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Climate Change Profile: GHANA

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Table of contents

Climate Change Profile: Ghana.....	2
Overall ranking	2
Biophysical vulnerability.....	2
Socio-economic vulnerability	5
National government strategies and policies.....	7
Intended Nationally Determined Contribution (INDC)	9
Climate finance	11
Climate change projects	11
Climate contribution of the Netherlands Embassy: Pitch & Bid	13
Map 1: Predicted precipitation changes, 2030 (left) and 2050 (right), compared to 2010	14
Map 2: Predicted temperature changes, 2030 (left) and 2050 (right), compared to 2010.....	14
Map 3: Area suitability for cocoa production, current (left) and 2030 (right).....	15
Map 4: Area suitability for cocoa, cotton and cashew production, current (left) and 2050 (right).....	16
Annex: List of projects in Ghana under bilateral and multilateral climate funds	17

Climate Change Profile: Ghana

Climate change in Ghana is projected to affect the country's vital water resources, energy supplies, crop production and food security. With its three northern regions the most vulnerable, Ghana is already experiencing increased extreme weather conditions with higher incidences and more prolonged periods of flooding and droughts¹. High temperatures will further increase, and rainfall patterns will be less predictable. More intense rainfall is expected to increase erosion, while less total rainfall may decrease the water flow. The country's vulnerability is largely due to dependence on the production of crops that are sensitive to climate change, including cassava and cocoa, and by a lack of agricultural diversification.

Overall ranking

Ghana ranks 108 out of 180 countries in the ND-GAIN index² (2014), which is slightly lower than its ranking in 2013 (rank 107). Ghana is the 59th most vulnerable country and the 83rd least ready country— meaning that it is vulnerable to, and moderately ready to combat climate change effects. *Vulnerability* measures the exposure, sensitivity, and ability to cope with climate related hazards by accounting for the overall status of food, water, environment, health, and infrastructure within a country. *Readiness* targets those portions of the economy, governance and society that affect the speed and efficiency of adaptation.

Biophysical vulnerability

Current climate. Ghana has different climatic **zones**, from coastal savannah in the far south to humid rainforests in the southern half of the country and the dry, hot Sahel in the north. Total annual rainfall is over 2,000 mm in the extreme southwest, less than 1,100 mm in the north, and 750 mm in the south eastern coastal tip³. Rainfall is characterized by strong inter-annual variations due to El Niño events causing drier than normal conditions. There is a strong rainfall **seasonality** differing per zone:

- North – Wet season: May – October (150–250 mm per month in peak months July–September);
- North – Dry season: November – April (with hot 'Harmattan' winds)⁴;
- South – Long dry season: November – March;
- South – Long wet season: April – July;
- South – Short dry season: August;
- South – Short wet season: September – October (20–25% of total annual rainfall)⁵.

Monthly mean **temperature** is between 25 and 30°C throughout the year. Temperature variations are greater in the north than in the south, with highest temperatures at the onset of the dry season (April–June, 25–27°C) and lowest temperatures during the wet season (July–September, 25–27 °C)⁶.

¹ Cameron, C. (2011): Climate change finance and aid effectiveness: Ghana Case Study. OECD <http://www.oecd.org/dac/environment-development/48458430.pdf>

² GAIN index summarizes a country's vulnerability to climate change and other global challenges in combination with readiness to improve resilience. <http://index.gain.org/country/ghana>

³ Nutsukpo, D.K.; Jalloh, A.; Zougmore, R.; Nelson, G.C.; Thomas, T.S. (2012): *West African Agriculture and Climate Change: Chapter 6 – Ghana*. IFPRI/CGIAR <http://www.ifpri.org/sites/default/files/publications/rr178ch06.pdf>

⁴ McSweeney, C.; New, M.; Lizcano, G. (2010): *UNDP Climate Change Country Profiles: Ghana*, http://www.geog.ox.ac.uk/research/climate/projects/undp-cp/UNDP_reports/Ghana/Ghana.hires.report.pdf

⁵ Climate Service Center (2015): Climate Fact Sheet Benin–Ghana–Togo.

⁶ McSweeney et al. (2008)

With most of the **rain** falling in intense storms of short duration, the country is vulnerable to extreme events such as heavy rainfall (with on average 44 mm per day) resulting in heavy runoff and erosion, especially at the beginning of the rainy season⁷. At the same time, the long dry season in the north has led to serious droughts in the region.

Current trends. Over the last 30 years, a slight increase of total annual **precipitation** was observed⁸. Ghanaian farmers have identified erratic rainfall patterns, longer periods of Harmattan (hot desert winds) and desertification as the main current effects of climate change⁹. In the eastern Volta Basin, prolonged dry seasons have replaced shorter dry spells¹⁰. No clear trend has been observed in the intensity or frequency of extreme rainfall events.

There is evidence of a **temperature** increase over the past decades. Mean annual temperature has increased (reports range from +0.4 °C over 100 years¹¹ to +1 °C over 50 years), with the strongest increase between April and July (+0.27 °C per decade). The rate of increase has been more rapid in the north of the country than in the south. Moreover, the number of 'hot days' and 'hot nights'¹² has increased significantly in all seasons (by 13.2% and 20% respectively between 1960 and 2003), while the number of 'cold days' and 'cold nights' has decreased (by 3.3% and 5.1% respectively over the same period)¹³.

The north of the country has repeatedly experienced incidences of **droughts and floods**¹⁴. The 2007 floods in the northern part of the country, immediately following a period of drought, affected more than 325,000 people¹⁵. In 2015, days of torrential rain around Accra resulted in widespread flooding and left 159 dead¹⁶.

Climate change. Projections for climate change show large uncertainty concerning the change in **rainfall**. For the future, precipitation estimates range between predicting a -3% to +7% change in precipitation. For total annual precipitation, projections for the year 2100 vary from -15% to +16% compared to current annual rainfall. Some models predict an initial increase of rainfall in some regions, followed by a decrease of rainfall in most regions over the longer

⁷ Nutsukpo et al. (2012)

⁸ Climate Service Centre (2015)

⁹ Akon-Yamga, G.; Boadu, P.; Obiri, B.D.; Amoako, J.; Mboob, F.J. (2011): *Agricultural Innovations for Climate Change Adaptation and Food Security in Africa: The Cases of Ghana and The Gambia*. African Technology Policy Studies Network. <http://www.atpsnet.org/Files/rps11.pdf>

¹⁰ De Pinto, A.; Demirag, U.; Haruna, A.; Koo, J.; Asamoah, M. (2012): *Ghana Strategy Support Program: Climate Change, Agriculture, and Foodcrop Production in Ghana*. IFPRI. <http://www.ifpri.org/sites/default/files/publications/qssppn3.pdf>

¹¹ Climate Service Center (2013)

¹² Defined as days with a temperature that is exceeded on 10% of days/nights in the reference period - i.e. the number of hot days/nights in the reference period is always 10%.

