



**Adaptation to climatic hazards in the savannah
ecosystem: improving adaptation policy and action**

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Abstract

People in the savannah ecosystem of Ghana have historically experienced a range of climatic hazards that have affected their livelihoods. In view of current climate variability and change and the projected increase in extreme events, adaptation to climate risks is vital. Policies have been put in place across sub-Saharan Africa in accordance with international agreements to enhance adaptation. At the same time, local people, through experience, have learned to adapt. This paper examines current policy actions and their implementation alongside an assessment of barriers to local adaptation. Policy documents on agriculture, water, roads, housing and health- sectors that support key livelihoods and which were identified as highly climate sensitive- were analysed, while questionnaire interviews and focus group discussions were held with key stakeholders in the Upper East Region of Ghana. We find that although policies and actions complement each other, their integration is weak. This is largely due to barriers (financial, institutional, social, and technological) that hinder successful local implementation of some policy actions, as well as a lack of local involvement in policy formulation. Integration of local perspectives into policy needs to be strengthened in order to enhance adaptation. Coupled with this is a need to consider adaptation to climate change in development policies and to pursue efforts to reduce or remove the key barriers to implementation at the local level.

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1. Introduction

Adaptation refers to processes of deliberate change, often in response to, or anticipation of, multiple pressures and changes that affect people's lives (Nelson et al., 2007, cited in Stringer et al., 2010). Adaptation to climate change and variability has been seen as necessary for poor countries and communities, especially those in sub-Saharan Africa, where nations suffer the brunt of climate risks (Ludi et al., 2012). Studies have shown that sub-Saharan Africa is vulnerable to climatic hazards including droughts, floods, high temperatures, windstorms and heavy precipitation (IPCC, 2014). These take place in the context of other pressures such as poverty, disease, insecurity (particularly of food, water and energy) and other environmental changes (Stringer et al., 2009). To meet human well-being and developmental goals while minimising the negative impacts on the environment as well as the people, sectoral policies have been formulated to address these challenges. At the same time, local people have, over the years, been adapting to these changes and pressures that they face. This paper examines key local barriers to adaptation and explores the interplay between sector based policies and local actions, identifying important areas of both support and conflict. Very few studies have explored barriers to implementation sector by sector let alone linking this to the interplay between policy and local practices. Our findings aid identification of those policy actions that require strengthening, as well as highlighting local practices that could be better integrated into and supported by policy to enhance adaptation to climate hazards.

1.1. Hazards and climate change

The term hazard is defined as “the potential occurrence of a natural or human-induced physical event that may cause loss of life, injury, or other health impacts, as well as damage to and loss of property, infrastructure, livelihoods, service provision, and environmental resources” (IPCC, 2012:44). When hazards occur and cause harm to people and property, then they can become disasters (UNISDR, 2009). Thus, a disaster is the outcome of a hazard, often measured in human terms (lives lost, people affected, economic losses, environmental losses) and mediated by the properties of the social and environmental systems that are exposed to and affected by the hazard (UNISDR, 2009). Disasters are thus socially constructed events; products of impacts of hazards on people whose vulnerability has been created by social, economic, political and other mediating conditions (Cannon and Müller-Mahn, 2010). Disasters caused by hazards are not only influenced by the magnitude and frequency of the hazard event but also by the vulnerability of the affected society and its environment.

1.2. Calls for adaptation policies

At the international level, policies have focused on both mitigation and adaptation (Stringer et al., 2009). Regarding adaptation, Ghana initiated steps to promulgate a National Climate Change Policy (NCCP) in 2010. The country also has development policies that target various sectors of the economy. These sectoral policies are analysed in this paper in relation to their role in supporting adaptation to climate change. In doing this, we provide a valuable extension to the growing body of literature that has sought to better understand climate adaptation in Ghana (Antwi-Agyei et al., 2012; 2013; 2014).

1.3 Barriers to adaptation

Calls for adaptation have been met with a number of challenges that are described as barriers to adaptation. These barriers are factors, conditions or obstacles that reduce the effectiveness of adaptation strategies (Huang et al., 2011; Moser & Ekstrom, 2010, cited in Antwi-Agyei et al., 2014). The literature categorises barriers into financial, institutional, political, social, cultural, biophysical, cognitive and behavioral types (IPCC, 2014). Barriers can nevertheless be overcome with concerted effort, creative management, changes in thinking, prioritization and related shifts in resources, land uses, institutions, etc. (Ekstrom et al., 2011). Overcoming some of these obstacles however, requires sufficient political will, social support, resources, and effort (Adger et al. 2009).

The recognition that barriers can be surmounted and that there is an urgent need to adapt, has motivated a growing body of research into barriers to adaptation. Some researchers have examined the existence and nature of barriers to adaptation and how societies try to overcome them (e.g., Adger et al. 2009; Antwi-Agyei et al., 2014; Islam et al., 2014). While studies on barriers to adaptation have focused on the categories mentioned above much still remains to be learned (National Research Council, 2009). For example, Islam et al. (2014) identify a key research gap, noting that there is a lack of evidence on barriers; a lack of knowledge about the interactions between barriers; and little is known about how these interactions affect the wellbeing of small-holder communities. Antwi-Agyei et al. (2014) point out that the focus on types of barriers by many studies in sub-Saharan Africa do not show how the barriers interact at different levels to influence adaptation. To improve the body of knowledge on barriers, all

aspects of the adaptation process, including the actors involved, every stage of decision processes, and the governance contexts, need to be carefully examined. This, according to Ekstrom et al. (2011) is a challenge of enormous complexity, and single disciplines or theoretical constructs are not likely to fully capture it. In this paper we contribute to knowledge on barriers by examining the barriers and the interplay between national sectoral policy and local practices. We further identify how barriers to adaptation may be overcome at the local level.

