



Ministry of Foreign Affairs

# Climate Change Profile Ghana

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## Introduction

This climate change profile is designed to help integrate climate actions into development activities. It complements the publication 'Climate-smart = Future-Proof! – Guidelines for Integrating climate-smart actions into development policies and activities' and provides answers to some of the questions that are raised in the step-by-step approach in these guidelines.

The current and expected effects of climate change differ locally, nationally and regionally. The impacts of climate change effects on livelihoods, food and water security, ecosystems, infrastructure etc. differ per country and region as well as community and individual, with gender a particularly important vulnerability factor. This profile aims to give insight in the climate change effects and impacts in Ghana, with particular attention for food security and water. It also sheds light on the policies, priorities and commitments of the government in responding to climate change and important climate-relevant activities that are being implemented, including activities being internationally financed.

## Summary

Climate change in Ghana is projected to affect its 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 droughts<sup>1</sup>. 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

For GHG emissions, Ghana ranks 151 of 188 countries for per capital emissions<sup>2</sup>, contributing only 0.07% of global emissions<sup>3</sup>. However, Ghana is highly vulnerable to global climate change. Ghana ranks 101 out of 181 countries in the ND-GAIN index<sup>4</sup> (2016) for climate vulnerability. Ghana is

the 68<sup>th</sup> most vulnerable country and the 85<sup>th</sup> least ready country— meaning that it is vulnerable to, and moderately ready to combat climate change effects. *Vulnerability* measures the country's exposure, sensitivity, and ability to cope with the negative effects of climate change by considering vulnerability in six life-supporting sectors: food, water, ecosystem service, health, human habitat and infrastructure. *Readiness* measures a country's ability to leverage investments and convert them to adaptation actions by considering economic, governance and social readiness.

## Biophysical vulnerability

*Current climate.* Ghana has different ecological and climatic **zones** (see [Map 1](#)), 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 tip<sup>5</sup>. 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 that blow from the Sahara Desert)<sup>6</sup>;
- 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)<sup>7</sup>.

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)<sup>8</sup>.

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 season<sup>9</sup>. At the same time, the long dry season in the north has led to serious droughts in the region.

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

<sup>2</sup> <https://en.actualitix.com/country/wld/co2-emissions-per-capita.php> analysis of World Bank data (2011 dataset)

<sup>3</sup> WRI (2017) <http://caitz.wri.org/>

<sup>4</sup> 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>

<sup>5</sup> 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/r178cho6.pdf>

<sup>6</sup> 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](http://www.geog.ox.ac.uk/research/climate/projects/undp-cp/UNDP_reports/Ghana/Ghana.hires.report.pdf)

<sup>7</sup> Climate Service Center (2015): *Climate Fact Sheet Benin-Ghana-Togo*. [http://www.climate-service-center.de/products\\_and\\_publications/fact\\_sheets/climate\\_fact\\_sheets/index.php.en](http://www.climate-service-center.de/products_and_publications/fact_sheets/climate_fact_sheets/index.php.en)

<sup>8</sup> McSweeney et al. (2008)

<sup>9</sup> Nutsukpo et al. (2012)

*Current trends.* Over the last 30 years, a slight increase of total annual **precipitation** was observed<sup>10</sup>. Ghanaian farmers have identified erratic rainfall patterns, longer periods of Harmattan (hot desert winds) and desertification as the main current effects of climate change<sup>11</sup>. In the eastern Volta Basin, prolonged dry seasons have replaced shorter dry spells<sup>12</sup>. 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 years<sup>13</sup> 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'<sup>14</sup> 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)<sup>15</sup>.

The north of the country has repeatedly experienced incidences of **droughts and floods**<sup>16</sup>. The 2007 floods in the northern part of the country, immediately following a period of drought, affected more than 325,000 people<sup>17</sup>. In 2015, days of torrential rain around Accra resulted in widespread flooding and left 159 dead<sup>18</sup>.

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 although a national decrease of 4% by 2040 is a commonly cited projection<sup>19</sup>. Some models predict an initial increase of

rainfall in some regions, followed by a decrease of rainfall in most regions over the longer term<sup>20</sup> (see [Map 2](#)). Projections in seasonal differences are a bit more convergent: in general, rainfall increases are predicted for July – December, and decreases for March – June<sup>21</sup>. For the northern regions, this suggests that the start of the wet season may be delayed and the growing season may shorten.

The temperature is expected to increase further, for the end of the century a warming ranging between 1.4 to 4.2 °C is likely<sup>22</sup>. The increase is expected to be most severe in the north of the country (see [Map 3](#)). 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 – September<sup>23</sup>.

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 increase<sup>24</sup>. This combination may intensify seasonal and inter-annual variation – with drought in one year and floods in the next<sup>25</sup>, or even droughts and floods within the same season<sup>26</sup>. Another projected effect of climate change is a rising sea level. Ghana's coastal regions, including its largest city, Accra, are expected to face a sea level rise of 13-45 cm in 100 years<sup>27</sup> and are especially vulnerable to flooding and waterborne disease<sup>28</sup>.

