

Country:	Ghana
Request Identification Number:	2016000006

Title:	Improving resiliency of crops to drought through strengthened early warning within Ghana.
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Summary of the CTCN Technical Assistance

Historical data indicates a climate signal for Ghana resulting in a rise in temperature and decrease in mean annual rainfall in most of the country. It is expected that this trend will continue over the coming decades. The economy of Ghana, which relies mainly on sectors such as agriculture, energy and water, is sensitive to climate change, thus climate change adaptation is critical for the future water management within these sectors. Due to the limited use of irrigation in Ghana, the majority of the agricultural areas are very vulnerable to changes related to the climatic conditions and increased frequency of flood and drought events (National Climate Change Adaptation Strategy, Ghana). The agricultural and water sectors were identified in the climate change technology needs assessments report (TNA) from 2013 as the main sectors in needs of adaptation technology for climate change.

The CTCN technical assistance relates to ***Improving resiliency of crops to drought through strengthened early warning*** within Ghana. The proposed technologies and methods are aligned with both the National Climate Change Adaptation Strategy (NCCAS) and the technology needs assessment (TNA) reports, and aim at improving the ability for climate change adaptation within Ghana. The objective of this technical assistance is to facilitate transfer and capacity building for climate change adaptation focusing on dry season management and planning. The proposed support will utilise existing knowledge and capacity and further develop and validate these for applications to local issues within Ghana.

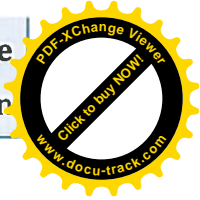
The following aspects of climate technologies are of relevance to the specific focus of this Response Plan:

Data accessibility: Data is one of the key components in any warning or information management systems. The use of existing satellite based data will be strengthened by methods for automated download and processing of relevant satellite data. The aim is to avail near real time satellite products related to drought warning and forecasting.

Climate forecasting: Seamless weather forecasting functionalities enabling climate forecasting across different temporal scales (including short, seasonal and decadal periods) is critical for description of how droughts will evolve in the future. CTCN technical assistance will enable the use of climate forecasting to produce information on droughts severity and impacts in Ghana.

Early warning: An early drought warning system facilitates the provision of timely and effective information related to the water and agriculture sectors allowing these sectors to take actions to mitigate impacts of the upcoming drought. The early warning system will be designed through the national stakeholders' consultation.

Adaptation Planning: Planning methods incorporating the early warning assessments and the uncertainty associated with climate predictions will be addressed in the



proposed technical assistance. Solutions that are robust and resilient towards droughts will be explored as part of this support. Experience and knowledge from other projects will be incorporated into the proposed request.

Early warning communication: The dissemination and outreach part of a warning and forecast system is one of the key components. The dissemination part will focus on national and regional organizations as well as on gender related issues associated with drought warning and forecast.

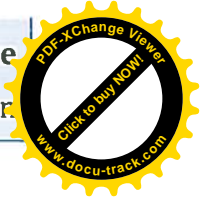
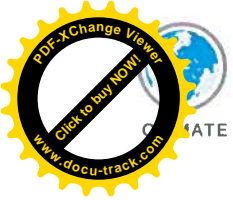
This technical assistance is aiming at improving the preparedness to drought through increased capacity and technologies for improved and timely early warning information provided to the relevant sectors and organisations. Moreover, the technologies will be tailored and tested for the specific local conditions of Ghana. The expected outputs from this CTCN technical assistance will be of immediate use in fulfilling the goals of the TNA and the NCCAS, and will potentially be one of the key tools for accomplishing the goals described in these documents related to the agriculture and water sector in Ghana.

1. Overview of the CTCN technical assistance

1.1 Technology aspects

The specific technologies supported by the CTCN assistance will be related to climate change and variability in seasonal and long-term planning for the dry season. It is anticipated that a web-based data portal will support the following components:

- **Data accessibility.** Web-based technology allowing the stakeholders to access near real-time satellite-based data for Ghana. The available data will be related to climate (rainfall and temperature), crop and soil moisture conditions. The aim is to avail near real time satellite products related to drought warning and forecasting, and provide the required data input for the drought warning and forecasting system.
- **Climate forecasting.** Climate forecasting is a key product for assessing the evolution of a drought in the coming season. Existing seasonal forecast products and associated skills within Ghana will be explored, and a near real-time product will be made available through the mentioned web-based data portal.
- **Climate change.** The latest climate change results from the CORDEX project will be evaluated and included in the data portal. Focus will be on technologies for utilising and accessing the climate change information.
- **Early warning.** An early drought warning system facilitates the provision of timely and effective information related to the water and agriculture sectors allowing these sectors to take actions to mitigate impacts of the upcoming drought. The available data will be used for establishing a web-based drought early warning system on a seasonal scale and a drought forecasting system on the long-term scale. The early warning system will be designed through



the national stakeholders' consultation, and will be closely integrated with the proposed data portal.

- **Adaptation planning.** The technology will support identification of solutions that are robust and resilient towards drought taking climate variability and climate change into consideration. Capacity building and knowledge transfer will be key elements of this component.
- **Early warning communication.** Tools for disseminating warnings and forecasts will be evaluated in close cooperation with the local stakeholders.

All the mentioned technologies will be made freely available for the stakeholders and will not be associated with any license or maintenance cost.

1.2 Objectives (outcomes)

Broadly, the objective of this technical assistance is to facilitate transfer and capacity building of technologies for climate change adaptation aligned with the Ghana National Climate Change Policy, the National Climate Change Adaptation Strategy (NCCAS) and the technology needs assessment report (TNA). The CTCN assistance will be important for fulfilling these national strategies. More specifically, this CTCN technical assistance Response Plan is designed to enhance the capacity of relevant local government agencies to address a number of drought related issues.

