CTCN assistance in Ghana

Improving Resiliency of Crops to Drought through Strengthened Early Warning within Ghana

Technology specification report (activity 1.3)

Methodology for validation and testing (activity 2.1)

Report / Technical Note

February 2017

The expert in WATER ENVIRONMENTS

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CTCN assistance in Ghana

Improving resiliency of crops to drought through strengthened early warning within Ghana Needs Assessment report

Technology specification report (activity 1.3)

Methodology for validation and testing (activity 2.1)

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Project number	11819285-1
Approval date	
Revision	Draft version 1
Classification	Restricted

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Acronyms and Abbreviations

CREW	Community Resilience Early Warning
CTCN	Climate Technology Centre & Network
DHI	DHI - see more at www.dhigoup.com
EPA	Environmental Protection Agency
EWS	Early Warning System
GIDA	Ghana Irrigation development Authority
GMET	Ghana Meteorological Agency
GWP	Global Water Partnership
HSD	Hydrological Services Department
MOFA	Ministry of Food and Agriculture
MWRWH	Ministry of Water resources, Works and Housing
NADMO	National Disaster Management Organisation
SDG	Sustainable Development Goals
UNEP-DHI	UNEP-DHI Partnership – Centre on Water and Environment
VRA	Volta River Authority
WRC	Water Resources Commission

WRI	Water research institute

1 Introduction

1.1 Background

The national workshop held in Accra on the 26th of October 2016 and the Needs assessment report presented the objectives and requirements for the CTCN assistance based on feedback and discussions from stakeholder consultations. The recommendations have been taken into consideration to draft a more detailed description of the proposed outcome in this Technology specification report as well as the methodology for how the outcomes is to be validated.

A detailed overview of the proposed technology is given in this report as well as the linkage to the stakeholders' needs and requirements identified during the initial phase of the technical assistance. This also includes specifications for how the developed technology should be tested and validated before being transferred to the end users. The validation will be based on observed data from a selected location in northern Ghana.

1.2 Rationale of the 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 [1]). The agricultural and water sectors were identified in the climate change technology needs assessments report (TNA) from 2013 [2] as the main sectors in needs of adaptation technology for climate change.

The CTCN technical assistance aims at improving resiliency of crops to drought through strengthened early warning in 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.

2 Stakeholder consultations

The technical description is based on the outcomes of a number of stakeholder consultations carried out in the initial phase of the technical assistance.

2.1 National workshop

The national workshop was held at the Water Resources Commission in Accra on 26th October 2016. Minutes of the workshop are available as Deliverable 2 of the CTCN assistance.

The key outcomes from the first national workshop were:

- All participating institutions appreciated the CTCN initiative and offered to support the technical assistance through possible future stakeholder meetings and through review of relevant project outputs.
- The workshop concluded that drought is a very relevant topic to support in Ghana as only few organisations and projects address drought management. Previous water resource management projects mainly focused on flooding although drought is often affecting more people over a longer time period compared to flooding.
- It was agreed that the pilot area will be located in the Northern part of Ghana where drought is more often experienced compared to the Central and Southern Ghana.
- There is a scope for improving the existing drought monitoring and forecasting methodologies in Ghana based on latest Earth Observation technologies.
- The main activities of the CTCN technical assistance are likely to be focused towards improved drought forecasting (in terms of timeliness, quality, and format).
- The dissemination aspects – including how to reach female farmers – needs to be investigated via consultations with the Ministry of Food and Agriculture as dissemination of drought warnings to the farmers are their responsibility.
- The key stakeholders for the technical assistance will be:
    - Water Resources Commission as they are responsible for the overall water resource management in Ghana including the basin organisation in the Northern Ghana where the pilot area is likely to be located.
    - Ghana Meteorological Agency as they have experience with drought management and are currently providing seasonal forecast to different ministries.
    - Ministry of Food and Agriculture as they are the main organisation disseminating drought related information in Ghana via their regional and local structures.
- It is important that the outcomes from the technical assistance supports the existing dissemination processes e.g. dissemination from ministries to farmers and related organisations.

There will be a need for follow-up meetings with some of the key stakeholders within the coming months to further understand how the technical assistance results should embed into the current dissemination processes related to drought management in Ghana.

2.2 Stakeholder meetings during the initial phase of the CTCN assistance

A number of meetings with relevant stakeholders in Accra and in the northern part of Ghana was initiated as part of the initial phase of the CTCN technical assistance. These meetings are described in details in the needs assessment report, and the key outcomes are shown below:

- The upper east region will be selected as the area for validation of the drought early warning system based on the available data and the frequent occurrences of drought spells.
- The MOFA regional office in Bolgatanga will be able to provide validation information related to the climate conditions, food production data from the different districts in the area and marked prices of the main crops
- The UNDP funded Community Resilience through Early Warning project (CREW) might be an important stakeholder as they are currently developing a flood and drought warning system for NADMO. There is a need for further evaluation of their outcomes to ensure compatibility with the CTCN outcomes.