2. Methodology

Although Ghana is practicing a decentralised governance system, most of its policies are formulated at the national level and were developed in line with international considerations, especially the Millennium Development Goals (MDGs) and the country's obligations under the United Nations Framework Convention on Climate Change (UNFCCC). However, those policies targeting sectors identified to be highly vulnerable to climatic hazards in the savannah ecosystem (i.e. agriculture, water, health, housing and roads, see Yiran (2014)) were selected for analysis, so as to identify priority areas that can be improved upon to enhance adaptation. Specific climate policies were also included in the sample. Policies that were analysed are: the National Climate Change Policy (NCCP) (which is still under development as of 2014), the Food and Agricultural Sector Development Policy (FASDEP II) (2007) and its programmes and action plans including the Medium Term Agricultural Sector Investment Plan (METASIP) (2009), the Health Sector Policy (2007), the Housing Policy (still under development as of 2014)

and the Water Sector Policy (2007). These policies were analysed using content analysis following Wesley (2010).

An overview of the documents was first gained to identify and note themes or focal areas that are climate related. The documents were then thoroughly reviewed and their objectives, actions and outputs on identified themes or focal areas were recorded. The implementation of policy actions and their outcomes were verified through focus group discussions with community members and in-depth interviews with institutional heads or their representatives in the Region. These approaches have been applied elsewhere to analyse the content of policy documents and related actions (e.g. WHO, 2009; Huang et al., 2010).

Focus group discussions and in-depth interviews were held in the Upper East Region. Though the savannah ecosystem stretches from latitude 7°N to latitude 11°N, the Upper East Region (Fig. 1) was chosen for the study because it experiences nearly all the climatic hazards that occur in the savannah and receives the lowest rainfall (Logah et al., 2013). The region also has the highest percentage (90%) of poverty in the savannah ecosystem and is the only region with variant ecological zones of the savannah (Guinea and Sudan). Communities for participation in the study were selected using the restricted random sampling technique (Steven and Olson, 2004). Focus group discussions (FGD) were held, encompassing both rural and urban districts and covering adaptation actions at both the local level and those identified during the policy analysis. This enabled identification of key local barriers to implementation as well as local practices. Discussants were selected in order to reflect the diversity of the communities,

following meetings with opinion leaders. The initial intention was to hold a FGD in each district (in selected communities in Fig. 1).

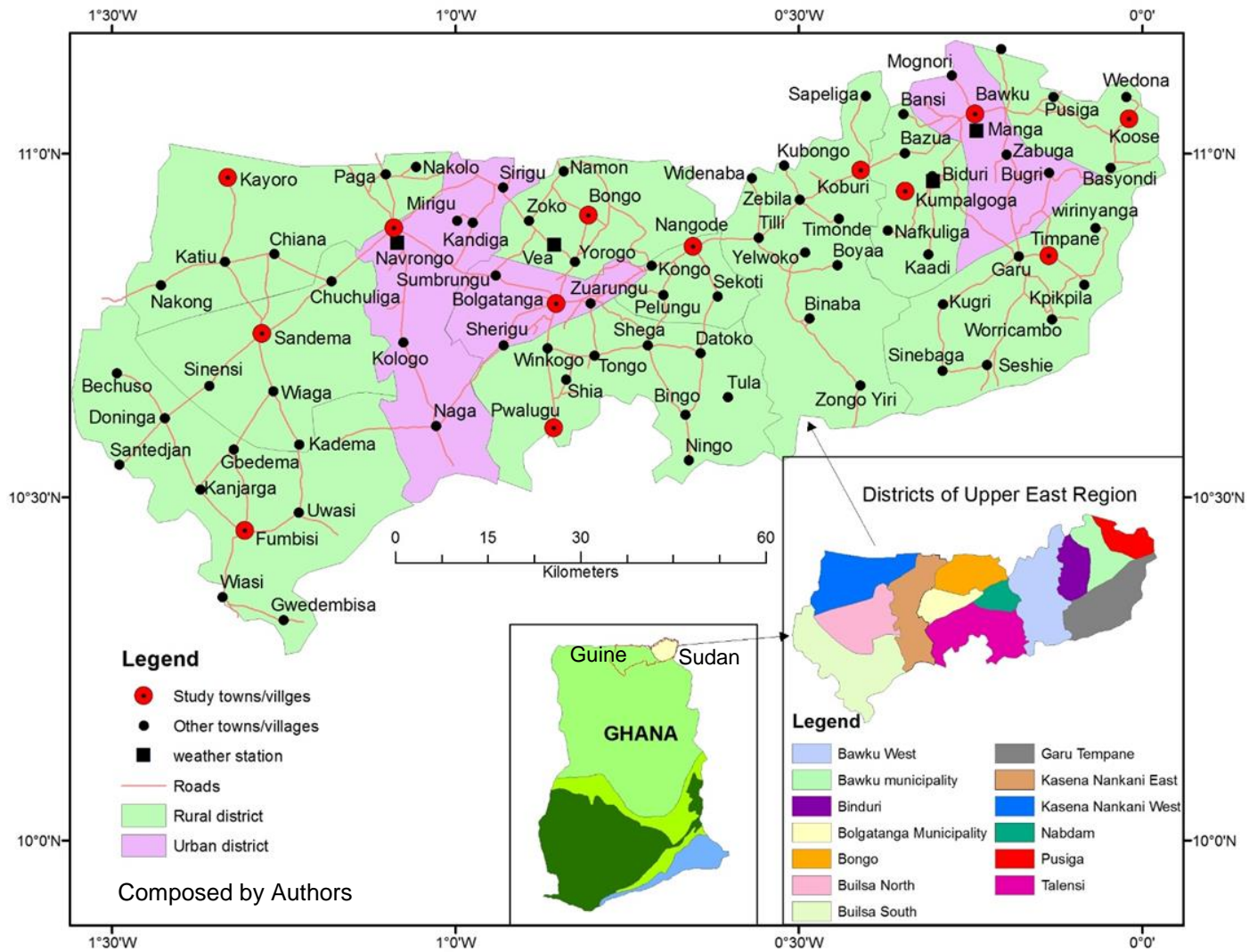


Fig. 1 Map of the study area

However, after five FGDs (in Navrongo, Bongo, Koore, Kumpalgogo and Tempane), the information being obtained was almost the same. Saturation point was assumed to have been reached (Rebar et al., 2011) and the FGD process ended.

