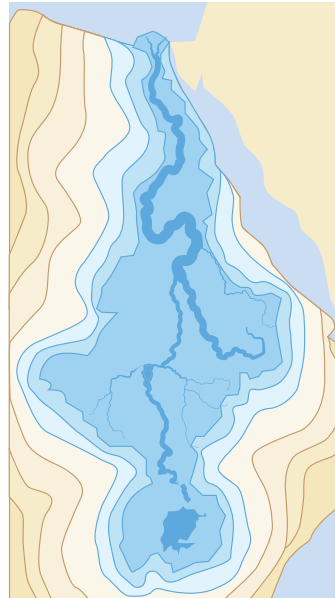
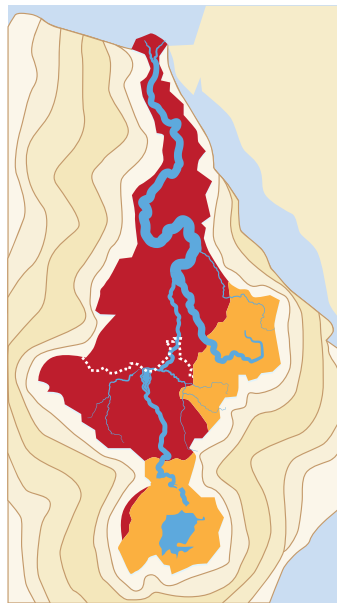


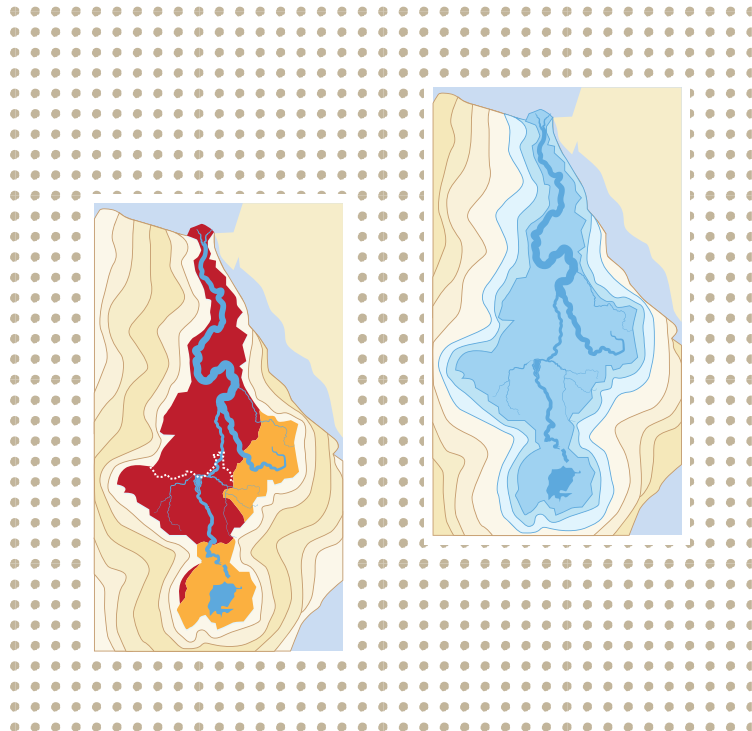
BLUE PEACE

for the **NILE**



BLUE PEACE

for the **NILE**





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PREFACE

It is my pleasure to present our report Blue Peace for the Nile. Strategic Foresight Group has been engaged with trans-boundary water issues since 2008 in Asia and the Middle East. With this report, we extend our work to Africa.

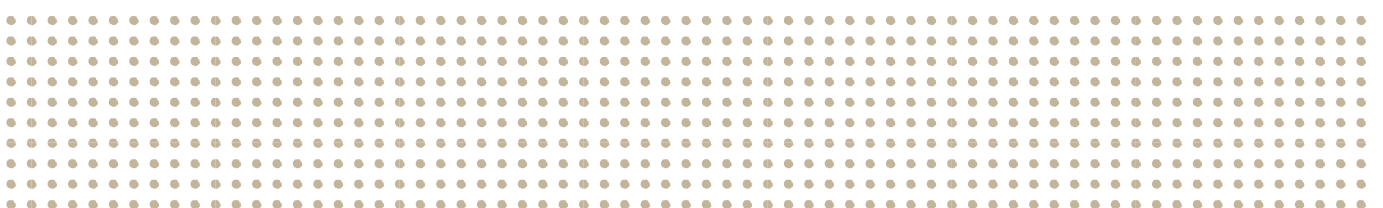
The Blue Peace approach advocates collaborative, comprehensive and sustainable solutions to trans-boundary water issues. It promotes engagement of mainstream decision makers and national leaders to address the water issue, going beyond the conventional approach over dependence on the domain ministries. It also explores how water can be used as an instrument for peace.

The countries of the Nile Basin have made commendable progress in regional cooperation under the auspices of the Nile Basin Initiative. They have also encountered difficulties and differences of opinion on some of the key legal and political issues. We hope that the recommendations made in this report will help strengthen institutional cooperation, overcome political and legal hurdles and build on technical cooperation.

This report has been possible with support from the Government of Switzerland, and particularly the Swiss Agency for Development and Cooperation (SDC) as well as the Political Directorate of the Federal Department of Foreign Affairs. We appreciate their cooperation in co-hosting a high level workshop in Zurich in February 2012, with senior government officials, parliamentarians and experts participating from Burundi, Rwanda, Kenya, Uganda, Tanzania, Sudan, South Sudan, Ethiopia and Egypt. We have also gained from insights and information shared by a large number of experts and officials in Kenya, Uganda, Tanzania, Rwanda, and Egypt in their interaction with the teams of Strategic Foresight Group during visits to these countries for field research. We had enriching discussions with officials of Burundi, Ethiopia, and Sudan at the World Water Forum in Marseilles, France, in March 2012 and Africa Water Week in Cairo in May 2012 as visits to these countries were not possible. We wish to express our appreciation to Hon. Charity Ngilu, Kenya's Minister for Water Resources and Chair of Nile-COM until July 2012, as well as the officials of the Nile Basin Initiative Secretariat for their ideas and interaction. However, the analysis and views expressed in this report are only of the Strategic Foresight Group. They do not in anyway represent the views of the Government of Switzerland or any of the governments in the Nile basin.

The report is thus a result of a comprehensive international effort, primarily with input from the Nile Basin countries. It presents an overview of challenges from a futuristic perspective. Much has been published about the past and present situation in the Nile Basin. However, it is important to examine trends and discontinuities for the next 40-50 years. It is an insight into the future that will help us to prepare policy options.

The recommendations are divided into political and technical components. While we appreciate the

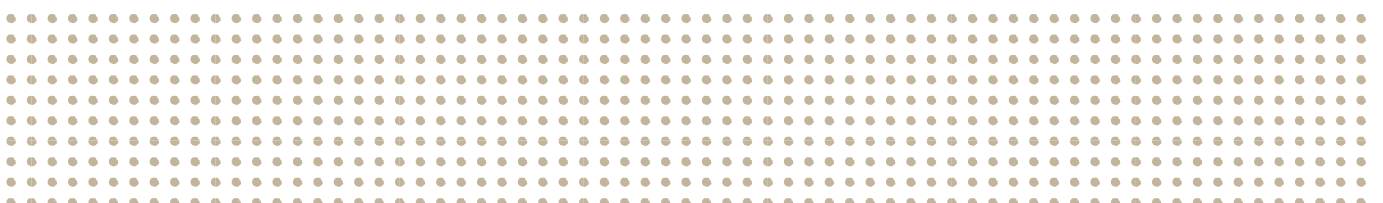


groundwork laid by the Nile Basin Initiative in technical areas, a more comprehensive approach is required for institutionalising political cooperation. It is essential to create an institutional architecture which can address the current political differences and prevent future political problems. Since the future of the Nile is not only about water but also about climate, food, health, electricity, social stability and national security of all countries in the basin, it is important to engage Heads of Government in leading the process of cooperation. The report calls for an urgent and informal retreat of Nile Ministers of Foreign Affairs and Water Resources at a neutral location outside the Nile Basin to examine our recommendations.

We hope that such an informal retreat will take place soon in 2013, International Year for Water Cooperation, and that our analysis and recommendations will contribute to a constructive policy discourse in the region making greater cooperation feasible.

