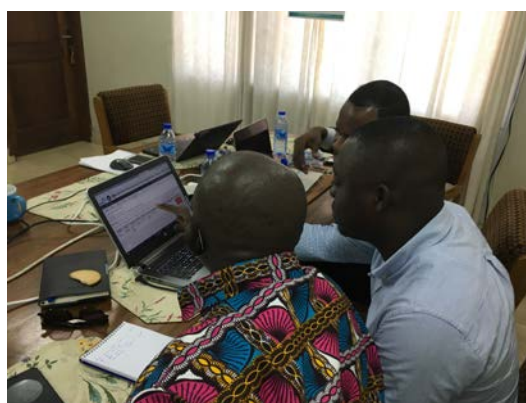


CTCN assistance in Ghana

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

Summary report of the technical training (activity 6)



This report has been prepared under the DHI Business Management System certified by Bureau Veritas to comply with ISO 9001 (Quality Management)

Approved by

06-11-2017

X



Approved by
Head of Projects, Water Resources
Signed by: Oluf Zeilund Jessen

CTCN assistance in Ghana

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

Summary report of the technical training (activity 6)

Prepared for UNEP
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Acronyms and Abbreviations

CCA	Causal Chain Analysis
CREW	Community Resilience Early Warning
CTCN	Climate Technology Centre & Network
DHI	DHI - see more at www.dhigoup.com
DEWS	Drought Early Warning System
EPA	Environmental Protection Agency
GIDA	Ghana Irrigation development Authority
GMET	Ghana Meteorological Agency
GWP	Global Water Partnership
HSD	Hydrological Services Department
MWRWH	Ministry of Water resources, Works and Housing
NADMO	National Disaster Management Organisation
RIAM	Rapid Impact Assessment Matrix
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
WRIAM	Water Resources Issues Method



1 Introduction

The technical training course is part of the Climate Technology Centre and Network (CTCN) funded technical assistance on “Improving resiliency of crops to drought through strengthening early warning”.

The CTCN funded technical assistance relates to improving resiliency of crops to drought through strengthened early warning within Ghana. The objective is to facilitate transfer and capacity building for climate change adaptation focusing on dry season management and planning.

2 Objectives

The objective of the training is train the participants in using the Drought Early Warning and Forecasting system developed as part of the technical Assistance to Ghana.

Key organisations, carefully selected by the main applicant (WRC), have been invited to take part of this two-day technical training that took place at the head quarter of the Water Resources Commission in Accra.

The training course, scheduled for a duration a two days, has been divided into a sequence of logical modules. Each module is addressed as follows:

- Presentation by one of the trainer
- Step by step exercise that can be performed individually
- Applied example that can be performed in small groups
- Presentation of the main findings by the participants to the entire group

This ensured both hands on practice by all the participants as well as group discussions.

3 Programme

The training course was divided into several modules that were addressed sequentially.

The detailed agenda that was proposed and followed is given below.

DAY 1:

Time
09.00 – 09.30
09.30 – 09.45
09.45 – 10.00
10.00 – 10.30
10.30 – 10.45

10.45 – 12.00
12.00 – 13.00
13.00 – 14.30
14.30 – 14.45
14.45 – 16.45
16.45 – 17.00

DAY 2:

Time	Title
09.00 – 09.30	Reflection and follow up on day 1
09.30 – 10.30	Drought indicators <i>In depth understanding of key indicators to be used for drought assessment in Ghana.</i> Hands on exercises - how key indicators could be used for drought assessment Specific examples from Ghana Outcome: Capacity and knowledge to use key indicators for drought assessment in Ghana.
10.30 – 10.45	Break
10.45 – 13.00	Drought – early warning <i>Implement and understand workflow for drought early warning in Ghana.</i> Hands on exercises based on the drought assessment app Outcome: Practical understanding on application of drought early warning in Ghana.
12.00 – 13.00	Lunch
13.00 – 14.30	Drought – use case <i>Drought assessment and warning based on an actual use case in the north eastern region.</i> Hands-on exercises based on an use case from the north eastern region in Ghana. Outcome: In-depth understanding of how to apply the CTCN outputs within Ghana.
14.30 – 14.45	Break
14.45 – 16.45	Drought – use case continued
16.45 – 17.00	Discussion and wrap up