¹³ McSweeney et al. (2008)

¹⁴ Akudugu, M.A.; Alhassan, A.R. (2012): *The Climate Change Menace, Food Security, Livelihoods and Social Safety in Northern Ghana*. International Journal of Sustainable Development & World Policy 1(3): 80-95. [http://www.aess-web.com/pdf-files/1%20\(3\)%2080-95.pdf](http://www.aess-web.com/pdf-files/1%20(3)%2080-95.pdf)

¹⁵ GFDRR (2013): *Country Program Update: Ghana*. http://www.gfdrr.org/sites/gfdrr.org/files/Ghana_Country_Program_Updates_2013.pdf

¹⁶ Floodlist (2016). Ghana-Accra floods again. Available via <http://floodlist.com/africa/ghana-accra-floods-june-2016>

term¹⁷ (see [Map 1](#)). Projections in **seasonal** differences are a bit more convergent: in general, rainfall increases are predicted for July – December, and decreases for March – June¹⁸. For the northern regions, this suggests that the start of the wet season may be delayed.

The **temperature** is expected to increase further, for the end of the century a warming ranging between 1.4 to 4.2°C is likely¹⁹. The increase is expected to be most severe in the north of the country (see [Map 2](#)). It is expected that 25–90% of all days will count as ‘hot days’ by 2100 (compared to 10% under the current climate) – with the highest percentage (up to 99%) in the months of July – September²⁰.

These changes in rainfall and temperature will increase the frequency and intensity of **extreme events**. The duration of long-lasting heat waves is expected to increase by 22 days by 2100, potentially causing more severe droughts. At the same time, intensity of heavy rains is expected to increase (+4% by 2100) and the proportion of total annual rainfall that falls in such heavy rain events will also increase²¹. This combination may intensify seasonal and inter-annual variation – with drought in one year and floods in the next²², or even droughts and floods within the same season²³. Another projected effect of climate change is a rising sea level. Ghana’s coastal regions are expected to face a sea level rise of 13–45 cm in 100 years²⁴. Under IPCC’s high emission scenario, flooding due to sea level rise will place an increasing number of people under threat from flooding²⁵.

These changes are likely to affect Ghana’s **water availability** and **food security**, especially in the north of the country, where the mono-modal rainfall pattern results in a long ‘hunger season’ before the harvesting of new crops. This season used to be April – July, but some reports indicate that this has extended to March – August²⁶ due to an ongoing decline in productivity of subsistence food crops²⁷. Food insecurity is largest in the Upper East (6–7 months for all crops), followed by the Upper West and the Northern Region (depending on the crop, on average 5 months)²⁸. Projected future climate-related impacts to food security include:

- Increased water stress as streams and rivers as well as small-scale dam systems dry up (–15–20% of water flow in all Ghana’s basins for 2020, and –30–40% for 2050²⁹), flooding

¹⁷ Läderach, P.; Eitzinger, A.; Martínez, A.; Castro, N. (2011): *Predicting the Impact of Climate Change on the Co-coa-Growing Regions in Ghana and Cote d'Ivoire*. CCAFS and CIAT. http://www.eenews.net/assets/2011/10/03/document_cw_01.pdf

¹⁸ Climate Service Center (2015); McSweeney et al. (2008)

¹⁹ Climate Service Center (2015); De Pinto et al. (2012); Nutsukpo et al. (2012)

²⁰ McSweeney et al. (2008)

²¹ Climate Service Center (2015); McSweeney et al. (2008)

²² De Pinto et al. (2012)

²³ Akudugu and Alhassan (2012)

²⁴ Climate Service Center (2015); McSweeney et al. (2008)

²⁵ WHO & UNFCCC (2105), *Climate and Health Profile – 2015, Ghana*. http://apps.who.int/iris/bitstream/10665/208862/1/WHO_FWC_PHE_EPE_15.08_eng.pdf?ua=1

²⁶ Akudugu and Alhassan (2012)

²⁷ Antwi, A. (2013): *Climate Change and Food Security: An overview about the issue*. Friedrich Ebert Stiftung. <http://library.fes.de/pdf-files/bueros/ghana/10518.pdf>

²⁸ Ministry of Food and Agriculture Ghana (2006): *Food Security Situation in Ghana*. <https://mofafoodsecurity.wordpress.com/food-security-situation-in-ghana/>

²⁹ De Vit, C.; Parry, J.O. (2011): *Review of Current and Planned Adaptation Action: West Africa, Ghana*. Adaptation Partnership. https://www.iisd.org/pdf/2011/West_Africa_Adaptation_Action.pdf

- of coastal areas and low water levels that will affect operation of the only hydro-generating dam in the country (which produces 80% of national electricity supply)³⁰;
- outbreaks of crop/livestock pests/diseases due to high temperatures and/or standing water;
 - loss of productive lands due to ecosystem deterioration;
 - post-harvest losses due to difficulties in crop preservation as a result of erratic/heavy rainfall³¹;
 - salinization effects on crops due to sea erosion and tidal flooding in the coastal region³².

Socio-economic vulnerability

Key facts:

GDP (PPP) per capita (2015) ³³ :	USD 4,200.5
Population (June 2016) ³⁴ :	28,029,957
Projected population (2050) ³⁵ :	50,070,660
Population density per km ² (2014) ³⁶ :	118
Human Development Index (2014) ³⁷ :	140 out of 188 countries
Corruption Perceptions Index (2015) ³⁸ :	56 out of 168 countries
Gender Inequality Index (2014) ³⁹ :	127 out of 188 countries
Adult literacy (2015) ⁴⁰ :	76.6% (male 82%; female 71.4%)

Climate change vulnerability in Ghana is greatest for those who are strongly dependent on natural resources and have the lowest capacity to cope with these changes. Smallholder farmers (particularly female-headed farming households) in Ghana are particularly vulnerable to the impacts of climate change and variability due to the compounding impacts on yield from poor lateritic soils, limited irrigation, and limited transport to markets. In Ghana, women constitute 52% of the agricultural labour force and produce 70% of subsistence crops. In addition, they depend on water and crops due to their responsibilities in the household. They are hampered in their adaptive capacity to climate change due to various factors, including inaccessibility of financial resources, a lack of information and technology, and unfavourable land tenure systems⁴¹.

