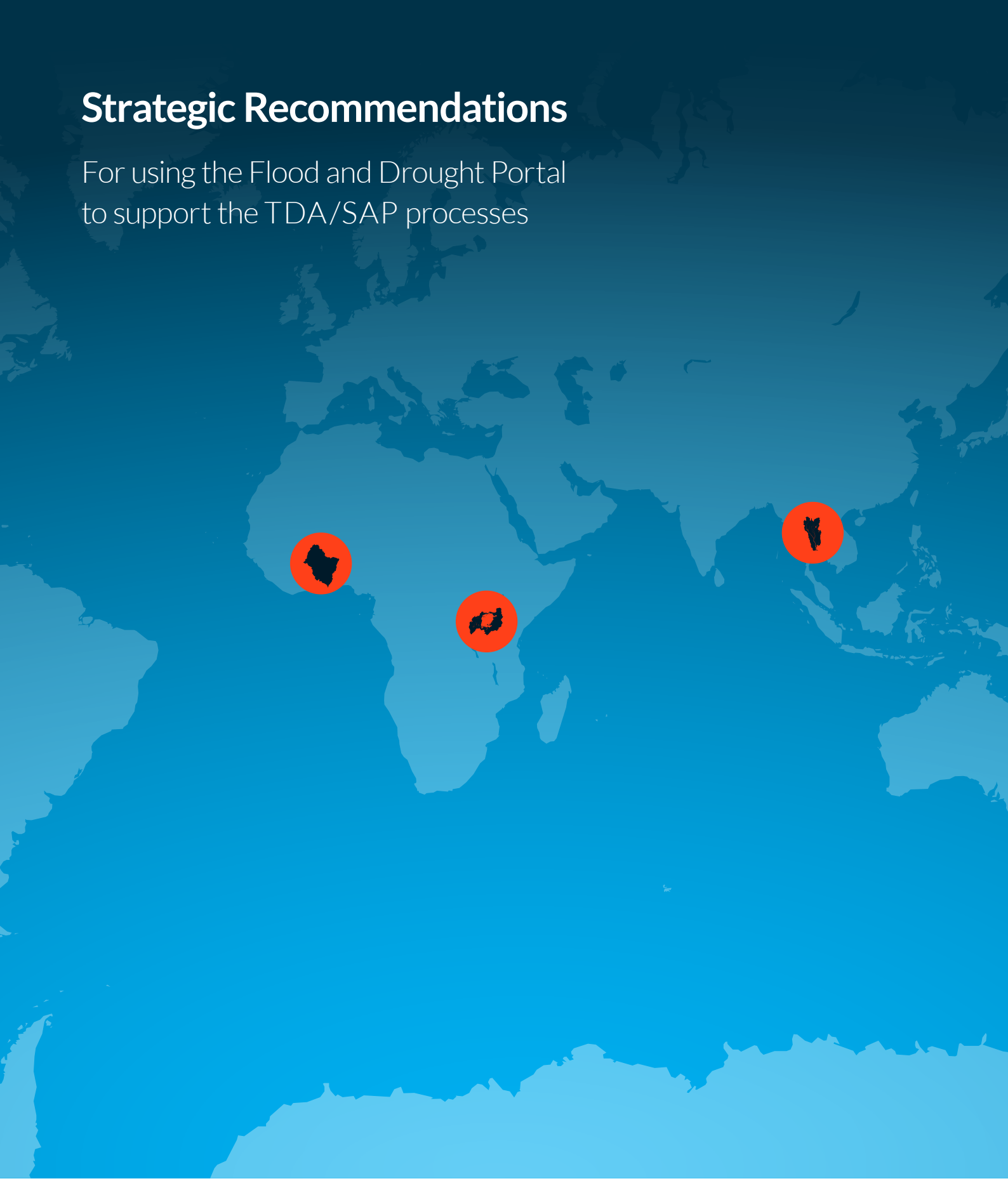
Strategic Recommendations

For using the Flood and Drought Portal
to support the TDA/SAP processes



gef

UN environment

DHI

IWA the international water association

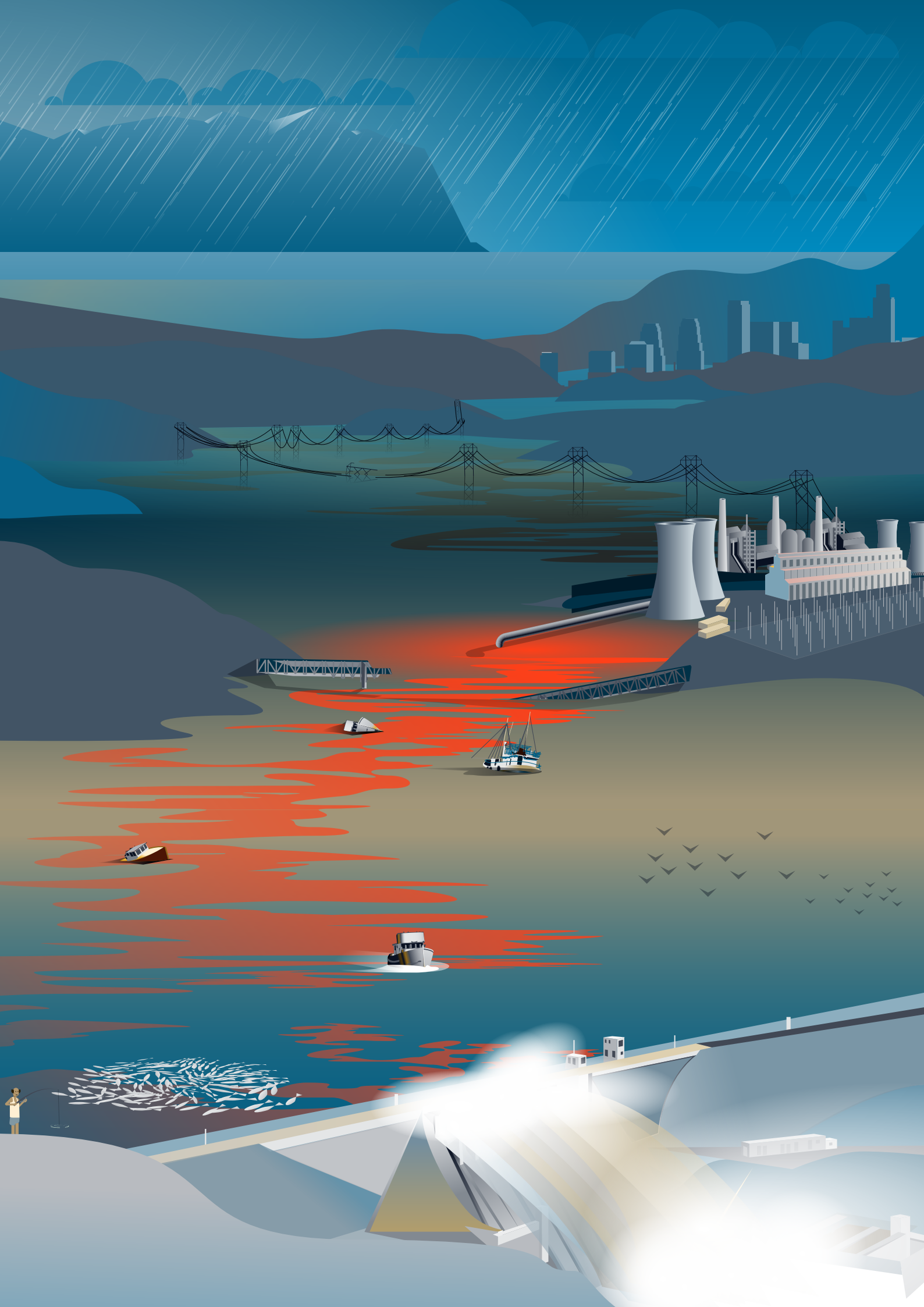


Table of contents

1 Introduction

The Flood and Drought Management Tools (FDMT) project, funded by the Global Environment Facility (GEF) under its International Waters (IW) portfolio, was implemented by UN Environment and jointly executed by DHI and the International Water Association (IWA) during the period 2014—2018. Its objective was to improve the ability of water managers in transboundary river basins to recognize and address the implications of the increased frequency, magnitude, and unpredictability of flood and drought events arising from climate variability and change. The planning approaches supported by the FDMT project included Transboundary Diagnostic Analysis/Strategic Action Programme (TDA/SAP), Integrated Water Resources Management (IWRM), and Water Safety Planning (WSP). The project also developed a methodology to support water utilities and basin organisations, involving web-based technical applications to share data and planning tools with stakeholders in their basins.

The Flood and Drought Portal (www.flooddroughtmonitor.com) is the main output of the project and has a series of technical applications supporting stakeholders to carry out baseline assessments using readily available satellite data, impact assessments through the analysis of the data, planning options and means for disseminating information to relevant groups or individuals. Within the Portal, there is a Data and Information application, which provides near real-time satellite based data related to determining floods and droughts, seasonal and medium range climate forecasts, climate change projections and information relevant for basin and local planning. Other applications hosted on the Flood and Drought Portal include the Water Indicator, Drought