In-depth interviews required purposive sampling of district level offices linked to key ministries involved with development of the documents considered in the policy analysis. Twenty-five institutions drawn from district level offices of Ministry of Food and Agriculture (MOFA), National Disaster Management Organisation (NADMO) and NGOs were contacted for interview. All district officers responded to the questions. Six individuals, mainly opinion leaders and commercial farmers, were also purposively selected and interviewed. The thematic analysis of notes from focus group discussions and interviews aided in identifying policy successes, failures and good practices, as well as highlighting the barriers.

3. Results

Sector policies are formulated at national level and intended to be implemented at district level. Those reviewed in this analysis are at various stages of implementation, but already barriers to the local success of their implementation are emerging. This section presents the barriers to policy the implementation, drawing on and extending the types of barriers identified by Antwi-Agyei et al. (2014), analysing them sector by sector, and considering the climate hazards faced by each.

3.1. Barriers to local level adaptation

The categories of barriers to adaptation developed by Antwi-Agyei et al. (2014), and supported with FGDs with local people for all sectors are summarised in Table 1, where it can be seen that a group of biophysical barriers hinder adaptation to climate hazards. These barriers largely affect the agricultural sector, which is the main

economic activity in the study sites, and which consequently receives the most attention in the rest of this paper. Respondents attributed low crop yields to low soil fertility, decreasing land size as a result of land fragmentation, diseases and pest as well as climatic hazards.

Table 1: Barriers to adaptation to climatic hazards in the study area

Barriers	Components	Sector affected
Biophysical	Poor soil quality, water scarcity, land fragmentation, diseases	Agriculture
Financial	Poverty, lack of credit, delayed release of funds for projects	All sectors
Cultural	Belief system, taste for traditional food crops, land management practices	Agriculture, health
Political	Political promises and interference, corruption, inadequate institutional capacity	All sectors
Infrastructure	Limited irrigation facilities, inadequate health facilities, poor roads	All sectors
Social	Limited access to land, land tenure system, limited knowhow, illiteracy, conflicts	Agriculture, health
Technological	Lack of agricultural inputs, lack of storage/processing facilities, inadequate early warning system, uncertainties in weather	Agriculture, housing, health,

Source (Authors' own construct)

Financial problems were reported by nearly all the respondents to limit their ability to adapt across all sectors. For example, in FGDs, poverty was said to have affected people's ability to access agricultural inputs, health care, portable water and quality housing. Government funding was frequently reported to be inadequate and in most cases had been delayed, resulting in delays in executing interventions.

Cultural factors also affected adaptation, particularly in the agriculture and health sector. Participants in this study believed that the occurrence of climatic hazards is due to anger of God, or their ancestors, or smaller gods, and therefore pray or perform sacrifices to appease them when events manifest. Preference of traditional crops for staple food and sacrifices slowed the adoption of improved crops varieties, increasing food insecurity and malnutrition. Traditional crops record higher production losses due to increasing occurrence of the hazards.

Social/institutional factors also contributed to low adaptive capacity. People mentioned that landholdings are small (<5 acres) because of the inheritance system and the farms also have low soil fertility resulting from continuous farming. Land is largely acquired by inheritance and a male child has a right to land that has been handed to his father. This type of holding is communal and therefore cannot be used for long-term investments without consent of the entire family. These institutional factors have hindered some of the actions of the agriculture sector policy.

Politics and failed promises by politicians, according to the people, have contributed to making some people dependent on handouts or reluctant to embrace certain policies from governments which they do not support. The National Health Insurance Scheme (NHIS) was said to have suffered from reluctance of people to register initially because of politics, affecting the health sector policy. Change in government also hindered adaptations across all sectors because of lack of continuity of projects or interventions, as some projects from previous governments are still not complete. Diversion of projects to strongholds of certain politicians and misappropriation of funds were seen corruption that hindered policy implementation and adaptation.

Having examined some of the barriers to adaptation more generally, we now consider the policies of the sectors where some these barriers are explored further. There are overlaps in the policies and therefore when one policy item has been reviewed it is not repeated in subsequent sections.

3.2. Agriculture sector policy

The food and agricultural sector development policy is a framework that guides development and interventions in the agricultural sector. The purpose of the policy is

to “enhance the environment for all categories of farmers, while targeting the poor and risk-averse producers” (MOFA, 2007:1). One of the aims is to increase agricultural productivity to ensure food security, sustainable shared growth and poverty reduction. To meet the set purpose, the policy has several objectives linked to the Millennium Development Goals (MOFA, 2007:22). Two objectives were examined in this study as they focus on areas important to the management of climate change impacts:

- i. Food security and emergency preparedness
- ii. Improve growth in incomes

Each objective had different strategies and implementation procedures. The strategies are divided into components, actions and outputs. Actions relevant to the research focus (because climate hazards affect agricultural productivity) are presented in Table 2. From FGDs and in-depth interviews, it became clear that some aspects of the policy have been implemented while others have not.

