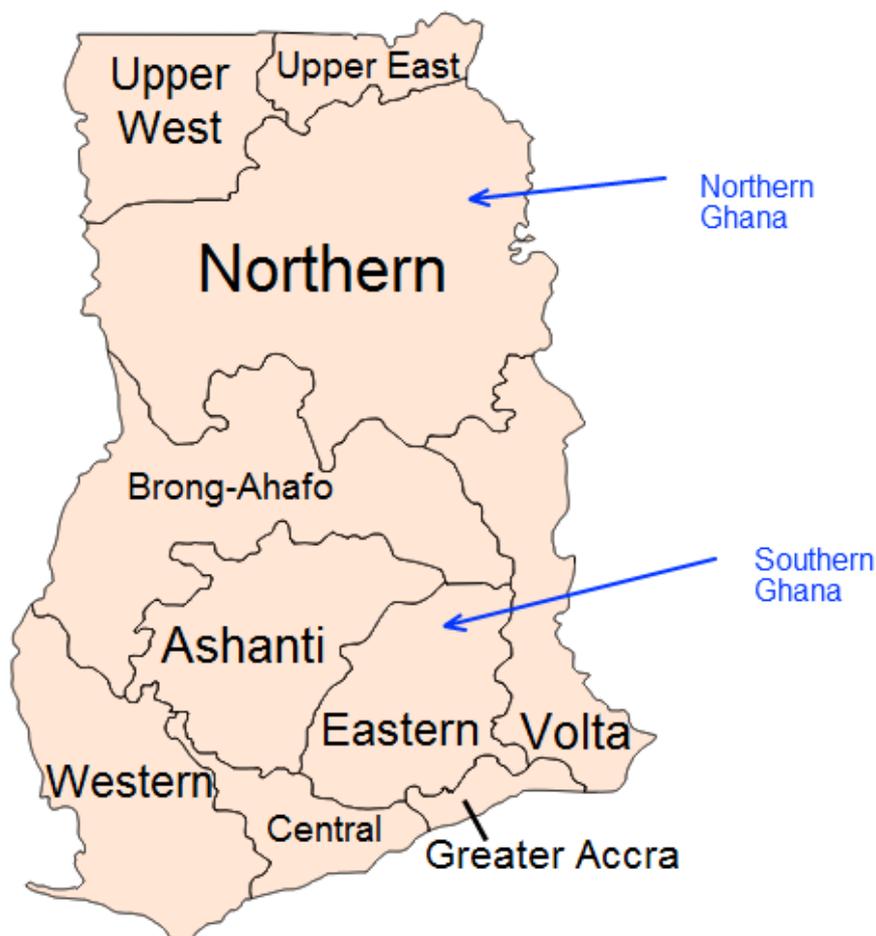
I have, furthermore, used statistics, based on research work carried out by scholars and institutions in Ghana, with particular emphasis on the Upper East Region. Statistical data from the Regional meteorological agency, Ghana statistical service and Environmental Protection Agency is used so as to provide good information on trends in the climate and weather variability, such as rainfall and temperature.

III. Background

3.1 Ghana and the Upper East Region (UER)

In this chapter, Northern Ghana, including Upper East Region (UER) is described. The description consists of the climatic pattern of the area and the infrastructural development challenges. A comparison is made between it to southern part of Ghana in terms of infrastructural development. The proceeding sections explain some of the livelihood diversification methods used to mitigate climate change in order to improve upon their living standards. Households are used as cases to describe how the various groups diversify their livelihoods to cope with some of the challenges they face.

Figure 1: Regional Administrative Map of Ghana



Source: Wikipedia

Ghana is divided into 10 administrative regions. The country is geographically divided into the Northern and Southern sectors. The north consists of a vast area made up of 3 regions; Northern Region, Upper West Region and Upper East Region. These regions, characteristically, lag behind in terms of infrastructural development, compared to southern Ghana. The small plots of land, the lack of irrigation systems and poor infrastructure of the region has contributed to impoverishment in the livelihoods of the population.

According to the Overseas Development Institute, ODI and Centre for Policy Analysis, CEPA (2005), the history of colonialism, unfavorable climate and low agricultural production, political and economic neglect have contributed to this situation of impoverishment. Shepherd and Gyimah-Boadi (2004), states that activities during the colonial era such as economic investments, infrastructure development and

incentives for agriculture, coupled with other favorable policies ensured massive improvement in the livelihood of the people in Southern Ghana. These investment and policies of the colonial era ensured that majority of the people in Northern Ghana migrated to the south to provide cheap labor and to look for other forms of informal employment.

The increasing rate of low infrastructural development in the North, which continued after independence, prompted the attention of the first government (1957-1966) to implement policies such as free education, capital investment in factories and agricultural development with incentives for small-scale farmers (Shepherd and Gyimah-Boadi, 2004). These policies were not able to bridge the gap compared to Southern Ghana. Some reasons such as unsustainable policies on subsidies to create more jobs and improve the infrastructural base by the successive regimes due to lack of funding, military coup d'états etc have all been documented as contributing to this situation.

Furthermore, Shepherd and Gyimah-Boadi (ibid) noted that most of the policies were out of place and thus failed to meet their intended priorities. For example, small-scale agriculture, which is a major occupation of the northern region and a major contributory factor in terms of livelihoods, did not receive the needed support. According to Shepherd and Gyimah-Boadi (ibid), the focus shifted from investing in small-scale agriculture to rather large scale and state-owned farms. The idea behind this policy was to employ many of the people, in order to reduce unemployment and the rampant migration to Southern Ghana.

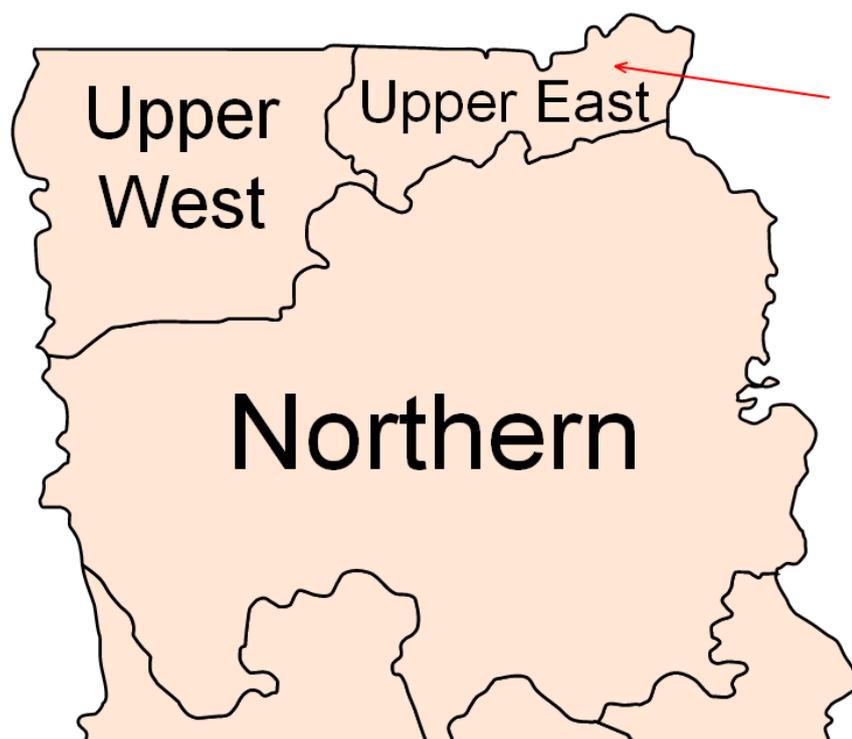
Moreover, the infrastructure development of the area has been extremely poor, compared to Southern Ghana. The entire Northern Ghana became connected to the national grid (electricity) in the late 1980s and early 1990s compared to many places in Southern Ghana, which had this resource as far back as the days of colonialism (Shepherd and Gyimah-Boadi 2004).

Another important factor that has contributed to the low development in the area is the adoption of the structural adjustment policy by the country during the 1980s. Furthermore, Aryeetey and McKay (2004) argued that the structural adjustment policy which was adopted by Ghana did not focus on investment in food crop and small-scale agriculture, an occupation of many people in Northern Ghana. However, the focus involved the provision of incentives for export crops like cocoa and other cash crops,

mostly cultivated in Southern Ghana. Although, small-scale agriculture is also practiced in Southern Ghana, a majority of the people cultivate cash crops compared to the North where none of these crops are cultivated.