and Flood Assessment, Water Safety Planning, Issue Analysis, Crop, Basin Planning and Reporting. Each application or tool can be applied individually or combined to include information about floods, droughts and future scenarios. The applications in the Flood and Drought Portal support planning across scales from a water utility to transboundary basin level, enabling both water basin authorities and local water utilities to be better equipped and prepared for extreme weather events.

The FDMT methodology and tools were developed to have a global approach to flood and drought planning, which can then be applied to local settings around the world. Three pilot locations affected by extreme weather challenges were selected to develop, test and validate the FDMT methodology. The pilot cases were the Chao Phraya Basin (Thailand), Lake Victoria Basin (East Africa) and Volta Basin (West Africa).

The purpose of this note is to describe the relevance/advantages of applying the FDMT applications as part of the Transboundary Diagnostic Analysis/Strategic Action Programme (TDA/SAP) processes and how this can be implemented in practice.

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

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.

Crop application
Visualise crop calendar, estimate crop water requirements and crop yield.

Flood assessment
Locate and identify hazards, estimate impacts and provide risk assessment.

Basin planning
Create and evaluate basin plans. Linkage to water resource model.

RDM tool
Robust decision making tool

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

Figure 1: The FDMT applications available via the Flood and Drought Portal (www.flooddroughtmonitor.com)

2 The TDA/SAP Processes

The TDA/SAP approach is a highly collaborative process that has proven to be a major strategic planning tool for GEF International Waters Projects for more than 20 years.

The main technical role of a TDA is to identify, quantify, and set priorities for environmental problems that are transboundary in nature. In particular, the TDA aims to:

- Identify and prioritise the transboundary problems;
- Gather and interpret information on the environmental impacts and socio-economic consequences of each problem; and
- Analyse the immediate, underlying, and root causes for each problem, and in particular identify specific practices, sources, locations, and human activity sectors from which environmental degradation arises or threatens to arise.

Ultimately, a TDA provides the factual basis for the formulation of a Strategic Action Programme (SAP), but the TDA is also part of a larger facilitative process of engagement and consultation with all the key stakeholders from the initial TDA steps through to the subsequent development of alternative solutions during the formulation of the SAP. The TDA is a mechanism to help the participating countries to 'agree on the facts' – many conflicts are driven by perceptions and removing these can be an enormous step in itself. Furthermore, the TDA should be seen as more than just an analysis of data and information. It is a robust process that can help create trust and confidence among the partners involved across sectors and across national boundaries.

The SAP is a negotiated policy document that should be endorsed at the highest level of all relevant sectors of the respective government. It establishes clear priorities for action (e.g. policy, legal, institutional reforms, or investments) to resolve the priority transboundary problems identified in the TDA. A key element of the SAP is a well-defined baseline. This enables a clear distinction between actions with purely national benefits and those addressing transboundary concerns and thus providing benefits at the basin level. Another key element involves the development of institutional mechanisms at the regional and national levels for implementing the SAP as well as monitoring and evaluation procedures to measure effectiveness of the outcomes of the process.