Table 2 Actions and evidence supporting objectives 1 and 2 of the agricultural policy and links to local practices

Policy actions	Evidence of implementation	Additional supporting actions taken by local people
Objective 1: Food security and emergency preparedness		
Introduce improved crop varieties (high yielding, short duration, disease and pest resistance, and nutrient fortified).	Maize varieties, soya bean introduced	Crop diversification, mixed/inter cropping,
Increase access to fertilizer	Access points in big towns	Use animal droppings, fertilizers
Seed/planting material	Seeds sold in markets and agriculture input outlets	Transplanting, keep part of harvest as seeds, farmers borrow or buy seeds using own resources or remittances
Introduce improved livestock breeds	Some introduced	Farmers largely keep local breeds
		Soil moisture conservation measures such as mulching, stone bunds, watering crops in

		the evening, etc. practiced
Promote off-farm activities with particular focus to supporting establishment of agro processing Micro and Small Enterprises (MSEs), and targeting women and the youth	Artisanal activities largely supported by NGOs and private sector	Basketry, pottery, smock making, ICT sales, other trades
Introduce targeted grants and subsidies on inputs to poor farmers to improve farm level production and marketing activities	MASLOC ¹ and NGOs granting loans, loans from banks	Farmers organised in groups and supplied with fertilizer in a form of loans
Rehabilitate Vea and Tono dams	Rehabilitation started	
Identify sites in various river flood plains for micro irrigation systems		Flood recession agriculture practiced in some areas, water tolerant crops grown in flood plains, early planting and harvesting before floods, ploughing across slopes to reduce runoff and retain water for crops
Facilitate installation and establishment of pump irrigation systems		Dry season gardening/farming using groundwater, electric pumps are also used for irrigation
Facilitate the formation of water users' associations at the irrigation sites.		
Promote use of existing small community and small scale dams		Some dams/dugouts are used
Identify suitable areas for the construction of community small scale irrigation dams and establish small scale furrow irrigation systems		
Objective 2: Increased growth in incomes		
Identify areas with acute problems of water for livestock and construct water points (at least 50 per year starting from 2009)		Keep different types of livestock and birds with lower water requirements
Promote communal grazing lands		Free range grazing
Facilitate and support establishment of pastures and fodder crops by farmers		
		Migration/remittances, social networks,

Source (Authors' own with data from MOFA 2007, 2009, focus group discussions and institutional interviews)

¹ Microfinance and Small Loans Centre

People mentioned they now cultivate drought resistant, short duration and improved maize varieties mixed with other crops. Many adaptive practices, such as transplanting of sorghum, late millet and rice, flood recession agriculture, early planting in flood prone areas and soil conservation practices, address both droughts and floods, but were not supported by policy. A farmer said “I believe transplanting has reduced losses due to drought for me because I usually pour more seeds into a hole and those that are able to survive the drought/dry spell, I pick them and transplant in empty spaces. I think if we are encouraged to do this in beds and transplant when the rains become normal, it will help a lot”. Another adaptation is that the Bawku East Small Scale Farmers’ Association Rural Bank (BESSFAR) have constituted farmers and traders in the eastern part of the region into groups and support them with loans in the form of agriculture inputs or credits. This has increased productivity and the groups repaid their loans easily, as evidenced by a statement from a farmer: “I used to harvest about 3 bags of millet from my farm. But ever since I started benefiting from BESSFAR, I harvest about 6 bags of maize, 4 bags of millet and 2 bags of soya beans”. Some local adaptations are supported by policy actions or policy actions have stimulated local adaptations. Adoption of improved maize varieties is a clear case. Also, use of groundwater and small dams (even around dams/dugouts that were meant for only livestock for dry season farming) has been stimulated by policy action. Such close links, are positive but need further strengthening, and are less apparent in the other sectors.

3.3. Health sector policy

A key element of the healthcare policy is the recognition that good health plays a critical role in the socio-economic development of the country. Based on this understanding, it has developed some key shifts in healthcare delivery in the

country. That “health improves productivity and creates wealth” (MOH, 2007:32) is in line with the interest of this research: a healthy population will productively engage in their livelihood activities, spending less on treatment. This will result in increased incomes and financial capacity to adapt to climate hazards.

The main goal of the health sector is to have a healthy and productive population that reproduces itself safely. It will achieve this by (MOH, 2007:33):

- i) Ensuring that people live long, healthy and productive lives and reproduce without increased risk of injury or death
- ii) Reducing the excessive risk of burden of morbidity, mortality and disability, especially among the poor and marginalised
- iii) Reducing inequalities in access to health, populations and nutrition services and health outcomes.

Based on these objectives, seven priority areas of action were developed to address the challenges of the health sector. Several policy measures guide the implementation of the policy but those that could enhance adaptation to climate hazards are presented in Table 3, which also details supporting actions taken by local people.

Table 3 Actions and evidence of policy and local practice in the health sector

Policy measure	Evidence of implementation	Additional supporting actions taken by local people
Policy result area: Human resources		
The increase in the production, recruitment and retention of health workers, focusing on middle-level health professionals	Enrolment increased, more training schools built	
The advocacy for orientation and mobilization of other professionals, including, but not limited to, teachers and agricultural extension workers, in contributing to the promotion and maintenance	Outreach programmes, TV and Radio jingles on food safety and sanitation, provision of	Clean-up exercises particularly in big towns,

of good health practice	sanitation facilities	
Policy result area: Health infrastructure		
Investment in the construction of a health service infrastructure to fill gaps in access to service, particularly in deprived and hard-to reach areas and in collaboration with the transport sector to improve Access	Building of health facilities, Presby mobile clinic	
Ensuring of sufficient financing for priority renovations and planned preventive maintenance of existing health service facilities		
Policy result area: Health supplies and logistics		
Promotion of local production of supplies and logistics including pharmaceuticals and traditional medicines for the national and regional/international markets	Pharmaceutical companies, traditional medicine producers, improved supplies of vaccines, drugs, etc.	Use of local herbs, insecticides, clinical services and drugs, immunizations, etc.
Policy result area: Health financing		
To pursue equity in health financing, with special emphasis on risk pooling, targeting resources to services for the poor, vulnerable groups, and public health interventions and reducing catastrophic cost of care	Health insurance, subsidies on medicines	Out of pocket payment, assistance from relatives, NGOs

Source (Authors' own construct with data from MOH, 2007, focus group discussions and institutional interviews)

Table 3 indicates many policy measures have not been implemented. Local practices hinge largely on finances and therefore poverty is a major barrier. However, people observed that health facilities have increased over time and with the introduction of the health insurance scheme, access to health care has improved greatly. Interviews with health workers supported this. A Community Health Nurse in charge of one of the Community-based Health Planning Services (CHPS) compounds in Talensi district, noted that: "Since I came here, I have managed a lot of minor ailments that could lead to severe CSM and malaria cases and I can say that there is improvement in the health status of the people in this and surrounding communities".