The specific objectives of this technical assistance are to:

- a. Enhance awareness and knowledge of spatially distributed drought issues within Ghana
- b. Increase the data accessibility of relevant near real-time satellite information
- c. Provide scientific based information for drought warning and forecasting within Ghana
- d. Enable decision makers and stakeholders to use the transferred knowledge, practices and technologies actively in the dry season planning

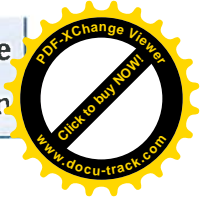
The overall contribution of the CTCN technical assistance will be the establishment of scientific based practices and capacity for inclusion of climate change and climate variability into dry season management.

1.3 Results (outputs expected from CTCN assistance)

Consistent with the national strategies identified in the National Climate Change Adaptation Strategy (NCCAS) and the technology needs assessment report (TNA), the expected outputs from the CTCN assistance are be as follows:

- a. The operational early drought warning system for Ghana is to be used actively by the stakeholders for dry season management. This will further increase the knowledge and awareness of drought management within Ghana.
- b. Technologies for evaluation of, and adaptation to, climate change impacts from drought frequency and duration, and therefore on crop production within Ghana. This output is to be used for long term planning within the agriculture, water and energy sectors in Ghana.
- c. Facilitating and seeking a stronger collaboration between the regional institutions with respect to drought management and resilience of crop production to a changing climate.

1.4 Expected use of outputs



The expected outputs from the CTCN assistance will be tailored to the conditions in Ghana and thus of immediate use to fulfil the goals of the TNA and the NCCAS. They will be one of the key tools for accomplishing the goals specified in the TNA and NCCAS related to the agriculture and water sector in Ghana.

WRC and key institutes in Ghana have a very specialized knowledge and focus on flood preparedness and there are a number of ongoing projects focusing on flood (e.g. White and Black Volta), while less focus is given to drought preparedness and management. As impacts of droughts will become more severe in Ghana, the CTCN assistance will help in increasing capacity and knowledge at WRC and other organisations in understanding and dealing with drought related issues.

The outputs of the CTCN assistance will be used to issue timely information and warnings to key stakeholders, and support planning adaptation measures for future drought events. In addition, they will also contribute to address a current knowledge gap and provide an essential platform for future projects and funding. The outcomes will be a catalyser for financing of larger projects focusing on drought and climate adaptation within Ghana.

2. Description of the Assistance

2.1 Activities

The activities have been assigned into 3 main categories, as detailed below. The first activity consists of identifying the requested need within relevant stakeholders and detail the required technology. The second activity focuses on adjustment of the existing technologies and validation within an assigned area in Ghana, while the third activity contains the final technology transfer through workshops and training events in Ghana.

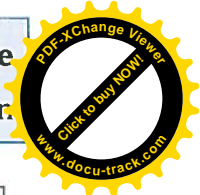
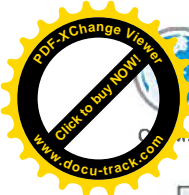
Activity 1 – Stakeholders consultation

The activity aims at presenting the scope of the request to a wide range of stakeholders in Ghana and identify the needs for improved dry season management technologies.

Activity 1.1 – National workshop to identify priorities for the CTCN assistance

A national workshop with relevant stakeholders will be organized (2-day workshop with a maximum of 15 participants) in order to present the scope of the CTCN assistance, prioritise the outcomes and finalise the workplan. The NDE and WRC will assist in identifying the relevant stakeholders for the workshop. The scope of the workshop will be to present the scope of the CTCN response plan, identify the current specific gaps related to drought forecasting and dissemination and the associated needs for including climate variability and climate change into dry season management in Ghana. The national workshop will also identify existing technologies, and potential gender issues, such as reaching the maximum amount of woman farmers through the CTCN assistance.

Deliverables	Delivery date
<i>List of relevant stakeholders drafted</i>	<i>Week 2</i>



<i>National workshop (minutes from workshop) reports</i>	<i>Week 8</i>
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Activity 1.2 – Needs assessment

The national workshop will address the prioritised gaps and requirements for the CTCN assistance. The outcomes of the national workshop and additional stakeholder meetings will be compiled into a needs assessment report describing the requirements for the CTCN assistance. The report will address the current practices for dry season management in Ghana, list gaps in the current practices, describe typical challenges and risks, and detail results and outcomes from previous projects. Finally, the report will map out the specific needs and requirements for the outputs from the CTCN assistance.

Deliverables	Delivery date
<i>Needs assessment report (maximum of 30 pages)</i>	<i>Week 10</i>

Activity 1.3 – Technology description

The outcomes from the national workshop and the needs assessment report will lead to a more detailed description of the proposed technology in a technology specification report. The following issues will be described in the technology specification report:

Technology development: detailed specifications for the developed technology, this includes how the adjustment of existing methods or technology will be done and specifications for development of new methods or technology. This refers to the implementation of activity 2.1.

Testing and validation of the technology: specifications for how the developed technology should be tested and validated. This includes technical use cases to validate the functionality, and specifications for an in-situ validation on a selected location in northern Ghana. This refers to the implementation of activity 2.2.

The technology specification report should be approved before activity 2 is initiated.

Deliverables	Delivery date
<i>Technology specification report (maximum of 50 pages)</i>	<i>Week 14</i>

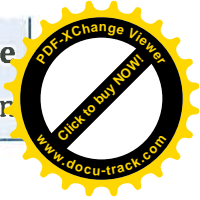
Activity 2 – Technology implementation

The activity aims at developing the early warning and forecasting system and validating the use of it on a selected location within northern Ghana.