4 List of participants

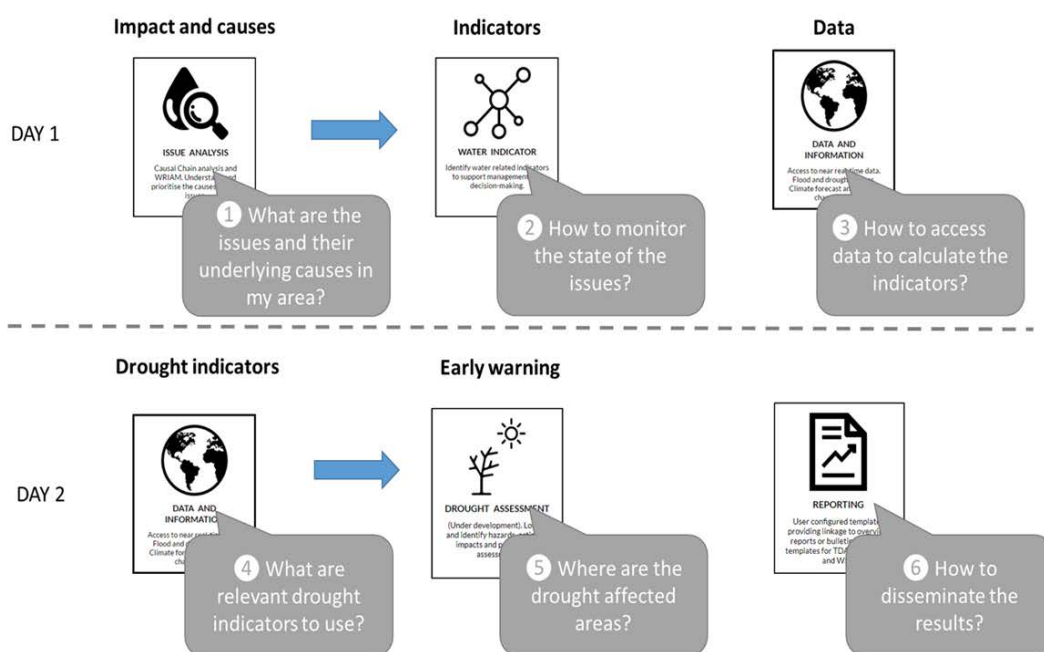
Key organisations have been invited, most of them have been able to attend the two-day training course with one or two representatives with the exception of Ministry of Food and Agriculture, which did not manage to send any representatives.

List of participants with contact information is given below:

	Name	Email	Organisation
1	James Aggrey	jamgrey04@yahoo.com	Water Resources Commission
2	Joachim Ayiwe Abungba	joachimayiwe@yahoo.com	Water Resources Commission-Black Volta Basin
3	Kofi Osei	nanaoseikofi30@yahoo.com	NADMO
4	Naa Koteikor Amon	naa_koteikor@yahoo.com	Ghana Irrigation Development Authority
5	Peter Wuni	peterwuni123@gmail.com	NADMO
6	Rufina Afanga	ruphina85@yahoo.com	Environmental Protection Agency
7	Ransford Welbeck	ransfordwelbeck@gmail.com	Hydrological Services Department
8	samuel owusu ansah	ansahsamuelowusu2014@gmail.com	Ghana meteorological agency
9	Zimi Alhassan	zimip554@gmail.com	Department of Agriculture
10	Bob Alfa	bobalfa@yahoo.com	Water Resources Commission

5 Key components in the training

The training was developed so the participants would be introduced to relevant modules with an increased complexity and understanding of drought management and early warning.



