Assessment of WEFE Interdependencies across the Nile River Basin Upstream of GERD

Inception Report

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1 INTRODUCTION

It is clear that having access to safe and adequate water supply, reliable energy source and improved food security are the bottom line for any development endeavor. These three sectors are so interlinked and complex that critical and in-depth analyses need to be done. The Nexus of the three needs to be established in such a way that the hidden connections are well understood. The core of the matter is that we should avoid costly trade-offs and bad investments, protect the public from unintended side effects of uninformed decisions, use the opportunities properly, and can make the synergy of the three sectors more balanced and sustainable. However, developing methodologies and analytical tools for assessing impacts that emerge from decisions taken in the area of water, food, energy and ecosystems are more challenging.

The Upper Blue Nile River Basin is the source of the water for hundreds of millions of people in Ethiopia, Sudan and Egypt. Various tributaries of the Blue Nile supply water for irrigation, power, industrial demands and domestic purposes down the riparian. Ethiopia has so far little utilized the water resources of the Blue Nile Basin although it contributes nearly 84% of the annual flows of the Nile (Block and Strzepek, 2010). The irrigation potential in the Ethiopian part of the Blue Nile (Upper Blue Nile) is estimated to be over 815,000 ha (Awulachew et al., 2007), while the developed area so far, though not accurately known, is estimated to be not more than 15-20%. The hydropower potential in the basin is estimated to be over 10,000 MW or 78,820 Gwh/year (Awulachew et al., 2007). There are four operational hydropower plants in the basin in the Ethiopian part; namely, Tana Beles (installed capacity of 460 MW), Tis Abay I (Installed capacity of 11.4 MW), Tis Abay II (installed capacity of 73 MW), and Fincha (installed capacity of 100 MW). The ongoing Great Ethiopian Renaissance Dam is the 5th hydropower plant in the Upper Blue Nile and will be the largest in Africa upon completion. In 1964, the US Bureau of Reclamation (USBR, 1964) identified four hydropower sites: Karadobi, Mabil, Mendaia and Border in on the Upper Blue Nile. In view of the large hydropower potential in the basin, there are several recently identified hydropower projects sites in the basin on the main river course and tributaries.

Better understanding the WEFE interrelationships in the BNB will enable optimum utilization of basin water resources for various uses, and enhances cooperation between local and regional stakeholders. Owing to its huge socio-economic importance and trans-boundary nature, the WEFE interrelationship assessment under impacts of climate change and population pressure will make a significant contribution.