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 – August<sup>29</sup> due to an ongoing decline in productivity of subsistence food crops<sup>30</sup>. Food insecurity is largest in the Upper East (6-7 months for all crops), followed by the Upper West and the Northern Region

<sup>10</sup> Climate Service Center (2015)

<sup>11</sup> 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>

<sup>12</sup> 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/gssppn3.pdf>

<sup>13</sup> Climate Service Center (2015)

<sup>14</sup> 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%.

<sup>15</sup> McSweeney et al. (2008)

<sup>16</sup> 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.aessweb.com/pdf-files/1%20\(3\)%2080-95.pdf](http://www.aessweb.com/pdf-files/1%20(3)%2080-95.pdf)

<sup>17</sup> GFDRR (2013): *Country Program Update: Ghana*. [http://www.gfdrr.org/sites/gfdrr.org/files/Ghana\\_Country\\_Program\\_Updates\\_2013.pdf](http://www.gfdrr.org/sites/gfdrr.org/files/Ghana_Country_Program_Updates_2013.pdf)

<sup>18</sup> Flood list (2016): Ghana-Accra floods again. Available via <http://floodlist.com/ghana/ghana-accra-floods-june-2016>

<sup>19</sup> USAID (2017). Climate Change Risk Profile: Ghana. <https://www.climatelinks.org/resources/climate-change-risk-profile-ghana>

<sup>20</sup> Läderach, P.; Eitzinger, A.; Martinez, A.; Castro, N. (2011): *Predicting the Impact of Climate Change on the Cocoa-Growing Regions in Ghana and Cote d'Ivoire*. CCAFS and CIAT. [http://www.eenews.net/assets/2011/10/03/document\\_cw\\_01.pdf](http://www.eenews.net/assets/2011/10/03/document_cw_01.pdf)

<sup>21</sup> Climate Service Center (2015); McSweeney et al. (2008)

<sup>22</sup> Climate Service Center (2015); De Pinto et al. (2012); Nutsukpo et al. (2012)

<sup>23</sup> McSweeney et al. (2008)

<sup>24</sup> Climate Service Center (2015); McSweeney et al. (2008)

<sup>25</sup> De Pinto et al. (2012)

<sup>26</sup> Akudugu and Alhassan (2012)

<sup>27</sup> Climate Service Center (2015); McSweeney et al. (2008)

<sup>28</sup> 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](http://apps.who.int/iris/bitstream/10665/208862/1/WHO_FWC_PHE_EPE_15.08_eng.pdf?ua=1)

<sup>29</sup> Akudugu and Alhassan (2012)

<sup>30</sup> 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>

(depending on the crop, on average 5 months)<sup>31</sup>. 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 2050<sup>32</sup>), flooding 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)<sup>33</sup>;
- increased crop loss/failure and reduced yields, particularly for cassava;
- desertification and loss of arable land for agricultural production;
- outbreaks of crop/livestock pests/diseases due to high temperatures and/or standing water;
- loss of productive lands due to ecosystem deterioration;
- reduced freshwater water stocks due to reduced river flows;
- post-harvest losses due to difficulties in crop preservation as a result of erratic/heavy rainfall<sup>34</sup>;
- salinization effects on crops due to sea erosion and tidal flooding in the coastal region<sup>35</sup>.

## Socio-economic vulnerability

### Key facts:

GDP (PPP) per capita (2016) <sup>36</sup> :	USD 4,293.6
Population (July 2017) <sup>37</sup> :	28,833,629
Projected population (2050) <sup>38</sup> :	51,270,000
Population density per km <sup>2</sup> (2016) <sup>39</sup> :	124
Human Development Index (2016) <sup>40</sup> :	139 out of 188 countries
Corruption Perceptions Index (2016) <sup>41</sup> :	70 out of 176 countries

<sup>31</sup> Ministry of Food and Agriculture Ghana (2006): *Food Security Situation in Ghana*. <https://mofafoodsecurity.wordpress.com/food-security-situation-in-ghana/>

<sup>32</sup> 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](https://www.iisd.org/pdf/2011/West_Africa_Adaptation_Action.pdf)

<sup>33</sup> MEST (2000), in De Vit, C.; Parry, J.O. (2011)

<sup>34</sup> Akudugu and Alhassan (2012); De Pinto et al. (2012)

<sup>35</sup> 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>

<sup>36</sup> World Bank Data – GDP per capita, PPP. <http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD>

<sup>37</sup> World Population Review – Ghana <http://worldpopulationreview.com/countries/ghana-population/>

<sup>38</sup> UNDESA (2017): *World Population Prospects: The 2017 Revision, Key Findings and Advance Tables*. Working Paper No. ESA/P/WP/248. [https://esa.un.org/unpd/wpp/Publications/Files/WPP2017\\_KeyFindings.pdf](https://esa.un.org/unpd/wpp/Publications/Files/WPP2017_KeyFindings.pdf)

<sup>39</sup> World Bank Data (2017) – Population density. <https://data.worldbank.org/indicator/EN.POP.DNST>

<sup>40</sup> UNDP (2017) Human Development Report 2016: Human Development for Everyone. Table 1. <http://hdr.undp.org/en/content/human-development-index-hdi>

<sup>41</sup> Transparency International (2017) Corruption Perceptions Index [https://www.transparency.org/whatwedo/publication/corruption\\_perceptions\\_index\\_2016](https://www.transparency.org/whatwedo/publication/corruption_perceptions_index_2016)

Gender Inequality Index (2016)<sup>42</sup>: 131 out of 188 countries

Adult literacy (2015)<sup>43</sup>: 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 (especially 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 systems<sup>44</sup>.

