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Collaborative Adaptation Research Initiative in Africa and Asia

Review of Current and Planned Adaptation Action in Ghana

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Angie Dazé
Daniella Echeverría

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Titles in this series are intended to share initial findings and lessons from research and background studies commissioned by the program. Papers are intended to foster exchange and dialogue within science and policy circles concerned with climate change adaptation in vulnerability hotspots. As an interim output of the CARIAA program, they have not undergone an external review process. Opinions stated are those of the author(s) and do not necessarily reflect the policies or opinions of IDRC, DFID, or partners. Feedback is welcomed as a means to strengthen these works: some may later be revised for peer-reviewed publication.

Contact

Collaborative Adaptation Research Initiative in Africa and Asia
c/o International Development Research Centre
PO Box 8500, Ottawa, ON
Canada K1G 3H9
Tel: (+1) 613-236-6163; Email: cariaa@idrc.ca

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Abstract

In Ghana, the impacts of climate variability and change, including rising sea levels and temperatures and increasing rainfall variability, challenge the country's efforts to realize its vision of inclusion and prosperity. Although Ghana is comparatively less vulnerable than its neighbours in West Africa, climate change is expected to negatively impact progress in sectors such as agriculture, water, fisheries, energy, and health. The northern part of the country, in particular, will require concerted adaptation efforts to reduce poverty and build resilience. The Government of Ghana has made efforts to recognize climate change as a risk in sectoral policies on water, agriculture, and energy; however, these policy documents contain few concrete actions to address the risk. The National Climate Change Policy and the National Climate Change Adaptation Strategy aim to fill this gap, identifying key adaptation priorities across the sectors described above. Among the ongoing adaptation initiatives in Ghana, a number of projects are concentrated in the northern regions and in the agricultural sector, reflecting the particular vulnerability of the north and the importance of this sector for poverty reduction and economic growth, as reflected in government priorities. Key priorities for the future include the development of the evidence base for adaptation through effective monitoring and evaluation, and strengthening capacity for civil society networks and subnational actors. This report is one in a series of country reviews prepared to provide the Collaborative Adaptation Research Initiative in Africa and Asia with a snapshot of adaptation action in its countries of engagement.

Résumé

Examen des mesures d'adaptation actuelles et prévues au Ghana

Au Ghana, les effets de la variabilité du climat, notamment la montée du niveau de la mer, la hausse des températures et l'augmentation de la variabilité des précipitations, compliquent les efforts du pays visant à réaliser sa vision en matière d'inclusion et de prospérité. Bien que le Ghana soit moins vulnérable que ses voisins d'Afrique de l'Ouest, on s'attend à ce que les changements climatiques nuisent aux progrès dans des secteurs comme l'agriculture, l'eau, les pêches, l'énergie et la santé. Le nord du pays, notamment, a besoin de mesures d'adaptation concertées pour réduire la pauvreté et renforcer la résilience. Le gouvernement du Ghana s'efforce de reconnaître les changements climatiques comme un risque dans les politiques sectorielles relatives à l'eau, à l'agriculture et à l'énergie. Cependant, ces documents stratégiques comprennent peu d'actions concrètes pour faire face au risque posé. La politique nationale relative aux changements climatiques et la stratégie nationale d'adaptation aux changements climatiques visent à combler ces lacunes et à déterminer les priorités en matière d'adaptation dans les secteurs susmentionnés. Parmi les initiatives d'adaptation continues déployées au Ghana, un certain nombre de projets ciblent les régions du nord et le secteur agricole, du fait de la vulnérabilité particulière de cette région du pays et de l'importance de ce secteur pour réduire la pauvreté et encourager la croissance économique, comme le montrent les priorités du gouvernement. Les priorités pour l'avenir sont, entre autres, le développement d'une base de données probantes pour l'adaptation au moyen du suivi et de l'évaluation, et le renforcement de la capacité des réseaux de la société civile et des acteurs infranationaux. Ce rapport fait partie d'une série d'examens des pays préparés dans le cadre de l'Initiative de recherche concertée sur l'adaptation en Afrique et en Asie qui donnent un aperçu des mesures d'adaptation dans les pays où elle est déployée.

Acronyms

ALP	Adaptation Learning Program
ASAP	Adaptation for Smallholder Agriculture Programme
CARIAA	Collaborative Adaptation Research Initiative in Africa and Asia
CBA	community-based adaptation
CCA	climate change adaptation
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CFTC	Canadian Feed the Children
DANIDA	Danish International Development Agency
DFID	Department for International Development (UK Government)
DRR	disaster risk reduction
EPA	Environmental Protection Agency (Government of Ghana)
FAO	Food and Agriculture Organization of the United Nations
GASIP	Ghana Agricultural Sector Investment Programme
GCM	general circulation model
GSGDA II	Ghana Shared Growth and Development Agenda II
ITCZ	Inter-Tropical Conversion Zone
IFAD	International Fund for Agricultural Development
IPCC	Intergovernmental Panel on Climate Change
M&E	monitoring and evaluation
MESTI	Ministry of Environment, Science, Technology and Innovation (Government of Ghana)
MMDA	Metropolitan, Municipal and District Assembly
MOFA	Ministry of Food and Agriculture (Government of Ghana)
NADMO	National Disaster Management Organization (Government of Ghana)
NCCAS	National Climate Change Adaptation Strategy

NCCP	National Climate Change Policy
ND-GAIN	University of Notre Dame Global Adaptation Index
NDPC	National Development Planning Commission (Government of Ghana)
NGO	non-governmental organization
OECD	Organisation for Economic Co-operation and Development
RELBONET	Religious Bodies Network on Climate Change
SRES	Special Report on Emissions Scenarios
SV-Adapt	Southern Voices on Adaptation
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNISDR	United Nations Office for Disaster Risk Reduction
WHO	World Health Organization
WISE-UP	Water Infrastructure Solutions from Ecosystem Services to Underpin Climate-Resilient Policies and Programmes

About the authors

Angie Dazé

Associate, International Institute for Sustainable Development

Geneva, Switzerland

Angie Dazé is a researcher with the CARIAA-supported review of current and planned adaptation in the CARIAA program's countries of focus. As an associate with IISD, her research focuses on integrating climate risk management in policy and practice in areas such as food security and peacebuilding.

Contact: angie.daze@iisd.org

Daniella Echeverría

Project Officer, International Institute for Sustainable Development

Winnipeg, Canada

Daniella Echeverría is a researcher with the CARIAA-supported review of current and planned adaptation in the CARIAA program's countries of focus. Her work focuses on building capacity to manage climate risks through knowledge sharing, the use of decision-support tools, and policy analysis focused on the green economy and food security.

Contact: decheverria@iisd.ca

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Contents

Synopsis

Climate risks	• **Rising sea level** • **Increasing temperatures** • **Increasing rainfall variability** • **Increased intensity of drought**	**Drivers of vulnerability**	• **Inequitable progress on poverty reduction** • **Gender inequality** • **High dependence on agriculture for livelihoods** • **Weaknesses in the health care system**	
Vulnerable sectors	**Illustrative potential impacts on vulnerable sectors**		**Illustrative adaptation priority adaptation measures in each vulnerable sector**	**Projects in sector[1]**
Agriculture	• Increased incidents of fires, droughts, floods • Decreased water availability • Loss of crop production • Increased environmental degradation • Changes in agricultural calendar • Increased incidence of pests and diseases		• Build farmer awareness of climate change and capacity for adaptation • Build capacity of extension officers to better support adaptation by farmers • Promote alternative livelihood strategies, particularly for vulnerable groups • Promote agricultural biodiversity • Promote crop and livestock production practices that are climate resilient • Promote post-harvest technologies to minimize losses	58%
Water	• Decreased water flow • Increased incidence of flooding and drought		• Promote water preservation and conservation • Increase accessibility and availability of water for domestic, agricultural, industrial, and commercial use and energy production • Improve and sustain quality of water resources • Build capacity in water resource management	8%
Fisheries	• Loss of marine and freshwater production • Decrease in marine and freshwater catchability • Increase in food insecurity, unemployment • Intrusion of salinity and coastal erosion in coastal areas		• Promote fish farming • Design and implement programs for fisheries management and disease control • Develop alternative livelihood strategies for fishers	0%
Energy	• Interruption and reduction in hydropower generation		• Increase the use of off-grid alternative energy resources and natural gas	0%

[1] Percentage of total identified discrete adaptation projects and programs based upon research undertaken as part of this review. Note that individual projects may address more than one sector.

	• Damage to energy infrastructure	• Encourage energy conservation on a large scale and expand use of efficient technologies • Develop low-head run of river hydroelectricity schemes	
Health	• Increased incidence of water-, air-, and vector-borne diseases • Increased expenditures on health care • Damages to health infrastructure • Interruption in health services	• Raise public awareness of climate change and its impacts on health, livelihoods, and environmental sanitation • Improve waste management and environmental sanitation systems • Reduce incidence of water- and air-borne diseases • Increase capacity of health care workers to deal with climate-related health problems	0%

Particularly vulnerable regions	**Particularly vulnerable groups**	**Status of climate governance**
• Northern Ghana, due to high levels of poverty, dry conditions, heavy reliance on agriculture	• People living in drought- and flood-prone areas and eroding coastal areas • People living in informal settlements • Poor women in rural areas	• *National Climate Change Policy* launched in 2014 • *National Climate Change Adaptation Strategy* for 2010–2020 developed • National Climate Change Committee established

Introduction

Ghana is located in West Africa next to the Gulf of Guinea, sharing borders with Côte d'Ivoire to the west, Togo to the east and Burkina Faso to the north. The country has achieved significant economic growth in recent years, and the proportion of the population living below the poverty line shrank from 32% to 24% between 2006 and 2012 (World Bank, 2014). However, there are stark differences in development outcomes between the south of the country and the north. Numerous challenges must be overcome for Ghana to maintain its middle-income developing country status and to accelerate development in the northern regions. These include large fiscal deficits, inefficient use and management of public funds, slow growth in the agricultural sector, and inadequate progress in job creation (NDPC, 2014), as well as alarming rates of deforestation and a significant proportion of the country affected by desertification (United Nations Environment Programme [UNEP], 2008). For Ghana to realize its vision of an inclusive and prosperous country by 2020, a transformation will be required (NDPC, 2014).

The impacts of climate variability and change present a further challenge to this transformation. In the coming decades, Ghana is expected to experience rising temperatures, increasing rainfall variability and sea level rise. Changes in temperature are projected to be greatest in the northern part of the country, where they combine with high levels of poverty, environmental degradation and weak institutional capacities to create a situation of high vulnerability. There are also implications for economic development in the south, which will be affected by sea level rise and increasing variability in coastal weather patterns (Stanturf et al., 2011). The Government of Ghana has recognized these challenges and is actively working to integrate climate change adaptation (CCA) into development policies and programs, with support from international partners. Civil society in Ghana is also active on the issue, engaging in

Figure 1 – Map of Ghana showing administrative regions

Source: University of Texas Libraries, University of Texas at Austin

practical actions with communities and other local stakeholders as well as advocacy for an effective policy environment for adaptation.

This paper provides a snapshot of current and planned efforts in Ghana to advance action at the local, subnational and national levels to adapt to the impacts of climate change. Drawing upon available literature and key informant interviews, it has been prepared to support the contribution of the Collaborative Adaptation Research Initiative in Africa and Asia (CARIAA) to adaptation policy and practice. CARIAA is jointly funded by the UK Department for International Development (DFID) and the International Development Research Centre, with the aim of building the resilience of vulnerable people and their livelihoods in three "hot spots" of climate change vulnerability in Africa and Asia: semi-arid areas, deltas in Africa and South Asia, and glacier- and snow-fed river basins in the Himalayas. To achieve this goal, CARIAA is supporting four consortia to conduct high-calibre research and policy engagement activities that will inform national and subnational planning processes in 17 countries.

