Nyamedor, Felix H. Address: Regional Institute for Population Studies, Box LG 96, University of Ghana, Legon. Email: fnyamedor@yahoo.com

S. N.A. Codjoe Address: Regional Institute for Population Studies, Box LG 96, University of Ghana, Legon. Email: scodjoe@yahoo.com

Abstract

Adapting to Sea Level Rise: Household head gender role differences from Ada, Ghana

Recent anthropogenic changes in the climate exacerbated effects on the human population. Sea-level rise and its resulted coastal flooding affect the livelihoods of many coastal settlers globally. Understanding how the sex of a household head influences adaptation decisions is beneficial to help target adaptation efforts. A mixed method of 350 household self- administered survey and 12 focus group discussions, 16 in-depth interviews to coastal settlers were analyzed using bivariate and thematic analysis for both quantitative and qualitative data respectively. Adaptation efforts in communities include construction of drains, use of sack bags, relocation, migration and change of house wall materials. Male household heads were found to have high migration expectations and 34% (P=0.05) more likely to adapt than their female counterparts. Ghana's efforts in building resilience will be enhanced if adaptation efforts and interventions are gender sensitive. This also empower the nation meet its Millennium Development Goal 1 of halving poverty by 2015.

Introduction

Until recently, climate change research and negotiations have focused almost exclusively on the imperative of reducing greenhouse gas emissions. However, it is clear that emissions reductions efforts have been too little, and too late. Therefore, the challenges and complex politics of adaptation are joining those of mitigation at the centre of policy debates. It is, therefore, crucial for the international community to accelerate learning about effective adaptation. One of the most important tasks will be to improve our understanding of how sea-level rise (SLR) affects coastal ecosystems, economic life and human mobility (IPCC, 2007:18). Sea level rise could motivate resettlement, forced migration, or other forms of human mobility (Care for shelter, 2008). Sea level rise also affects physical infrastructure, health systems, natural, economic and social systems that existed in the past in the coastal environment.

Despite the current and future scenarios provided for sea level rise, a larger part of the global human population lives in coastal areas: estimates range from 20.6 per cent within 30 km of the sea to 37 per cent of global population in the nearest 100 km to the coast. The population in the "near-coastal zone "in 1990 was estimated at 1.2 billion (Nicholls and Small, 2002).

In the nations in sub-Saharan Africa, most of the land classified suitable for human habitation is in the coastal belt and in some countries; most of the economic centres as well as major urban

centres are located near the coast (Nicholls 2004). Major cities in Africa such as Lagos, Cairo, Accra, Douala and Monrovia are all situated within 1.5 kilometers from the coast. This makes inhabitants vulnerable to stressors post by sea- level rise. SLR will impede regional and national economic growth as a result of impacts on economic processes (natural, physical, social, financial and human) which will cause inundation and eventual lose to the low lying coastal areas and islands in Africa which already lacks proper adaptation structures.

Ghana's population increase and urbanization which has led to more than 50% of the population living in urban areas mostly at the Southern belt of the country. This poses development challenges to the country in terms of fish food security, groundwater quality and sanitation problems. Most households who used to depend on agriculture at the fishing communities on the country side are in constant migration to the cities for livelihood survival strategies.

Currently, comparably good number of households are migrating from the Dangme East District to various places which could be classified as internal and international migration for various economic, social, and cultural reasons as an adaptation strategy. In addition to the current flow of people, climate change exacerbated sea-level rise and attendant direct and indirect livelihood problems in the Dangme East District as a "push" factor for people to migrate in a large scale to places that could provide alternative livelihood strategies for them. It is imperative therefore to understand to what extent men and women approach the issues differently; what activities do the households engage in to help them adapt to impacts of SLR.

This paper considers the nexus between sea-level rise impacts and household head gender and adaptation differences, from the Ada community through the lens of current and future sea-level rise. In doing so, the paper attempts to operationalize the concept of nested vulnerability in understanding how the effects of sea-level rise and resulting vulnerability are interlinked as well as the part gender plays in adapting to the stressors of SLR. Furthermore, it argues that there are significant gaps under the current interventions the government has adopted as well as those of the district assembly short and long term plans. The plans have no outlined gender mainstreaming component and if not enhanced would make the communities more vulnerable. This will increase out- migration to undermine tourism and other economic prospects for the people of Ada.

Theoretical Context

Some scholarly work is available on sea-level rise and adaptation practices but in paucity. Among the few available is: (Adger et. al, 2007; Gupta et al, 2006, Swain, 1996; Kaplan, 1994; Sawar, 2005). Adaptation of population due to climatic stressors like drought and floods is not new. Societies have a long record of adapting to the impacts of weather and climate through a range of practices that include crop diversification, irrigation, water management, disaster risk management, and insurance (Adger et. al, 2007). But climate change poses novel risks often outside the range of experience, such as impacts related to drought, heat waves, accelerated

glacier retreat and hurricane intensity and inundation as a result of SLR. Archaeological evidence indicates that human population has been migrating as a form of adaptation within Pakistan and India for the past 10,000 years in response to changing dynamics of summer monsoon (Gupta et al, 2006). Also, there are some studies available on adaptation practices in response to the impacts of SLR (Brashaw, 2004; IPCC, 2007). All the growing literature in this field share how different adaptation practices are from one group of people to the other. Most of the practices are also gender sensitive and also mostly influenced by the development path, physical exposures, resource distribution, prior stresses and social government institutions interventions and policies. (Kelly and Adger, 2000; Jones, 2001; Yohe and Tol, 2002; O'Brien et.al., 2004). Due to the different part ways to development, societies have inherent abilities to deal with certain variations in the climate, yet adaptive capacities are unevenly distributed, both across countries and within societies. The poor and marginalised have historically been most at risk, and are most vulnerable to the impacts of climate change and their adaptation capacity is partly dependent on their gender roles at the household level (Adger et. al, 2007).

Adaptation and Gender

CARE's 2008 Gender Policy defines gender as "social differences between females and males throughout the life cycle that are learned, and though deeply rooted in every culture, are changeable over time, and have wide variations both within and between cultures." Gender – along with class, race and age – contribute to shaping the roles, power and resources available to women and men in any culture (CARE, 2008).

The differences that exist in society and the cultural setting underpinnings determine to a large extent the adaptation options available to households to effectively adapt to the impacts of climate change. Societies mode of inheritance, either patrimonial or matrimonially defines the social resources available to an individual in an adaptation effort . Each of these ways of inheritance posts uneven challenges for which women especially are the hardest affected as far as adaptive capacity is concerned. World evidence shows that women and children are more vulnerable to the impacts of climate change globally but Africa is the hardest hit of all the impacts of climate change (IPCC, 2007).

These differences come about as a result of the differences society accord men and women variedly in terms of roles, power and resources. Women are supposed to be caretakers of children, the elderly whiles men are free to move for economic gains. The ability for men to move afford them the capacity to tackle crisis than women (CARE, 2010). Men have more resources in a typical society and can therefore afford to a large extend to invest in alternative livelihood opportunities than women. Family assets such as lands, cultural heritage and estates are mostly under the authority of men. This and many other assets in the possession of men give them more power than women (CARE, 2010). All these differences bring adaptation response gap between men and women.