Sundeep Waslekar
President
Strategic Foresight Group

Mumbai, March 2013



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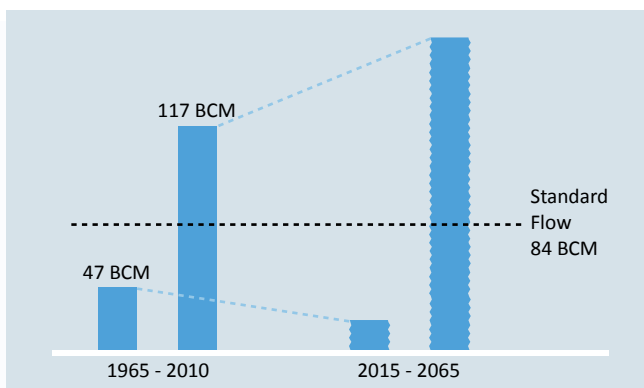
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OVERVIEW

The people of Rwanda, Burundi, Tanzania, Kenya, Democratic Republic of Congo, Uganda, Eritrea, Ethiopia, South Sudan, Sudan, and Egypt to varying degrees depend on the Nile River. The Nile River system has the White Nile originating in Lake Victoria in the South, or in Burundi if rivers that feed into Lake Victoria are taken into account; and the Blue Nile which originates mainly in Ethiopia. The two Nile Rivers merge near Khartoum in Sudan and enter Egypt as one river. The term Nile is therefore used to encompass the entire Nile system, including White Nile, Blue Nile (also known as the Eastern Nile) and tributaries, unless otherwise specified.

The flows of the River Nile as measured at Aswan on the border of Sudan and Egypt experience very high degree of fluctuations, rendering the management of trans-boundary water very difficult.

Oscillations in Nile Flow



In the last 150 years, the lowest recorded flow at Aswan was 42 BCM (1913-14) and the highest was 150 BCM (1878-79), whereas the mean annual flow from 1900 to 2004 was 85.31 BCM. The flow has oscillated between 117 BCM to under 50 BCM in the half century from 1960 to 2010.

The fluctuations in the flow of watercourses are likely to increase in the twenty first century. The Nile

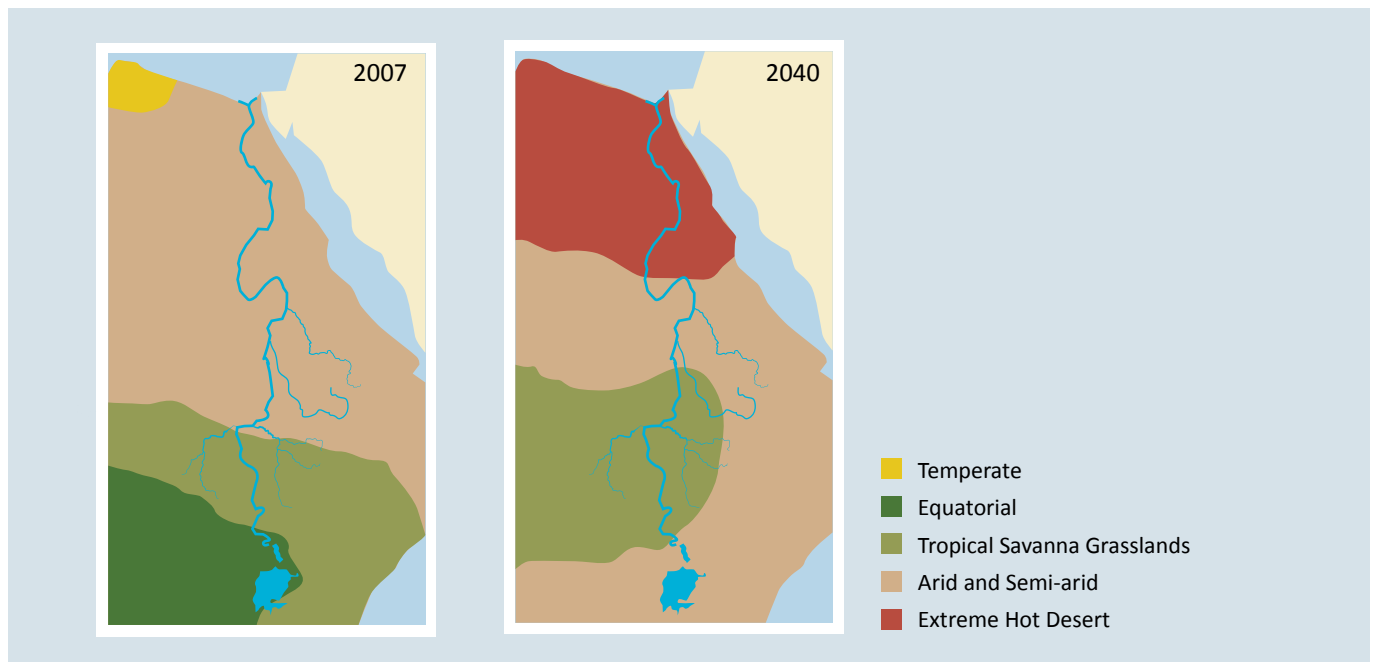
river basin is witnessing a change in rainfall patterns with changes in seasonal periods, and shorter bursts of intense rains that are too rapid for agricultural growth. Climate change models predict increase or decrease of 15-20 per cent precipitation on an annual basis. However, most models concur that irrespective of the overall annual quantum, erratic patterns of rainfall and concentration over fewer days would affect productivity of agriculture. If the experience of Ethiopia, Kenya and Sudan in recent years is used as a basis, and also if experience from other developing countries is considered, depletion of water resources during relevant seasons for agriculture can lead to a decline in yield by up to 50 per cent.

It is expected that temperature across the Nile Basin will increase by 1.5 – 2.1 per cent by 2050. Almost the entire Nile region may become arid to semi-arid in the next 30-40 years which will significantly reduce agricultural land.

Most of equatorial Kenya is getting drier since 1962. From 1960 to 2000, droughts have been witnessed every 2 to 3 years. Since the 1990s prolonged droughts exceeding five years have occurred regularly. The pattern in the last few decades clearly shows the gradual expansion of arid and semi-arid area initially surrounding the Nile Basin and eventually encroaching upon the basin itself. The continuation of this trend is bound to lead to the narrowing of fertile area. It will be increasingly confined close to the banks of the river with much of the remaining basin turning into an arid or semi-arid zone. The expansion of arid and semi-arid areas is concurrent with rise in temperature, which leads to increase in water need of crops, thereby effectively bringing down the crop yield per acre.

Floods and droughts have caused immense damage to the Nile River basin countries both in terms of people

Climate Change in the Nile River Basin



affected as well as economic damage. Between 1900 and 2012, there have been almost 140 incidents of floods in the Nile Basin. More than 100 of them occurred in Ethiopia, Sudan, South Sudan, Kenya and Tanzania. During this period, more than 10 million people living in the Nile basin were affected by floods with around 4000 casualties.

Droughts in the Nile River Basin have proved to be even more fatal than the floods. Between 1900 and 2012, there were almost 70 incidents of drought. Out of them about 55 incidents took place in Ethiopia, Sudan, South Sudan, Kenya and Tanzania. Around 170 million people have been affected by droughts in the last century with half a million lives lost.

From 1970 to 2004, Tanzania, Kenya, Sudan, South Sudan, Ethiopia have had more than 10 droughts; Uganda has had 6-9 droughts; and Rwanda and Burundi have had 3-5 droughts.