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 requirements<sup>45</sup>. Since Ghanaian agriculture is predominantly rain-fed (with only 4% of its irrigation potential developed)<sup>46</sup>, particularly in the semi-arid north<sup>47</sup>, it is 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 erosion<sup>48</sup>), but also because of general poverty and limited access to alternative livelihoods. In the northern regional total crop failure is expected to occur approximately once every 5 years due to delayed or diminished rains<sup>49</sup>.

Ghana's main staple crops are, in order of amount produced and consumed: cassava, yam, plantain, maize, and rice<sup>50</sup>.

<sup>42</sup> UNDP (2017) Human Development Report 2016. Table 5. <http://hdr.undp.org/en/content/human-development-index-hdi>

<sup>43</sup> CIA (2015). The World Fact book, Ghana. Available via <https://www.cia.gov/library/publications/the-world-factbook/geos/gh.html>

<sup>44</sup> Agyeman-Bonsu, W. (no date): *Women's Livelihoods and Vulnerability to Climate Change*. Netherlands Climate Assistance Programme : Ghana. <http://www.nlcap.net/fileadmin/NCAP/Countries/Ghana/032135.0403xx.GHA.CON-01.Output9.v1.pdf>

<sup>45</sup> CIA (2015). The World Fact book, Ghana. Available via <https://www.cia.gov/library/publications/the-world-factbook/geos/gh.html>

<sup>46</sup> Nutsukpo et al. (2012)

<sup>47</sup> De Pinto et al. (2012)

<sup>48</sup> GFDRL (2009): *Ghana*. <https://www.gfdrr.org/sites/gfdrr/files/region/GH.pdf>

<sup>49</sup> USAID (2017)

<sup>50</sup> Nutsukpo et al. (2012)

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)<sup>51</sup>.

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 2080<sup>52</sup>.
- 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<sup>53 54</sup>.
- Maize yields will decrease by about 15% by 2050 in all regions. Some models however predict a yield increase for the north of the country<sup>55</sup>.
- 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 estimated<sup>56</sup>.
- Cocoa, a major cash crop and Ghana's second leading foreign exchange earner, is highly sensitive to rising temperatures and drought. Areas suitable for cocoa production will contract by 2030 as temperature rise, floods increase, and soil salinization and coastal erosion occur. It is also vulnerable to pests and diseases that may be triggered by increasing temperature and humidity<sup>57 58</sup> (see [Map 4](#))<sup>59</sup>.

An analysis 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 cultivation<sup>60</sup> (see [Map 5](#)).

Access to water resources will also decline. About half of the water used in Ghana originates from three international rivers (Volta, Bia and Tano) which flow from outside its borders. A recent study projected flows in the Volta Basin could fall by 24% by 2050 and 45% by 2100 due to reduced rainfall and increased evaporation (from increased temperature)<sup>61</sup>. Transboundary climate-related conflicts are likely to increase, e.g. current tensions with Burkina Faso over its decision to withdraw water from the Volta which would reduce the water levels required for hydropower generation in Ghana<sup>62</sup>. Other conflicts/tensions include the movement of Fulani herdsmen and their cattle from the dry Sahel region into farming communities in southern Ghana<sup>63</sup>, water allocation disputes between the north and south of the country, and tensions arising from economic dependence on climate change-susceptible crops such as cocoa<sup>64</sup>. 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 quality<sup>65</sup>.

In 2013, the Ministry of Environment, Science, Technology and Innovation (MESTI) and the National Climate Change Committee (NCCC)<sup>66</sup> formulated both Ghana's National Climate Change Policy (NCCP) and the National Environment Policy (NEP) to provide strategic directions and co-ordinate issues of climate change in Ghana, as well as to help the

<sup>51</sup> WFP (2009): *Comprehensive Food Security & Vulnerability Analysis Ghana*. <http://documents.wfp.org/stellent/groups/public/documents/ena/wfp201820.pdf>

<sup>52</sup> Sagoe, R. (2006): *Climate Change and Root Crop Production in Ghana*. EPA. [http://www.nicap.net/fileadmin/NCAP/Countries/Ghana/ROOT\\_TUBERS\\_DRAFT\\_FINAL\\_REPORT.pdf](http://www.nicap.net/fileadmin/NCAP/Countries/Ghana/ROOT_TUBERS_DRAFT_FINAL_REPORT.pdf)

<sup>53</sup> Sagoe (2006)

<sup>54</sup> 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>

<sup>55</sup> 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 <https://www.africaportal.org/documents/12924/gpj-v5-n4.pdf>

<sup>56</sup> De Pinto et al. (2012)

<sup>57</sup> Yaro (2013)

<sup>58</sup> USAID (2017)

<sup>59</sup> World Bank Climate Change Knowledge Portal: Ghana Dashboard (2017) [http://sdwebx.worldbank.org/climateportalb/home.cfm?page=country\\_profile&CCode=GHA&ThisTab=ImpactsVulnerabilities](http://sdwebx.worldbank.org/climateportalb/home.cfm?page=country_profile&CCode=GHA&ThisTab=ImpactsVulnerabilities)

<sup>60</sup> Läderach et al. (2011)

<sup>61</sup> USAID (2017)

<sup>62</sup> USAID (2017)

<sup>63</sup> Antwi (2013); Akudugu and Alhassan (2012)

<sup>64</sup> De Pinto et al. (2012)

<sup>65</sup> 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](http://www.undp-alm.org/sites/default/files/downloads/ghana_national_climate_change_adaptation_strategy_nccas.pdf)

<sup>66</sup> 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*.

country achieve sustainable development through equitable, low carbon economic growth<sup>67</sup>. 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 projects<sup>68</sup>.