The modules constituting the training are:

- **Impact and causes:** Identification of prioritised impacts and their underlying causes from drought in Ghana.
- **Assessing drought state through indicators:** Identification of indicators and the required data for assessing the state of drought in Ghana.
- **Data and Information:** Knowledge and understanding of available data to be used for drought assessment.
- **Drought Indicators:** Capacity and knowledge to use key indicators for drought assessment in Ghana.
- **Early warning:** Practical understanding on application of drought early warning in Ghana in Ghana.
- **Reporting:** dissemination of the relevant information via a drought report.

The following sections contains a brief description of the different training sessions.

5.1 Introduction to the web based portal

Introduction to the Drought Early Warning and Forecasting Portal, see Figure 1.

Technical applications

Description of the assistance and link to CTCN page

Knowledge portal and tutorials.

Drought Early Warning and Forecasting Portal - Ghana

User: CTCN | Workgroup: Private | Area: Ghana

About the DROUGHT EARLY WARNING AND FORECASTING PORTAL for Ghana

This Drought Early Warning and Forecasting portal is developed as part of the CTCN Technical assistance in Ghana. For more information on the project please visit the project description page at: [link to CTCN project page](#)

Please visit the [user guide](#) (a link can always be found in the top right corner) for more indepth information on the use of the different modules.

Knowledge portal with discussion forum and upcoming online courses: Select the "Knowledge portal" in the ? menu or use the link - [KnowledgePortal](#)

For video tutorials and overview: [YouTube](#)

For technical exercises (pdf files) : [Dropbox](#)

For technical questions please contact:
[Oluf Jessen \(Project manager\)](#) or [Bertrand Richaud \(Water resources expert\)](#)

DATA AND INFORMATION
Access to near real-time data. Flood and drought indices. Climate forecast and climate change data.

DROUGHT ASSESSMENT
Locate and identify hazards, estimate impacts and provide risk assessment.

ISSUE ANALYSIS
Causal Chain analysis and WRIAM. Understand and prioritise the causes behind issues.

WATER INDICATOR
Identify water related indicators to support management and decision-making.

REPORTING
User configured templates providing linkage to overview reports or bulletins. Specific templates for TDA/SAP, IWRM and WSP.

Figure 1 The Drought Early Warning and Forecasting Portal developed as part of the CTCN assistance (www.flooddroughtmonitor.com)

The main output from the CTCN assistance is the Drought Early Warning and Forecasting Portal, which is accessible through the following link: www.flooddroughtmonitor.com.

The web-based portal contains a number of web applications assisting the user within drought management and drought early warning.

5.1.1 User registration and login

All stakeholders in Ghana will be able to register to the Drought Early Warning and Forecasting Portal by registering as a new user on the web site. There will be unlimited and free access to all stakeholders from Ghana. During the training, all the participants had to select Volta as the basin of choice but this will shortly be changed so they can select CTCN and then Ghana as their area of choice.

5.1.2 Help and user guides

User guides are available through the main landing page. There will be developed brief video tutorials as well explaining the use of the different applications.

5.1.3 Knowledge portal

The Knowledge Portal, accessible from the web portal, allows users to share knowledge and experience within drought management and drought early warning in Ghana. Users are able to post a question, which will be visible for the other users in the system as well as being able to read previous postings by users.