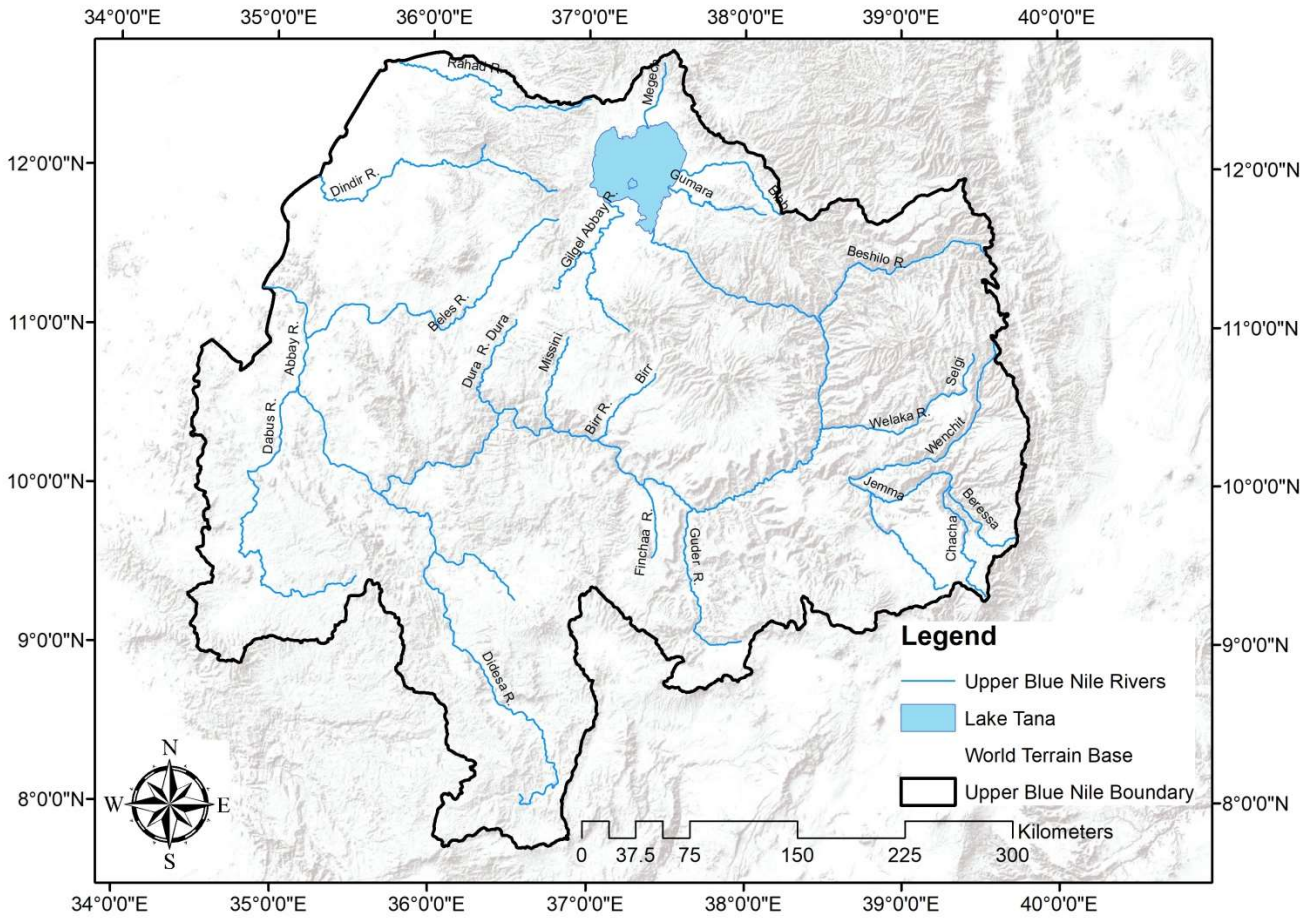

Figure 1. Blue Nile Basin upstream of GERD

2 OBJECTIVES

The objectives of the WEFE interrelationship assessment study upstream of GERD are the following:

i. To produce baseline database on hydrology and water use and describing report;
ii. To produce Guidelines on methodological approach to impact assessment of water access and quality on health in BNB;
iii. To carry out WEFE assessment and produce report, including modelling framework, over the BNB;
iv. To disseminate material on models setup and outcomes of current conditions and scenarios-based simulations (on demand).

3 CONCEPTUAL FRAMEWORK

Methodological approaches are to assess and integrate inputs for both sides of water resources management which are demand-side and supply-side management. Climate, population and socio-economic changes have a determinable effect on both sides while accessing and utilizing the resources. The equilibrium between accessing the resource and utilizing for different purpose of economic

significance will later be determined as WEFE in the BNB specifically upstream of GERD. Statistical modeling and geo-spatial analysis using GIS based application tools will be employed to assess trends on the resource availability and utilization.

The detailed assessment on resource availability and utilization is a necessary condition to build a database which later to be used for building a river basin simulation model to perform simulation under different management scenarios. Through iterative approach an attempt will be made to maximize the benefit of natural resources looking at different management options. Water resources systems modeling tools such as MIKE Hydro or RIVERWARE, SWAT will be used for water resource modeling task specifically for basin wide water resource allocation and hydrological simulation, respectively. From all these assessments and modeling, detailed results on spatio-temporal trends on the available resources and sector based utilization will be prepared together with plausible management options to sustain socio-economic development while maintaining the equilibrium amongst nexus components. The following logical framework portrays the general methods and components that will be incorporated during the study.

