Ghana's Request for Support to the Global Shield against Climate Risks

(including support by the Global Risk Modelling Alliance)

Submitted by: ***Ministry of Finance, Ghana***

ANNEX

In-Country Coordinator:

Dr Alhassan Iddrisu, Director, Economic Strategy and Research Division

Governmental focal persons:

Foster Gyamfi, Principal Economics Officer

Abena Takyiwaa Asamoah-Okyere, Technical Advisor to the Minister for Finance

ANNEX

Individual proposals from institutions in Ghana for the Request for Support

1) NADMO - Flood Risk Reduction and Sovereign Risk Insurance
2) NIC - Agricultural Insurance Fund (AIF)
3) MOFA - Climate-Smart Agriculture in major Cocoa growing Zones
4) Ghana Hydrological Authority - Enhancing Flood Resilience in Kumasi
5) HATOF Foundation – Coastal Zone Volta Region
6) GMet – Strengthening Forecasts
7) MoF - Addressing the Akosombo Dam Disaster

Proposal for Flood Risk Reduction through Institutional Strengthening, Capacity Building and Sovereign Risk Insurance for Enhanced Climate Change Resilience in Ghana

Background

The National Disaster Management Organization (NADMO) was established by Act 517 of 1996 but now amended to Act 927 (2016) to play the coordinating role in the implementation of Disaster Risk Reduction (DRR) in the context of global DRR frameworks and also advise government on policies toward prevention and management of national disasters and similar emergencies. Ghana has limited resources to invest in disaster risk reduction and minimal fiscal space to fund response and recovery efforts after major disasters. The challenges faced by the country in relation to most disasters are greatly influenced by anthropogenic activities and low appreciation of climate change impact. However, the institutional capacity of some Metropolitan, Municipal, and Districts Assemblies as well as community based organizations such as Disaster Volunteer Groups (DVGs) and similar organizations at the district and community scales are limited. Reasons include inadequate access and interpretation of climate information, low competence to implement climate change adaptation and mitigation measures and poor coordination of climate resilience interventions at community levels.

In readiness towards promoting and coordinating Early Warning System as a climate change adaptation and DRR measures in districts and communities**,** NADMO has planned for number of initiatives to reduce disaster risk in Ghana. Prominent among the planned interventions include Sovereign Risk Insurance, Institutional Strengthening and Capacity Building at the sub-national levels across the country. **Unfortunately, funding limitations have left these planned interventions on the shelves for some time now. For this reason, NADMO is seeking funding from the Global Shield funding assistance through this proposal to enhance the Disaster risk Reduction Efforts of the organization. Most often, per their unique structure and community experience, NADMO relies on first** line responders before, during and emergency situations. This proposal is therefore largely targeted at these first line responders at the regional, districts and community levels. In order to achieve the long term objective of making Subnational Institutions and Communities resilient, it has become necessary to improve the capacity of same in the areas of climate change and DRR information accessibility for increase climate resilience.

Undoubtedly, the envisaged interventions will greatly enhance the community institutional competence base to make inputs into the development of a comprehensive national DRR system. This in turn will contribute to the Nationally Determined Contributions (NDCs) in particular and other national assignments enshrined in the Sendai Framework, United Nations Framework Convention on Climate change (UNFCCC) and SDGs.

2. Needs Assessment

Inadequate knowledge base and capacity to educate appropriately on natural climate related risks (for example, drought and floods) and their impact on livelihoods and socio economic position of Ghana has been the bane of climate risk management in Ghana.

The over dependence of National Disaster Management Organization on limited government subvention has been the key challenge to climate risk reduction efforts at community levels. The organization is therefore unable to leverage on this limited resource to adequately support capacity development of CBOs and other stakeholders in areas of disaster risk reduction including climate risk awareness creation.

The approval of this proposal and subsequent financial support from the Global Shield Finance Initiative will enable NADMO to effectively coordinate and roll out a comprehensive capacity building program, to equip targeted first line responders to promote effective community DRR system in medium to long term.

Main objective

To enhance early warning mechanisms through sovereign risk insurance, institutional strengthening, capacity building and sensitization on the risk insurance and awareness creation interventions to promote disaster risk reduction for increased community resilience against extreme weather events such as floods and drought.

Specific objectives

- To continue the African Risk Capacity process for drought risk insurance for smallholder farmers in the northern regions of Ghana
- To continue the tripartite risk insurance project involving UNDP, Alliance and….. to buy flood risk insurance for the Greater Accra Metropolitan Area
- Create Climate Change Desks at all district offices and train focal persons at the district to lead climate change activities at the local level
- Build the capacities of the districts to develop and review contingency plans
- To organize and train first line responders for effective implementation of climate risk reduction activities including simulation exercises to text existing early warning systems.
- To create and maintain stakeholder platforms for information and knowledge sharing on best practices towards disaster risk reduction
- To equip subnational institutions to enhance disaster risk reduction measures in jurisdictional communities.

Components and Expected Results

For the purposes of easy implementation, the project will be divided into four (4) components as follows;

Component 1

Sovereign Risk Insurance

Expected result

Flood and drought risk insurance bought for the Greater Accra Metropolitan Area and Smallholder farmers in the northern regions

Component 2

Capacity building

Expected result

Flood contingency plans in place at the districts and improved knowledge and skills of subnational institutions and first line responders for successful implementation of DRR measures.

Component 3

Awareness creation

Expected result

School clubs, Gender based groups and communities sensitized on sovereign risk insurance, climate change and DRR.

Component 4

Institutional Strengthening

Expected result

Climate change desk created in all districts offices, focal persons trained and offices equipped with laptops and desktops

Justification

At a third conference in Sendai in Japan on the 18th of March, 2015, the Sendai Framework for Disaster Risk Reduction was adopted to succeed the Hyogo Framework for Action (HFA) which had focused on building the resilience of nations and communities to disasters supported by the UN. The Sendai Framework by extension serves as continuity policy guidelines to primarily ensure that progress made by countries and stakeholders under the HFA are not eroded. Rather, the Sendai Framework introduced quite a number of innovations through consensus building to significantly place emphasis on disaster risk management as opposed to disaster management. In simple terms, implementation of the HFA identified some gaps in addressing disaster risk factors hence there was the need to formulate policy actions to guide countries and relevant stakeholders to implement disaster risks efforts in a complimentary manner to improve resilience.

Significantly therefore, the Sendai framework and other global conventions such as the Paris Agreement and UNFCCC have provided policy platforms on which nations like Ghana can tackle disaster risk drivers to reduce disaster risk in a coherent manner throughout intergovernmental process regarding institutional policies, goals, monitoring and evaluation mechanisms whilst maintaining respective mandates. In this regard, there is need for governmental institutions and relevant stakeholders working to achieve disaster risk reduction in Ghana to focus on information sharing to understand disaster risk and its governance and ensuring coordination across in-country institutions and sectors as enjoined by the Sendai Framework.

More so, advances in climate modeling have provided scenarios of future impacts which are underpinning adaptation efforts aimed at reducing natural disasters and climate change

vulnerability (IPCC, 2014). In 2013 and 2014 for instance, Ghana launched the National Climate Change Policy and National Climate Change Policy Action Plan respectively to provide framework for dealing with climate change and natural stresses. Lessons drawn from Ghana's context so far clearly indicate that in spite of the efforts, it is quite unlikely that extra gasses in the atmosphere would be cleaned through mitigation measures and also natural disasters stopped. Hence, there is the need for institutional strengthening at all governance scales in the country in readiness towards promoting DRR.

Implementation Arrangement

The National Disaster Management Organization will implement the project through its Climate Change Department. The financial disbursement and other logistical arrangements will be done according to existing structures of the organization. In areas where expertise are lacking, consultants will be hired through tender process and in accordance with in-country procurement regulations.

With regards to training, the methodology will be to cluster trainees at a convenient venue at the various regional capitals and district capitals where applicable. For accounting purposes, NADMO will use its internal control, monitoring and evaluation systems to ensure that the project is delivered efficiently.

It is expected that disbursement of projects funds will be used to implement many of the activities outlined in the work plan of the project to allow for trained staff to go back to their operational districts to promote DRR.

As is already part of the implementation policy of NADMO, gender considerations will be mainstreamed throughout the implementation of the project.

Logical Framework

OUTCOMES	BASELINE	TARGET	ACTIVITIES
1. Project awareness among Stakeholders and efforts harmonised	*Efforts of stakeholders in combating climate change issues and DRR often are not known or coordinated leading to duplication of interventions*	*All relevant stakeholders are well informed about the Global Shield Initiative assistance for Ghana*	***1.1.1: Project inception workshop*** *To ensure that adequate information is given to all relevant stakeholders including MMDAs, MDAs and Development Partners, project inception workshops will be organised at all administrative levels to provide stakeholders with the opportunity to make inputs into the project implementation and as well enhance coordination.* ***Deliverable:*** *Workshop reports, participants list and media news bulletins.* ***Completed:*** *This is expected to be completed within 1 day*
1. Flood and drought risk insurance bought for the Greater Accra Metropolitan Area and Smallholder farmers in the northern regions	*Risk transfer has become necessary as a result of NADMO's financial constraints and increase in extreme weather events*	ARC and Flood Insurance	*1.1. Develop and review contingency plans* *1.2. Create community awareness* *1.3. Solicit support for premium payment* ***1.1.*** *Undertake a study tour to learn from countries that have bought sovereign risk insurance*
2.0. Flood contingency plans in place at the districts and improved knowledge and skills of subnational institutions and first line responders for successful implementation of DRR measures	*Contingency plans are not in place or needs to be reviewed*	*Districts offices*	*2.1. Conduct needs assessment* *2.2. Train district staff* *2.3. Build capacity to develop or contingency plans* *2.4. Conduct simulation exercises to test contingency plans*
2.0. Knowledge and skills of NADMO and Stakeholders' staff and Disaster Voluntary Groups (DVGs) upgraded			

2.1. Knowledge gaps and skills on climate change and DRR identified	*Knowledge and skills of about 80% of front line staff of NADMO, stakeholder institutions and CBOs on climate change and DRR concepts are limited*	*About 200 frontline staff and NADMO, Collaborators and DVGs have their knowledge and skills on climate change and DRR upgraded*	***2.1.2. Conduct training needs assessment*** *Though there is some knowledge on the trainings gaps that exist, there will be detailed assessment of the needs of selected frontline staff and DVGs to provide bases for the development of training contents. The needs assessment will be done at both national and sub-national levels. In the selection of trainees, recognition will be given to the needs of women, men and persons with special needs.* ***Deliverables:*** *Training needs assessment reports.* ***Completed****: Within 5 days.*
2.2. Knowledge and skill gaps of NADMO, DVGs and CBOs addressed allowing frontline staff and volunteers deliver professionally	*Knowledge and skill of frontline staff, DVGs and CBOs in climate change and DRR limited*	*About 200 trainees are being targeted for the training program*	***2.2.2. Organised training programs for selected NADMO staff, DVGs and CBOs*** *Experts from both within NADMO and Outside will be engaged to train and equip trainees with knowledge and skills in basic concepts of climate change adaptation and mitigation concepts as well as DRR to ensure that trainees are better placed to promote effective measures. The training program will not only be limited to the concepts mentioned here but also other concepts that may be necessary depending on the knowledge gaps that will be identified. In terms of methodology, the training will be clustered according administrative scales.* ***Deliverable:*** *Training and simulation reports.* ***Completed****: 10 days*
2.4 Knowledge and skills acquired by trainees pre-tested in selected communities	*Often knowledge is not tested after training programs*	*Trainees will be divided into teams and shared among selected communities across the country for pre-testing*	***2.2.4 Pre-testing*** *As part of the training package, knowledge and skills will be pre-tested after impartation in selected communities to test the understanding of the concepts delivered at the training program. This will afford the project implementation team and the trainers opportunity to assess the trainees to provide further training support if need be.* ***Deliverable:*** *Pre-testing reports.* ***Completed****: 3 days*
3.0. Functional structures of NADMO at all administrative levels			

3.1 Functional climate change and DRR units at all sub-national levels for effective management of climate change and DRR	*All sub-national level secretariats lack climate change and DRR units*	*Climate change and DRR units created at all 10 regional and 216 district secretariats*	***3.1.1Create Climate Change Units at all Administrative levels*** *NADMO has created Climate Change and Disaster Risk Reduction Department at the National level since 2009. Unfortunately, however, the sub-national levels lack units designated for climate change and DRR. What this means is that expertise in climate change and DRR is concentrated only at the headquarters. Creation of the climate change units at sub-national levels will therefore help to decentralise competencies necessary for raising awareness on need for adopting climate saving activities and also promoting green initiatives at the community level* ***Deliverable:*** *Climate change units created and documented.* ***Completed****: 5 days*
3.0. Communities sensitised on issues of climate change and need for Disaster Risk Reduction (DRR)			
3.1 *School clubs, Gender based groups and DVGs formed or reactivated and raising awareness on climate change and DRR and also promoting green initiatives*	*Some communities do not have the existence of the DVGs and the school clubs and where they exist they are simply dormant*	*Communities where the existence of DVGs or School Clubs are lacking or have become inactive*	***3.1.1 Formation/Reactivation of School Clubs and DVGs*** *The formation and reactivation of DVGs and School Clubs are very critical to the success of raising awareness on climate change and DRR in the sense that these groups compliment the efforts of NADMO staff to educate the public on the need for disaster risk reduction efforts by all. Over the years, community based organisation like the DVGs are played pivotal roles in combating and preventing disaster at the community level, hence the readiness project will make the CBOs an integral part of the project implementation and also to ensure sustainability* ***Deliverable:*** *Formation and reactivation reports.* ***Completed****: 5 days*
3.2 Awareness creation materials and messages on climate change and DRR produced	*Available campaign materials and messages not specific on climate change and DRR*	*Produce 226,000 education materials*	***3.1.2 Produce awareness materials and messages*** *Considering the literacy levels of the target audience and beneficiaries, simple awareness creati videos and documentary. The project is targeting a mixture of 226 campaign materials and mes district secretariat* ***Deliverable:*** *Available campaign materials.* ***Completed****: 10 days*
4. Institutional Strengthening			
4.1Sub-national secretariats logistically equipped and	*Currently, the sub-national secretariats are poorly resourced and*	2 selected districts	***4.1.1 Logistics and furnishing*** *To ensure functional structures at the sub-national level to serve as frontlines in the implementation of the project, there is need for resourcing decentralized offices in terms of*

furnished to facilitate implementation	*live on the benevolence of the District Assemblies who themselves are facing logistical challenges*		*equipment, furniture and transport. Currently, the sub-national level secretariats are poorly resourced making them ineffective. This readiness project will therefore provide basic office equipment such as Laptops/ Desktop computers, internet, stationery and files. In addition, where furniture is lacking, those offices will be furnished since they will be serving as the project offices at the district levels. To facilitate regular movement to the communities, basic means of transport including motor bikes and bicycles will be procured.* ***Deliverable:*** *Climate change units created and documented.* ***Completed****:1 week*

Implementation Schedule

Activity	Year		
	1	**2**	**3**
1. Project inception workshop			
2. Sovereign risk insurance: Solicit support for premium payment			
3. Undertake a study tour to learn from countries that have bought sovereign risk insurance			
4. *Conduct training needs assessment*			
5. Organize training programs for selected NADMO staff, DVGs and CBOs			
6. *Pre-testing*			
7. *Create Climate Change Units at all Administrative levels*			
8. *Formation/Reactivation of School Clubs and DVGs*			
9. *Produce awareness materials and messages*			
10. Logistics and furnishing (Laptops and desktops)			

NATIONAL INSURANCE COMMISSION

Concept Note: Agricultural Insurance Fund (AIF) Funding Proposal

Introduction

The Agricultural Insurance Fund (AIF) in Ghana, established under the Insurance Act, 2021 (Act 1061), is a critical initiative aimed at supporting the agricultural sector by subsidizing insurance premiums and enhancing the resilience of farmers against the impacts of climate change and other risks. This concept note outlines the objectives of the AIF, its governance structure, and the need for funding from Global Shield to fulfill its mission. The AIF seeks financial support to subsidize agricultural premiums and acquire technical assistance for data analytics.