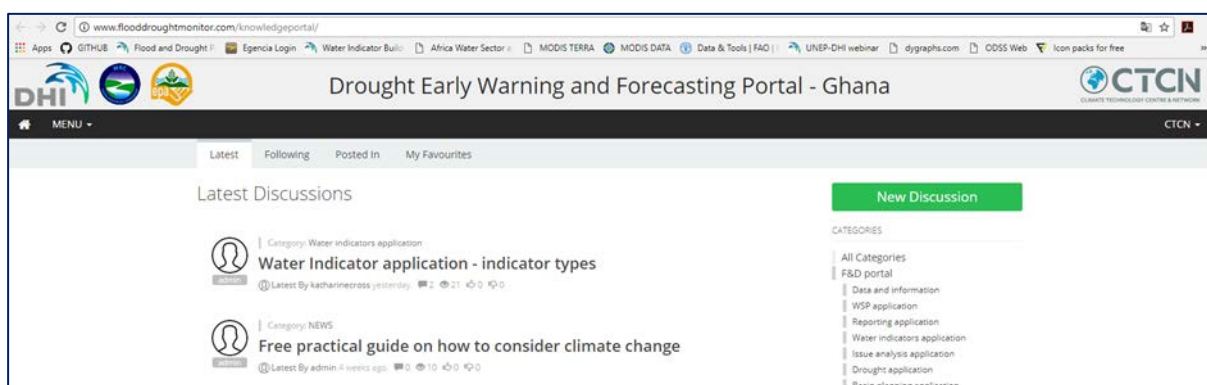


Figure 2 Knowledge Portal allowing users to share knowledge and experience

5.1.4 Applications

The Drought Early Warning and Forecasting Portal contains a number of applications all tailored to support the users within drought management and drought early warning. Each application is described in details to the participants through separate sessions. The available applications are:

- **Issue Analysis** – *Identify and prioritize the key environmental impacts from drought using a CCA and WRIAM approach*

- **Water Indicator** – *Identify relevant indicators for measuring the state of the causes for drought in Ghana*
- **Data and Information** – *Overview, understand and access available near real time data for drought assessment in Ghana*
- **Drought Assessment** – *Understand and implement workflow for drought early warning in Ghana*
- **Reporting** – *Access relevant status reports or bulletins regarding drought status in Ghana*

5.2 Drought – impact and causes

Objective: Identify and prioritize the key environmental impacts from drought using a CCA and WRIAM approach

Outcome: Identification of prioritised impacts and their underlying causes from drought in Ghana.

The session contains an introduction to the basic functionalities within the developed Issues Analysis application and application on a use case for Ghana focussing on drought as the environmental issue.

The purpose of the session is to develop a Causal Chain Analysis (CCA) for different environmental impacts caused by drought and identify the underlying causes behind the environmental impact. The underlying causes are essential in drought management as these are to be targeted through later interventions in drought action plans or other planning efforts.

The participants were introduced to the CCA concept through discussions and exercises based on the Issue Analysis application allowing them to identify the underlying causes behind different drought impacts.






Figure 3 CCA chain

The priority of drought impacts are important as limited resources makes it impossible to target and mitigate all identified impacts. The Water Resources Issues Method (WRIAM) was introduced to the stakeholders, this method is included in the Issues Analysis application, and is derived from the screening and ranking techniques used in RIAM (Rapid Impact Assessment Matrix). It is an objective and robust technique for assessing and prioritizing water resources issues. The method was developed and tested in Burkina Faso (1990), where 107 potential water issues problems were identified and ranked - now forming the basis for actions in the Integrated Water Resources Management Plan for Burkina Faso.




Figure 4 Participants discussing drought issues in Ghana and performing a CCA and WRIAM analysis

The session included an exercise where the participants, in three 3 groups, discussed and listed the key drought impacts in Ghana and developed a CCA and WRIAM approach for one or two of the listed drought impacts.

Drought Early Warning and Forecasting Portal - Ghana



ISSUE ANALYSIS
User: CTCN Workgroup: Public Area: Ghana

Open
New
Clone
Copy

Issue: Drought impact over Ghana
User: Zimi
Last change: 2017-10-25 11:12:47
Description: Farmers destroy the environment for the purpose of cropping

Issue analysis

No importance
 Slight negative impact
 Moderate negative impact
 Negative impact
 Significant negative impact
 Major negative impact

Immediate impact	Immediate cause	Underlying cause	Root cause	Extent	Seriousness	Permanence	Irreversibility	Cumulative character	Level of documentation	Score	Assessment
Food shortage	Decline in soil fertility	Inadequate early warning system	Bad farming practices	National	Significant change	Temporary	Reversible	Moderate	Little	18	Moderate negative impact
Low rainfall	Seasonal rainfall shift patterns	Destruction of vegetation	Climate change	National	Significant change	Temporary	Reversible	Moderate	Little	18	Moderate negative impact

Figure 5 Example of assessment by the participants of issues related to drought in Ghana

5.3 Drought – assessing drought state through indicators

Objective: Identify relevant indicators for measuring the state of the causes for drought in Ghana.