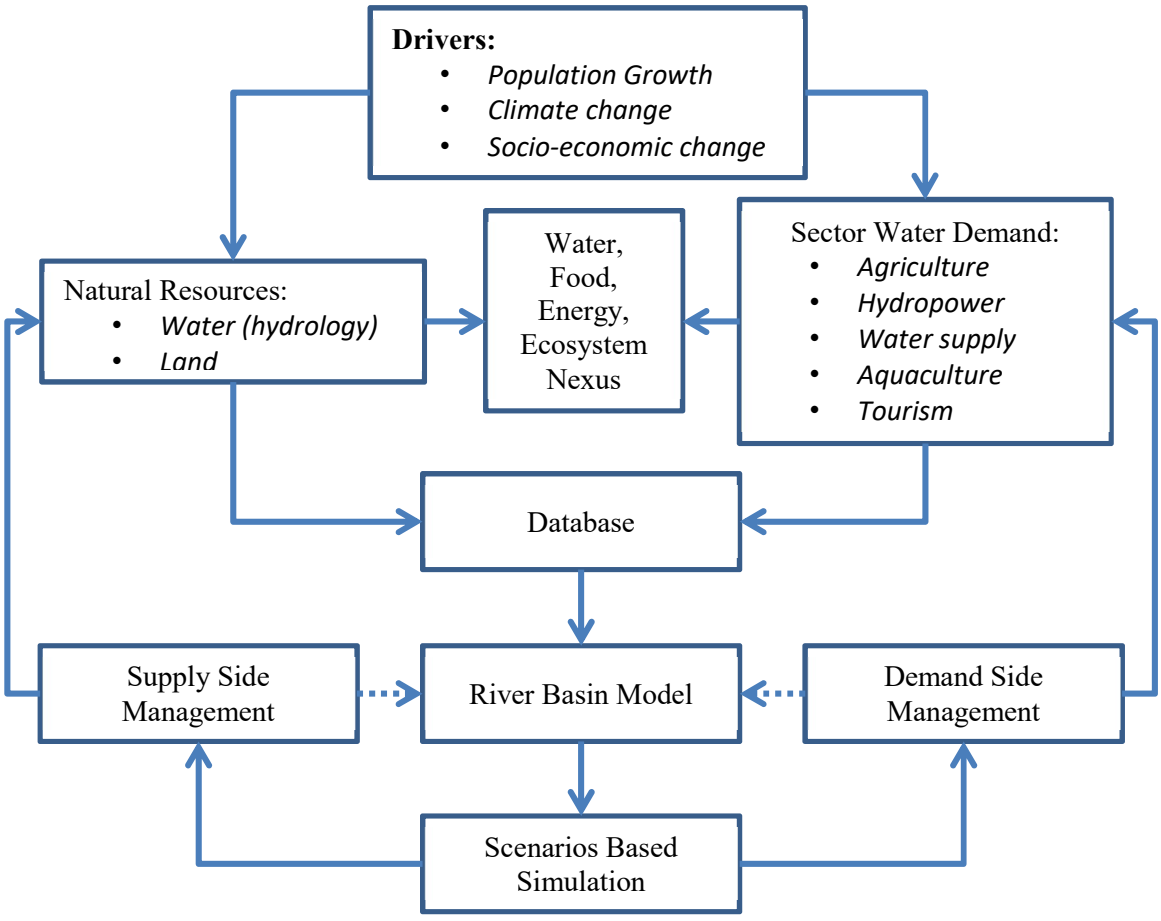

Figure 2. Conceptual framework for WEFE assessment in BNB

4 DATA AVAILABILITY

Data necessary for the water balance assessment and multipurpose optimization of water resources systems across the BNB can be found in different format from different sources. Metadata related to meteorology will be collected from the national meteorological services agency and global databases. Particularly, global rainfall datasets shall be explored and utilized for watersheds with insufficient rainfall data. As the analysis will be under the changing climate conditions, future data on climate is a necessity. To this end, data on future climate over the basin will be acquired from ICPAC. On the other hand, hydrological and geo-spatial, reservoir characteristics, water use and efficiency, crop production and sedimentology can be obtained from the Ministry that is responsible for the collection and distribution of such data. Socio-economic data which are basic for the demand analysis and water allocation can be found from river basin and regional bureaus.

5 ARCHITECTURE OF THE DATABASE

One of the WEFE Nexus objective proposed to enhance scientific and technical cooperation, including sharing and effective data management, among relevant stakeholders at both national and regional level will be achieved by implementing the architecture of database system designed below.

A properly designed WEFE database provides us access to up-to-date, accurate and DSS information. A correct design is essential in achieving the objectives stated above, and in the end, it meets our needs and can easily accommodate change.

