WATER SECURITY IN THE GREATER HORN OF AFRICA

Addressing the Challenges

REGIONAL SYNTHESIS PAPER

AFRICAN DEVELOPMENT BANK GROUP
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Table of Contents

List of Boxes

List of Figures

List of Tables

List of Acronyms

AfDB	African Development Bank	NRW	Non-Revenue Water
AMCOW	African Ministers' Council on Water	O&M	Operation and Maintenance
AU	African Union	ODA	Official Development Assistance
COMESA	Common Market for Eastern and Southern African State	OWNP	One Wash National Programme
COVID-19	Corona Virus Disease, 2019	PPP	Public Private Partnership
CRGE	Climate Resilient Growth Economy	RBAs	River Basin Authorities
CSO	Civil Society Organization	RMC	Regional Member Countries
CSP	Country Strategy Paper	RSPWS	Regional Synthesis Paper on Water Security
CWA	Consolidated Wash Account	RWB	Regional Water Boards
CWSP	Country Water Sector Profile	SWAp	Sector-wide Approach to Planning
DAG	Development Assistance Group	TVET	Technical and Vocational Education and Training
DFID	UK Department for international Development	TWB	Town Water Board
EIA	Environmental Impact Assessment	TYS	Ten Year Strategy
ENSO	El Niño Southern Oscillation	USAID	United States Agency for International Development
EU	European Union	VNR	Voluntary National Review
GDP	Gross Domestic Product	WASH	Water, Sanitation and Hygiene
GHG	Greenhouse Gases	WB	World Bank
GHoA	Greater Horn of Africa	WRDF	Water Resource Development Fund
HOA	Horn of Africa	WRI	World Resources Institute
IGAD	Intergovernmental Authority on Development	WSDP	Water Sector Development Program
INDC	Intended Nationally Determined Contribution	WTWG	Water Technical Working Group
IWRM	Integrated Water Resources Management		
JICA	Japan International Cooperation		
M&E	Monitoring and Evaluation		
MDG	Millennium Development Goals		
MOU	Memorandum of Understanding		
MoWIE	Ministry of Water, Irrigation and Energy		
MSF	Multi Stakeholder Forum		
MtCO2e	Million Tonnes of Carbon dioxide equivalent		
NBI	Nile Basin Initiative		
NEPAD	New Partnership for Africa's Development		
NGO	Non-Governmental Organization		

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Executive Summary

This note on water security presents a synopsis of the water security situation for the Greater Horn of Africa (GHoA). It complements the Country Water Sector Profiles (CWSP) of seven nations of the GHoA, including Eritrea, Ethiopia, Kenya, Somalia, South Sudan, Sudan, and Uganda. The note examines the dimensions through which the risks and impacts will be felt most strongly in the future. These include water quantity; water quality; and water accessibility. It is prepared to inform the Bank engagement in strengthening investments in enhancing water security.

Despite its rich endowment in human, social, and natural capital, the region is plagued by a complex history of weak governance, insecurity, increasing environmental degradation, entrenched poverty, and a range of persistent development challenges**.** Two key constraints in the Horn of Africa are weak state institutions and capacity, and the effects of a long history of distrust among countries. These constraints limit the options for sustainable governance of water resources and for anticipating and pre-empting other climate-related security risks in the Horn of Africa. The Horn of Africa (HOA) has a rapidly growing population estimated at over 289 million people Most of the population is poor and relies on rain-fed agriculture for its livelihood, in a climate characterized by recurrent droughts. Fragility, conflict and violence (FCV) undermine water security, through growing numbers of refugees and internally displaced people. Changes in water availability and variability have been known to induce migration and ignite civil conflict in areas like Darfur. Inadequate governance of shared water resources amplifies water insecurity.

Water is a vital factor of production, so diminishing water supplies translates into slower growth[1]. The drivers for the region's soaring demands, include population growth, rapid urbanization, and rising incomes associated with economic growth, all of which increase demand for water, energy and food. The most significant driver is population growth, with population projected to reach 462 million in 2050. Structural transformation of the economies will drive rapid urbanization and increasing pressure on service provision, including for Water supply and Sanitation Services.

Considerable progress has been made in addressing SDG 6 however, the infrastructure gap to achieve water security remains large. With annual water withdrawals estimated at 14%, of the renewable water resources (dominated by Sudan, for irrigation), water for economic growth remains limited. Efforts to manage water and make it available where it is most needed are hampered by limited storage, changing climate and the shared nature of the water resources. Although access to water services has increased greatly in recent decades, countries need to keep investing to close the gap for universal access even to "basic" services— with the 2017 coverage rate at 49% for water and at 20% for sanitation (JMP). Achieving universal access to "safely managed" WSS services poses an even greater challenge, given the significantly lower coverage rates and higher investment costs for "safe" water and sanitation. The COVID-19 pandemic illuminates the challenges related to WASH and inequalities (IFPRI, May 2020).

In all countries, save for Eritrea and Somalia, there are existing policies either drafted, completed and/or awaiting implementation. At the regional level IGAD countries a Regional Water Resources Policy (2015) is in place which seeks to harmonize and consolidate existing water policies, address the existing gaps and coordinate all sectors of the economy on water resources issues at all levels. However, inadequate policy and regulatory frameworks continue to constrain service delivery. Eritrea, Ethiopia, Somalia, South Sudan, Sudan and Uganda lack independent regulatory agencies for water services.

[1] World Bank. 2016. "High and Dry: Climate Change, Water, and the Economy." World Bank, Washington, DC. License: Creative Commons Attribution CC BY 3.0 IGO

Under-pricing undermines service levels and cost recovery. Overlapping roles, institutional ambiguities, poor inter-sectoral collaboration and inefficiencies continue to curtail service delivery. Several policy priorities exist that can support countries towards realising water security. However, measures would need to be country and context specific considering the risks and circumstances.

Optimizing the use of water through better policies and incentives. While adopting policy reforms (example Sudan, Eritrea, Somalia and South Sudan) will be demanding, the costs of inaction are higher. The future will be thirsty and uncertain, but with the right reforms, governments can help ensure that demands are not left vulnerable to the consequences of water-related shocks. Measures could include strengthening sector regulation as well as pricing which could be valuable for improved water stewardship, cost recovery and promotion of private investment financing[2].

Promoting a water-food-energy nexus. Strengthening water security requires looking beyond the water sector: recognizing the synergies and managing risks that arise from linkages with energy and food policies. For each sector, regulatory frameworks, organizations, and infrastructure are put in place to address specific challenges and demands[3]. A change in approach would be required, one that views the demands and related policies arising from the three sectors as interconnected and emerging in response to common social, economic, and environmental trends.

Expansion of water supply and availability. This includes investments in water and sanitation systems (including recycling, re-use, pollution control, solid waste management), storage infrastructure (dams for energy, fisheries and livestock); irrigation systems, groundwater recharge, and where viable, desalination (in coastal cities of Kenya, Sudan). To be effective, these interventions should be accompanied by policies to promote water use efficiency and allocation across sectors.

Strengthening water use efficiency. This calls for deployment of technologies, reduction of NRW and increasing water production. Approaches are already available, such as smart metering as well as the Technologies for Africa's Agricultural Transformation (TAAT), under the Bank Feed Africa Program, that allow farms to increase yields, while reducing their energy and water footprint.

Reducing the impact of climate extremes. Increasing storage capacities, investment in information systems, and water reuse systems will strengthen resilience. Strengthening transboundary water management, on the Nile, Juba-Shebelle and Omo-Turkana river systems is also key to resilience.

Reducing the infrastructure finance gap. According to the World Bank (2019) [4] achieving universal coverage for WSS services will require much more than a one-off injection of capital. Total cost amounts to 1.1% to 1.4% of GDP per year to achieve targets 6.1 and 6.2—except for Sub-Saharan Africa, where it could reach 4% of GDP or more. Operations and maintenance (O&M) would account for more than 50% of the spending. Extending irrigation to the full extent of available water (after satisfying human and industrial consumption) would cost between 0.6% to 0.7% of GDP per year to improve food availability by 0.3% to 0.9 % depending on policy choices on subsidies (Ibid).

[2] World Bank. 2016. "High and Dry: Climate Change, Water, and the Economy." World Bank, Washington, DC. License: Creative Commons Attribution CC BY 3.0 IGO

[3] Borgomeo, Edoardo, Anders Jägerskog, Amal Talbi, Marcus Wijnen, Mohamad Hejazi, and Fernando Miralles-Wilhelm. 2018. "The Water-Energy-Food Nexus in the Middle East and North Africa: Scenarios for a Sustainable Future." World Bank, Washington, DC

[4] Rozenberg, Julie, and Marianne Fay, eds. 2019. Beyond the Gap: How Countries Can Afford the Infrastructure They Need while Protecting the Planet. Sustainable Infrastructure Series. Washington, DC: World Bank. doi:10.1596/978-1-4648-1363-4. License: Creative Commons Attribution CC BY 3.0 IGO

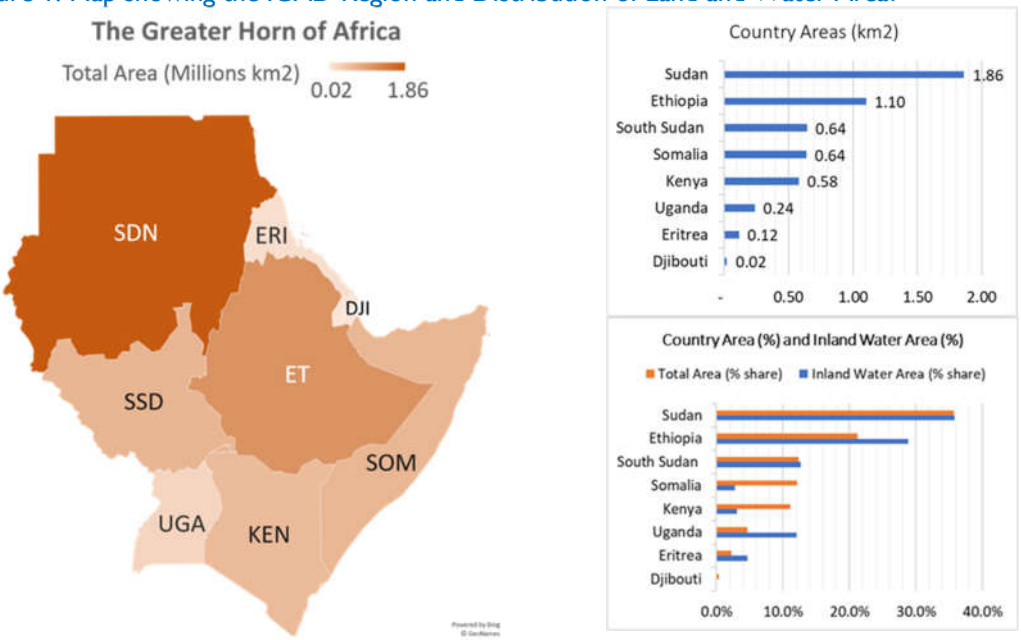
1 Regional Context and Drivers

1.1 Why Water Security matters

This note has been developed to provide a snapshot into water security in the Greater Horn of Africa. The GHoA (Figure 1) encompasses the eight countries of Djibouti, Ethiopia, Eritrea, Kenya, Somalia, South Sudan, Sudan and Uganda - and stretches over an area of 5.21 million km² of which 4.89 million km² comprises the land area and 0.362 million km² comprises inland waters. The region has an estimated 6960 Km of coastline with the Indian Ocean, Gulf of Aden, Gulf of Toudjoura and the Red Sea.

The Greater Horn of Africa represents one of the marginal regions of the world in terms of rainfall available for natural vegetation growth and crop production5. Some 80% of the region is made up of Arid and Semi-Arid Lands (ASALs), which receive less than 600 mm of rainfall annually. Both Djibouti and Somalia are 100% arid, while more than 80% of Kenya and Sudan are classified as ASAL. Nearly 80% of Eritrea land falls within the ASAL zone, while 51% of Ethiopia is classified as ASAL. The rest of the region has a great variety of climates and landscapes including cool highlands, swamp areas, tropical rain forests and other features typical of an equatorial region[6] The HOA is characterized by drought, which is by far the most extensive and potentially damaging natural disaster in the region.

Figure 1: Map showing the IGAD Region and Distribution of Land and Water Area[7]



With only 15% of an estimated renewable water resource of 322 km3, withdrawn on an annual basis, the region, doesn't appear to be water stressed, however this picture masks, the uneven distribution of the resources and the inadequate investment in hydraulic infrastructure. The shared nature of the water resources amplifies inequality and promotes tension within the region. This is compounded by fragility and demographic shifts where rural to urban migration is increasing at an accelerating rate, especially in Somalia and South Sudan, as people flee from conflict and seek better economic opportunities.

[5] Mapping, Assessment & Management of Transboundary Water Resources in the IGAD Sub-Region Project: Volume II – Socio Economic Component

[6] IGAD Regional Strategy; Volume 1 The Framework (2016)

[7] Data Source: CIA Fact Book 2020

Compounding the "bad hydrology" problem, most of the GHOA countries face a rapid growth in water demand, have limited endowments of water infrastructure, have fragile institutions, and confront ever greater variability as the world climate changes. Faced with water-security challenges, there is need for all countries, to develop suites of institutions and technologies that are adapted to their cultural, historic, natural, and financial realities and which can bring their people improved and more harmonious development. The development of transport corridors to seaports (as promoted by the IGAD infrastructure Masaterplan), the management of shared water resources, improved connectivity, and enhanced energy security are all potential drivers of economic integration and achievement of wider water security.

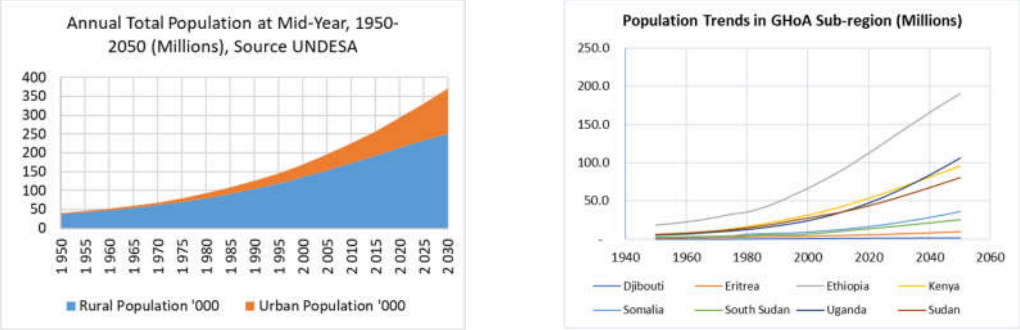
1.2 The Region's Water Challenges

A summary of Water Sector Challenges in the Greater Horn of Africa is presented in Appendix 1.

1.2.1 Population Growth and Urbanisation

One of the demographic processes that create the greatest pressures on water resources is population growth. The others are urbanization and migration**.** The subregion is home to a rapidly growing population of over 289 million people in 2020. The population is growing at about 2.7% per year and is projected to increase to 339.6 million in 2030 (Figure 2).

Figure 2: Population Trends in GHoA Subregion (Source: UN – Population Division; UNFPA; 2050 projections are from UNFPA State of World Population 2019)



High fertility rates against declining mortality rates are the main driving forces behind the high population growth. Population growth impacts water security at two levels (i) at the level of domestic water supply – where pressure will be exerted to provide more water from existing and new water sources; and (ii) at the level of agricultural withdrawals, primarily for irrigation but also for livestock .

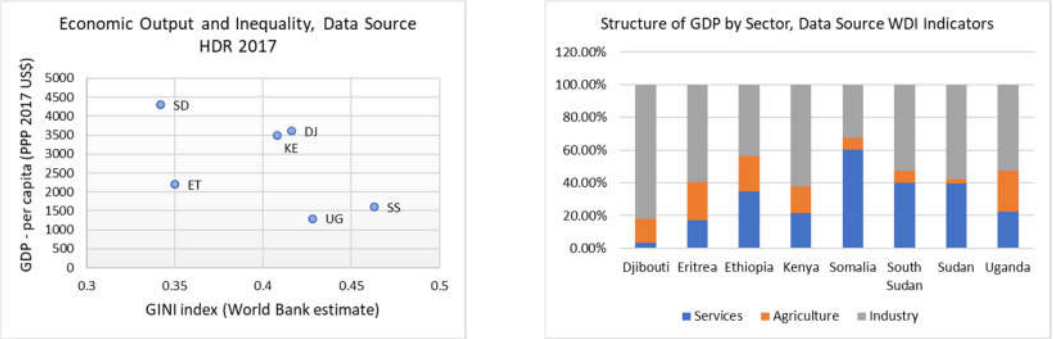
The indirect impacts of population growth include increased pressures on the already fragile environments, resulting in progressive land degradation, greater exploitation of marginal lands, declining soil fertility and reduced crop yields; forest degradation leading to declining fuel-wood supplies, increasing use of crop residues for fuel – hence competition with livestock; and frequent droughts leading to frequent famines. Poverty prevalence; fragility; industrialization, growth of the services sector, and rising levels of education also contribute towards urbanisation. An estimated 132 million people will be added to the current urban population or about 4 million new additions annually (by 35 million between 2020 and 2030 and by 97 million between 2030 and 2050).