The Mid-Term National Development Policy Framework (2010-2013) proposed 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-making<sup>69</sup>. The Economic and Social Development Policy (CPESDP) (2014-2020) has been completed and is in the process of being submitted to Parliament.

Ghana launched its National Climate Change Master Plan (2015-2020) containing action programmes for implementation. 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.

The action programmes of the master plan include details on initiatives and corresponding budget estimates, to achieve each policy focus area's objectives<sup>70</sup>.

Ghana ratified the UN Convention on Biological Diversity (CBD) for which it elaborated a Biological Diversity National Strategy and Plan of Action<sup>71</sup>, the Convention to Combat Desertification (CCD) for which it elaborated a National Plan of Action to Combat Desertification<sup>72</sup>, 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 Accord<sup>73</sup>. It signed the Paris Agreement on climate change in April 2016 and ratified the agreement in September 2016 with it entering into force in November 2016 (see Nationally Determined Contributions below).

Ghana submitted its First National Communication on climate change in 2000 to the UNFCCC, its Second National Communication (SNC) and Greenhouse Gas (GHG) Inventory report in 2011<sup>74</sup>, and its Third National Communication and Greenhouse Gas (GHG) Inventory Report in 2015<sup>75</sup>. Ghana's First National Communication on climate change prioritized water, agriculture and coastal zone management; the Second National Communication specified projects to be implemented in the field of energy adaptation, water resources management, and agricultural diversification (adaptation), as well as climate-smart agroforestry, capacity development for GHG emission modelling and climate mitigation assessment (mitigation)<sup>76</sup>. The Third National Communication (2015) put forward actions to lower

<sup>67</sup> Government of Ghana (2014): <http://www.ghana.gov.gh/index.php/media-center/news/882-president-mahama-launches-two-national-policy-documents?highlight=WyjibGltYXRlliwY2hhbmdlliwY2xpbWFoZSBjaGFuZ2UjXQ>

<sup>68</sup> European External Action Service (EEAS) (2014): [http://eeas.europa.eu/delegations/ghana/press\\_corner/all\\_news/news/2014/20140722\\_en.htm](http://eeas.europa.eu/delegations/ghana/press_corner/all_news/news/2014/20140722_en.htm)

<sup>69</sup> Government of Ghana, Medium Term National Development Policy Framework. Ghana Shared Growth and Development Agenda (GSGDA) II, 2014-2017. <http://www.worldcat.org/title/medium-term-national-development-policy-framework-ghana-shared-growth-and-development-agenda-gsgda-ii-2014-2017/oclc/935383727>

<sup>70</sup> [https://www.weadapt.org/sites/weadapt.org/files/ghana\\_national\\_climate\\_change\\_master\\_plan\\_2015\\_2020.pdf](https://www.weadapt.org/sites/weadapt.org/files/ghana_national_climate_change_master_plan_2015_2020.pdf)

<sup>71</sup> Ministry of Environment and Science (2002): *National Biodiversity Strategy for Ghana* <http://www.cbd.int/doc/world/gh/gh-nbsap-01-en.pdf>

<sup>72</sup> Environmental Protection Agency (2002): *National Action Programme to combat drought and desertification* <http://www.unccd.int/ActionProgrammes/ghana-eng2002.pdf>

<sup>73</sup> Cameron, C. (OECD) (2011): *Climate Change Financing and Aid Effectiveness, Ghana case study*. <http://www.oecd.org/dac/environment-development/48458430.pdf>

<sup>74</sup> Ghana Environmental Protection Agency (2011a): *National Greenhouse Gas Inventory Report for 1990-2006*. [http://unfccc.int/resource/docs/natc/nir\\_1990-2006.pdf](http://unfccc.int/resource/docs/natc/nir_1990-2006.pdf)

<sup>75</sup> [http://unfccc.int/national\\_reports/non-annex\\_i\\_natcom/items/10124.php](http://unfccc.int/national_reports/non-annex_i_natcom/items/10124.php)

<sup>76</sup> Ghana Environmental Protection Agency (2011b): *Ghana's Second National Communication to the UNFCCC*. <http://unfccc.int/resource/docs/natc/ghanc2.pdf>

emissions (mitigation) in the energy sector, forestry (reforestation) and landfills with gas collection; adaptation actions are explicitly linked to the actions cited in the National Climate Change Policy and National Adaptation Strategy including climate-resilient agricultural, agricultural diversification, off-farm income; integrated water management and improved livelihoods (targeting the poor)<sup>77</sup>.

## Nationally Determined Contributions (NDC)

Ghana submitted its First Nationally Determined Contributions (NDC) to the UNFCCC in September 2016<sup>78</sup>. The NDC 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 Development Goals (SDGs). In its NDC, 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.