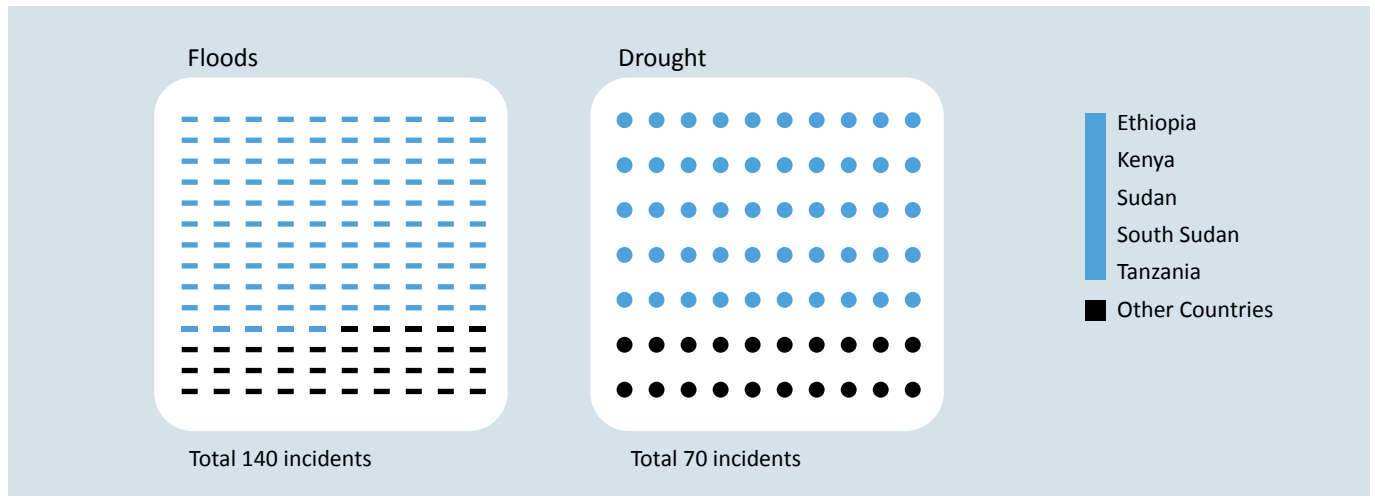
The experience of the last 30 years indicates that the five countries have greatest exposure to risks from floods and droughts in the next 30-40 years as well.

The Nile Basin is suffering from land degradation on

account of deforestation, urbanisation, and over grazing. It results in

- ≡ **Soil Erosion and Sedimentation:** Due to its topography and torrential rainfall, the Blue Nile catchment faces high rates of sedimentation as compared to the White Nile, whose sedimentation is largely retained in the Equatorial Lakes and the Sudd region. While the Nile catchment's Precipitation/ Runoff ratio is estimated at a low rate of 5.5%, the ratio of the Blue Nile catchment on its own is 20%. Sedimentation has a negative effect on reservoirs built along the Nile River Basin. It clogs the area thereby reducing the amount of water that is to be stored.
- ≡ **Desertification: Desertification threatens 40 to 80 per cent territories of countries in the basin.** While it is difficult to specify the precise year, sometime in the course of the twenty first century, this risk is set to threaten transformation of the Nile countries into arid and semi-arid countries. **The countries facing maximum risk of desertification are Ethiopia, Kenya and Sudan, some of the same countries that face the twin challenges of floods and droughts.**

Countries Severely hit by Flood and Drought between 1900 and 2012



≡ **Sand Encroachments:** Instances of sand encroachment in Sudan are increasing, whereby the entire strip of the country along the Nile especially between Delgo and Karima in northern Sudan is threatened by it. Sand dunes on the eastern bank of River Nile in Sudan and encroachments in north-central regions can threaten the river’s course. Sand encroachment is also affecting the productivity of soil which has been witnessed extensively in the Gezira scheme and also in some areas of North Kordofan, North Darfur and Kannar in the Northern State of Sudan. In the Dongola-Merowe region of Sudan, the area covered by sand dunes increased from 51.2 km² to 61.2 km² between 1976 and 1996 and decreased to 35.1 km² in 2000. This decrease could be attributed to an increase in the area covered by gravel and/or coarse sand. In Egypt, active sand dunes and encroachments occupy more than 16.6 per cent of the country’s total land area. Sand encroachment in Egypt is further enhanced by the erratic rainfall, active winds, and scarcity of plant cover. Some inactive sand accumulations have been noticed in the eastern side of the Nile delta and in the Sinai Peninsula.

While factors discussed earlier are bound to affect the availability of fresh water in quantitative terms, each and every country in the Nile Basin faces severe

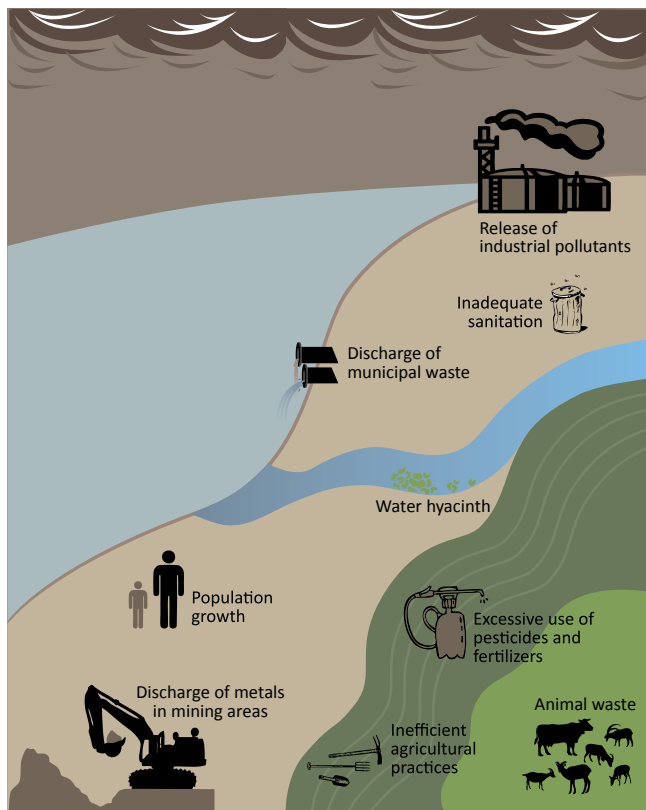
challenge with regards to deterioration of the quality of water, growing pollution, in some cases spread of water hyacinth, with implications for health and development.

The capacity for monitoring water quality is grossly inadequate across the basin, with some variation between countries, due to shortage of laboratories, shortage of equipment, trained personnel and testing facilities for all relevant parameters and absence of clear legal frameworks. While this is the situation within countries, it is not clear how trans-boundary flow of pollutants and the process of quality deterioration can be managed.

The crisis of climate, water flows and water quality have combined to result in the weakening of food security in the region.

Beans, maize, millet and sorghum are produced locally and exported to countries within the basin. Uganda, Ethiopia and Tanzania are the largest regional exporters of food staples. Sudan, Kenya and Egypt are the largest importers of food in the region from regional, as well as international sources. Wheat, palm oil and sugar are the top imported food crops in the Nile Basin countries whereas coffee, tea, tobacco are the main exports for all countries, except Sudan and Egypt. Egypt mainly exports oranges and rice, whereas Sudan exports sesame seeds and cotton.

Deterioration of Water Quality in the Nile

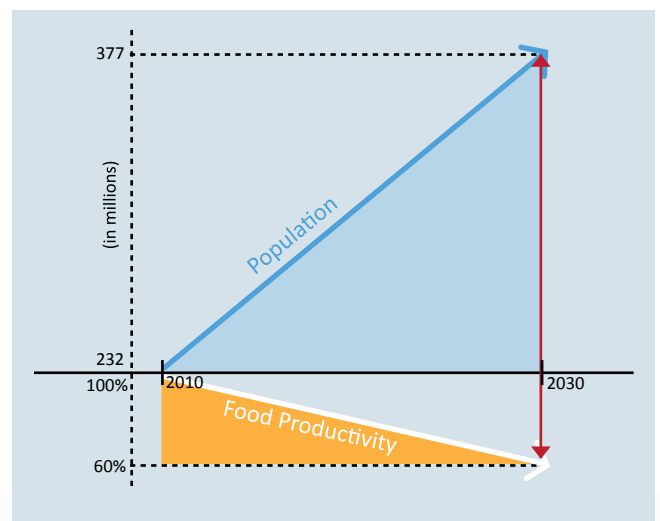


The source of imports and destination of exports is predominantly outside the basin. Wheat imports are mainly sourced from Russia, Ukraine, Argentina and USA to the Nile basin countries, whereas maize is sourced from India and palm oil from Indonesia and Malaysia. Egypt and Sudan mainly export their produce to Asia and the Middle East and also to Europe and North America in smaller quantities. Uganda mainly exports to the European Union.

Food deficit within the basin has created need for food aid. Over 35 per cent of the population in Rwanda, Burundi and Ethiopia is food insecure and depends on food aid. About 25 per cent of Kenyans and Tanzanians lack adequate access to food and risk dependence on external aid. Conflict ridden Sudan and South Sudan's food insecurity is unclear although it is estimated that the vast majority of the population, especially in western and central Sudan and along the disputed new borders are food insecure. Egypt has been receiving subsidised food grains as a part of its bilateral security relationship with the United States.