This report is one in a series of country reviews prepared to provide CARIAA with a picture of the policies, programs and projects designed and implemented specifically to address the current and projected impacts of climate change in its countries of engagement. Section 2 provides an overview of Ghana's current and projected exposure to climate risks. In Section 3, Ghana's vulnerability to climate variability and change is discussed, including the development challenges that act as drivers of vulnerability, and vulnerable sectors, regions, and groups are identified. This is followed by a review of the critical policies and plans shaping Ghana's efforts to address CCA at the national and subnational levels. To assess the extent to which efforts are presently underway to address the country's critical adaptation priorities, Section 4 paints a general picture of the scale, type and focus of current and planned adaptation-focused programs and projects underway in Ghana as well as the level of climate finance flowing into the country to support this work. Section 5 then provides a profile of in-country efforts to advance adaptation learning and knowledge-sharing by identifying networks and communities of practice active in this field. The paper concludes with an assessment of the general status of adaptation action at the national and subnational levels in Ghana.

1. Current climate and projected changes

This section provides an overview of the climate risk context in Ghana, beginning with a general description of the country's current climate and eco-climatic zones, followed by discussions of observed trends and projected changes to its climate over the remainder of this century.

1.1 Current climate

Ghana is composed of six major eco-climatic zones characterized by different temperature and rainfall patterns. These zones appear as bands that run roughly from west to east across the country. Table 1 presents the average annual temperatures and rainfall for these zones based on data from 1961 to 2000, listing the zones from north to south (Minia, 2008, in Stanturf et al., 2011).

Seasonal patterns in Ghana are heavily influenced by the position of the Inter-Tropical Conversion Zone (ITCZ) as it oscillates between the south and the north. The shifts in wind directions caused by the migration of the ITCZ northward creates the West African monsoon, which occurs as the land warms more than the Atlantic Ocean, leading to cooler, moist air from the ocean travelling inland along the region's coastal areas. As the ITCZ subsequently moves southward, it pulls dust-laden air from the Sahara desert to generate the Harmattan winds and moves hot, dry air south (Conway, 2009; Daron, 2014; McSweeney, New, & Lizcano, 2010).

Seasonal variations in precipitation and temperature differ between northern and southern Ghana. The northern part of the country experiences a single rainy season, which generally occurs between May and November. Temperatures range from 27°C to 30°C during the hot season from April to June, and from 25°C to 27°C during the coolest part of the year, from July to September. In the southern regions there are two rainy seasons: the main one occurring from March to July, followed by the short rains from September to November. Temperatures range from 25°C to 27°C during the warm season and from 22°C to 25°C during the cool season (McSweeney, New, & Lizcano, 2010). There is considerable variability in rainfall patterns, both interannually and between decades, caused partly by variations in the ITCZ, the West African monsoon and the El Niño Southern Oscillation. The last typically causes drier-than-average conditions across West Africa (McSweeney, New, & Lizcano, 2010). The northern and coastal savannah areas in Ghana are more vulnerable to droughts, primarily due the influence of the ITCZ (MESTI, 2012a).

Table 1 – Ghana's eco-climatic zones

Zone	Average annual temperature (°C)	Average annual rainfall (mm)
Sudan savannah	28.6	992
Guinea savannah	27.5	1115
Transitional zone	27.0	1301
Deciduous forest	26.4	1303
Coastal savannah	26.9	890
Rainforest	26.4	2093

1.2 Observed climate trends

Since 1960 the mean annual temperature in Ghana has increased by 1°C, or 0.21°C per decade (McSweeney, New, & Lizcano, 2010; MESTI, 2012a). The most significant increase has been in the months of April, May, and June, at an average of 0.27°C per decade. Northern Ghana has experienced a higher rate of temperature increase than the southern region. Between 1960 and 2003, a rise in the number of hot days has been observed (48 days, an increase of 13.2%), particularly during the months from September to November (McSweeney, New, & Lizcano, 2010). The mean annual and seasonal temperature increase is consistent with the regional temperature observations for West Africa; however, localized cooling has been observed in border regions between Burkina Faso, Ghana, and Cote D'Ivoire (Daron, 2014).

Rainfall trends in Ghana have been variable since 1960 along both interannual and interdecadal timescales, making it difficult to determine longer-term trends (McSweeney, New, & Lizcano, 2010; MESTI, 2012a). A decrease in rainfall was observed between 1960 and 2006; however, this period included drier and wetter decades. There is no evidence of an increase or decrease in heavy rainfall events during this period (McSweeney, New, & Lizcano, 2010; Stanturf et al., 2011). Regionally, there has been a shift in rainfall patterns along the coastline, with decreased rainfall in spring (March to May) and summer (June to August) and an increase in the autumn (September to November). However, overall observed rainfall pattern changes are not consistent throughout the region, given its sensitivity to atmospheric and sea-surface temperature changes (Daron, 2014). A rise in sea level of 2.1 mm per year has been observed over the last 30 years (MESTI, 2012a).

1.3 Climate projections

General circulation models (GCMs) consistently indicate an increase in temperatures over the next 50 years across all regions of Ghana (De Pinto, Demirag, Haruna, Koo, & Asamoah, 2012) but vary with respect to the rate of this projected increase. Stanturf et al. (2011) , for example, cite studies that project a mean temperature increase in the dry season of between 1.5°C and about 3.0°C by 2080 in most ecological zones. Similarly, the Government of Ghana projects an increase in average annual temperature of up to 0.8oC by 2020 and 5.4°C by 2080, across all ecological zones (Minia et al., 2004, in MESTI, 2012a). These projections are consistent with available projections for West Africa. Using GCMs, the Intergovernmental Panel on Climate Change (IPCC) projects that the midpoint of the range of mean annual temperatures for West Africa will be an increase of 0.9°C, 2.1°C, and 4.0°C by the years 2035, 2065, and 2100, respectively (Christensen et al., 2013). Regional modelling by the Climate System Analysis Group at the University of Cape Town projects an increase in winter temperatures of at least 2°C across the Sahel and by 1°C to 2°C in the southern coastal regions by the 2040s, with similar trends but a slightly lower magnitude of change in the summer season. The northern region is projected to experience a greater rate of warming than coastal areas of the country (Daron, 2014; McSweeney, New, & Lizcano, 2010;

World Bank, 2011b). The months with the greatest temperature increase are expected to be December, January, and February (Christensen et al., 2013).

Rainfall projections in general are harder to model, particularly in West Africa, where the complexity of atmospheric systems coupled with limited climatic data make precipitation modelling uncertain (Conway, 2009; Stanturf et al., 2011). Models such as the array used by the IPCC and others produce a range of drier and wetter scenarios, depending on the model used (Christensen et al., 2013; Daron, 2014). While there is no consensus on the direction of change in the amount of rainfall received in West Africa (Daron, 2014), some researchers have suggested that Ghana will experience a decrease in rainfall by 2080 (Minia et al., 2004, in MESTI, 2012a) and that the Ashanti region and the coastal areas of Volta, Eastern, and Greater Accra and the Central and Western regions will continue to be the wettest parts of the country, while the northern and southern savannah zones will experience drier conditions (World Bank, 2011a).

Current variability in rainfall is expected to continue. Regional projections for West Africa suggest an increase in rainfall during the summer monsoon, a small delay in the onset of the rainy season, and an increase in late-season rains (Christensen et al., 2013). The IPCC also projects that drought will increase in intensity (Stocker et al., 2013). A World Bank study for Ghana projects that a cyclical pattern of increased rainfall levels followed by drought will occur every decade or so between 2010 and 2050 (World Bank, 2011a).

Sea-surface temperature rise is expected to continue, disrupting the timing and intensity of coastal upwelling. Sea levels are projected by some models to rise by 16.1 cm to 58.4 cm by the turn of the 21st century (Stanturf et al., 2011), while other models project an increase of up to 34.5 cm by 2080 (MESTI, 2012a).

2. Vulnerability to climate change

Given the climate risks and changes projected for Ghana, it is clear that climate change will be a key factor influencing the country's development going forward. This section discusses Ghana's vulnerability to climate change, beginning with an overview of key development challenges that represent drivers of its vulnerability. This is followed by a discussion of the most vulnerable sectors, regions and groups, as well as an assessment of Ghana's vulnerability in relation to its neighbouring countries.

2.1 Current drivers of vulnerability

A number of development challenges contribute to Ghana's vulnerability to climate change: notably its need to achieve sustainable economic growth and poverty reduction in all regions, reduce its high dependence on agriculture for livelihoods, address gender inequality, and improve health care provision. Ghana's ability to manage climate risks into

the future will be strongly influenced by progress in these areas. Table 2 provides an overview of the key indicators of development progress in Ghana.

After years of strong economic growth, which propelled Ghana to the status of a lower-middle-income country, the country's economic performance has slowed in recent years (falling from 8.8% in 2012 to 4.7% in 2014). While a modest reversal of this trend is expected in the coming years (World Bank, 2015), greater growth will be needed in the future for the country to strengthen its capacity to plan for and respond to climate change. Ghana's continuing high economic dependency on natural resources is also a concern, with timber, cocoa, minerals, and fish collectively making up 90% of the country's total exports (World Bank, 2015). Moreover, an estimated 70% of Ghana's population of 25.9 million people is either directly or indirectly dependent on rain-fed agriculture and its subsectors, including subsistence crops and livestock, cash crops (such as cocoa), forestry, logging, and fishing (MESTI, 2012a; World Bank, 2011a).

Table 2 – Key indicators of development progress in Ghana

Category	Indicator	Year	Value	Source
Human development	Human Development Index (score[d]/rank[d] out of 187 countries)	2013	0.573/138	UNDP (2014a)
	Population in multidimensional poverty (%)	2013	30.5%	
	Under-five mortality rate (per 1000 live births)	2013	72	
	Adult literacy rate (15 years of age and above)	2013	71.5[c]	
	Improved water source, rural (% of population with access)	2012	81%	World Bank (2015)
	Improved sanitation facilities (% of population with access)	2012	14%	
	Access to electricity (% of population)	2010	60.5%	
Gender	Gender Inequality Index (value[e]/rank[d] out of 187 countries)	2013	0.549/138	UNDP (2014a)
Demographics	Total population (in millions)	2013	25.9[a]	UNDP (2014a)
	Average annual population growth rate	2010	2.1%	
	Population, urban (% of population)	2011	53.2%[b]	

Economic development	Gross domestic product (GDP) (in current USD, millions)	2013	48,137.02	World Bank (2015)
	GDP growth (annual %) (average of period from 2010 to 2013)		9.9%	
	Agricultural land (% of land area)	2012	69.0%	
Governance	Corruption Perceptions Index (score[f]/rank[d] out of 174 countries)	2014	48 / 61	Transparency International (2014)
	Fragile States Index (score out of 120[g]/status)	2014	70.7 / High Warning	Fund for Peace (2014)
	Expenditure on education, public (% of GDP)	2012	8.2%[c]	UNDP (2014a)
	Expenditure on health (% of GDP)	2011	4.8%	
Environment	Population living on degraded land (%)	2010	1.4%	UNDP (2014a)
	Change in forest area, 1990/2011	2013	–35.2%	

[a] Projections based on medium-fertility variant
[b] Because data are based on national definitions of what constitutes a city or metropolitan area, cross-country comparison should be made with caution
[c] Data refer to the most recent year available during the period specified
[d] Where 1 or first is best
[e] Where 0 is best
[f] Where 0 is highly corrupt and 100 is very clean
[g] Where 120 is very high alert and 0 is very sustainable

Ghana has also seen improvements in its level of social development in recent years, as reflected by its rise on the Human Development Index from 0.487 in 2000 to 0.573 in 2014 (UNDP, 2014b). A factor contributing to this rise has been a reduction in poverty and extreme poverty rates by 7.7% and 8.1%, respectively, since 2006 (World Bank, 2014). Despite this progress, an estimated 29% of Ghanaians continue to live on less than US$1.25 a day (UNDP, 2014b). Poverty rates are higher in the northern savannah regions, at 55% in rural areas and 26.4% in urban settings (World Bank, 2014). Ghana must make a considerable effort to ensure that the benefits of future growth are more equitably distributed.