Outcome: Identification of indicators and the required data for assessing the state of drought in Ghana.

This session contained an introduction to indicators and how they are used to measure the state of drought related issues. The participants discussed which indicators are used in Ghana for drought assessment and their experience with the use of these.

The Water Indicator application was introduced as an application supporting the users with overviewing and selecting the best indicator for drought assessment. The Water Indicator application can help users identify water related indicators to understand the current state of water resources and drought related issues, the changes in these resources and whether or not interventions produce the desired effect.

The application provides the following support:

- Assists user in selecting relevant indicators based on a specific drought related issue
- Provides a starting point through a default indicator framework that can be adjusted and complemented to match user needs
- Provides an online tool for stakeholders to share their indicator frameworks with others to allow for consistency (it helps if you are all measuring the same thing)

The session on hands-on exercises included an introduction to the Water Indicator application as well as separate exercises allowing the user to select and discuss relevant indicators for drought management in Ghana.

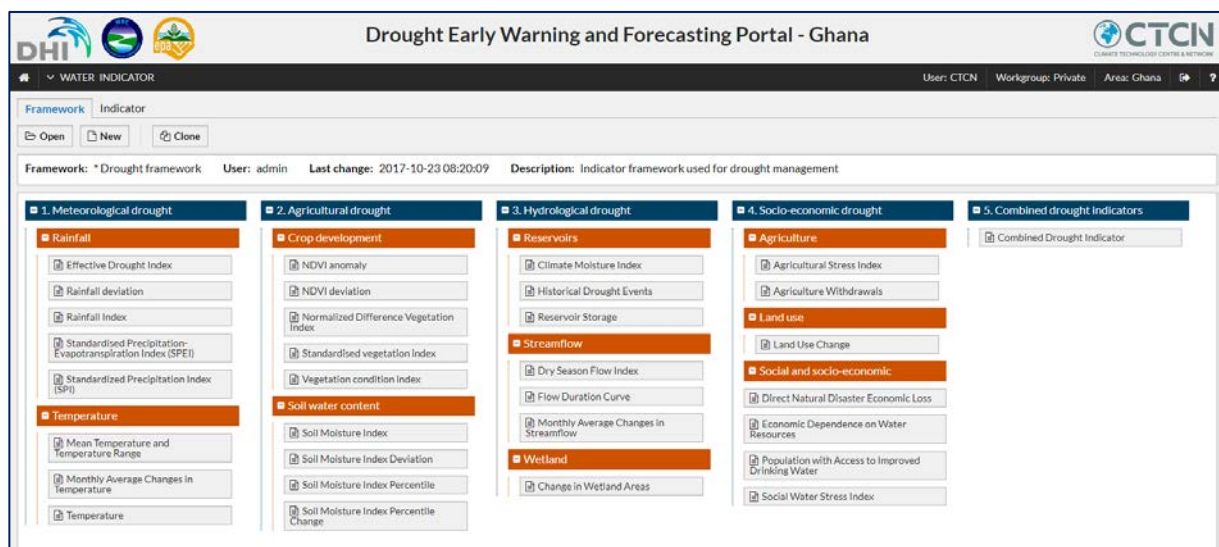


Figure 6 Example of drought indicator framework developed as part of the training

5.4 Drought – data

Objective: Overview and understand available near real time data for drought assessment.

Outcome: Knowledge and understanding of available data to be used for drought assessment.