The main components of the TDA/SAP process. Source: TDA/SAP Manuals

2·1 The TDA/SAP process

The elaboration of both the TDA and the SAP is based on a well-defined stakeholder consultation process involving all relevant sectors from the respective countries within the transboundary unit. Discussions and decisions are taken in large workshops at the basin level often based on analysis and recommendations prepared by an Interdisciplinary Development Team[1]. The process, involving several "physical" meetings is well accepted by the stakeholders, but often also very costly and time consuming due to the fact that the workshop participants often travel long distances within the basin. The physical meetings/workshops are however needed; not least to create relations and trust between the stakeholders especially during the initial stages of the TDA and the SAP process.The question now is if new technologies (e.g. web based tools, online meeting forums etc.) and innovative methods (e.g. near real time earth observation combined with predictive models) will be able to support the TDA/SAP process by:

- Involving more stakeholders for no or limited additional costs.
- Providing timely and reliable/mutually/neutral information.
- Providing results/impacts of various development scenarios based on indicators decided by the stakeholders.
- Reducing the number of physical meetings/workshops, which in return reduced costs.
- Allowing stakeholders in specific sectors or countries to make own simulations of preferred development scenarios as preparation for discussions in larger meetings/ workshops.
- Ensuring that the meeting participants are well informed prior to the actual meetings/ decision making.
- Monitoring the national and the basin wide impact of the actual implementation of the SAP (e.g. change in agricultural practices, protection of forests and wetlands, dam construction and operation, location and size of irrigation schemes, etc.).
- Verifying/confirming the quality of data provided by the individual countries.

An important step towards meeting the above ambitions would be the creation of a web based "TDA/SAP support tool" to facilitate a more dynamic, more efficient and more evidence based interaction among more stakeholders of a basin during the elaboration of the TDA and the SAP. Such web based "TDA/SAP support tool" would also provide for easy and regular updating and ensure the TDA and SAP processes inform adaptive planning as well as operational management of transboundary basins.

The FDMT applications can, to a large extent, serve as building blocks for a future "TDA/SAP support tool". The following chapter describes the different FDMT applications and how they can potentially serve the TDA/SAP process.

1 GEF TDA/SAP Manual, Vol. 3, Planning the TDA/SAP Process, 2013

3 The Flood and Drought Applications and how they can potentially support the TDA/SAP process

This chapter briefly describes the FDMT applications and how they can potentially serve the TDA/SAP process. For a more comprehensive description of the FDMT application reference is made to the User Guide, which can be accessed via the Flood and Drought Portal (www.flooddroughtmonitor.com).

The relevant FDMT applications include:

1. Issue Analysis
2. Water Indicator
3. Data and Information
4. Drought Assessment
5. Crop Application
6. Flood Assessment
7. Basin Planning
8. Robust Decision Making Tool
9. Reporting

3·1 Issue Analysis

Causal Chain Analysis and WRIAM, Understand and prioritise the causes behind issues

The Issue Analysis application is designed to identify and analyse key environmental issues affecting water resources in a region. The application also examines and evaluates the causes behind associated impacts of each environmental issue based on the Causal Chain Analysis (CCA), a method using an ordered sequence of events to link a problem's causes to its effects. After the identification of issues and causes, a rapid assessment prioritises the issues according to the level of severity. This is based on the Water Resource Issues Assessment Method (WRIAM)[2], a process which provides an evaluation of a given issue, a value which can be used for comparison with other issues and a record that can be re-assessed in the future. Ultimately the issue analysis application assists users in understanding the deeper causes contributing to environmental issues such as droughts and floods, and in assessing the severity of each problem, so that they can shape their planning activities accordingly.

The key objectives of the application are to:

- Evaluate the key issues and assess the causes behind the associated environmental impacts.
- Prioritise the environmental impacts based on a rapid assessment (WRIAM).