Gender Inequality

Gender equality refers to the "equal enjoyment by women, girls, boys and men of rights, opportunities, resources and rewards. Equality does not mean that women and men are the same but that their enjoyment of rights, opportunities and life-chances are not governed or limited by whether they were born female or male. In the light of such differences that mostly affect women, scholars have advocated that gender empowerment of both vulnerable men and women could minimize such challenges. One major way of adaptation that favours men mostly is the ability to move easily to different places for economic gains (UNDP, 2007). This is in itself is a social stereotype arrangement that society needs to overcome.

Migration as an adaptation to SLR

There is a role environmental degradation and natural disasters play in inducing people to migrate. With the increasing certainty about the impacts of climate change, it is believed that it will lead to forced migration of many people. For example, sea level rise and melting glaciers may induce people to migrate. If sea levels rise by 1 meter due to climate change, storm surges could make island nations such as the Maldives, the Marshall Islands, Kiribati, or Tuvalu largely uninhabitable and force inhabitants to take refuge in other countries (GACGC, 2006). Furthermore, 1 meter SLR will put 145 million people at the risk, 41% of whom will be in South Asia, and 32% in East Asia (Anthoff et al, 2006). SLR is also likely to increase the vulnerabilities of people to coastal flooding. It has been estimated that by 2020 SLR may have exposed an additional 6 million people living in coastal areas to flood (GACGC, 2006).

Similarly, glacial melting could profoundly induce migration by affecting the livelihoods of people who are directly dependent on irrigated water, small scale fishing and aquaculture. For example, Himalayan glaciers are already in retreat (Kehrwald et al., 2008). If due to climate change storage capacity of glaciers is lost, flooding risk increases in the medium term. This can affect rural agriculture and urban areas located in river deltas. Once the glacier disappears, it no longer releases water during the summer months which imply decreased water supply and untimely flows. The large population depending on these waters will be vulnerable to glacier melting. Thus, glacier melting has the potential to force people to migrate out of the areas depending on rivers from the glaciers due to SLR.

Also, SLR has also caused many encroachers of coastal buffer zones to migrate or have intentions to migrate due to continuous vulnerability from SLR. Swain (1996) has attributed the Indian-Pakistan migration to be as a result of SLR which has caused many damages in the region. Elliot (2004) citing Kaplan (1994) highlighted different environmental problems including SLR will prompt mass migration, and in turn, incite group conflicts that will be more rampant in areas where resources are scarce to strengthen adaptation capacity. Dalby (2002)

cited in Sawar (2005), explains the concept ‘ecosystem people’ which include people who lack technology to lessen impacts of environmental problem and adapt appropriately, yet their livelihood and general economic life depend on the environment. He stressed that any change in the environment will therefore prompt a coping strategy which when fail will result in intentions to migration or conflicts in competing for few remaining resources in the environment. This arrangements in themselves affect women mostly.

Adaptive Capacity

Adaptive capacity is the ability or potential of a system to respond successfully to climate variability and change, and includes adjustments in both behaviour and in resources and technologies (IPCC, 2007). The presence of adaptive capacity has been shown to be a necessary condition for the design and implementation of effective adaptation strategies so as to reduce the likelihood and the magnitude of harmful outcomes resulting from climate change (Adger, 2005). Adaptive capacity also enables sectors and institutions to take advantage of opportunities or benefits from climate change, such as a longer growing season or increased potential for tourism (IPCC, 2007).

Much of the current understanding of adaptive capacity comes from vulnerability assessments. Even if vulnerability indices do not explicitly include determinants of adaptive capacity, the indicators selected often provide important insights on the factors, processes and structures that promote or constrain adaptive capacity (Eriksen and Kelly, 2007). Institutional structures at play in any vulnerable community has the potential either to enhance or inhibit adaptive capacity in various ways. Most institutional and cultural settings of most societies have inherent structures that work against women. Despite most of these differences in the capacity displayed by men and women differently in society; most adaptive capacity building arrangement are based on national figures with less or no regard to how different people are in society. It has been argued that national indicators fail to capture many of the processes and contextual factors that influence adaptive capacity, and thus provide little insight on adaptive capacity at the level where most adaptation efforts will take place (Eriksen and Kelly, 2007).

This implies that the structural underpinnings of society itself lowers the adaptive capacity of women who are the most vulnerable in society. This in itself put women at the background that limits their adaptive capacities as their potential to offset challenges post by SLR is being constrained (Ericksen and Kelly, 2007).

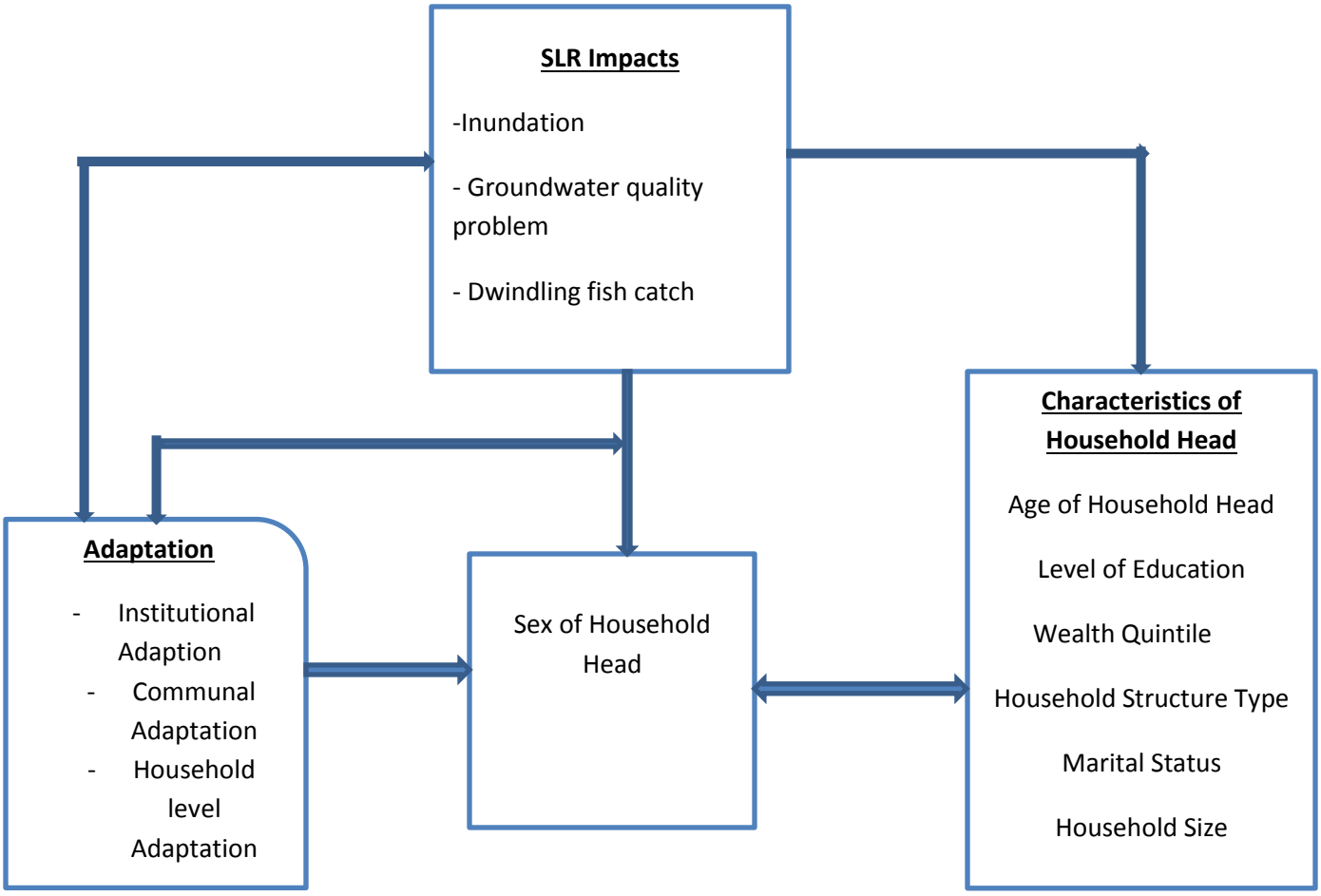
Policies as well as structural changes may affect adaptive capacity either positively or negatively. This means that a policy that is working now may not work tomorrow due to issues that may come with it. The policy may also work either favourably to one group and serve as a constraint to other groups within the same community. This means that adaptive capacity may diminish over time depending on the intensity of the stressor(s) in question and how the capacity of the vulnerable has been built.