1.2.2 Widespread Inequality

Growth in income per capita is correlated with many development indicators such as access to water and sanitation, education, technological advancement and increased consumption, amongst others.

Economic growth demands an increased harnessing of water resources because as households become richer, they demand and use more water resources. This is shown by the concentration of industrial establishments in urban centres where developed water resources are found. Economic growth affects water use through growth in the consumer base and through changes in their water use habits, in the way goods and services are produced and in the location of activities, all of which affect regional and international trade. A summary of the key socioeconomic indicators is presented in figure 3.

Figure 3: Summary of the key socioeconomic indicators of GHoA nations

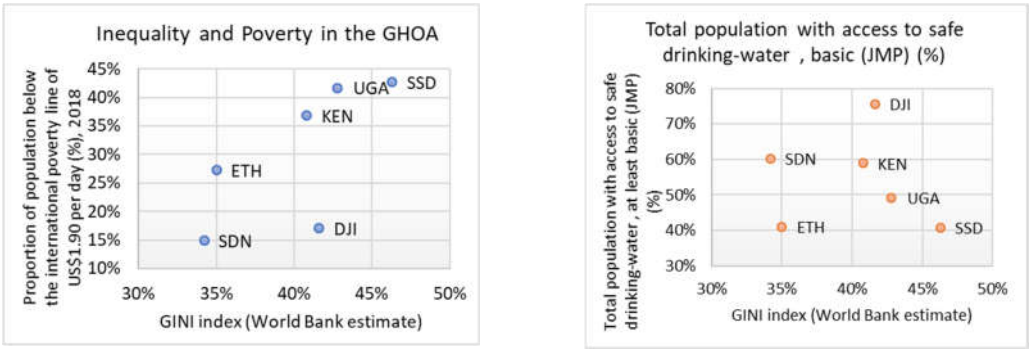


The Sub-region's total GDP was estimated at US$ 684.38 billion (PPP valuation – US$2017)[8] in 2017 with an average annual growth of 6.07%. Although the region's economies show some relatively impressive growth rates, most of the population remain poor, due to widespread inequality. Sudan and Ethiopia ranks highest with adequate equality (GINI coefficients 0.34 and 35 respectively). The rest of the GHOA countries have big income gaps with GINI coefficients ranking between 0.4 and 0.5.

The services sector contributes an estimated 52% of the GDP making it the fastest growing sector in the Sub-Region. Although the share of the agriculture sector in GDP has been declining over a period, the proportion of the active population engaged in agriculture remains high at more than 70%, with the highest contribution to livelihoods. Because the agricultural sector has either stagnated or been declining over a long-term period, poverty is more rooted in the rural rather than in the urban areas.

Poverty remains widespread in the GHOA countries. The proportion of people living on less than US$1.9 a day has only declined marginally (figure 4) and the absolute number of poor people is increasing.

Figure 4: Poverty, Inequality and Access to Basic Water Supply in the GHOA



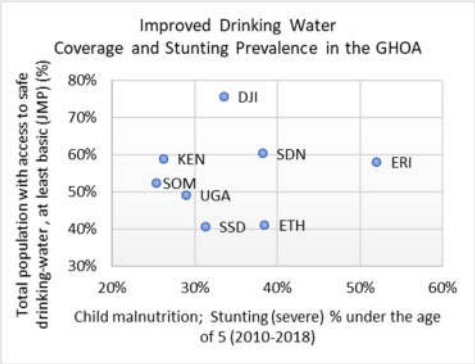
The average population growth rate of 2.7% compounds efforts to reduce poverty rates. The GHOA is a region where access to clean water, food and health care) are not available to much of the

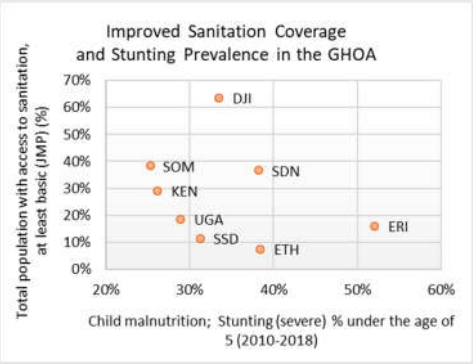
[8] The World Factbook 2020. Washington, DC: Central Intelligence Agency, 2020. https://www.cia.gov/library/publications/resources/the-world-factbook/index.html

population, and where some countries have mortality rates that are among the highest in the continent.

Poverty, deprivation and inequality also result in chronic undernutrition. Inadequate nutrient intake and diseases are immediate determinants. Chronic exposure to environmental pathogens is a key link between inadequate water, sanitation, and hygiene and child undernutrition. From figure 5 Eritrea, Ethiopia, and South Sudan stand out as countries with both low levels of sanitation and high levels of stunting. The rest of the countries have modest improved sanitation rates, as well as levels of stunting

Figure 5: Relationship between Improved access to Drinking Water and Stunting Prevalence





Countries with the lowest levels of coverage of improved drinking include water and highest levels of stunting include, Eritrea, Ethiopia, South Sudan and Sudan. Although childhood stunting rate in SSA is 32%, on average, the stunting rate in Eritrea is more than 50% or more. This suggests that other factors could be more important for driving improvements in childhood nutrition outcomes.

Safe drinking water systems and adequate sanitation that effectively disposes of human waste will thus be essential to ensure cities and towns grow sustainably. Extending these services to the millions of urbanites currently unserved will play a key role in underpinning the health and security of cities, protecting economies and ecosystems and minimising the risk of pandemics. Failure to do so will result in water and sanitation related diseases arising from urban water pollution.

1.2.3 Gender inequality

Gender mainstreaming is a strategy for making women's as well as men's concerns and experiences an integral dimension of the design, implementation, monitoring and evaluation of policies and programs so that women and men can benefit equally, and inequality is not perpetuated[9]. Throughout the GHOA—women labor to provide water for household needs while men make decisions about water resources management and development at both local and national levels. Without specific attention to gender issues and initiatives, projects can reinforce inequalities between women and men and even increase gender disparities. Projects, programs and policies that address gender inequalities have the potential to enhance both water resources management and human development opportunities for both men and women. A deliberate strategy of gender mainstreaming can be useful to ensure that the issues that affect women and men are part water sector programming, implementation, and evaluation. More importantly, gender mainstreaming can assist in bringing about the institutional and organizational change necessary to ensure gender equality as an on-going commitment.

[9] Mainstreaming Gender in Water Management. Available online at https://www.undp.org/content/dam/aplaws/publication/en/publications/environment-energy/www-ee-library/water-governance/resource-guide-mainstreaming-gender-in-water-management/IWRMGenderResourceGuide-English-200610.pdf. Accessed 21 May 2020.

1.2.4 Inadequate Sector Policy legal and regulatory Frameworks

In all GHOA countries, bar Somalia, Eritrea, policies exist either drafted, completed and/or awaiting implementation. Much of this activity stems from the post-1992 era, reflecting global policy change and the widespread adoption of IWRM principles. Several initiatives have been undertaken to inform policy processes, notably inclusion of the management of shared waters, mainly supported by GIZ. These have resulted into non-binding instruments of good practice like the IGAD regional water policy. An indicative table of key issues and water sector policy status across the GHOA states is shown in the table 6.

Figure 6: Indicative table of key issues and policy status across the nine riparian countries

Key Issues	Djibouti	Eritrea	Ethiopia	Kenya	Somalia	S-Sudan	Sudan	Uganda
Policies								
No Policy Document		√			√		√	
Policy implemented	√		√	√				√
Inadequate water services regulatory framework	√	√	√	√	√	√	√	√
Inadequate regulatory framework for Private Sector Participation and Finance	√		√		√	√		√
Need for effective and consistent legislation		√	√	√	√	√	√	
Reference to Transboundary Water Management	√		√	√		√	√	√
Institutions						√	√	
Overlapping & conflicting responsibilities		√	√					
Poor inter-sectoral collaboration and control	√	√	√	√	√	√	√	√
Need for greater decentralisation of WRM		√	√		√	√	√	
Need for capacity strengthening	√	√	√	√	√	√	√	√
Low public awareness / stakeholder involvement	√	√	√	√	√	√	√	√
Monitoring and evaluation lacking	√	√		√		√	√	
Weak management / enforcement capacity	√	√	√	√	√	√	√	√
Low integration of private sector / civil society	√	√	√	√	√	√	√	√
High costs / need for process financing for utilities	√	√	√	√	√	√	√	√

The content of existing water sector policy varies between countries, reflecting both the different stages of policy development and varying social, economic and geographic contexts. Reflecting broader global shifts in policy reform processes, most the GHOA countries have water sector policies and institutions in place. In countries like Somalia, Eritrea and South Sudan, however, there is need to augment the range and type of institutions involved in developing and implementing policy. Issues requiring greater reflection in policy include analysis of equitable and reasonable water utilization, rainwater harvesting, pastoralism, the private sector participation and finance, cost recovery and water pricing. Opportunities do exist for private sector participation and finance, as demonstrated in Kenya, however for the rest of the countries, enabling legal and policy framework for private participation would enhance investment.

There is notable imbalance in the water sector policies, with limited reflection or guidance on sanitation. Most do not present meaningful linkages between water and sewerage services. This results in non-coherence in issuance of water and wastewater permits, laxities in the institution and enforcement of laws for pollution control and environmental protection. Last but not the least, absence of cooperative agreements on the major shared water systems, which include the Omo river, the Nile River and the Jubba Shebelle systems, hampers the cooperative management and development of the shared waters. political 'distractions' exist which hinder management of the policy environment.

Analysis of the national CWSPs revealed a high frequency of overlapping and conflicting roles and responsibilities between institutions, linked to which is poor inter-sectoral collaboration and control. Several countries have decentralised water management. However clearer definition of institutional roles within policy is an important issue flagged and linked to a recognised need for greater capacity in achieving accountability, monitoring performance and enforcing sanctions against institutional underperformers. Linked to issues of local capacity is the requirement for greater stakeholder involvement and awareness raising at lower levels. This often reflects a lack of public information accompanying policy reform processes, although in only a few instances did the reports make explicit mention of sharing responsibilities with civil society as part of policy development and implementation

Inadequate regulatory frameworks for water pricing and cost recovery continue to constrain performance of water and sewerage systems. As noted in the Kenya WASREB regulators 2018/2019 report, maintaining revenue remains a day-to-day challenge for many utility managers. Data from the International Benchmarking Network for Water and Sanitation Utilities (IBNET) also shows that only 64% of the 4,500 utilities in the database cover more than their O&M costs from user fees.

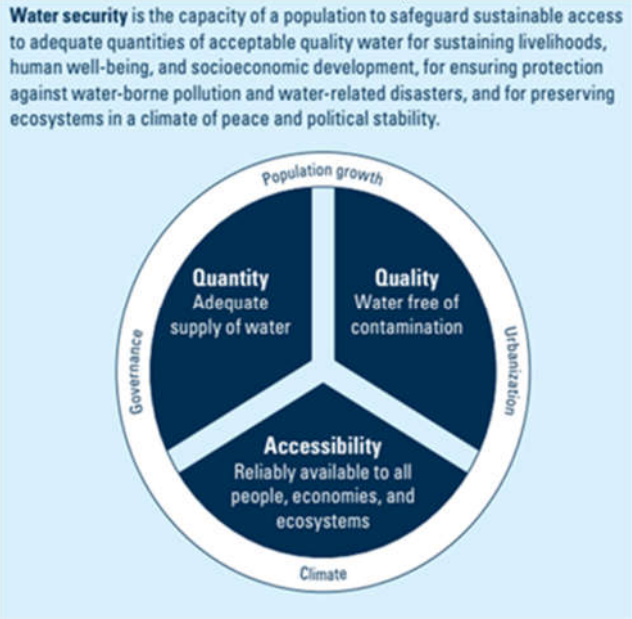
Most country reports note, the absence of an effective approach to private sector involvement in water sector policy implementation. There is recognition that greater private sector participation might require greater incentives, including possibly guidance and training to private sector organisations that are significant in local-level implementation.

1.3 Elements of Water Security

The demand for water is projected to increase. At the same time water is becoming increasingly scarce as a result of climate change, urbanization, population growth, poor management of water resources and pandemics like COVID-19.

Water insecurity could therefore drastically affect the way water is used in the future to sustain livelihoods, provide basic services for human well-being, and support economic activities and development. The World Bank indeed projects that parts of Africa could lose as much as 6 % of the GDP by 2050 as a result of losses in agriculture, health, incomes, and property (World Bank 2016). The subsequent analytics therefore follows three dimensions of water security through which the risks and impacts will be felt most strongly in the future: water quantity (adequate supply of water resources); water quality (water resources free of contamination); and water accessibility (reliable availability to all people, economies, and ecosystems), Figure 7.

Figure 7: Water Security Analytical Framework (Source UN-Water 2013)



2 State of Water Security in the Horn of Africa

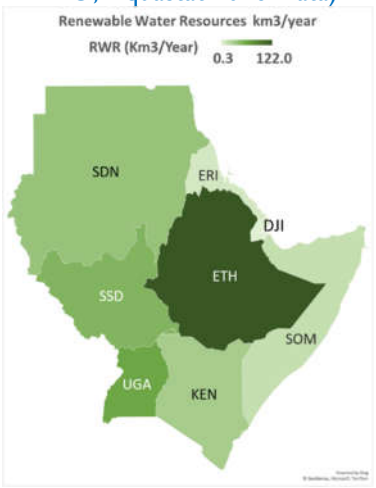
2.1 Managing Water Resources

2.1.1 Water Resources Availability

A great part of the region is composed of arid and semi-arid lands (ASALs), in which around 30% of the total population is found. Water distribution in the Greater Horn of Africa is varied and spatial with precipitation ranging from 220mm/year in Djibouti to 1180mm/year in Uganda (Figure 8). Adding to this average low water availability, the region has been affected by longer dry periods since the second half of the 20th century until now, suffering several episodes of catastrophic and intense drought, and is now affected by increasing inter-annual variation in the length of the rainy season.

The Sub-Region has total renewable resources (RWR) estimated at 322.4 km3/year[10].Rainfall is concentrated in the Ethiopian highlands, in South-Sudan and Uganda. While the region's freshwater resources account for only 4.7% of Africa's total, it is home to 19% of the continent's population. Thus, rising population contributes to the reduction of the available RWR, with reduction on water that is available for the population, economies, and ecosystems. Groundwater is the largest source having the greatest potential for providing water security and socio-economic benefits. Adding to this average low water availability, the region has been affected by longer dry periods since the second half of the 20th century until now, suffering several episodes of catastrophic and intense drought, and is now affected by increasing inter-annual variation in the length of the rainy season.

Figure 8: Total renewable water resources in the GHOA (Based on FAO, Aquastat 2016 Data)



2.1.2 Ground water availability

Groundwater is the largest water resource in the ASAL of the HoA, if not the only one available, having the greatest potential for providing water security and socio-economic benefits. Groundwater is essential in the Horn of Africa region and its development through boreholes and water harvesting has been instrumental in reducing conflicts for water access and transboundary resource sharing. Important examples are found among the pastoralists and agro-pastoralist cross-border communities. Groundwater is harnessed by the rural and urban population through dug wells, bore holes and springs to meet water needs. In countries like South Sudan or Somalia, entrepreneurs have built berkads, drilled private boreholes and provided services throughout the main cities. However, the drilling is done without proper coordination and community consultation, posing risks of environmental damage to critical pasture areas and over-depletion of fragile aquifers. Notwithstanding these benefits, there are significant risks of over-exploiting this strategic resource. Uncontrolled groundwater development may threaten water security. Although several studies seem to agree that the existing regional groundwater potential is not fully utilized in the IGAD region, questions remain about how to quantify the potential and how to mobilize the groundwater resource in a sustainable way. There are major deficiencies in our knowledge and understanding of groundwater in the Horn of Africa (World Bank 2018)[11].

[10] FAO, 2016. AQUASTAT Main Database - Food and Agriculture Organization of the United Nations (FAO).
[11] Wondem, Tesfaye Bekalu.2018. Project Information Document (PID) - Horn of Africa - Groundwater Initiative - P169078 (English). Washington, D.C.: World Bank Group. http://documents.worldbank.org/curated/en/259271539954342284/Project-Information-Document-PID-Horn-of-Africa-Groundwater-Initiative-P169078

Moreover, the transboundary nature of a large share of groundwater resources makes their assessment and management complex. The question arises how much groundwater should be set aside to ensure water security for populations and livestock, especially during periods of reduced surface water availability, and which share of the available groundwater resource can safely be mobilized for economic development without threatening priority uses like water supply for citizens and livestock during periods of lowest availability. A number of efforts are being made at quantifying the ground water in the HoA.