3.4. Water sector policy

Water is central to many human activities, being needed for food production and consumption, hygiene and good health, the building of structures and many other industrial uses. The water policy focuses on water resource management, access to potable water, climate change and water for food security. Food security was covered in section 3.2, so is not considered again here.

The objectives of focus area 1 (Integrated Water Resource Management) are to achieve sustainable water resource management and ensure equitable and sustainable exploitation, utilisation and management of water resources while maintaining biodiversity and quality of the environment for future generations (MWRWH, 2007:13). The objective of focus area 2 (access to water) is to improve access to potable water to all people without discrimination. To meet the objectives, several policy measures and/or actions have been developed. Measures/actions related to adaptation, with evidence of implementation and local practices, are shown in Table 4.

Table 4 Actions and evidence of policy and local practice in the water sector

Policy measures and/or actions	Evidence of implementation	Additional supporting actions taken by local people
Focus area 1: Integrated water resources management		
Promote partnerships between the public and private sectors for the protection and conservation of water resources through the use of cleaner and efficient technologies, effective waste management and sound land management and agricultural practices	Collaboration between Ghana water company, water resources commission, community water and sanitation agency and NGOs	
Focus area 2: Access to water		
Improve efficiency in production and distribution through effective and improved Operations and Management and pricing mechanism (strategy and structure) taking into account the poor	Small town water projects, boreholes, wells	Urban dwellers pay for water, villagers do not pay, individuals dig wells around homes and on riverbeds
Focus area 6: Climate variability and change		
Construct flood protection structures at appropriate locations		
Apply appropriate technologies to provide the necessary information for detection and early warning systems for floods and drought		
Establish and enforce appropriate buffer zones along river banks including measures to compensate for loss of lands	Buffer zone policy formulated	
Ensure that land-use planning/building regulations are adequate and enforced in respect of waterways and flood-prone areas		
Ensure rainwater harvesting techniques are incorporated into the building code and enforced		Some individuals in urban towns harvest rain water for domestic use

Authors' own construct with data from MWRWH, 2007, focus group discussions and institutional interviews

Several policy actions again remain on paper due to lack of funds or enforcement. Despite a buffer zone for all rivers in the country, human activities have been taking place on river banks. FGD participants attributed their use of river banks to the frequent occurrence of drought. Data from Ghana Water Company (GWC) and Community Water and Sanitation Agency (CWSA) indicate that with the exception of Bolgatanga township, which is served with treated water from the Veia dam, all urban towns are served with water from mechanised boreholes while almost all other communities are fitted with more than one borehole or well from which the people get their water. People do not pay for the water. However, in communities where it is difficult to sink boreholes, residents still have water problems, especially in the dry season. A resident in Pwalugu, a community in Talensi district said “I walk long distances, spend long time and even sometimes wake up at dawn to search for water because we settled on rocky ground and it is difficult for us to get water”.

3.5. Housing sector policy

Increases in population are resulting in high demand for housing, especially in urban areas where demand is so critical that people (especially the vulnerable) are settling in disaster-prone areas (UN-Habitat, 2011). The Government of Ghana promulgated the urban housing policy in 2012 to alleviate the housing problem. The policy is divided into 12 action areas each with its own objective. We discuss those of action areas 8 (Urban Safety and Security) and 10 (Climate Change Adaptation and Mitigation) because these are related to adaptation. Key actions of these areas together with local practices are shown in Table 5.

Table 5 Actions and evidence of policy and local practice in the housing sector

Policy key activities	Evidence of implementation	Additional supporting actions taken by local people
Action area 8: Urban safety and Security		
Mainstream security and disaster prevention into urban planning and management systems		
Provide adequate sites in planning schemes for security agencies		
Acquire ecologically sensitive areas, and flood prone areas and designate and protect them as nature reserves	Flood prone areas identified	
Provide a portfolio of appropriate investments in the social and economic sectors of neighbourhoods of different socio economic status		
Action area 10: Climate Change Adaptation and Mitigation		
Adopt energy conserving systems/technologies in public and private buildings		Use of local building materials to control room temperature
Introduce or strengthen school curricula awareness on climate change and its mitigation and adaptation strategies		
Intensify public education programmes (including video clips) for awareness creation on climate change, mitigation and adaptation strategies	Sensitization on the media, NGOs educate farmers	
Develop structure plans with clear provision for open spaces, green belts and other amenity values	Urban towns have planning schemes	

Authors' own construct with data from MLGRD, 2012, focus group discussions and institutional interviews

Despite these laudable policy ideas, implementation is severely lacking. Legislation and regulations cover all the main sectors involved in housing provision and control but many of them impose significant transaction costs and unnecessary delays (UN-Habitat, 2011). The major reasons for lack of implementation given by interview respondents were lack of coordination of various institutions and resources to enforce the provisions. This has resulted in the development of residential facilities in areas without planning schemes or in unapproved areas. FGDs also identified

poverty, corruption and bureaucracy as important barriers. A tour around some of these areas revealed some houses sitting on pools of water (Fig. 2), buildings that were possibly approved without knowledge of the nature of the land or soil. Community members also indicated the presence of mosquitoes throughout the year because water from the bathrooms and domestic chores sits behind the houses and becomes a breeding ground. These areas are increasingly being used, putting human lives and property at risk as climatic hazards are expected to increase.



Fig. 2 Houses built on flood prone land

3.6. The National Climate Change Policy (NCCP)

The NCCP is a cross-sectoral policy and captures all sectors in its framework. Unlike the sectoral policies, it identifies sectors that a focus area fits, and assigns implementation to the Ministry, Department or Agency responsible for that sector. This avoids duplication of projects as seen in the other policies and reduces unnecessary competition between ministries for funding. Areas related to the sectors discussed above will not be covered here. Emphasis is instead on the disaster

preparedness and response focus areas where the programmes in Table 6 are of interest.