3.2 The Upper East Region (UER)

Figure 2: Map of Northern Ghana



Source: Wikipedia

The Upper East Region (UER) lies within latitudes 78 and 128 N of the equator and longitudes 30 W and 18 E. It has a relatively dry climate and belongs to the Sahel and semi-arid zones, with a geography that makes it very prone to desertification. This has a negative effect on small-scale agriculture production, which is the major livelihood occupation in the area (Van der Geest, 2004). The main crops cultivated in this area are maize, sorghum, soybeans, millet and cassava. UER has a rainfall pattern which is uni-modal and mainly occurs between April- May and September- October. Rainfall levels have decreased while temperature levels have risen with a tendency to experience more extreme and unreliable climate and weather variability in the future (Environmental Protection Agency, EPA, 2000).

Poverty is very high in UER compared to other parts of the country, and the highest in the entire Northern Ghana. In this region, many people live on less than one dollar a day (GSS, 2000).

3.3 Who are the small-scale farmers in UER?

Subsistence farming or rain-fed activities carried out by farmers in UER are grouped into *compound* and *bush farming* (Slaymaker and Blench, 2002). The compound farms are located closer to the residence of the people, while bush farmers are located several kilometers away from the villages.

In UER, crops which are normally cultivated on compound farms include early and late millet, sorghum and maize. The sizes of these farms are averaged at about 0.8 hectare. On the other hand, bush farms have larger sizes compared to compound farms, mostly 1.2 hectares, and involve the rotation of crops on the land annually depending on the choice and selection of crops by the farmers. Manure or droppings of livestock are rarely used on these farms (Slaymaker and Blench, 2002).

According to Yiridoe et al (2006), a majority of the farmers raise livestock, usually on a smaller- scale, compared to crop farming. Some of these livestock include sheep, goats and poultry ranging from 0-10 depending on the type of household (Al-Hassan and Poulton, 2009). The research team (ibid) concluded that farmers hardly consume the livestock or sell them. They are rather used as buffers against economic insecurity and periods of food insecurity.

Agriculture activities in UER are mostly rain-fed, which is done between April-May and September-October, followed by a long dry season, usually from October-April. The activities of small-scale farmers have been affected over the last two decades by climatic and weather related phenomena such as low and unpredictable rainfall, persistent droughts, poor and non-fertile soils and erosion in UER (Ofori-Sarpong, 2001). Moreover, social conditions, such as lack of access to credit facilities and subsidies, higher farmers to extension agent ratio and weak policies by the state and institutions have all increasingly contributed to the non-profitability of small-scale activities in UER, although this is not a recent phenomenon (Slaymaker and Blench, 2002). For example, Slaymaker and Blench (2002) found out that small-scale farmers can apply for loans and other credit facilities. However, only few are able to have access to these facilities due to extensive bureaucratic processes coupled with the perceived reasons attached to small-scale farming activities as a highly risky venture by many lending and banking institutions in UER, because many farmers are not able to pay back their loans (Slaymaker and Blench, 2002).

The reasons above and other challenges which are not recent, but are becoming more endemic, ensure that small-scale farming activities are gradually becoming extremely non-profitable constantly in many parts of Northern Ghana (Van der Geest, 2003).

3.4 Types of Households in Upper East Region (UER)

In this section and the other paragraphs that follow, I will provide a description of the various household types and their structures in UER. The various household types that would be discussed are monogamous (husband, wife and children), polygamous (husband and several wives, children), female headed households (made up of divorcees with/out children) and extended kinship.

The various household types described are based on the observations and experiences of the author²

The UER consists of many ethnic groups such as Frafra, Kassena, Builsa, Kusasi etc. However, these ethnic groups are relatively homogenous concerning traditions and customs which are homogenous with very little differences. Among these ethnic groups, womens' roles in the household, especially on the farm are very important for production. They work along with their male counterparts in various stages of production.

² Monogamous household, Polygamous households, Female headed households and Extended kinship

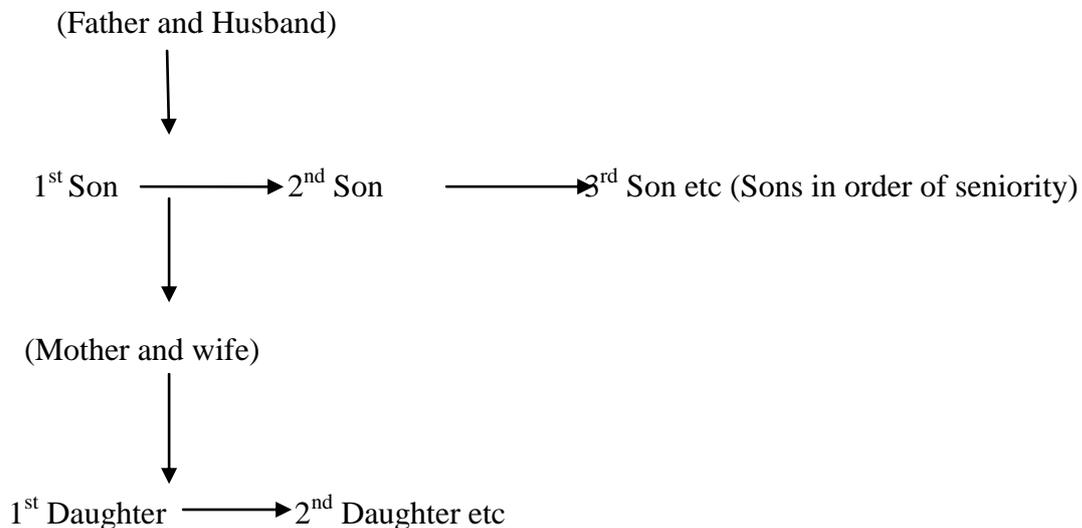
Women Roles: Inheritance and Status in Society

Inheritance is strictly patrilineal among the ethnic groups in UER, which provide men and boys the opportunities to inherit property and other valuable items (Apusigah, 2009). Historical traditions and customs prevented many girls from having access to education while boys were given the privilege to attend school. This customarily practice has ensured that a majority of the women in these (Frafra, Kasena, Bulisa etc) ethnic groups in UER are highly illiterate and at a huge disadvantage in terms of searching for employment that requires skills and formal education (Apusigah, 2009). The last two to three decades have witness a gradual increase in the population of female enrolment in education, however, the challenge still exist (Bortei-Doku Ayeetey, 2000). Culturally, women and girls are expected to stay at home and cook for their husbands and families, engage in the sales of harvested products from farms and other activities assigned by the household head. A majority of rural women's rights are restricted regarding decision-making publicly and coupled with the facts enumerated above, they become extremely dependant on their male counterparts for all forms of support, especially financially. Based on personal experience among a majority of the ethnic groups in UER, I learnt that women do not inherit property, especially, land because there is the notion that women will move to their husbands' home during marriage and they will be taken care and supported by their husbands.

During the period that I spent in cities and towns like Bolgatanga, Bongo and Navrongo in UER, I observed how divorced and unmarried women are integrated into the society. Women inherit property through their sons when they become widowed. However, under certain customarily circumstances if proven that the death of her spouse is related to the witchcraft activities of the wife, then she is deprived of all benefits which were acquired together with the late spouse. Under extreme conditions, children are taken away from her and incorporated into the family of the late spouse. These women become societal stigma and this has serious consequences on their existence in the larger society. However, these women are at an advantage when they are younger and can migrate to other towns and remarry. On the other hand, older women in the rural areas become more vulnerable since they cannot remarry and the challenge is severe if they do not receive support from their kinsmen in the society. Furthermore, if women from these female headed households are not branded as witches, they are accepted by both kinsmen (including her late spouse family). The

children from these households are supported by their uncles and other members of the family while a majority of the women are supported with economic capital to engage in petty trading activities and also plots of land for cultivation.