³⁰ MEST (2000), in De Vit, C.; Parry, J.O. (2011)

³¹ Akudugu and Alhassan (2012); De Pinto et al. (2012)

³² Yaro, J.A. (2013): *Building Resilience and Reducing Vulnerability to Climate Change: Implications for Food Security in Ghana*. Friedrich Ebert Stiftung. <http://library.fes.de/pdf-files/bueros/ghana/10517.pdf>

³³ World Bank Data – GDP per capita, PPP. <http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD>

³⁴ World Population Review – Ghana <http://worldpopulationreview.com/countries/ghana-population/>

³⁵ UNDESA (2015): *World Population Prospects: The 2015 Revision*. <http://esa.un.org/wpp/>

³⁶ World Bank Data – Population density. <http://data.worldbank.org/indicator/EN.POP.DNST>

³⁷ UNDP (2015) <http://hdr.undp.org/en/content/table-1-human-development-index-and-its-components>

³⁸ Transparency International (2015) <http://www.transparency.org/cpi2015/results>

³⁹ UNDP (2015) <http://hdr.undp.org/en/content/table-4-gender-inequality-index>

⁴⁰ CIA (2015). The World Fact book, Ghana. Available via <https://www.cia.gov/library/publications/the-world-factbook/geos/gh.html>

⁴¹ Agyeman-Bonsu, W. (no date): *Women's Livelihoods and Vulnerability to Climate Change*. Netherlands Climate Assistance Programme: Ghana. <http://www.nicap.net/fileadmin/NCAP/Countries/Ghana/032135.0403xx.GHA.CON-01.Output9.v1.pdf>

Agriculture is the backbone of Ghana's economy, providing employment to 45% of its workforce, contributing to 21% of GDP and supplying over 70% of its national food requirements⁴². The fact that Ghanaian agriculture is predominantly rain-fed (with only 4% of its irrigation potential developed)⁴³, particularly in the semi-arid north⁴⁴, makes this sector highly vulnerable to climate change. Agriculture is characterized by a low level of diversification, which makes farmers more vulnerable to crop failure. Farmers in the north of the country – and particularly in the Upper East – are most vulnerable. This is partly due to the hot and dry conditions of the area and the bad quality of agricultural lands (the Upper East is most exposed to land degradation and soil erosion⁴⁵), but also because of general poverty and limited access to alternative livelihoods.

Ghana's main staple crops are, in order of amount produced and consumed: cassava, yam, plantain, maize, and rice⁴⁶. Root and tuber crops are predominantly grown and consumed in the south of the country, while grain crops are cultivated in the north. Important cash crops include cocoa (mainly in the south) and groundnuts (in the north)⁴⁷.

Projected climate change impacts for these crops include:

- Cassava yields are expected to reduce due to both increased temperatures and periods of water stress. Projections of productivity losses are up to 3% in 2020, 13.5% in 2050, and 53% in 2080⁴⁸.
- Yam requires fertile soils but less water than cassava. Yam yields are expected to decrease by 11.8% by 2020, 29.6% by 2050 and 68% by 2080^{49 50}.
- Plantain yield projections for the effect of climate change on this crop are currently available.
- Maize yields will decrease by about 15% by 2050 in all regions. Some models however predict a yield increase for the north of the country⁵¹.
- Rice cultivation is expected to be subject to a similar decrease of 0–25%.
- Groundnuts are currently cultivated mainly in the north, but no clear yield change projections under climate change exist for this part of the country. In the south, however, yield increases of around 25% have been estimated⁵².
- Cocoa is highly sensitive to climate change as it demands specific temperature and water amounts. It is also vulnerable to pests and diseases that may be triggered by increasing

⁴² CIA (2015). The World Fact book, Ghana. Available via <https://www.cia.gov/library/publications/the-world-factbook/geos/gh.html>

⁴³ Nutsukpo et al. (2012)

⁴⁴ De Pinto et al. (2012)

⁴⁵ GFDRR (2009): *Ghana*. <https://www.gfdrr.org/sites/gfdrr/files/region/GH.pdf>

⁴⁶ Nutsukpo et al. (2012)

⁴⁷ WFP (2009): *Comprehensive Food Security & Vulnerability Analysis Ghana*. <http://documents.wfp.org/stellent/groups/public/documents/ena/wfp201820.pdf>

⁴⁸ Sagoe, R. (2006): *Climate Change and Root Crop Production in Ghana*. EPA. http://www.nlcap.net/fileadmin/NCAP/Countries/Ghana/ROOT_TUBERS_DRAFT_FINAL_REPORT.pdf

⁴⁹ Sagoe (2006)

⁵⁰ Olesen, J., Chirinda, N., & Adiku, S. (2013). Climate change impacts on crop productivity and possible adaptations in Ghana. Ghana Policy Journal Edition on Climate Change. Available via <http://dspace.africaportal.org/jspui/bitstream/123456789/34938/2/gpj-v5-n4.pdf?1>

⁵¹ Olesen, J., Chirinda, N., & Adiku, S. (2013). Climate change impacts on crop productivity and possible adaptations in Ghana. Ghana Policy Journal Edition on Climate Change. Available via <http://dspace.africaportal.org/jspui/bitstream/123456789/34938/2/gpj-v5-n4.pdf?1>

⁵² De Pinto et al. (2012)

temperature and humidity⁵³. Cocoa is currently ideally cultivated at 100–250 meters above sea level, but under climate change areas at 450–500 meters above sea level will become more suitable – resulting in a potential shift of cocoa cultivating areas and a strong reduction of the amount of suitable land for cocoa cultivation, by 2030 (see [Map 3](#))⁵⁴.

An investigation of area suitability for cash crops cocoa, cotton and cashew shows that climate change also creates opportunities for cultivation of crops that are currently not grown in certain areas. For example, parts of the north and east will become more suitable for cashew cultivation⁵⁵ (see [Map 4](#)).

Ghana's vulnerability to climate change is closely linked with ongoing climate-related conflicts, e.g. due to the movement of Fulani herdsmen and their cattle from the dry Sahel region into farming communities in southern Ghana⁵⁶, water allocation disputes between the north and south of the country, and tensions arising from economic dependence on climate change-susceptible crops such as cocoa⁵⁷. Such conflicts not only arise from climate change but can also deepen vulnerability to climate change effects as they often result in increased poverty and eroded social networks.

National government strategies and policies

In 2012, a National Climate Change Adaptation Strategy (NCCAFS) was developed by the Ministry of Environment with support from UNEP and UNDP via the CC-DARE project.