Food insecurity is expected to increase in the next 30-40 years due to drop in agricultural productivity by up to 50 per cent, which is expected to be caused by rising temperature, climate change, drought and reduction in rainy season to narrow and intense period (irrespective of whatever happens to the annual average precipitation levels). This can also lead to drop in food production by 30 to 50 per cent. During the same period, population of the Nile Basin will double. Therefore, per capital food availability can decline substantially, creating need for food imports and food aid.

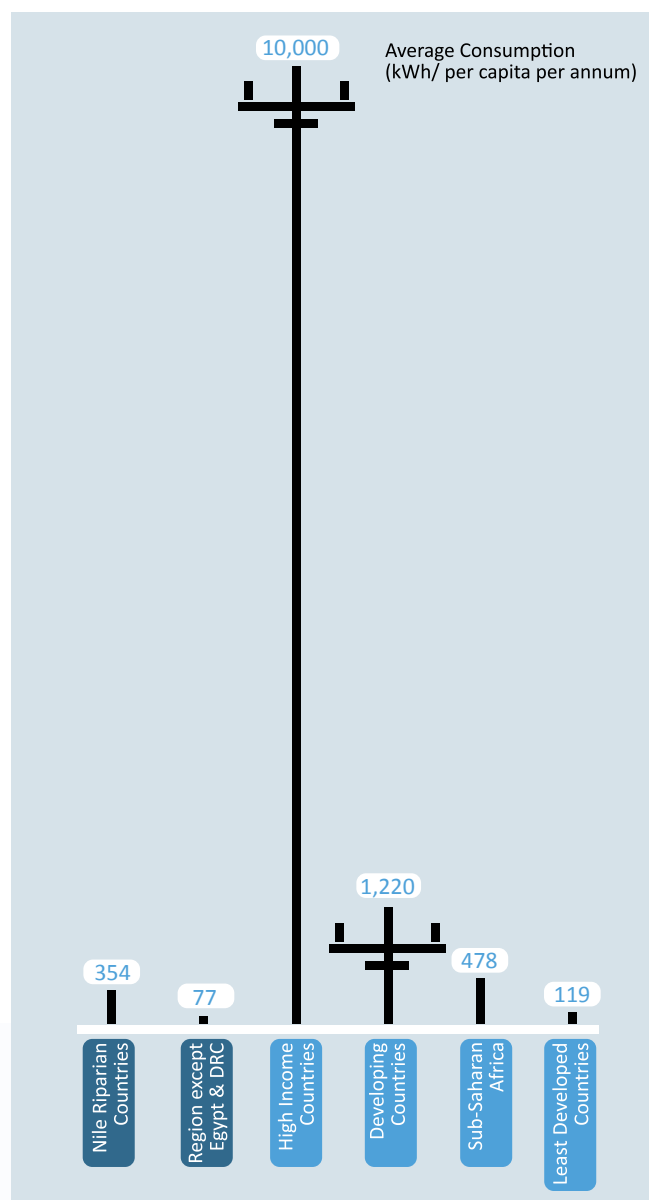
Increasing Food Insecurity



While some countries in the Nile Basin depend on food aid from foreign countries, they have been offering their land at extremely low rates and water almost free to foreign investors for export of agricultural produce. Thus, the water of Nile River is exported in virtual terms and used for other countries outside the basin, while the people in the basin face food insecurity.

In order to improve food security, the countries in the region will need to improve farm productivity and expand irrigation, including drip irrigation, on a large scale. There is potential for **increasing irrigated area by almost 7-8 million hectares in upper riparian countries. But it will require financial resources to the tune of US\$ 50 billion.** Most of this requirement

International Comparison of Access to Electricity



will be in the upper riparian countries.

Besides food insecurity, Nile countries also suffer from energy insecurity. As a result of extremely low electrification rates with the exception of Egypt, over 80 per cent of the region’s population relies on traditional methods of fuel, firewood, charcoal, certain crops or manure.

The Nile countries plan to install additional capacity of at least 30,000-35,000 MW over the next 20-30 years, for domestic consumption and exports. Ethiopia alone accounts for 50-60 per cent of this projected

expansion. **The cumulative cost of investment in power sector for the Nile countries is expected to be US\$ 60 billion**, inclusive of direct and indirect costs.

A US\$ 30 billion bill for Ethiopia alone is almost equivalent to its GDP for the year 2011. With per capita income under 400 dollars (barely dollar a day income) and government budgetary outlay of US\$ 4 billion, there are fiscal and economic limitations on the country’s ability to raise resources from within. According to some media reports, Ethiopia can fund about 20 per cent of the cost of the Grand Renaissance and other dam projects. It has to depend on other sources, including China, multilateral organisations and donor funds for 80 per cent of the financial requirements.

The other countries in the Nile basin will have to budget around US\$ 1 billion annually. For many of these countries, this exceeds their total annual expenditure (as per 2010 budget) and will put them in further debt. For example Uganda, which has some of the largest future plans had total budget outlay of US\$ 2.75 billion in 2010. Tanzania which has planned for over 20 Hydro power projects saw a 2010 expenditure of US\$ 5.21 billion. These costs do not include the current and future regional plans to build grids and regional power lines.

Besides financial costs, there are also social and economic consequences of large dams. There are questions of settlement of affected population and respect for their human rights. Overall, the challenge of energy security is a compound challenge of power production, mobilising financial resources and addressing socio-economic issues of population in affected areas.

At a time when the Nile Basin countries are facing critical challenges for their future, they are involved in a legal and political discord on the proposed Comprehensive Framework Agreement for cooperation in the basin, and particularly its proposed Article 14 (b). While the CFA was drafted in 2010, there is a long history of negotiations and treaties

involving the Nile Basin countries. The legal history can be traced to the 1902 agreement on the Nile between the then colonial powers. Since then Egypt and Ethiopia have negotiated and signed agreements on the flow of the Nile. The most significant of them is the 1993 treaty signed by the heads of the two governments and deposited with the UN. It would be useful to see how this bilateral treaty relates to the multilateral CFA. The formation of South Sudan as a sovereign state may add another element to the legal challenges. The differences over legal and political issues threaten the political unity of the basin, with a risk of undermining confidence of the international aid and investment community in the basin. More significantly, it poses the risk of depriving people of the basin of the opportunity to live and grow in peace and harmony, achieving economic development and realising their full potential.

SUMMARY OF RECOMMENDATIONS

Premise: Political unity of the Nile Basin should be achieved and fostered through the benefit sharing approach.

The Nile Basin Initiative represents a highly successful mechanism to promote technical cooperation between the Nile Basin riparian countries. However, it has been facing a political deadlock over the finalisation of the Comprehensive Framework Agreement (CFA) and in particular Article 14 (b) about the competing rights of riparian countries to use the trans-boundary water.

The governments of all Nile countries have expressed desire to work together and achieve political unity of the basin. This sentiment was evident in statements made by ministers attending the meeting of the Nile Council of Ministers (Nile-COM) in July 2012 at Kigali, Rwanda. Here, the term ‘political unity’ represents integrity of the Nile Basin as one basin with all riparian countries being members of a basin organisation as sovereign states.

Any way forward has to be based on the principle of cooperation and benefit sharing among all the countries that presently constitute the Nile Basin. The division of the Nile basin into White Nile and Blue Nile (Eastern Nile) sub-basins is not an effective option since the political deadlock is primarily between members of the Blue Nile basin countries. There can be separate organizations of White and a Blue Nile area, for promoting certain development projects, as the NBI already has through its two subsidiary action programmes. However, separate organization of technical projects should not be confused with the issue of political unity of the Nile Basin.

The enforcement of the CFA in the area under jurisdiction of present signatories is also not an effective option, since more than 70 per cent basin

area, and more than 50 per cent of basin population would be out of the scope of such an arrangement. In other words, as the present 6 signatory countries of the CFA account for less than one third of the basin geography and less than half of the basin population, an arrangement confined to them would result in the Nile Basin being truncated to a small and unviable size of its real self. Therefore, while the process of CFA endorsement goes on, as desired by the present signatories, it is also important to find various mechanisms which can ensure political unity of the Nile Basin.