Figure 3: Monogamous Inheritance Pattern in UER Households



Source: Author

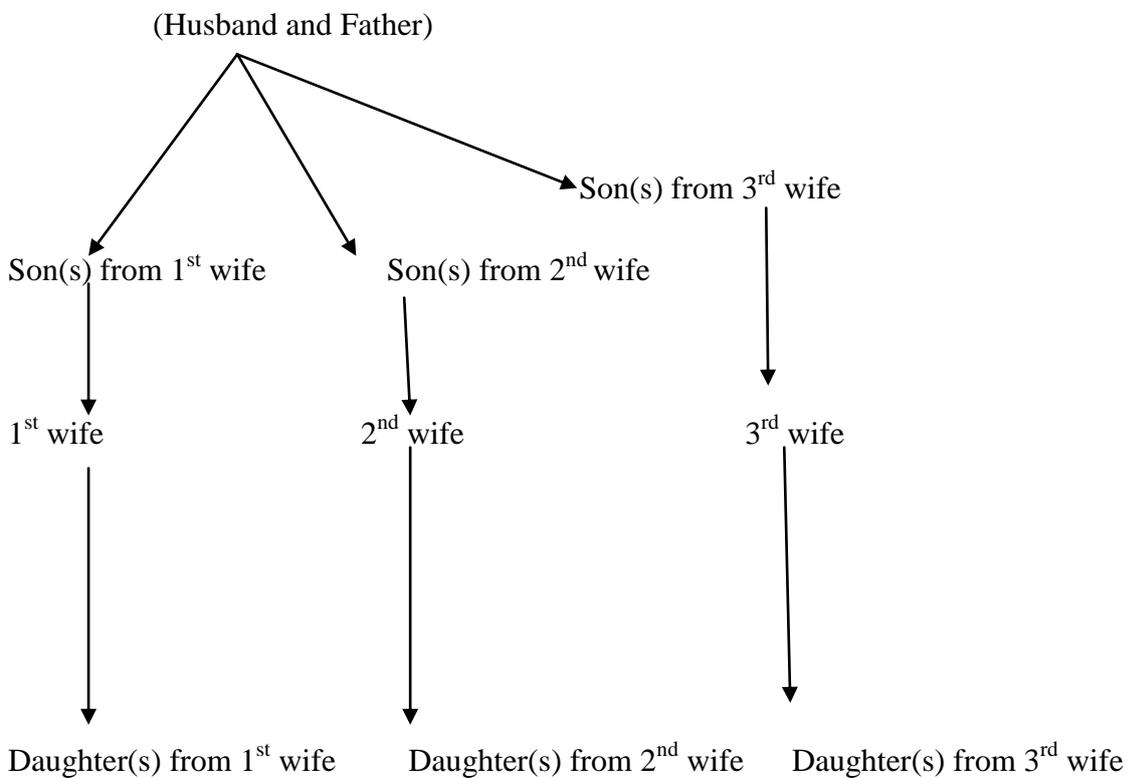
Case 1: The Monogamous Household

The figure above demonstrates the inheritance system in a typical monogamous household among a majority of the ethnic groups in UER. The father is the head of the household and controls how property such as land is used. Again, important decisions such as the type of crops to cultivate and animals to rear are all sphere-headed by him. Although in terms of age the mother is older than his sons, however, they are regarded publicly in terms of decision making. In this household, if the husband dies or is incapacitated, the next heir to assume leadership responsibilities regarding decision making and distribution of property will be the eldest son followed by the others in a descending order.

Among a majority of these ethnic groups and households, women are considered as farm hands³ (Apusigah, 2009).

³ Farm –hands is a terminology which defines the help provided by women on the farm

Figure 4: Polygamous Inheritance Pattern in UER Households



Source: Author

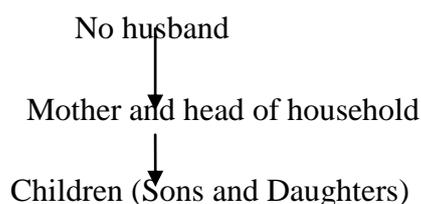
Case 2: Polygamous Households

In this household, the husband marries a lot of women due to his high economic standing determined mainly by the abundance of resources such as land and livestock at his disposal. The inheritance pattern in this household is also based on seniority of the son(s). The succession process involves the eldest son from the first wife considered as the direct successor to his father followed by the eldest son of the

second and third wives respectively. However, if the eldest wife has no son(s) or they are too young to take decisions, the button of responsibility shifts to the next son in succession among the other wives based on a rotation pattern set aside by traditions and custom. Moreover, it is important to note that the distribution of family property among the wives and children, especially in this type of household is beyond the experience of the author.

Many polygamous households, depending on the number of women married, are also found in one large compound. All the women, together with their children, help their husband, usually on larger plots of farmlands. In addition to food crop agriculture production, usually these polygamous households owe large herds of sheep, goats and cattle, which contribute significantly towards the household income.

Figure 5: Diagrammatical Representation of a Female Headed Household



Source: The author

Case 3: Female Headed Households

As described in the previous sections, women and girls especially, in rural areas occupy the lowest rank on the hierarchical order among a majority of the ethnic groups in the UER regarding inheritance. Female headed households are mostly made up of divorced or widows and do not have access to resources such as land. This is because a woman can only have access to certain property depending on the husband's status and wealth in the society. In many cases, widows who have sons from their previous marriages can also have access to some of these property especially, land for cultivation, while those who were divorced or become widows from their previous marriages as a result of strange customarily beliefs that they caused the death of their spouse are deprived of many or even at times all the property acquired with the late

husband. Under certain conditions, younger children are taken away from them and integrated into the kinship household of her late spouse. Most often, many of these female headed households are poorer, and depend on other family members for support. On the other hand, if the head of this household is from a wealthy family or has her own source of livelihood that does not depend entirely on the former spouse, she will be economically stable to be able to cater for herself and the children. She can also have support from extended kinsmen.

Case 4: The Extended Kinship/ Household

This form of household consists of a combination of many nuclear/monogamous and polygamous households. People from this social system play important roles which are aimed at providing help and assistance for one another. The assistance provided ranges from economic support, shelter, and land for cultivation. Children from other households are also supported in their education, trade and upbringing by those who have the means to do so. These roles are often assumed through social networks.

However, recent increase in population and migration to other parts of the country has weakened the social kinship among people thus weakening the support that can be provided. Although, it may serve as a bridge through which people may migrate to the cities. This is because people tend to focus their attentions and the little available economic resources on the immediate and nuclear families than others.

Table 1: Livelihood Strategies of Households in Northern Ghana

The arrows inserted into the tables are elaborations used by the author to explain the types of households stated in the above sections⁴

Group	Characteristics	Assets	Activities
Vulnerable (5%) ↑	High proportion of orphans, school drop-outs, youth economic migrants,	0-0.5 acres of land per active member, no livestock except	Sale of firewood, making baskets or ropes, collecting wild products, sheanut gathering, buy

⁴ The original research work produced by Al-Hassan and Poulton (2009) did not have the arrows and household types (Female headed, Monogamous and Polygamous) inserted in the table. These are clarification used by the author.

Female headed Household	widows with children, elderly, and handicapped, sick.	0-5 poultry, basic house & cooking equipment, clothes	and sell foodstuffs
Poor (35%) ↑ Monogamous Household	High proportions of widows with children, youth semi-permanent migrants, migrants creating farms outside their tribal areas, small-scale farmers with weak labour capacities	0.3-2.5 acres per active member, 0-5 sheep/goats, 0-3 cattle (per household), Bicycle, roofing sheets.	Food crops and livestock farming, petty trading, collection/processing/sale of NR products, seasonal and semi-permanent migration
Medium (51%) ↑ Polygamous Household	Large family and high labour capacity (i.e low dependency ratio)	1.5-4 acres per active member, 10-40 sheep/goats, 3-30 cattle (semi-permanent house, modest education and assets(e.g sewing machine, shop, T.V)	Farm and non-farm activities
Well-off (9%)	Large family and high labour capacity, higher proportion of skilled labour	1-25 acres per active member, 0-120 sheep/goats, 0-1000 cattle, larger, permanent house with water, electricity, kitchen, toilet, fridge, tractor,	Agricultural: perennial (cocoa, rubber, mango), non-traditional or food crops (all on commercial sale); livestock (including commercial poultry). No- agric: tractor or transport services, medium-large-scale trading, shop/house

		car/truck. May have two houses- one in town, more modest on farm	rental, salaried positions
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Source: Al-Hassan and Poulton (2009) with elaboration by the author

3.5 Explanation of the Case studies

The various case studies in the sections above provide a description of the major types of households in the UER. A study conducted by Al-Hassan and Poulton (2009) in Northern Ghana demonstrated in the table above, is used as a basis for the explanation. The research study categorizes the various household groups as vulnerable, poor, and medium and the well-off. I will use some of the description developed by Al-Hassan and Poulton (2009) to explain the various assets, characteristics and livelihood strategies and practices used by the people.

Based on my personal experience from some towns and communities in UER, such as Navrongo, Bawku, Bongo and Bolgatanga, I will classify monogamous households as those with asset of 0.3-2.5 acres of land, 0-5 sheep/ goats, 0-3 cattle, bicycle and other items such as roofing sheets. Most of these households are usually classified as poor. A high proportion of households in UER are found in this category. Their major activities or livelihood strategies include food crop production and livestock farming, petty trading, seasonal and semi-permanent migration. These households comprises of small-scale farmers who use non-sophisticated labor equipment such as hoes, cutlasses (Al-Hassan and Poulton, 2009). A very few of these households are able to afford the services of cattle for land ploughing during the planting season.