Activity 2.1 – Technology adjustment and development to local conditions

This sub-activity consists of the establishment and development of the required technologies for the CTCN assistance. This includes:

- **Web-based data and information portal** aims at providing relevant stakeholders in Ghana with near real-time information and data required for drought monitoring and forecasting. The



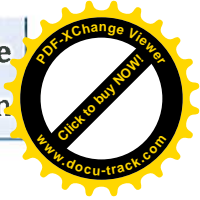
data sources will include rainfall, temperature, vegetation cover, water availability in the root zone, forecasted rainfall (seasonal forecast), climate change factors and a number of relevant drought indices derived from these data sources. The drought indices will be included to compare the current situation against historical records. Example of indices to be included will be standardized precipitation index, anomaly and deviation index. All data sources will be spatially distributed and updated in near real time. In normal operation, the time lag from when the data is available at the source and when it is available at the portal will be maximum a few days, thus operating in near real-time. The web-based portal from where data can be visualised and accessed will be the central information platform for the early warning and forecasting system.

- Web-based early warning and forecasting system** aims at providing timely and correct information to relevant stakeholders related to the current and projected drought status. The early warning and forecasting system will be the key technology in the CTCN assistance, as it will make use of the available near real-time data in the data portal to provide analysis of the current and projected drought status and impact in Ghana. The assessment of the current drought status will be based on near real-time data and associated drought indices. Climate, vegetation and soil moisture impacts will be assessed using predefined drought categories. The drought assessment will be prepared for dissemination to relevant stakeholders within Ghana. In addition, the forecasted drought status (for the coming 2 to 4 months) will be assessed based on the seasonal forecast and will be used to predict climate impacts as well as the estimated crop yield and impact on selected crops in Ghana. The long term drought assessment (decades) will be built upon results from the latest climate models where results such as changes in number of dry days, extreme events and rainfall pattern will be made available for assessment of the expected long term changes in drought spells. The early warning and forecasting system will be a web-based system and closely linked to the data and information portal.
- Knowledge and methods** for including the drought status and forecast in a planning context are important for the drought adaptation and preparedness in Ghana. The CTCN assistance will evaluate planning methods and solutions applicable in Ghana, which are robust and resilient towards climate variability and climate change. These methods will be disseminated as part of the technical training and will provide the linkage between the warning and forecasting system and the local application of the technologies in Ghana.
- Dissemination technologies** to present the outputs from the early warning and forecasting system are a key component of the CTCN assistance. A specific focus on technologies and methods for dissemination of the technical outputs to relevant stakeholders will be given as part of this activity. The dissemination tools will be targeted towards the different potential end users in Ghana.

Deliverables	Delivery date
<i>Methodology for validation and testing</i>	<i>Week 15</i>
<i>First version of the system for QA and testing by the main applicant</i>	<i>Week 35</i>

Activity 2.2 - Technology validation

The technologies will be validated on a selected location in northern Ghana. The location will be selected in close collaboration with the main applicant and will be an area with frequent drought spells. The dry season in Ghana is typically between November and February. The validation of the technology will be done in two steps, firstly on a historical drought event using the available information from that period (validation of the forecast on a past period), and secondly on a current event with real time assessment of the drought status in the selected location in the northern part of Ghana.



The objective of this activity is to ensure validated outcomes are produced in a correct and timely manner and their dissemination can support the relevant stakeholders. The specific content of the validation will be determined as part of Activity 1.1 (National workshop) and 1.2 (Needs assessment report).

Deliverables	Delivery date
<i>Review report from main applicant</i>	<i>Week 40</i>
<i>Technology validation report</i>	<i>Week 45</i>
<i>Technology description and user guide</i>	<i>Week 45</i>

Activity 3 – Technology transfer and dissemination

The activity aims at ensuring the transfer of knowledge and technology to the local and regional stakeholders.

Activity 3.1 – Second national workshop to create awareness and knowledge of the outcomes

A second national workshop will be held with relevant stakeholders and organisations in Ghana with the aim of creating awareness and knowledge of the technology transfer. The workshop will include a maximum of 15 participants for a duration of 1 day. At the workshop, the validation case will be presented in details in order to provide in-depth information on the use and benefits of the technologies. A summary report describing the key outcomes of the workshop will be produced.

Deliverables	Delivery date
<i>Summary report of the second national workshop</i>	<i>Week 50</i>

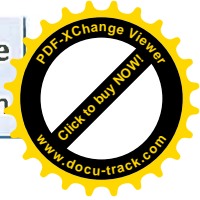
Activity 3.2 – Technical training

A technical training (2-day) for selected staff within the key organizations (maximum 5 organisations and a total of 15 participants) will be organised with the objective of providing detailed knowledge and capacity in using the transferred technologies in Ghana on an ongoing basis. Five organizations to send trainees to this workshops will be selected by the implementers together with the main applicant. All training material will be made available to the trainees for further use after the training. In addition, a short summary report with outcomes of the training will be produced. This report will identify key areas where further capacity building is required.