The Nile Basin countries require in excess of US\$ 100 billion for the development of hydro-electricity (US\$ 60-65 billion), irrigation (US\$ 50 billion) and water infrastructure (estimates not available) over the next 20-25 years or almost US\$ 3-4 billion per year. (Since estimates of projected expenditure will have some overlap, the total of US\$ 100 billion is less than the sum of its parts.) More than 70 per cent of these financial resources are required by 6 countries that are the present signatories to the CFA. As economies of most Nile countries are weak as demonstrated in low per capita income, poor infrastructure and undeveloped private sector, they substantially depend on external donors, including both traditional and newly emerging donors, and multilateral organisations to raise US\$ 100 billion for energy, water and food sector, which would be in addition to other human needs such as health and education. It would be impossible to raise these funds from multilateral organisations in the absence of political unity of the basin and guarantee of trans-boundary environmental impact and techno-economic assessments that political unity can deliver. It is possible to raise some funds from newly emerging donors from Asia, but it is known that Asian investments have their own limits and are linked to

specific quid pro quo. Therefore it would be difficult to expect to raise US\$ 100 billion for water, food and energy sectors. If Nile Basin countries wish to bring about socio-economic development, they have to be in a position to attract international funding, which would be only possible if there is the context of harmony.

There is a fresh opportunity for achieving political unity since new governments are taking power in Egypt and Ethiopia, the two main parties, at the time of publishing this report. The process of internal political consolidation, which began in 2012 in the two countries, will go on through 2013. This offers a window of opportunity for the new governments to explore new and renewed ideas to lead all basin countries onto a path of cooperation. In October 2012, Egypt sent a large delegation of NGOs to Ethiopia and other riparian countries to initiate a new process of building good will. The efforts to reactivate ENTRO is also a positive development.

This report proposes several mechanisms to achieve and enhance regional cooperation with benefit sharing approach in the Nile Basin and also to improve domestic governance, efficiency and demand and supply variables within each of the Nile countries.

Component A- Regional Cooperation

1. Informal Meeting of the Nile Ministers of Foreign Affairs and Water

Several proposals made here are politically challenging. They have potential for huge benefits, but also require high degree of political understanding and compromise. This can be best done in an informal meeting of Ministers of Foreign Affairs and Ministers of Water and Irrigation of all Nile countries. The meeting should be an informal gathering or a retreat and the venue could be outside of the Nile basin. In a formal meeting, the ministers are bound to present the positions of their countries and there is less flexibility. They are usually accompanied by senior

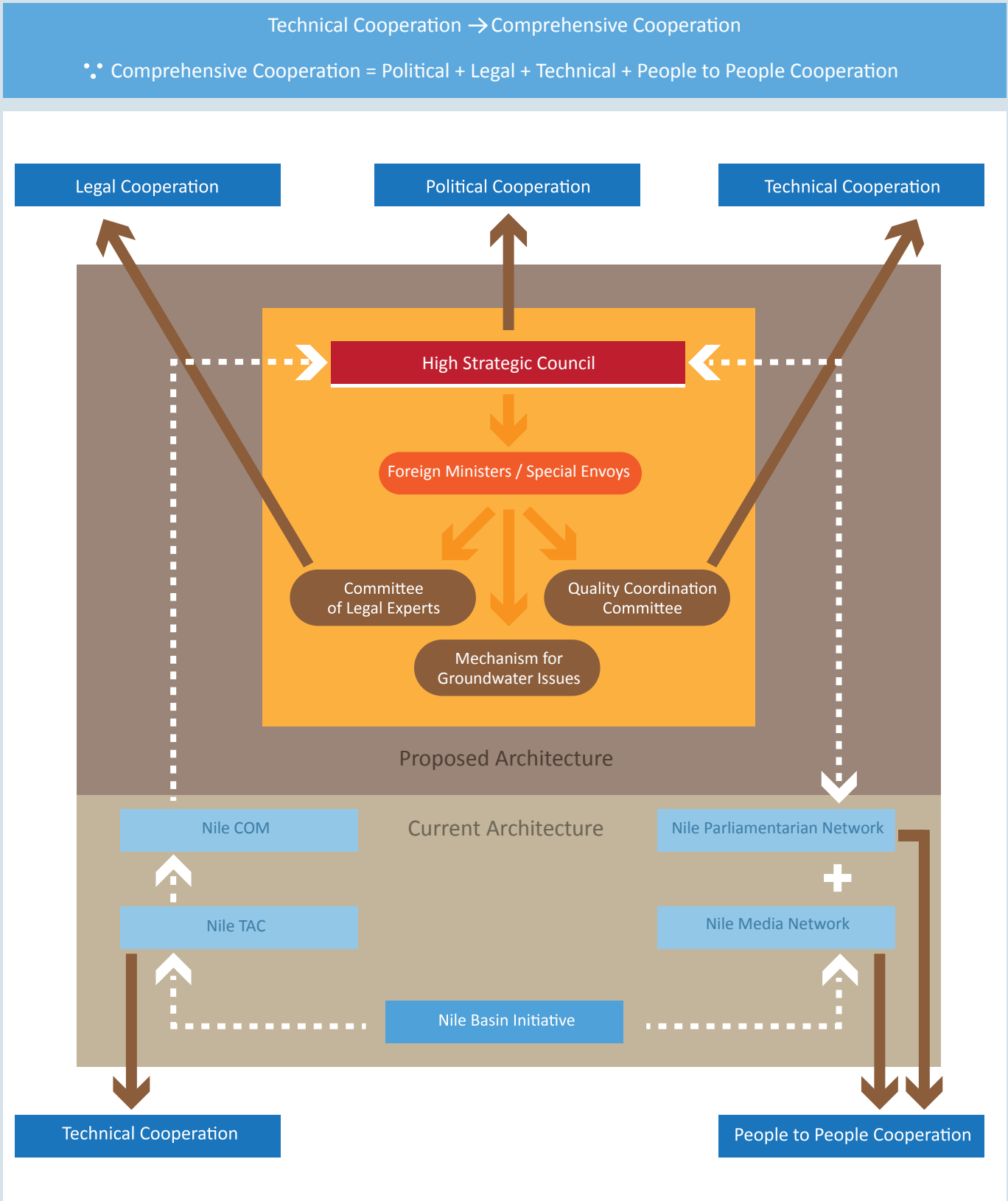
civil service officers and they present positions which are prepared by these civil servants. In an informal meeting there is a lot of flexibility. Ministers can interact with each other in an open manner without conventional constraints. They can have discussions without being bound by treaty obligations. This makes it possible to reach common ground. It is also important that the participants in this meeting are not merely Ministers of Water and Irrigation but also Ministers of Foreign Affairs, since the latter seem to command greater political authority in Nile countries than their counterparts in Water Ministries. As Ministers of Foreign Affairs have a wider perspective of political, economic and social issues, they are in a much better position to form a view on ideas that can change dynamics on the basis of a common position. However, it is also important that the Ministers of Water and Irrigation are part of this retreat since they have domain authority.

Once a common position is identified, the ministers can channelize it into official processes and convert it into an intergovernmental treaty or a MoU. Or they may choose to recommend a summit of Heads of Government to take a final decision on their proposals. This method of informal interaction has been used by several countries around the world to resolve disputes in difficult situations. It is recommended that the leaders of the Nile Basin Countries consider this approach to examine proposals put forward in this report.

2. High Strategic Council should be established to address core issues and a Committee of Legal Experts reporting to the High Strategic Council should be established to address outstanding or ambiguous legal issues.

First, it is recommended that a High Strategic Council should be established to address difficult but significant issues which are core to the future of the Nile Basin. The Council should be at the level of Heads of Government and meet once a year. The

New Architecture for the Nile Basin



Heads of Government should designate either Foreign Ministers or Special Envoys to meet during the year, as and when needed. The High Strategic Council should receive political input from the Nile Parliamentary Forum with the latter being restructured as explained in Recommendation 5. The High Strategic Council should receive specialised legal input from the Committee of Legal Experts on outstanding and ambiguous legal issues (Recommendation 2.2) and Quality Coordination Committee (Recommendation 3). The High Strategic Council should also receive input from the Nile Council of Ministers (Nile-COM) who in turn obtain support from Nile-TAC (Technical Advisory Committee) of the Nile Basin Initiative.