The Issue Analysis application is intended for a workshop focusing on the following outcomes:

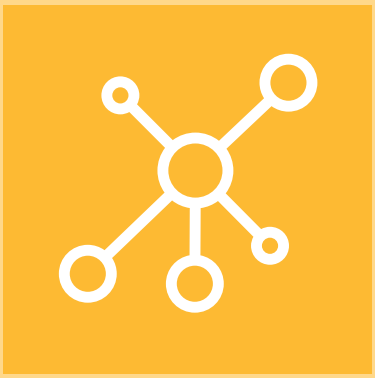
- Understand the causes behind specific issues.
- Target the planning towards the "deeper" causes.
- Increase the efficiency of the planning process.

Potential for supporting the TDA/SAP process:

The Issue Analysis application is ideal for the TDA process as it guides the stakeholder from the actual issue to the root causes to be addressed in a transparent way ensuring that all stakeholders have the same level of information.

The use of an online based tool facilitates information sharing and collaboration between organisations within the river basin and the Issue Analysis tool is seen as one tool which can facilitate the collaboration in a cost efficient way. The Issue Analysis tool could be further extended to support document handling and storing, video conferences, help desk facilities etc.

2 Developed and tested by UNEP-DHI in Burkina Faso and has later been applied in more than 30 countries as part of the IWRM process



3·2 Water Indicator
Identify water-related indicators to support management and decision-making

The water Indicator application can be used to select indicators for measuring the state of specific issues. It is a library of indicators which can also be set with a user defined framework to shape topics with all the data needed for planning. There are several default frameworks with a selection of indicators which can be used to help shape an IWRM plan, or a framework for water utilities needing to monitor upstream risk. Indicators monitor the current state or the pressure of a specific issue, through providing the status of a parameter. The indicators and platform for displaying this information in the tool help users better understand the current state of water resources in their region, the changes in these resources and whether interventions produce the desired effect.

Overall, the water indicator application is a learning tool for basin or catchment users and provides the following specific support:

- Assists users in selecting relevant indicators based on a specific 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.
- A tool for storing indicator information to support management and planning.

Potential for supporting the TDA/SAP process:
The use of the Water Indicator application in the TDA/SAP process will facilitate a structured discussion among the stakeholders once they all refer to well defined and jointly agreed indicators based on the recognised issues and planned future actions within the basin. The indicators can be shown on maps or graphs via the Data and Information application to demonstrate possible changes.

The water indicator application serves as a valuable tool for dissemination and access to the “approved” water indicators within a specific river basin. The use of similar water indicators across a river basin is important as it provides the same monitoring and evaluation basis for the different organisations.

3·3 Data and Information

Access to near real-time data, Flood and drought indices, Climate forecast and climate change data

The Data and Information application is developed to ensure that any user will always have a basic data set available for planning related to water resource, drought or flood management. The objective is to provide spatially distributed data in near real time for any focus area on the globe.

The tool makes up a basic data set of spatially distributed information needed to produce a baseline assessment, available as near real-time satellite data (approximately 48 hours), short-term and seasonal forecast data for up to nine months, and climate projections. Furthermore, users have the ability to download data as raster files into a commonly used format including netcdf or csv, which is compatible with most GIS tools. The FDMT project does not itself generate the climate data, but rather collects it from other sources (e.g. NASA: https://lpdaac.usgs.gov/dataset_discovery, Copernicus(ESA): http://land.copernicus.eu/, NOAA: https://www.ncdc.noaa.gov/data-access) and processes the information before making it available in the application and relevant for decision making. As there is limited access to data, particularly in the African pilot basins, prompting a need to provide a basic set of data. As such, the data provided in the application originates from global and freely available data sets and, satellite based information.

The Data and Information application contains a number of different data types having the following features in common:

- Spatially distributed data (raster data visible on a map).
- Temporal resolution maintained in near real time (data is updated regularly).
- Short time delay (data is published with a maximum delay of 5 days).
- Available for download through the Data and Information application in commonly used formats.