In the 10-year period, implementation would require USD 22.6 billion in investments from domestic and international public and private sources to finance these actions. USD 6.3 billion is expected to be mobilized from domestic sources (unconditional contribution) and USD 16.3 billion will need to come from international support (conditional contribution). Out of the USD 22.6 billion investment, USD 9.81 billion (representing 45 % of the total investment) is needed for mitigation whereas the remaining USD 12.79 billion will be required for adaptation.

*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 if international (external) support is made available to Ghana to cover the full cost of implementing the mitigation action (finance, technology transfer, capacity building). With this external support, a total emission reduction of 45% below the BAU emission levels can be achieved by 2030.

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 to improve energy and resource efficiency and the utilization of low global warming potential refrigerants

*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 has made significant progress in developing a national policy framework, master plan, and NDC that provided detailed guidance to implement actions for its response to climate change. The current budget (e.g. USD 210 million in 2014) is not sufficient and as detailed in the NDC external financing will also be needed. Ghana has been proactive in seeking climate finance from international climate funds and has been successful in being a recipient of a Climate Investment Funds (CIF)/Forest Investment Program grant. Its Investment Plan for the CIF's Scaling Up Renewable Energy in Low Income Countries Program (SREP) was endorsed in May 2015 and is being finalized<sup>79</sup> with program development funding

<sup>77</sup> [http://www4.unfccc.int/ndcregistry/PublishedDocuments/Ghana%20First/GH\\_IND\\_C\\_2392015.pdf](http://www4.unfccc.int/ndcregistry/PublishedDocuments/Ghana%20First/GH_IND_C_2392015.pdf)

<sup>78</sup> [http://www4.unfccc.int/ndcregistry/PublishedDocuments/Ghana%20First/GH\\_IND\\_C\\_2392015.pdf](http://www4.unfccc.int/ndcregistry/PublishedDocuments/Ghana%20First/GH_IND_C_2392015.pdf)

<sup>79</sup> Climate Investment Funds (2015b): [http://www.climateinvestmentfunds.org/cif/Scaling\\_Up\\_Renewable\\_Energy\\_Program\\_in\\_Low\\_Income\\_Countries](http://www.climateinvestmentfunds.org/cif/Scaling_Up_Renewable_Energy_Program_in_Low_Income_Countries)

provided by SREP. For a list of international and multilateral climate projects in Ghana, see the [Annex](#).

Ghana has also established the Ghana Climate Innovation Centre with funding provided by DANIDA and the Netherland in collaboration with InfoDev (a global partnership with the World Bank) to support the growth of Ghana's clean technology businesses by providing financing and business incubation services<sup>80</sup>.

## Climate change projects

Current bilaterally funded projects with a link to water and/or food security include (see next section for Netherlands contribution):

- the 'Comprehensive Africa Agriculture Development Programme' (CAADP) of the New Partnership for Africa's Development (NEPAD) (2003-2025)<sup>81</sup>, of which one of the currently implemented projects is the 'NEPAD/CAADP: Adaptation of agriculture to climate change' (2012-2017), executed by GIZ<sup>82</sup>. Ghana is one of the partner countries;
- Climate Change Adaptation of Agro-ecosystems in Ghana, BMZ, 2012-2017;
- Water, Sanitation and Hygiene in Disaster-Prone Communities in Northern Ghana, CIDA, 2014-2017;
- Coastal Sustainable Landscapes Project, USAID, 2013-2019;
- Sustainable Fisheries Management Project, USAID, 2013-2019;
- Integrated Resource and Resilience Planning, USAID, 2016-2018;
- GIZ is executing several climate relevant programmes in Ghana, some of which also have a more regional focus<sup>83</sup>.

The following regional programs with a focus on food security and/or water are 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<sup>84 85</sup>;
- 'West African Science Service Centre on Climate Change and Adapted Land Use' (WASCAL), a project for the design of resilient land-use systems<sup>86</sup>;

- '2SCALE'<sup>87</sup> 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 agribusiness;
- 'Great Green Wall', financed by the Multi Trust Fund (GEF), SCCF, World Bank, and the AfDB, to address desertification by creating a biological corridor<sup>88</sup>.

## Climate contribution of the Netherlands

The Netherlands supports climate-relevant projects in Ethiopia through a variety of channels and in cooperation with range of actors with a focus on food security, integrated water management, WASH and renewable energy. These include projects that:

- 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;
- contribute 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.
- promote increased access to renewable energy for micro, small and medium-sized enterprises through business development services, technical advice and training; support farmers using solar PV pumps for irrigation; support the introduction of improved institutional stoves for thermal processing of gari (Energising Development).