Background

The National Insurance Commission (NIC) of Ghana, mandated to regulate the insurance industry, including agricultural insurance, established the AIF to address the specific challenges faced by the agricultural sector. The AIF operates independently, with a dedicated committee nominated from various stakeholders responsible for its governance and financial management.

Objectives of the AIF

The AIF has been set up with the following objectives:

1. **Subsidize Agriculture Insurance Premiums:**

   To make agricultural insurance more affordable for farmers, ensuring they have access to vital protection against risks and provide leverage for access to credit.

   Agriculture is highly susceptible to several hazards, such as natural disasters, pests, diseases, and market fluctuations. Subsidies are vital to maintaining the healthy agricultural economy of Ghana where 68% of the population are involve in the agricultural value chain. Agricultural insurance helps producers mitigate these risks by providing financial protection against unforeseen events. Subsidies make insurance more accessible for

farmers, encouraging them to acquire protection and effectively manage their risks. When a natural disaster or other unfavourable event occurs, farmers can incur significant financial losses. Subsidised agricultural insurance allows farmers to recover a portion of their losses, allowing them to maintain their financial stability and continue cultivating. One of the key components of AIF will be to provide premium subsidies to farmers cultivating major crops and broiler farmers under the government's flagship project 'Planting for Food and Jobs Phase II' (PFJ 2.0) to begin with. Subsequently, it will be extended to other crops.

Specifically, the premium subsidy is expected to support the following:

a) **Risk Mitigation:** By offering insurance coverage for crops and livestock, we can help farmers recover from financial losses incurred due to adverse events beyond their control.
b) **Financial Stability:** Insurance can provide farmers and aggregators with the confidence to invest in modern farming techniques, purchase high-quality inputs, and expand their agricultural activities, thereby contributing to increased productivity.
c) **Inclusivity:** The AIF is designed to accommodate smallholder farmers and large-scale agricultural enterprises alike, ensuring equitable access to risk protection for all participants
d) **Sustainable Agriculture:** By promoting responsible and resilient farming practices, the insurance program will align with the Ministry's long-term vision for sustainable agriculture.

2. **Capacity Building:** To train agricultural extension officers and other stakeholders involved in disseminating information on agricultural insurance to farmers, ensuring widespread awareness and understanding.

This is essential to ensure that farmers comprehend the benefits of insurance, how to access it, and how to make informed risk management decisions. The NIC which also houses Ghana Insurance College will develop customized training for agriculture extension

officers based on an understanding of the needs and context of farmers. This activity will be funded by AIF and will be included in the detailed plan.

3. **Data Acquisition:** To equip relevant agencies with the necessary tools and equipment to generate data required for the development of agricultural insurance products.

   The assessment and quantification of the risks that farmers confront in agriculture, such as weather-related events, pests, diseases, and market fluctuations, requires data. The use of historical meteorological information, crop yield records, and market trends aid insurance companies in accurately assessing potential risks and determining appropriate premiums. Data obtained from weather stations is also very important for this exercise. Ghana Meteorological Agency (GMet), for example, which provides accurate and dependable meteorological information by accumulating, processing, archiving, and disseminating meteorological data is one such institution that will be supported in strengthening its existing infrastructure like weather stations.

4. **Data Capacity Building:** To enhance the capacity of state institutions in providing consistent and reliable data for the development of insurance products.

   Once requisite infrastructure is in place, collection and maintenance of data assumes great importance. The development and maintenance of a robust insurance industry rely heavily on the availability of accurate and current data. State institutions play a crucial role in collecting, analysing, and disseminating this data, which is indispensable for regulatory supervision, market transparency, and informed decision-making. Building the capacity of these institutions to provide consistent and trustworthy data on the evolution of insurance products is a strategic imperative for several reasons. AIF will support these state institutions in the collection and maintenance of reliable data by providing them regular training, developing guidelines etc.

5. **Technology Investment:** To invest in technology for the dissemination of agricultural insurance information to farmers, making it accessible and user-friendly.

Utilising the power of technology is crucial to reaching and empowering farmers with vital information about agricultural insurance in today's swiftly evolving technological landscape. Investing in technology to disseminate information on agricultural insurance to producers has the potential to enhance outreach, enhance comprehension, and ultimately strengthen the agricultural sector's resilience. Digital platforms can offer information in multiple languages and formats, including audio and video. This accommodates farmers with varying levels of literacy and language proficiency, ensuring that no one is left behind in accessing critical information. One of the areas in which AIF will focus is to ensure that farmers are informed and educated about agriculture insurance using technology.

6. **Support for Related Activities:** To support any other activities related to the development of agricultural insurance.

   Sustainable agricultural practices is crucial in managing and reducing climate risk. Agricultural insurance encompasses a vast array of activities, all of which are essential to its development and success and also serve as a valuable support mechanism for sustainable agriculture.

   AIF will support all activities that strengthen the landscape of agricultural insurance, such as product innovation, risk assessment and modelling, market research and analysis, policy framework, monitoring and evaluation, etc.

Governance Structure

The AIF is governed by a committee, as stipulated in Clause 248 of Act 1061, comprising representatives from the Ministry of Finance, Ministry of Agriculture, the NIC, and the insurance industry. This committee ensures effective management, transparency, and accountability. The

Current Status

As of January 2023, the AIF is formally established and operates under the NIC. It has its bank account and will undergo regular audits by the Auditor General to ensure financial transparency. The AIF's operational guidelines and modalities are being developed in collaboration with Policy

Link, Ghana, and other development partners, including the International Labour Organization (ILO) and the United Nations Environment Programme - V20 (UNEP-V20). The AIF is crucial to support Ghana's flagship program, Planting for Food and Jobs Phase II (PFJ-2.0).

Funding Request to Global Shield

The AIF recognizes the significant importance of subsidizing agricultural insurance premiums in achieving national food security, sustainable agriculture, and risk mitigation for farmers against climate change-related challenges. To effectively fulfill its mission, the AIF is seeking funding from Global Shield.

Funding Objectives

1. **Subsidizing Agricultural Premiums:** To provide financial support for farmers, making agricultural insurance affordable and accessible, thereby increasing the uptake of insurance coverage in the agricultural sector.
2. **Technical Support for Data Analytics:** To acquire technical expertise and tools for data analytics to enhance the development of data-driven agricultural insurance products.

Expected Outcomes

- Increased agricultural insurance coverage among Ghanaian farmers.
- Improved data analytics capabilities for more precise risk assessment.
- Enhanced resilience of farmers to climate change impacts.

Budget Summary

The AIF is working on the details of financial proposals in this request to Global Shield to achieve its funding objectives. The budget shall be for:

- Subsidizing Agricultural Premiums; and
- Technical Support for Data Analytics.

Conclusion

The Agricultural Insurance Fund (AIF) is a critical component of Ghana's efforts to promote sustainable agriculture, ensure food security and create jobs, safeguarding the well-being of our farming communities. We believe that support from Global Shield will significantly contribute to achieving these goals, that is: subsidizing agricultural insurance premiums and enhancing data analytics capabilities. This partnership will contribute significantly to the resilience and prosperity of Ghana's agricultural sector and also contribute to global efforts to promote sustainable agriculture.

CONCEPT NOTE

Project Title: Up-scaling Climate-Smart Agriculture innovations to improve livelihoods of Farm Families in the major Cocoa growing Zones of Ghana.

Submitting Institution**: MOFA/CSIR-Ghana CCAFS PLATFORM, Ghana**

Funding Organisation: **Global Shield Initiative**

Project Summary: This projectc is intended to support rural cocoa and food crop farmers in Ghana. It aims to reduce emmissions from energy access and power generation, enhance resielience of most vulnerable people and communities, enhance health and well being and food and water secuirty , infrasstructure and built environment, ecosystems and social services are results areas for the project. As impact, the project is anticipated to yield 19.12 million TCO_2 eq. The Estimated adaptation impact (number of direct beneficiaries and % of population) is expected to be 1.1 Million inhabitants made up of 40% youth, 30% women and 10% PWD's. Indicative total budget is estimated to be USD 36 with estimated duration of 5 years.

Project/Programme rationale, objectives and approach	 Ghana's agriculture is exposed to climate change risks (CSAIP, 2020). Studies reveal that high temperatures and reduced rainfall catalyse desertification, ecosystem deterioration, and losses of arable lands. Agricultural GDP in Ghana is estimated to decline by 0.8% to 2.5% by the year 2050 which poses threats to achieving the Sustainable Development Goals, Africa's Agenda 2063 and the nation's commitment to the 2015 Paris climate agreement. This propose project, seeks to curb these adverse effects and strengthen resilience of cocoa farmers. The proposed project will be implemented by Ministry of Food and Agriculture through the Council for Scientific and Industrial Research (CSIR)-Ghana CCAFS Platform.

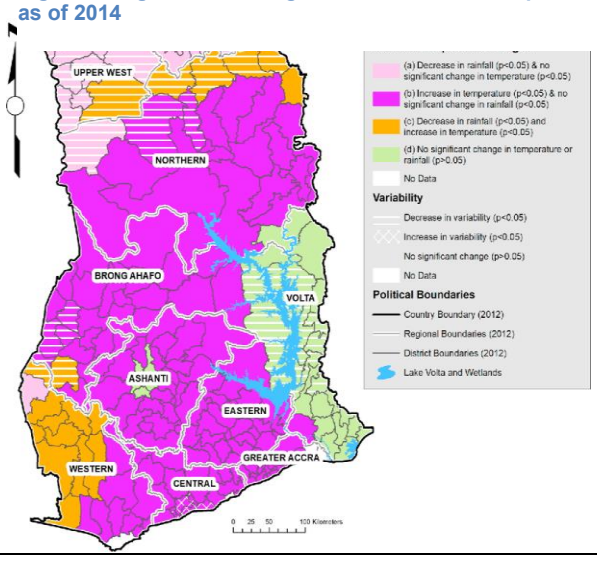
A. Project Information

A.1. Context and baseline

Country and Climate Rationale

Ghana covers a territorial area of approximately 238,540 square kilometres and has a population of about 30.8 million people as of September, 2021 (GSS, 2021). The economy is highly dependent on agriculture activities, employing about 42% of the workforce and contributing about 19.7% of the national gross domestic product (GDP) (World Bank, 2019). It is evident that climate change is impacting the entire globe, particularly on developing countries that are relatively vulnerable. Evidence abounds in Ghana that temperatures in all the ecological zones are rising whereas rainfall levels and patterns are becoming erratic (Agyemang-Bonsu et al., 2008). The national economy stands to suffer from the impacts of climate change because it is dependent on climate sensitive sectors, most especially agriculture. Analysis of long-term climate data shows a general increase in temperature in the country with a steady annual rise of 0.06oC and an overall increase by about 1°C over the past 40 years (World Bank, 2020). The national monthly mean temperature is currently between 25 and 30oC. Projections of future climate show that there will be an increase in temperature for all agro-ecological zones but changes in precipitation will vary considerably both spatially and temporally (World Bank, 2020). Both transitional and guinea savannah agroecological zones have relatively higher temperatures, with up to 200 days each year exceeding 35°C (World Bank, 2020). There has been evidence of significant changes in rainfall and temperature as of 2014 (see Figure 1). Climate change and variability effects threatens food production systems and livelihoods of millions of Ghanaians who depend on agriculture. It is projected that the agricultural GDP will decline from 0.8% to 2.5% due to the impact of climate change by the year 2050 (Ardnt et al., 2015). The agricultural sector is characterized by small-scale rain-fed crop and livestock farming systems with average farm size of less than 1.2 ha. Other agricultural activities that are under threat of climate change impact include fisheries and forestry (Essegbey et al., 2020). Climate vulnerability has significantly contributed to the high poverty levels in the country (Al-Hassan et al., 2018). Smallholders account for about 80% of total agricultural production in Ghana, with crops, livestock, and fisheries all contributing to Ghana's agriculture sector.

Figure 1: Significant Changes in Rainfall and Temperature as of 2014



Climate change provokes extreme and unpredictable events including prolonged droughts, floods, heat waves, and erratic beginnings and ends to the rainy seasons. These are expected to catalyse desertification, ecosystem deterioration, and concomitant losses of arable land and create the conditions for pest and disease outbreaks. Climate change lowers agricultural productivity, with substantial yield gaps, livestock offtake and decrease opportunities for future prosperity. Postharvest losses are not left out due to erratic and unpredictable weather conditions. Fish stocks appear to equally be on the decline (Quansah and Ofori-Danso, 2016).

Ghana's total GHG emissions according to Ghana's Fourth National Communication to the United Nations Framework Convention on Climate Change was estimated to be 42.2 MtCO2e thereby an increase of 7.1% more than the 2012 total emissions. The Agriculture, Forestry and Other Land Use (AFOLU) sector constituted the largest source of GHG emissions in Ghana. It accounted for 54.4% of the overall national emissions of 42.2 MtCO2e (National Climate Change Report, 2020). The land category was the leading emissions source in the AFOLU sector accounting for 46% of the overall AFOLU emissions. Livestock emissions were 3.03 MtCO2e and made up 8% of the total net emissions. The emissions from livestock increased by 18% between 2012 and 2016. The EPA (2019) emphasized that there were more emissions associated with enteric fermentation than manure management which calls for an intervention in livestock feed management. Improved feed with enhance feed conversion ratio which this project seeks to address.