Conceptual Framework

In this framework, the concept, " Vulnerability is the degree to which a system is susceptible to and unable to cope with adverse effects" (IPCC, 2007). Households become vulnerable as a result of impacts of SLR. Impacts of SLR such as inundation of low lying areas, groundwater quality problems and dwindling fish catches. Adaptation is very important to help people cope well with the impacts and build resilience in the process (Annecke, 2010). This becomes more rampant in Africa unlike in Europe when men and women are mostly in the middle class (Răty and Carlsson-Kanyama 2009) .

Adaptation strategies can be implemented by government, regional and district before the effects of SLR become more destructive to households. In the situation where this responsive adaptation strategy fails and impacts are already experienced before a reactive adaptation strategies have to be in place poses lots of challenges to the household. Household heads then has the greatest challenge to deal with such impacts and they have to cope and build resilience around them (**See Fig. 1.0**).

Figure 1.0: Conceptual framework of impacts of SLR and household head gender adaptation.
Source: Adapted from UNDP (2007)



deal with the impacts of SLR is different among men and women. Gender refers to the relations between men and women: the significant differences that exist in most societies between the rights and opportunities of men and women, including rights to land, resources, work opportunities and wages, and participation in decision making processes. Ensuring that men and women have equal rights, opportunities and responsibilities, ie gender equality, is something which most countries have signed up to through a number of international and national agreements and accords (Anneke, 2010). These differences in themselves differentiate men from

women and affords them different approaches to adaptation strategies, practices, constraints and opportunities.

On the other hand, opportunities that men and women have access to such as the level of education, the age at time of occurrence of climatic stressor, type of occupation, wealth quintile in society, marital status, size of the household and many others are also determinants on the level of adaptation capacity is or how it can be developed (UNDP, 2007). Impacts of SLR can also directly affect the extent to which some of these characteristics help build the resilience of household heads (Babugura,2009).

Data and Methodology

The Study area

The Dangme East District is situated in the Eastern part of the Greater Accra Region. It is located between latitudes 5°45'S and 6°00'N and Longitude 0°20'W and 0°35'E. The total land area of the District is about 909 square km, which represents almost 28% of the total land size of the Greater Accra Region.

The District shares common boundaries, to the North with the North Tongu District, to the East with South Tongu District and Dangme West District to the West respectively. It is bounded to the south by the Gulf of Guinea, which stretches over 45 kilometres (27.9 miles) from Kewunor to Wokumagbe. Also, it is bounded by the Volta River South–Eastwards extending to the Gulf of Guinea southwards thereby forming an Estuary, about 2 kilometres away from the District capital, Ada-Foah (DPCU, 2012).

The location of the District has made it particularly fruitful for local folks to engage in fishing and fish processing as their main economic endeavour for sustained livelihood. However, the corrosive nature of the coastal breeze has rendered most facilities ancient with the related burden of frequent maintenance and replacement (DPCU, 2012).

Climate vegetation

The vegetation is basically the coastal savannah type, characterised by short savannah grasses and interspersed with shrubs and short trees. Along the coast, there are stretches of coconut trees

and patches of coconut groves which combine to give the area a classic look. A few strands of mangrove trees such as the Angor[1] mangrove can also be found around the Songhor Lagoon and the tributaries of the Volta River where the soil is waterlogged and salty.

The Dangme East District is encapsulated by the south-eastern coastal plains of Ghana which is one of the hottest parts of the country. Temperatures are high throughout the year and ranges between 23°C and 28°C. A maximum temperature of 33°C is normally attainable during the very hot seasons. Rainfall is generally heavy during the major seasons between March and September. The average rainfall is about 750 millimetres. The area is however very dry during the harmattan season when there is no rainfall at all. Humidity is about 60 per cent high, due to the proximity to the sea, the Volta River and other water bodies. Daily evaporation rates range from 5.4 - 6.8 millimetres. The relatively high temperatures help in the quick crystallization of salt for the salt industry around.

Frequent high tides and coastal flooding especially in July-August annually for the past five years has caused lots of natural and physical damages in the area. Many housing structures have been destroyed as well as tourist monuments of cultural importance that used to attract lots of tourists to the area. The linkage of SLR and poor revenue generation in the area cannot be emphasized. SLR has also brought about salinization of groundwater that is used for irrigation and drinking in some communities which is a 'push' factor for migration (DPCU, 2012; EIA, 2010).

The high temperature provides an opportunity for the installation of solar panels in generating solar energy for communities where there is no electricity, and more specifically for educational institutions and clinics. This energy option is yet to be explored. The unreliability and dependence of farmers on the rainy season makes farming a vulnerable occupation. Periodic crop failure is a common phenomenon even in the better-watered northern parts. It is obvious therefore that the provision of irrigation facilities will be of great value in the district.

Population Size and Growth Rates

The Dangme East District has a population of 109,225 people with females slightly outnumbering their male counterparts. The Ghana 2010 Population and Housing Census (PHC,

[1] Name of a village in the study area

2010) put the female population of the district at 57,375, representing 52.53 per cent of the total district population. The male population was 51850 representing 47.47 per cent.

Data from the 1960, 1970 and 1984 censuses suggest that, the population of the District rose from 43,844 in 1960 to 52,164 in 1970 and further to 71,550 in 1984. This gives inter-censal growth rates of 1.7 per cent and 2.3 per cent per annum respectively for the periods between 1960 – 1970, and 1970-1984. However, the period between 1984 -2000 was 1.6 per cent annually for an extensive sixteen (16) years of population growth. The growth rate was slow as compared to the national figure of 2.6 at the time (GSS, 1984). The growth rate for the period 2000-2010 was 3.0 per cent which was the highest so far from 1960.

It is quite possible (looking at the annual inter-censal growth rate of 1.7, 2.7 and 1.6 percent for 1960-1970, 1970-1984 and 1984-2000 respectively) to conclude positively that, the population of the District has decreased tremendously between the period of 1984-2000. However, it should be noted that, the percentage increment for the sixteen (16) years of population growth outweighs the periods of 1960-1970 and 1970-1984 respectively. An observed trend of the national population figure revealed that, the 1984-2000 population growth has not recorded any significant increment over the 1970-1984 rate of growth.