Deliverables	Delivery date
<i>Technical training material (including exercises, presentations)</i>	<i>Week 50</i>
<i>Summary report of the technical training (including key outcomes, list of participants)</i>	<i>Week 50</i>

Activity 3.3 – Outreach and dissemination

The outreach and dissemination part aiming at providing awareness and knowledge of the technology to relevant organizations. This activity includes:



- Presentations for key Ghana institutes and relevant partners through separate meetings (maximum of 3 meetings). The CTCN contractor will organize and attend the meetings and will report the outcome of these meetings to the main applicant. The minutes will be published in the lesson-learned report.
- Presentation of the technologies for VBA and ECOWAS as they are the relevant bodies for the Volta basin and the West Africa Union. The CTCN contractor will organize and attend up to 2 meetings with relevant regional organisations. The CTCN contractor will report the outcome of these meetings to the main applicant, and the minutes will be published in the lesson-learned report.
- Lesson-learned report from the validation case and the initial use of the system in Ghana (maximum of 30 pages). This also includes description and design of gender relevant indicators, and identifying at-risk groups and recommendations to improve gender-sensitive drought planning. The report will be submitted to the main applicant.
- Roadmap documentation describing recommendations for transfer of the technology and scaling up within future projects (maximum of 20 pages).
- Dissemination of reports, materials and tools to all relevant stakeholders. This will be done through the main applicant, where the CTCN contractor will make the required documents and tools available.
- Evaluate funding options through regional partnerships and donors for post response interventions. This will be reported in the roadmap document.

Deliverables	Delivery date
<i>Lesson learned and recommendation report (maximum of 30 pages)</i>	<i>Week 52</i>
<i>Roadmap documentation in transfer of technology and scale up (maximum of 20 pages)</i>	<i>Week 52</i>

2.2 Synergies and Baseline Setting

There are a number of past and ongoing initiatives, which the CTCN assistance will have to link to or take into consideration. Examples of relevant projects or initiatives are:

- **Flood and drought Management Tools project** (<http://fdmt.iwlearn.org/en>)
 - GEF funded project implemented by UNEP aiming at delivering tools for embedding flood and drought issues into water related planning at basin and catchment scale. The developed tools are to be applied at a global level and could be used as the starting point for the CTCN support.
- **CREW** (<https://crewghana.wordpress.com/>)
 - Implementation of hazard mapping, early warning, and vulnerability assessment at 10 pilot sites.
- **African Adaptation project** (<https://www.undp-aap.org/>)
 - Programme developed designed to assist 20 countries across Africa to incorporate climate change risks and opportunities into their national development processes
- **Rainfall Ghana** (<http://www.rainsat.net/index.html?country=Ghana>)
 - Web portal presenting near real-time rainfall data from the Meteosat observations
- **National Climate Change Adaptation Strategy (NCCAS)**
- **Technology needs assessment (TNA)**



The agricultural sector in Ghana relies to a large extent on rainfed agriculture, and is very sensitive towards climate variability. The agricultural sector is also mentioned as one of the main sectors in need of adaptation technology for climate change in the technology needs assessment report (TNA). There are currently a number of ongoing initiatives looking at flood impact and flood forecasting, but less attention has been given to drought warning and dissemination in Ghana. The CREW project is one of the few ongoing national initiatives focusing on drought.

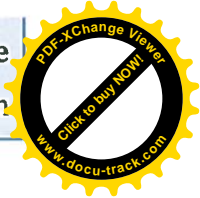
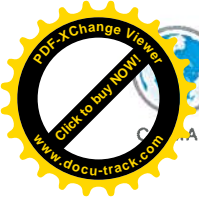
Reliable and timely information for drought monitoring is critical, and currently there are services providing near real time rainfall data, but little attention have so far been on dissemination of drought information. Furthermore the knowledge and capacity within drought seem to be present within the research institutes while the main water related organizations have more focus on flood forecasting compared to drought.

2.3 Timeline

Activity	Weeks											
	4	9	13	17	22	26	31	36	40	44	49	52
1 Stakeholder consultation												
1.1 National workshop to identify priorities for the CTCN assistance	█											
1.2 Needs assessment	█	█										
1.3 Technology description	█	█	█									
2 Implementation												
2.1 Technology adjustment and development		█	█	█	█	█	█	█	█			
2.2 Technology validation			█	█	█	█	█	█	█	█		
3 Technology transfer												
3.1 Second national workshop to create awareness and knowledge of the outcomes											█	█
3.2 Technical training											█	█
3.3 Outreach and dissemination											█	█

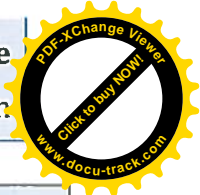
2.4 Expertise required

This section describes the expertise required to deliver a successful technical assistance, in order to achieve the described objectives and outcomes. This expertise to deliver the CTCN assistance includes:



- Documented knowledge of the local conditions and institutional setup in Ghana
- Demonstrated experience in drought management and dissemination in Western Africa
- Experience in working with technologies applied to remote sensing data
- Experience and knowledge of relevant near real time data used for drought management
- Experience with planning solutions used for seasonal and long term planning of drought adaptation measures
- Expertise with climate adaptation with the agriculture and water sector in Western Africa
- Familiarity with multiple stakeholder consultations and workshop facilitation
- Technical knowledge and skills for development of web based solutions