2.3 Stakeholder meetings with specific focus on the technical description

As a follow up on the national workshop an additional travel to Ghana was initiated during the period January 24 to February 2, 2017, with the objective of discussing and finalizing the description and content of the proposed technology. Besides the below described meetings a number of meetings with Water Resources Committee (WRC), the Green Climate Fund National designated authority (GCF NDA) and Environmental Protection Agency (EPA) was held during the mission to Accra.

2.3.1 National Disaster Management Organisation (NADMO)

Accra, Ghana, 27th of January 2017

Name	Position	Email
Mr. Gavivina Yao Tamakeo	Chief Disaster Officer	gavivinaytamakloe@gmail.com
Fred Akatur	PACO	
Kofi Osei	PACO	
Benjamin Larbi	IT specialist	

NADMO is responsible for the coordination, management, dissemination and planning when an event turns into an emergency (defined as an event that the local organisations are not able to cope and adapt to). NADMO coordinates the disaster operation with relevant organisations as WRC, Meteorological Department, MOFA and Hydrological Service department. NADMO has by law the power to mobilize emergency relief and aid in case of an emergency.

NADMO relies on information from the other key agencies with respect to identification of a drought emergency. There are no drought categories defined in Ghana, but a system of red, yellow and green alert categories is used (without a formal definition of the categories). There is a need for a more specific definition of drought alert levels and linkage between alert categories and action plans.

The CREW project (UNDP) located within the premises of NADMO is developing an early warning system for both floods and droughts, which will be handed over to NADMO in the early part of 2017. The CREW system provides a link with 10 pilot centres, providing near real time information of flood and drought status. A request for more detailed information

on the CREW outcomes have been submitted to the team leader of this UNDP funded project.

2.3.2 Ghana Meteorological Agency

Accra, Ghana30th of January 2017

Name	Position	Email
Juati Ayilari-naa	Director Synoptic meteorology and forecasting	a.juati@meteo.gov.gh juatia@yahoo.co.uk

The Ghana Meteorological Agency (GMET) is responsible for forwarding relevant meteorological information to MOFA regarding:

- Climate patterns
- Rainfall monitoring within each of the districts (10-day rainfall)
- Rainfall forecast for the coming season
    - Seasonal forecast issued each year in February (with 3 month lead time)
    - Updated in June based on the observed values
    - Focus on the forecast of dry spells and monthly accumulated rainfall

GMET interfaces with MOFA on climate data and information but does not provide drought warnings or information as such, as MOFA is responsible for impact and risk assessment based on the delivered data from GMET.

MOFA then disseminates information to the farmers via the extension officers.

GMET is currently not using drought indices to evaluate how the current rainfall relates to previous years, but relies mainly on comparison of rainfall amounts.

GMET has just initiated a project focussing on utilising satellite based data for bio-physical parameters which will enable them to evaluate the climate impact on the vegetation

3 Technical description

3.1 Solution supporting a risk-based approach

The overall objective is the development and implementation of a **drought early warning system** facilitating the provision of timely and effective information related to the water and agriculture sectors allowing these sectors to take actions to **mitigate impacts** of

upcoming droughts. The established drought early warning system will be web-based allowing relevant stakeholders to utilize the system without the installation of any software. The technical design of the system is based on the feedback from the national workshop and the stakeholder consultation meetings during the initial part of the technical assistance.

The drought early warning system will enable decision makers and stakeholders to use the transferred knowledge, practices and technologies actively in the dry season planning. The solution will focus on **improving the adaptation** to upcoming drought events by supporting elements within the **risk management** part of the drought management process as highlighted in Figure 3-1. The crisis management or the response to an already occurred drought event or disaster will not as such be included in the outcomes of the CTCN assistance. The outcomes will cover the following main topics:

- **Web-based drought early warning and forecasting portal** providing access to the technical functionalities, and enable stakeholders to view and download data and information;
- **Data and information** 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
- **Risk management components** supporting the risk-based drought management through drought early warning and detection for increased adaptation and preparedness to upcoming drought events
- **Dissemination** relating to how the technical information is conveyed from the web-based system to the end-users in form of reports, messages or warnings.