The periods 1984-2000, 2000-2010 have seen increments from 1.6 to 3.0 respectively. This suggests that the population is growing in recent times as compared to the past. Anecdotal evidence has it that most of the population is very concentrated at the hinterlands of the district as compared to the coast where there is comparably higher migration as a result of SLR.
Questions remain to answer as to how those still leaving in the immediate coast are adapting to the impacts of SLR and what might the reason why most people seem migrating from the coast to the interior parts of the district. How different is this in the eyes of both men and women household heads?

Sampling

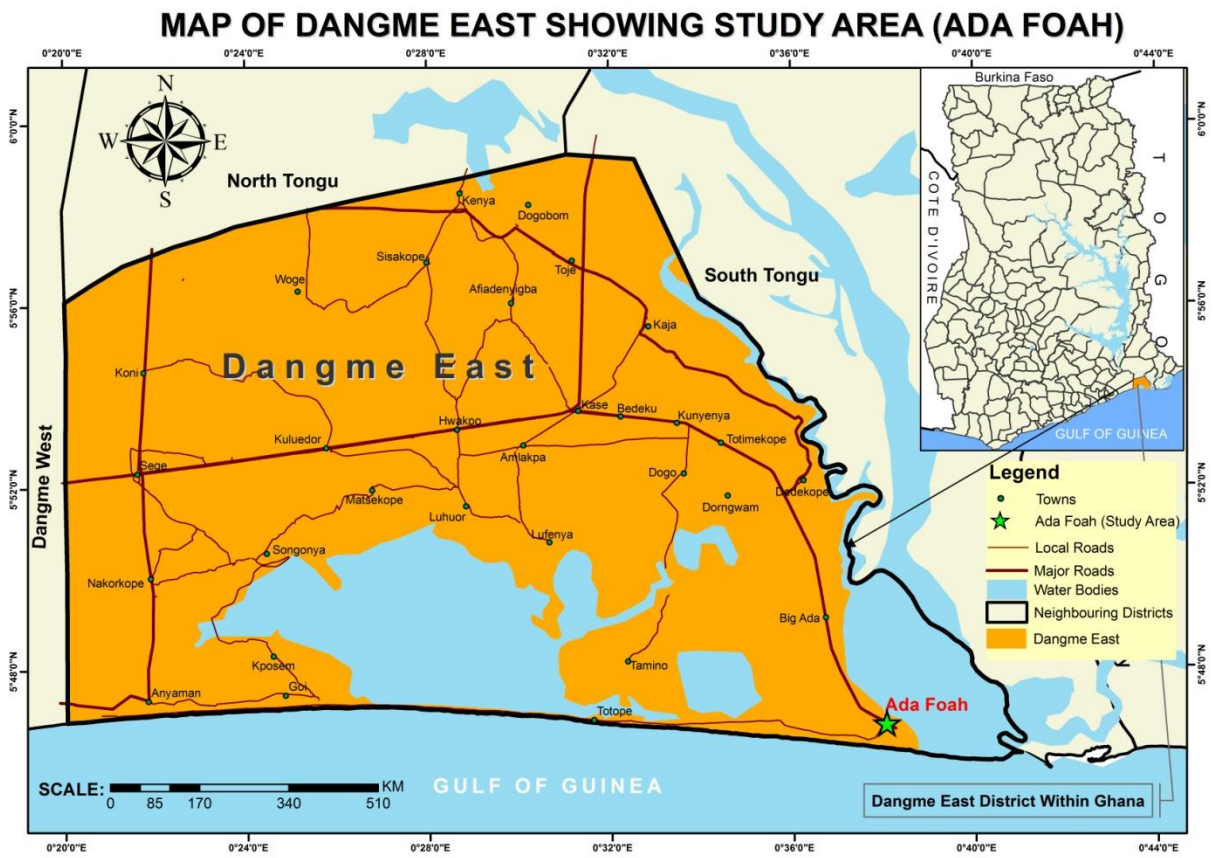
The data for this paper is derived from the Climate and Development Knowledge Network (CDKN) Sponsored field work conducted in 2012. A representative sample of 350 households were selected, 100 households from Ocanseykorpe and Anyakpor with 150 from three different enumeration areas in Ada Foah. A sampling frame was formed with a Global Positioning System

(GPS) codes picked on all housing structures in the study communities. The total number of households for each community was obtained using the average household size of 5.3 to divide the baseline populations of each community to get the number of eligible households. The number eligible in the community then informs the number of household structures to be selected from the sampling frame. One household was picked at random from that structure in cases where there were more than one household in the structure whose code was picked from the sampling frame.

Twelve focus group discussions were conducted. Four interviews from each community as well as in-depth interviews were done with assembly members, chiefs and other opinion leaders in the three communities. The three communities were selected from the district based on three reasons (i) the fact that they have the least distance to the coast comparably (ii) the fact that prospective tourism development and industrialization is to be based at the area and (iii) on the fact that preliminary work for sea defense is on-going there.

Questions were asked on what changes have come around the coast, frequency of high tides as compared to the past ten years? Have these changes post any challenges to in any way for the past three years? What is the household doing about the situation? Is anything being done now that has not been done before in response to these stressors? how many people have moved out of their household. Do you intend to migrate, do they know any household whose member has migrated and where they migrated to, what do they think might be the reason for the migration. Specifically on how sea erosion, salinization and flooding pose them in terms of what practices they have put in place to help themselves curb the stressors in terms of health, natural, physical, social and financial resources. How do these resources play back in helping them to develop greater capacity to adapt to the stressors of SLR?

Data from the Takoradi Port where the Ghana tide gauge is located was obtained through the Oceanography Department of the University of Ghana for analysis on sea-level rise in Ghana.