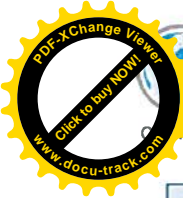
Activity 1 – stakeholder consultation	Required expertise
<i>Activity 1.1 - National workshop to identify priorities for the CTCN assistance</i>	<i>Workshop (2 day workshop with 15 participants). Experience in stakeholder consultation and knowledge of the institutional setup in Ghana (expected input: 2 experts, 4 to 5 days each)</i>
<i>Activity 1.2 – Needs assessment</i>	<i>Drought and climate change expert with experience from the current practice in Ghana and Western Africa (expected input: 3 to 6 days)</i>
<i>Activity 1.3 – Technology description</i>	<i>Knowledge of institutional setup and capacity in Ghana. Expertise in drought and climate change related issues. Remote sensing expert Expert in web based technology, and experience with analysis and dissemination of drought and climate related issues (expected input: 3 to 6 days)</i>
Activity 2 – Technology implementation	
<i>Activity 2.1 – Technology adjustment and development</i>	<i>Knowledge of institutional setup and capacity in Ghana. Proficient analytical and writing skills (English) Local knowledge of the selected site in Northern part of Ghana (expected input: International expert 60 to 70 days and web developer 20 to 30 days)</i>
<i>Activity 2.2 – Technology validation</i>	<i>Expertise in drought and climate change related issues. Demonstrated experience in drought management and dissemination in Western Africa Expert in web based technology Proficient analytical and writing skills (English) (expected input: 30 to 35 days)</i>
Activity 3 – Technology transfer and dissemination	
<i>Activity 3.1 – Second national workshop to create awareness and knowledge of the outcomes</i>	<i>Workshop (1 day workshop with 15 participants). Experience in stakeholder consultation and knowledge of the institutional setup in Ghana Expert in drought management and climate change Experience with planning solutions used for seasonal and long term planning of drought adaptation measures Demonstrated experience in drought management and dissemination in Western Africa (expected input: 8 to 10 days)</i>



Activity 3.2 – Technology training	<p>Training workshop (2 day workshop with 15 participants)</p> <p>Expert in drought management and climate change</p> <p>Experience with planning solutions used for seasonal and long term planning of drought adaptation measures (expected input: 8 to 10 days)</p>
Activity 3.3 – Outreach and dissemination	<p>Experience in stakeholder consultation and knowledge of the institutional setup in Ghana (expected input: 12 to 20 days)</p>

2.5 Main partners

Stakeholder	Role to support the implementation of the CTCN assistance
Water Resources Commission	<p>Main applicant and assisting the CTCN contractor in the implementation of the CTCN supported technology in Ghana. In addition, the WRC will support this technical assistance in:</p> <ol style="list-style-type: none"> 1. Requirements for needs assessment 2. QA and review of the proposed technologies 3. Review of the validation report 4. Host for the national workshops
Ghana Meteorological Agency	<p>GMET Provide meteorological information since they collect, process, archive and analyse meteorological data</p>
Environmental Protection Agency	<p>EPA coordinate climate change activities in Ghana to realize full impact in country</p>
Hydrological Services Department	<p>HSD collects and manages hydrological data in Ghana</p>
National Disaster Management Organization (NADMO)	<p>National disaster management by coordinating resources while developing the capacity of communities to respond effectively to disasters</p>
Ghana Irrigation Development Authority (GIDA)	<p>GIDA promote agricultural growth through provision of irrigation infrastructure and other Agricultural water management techniques</p>
Regional Coordination Councils in the Project Area (3)	<p>RCCs coordinates the activities of all decentralized local authorities</p>
Ministry of Water Resources, Works and Housing (MWRWH)	<p>MWRWH formulates, implement and co-ordinate policies and programmes for the development of infrastructure requirements in respect of Works, Housing, Water Supply and Sanitation, Hydrology and Flood Control Systems</p>
Ministry of Food and Agriculture (MOFA)	<p>MOFA develops agriculture growth in the country with formulation of appropriate agricultural policies, planning & co-ordination, monitoring and evaluation</p>



<i>Ministry of Environment, Science, Technology and Innovation (MESTI)</i>	<i>MESTI formulates, develops, implement, monitor and evaluate environmental, science and technology and innovation policies.</i>
<i>Ministry of women and Gender</i>	<i>MWG responsible for coordinating Gender Issues in Ghana</i>
<i>Water Research Institute</i>	<i>WRI carries out water related research including impacts of climate change</i>
<i>Savanna Accelerated Development Authority</i>	<i>SADA has the mandate to facilitate development activities within the Savanna zone</i>
<i>Centre for Remote Sensing and Geographic Information Services</i>	<i>Provide geographic information and remote sensing services for sustainable development planning and management of resources.</i>

2.6 Indicative budget

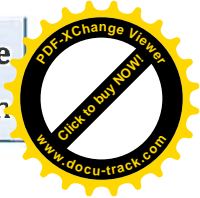
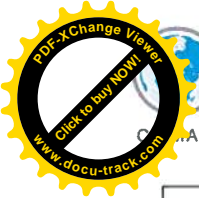
Activities	Estimated Budget (USD)
Activity 1	41,000
Activity 2	138,000
Activity 3	62,000
Audit	2000
Total	243,000

Implementation of this Response Plan will be led by the Climate Technology Centre (including selection, contracting, supervision and monitoring of implementation partners) in close coordination with the corresponding National Designated Entity and relevant national actors. Implementation will be led by an International Consortium or Network Partner of CTCN.

2.7 Gender considerations

Households and farmers relying solely on rainfed agriculture are the most vulnerable group for climate change induced drought impacts, as they have few resources and little capacity for adaptation measures. Many of these farmers will be women and the CTCN assistance will provide improved information on crop security and solutions for climate adaptation targeting these vulnerable groups. This TA response will ensure a proper dissemination of the results to this group, which is one of the key criteria when disseminating the key results from the project. In addition, impacts on family life, female employment, and other gender considerations will be explored when designing the dissemination performance indicators. More specific gender related indicators will be developed as part of Activity 3.3 (outreach and dissemination). Outcomes can include identifying at-risk groups and recommendations to improve gender-sensitive drought planning. These findings are to be incorporated within the recommendations for how the technologies will be disseminated and used within Ghana (Activity 3.3).