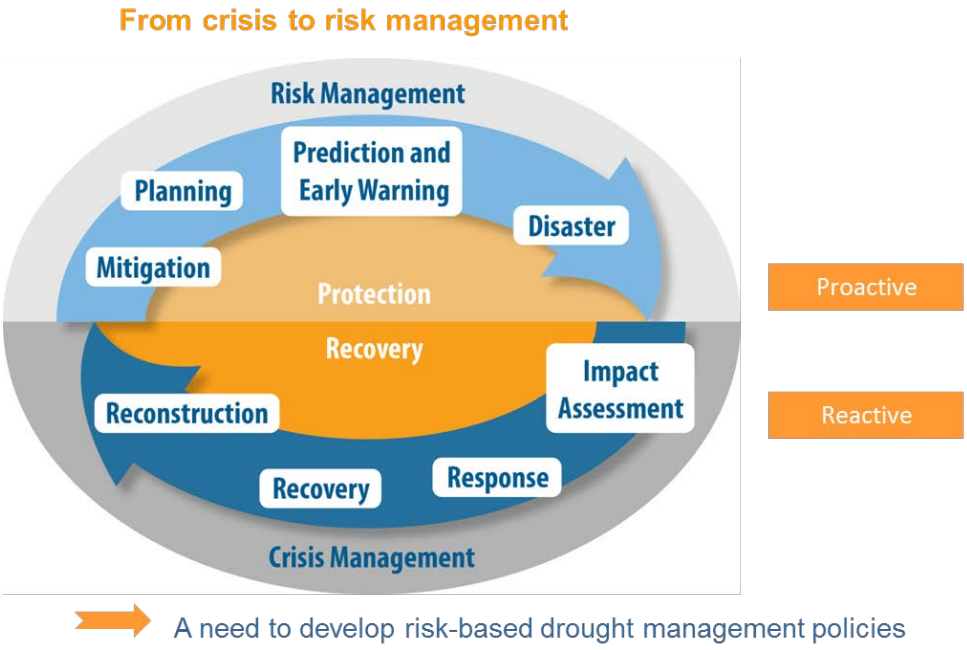

Figure 3-1 Drought management (adapted from [3])

3.1.1 Integration with overall planning workflow

The drought early warning system integrates into the **overall national planning process** to support decision makers from **drought hazard assessment** to the **implementation** of drought action plans or drought policies. The CTCN assistance will be embedded into the overall drought management process within Ghana, but the focus will be limited to assessing the **drought risk** and as well as the **dissemination and warning** components.

Using the proposed technology, end-users will be able to assess the drought situation and identify potential drought hazard in order to predict, plan and adapt before drought events actually occur with the ultimate objective that vulnerable groups become more resilient to drought situations.

The planning workflow shown on Figure 3-2 supports planning within existing planning methods as IWRM or TDA/SAP, and is an ongoing process initiated when an issue emerges or there is a need to implement new investments within a specific area.