Results and Discussion

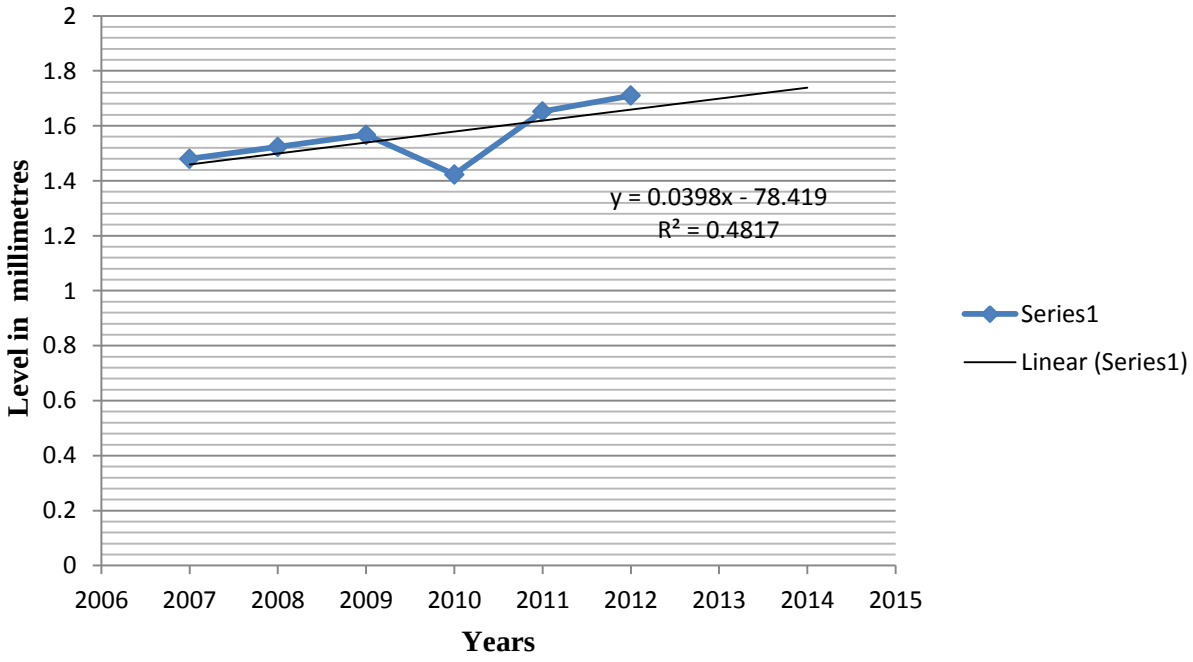
My objective was to find out how the livelihoods of households head are being impacted by SLR and how differently are men and women adapting to the challenges**.** Below are the findings and their implications for gender adaptation at the household level.

Sea level rise in Ada

Based on global chart datum for Ghana, recorded mean annual tide data for Ghana revealed between 1.4 to 2.0 millimetres of sea-level rise in Ghana (Appeaning-Addo, 'pescom' 2011) **(See Fig. 1.1).** Tidal data from 1965-2009 have shown that the mean sea-levels for Ghana had a sharp rise from 2006 and expectations are high for further rises in the future (IPCC, 2007). The current rise in sea level is attributed to thermal expansion in the ocean caused by global warming (Church et. al, 2001; Appeaning-Addo et. al, 2012).

The figure 1.1 shows that there has been a rise in sea level and the positive coefficient of determination (R^2 = 0.4817) shows that the likelihood is high for further increases in sea level (Y) over time in millimeters.

Fig. 1.1 :A chart showing average rise in mean sea-level for Ghana



Data on sea erosion gathered for the past 65 years up to 2004 has shown an average of 6m of erosion of the coastal buffer zone in the area. This alludes to the rate of destruction of infrastructure and other monuments of cultural importance in the area. Results in **Table 1.1** portrays how the landing sites for fishermen will be greatly affected as well as encroachment of farming lands that will serve economic benefits for the people when is fishing is hardly affected.

Table 1.1: Ada coastal rates of erosion

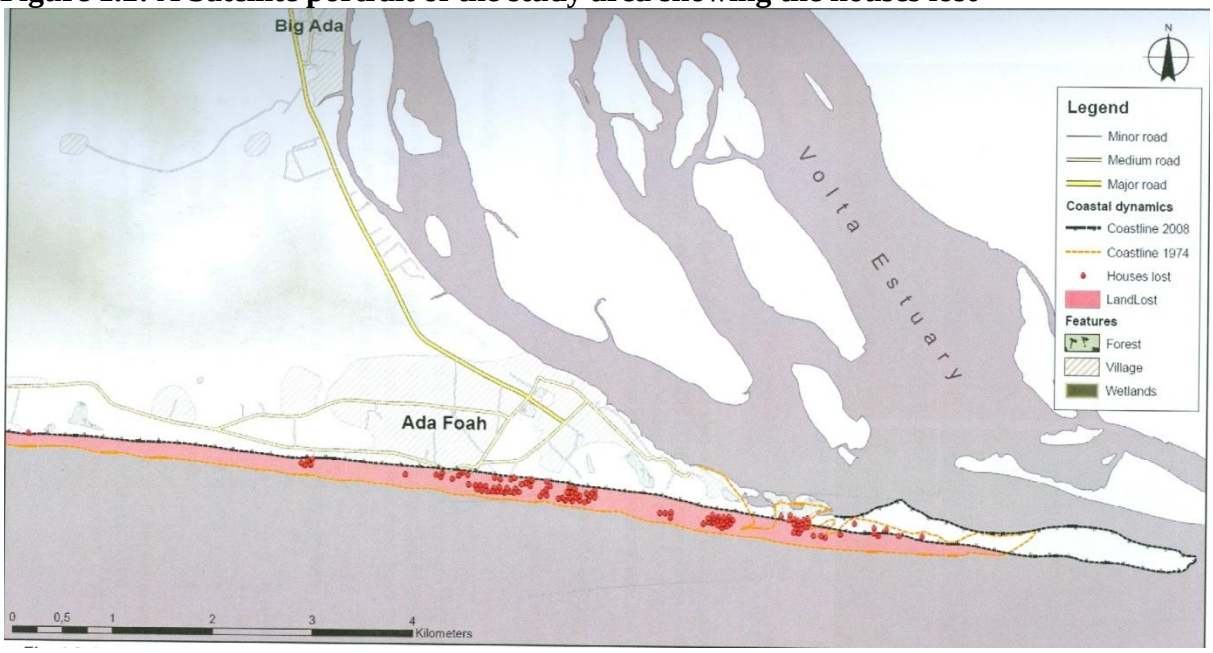
#	Period	Average Erosion Rate (Annual)
1	1939- 1976	2- 2.5m
2	1979-1981	3- 4m
3	1981-1985	8-10m
4	1985-2004	Appr. 10m

Source: Ministry of Housing Ada Coastal and Volta Estuary Project (2004)

The Satellite portrait of the study area shows the number of housing and other importance structures that have been destroyed as a result of coastal erosion resulting from SLR. The Volta Lake in the area that serves as a source of fresh water for both irrigation and for drinking

purposes for the people is also being affected. Salinization of the fresh water bodies by the sea also poses lots of health challenges to the inhabitants in the area.

Figure 1.2: A Satellite portrait of the study area showing the houses lost



Source: EIA of Coastal Ada, 2010

Locality by Sex

This percentage of female household heads (42.9) is higher than the 29.5% reported in the district planning office (DPCU, 2011). The difference might be as a result of male household heads that do migrate to other countries like Togo, Cameroon, Nigeria and other places in Ghana like Tema, Accra, Takoradi and many other countries for greener pastures.