Table 6 Actions and evidence of policy and local practice of the NCCP

Policy actions	Evidence of implementation	Additional supporting actions taken by local people
Program: Develop climate resilient infrastructures		
Support the development of climate proof infrastructure that provide key services to increase resilience of communities during extreme climate events	Ambulances service available, use of schools and other public places are temporary shelters	
Ensure safe and constant water supply during times of floods and droughts	Water points constructed at safe places	
Ensure that rural communities have access to all weather roads and reliable access to markets and key services	Gravelling of feeder roads, construction of bridges,	
Program: Early warning mechanisms		
Document and disseminate appropriate community-based indigenous early warning systems on climate related disasters		
Establish effective hazard monitoring and early warning systems with sound scientific and technological basis.	Use of mobile vans to sound warnings, radio/TV announcements	Community announcements, peer to peer communication,
Enhance the technical capacity of Ghana Meteorological Agency (GMet) and other related institutions such as Water Resources Commission (WRC), the Universities and the Geological Survey Department (GSD).	GMet is densifying its weather observatories with modern equipment	
Program: Public education and adaption skills		
Promote the use of ICT and information systems to enhance access to public information on Climate Change Adaptation.		Use mobile phones
Build capacity of the media and establish clear working relationship and links to ensure the media is well placed to support climate change adaptation.		
Increase public awareness on climate change adaption and provide skill training to ensure preparedness on climate change and adaptation strategies	NGOs and other institutions educate people on climate change	Relatives act as first responders, send the sick/injured to hospital
Program: Rapid response and disaster management		
Strengthen the institutional framework for disaster risk response and management.		

Enhance institutional capacity of agencies in disaster risk management especially NADMO		
Improve technical capacity and facilities to communities for rapid response to disasters and disaster management.		
Review, update, adopt and disseminate National Disaster Management Strategy and Emergency Preparedness/Response Policy and Framework		

Authors' own construct with data from MLGRD, 2012, focus group discussions and institutional interviews

Programs in Table 6 aim to increase the resilience of communities to climate hazards. Although this policy is yet to be rolled out in full, its actions are good for adaptation, some of which are already being implemented by state, NGOs and local people. Building climate resilient infrastructure will enhance adaptation. There is currently an early warning system in place where NADMO takes signals of events from either GMet or Burkina Faso and informs the people to prepare beforehand using information service vans. Agriculture extension officers also sensitise the people, especially on drought issues. Local people inform each other of events by word of mouth and/or community announcements. Early warning systems are reported to be gaining ground in Africa but need to operate within an integrated policy framework (Vincent *et al.*, 2011; Funk *et al.*, 2012).

FGDs suggested that social networks have been used by community members to adapt, especially to floods and/or windstorms. Family members or neighbours are often the first to help following occurrence of a hazard, particularly in rural communities where aid in terms of food and temporary accommodation for flood victims is urgently/desperately needed. In an interview with an old lady, a victim of rainstorm, she said "I was nearly killed when my room collapsed on me but for the timely intervention of my senior husband's son who rescued me. He also accommodated me until my room was reconstructed". However, these social support

systems were found to be waning because of western values and capitalism which is making people more individualistic.

4. Discussion

Our analysis indicate that across all sectors, some policy actions have been implemented or initiated and have been embraced by the people. There are also local adaptations taking place, some of which are supported by policy. Some policy actions have achieved successes because they overlap with local practices. Whereas local adaptations have been reactive to climate hazards, policy actions have been largely concerned with the broader development framework, particularly relating to the MDGs. To achieve these broader goals, adaptation and sustainable development have to take place simultaneously (Schipper, 2007). This is starting to be recognized in the growing literature on climate compatible development, where development is pursued together with adaptation and mitigation (Suckall et al., 2014).

It was also found that sectoral policies were often developed without reference to other sector policies with similar agendas. This tends to lead to duplication, as was evident in most of the policies. It could concentrate projects in certain areas and duplicate results while demanding extra funding, putting a double strain on limited national resources. Another danger is that actions may not be implemented because institutions may think that others may carry out that action. Some of these challenges have been found to affect adaptation in southern Africa (Stringer et al., 2009). Despite these problems, the policies strive to increase productivity and improve the welfare of the people while maintaining the savannah ecosystem's integrity. Each policy thus filled development gaps that are absent in the other policies. The people

however, take a more holistic approach towards adaptation, evaluating and responding to the range of pressures that affect their livelihoods and well-being. This is noted as a key difference between the dominant sector-approach of adaptation within policy compared with reality on the ground.

The policy actions have not been implemented fully due to the barriers noted in Table 1. These development policies are likely not to achieve their goals as some actions are being delayed. Delays, according to Stringer et al. (2010), can increase the cost of implementation of interventions and hence adaptation. Policies were also designed by policy makers and implemented without consultation with the local people, leading to a lack of local acceptance of some of the actions, especially due to cultural reasons. For example, maize cultivars were initially rejected because maize was not considered “proper food” for dinner and its flour is not used for sacrifices (Yiran, 2014). These value systems are gradually changing though, because of repeated losses in rainfed agriculture and farmers are beginning to embrace maize cultivation. Preferences leaning towards crop production instead of livestock keeping, along with the traditional reasons for keeping livestock, hindered the adoption of adaptations that encourage the rearing of animals as an alternative livelihood activity. Amankwah et al. (2012) attributed the unviability of commercialisation of small ruminant production in northern Ghana to these cultural value systems.