Another important livelihood strategy used by this category of household (monogamous) is migration. Usually, many of the youth in the families embark on this strategy as an option, either to their kinsmen (extended family members) in the bigger cities or to southern Ghana, permanently or temporally.

On the other hand, I will classify polygamous households as a “medium household” based on the description provided in the table above by Al-Hassan and Poulton (2009). These households have a predominately larger labor for agricultural activities

as a result of many people in the households. Their assets includes about 1.5-4.0 acres of land for agricultural activities per household, 10-40 sheep/goats, 3-30 cattle, semi-permanent constructed house and educated people. They are mostly engaged in farm and non-farm economic activities (NFEA) for survival as a livelihood diversification option. Moreover, their ability to engage in these non-farm activities ensures that they are able have a buffer in terms of dealing with the fluctuations in the climate mostly determined by irregular rainfalls and droughts on their agricultural activities (Al-Hassan and Poulton, 2009).

I described female headed households in the previous sections as the most deficient in terms of options to cope with challenges of poverty. However, I will like to make a distinction. There are two types of female headed households in many communities in Upper East Region (UER) which were observed during my stay in the area. The first group is those with children, especially with an elderly son who has inherited the late father as a result of death and the second group consists of households made up of divorced women. Since inheritance is strictly patrilineal, such divorced women are prevented from having access to property acquired with their former husbands, which make them even poorer than other female headed households.

Based on Al-Hassan and Poulton (2009), I will classified this group as “vulnerable” and their assets include 0-0.5 acres of land, no livestock, except 0-5 poultry and kitchen utensils. Their major livelihood is based on the sales of firewood; which they search for from the wild, collection of wild foods and products, gathering and sales of shea nuts etc. Another livelihood strategy I observed among this household group is share cropping⁵. However, my observations revealed that land scarcity in many of these communities has limited this option as a livelihood strategy.

The description of the various households used as case studies in the sections above reveals the various capacities and the livelihood strategies used to solve some economic challenges at the household level. It is very clear based on my personal experiences from some communities, like Navrongo, Bongo and Bolgatanga and the evidence of research carried out by Al-Hassan and Poulton (2009) which is used as the basis of this analysis, that in terms of coping with some of the challenges of poverty and other challenges like climate variations and fluctuations among small-scale

⁵ Share cropping is a system where land owners lend their available lands to people for farming with the intension to share the harvest products at the end of the farming season.

farmers in UER, polygamous households rank higher and perform better, followed by monogamous with the least to adapt and cope been female headed households.

3.6 Climate Change and Rainfall irregularities in Upper East Region (UER)

As stated above, many of the people in UER practice subsistence agriculture, which is dependent on the patterns of the climate. Although, there are other climate parameters such as wind speed and wind direction, evapo transpiration etc, this section will focus on two of the most important ones that are important to agriculture production, especially, temperature and precipitation (rainfall).

Rainfall

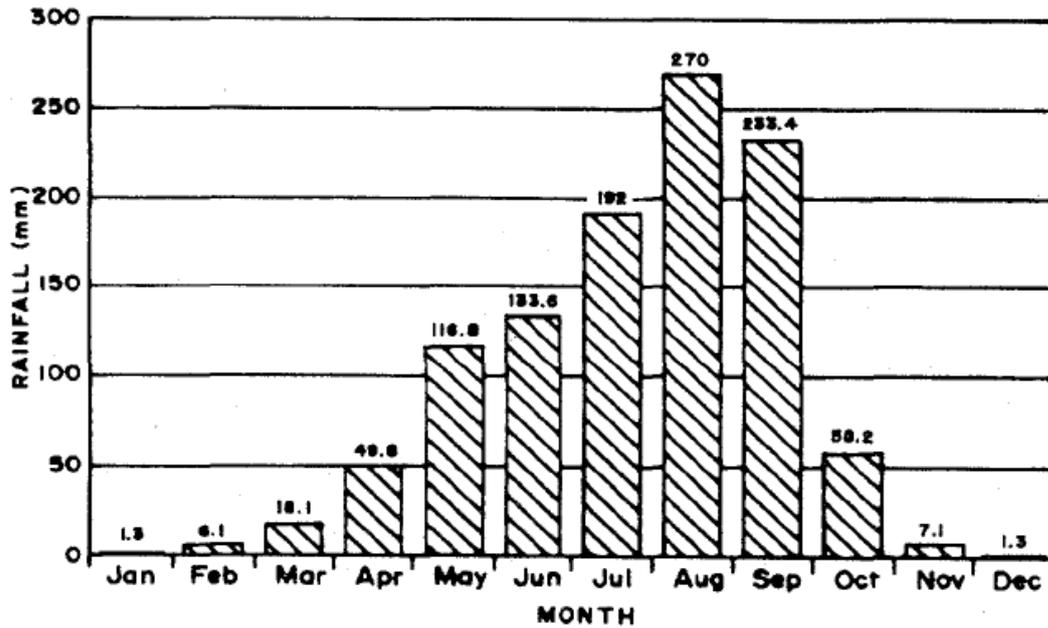
Rainfall irregularities and fluctuations are major factors that affect subsistence farming among small-scale farmers. Over the years, rainfall patterns have become very irregular coupled with the fact that the region (UER) is the driest in Ghana. See figures below.

Research studies conducted by Ofori-Sarpong (2001), Assan et al (2009) and the regional department of Ghana Meteorological Agency (GMA) of UER demonstrate variations which are irregular and inconsistent and this affects subsistence activities of many rural households.

In 2001, Ofori-Sarpong, used two major towns in the region which have special climatic characteristics and belong to different geographical positions, mainly Navrongo (western) and Bawku (eastern) over a 60 year period. The study was divided into two parts (1931-1960 and 1961-1990). Navrongo (1931-1960), figure (6) below recorded an annual mean rainfall of 1,087.6 mm. Again, the study revealed a mean annual rainfall of 986.1 mm during the period 1961-1990, figure (7) below. Interestingly, the two figures below demonstrate that the first period (1931-1960) was wetter than the latter years (1961-1990). Over the 60 year period, Navrongo recorded a mean rainfall of 1,036.9 mm. It can also be observed that 19 out of the 30 years (1931-1960) recorded values below the mean annual rainfall whilst 17 out of the 30 years (1961-1990) recorded values below the mean annual rainfall values.

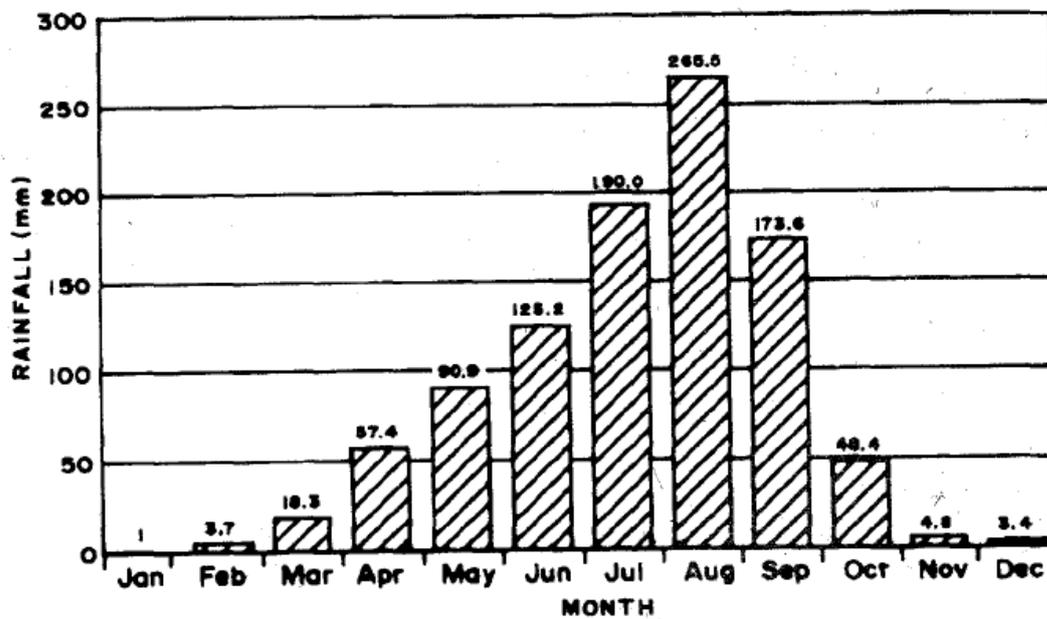
According to Ofori-Sarpong (2001), drought is a period when the rainfall recorded is below the mean annual value. Therefore, in relation to Navrongo, a total of 36 drought years were measured during the 60 year period.