<sup>80</sup> Ghana Climate Innovation Centre. <http://www.ghanacic.org>

<sup>81</sup> 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>

<sup>82</sup> GIZ (2015a): <https://www.giz.de/en/worldwide/15891.html>

<sup>83</sup> GIZ (2015b): Ghana. [https://www.giz.de/projekt/indext.action?request\\_locale=en\\_EN#?region=3&countries=GH](https://www.giz.de/projekt/indext.action?request_locale=en_EN#?region=3&countries=GH)

<sup>84</sup> START (2014): *Adaptation at Scale in Semi-Arid Regions (ASSAR)*, <http://start.org/programs/assar>

<sup>85</sup> [http://www.assar.uct.ac.za/sites/default/files/image\\_tool/images/138/West\\_africa/ASSAR%20Ghana%20Information%20Brief%20001%20-%20March%202016.pdf](http://www.assar.uct.ac.za/sites/default/files/image_tool/images/138/West_africa/ASSAR%20Ghana%20Information%20Brief%20001%20-%20March%202016.pdf)

<sup>86</sup> WASCAL (2015): *West African Science Service Center on Climate Change and Adapted Land Use*. <https://icg4wascal.icg.kfa-juelich.de/>

<sup>87</sup> 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) <https://ifdc.org/zscale/>

<sup>88</sup> GEF (2015). [https://www.thegef.org/gef/project\\_detail?projID=4511](https://www.thegef.org/gef/project_detail?projID=4511)

# Maps

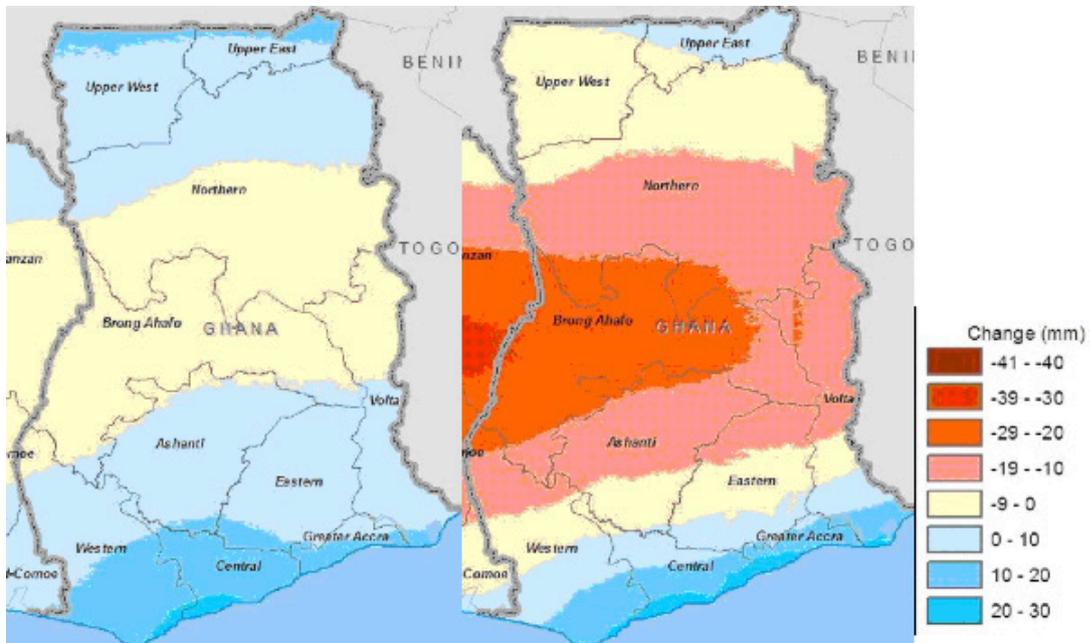
**Map 1** Ghana Ecological Zones



Source: USAID (2017) Climate Change Risk Profile: Ghana.

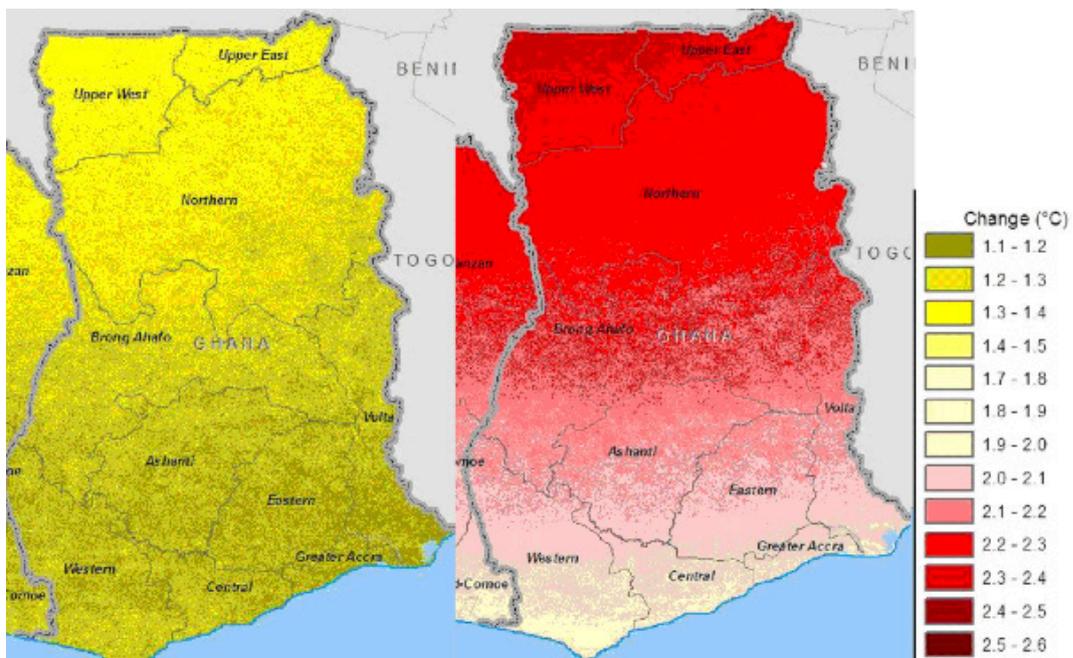
<https://www.climatelinks.org/resources/climate-change-risk-profile-ghana>