Table 5.1: Percentage distribution of households' locality by Sex

Locality Name	Sex		
	Male	**Female**	**Total**
Anyakpor	59	41	**100**
Ada-Foah	88	62	**150**
Ocanseykorpe	62	38	**100**
Total	**209**	**141**	**350**

Source: Computed from Fieldwork 2012

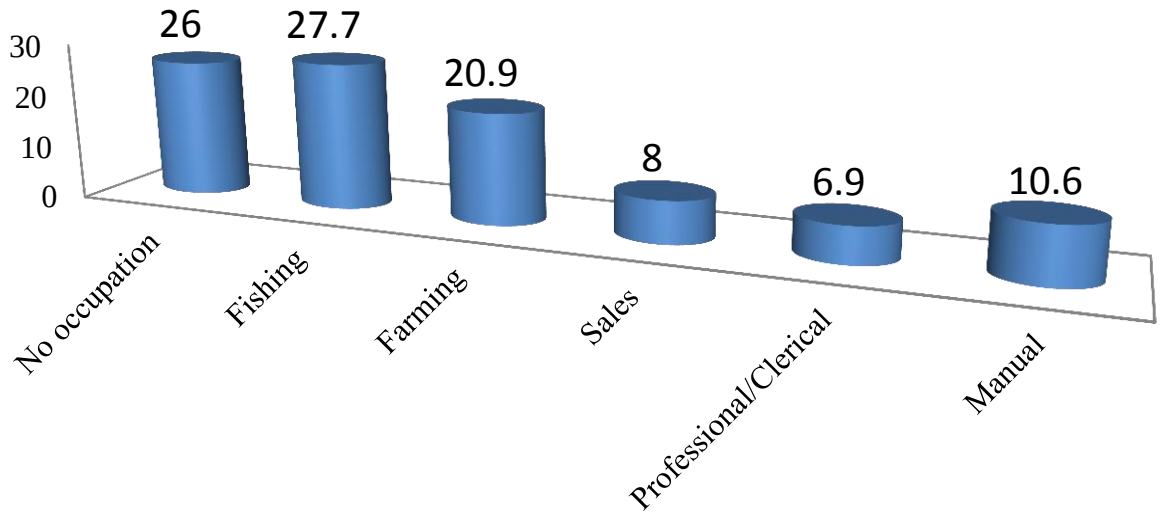
The total number of households interviewed showed that there were 209 male household heads and 141 female household heads. Male household heads form 60% of the total respondents. Men are known to be migrating more than the women in the area which could be the reason why women share 40% of the population of household heads (DPCU, 2012). This is in deviation with the national figures for the female household heads (DPCU, 2012).

Occupation of household heads

The main occupation in the district is agriculture which comprises fishing and farming. From **Figure 2.1**, fishing and farming pulled the highest percentage of the occupations of household heads. This is quite lower than the national percentage of almost 60% (GSS, 2000), which might be due to troubles such as SLR associated recently with the fishing industry in the district taking lots of fisher folks from their work. This might also contribute to the recorded 26% level of 'no occupation' category. The least among the percentages was the Professional/Clerical group that recorded 6.9% as against the manual occupation category of 10.6%.

Both skilled and unskilled household heads pulled almost 11% of the occupation categories. This suggests the scale of human development and the need for human capacity building in the district (DPCU, 2011).

Figure 2.1: Percentage distribution of household heads' occupation categories

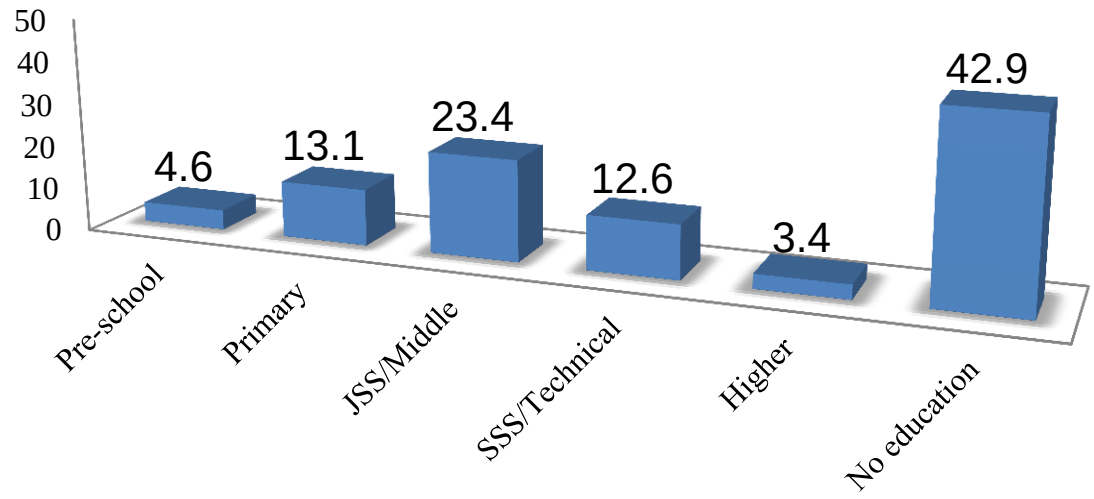


Source: Fieldwork 2012

Level of education of household heads

From **Fig. 2.2.**, level of education among household heads shows that about 43% of respondents have no formal education while about 18% have pre-school and primary education. Respondents with Junior High / middle school level recorded 23.4% while 12.6% had Secondary/Technical level of education. Household heads with higher education, Polytechnic, University or Teacher Training College had 3.4%. Education amongst the first generation in the district was poor since most people were into fishing and girl child education was also not accepted largely by the local people by then. Majority of such group are the heads of today's households in the area.

Figure 2.2: Percentage distribution of level of education of household heads



Source: Fieldwork 2012

Household Size

The number of people in the household of the respondents gives an overview into the level of dependency in the household and the ability of the head of household to meet daily needs of the members in order not to compromise the issues of water quality and the related problems that it might bring to the household. The number of mouths to feed also plays a significant role in the level of burden the household needs and the magnitude of the impacts of SLR on the household.

From **Table 2.2**, about 41% of respondents fall within single households to households of size of four members. This number is in correspondence with the national average household size of 5.1 (GSS, 2012).

Households with sizes between 5-8 inclusive takes about 38% of the number of households which were averagely more than the national household size which might be due to high fertility in the area (GSS, 2000). Almost 20% of the respondents have household membership from nine inclusive showing the level of fertility and the population per the area.

The mean household size was 6.57, a median of 5.00 and a standard deviation of 7.02. The mean household size is greater than the average national household size of 5.1 which might be as a result of the traditional setting of the community and the fertility rate of women in the district.

Many parents have also left their homes for greener pastures elsewhere whose children are left with their relatives and other siblings who might have added to the household sizes thereby increasing the number of people in the households (DPCU, 2011,).

This suggests that the average dependence on groundwater would be high. This will increase the level of abstraction in the area which could increase the rate of infiltration from the shallow water tables in the area due to SLR.

Table 2.2: Percentage distribution of household Size

Household size	Frequency	Percent
1-4	144	41.1
5-8	133	38.0
9+	73	19.9
Total	**350**	**100.0**

Source: Fieldwork 2012

Age of household heads

One of the most important demographic factors is age. Age is a determinant of lots of population concerns. The population of the district is generally made of young people as that of the nation, Ghana and sub- Saharan Africa for that matter.

From **Table 2.3**, ages have been grouped to cancel out errors that might come as a result of memory lapses due to time. Percentage of respondents aged 15-29 as depicted by the table was

34.1%. This suggests that many household heads were young mostly with household sizes of one, two, and three at most.

Middle age groups from 30-44 were about 29% which was comparably slightly higher than those in the groups of 15-29. This shows that more youthful individuals perform duties as parents or as singles on their own.

Respondents aged 45-59 made 20% only which also reflects the fact that the population is youthful in the locality. Ages 60-70+ forms 17.2% of the population, this is the number of people who are out of the main working class who may be dependents on the few working class thereby increasing the dependency ratio of an already marginalized area.