Figure 3: Major agro-ecological zones in Ghana

The transitional agro-ecology zone of Ghana as depicted in figure 2 lies between the tropical forest in the south-west and the guinea savannah agro-ecology in the north. It runs from east to west (5o - 8o North) which clearly matches coordinates of the regional rainfall pattern. The major raining season starts in late March and lasts till mid-July. The season has an excess of 200 rainy days while the minor season has only 60 days (MoFA-SRID, 2018). Of the total land areas of the country, transitional agroecological zone occupies 28%. Agriculture is the main source of revenue of the transitional zone inhabitants. Predominantly, most farmers are smallholders with farm holdings of less than a hectare (2.5 acres). The agrozone has potential for food and cash crops cultivation as well as livestock and poultry production (Egyir et. al., 2014). There are rivers, streams and lakes in the zone, which have potential for aquaculture development. Mean annual temperature in Ghana has increased by 1°C (Agyemang-Bonsu et. al., 2008), representing an average rate of increase by 0.21 degrees Celsius per decade. Projections by the Ghana Meteorological Agency (GMet) show that rainfall will decline by 8.8 percent by 2050 and 14.6 percent by 2080. In the transitional agro-ecology, records show declining rainfall totals, increased variability and changes in land use and land cover. (Essegbey and McCarthy, 2020).

It has been recorded that climate change also create challenges for food security and land use management, water and other natural resources (CARE International, 2017). These challenges are particularly critical for rural communities, where rain-fed agriculture, livestock rearing and fisheries are the primary livelihood strategies. For the vulnerable group, heavy dependence on climate sensitive occupations, less diversified sources of income and limited access to climate change information coupled with the low capacity to adapt contribute to their high vulnerability. Climate change impacts in the zone include erratic rainfall, reduction in crop yield, prolonged drought and shift in cropping season. The main drivers for the project are land and forest degradation due to unsustainable agriculture, and unsustainable charcoal production; poverty and issues of farmer-fulani herdsmen conflicts amidst many climate impacts hotspots in the transitional zone.

The Ghanaian CSA Investment Plan (CSAIP) recommends that national investments should be designed to provide information, capacity building, infrastrucutre and national-level services that enable CSA to be practiced across Ghana of which investment areas that focusses on increasing productivity, building resilience and reductions of greenhouse gas emissions were of significant importance (World Bank, 2020). Assessing Ghana's priority investments, CSAIP recommends that in terms of CSA interventions in the transitional zone of Ghana, attention should focus on livestock and poultry, tree crop diversifications, root and tuber crops, water management and knowledge system and advisory services which have received adequate attention and consideration in the choice of the proposed project. It is necessary to develop a new paradigm for agricultural production in the cocoa producing areas under the conditions of climate variability and change. Thus, the project to strengthen the resilience of rural farmers in Ghana to climate change through the promotion of CSA technologies and associated actions is crucial for Ghana. This proposed project seeks to develop a holistic approach in order to overcome the recurrent problems facing rural poor communities by building their resilience to climate change and provide sustainable solutions against Cocoa farm incomes, food and nutrition insecurities. The project would create jobs, increase incomes and improve livelihoods of the people especially the vulnerable [women, youth, migrant farmers, people living with disabilities (PWD's), restore degraded lands and forest, improve fertility and organic matter content of the soil as well as the microclimate and agricultural biodiversity. Additionally, the project would contribute to national food and nutrition security through the cultivation of fruit trees, food crops, aquaculture and livestock production. The project will also contribute to the efficient energy use and water security in the transitional zone through the application of renewable energy systems smart technologies.

Policy and regulatory context

The sustainability of current agricultural production systems is an issue that needs thorough debate and policy attention. The stability and security of agricultural production systems depend largely on available environmental resources. However, evidence suggests that these resources are being managed and used in ways that may jeopardise their ability to sustain food production in the long term (World Bank, 2019a). This has implications for food security and welfare in general and brings to the fore the need to realise a balance between increased agriculture

productivity on the one hand, and sustainability on the other— "sustainable intensification" (Garnett and Godfray, 2018). As Ghana's population increases, the need to increase food production to meet demand may generate more environmental damage, which will further reduce the capacity of the natural resource base to deliver the level of productivity required. Unless, the issue of sustainable intensification is addressed using a systems approach, the progress being made to achieve the Millennium Development Goal of reducing hunger may not be sustained.

The topical issue of climate variability and change ties in with that of sustainability of productions systems. Climate change is a global issue which has already altered and is expected to continue to significantly alter food production patterns, productivity and yields. These in turn create new challenges for food security and sustainability and management of productive resources such as land and water. Research (for example Nelson et al., 2018) has shown that agriculture and human welfare will be negatively affected by climate change in a number of ways including: decline in staple crop yields (including maize, rice and soybeans) and feed price increases, and decline in calorie availability resulting in malnutrition. Increasing investment in agriculture (including livestock) is one of the important ways of mitigating these effects. As the analysis above shows, Ghana must comply with provisions of the "Petroleum Revenue Management Act" (PRMA) and possibly increase the allocation of petroleum revenue to agricultural investments. Ghana cannot depend on unstable donor assistance to mitigate the effects of climate change. As this change occurs on a global scale, the important issue, aside from mitigation, is how to develop effective ways of adaptation. Climate change adaptation and mitigation issues have been addressed in the Medium Term Agriculture Sector Investment Plan (METASIP III) but there are no clearly defined policies and indicators for monitoring. This has to be addressed so as to enable measurement of progress in this area. As policy seeks to promote smallholder farmer market integration, it must be noted that price fluctuations would likely be a by-product of such efforts. There must, however, be well coordinated efforts to mitigate the effects of food price volatility as this has adverse food security implications. As an important policy option, there is the need to reinvigorate the country's agriculture diversification drive. As the analysis shows, Ghana is still heavily dependent on cocoa for export earnings. Investment is needed in other crops and commodities. There is also very little value addition to Ghana's agricultural exports. This means that forward and backward linkages to other sectors of the economy are missing. It would be a logical policy option to encourage and invest in value addition of current export products. Linking the commodity sector to other sectors of the economy is important as this would help reduce the huge unemployment problem the country is currently facing.

Another policy issue worth considering going forward is that there appears to be a large gap between policy formulators and implementers on the one hand and targeted beneficiaries on the other. Thus, it appears that the "top-down" approach to policy making has not changed much. In such a case, agriculture sector problems may not be well understood from the perspective of the target population. This has to be addressed in order that beneficiaries derive full benefit from agricultural programmes and projects. This is partly or entirely an issue of governance (Annan K, 2017). It is clear that prudent agriculture policy formulation, implementation, monitoring and evaluation are critical to Ghana's economic growth for at least five reasons. First, received wisdom suggests that although not the only way, agriculture is the single most pragmatic channel of poverty reduction; secondly, growth in agriculture has a substantial multiplier effect on overall economic growth; thirdly, it is the surest way for ending hunger and achieving food and nutrition security; fourthly, visionary agriculture policy is critical for avoiding the "Dutch disease" in the wake of the recent oil find; and finally, as raised above, climate variability and change could have a devastating effect on Ghana's agriculture and food security if steps are not taken to mitigate the possibility.

Key Problems of the Agricultural Sector

- ***Poor Financial Support:*** The absence of financing limits the average acreage of cultivated farmlands and adoption of proven technologies and innovations thereby, impedes agricultural growth with consequences for the macro economy as a whole.
- ***Poor transportation and storage facilities:*** Road, transport and storage infrastructure for the movement and storage of agricultural commodities and inputs are inadequate. It leads to loads of post-harvest losses and does not favour the manufacturing industry to use agro-produce as inputs.
- ***Lack of information/data:*** Data is a big influence in decision-making especially in agriculture. The agriculture sector in Ghana has no centralized structured data accessible for all. The lack of reliable information has also affected the market structure of the sector.
- ***Inadequate agriculture extension services:*** The extension officer to farmer ratio stands at 1:706 as compared to FAO standard of 1:500. This means most farmers are not updated with current trends of farming and do not get the timely intervention if there is a pest or disease attack on their farms.
- ***Low mechanization/poor adoption to technology:*** Generally, farmers in Ghana are slow to adopt to new technologies because they are not exposed to it or cannot trust how well it would affect their production.
- ***Land Tenure systems:*** The Ghanaian land tenure system does not foster commercial farming. This is because the land tenure system is not controlled by central government but by chiefs, families and other communal structures that takes one through a frustrating to acquire land. This inhibits people with the aim of doing large-scale farming hence.

B.1. Project

The project is designed to enhance the resilience of agricultural livelihoods of rural households in the major cocoa growing areas while reducing their vulnerability to threats of climate variability and its changes. It will also contribute to the sector's GHG mitigation reduction potential. The project would specifically: (**i**) promote proven CSA technologies amongst Cocoa and food crops smallholder farmers in climate vulnerable landscapes (**ii**) strengthen capacity of stakeholders to facilitate dissemination and adoption of CSA technologies (**iii**) upscale science-policy interface at the subnational level in promoting climate change mitigation and adaptation. The structured project components are as follows:

Component 1: Pre-feasibility and Feasibility studies and project design

1.1 Identification of sites and major Cocoa producing districts and communities in the agro-ecological zone for adopting proven CSA practices

The objective is to coordinate with Cocoa producer associations, for the selection of beneficiaries to participate in the project with the adoption of the following technologies: Use of agro-climatic forecasting systems; Low carbon technological options; Site specific agriculture. This activity includes a series of workshops with the producer associations, organized by CSIR (GCCAFS Platform) backed by the Ministry of food and Agriculture, using existing information regarding impact, vulnerability and existing risks, and assessing specific technology costs and required conditions. Information relating to Impact Assessment will also be used to strengthen the dissemination of the project, as actual benefits from yield increase and cost reduction levels from former experiences will be presented to potential participants.

Deliverables: Study including: The Identification and registration of potential farmers that will participate in the Project; Identification of sensors and equipment; Identification of average incremental costs per technology per farmer; System for selecting interested farmers, and contractual arrangements; Plan for implementing detailed interventions at farmer level.

1.2 Impact assessment Objective:

Experts' team of the Platform will be established to assess the impact of CSA pilot experience, and establish the effects of CSA on avoided losses, increased yields and income, and expansion to beneficiaries over time, so that potential benefits can be extrapolated to the project´s planned interventions. This will include identification of changes in yields, quality of produce, avoided losses, income generation, food security, and resulting adaptation and resilience capacity for farmers, comparing baseline and outcome scenarios.

Deliverables: Report including the assessment of the impacts of CSA pilot experiences, and find its effects on avoided losses, increased yields and income, and expansion to beneficiaries over time.

1.3 ***MRV and carbon footprint Objective****:*

This is to identify and assess the impact on GHG emissions as a result of the adoption of low carbon technologies and CSA practices in the agriculture sector. This study will include the estimation of GHG reduction potential as a result of the adoption of low carbon technologies; and the establishment of a protocol for Monitoring, Registering, and Verifying the reduction of GHG emissions as a result of Project activities and technologies.

Deliverables: Study including ex-ante GHG emission reduction potential and MRV mechanism for the Project.

1.4 Conduct *Environmental, Social and Gender Assessment*

The objective is to assess potential environmen*tal and social impacts of the project´s intended interventions, and build a framework for avoiding, preventing or mitigating social and environmental risks. The assessment will also include a gender assessment, especially for the crops identified, and provide recommendations to promote a proper gender management during the project implementation. The management measures will take into consideration Ghana's and FAO environmental and social management regulations and requirements. Also, the assessment will build on the studies about challenges and priorities for gender related work in the agriculture sector in Ghana, carried out by CSIR. And the approach will follow FAO´s social inclusive orientation to agriculture and climate agricultural adaptation and development.*

Deliverables: *Environmental and Social Assessment of the Project; Environmental and Social Management Framework of the Project; Report of the stakeholder engagement on the Project.*

Component 2: Promotion of proven Cocoa and Food Crops Climate Smart Agriculture (CSA) technologies and disaster management strategies.

This component aims to promote best innovative technologies resilient to the adverse effects of climate change within the transitional zone. These are techniques and technologies for restoring and improving soil quality for agricultural production, techniques for water harvesting and irrigation. The proposed project also seeks to train and promote pests and diseases prevention strategies associated Cocoa and food crops integrated climate-smart farming system; develop alternate feed and feed resources for addressing dry season livestock feeding challenges while reducing enteric fermentation. Leveraging existing and new research, and guided by the results of the feasibility study to be undertaken a toolkit comprising of customized interventions and CSA production technologies for the identified crops including Cocoa would be developed. Cocoa farmers will be supported with appropriate and effective cocoa drying innovations as well as product storage facilities. The toolkit would also include pre-validated production technologies for reducing GHG emissions from the crops by at least 5% in the target area (to be validated during baseline). Further in line with the learnings from the needs assessments, technologies and practices for economic water use including micro irrigation, soil and water conservation techniques, etc. would be promoted (SDGt 2.4). Further, this component would also train and build the capacities of the smallholders, especially women farmers and youth in the target areas in crop and livelihood diversification to enable them to safeguard their household income in the event of crop/farm devastation during calamities (SDGt 2.3; 8.2; 8.6). The project would support on-going national project of Planting for Export and Rural Development (PERD) by promoting afforestation and planting tree crops such as cashews and mango.

Upscaling climate smart technologies will be carried out at the community level through experiential learning techniques. For example, farmer groups will be formed to be trained on climate smart technologies that will be conducted on demonstration fields. Alternative livelihood through tree growing is to help in reduction of GHG emissions through the planting of trees on farms and farm settlements as well as degraded areas. Available water bodies will be protected through tree planting to create integrated aquaculture. Effective disease and pests control measures relating

Tree crops such as Cocoa cashew, mangoes and shea will be promoted. Other alternative livelihoods that the project will promote will include integrated bee-keeping and micro-livestock (snail and grasscutter). The packaging, training and transfer of relevant CSA technologies such as composting, use of improved crop varieties and forages (e.g. drought tolerant, early maturing, pest and disease resistant), construction of bunds, improved aquaculture development and management practices, maize leaf stripping, manure management, cover cropping, improved livestock breeds and fisheries will be promoted. The value chain approach is adopted in this project. It focuses on other actors such as processors of cashew fruits, mangoes, cocoa, coconut, herbs and spices such as ginger, garlic, nut meg, and fish processors and traders.