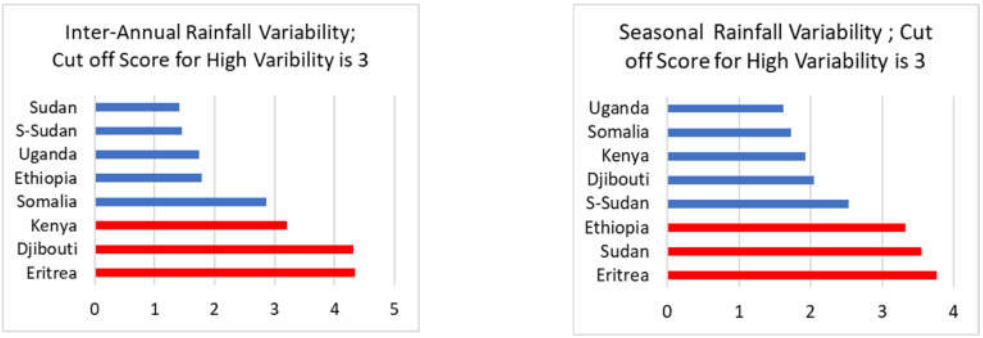
Over the last 5 years, the Bank has supported a Groundwater Assessment, Aquifer Mapping and Well Development Project , as part of the preparatory activities that will lead to effective implementation of the investment operation (RWSISPRC) in Eritrea. Under the Horn of Africa - Groundwater Initiative, the World Bank is currently supporting studies to undertake a comprehensive assessment of the ground and surface water potential in the IGAD member countries, strengthen the regional ground water information data availability and support IGAD member countries to Strengthen and manage the sustainable development of their groundwater potential(World Bank 2018).

Besides the need to better quantify and map the usable groundwater resource, it is necessary to improve governance arrangements to reduce the risk of pollution and over-abstraction. Governance arrangements need to be strengthened and supported by adequate water resources management (i.e. including planning) at the national and basin level before the resource is over allocated (Ibid).

2.1.3 Water Resources Variability

The GHOA is characterized by highly variable water resources (Figure 9), with relatively low per capita supply on average. According to indices, by the World Resources Institute (WRI), the highest variability is found in the ASALs of Eritrea, Ethiopia, Kenya and Djibouti, where average rainfall is so low that even modest rainfall represents a huge variation on the mean. Countries with this level of aridity would need to build storage infrastructure (dams) when rainfall does occur and or encourage aquifer recharge.

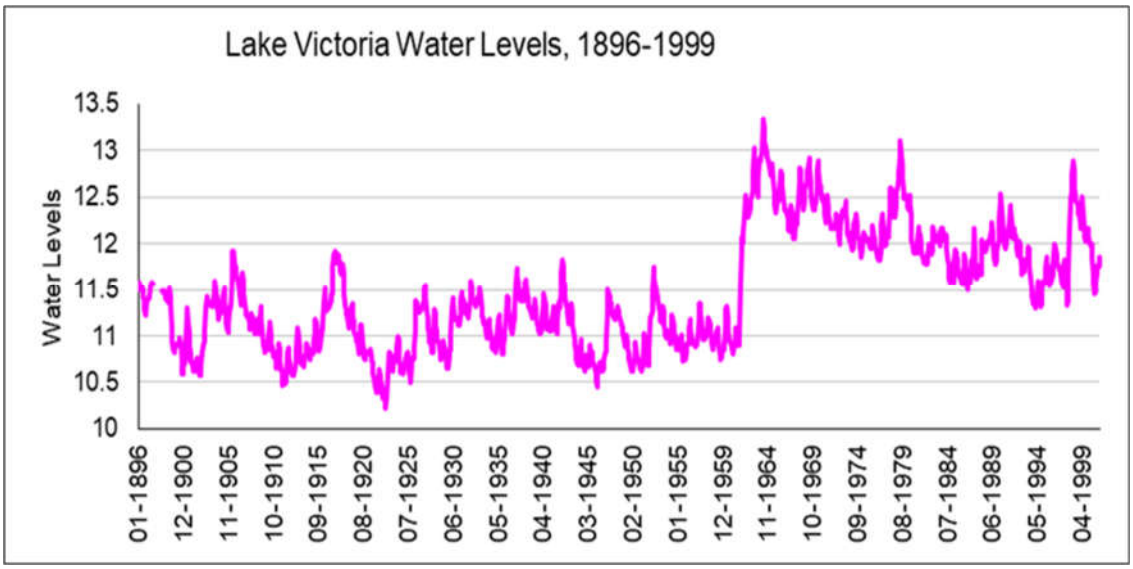
Figure 9: Inter-annual and Seasonal Rainfall Variability



In the Equatorial Lakes Region, the Lake Victoria levels are sensitive to precipitation rising during periods of heavy rain and declining during times of suppressed precipitation. Figure 10 shows the historical fluctuations in lake levels. Lake Victoria is the largest lake in the Nile basin, by Kenya, Uganda and the United Republic of Tanzania; although Burundi and Rwanda are also part of its catchment area which covers 184 000 km2 (ILEC 1999)[12]. The annual average rainfall on the lake is 1500 mm, which represents about 85% of the water entering the lake; the balance comes from the rivers that drain the catchment. The annual evapo-transpiration (ET) rate from the lake is about 1260 mm (Fahmy 2006).

[12] NELSAP / NBI, December 2012. Nile Equatorial Lakes Multi Sector Investment Opportunity Analysis (NEL MSIOA). Final Situational Analysis Report. Report prepared by BRL Ingénierie. 111 pages.

Figure 10: Lake Victoria Inter-annual Variability



Although Lake Victoria loses a significantly higher volume of ET (104.6 BCM) than any of the other lakes in the basin, it only accounts for 3.8% of its total volume[13]. Because water is a key input in agriculture, energy, and industry, water shortages and variability can lead to food insecurity, raise production costs[14], and constrain productivity growth. The Falkenmark indicator is one of the most widespread used indicators for assessing the stress on water and has been used to assess the status of water availability in the GHOA.

The indicator relates the total freshwater resources with the total population in a country and indicates the pressure that population puts on water resources, including the needs for natural ecosystems. Falkenmark developed this indicator on the grounds of a minimum need of 100 l/day/cap for household use and from 5 to 20 times as much as for agricultural and industrial uses (Hinrichsen D Robey B Upadhyay UD . 1998[15]). The threshold for this indicator is that water stress begins at less than 1 700 m3 /cap/year (Cosgrove et al., 2000[16]). When the indicator drops below 1 000 m3 /cap/yr, the country can face water scarcity.

From Figure 11, all the 7 GHOA countries save for South Sudan, have less than 1700 m3 /cap/year according to the 2017 data (FAO, 2019), while 4 of the countries (Djibouti, Kenya, Sudan and Somalia) are experiencing water scarcity. Considering the Water Exploitation Index (WEI), most of the GHoA are not classified as "water stressed," since per capita withdrawals remain lower than per capita supplies (Figure 11)[17]. Sudan and Somalia exceed the warning threshold of 20% for water stress [18].

[13] UNEP. (2013). "Adaptation to Climate-change Induced Water Stress in the Nile Basin: A Vulnerability Assessment Report". Division of Early Warning and Assessment (DEWA). United Nations Environment Programme (UNEP). Nairobi, Kenya

[14] As examples at the business level, power plants have cut generation or scrapped plans for expansion in the face of water shortages, and companies have incurred additional costs to build their own desalination or treatment capacity to ensure sufficient water supply.

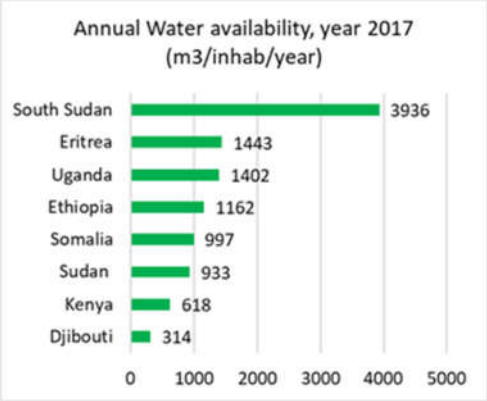
[15] Hinrichsen D Robey B Upadhyay UD . 1998. Solutions for a Water-short World. Baltimore: Johns Hopkins School of Public Health, Population Information Program. Population Reports, series M, no. 14.

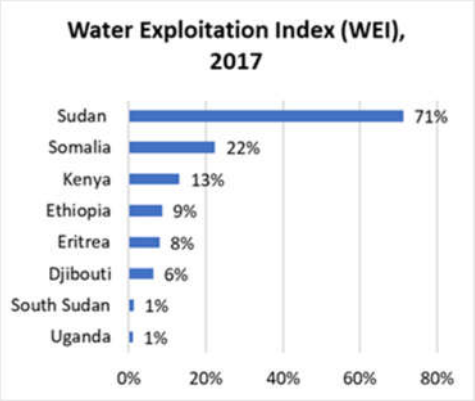
[16] WILLIAM J. COSGROVE & FRANK R. RIJSBERMAN, World Water Council, Paris, France (2000); Challenge for the 21st Century: Making Water Everybody's Business

[17] Conducted at national scale, a country is considered 'water stressed' if annual withdrawals are between 20% and 40% of annual freshwater supply and 'severely stressed' if this figure exceeds 40% (Raskin et al. 1996; Alcamo et al. 2003; Rijsberman 2006).

[18] According to the literature, the warning threshold can be 20 %, which distinguishes a non-stressed region from a stressed region (Raskin et al., 1997, Lane et al., 2000). Severe water stress can occur where the WEI exceeds 40 %, indicating strong competition for water but which does not necessarily trigger frequent water crises.

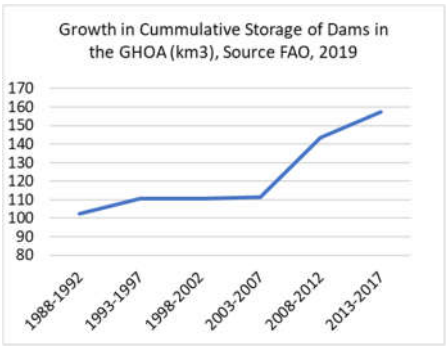
Figure 11: Annual Water Availability and Exploitation

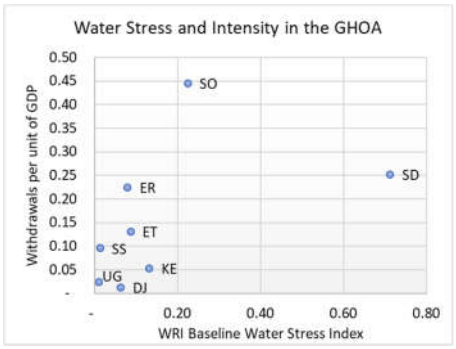




However rising water stress due to an average population growth rate of around 2.5%, urbanisation, large supply variability, weak governance structures, less developed policy and institutional capacity[19]., low investment in storage infrastructure (Figure 12) and pollution are already affecting the already declining per capita supplies, making water scarcity evident in the future.

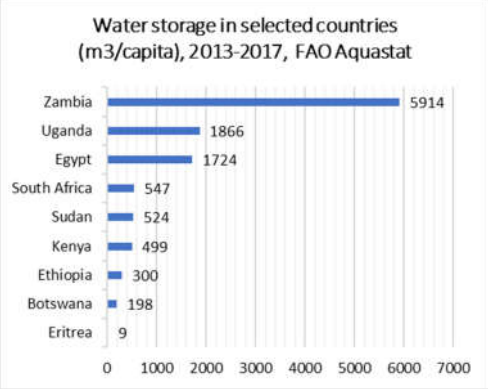
Figure 12: Water stress and Intensity of Use

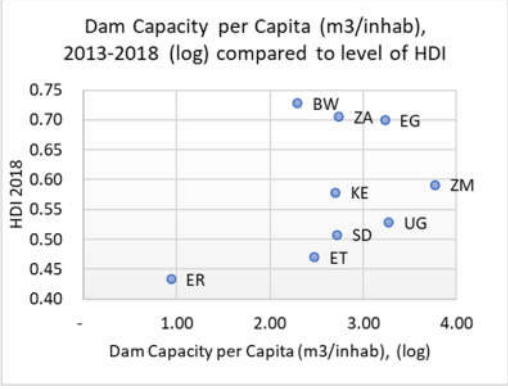




Absence of adequate storage capacity means more vulnerability to impacts of climate shocks. Most of the GHOA countries have limited storage and this is also reflected in the low Human Development Indices (HDIs), which range between 0.40 and 0.60, when compared to countries like South Africa and Egypt (Figure 13).

Figure 13: Human Development Index (HDI) and per capita water storage





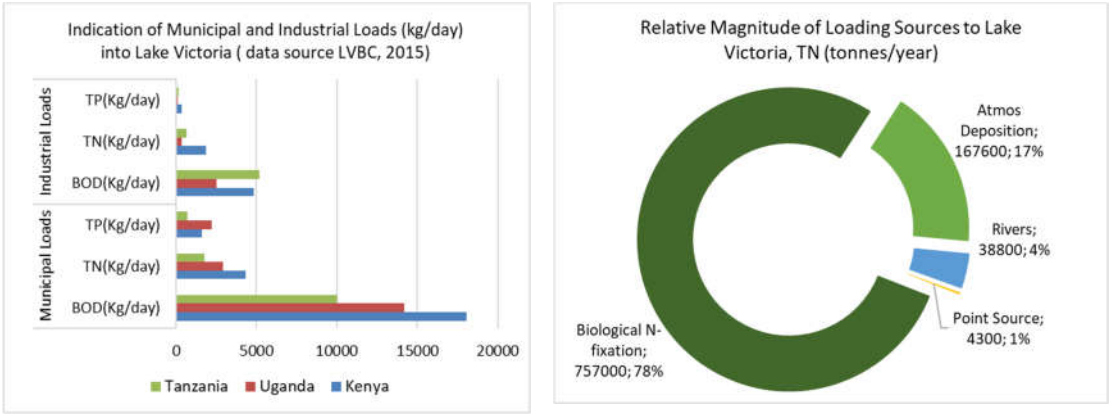
[19] Adapted from IMF, 2015 Is the Glass Half Empty or Half Full? Issues in Managing Water Challenges and Policy Instruments1

According to a UN report on Dams and Reservoirs under Changing Challenges (2009), water storage in countries with a high HDI (>0.85) tends to be in the range of 2,500 and 3,000 m3/capita. Countries with HDI of 0.55 tend to have has a storage of about 173 m3 per capita[20] Significant economic returns could accrue from improved water storage and this calls for improved storage as a means of hedging risks from more variable rainfall and strengthening resilience to climate.

2.1.4 Water Quality and freshwater ecosystems

The declining quality of water resources contributes towards water insecurity. Poor water quality makes water unfit for use, has multiple health and environmental consequences, and further reduces water availability. According to the NBI State of the Basin Report (2012)[21], pollution mainly occurs in large urban areas, from improper disposal of untreated treated domestic and industrial wastes. The Lake Victoria Environmental Management project (2005) carried out an assessment to determine pollutant loads from industrial and municipal effluents and urban run-off into Lake Victoria. Drawing from the assessment, an impression of the total pollution loads into the lake measured by Biochemical Oxygen Demand (BOD5), Total-Nitrogen (TN), and Total-Phosphorus (TP) was determined and is shown in Figure 14. While industry, in the macro view, is not necessarily the worst polluter in terms of concentrations and loads, its effects was considered significant at local scales (World Bank, 2010). Industrial contamination tends to be more concentrated, more toxic and harder to treat than other pollutants (especially effluent from tanneries, paint mixing, drug and battery manufacture).

Figure 14: Relative Magnitude of Loading Sources to Lake Victoria



Ethiopia is also notable for the number of tanneries in operation, without adequate effluent discharge treatment[22]. Oil spills and industrial effluents discharges in South Sudan are another case in point. The persistence of these contaminants with respect to their degradation and rate of movement though the environment and hydrological cycle is lengthy[23] Salinity levels exceeding allowable limits have also been observed in Jonglei and Unity states making ground water unsafe in some areas. Rising temperatures and extreme hydrological variability could exacerbate the environmental fate of contaminants.

In Eritrea, the coastal water sources are highly mineralized with salinity reported to range from 2000–20,000 µs/cm.[24]. Fluoride concentrations of 7-17 mg/l are common, causing dental fluorosis[25].Saltwater intrusion and its impact on the natural environment created by high evapo-transpiration and irrigation

[20] Dams and Reservoirs under Changing Challenges. Editors Anton J Schleiss and Robert M Boes
[21] NBI (2012). State of the River Nile Basin 2012. Nile Basin Initiative Secretariat, Entebbe, Uganda.
[22] Ademe Alemayehu M (2014) Source and Determinants of Water Pollution in Ethiopia: Distributed Lag Modelling Approach. Intel Prop Rights 2: 110. doi:10.4172/2375-4516.1000110
[23] WWAP. 2012. The United Nations World Water Development Report 4: Managing Water under Uncertainty and Risk. Paris, UNESCO
[24] Action Plan for Integrated Water Resource Management (IWRM) in Eritrea.
[25] Zerai, H., et al (1996). Groundwater and Geothermal Resources of Eritrea with the Emphasis on their Chemical Quality. Journal of African Earth Sciences. Vol. 22, Issue 4, May 1996. PP. 415-421. https://www.sciencedirect.com/science/article/abs/pii/0899536296000280. Accessed 11 May 2020.

practices is pronounced in the Red Sea catchments[26]. This is also mirrored in other countries with coastal regions like Kenya, Somalia, Sudan and Djibouti.