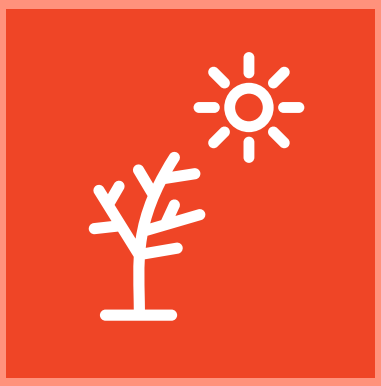
This application provides the user with a map of the relevant transboundary basin showing the selected features and thus a good basis for creating common understanding and overview among the stakeholders.

Potential for supporting the TDA/SAP process:

The data and information application provides a valuable repository for data and information used in the development of the TDA. It should be noted that all data are updated on a daily basis (or as soon as the data provider updates the data) enabling stakeholders to dynamically monitor the status of the basin.

The application is highly relevant for the TDA/SAP process as it shows the basin delineations and the overall condition of the basin. It is relevant when discussing and agreeing on the existing issues and its causes (TDA) as well as when discussing and agreeing on future actions/investments (SAP) and potential communities/investments to be impacted upstream or downstream.

The Data and Information application is also relevant for monitoring the implementation progress of the SAP and its impacts (e.g. by linking the application to relevant earth observation data sources freely providing maps/layers showing wetlands, deforestation, soil degradation, infrastructure etc.).



3·4 Drought Assessment

Locate and identify hazards, estimate impacts and provide risk assessment

Both the Drought and Flood Assessment applications establish prediction and early warning systems as part of a proactive risk management process, through identifying current and upcoming hazards as well as their associated level of risk. The main objective of these applications is to detect when and if a drought or flood hazard might occur, along with the location, and severity of this hazard. The procedure for completing a drought and flood risk assessment begins with determining the location and timing of a drought or flood event, followed by quantifying how the area and sectors exposed to this hazard will be impacted. After the impact assessment, a vulnerability analysis examines the causes behind the drought or flood impact and the priority of these causes. Vulnerability analysis provides the means for interventions or mitigation measures to be targeted specifically against the underlying causes for the drought or flood impacts. While the Drought and Flood Assessment applications function similarly, they are slightly different.

The drought assessment application provides warning and risk analysis, whereas the flood assessment application mainly focuses on selected datasets and indicators as well as a rainfall runoff model to predict extreme events.

Drought early warning systems are an important component of the risk management part of the drought management process. It provides an identification of current or upcoming hazards and provides an assessment of the associated risk related to the hazards.

The main objective of a drought early warning system is to detect when and if a drought hazard might occur and the location and severity of the hazard. Drought warnings could be expressed based on the hazard itself or on the associated risk towards specific vulnerable sectors or areas.

Potential for supporting the TDA/SAP process:

The Drought assessment application highlight issues related to water shortage or scarcity with in the basin as well as impacts on the agricultural sector. In addition to the TDA/SAP process, the results of the Drought Assessment application may be an important input for the agricultural sector (e.g. advising on timing for planting and harvesting) (see section 3.5).

3·5 Crop Application

Visualise crop calendar, estimate crop water requirements and crop yield

The Crop application enables users to access all data, information and tools related to crop phenology, crop water requirements and crop yield. The application is based in the FAO developed AquaCrop tool and a direct linkage with the FAO tool is built into the application.

The application is composed of three main sections:

- Data: All relevant data from the Data and Information application are available in this section.
- Crop calendar: Crop calendar for all relevant crops in the selected area.
- Yield estimate: Tool for calculating crop water requirement and yield estimate based on the AquaCrop model.

Potential for supporting the TDA/SAP process:

The Crop application is relevant for both the TDA and SAP processes as it serves as a mean to evaluate the water demand for the agricultural sector and impacts of interventions such as the introduction of climate resilient crops within the basin.