We also observed that policy actions that supported or stimulated local practices were quickly adopted locally. The guinea fowl (*Numida meleagris galeatus*), a drought resistant bird, which has been part of the agricultural system of the people has the potential to increase productivity and income (Teye and Adam, 2000; Gono et al., 2013) if given special policy focus. Our analysis of FGDs identified death of

keets due to excessive and predators and hatching of eggs as major barriers to guinea fowl production, similar to observations by Teye and Adam, (2000). Sensitisation on ways of minimising deaths of keets by keeping them under shades and quarantined, combined with incubator support, will boost production. Financial support required here could be provided using the procedure adopted by BESSFAR. Also, people are accustomed to raising livestock alongside cultivating crops. Integrating small ruminant animals into crop farming will most likely be easily adopted as has been the case in neighbouring Burkina Faso (Amankwah et al., 2012), and should be encouraged.

Increasingly, people are using groundwater extracted largely from wells and riverbeds to irrigate their crops (Yiran, 2014). Irrigation is being accepted by the people and thus, if pursued vigorously, especially with sprinkler irrigation systems observed to manage water better in other parts of the country, it may lead to most of the food crops being cultivated under irrigation. This will greatly reduce reliance on rainfall which is unreliable and erratic (Logah et al., 2013). While sprinkler systems could be a viable option, research into the sustainability of groundwater needs to be carried out.

Successful implementation of the agriculture policy, especially those objectives discussed in this paper, will increase productivity and enhance incomes and food security as the people largely depend on agriculture. This has the potential to reduce long-term poverty and enable investment in other livelihood activities. The health sector in particular will benefit greatly from increased productivity because there will be more income to spend on health care. Enhanced food security will help to reduce malnutrition. According the Ghana Health Service (2012), the region has very high malnutrition (above 30%) because most people do not have enough income to buy food when they run out of their own produce. They rely on social networks and

remittance and, in some cases, food aid. However, these sources are not regular. We therefore recommend sensitising people on the need to support their relatives back home. Just as the health sector benefits from increased productivity, the agriculture sector also benefits from the health sector, in that, the people can only be productive if they are healthy. The health sector policy needs to be implemented without delay, especially those aspects aiming to increase access and reduce cost of healthcare for the poor. As payment of the premium, was seen as a major barrier, we recommend adoption of payment by instalment programmes, which have been successfully implemented elsewhere (Morestin and Ridde, 2009). The other sectors also benefit from increased productivity and improve. When people have money, they can afford to build or rent quality houses and thus have more options to reduce the impacts of the hazards.

The policy successes emerging from our analyses are those that support people to continue to use their current good adaptive strategies, or adopt other strategies promoted by the policies. For example, crop/livelihood diversification is found to serve as a buffer to shocks and stresses from climatic hazards (Mkwambisi, 2009). People are accustomed to planting diverse crop varieties and this was boosted with policy action (Table 1). Also, the group loan scheme, if properly combined with insurance and education, can increase confidence in obtaining larger amounts of credits to increase production. This requires policy to give more prominence to cultural- and context-specific practices and recognise that adaptations are a response to multiple climatic risks that change over time and space. Participatory approaches, as recognised by Stringer et al. (2009) in their southern African study, can ensure that local practices and adaptation to climatic hazards are taken onboard in policy development. Participatory approaches will also increase the awareness of

the people on the impacts of climatic hazards and the implications on the use of hazard prone areas (Yiran et al., 2012).

5. Conclusions

We set out to examine current policy objectives, implementation as well as local adaptations. We found that sector policies are complementary, aimed towards achieving the MDGs, though there are some overlaps. Some policy actions that were not formulated with adaptation in mind were found to be very relevant for adaptation to climatic hazards. Some policy actions and local practices reinforce each other, though many local concerns and good practices are not taken advantage of by policy. This is largely explained by the top-down approach to policy development. Thus, the link between policy and local adaptation needs further development. It clearly emerged that local people implemented (or fully embraced) policy actions that they identified most strongly with, for example, crop diversification. However, not all local adaptations are relevant for policy. Finally, we identified several barriers to the implementation of the policies for adaptation to climatic hazards. For policies to achieve their targets and promote sustainable development in the context of climate hazards, they should explicitly consider adaptation and take a participatory approach in their development in order for decision-makers to work towards reducing the barriers.

References

- Adger, W. N., Dessai, S., Goulden, M., Hulme, M., Lorenzoni, I., Nelson, D., Naess, L., Wolf, J. & Wreford, A. (2009). Are there social limits to adaptation to climate change? *Climatic Change*. 93: 335-354.
- Amankwah, K., Klerkx, L., Oosting, S.J., Sakyi-Dawson, O., van der Zijpp, A.J. & Millar, D. (2012). Diagnosing constraints to market participation of small ruminant producers in Northern Ghana: An innovation systems analysis. *NJAS - Wageningen Journal of Life Sciences* 60– 63 (2012):37– 47
- Antwi-Agyei, P., Dougill, A.J. & Stringer, L.C. (2014). Barriers to climate change adaptation: evidence from northeast Ghana in the context of a systematic literature review. *Climate and Development*. DOI:10.1080/17565529.2014.951013
- Antwi-Agyei, P., Fraser, D.G., Dougill, A.J., Stringer, L.C. & Simelton, E. (2012). Mapping the vulnerability of crop production to drought in Ghana using rainfall yield and socioeconomic data. *Applied Geography* 32 (2012) 324-334. www.elsevier.com/locate/apgeog
- Cannon, T. & Müller-Mahn, D. (2010). Vulnerability, resilience and development discourses in context of climate change. *Nat Hazards* DOI 10.1007/s11069-010-9499-4
- Dixon, J.L., Stringer, L.C. & Challinor, A.J. (2014). Farming System Evolution and Adaptive Capacity: Insights for Adaptation Support. *Resources* 2014, 3, 182-214. doi:10.3390/resources3010182.
- Ekstrom, J.A., Moser, S.C. & Torn, M. (2011). Barriers to Climate Change Adaptation: A Diagnostic Framework. California Energy Commission. Publication Number: CEC-500-2011-004
- Huang, X., Zhao, D., Brown, C.G., Wu, Y. & Waldron, S.A. (2010). Environmental Issues and Policy Priorities in China: A Content Analysis of Government Documents. *China: An International Journal*. Volume 8, Number 2, pp. 220-246. DOI 10.1353/chn.2010.0007
- Ghana Health Service (2012). Annual Report, 2012. Upper East Regional Health Administration. Bolgatanga
- Gono, R.K., Svinurai, W. & Muzvondiwa, J.V. (2013). Constraints and Opportunities to Guinea Fowl Production in Zimbabwe: A Case Study of the Midlands Province, Zimbabwe. *International Journal of Science and Research (IJSR), India*. Vol. 2, Issue 3, pp236-239. www.ijsr.net
- Gyasi, E.A., Karikari, O., Kranjac-Berissavljevic, G. & Vordzogbe V.V. (2006) *Climate Change and Vulnerability and Adaptation Assessment Relative to Land Management in Ghana*. Integrated and edited by Gyasi, E.A. Accra, Ghana.
- IPCC (2012). *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*. A Special Report of Working Groups I and II of the