The strategy encompasses eight major themes, including food security and water. Among the main activities proposed are: increasing agricultural productivity via new (including post-harvest) technologies; raising awareness and using indigenous knowledge on climate change; encouraging alternative livelihoods skills (specifically fish farming); promoting agricultural biodiversity and crops and animals adapted to climatic change; and improving water resources conservation, accessibility, availability and quality⁵⁸.

Ghana listed 55 Nationally Appropriate Mitigation Actions (NAMAs), which were submitted to the UNFCCC⁵⁹. Ghana prioritised that list down to five actions, which were included in its 2013 National Climate Change Policy (NCCP, see below).

In 2013, the Ministry of Environment, Science, Technology and Innovation (MESTI) and the National Climate Change Committee (NCCC)⁶⁰ formulated both Ghana's National Climate Change Policy (NCCP) and the National Environment Policy (NEP) to provide strategic directions

⁵³ Yaro (2013)

⁵⁴ World Bank (no date): *Ghana Dashboard*. http://sdwebx.worldbank.org/climateportalb/home.cfm?page=country_profile&CCCode=GHA&ThisTab=ImpactsVulnerabilities

⁵⁵ Läderach et al. (2011)

⁵⁶ Antwi (2013); Akudugu and Alhassan (2012)

⁵⁷ De Pinto et al. (2012)

⁵⁸ UNEP and UNDP (2012): *National Climate Change Adaptation Strategy*. http://www.undp-alm.org/sites/default/files/downloads/ghana_national_climate_change_adaptation_strategy_nccas.pdf

⁵⁹ UNFCCC (2015): NAMA Registry. <http://www4.unfccc.int>

⁶⁰ The NCCC is composed of representatives of the relevant Ghanaian ministries, commissions, agencies, research institutes as well as international organisations, embassies and NGOs. Consult: Ministry of Environment, Science, Technology and Innovation, Republic of Ghana, (2013): *Ghana National Climate Change Policy* for more information.

and co-ordinate issues of climate change in Ghana, as well as to help the country achieve sustainable development through equitable, low carbon economic growth⁶¹. The NCCP prioritises five main policy areas, which include agriculture and food security, disaster preparedness and response, natural resource management, equitable social development and energy, and industrial and infrastructural development. The NEP presents a road map to address major environmental threats jeopardizing the natural and common resource base of the country. It has integrated the currently most urgent environmental concerns to provide clear strategies for overcoming existing hurdles. Also, it validates the strategic environmental assessment (SEA) process as a tool for mainstreaming environment into all government policies, programmes and projects⁶².

The Mid-Term National Development Policy Framework (2010–2013) proposes various activities related to climate change, including integration of climate change into sectoral and district plans, promoting the adoption of principles of the green economy in national planning, early warning systems, implementing alternative livelihood strategies to minimise impact of climate change on the poor and vulnerable, establishment of a climate change centre, management of water resources as a climate adaptation strategy to enhance productivity and livelihoods, improved agricultural practices, adapting the national energy system to impacts of climate change, and developing a long term Low Carbon Growth (LCG) model for effective decision-making⁶³.

Recently, Ghana launched its National Climate Change Master Plan (2015–2020) containing action programmes for implementation⁶⁴. This master plan has identified four areas of concern, that are linked to climate change and climate variability: increased Greenhouse Gas emissions and loss of carbon sinks; increasing temperatures; rainfall variability leading to extreme events and sea level rise. The master plan identified 10 Policy Focus Areas for addressing these challenges. These policy focus areas are:

1. develop climate resilient agriculture and food security systems;
2. build climate resilient infrastructure;
3. increase resilience of vulnerable communities to climate related risks;
4. increase carbon sinks;
5. improve management and resilience of terrestrial, aquatic and marine ecosystems;
6. address impact of climate change on human health;
7. minimize the impact of climate change on access to water and sanitation;
8. address gender issues in climate change;
9. address climate change and migration;
10. minimize GHG emissions.

⁶¹ Government of Ghana (2014): <http://www.ghana.gov.gh/index.php/media-center/news/882-president-mahama-launches-two-national-policy-documents?highlight=WyljbGltYXRlliwiY2hhbmdlliwiY2xpbWF0ZSBjaG-FuZ2UiXQ==>

⁶² European External Action Service (EEAS) (2014): http://eeas.europa.eu/delegations/ghana/press_corner/all_news/news/2014/20140722_en.htm

⁶³ Government of Ghana, Medium Term National Development Policy Framework. Ghana Shared Growth and Development Agenda (GSGDA) II, 2014–2017. <https://s3.amazonaws.com/ndpc-static/pubication/GSGDA+II+2014-2017.pdf>

⁶⁴ <https://www.weadapt.org/knowledge-base/national-adaptation-planning/ghana-national-climate-change-policy-action-programme>

The action programmes of the master plan include details on initiatives and corresponding budget estimates, to achieve each policy focus area's objectives⁶⁵.

Ghana ratified the UN Convention on Biological Diversity (CBD) for which it elaborated a Biological Diversity National Strategy and Plan of Action⁶⁶, the Convention to Combat Desertification (CCD) for which it elaborated a National Plan of Action to Combat Desertification⁶⁷, the Framework Convention on Climate Change (UNFCCC), and the Kyoto Protocol. Ghana has been an active participant in the Conferences of the Parties (COP) over a number of years with a reasonable range of participation, and has associated itself with the Copenhagen Accord⁶⁸. It also drafted its Second National Communication that was submitted to the UNFCCC in 2011, and completed its Greenhouse Gas (GHG) inventory⁶⁹. Ghana's Initial National Communication on climate change (2000) prioritized water, agriculture and coastal zone management. The Second National Communication specifies projects to be implemented in the field of energy adaptation, water resources management, and agricultural diversification (adaptation), as well as climate smart agro-forestry capacity development for GHG emission modelling and climate mitigation assessment (mitigation)⁷⁰. As Ghana is not a least developed country (LDC), it is not required to submit a National Adaptation Programme of Action (NAPA) to the UNFCCC.

A Plan of Action for Disaster Risk Reduction and Climate Change Adaptation (2010–2015) was drafted with support from UNDP⁷¹. UNDP also assisted in improving the coordination structures and mechanisms so that stakeholders in Ghana are addressing climate change related needs in an effective manner. The project is under implementation and will help the Government merge all existing management structures at national level into one structure consisting of the Ghana Environmental Conventions Coordinating Authority (GECCA) and its Secretariat. As soon as this managing structure is in place, these mechanisms become operational by building their capacity and supporting them to perform specific tasks. At last, the project is to help these mechanisms provide support to five pilot districts, in order to build national level capacity to support districts.