**Map 2** Predicted precipitation changes, 2030 (left) and 2050 (right), compared to 2010



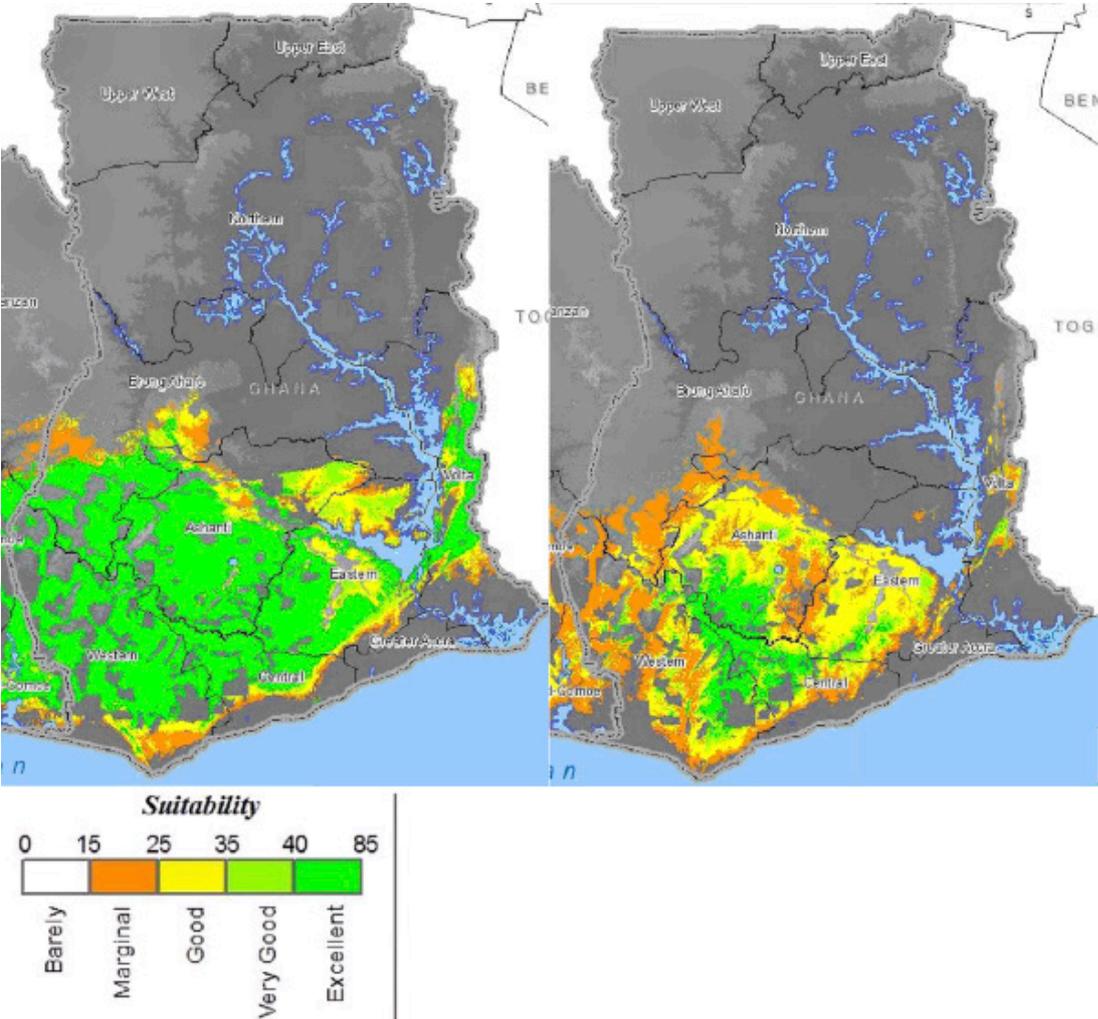
| 12 |

**Map 3** Predicted temperature changes, 2030 (left) and 2050 (right), compared to 2010



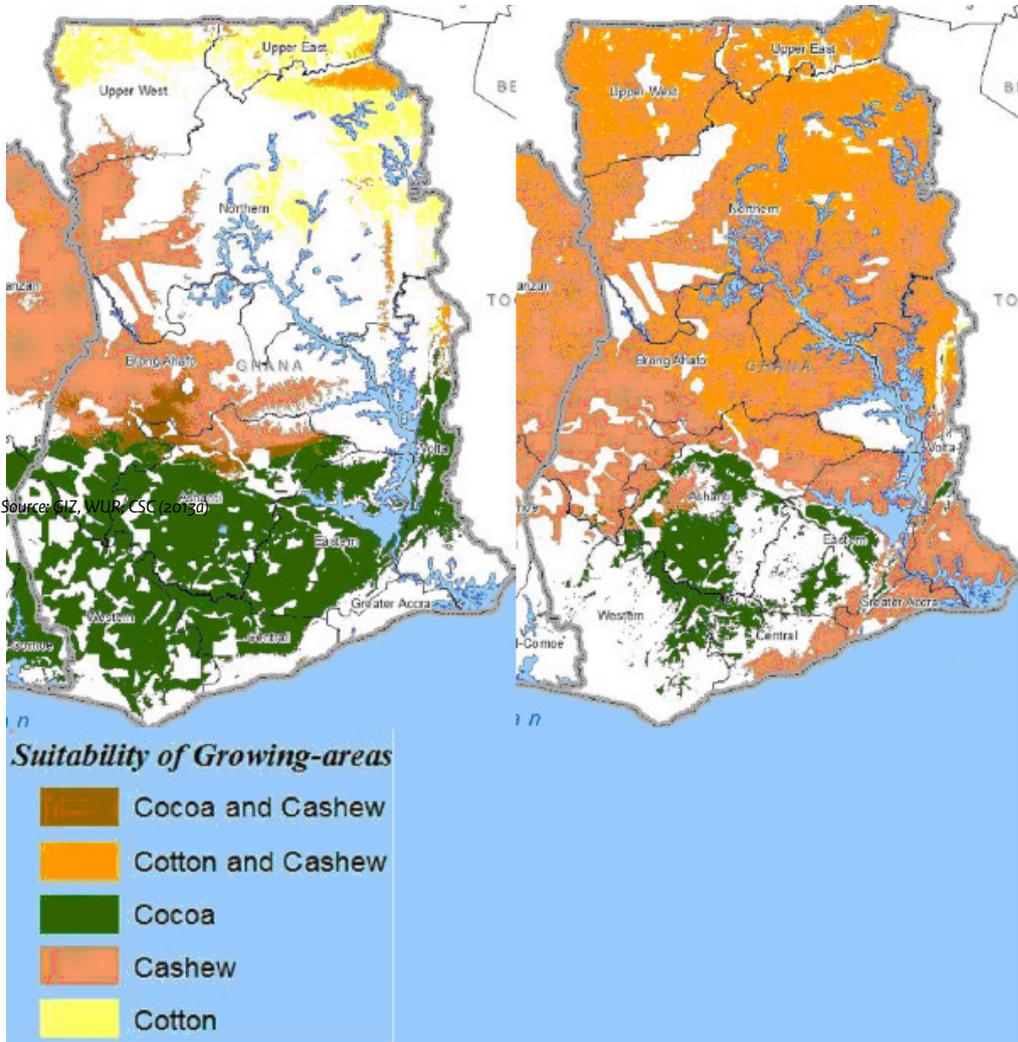
Source: Läderach et al. (2011)

Map 4 Area suitability for cocoa production, current (left) and 2030 (right)



Source: Läderach et al. (2011)

**Map 5** Area suitability for cocoa, cotton and cashew production, current (left) and 2050 (right)



Source: GIZ, WUR, CSC (2013)

Source: Läderach et al. (2011)

## **Annex**

# **List of projects in Ghana under international and multilateral climate funds (since 2012)**

**Main source** Climate Funds Update (2017)<sup>89</sup> and World Bank (2017)<sup>90</sup>

Name of Project	Fund	Amount of Funding Approved (USD millions)	Disbursed (USD millions)	Dates
Increased resilience to climate change in Northern Ghana through the management of water resources and diversification of livelihoods	Adaptation Fund (AF)	8.3	.57	2015-2020
Ghana Agricultural Sector Investment	Adaptation for Smallholder Agriculture Programme (ASAP)	10	0.8	2014
Preparation Grant for Program Planning	Scaling-Up Renewable Energy Program for Low Income Countries (SREP)	1.51		2015
Enhancing Natural Forest and Agroforest landscapes Project	Forest Investment Program (FIP)	30	5.0	2014