For drought management it's important to have spatial and near real time data available as it allows users to evaluate the current drought status and identify impacted areas. The CTCN assistance have focussed on the use of satellite data as these data are freely available for the whole country.

The session included an introduction to the Data and Information application followed by specific exercises on relevant data for Ghana with respect to drought management. Some of the functionalities introduced through the exercises are:

- Display and download spatial data e.g. TRMM and CHIRPS rainfall
- Display and download time series of selected data types. Time series are available as area weighted time series at different scales and at user defined point locations.
- Introduction to some of the more advanced data formats as “ensemble plots”, “envelope plots” or statistical tables.

The session ended by a discussion on the current level of data availability in Ghana.

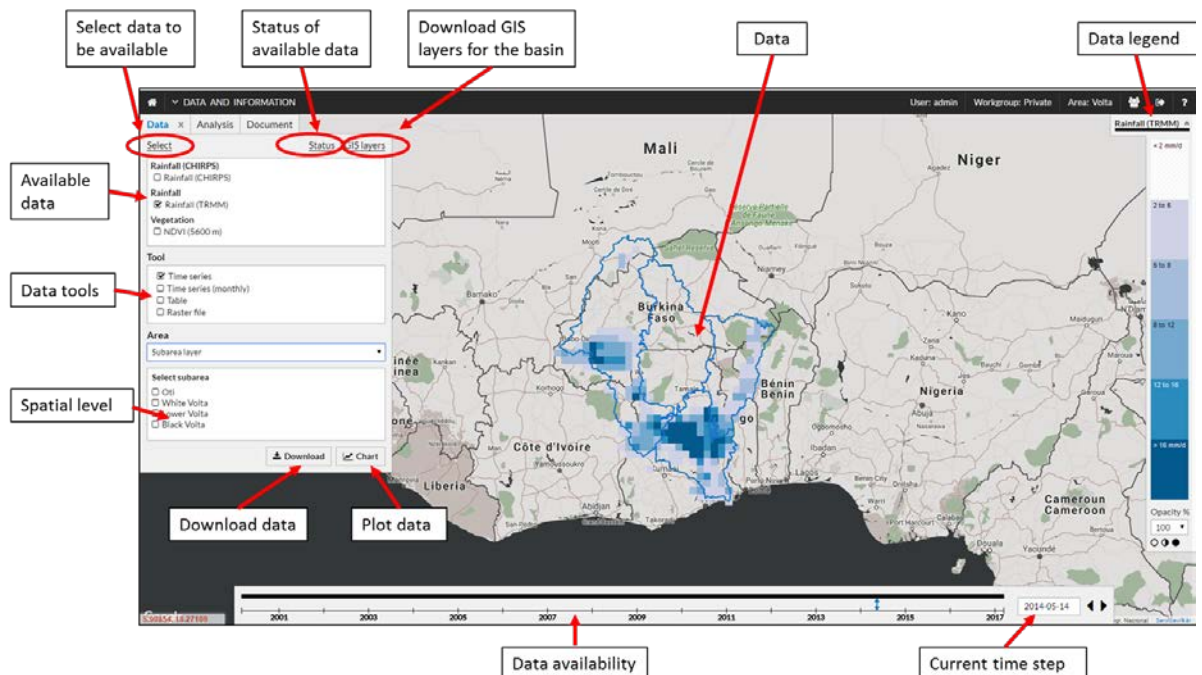


Figure 7 Overview of the functionality in the Data and Information application

5.5 Drought indicators

Objective: In depth understanding of key indicators to be used for drought assessment in Ghana.

Outcome: Capacity and knowledge to use key indicators for drought assessment in Ghana.

This session included an introduction to specific drought indicators, all indicators available as near-real time data within the data and information application. A long range of drought indicators were presented and discussed with specific focus on the use and relevance for Ghana. Some of the presented drought indicators are:

- Deviation indicator based on different datatypes e.g. rainfall deviation
- Standardised Precipitation Index (SPI)
- Effective Drought Index (EDI)
- Temperature Condition Index (TCI)
- Combined Drought Index (CDI)
- Agricultural Stress Index (ASI)

A long range of relevant drought indicators are made available for the participants through the web portal and each of these were presented and discussed during this session, see Figure 7 for an example of a drought indicator used in the exercise.