3·6 Flood Assessment

Locate and identify hazards, estimate impacts and provide risk assessments

Floods are one of the main disaster events in many river basins and as such there is already a lot of attention on flood warning, flood prediction and flood impact assessment in many river basins. The flood application within the FDMT project aims at providing stakeholders with an overview of areas impacted by floods in the past through available information from historical records as well as using a simple flood risk indicator for locating future areas of risk. The flood application is to serve as a screening tool before real-time flood early warning systems are developed within a river basin. The flood assessment application mainly focuses on selected datasets and indicators as well as a rainfall runoff model to predict extreme events.

The application is composed of two main parts:

- Relevant data and indices have been selected from the Data and Information app and are made available at this section
- A hydrological model is included and allows the user to run, calibrate and execute forecasted and projected simulations of flows based on the data included in the portal.

Potential for supporting the TDA/SAP process:
Understanding flood conditions in the past as well as climate change impacts on the river run-off is an essential part of the TDA process, and the flood applications serves as a tool for providing stakeholders with an overview of areas likely impacted by flood events as well as understanding the likely impact on river run-off.

3·7 Basin Planning

Create and evaluate basin plans.
Linkage to water resource model

The Basin Planning application uses an user uploaded water resources model and the embedded planning tools to support the evaluation of various plans, targeted at decision makers without any modelling expertise. The application begins by providing a baseline model plan of the specific basin, previously established in the backend of the Portal. Users can create new plans on top of this baseline using a combination of identified and clearly defined investments and external factors. Each plan or scenario is represented by a series of these inputs to the model.

The Basin Planning application targets stakeholders as well as decision makers without any hydrological/hydraulic modelling expertise. The purpose of the application is to evaluate and compare various development plans for the water and energy sector. The basin planning application is based on the following principles:

- Investments are limited to water supply, irrigation schemes, hydropower, reservoirs and storage.
- External factors such as climate change and population growth are taken into the various development scenarios.
- The results of the simulations of the development scenarios are presented as time series of the agreed indicators
- A "weighting system" is applied to reflect various agreed policies and strategies (e.g. domestic water supply has higher priority than water for energy production, etc.)

Potential for supporting the TDA/SAP process:

The Basin Planning application is highly relevant when discussing, comparing and agreeing on future actions to be implemented in the basin. The basin planning application will facilitate a transparent process and make it easy to revise development scenarios in order to evaluate sensitivity/impacts. The results of the basin planning application can be linked to the Reporting application (see section 3.9) and made available online for all stakeholders who want to prepare themselves prior to the meetings/decision making.

The Basin Planning application is targeting the SAP process as it enables decision makers to evaluate the impact of future investments. Impacts are described based on hydrological or socio-economic indicators enabling stakeholders to evaluate a holistic impact of planned investments within the river basin. The Basin Planning application is further extended outside of the project and additional models related to cost benefit analysis and socio-economic indicators will be released during 2019.

3·8 Robust Decision Making
Robust Decision Making Tool

The Robust Decision Making (RDM) application supports decision making under uncertainty and can be used with outputs from any model.

Robust decision making focuses on evaluating investments under different combinations of external factors in order to identify combinations that are likely to result in failure. Hence, the purpose of the methodology is to help decision makers and stakeholders identify ways in which investments are vulnerable to factors outside of their control. Decision makers and stakeholders can then identify investments that are likely to perform well regardless of future conditions or, in other words, "robust" investments.

The methodology behind the application is appropriate for use in two different, but related, contexts. The first is seasonal planning, where decisions are made based on forecasts of conditions up to one year in the future. The second is long-term planning, where decisions are made based on forecasts of conditions up to 50 years ahead.

The methodology uses the terms scenario and alternative. Because these terms are sometimes defined differently in different contexts, we provide the following precise definitions:

- Scenario: A representation of future conditions that affect the outcome of a decision. For example, a scenario could consist of a single seasonal rainfall forecast time series.
- Alternative: A possible course of action and decision makers must decide among two or more alternatives. For example, an alternative could consist of a crop and a planting date.

Potential for supporting the TDA/SAP process:
The Robust Decision Making (RDM) application combined with the Basin Planning application (see section 3.6) can support the SAP process in helping the decision makers/ stakeholders in comparing and selection of future development plans or actions.