Two categories of databases shall be produced: A GIS based spatial database and a secured desktop database of baseline information.

A Geographical Information Systems (GIS) based spatial baseline database on water resources, land utilization (cover), and water use (agriculture, domestic and industrial water supply, hydropower, ecosystem, tourism, etc.) will be built. Baseline information will be obtained from various sources: literature, recent research outputs, policy documents, remote sensing data, Ministries, regional water and agriculture bureaus, etc.

A secured desktop database that can be easily operated by concerned parts shall also be produced. Possible system architecture for the database system that will be applicable for WEFE database in the Upper Blue Nile Basin shall have three tier of logical schematic architecture.

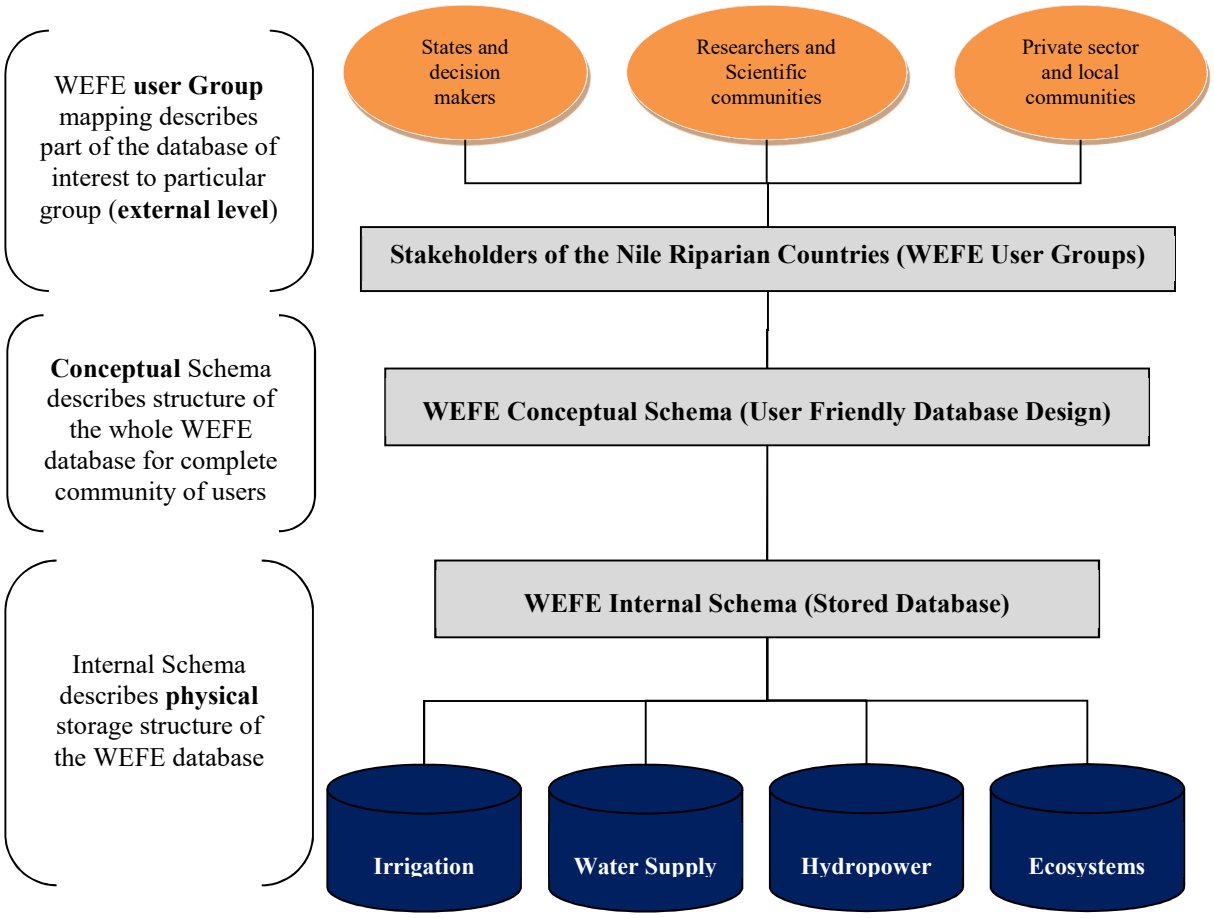

Figure 3. Schematic Representation of three lyres of WEFE Database Architecture

6 ISSUES

As the river basin has a trans-boundary nature, issues related to the use and development of water resources is complex. Some of the major issues are: rapid population growth and urbanization, economic development, competition for accessing water and emergency of regional conflict, pressure on the water resources as a result of climate change and environmental degradation, environmental sustainability and uncoordinated operation of water resources systems.