Intended Nationally Determined Contribution (INDC)

Ghana submitted its Intended Nationally Determined Contribution (INDC) in September 2015⁷². The INDC is aligned with Ghana's National Climate Change Master Plan (2015–2020), its national medium-term development plans (Ghana Shared Growth Development Agenda II – GSGDA2), the anticipated socio-economic transformational plan and the Sustainable Develop-

⁶⁵ https://www.weadapt.org/sites/weadapt.org/files/ghana_national_climate_change_master_plan_2015_2020.pdf

⁶⁶ Ministry of Environment and Science (2002): *National Biodiversity Strategy for Ghana* <http://www.cbd.int/doc/world/gh/gh-nbsap-01-en.pdf>

⁶⁷ Environmental Protection Agency (2002): *National Action Programme to combat drought and desertification* <http://www.unccd.int/ActionProgrammes/ghana-eng2002.pdf>

⁶⁸ Cameron, C. (OECD) (2011): *Climate Change Financing and Aid Effectiveness, Ghana case study*. <http://www.oecd.org/dac/environment-development/48458430.pdf>

⁶⁹ Ghana Environmental Protection Agency (2011a): *National Greenhouse Gas Inventory Report for 1990–2006*. http://unfccc.int/resource/docs/natc/nir_1990-2006.pdf

⁷⁰ Ghana Environmental Protection Agency (2011b): *Ghana's Second National Communication to the UNFCCC*. <http://unfccc.int/resource/docs/natc/ghanc2.pdf>

⁷¹ GFDRR (2013)

⁷² Republic of Ghana (2015). Ghana's Intended Nationally Determined Contribution (INDC) and accompanying explanatory note. Available via http://www4.unfccc.int/submissions/INDC/Published%20Documents/Ghana/1/GH_INDC_2392015.pdf

ment Goals (SDGs). In its INDC, Ghana presents 31 programmes of action (20 mitigation programmes and 11 adaptation programmes), focusing on 7 priority economic sectors, to be implemented within a 10-year period (2020–2030). Ghana's priority sectors are:

1. sustainable land use, including food security;
2. climate proof infrastructure;
3. equitable social development;
4. sustainable mass transportation;
5. sustainable energy security;
6. sustainable forest management;
7. alternative urban waste management.

Implementation of all mitigation and adaptation programmes is expected to cost **USD 22.6 million**, of which USD 6.3 million will come from domestic sources (unconditional contribution) and USD 16.3 million has to come from international support (conditional contribution).

Mitigation. Ghana's emission reduction goal is to (unconditionally) lower its GHG emissions by **15%** compared to a Business-as-Usual (BAU) scenario by 2030. An additional 30% emission reduction can be achieved with adequate international support.

Ghana proposed the following mitigation measures:

- Energy:
 - scale up renewable energy penetration by 10% by 2030;
 - promote clean rural household lighting;
 - expand the adoption of market-based cleaner cooking solutions;
 - double energy efficiency improvement to 20% in power plants.
- Transport:
 - scale up sustainable mass transportation.
- Agriculture, Forestry and Land Use (AFOLU):
 - promote sustainable use of forest resources through REDD+.
- Waste:
 - adopt alternative urban solid waste management.
- Industry:
 - double energy efficiency improvement to 20% in industrial facilities;
 - green Cooling Africa Initiative.

Adaptation. The long-term goal of Ghana's adaptation is to increase climate resilience and decrease vulnerability. Adaptation measures are centred on three strategic areas:

- Sustainable land use:
 - agriculture resilience building in climate vulnerable landscapes;
 - value addition-based use of forest resources.
- Climate resilient strategic infrastructure:
 - city-wide resilient infrastructure planning;
 - early warning and disaster prevention;
- Equitable social development:
 - managing climate-induced health risk;
 - integrated water resources management;
 - resilience for gender and the vulnerable.

Climate finance

Ghana's 'own revenues' or 'internally generated funds' (such as environmental taxes like licenses, royalties and export levies, and service charges – designed to cover the costs of providing a service, e.g. environmental impact assessment or park rangers) have become an important source of funding for environmental and natural resource agencies⁷³. The Ghanaian self-financing model for the environmental agencies has become effectively institutionalized, with the designation of these agencies as 'sub-vented agencies'. Whilst such a model might conceivably be workable for the management of game parks, it is not suitable for most other environmental functions because the most important environmental functions are not typically those that attract fees.

According to the Overseas Development Institute (ODI), Ghana, considered a state with lower-middle incomes, received USD 18,420,000 in climate funds between 2004 and 2014 – placing the country at number 59 of the climate finance approved ranking list composed of 135 countries⁷⁴. Ghana also received around USD 13 million in total from the Forest Investment Programme (FIP) and the Forest Carbon Partnership Facility (FCPF)'s Carbon Fund – placing it 7th in the top 10 recipients of REDD+ finance. As of 2015, Ghana executes five projects in the FIP framework⁷⁵: 1) the 'Enhancing Natural Forest and Agroforest Landscapes Project'; 2) 'Public-Private Partnership for Reforestation of Degraded Forest Reserve through VCS and FSC Certified Plantations'; 3) 'Engaging Local Communities in REDD+/Enhancement of Carbon Stocks'; 4) Ghana dedicated grant mechanism; and 5) Reducing degradation and deforestation due to mining in forest landscapes⁷⁶. Ghana is one of fourteen new pilot countries (2014) for the Climate Investment Fund's Scaling Up Renewable Energy in Low Income Countries Program (SREP). Its Investment Plan was endorsed in May 2015 and is now being finalized in response to comments from the SREP Sub-Committee⁷⁷.

Climate change projects

In 2011, Ghana had among the highest number of adaptation projects underway in the West African region⁷⁸. These projects were focused on sectors such as human health, freshwater resources, agriculture, urban sustainability, ecosystem conservation and enhancing the capacity of government to facilitate adaptive action, with a number of them linked to food security and/or water. The 2011 analysis concluded that most of the action underway focuses on the human health, agriculture and freshwater sectors; Ghana was also engaged in projects that

⁷³ Lawson, A.; Bird, N., Overseas Development Institute (2008): *Environmental funding, How to increase the effectiveness of public expenditure in developing countries*. ODI. <http://www.unpei.org/sites/default/files/PDF/budgetingfinancing/Environmental-funding.pdf>

⁷⁴ Nakhooda, S.; Norman, M. (2014): *Climate Finance: Is it making a difference? A review of the effectiveness of Multilateral Climate Funds*. ODI. <http://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/9359.pdf>

⁷⁵ Climate Investment Funds (2016): <http://www-cif.climateinvestmentfunds.org/country/ghana/ghana-fip-programming>

⁷⁶ African Development Bank (2014): *AfDB supports Ghana local communities with \$14.55 million to reduce deforestation*. <http://www.afdb.org/en/news-and-events/article/afdb-supports-ghana-local-communities-with-14-55-million-to-reduce-deforestation-12787/>

⁷⁷ Climate Investment Funds (2015b): http://www.climateinvestmentfunds.org/cif/Scaling_Up_Renewable_Energy_Program_in_Low_Income_Countries

⁷⁸ Adaptation Partnership (2011)

include strong gender components, and in the areas of urban adaptation and ecosystem conservation. Although Ghana's National Communication highlights the vulnerability of its coastal zones, no projects underway appear to specifically address this sector.