Gender inequality remains a concern in Ghana, as reflected in its performance on the Gender Inequality Index (see Table 2). Fewer women than men have at least some level of secondary education (45.2% compared with 67.2%, respectively) and only 11 percent of members of parliament are women (UNDP, 2014a). While women compose over half of the agricultural labour force and produce most of the country's subsistence crops (Netherlands Climate Assistance Programme, n.d.), they continue to face barriers in accessing important

resources, including financial services, information, appropriate technology, and secure land tenure (Food and Agriculture Organization of the United Nations [FAO], 2012).

Ghana's health profile has improved over the past decade and currently exceeds the average progress in the West Africa region. For example, life expectancy at birth is 62 years in Ghana, while regionally it is 58 (World Health Organization [WHO], 2015). While deaths related to malaria and diarrheal diseases have decreased in the last decade (WHO, 2015), the impacts of climate change on water and vector-borne diseases have been identified as a concern, as discussed in the following section.

Overall, Ghana has moderate level of vulnerability to climate change, as reflected by its performance on the University of Notre Dame Global Adaptation Index (ND-GAIN), which provides a quantitative evaluation of a country's vulnerability to and preparedness for climate change. As indicated in Table 3, Ghana is the 55th most vulnerable country globally in these rankings, and is considered to be less vulnerable than its neighbours, such as Togo and Côte d'Ivoire. In terms of its readiness to respond to climate change, Ghana ranks as the 90th most ready country globally. This suggests that it is also more prepared than its neighbours (ND-GAIN, 2015).

Table 3 – Comparison of Global Adaptation Index scores for Ghana and neighbouring countries (ND-GAIN, 2015)

Country	Vulnerability*		Readiness**		Overall
	World rank	Score	World rank	Score	World rank
Ghana	55	0.440	90	0.465	102
Côte d'Ivoire	138	0.486	174	0.285	154
Nigeria	51	0.460	167	0.300	140
Burkina Faso	162	0.546	146	0.337	156
Togo	154	0.525	149	0.333	150

* Lower score indicates lower vulnerability. The vulnerability score is determined based on indicators of exposure, sensitivity, and adaptive capacity, taking into consideration indicators related to six life-supporting sectors: food, water, health, ecosystem services, human habitat, and infrastructure.
** Higher score indicates higher degree of preparedness. The readiness score takes into account measures of economic readiness, governance readiness, and social readiness to pursue adaptation actions.

2.2 Vulnerability of key sectors

From a sectoral perspective, agriculture and water are of particular concern for the Government of Ghana, along with the fisheries, energy, and health sectors, as summarized in Table 4. Potential increases or decreases in total rainfall and variability will negatively impact crop production, putting in jeopardy the livelihoods of many communities. Transitional zone rainfall patterns are already demonstrating changes, with the short dry

season in July and August becoming wetter, affecting farmers' ability to prepare land for a second crop (MESTI, 2012a). A World Bank (2011a) study using crop simulation models demonstrated significant losses in crop production by the mid-21st century, shrinking the country's GDP by between 1.9% and 7.2%. Of particular concern is the production of cocoa, Ghana's biggest export, as it is highly vulnerable to climate change; production decreases will negatively affect the country's economic stability (Stocker et al, 2013). In addition, increases in temperature and occurrence of drought will contribute to greater incidence of bushfires and environmental degradation (MESTI, 2012a), particularly in the savannah regions. Among the most vulnerable groups engaged in agriculture are those residing in the drylands, located in the Upper East, Upper West, and Northern regions (De Pinto et al., 2012).

Changes in precipitation patterns and rising temperatures will also affect the future availability of surface and groundwater resources in Ghana, with direct and indirect implications for a range of sectors, including agriculture, industry, and energy. Ghanaians, particularly those in the northern regions, already experience water access limitations due to technical inefficiencies (MESTI, 2012a). Water scarcity particularly affects women and children in rural communities, who are tasked with collecting water and must travel longer distances to obtain good-quality water. Communities living near water bodies can also be put at risk by increases in intensity of rainfall and incidence of flooding. In 2007, for example, flooding affected over 330,000 people in the Upper East, Upper West, and Northern regions, as well as part of the Western Region (Kankam-Yeboah et al., 2010).

The fisheries sector plays a major role in Ghana's economy, generating 16% of GDP. It is also a significant contributor to local and national food security (MESTI, 2012a), providing 60% of the animal protein consumed in the country (FAO, n.d.; 2004). Marine fisheries compose the majority of the sector, followed by inland fisheries and aquaculture production. Impact scenarios for Ghana's marine and inland production areas demonstrate that stock production and, to a lesser extent, catch rate relative to the true size of the fish population are susceptible to climate change and variability. For some marine fish species, such as round sardinella and anchovy, changes in sea-surface temperatures affect the coastal upwelling of nutrient-rich waters (Dontwi, Dontwi, Buabeng, & Ashong, n.d.) as well as the catchability of fish by the artisanal fishers (MESTI, 2012a). Changes in precipitation patterns affect production and catchability of Ghana's inland and aquaculture fish, such as tilapia and catfish (MESTI, 2012a). Overall, climate variability and change affect the growth rate of fish, employment in the sector, and food security (Environmental Protection Agency [EPA], 2011). In addition, sea level rise may present a risk for coastal fishing communities due to coastal erosion and saltwater intrusion (MESTI, 2012a).

Hydroelectric and thermal power (through diesel and natural gas) contribute 67% and 33%, respectively, to the energy grid in Ghana. Given the current high dependence on hydropower, Ghana has already experienced a decline in energy generation during dry years. In 2003, for example—a wet year—lower precipitation levels still led to energy

production reaching only 60% of 2000 levels. In order to compensate for the low energy production, thermal energy generation was put into the grid (MESTI, 2012a). With greater rainfall variability and higher frequency and intensity of climate extremes, such as droughts and floods, stress on the country's hydropower generation and its infrastructure will increase, affecting both households and businesses.

The impacts of climate change on health are one of the major social concerns in the country. At present, air-, water-, and vector-borne diseases, including malaria and cholera, are among the main health threats in Ghana. Heavy rainfall and flooding combine with poor sanitation to increase the incidence of malaria and cholera, while heat waves and increased incidence of dust during dry periods elevate the risk of cerebrospinal meningitis (Codjoe & Nabie, 2014; MESTI, 2012a; Stocker et al., 2013). Facing limited resources in its health care system, including human resources, infrastructure and budgetary constraints, Ghana has limited capacity to look after the ill and raise awareness among individuals about climate change and its impact on health. Increased incidence and intensity of floods can damage health infrastructure as well as create disruption to health service delivery (MESTI, 2012b). This is particularly true in northern Ghana, which is faced with greater restrictions compared with the rest of the country (Darko & Atazona, 2013).

Table 4 – Key vulnerable sectors in Ghana

Sector	Likely impacts of climate change
Agriculture	• Increased incidence of fires, droughts, and floods • Decreased water availability • Loss of crop production • Increased environmental degradation • Changes in the agricultural calendar • Increased incidence of pests and diseases
Water	• Decreased water flow • Increased incidence of flooding and drought
Fisheries	• Loss of marine and freshwater production • Decrease in marine and freshwater catchability • Increase in food insecurity and unemployment • Intrusion of salinity and coastal erosion in coastal areas
Energy	• Interruption and reduction in hydropower generation • Damages to energy infrastructure
Health	• Increased incidence of water-, air-, and vector-borne diseases • Increased expenditures on health care • Damages to health infrastructure • Interruption in health services

2.3 Vulnerable regions and groups

From a regional perspective, the highest vulnerability to climate change is in Northern Ghana, due to its high levels of poverty, dry conditions, and heavy reliance on agriculture as a livelihood source (Darko & Atazona, 2013). The vulnerability of the drylands of northern Ghana, and West Africa more generally, to climate change stems from the multi-dimensional interplay between land and resource use, governance systems, and policies, as discussed in greater depth in Padgham et al. (2015).

To escape the hardships of poverty and environmental degradation within this region, migration from water-stressed areas in northern Ghana to wetter southern regions and urban areas is increasingly used as a coping strategy (MESTI, 2012a). Across Ghana, the proportion of the population living in rural areas has decreased from almost 57% in 1999 to just over 46% in 2014 (FAO, 2015). With current trends of migration and extreme climate events, migration flows may intensify toward urban and open areas; however, population densification increases the number of people exposed to flooding, diseases, and heat waves, primarily in areas that lack adequate planning and infrastructure (MESTI, 2012a).

Climate change is also expected to impact some groups more seriously than others. Vulnerability assessments undertaken in Ghana have found that current and projected climate change pose the greatest threat to people living in drought- and flood-prone areas, particularly those living in informal settlements or residing in eroding coastal areas (MESTI, 2012a). Ghana's population living in poverty is particularly vulnerable to the effects of climate change on socioeconomic and environmental resources, such as water, arable land, and job opportunities, which limit their growth opportunities and jeopardize their food security and health (Nelson & Agbey, 2005). Reflecting the persistence of gender inequalities in Ghana and women's relatively greater dependence on climate-sensitive economic sectors such as agriculture, women living in rural areas have also been identified as particularly vulnerable to climate change. As noted previously, social and cultural norms often create barriers for women in accessing resources, information, and opportunities (NCAP, n.d.). For example, access to land in rural areas is heavily skewed toward men. Finance is another resource that women face barriers in accessing. Women obtain access to financial resources mostly through informal networks, while men, although still facing limitations, have greater access to formal credit from the public sector (FAO, 2012). Limitations such as these inhibit the ability of women to manage risks to their livelihoods and affect the resilience of their families and communities (NCAP, n.d.).

3. Adaptation planning context

This section provides an overview of the policies, plans, and strategies that have the potential to advance adaptation efforts in Ghana. This includes national development policies and plans that establish the broad vision and goals of the country as well as climate change plans and strategies, including those specifically addressing adaptation. We also

discuss the extent to which current strategies and plans of relevance to particularly vulnerable sectors address climate change, as well as progress by subnational governments to prepare for climate change. Table 5 provides a general assessment of Ghana's progress on adaptation planning.

Table 5 – Ghana's national adaptation planning context: Summary of progress as of May 2015

Indicator	Progress
Climate change recognized in Ghana's guiding development vision/plan	Yes, visible in the Ghana Shared Growth and Development Agenda
National-level coordinating entity for climate change established and active	Yes, the National Climate Change Committee
Climate change policy and/or law in place	Yes, the National Climate Change Policy (NCCP) launched in 2014
Climate change strategy published	Not present
Climate change action plan published	Not present
Adaptation plan published	Yes, the National Climate Change Adaptation Strategy (NCCAS) for 2010-2020
Climate change fund or adaptation fund operational	Not present
Climate change units established in key ministries	Some
Climate change integrated into national sectoral policies	Some, for example the Water Policy

3.1 National-level development policy context

Ghana's long-term development vision is outlined in its Vision 2020 document, developed in 1995 (Government of Ghana, 1995). It identifies long-term development objectives in five key areas: human development, economic growth, rural development, urban development, and an enabling environment. This includes objectives related to water and sanitation, agriculture and forestry, and environmental sustainability. Since Vision 2020 was developed, a series of medium-term development plans and strategies have been prepared to guide implementation of actions toward these objectives. Most recently, the second Ghana Shared Growth and Development Agenda (GSGDA II) (2014–2017) was designed to lay the foundation for the structural transformation of the economy to achieve the objectives in Vision 2020. The GSGDA II document is currently in final draft form.