They may be dependents as most of them have not earned any social security on their fishing and farming job. The mean age of the district was 40.22 years and a median age of 35.00 years. This implies the adult population of the area was less compared to other districts in the region such as the Dangme West that has a mean age of 42.1. This might be as a result of migration of the youthful age family heads for better livelihoods elsewhere.

The Dangme East District has the highest dependency ratio in the Greater Accra Region with a ratio of 102.8 (DPCU, 2011). This buttresses on the age distribution and the number of people in productive work as well as the percentage of those not working. High dependency ratio emerges as a result of the age of the people who are in productive work as compared to the non-working class.

Table 2.3: Percentage distribution of age of household heads

Age of respondents	Frequency	Percent
15-19	17	4.9
20-24	51	14.6
25-29	51	14.6
30-34	37	10.6

35-39	41	11.7
40-44	23	6.6
45-49	26	7.4
50-54	30	8.6
55-59	14	4.0
60-64	8	2.3
65-69	21	6.0
70+	31	8.9
Total	**350**	**100.0**

Source: Fieldwork 2012

Adaptation Strategies by Gender

Men and women are faced with same impacts of SLR such as inundation of low lying areas in the communities, dwindling fish catches, poor quality groundwater for both consumption and their associated health and economic challenges. Adaptation practices among men and women household heads are different in many respects.

For example, some fishermen mostly due to challenges SLR pose to their fishing work particularly prefer to move to habour cities where they can have better landing sites and better prices for the fishes they may catch from time to time. This is in compliance with other studies such as Nyamedor (2012) that argue that men are more likely to resort to migration as a medium of adaptation in response to disasters as compared to their female counterparts who are seen mostly as care takers of children and the elderly in the household (CARE, 2010).

In response to what they do to protect their housing structures from falling from inundation, 53% of women as compare to 47% of men said they use sand bags to provide some protection for their housing structures because to provide some support for the housing structure from sea flooding.

Table 2.4: Adaptation options of household heads by sex

Adaptation Strategy	Men	Women
Migration	More men migrating (68%)	Less women migrating (32%)
Using sand bags	Use less number of sand bags (sand heaps) (47%)	More sand bags for protection around houses (53%)
Dependence on Land resources	Have more land for farming (73%)	Have less land for farming (27%)
Water for drinking	More reliant on satchet water (64%)	Less reliant on satchet water but more on tube wells (36%)
Relocation	Leave wife(s) and children to stay behind	Shifts housing structure to different part of the community farther from the sea
Social Networks	Strong social networks	More stronger and caring social networks
Fish consumption as fish catches dwindle	Depend sometimes on seine nets for fish as well as the catches from the Volta Lake	Buy fish from outside for sale in community
Prayers	Pray to God	Intense Prayers to God
Taboo	Hold on to major taboos about what to eat and when to do fishing	Pay less attention to what to eat and other taboos in the community defined by taboos
Infrastructure	Using thatch to develop structures close to sea coast to avoid corrosion	Moving housing structure to interior part of community
Dependence	Men depend on 'fish mothers' for support during low catches	Women who are not 'fish mothers' more often have no credit facility to depend on

Source: Fieldwork 2012, P>0.005

Careful look at the table reveals that community in-built structures of all the communities in themselves post challenges to building the capacity of women to adapt in terms of power, dependence and use of resources. The table shows that all the cases where there is some alternative arrangement when some financial investment has to be done men are the dominant. For example, in the use of groundwater, the quality that has been compromised by salinization by SLR where alternative arrangement is to be made in terms of the purchasing satchet water. Most male household heads could afford that arrangement as compared to 36% of their female counterparts. This is consistent with the findings of CARE (2010) who found out that women has

less power, resources and depend mostly on men and thus have lower adaptive capacity as compared to their male counterparts.

The district planning office also captures cases of events where women were more vulnerable, for example in cases of coastal flooding in the district. Their report also shows that women find it difficult to recover from disasters and therefore must be well covered in a contingency planning (DPCU, 2011).

The adaptation practices with the percentages are those that were significant when thrown into the model with the gender of the household head. **Table 2.5** shows the changes in the gender adaptation model when the background characteristics were added.

Binary Logistic Regression

In this section, binary logistic regression was done on adaptation options by background characteristics. Sex of the head of the household head was used as a proxy for the role he/she plays in the household as a male or female. Adaptation options of the household were linked to the sex of the household head.

Results from the multivariate logistic regression analysis suggest that out of five socio-demographic characteristics only two were found to be significant predictors of adaptation options in the district apart from the sex of the household head. The variables found not to be significant at 95 percent confidence interval were age of head of household, level of education of household head, wealth quintile, and locality of head of household and household size (**See Table 2.5)**.

Even though, studies found many of the characteristics that were not significant as determinants of adaptation options especially age which was found by CARE (2010), that level of education, age and locality determines the type of adaption options and practices households indulge in IPCC (2007). The different case in this study could be as a result of interactions effects of other

factors in the model since most were significant at the bivariate level of analysis. It could also be that the main focus on the sex has brought about some multi-collinear effect on other determinants of adaptation options. The analysis shows that at 95 percent confidence level, sex of household head determines migration intentions of the household. The table indicates that females are 30% less likely to migrate as compared to their male counterparts. This is consistent with studies which indicate that females do not migrate largely as compared to males (Burnett, 2006).

Table 2.5: Binary logistic regression of socio-demographic characteristics, salinization and intentions to migrate

Background Characteristics	B	Standard Error	Difference	Significance	EXP(B)
Ages					
15-19 (RC)			11	0.084	
20-24	1.629	0.863	1	0.059	5.099
25-29	-0.156	0.739	1	0.833	0.856
30-34	-0.135	0.726	1	0.853	0.874
35-39	-0.282	0.739	1	0.703	0.754
40-44	-1.11	0.767	1	0.148	0.330
45-49	-0.36	0.775	1	0.642	0.697
50-54	-1.347	0.812	1	0.097	0.260
55-59	-0.008	0.828	1	0.992	0.992
60-64	-1.358	1.146	1	0.236	0.257
65-69	-1.169	0.775	1	0.131	0.311
70+	1.053	0.421	1	0.032	0.234
Locality					
Anyakpor (RC)			2	0.661	
Ada-Foah	-0.61	0.386	1	0.941	0.965
Ocanseykorpe	0.246	0.363	1	0.875	1.28
Level of Education					
No education (RC)			4	0.482	
Primary	0.409	0.67	1	0.542	1.505
J.S.S/Middle	-0.226	0.39	1	0.607	0.798
SSS/Technical	-0.631	0.363	1	0.082	0.532
Higher	1.325	0.442	1	0.003	3.763