Some current climate change projects with a link to water and/or food security are:

- the 'Ghana Climate Innovation Centre' has been established in 2014 with funding provided by DANIDA and the Embassy of the Netherlands in collaboration with InfoDev (a global partnership with the World Bank) and is to support the growth of Ghana's clean technology businesses by providing financing and business incubation services⁷⁹;
- Ghana is part of the 'Comprehensive Africa Agriculture Development Programme' (CAADP) of the New Partnership for Africa's Development (NEPAD) (2003–2025)⁸⁰, of which one of the currently implemented projects is the 'NEPAD/CAADP: Adaptation of agriculture to climate change' (2012–2017), executed by GIZ⁸¹;
- GIZ is executing several climate relevant programmes in Ghana, some of which also have a more regional focus⁸².

The following regional programs with a focus on food security and/or water are currently also being implemented in Ghana:

- 'Adaptation at Scale in Semi-Arid Regions' (ASSAR), a five-year project (2013–2017) funded by IDRC and DFID to improve understanding of climate change in semi-arid areas across Africa and Asia^{83 84};
- 'West African Science Service Centre on Climate Change and Adapted Land Use' (WASCAL), a project for the design of resilient land-use systems⁸⁵;
- '2SCALE'⁸⁶ funded by the Netherlands Ministry of Foreign Affairs (2012–2017) to improve rural livelihoods and food and nutrition security in Africa by creating partnerships to enable farmers and entrepreneurs to grow together in their agribusiness⁸⁷;
- 'Great Green Wall', financed by the Multi Trust Fund (GEF), SCCF, World Bank, and the AfDB, to address desertification by creating a biological corridor⁸⁸.

For a list of projects in Ghana funded through bilateral/multilateral climate funds, see the [Annex](#).

⁷⁹ Ghana Climate Innovation Centre. <http://www.ghanacic.org>

⁸⁰ Kolavalli, S.; Silver, J.; Benin, S.; Johnson, M.E., (2015): *After the ten percent: Moving Agriculture in Ghana*. IFPRI, Ghana Strategy Support Programme, <http://www.ifpri.org/publication/after-ten-percent>

⁸¹ GIZ (2015a): <https://www.giz.de/en/worldwide/15891.html>

⁸² GIZ (2015b): *Ghana*. https://www.giz.de/projektdaten/index.action?request_locale=en_EN#?region=3&countries=GH

⁸³ START (2014): *Adaptation at Scale in Semi-Arid Regions (ASSAR)*, <http://start.org/programs/assar>

⁸⁴ http://www.assar.uct.ac.za/sites/default/files/image_tool/images/138/West_africa/ASSAR%20Ghana%20Information%20Brief%20001%20-%20March%202016.pdf

⁸⁵ WASCAL (2015): *West African Science Service Center on Climate Change and Adapted Land Use*. <https://icq4was-cal.icq.kfa-juelich.de/>

⁸⁶ 2SCALE is a consortium of the International Fertilizer Development Center (IFDC), BoP Innovation Center (BoPInc.), and the International Centre for development oriented Research in Agriculture (ICRA)

⁸⁷ 2SCALE consortium (2013): *Business as unusual, the 2SCALE project – highlights 2013*. <http://ifdc.org/south-sudan/>

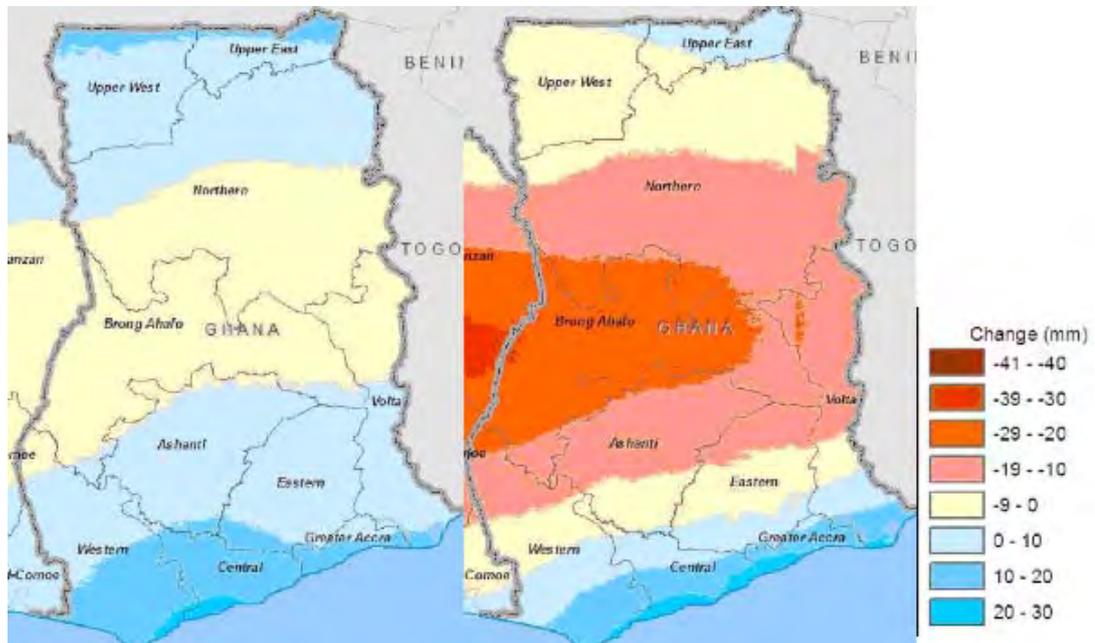
⁸⁸ GEF (2015). https://www.thegef.org/gef/project_detail?projID=4511