Ghana's medium-term vision as articulated in the GSGDA II is "a stable, united, inclusive and prosperous country with opportunities for all" (NDPC, 2014, p. 30). This will be achieved by

action in four priority areas: building a strong and resilient economy, investing in people, expanding infrastructure, and maintaining transparent and accountable governance. Within these areas, a number of strategic directions have been identified: ensuring and sustaining macroeconomic stability; enhancing the competitiveness of the private sector; accelerating agricultural transformation and sustainable natural resource management; developing oil and gas resources; developing infrastructure and human settlements; improving human development (including health), productivity, and employment; and providing transparent and accountable governance (NDPC, 2014).

Climate change is discussed in the GSGDA II document, where it is described as a "major threat to national development" (NDPC, 2014, p. 82). That document identifies management of climate variability and change as a focus area within the theme of sustainable natural resource management. Objectives related to this theme include strengthening early-warning systems, intensifying research and raising awareness of climate change, supporting implementation of alternative livelihood strategies to minimize negative impacts of climate change on poor and vulnerable women and men, and establishing a national climate change centre. There are also objectives that aim to minimize the impacts of climate change on progress in other priority areas, such as agriculture, water resource management, and energy (NDPC, 2014).

3.2 National-level climate policy context

The key adaptation-focused policy documents in Ghana are the National Climate Change Policy (NCCP) and the National Climate Change Adaptation Strategy (NCCAS), which are described in the following sections, followed by a summary of the identified adaptation priorities.

National Climate Change Policy

Ghana's NCCP was developed between 2009 and 2012 but formally launched in 2014, as a complementary document to the GSGDA II (Sova et al., 2014). The National Climate Change Committee led its development (see Section 4.3 for more details), with technical support from MESTI and Ghana's Environmental Protection Agency (EPA)[2]. The vision of the NCCP is "to ensure a climate-resilient and climate-compatible economy while achieving sustainable development through equitable low carbon economic growth for Ghana" (MESTI, 2012b, pp. 1–8). The NCCP identifies five focus areas for action on climate change: agriculture and food security, disaster preparedness and response, natural resource management, equitable social development, and energy, industrial, and infrastructural development.

[2] The Institute for Environment and Sanitation Studies, University of Ghana, also provided technical assistance in this process.

The NCCP comprises ten programme areas: developing climate-resilient agriculture and food security systems; building climate-resilient infrastructure; increasing resilience of vulnerable communities to climate-related risks; increasing carbon sinks; improving management and resilience of terrestrial, aquatic, and marine ecosystems; addressing impacts of climate change on human health; minimizing impacts of climate change on access to water and sanitation; addressing gender issues in climate change; addressing climate change and migration; and minimizing greenhouse gas emissions. The second phase of the NCCP implementation process, which is currently underway, will identify specific actions within these programme areas, as well as timelines and budgets for implementation (MESTI, 2012b).

While recognizing the potential for Ghana to pursue lower-carbon development pathways and to increase its carbon sinks, the NCCP places significant emphasis on integrating adaptation across a range of different sectors important for the country's development progress. There is potential for this to make a difference both in terms of reducing Ghana's vulnerability to climate change and in ensuring that development outcomes are resilient to climate change over time. The inclusion of equitable social development as a theme is also promising, as it suggests that the Government intends to consider differential vulnerability to climate change in its adaptation action. Whether this potential can be realized will depend on the processes put in place to identify and prioritize appropriate responses, as well as the allocation of resources to implement the priority adaptation actions. The NCCP does not provide details on financing mechanisms for implementation, however it does indicate that substantial additional resources will be needed, and that these will come from "a mix of public and private, national and international sources" (MESTI, 2012b, pp. 2–12).

National Climate Change Adaptation Strategy

In parallel with the development of the NCCP, Ghana prepared its NCCAS, which was released in 2012 and covers the period from 2010 to 2020. Preparation of the NCCAS was supported by the Climate Change and Development – Adapting by Reducing Vulnerability program funded by the Danish Ministry of Foreign Affairs and jointly implemented by the United Nations Environment Programme (UNEP) and United Nations Development Programme (UNDP). Its implementation is led by MESTI, with support from the NCCC. Although the NCCAS was developed before the NCCP, the two documents are generally aligned in terms of their objectives and types of interventions.

The overarching goal of the NCCAS is "to [protect] Ghana's current and future development [from] climate change impacts by strengthening its adaptive capacity and building resilience of the society and ecosystems" (MESTI, 2012a, p. 17). This is to be achieved through five key objectives:

- Improving society's awareness of and preparedness for future climate change;
- Mainstreaming of climate change into national development to reduce climate risks;

- Increasing the robustness of infrastructure development and long-term investments;
- Increasing the flexibility and resilience of vulnerable ecological and social systems to enhance their adaptive capacity; and
- Fostering competitiveness and promoting technological innovation.

These objectives are to be achieved through interventions in the following key areas: livelihoods, energy, agriculture, health, early warning, fisheries management, land use and water.

The NCCAS is designed to be implemented through a series of programs that address Ghana's urgent adaptation priorities, namely

- Strengthening early warning systems
- Supporting alternative livelihoods for the poor and vulnerable
- Improving land use management
- Researching and creating awareness of CCA
- Implementing environmental sanitation strategies for adaptation to climate change
- Managing the impacts of climate change on water resources
- Diversifying agriculture
- Improving access to health care to minimize climate change impacts on human health
- Establishing demand- and supply-side measures to adapt national energy systems
- Enhancing fisheries resource management (MESTI, 2012a)

Table 6 summarizes the key actions identified for different sectors in the NCCAS.

Table 6 – Key adaptation actions by sector identified in Ghana's NCCAS (MESTI, 2012a)

Sector	Adaptation priorities
Agriculture	• Build farmer awareness of climate issues • Strengthen farmer capacity to increase agricultural productivity • Build capacity of extension officers to better support adaptation by farmers • Promote alternative livelihood strategies, particularly for vulnerable groups • Promote agricultural biodiversity • Promote crop and livestock production practices that are climate resilient • Promote post-harvest technologies to minimize losses • Identify and document indigenous adaptation strategies
Water resources	• Promote water preservation and conservation • Increase accessibility and availability of water for domestic, agricultural, industrial, and commercial use and energy production • Improve and sustain quality of water resources • Build capacity in water resource management
Fisheries	• Promote fish farming

	• Design and implement programs of fisheries management and disease control • Develop alternative livelihood strategies for fishers
Energy	• Increase the use of off-grid alternative energy resources • Expand the use of efficient domestic appliances • Develop low-head, run-of-river hydroelectricity schemes • Encourage energy conservation on a large scale • Increase use of natural gas
Health	• Raise public awareness on climate change and its impacts on health, livelihoods, and environmental sanitation • Improve waste management systems and provide new and affordable technologies for environmental sanitation • Reduce incidence of water- and air-borne diseases • Increase capacity and knowledge of health care workers concerning climate change–related health problems • Improve and increase existing health facilities and equipment
Cross-sectoral	• Develop or strengthen information management and early-warning systems for droughts and floods • Implement risk-mitigation strategies at the community level • Develop and strengthen a network of rapid disaster-response teams • Improve productivity and incomes for vulnerable groups • Raise awareness of climate change and adaptation strategies • Improve access to financial services, notably credit • Improve technical and financial capacities to enable adaptation • Strengthen links between scientific knowledge and indigenous knowledge • Promote sustainable land management • Strengthen research capacity on climate change at universities and research institutions

It is as yet unclear how and when the NCCAS will evolve into a formal National Adaptation Plan (NAP) under the United Nations Framework Convention on Climate Change (UNFCCC) process established in the Cancun Adaptation Framework in 2010 (CCAFS, 2014).

3.3 Institutional structure for climate governance

MESTI, through the EPA, is Ghana's focal point for the UNFCCC and is therefore responsible for leading climate change policy development and facilitating implementation of actions to address the causes and effects of climate change. The EPA takes a leadership role in developing National Communications to the UNFCCC, engaging with UNFCCC negotiations and technical coordination of climate change activities in Ghana. The EPA also works with the National Development Planning Commission (NDPC) and the National Disaster Management Organization (NADMO) to facilitate integration of CCA and disaster risk reduction (DRR) into development initiatives at all levels down to the district (MESTI,

2012). To support this process, the EPA developed a guidance document on mainstreaming climate resilience and DRR strategies into medium-term development planning, budgets and implementation mechanisms at national and district levels. Several ministries, including MOFA and the Ministry of Finance, have established climate change units at the national level to support this process (CCAFS, 2014).

MESTI coordinates the NCCC, which was established under a ministerial directive with a mandate to review climate-relevant policies and programs and to advance objectives related to climate change mitigation and adaptation. The NCCC includes representation from the key government ministries, namely MESTI, NDPC, MOFA, NADMO, the Ministry of Finance and Economic Planning, the Ministry of Foreign Affairs, the Ministry of Energy, the Energy Commission, the Ministry of Health, the Forestry Commission, the Centre for Scientific and Industrial Research, the Environmental Application and Technology Centre, the Forestry Research Institute of Ghana, the Ghana Health Service, and Ghana Meteorological Services. In addition, several civil society organizations participate, including ABANTU for Development, Conservation International Ghana, and Friends of the Earth Ghana. Donors such as the Dutch Embassy and the UK DFID are also represented (MESTI, 2012b).

Key priorities for the NCCC include capacity development on climate change for actors at all levels, as well as oversight of projects and programs, including preparation of guidelines, approval of projects and making funding recommendations. Its mandate also includes monitoring and evaluation (M&E) of the NCCAS at the national level, as well as M&E of projects and programs. This will occur through a dedicated M&E unit within the committee, which had not been created when the strategy was launched. The monitoring system will include tracking of the implementation of the strategy in terms of time and cost schedules and budget allocations, as well as progress of projects and programmes against agreed targets (both qualitative and quantitative). External evaluations will be conducted periodically to assess the impact of the strategy. Indicators, baselines and targets are still to be established (MESTI, 2012a).

The National Platform for Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) is led by NADMO. It was established in the context of the Hyogo Framework for Action under the leadership of the United Nations Office for Disaster Risk Reduction (UNISDR). The platform operates at the national level, with the objectives of increasing understanding of disaster management concepts, improving coordination and cooperation among different actors working on DRR and CCA, and creating a sense of mutual responsibility and accountability among stakeholders (NADMO, n.d.). Although there is an intention to use this platform to coordinate CCA and DRR efforts, to date its focus has been primarily on DRR (R. Gyang, personal communication, January 26, 2015).

3.4 National-level sectoral policies

A number of sectoral policies also support achievement of the goals set out in Ghana's Vision 2020 document and guide its CCA efforts. The National Water Policy, developed in 2007, recognizes climate variability and change as a focus area for strategic action. The policy objectives in this focus area are to minimize the effects of climate variability and change and to institute measures to mitigate the effects of, and prevent damage caused by, extreme hydrological events, notably droughts and floods. Actions identified include constructing flood-protection structures; creating early-warning systems for droughts and floods, establishing buffer zones along river banks, strengthening and enforcement of land-use planning regulations for waterways and flood zones, constructing water conservation structures, promoting rainwater harvesting, and implementing risk-mitigation strategies at the community level (Ministry of Water Resources, Works and Housing, 2007).