Solid waste management also remains a constraint and uncollected garbage accumulates in the streets and drains into the water courses via stormwater runoff. In rural areas, where a considerable portion of the population has no access to improved sanitation facilities, diffuse pollution from domestic solid and liquid wastes commonly occurs. Overall, most of the large urban areas in the region have dated conventional municipal wastewater treatment systems, whose capacity has not grown in tandem with population growth. The systems are therefore inadequate for handling wastewater, which ends up contaminating the environment with organic matter, nutrients, suspended solids, and pathogens.

Accelerated erosion from deforestation and agricultural conversion of natural areas has also led to increased sediment loads being carried into water systems. The cost of watershed degradation is enormous and affects the sustainability of water infrastructure as shown in Box 1 (World Bank 2015).

Box 1: Cost of watershed degradation and implications on water infrastructure[27]
The annual economic cost of watershed degradation originating in the Ethiopian highlands has been estimated at US$670 million. This is expected to reach around US$4.5 billion over the next 25 years if affected countries continue 'business as usual'. Studies show that between 157 and 207 million tons of sediment are transported annually by the Blue Nile. Sedimentation impacts Sudan and Egypt through a reduction in hydropower performance and an increase in hydropower infrastructure maintenance costs. In addition, there are significant investment costs related to clogged irrigation canals. For example, sedimentation removal costs the Roseires Reservoir in Sudan US$7.5 million annually. It has been estimated that a significant reduction of sedimentation load in Ethiopia would result in Sudan gaining an additional US$88 million worth of hydroelectric power

Another example is the Mau forest, Kenya's largest "water tower", where profound forest degradation decreases the buffering (water storing) capacity of the land, weakening the capacity of the land to endure long drought periods. The encroachment has led to drastic and considerable land fragmentation, deforestation of the headwater catchments and destruction of wetlands previously existing within the fertile upstream parts. Today, the effects of the anthropogenic activities are slowly taking toll as is evident from the diminishing river discharges during periods of low flows, and deterioration of river water qualities through pollution from point and non-point sources.[28]

Biodiversity within the Horn of Africa's inland freshwaters is both highly diverse and of great importance to livelihoods and economies and its conservation is of great importance to strengthened water security. However, degradation of mangrove forests and coastal vegetation in Somalia has taken away the natural buffers that protect coastal communities from the impacts of storms and waves, such as the tsunami in 2003. Habitat loss and fragmentation due to agricultural expansion as well as pollution from domestic and industrial effluents and chemical spills due to industrial waste threaten the aquatic biodiversity ecosystems. As a result, reduction in fish populations, habitat destruction, and loss of biodiversity are already being experienced. Aquatic macrophytes notably of the water hyacinth also have implications on hydropower and ecosystems. Development planning policy must include adequate consideration for the conservation of aquatic life to ensure development moves forward in an environmentally sustainable way, with minimal impact to wetland ecosystems wherever possible. More structurally, the mangroves in Somalia, that also perform various ecological services including water

[26] Alemngus, A., et al (2017). An Overview of Eritrea's Water Resources. International Journal of Engineering Research and Development. Vol. 13, Issue 3 (March 2017), PP.74-84. http://www.ijerd.com/paper/vol13-issue3/Version-1/I13317484.pdf. Accessed 11 May 2020.

27 "World Bank Group. 2015. Restoring the Nile Basin. The Nile story briefing note, no. 8; World Bank, Entebbe. © World Bank. https://openknowledge.worldbank.org/handle/10986/23583 License: CC BY 3.0 IGO."

[28] Luke Omondi Olang and Peter Musula Kundu (2011) Land Degradation of the Mau Forest Complex in Eastern Africa: A Review for Management and Restoration Planning

supply, fish habitats and biodiversity preservation, play a vital role in reducing shoreline erosion. A combination of catchment and site scale actions as well as enacting water and environmental laws and accompanying regulations such as those for wastewater discharge and environmental impact assessment would comprise key regulatory instruments for governing water allocation, environmental assessment and pollution control.

2.1.5 Transboundary Water Management

Water scarcity stands at the forefront when considering the water-related challenges that impede progress towards sustainable development in the Greater Horn of Africa region. Transboundary water management and cooperation within and across states on the development and protection of transboundary water resources is therefore essential in the context of water security. In 2011, the Bank conducted Mapping, Assessment and Management of Trans-boundary Water Resources in the IGAD Sub-Region in 2011 with IGAD and "Observatoire du Sahara et du Sahel". From the report, transboundary basins cover about 75% of the land area of the GHOA (Appendix 2: Transboundary Water Basins in the GHOA). Some of the basins are subdivided into several distinct sub-basins that are separately managed (as in the Nile Basin) while others are managed as single entities. A profile of these basins is presented in the Table 1. Large aquifers are also transboundary, including the Nubian sandstone (South Sudan, Sudan, Egypt etc). The Nile Basin extends over 11 countries, and the Nubian Sandstone Aquifer is shared by 4 countries; both are of high relevance for states in the GHOA region.

Table 1:The major transboundary basins of the IGAD Region[29]

River/Lake Basin	Catchment area (km^2)	Population (million)	Riparian Countries[a]
Nile River	3,176,543	238	Burundi, DR Congo, Egypt, Ethiopia, Eritrea, Kenya, Rwanda, S-Sudan, Sudan, Tanzania, Uganda
Lake Victoria (a Nile River sub-basin)	184,000	25	Burundi, Kenya, Rwanda, Tanzania, Uganda
Barka (Baraka) (Rift Valley basin)	66,177	2.03	Eritrea, Sudan
Gash (Mareb) (Rift Valley basin)	39,892	3.688	Eritrea, Ethiopia, Sudan
Lake Turkana – Omo River (Rift Valley basin)	206,216	18	Ethiopia, Kenya, South Sudan, Uganda
Lotagipi Swamp (Rift Valley basin)	38,687	0.329	Ethiopia, Kenya, South Sudan, Uganda
Lake Natron (Rift Valley basin)	55,189	1.513	Kenya, Tanzania
Lake Chala, Lake Jipe, Umba River	8,200[b]	0.435[b]	Kenya, Tanzania
Juba-Shabelle River	805,100	18.361	Ethiopia, Kenya, Somali
Ogaden	207,363	3.05	Ethiopia, Somali

[a] IGAD Member countries are presented in blue font.

[b] Combined statistic for all three basins.

[29] Azza N. and Olet E. 2015. Towards improved cooperation and coordination between NBI, IGAD and EAC on management of transboundary water and environmental resources: A Background Paper. x+127 pp.

Despite a long history of shared water management in the region, there has been little attention paid to cooperative management of transboundary waters. Most of the basins Lack policy, legal and institutional frameworks for cooperation among co-riparian countries in the management and development of the shared water resources. Other constraints include weak state institutions and capacity, and the effects of a long history of distrust among countries for governance for national and transboundary surface water and groundwater resources. These constraints limit the options for sustainable governance of water resources and for anticipating and pre-empting other water security risks. Acceptance of shared interests at a regional level is impeded by national agendas and ambitions. Interstate collaboration in transboundary water governance is essential for regional prosperity.

The Nile, the Omo and the Juba–Shabelle basins are of core relevance for the GHOA because of the interaction and confluence of several political, social, economic and environmental processes. The Nile River—with its two major tributaries, the Blue Nile and the White Nile—is a main source of water, energy and food. The expected variability in water availability requires cross-country collaboration. However, it also causes regional tensions. The political tensions between Egypt and Ethiopia around the Grand Ethiopian Renaissance Dam (GERD) exemplify the security risks of resource sharing against a backdrop of changing climatic, geopolitical and economic conditions. Absence of cooperative agreements has also brought several tensions between countries in the region. Nile. Boxes 2 and 3, illustrate the strains on cooperative water management and development on the Nile river.

Box 2: The Nile Cooperative Framework Agreement

In 2010, some of the Nile riparians agreed to close the negotiation period on a new legal agreement for Nile water use, the Cooperative Framework Agreement (CFA), and to move ahead with signing of the document. That year, two countries, Egypt and Sudan, froze their participation in the NBI, as they opposed certain provisions of the CFA and sought legal and institutional clarification of the implications of the signing of the CFA on the NBI. The major contention dwells on (i) whether to include protection of historical rights or current uses (favoured by Egypt and Sudan) and (ii) the way CFA would be amended: "consensus" vs. "simple majority rule". Once ratified by six countries, the CFA would lead to the establishment of a Nile River Basin Commission, with membership of those who had ratified the treaty. To date, six countries have signed the CFA and three (Tanzania, Rwanda and Ethiopia) have ratified the agreement. Sudan has since resumed participation in the NBI. With the differences in position on the CFA, there are many questions remaining about the institutional future of transboundary cooperation in the basin. In addition, disagreements over national-level water developments and issues outside water are creating tensions between several riparians.

The tensions among Egypt, Ethiopia and Sudan around the building of the Grand Ethiopian Renaissance Dam (GERD) have become part of the larger geopolitical playing field in the Horn of Africa.

Box 3: Infrastructure Development and water security- The Grand Ethiopian Renaissance Dam

The Eastern Nile Basin shared between Ethiopia, Sudan and Egypt is of geopolitical importance to the Nile's overall hydro-political regime. In the absence of an agreed cooperative framework agreement on the Nile, Ethiopia and Sudan are engaged in unilateral development of water infrastructure projects - as Egypt has done in the past and continues to do. Ethiopia's construction of the Grand Ethiopian Renaissance Dam (GERD), for hydropower has been the flashpoint of conflicts in the Eastern Nile Basin (Gebreluel, 2014[30]). The unilateral developments appear to be elements of a hydro-political strategy where the riparian countries aim to increase their water utilization (and underpin legal claims based on those uses) and increase their bargaining position for renegotiations of volumetric water allocations. However, this threatens the basin's long-term sustainability (as water use expands beyond what is environmentally feasible) and suboptimal in terms of capital allocation (as higher water use upstream may make downstream projects uneconomical (Swain, 2011[31]).

[30] Goitom Gebreluel (2014) Ethiopia's Grand Renaissance Dam: Ending Africa's Oldest Geopolitical Rivalry?, The Washington Quarterly, 37:2, 25-37, DOI: 10.1080/0163660X.2014.926207

[31] Ashok Swain (2011) Challenges for water sharing in the Nile basin: changing geo-politics and changing climate, Hydrological Sciences Journal, 56:4, 687-702, DOI: 10.1080/02626667.2011.577037

The GERD has the potential to act both as driver for conflict, but also for cooperation. It provides clear benefits to all three riparians, such as hydropower, flood control and reduced flood damages and sediment control (for downstream reservoirs). Development of the GERD follows a "hydropower" expansion strategy on the Blue Nile, and not an "irrigation strategy". This is good news for Egypt and Sudan as hydropower means little actual water withdrawal. One of the benefits of the GERD Dam is flow regulation of the Blue Nile towards flow stability all year round. This would allow for crop intensification in the irrigated schemes along the Nile, including the large national schemes i.e. Gezira. This will allow for maximum utilization of the irrigated agricultural land[32]

However, the GERD entails potential negative effects on Egypt, if not carefully managed. The filling regime and operational methods of GERD will affect Egypt, through its impact on the operation of its Aswan High Dam (AHD) which aims at mitigating the high variability of the Nile River flow. The 10-year filling time of the GERD will likely contribute to enhanced salinization in Egypt. If it were to take place during a sequence of years in which the Blue Nile flow and the AHD reservoir itself was low, Egypt might not be able to withdraw enough water supplies to meet its agricultural needs. Additional irrigation for Sudan also presents a threat for Egypt's' current Nile water utilization (Whittington et al., 2014).

In March 2015, a 'Declaration of Principles' was signed by the leaders of Egypt, Sudan and Ethiopia, setting the foundations for an initial cooperation (Sudan Tribune, 2015a). This agreement could pave the way for a more detailed cooperation framework and represents a major step toward dispute resolution. However, the principles of cooperation have yet to be translated into specific technical agreements on dam management (and more), in the context of difficult domestic politics.

Another complex set of security challenge is concentrated along the Juba and Shabelle rivers between Ethiopia and Somalia and to a marginal extent by Kenya. Ethiopia and Somalia have the clearest domestic interests in the Juba–Shabelle Basin's water resources and their development. The region around the basin, marked by three decades of civil war and state collapse, is dependent on the river for agriculture, drinking water and hydropower[33]. Despite the significance of water access, there has never been a bilateral agreement for international cooperation over the rivers' usage. Domestic interests and interstate tensions—as well as Ethiopia's role in the Somali civil war and state-building process—inhibit the potential of transboundary water cooperation in the Juba–Shabelle Basin. The tensions are likely to be complicated by impacts of climate change. The tensions may amplify societal stress and relations and affect political dynamics at the communal, bilateral and regional levels.

Given the particular characteristics of transboundary aquifers and their greater vulnerability to contamination, exploitation, and the impending impacts from climate change, increased attention is needed to ensure that these resources are protected and sustainably and equitably managed. Further, despite the increasing adoption of integrated water resources management (IWRM) concepts, political levels of decision-making are still often misaligned with the natural boundaries of water resources. This is particularly the case for transboundary river basins and groundwater aquifers.

A regional approach to water security, governance and development should be a priority, given the importance of transboundary water resources like the Nile and Juba-Shabelle basins to the riparian countries. This calls for shifting the regional narratives moving from a narrative of competition and tension to one of shared problems and shared solutions[34]. Such cooperation can also support the cooperative management and development of the shared water resources in the region.

[32] Voluntary National Review 2018; implementation of agenda 2030 and the SDGs for peace and development in the Sudan June 1, 2018; national population council; https://sustainabledevelopment.un.org/memberstates/sudan

[33] SIPRI Policy Paper No. 54 (2020) Water Security and Governance in the Horn of Africa Florian Krampe, Luc Van De Goor, Anniek Barnhoorn, Elizabeth Smith And Dan Smith

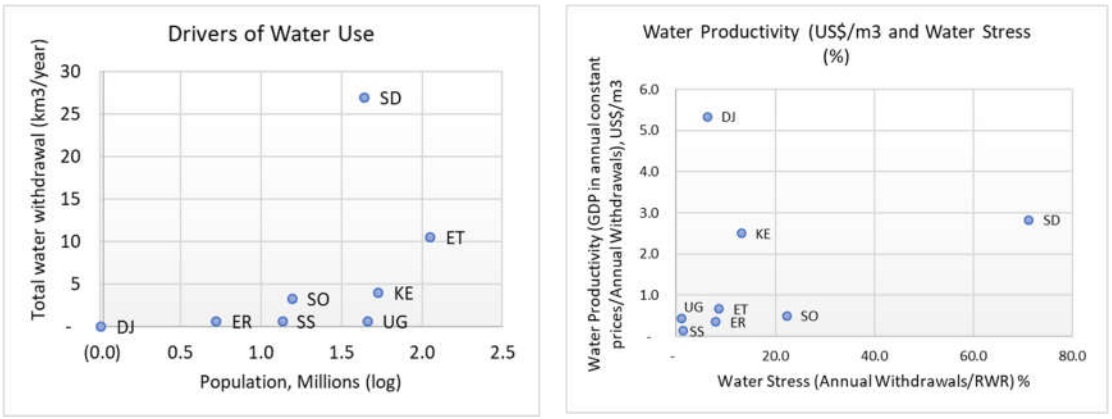
[34] Water Security and Governance in the Horn of Africa. Available online at https://sipri.org/publications/2020/sipri-policy-papers/water-security-and-governance-horn-africa. Accessed 21 May 2020

2.2 Delivering Water Services for the Population and Economies

2.2.1 Drivers of Water Demand and Use

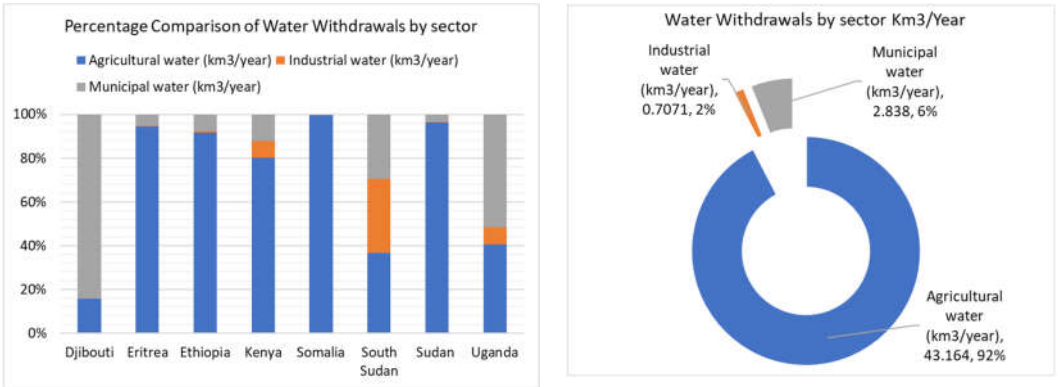
Water demand is largely influenced by population growth, urbanization, food and energy policies, and macro-economic processes such as trade globalization and changing consumption patterns (Figure 15). Sudan, with high population growth and greatest command area dominates the water withdrawals, followed by Ethiopia. However, water productivity has also not been matched by the withdrawals.