Engaging Local Communities in REDD+/ Enhancement of Carbon Stocks	Forest Investment Program (FIP)	10.0	2.95	2013-2018
Reducing Degradation and Deforestation due to Mining in Forest Landscapes	Forest Investment Program (FIP)	10.2		2015
Public-private partnership for the restoration of degraded forest reserve	Forest Investment Program (FIP)	10		2016
Dedicated Grant Mechanisms	Forest Investment Program (FIP)	6.0	6.0	2016
Preparation of Ghana's Initial Biennial Update Report to UNFCCC	Global Environment Facility (GEF5)	0.4	0.4	2013
Enabling Preparation of Ghana's Fourth National Communication and Second Biennial Update Report to UNFCCC	Global Environment Facility (GEF6)	0.85		2016
Ghana Climate Innovation Center <sup>91</sup>	World Bank (contribution by Netherlands and DANIDA)	17.2		2016
Second additional financing for sustainable land and water management project	World Bank	12.8		2016
Sustainable rural water and sanitation additional funding	World Bank	45.7		2017
Sustainable land and water management	World Bank	8.6		2014

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

<sup>90</sup> [http://projects.worldbank.org/search?lang=en&searchTerm=&countrycode\\_exact=GH](http://projects.worldbank.org/search?lang=en&searchTerm=&countrycode_exact=GH)

<sup>91</sup> <http://www.worldbank.org/projects/P145765?lang=en>

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