Ghana's Food and Agriculture Sector Development Policy is in its second phase, which began in 2007. The policy presents a vision of "a modernized agriculture culminating in a structurally transformed economy and evident in food security, employment opportunities and reduced poverty" (MOFA, 2007). To achieve this, the strategic objectives for the food and agriculture sector are food security and emergency preparedness, improved growth in incomes, increased competitiveness and enhanced integration into domestic and international markets, sustainable management of land and the environment, application of science and technology in food and agriculture development, and improved institutional coordination. Surprisingly, given the vulnerability of the agricultural sector and that this policy was developed during the same period as the water policy, climate change is nearly invisible in the document. It is mentioned briefly as a barrier to making progress on food security (particularly in the three northern regions), and again under the objective relating to sustainable environmental and land management. However, there are no specific objectives or actions identified to address climate risks to agricultural production and food security (MOFA, 2007).

In terms of other policies for sectors identified as climate-vulnerable, climate change is recognized as an issue in the 2009 energy policy; however, this policy is focused not on managing climate risks but on promoting renewable energy for climate change mitigation (Ministry of Energy, 2009). Climate change is not mentioned in the National Health Policy, developed in 2007 (Ministry of Health, 2007), or the Fisheries Act, developed in 2002 (MOFA, 2002). Table 7 provides an overview of the extent to which climate change is integrated into sectoral policies.

Table 7 – Integration of climate change into national sectoral strategies, policies, and plans: An assessment of progress				
Policies	**Absent**	**Climate change mentioned as potential risk**	**Possible actions for reducing risk identified**	**Targets identified for specific adaptation measures**
Water Policy (2007)		✓	✓	
Food and Agriculture Sector Development Policy (2007)		✓		
Energy Policy (2009)		✓		
Health Policy (2007)	✓			
Fisheries Act (2002)	✓			

3.5 Sub-national policies

At the sub-national level, municipalities and districts are the main bodies responsible for development planning and implementation. Government-led adaptation initiatives, within the framework of the NCCAS, will be implemented primarily by actors at the local level, led by the metropolitan, municipal and district assemblies (MMDAs) through their environmental committees. Planning at this level is guided by the NDPC guidelines for medium-term development planning at the district and municipal level. In 2014, these guidelines were updated to explicitly address climate change issues, among other cross-cutting themes (Adaptation Learning Program [ALP], 2014a; CCAFS, 2014). The MMDAs are expected to collaborate with the decentralized representatives of different sectoral ministries, as well as NGOs, community-based organizations, traditional authorities, and the private sector to develop plans that link CCA and disaster risk management, incorporating actions identified in community-level adaptation plans. To support local government representatives in integrating adaptation into their plans, the government provided training to officials from all districts as well as 10 regional coordinating councils (ALP, 2014a).

To support implementation of the plans, the Ministry of Finance has established a Local Climate Adaptive Living Facility, which will support climate change adaptation activities on a pilot basis in one municipality and two districts during the implementation period from 2014 to 2016 (CCAFS, 2014). The district-level plans will be monitored and evaluated by the Regional Coordination Council, which includes representatives from the region and its districts, as well as chiefs and the decentralized ministries (MESTI, 2012a). While the ongoing decentralization process in Ghana creates opportunities for more locally driven adaptation planning, MMDAs face significant capacity and resource challenges that will present a barrier to the effectiveness of this process (CCAFS, 2014).

4. Current and planned adaptation programs and projects

This section provides a snapshot of the adaptation projects and programs underway in Ghana, including an overview of ongoing projects and a brief analysis of the climate finance flowing into the country.

4.1 Adaptation projects and programs

We conducted a review of adaptation programs and projects in Ghana using online resources. We captured projects with a specific focus on supporting CCA, as reflected in their title or objectives, in a database and classified them by their type and area of focus. For details on the methodology used for this component of the review, please see Annex A. The review process yielded 12 significant initiatives that are currently being implemented, as well as a number that have recently been completed (several of which have evolved into new phases that are now ongoing). Table 8 presents an overview of these ongoing projects. More details on the projects can be found in Annex B.

Table 8 – Sector of focus of current adaptation projects and programs identified in Ghana

Sector of focus	Priority sectors for adaptation	Number of projects active in sector*	Percentage of total projects identified**	Geographical Scale	
Agriculture	✓	7	58%	National projects	6
Watershed management	✓	1	8%	Regional projects	3
Disaster risk management		2	16%	Global projects	3
Migration		1	8%	**Total**	**12**
Multi-sectoral		1	8%		
Climate information		6	50%		
Government		4	32%		
Civil society		1	8%		
Private		1	8%		

*Individual projects may address one or more sectors.
**Calculated by the number of projects active in this sector relative to the total number of projects identified. Sums to more than 100%, reflecting the potential for a single project to address adaptation needs in more than one sector.

As shown in Table 8, most adaptation initiatives in Ghana focus on the agricultural sector, often combined with climate information activities to support informed and risk-oriented decision-making. Several of these are community-based adaptation (CBA) and/or field implementation projects led by international NGOs, such as CARE's Adaptation Learning Program (ALP), the Canadian Hunger Foundation's Resilient and Sustainable Livelihoods Transformation in Northern Ghana, and the Climate Change Adaptation in Northern Ghana Enhanced project conducted by Canadian Feed the Children (CFTC) and Farm Radio International, all implemented in partnership with local NGOs.

These projects focus on building the adaptive capacity of individual farmers, primarily in the north of the country, through a range of activities that support adoption of climate-resilient agricultural practices, strengthen access to climate information for decision-making (for example, using participatory scenario planning and community radio), and increase livelihood security and sustainability. In some cases, such as the ALP, they also aim to build the capacity of local government actors and support integration of climate change into local planning processes, creating an enabling environment for action by individual farmers and their communities. NGO-led projects tend to have an explicit gender dimension. They are funded largely by bilateral donors, notably the Canadian Department of Foreign Affairs, Trade and Development, the United Kingdom, and the Danish International Development Agency (DANIDA).

Building on these existing initiatives, CFTC, Farm Radio International, and CARE are in the process of developing a joint project that will focus on enhancing resilience and food security for children, women, and men in northern Ghana. The project will scale up successful approaches to strengthen use of weather information for decision-making in agriculture, promote climate-smart agricultural practices and enable adaptation planning by communities and at the district level, among other activities. Although in the early stages of development, the project has already generated donor interest (J. van Mossel, personal communication, January 27, 2015).

Ghana is one of the five target countries for the International Fund for Agricultural Development (IFAD)'s Adaptation for Smallholder Agriculture Programme (ASAP). In Ghana, ASAP funds will be used to integrate CCA and resilience-building in the Ghana Agricultural Sector Investment Programme (GASIP). Complementing the core GASIP objectives, ASAP-funded activities will focus on northern Ghana and aim to strengthen the capacity of relevant institutions to collect and manage climate data, and of smallholder farmers to understand and use climate information. It will also support implementation of technologies and practices for climate-resilient agriculture and increased availability and efficient use of water for smallholder agriculture. IFAD has another initiative in Ghana, the Promoting Value Chain Approach to Adaptation in Agriculture project, which is funded through the Special Climate Change Fund and implemented in partnership with the Roots and Tubers Improvement and Marketing program of MOFA. This project aims to reduce

climate-related risks along the cassava value chain through awareness-raising and implementation of adaptation measures.

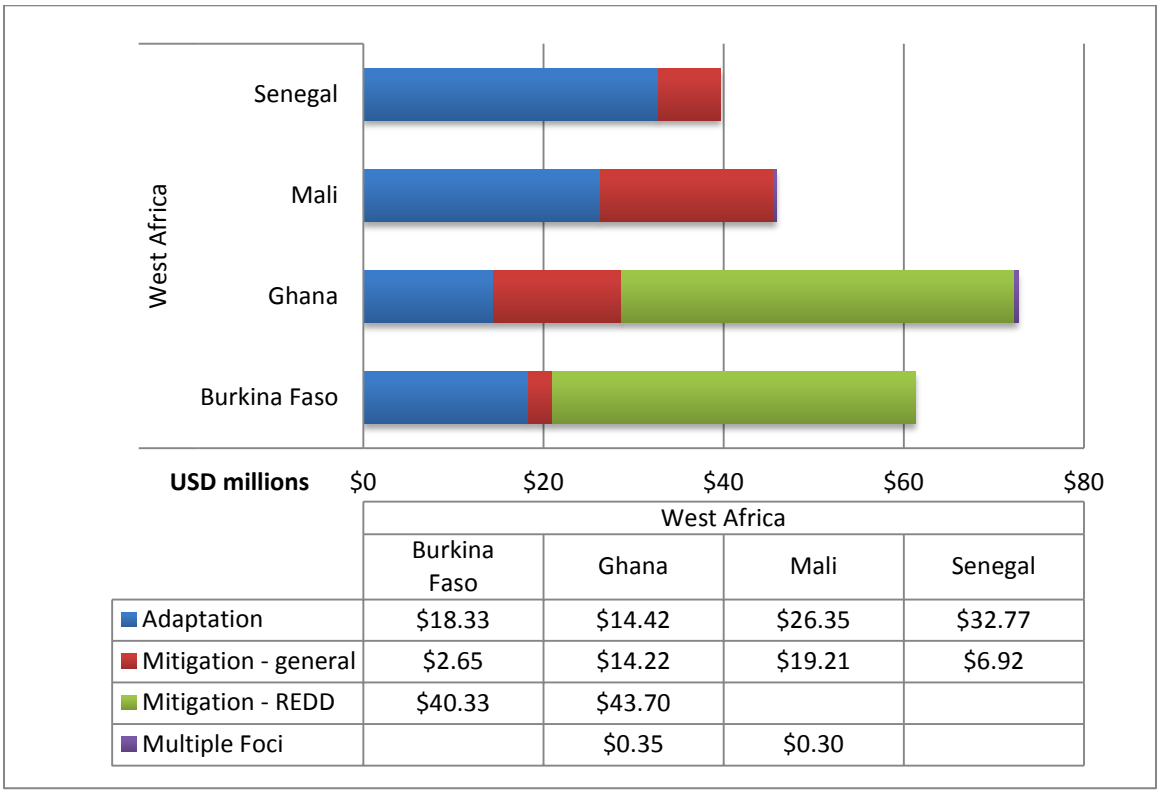
At the policy level, there are two key initiatives in the agricultural sector. UNDP's Resilient Landscapes for Sustainable Livelihoods project aims to address CCA and DRR to support longer-term food security. It will develop the capacity of national and local institutions to promote sustainable land management approaches that support adaptation and DRR, while also working with communities in northern Ghana to plan and implement adaptation measures. The German-funded Adaptation of Agro-Ecosystems to Climate Change project is implemented by MOFA, the Ghana Meteorological Agency, and the Savannah Agricultural Research Institute. It focuses on developing agricultural sector policy and national support measures for adaptation of land-use systems in the savannah and transitional regions. The project also includes elements of support for smallholder farmers and training for government and other service providers.

Despite the implications of climate change for water availability and management in Ghana, only one major adaptation initiative is currently being implemented in this sector. The Water Infrastructure Solutions from Ecosystem Services to Underpin Climate-Resilient Policies and Programmes (WISE-UP to Climate) project aims to improve water supply and increase resilience to climate change in the Volta River basin in Ghana and Burkina Faso. The project is implemented by the International Union for Conservation of Nature and the Volta Basin Authority, an intergovernmental body with a mandate to promote the implementation of integrated water resource management and equitable distribution of the benefits resulting from water use, among other objectives (Volta Basin Authority, 2011). Activities of the WISE-UP to Climate project include compilation of hydrological, environmental, and economic data to inform analysis of decision-making by relevant institutions and policymakers and organization of training events. We identified no projects in the fisheries and health sectors, which the government also identified as priorities.