Figure 15:Drivers of Water Demand in the Horn of Africa Countries



The water withdrawals by sector in 2019 vary (Figure 16), with the agriculture sector being the dominant use with 92% of all withdrawals, followed by Municipal water at 6% and Industrial Water Use at 2%. The ratio of aggregated water demands to available supply was estimated at 9% in 2011; but this will increase to 15% in 2030, driven by population growth and expansion of irrigable land. Indeed, farmers will have to contend with decreasing freshwater availability and higher demand for water from sectors, such as energy, which is projected to consume 85% more water by 2035 (World Bank 2016). A summary of planned interventions in the water sector is presented in Appendix 3.

Figure 16: Withdrawals by sector for the Horn of Africa Countries



That said, water use is complex to measure, as water is not a homogenous good and is subject to sequential uses. Withdrawals of water—total water diverted for human use—are widely used to proxy the reliance of human activity on water[35]. It is the broadest measure that encompasses domestic, agricultural, and industrial use of water. Water withdrawals/inhabitant/year, ranges from 20 m^3 /inhabitant/year in Uganda to more than 750 m^3/inhabitant /year in Sudan, perhaps due to the ASAL.

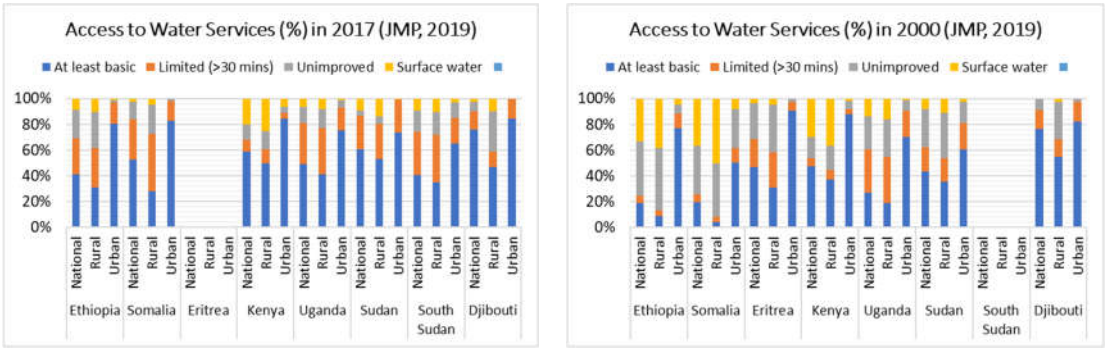
[35] IMF STAFF DISCUSSION NOTE (2015); Is the Glass Half Empty or Half Full? Issues in Managing Water Challenges and Policy Instruments

Other countries low withdrawals are due to inadequate development of hydraulic infrastructure. Current estimates suggest that population growth will have a great impact on water availability[36].

2.2.2 Water Supply and Sanitation Access

Lack of access to drinking water supply services remains a key issue and area of infrastructure need. According to the Progress on household drinking water, sanitation and hygiene 2000-2017, the average access to water supply in the GHOA region for 2017 was estimated at 49.5%. Although progress has been made towards access to improved water sources (Figure 17), with a 21% increase in the population accessing improved sources of water[37].

Figure 17: Access to Improved Water Sources (% of Population), data source JMP (2019)



Since 2000, the total population without access remains 137 million, with a lag in the rate of access of rural vs. urban areas, estimated at 37%. The countries with the lowest water supply coverage are Ethiopia and South Sudan. To respond to growing demands for drinking water, massive deployment of water infrastructure is essential in enabling universal access to WASH services leading to improved livelihoods.

The GHOA countries also need to increasingly consider 'unconventional' water sources such as desalination and wastewater reuse (in the coastal regions of Kenya, Somalia, Sudan and Djibouti), as well as integrated urban water management solutions, to mobilize additional supplies and protect existing ones. Desalination remains costly, due to high reliance on energy and disposal of brine, which is an environmental constraint. While recycled water may be a viable long-term alternative, setting up production facilities requires substantial upfront investment, which can be expensive.

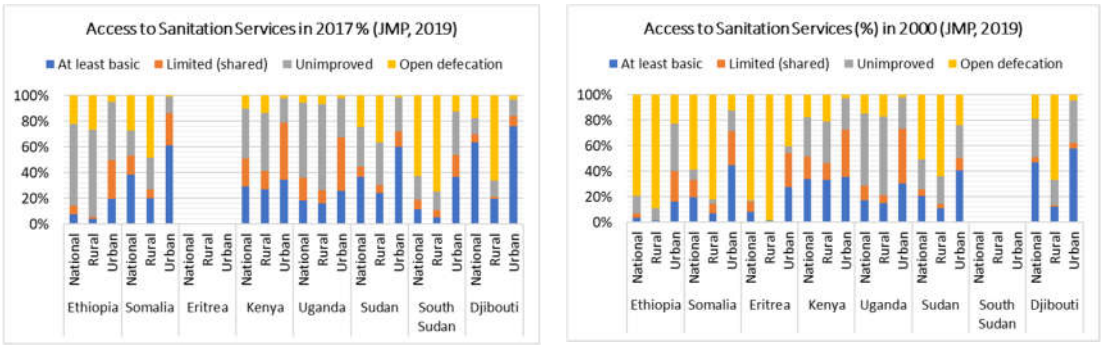
Inadequate access to safely managed sanitation, including wastewater treatment capacity, are a key sector issue. According to the JMP (2019) report, limited progress that has been made towards greater access in the region, with a 3% increase in the population accessing improved sanitation since 2000 (Figure 18). The average access to improved sanitation is estimated at 20% (JMP, 2019), with an estimated population of 218 million, without access.

The gap between urban and rural rates of access to sanitation is estimated at 28% (JMP, 2019). Only Djibouti, has improved sanitation above the 50% mark while the rest of the countries are below that, the lowest being Ethiopia at 7%. These statistics however mask the challenges faced by vulnerable groups, notably women and girls. The uncoordinated implementation of sanitation activities reduces efficiency and effectiveness in service delivery.

[36] Chase, Claire, Aroha Bahuguna, Yue Chen, Sabrina Haque, and Mik Schulte. 2019. "Water and Nutrition: A Framework for Action." World Bank, Washington, DC

[37] Improved access encompasses three dimensions of water security: proximity, quantity and quality.

Figure 18:Change in Access to Sanitation at least basic



A range of technical solutions must be promoted to ensure safely managed sanitation services and avoid public health risks[38]. However, as noted, in the World Bank report "Beyond the Gaps" it could make sense to start with low-cost technologies where the conditions (population density, urbanization) allow for wastewater and sanitation, and then phase in the implementation of conventional sewerage and wastewater treatment—in the less densely populated areas. Such an approach facilitates building up the economic and financial sustainability of both the service and the utilities tasked with providing it. The Citywide Inclusive Sanitation comprehensive approach also shows promise in integrating a range of technical solutions with the financial, institutional, regulatory and social dimensions[39].

Technologies for energy recovery in wastewater treatment plants could reduce the total electricity demands, reduce operating costs and contribute to meeting carbon emission reduction targets with the potential to mobilize climate funds. An example is the Bugolobi sewerage and wastewater treatment plant, under National Water and Sewerage Corporation (NWSC) in Uganda, which besides treating 33 million litres of water daily before it goes into Lake Victoria, generates 650Kwh of electricity. Measures like these could allow countries to achieve SDG target 6.3 ("By 2030, improve water quality by reducing pollution, "… halving the proportion of untreated wastewater") and target 6.6 ("By 2020, protect and restore water-related ecosystems")—both of which require wastewater treatment facilities.

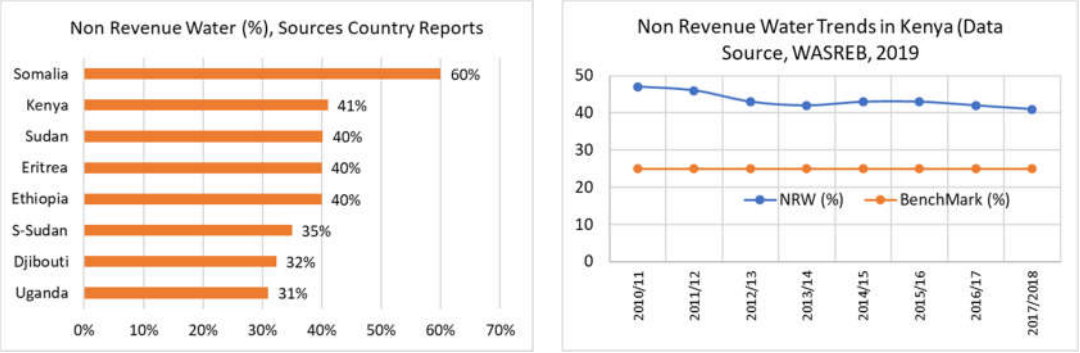
Water service providers in the GHoA suffer from technical inefficiency, low levels of service, weak governance and poor financial performance. This arises from limited incentives, vested interests that benefit from the low-level status quo, low and politicized tariffs and weak capacity. A key indicator of technical performance is the high levels of non-revenue water (NRW), in the GHOA countries (Fig 19).

NRW has a direct and adverse effect on water service delivery financial performance[40]. In 2013/14, NRW in Kenya is estimated to have cost KES 10.6 billion (US$ 10 Million)[41]. In the financial year 2016-2017, the Auditor General warned that high levels of NRW posed a threat to the financial sustainability of the sector, with implications to water security. According to the regulator, given current levels of

[38] Rozenberg, Julie, and Marianne Fay, eds. 2019. Beyond the Gap: How Countries Can Afford the Infrastructure They Need while Protecting the Planet. Sustainable Infrastructure Series. Washington, DC: World Bank. doi:10.1596/978-1-4648-1363-4. License: Creative Commons Attribution CC
[39] https://www.eawag.ch/en/department/sandec/e-learning/spotlight/towards-citywide-inclusive-sanitation/, accessed May 28, 2020
[40] Soppe, Gerard, Nils Janson, and Scarlett Piantini. 2018. "Water Utility Turnaround Framework: A Guide for Improving Performance." World Bank, Washington, DC.
[41] Innovations for reduced Non-Revenue Water Posted on 26 Sep 2016; https://www.kenyamarkets.org/innovations-reduced-non-revenue-water/

NRW, the sector would need to increase water production by 250% of the current level to meet existing demand.

Figure 19: Non-Revenue Water across the GHOA countries, and Kenya



To invest in water production and the creation of new assets without solving the issues at the heart of NRW could jeopardize water access. To sustain good-quality services, strategies for reducing NRW to its economic levels need to be developed[42]. Reducing NRW could help close the supply and demand gap without the need to build costly infrastructure or exploit new water sources (which are dwindling). Additionally, it would increase revenue for utilities while reducing operating costs thus unlocking savings that can be used to expand access and improve service delivery. If greater operational efficiency and cash surplus can be maintained through good governance and incentives, utilities could mobilize private finance. However, most utilities are far from being creditworthy.

As noted in the World Bank's Utility Turnaround Framework report (2018)[43], improving performance of public utilities takes time – up to 10 years to fully embed improved practices and performance improvements. This calls for dedicated tools to support the evaluation of the key challenges facing utilities and guidance on solutions. There are also opportunities to review the institutional structure of utilities to facilitate progress towards financial and managerial autonomy, accountability and market and customer orientation. The introduction of regulatory mechanisms is also possible, but care is needed to ensure that such mechanisms are appropriate to the regulatory capacity in the country.

Operation and maintenance (O & M) costs for WSS systems remain high which constrains service delivery. The World Bank report on "Beyond the Gap"[44] estimates O & M costs at 54% to 58% of the total annual expenditure needed to deliver the service in Lower-Income countries. The report further mentions that, failure to perform routine maintenance would reduce the useful life of installed capital and increase overall capital replacement costs by at least 60%. The fact that O&M constitutes the bulk of overall costs means that countries need to think about the affordability of expansion plans. According to the Kenya Water Services Regulatory Board, (WASREB), a cost recovery below 110% compromises the quality of services provided (WASREB, 2019). In Kenya, the regulator reports that the average cost coverage declined from 102% in 2016/17 to 99% in 2017/18[45] . The Addis Ababa Water and Sewerage Authority on the other hand reported a cost

[42] The economic level of NRW is defined as the level of water losses that results from a policy where the marginal cost of managing losses is equal to the marginal value of water in the supply zones

[43]Soppe, Gerard, Nils Janson, and Scarlett Piantini. 2018. "Water Utility Turnaround Framework: A Guide for Improving Performance." World Bank, Washington, DC.

[44] Rozenberg, et al, eds. 2019. Beyond the Gap: How Countries Can Afford the Infrastructure They Need while Protecting the Planet. Sustainable Infrastructure Series. Washington, DC: World Bank. doi:10.1596/978-1-4648-1363-4. License: Creative Commons Attribution CC BY 3.0 IGO

[45] Impact: Water Services Regulatory Board (WASREB, 2019); A Performance Report of Kenya's Water Services Sector – 2017/18

coverage of 104 % and 114% between 2011-2016[46]. Allowance for an equivalent amount, or more, must be made for O&M in order to ensure service sustainability. This will mainly be through strengthening water pricing and cost recovery.

Private sector participation and finance in WSS remains limited, mainly due to absence of an enabling environment. The World Bank Public and Private Sector Infrastructure Advisory Facility (PPIAF), has over the last decade supported numerous countries like Kenya, Ethiopia, Somalia, Uganda and South Sudan to put in place policy and regulatory frameworks for private sector participation and investment. However, the success of application in the water sector remains limited. In countries like Ethiopia, there are examples of private engagement in fecal sludge management, however, the regulatory frameworks for engaging private partners remain a constraint. Uganda on the other hand has a clear tariff and regulatory structure based on socioeconomic conditions and cost recovery principles (World Bank, 2018), however, the absence of an independent regulator constrains sector regulation and private sector investment. Kenya remains the most successful example, where development partners are supporting the development of commercial financing for delivery of WSS services. The World Bank Group and international development partners helped scale up the financial and operational performance of water service providers, supported creditworthiness assessments, and piloted financing initiatives focused on delivering improved water supply and sanitation services to low-income homes. As a result of this support, Utilities are gaining experience in executing commercially bankable projects, and there is growing interest among local banks to lend to the water sector, with four banks now actively participating, and others looking to enter the market [47]

In addition to an inadequate enabling environment, absence of pipelines constrains access to private finance. Strengthening access to private finance calls for development of strategies that respond to the capacity constraints and promote partnership between the public and private providers to pave the way for efficient, universal and affordable service provision within a supporting policy, regulatory framework and financing framework. Borrowing from the pioneering approach in Kenya, the Bank, could support creditworthiness assessments, technical assistance to borrowers and lenders for project pipeline development and implementation as this would facilitate the flow of commercial financing, supported by equity and debt instruments available within the Bank Non-Sovereign Operations.

2.2.3 Water and agriculture

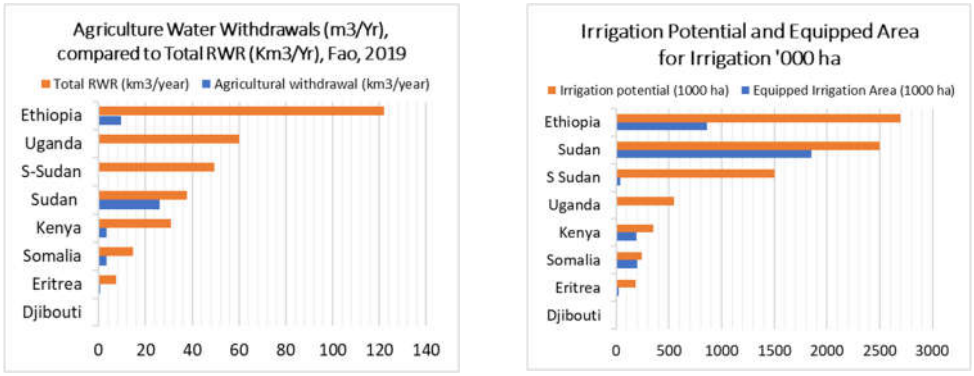
Agriculture and by extension irrigation already play a key role in the economies of the GHOA countries with an average contribution of 19% to the GDP. However fully irrigated agriculture is a relatively recent practice, except in Sudan, where 60% of the Irrigation withdrawals in the GHOA are found. The region is far from exploiting its technical and economic agricultural water management potential, with an estimated equipped area of 39% out of a potential 8 million ha. Agricultural water withdrawals are estimated at 92% of all freshwater withdrawals, while aggregate irrigation water withdrawals are estimated at 14% of the total RWR, suggesting that scope exists for further expansion of irrigation. Figure 20 compares the current Agricultural withdrawals to the total RWR.