Component 3: Building early warning systems and Strengthening the adaptive capacities of stakeholders

The implementation of agroforestry related project requires extensive engagement and dialoguing with local communities through approved traditional structures (e.g. chiefs, Municipal and District Assemblies, religious leaders, civil society organization, security agencies) in order to elicit the right levels of patronage and community acceptance. Extensive community engagement is also critical towards ensuring that interventions of this nature do not fuel communal tensions and conflict which may arise from competing interests. Further stakeholder engagements and needs assessment will be conducted to identify areas that require adaptive capacity building. This is an important component and will have a lasting impact on all the other interventions, and any future projects that will be undertaken in the zone. It is intended to invigorate the interests of stakeholders in the communities for the development of alternative livelihoods by diversifying from the usual rain-fed agriculture to integrated forms of climate smart agriculture in the project area. The project will develop and strengthen small community-based groups/networks that are relevant for the transfer of information/knowledge on any aspect of current and/or future interventions. This will require an elaborate community entry strategy and a properly phased plan of social awareness creation and knowledge transfer. Building the capacity of mass media to appropriately communicate science to the population at the subnational levels is relevant as part of technology transfer approaches. As part of the project activity, capacity of stakeholder beneficiaries within the transitional agro-ecological zone will be strengthened to interlink community savings-insurance-credit for sustainable climate-smart agricultural technologies. There will be climate information centres and mini weather stations established to promote climate information services. The project will conduct action research for the technology transfer to the farmers and knowledge management systems and databases as well as equipping research laboratories to facilitate trainings and measurement of emissions. Also, support systems to enhance water travel safety by rural farmers in deprived communities (cut-off villages around river banks) will be considered to enable farmers' access market facilities.

Component 4: Upscaling of science-policy interface at the municipal and district levels in promoting climate change mitigation and adaptation and innovations to reduce coastal erosions.

The experience in establishing district platforms has shown that science-policy interface practice facilitates the efforts of stakeholders within the districts in addressing climate change issues. This component is aimed at replicating the district science-policy platforms in the project areas to enhance effective CSA mainstreaming at the subnational levels. This effort will ensure ownership and sustainability of the project. This multi-stakeholder platform practically involves the district assemblies, NGOs, traditional authorities, media, FBOs and other organisations whose activities are related to climate change. Steering committees will be formed from these stakeholders. There will be capacity building opportunities for the steering committees for effective management of platforms' activities. The committees will support the development and implementation of action plans within the CSA framework of the medium term agricultural development plan within the districts. The platform will therefore serve as the basis for mainstreaming CSA activities within the district assembly operations for climate change mitigation and adaptation. Critical coastal management strategies to reduce erosion at the coastal agroecological zone of Ghana will be introduced and capacity of stakeholders built.

The promotion of climate smart agricultural practices that exploit the synergies between different technologies as an innovation will ensure the building of resilience, food security and greenhouse gas mitigation in the agriculture sector. Outputs will ensure that Ghana's agricultural sector become climate resilient and very sustainable. The proposed project will upscale proven CSA technologies that complement each other to sustainably strengthen the resilience of rural farmers that are vulnerable to climate change effects at the subnational level. These include **(i**) the transfer of water and soil conservation practices and the development of water mobilization and distribution infrastructure to cope with dry spell; (**ii**) the implementation of soil fertility improvement and land reclamation techniques; (**iii**) providing farmers with meteorological information for better agricultural planning. The use of all these techniques and technologies will improve adaptation and resilience in target communities within the transitional zone and make a significant contribution to income and food security. Upscaling science-policy interface innovation to ensure exchanges and sharing of experiences and policy dialoguing at the subnational level to influence policy regarding climate change mitigation and adaptation. This paradigm shift will enhance the adoption of proven CSA practices to attain adaptation and mitigation benefits that are essential component of the objectives of the Green Climate Fund. Experiential learning techniques to reinforce learning will help to better understand the adverse effects of climate change and its impact reduction strategies.

The following are some expected project outputs as evidence of enhanced resilience livelihoods of rural households and reduced vulnerability to threats of climate variability and change:

- A network of stakeholders established and improved activity designed
- Cocoa and aquaculture integrated climate-smart farming system promoted.
- Efficient water-use technology within irrigation schemes promoted.
- Pests and disease infestation in the agricultural sector reduced
- Solar panels promoted to support small-scale irrigation systems
- Climate-smart infrastructure (solar dryers, food storage systems, improved abattoirs, fish processing equipment) promoted.

- Mini weather stations established
- Community savings-insurance-credit for sustainable climate-smart practices promoted.
- Agro-advisory service and information centres to facilitate farmer decision making and planning processes established.
- Alternate feed and feed resources for addressing dry season livestock feeding challenges developed.
- Policy briefs, journal papers, training manuals, advocacy materials, mass media publications
- Publications of research on successes, failures and lessons learnt

B.2: Expected project outcomes are as follows

Development Outcomes:

1. Resilience of smallholder farmers and vulnerable groups in the major cocoa growing zones enhanced
2. Proven CSA practices among smallholder farmers' in the major cocoa growing zones promoted.
3. Stakeholders' capacity to facilitate the dissemination and adoption of CSA technologies strengthened.
4. Science-policy interface at the subnational levels in promoting climate change mitigation and adaptation up-scaled.
5. Increased contribution to the achievements of the following SDGs: SDG 1 - no poverty, SDG 2 - zero hunger, SDG 3 - good health and well-being, and SDG 13 - climate action; and achievement of Ghana's NDCs.

Intermediate Outcomes:

1. Improved agricultural livelihoods of rural households and vulnerable groups.
2. Policy makers, professional groups, advocates and other relevant actors using the evidence from the project to inform policies, strategies, programmes and action plans.

Immediate Outcomes:

1. Smallholder farmers adopting the proven CSA technologies.
2. Stakeholders capacities improved to facilitate the dissemination and adoption of CSA technologies.
3. Science-policy interface at the subnational levels to promote climate change mitigation and adaptation up-scaled.

B3: Proposal activities consistency with national regulatory and legal framework

The project is consistent with national priorities on climate change to improve the lives and livelihoods of the farmers and vulnerable groups while maintaining ecosystem sustainability. In addressing climate change and variability effects on agriculture, Ghana has developed several policies that clearly set out the national priorities on agriculture and climate change. These are defined within 'The Coordinated Programme of Economic and Social Development Policies (2017-2024) and other policies such as Ghana National Adaptation Strategy, National Climate Change Policy (NCCP) and Ghana's Intended Nationally Determined Contribution to the Paris climate agreement which highlight the priority actions in respect of climate change mitigation and adaptation. Other sector policies in line with the project include Food and Agriculture Sector Development Policy (FASDEP II), Investing for Food and Jobs, National Climate Smart Agriculture and Food Security Action Plan, National Gender Policy and National Youth Policy, among others. The NCCP highlights livelihood improvement through climate resilient agriculture. The policy objective 4 of FASDEP II (Sustainable Management of Land and Environment) is aimed at addressing the interactions between agricultural biodiversity and climate change. In respect of these policies, it is necessary to develop a new paradigm for agricultural production and transformation in the transitional zone which is one of the zones facing challenges under the conditions of climate variability and change. Thus, the proposed project to strengthen the resilience of rural farmers in the transitional zone of Ghana to climate change through the promotion of proven CSA technologies and associated actions is crucial for Ghana.

This proposed project seeks to develop a holistic approach in the transitional zone in order to overcome the recurrent problems facing rural poor communities by building their resilience to climate change and provide sustainable solutions against income, food and nutrition insecurities. The project will contribute to the implementation of the above policies which aimed at contributing to the mitigation of adverse effects of climate variability and climate change on the most vulnerable populations in the perspective of sustainable development. Planting for Food and Jobs (PFJ), Rearing for Food and Jobs (RFJ) and Planting for Export and Rural Development (PERD) of the Investing for Food and Jobs program is to contribute to modernization of agriculture sector that will lead to structural transformation of national economy through food security, employment opportunities and reduced poverty. The objectives of the PFJ and RFJ, among others are to: (i) ensure immediate and adequate availability of the selected crops and livestock in Ghana through improved productivity and intensification of food crops, and extended support to private sector service providers and (ii) provide job opportunities for the teeming unemployed youth in the agriculture and allied sectors. The project will also contribute to the implementation of the adaptation component of Ghana's Nationally Determined Contribution (NDC) guidelines. Adaptation actions still remain, according to the NDC, a very important and crucial for the coming years in the fight against climate change.

B.4. Implementation arrangements

Ministry of Food and Agriculture is a specialised institution that leads efforts to defeat hunger and improve nutrition and food security. It will collaborate with CSIR-Ghana CCAFS Platform to implement the project in Ghana. MOFA will provide technical backstopping and ensure that the project complies with standards. The MOFA is a national ministry with the capacity to monitor climate resilient agriculture projects. The Ministry has performed these tasks for several adaptation projects in the agricultural sector at the subnational levels. The Council for Scientific and Industrial Research (CSIR) hosts the Ghana Climate Change Agriculture and Food Security (CCAFS) Platform, which is a science-policy dialogue multi-stakeholder platform on climate change. The CSIR-CCAFS Platform is the implementing entity of this project. The CSIR which is a research organisation is highly recognised for technology development and transfer and

has wide experience and involvement in climate smart farming projects across the country. The CCAFS Platform is endowed with organisational strength of diverse expertise and networks with key stakeholder institutions in adapting e capacity building in climate change mitigation and adaptation. The implementing organization, CSIR-CCAFS Platform has adequate knowledge and capacity to design and implement planned activities due to its strong collaboration and networking relationships with numerous local organisations and agencies across the country to ensure project success. Internationally, it strongly collaborates with ICRISAT and CIAT for successful implementation of various projects. Other implementing partners include Ministry of Food and Agriculture (MoFA), Ministry of Local Government and Rural Development (MLGRD), Ministry of Fisheries and Aquaculture Development (MoFAD), Environmental Protection Agency (EPA) and Ghana Meteorological Agency (GMet).
Collaboration with the above organisations will ensure that policies pronouncements are mainstreamed and project activities are in alignment with the country's set priorities.

Key financial and operational risks identified at this stage.

Type of risk	Risk	Level	Mitigation measure
Financial	Currency instability, availability and price fluctuations of project inputs	Low	All funds for international purchases will be held in USD to reduce the risk currency exchange fluctuations. Procurement will be in accordance with the project work plan to ensure availability of inputs in a timely manner
Policy	Political and security instability affects the implementation of the project	Low	The project will occur in relatively secure areas and every effort will be made to ensure that project activities are carried out with the participation of all stakeholders, including government departments and local authorities.
Management and coordination	Inactive involvement of stakeholders in the project	Low	Project partners have varied expertise and experience in carrying out multi-stakeholder initiatives and will aim to ensure that all relevant stakeholders are engaged and involved throughout the project cycle.
Institutional collaboration and networking	Overlapping interventions by public and private institutions	Low	Memoranda of understanding (MoU) between CSIR-CCAFS Platform and the different partner institutions involved in the implementation of the project.

B.5. Expected project results

This Cocoa adaptation project aligns with the strategic impact areas of the adaptation component such as: (i) Health, food and water security; (ii) Livelihoods of individuals and communities. The project also promotes agriculture in low-carbon and climate resilient which happens to be one of the five (5) transverse to strong investment priorities for mitigation and adaptation impacts. The following table presents the indicators of alignment of the project.

Impacts and indicators		Project
Impacts and core indicators	Area (ha) of agricultural land made more resilient to climate change through agricultural practices	667,898 Ha
	Expected tonnes of carbon dioxide equivalent (t CO_2 eq.) to be reduced or avoided (Mitigation only)	19.12 million tonnes CO_2 eq. (over 20 years)
	Number of households adopting a wider variety of livelihood strategies/coping mechanisms	56,000
	Direct beneficiaries	230,000
	Indirect beneficiaries	800,000
	Percent of target population aware of the potential impacts of climate change and range of possible responses	54%
Other relevant indicators	Expected strengthening of adaptive capacity and reduced exposure to climate risks	40%
	Potential for scaling-up and replication	The project, with the expected results, can be replicated at least 20 times in the coastal, guinea and Sudan savannahs in Ghana
	Expected increase of production	60 - 80%

B.6: Estimate of the expected impacts:

In Ghana as indicated above the carbon sequestration will be 19.12 million tonnes CO_2 eq. (over 20 years). However, there will be other sources of GHG. For example, the predominant agricultural practices include cut-and-burn agriculture and expansion of crops on forest surfaces which contributes to the emission of GHGs. Through the promotion of land reclamation and soil fertility improvement techniques (e.g. agroforestry and associated natural regeneration techniques), the project will contribute to carbon sequestration. With regards to irrigation, it should be noted that people use motor pumps to ensure water is supplied to their fields. These motor pumps work with fossil fuels which is one of the sources of GHG emissions. On average, a motor pump is used for the development of 0.25 ha of crops. Each motor pump consumes about 7.5 litres of fuel per day for optimal irrigation. Considering that a crop year lasts on average 90 days of irrigation, fossil fuel consumption would be 2,700 litres/ha/crop year, or 16,200,000 litres for the 6,000 hectares to be promoted under the project. With two crop seasons per year, the annual fuel consumption on 6,000 ha would be 32.4 million litres. This project will therefore save the consumption of 32.4 million litres of fuel over a period of 20 years (average life of solar panels) and micro dams. In terms of GHG emissions, this would correspond to 1,717,200 tonnes CO_2e-. Thus the total number of beneficiaries that will strengthen their resilience to the adverse

effects of climate change is estimated at 1,030,000.

Paradigm shift potential: The paradigm shift is where we use the science-policy platforms at subnational levels to spearhead the mitigation and adaptation to climate change in the identified municipalities and districts of the transitional zone. Climate change challenges are contextual and therefore demand location-specific actions. The proposed project will promote CSA innovations that exploit the synergies between different technologies that, together, further strengthen and sustain resilience, food security and greenhouse gas mitigation in the respective locations of the project. The promotion of on-site learning and experience sharing to develop viable resilient strategies are important in building adaptive capacities of stakeholders. Approximately 6000 hectares of agricultural land made more resilient to climate change through improved agricultural practices (e.g. scientific production, efficient irrigation) systems based on community approaches and entrepreneurial models. Process innovations would be introduced to address critical gaps and improve synergies to maximize impacts of existing and new funding through improved markets. These would also be systematically captured in the toolkit and the knowledge repository to generate lessons learned for broader applicability of these models across the globe

Sustainable development: The project has a potential for sustainable development. The techniques and technologies promoted will strengthen the resilience of farmers and improve production to support food security, increase incomes and contribute to carbon sequestration. At least 60% of the direct beneficiaries would have improved economic conditions through reduced costs, higher returns and alternative livelihoods with improved social and health outcomes. Environmental benefits would also be realised through reducing the fertilizer use (currently very high due to highly deficient soils) and mitigation potential (currently the transitional zone contribute to 8.5% of CO2 e of the state's GHG emissions. Due consideration would also be given to specific gender roles and climate induced vulnerabilities to ensure that the needs of both men and women are addressed through the interventions.