Figure (6) Mean annual rainfall for Navrongo (1931-1960)



Source: Ofori-Sarpong (2001)

Figure (7) Mean annual rainfall for Navrongo (1961-1990)

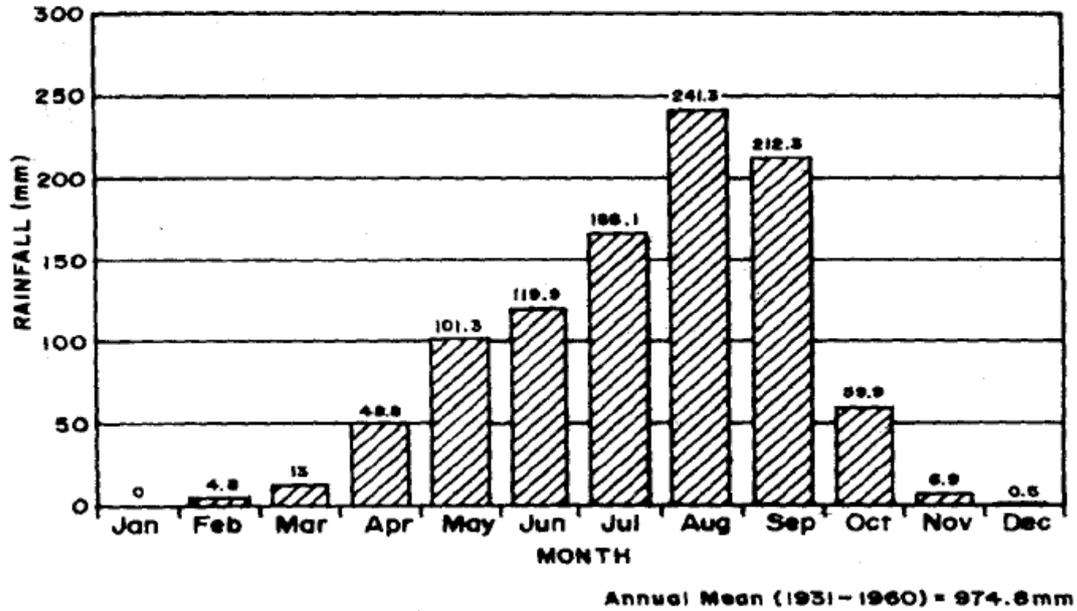


Source: Ofori-Sarpong (2001)

In Bawku (in the eastern part of the region), 974.6mm was recorded as the mean annual rainfall during the period 1931-1960, (see figure 8), whilst 955.2mm was recorded as the mean annual rainfall for the period (1961-1990), see figure (9).

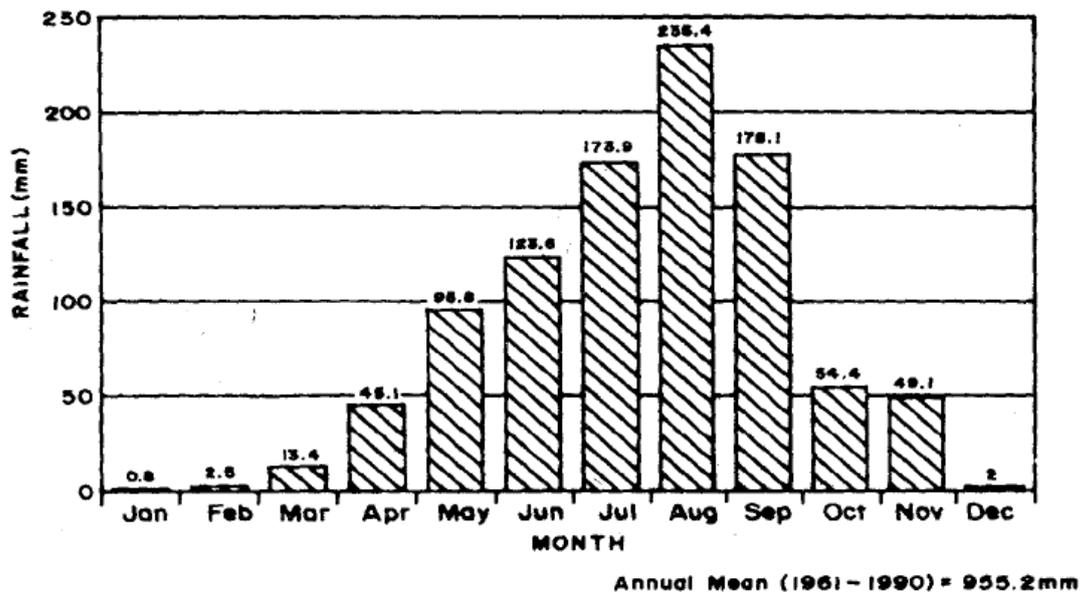
Comparatively, the latter years (1961-1990) were wetter than the previous. During the period (1961-1990), 18 years of drought were measured.

Figure (8) Mean annual rainfall for Bawku (1931-1960)



Source: Ofori-Sarpong (2001)

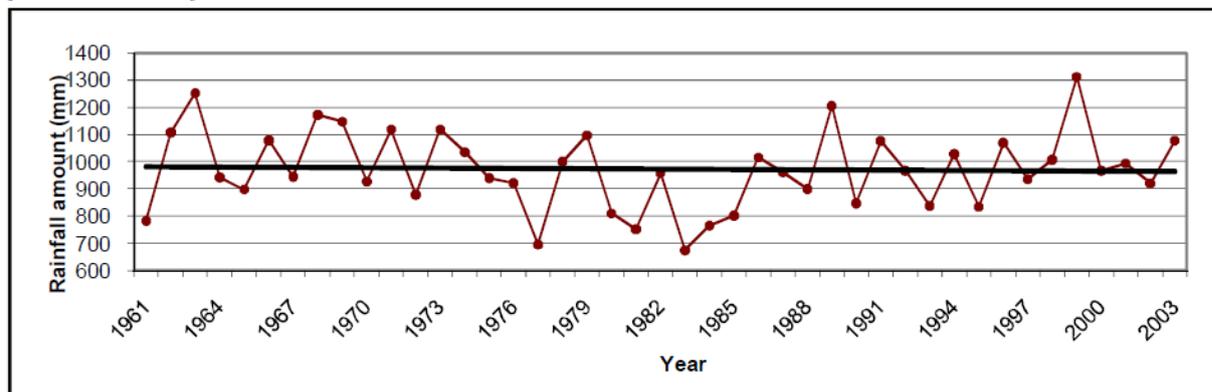
Figure (9) Mean annual rainfall for Bawku (1961-1990)



Source: Ofori-Sarpong (2001)

A little over a 40 year period, the Ghana Meteorological Agency (GMA), refer to figure (10) below, also recorded an aggregate mean total rainfall for the entire Upper East Region (UER) from 1961-2003 in a research study it conducted. The trend shows variations and fluctuations with the highest amount of rainfall recorded in 1999 as 1,312.5mm. The Agricultural Ministry in the UER, estimates that about 950 mm/yr of rains are required for crop production. Hence, if 950 mm/yr of rains is used as the benchmark, then UER has experience about 20 years of irregular or too small rainfall for effective agricultural activities. In the figure below, the rainfall values recorded demonstrates the precariousness of the regions' rainfall pattern which presents an unpleasant situation for agricultural activities especially due to the high level of dependence for subsistence farming.