3·9 Reporting

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

Dissemination in the form of reports or bulletins are important in relation to planning and decision making in order to involve all relelvant stakeholders. The content and format of the dissemination reports or bulletins depend to a large extent on the specific content of the decision and the intended receiver. In some cases the reports or bulletins needs to be very detailed with technical content whereas in other cases it should highlight the key issues using non-technical terms. For this reason, the Reporting application is based on a process allowing the user to select between a number of default reports, or develop their own reports based on the specific requirements.

The Reporting application is based on reporting templates (Word documents) containing a number of tags, where the user is able to specify which type of content the reporting application should replace the tags with. Currently the tags could be replaced with images, text, charts or tables.

Potential for supporting the TDA/SAP process:
As both the TDA and SAP processes are highly stakeholder intensive the timely sharing of information and data is important. The Reporting application serves well this purpose.

The reporting application will be further developed during 2019 and functionalities supporting the different applications will be released. The specific information will be made available on the portal (www.flooddroughtmonitor.com).

4 Potential for the FDMT to support the TDA/SAP Process

As can be seen from Chapter 3 all the applications developed during the FDMT project have a potential for supporting the TDA/SAP process.

Figure 2 and Figure 3 show how the developed FDMT applications can potentially support the various steps of TDA/SAP process. Going the next step of developing a "TDA/SAP support tool" by using the developed FDMT applications as building blocks will require the following tasks:

- Development (step-wise) of the "TDA/SAP support tool" based on the FDMT applications.
- Testing by "pilot stakeholder groups".
- Training of decision makers and stakeholders in using the "TDA/SAP support tool" including holding online meetings.

Figure 2: Potential of different FDMT applications supporting the TDA process

The use of a web based "TDA/SAP support tool" and holding on-line meeting will require fast and reliable internet. The consideration of a step-wise development, training and implementation of the "TDA/SAP support tool" shall thus take into account the reality of the internet infrastructure. Some developing countries still have unreliable internet connections, but the hope is that within a few years all countries will have updated and reliable internet connections.

This note has shown that all of the FDMT application have a potential for supporting the TDA/SAP process and thus could be integrated as building blocks into the "TDA/SAP support tool".

Figure 3: Potential of different FDMT applications supporting the SAP process

5 Conclusion

The applications developed during the GEF funded FDMT project have a potential to support the existing TDA/SAP process. A careful evaluation is needed before deciding which of the FDMT applications should serve as building blocks in the first generation of a "TDA/SAP support tool". The first generation "TDA/SAP support tool" may only target the Interdisciplinary Development Team. Later versions may then be prepared for all stakeholders covering other sectors with socio-economic, gender and other aspects included in the tools.

The "TDA/SAP support tool" proposed to be built on top of the FDMT applications must take into account the internet infrastructure of the target countries. For this reason, the first generation might be a light version, which may be extended depending when the internet infrastructure will improve.

A successful "TDA/SAP support tool" will also depend on a solid training of the users and it is recommended to consider if more user levels shall be available (e.g. modellers, result viewers, reports, conclusions).

A web based "TDA/SAP support tool" invites more stakeholders to take part in the TDA/SAP process. To fully harvest the inputs from the stakeholders, the idea of arranging online meetings among the stakeholders themselves and with the decision makers shall be tested. If proven successful training shall be given in chairing and participating in online meetings.

The combination of innovative applications that are easy to use by the stakeholders and the ability to carry consultations and meetings via the internet are expected to contribute to a more dynamic dialogue and thus better understanding among the stakeholders of their transboundary basin, where often the dialogue itself is very costly.

6 Resources

TDA/SAP Manuals, https://iwlearn.net/manuals/tda-sap-methodology

FDMT User Guides, www.flooddroughtmonitor.com

Flood and Drought Management Tools Case Study, IWRA, 2018

For more information contact:
Oluf Zeilund Jessen – DHI: ozj@dhigroup.com
Katharine Cross – IWA: katharine.cross@iwahq.org

Design: www.chris-wells.com

gef UN environment DHI IWA the international water association