Occupation of household head					
No Occupation (RC)			5	0.482	
Fishing	0.351	0.505	1	0.487	1.421
Farming	0.521	0.509	1	0.306	1.68
Sales	-0.194	0.529	1	0.713	0.823
Professional/Clerical	0.135	0.651	1	0.835	1.145
Manual	-0.287	0.72	1	0.69	0.75
Wealth Quintile					
Poorer (RC)			4	0.233	
Poor	-1.045	0.458	1	0.023	0.352
Rich	-0.399	0.452	1	0.377	0.671
Richer	-0.579	0.423	1	0.171	0.561
Richest	-0.365	0.44	1	0.407	0.694
Migration intentions					
Intentions to leave community	-0.388	0.894	1	0.665	0.679
Making water clean					
Adding alum (RC)			2	0.651	
Depending on water tanker	-4.37	0.472	1	0.355	0.646
Depending on satchet water	-0.303	0.442	1	0.493	0.738
Household structure protection					
creating drains around house	0.748	0.315	1	0.18	0.005***
Vacating household premises	-0.344	0.338	1	0.307	0.211
moving to stay with a different HH	-0.18	0.361	1	0.618	0.709
Using sand bags	-0.304	0.355	1	0.392	0.835
Scooping sand from room	-0.261	0.325	1	0.422	0.738
Social Networks					
People ready to help	0.234	0.612	1	0.342	0.032***
Resources					
Land resources available for use	1.671	0.211	1	0.761	0.048**
Had savings to depend on	1.243	0.564	1	0.672	0.065

Source: Fieldwork 2012; p<0.05, R-squared = 0.27; RC = reference category; N=350 * very significant**

Among the adaptation options, men are 25% more likely to create drains around their house structures as compared to their female counterparts. This could be as a result of the muscular

nature of this work. Female household heads have to pay for this services in most cases for men to help them do. They may also rely on family ties in other cases where they is somebody willing to help. This is very significant as it is one of the major adaptation use in the community by observation. It was reported that at places where the water table is very shallow, they are challenges to creating drains in the communities. This is in conformity with the findings of the fourth technical report of the IPCC (2007) , that some adaptation practices may be more practicable and cost effective as compared to others. The nature of the adaptation option is the determinant of whether more men or women households head will indulge in.

The cost of acquiring equipment and support in creating drains around households in many circumstances may demand some investment which men are more likely to be capable of doing as compared to women. Women tend to use more of sand bags, move to stay with different household whose social networks can better afford as compared to creating drains around households to prevent flooding. The practice of creating drains turned to be a more usable activity for community members as compared to vacating housing structure, moving to stay with a different household, use of sand bags and scooping sand from filling their room before using it. The latter is very crucial since the movement of the sea sometimes bring sand to fill some of the houses close to the buffer zone.

On the availability of people from time to time to help in adaptation capacity building and support from community, NGOs, Faith Based Organizations (FBO) and some generic community social meetings. The analysis revealed that women are almost 77% more likely to be helped. These help is mostly by these para-groups as compared to their men counterparts. This may be as a result of recent advocacy in the area on the need for gender empowerment in the area. Though most men are said to be naturally able to stand the challenges, some are also equally vulnerable and need help in adaptation capacity building as well, CARE (2010).

Access to resources is one major player of adaptation capacity and options which goes the long way to influence adaptation practice. The result on the occupation of household heads revealed that, almost 50 per cent of household heads are into fishing and farming. In the event that SLR threatens the fishing business, farming is the next available work opportunity in the area. Land

resources support farming and affords greater support by serving as a shock absorber that provides resources to help household heads cater for many other adaptation needs.

However, in a typical matrilineal environment like the Dangme East District, women do not own lands. The analysis revealed that men are 67% more likely to own lands than their female counterparts. This is in support of the inheritance system in place in the study area. Women who support their households through farming need to depend on their extended families for pieces of land. On the other hand, women have to depend on the land tenure arrangements in the area. This arrangement normally demands that farm produce are shared for the owner of the land to take one-third remaining two- third to the farmer. Farming in the area is rain-fed which affects farm produce generally which does not make the farming lucrative, how much more the land tenure farming arrangement. Another aspect of this land resources is in the area of relocation to a farther place from the buffer zone and to a high land where inundation from the sea may not disturb them. Female household heads have problems in relocation as they don't have land resources to allow them do so. This is one major constraint to adaptation women face as reported in the fourth technical report of the IPCC(2007).

Another area that strengthens adaptation is in the resources the household has. How much the household has been able to save either from the previous year or earlier. Men are 24% more likely to have savings as heads of households than their female counterparts. Some women call "fish mothers" provide some saving help to the fishermen. This women are fishmongers who buy from the men and later provides support to them in times of their need. A number of these fishermen who fish with to one canoe can be served during off season and in times when there are no catches. Generally however, women due to little access to credit can hardly save and in cases where they are living with their husbands, they are required to be caretakers for their husbands to go to work and come back.

Conclusion

I set out to see how differently men and women household heads adapt to the impacts of Sea Level Rise. It was found that SLR has occurred in Ghana in the range of 1.4mm to 2.00 mm attributed to thermal expansion in the sea. There are predictions for further rises in the future.

It was found out that SLR impacts negatively on natural, social, financial, health and physical resources. These impacts lead to poor groundwater quality, dwindling fish catches, destruction on housing structures and the natural ecosystem. Although men and women live in the society, their adaptive capacities to these impacts are different at the household level.

More men are likely to create channels around their housing structures to allow water to move in order to avoid flooding of their households. Women are also more likely currently to receive support from Para-governmental organizations than their male counterparts. Women are less likely to have access to land resources to help them build adaptive capacity as compared to their male counterparts. Men are also more likely to save from their work than their female counterparts except some few other women who work more closely with the men.

Sea defense intervention has been put forth by the Government of Ghana to help reclaim some parts of the land in the area. The intervention itself lacks a thorough gender mainstreaming that will tell government what will benefit men and women in the area and that which will work best for them. Attempts to move the people has not worked since the policies lack the involvement of the people. A thorough platform is needed to dialogue with community members on the reasons behind the decision especially at places where the sea defense will not cover. It is imperative also for district assembly to solicit for funds from the tourism industry to help depend places of tourism importance in the district.

A community specific contingency plans should be put in place for community members especially household heads to contribute to, to inform policy on what should be done during SLR disasters like flooding to avoid situations where the assistance provide by the National Disaster Management Organization (NADMO) as being misplaced as complaint by community members. District Assemblies are also encouraged to set up Disaster Management Fund to help the district to effectively manage victims of coastal flooding and inundation.

These differences in themselves stems largely from cultural build ups in the society that put women in a low background. This calls for mass education in the area of community building and the contribution of women in that area. Concentration should be on the vulnerable both men

and women whilst efforts are being made to break cultural and environmental factors that inhibit the adaptive capacity of women such as access to land resources. Ensure that women participate in all decision making processes especially those related to climate change at all levels to build an effective alliance for community adaptation.

Attention should be given by the district assembly to conduct a research into the impacts of SLR on groundwater quality and on health thoroughly in order to map out strategies that will help in gender mainstreaming in the district.

Adaptation among women and other vulnerable men will be more enhanced if household asset assessment is done to enable the district social welfare programme to function more effectively in meeting the needs of the vulnerable. Financial assessments that have so far been provided has not worked properly for the farmers due to the failure of the rains in the past three years. Irrigation technology should be provided to allow farming households have all-year farming to help them build resilience to impacts of SLR. Women have great knowledge that can be tapped into by interventions that attempts to bridge the gap between the men and women in community adaptation. No intervention will work if it does not attack the stereotypes that create obstacles against opportunities for women, men and children to work together towards sustainable societies.

Interventions that work will enable Ghana attain the Millennium Development Goal of reducing poverty by half in 2015 and thus achieving sustainable development in the light of climatic challenges.

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