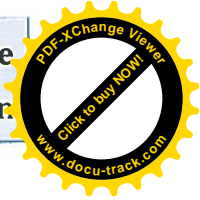
2.8 Risk identification and risk mitigation



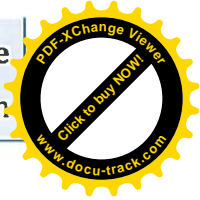
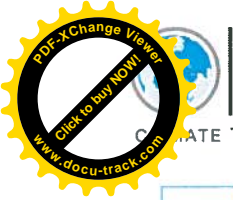
Risk	Consequence	Probability	Mitigation measure
Inadequate information or data not available for the CTCN assistance	Local validation of the technologies will not be successful.	Less than 10 %	The use of freely available remotely sensed data limits the need for local information.
Inadequate stakeholder mapping	Required information for the local conditions in Ghana might not be embedded in the technology	Less than 10 %	Water Resources Commission will be responsible for the stakeholder mapping and they have extensive knowledge of the local stakeholders
Political instability or other forms of unrest	Impact the local presence in the country	Less than 10 %	The situation in Ghana is at the moment very stable and it is not foreseen that the country will be affected by any form of unrest within the period of the CTCN support.
Validation of the technologies within the dry season	Technologies not validated within the present dry season	Less than 25 %	The technologies will initially be validated against a previous drought spell using the available information from that period. This validation will provide a sound baseline for the validation and testing of the technologies, in case a validation within the present dry season is not possible.

3. Long-term impacts of the assistance

3.1 Expected climate change-related benefits



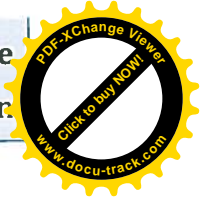
	CTCN climate technology impact	Anticipated contribution from CTCN assistance
1	Climate technologies adapted to national context are identified and prioritized to enable their deployment and/or transfer in the requesting countries	The technologies will be adapted to the local context in Ghana through a series of workshops and training sessions. The main applicant WRC will be responsible for ensuring the final technologies to be embedded into a local context.
2	New national Technology Needs Assessment (TNA) and Technology Action Plan (TAP) as a result of the response	The CTCN assistance will include technologies and methods within the component of <i>Integrated Climate Monitoring and early warning</i> from the TNA (2013), and will be a key component for a future revision of the TNA.
3	Progress made against mitigation objectives (i.e. energy and carbon intensity reduction) as a result of the response	
4	Progress made against adaptation or resilience objectives (e.g. climate vulnerability index improvement) as a result of the response	The technologies will improve the information base for future adaptation measures and climate resilient solutions within Ghana.
5	New mitigation or adaptation technology projects/initiatives implemented as a result of the response	The results will identify focal areas for new adaptation initiatives, e.g. technical, structural or community, and provide recommendations and/or guidelines to achieve the objectives.
6	New or strengthened policies/ laws developed, approved and enacted as a result of the response	The recommendations resulting from the assistance could be used to enhance the regulatory framework within drought mitigation and adaptation policies.
7	New policies/laws where climate change was mainstreamed as a result of the response	Technologies could be used to develop new policies or laws aiming at drought resilient solutions or adaptation measures.
8	Country integrating climate change mitigation and/or adaptation issues into its planning and policies as a result of the response	The technical assistance is aligned with the National Climate Change Adaptation Strategy (NCCAS) and the resulting technologies will enhance the capacity to integrate new solutions and technologies into planning and policies.
9	New or strengthened Public-Private Partnerships (PPP) created directly as a result of the response	There is likely to be an enhanced partnership between the technology recipient (public) and local industries, farmers or farming corporative. Further development of the technology will likely strengthen this partnership.
10	New or strengthened twinning arrangement	The assistance will be looking at creating



	created as a result of the response	new partnerships with regional organisations as ECOWAS, VBA or GWP.
11	Capacities to access and attract public and private finance increase to enable financing of technology deployment	The initial stakeholder workshops will be used to identify options for local financing mechanisms to be used in the response.
12	Post-response intervention funding attributable to the response.	The response will evaluate funding options through regional partnerships and donors for post response interventions (activity 3.3).
13	Framework and analysis of local production developed to enable deployment of national production of climate technologies	The technology transfer will increase the capacity and role of WRC within drought management in Ghana, and result in an increased focus on deployment and production of climate technologies in relation to drought management and warning.

3.2 Co-benefits

	Sustainable Development Goal	Contribution from CTCN assistance
1	End poverty in all its forms everywhere	Reduction in loss of property and possessions through drought
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	Enhance climate resilient agriculture production and reduce crop losses.
3	Ensure healthy lives and promote well-being for all at all ages	Climate resilient crop production will ultimately have a positive impact on livelihood and wellbeing.
4	Ensure inclusive and equitable quality education and promote life-long learning opportunities for all	
5	Achieve gender equality and empower all women and girls	Gender specific indicators will be developed for monitoring the gender specific issues related to drought management.
6	Ensure availability and sustainable management of water and sanitation for all	Improved drought management will enhance the goals for sustainable water management.
7	Ensure access to affordable, reliable, sustainable, and modern energy for all	Improved hydropower production by improving water resources management.
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	Improved crop production will enhance the economic growth.
9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	

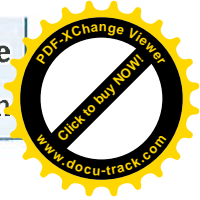
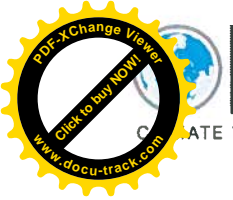