Intergovernmental Panel on Climate Change (IPCC) [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, & P.M. Midgley (Eds.)]. Cambridge University Press, Cambridge, UK, and New York, NY, USA, pp. 555-564.

IPCC (2014). Regional Aspects (Africa). *Climate Change 2014: Impacts, Adaptation and Vulnerability*. Contribution of working group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Volume 1: 1-115. <http://ipcc-wg2.gov/AR5/report/final-drafts/>

Islam M.M., Sallu, S., Hubacek, K. & Paavola, J. (2014). Limits and barriers to adaptation to climate variability and change in Bangladeshi coastal fishing communities. *Marine Policy*. 43, pp.208-216. doi:10.1016/j.marpol.2013.06.007

Ludi, E., Jones, L. & Levine, S. (2012). *Changing focus? How to take adaptive capacity seriously. Evidence from Africa shows that development interventions could do more*. ODI Briefing Paper 71. Overseas Development Institute (ODI). London, UK. pp 4.

Mkwambisi, D.D. (2009). Urban agriculture and food security in Lilongwe and Blantyre, Malawi. In: *Agriculture in Urban Planning: Generating Livelihoods and Food Security* [M. Reedwood (ed.)]. Earthscan, London. 91–103.

MOFA (2007). *Food and Agriculture Sector Development Policy (FASDEP II)*. Ministry of Food and Agriculture. Accra, Ghana.

MOFA (2009). *Medium Term Agriculture Sector Investment Plan (METASIP)*. Volume 2: Programme of Actions. Ministry of Food and Agriculture. Accra, Ghana.

MOH (2007). *The National Health Policy: Creating Wealth through Health*. Ministry of Health. Accra, Ghana.

Morestin, F. & Ridde, V. (2009). How can the poor be better integrated into health insurance programs in Africa? An overview of possible strategies. Université de Montréal. <http://www.medsp.umontreal.ca/vesa-tc/ressrc.htm>

MWRWH (2007). *National Water Policy*. Government of Ghana. Ministry of Water Resources, Works and Housing. Accra. Ghana

National Research Council (2009). *Informing Decisions in a Changing Climate*. Washington, D.C.: National Academies Press

Rebar, C.R., Gersch C.J., Macnee, C.L. & McCabe, S. (2011). *Understanding Nursing Research* (3rd Edition). London: Lippincott Williams & Wilkins.

Schipper, E.L.F. (2007). *Climate Change, Adaptation and Development: Exploring the Linkages*. Tyndall Working Paper 107.

Stringer L.C., Dyer, J.C., Reed, M.S., Dougill, A.J., Twyman, C. & Mkwambisi, D. (2009). Adaptations to climate change, drought and desertification: insights to enhance policy in southern Africa, *Environmental Science and Policy*, **12**, pp.748-765. [doi:10.1016/j.envsci.2009.04.002](https://doi.org/10.1016/j.envsci.2009.04.002)

Stringer, L.C., Mkwambisi, D., Dougill A.J. & Dyer, J.C. (2010). Household and policy adaptations to climate change and desertification: perspectives from Malawi. *Climate and Development*, pp.145-160. [doi: 10.3763/cdev.2010.0042](https://doi.org/10.3763/cdev.2010.0042)

Suckall, N., Tompkins E. & Stringer, L. (2014). Identifying trade-offs between adaptation, mitigation and development in community responses to climate and socio-economic stresses: Evidence from Zanzibar, Tanzania. *Applied Geography*. 46 (2014) 111e121.

Teye, G.A. and Adam, M. (2000) Constraints to Guinea fowl production in Northern Ghana: A case study of the Damongo area. *Ghana Jnl agric. Sci.* 33: 153-157

UN-Habitat (2011). *Cities and Climate Change*. Global Report on Human Settlements 2011. United Nations Human Settlements Programme. Earthscan Ltd, Dunstan House, 14a St Cross Street, London EC1N 8XA, UK. www.unhabitat.org

UNISDR (2009). *Terminology on Disaster Risk Reduction*. United Nations International Strategy for Disaster Reduction. Geneva, Switzerland.

Wesley, J.J. (2010). Qualitative Document Analysis in Political Science. Working Paper. *T2PP Workshop*, 9-10 April 2010, Vrije Universiteit Amsterdam

WHO (2009). Promoting sport and enhancing health in European Union countries: a policy content analysis to support action. World Health Organization, Regional Officer for Europe.

Yiran, G.A.B. (2014). Hazards and Vulnerability Mapping for Adaptation to Climate Risks in Savannah Ecosystem: A Case Study of the Upper East Region, Ghana. A thesis submitted to the School of Graduate Studies in fulfillment for the award of Doctor of philosophy degree in Geography and Resource Development. University of Ghana.

Yiran, G.A.B., Kusimi, J.M, & Kufogbe, S.K. (2012). A synthesis of remote sensing and local knowledge approaches in land degradation assessment in the Bawku East District, Ghana. *International Journal of Applied Earth Observation and Geoinformation* 14 (2012) 204–213.