At the social level: The proven CSA technologies promoted by the project will significantly improve agricultural yields and incomes and contribute to poverty reduction. This will help support the food security of beneficiary households. Good nutrition is the foundation of better health. The project will improve livestock processing methods devoid of tyre burning to singe. This will improve meat quality and hygiene as well as reduction of air pollution. Support to enhance food storage systems prevents excessive use of agrochemicals to store grains, hence support for better health. Improvement of incomes will enable farmers to educate their children and thus improve the rate of access to education in the project's intervention areas. At the economic level, the project will create local direct and indirect jobs for young people and women, particularly in market gardening activities.

Gender-sensitive development impact: The inclusion of women in productive structures is essential for the improvement of the well-being and poverty reduction in Ghana. The key development impact will be on women, youth, children and PLWD. In choosing direct beneficiaries, the gender criterion will be included to give women, youth and adults the opportunity to participate fully in the project. The proposal will: (i) include qualitative and quantitative gender indicators; (ii) align with national policies and gender priorities; and (iii) enhance equitable opportunities for women throughout the project cycle. Jobs will be created for women in sowing, maintenance, harvesting, marketing, etc. as well as for the youth. Capacity building will be particularly beneficial for women, youth and PLWD, providing them with a unique opportunity to participate in learning activities and improve their skills.

Needs of recipients: The transitional zone is vulnerable to the adverse effects of climate change, with the experience of decreasing in rainfall and pockets of drought. Production is insufficient to meet food needs and food insecurity persists in poor and vulnerable households. Land degradation and deforestation affect the zone creating the need for small-scale irrigation or family-based irrigation systems. There is the need to strengthen capacities of beneficiaries to develop climate resilient strategies.

Country ownership: The project is in alignment with the objectives of the NCCP, Ghana NDCs and the priorities of FASDEP II. The project will establish a science-policy and learning platform and adopt capacity-building approach for rapid ownership of project. Ministry of Finance, MoFA, CSIR and other stakeholders are committed to the project.

Efficiency and effectiveness: Leveraging learnings from pre-piloted initiatives, the project would also synergise with climate investments in the zone to demonstrate impact at scale in the target areas for a higher per dollar impact. Through the project outcomes and outputs, it is envisaged that other stakeholders, including public and private sector players would have a stronger platform to engage with the beneficiaries. Interventions such as producer aggregation, climate innovation hubs, stronger ground level capacities and ICT backed flow of critical information are envisaged to serve as critical enablers for future investments while catering to the immediate needs to the vulnerable population in these districts through effective strengthening of adaptive capacities.

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C. Indicative Financing/Cost Information

C.1. Financing by components

Total cost estimate per component/output and disaggregate by source of financing.

Component/Output	**Indicative cost (USD)**
Promotion of climate smart technologies and Development of alternative livelihood agroforestry systems	20M
Strengthen capacity of stakeholders to facilitate dissemination and adoption of CSA technologies	10M
Upscale science-policy interface at the district level in promoting climate change mitigation and adaptation	5M
Project management and coordination	1M

Indicative total cost (USD)	36M

C.2. Justification for funding request

Given the current economic situation in Ghana, the contribution of funds is critical for the successful implementation of the proposed project. Without investment into climate change related interventions, the livelihoods of the population in Ghana that are reliant on the agricultural sector are at risk to the threats of climate change, as the smallholder farmers are unable to make the necessary investments to retrieve climate information services on their own. It is expected that impacts of climate change and climate vulnerability will affect a large part of the country in the coming years. The development of the agricultural sector in Ghana is already largely reliant on foreign funding, with ~65% of total public expenditure in support of food and agriculture funded by external sources including the World Bank, USAID and the European Union. The need for external funding is compounded by the current state of the Ghanaian economy. Despite a period of rapid economic growth over the last two decades moving Ghana to a lower middle-income status, the country's economy has seen a decline in growth over the past five years. Increasing debt, high inflation and currency depreciation have contributed to the deterioration of the economy, leading to a current account deficit of -4.1 % and a debt-to-GDP ratio of 83.54%. Further challenges to Ghana's economic outlook include inflated domestic financing costs, technical problems in the oil and gas sectors, energy problems related to state-owned enterprises, Covid19 pandemic and continued weak commodity prices. These factors result in an unfavourable fiscal climate for the Ghanaian government to secure loan financing for large-scale investments into innovative climate change adaptation measures.

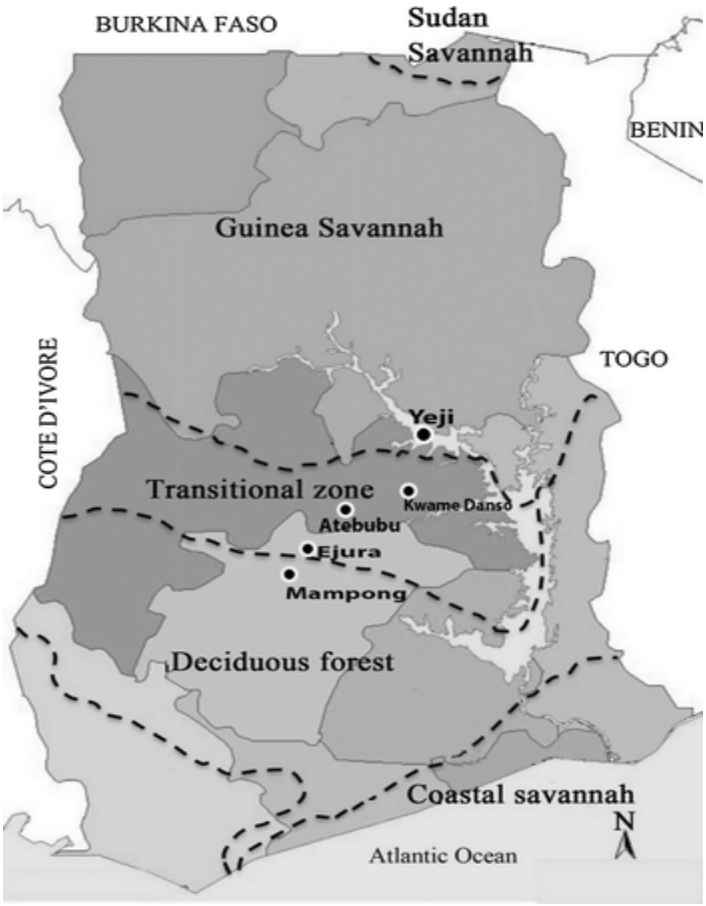
The objective of promoting a paradigm shift towards low-emission and climate-resilient development, demands substantial investment in developing countries such as Ghana. This project is crucial for providing the necessary support for the implementation of the various climate change mitigations and adaptation actions particularly in the Cocoa subsector sector in the country. The proposed resources will be used to: (i) promote proven CSA practices among smallholder and Cocoa farmers in climate vulnerable landscapes (ii) strengthen technical capacity of stakeholders to facilitate the disseminate and adoption of CSA technologies, achieve national ownership and sustainability of project activities (iii) upscale science-policy interface at the subnational level in promoting climate change mitigation and adaptation. A grassroot-based approach at scale to facilitate learning in sustainable local development planning systems will be ensured. (iv) implement concrete actions to protect food production landscapes against the adverse effects of climate change; (v) put in place adequate infrastructure and equipment for water management; (vi) establish climate information centres and mini weather stations to support planning and decision making at the subnational levels. Given all these proposed interventions, with the indicative budget, the grant is crucial for the realization of the project.

C.3. Project Sustainability

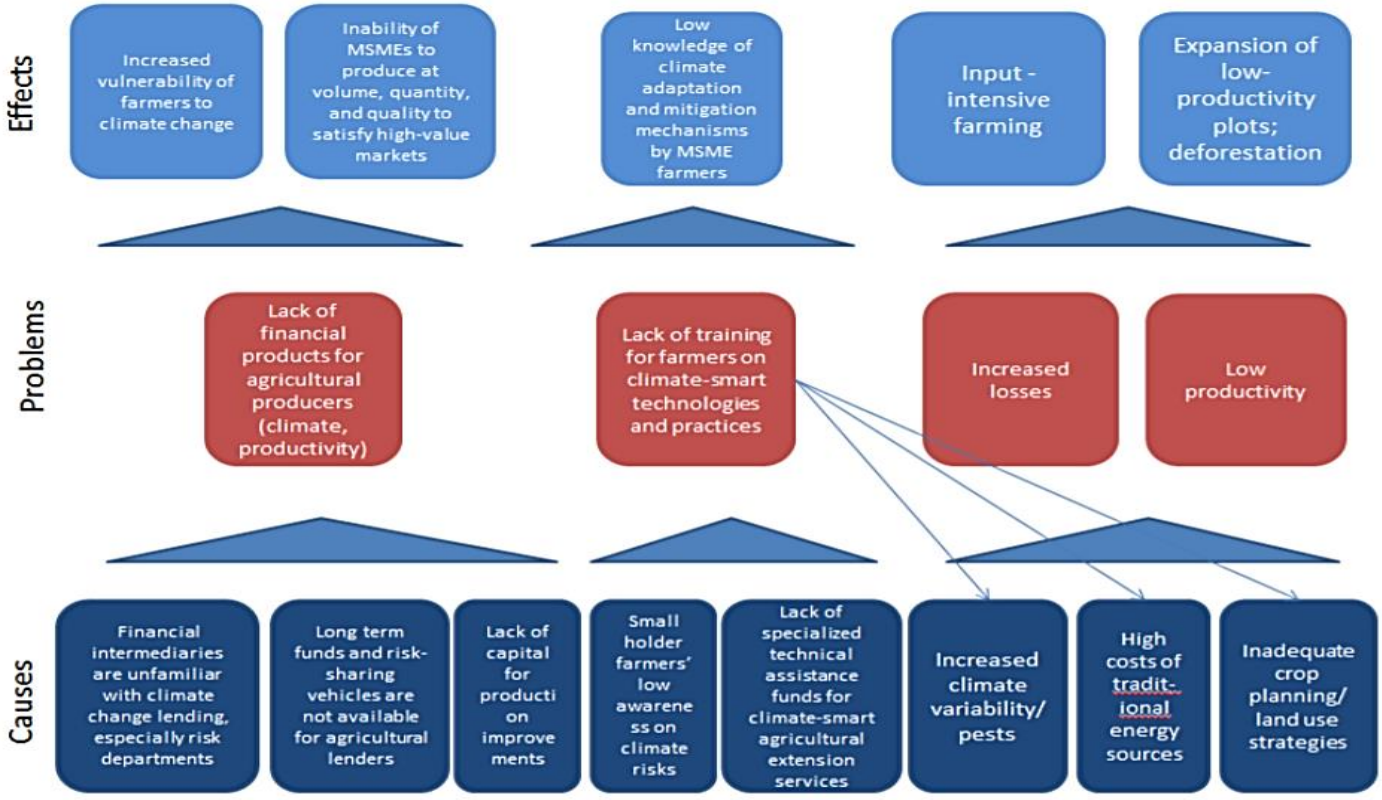
The proposed project incorporates several design features that will ensure the sustainability of activities following project termination. Firstly, the project is a nationally driven effort and is fully aligned with national strategies, policies and plans. It is expected that the government will contribute to the sustainability of the project activities through co-finance to maintain the technical infrastructure after project closure (maintenance costs are expected to be limited because the project uses globally existing and freely available data sources, and the details of this are to be confirmed in the project development phase. Secondly, project management will be mainstreamed into existing government structures at the national and regional levels and the training activities will contribute to strengthening the technical capacity of government staff to collect, analyse and disseminate climate information vertically across institutional structures. By introducing a focus on the integration of climate policy into regulatory frameworks with the support of the Science-Policy Platforms, the country will have the necessary structures to maintain and sustain the developed capacity and technical services beyond the completion of the funding period.

The potential for replicating structural elements of the proposed project within the agricultural sectors and other administrative regions of Ghana will be enhanced by: i) mainstreaming the project activities into government institutions such as the Ministry of Agriculture and its regional offices; ii) strengthening the technical capacity of government staff to disseminate CSA innovations information's vertically across institutional structures, potentially expanding project activities to specific locations/regions/communities in future; and iii) creating linkages for the transfer of information between national and local level decision makers. The mainstreaming of the project interventions and the strengthening of institutional capacity will create an enabling environment for the country to successfully replicate the proposed project activities after the investment period.

ANNEX 01: GHANA MAP SHOWING THE AGRICULTURAL ZONES



ANNEX 02: MAJOR COCOA GROWING ZONES AND AGRICULTURAL CHALLENGES TREE



GLOBAL SHIELD PROJECT PROPOSAL

ORGANIZATION: GHANA HYDROLOGICAL AUTHORITY

Project Topic: Enhancing Flood Resilience in Kumasi, Ghana through an integrated approach of Multi-Stakeholder and Digital technologies

1. Summary

The proposal aims to improve flood and climate resilience in Kumasi, Ghana, by integrating advanced technologies and community engagement. The city faces recurring urban flooding issues due to heavy rainfall, overflowing river channels, and drainage systems. The project aims to develop an integrated flood management system that includes a database of drainage systems, flood-prone areas, waste disposal amount and behavior, urban topographic characteristics, river systems data collection, and flood-affected social groups. It will also implement an early warning system using real-time data, foster community resilience through capacity building, and offer policy recommendations to government institutions and local authorities on green infrastructure. The project also considers establishing community flood warning and response teams. This project will be implemented with the lead of the Ghana Hydrological Authority (HYDRO), co-lead of the International Water Management Institute (IWMI) and supported by the Kumasi Metropolitan Assembly (KMA).

2. Introduction

Many contemporary urban areas in Africa are vulnerable to flooding and its associated risks are projected to increase due to climate change, urban population growth, poor land use planning, informal settlement, and inadequate infrastructure. With projected increased runoff and peak flows, the structural systems such as the drainage system built today, and non-structural systems such as flooding area mapping and prediction are not meeting the desired service level in the urban areas of Africa. Flooding has become perennial in the cities and as such alternative mapping and prediction systems are required.

Kumasi, the capital city of the Ashanti Region in Ghana, has long grappled with recurrent urban flooding issues attributed to heavy rainfall and the overflowing of its river channels. In June 2021, for example, Ghana Business News reported that hundreds of residents were displaced in Kumasi while three others died after hours of downpours[1]. This problem is exacerbated by the rapid population growth and expansion of settlements, resulting in higher vulnerability to flooding events. The undulating terrain of Kumasi, coupled with the silting of river channels due to erosion and solid waste disposal in the drainage system (Ouattara et al., 2023)[2], creates conditions that make low-lying areas susceptible to flooding. Another critical situation is the country's ground-based hydrological and meteorological data that are insufficient and of low quality, with the exception of a few stations (Adiku et al., 1997[3]). Some river gauging stations are no longer in use, while others are degrading creating weather and streamflow data and information barriers.