Second, it is recommended that an independent Committee of Legal Experts be established to consider and clarify the following and similar legal instruments with a view to remove misunderstanding, ambiguity, conflict and to promote cooperation in a manner that will enable sustenance of Nile waters, socio economic development, and environmental sustainability of the basin:

- ≡ Comprehensive Framework Agreement, which has been signed by 6 countries and not signed by 4 countries due to discord over Article 14 (b).
- ≡ The 1929 and 1959 Agreements on allocation of water share between Egypt and Sudan, which are not acceptable to other countries on the grounds that they were signed when the opponents to these treaties in the Nile Basin were colonized, and the application of these agreements to Republic of South Sudan in the context of the laws on state succession
- ≡ Bilateral treaty between Egypt and Ethiopia, signed by Heads of States of two independent and sovereign states in 1993, who are main parties in the Nile dispute, and the question of how it relates to other treaties in the Nile basin
- ≡ The application of the Convention on Biological Diversity (CBD) to the Nile Basin countries, and especially CBD signatories in the Nile Basin to

examine impact and implications for ecology

- ≡ The relevance of African Convention on the Conservation of Nature and other African continental, regional or sub-regional legal instruments such as COMESA and EAC instruments to the Nile basin countries.

Such an independent committee should be established by the mandate of the High Strategic Council, or even Nile-COM if the governments determine that it would be appropriate for such a Committee to precede the High Strategic Council for practical reasons. It should have members from the basin countries as well as independent international experts from outside the basin. It should have a definite but realistic time frame to produce its recommendations.

The Committee of Legal Experts should have two purposes. It should clarify the plethora of laws which can have implications for cooperation in the Nile Basin to propose legal instruments to advance basin-wide cooperation on terms unanimously acceptable to all riparian countries. The Committee should also examine state compliance to the agreements or draft agreements which have been already signed by countries in the Nile Basin and recommend strategies for improving such state compliance.

Third, the governments of the Nile countries should begin informal consultations for alternative formulation of the disputed Article 14 (b) of the CFA. One formulation, had informal acceptance of all countries, **without exception of any country in the basin whatsoever** at the Nile-COM meeting in Bujumbura. It can be re-examined with a fresh conflict resolution approach.

- ≡ “not to significantly harm **current and future uses and rights** and water security of any other member states.” where water security is defined as “ the right of all Nile Basin States to reliable access to and use of the Nile River system for health, agriculture, livelihoods, production and environment.” (Article 2(f)).

The inclusion of “current uses and rights” should address the needs of Egypt and Sudan. The use of “future uses and rights” should address the needs of the upper riparian countries, while recognising the future needs of the lower riparian countries as well.

If this precise formulation is not acceptable, it may be possible to craft another formulation either directly through informal consultations by the member countries or under the auspices of the Committee of Legal Experts proposed earlier.

Fourth, the Nile countries should appoint a specific arbitration mechanism. The CFA does not provide for a specific arbitration mechanism, though its provisions for dispute resolution are based on the hypothesis that the member countries could appoint or approach an arbitration body. Such a vague provision can hinder resolution of disputes. There are two, among others, effective options for appointing an arbitration mechanism.

- ≡ The World Bank, which has played critical role in the establishment of the Nile Basin Initiative, can be a designated arbitration mechanism. It may operate in ways similar to its arbitration services to the Indus Commission by receiving requests from member countries and appointing Neutral Experts or Arbitration Committees to address specific issues, as the case may be
- ≡ If for some reason, the member countries do not want to depend on the World Bank alone for this purpose, they may appoint an Arbitration Quartet composed of The World Bank, UNDP, European Union and the African Development Bank (or the African Union).

Fifth, the High Strategic Council can consider specific sub-regional legal and technical initiatives to address issues arising from specific projects. In 2012, Egypt, Ethiopia and Sudan established International Panel of Experts on Grand Renaissance Dam, also known as the Tripartite Committee of Experts. The Committee comprising of the three countries as well as independent external experts was expected to identify

mutually beneficial options for the construction of the dam. In order for such a panel to function effectively and enable cooperation, it is essential that all parties give information in a transparent manner and uphold the principle of mutual accountability. If the Grand Renaissance Dam Tripartite Committee succeeds in achieving results, based on transparency and mutual accountability, it could be a good example for similar Committees to be formed in future.

3. Coordination of policies on the quality of water and ecological preservation of water resources and wetlands should be a priority.

Article 6 of the CFA proposes “protection and conservation of the Nile River Basin and its ecosystems” which includes improving the quality of water, protecting wetlands, saving biodiversity as well as restoration of depleted resources. The Article also advocates harmonizing regional policies across the basin to achieve this end. It appears that all countries in the Basin have no problem with this Article. It is therefore recommended that practical measures should be adapted to implement ideas embodied in the Article in letter and spirit irrespective of the future of the CFA itself. These include:

- ≡ *Co-ordination of policies related to managing ecosystems*: Harmonization of policies needs to take place at two levels. At the national level, individual countries need to streamline relationship between various ministries and departments responsible for the water quality issues. At the regional level, countries in the basin need to adjust their policies together as they are all dependent on the same water sources and their choices are bound to have impact on the entire basin.
- ≡ *Setting analogous targets*: The Nile Basin countries need to identify similar ‘base line targets’ to achieve, in the context of water quality as well as protection of biodiversity.
- ≡ *Economic valuation of the biodiversity*: It is difficult

but helpful to evaluate direct and indirect returns from protecting the eco-systems in monetary terms.

- ≡ *Polluters pay*: The Nile River Basin countries need to pool internal and international funds to restore extremely depleted areas. Also, they need to lay a standard for industries in terms of pollution and periodically monitor it. The riparian states need to follow the 'polluters pay' scheme where industries which cause pollution beyond the permissible limit need to pay fines or restore the area themselves.

The Nile Basin countries share similar water pollution issues, such as - oxygen demanding substances, improper sanitation, nutrient runoffs from agricultural activities, and industrial and mining related water contamination. In order to combat these problems, the following measures need to be introduced:

- ≡ Monitoring of oxygen demanding substances, COD and BOD, which warm water and reduce water transparency, thus, undermining water quality as well as sediment loads in the catchment of Lake Victoria. Additionally, monitoring contaminants which have bio-accumulation effects in water bodies and affect trans-boundary water resources, including nitrates and phosphates
- ≡ Chemical contaminants from industrial and mining activities need closer monitoring as high levels of heavy metal substances like mercury, cadmium, lead, copper, chromium among other chemicals are consumed by fish through irrigated water
- ≡ Point sites of pollution such as industrial units need mapping and monitoring using analogous terms of reference in all countries.
- ≡ Control of pesticides and fertilizer levels in water bodies is needed. The monitoring of nutrient runoffs can help curb water hyacinth without having to resort to pesticide use
- ≡ As recommended by NBI, regional laboratories can be used in the interim period until adequate water quality monitoring sites are developed in all

countries

- ≡ Current initiatives for controlling water hyacinth in the Lake Victoria region should be expanded to cover as many relevant parts of the Nile Basin as possible.

It is recommended that a Quality Coordination Committee should be established to harmonise legislation, standards, and practices dealing with waste water treatment, water pollution and quality control. Such a mechanism should prepare dynamic inventory of pollutants in different parts of Nile and a public information and warning system. It is recommended that modern management techniques and technologies for the restoration of depleted water resources should be undertaken. It is further recommended that the Quality Coordination Committee should report to the High Strategic Council.

4. While negotiations in the Nile Basin are focussed on surface water, it is necessary to craft agreements that can prevent future conflict over groundwater and also to manage the relationship between groundwater and surface water.

The Nile Basin is estimated to have groundwater reserves of 500 BCM. As of now, less than 5 per cent of the groundwater is utilised. However, there is an increasing trend of using groundwater by digging tube wells, shallow wells, and using pumps in some of the Nile Basin countries.

The need to address trans-boundary aquifers: Most of the countries get their groundwater through direct precipitation/rainfall to recharge their aquifers or from fossil waters stored in their deep aquifers and through seepage or interaction with surface water. These aquifers extend across various countries. Currently, there is no law governing groundwater, specifically for that which is derived from these shared aquifers. The CFA Article 2 clause (b) includes groundwater in its definition of Nile water resources. However

groundwater is missing in most of the political discourse. This issue might crop up in the future as dependence on an aquifer of one country might affect the groundwater levels of the other countries involved. Also, pollution by a country might affect the groundwater in the complete aquifer.