10	Reduce inequality within and among countries	Drought affected areas is one of the key impacts for maintaining a low economic growth in dry rural areas. The technologies will specifically be able to reduce economic inequality between these areas.
11	Make cities and human settlements inclusive, safe, resilient and sustainable	
12	Ensure sustainable consumption and production patterns	
13	Take urgent action to combat climate change and its impacts	The response plan will ensure improved technologies and information to combat climate variability and climate change.
14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development	
15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	The technologies for improved drought management could assist in reversing land degradation and desertification through improved agricultural dry season management.
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	
17	Strengthen the means of implementation and revitalize the global partnership for sustainable development	The response will interact with regional organisations with the aim of strengthening synergies in building resilience to drought in the region

3.3. Post-assistance plans and actions

Post assistance plans include actions that may support and increase the ownership of the outcomes, the scaling up of the technologies and deployment in the region outside of Ghana. Some of the immediate actions might include:

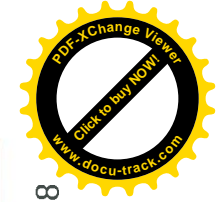
- The outcome of the CTCN assistance will be an important step towards fulfilling some of the specified goals in the TNA and NCCAS and the outcomes will be used actively in this process, ensuring a local ownership of the technologies.
- The main applicant will actively facilitate that the outcomes of the CTCN assistance is embedded in future projects related to drought management and climate change
- The developed roadmap documentation in transfer of technology and scale up will be used actively to pursue further funding within drought management and climate change adaptation in future national or regional projects.
- The linkage to regional organisations and institutes (activity 3.3) will be used to pursue further collaboration on drought management and climate change adaptation in the region.

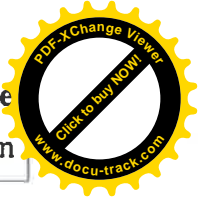
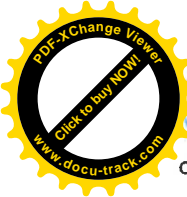


3.4 Monitoring and Reporting of technical assistance results and impacts

Expected activities and milestones under this assistance are explicitly described in section 2.1 and the performance indicators table below (see also log frame in annex). Activities progress and deliverables will be monitored closely by the CTCN contractor of this Response Plan with the collaboration of the NDE in Ghana, the main applicant – Water Resources Commission – and CTCN. The CTCN contractor is responsible for verifying project progress against timeline and associated milestones and communicates these results to the NDE and CTCN. At the end of each activity, the CTCN contractor will provide a short summary of lessons learned of the activity reflecting on the progress, successes and challenges encountered during the activity. Every month a teleconference with country and international partners is held to communicate the state of advancement of the project, challenges, possible needs for adjustments etc. The CTCN contractor is responsible for planning these. All suggested changes to the activities, processes and/or approaches as outlined in current response plan must be accepted by the CTCN and NDE before they can be applied.

Response output <i>(linking to sec 1.2)</i>	How output will be used to ensure creation of result	Expected result	Expected outcome of result <i>(linking to sec 1.1)</i>	Anticipated impact that outcome will produce <i>(linking to section 3)</i>
Enable decision makers and stakeholders to use the transferred knowledge, practices and technologies actively in the dry season planning	Capacity for using the transferred knowledge is required for ensuring the sustainability of the technologies after the proposed response.	Engaged stakeholders with the needed understanding and knowledge of climate change adaptation for drought related impacts.	Technical training for selected staff within selected organizations with the objective of providing detailed knowledge and capacity in using the transferred technologies in Ghana.	Increased capacity for climate change and climate variability adaptation within Ghana. Ability to utilize the technology from the CTCN support.
Enhance awareness and knowledge of spatially distributed drought issues within Ghana	Enhanced knowledge of information and adaptation measures for climate resilient solutions are critical for the sustainability of the proposed technologies.	Increased focus and engagement in the proposed CTCN response from all relevant stakeholders in Ghana.	Technologies for dissemination of the warming and forecasting system.	Increased focus on climate change adaptation for climate resilient solutions within a wide range of stakeholders in Ghana.
Increased data availability by accessing relevant near real time satellite information	Data availability is one of the key issues and is needed in order to provide the required technology solutions.	Data availability sufficient for providing timely and orderly drought warnings and dissemination in Ghana.	Web based technology allowing the stakeholders to access near real time satellite based data for Ghana.	Increased capabilities for climate and drought management in general, not only using the technologies as result of the CTCN response.
Provide scientific based information for drought warning and forecasting within Ghana	Scientific based information are critical for the sustainability and trust in the technologies, and for the future use of the technologies in Ghana.	Stakeholders with an active and confident engagement in the CTCN assistance in terms of drought management and dissemination.	Establishing a web based drought early warning system on a seasonal scale and a drought forecasting system for the long term.	Linkage with existing and future initiatives and projects in Ghana, ensuring that the technologies from the response is captured and embedded into future climate change and drought related initiatives.