Because of the need to substantially increase agricultural productivity to meet rising food demand, the expansion of irrigated agriculture as well as improved management of water in rain-fed agriculture has become an urgent policy consideration. However, underperformance of existing irrigation schemes remains a challenge. Irrigation schemes like Gezira in Sudan, suffer from weak underlying economics, lack of viable institutional models, and technical flaws that result in poor water service, diminished

[46] World Bank. 2018. Maintaining the Momentum while Addressing Service Quality and Equity: A Diagnostic of Water Supply, Sanitation, Hygiene, and Poverty in Ethiopia. WASH Poverty Diagnostic. World Bank, Washington, DC.
[47] https://www.worldbank.org/en/about/partners/brief/kenya-using-private-financing-to-improve-water-services, accessed June 03, 2020

water use efficiency (WUE) ranging from 10-30% and poor crop productivity (World Bank 2016[48]), Box 4.

Figure 20: Agricultural Withdrawal, current and planned trends



Inadequate O & M of irrigation systems initiates a vicious cycle of performance decline (much like in the urban utility sector): poor irrigation service reduces farmers' willingness to pay and reduces collected fees. Reduced revenues mean that they lack the financial resources to cover O&M, service debt, and take on new capital investments. This leads to a further deterioration in the performance of the systems.

Box 4: Status of the Gezira Irrigation Scheme

Sudan's irrigation schemes are deteriorating rapidly, and the largest, Gezira, is almost at the point of collapse in terms of delivering water. The Gezira scheme was once the pride of Sudan, given the enormous size of the irrigation system (900,000 ha), close to both the capital (and metropolis) of an arid country (Khartoum), and its major port (Port Sudan). With its 90 years of history, three million inhabitants, and certain natural advantages (much of the scheme could be irrigated by gravity with proper infrastructure maintenance), it is obviously the heart of Sudan's agriculture. Sudan's President in 2014 declared the Scheme a failure in 2014. Yet the natural advantages which led to its construction and expansion still exist slopes permitting gravity irrigation, decent soils, good climate, and now a knowledgeable workforce from among the three million residents of the area. The World Bank notes that a thorough, yet quick feasibility study would be needed to determine if rehabilitation of the scheme is economically beneficial and what needs to be done differently to again make it a success.

In 2016, the International Food Policy Research Institute, examined, the Technical and Economic Scope for Irrigation Expansion in Drylands of the GHOA (Eastern Africa). Under a medium -cost scenario, they assume, expansion of an estimated 2,684,000 ha (for both small and large-scale irrigation) or 34% of the irrigation potential at acceptable Rates of Return (5%). Of this an estimated 326, 000 ha could be developed under large scale irrigation at a unit cost of US$12,000/ha, and total cost of US$ 3.92 billion, while an estimated 2,358,000 ha could be developed under large scale irrigation at a cost of US$ 4,500/ha, and total cost of US$ 10.61 billion. The total cost for the expansion would amount to US$ 14.53 billion by 2030. Successful development of the region's irrigation potential could have a transformative impact on the lives of up to 25% of the total rural population living in the drylands[49].

Given that a significant population lives in the drylands (> 30%) developing irrigation potential would be a priority in reducing poverty and improving resilience. Assuming a weighted mean unit water

[48] World Bank Group. 2015. Sudan Country Economic Memorandum: Realizing the Potential for Diversified Development. World Bank, Washington, DC. © World Bank. https://openknowledge.worldbank.org/handle/10986/25262 License: CC BY 3.0 IGO."

[49] Ward, Christopher, with Raphael Torquebiau and Hua Xie. 2016. Improved Agricultural Water Management for Africa's Drylands. World Bank Studies. Washington, DC: World Bank. doi: 10.1596/978-1-4648-0832-6. License: Creative Commons Attribution CC BY 3.0 IGO

requirement of 7498 m3/ha[50], expansion of the 2,684,000 ha, would result in additional withdrawal requirements of 20 km^3. From a water security perspective, improved water efficiency and water management practices could be the driving force behind future irrigation expansion leading to greater productivity sustainability[51]. It is worth noting, though, that most of the gains from expansion of equipped area will only be realized if it is accompanied by modernizing (both technical and institutional) and upgrade of existing irrigation and drainage systems and increase of water use efficiency.

Although there is scope for developing new large-scale irrigation schemes, the economic, institutional, and technical conditions remain demanding. It is important to design new schemes within the right enabling environment and incentive structure. Investments must be optimized at the basin scale given the shared nature of water resources within a water resources management framework.

Water resources for livestock are also critically important in the GHOA. However, livestock production is constrained by inadequate water mobilisation and grazing resources. Pastoralists are faced with declining amounts of water and grazing land for their cattle, especially during periods of extreme drought. According to the World Bank (2016) [52]; the livestock sector in the GHOA was affected by five major droughts between 1998 and 2011, which killed more than one-half of the cattle in the most heavily affected areas and decimated the livelihoods of 3–12 million people (depending on the year). Policy reforms and supporting investments including water mobilisation could stimulate changes in production technologies and management practices that could halve the regional deficit in livestock-sourced products that is projected to develop by 2030, should current supply and demand trends continue.

According to the same report, water resource development could play an important role in facilitating mobility as it enhances the feed balance of drylands in three aspects. First, development of water resources—mainly by constructing shallow wells and drilling boreholes—could open these areas for grazing, and thereby improve the overall amount of feed resources available, providing additional flexibility during times of drought. Second, water resource development could reduce the range that livestock must trek to a water point, thereby increasing the efficiency of feed utilization. Finally, as water development is one of the most demanded interventions by pastoralists, well-implemented water points can be a major step towards (re)gaining pastoralists' trust (Ibid).

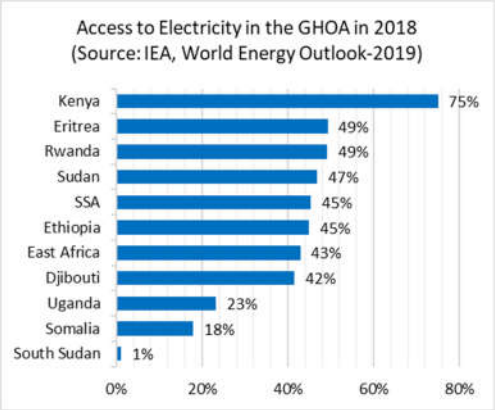
A Multinational - Drought Resilience and Sustainable Program in the Horn of Africa, financed by the African Development Bank is under implementation. The project aims to develop infrastructures for i) water mobilisation and management, and ii) livestock production, health and marketing. It also engages in capacity strengthening of the populations and Governments of the region to better cope with the effects of climate change, resources scarcity and conflicts related to resources utilisation[53].

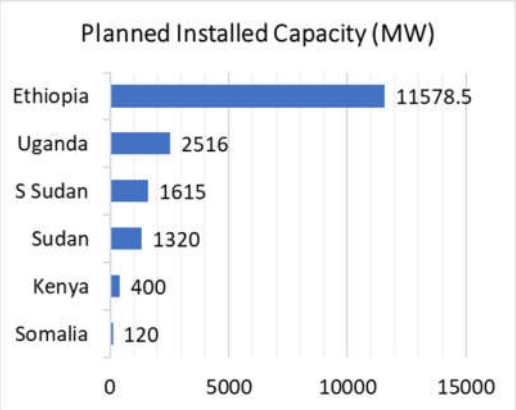
2.2.4 Water for Energy Production

The interdependency of water and energy is set to intensify in the coming years, with significant implications for both energy and water security. The electricity access rates and planned hydroelectric power capacity are shown in Figure 20.

Figure 20: Access to electricity and planned generation capacity (IEA, World Energy Outlook-2019)

[50] FAO-Nile Basin Project GCP/INT/945/ITA 2004 to 2009; Synthesis Report
[51] Ian McAllister Anderson (2008); Efficient Water Use for Agricultural Production (EWUAP) Project Agricultural Water in the Nile Basin-An Overview.
[52] De Haan, C. (editor). 2016. Prospects for Livestock-Based Livelihoods in Africa's Drylands. World Bank Studies. Washington, DC: World Bank. doi:
10.1596/978-1-4648-0836-4. License: Creative Commons Attribution CC BY 3.0 IGO
[53] https://www.afdb.org/en/documents/document/multinational-eritrea-ethiopia-somalia-sudan-drought-resilience-and-sustainable-program-in-the-horn-of-africa-drslp-approved-12-2014-50803





The average electricity access rate is estimated at 39%, while the planned installed hydroelectric power capacity has been estimated at 17.6 GW. Ethiopia has the highest hydroelectric generation potential. The planned thermal electric power is estimated at 1740 MW (mainly in Djibouti, Eritrea, Sudan and Kenya). Thermal power generation has been shown to be vulnerable to water scarcity as water is required for activities such as cooling. Except for evaporative losses, hydropower is generally non-consumptive but requires the storage of large amounts of water in reservoirs, which may or may not be available for other uses at certain times.

Meeting ever-growing demands for energy will generate increasing stress on freshwater resources with repercussions on other users, such as agriculture and industry. Since these sectors also require energy, there is room to create synergies as they develop together. Addressing these vulnerabilities not only requires investments in power but also water resources management to minimize potential conflicts, given the shared nature of water resources. Given the vulnerability of the energy sector to hydrological extremes, infrastructure investments involving both water and energy will have to consider the changing frequency and intensity of water-related hazards under climate change.

2.2.5 Inland water way transport

The land-locked economies of the upper Nile region (Uganda, South Sudan and Ethiopia) are hampered by expensive road transportation and logistics that reduce their economic opportunities. Efforts under the AU and regional economic communities have resulted in improved road interconnections between the Nile countries. Several reaches of the Nile could form elements of a comprehensive bulk cargo transportation system that could provide cost-effective access to internal and external markets.

The Bank financed IGAD infrastructure Masterplan[54] identified key water related constraints to improved inland water way transport. These include (i) aquatic macrophytes ;like the water hyacinth (ii) inadequate investments in facilities such as lake and river ports, dredging of waterways and provision of navigation aids; and (ii) obstructions in the river waterways, which would require, training the rivers, widening and deepening river beds and construction of navigation locks as required.
Along the East African coast, artificial harbors have been developed in Kenya, Somalia, Djibouti and Eritrea—and there is immense potential to expand these, as well as develop new ones to scale up alternatives for cargo movement. New berths have been added to established port facilities, and several ports have been constructed. In planning new ports, the choice of site, probable costs, and the possibilities of using containers or other unitized loads have been taken into consideration. Fiscal constraints have slowed down the development of a new maritime port in north-eastern Kenya.

[54] Multinational - Intergovernmental Agency on Development (IGAD) Regional Infrastructure Master Plan (IRIMP) Project; https://projectsportal.afdb.org/dataportal/VProject/show/P-Z1-KE0-016

Developing the inland navigation potential of the river Nile – the 'southern reach' from Kosti to Juba—may provide a low-cost transport route for bulk cargo from South Sudan and the Nile Equatorial Lakes region to Sudan and Egypt; it could thus encourage north–south intra-basin trade and regional integration (Appendix 4. Inland Navigation System within Context of a Bulk Cargo Transportation system). Lake Victoria could provide a critical link between the Northern Corridor (Kampala–Mombasa) and enlarge the economic impact zone of the respective corridors; improved Lake Victoria navigation would also strengthen inter-regional transport connections and economic integration.

2.2.6 Water for Industry and Manufacturing

Industry uses little water in the GHOA (2% of withdrawals), when compared to Agriculture (92% of withdrawals) but it does require an accessible, reliable water supply of consistent and acceptable quality. The OECD (2012[55]) predicts that global industry water demand will increase by 400% from 2000 to 2050 which is larger than any other sector. Most of this increase will be in emerging economies, including the GHoA, with implications on water supply, allocation and quality. It is worth noting that industry creates more pressure on water resources from the impacts of wastewater discharges and pollution potential than by the quantity used in production. This calls for innovations in cleaner production (Box 5).

Box 5. Engaging Private Sector for Green Growth in the Lake Victoria Basin Project[56]

As part of the Lake Victoria Environment Management program (LVEMP II), the World Bank, financed the private sector to pilot a mechanism on reduction of pollution in the Lake through Resource Efficient and Cleaner Production (RECP) Mechanisms. The RECP program engages private industry within the Lake Basin to assess their production systems and adopt greener practices and technologies. An expenditure of a couple of million USD solely on technical assistance (training of industries, and in-plant RECP assessments), directly leveraged over $80m in private sector investments in improved environmental practices. A survey of 30 of the most active firms in the program (from a total of 88), revealed that factories were investing around $1m in RECP technologies, with pay-back periods of around 2 years (IRR of around 35%).[57] Most of these savings come from reduced usage of energy and water. Initial results show that actively participating industries are also able to reduce their pollution generation by around 90%. Despite the success of the RECP program, the scale of the environmental challenges within the basin far exceed the capacity of the funds allocated by LVEMP. Further efforts are required to mobilize private sector investments to promote cleaner production technologies which the existing RECP program has already demonstrated to leverage in significant quantities.

The shape and form of industry's plans and actions and the degree to which they are executed are conditioned by national and local regulatory regimes as well as by trade- and investment-protection agreements. Industry's priority is to maximize production rather than water efficiency and conservation. Even in the case of improved water efficiency there may be a rebound effect (Ercin and Hoekstra, 2012[58]) where the water savings obtained are reinvested to increase production.

Actions to improve water sustainability in industry originate from one of two directions. They include command-and-control methods of policy, regulation, enforcement and incentives. Second, bottom-up approaches come from industry as it reacts to government approaches, a company's own internal policies, customer demand and public pressure (UNIDO, 2014[59]). The rationale is to capture the core strengths of the private sector and to change business operations in line with sustainability goals.

[55] OECD Environmental Outlook to 2050: The Consequences of Inaction - ISBN 978-92-64-122161 © OECD 2012

[56] World Bank. 2017. Africa - Engaging Private Sector for Green Growth in the Lake Victoria Basin Project (English). Washington, D.C. :.http://documents.worldbank.org/curated/en/952851535362610560/Africa-Engaging-Private-Sector-for-Green-Growth-in-the-Lake-Victoria-Basin-Project

[57] Status report for APL1 countries (Kenya, Tanzania, and Uganda) as of June 2014

[58] Ercin, A.E. and Hoekstra, A.Y. 2012. *Carbon and Water Footprints: Concepts, Methodologies and Policy Responses.* WWdr4 side Publication series no. 04. Paris, UNESCO.

[59] UNIDO, 2014. *UNIDO-Industry Partnerships.* Presentation by I. Volodin at 2014 UN-Water Annual International Zaragoza Conference. Preparing for World Water day 2014: Partnerships for improving water and energy access, efficiency and sustainability.

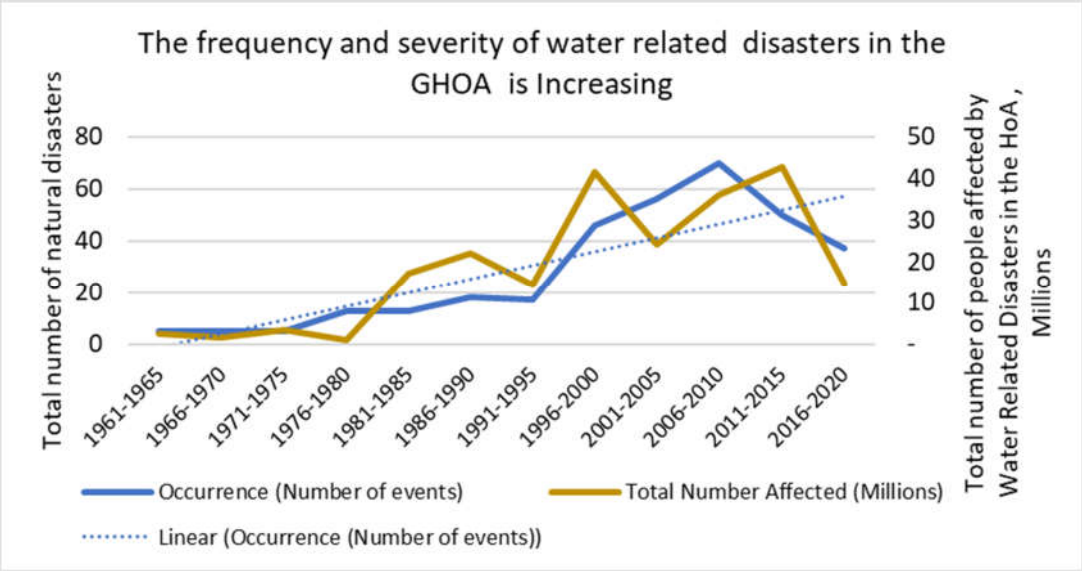
2.3 Water Sector Resilience

2.3.1 Climate change, environment, and water

Many of the HOA countries are among the countries impacted by droughts and floods and at the highest risk of climate-related impacts. With climatic impacts such as droughts and floods increasing in intensity, frequency and duration, the Horn of Africa is suffering from vulnerabilities contributing towards increased pressures on natural resources in the region[60].