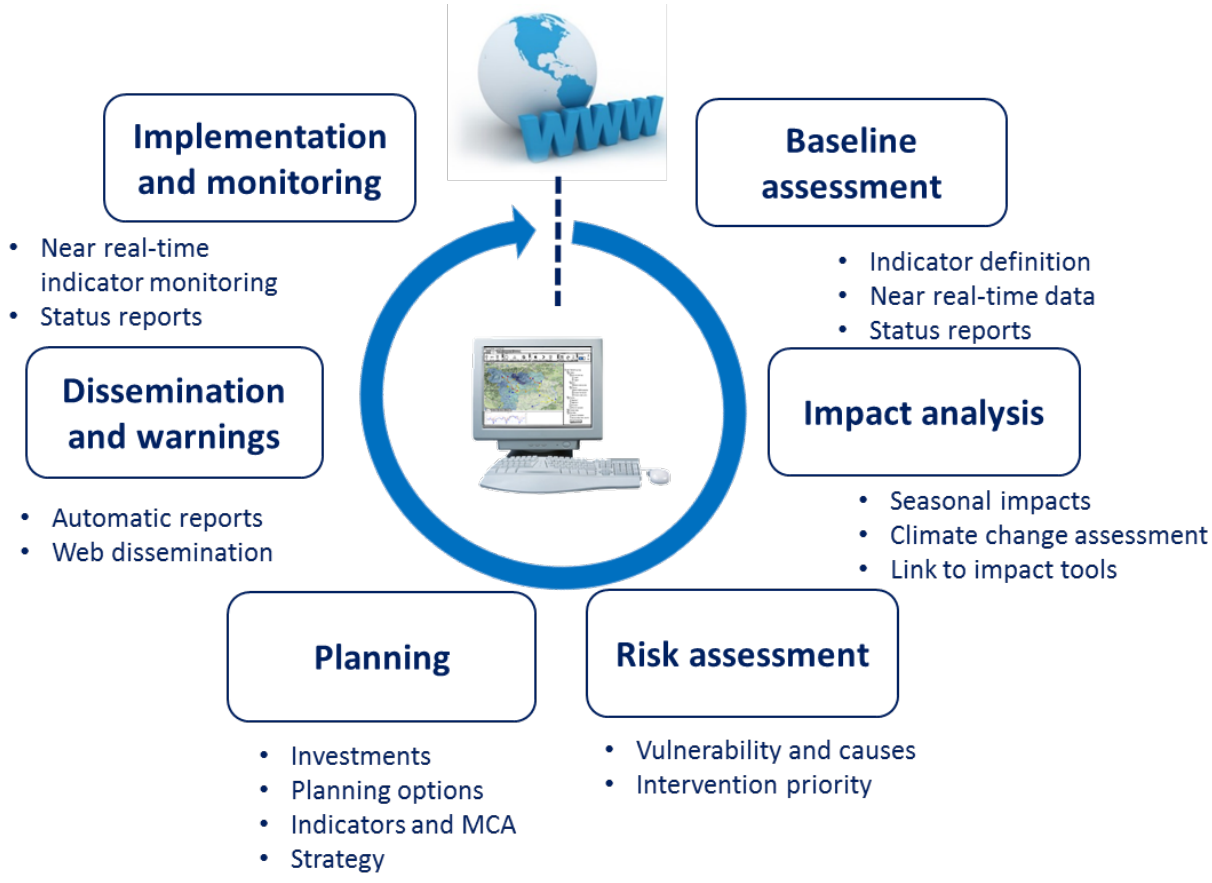

Figure 3-2- Planning workflow

The aim is to link the CTCN outcomes to a general planning workflow in the following way:

- Baseline assessment: identification of current and future drought related hazards through the use of drought indices with near real-time satellite data

- Impact analysis: assessment of the impact on exposed areas related to drought hazards with specific focus on the agricultural sector. The assessment will cover the current and the future impact.
- Risk assessment: vulnerability analysis for identification, understanding and priority of the underlying causes behind the drought impact.
- Planning: the planning part will not be covered in the CTCN assistance but the outcomes from the risk assessment will feed into national planning workflows related to drought adaptation.
- Dissemination and warning: the CTCN assistance will support the existing drought dissemination and warning through automated status reports and timely reported warning alerts submitted to WRC, MOFA and NADMO.
- Implementation and monitoring: the access to near-real time indices and automated status reports will support the ongoing drought monitoring within Ghana.

3.2 Web-based drought early warning and forecasting portal

The web-based platform will provide access to the technical functionalities, and enable stakeholders to view and download data and information related to drought warning and dissemination. The web-based platform will be user restricted, and users will have to be approved in order to get access. Information will not be shared between users but will be restricted to the individual user. The web-based platform will be free to access without restriction in the form or subscription requirements or any type of other fee.

The **web-based drought early warning and forecasting portal** will be the key outcome of the CTCN technical assistance and serve several purposes for the end-users in Ghana with respect to drought management; i) a data and information provider, ii) location of drought hazards, iii) provide warnings for future drought events, iv) providing risk estimates and v) as one of the key dissemination tools supporting the existing dissemination process at MOFA and NADMO.

Figure 3-3 illustrates some of the basic components in a web solution allowing the user to view different data types, plot data as maps or time series and download data for further analysis. It will also include an assessment part providing the actual identification of drought impacted areas and a dissemination part for automated reporting of drought impacts and warnings of future events.

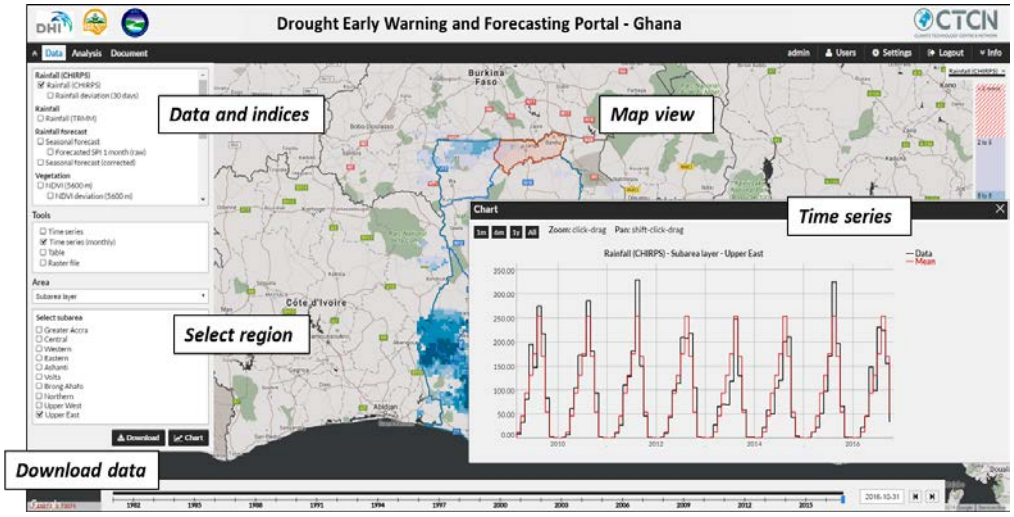

Figure 3-3 Illustration of web based interface for drought early warning and forecasting portal

3.3 Data and information

Relevant data and information are required for any drought assessment. Hence there is a need to include data related to the climate condition, crop distribution and status, soil moisture conditions and different types of socio-economic activities. In order to determine the current hazard, near-real time information is critical, and functionality allowing the stakeholders to access near real-time satellite-based data for Ghana will be included. 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.