Kumasi is **among the largest metropolitan areas in Ghana.** It is situated within the rainforest region of Pra-basin, which consists of several sub-basins, each with its network of rivers. The flooding of areas surrounding these rivers has had dire consequences, including property damage and loss of lives and livelihoods to its 1.5 million population. This proposal outlines an integrated approach to urban flood management, utilizing machine learning, remote sensing, and community-sourced data collection to mitigate the impact of flooding in Kumasi and enhance the climate-resilience of the city

3. Objectives

The primary objective of this proposal is to develop an integrated flood management system for Kumasi that combines advanced technologies and community engagement to mitigate and respond to flooding events. Specific goals include:

[1] Fact Sheet: The June 24 flooding in Kumasi: deaths, destruction and displacement - Ghana Business News

[2] Ouattara ZA, Kabo-Bah AT, Dongo K, Akpoti K. A Review of sewerage and drainage systems typologies with case study in Abidjan, Côte d'Ivoire: failures, policy and management techniques perspectives. Cogent Engineering. 2023 Dec 31;10(1):2178125.

[3] Adiku, S. G. K., & Stone, R. C. (1995). Using the Southern oscillation index for improving rainfall prediction and agricultural water management in Ghana. *Agricultural Water Management*, 29(1), 85–100. https://doi.org/10.1016/0378-3774(95)01181-1

1. **To establish and strengthen a database of** drainage systems, flood-prone areas, waste disposal behavior and magnitude in drainage systems, urban topographic characteristics, river systems data collection, and flood-affected social groups using a **multi-stakeholder dialogue** and a combination of remote sensing, and in-situ data collection.
2. **To** Leverage the gathered data to perform an in-depth assessment of flood risks in Kumasi Metropolis, which includes the identification of at-risk areas and vulnerable communities**.**
3. To **co-create and implement an early warning system** that utilizes real-time data for delivering timely alerts to residents and authorities, empowering them to undertake essential precautions in response to flood events**.**
4. To **foster community resilience by partnering** with local communities to enhance their preparedness for flooding through capacity building, enhancements in management practices such as waste in drainage systems, and the establishment of community flood warning and response teams.
5. To **offer policy recommendations** to government institutions and local authorities (Kumasi Metropolitan Assembly) concerning urban planning, zoning regulations, waste management, and green infrastructure enhancements aimed at reducing future flood risks.

4. Theory of change

In the Kumasi Metropolis, practitioners such as Ghana Hydrological Authority (HYDRO), communities in Kumasi, and other stakeholders in Kumasi city are informed with objective and location and time-specific information on urban flooding, THEN decision-makers in Kumasi town and residents can more effectively manage urban flood in a timely manner and enhance resilience to water risks from flooding.

5. Methodology

Data Collection Strategy: A multi-pronged approach will be used to collect data. In-situ data collection will involve socio-environmental surveys, field surveys, and semi-structured interviews with residents to identify the different factors that contribute to poor performance for the

operational and structural failure of the river system and Kumasi city drainage network. In addition, it is to understand local challenges with the flood and gather historical flood data. Stakeholder dialogue, semi-structured interviews, and focus group discussions will be conducted to understand the type of management system needed and the social group who are most affected. Remote sensing technologies, including satellite imagery, will provide information on land use, drainage systems, and topography. The hydrological data collection system in the river system will be evaluated and strengthened to have better data sources to close the gap in data and information.

Flood Risk Assessment: As a starting point, the prediction approach of supervised classification will be followed whereby an algorithm (eg., Random forest or other) is trained on labeled data from the existing dataset (such as flooding area or magnitude, collected in objective one). The ML algorithm thus learns from input features and flood areas as output and this can then be applied to new data to assess the likelihood of a certain flooding result from a likely new input feature. For flooding, rainfall, elevation, slope, curvature, aspect, stream power index (SPI), distance to the river, distance to the drainage system, Topographic Ruggedness Index (TRI), Topographic wetness Index (TWI), land use, % imperviousness, and others are potential variables used as input extracted from topographic and remote sensing images. In addition, the amount of waste in the drainage system in objective 1 will be quantified and will be used in machine learning to estimate the flood. These input variables will be discussed with stakeholders, and experts and re-defined during the actual implementation.

Flood Early Warning System (FEWS): Real-time data from weather stations, automatic river gauges, water level sensors and community information will feed into an early warning system. This system will provide timely alerts via various communication channels, including user-friendly websites, SMS, FTP and mobile apps. IWMI has a digital solution in support of integrated flood and drought management tools with technical applications and near real-time flood and drought indicators. IWMI has a record of facilitating a sustainable action plan towards addressing the challenges of extreme weather events in Senegal, Zambia, Sri Lanka, and other countries. The plan is to use this existing experience and an existing AWARE platform that provides flood

forecasting and early warning information and guides early warning actions in flood-risk areas. The use of the AWARE platform in has shown great potential as an early warning system that can guide early actions across Africa. This platform will be customized and adapted to the community of Kumasi, the metropolis, and the interest of HYDRO and other stakeholders engaged in disaster management efforts.

Community Engagement: From objective 2, communities in Kumasi at various flood risk levels will be identified. Collaborative workshops and community engagement programs will be conducted with those at different risks to empower residents with knowledge and skills to respond effectively to flooding. The type of responses will be defined by the community and stakeholders. The type of information they want to receive from objective 3 and how they would like to receive the information will also be considered so that the community will be ready for the defined responses. This project is considering the establishment of community flood warning and response teams which likely need the existing social network study and integration with the local government system.

Policy Recommendations: Based on the research findings, policy recommendations will be developed and shared with government and local authorities to inform urban planning, disaster preparedness, and infrastructure development. For example, we envision recommendation of green infrastructure, including green roofs, pavements, parks, micro detention basins and swales, to aid in urban flood management by absorbing rainwater, slowing it down, reducing drainage burden, promoting biodiversity, improving air quality, and enhancing aesthetics, thereby fostering a resilient, environmentally friendly approach. The possibility of such a recommendation is researched on its practical possibility and how it could be integrated as part of the Kumasi Metropolitan Assembly's routine activities.

6. Outputs

The output includes better hydrological data collection for river systems around Kumasi, establishing flood warning and response teams, comprehensive datasets for targeting important variables and their features controlling floods, a list of relevant features from the collected data

set through feature engineering to predict flood area and magnitude, tailored machine learning models, implementation of flood early warning system to support decision and spatiotemporal maps of target variables.

7. Outcome

The outcome of this research for development project is to mitigate the impact of flooding in Kumasi, Ghana by establishing a comprehensive flood risk management framework. This includes the creation of a robust database for flood-prone areas and vulnerable populations, the implementation of an effective early warning system, improved community resilience against flooding, and informed policy recommendations for urban planning and infrastructure enhancements. Ultimately, these efforts aim to reduce the frequency and severity of flood events and minimize their impact on residents and local authorities in Kumasi.

8. Collaboration and Partnership:

In the collaborative effort to enhance flood resilience in Kumasi, Ghana, through an integrated approach of multi-stakeholder engagement and digital technologies, the responsibilities for various project components are distributed as follows:

- The Ghana Hydrological Authority (HYDRO) will take the overall lead of the project and coordinate particularly the data collection strategy component of this project, with dedicated support from the International Water Management Institute (IWMI).

- IWMI, in turn, will spearhead the flood risk assessment and the co-creation and implementation of the flood early warning system component of the project, with active collaboration and support from HYDRO and the Kumasi Metropolitan Assembly (KMA).

- The Kumasi Metropolitan Assembly will lead the community engagement initiatives, bolstered by close support and collaboration with IWMI. To ensure comprehensive community involvement and engagement in disaster management efforts, KMA will be

responsible for coordinating with non-governmental organizations (NGOs) and community-based organizations, thus fostering a strong community-centered approach.

- Lastly, policy recommendation efforts will be steered by IWMI, in partnership with HYDRO and KMA, to ensure that evidence-based recommendations align with the overarching project objectives and stakeholder needs.

9. Time Period

We have proposed a 3-year period to complete this project with a draft time schedule as shown below.

S/No	Activities	Year 1				Year 2				Year 3			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Data Collection strategy including kick off and stakeholder engagement	■	■	■	■								
2	Flood Risk Assessment					■	■						
3	co-creation of flood early warning system							■	■				
4	Implementation of flood early warning system									■	■	■	■
5	Community and stakeholder engagement	■	■	■	■	■	■	■	■	■	■	■	■
6	Policy recommendations	■	■	■	■	■	■	■	■	■	■	■	■
7	Reports, briefs, blogs and scientific publications				■				■				■

10. Budget

Out of the total budget, 60% is for the leading institution GHA and local partner, KMA. IWMI will take a share of 40% of the total budget.

Budget Items	**Budget (USD)**
Personnel	530,000
Travel and per-diem	81,840
Equipment	250,000
Capacity buildings, workshops, and supplies	50,000
Subcontracting	100,000
Indirect	202,368
Total costs	1,214,208

CLIMATE CHANGE ADAPTATION AND RISK REDUCTION SOLUTIONS FOR LOCAL AUTHORITIES IN THE ANLOGA, KETA, AND KETU ASSEMBLIES IN THE VOLTA REGION OF GHANA

1. Context and Justification

Ghana is vulnerable to several climatic hazards. Climate change in Ghana is expected to render rainfall patterns increasingly unpredictable and erratic, increasing mean temperature to 1-3C by 2060 and 1.5 – 5.2°c by 2090. Rainfall will continue to be uncertain and difficult to predict. Projections of mean annual rainfall from different models predict a wide range of changes, but the proportion of total annual rainfall that falls in heavy events tends to increase. This will likely have severe implications for the agricultural sector, contributing to Ghana's GDP. Sea level rise will continue to affect vulnerable coastal areas. The national data shows sea-level rise of 2.1 mm per year over the last 30 years (1960 – 1990), indicating a gradual rise of 5.8 cm, 16.5 cm, and 34.5 cm by 2020, 2025, and 2080, respectively. This increase will affect the 30-meter contour of the nation's coastal zone, which covers 6.5% of the 238,535km^2 land area,[1] where more than 39.1% (12 million) of the population lives.[2]

The coastal zone of Ghana contributes 80% of the country's annual captured fish production[3] and houses 80% of Ghana's industrial firms.[4] According to Charuka et al., 2023, at least 75% of Ghana's coast is moderate to very high in coastal vulnerability, with 92% having a slope ratio below 5%.[5] Poor communities in Ghana's coastal regions, particularly Keta, Anloga, and Ketu assemblies, and environs, are adversely impacted by frequent sea erosion, sea level rise, tidal waves, and flooding, which culminate in water pollution, including saline intrusion into their aquifers, vital for farm irrigation and drinking water sources, dwindling fish stock and destruction of fish landing sites.

2. Main Challenges

The construction of the Akosombo hydroelectric dam in 1961 led to intense erosion and flooding in Keta's eastern coast, mainly due to low-lying lands, unconsolidated sediments, shoreline orientation, and sediment starvation from the Volta River. This was exacerbated by a shortage of littoral sediment, which was created due to the Volta River's rise in sea level and lagoon water.[6] Approximately 1,000 houses were destroyed annually by tidal waves, floods, and storms in the three assemblies (Anloga District Assembly, Keta Municipal Assembly, and Ketu South Municipal Assembly) from 2020- 2023.[7] Flooding and storms displaced nearly

[1] Armah, A. K., & Amlalo, D. S. (1998). *Coastal zone profile of Ghana: Accra, Gulf of Guinea large marine ecosystem project.* Accra: Ministry of Environment, Science and Technology.
[2] Ghana Statistical Service 2021 Population and Housing Census.
[3] Armah, A. K., & Amlalo, D. S. (1998). *Coastal zone profile of Ghana: Accra, Gulf of Guinea large marine ecosystem project*.
[4] Amlalo, D.S., 2006. The protection, management and development of the marine and coastal environment of Ghana. Administering Marine Spaces: International Issues 36, 148–158.
[5] *Assessment of the integrated coastal vulnerability index of Ghana toward future coastal infrastructure investment plans*. (2023, August 14). Assessment of the Integrated Coastal Vulnerability Index of Ghana Toward Future Coastal Infrastructure Investment Plans - ScienceDirect. https://doi.org/10.1016/j.ocecoaman.2023.106804
[6] https://documents1.worldbank.org/curated/en/541981527661149414/pdf/Fighting-coastal-erosion-in-Keta-area.pdf
[7] XXXXXXXX

2,000 people in 2020[8], 4,000 people in 2021[9], and 5,000 in 2023,[10] and caused damage estimated at US$ 474 million in 2017 (2.1% of GDP). The coastline is experiencing rapid erosion, displacing coastal communities and destroying infrastructure, with rates reaching up to 10 meters per year in some areas. This is likely to worsen, given the climate change scenarios for Ghana. Resultant economic impacts make it increasingly difficult for vulnerable families to escape the cycle of poverty.

Ecosystem-based climate change adaptation solutions, such as coastal ecosystem management and restoration, are crucial for coastal communities' resilience and could provide 30% mitigation benefits. Coastal ecosystems, such as mangroves, are vital for carbon sequestration, erosion protection, and waste processing. They also protect against sea level rise and storm surges by protecting settlements and agricultural land from wave impacts and stabilizing receding coastlines.

A mangrove forest absorbs 840 metric tons of carbon dioxide from 2,800 trees, producing 308 kg of carbon dioxide sequestration per tree over its 12.3kg growth life per year. However, mangroves are rapidly depleting, making these solutions essential for reducing global warming. Ghana's mangrove forest, spanning 72.4 km2 and containing 18 million trees, has experienced a 24% loss in the last 30 years, from 18,100 ha to 13,700 ha.

The climate hazards this project seeks to address are adapting to sea level rise, tidal waves and storm surges, coastal erosion, perennial folding, increase in temperature, and variability in rainfall patterns.

3. Goal

To reduce climate vulnerability, lower health risks, and increase socioeconomic development for vulnerable communities by improving food and water security, enhancing disaster risk reduction and recovery, and building local adaptive capacity to respond to climate change in the Anloga, Keta, and Ketu assemblies and their environs.