Climate-change-induced water scarcity and drought will continue to put pressure on a region whose resources are already stretched by population growth and environmental degradation.The frequency and severity of water related disasters (floods, droughts and storms has been increasing (Figure 21), putting further pressure on social protection systems to expand their coverage to those who become vulnerable because of such shocks. Efforts to manage water and make it available where it is most needed and in a balanced manner are hampered by underdeveloped water storage infrastructure, changing climates, and the weak capacity of regional water resource management institutions.

Figure 21: Frequency and severity of water related disasters in the Greater Horn of Africa



Figures 22 and 23, show the frequency of occurrence of floods and droughts and population affected by these extreme events.

Drought which are strongly correlated with El Niño affect more people frequently. The national costs and losses incurred also threaten to undermine economic growth and other development gains being made in the GHOA states. Reflecting the high frequency of droughts, Kenya, Somalia, Ethiopia and Sudan have the highest percentage of population affected. The 2015 drought in Ethiopia affected an estimated 10,200,000 million people, with damages estimated at US$ 1,4 billion. The 2018 floods on the other hand affected 211,188 people and caused an estimated damage of US$ 350 million. During the same year, floods in Somalia affected 700,000 people with economic costs estimated at US$ 80million. In terms of mortality the 1983 drought in Ethiopia ranks highest with an estimated mortality rate of 300,000 people. (EMDAT data base, accessed May 22, 2020).

[60] Water Security and Governance in The Horn of Africa; florian krampe, luc van de goor, anniek barnhoorn, Elizabeth smith and dan smith

Figure 22.Frequency of occurrence and population affected by droughts (Data Source EM-DAT, 2020)

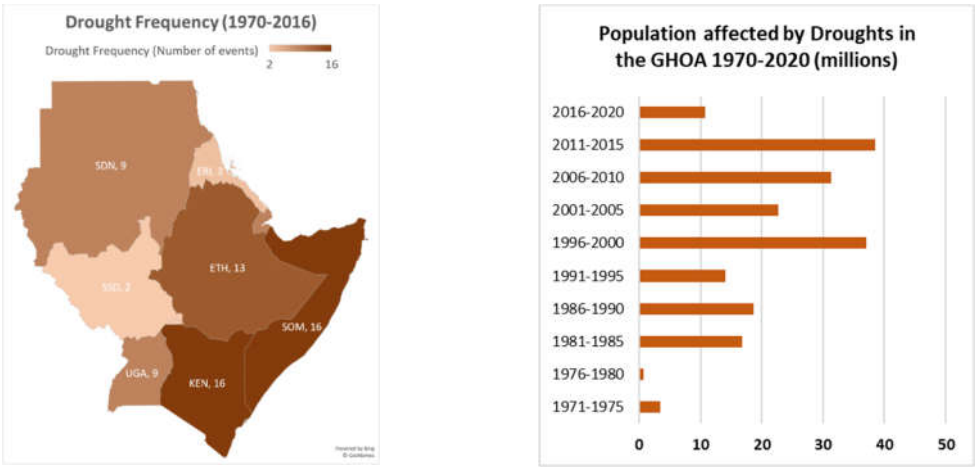
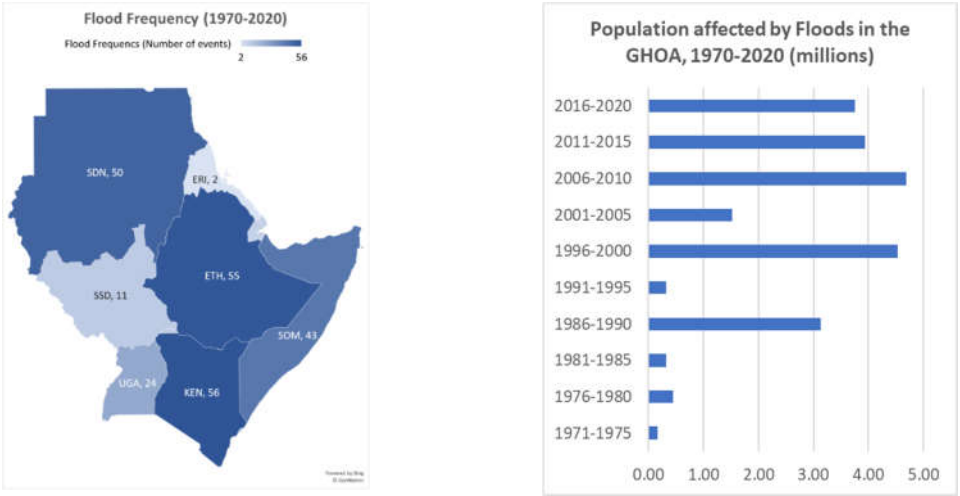


Figure 23.Frequency of occurrence and population affected by floods (Data Source EM-DAT, 2020)



A recent study commissioned by USAID, assessed the cost savings that could result from an earlier and more proactive response to drought in Kenya, Ethiopia and Somalia. The study finds that countries could save 30% on humanitarian aid spending through an earlier and more proactive response; this is equivalent to savings of US$1.6 billion spending over the last 15 years in these three countries alone[61].Investing in early response and resilience is therefore more cost effective than providing humanitarian aid. Investing in resilience is a win-win. It does not only reduce human suffering, but also reduces the cost to donors, allowing humanitarian aid resources to go further and help more people.

Increased surface water stress due to climate change will occur in countries facing politically and environmentally fragile situations like Somalia and Eritrea. Efforts to manage water and make it available where it is most needed are hampered by underdeveloped water storage infrastructure, changing climates, and the weak capacity of regional water resource management institutions.

At a regional level, the IGAD coordinates drought emergencies responses and provides governments in the GHOA with a fresh impetus to re-examine and revise policy and programming from a DRR

[61] The Economics of Resilience to Drought. Available online at https://www.usaid.gov/resilience/economics-resilience-drought.

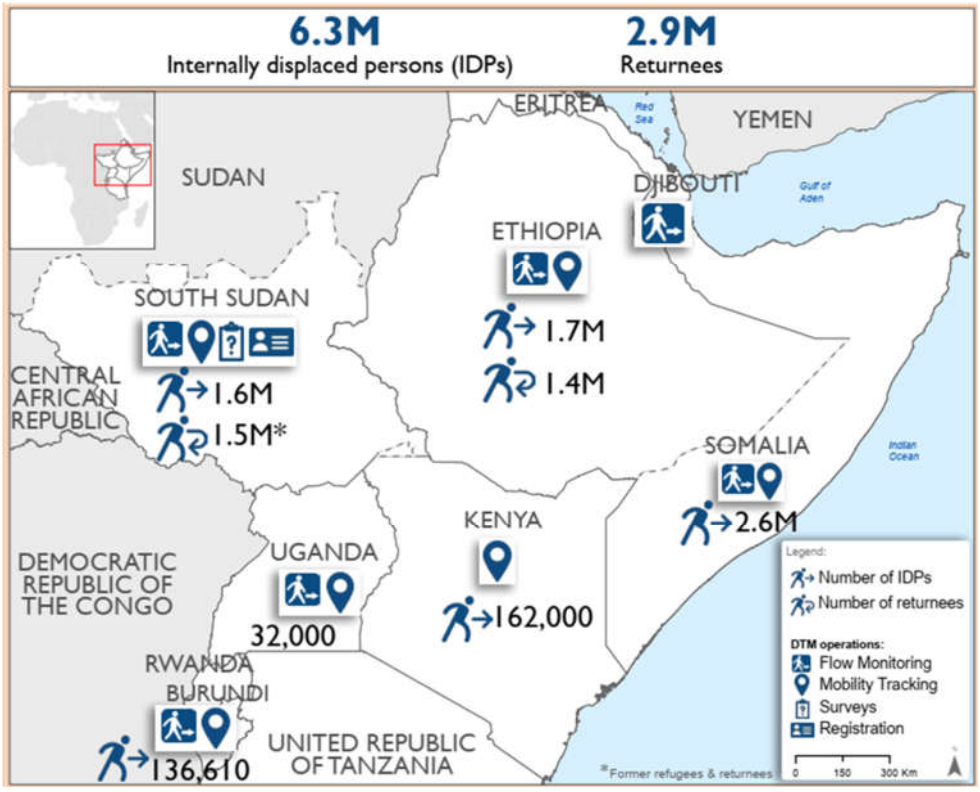
perspective. The institution has developed a Drought Disaster Resilience and Sustainability Initiative (IDDRSI) Strategy, 2019-2024[62], which aims at building the resilience of vulnerable communities to the effects of recurrent droughts and promoting sustainable growth. The response and sustained interest demonstrated by the affected countries; and the goodwill shown by development partners, is evidenced by the large amounts of resources invested in resilience-enhancing interventions.

The IGAD Climate Prediction and Application Center (ICPAC) works to reduce loss of lives and livelihoods by providing timely early warnings and preparedness for disasters. They create capacity to mitigate impacts and manage risks and ensure that when people are affected by disasters, they can continue to meet their minimum needs for food, water, shelter, health and security[63].Building onto the IGAD infrastructure Masterplan, a regional water development plan that addresses all the facets of water security and consolidates it into a regional comprehensive implementable plan is critical.

2.3.2 Fragility

Conflicts and disasters can have cascading effects and far-reaching implications on water security, with political, social, economic and environmental consequences. This is compounded by demographic shifts due both to population growth and the movement of people, as well as imbalanced service provision, inaccessibility, the growing threat of pandemic diseases, conflicts over scarce natural resources, and harsh climatic conditions including frequent droughts and floods[64]. An illustration of the displacement overview in the Horn of Africa is shown in Figure 24.

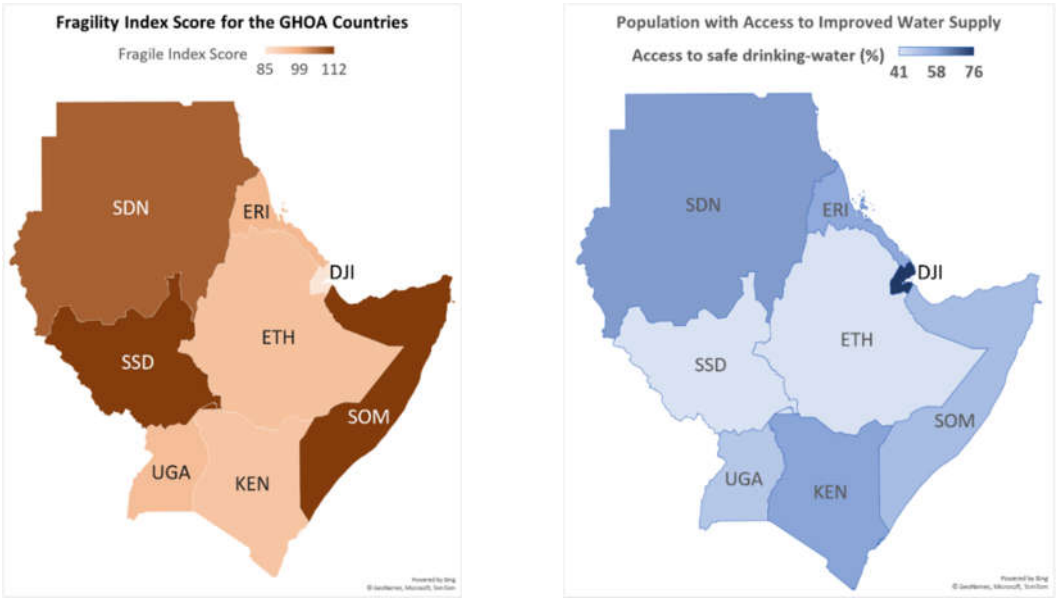
Figure 24: Displacement Tracking Matrix - East and Horn of Africa Monthly Regional Snapshot - July 2020 (Source: International Office on Migration)



[62] The IGAD Drought Disaster Resilience and Sustainability Initiative--The IDDRSI Strategy (2019 – 2024). https://icpald.org/wp-content/uploads/2019/10/IDDRSI-STRATEGY.pdf
[63] https://www.icpac.net/disaster-risk-management/
[64] World Bank Group; UNHCR. 2015. Forced Displacement and Mixed Migration in the Horn of Africa. World Bank, Washington, DC and UNHCR, Geneva. © World Bank. https://openknowledge.worldbank.org/handle/10986/22286 License: CC BY 3.0 IGO.

In 2016, the region was home to more than 4 million internally displaced people and 2.5 million refugees[65]. In Somalia and South Sudan (Figure 25), lower access to water services can be correlated with fragility, while in Ethiopia and Uganda, access is more influenced by inadequate investment in water infrastructure. The influx of refugees exacerbates demographic pressures on water resources, leading to social tensions within communities. When large-scale population movements take place, host communities (e.g. Sudan, Kenya, Uganda) struggle with increases in need for water supply and wastewater treatment. Similarly, human fragility greatly increases as the most vulnerable members of the displaced and host communities face significant challenges in accessing affordable water. Increased water security could help reduce some of the drivers for immigration as they are linked to lack of economic opportunity and loss of livelihoods due to climate shocks.

Figure 25: Access to drinking water supply is correlated to Fragility



In fragile contexts, institutional issues are exacerbated by challenges in revenue collection. During armed conflict, it is impossible for service providers to collect revenues as economic conditions worsen and service areas become dangerous to access physically. On the ground, shortfalls in cost recovery compromise the operating performance of water systems, preventing essential maintenance from taking place and causing loss of skilled personnel in institutions charged with water service provision.

Furthermore, poorly maintained systems and poorly staffed agencies lead to declines in service levels and lower cost recovery. This decline fuels perceptions of exclusion and social grievances and undermines the legitimacy of public institutions, perpetuating the water-fragility cycle. Furthermore, those increased demands are for an unknown period, making service solutions extremely complicated to plan. Investments in water security can help break this vicious cycle of water insecurity and instability and contribute to stability and resilience (Sadoff, Borgomeo and de Waal, 2017[66]).

[65] Ward, Christopher, with Raphael Torquebiau and Hua Xie. 2016. Improved Agricultural Water Management for Africa's Drylands. World Bank Studies. Washington, DC: World Bank. doi: 10.1596/978-1-4648-0832-6. License: Creative Commons Attribution CC BY 3.0 IGO

[66] Sadoff, Claudia W.; Borgomeo, Edoardo; de Waal, Dominick. 2017. Turbulent Waters : Pursuing Water Security in Fragile Contexts. World Bank, Washington, DC. © World Bank. https://openknowledge.worldbank.org/handle/10986/26207 License: CC BY 3.0 IGO

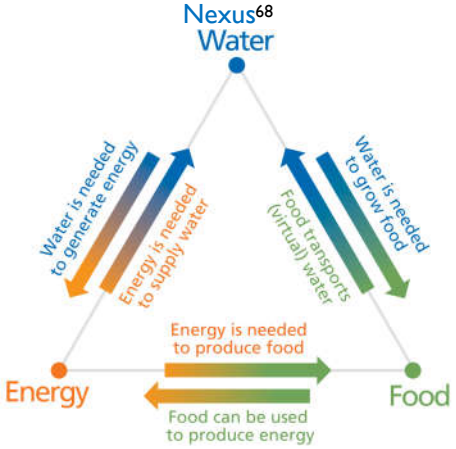
3 Strengthening Water Security

Under the framework of the IGAD, the member states recognize the centrality of water not only for national, but regional development. This is also highlighted in the national multi-year strategic plans, water and sanitation sector strategic plans, policies and related legal texts on water security. This section looks at the key water related risks and pathways towards attaining water security.

3.1 Water-related Risks in the greater Horn of Africa

Water, food and energy are inextricably linked security concerns and form a critical nexus for understanding and addressing challenges and managing trade-offs in the Horn of Africa (Figure 26). The need for water to produce food, and the need for energy to produce water, demonstrate the importance of linkages across these sectors for addressing water security. The challenges of the nexus are intensified in the context of climate change, population growth, and urbanization[67]. Reliance on transboundary waters adds a layer of uncertainty and risks to water management. Transboundary waters pose enormous challenges for achieving water security in systems, such as rivers and aquifers, which are shared across political boundaries.

Figure 26: The Water-Food -Energy Nexus[68]



Fragility and political instability could reverse gains in water security, and water insecurity in turn could in turn compound fragility. In conflict or disaster zones, inequitable and difficult access to water supply and sanitation services may aggravate existing social fragility, tensions, violence and conflict, thus increasing the risk to water security. Forced population displacement exacerbates demographic pressures on limited water resources, leading to increased social tensions within communities.[69]).

3.2 Pathways for Strengthening Water Security

In addressing water security, given the constraints, the UN approach is adopted and includes addressing risks along the water value chain.

This includes water quantity; water quality (water resources free of contamination) and water accessibility (reliable availability to all people, economies, and ecosystems).Measures which include sustaining water Resources: delivery of water services; and strengthening resilience are inspired by the Global Water Security & Sanitation Partnership report on water security "World Bank 2019[70]" - Figure 27.