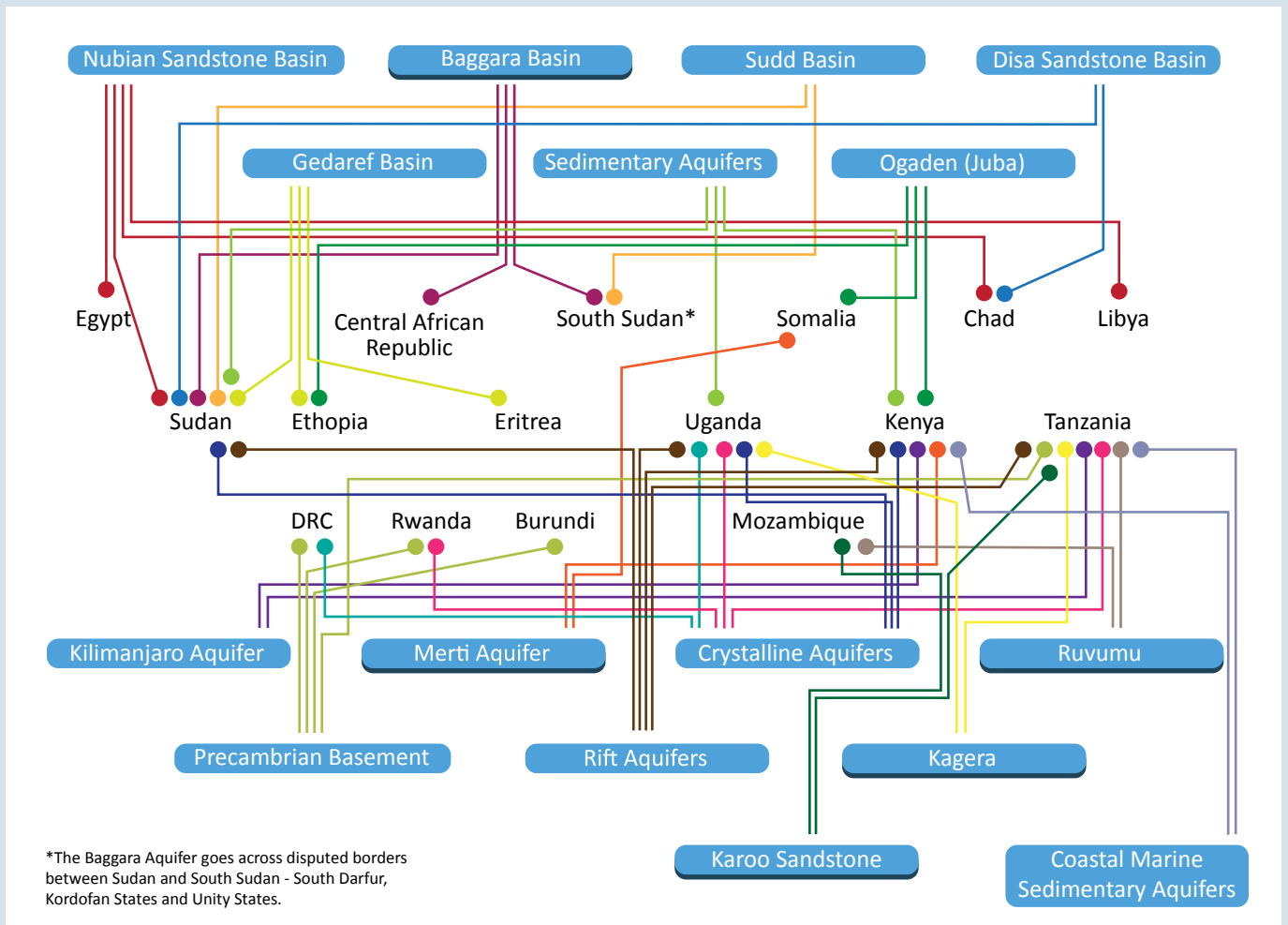
Understanding the interaction between surface water and groundwater: It is essential to understand the overlap between the groundwater and surface water and their effects on each other. Surface water pollution may also lead to groundwater pollution. This has been noticed in Lake Victoria where polluted water from the lake had seeped in as groundwater which is of poor quality and unsuitable for drinking purposes. In the coastal regions this overlap may lead to high levels of salinity. Over abstraction of

groundwater may lead to reduction in the surface water levels. For instance, surface water levels in Lake Alemaya in the Ethiopian highlands, are gradually declining due to over abstraction of groundwater in the adjoining aquifers. It is necessary to introduce trans-boundary laws to protect the quality of groundwater. Perhaps, this can be done under Article 6 of CFA or under a new treaty on groundwater.

5. Political infrastructure of cooperation should be created through parliamentarians and media networks.

The process of cooperation is often difficult for common citizens to comprehend. It is therefore not enough merely for governments to explore means of cooperation in the Nile Basin. It is important to create

Transboundary Aquifers in the Nile River Basin Countries



a political infrastructure of cooperation by developing basin wide networks of parliamentarians and media persons.

The parliamentarians represent people and work closely with governments. Some of them may even join governments at some stage. They have legislative authority to introduce and scrutinise bills. They have extraordinary access to ministers. These assets can be utilised in the interest of basin cooperation. Currently, NBI has established NBI Parliamentarians Forum. It had two meetings in the last 10 years. However, these meetings had a few parliamentarians and a large number of civil society and technical representatives. It is necessary to have a parliamentary network, which harnesses the specific strengths Members of Parliament have. Such a network should have Nile Parliamentary groups in national legislatures, which are linked through pro-active and interested members interaction, rather than the current practice of Speakers nominating a couple of members for an occasional meeting.

The media is another important constituent of political infrastructure of any country. There is already the Nile Media Network, which provides meeting space for journalists from Nile countries. Such a network needs to be sharpened and strengthened with emphasis on the following roles:

- ≡ Agreements between governments and national media organisations for transparency and free flow of information to one another
- ≡ Creating awareness and sensitizing the citizens on water related issues which will increase their involvement and support to the cause of cooperation and improved governance
- ≡ Increasing access to information regarding new technologies
- ≡ Conscious efforts by media to promote investments in the water sector
- ≡ Reaching agreement on reducing mutual hatred and hostile sentiments towards one another

- ≡ Reaching agreement on not spreading rumours against one another
- ≡ Exchange of media persons to check and verify facts related to issues of misunderstanding.

In case of the parliamentarians as well as the media, there is no need to reinvent the wheel. Existing organisations and networks can be strengthened and reoriented for better results.

6. In the long term, the Nile Basin countries can aspire to develop regional cooperation with the Nile and its tributaries as a 'regional common'.

The Nile Basin countries can consider establishing Nile Regional Economic Community. Water is required for irrigation (agriculture), hydro-electric dams (industry), urbanisation, trade, transit and other economic needs. If cooperation in water is integrated into broader regional economic cooperation, it will be possible for parties to appreciate the development needs of one another.

The role of a Regional Economic Community (REC) in Africa has been such that it has helped to develop a level of trust between the countries by working towards economic as well as political integration. The Southern African Development Community (SADC) for example was established to focus on areas of "transport and communication, agriculture, energy and human development". However, over the course of time, its role expanded into "attracting investment into natural resource management, sharing of energy, conflict resolution to cooperation". SADC now has a mandate on Water. In the case of SADC, REC was first established and the vision for water came later. In the case of Nile Basin, technical cooperation in the water sector has already been launched in the form of the Nile Basin Initiative but it can be expanded to cover other aspects of regional integration. Whether a region starts with water or adds water at a later stage in its continuum to evolve a process of cooperation, it is important to note that water is an integrated part

of regional economic dynamics, and not a resource to be utilised in isolation.

The Nile member countries are already members of two regional economic bodies. Countries such as D.R. Congo, Egypt, Ethiopia, Eritrea and Sudan are members of the Common Market for Eastern and Southern Africa (COMESA) while Tanzania is a member of the East African Community (EAC). Rwanda, Burundi, Kenya and Uganda are members of both the organizations with South Sudan expected to join soon. Thus, the Nile member countries have been positively disposed towards institutionalised economic cooperation in Africa. They can draw from their experience of the two organisations, or indeed their analysis of regional cooperation agreements in other parts of the world, to envisage, shape and structure regional economic cooperation agreement in the Nile Basin.

The main difference between the proposed Nile REC and COMESA and EAC is that the latter two, like SADC, are driven by trade and industry agenda, whereas the Nile REC could be driven by water cooperation agenda.