Two of the projects being launched under the CARIAA program will have research activities in Ghana. The Adaptation at Scale in Semi-Arid Regions initiative aims to enable proactive, longer-term approaches to CCA in semi-arid regions in 14 countries across Africa and Asia, including Ghana. Activities will include transformative scenario planning with stakeholders to enable different decision-makers to develop robust adaptation strategies. The Deltas, Vulnerability and Climate Change: Migration and Adaptation project will work in Ghana's Volta delta to understand adaptation decision-making processes, with a focus on migration. In collaboration with stakeholders and key decision-makers, the project will integrate climate and socioeconomic data to assess when migration may be an appropriate adaptation option (CARIAA, n.d.). Finally, Ghana is one of 12 countries targeted by the Climate for Development in Africa (ClimDev) program, which aims to strengthen access to and utilization of climate information for decision-making.

4.2 Climate finance

According to the Climate Funds Update, as of February 2015 Ghana had received approval for over US$70 million in climate finance, representing 15 climate change projects, including initiatives focused on both adaptation and mitigation. Among these, approximately half address adaptation issues, representing about US$20 million of the total financing. The major multilateral sources financing Ghana's adaptation projects are the Special Climate Change Fund and IFAD through ASAP. Ghana is also receiving financing from bilateral funds, notably the United Kingdom's International Climate Fund and Germany's International Climate Initiative. This places Ghana in the third-to-last position in the top 20 Sub-Saharan African countries receiving climate funding for adaptation from multilateral sources, with least developed countries such as Niger receiving significantly more. When compared to other lower-middle-income countries in Sub-Saharan Africa, however, Ghana falls in the middle, in the sixth position out of 12 countries receiving multilateral adaptation funding. From bilateral sources included in the Climate Funds Update, Ghana is the biggest recipient of adaptation funds in Sub-Saharan Africa (Climate Funds Update, 2015). Figure 2 shows how the amount of funding in Ghana compares with other countries in West Africa.



	West Africa			
	Burkina Faso	Ghana	Mali	Senegal
Adaptation	$18.33	$14.42	$26.35	$32.77
Mitigation - general	$2.65	$14.22	$19.21	$6.92
Mitigation - REDD	$40.33	$43.70		
Multiple Foci		$0.35	$0.30	

Figure 2 – Comparison of approved funding from designated climate funds to countries in West Africa since 2003 (based on Climate Funds Update, 2015)

According to the Organisation for Economic Co-operation and Development (OECD)'s Rio Markers system, Ghana received over US$465 million in "climate-related" bilateral aid between 2010 and 2013. Of this total amount, approximately US$106 million, or 23%, is tagged for adaptation, with the rest focusing on mitigation or on both adaptation and mitigation. However, as shown in Figure 3, the proportion of this funding that has adaptation as its principal objective has varied from over 75% in 2010 to just over 5% in 2013. Approximately one-half of the adaptation-focused funds target the agriculture sector, with general environmental protection, water supply, and sanitation also representing significant investment. Activities tagged as having adaptation as a significant objective include budget support for the health sector, market development assistance, water supply projects for schools, and a project supporting local development and sustainable management of Mole National Park. While these efforts may indeed contribute to adaptation, they do not seem to have an explicit focus on addressing climate change impacts, and therefore the numbers should be treated as indicative only.

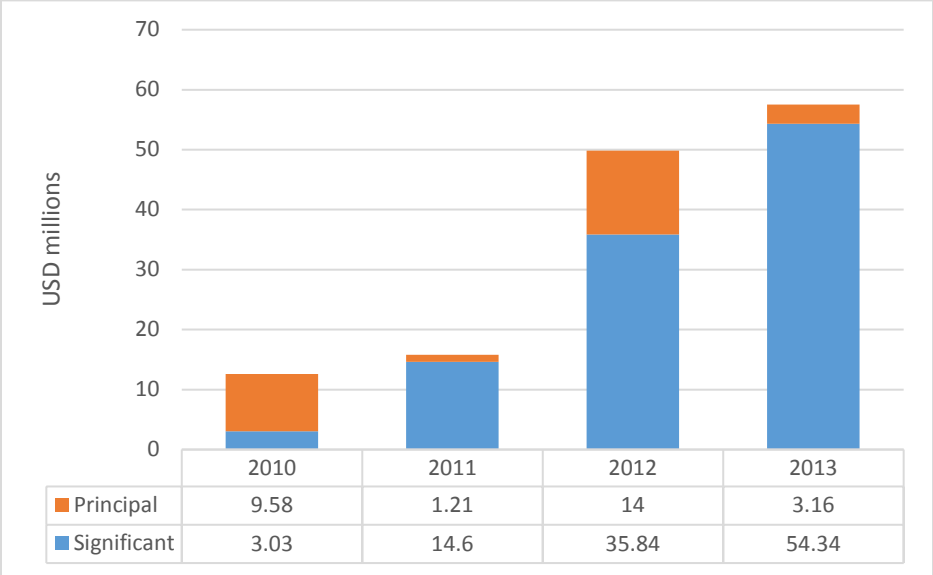


Figure 3 – Bilateral development aid in Ghana identified as having adaptation support as its principal or significant objective,[3] 2010 to 2013, constant 2012 prices (based on OECD, 2015)

Ghana was a case study country for the second Africa adaptation gap report (Schaeffer et al., 2015), which aimed to assess the gap between current funding for adaptation and what is needed for the continent to respond to climate change impacts. The analysis found that Ghana is contributing some of its own resources to support adaptation efforts,

[3] Based on the definitions used by the OECD Rio Markers system, activities are considered to have supporting adaptation as their "principal" objective "when promoting the objectives of the UNFCCC is stated in the activity documentation to be one of the principal reasons for undertaking the activity. In other words, the activity would not have been funded but for that objective. Activities marked 'significant' have other prime objectives, but have been formulated or adjusted to help meet climate concerns" (OECD, 2011, p. 3).

complementing international sources of funding. However, even if new mechanisms are put in place to increase public financing for adaptation, the funding will not be sufficient to meet the costs of adaptation through 2030. Consequently, international sources of financing will continue to be important, as will private sector investment in CCA efforts.

5. Networks and communities of practice

While Ghana is comparatively less vulnerable to climate change than some of its neighbours in West Africa, the northern part of the country, in particular, faces considerable challenges from a changing climate. Rural communities in the north, and elsewhere in the country, are highly dependent on climate-sensitive sectors such as agriculture and fisheries. These sectors contribute significantly to Ghana's GDP, making the country at large vulnerable to the effects of increasing temperatures, rising sea levels, and increasing rainfall variability. CCA must therefore be a priority for Ghana if it is to maintain its middle-income status, reduce poverty, and increase equity in benefits from economic growth.

Ghana's policy suite provides some clear directions for adaptation action. The GSGDA II, the main document guiding development planning in the country, recognizes the threat posed by climate change to sustainable development and prosperity, placing CCA efforts in the framework of sustainable natural resource management and disaster risk management. The NCCP supports this, identifying adaptation priorities in the areas of agriculture and food security, disaster preparedness and response and natural resource management. It is unclear how much weight the NCCAS holds in terms of guiding decision-making and allocation of resources, however it provides a good basis for the development of Ghana's NAP.

Across these key documents, several common priorities emerge. Making Ghana's agricultural sector more climate resilient is critical for the achievement of both food security and economic growth objectives. Decision-makers in this sector, from individual farmers to private sector actors to national-level policy-makers, require increased information, knowledge, and analytical capacity for this transformation to occur. A significant amount of work is ongoing in this area, from the farm to the policy level, by a range of different actors. More effort is needed to link these actors together to enable knowledge sharing and innovation, in line with the commitment to horizontal and vertical integration as stated in the NCCP.

Management of Ghana's freshwater resources is a growing challenge in the context of a changing climate. Despite the emphasis on the water sector in the NCCP and NCCAS, at present only a single project is explicitly addressing this issue (although many of the projects in the agricultural sector incorporate actions related to water for agriculture). The NCCAS also highlights the vulnerability of the fisheries, energy, and health sectors; however, there does not seem to be much action underway to enable adaptation in these important sectors. These issues will require increasing attention in the coming years.

The policy documents recognize the particular vulnerability of the northern regions, and of specific groups including poor women and men. Social equity is an important theme in both the NCCP and the NCCAS; however, it is unclear as yet how the Government of Ghana will translate these commitments into concrete actions that will ensure that adaptation efforts are inclusive and gender-equitable. NGOs are stepping in to fill this gap through a range of CBA projects that aim to increase food security and build the adaptive capacity of the poorest people. Current efforts to capture evidence emerging from these efforts and share it with policy-makers must be continued to ensure that government-led action on adaptation addresses the needs of the most vulnerable women and men.

Ghana's policy-making and action on climate change is informed by a few significant pieces of research done between 2000 and 2010. This includes a series of vulnerability assessments of different sectors completed through the Netherlands Climate Assistance Programme and a country case study completed through the World Bank–funded Economics of Adaptation to Climate Change project. These studies provided decision-makers in Ghana with a solid base of information for identifying adaptation priorities. At present, however, there is little adaptation-related research being undertaken to build on these efforts and develop a more comprehensive and nuanced evidence base on CCA in Ghana. The CARIAA research projects that are currently being launched will help fill this gap.

Related to this is the issue of M&E of adaptation efforts. A considerable number of adaptation initiatives are ongoing or recently completed; however, limited documentation is available to assess the impact of these projects on risk management and adaptive capacity. To support the Government of Ghana and its partners in effective implementation, monitoring, and evaluation of the NCCAS (and the NAP when it is developed), learning from these initiatives must inform the design of projects, programs and M&E systems. Strengthening and building sustainability of networks such as the Ghana Climate Adaptation Network would enable better collaboration and knowledge sharing among civil society actors, providing a basis for increased dialogue and coordination with government actors at different levels. Capacity development and resource allocation for subnational actors will be essential to support this process.

6. Conclusions

Ethiopia is faced with many social and environmental challenges that exacerbate its vulnerability to climate change. These issues jeopardize not only the achievement of its goal of becoming a middle-income country by 2020 to 2023, but also, and most importantly, the well-being of its population. Communities dependent on crop production and pastoralism for their livelihoods are particularly vulnerable. Pastoralists rely on climate-sensitive resources such as pasture and water, while farmers are strongly affected by climate risks, including direct impacts such as crop losses caused by drought, as well as indirect impacts such as soil erosion. Despite these challenges, Ethiopia has put most of its efforts toward

mitigation and economic development priorities under its new climate resilient and green economy pathway, with a particular focus on accessing carbon finance.

Under its current low-carbon, climate resilient development pathway, Ethiopia has created various governance structures and policies to support the implementation of the GTP and CRGE Strategy. By linking its national development plan with climate and green initiatives, the Ethiopian government seeks to decrease vulnerability to climate change and move its economy onto a greener pathway. The CRGE Strategy mandates that adaptation to climate change be mainstreamed into sectoral and subnational policies. The EPA spearheads the implementation of the CRGE Strategy and provides technical assistance to regional governments and sectoral ministries on climate change planning and action and support for adaptation mainstreaming. To finance both actions and capacity building, the government has set up the CRGE Facility. Despite its recognition of the need to increase climate resilience in Ethiopia, measures and efforts tend to be focused on mitigation and disaster risk reduction, and mainstreaming of adaptation appears to be lacking. To implement both adaptation and mitigation measures, the government faces gaps in institutional capacity, monitoring and implementation, and reporting and verification of the measures implemented. National networks are lacking to facilitate the exchange of information between governmental and non-governmental actors. In addition, implementation of most of the climate-related objectives and priorities are tied to international funding, which creates uncertainty for the longer term.