Data and information will be the key focus as it constitutes the core requirement for an appropriate and effective use of the drought early warning and forecasting. Due to the limited amount of station data, the initial focus will be on using satellite and earth observation products combined with model based weather forecast and climate change products. Depending on the availability of station data these might be included as well. Figure 3-4 shows a schematic description of a process where the web based drought early warning portal gets updated with the latest satellite and climate forecast data. The data gets processed and used for calculation of a number of drought indices. The latest data will then be available for the user in near real-time (maximum delay of a few days from the actual release).

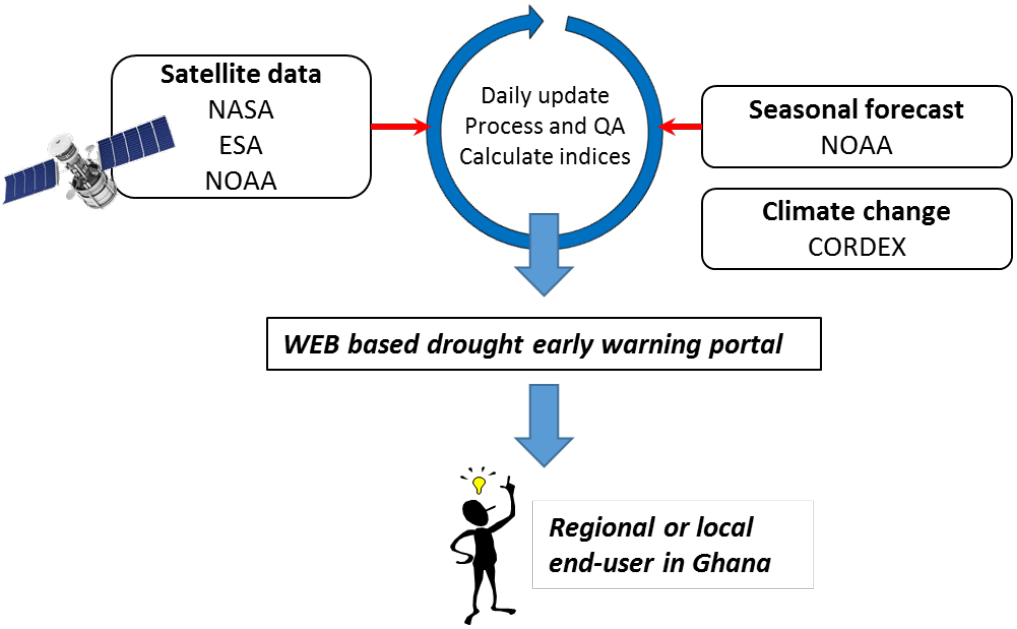

Figure 3-4 Schematic description of how a web portal could be updated with satellite based data, climate forecast and climate change data

The following data types of data sources are considered to be included:

Table 3-1 - list of data products included in the portal

Data type	Source	Note
Different types of satellite based rainfall	NASA and ESA	Spatially distributed rainfall available for the last 15 to 30 years available in near real time
Observed rainfall data	GHCN	Few stations and not available in near real time
Forecasted rainfall	NOAA	Downscaled seasonal rainfall forecast available as 20 members every 5 day
Climate change	CORDEX	Climate change information in the form of change factors for rainfall, temperature and potential evapotranspiration for different future periods
Temperature	NASA	Spatially distributed data available for the last 15 years
Vegetation data	NASA	Spatially distributed satellite data describing the biomass and leaf area index to be used as an vegetation indicator
Soil moisture data	NASA	Spatially distributed satellite data describing the relative soil moisture content in the root zone
Administrative data	Different sources	Administrative data related to the exposure and vulnerability of drought hazards. The data will be

		based on global and nationally available data sources.
Historical drought events	Different sources	Data and information describing historic drought hazards and impacts within Ghana, this could be hazard frequency, vulnerability towards different sectors, impacts described as crop losses or underlying impacts on vulnerable groups or sectors.
Drought risk related data	Different sources	Information describing drought risk based on historical data. To be used as baseline descriptions for the risk component.

3.4 Risk management components

The key technical components relates to the objective of supporting the risk-based drought management (see Figure 3-5) through drought early warning and detection for increased adaptation and preparedness to upcoming drought events.