Agricultural Stress Index (ASI)

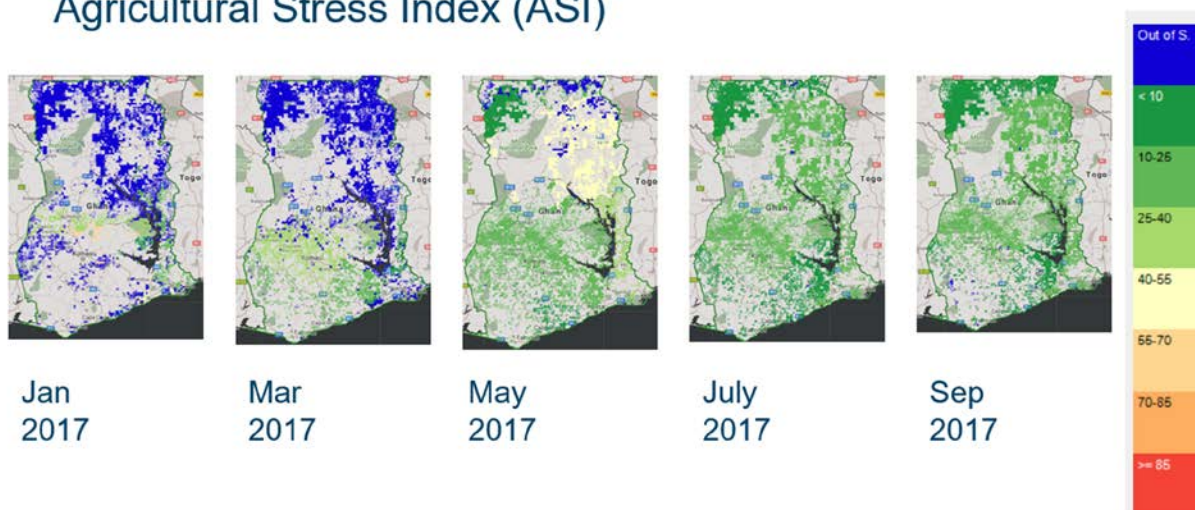


Figure 8 Example of drought indicator presented in the training. In this case the agricultural stress index (ASI)

The session contained two exercises focussing on climate related hazards and drought hazards based on a number of causes. At the end, there were discussions on the relevant drought indicators to be used in Ghana for identification of drought hazards and how the values should be interpreted.