4. Signatures

Signatures of the requesting country

NDE

Name: Joseph A. Buffoe
Title: Principal Programme Officer
Date: 26-04-2016

Signature: 

Request Proponent

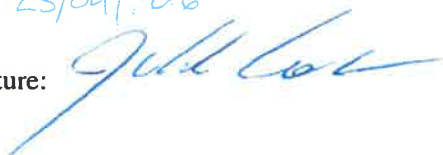
Name: BEN YAW AMPOMAH
Title: EXECUTIVE SECRETARY
Date: 26/04/2016

Signature: 

Signatures of the CTCN

CTCN Director

Name: Jukka Uusikangas
Title: Director
Date: 25/04/2016

Signature: 

Climate Technology Manager

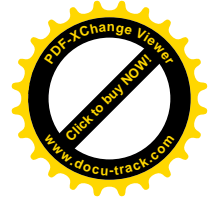
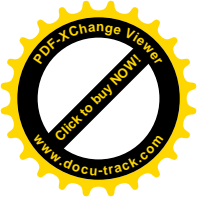
Name: JASON SAINSLER
Title: CLIMATE TECHNOLOGY MANAGER
Date: 25/04/2016

Signature: 



Annex 1: Response Logframe

Activity (link to sec 2)	Description of sub-activities conducted by the CTCN	Output/ Deliverable (link to sec 2.1)	Expected Outcome (link to sec 1.2)	Main national partners involved	Objectively Verifiable Indicator (see Annex 5 guidance)	Means of Verification (data source, method of collection, responsibility and periodicity)
Activity 1: Stakeholders consultation	Activity 1.1: National workshop Activity 1.2: Needs assessment Activity 1.3: Technology description	Minutes from workshop Needs assessment report Technology specification report	Increased knowledge of existing adaptation measures and practices using at a local context in Ghana.	Water Resources Commission	Recommendations and feedback received from stakeholders Number of participants Number of meetings with stakeholders in Ghana Description of the technology	Reported as part of the output. Responsibility: implementing organisation
Activity 2: Technology implementation	Activity 2.1: Technology adjustment and development Activity 2.2: Technology validation	Selection of location for validation and testing of the proposed technology Deliverable of draft version of system Review report from local stakeholders Technology validation report Technology description and user guide	Validated and tested technology available for application within a local context in Ghana.	Water Resources Commission	Feedback and review from national partners Selected validation location Validation report drafted User guide drafted	Reported as part of the output. Responsibility: implementing organisation
Activity 3: Technology transfer and	Activity 3.1: National workshop Activity 3.2: technical	Training outputs Technology transfer of early warning and	Decision makers and stakeholders to use the transferred	Water Resources Commission	Number of participants trained or training days received	Reported as part of the output. Responsibility: implementing organisation

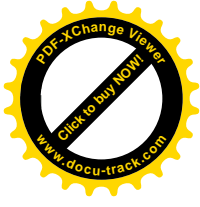
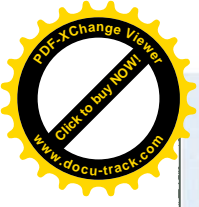




CTCN
CLIMATE TECHNOLOGY CENTRE & NETWORK

**CTCN Technical Assistance
Response Plan**

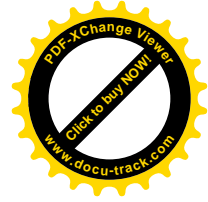
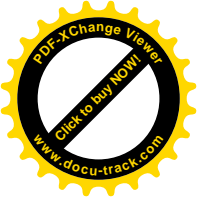
<p><i>dissemination</i> <i>training</i> <i>Activity 3.3: Outreach and dissemination</i></p>	<p>forecasting system Outreach document for local and regional initiatives</p> <p>knowledge, practices and technologies actively in the dry season planning</p>	<p>Number of female participants Post training evaluation and feedback Feedback or recommendations from regional organizations</p>
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Annex 2: Indicative list of performance indicators

Overall Activity	Specific Activity	Indicator
Capacity Building	<ul style="list-style-type: none"> ▪ development and delivery of workshops ▪ development and delivery of trainings (e.g. webinars, e-learning, ad-hoc) ▪ development and delivery of toolkits 	Number of participants trained or training days received; Post training evaluation and feedback (and minutes); CTCN Knowledge Management System (KMS) users; Webinar content/minutes/feedback; e-learning content/feedback
Advisory	<ul style="list-style-type: none"> ▪ development of needs assessment/ studies/ reports/ etc. ▪ establishment/development of recommendations 	Diversity of sources used; Response Implementer efforts days; Recommendations; Scope of dissemination; Level of detail used; Feedback; Uptake of recommendations
Policy development	<ul style="list-style-type: none"> ▪ development of strategy ▪ drafting of implementation plan ▪ formulation inputs to policy/ law 	Strategy available and adapted to local context and national priorities; Number of interview/events conducted to develop the strategy/ plan; Strategy/Plan dissemination; Number of technologies recommended in the strategy/plan; Scope of changes recommended by the strategy/plan.
Project implementation	<p>Mitigation</p> <ul style="list-style-type: none"> ▪ Energy supply ▪ Energy use ▪ Industry ▪ Transport ▪ Agriculture ▪ Waste management ▪ Forestry <p>Adaptation</p> <ul style="list-style-type: none"> ▪ Water ▪ Infrastructure, transport and urban design ▪ Early warning and environmental assessment ▪ Coastal zones ▪ Agriculture and forestry 	Outputs available and adapted to local context and national priorities; Level of private sector participation; Planning/Outputs distributed to decision makers with feedbacks; Integration of outputs/outcomes into planning of host country; implementation of outputs/outcomes by host country or other multi/bi-lateral organisation; Level of cooperation between Response Implementer, NDE and Response Proponent(s).





CTCN

CLIMATE TECHNOLOGY CENTRE & NETWORK

**CTCN Technical Assistance
Response Plan**

Overall Activity	Specific Activity	Indicator
Development of a new partnership or strengthening of an existing one	<ul style="list-style-type: none">▪ Human health▪ Marine and fisheries ▪ Development/ Establishment of basis for Twinning▪ Development/ Establishment of basis for PPP▪ Development/ Establishment of basis for knowledge partnership	