Climate contribution of the Netherlands Embassy: Pitch & Bid

Beginning in 2014, embassies with development programs have annually been preparing a climate Pitch & Bid. The *Pitch* communicates the embassy's climate-smart actions that will address climate change. Based on the actions described in the Pitch, assignment of the Rio Markers and budget information, the embassy prepares a *Bid* which is an estimate of how much is likely to be spent on projects that are relevant for climate in the coming three years. For Ghana the Bid estimates a climate contribution for € 2016–2018 of 4,424,000 (2,094,000 for 2016; 1,530,000 for 2017; 800,000 for 2018). Of these, three projects are related to adaptation, one project is related to mitigation and two projects are related to both mitigation and adaptation:

- introduce diversified cropping and farming systems, horticulture and drought resistant varieties in particular for Ghana's cocoa and palm oil production systems;
- develop and marketing of cocoa and palm oil products to stimulate economic development and build resilience to climate change in their value chains;
- improve sustainable and equitable access to drinking water for people through protection and sustainable management of water resources, rainwater harvesting structures and the restoring of the natural drainage systems to adapt to prolonged dry spells and erratic rainfall;
- protect the Atewa watershed, an important regional water tower, contributing to the sustainability of the water supply to residents of Greater Accra and two other focal areas in southern Ghana (Cape Coast and Elmina);
- integrate development and management of water resources and related capacity building to improve sustainable use of water resources and sanitation in decision making by municipal assemblies;
- support targeted local communities with a view to contribute to water security, resulting in increase of access to sustainable and reliable supply of water for people and small enterprises;
- contributing to the Ghana Climate Innovation Centre to allow climate smart investments by private sector;
- expand, adapt and rehabilitate infrastructure for water supply, drainage and sanitation to reduce disaster risks and vulnerability for extreme rainfall events.

Map 1: Predicted precipitation changes, 2030 (left) and 2050 (right), compared to 2010

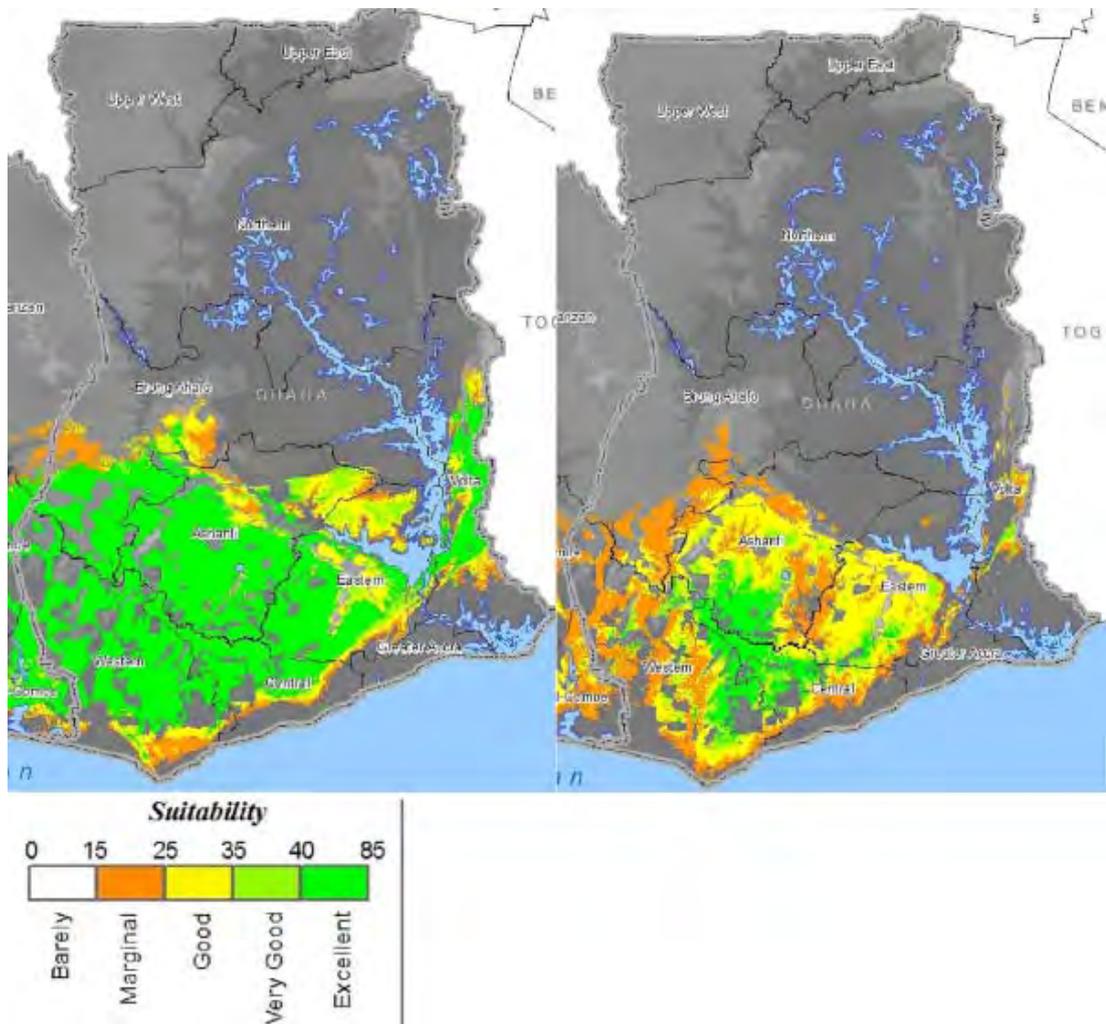


Map 2: Predicted temperature changes, 2030 (left) and 2050 (right), compared to 2010