4. Objectives

Objective 1: To increase local authorities' capacity to respond to projected climate impacts

Component 1: Local authorities empowered to deliver climate change adaptation services to their populations

[8] Ghana Statistical Association (2020).
[9] https://news.mongabay.com/2022/03/as-rising-seas-destroy-ghanas-coastal-communities-researchers-warn-against-a-seawall-only-solution/#:~:text=Some%2037%25%20of%20the%20country's,and%20beds%20as%20they%20slept.
[10] https://www.graphic.com.gh/news/general-news/ketu-south-keta-cry-for-relief-items.html

- Output 1.1: Capacity building and awareness raising to improve understanding of the nexus between climate change and ecosystem-based adaptation solutions to climate change.
- Output 1.2: provide technical support on preparing climate change adaptation projects to improve access to climate financing.
- Output 1.3: Knowledge management mechanisms among the three local authorities to develop solutions to local adaptation challenges.
- Output 1.4: Knowledge exchange and experience sharing at international climate and disaster-related conferences.

Objective 2: To reduce the risk of flooding and erosion in coastal communities by 20% by 2027.

Component 2: Climate Risk Preparedness

- Output 2.1: establish early warning systems and hydrometer observation centers to improve data collection, interpretation, and understanding, generating relevant, science-based information for decision-making and business opportunities.
- Output 2.2: Three community-based mangrove nurseries established in selected second-cycle schools in the three municipalities.
- Restore 2,000 hectares of mangroves in the Anloga District, Keta Municipality, and Ketu Municipality of Ghana by 2027.

Objective 3: To increase the incomes of local communities by 10% by 2027 through sustainable local economic development enterprises.

Component 3: Local Economic Development

- Output 3.1: Improve five fish processing facilities
- Output 3.2: procure 50 canoes and outboard motors for fisher folks.
- Output 3.3: rehabilitation of Atiavi, Abor, and Anloga markets
- Output 3.4: Improve rice farming in Aborlorve-Norlorpi

3. Monitoring and evaluation

The project will monitor and evaluate the progress of the restoration activities and the project's impact on the environment and local communities.

4. Budget

The total budget for the project is $50 million. This will cover the costs of mangrove restoration, community engagement, and monitoring and evaluation. Table 1 in Appendix A provides a breakdown of the amount.

5. Proposed Location of Project

The proposed location for the project is the Anloga District, Keta Municipality, and Ketu Municipality of Ghana. These municipalities are located on the coast of Ghana and are particularly vulnerable to flooding and erosion. The project will focus on selected electoral areas in the Amugo and Wego electoral areas in Keta Municipality, including towns like Dzelukope, Atiavi, Asadame, Netsime, Anyako, Seva, and Alakple, Shime.

APPENDIX A

Table 1: Breakdown of the proposed $50 million budget

Components	**Amount (USD)**
Local authorities empowered to deliver climate change adaptation services to their populations.	**$8.5 million**
Climate Risk Preparedness	**$15 million**
Local Economic Development	**$15 million**
Monitoring and evaluation	**$5 million**
Project management and administration	**$6.5 million**

Proposal for Funding from Ghana Meteorological Agency from GRMA

INTRODUCTION

In General, sub- Saharan Africa is regarded as one of the most vulnerable regions to climate change. This may be attributed to the variability of its climate and the fragile nature of its economies, in combating emerging climate variability. Essentially, the exploitation of its natural resources is strongly dependent on the evolution of the characteristics of its rainfall pattern, (spatial and temporal distribution of the rains, dates of starting and ending period and lengths of the rainy season, length of dry spells, river basins flows etc). These characteristics have significant impacts on Agro-pastoral production, food and nutritional security of the populations, as well as on the occurrence of disasters of different kinds.

In recent years, countries in West Africa and the Sahel have faced risks related to climate change and variability. Most of them were affected by catastrophic floods which, in some cases have resulted in loss of property and human life. Similarly, a combination of the effects of environmental changes, demographic pressure and high hydro-climatic variability have considerably increased agricultural risks and natural disasters. In addition , future projections for this part of the world, despite the uncertainties, indicate a further increase in rainfall variability, rise in temperature and sea level and an increase in extreme hydro-meteorological phenomena such as, longer dry spell, droughts, floods, etc.

To better manage these risks, it is important to support the production of scientific data essential for decision-making as well as strengthen the operational systems for prevention and management of these risks.

OBJECTIVES OF THIS PROPOSAL

The main objective

i. is to strengthen the capacities of the Ghana Meteorological Agency to be able to reach the end user especially the farmers and farmer groups with the seasonal forecast after each issue
ii. to disseminate of the forecast the start of the rains, the dry spell, the cumulative amount runoff from coastal basins, to the end-user and explain in the language they understand the outcome
iii. strengthen the capacity of the participants on the technics to analyse and characterize the agro-hydro-climatic risks related to the major and minor rainy season in the country

iii) Discuss with users, in particular on the disaster risk reduction platforms, on the results of seasonal forecasts in order to better adapt these products to their needs and consider this information in their planning.

WHY SEASONAL FORECAST

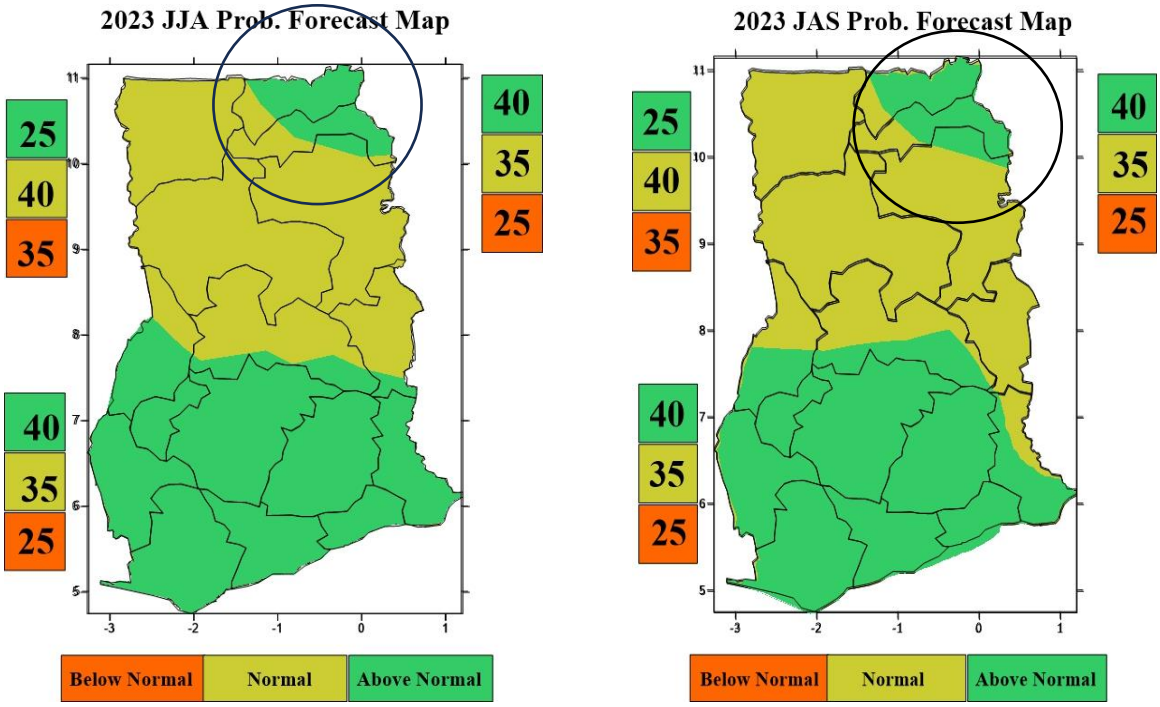
Seasonal forecasts are forecasts of average seasonal conditions over a region made many months in advance due to slowly changing parts of the climate system. By seasonal forecast

we are looking at a strategy for adapting to climate variability and change in Ghana, Gulf of Guinea Coast, West Africa and the Sahel.

One key part of the climate system that influences weather systems is the ocean; for instance, the ocean surface temperature may be warmer than normal and still retain that heat over the next few months.

When conditions that differ from the norm (i.e., anomalies) extend over a large part of the ocean, the air above the ocean may consequently be affected. Ultimately, atmospheric circulations and the weather systems over land are affected, as well. Analysing ocean temperatures provides some ability to forecast average conditions for months in advance.

In addition to the above, seasonal forecast is necessary for the following reasons:



For example this forecast was given by GMET way back in May 2023, when action was not taken, the flooding in the Volta lake took place.

a) <u>Decision Making - Policy Makers</u>

Indeed, the production and dissemination of information, characterizing the rainy season even before its start, would help farmers for food security, water resource managers, desertification control, climate change impacts decision-makers and various stakeholders to make optimal choices. Thus, knowing in advance an early or late start of the season will allow farmers to make strategic choices regarding the varieties to be used and invest in the appropriate labour and agricultural inputs. Likewise, the forecast of a very wet year would make it possible to organize rescue systems in advance and advise against the occurrences and impact (crops, homes, animals) of the flood zones: whilst the forecast of a dry season would allow preparation

against possible shortfalls in the quantities of water that can lead to food and nutritional insecurity.

b) Capacity Building

It is necessary to strengthen the capacity of the Ghana Meteorological Agency (GMet) particularly at the National level to better characterize and forecast Agro-Hydro-Climatic risks. Consistent with its mandate, GMet provides meteorological information on food security, climatic conditions on hydrological disasters in collaboration with its international partners including African Centre of Meteorological Applications For Developments (ACMAD) and Agrometeorology, Hydrology, Meteorology Regional Centre (AGRHYMET) in Niger and issues the Seasonal Forecast three times every year for the end users and stakeholders. The first Seasonal forecast is issued for the period March April May (MAM) and April May June (AMJ). This is released for the major season for the South of Ghana. The second is issued for the season May June July (MJJ), June July August (JJA) and July August September (JAS) for the Northern Ghana which is above Lat 8N and above. The final one is issued for the September October November (SON) for the Minor season for the South of Ghana. It is important to build capacity at the regional level to sustain this recurring exercise.

GMET does Marine and Inland forecast also.

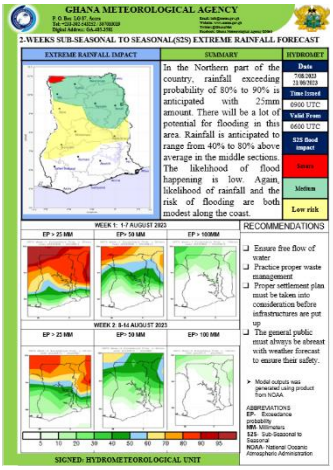
c) International Collaboration

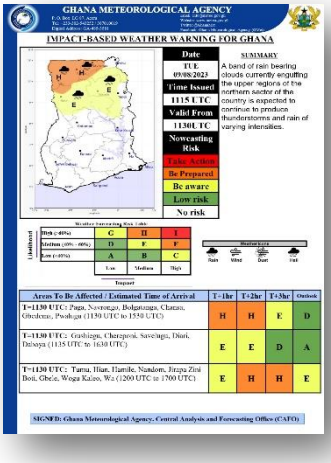
Through Seasonal forecast, GMet is able to collaborate with its international organisations such as the International Climate Centre (IRI) in University of Columbia ,National oceanic and Atmospheric Administration (NOAA) in Maryland USA , The Meteorological Office(Met Office) Exeter UK, National Centre for Atmospheric Research (NCAR), European Centre for Medium-Range Weather Forecast (ECMWF) , Copernicus Climate Change Service (European Union) and National platforms for the preparation of risks and disasters etc. These international collaborations afford GMet the opportunity to learn experiences across the globe. Experiences acquired positively impacts on future forecast and beneficial to stakeholders such as farmers, policy makers etc.

d) Disaster Prevention - Catastrophic floods

The provision of Seasonal forecast enables national disaster institutions, organisations and individuals to be able to plan adequately in order to prevent and or avoid climate related disasters including flooding, destruction to agricultural output, and infrastructure in general.

e) Drought and Flood forecast





Walewale and Nalerigu major roads and houses destroyed in the Mamprusi area of the Northeast Region on **9th August 2023.**

CHALLENGES NEEDS ASSESSMENT

Research into data available with Ghana Meteorological Agency indicates a decreasing rainfall amount along the coast of Ghana and the forest zone with slightly increasing amount in rainfall along the Northern Zone within the March April May (MAM), April May June (AMJ) season.

Farmers are particularly impacted by extreme weather conditions, which include drought, severe heat, flooding, and other shifting climatic trends. All these pose challenges for farmers as they work to grow enough food. Which is why we are devoted to finding ways to transform agriculture in this era of climate variability.

Drought in parts of Ghana primarily, caused by decreasing rainfall and compounded by the already small amount of water available in streams and soils. Most drought are driven by natural variability in precipitation. Climate change driven hotter temperatures, evaporate water in streams and lakes and evaporate water in soils, turning what would have been a moderate drought into a much more severe drought. Rainfall patterns over Ghana are showing decreasing rainfall pattern within season (intra seasonally) and increasing rainfall trend within some seasons too across the country as depicted as examples in the two representations below as in Axim. Example

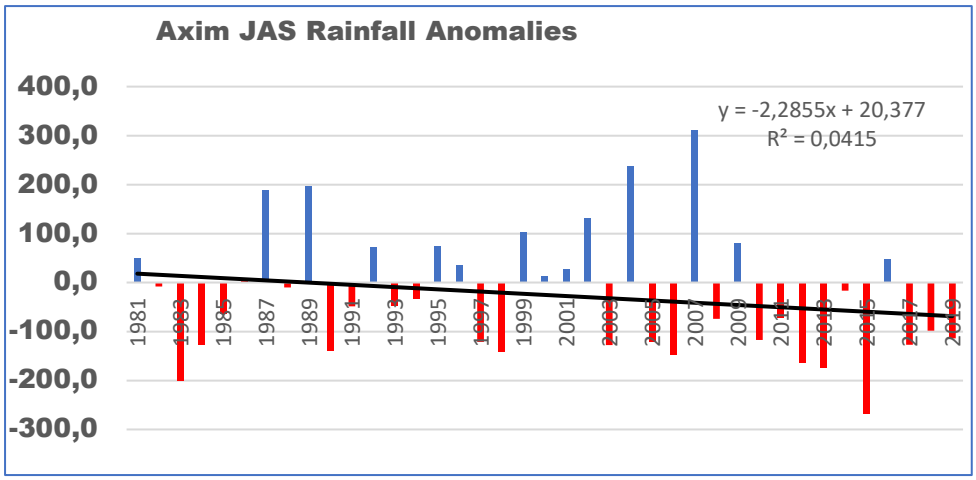


Fig 1: decreasing rainfall trend for Axim for the July August (Source: GMet)

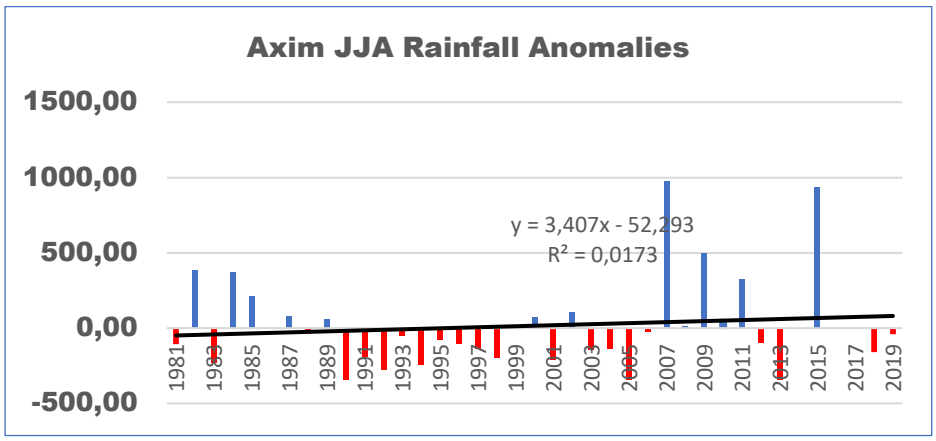


Fig 2: Increasing rainfall trend for Axim for the June July August. (Source: GMet)

In the same vain, too much water could be devastating Above average rainfall in some parts of the country could also affect the yield. Early onset of rains and late onset is also devastating to the farmer. Longer dry spell before or after flowering of crops if not watched is also catastrophic to the small holder farmer.