The internationally funded adaptation projects and programs underway in the country have the potential to assist Ethiopia in addressing its institutional and capacity gaps, and to increase adaptive capacity in critical sectors such as water, agriculture, and pastoralism. Not surprisingly, most of the initiatives are focused in the agricultural sector, given its importance to the economy and its high vulnerability to climate change. However, a few of the projects identified focus on the water and energy sectors, which also are priority areas for adaptation. Improving climate resilience in the health sector is also among its priorities; however, there are few initiatives addressing this concern. Disaster risk management is tied closely to projects in the agricultural sector, along with capacity development for government and civil society.

The need to strengthen climate resilience is recognized in Ethiopia's current and emerging national development strategies, and the country is making strides toward increasing the adaptive capacity of its citizens and communities through improvements in its health and agricultural sectors. However, continued efforts are needed to address the underlying factors of multi-dimensional poverty, population growth, gender inequality, and resource degradation that leave many Ethiopians vulnerable to the impacts of climate change. Positive indications that these challenges will be addressed are the government's demonstrated political will to respond to climate change as part of a broader green growth strategy, progress to date in establishing a policy framework for climate action at the

national and subnational levels, and the country's capacity to attract international financial support.

7. Annexes

Annex A: Methodology

This section presents the research parameters established to guide development of the standardized reviews of current adaptation action in the CARIAA program's countries of engagement. It sets forward definitions used in this study, particularly with respect to the identification, selection, and classification of programs and projects considered in the review. This methodology was previously developed by the International Institute for Sustainable Development to support a review of current and planned adaptation action in 12 regions, which was completed in 2011 for the Adaptation Partnership. Modest updates to this original methodology were made to support the current review undertaken for the CARIAA program. For more information, see Adaptation Partnership (2015).

A.1 Adaptation actions included in the review

Within the review, adaptation action was defined as "policies, programs, and projects designed and implemented specifically to address the current and projected impacts of climate change." Therefore, the review focused on examining policies, programs, and projects in which specific reference has been made to supporting adaptation to climate change or climate risk reduction.

Consistent with this definition, the review gave attention to discrete, time-bounded programs and projects designed and implemented specifically to support preparation for or implementation of practical adaptation actions within the broader context of achieving development objectives. Therefore, at least one of the following terms appeared in the title, goals statement, or objectives statement of each program or project included in the review: "adaptation," "climate change adaptation (CCA)," "climate risk management," or "climate vulnerability reduction."

Based upon these parameters, the following types of programs and projects were not included in the review: disaster risk reduction, prevention, or management projects, unless they specifically reference that this activity is being undertaken in support of CCA; primary scientific research studies (for example agrology, botany, or meteorology) on the potential impacts of climate change (for example on changes in crop production, glacial melt rates, or typhoon patterns); long-term monitoring efforts (whether climatic or socioeconomic) needed to inform decision-making; stand-alone workshops, conferences, and training programs; and capacity building to support participation in processes related to the UNFCCC (such as training for negotiators, enabling activities to prepare reports).

The following additional parameters were established to guide the selection of programs and projects incorporated in the study:

- *Official start date.* To ensure that only "current" projects were included in review, selected projects needed to have begun on or after January 1, 2012, with the

exception of projects that began before this date but were still ongoing as of January 1, 2015.

- *Official end date*. Ongoing projects are those who official completion day is on or after January 1, 2015. Projects completed after January 1, 2012, were classified as completed.
- *Funding characteristics*. Projects with a value of US$100,000 or more were included in the study. However, reflecting the greater level of adaptation action underway in Bangladesh and India, the minimum value of projects included in the reviews for these two countries was raised to US$250,000. Projects financed by international and domestic sources of funding were considered.

Additionally, identified projects were classified by geographical scale in accordance with the following definitions:

- Global: Projects involving countries throughout the world, including the profiled country.
- Regional: Multi-country projects within a particular subregion, be it a continent or subcontinental area (such as South Asia or West Africa), that includes the profiled country.
- National: Projects occurring within one country.

A.2 Type of project being undertaken

To better understand the orientation of the projects underway in the countries examined as part of the review, projects were classified by type using the following definitions:

- *Research*. Encompassing efforts to develop new knowledge or organize existing information so as to increase understanding of the links among climate change, human society, and ecosystems and inform adaptation decision-making.
- *Assessment*. Encompassing risk, impact, and vulnerability assessments, as well as monitoring of ecological and societal trends.
- *Capacity building*. Encompassing the provision of technical training, technical assistance, institutional strengthening, and education.
- *Knowledge communication*. Encompassing efforts to share information, knowledge, and practices related to CCA, including awareness raising and engagement of media.
- *Policy formation and integration*. Encompassing efforts to inform, develop, and implement CCA plans, strategies, frameworks, and policies at the local, subnational, national, and international levels.
- *Field implementation*. Encompassing physical measures to reduce vulnerability to the impacts of climate change, including the implementation of pilot projects, construction of infrastructure, development and modification of technologies, and management of physical resources.

- *Community-based adaptation*. Encompassing actions that directly engage community members in efforts to understand, plan for, and respond to the impacts of climate change.

A.3 Sector or area of focus

To further inform analysis of the range of adaptation action taking place in each country reviewed, programs and projects examined in the study were classified by sector using the following definitions:

1. **Food, fibre, and forests**. Defined as the management and use of terrestrial natural resources to directly improve human well-being. Its subcategories are:
   - *Agriculture*. Encompassing subsistence agriculture, commercial agriculture, and the rearing of confined domestic animals.
   - *Pastoralism*. Encompassing the use of domestic animals as a primary means for obtaining resources from habitats (UNEP, 2007), particularly in nomadic and semi-nomadic communities.
   - *Forestry*. Encompassing afforestation, reforestation, agroforestry, commercial forestry, community-based forest management, and woodland management.
   - *Fire management*. Encompassing monitoring, planning, and management to address the impact of fires on settlements and ecosystems, including forested and grassland ecosystems.
   - *Aquaculture.* Food production through the rearing of aquatic animals, such as fish, crustaceans, and molluscs, or the cultivation of aquatic plants in natural or controlled marine or freshwater environments.

2. **Ecosystems**. Defined as a system of living organisms interacting together and with their physical environment, the boundaries of which may range from very small spatial scales to, ultimately, the entire Earth (IPCC, 2001). Its subcategories are:
   - *Biodiversity protection*. Encompassing activities related to the maintenance of living organisms at various spatial scales, including the establishment and protection of parks and bioreserves.
   - *Ecosystem conservation*. Encompassing efforts to *maintain* the health of particular ecosystems, such as wetlands, grasslands, forests, mangroves, and coral reefs.
   - *Ecosystem restoration*. Encompassing efforts to *restore* the health of particular ecosystems, such as wetlands, grasslands, forests, mangroves, and coral reefs.

3. **Freshwater resources**. Defined as the management and use of freshwater contained in terrestrial ponds, lakes, rivers, and watersheds, among others. Its subcategories are:
   - *Freshwater fisheries*. Encompassing the catching, packing, and selling of fish and shellfish derived from lakes, rivers, and ponds, as well as through freshwater aquaculture.

- *Watershed management*. Encompassing management of the basins that supply water to different streams, rivers, lakes, and reservoirs, including integrated watershed management.
- *Freshwater supply*. Encompassing efforts to access and preserve freshwater for human consumption and use, including drinking water sources, groundwater resources, rainwater harvesting, and water infrastructure such as wells, dams, and dikes.

4. **Oceans and coastal areas**. Defined as the management and use of coastal areas and oceans. Its subcategories are:
   - *Coastal zone management*. Encompassing the management of land and water resources in coastal areas, including through integrated coastal zone management and the establishment and maintenance of coastal infrastructure.
   - *Marine management*. Encompassing the management and use of offshore ocean and sea resources.
   - *Marine fisheries*. Encompassing the catching, packing, and selling of fish, shellfish, and other aquatic resources found in the oceans and seas, including through marine and coastal aquaculture.

5. **Disaster risk management**. Defined by the United Nations International Strategy for Disaster Reduction (2009) as the "systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster" (p. 10). It includes emergency response measures, preparation for extreme events and early warning systems. No sub-categories were established in relation to this macro project category.

6. **Migration and security**. Defined as efforts to support the movement of people and maintain their personal security in the face of incremental climate changes or climate shocks.
   - *Migration*. Encompassing preparations for and responses to the potential movement of people from one location to another due to climate change impacts.
   - *Security*. Relating to personal security and freedom from violence, crime, and war due to natural and human-induced disasters (UNEP, 2007) and encompassing peace building, conflict reduction, and conflict avoidance.

7. **Gender**. Defined as the social attributes and opportunities associated with being male and female and the relationships between women and men, and girls and boys, as well as the relations among women and among men. These attributes, opportunities, and relationships are socially constructed and are learned through socialization processes (United Nations Entity for Gender Equality and the Empowerment of Women, n.d.). This category includes efforts to understand the vulnerability of women to the impacts of climate change, gender-sensitive adaptation strategies, and measures to improve the

situation of women at the local and policy level, including through gender mainstreaming. No subcategories were established in relation to this macro project category.

8. **Business**. Defined as the purchase and sale of goods and services with the objective of earning a profit. Its subcategories are:
   - *Tourism*. Encompassing the adjustment and development of tourist facilities and operations to account for current and future vulnerabilities, including these actions in relation to ecotourism.
   - *Private sector*. Encompassing potential impacts of climate change and potential adaptation strategies on the diverse activities underway in the portion of the economy in which goods and services are produced by individuals and companies including industry, mining, and other economic sectors.
   - *Trade*. Encompassing the exchange of goods and services within and between countries.
   - *Insurance*. Encompassing the development, testing, and adjusting of insurance and risk-management schemes, including weather-based index systems.

9. **Infrastructure**. Defined as the basic equipment, utilities, productive enterprises, installations, institutions, and services essential for the development, operation and growth of an organization, city or nation (IPCC, 2001). Its sub-categories are:
   - *Energy*. Encompassing energy-related systems and infrastructure, including small-scale and large-scale energy generation through hydroelectric power generation, wind, solar, and other forms of traditional and new energy sources, as well as transmission networks.
   - *Transportation*. Encompassing the components of the system required to move people and goods, including roads, bridges, railway lines, shipping corridors, and ports.
   - *Waste management*. Encompassing sanitation, sewage systems, drainage systems, and landfills.
   - *Buildings*. Encompassing actions related to built structures such as houses, schools, and offices, including changes to building codes, building practices, and green ways of construction.

10. **Human settlements**. Defined as a place or area occupied by settlers (IPCC, 2001). Its subcategories are:
    - *Peri-urban areas*. Encompassing the outskirts of urban centres and the transition zones between rural and urban areas.
    - *Urban areas*. Encompassing municipalities, towns, and cities, as well as areas in these centres (such as slums).
    - *Rural areas*. Encompassing villages and other small settlements, as well as rural landscapes and integrated rural development.

11. **Human health**. Defined as a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity (WHO, n.d.). It includes efforts to assess vulnerabilities to and the impacts of climate change on human health directly and indirectly, and the development and implementation of appropriate adaptation strategies at the local, regional, and national levels. No subcategories were established in relation to this macro project category.

12. **Climate information services**. Defined as the production and delivery of authoritative, timely, and usable information about climate change, climate variability, climate trends, and impacts to different users at the local, subnational, national, regional, and global levels. It includes efforts to develop, adjust, and provide short- and long-term climate forecasts, including climate change projections, to different audiences. No subcategories were established in relation to this macro project category.