Figure 10: Aggregate Mean Total Rainfall for Upper East Region (1961-2003)

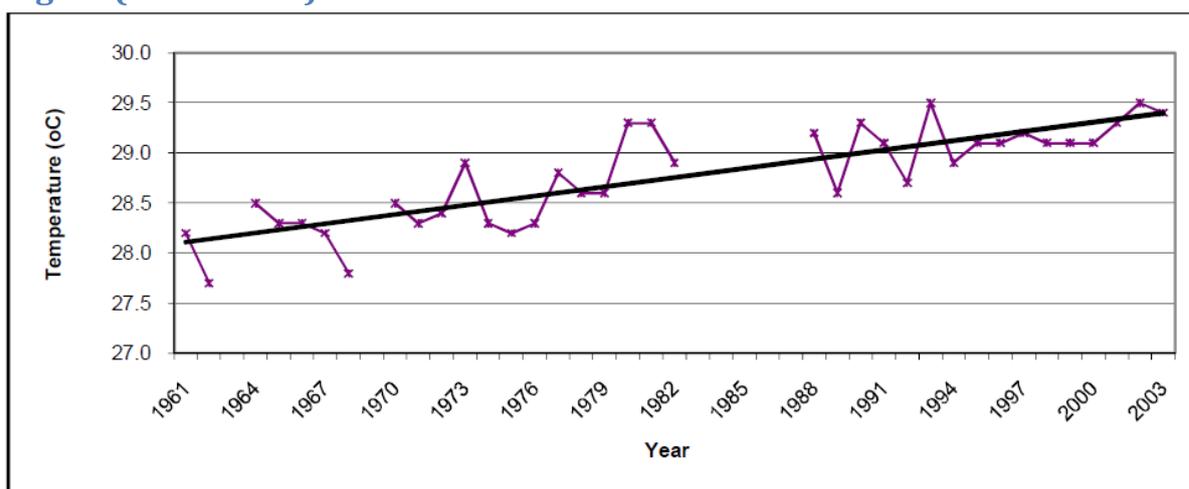


Source: Meteorological Services Agency, Bolgatanga, Ghana

Temperature

UER shares boundaries to the north with Burkina Fasso, which belongs to the Sahel region. Therefore, it has been experiencing some characteristics such as long dry seasons, which are peculiar to the Sahel. Regional values from 1961-2002 from the GMA over the last four decades suggests a gradual increase in temperature. It shows a gradual rise from 27.6 C in 1962 to 29.5 C in 2002. During the last 40 years (1961-2002), an increase of 1.9 C has been recorded. Evapo transpiration, evaporation and loss of soil moisture have contributed negatively to agriculture production with a high tendency to threatening livelihoods. According to Ofori-Sarpong (2001), if the trend continues with rising temperature as seen in the figure below, droughts will become more frequent in UER risking to disrupt small-scale farming activities.

Figure 11: Aggregate Mean Annual Temperature for Upper East Region (1961-2003)



Source: Meteorological Services Agency, Bolgatanga, Ghana

3.7 Coping strategies and Practices to climate fluctuations of small-scale farmers

Among a majority of the households described in the sections above, livelihood diversification is a major strategy used to cope with the fluctuations of climate change, which directly affects their agricultural system, since they are subsistence farmers.

Livelihoods Diversification in UER

The main sources of livelihood diversification used in UER among the household types described in the case studies include migration and engaging in other NFEA (non-farm economic activities) such as petty trading, masonry, blacksmithing and the sales of auto-mobiles etc. These activities are described in this section.

Petty Trading

My experiences from many communities in UER revealed that many of the people engage in petty trading. These activities include; sales of agricultural products such as yam, cassava, millet, rice and vegetables. A majority of the people who engage in petty trading are women, although in some communities, men also engage in these activities. In many of the poor communities and villages, petty trading constitutes an important source of employment and livelihood diversification. In a research study conducted by Assan et al (2009) in two of the largest cities in the UER (Bolgatanga

and Bongo), a majority of the respondents to the research survey were intensely participating in petty trading compared to other forms of employment such as handi craft weaving, pottery, masonry etc. The statistics of the research results are found in figure (12) below.

Weaving

Weaving of textiles and other handicrafts is also a major source of livelihood among people in UER. Traditionally, clothes worn for important events are colorfully woven by both men and boys whilst women and girls are mainly engaged basket making. This is a big industry through which their cultural heritage is demonstrated especially, to others who do not form part of their ethnic group. Although this is a major economic industry, the number of people engaged in this handi craft industry is lower compared to petty trading (Assan et al 2009). I also found out that the act of weaving is normally carried out during the off seasons/ non-farm seasons after harvesting the major crops.

Firewood/ Charcoal Processing

Charcoal making and firewood collection is a major form of economic activity among many of the small-scale farmers in UER. In many rural communities, the major source of energy is derived either from charcoal or firewood. Many of the people resort to the sales of these products to make a living. This activity is mainly done by women.

Livestock Farming

Livestock farming is carried out by many households in UER. The most important livestock include goats, sheep, cattle and poultry depending on the kind of household with quantities based on their economic strength. Many small-scale farmers' rear poultry such as guinea fowls and chicken with smaller quantities sold to improve upon the economic livelihood of the household. Bigger livestock such as cattle are usually owned by well endowed households.

Pito Brewing (Local Beer)

Pito is a common local alcoholic beverage made from millet or sorghum. This beverage is very common among many households, especially villages and even cities in UER. Comparatively, it is extremely cheap compared to other alcoholic beverages, and has other important nutritional benefits, according to the rural people. One of such belief is its ability to cure feverish conditions.

The sale of the beverage is done mostly by women and it is common throughout the entire year mainly in many communities with cheaper and affordable drinks available immediately after the harvest season. This is due to the abundance of millet and sorghum. The sorghum and millet used for this beverage are harvested by the men from their farms. Consumption of this beverage is among men and women, with men been the highest consumer. A majority women from the household types described above engage in this activity.

Share Cropping

Share cropping⁶ is a system of farming whereby people especially with abundant land resources release their available land(s) to others in need for cultivation. During the process, the parties involved, decide on how to share the farm products during the harvest season based on agreeable percentages. This system of farming is very common in southern Ghana; however, recently, this practice has become a common livelihood occupation in Northern Ghana. The system has provided a very important opportunity for many people, especially women, who do not have access to land for farming activities.

Migration

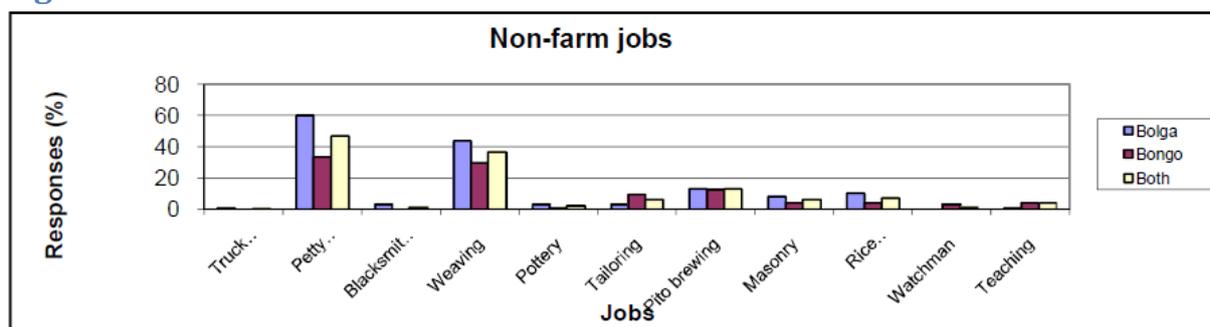
Rural-urban migration is an old source of livelihood option that is used by many people in poor households in UER and many parts of Northern Ghana (Shepherd and Gyimah-Boadi, 2004). According to Ellis (2000), many households in developing countries, especially, Africa have linked this source of livelihood activity to the agricultural calendar. Income or remittances generated from this activity help to solve some of the economic challenges of the households.

In UER, rural-migration has become very rampant and research studies carried out by Assan et al (2009) shows that the phenomenon increases especially during periods of droughts based on evidence from two cities, Bolgatanga and Bongo. They (Assan et al) state that out-migration (migration outside UER) has become very important in the area due to natural resource scarcity and high poverty levels. It is therefore employed as a survival and adaptive strategy to mitigate some of the challenges that emanate from their effects on the people

⁶ Statistics on land ownership, hectares, etc on share cropping are not available for this study. It is based on personal observation and experience.

3. 8 Non-Farm Economic Activities (NFEA) in UER

Figure 12: Non-Farm Economic Activities in two cities in UER



Source: Assan et al (2009)

The figure⁷ above, indicates the level of dependence on NFEA, especially on petty trading, weaving of handicrafts by small-scale farmers in UER. On the other hand, Assan et al (2009) claim that other activities such as pottery, tailoring, masonry and blacksmithing involves a reasonable amount of economic investment and since many people in UER are poor, very few people can engage in such activities.

Furthermore, Assan et al (ibid), found out that climate and weather variability have an effect on how and the degree of intensity with which people engage in NFEA. It was evident that many people participated lesser in NFEA on good rainfall years compared to poor rainfall years (see table 2 below). This could be attributed to the fact that a majority of the people were engaged in activities on their farms which could provide improvement in their economic livelihood activities and vice versa. However, during times of poor or irregular rainfalls, NFEA increased to compensate for other economic activities. The table below demonstrates that NFEA vary with the impact of climate fluctuations and indicates that many of the participants who took part in the research work conducted by Assan et al (2009) engaged in a lot of NFEA to improve their livelihoods.