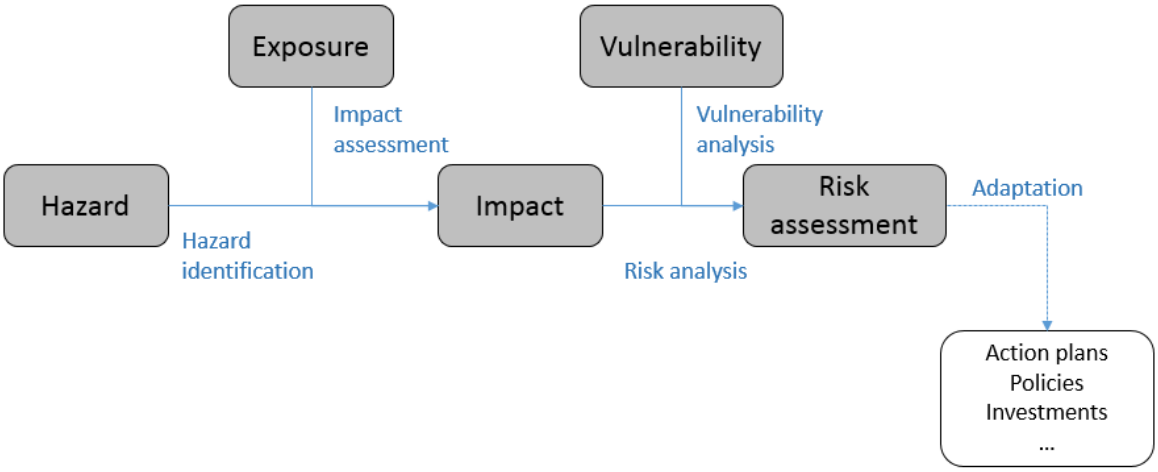

Figure 3-5 - Risk management workflow

The drought early warning and risk assessment component will be developed so it integrates and uses available data and provides the user with specific information of the current and upcoming risks related to drought hazards. The different components of the risk management workflow are described in Figure 3-5.

3.4.1 Hazard identification

The identification of the timing and location of a drought event is the first step in a drought assessment or drought management process. It is typically based on different types of drought indices each representing the state of a specific drought related issue at different times. The drought indices will cover the entire spectrum of the drought types: meteorological, agricultural and hydrological drought (see Figure 3-6).

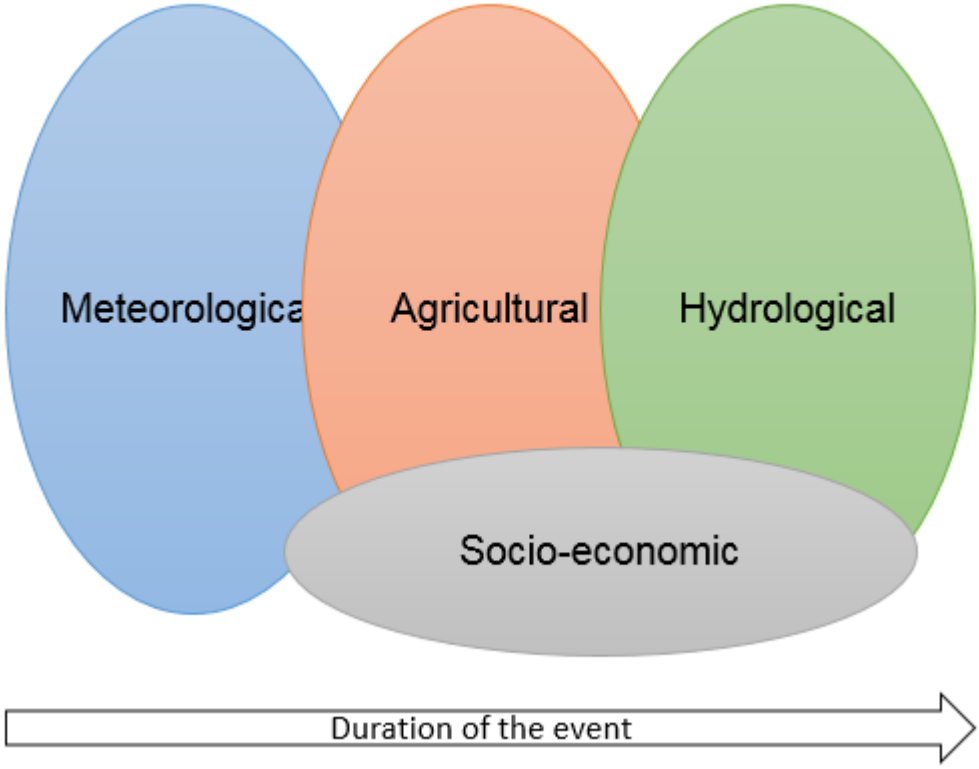

Figure 3-6 - Different types of drought

An example could be climate based drought indices describing the state of meteorological drought. The proposed technical solution will contain a number of drought indices based on different data sources as well as drought indices based on multiple data sources ensuring the best possible identification of the drought related hazards. The specific drought indices to be included will be based on locally accepted indices as well as scientific sound and validated indices.

Examples of drought indices are:

- Rainfall deviation expressed through the standardized precipitation index (SPI),
- Crop related drought hazard described through the vegetation conditioning index (VCI).

For all indices, the values will be linked to drought categories to express the severity of the hazard. The classification for drought categories will be inspired from the US drought monitor system using drought categories from D0 (abnormally dry) to D5 (Exceptional drought) (for more information see Figure 3-7 and [4]).