7 CHALLENGES AND POSSIBLE SULUTIONS

Some of the major challenges in the Blue Nile Basin are: meeting the demands of water for different water use and economic sectors to sustain development, sustainability of water resource systems, Trans-boundary management of the water resource between riparian countries. Accessing data for major hydro-infrastructures and socio-economic conditions in the sub-basin, data quality, lack of basin's environmental data will be the main expected challenges in due course of the study. Due to its political and legal sensitivity of the utilization of water in the BNB, policy makers are usually careful in using study outputs from any group to incorporate in the decision making process. However, an effort will be made to bring

all stakeholders to understand the objective of the study and its significance to manage water resources for socio-economic development in a sustainable way.

Stream flow (hydrological) data are generally scarce in Ethiopia including the Blue Nile Basin. In several sub basins, flow data are either incomplete (lots of missing data) or are available for very short periods of time. Complete and consistent primary data are available for some sub-basins with the Ministry of Water, Irrigation and Electricity of Ethiopia (MoWIE). However, data policy of the Ministry does not allow sharing Meta data to third party. However, it is possible to avail or share model results and any assessment data that can be integrated to other study or working group.

8 PROPOSED WORK PLAN OF ACTIVITIES

S. No	Activity	2018						2019					
		Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1	Inception Report												
2	Data collection on water resources and water use												
3	Building data base on water resources and water use in BNB												
4	Delivering database and report												
5	Guidelines for impact assessment of access to water and water quality on health in BNB												
	Modeling framework for WEFE nexus												
6	WEFE nexus assessment in BNB												
7	Reporting on WEFE nexus assessment												

9 FINAL REPORT FORMAT

Baseline data base (deliverable1)

1. Description of the Blue Nile Basin
   1.1. Background
   1.2. Climate
   1.3. Water resources development
   1.4. Land use and environmental issues

1.5. Socio-economic condition
1.6. Basin development policy and strategy
1.7. Challenges and opportunities in the basin

2. Baseline Water use, access and sectoral development
   1.1. Introduction
   1.2. Methodology
   1.3. Basin hydrology and water resources
   1.4. Water access and use
      1.4.1. Agriculture
         1.4.1.1. Irrigation water use by source
         1.4.1.2. Spatial irrigation water use
         1.4.1.3. Irrigation water quality by source and space
      1.4.2. Hydropower
         1.4.2.1. Existing hydropower schemes characteristics
         1.4.2.2. Challenges to hydropower schemes
      1.4.3. Industrial and domestic water supply
         1.4.3.1. Domestic and industrial water abstraction by source
         1.4.3.2. Spatial characteristics of water resources for domestic consumption
      1.4.4. Fisheries and aquaculture
      1.4.5. Tourism
      1.4.6. Environment

Guidelines (deliverable2)

1. Water quality characterization of the BNB
   1.1. Surface water quality
   1.2. Groundwater quality
   1.3. Mapping of sources of water pollution
   1.4. Institutional capacity
2. Water supply and sanitation conditions in the BNB
   2.1. Distribution of water, sanitation and hygiene related diseases
   2.2. Water supply status
   2.3. Sanitation and hygiene status
   2.4. Water safety plan
3. Guidelines on assessment of access to water and impacts on health
4. Guidelines on assessment of drinking water quality and impacts on health
5. Guidelines for surface water quality monitoring

WEFE Nexus assessment in BNB (deliverable3)

1. Concepts of WEFE nexus
2. WEFE assessment in the BNB

10 REFERENCES

Awulachew, S. B.; Yilma, A. D.; Loulseged, M.; Loiskandl, W., Ayana, M.; Alamirew, T. (2007). Water Resources and Irrigation Development in Ethiopia. Colombo, Sri Lanka: International Water Management Institute. 78p. (Working Paper 123).

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