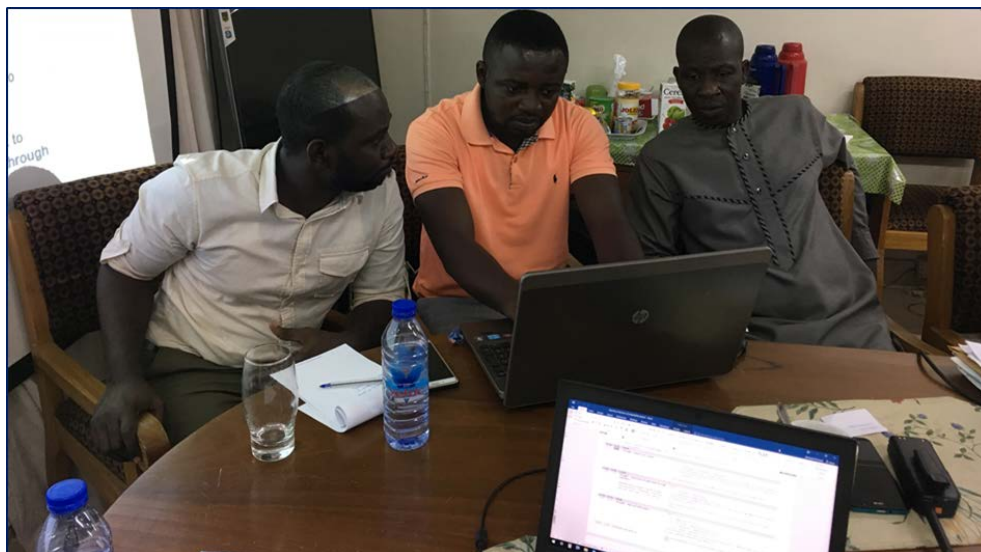


Figure 9 Participants discussing drought indicators in Ghana

5.6 Drought – early warning

Objective: Implement and understand workflow for drought early warning in Ghana.

Outcome: Practical understanding on application of drought early warning in Ghana

The last session focussed on drought early warning, which is the key output from the CTCN technical assistance, and the objective is to enable the participants to locate and identify current and future areas of drought impact. The exercises used the Drought assessment application allowing users to:

- Develop and use warning thresholds for drought early warning
- Identify areas impacted by a drought hazards
- Overlay the drought hazard with vulnerability layers for assessment of the drought risk.



Figure 10 Participants for the technical training

7 Key outcome

The key outcomes of the training are:

- **Strengthen capacity:** one of the main outcome of the training has been the capacity building in drought assessment and early warning topics. Various topics have been addressed a scientific approach and applied to the context in northern Ghana
- **Test and validation of the Drought Early Warning System for a large panel of users:** This training session have been an opportunity to test the DEWS on a large panel of users. Feedback from the participants has been collected during the training. It has been agreed that these comments will be addressed to further improve the DEWS (improvements are mainly related to the usability of the web system).
- **Constitution of a core team of experts among key organisations:** This training session has also been an opportunity to start a momentum in using the system. All participants have been advised to communicate among their respective organisations the use of the DEWS. WRC, as the anchor point, will support the organisations willing to use this system.

8 Remaining activities

The technical training and national workshop marked the end of the technical development within the CTCN and GCF assistance. The remaining activities within the CTCN and GCF assistance are:

- Initiation of the work by the selected four national experts
 - Expert 1: Validate and test the developed web based early warning and forecasting system, Analysis of the existing technical tools used for drought management and drought early warning in Ghana
 - Expert 2: Assessment on the current institutional and technical state of drought management, Recommendations for improving drought related services
 - Expert 3: Vulnerability assessment of the agricultural sector with focus on the food production
 - Expert 4: Identification of technical services needed to strengthen the water resource and drought planning, Identification of intervention sites where developed technical services could be implemented
- Development of the Technology validation report (December 2017)
 - Technology validation report describing how the drought early warning and forecasting system performs in relation to the selected area in the northern part of Ghana (results from the validation activities).
- Development of the Technology description and user guide (December 2017)
 - Report describing the content and use of the drought early warning and forecasting system (user guide with technical description in the annexes).
- Lesson learned and recommendation report (January 2018)
 - Lessons-learned report from the validation case and the initial use of the system in Ghana. This also includes description and design of gender relevant indicators, and identifying at-risk groups and recommendations to improve gender-relevant drought planning.
- High level national workshop (February 2018)
 - High level workshop aiming at achieving a national acceptance of the GCF concept note. The workshop will gather the most relevant accredited entities (national and/or international) to present and discuss the draft concept note, which will be revised accordingly.
- Roadmap documentation (February 2018)
 - The roadmap document provides recommendations for national scale deployment and use of the early warning drought forecasting technology deployment
- Draft GCF concept note (February 2018)

- Draft of a GCF project concept note based on the results and products of this technical assistance. The preliminary draft will serve as a reference document to present the project idea to accredited entities (national and/or international). The preliminary draft, prepared in coordination with and inputs from the NDE, the NDA and the Water Resource Commission, will cover all the relevant sections needed for submitting the concept note to GCF.