Category	Description	Impact
Normal	Normal	*Normal conditions*
D0	Abnormally Dry	*Short-term dryness some water deficit*
D1	Moderate Drought	*Some damage to crops*
D2	Severe Drought	*Crop or pasture losses likely; water shortages common*
D3	Extreme Drought	*Major crop/pasture losses; widespread water shortages*
D4	Exceptional Drought	*Exceptional and widespread crop/pasture losses*

Source: U.S. Drought Monitor Classification Scheme

Figure 3-7 Drought classification scheme (source: [4])

3.4.2 Impact assessment

The impact assessment aims at quantifying how the identified hazards affects specific areas or sectors exposed to this hazard. The outcome will describe how specific drought related hazards impact the agricultural production or the water supply.

Exposure: The exposure to drought relates to the identification of sectors or areas particularly sensitive to drought through impacts or consequences such as reduced crop yield, livestock losses, socio-economic impacts or reservoir depletion. Areas exposed to drought could be rainfed agricultural areas or urban areas relying on surface water resources.

The drought categories (describing the hazard) will be combined with different exposure categories and displayed as maps showing the drought hazard (within a specific exposure type) but also through tables describing the affected areas within specific exposure categories, e.g. rainfed agricultural areas.

Drought warning: Drought warnings will be identified based on the above mentioned drought indices but utilizing a user specified threshold and duration, indicating when a specific drought hazard turns into a state where a warning should be submitted. The drought warning will not only consider the present state of a given drought related condition but also take into account the duration – the hazard needs to have been present for a given duration before a warning is issued. This would for most of the drought indices apply when looking back in time, e.g. a warning is submitted if the rainfall for the past period was below a threshold (amount of rain in a given period). However for drought hazards which could be forecasted (e.g. based on precipitation) then the warning would help to anticipate drought situations. Both historical and forecasted drought indices will constitute the basis of the drought early warning system.

Impact assessment: The impact assessment will mainly be based on the crop production through calculation of impacts on the crop yield or crop water requirements based on the hazard and the exposure. The impact assessment identifies the direct consequences of drought related to the agricultural sector, but will also be used to trace the secondary consequences of the drought hazard (often social effects). The impact assessment will include assessment of historic crop failure based on available crop and

climate information, and assessment of crop risk failure for the coming months based on forecasted rainfall information.

3.4.3 Risk analysis

The risk will be expressed based on the vulnerability towards the impact from a specific hazard, or as the likelihood of harm, loss or disaster for a specific drought related hazard. The drought related impact will mainly be based on the crop productivity through analysis of how specific hazards impacts the agricultural sector through the crop production or required crop water demand, e.g. expressed in terms of the losses in crop production or increased water demand for irrigation. Risk is defined as the likelyhood of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions (UN-ISDR, 2009, EC, 2011). The risk analysis will identify areas or groups at different risk levels, which will be the targets for the following adaptation or mitigation planning.

Some specific analysis will be carried out with respect to:

- Evaluation of the vulnerability within sectors, groups or areas
- Linkage to available information describing the historic risk to droughts
- Linkage between drought hazard warning and known vulnerabilities in areas with specific hazard categories.
- Determination of the risk levels for selected sectors, groups or areas.

3.4.4 Vulnerability analysis

The vulnerability analysis provides a mean for analysing the causes behind the drought impact and the priority of these causes. This is an important step for increasing the effectiveness of drought risk management as it provides the means for drought interventions or mitigations measures to be targeted specifically against the underlying causes for the drought impact.

Vulnerability analysis directs the attention to the underlying causes of vulnerability rather than to its result, the negative impacts. In drought conditions, the direct impact of a lack of precipitation may be reduced crop yields. The underlying cause of this impact, however, may be that farmers did not plant appropriate crops because of cultural preference or government incentives, other seeds were unavailable or too expensive, or there was no drought warning [5]. The mitigation measures for increasing the adaptation capacity should target these underlying causes as they will increase the adaptation towards the impacts from the drought event.

The vulnerability analysis aims at providing the link between the drought risk assessment and the overall planning targeting the adaptation capacity for drought hazards. The vulnerability analysis links the drought impacts with the underlying causes, and enables the user to prioritise the causes based on the prioritised impacts. This is a critical step in order to understand the causes to be targeted through adaptation or mitigation measures in order to increase the adaptation capacity towards drought hazards. The vulnerability analysis will be based on a casual chain analysis (CCA) and water resource issues assessment methodology (WRIAM).

3.5 Dissemination

The dissemination relates to how the technical information is conveyed from the web-based system to the end-users in form of reports, messages or warnings. There will be a number of automated reports which the user can subscribe to, which will be submitted on a regular interval, and specific warning notes which will only be submitted in the case of an upcoming drought event or disaster. The specific format for the dissemination will be discussed and evaluated with the stakeholders after the first version of the system is made available.