13. **Governance**. Defined as the institutions (laws, property rights systems, and forms of social organization) through which societies define and exercise control over resources (UNEP, 2007). Its subcategories are:
    - *Government*. Encompassing efforts to build the capacity of government officials, either at the national or subnational level, to prepare for and facilitate adaptation to climate change, including through the development of policies, plans, frameworks, and strategies, as well as the establishment and operation of climate change trust funds.
    - *Civil society*. Encompassing efforts to build the capacity of the public, including NGOs, to understand, prepare for, and respond to climate change.

14. **Social protection**. Based on DFID's definition of social protection, projects within this category focus on three sets of instruments to address chronic poverty and vulnerability:
    - *Social insurance*. Referring to "the pooling of contributions by individuals in state or private organizations so that, if they suffer a shock or change in circumstances, they receive financial support."
    - *Social assistance*. Encompasses "non-contributory transfers that are given to those deemed vulnerable by society on the basis of their vulnerability or poverty."
    - *Workplace safety*. Involves the "setting and enforcing of minimum standards to protect citizens within the workplace" (DFID, 2006, p. 1).

    Adaptation projects that focus on labour market interventions and social assistance would be included in this category. No subcategories were established in relation to this macro project category.

15. **Multisectoral**. Defined as actions that simultaneously address more than one sector in one or multiple locations. It includes efforts that address more than one sector, which are challenging to tease apart, and in the context of this review includes large, multi-

country projects in which the specific sector of focus is nationally determined and, therefore, varies from country to country. No subcategories were established in relation to this macro project category.

16. **Other**. To capture areas of focus not clearly identified in the previous categories.

Annex B: Projects and programs

Projects working to address vulnerability to the impacts of climate change in Ghana are presented alphabetically in the table below.

Name of project	Objectives	Funder(s) and budget (if available)	Implementing agencies	Type of project	Sectors	Duration	Scale and location(s)
Adaptation at Scale in Semi-Arid Regions	This project will enable proactive, longer-term approaches to climate change adaptation in semi-arid regions, while supporting the management of current risks. It draws on a number of disciplines to address the complex interactions among climate, biophysical, social, political, and economic dynamics. Research on each of these aspects will be integrated through transformative scenario planning, involving stakeholders throughout. The project will generate credible information that decision-makers and others can use to develop robust adaptation strategies.	UK Department for International Development; International Development Research Centre through CARIAA	University of East Anglia; International START Secretariat; Oxfam; Indian Institute for Human Settlements; University of Cape Town, South Africa	Research; capacity building; knowledge communication	Climate information; multisectoral	2014–2019	Global India, Ethiopia, Kenya, Uganda, Burkina Faso, Ghana, Mali, Botswana, Namibia, South Africa, Niger
Adaptation Learning Program for Africa (ALP)	ALP's goal is to increase the capacity of vulnerable households in Sub-Saharan Africa to adapt to climate variability and change. The program purpose is CBA approaches for vulnerable communities incorporated into development policies and programs in Ghana, Kenya,	UK Government (UK Aid); Danish International Development Agency; Government of Finland; Austrian Development Authority	CARE International, with local partners in all four countries	Capacity building; CBA	Agriculture; pastoralism; gender; climate information	2010–2015	Regional Ghana, Kenya, Mozambique, Niger

	Mozambique, and Niger, with plans in place to replicate across Africa. To achieve this, the program works in five key areas: developing and supporting implementation of innovative approaches to CBA by communities and local partners; strengthening local voices in decision-making on adaptation; demonstrating good practice models for CBA and using them to make recommendations for improvements in policies and practices of government and other development organizations; promoting CBA approaches to influence the policies and plans of governments and regional and international organizations; and contributing to the global knowledge base on CBA.						
Adaptation of Agro-Ecosystems to Climate Change in Ghana	In the savannah and transitional region of Ghana, pilot measures help to define agricultural sector policy and national support measures for the adaptation of land use systems to climate change. The project operates at several levels. In cooperation with small farmers, tried-and-tested measures designed to facilitate adaptation to climate change are implemented and promising innovations tested. Training measures on adaptation to climate change are developed and implemented for government	German Federal Ministry for Economic Cooperation and Development (BMZ)	Ghana Ministry for Food and Agriculture; Savannah Agricultural Research Institute; Ghana Meteorological Agency	Capacity building; policy formation and integration; CBA	Agriculture; climate information; government	2012–2017	National Ghana

	consultants, private service providers, non-governmental organizations, and other institutions. At the policy advice level, the project supports the Ministry for Food and Agriculture in developing strategy.						
Climate Change Adaptation in Northern Ghana Enhanced	This project worked with women and men who were small-scale farmers in 17 communities to improve their adaptive capacity and resilience to the impacts of climate change on agriculture, food security, and livelihoods. While the goal was to engage 84,000 farmers, the project reached several hundred thousand in northern Ghana. The project provided farmers with quality and accessible, locally relevant information about climate, weather, and innovative agricultural practices. It also strengthened community- and radio-based agricultural extension services. Survey results indicate that half of all listeners made informed changes to their agricultural practices based on the radio programming. Women were also supported to develop and scale up non-agricultural, income-generating activities to help reduce poverty and decrease their dependency on male-dominated farming income.	Government of Canada Department of Foreign Affairs, Trade and Development	Farm Radio International, Canadian Feed the Children, TradeAID Integrated, Regional Advisory Information & Network Systems, Tumu Deanery Rural Integrated Development Program	CBA	Agriculture; climate information	2013–2016	National Ghana

Climate for Development in Africa (ClimDev) Programme	To increase the climate resilience of Africa's population, addressing the need for improved climate information in Africa and strengthening the use of such information for decision-making.	Global Climate Change Alliance (EU) and the governments of Norway, Sweden, and the United Kingdom (DFID) € 8 million	African Climate Policy Centre	Research; capacity building; knowledge communication	Climate information	2012–2015	Regional Ethiopia, Kenya, Tanzania, Uganda, Burkina Faso, Ghana, Mali, Senegal, Botswana, Namibia, South Africa, Egypt
Deltas, Vulnerability and Climate Change: Migration and Adaptation	This project aims to understand adaptation choices in delta regions with a strong focus on the role of migration as an adaptation strategy, including temporary, periodic, or permanent migration. Working with stakeholders and key decision makers, and taking gender into account, the project will integrate climate and socioeconomic data for each delta to assess when migration might be appropriate for the most vulnerable, compared with other adaptation options.	UK Department for International Development and the International Development Research Centre through CARIAA	University of Southampton; Bangladesh: Institute of Water and Flood Management; Bangladesh University of Technology and Engineering; India: Jadavpur University; Egypt: National Authority for Remote Sensing and Space Sciences; Ghana: University of Ghana	Research; capacity building; knowledge communication	Migration	2014–2018	Global Bangladesh, India, Ghana, Egypt

Ghana Agricultural Sector Investment Programme (GASIP)	The program will increase the climate resilience of 67,000 smallholders, with a special emphasis on women (50 per cent) and young people. Funding from IFAD's ASAP will support GASIP to mainstream the climate change adaptation and resilience of smallholder farms into the business models and value chain interventions of the wider program. ASAP investments will focus on increasing the availability and efficient use of water in smallholder crop and livestock systems to counter growing water stress; mainstreaming proven technologies, such as conservation agriculture, irrigation, and integrated soil fertility management, on a commercial basis; collecting and managing climate data through building the capacity of relevant institutions; deepening smallholder understanding of climatic trends through all training opportunities offered by GASIP, thereby increasing sensitization and outreach; and promoting climate-resilient cropping in the two areas that GASIP will directly support.	IFAD; adaptation component funded through ASAP Adaptation component US$10 million	Ministry of Food and Agriculture	Capacity building; field implementation	Agriculture; climate information; government	2015–2020	National Ghana
Promoting Value Chain Approach to Adaptation in Agriculture	The overall objective of the project is to reduce the vulnerability of the food supply system to the deleterious impacts of climate change. The specific objective is to	GEF through the Special Climate Change Fund	IFAD; Ministry of Food and Agriculture Roots and Tubers	Field implementation	Agriculture; private sector	2012–2015	National Ghana

	reduce climate-induced risks in the cassava value chain to the achievement of food security and income generation for pilot rural communities in Ghana. There are three project components: raising awareness of climate change and building capacity to address its impacts along the cassava value chain and other complementary food production; supporting adaptation of cassava production to climate change; promoting innovative adaptation solutions along the agricultural value chain.		Improvement and Marketing Programme				
Resilient and Sustainable Livelihoods Transformation in Northern Ghana	The project addresses the constraints that prevent smallholder farmers in Northern Ghana from producing sufficient food to feed themselves and generate revenue and from becoming resilient to unexpected events such as droughts. It offers transformative and sustainable solutions that address the root causes behind the lack of access to sufficient, nutritious food and the vulnerability to food shortages in the northern regions, while also promoting community and household resilience to external shocks and stresses. Expected activities include practical training for 21,000 smallholder farmers and service providers in sustainable cropping practices, livestock production, aquaculture, and	Government of Canada Department of Foreign Affairs, Trade and Development CAD$19 million	Canadian Hunger Foundation	Field implementation	Agriculture; disaster risk management; gender	2012–2018	National Ghana

	water management; provision of tools and services, including technical assistance in climate change adaptation and disaster risk management practices, to 150 communities to improve productivity; strengthening and promoting gender-responsive systems of agricultural extension and support; training for 21,000 women and men in income-generating activities; and strengthening access for 21,000 smallholder famers to high-value markets in selected agricultural and non-agricultural subsectors.						
Resilient Landscapes for Sustainable Livelihoods	The program addresses CCA and DRR with a focus on long-term food security. The goal is to develop the capacity of national and local institutions and strengthen the resilience of districts and communities in northern Ghana to climate change and disaster risks though development and implementation of sustainable land management approaches. The program is expected to result in a total of 16 climate-resilient communities across six districts in the three northern regions of Ghana, with CCA and DRR mainstreamed into district and sector plans, community CCA/DRR action plans developed, and implementation of adaptation measures commenced.	UNDP US$3.36 million	MOFA, NADMO, Savannah Accelerated Development Authority, MEST, NDPC, FAO, United Nations University Institute for Natural Resources in Africa, World Food Programme	Capacity building; Policy formation and integration; field implementation	Agriculture; Disaster risk management; government	2012-2015	National Ghana

	It will also provide a package of materials that can be used to strengthen the resilience of agriculture in other districts and communities.						
Southern Voices on Adaptation		DANIDA through the Climate and Development Fund	Denmark: DanChurchAid, Ibis, CARE Denmark; Ghana: ABANTU for Development	Capacity building; policy formation and integration	Government; civil society	2014–2019	Global Ghana
Water Infrastructure Solutions from Ecosystem Services to Underpin Climate-Resilient Policies and Programmes (WISE-UP to Climate)	The project tests, develops and demonstrates approaches for the use of a mixed water infrastructure that combines natural river courses with artificial elements such as reservoirs. It thereby improves water supplies and increases resilience to climate change in the basins of the Tana (Kenya) and Volta (Ghana, Burkina Faso). Furthermore, it supports sustainable development in the areas of poverty reduction, conservation of biodiversity, food security and secure supplies of energy and water. To this end the project partners collate hydrological, environmental, and economic data and analyze the political and institutional dynamics of the related decision-making processes. Based on this, tried-and-tested instruments and technologies are then adapted to	German Federal Ministry for the Environment; Nature Conservation; Building and Nuclear Safety through the International Climate Initiative € 5.31 million	International Union for Conservation of Nature; Tana-Athi Rivers Development Authority; Volta Basin Authority	Assessment; capacity building	Watershed management	2013–2017	Regional Kenya, Burkina Faso, Ghana

	users' needs with the aid of participatory learning methods. The project disseminates its results, experiences, and recommendations by holding training events and maintaining a regional and global exchange of information.						

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