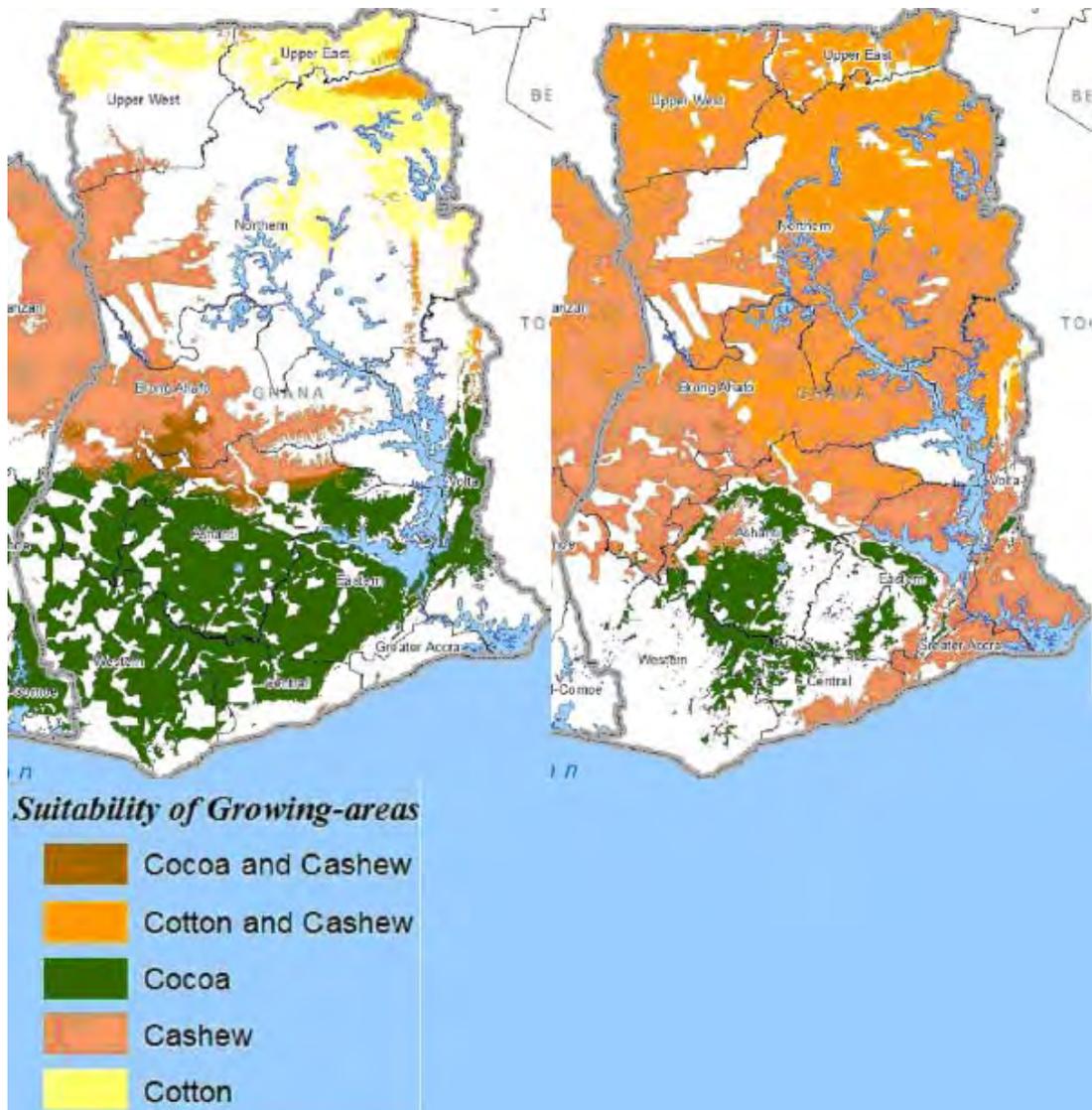
Source: Läderach et al. (2011)

Map 3: Area suitability for cocoa production, current (left) and 2030 (right)



Source: Läderach et al. (2011)

Map 4: Area suitability for cocoa, cotton and cashew production, current (left) and 2050 (right)



Source: Läderach et al. (2011)

Annex: List of projects in Ghana under bilateral and multilateral climate funds

Main source: *Climate Funds Update (2016)*⁸⁹

Name of Project	Fund	Funding Approved (USD million)	Disbursed (USD million)	Fund Type
Increased resilience to climate change in Northern Ghana through the management of water resources and diversification of livelihoods	Adaptation Fund (AF)	8.3		Multilateral
Ghana Rural Growth Programme	Adaptation for Smallholder Agriculture Programme (ASAP)	10	0.8	Multilateral
Integrating Climate Change into the Management of Priority Health Risks	Special Climate Change Fund (SCCF)	1.8	1.8	Multilateral
Promoting Value Chain Approach to Adaptation in Agriculture	Special Climate Change Fund (SCCF)	2.6	2.6	Multilateral
Ghana Urban Transport	Global Environment Facility (GEF4)	7	7	Multilateral
Energy Development and Access Project (formerly) Development of Renewable Energy and Energy Efficiency	Global Environment Facility (GEF4)	5.5	5.5	Multilateral
SPWA-CC Promoting of Appliance Energy Efficiency and Transformation of the Refrigerating Appliances Market in Ghana	Global Environment Facility (GEF4)	1.7	1.7	Multilateral
Investment Plan Preparation Grant	Scaling-Up Renewable Energy Program for Low Income Countries (SREP)	1.51		Multilateral

⁸⁹ <http://www.climatefundsupdate.org/data>

Name of Project	Fund	Funding Approved (USD million)	Disbursed (USD million)	Fund Type
Enhancing Natural Forest and Agroforest landscapes Project	Forest Investment Program (FIP)	30		Multilateral
Readiness preparation grant	Forest Carbon Partnership Facility (FCPF)	8.8	5.6	Multilateral
Engaging Local Communities in REDD+/Enhancement of Carbon Stocks	Forest Investment Program (FIP)	9.8		Multilateral
Reducing Degradation and Deforestation due to Mining in Forest Landscapes	Forest Investment Program (FIP)	10		Multilateral
Public-private partnership for the restoration of degraded forest reserve	Forest Investment Program (FIP)	10		Multilateral
Dedicated Grant Mechanisms	Forest Investment program (FIP)	5.5		Multilateral
Preparation of Ghana's Initial Biennial Update Report to UNFCCC	Global Environment Facility (GEF5)	0.4	0.4	Multilateral
Ghana Climate Innovation Center ⁹⁰	World bank	17.2		Multilateral
Second additional financing for sustainable land and water management project	World Bank	12.8		Multilateral
Disaster risk management country plan	World Bank	0.8		Multilateral
Sustainable land and water management	World Bank	8.6		Multilateral
West Africa regional fisheries program	World Bank	50.3		Multilateral
Maternal, child health and nutrition project	World Bank	68		Multilateral
Innovative insurance products for climate change adaptation	Germany's international climate initiative	5.4		Bilateral

⁹⁰ <http://www.worldbank.org/projects/P145765?lang=en>

Name of Project	Fund	Funding Approved (USD million)	Disbursed (USD million)	Fund Type
Climate change and environmental governance	UK's international climate fund	0.3		Bilateral
Ghana climate change programme	UK's international climate fund	0.3		Bilateral
Climate change adaptation of agro-ecosystems in Ghana	GIZ	3		Bilateral
Promoting integrated mechanisms for climate risk management and transfer	GIZ	5		Bilateral
Sustainable smallholder agribusiness	GIZ	9.5		Bilateral