4 Method for validation of the technical outcomes

4.1 Overall objective and concept

The overall objective with the validation of the technical outcomes is to ensure that the developed technology provides outcomes which are representing the actual conditions in Ghana, and therefore can be used for decisions aiming at increasing the adaptation capacity towards drought hazards.

Due to the limited duration of the CTCN technical assistance and as the dry season in Ghana is between November and February, then the validation of the outcomes will mainly be done on historical data, hence evaluating how the system is able to re-produce events which already occurred.

The steps in the validation phase will be as follows:

- Identify outcomes to be validated – see below table
- Collect information to be used for the validation e.g. observed data or historical information describing drought hazards, impacts or risks
- Assessment of how the outcomes from the CTCN assistance correlates with the actual information
- Adjustment of the CTCN outcomes aiming at getting a better description of the actual conditions.

4.2 Outcomes to be validated

Table 4-1 and Table 4-2 list respectively the outcomes related to hazard identification and risk assessment which will be prone to validation as part of the CTCN assistance.

Table 4-1 - Outcomes related to hazard identification

Hazard identification		
Outcome	**Means of validation**	**Purpose**
Drought indices	Compare index values with historic information in the form of records of drought impacted	Ensure that the most appropriate indices are used for hazard identification.

	areas or recorded hazards in the upper east region. Evaluate the need for adjustment of the selected indices.	
Drought warning	Compare early warning index values with observed climate and drought hazard information. The drought warning will mainly be validated on historic information.	Ensure proper warnings for the early warning part.
Exposure	Compare collected and available information with historic records of relevant exposure types.	Ensure that relevant exposure categories are included as part of the CTCN assistance.
Hazard categories	Assess the current hazard categories used by NADMO and MOFA with international standards for hazard categories and propose adjustment.	Ensure relevant hazard categories for the hazard identification and dissemination within Ghana
Impact assessment	Compare crop based impact analysis with available information regarding crop production and losses in the upper east region.	Correct and validate the tools used for impact assessment in relation to crop production.
Dissemination	Validate that the dissemination format from the CTCN assistance is compatible with the existing national dissemination from MOFA and NADMO.	Ensure that the dissemination format is compatible with the current dissemination from MOFA and NADMO.

Table 4-2 - Outcomes related to risk assessment

Risk assessment		
Outcome	**Means of validation**	**Purpose**
Vulnerability	Validate the vulnerability approach and analysis based on? earlier studies and relevant information from the upper east region.	Ensure proper and relevant vulnerability assessment.
Risk assessment	Evaluate the risk assessment based on? existing information or records related to economic or agricultural related drought risk.	Ensure that the risk assessment provides relevant information for linkage with adaptation measures and

		drought related action plans and investments.
Dissemination	Validate that the dissemination format from the CTCN assistance is compatible with the existing national dissemination.	Ensure that the dissemination format is compatible with the current national dissemination.

5 Summary and next steps

The overall objective is the development and implementation of a **drought early warning system** facilitating the provision of timely and effective information related to the water and agriculture sectors allowing these sectors to take actions to **mitigate impacts** of upcoming droughts. The established drought early warning system will be web-based allowing relevant stakeholders to utilize the system without the installation of any software. The technical design of the system is based on the feedback from the national workshop and the stakeholder consultation meetings during the initial part of the technical assistance.

The key components in the drought early warning system will be the following:

- **Hazard identification and forecasting**: Identification of current and upcoming hazards based on different types of drought indices each representing the state of a specific drought related issue. The index values will be linked to drought categories expressing the severity of the hazard.
- **Drought warnings or alerts**: Drought warnings will be identified based on drought indices but utilizing a user specified threshold and duration, indicating when a specific drought hazard turns into a state where a warning should be submitted. Drought warnings will be based on both current and forecasted information.
- **Impact assessment**: The impact assessment identifies the direct consequences of drought related to the agricultural sector, but will also be used to trace the secondary consequences of the drought hazard (often social effects). The impact will be expressed in terms of drought categories affecting specific exposed areas and as specific losses to the crop production.

5.1 Validation

The overall objective with the validation is to ensure that the developed drought early warning system provides outcomes which are representing the actual conditions in Ghana, and therefore can be used for decisions aiming at increasing the adaptation capacity towards drought hazards.

Due to the limited duration of the CTCN technical assistance and as the dry season in Ghana is between November and February, then the validation of the outcomes will mainly be done on historical data, hence evaluating how the system is able to re-produce events which already occurred.

5.2 Next steps

The next steps in the CTCN assistance will be as follows:

- Development and testing of the drought early warning system
- Drought early warning system ready for QA and testing by April 30, 2017
- Validation of the drought early warning system
- Validation report available by July 1, 2017
- Description and user guide available by July 1, 2017
- National workshop by August or September 2017
- Technical training by August or September 2017

6 References

[1] “National Climate Change Adaptation Strategy, Ghana”.

[2] “Climate change technology needs assessments report,” 2013.

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