Figure 27: Framework for Delivery of Water Security

[67] Borgomeo, Edoardo, Anders Jägerskog, Amal Talbi, Marcus Wijnen, Mohamad Hejazi, and Fernando Miralles-Wilhelm. 2018. "The Water-Energy-Food Nexus in the Middle East and North Africa: Scenarios for a Sustainable Future." World Bank, Washington, DC.

[68] Adapted from: Water Security & the Global Water Agenda A UN-Water Analytical Brief; October 2013

[69] Sadoff, Claudia W.; Borgomeo, Edoardo; de Waal, Dominick. 2017. Turbulent Waters: Pursuing Water Security in Fragile Contexts.

[70] Connecting the Drops: Global Water Security and Sanitation Partnership Annual Report 2019 (English). Washington, D.C.: World Bank Group. 9

3.2.1 Sustaining water Resources

Good water governance is essential to achieving water security and requires well-designed and empowered institutions. Achieving water security requires institutional, legal and regulatory support and capacity for change, adaptive management structures, new partnerships, and models capable of integrating complex natural and social dimensions.

Capacity Development to Ensure Water Security. The lack of capacity related to water – human, financial, institutional, technological, and service provisioning – is a major hurdle towards achieving water security. In particular, capacity development at the institutional level across all of the countries in the HoA would be of great importance, as it sets the framework for capitalizing on human capacities and coordinating multi-sectoral policies. Capacity development is needed at different levels and requires a cross-sectoral enabling environment that supports water security.

Strengthening the water-food-energy nexus is key to strengthening water management efforts. The increasing interdependencies of water, food and energy may raise security concerns and create flashpoints for instability[71]. A nexus perspective would focus on the interdependence of WFE and recognize their interconnectedness and consequences of one sector on another. Successfully reducing water use and reallocating water to higher value uses requires coordination between different ministries, increased regulatory clarity, and data sharing. This includes application of more data-driven management, better understanding of water balances, and disruptive technology including use of earth observations to optimise resource benefits. Successful water management would happen in concert with policies that consider also energy and agriculture**.** Re-orienting policy frameworks will help to address the challenges in the nexus. Governments would need to strengthen policies, including planning systems and pricing, gradually removing energy, agricultural and water subsidies, to ensure productive and efficient use of resources (ibid).

3.2.2 Delivery of water services

Expanding water supply and availability is vital. This means new water storage, improved water reuse and recycling and, where viable, desalination and other technologies to create "new" water—while staying mindful of the social and environmental consequences, especially to downstream uses and users of water[72]. A human rights-based approach to water security would also address the critical gaps and bottlenecks and emphasize the establishment of regulatory functions and mechanisms for efficiency, participation and accountability. The Bank could build partnerships to promote collaborative investment. This could contribute to improved peace and stability in the region.

Water sector regulatory reforms are key to strengthened service delivery. Incentives for water conservation are needed to change the way water is managed. These can come through policies, pricing, allocation, or regulation. Experiences show the right incentives can encourage water savings in ways that avoid disproportionate impacts on the poor. Well-designed incentives include accurate targeting of price changes—for instance, by targeting higher consumption users—and awareness raising explaining the reason for pricing changes and the availability of compensatory mechanisms.

Integrated Water Management is key for water services delivery. Such approaches will encourage cities to create strong synergies within or outside the water basin—for example, through the development of wastewater recycling for agriculture or shared desalination with industries. Women's and youth's rights, representation, and resources need to be acknowledged and addressed, both for social inclusion and for sustainable development.

[71] Adapted from: Water Security & the Global Water Agenda A UN-Water Analytical Brief; October 2013
[72] Intergovernmental Authority on Development- IGAD Regional Strategy; Volume 1 The Framework

Strengthening access to Finance. Traditionally, most of the financing has come from the public sector. Innovative financial mechanisms need to be promoted towards the goal of achieving water security through a supportive policy environment conducive to ensuring that investments are protected. Irrigation projects developed in countries like Morocco, show that the private sector is motivated towards PPPs and to work toward creditworthy utilities that could attract sector financing when issues of tariffs, partial subsidies, and assurance of payments are addressed.

3.2.3 Strengthen resilience

With population growth, urbanization and climate change, disasters and their impacts are projected to become more severe. Inclusive water management could significantly contribute to addressing food insecurity threats and preventing/managing conflict. Ensuring water security in the face of climate change can be achieved through appropriate adaptation measures, which are highlighted in various policy instruments at national level, notably the Nationally Determined Contributions.

Changes in the hydrological cycle will threaten existing water infrastructure, increasing vulnerability to extreme water-related events and increased insecurity. Support could be made in coping with droughts through interventions in: drought vulnerability and impact assessment, monitoring and forecasting and mitigation through integrated approaches at watershed scale.

Support is required in strengthening hydrometeorological and weather information systems to strengthen water planning efforts. The decline of hydrological networks needs to be stopped and reversed so that decision-making can be based on solid empirical evidence. Hydrological data need to be freely shared between stakeholders, and several gaps in knowledge need to be filled. Research needs to be strengthened in order to assess uncertainties generated by climate change[73]. Efforts to strengthen hydromet services could build onto the NBI Hydromet design study (2015) and the WHO-IGAD hydromet network (2012).

Regional solutions are required to address water insecurity. The origins and consequences of the HOA challenges go far beyond the borders of any one country. From this perspective, regional solutions may be required to address water security issues in order to transform the risks and threats facing individual countries into opportunities for regional stability, socioeconomic development, and shared prosperity[74]. There is a need to shift the regional narratives around water resources and their governance—from a narrative of competition and tension to one of shared solutions.

It will be crucial to enable states to develop a joint vision for the region that stresses opportunities and implements cooperative solutions for the Horn of Africa. There is also need for more solid, shared and jointly accepted information. Reliable data can guide policies and decision makers in dealing with the current challenges as well as better anticipate climate impacts and climate-related security risks. There is also need strengthen the institutional architecture to manage water resources in the region. Currently, there is no suitable organization or framework that can address the regional water management and security challenges in the Horn of Africa[75]. Building on efforts of IGAD specialist institutions like ICPAC, ICPALD, and CEWARN would be critical to promoting water security in the fragile drylands of the GHOA.

[73] Adapted from: Water Security & the Global Water Agenda A UN-Water Analytical Brief; October 2013

[74] Adapted from : World Bank Group; UNHCR. 2015. Forced Displacement and Mixed Migration in the Horn of Africa. World Bank, Washington, DC and UNHCR, Geneva. © World Bank. https://openknowledge.worldbank.org/handle/10986/22286 License: CC BY 3.0 IGO."

[75] SIPRI Policy Paper No. 54 (2020) Water Security and Governance in the Horn of Africa Florian Krampe, Luc Van De Goor, Anniek Barnhoorn, Elizabeth Smith And Dan Smith

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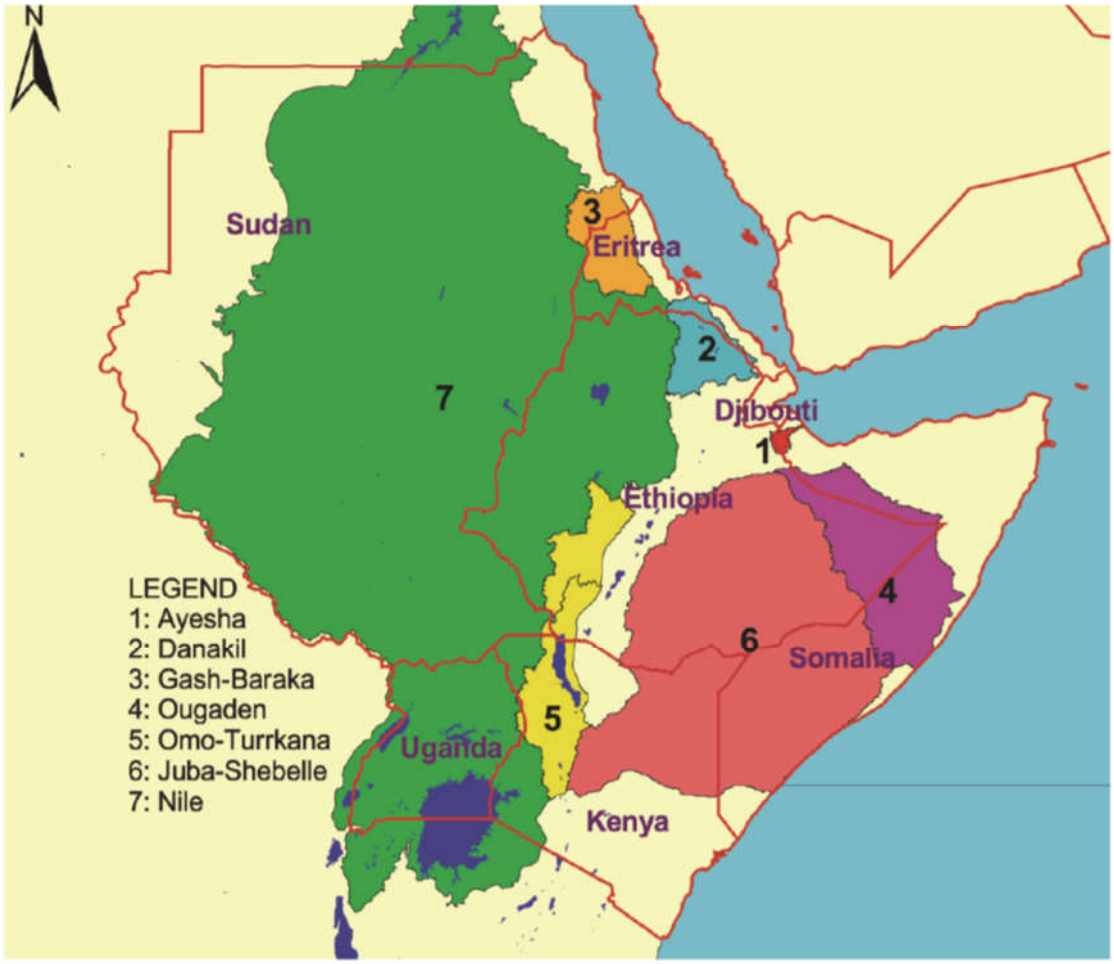
Appendix 1 Summary of Water Sector Challenges the GHoA

Water Resources Challenges	Djibouti	Eritrea	Ethiopia	Kenya	Somalia	South Sudan	Sudan	Uganda
1. Rapid population growth	+ + +	+ + +		+ + +		+ + +	+ + +	+ + +
2. Increasing climate variability	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +
3. Rapid desertification followed by Soil erosion	+ + +	+ + +	+ + +		+ + +		+ + +	
4. Ground water depletion	+ + +	+ + +					+ + +	
5. Salinity and saltwater intrusion in coastal regions		+ + +						
6. Over dependence on rain-fed agriculture			+ + +	+ + +		+ + +		+ + +
7. Water pollution due to chemical use in agriculture, and wastewater disposal.		+ + +	+ + +	+ + +			+ + +	+ + +
8. Deforestation resulting in catchment degradation and general deterioration of water quality	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +
9. Inadequate and fragmented data collection infrastructure		+ + +		+ + +	+ + +	+ + +		+ + +
10. Aging water infrastructure. Low expenditure on water sector especially in area of resource management		+ + +		+ + +	+ + +		+ + +	
11. Fragility which affects institutions and infrastructure					+ + +	+ + +		
12. Scarce water sources that are under extreme pressure	+ + +	+ + +			+ + +		+ + +	
13. Low access to safe water at only 23%		+ + +			+ + +	+ + +		
14. High incidence to water-borne diseases			+ + +		+ + +			
15. Frequent droughts	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +
16. Frequent Flooding in low lying areas		+ + +	+ + +	+ + +		+ + +		+ + +
17. High incidence of poverty		+ + +			+ + +	+ + +		+ + +
18. Conflicts over control of limited water resources					+ + +	+ + +		
19. Inadequate water storage capacity. Migration because of drought	+++	+ + +			+ + +			
20. Dependence on upstream transboundary waters		+ + +			+ + +		+ + +	

21. Involuntary resettlement due to construction of dams and reservoirs.			+ + +					

Appendix 2: Transboundary Water Basins in the GHOA



Appendix 3 Planned Interventions in the Water Sector

Country	Legal/Policy Documents	Key Strategies/Interventions
Eritrea	Action Plan for Integrated Water Resource Management in Eritrea	• Water resources assessment, development and protection; Water resources allocation and water use; Disaster management; Enabling environment; Implementation and financing mechanism; Research and information exchange; and Basin Management Plan.
Ethiopia	Second Growth and Transformation Plan, (GTP II) (2015/16-2019/20)	• Overall potable water supply coverage at 83% as per GTPII standards • Rural potable water supply coverage at 85% as per GTPII standards • Urban potable water supply coverage at 75% as per GTPII standards • Area of land developed with large and medium irrigation schemes at 954,000 ha • Target for area of land rehabilitated is 22.5 million ha against 10.86 in GTPI • Target for area of land developed with community-based watershed development Program target at 41.35 22.5 million against 12.162 in GTPI • Target for area of land developed with modern small-scale irrigation schemes targeted at 4.1 22.5 million against 2.3 22.5 million in GTPI
Kenya	Third Medium Term Plan (MTP3), 2018 – 2022	• Waste Management and Pollution Control; • Modernization of Meteorological Services; Rehabilitation and Protection of Water Towers; • Strengthening Environmental Governance; Advertent Weather Modification; Rehabilitation of Urban Rivers; Promotion and Piloting of Green Energy; • The Plastic Bags Initiative; Forest Conservation and Management; Wildlife Conservation and Management; Water Resource Management; • Provision of Water to Poor Unserved areas including informal settlements; Trans-boundary Waters; Water Harvesting and Storage; • Urban and Rural Water Supply; Water Research; • Irrigation and Drainage Infrastructure; Irrigation Water Storage; Irrigation Water Management; • Promotion of Drip Irrigation, Green Houses and Renewable Energy; Land reclamation; • Integrated Regional Development, Policy, Legal and Institutional Reforms.
Somalia	National Development Plan (NDP-9), 2020-2024	• Water management projects (including river management and irrigation) • Mobilization of resource for large-scale investments in watershed management and infrastructure to mitigate the impact of extreme cycles of rainfall, floods and drought • Rehabilitation of the pre-war irrigation and flood control infrastructure in southern Somalia to improve supply of surface water availability to agriculture • Greater access to clean water and sanitation • Repair of old water infrastructure • Development of water resource infrastructure (tube wells) • Availability and access to safe and clean drinking water for all the people. • Water management through water policies and construction of dams
South Sudan	Water, Sanitation & Hygiene (WASH) Sector Strategic Framework	• Review of Existing Policies and Legislation • Creation of an Enabling Environment for water resources management • Demand Creation for water and sanitation services • Accelerated Supply of water and sanitation services • Emergency Preparedness and Response (EP&R) • Development of guidelines, procedures, regulations and bylaws for involvement of Public Private Partnerships
Sudan	The Twenty-Five-Year National	• Protecting natural and water resources, optimizing their use and averting the threats of environmental and dangerous toxic wastes.

Country	Legal/Policy Documents	Key Strategies/Interventions
	Strategy 2007-2031	• Maximizing the benefits of membership to the Nile Basin Initiative that aims at collective management and use of shared of waters, and realization of sustainable development in this area. • Working and coordinating with other countries of the Nile Basin to benefit from the artesian waters particularly the waters of the Nubian sand rocks. • Fostering human resources by training, rehabilitation and provision of basic social services such as health, education and potable water • Mobilizing extra financial resources to fund infrastructure projects in a manner that realizes the best ratio in terms of individual share in health and education services, drinking water and other social services. • Developing available water by increasing reservoirs and rivers and ravines storage capacity, exploiting artesian water, expanding water catchments methods and providing drinking water for societies and livestock • Rehabilitating irrigation services in order to upgrade the efficiency of water uses, introducing appropriate technologies to optimize water uses and disseminate water awareness.
Uganda	Third National Development (NDPIII) 2020/21 – 2024/25 Uganda Vision 2040	• Rural water supply targeted at 85% in NDPIII and 100% in Vision 2040 • Urban water supply targeted at 100% both in NDPIII and Vision 2040 • Sanitation (improved toilet facilities) target at 40% in NDPIII and 100% in Vision 2040 • Hygiene (handwashing) targeted at 50% and 100% in NDPIII and Vision 2040 respectively • On Climate Change, Natural Resources, Environment, and Water Management, NDPIII aims to stop and reverse the degradation of Water Resources, Environment, Natural Resources as well as the effects of Climate Change on economic growth and livelihood security. Expected results relate to; increasing land area covered under forests and wetlands, increasing compliance of water permit holders with permit conditions and enhancing the accuracy of meteorological information.

Appendix 4. Inland Navigation System within Context of a Bulk Cargo Transportation system[76]

[76] NBI (2012). State of the River Nile Basin 2012. Nile Basin Initiative Secretariat, Entebbe, Uganda.