⁷ Research study conducted in Bolgatanga and Bongo, UER

Table 2: Non-farm Economic Activities by Gender and Rainfall in UER

Period of engagement	Participation in NFEA	% of respondents starting NFEA	Engagement in non-farm economic activities by gender	
	%	%	Male (%)	Female (%)
Good rainfall years	45.5	48.4	41.2	45.2
Poor rainfall years	54.5%	51.6	58.8	54.8
Total	100	100	100	100

Research study conducted in Bolgatanga and Bongo⁸

Source: Assan et al (2009)

IV. Gender and Coping strategies or Practices

Gender divided (especially women) activities in relation to climate change with particular emphasis on coping strategies and practices activities in Upper East Region (UER) are discussed. Women of all ages⁹ such as young, elderly and those working in the formal sector are used.

4.1 Gender and climate fluctuations

Gender constitutes socially and culturally constructed notions, roles and strategies and practices associated with either being categorized as a man or a woman and the interactions and social relations between these categories (Baden and Goetz, 1998).

In many developing countries, including Ghana, gender with respect to women, has been altered because of challenges such as lack of access to formal education, biased inheritance patterns that always favor men, absence or lack of power during decision making activities etc. A majority of them are jobless and form a huge percentage of

⁸ Assan et al(2009) conducted this research study among communities in Bolgatanga and Bongo

⁹ Ages used are based on the author's own criterion and experience and is not based on formal statistics

the informal economy, although men also are a part of this category in Ghana (Bortei-Doku Aryeetey, 2000).

During the last two decades, climate change fluctuations and hazards have also been documented as severe threats which face rural women in Ghana and this has contributed significantly towards their vulnerability (WEDO, 2008).

UNECA (2004) stated that women in Ghana are involved in time-consuming activities such as cooking, firewood collection etc, which make them spend more than double the amount of time on domestic activities than men. Moreover, other contributory factors such as their seclusion from decision making in the public sphere and lack of access to valuable assets and economic resources affect their livelihood. This is enhanced by patrilineal inheritance practices. Moreover, in the agricultural sector, according to Bortei-Doku Aryeetey (2000), activities of women constitute about 40% of all the landholding activities and production in Ghana. Although women form a majority in the small-scale agriculture sector, they are more vulnerable, especially those in female headed households due to the fact that most of them face obstacles in agriculture production and investment due to a host of factors, some of which have been explained above in the sections (case studies) that dealt with households. However, the most disturbing issue is that most of the rural women are usually engaged in the informal economy such as pito (local beer) sale, wild food gathering and collection which does not offer sufficient income in a sector which is not protected by labor laws and conventions (Bortei-Doku Aryeetey, 2000).

4.2 Climate fluctuations and coping strategies of women in Upper East Region (UER)

The difficulties faced by women in Ghana and many others in developing countries regarding climate fluctuations and hazards have been discussed above. However, it is important to distinguish how different women groups adapt to these changes, since all women face it differently. For example, elderly rural women (30 years and above) who are not employed in the formal sector are busily engaged in activities such as share cropping, petty trading, handi craft making etc. These activities generate income for their survival. Furthermore, since it is extremely difficult to survive on only one source of livelihood activity, many of these women, especially, in female headed

households practice small scale agricultural intensification through mixed cropping¹⁰ (WEDO, 2008).

Another important group that is worth considering is the youth, usually between the ages of 18-30. Many of the women in this category embark on migration, both temporally and permanently as an option to adapt. Their destination is either in the big cities in UER or southern Ghana. In the big cities, these people engage in activities which include working as house- helps¹¹ in wealthy homes, head potters or ‘kayaye’¹² and also in local restaurants known commonly as ‘chop bars’¹³. In these chop bars, the women engage in activities such as washing dirty utensils, running errands and other assigned responsibilities.

Finally, the last categories of women are those employed in the formal sector¹⁴. There are not many of such women in the UER who are in formal employment like nursing, teaching, NGOs etc. However, it is important to note that such women who are employed belong to the middle class in the society and can afford to live well. This group has the ability to move to other parts of the country due to their skills and abilities.

V. Climate Change Mitigation by the State (Ghana) in UER

In Chapter 3, the reasons that have contributed to the low level of infrastructural development in Northern Ghana, including Upper East Region (UER) were discussed. One of the major threats that were identified as a factor that is currently contributing to the poverty and vulnerability of the small-scale farmers is the ongoing climate change, particularly the increasing average temperature and irregular rainfall. Due to its high susceptibility to weather and climate fluctuations which have been demonstrated with

¹⁰ Mixed farming is a system of farming where different varieties of crops are cultivated on the same piece of land and it has a tendency to increase the chances of harvesting more crops on a very little land and to guard against crop failure.

¹¹ House-helps are people who are employed to help in domestic activities at homes especially among wealthy households.

¹² Head potters or ‘kayaye’ are people who carry load of goods for their clients to various destinations for an agreed fee.

¹³ Chop bars are local restaurants that specializes in the sales of local delicacies.

¹⁴ Statistics of women employed in formal sector in UER are not available. They are based on the author’s description.

charts and figures on rainfall and temperatures in Chapter 3, it is very important that people develop strategies and practices to mitigate the hazards and effects of the climate. However, efforts and activities to bridge this development gap between the North and the South, with respect to climate change has led to a policy document, which is currently under implementation by the government of Ghana.

5.1 Savannah Accelerated Development Authority (SADA) Policy and Implementation

The SADA¹⁵ constitutes Ghana's response to effects of climate hazards at large which are associated with floods, droughts and other challenges in Northern Ghana. The SADA is also tasked to promote sustainable development through the reduction of climate fluctuations and hazards by ensuring that livelihoods of vulnerable small-scale farmers are improved (GoG-SADA, 2010).

A lot of challenges have been identified as plaguing the development activities in the region. One of the major threats is floods which has become very recurrent over the years (Armah et al, 2010). During such moments, the homes and farmlands of many of the inhabitant are washed away, especially during the rainy seasons.

In tackling this recurrent phenomenon, the SADA has identified four policies to address the situation, out of which two are currently under implementation. It is been implemented around the white and black volta river basins, which are large rivers and overflow their banks during the rainy season. The two policies which are under implementation include the identification and preparation of mid catchment multipurpose flood protection options and also establishment of an early flood warning systems. According to the policy document from SADA, the government of Ghana (GoG) has started the implementation, which is aided by the Field Engineering Regiment of Ghana Armed Forces. They have been tasked to intervene in flood areas of Northern Ghana through the dredging of river basins and the installation of flood protection dykes.

¹⁵ SADA is a policy document which is currently under implementation in Northern Ghana hence an evaluation is beyond the scope of the study. An evaluation is possible only after the implementation period.

Furthermore, the Ghana government, in partnership with the World Bank and the UNDP (United Nation Development Program), has been engaged in activities such as education to help the people understand and see early warning signs of floods.

Another major problem considered by SADA is drought management. Figures and charts from Chapter 3 demonstrate it as a major climate hazard in UER. Through its implementation activities, SADA has begun reforestation activities to aid in soil and land covering, which will increase soil moisture contents. A majority of these trees are economic varieties, i.e trees with dual purposes to serve as a canopy for the soil and also provide economic benefits when they mature. To realize this objective, the SADA has also teamed up with the forestry commission to reduce the activities of illegal forest cuts and destruction.

According to the policy document of SADA (GoG-SADA, 2010), the body identified agricultural activities, especially small-scale intensification as a major milestone towards rural development and climate change mitigation, which is a contrast to the large scale and state-owned farms established by the earlier post-colonial administration (Shepherd and Gyimah-Boadi, 2004). Crops that are local staples in the area such as millet, sorghum, maize and yam are used. Higher yielding varieties, disease resistant and improved varieties are used to ensure competitiveness of these crops on the market and to improve the economic livelihoods of the people. Moreover, the use of semi-intensive farming to promote small ruminant production and other animals like pigs and guinea fowls is to increase and encourage livelihood diversification and to provide options for small-scale farming in areas with land scarcity. Moreover, water reservoirs and dams are also included in the implementation process to ensure that inhabitants have access to water for agricultural activities especially, during the dry season. The above strategy is aimed at ensuring that small-scale agriculture is focused on mitigating climate hazards.