It has therefore become necessary to take seasonal forecasting to the farmer. The result is two primary barriers to forecast information access for farmers: how to most efficiently get the information within the message to the farmer, and how to package the message so that the information within is most easily accessible and thus applicable. Ghana Meteorological Agency would also like to break down the information from the technical jargons to the language that the farmer can understand.

EXPECTED RESULTS

i. Collaboration with risk and disaster platforms and farmers organizations is strengthened.
ii. Forecast products are adapted to user needs for more efficient and targeted use.
iii. Forecast is given in the user's language

The working group will be made up of the

a) Climate department
b) Agricultural Meteorology department of the Research and Applied Meteorology Department Division of the Ghana Met Agency
c) Extension officers of MOFA.

Ways of Dissemination

We expect to disseminate the information to the farmer through the media which will be both the print and news media. The print will be through newspaper and bulletins. A news conference will also be organised after which the outreach team will visit the farmer groups in their places with their extension officers.

REGIONS AND DISTRICTS TO BE VISITED

March April May (MAM) and April May June

Region	Districts
Western North	Bia Juabeso Sefwi Wiaso
Ashanti	Sekyere East Sekyere West Asanate Akyem Bosumtwi Kwanwoma
Eastern	Fanteakwa Lower Manya Kwahu North
Volta	Kadjebi Jasekan

June July August and July August September

Region	**Districts**
Northern	Tamale Metropolitan Savelugu Gushegu

North East	East Mamprusi West Mamprusi Mamprugu Moagduri
Savannah	West Gonja North Gonja Central Gonja East Gonja North East Gonja Sawla Tuna-Kalba
Upper East	Kassena Nankena West Kassena Nankena East Bolganta Municipal Talesi Bawku West Garu Tempane
Upper West	Wa East Sisala East Sisala West Daffiama Bussie Issa
Bono East	Kibtampo North Kintampo South Nkoransa South

September October November

Region	**Districts**
Volta	Hohoe district Kpando Adaklu Anyigba Akatsi
East Coast	Ada Ga East Dangbe West
West Coast	Awutu/Afutu/Senya Mfatsiman Gomoa Agona Abura Aseibu Kwaman Nzema East

	Jomoro Wassa West

BUGDET

5 Automatic Weather Stations for parts of the North - $60,000 *5 == $300,000

5 Automatic Weather Stations for the Middle Belt- $60,000 *5 == $300,000

5 Automatic Weather Stations for the southern part of Ghana $60,000 *5 == $300,000

Items	**Number**	**Unit Cost**	**Frequency**	**Total in Cedis**
Boarding and Lodging	10	400	**10**	40,000.00
Conference Facility	30	250	**10**	75,000.00
Allowances:				
Resource Persons	10	250	**10**	25,000.00
Participants	25	150	**10**	37,500.00
Running of Vehicles	4	1200	**10**	48,000.00
Contingency	1	1,850	**10**	18,750.00
Total				**244,250.00**

TOTAL

$300,000+$300,000+$300,000+$20,354 = $920,354.00.

Request for Support from the Global Shield Against Climate Risk
Addressing the Akosombo Dam Disaster
Request Submitted by: the Ministry of Finance, Ghana

Executive Summary:
The Akosombo Dam disaster, resulting from necessary controlled spillage exercises, underscores the critical need for enhanced climate risk management and adaptive capacity in infrastructure and community resilience. This request seeks immediate assistance and long-term support from the Global Shield Against Climate Risk to address the direct impacts of the recent disaster, rectify identified risk management gaps, and fortify the Akosombo Dam and surrounding communities against future climate-induced threats.

I. Problem Statement:
The Akosombo Dam, a cornerstone of Ghana's energy infrastructure and a linchpin for the nation's economic activities, now faces imminent threats from climate-induced challenges. Recent unforeseen variations in climatic patterns have resulted in water inflow rates that stretch the dam's current operational and structural limits. The controlled spillage exercise initiated by the Volta River Authority (VRA) in October 2023, although a necessary measure to safeguard the dam's integrity, has manifested as a devastating event for the communities residing along the lower basin of River Volta.

Thousands of residents across multiple district assemblies have been displaced due to the river's overflow, leading to profound societal and economic disruptions. Beyond the immediate inundation, there are extensive power outages, disruptions in health services, and endangerment of lives due to the absence of electricity, damaged road networks, and the necessity for makeshift water transit. Vital installations like the GRIDCo sub-station and numerous hospitality facilities are submerged, amplifying the gravity of the current situation.

If such spillage events or other climate-induced challenges recur without any mitigation strategies in place, the results could be even more catastrophic, potentially compromising the dam's structural integrity entirely. Such a scenario would endanger millions in the Eastern, Volta, and Greater Accra Regions.

It is thus clear that while the Akosombo Dam has served Ghana well for decades, its current design, operational protocols, and the associated community infrastructure are ill-equipped to handle the evolving challenges of our changing climate. Immediate, comprehensive, and multi-faceted interventions are essential not only to secure the dam and its functions but also to safeguard and support the numerous lives and communities in its vicinity.

Type of Interventions
Financial Protection Instruments **I** Technical Assistance **I** Financial Assistance

II. Risk Management Gap Analysis:

A. **Vulnerabilities:**

1. **Infrastructure Rigidity:** The Akosombo Dam's current design lacks the flexibility to accommodate extreme climate events, evidenced by the limited spillage capacity relative to inflow increases.
2. **Inadequate Early Warning Systems:** The existing systems failed to provide timely, actionable information to downstream communities, contributing to the severity of displacement and property damage.
3. **Community Unpreparedness:** Affected communities lacked adequate knowledge, plans, and resources to respond effectively to the spillage-induced floods.
4. **Dependence on Centralized Solutions:** Over-reliance on the Akosombo Dam for power generation and flood control increases vulnerability due to the lack of decentralized, adaptive solutions.

B. **Solutions in Adaptive Capacity:**

1. **Flexible Infrastructure Design:** Invest in retrofitting the Akosombo Dam with advanced materials and spillway technology, increasing its adaptability to extreme climate scenarios.
2. **Enhanced Early Warning and Response Systems:** Develop and implement state-of-the-art forecasting tools that integrate real-time data, AI, and community-level communication channels.
3. **Community Education and Evacuation Strategies:** Establish ongoing community engagement programs that build local knowledge and capacity for effective emergency response, including safe evacuation practices and risk mitigation.
4. **Decentralized Energy and Flood Management Solutions:** Explore and invest in supplementary, smaller-scale reservoirs and renewable energy sources to reduce pressure on the Akosombo Dam and enhance regional resilience.

III. Request for Support:

A. **Immediate Humanitarian Assistance:**

- Provide emergency relief to displaced persons, including food, shelter, and medical services.
- Support the rapid restoration of essential services, such as electricity and healthcare, in affected areas.

B. **Infrastructure Strengthening and Technological Integration:**

- Fund the structural reinforcement and technological enhancement of the Akosombo Dam, incorporating flexible design elements and advanced monitoring systems.

- Support the development of auxiliary infrastructure, including secondary reservoirs and renewable energy installations.

C. **Community Resilience Building:**
- Finance the establishment and training of local disaster readiness teams.
- Support the reconstruction of resilient housing, road networks, and public facilities in flood-prone areas.

D. **Sustainable Economic Recovery:**
- Invest in sustainable livelihood programs, focusing on climate-smart agriculture, skill development, and small business recovery grants.
- Facilitate the establishment of a community-based insurance scheme to provide financial safety nets for future disasters.

E. **Knowledge Sharing and Capacity Building:**
- Facilitate partnerships with global climate risk and dam management experts for knowledge exchange and capacity building.
- Establish a regional climate risk research and education center focused on innovative solutions and community empowerment.

F. **Financial Readiness:**
- Create a dedicated fund, supported by international stakeholders, for ongoing dam maintenance, community resilience initiatives, and emergency responses.

IV. Conclusion:

The Akosombo Dam disaster is a stark reminder of the escalating risks posed by climate change, particularly for large infrastructures critical to national economies and community livelihoods. Proactive measures, focused on adaptive capacity, community resilience, and sustainable development, are essential to mitigating future risks. We urge the Global Shield Against Climate Risk to consider this a priority intervention[1] and extend the necessary support to safeguard the future of the Volta River basin communities and the integrity of essential national infrastructures like the Akosombo Dam.

[1] We recognise that not all the interventions need to be implemented immediately. However, given the immediate and ongoing impact of the floods on the communities within the impacted area, Section 3A which talks about Community support should be considered a priority that requires immediate support if possible.

Annexure 1

Intervention Area/Activity	Estimated Cost
1. Regular Comprehensive Assessments:	
- Engaging international dam safety experts	$500,000
- Advanced monitoring tools (Remote sensing, drones)	$200,000
2. Strengthening Dam Infrastructure:	
- Reinforcing dam walls with advanced materials	$5,000,000
- Upgrading spillway and outlet works	$3,000,000
3. Sediment Management:	
- Measures to reduce sediment inflow	$2,500,000
- Periodic sediment dredging	$2,000,000
4. Advanced Forecasting System:	
- Modern water forecasting system implementation	$1,500,000
- Collaboration with meteorological agencies	$300,000
5. Adaptive Operational Protocols:	
- Development and implementation of operational protocols	$400,000
- Training for dam operational staff	$300,000
6. Community Engagement and Evacuation Plans:	
- Community awareness campaigns	$200,000
- Development of evacuation plans	$250,000
7. Integrated Reservoir Management:	
- Establishment of supplementary reservoirs	$10,000,000
- Water conservation practices promotion	$500,000
8. Technological Integration:	
- IoT sensors for real-time monitoring	$2,000,000
- AI and machine learning tools	$1,500,000
9. Research & Collaboration:	

Intervention Area/Activity	Estimated Cost
- Collaborations with international dam management organizations	$200,000
- Research initiatives	$1,000,000
10. Financial Readiness:	
- Emergency reserve fund	$5,000,000
- Public-private partnerships setup	$500,000
Rebuilding and fortifying community infrastructure	$15,000,000
Social support to impacted communities and individuals	$10,000,000
Promotion of climate-smart agricultural practices	$2,000,000
Capacity-building and continual improvement	$3,000,000
TOTAL BUDGET	**$66,250,000**

Annexure 2

Detailed Background

In the heart of Ghana, the Akosombo Dam stands as a testament to human ingenuity and a lifeline for numerous sectors vital to the nation's well-being. However, October 2023 marked a period of unforeseen adversity for this monumental structure and the vibrant communities along the Volta River's lower basin. The precarious balance between harnessing nature and succumbing to its overwhelming force was starkly illuminated when the Volta River Authority (VRA) faced a critical decision – a controlled spillage exercise to prevent a catastrophic dam failure due to rapidly rising water levels. This necessary action, albeit an emblem of a larger climate crisis, triggered immediate and widespread ramifications for the surrounding regions, emphasizing the urgent need for a robust support system and adaptive measures to protect against such climate-induced risks.

The chain of events leading to this disaster commenced on September 15, 2023, when the dam's water levels reached a concerning 272.50 feet, a mere 5 feet below its maximum capacity. The VRA initiated a controlled spillage at 20,000 cubic feet per second (cfs/day) to alleviate this pressure, a measure deemed critical to preserve the dam's structural integrity and the technological apparatus within. Despite these efforts, water inflows persisted unabated, necessitating a significant escalation in the spillage rate to 183,000 cfs/day by October, compelling the opening of six spillage gates.

This drastic increase resulted in an overwhelming discharge of approximately 6,600 cubic meters of water, a minute fraction of the dam's capacity yet a colossal volume

for the downstream ecosystems and communities. The immediate aftermath was nothing short of devastating. Riverbanks overflowed, and floods swept through settlements across nine district assemblies, including North, Central, and South Tongu Districts; Shai Osudoku; and Ada, among others. Essential public installations, including hospitals and GRIDCo's sub-station at Fievie, faced operational paralysis due to inundation, endangering countless lives. Approximately 25 nurses were evacuated from the Comboni District Hospital alone, indicating the scale of the crisis faced by healthcare professionals and patients.

Moreover, the deluge ruthlessly consumed numerous residences, disconnecting communities, and rendering road networks invisible under its might. Residents were forced into perilous journeys by boats and canoes, often without life-jackets, risking their lives to navigate the new waterways where streets once stood. The disaster did not spare the economic sector either, with notable hospitality facilities such as Villa Cisneros, Sogakope Beach Resort and Spa, and Holy Trinity Spa and Health Farm reporting significant impacts.

The domino effect of the spillage extended to the environmental front as well, with lagoons in the Keta basin breaching their confines and flooding communities in the Anlo and Keta districts. While this measure was a lesser evil compared to the potential dam collapse as emphasized by Kenneth Mensah Arthur, Deputy Chief Executive-Services, VRA, it underscored significant gaps in risk management, early warning, community preparedness, and adaptive capacity at both the infrastructural and community levels. It also highlighted the region's vulnerabilities to climate phenomena and the profound implications of such events on human life, economic stability, and environmental integrity.

Through this request, we seek immediate and long-term assistance from the Global Shield Against Climate Risk to urgently fortify not only the Akosombo Dam but also to build the resilience and provide a social safety net for the communities impacted.