VI. Concluding Discussion

The objective of the study was to explore how small-scale farmers in Upper East Region (UER) cope with climate fluctuations and hazards and also to find out how the state (Ghana) tackles the challenges of climate fluctuations particularly in Northern Ghana. Furthermore, the study focused on the household level and tried to discern how

women are affected by and act towards climate fluctuation and their coping strategies at large.

In the previous sections, some of the challenges of small-scale farmers were discussed. Again, strategies and practices, referred to as coping, used by small-scale farmers to address the challenges of climate fluctuations and hazards were discussed. Some of these practices and strategies have been carefully linked to farm and non-farm economic activities (NFEA) through livelihood diversification. Examples of these practices and strategies include; migration (during off-seasons and bad agricultural years due to poor or erratic rainfalls), petty trading, share cropping etc. These activities are aimed at reducing poverty and enhancing economic livelihood at large.

The study also addressed some of the challenges of rural women, especially in female headed households, who are considered as poor and vulnerable based on the household categorizations used in the study. A key issue that was discussed is the inheritance system practiced among a majority of the ethnic groups in UER. The explanations from the research study revealed how biased inheritance patterns prevent women from acquiring property such as land for cultivation and their constant seclusion from actively participating in public decision making. Some of these challenges, which rural female headed households face, coupled with their low economic capabilities make them vulnerable and poor (Bortei-Doku Aryeetey, 2000). Although my personal experience and observations in most communities in UER demonstrates that kinship groups play important roles in helping people to integrate into societies with economic and other contributions, it is important to note that these contributions are not enough because many of these kinship groups are not economically stable themselves. I would rather argue for change in laws on inheritance to favor men and women rather than the current pattern which reproduce female vulnerability.

Furthermore, livelihood diversification has been emphasized by scholars, including Liyama (2006), as the best alternative to reduction of vulnerability and poverty in this era of climate change, especially, in rural areas of developing countries. I believe that a lot of emphasis must be place on large scale changes regarding new ways to use land in vulnerable areas, infrastructure development in poor and remote areas, migration and also improve upon the quality and access to education. For example, since land sizes continue to decrease due to the increase in population, new ways of cultivation

such as mixed cropping¹⁶ must be encouraged among small-scale farmers to increase food crop production. Moreover, I believe that female education in the area must be intensified to enable them seek employment in the formal sector to improve their economic strength and power.

Lastly, Ghana's intervention to bridge the development gap between the North and South is very important especially through the implementation of some of the policies of SADA which are aimed at tackling fluctuations in climate change and its hazards. I am of the view that the state (Ghana) must speed up its activities regarding the implementation of all the policies to tackle some of the challenges of climate change in Northern Ghana.

References

Al-Hassan, R and Poulton, C.(2009) "Agriculture and Social Protection in Ghana". FAC Working Paper, No.SP04, January.

Apusigah, A;(2009) " The Gendered Politics of farm livelihood Production and the shaping of women's livelihoods in Northern Ghana" Feminist Africa, Cape Town.

Armah, F A; Yawson D O; Yengoh G T; Odoi J A and Afrifa E K A (2010) Impacts of Floods on Livelihoods and Vulnerability of Dependent Communities in Northern Ghana. *Water* 2:2; 120-139.

Aryeetey, E and Mckay, A (2004). Operationalizing Pro-poor Growth: Ghana Case study. DFID (Department for International Development), London, UK.

Assan, K J; Caminade, C and Obeng, F. (2009) Environmental Variability and Vulnerability in Vulnerable Livelihoods: Minimising risks and optimizing Opportunities for Poverty Alleviation. *Journal of International Development*, 21: 403-418.

¹⁶ Mixed cropping is a system of farming where by farmers plant a lot of crops on a small piece of land. It is mostly used as a strategy to guard against crop failure and also to increase the total number of crops harvested on a small plot of land.

Baden, S. and Goetz, A.M (1998) “Who need (sex) when you can have (gender)? Conflicting discussions on gender at Beijing” In C. Jackson and R. Pearson (eds), *Feminist visions of Development: Gender and Analysis Policy*, London: Routledge.

Bortei-Doku Ayeetey, E (2000) “The Participation of Women in the Ghanaian Economy” In: Aryeetey, E., Harringan J and Missanke M (eds). *Economic Reforms in Ghana: The Miracle and Mirage*, James Curry, Oxford.

Ellis, F (2000) *Rural Livelihoods and Diversity in Developing Countries*, Oxford:Oxford University Press.

GoG-SADA (Government of Ghana/ Savannah Accelerated Development Authority) 2010. *Savannah Accelerated Development Authority-Strategy for SADA. Synopsis of Development Strategy (2010-2030)*. The Policy Unit, Office of the Vice-President. October 22, 2010.

GSS (Ghana Statistical Service) 2000. *Ghana Living Standards Survey: Report of the Fourth Round*, Accra: Ghana Statistical Service, Ghana.

Ifejika, S C (2010) *Drought Coping and Adaptation Strategies: Understanding Adaptations to Climate Change in Agropastoral Livestock Production in Makueni District, Kenya*. European Association of Development Research and Training Institute. *European Journal of Development Research*. Palgrave Macmillan Ltd.

IPCC (Intergovernmental Panel on Climate change), 2007: *Summary for Policy makers: In: Climate change 2007: The Physical Science Basis. Contribution of Working Group 1 to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Solomon, S,D; Qin, M; Manning, Z, Chen, M. Marquis, K.B. Avery, M. Tignor and H.L Miller (eds)). Cambridge University Press; Cambridge, UK and New York, NY, USA.

Liyama, M (2006) *Livelihood Diversification Patterns among Households and THEIR Implications on Poverty and ResourcesUse: A case study from Kerio River Basin Community*. *Land Use Change Impacts and Dynamics (LUCID)*.Project Working Paper. No.51 Nairobi, Kenya: International Livestock Research Institute.

Meteorological Service Agency, Bolgatanga, Ghana: In Assan, K J; Caminade, C and Obeng, F. (2009): *Environmental Variability and Vulnerability in Vulnerable*

Livelihoods: Minimizing risks and optimizing Opportunities for Poverty Alleviation. *Journal of International Development*, 21: 403-418.

Ofori-Sarpong, E (2001) Impact of Climate Change on Agriculture and Farmers Coping strategies in Upper East Region of Ghana. Department of Geography and Resource Development, University of Ghana.

Sivakumar, M V K; Das H P and Brunini, O (2005) Impacts of Present and Future Climate Variability and Change on Agriculture and Forestry in Arid and Semi-arid Tropics. *Climate change* 70 (1-2) :31-72

(ODI) Overseas Development Institute and (CEPA) Centre for Policy Analysis (2005) Economic Growth in Northern Ghana. Revised Report for DFID (Department for International Development), Accra, Ghana.

Sheperd A and Gyimah-Boadi E (2004) Bridging the North/ South Divide ? Background Paper for 2005. World Development Report *http:# siteresources.worldbank.org/INTWDR20061*. Accessed on 16-06-2012.

UNECA (United Nations Economic Commission for Africa) 2004 Africa Gender Development Index. UNECA. Addis Ababa.

Van der Geest, K (2003) Rural Migration and Livelihood Security in Ghana. Sussex Migration Working Paper: Sussex Centre for Migration Research: Brighton, UK.

Van der Geest, K (2004) “We’re Managing!” Climate Change and Livelihood Vulnerability in North/West Ghana. African Studies Centre, Leiden. Research Report 74/2004.

Wurtenberger L; Bunzeck I. G; Van Tilburg, X (2011) Initiatives Related to Climate Change .Towards Coordinating Efforts. Energy Research Centre of the Netherlands.

WEDO(Women Environment and Development Organization) 2008 Gender, Climate Change and Human Security. Lessons from Bangladesh, Ghana and Senegal. Prepared for ELIAMEP by WEDO with Abantu for Development in Ghana, Action Aid in Bangladesh and ENDA in Senegal. www.gdnonline.org/resources/WEDO. Accessed on 20-04-2012.

[www.http:#upload.wikimedia.org/wikipedia/commons/f/fg/clicable_Regions_of_Ghana.svg](http://upload.wikimedia.org/wikipedia/commons/f/fg/clicable_Regions_of_Ghana.svg). accessed on 05-07-2012.

Yaro, J A (2006) Is deagrarianisation real? A study of livelihood activities in rural northern Ghana. *The Journal of Modern African studies*, 44, pp 125-156.

Yiridoe E K; Langyintuo, A and Dogbe, W. (2006). Economics of the Impacts of Alternative Rice Cropping Systems on Subsistence Farming: Whole-farm Analysis in Northern Ghana, *Agricultural Systems* 91,pp 102-121.