Cooperation in water requires significant trade-offs. Shares of water can be negotiated in exchange for transit, hydro-electricity, agriculture and economic development opportunities. Cropping patterns can be developed on the basis of comparative advantage of natural resource endowment, supported by regional free trade in food and agricultural commodities. The Nile Basin countries should consider establishing a Regional Food Trade Network to formalise informal trade, reduce artificial food scarcity, create regional food buffer stocks, and facilitate judicious balance between food crops and cash crops, as well as drought-resistant crops and water-intensive crops on a regional basis. The NBI has already made small beginnings for regional power trade. The countries are negotiating power trade even outside the formal projects of NBI. Their willingness to explore this avenue demonstrates huge potential for

cooperation, trade and joint investments in power sector. The countries can jointly develop eco-tourism opportunities. Once regional cooperation in water, hydro-electricity, tourism and agriculture grows, trans-boundary cooperation in banking and communication will automatically expand.

Such regional cooperation is only possible if the River Nile and its tributaries are treated as a Regional Common by all governments and people in the region. This will mean ensuring sustenance, quality and flow of the river in the best interest of all people and environment of the entire basin.

Component B- Domestic Governance and Efficiency of Water Sector

7. Cooperation in meteorological data management, particularly for early warning of floods and drought has proved to be easy to achieve. It should be strengthened and extended to hydrometric data management as a confidence building measure.

First, the Eastern Nile region (primarily Egypt, Ethiopia, Sudan and South Sudan) has always been prone to extreme floods and droughts. Floods are commonplace between July-September, with devastating impact on urban centres. There is a good network of meteorological monitoring stations and practice of institutional cooperation with external space agencies at the national level in these countries. There is also good cooperation between them on early warning data management.

NBI's Eastern Nile Technical Regional Office (ENTRO) in Addis Ababa is coordinating the Eastern Nile Flood Preparedness and Early Warning Project (FPEW) by facilitating meetings and information sharing sessions among the Blue Nile countries regarding river flows, flooding, flood risk maps, weather patterns and emergency preparedness. The objectives of the project are "to establish a regional institutional

basis; to strengthen the existing capacities of Eastern Nile countries in flood forecasting, mitigation and management; to promote regional cooperation and last but not the least, to enhance the readiness of Eastern Nile countries for implementation of the subsequent phases of the project.”

In the Lake Victoria Basin of the White Nile, there is Drought Monitoring Centre at Nairobi in Kenya. The functions of the centre include acquiring and managing climate data, monitoring, early warning of extreme climate events, capacity-building, information sharing, and creating new tools, among others.

Despite the existence of institutional infrastructure in Blue and White Nile areas, and extensive cooperation with international organisations both floods and droughts occur regularly with large scale impact on people and environment. It is therefore necessary to improve the efficiency and coordination of the existing data centres and ensure their effective use for the benefit of people through community participation in their work and legislative support for this sector.

Second, it is necessary to develop similar national networks and cooperation in data management with regards to hydrometric monitoring stations, including both quantitative and qualitative data on water resources. Currently, there is active cooperation between Egypt, Sudan and South Sudan with a large network of hydrometric stations managed by Egypt. This needs to be extended to other countries. As the first step, it is necessary to prepare a status report on the current hydrometric monitoring capacity of the Nile Basin, identifying specific deficiencies and proposing ways to address them. Since cooperation in quality monitoring requires special effort, this issue is treated separately as an independent recommendation.

8. All efforts should be made to augment steady and reliable sources of water through canals mitigating effects of evaporation and

evapo-transpiration. Waste water treatment, reforestation, watershed development and other techniques that are environmentally sustainable should be promoted.

First, augmentation of water by reducing effects of evaporation and seepage should be explored. A large quantity of water gets evaporated or lost in seepage in the swamps in the Republic of South Sudan and Sudan. Supply-side proposals to create 18 BCM of additional water are already under discussion.

- ≡ Jonglei Canal Project: Stage 1-4 BCM, Stage 2-3 BCM
- ≡ Bahr El Ghazal Project: 7 BCM
- ≡ Machar Project: 4.4 BCM

These proposals need further examination. If they can add value, their implementation needs to be expedited. However, it is also important that the issues of bio-diversity preservation and environmental sustainability are adequately addressed. Since both the implementation and non-implementation of these proposals carries heavy opportunity costs, a decision that balances human, social, economic and ecological interests needs to be taken by the countries directly involved in the projects.

Second, reuse of water, rainwater harvesting and treatment of waste water needs to be explored. The reuse of water in agriculture is already practised in some parts of the basin. The expansion of this technique across the basin can be examined. Waste water treatment has maximum scope in industrial and urban areas. Also, in industrial and urban settings capturing and harvesting of rain water can be explored, as being increasingly practised in different parts of the world. Rainwater harvesting is particularly relevant in the Nile Basin because of seasonal nature of rain in many parts of the basin. Rainwater harvesting can be done at a small level in housing societies in cities or at a larger level by communities.

Third, in coastal areas small and solar run desalination and brackish water conversion plants

can be established. There is a fascination for large desalination plants in some parts of the world and the Nile Basin countries might be tempted to purchase them but this option has limited application due to heavy financial and environmental costs. It may be possible to establish small plants for desalination or treatment of brackish water which run on solar energy. This can help overcome financial and environmental challenges.

Fourth, reforestation can help raise the level of ground water. In the Nile Basin deforestation is taking place at a fast pace, obviously varying from one place to another. It is important to undertake reforestation on a large scale. Nile Basin needs a coordinated reforestation policy.

Fifth, well designed soil water conservation strategies are required. They should encourage participation of farmers through associations of small farmers. Care must be taken to construct right kind of bunds as per the density of rainfall. Vegetation, ground cover and check dams should be used where appropriate.

Sixth, systematic watershed development can help augment water resources for agriculture. There are many techniques of watershed development.

It is important to assess which specific technique would be optimal for a particular district, depending on the type of soil, terrain, rainfall and other factors. It would be helpful for each Nile country to develop a systematic watershed development strategy and determine most relevant techniques.

9. All efforts should be made to improve efficiency and governance of the water sector, particularly on the demand side, in individual countries – since domestic actions have an impact on overall water resource balance of the Nile Basin.

First, it is important to improve water efficiency of agriculture and rural areas since agriculture is the main consumer of water in the Nile Basin as in most

developing countries. This can be done in various ways, including the following:

- ≡ Understand water deficits arising from higher evapotranspiration than precipitation. For instance Rwanda's Irrigation Master Plan studied the relationship between precipitation and evapotranspiration (P/PET) in order to determine areas with higher evaporation which would require irrigation projects for agricultural expansion in order to find the most viable uses of these projects
- ≡ Use 'Water Footprint' concept as a tool to calculate real water use in agriculture (and also for industrial as well as commercial use). The tool helps to determine economic costs of efficient and inefficient water use. Determine whether water footprint calculated is environmentally and economically sustainable in the long run
- ≡ Construct anti-salinity barrages to improve the quality of water in the river
- ≡ Use drip irrigation wherever possible
- ≡ Maximise the use of drought-resistant crops, such as drought-resistant maize and rice developed in developing countries.

Second, it is important to reduce the unaccounted for water particularly in industry and urban areas. In several countries in the Nile Basin, significant portion of water is lost in conveyance. These include pipeline leakages, irrigation leakages as well as thefts. It is difficult to obtain reliable statistics of conveyance losses, which range from 30 to 50 per cent in different cities in different countries in the Basin.

In some countries water thefts have increased since the drought of 2011. For instance, disconnections of water pipes by thieves who collect and sell water, mugging and some petty thefts of water have become common occurrences in urban slums which lack sufficient access to piped water. As water theft is viewed as a petty offense, there is little judicial consequence of these actions.

Thus, improvement of water infrastructure to improve demand management will also require:

- ≡ Setting up water efficiency standards for water supply systems and industrial sector
- ≡ Upgrading and modernizing water supply and distribution systems particularly as a buffer during droughts and periods of water scarcity
- ≡ Improving energy efficiency in water pumping for urban domestic pipelines
- ≡ Minimizing non-revenue water such as controlling illegal connections, conveyance losses, unbilled water connections. In major cities with pipelines suffering from undetected leaks, the installation of remote sensing technologies to detect leaks could go a long way in reducing water losses
- ≡ Encouraging partnership between the government, municipal authorities and the civil society in order to increase community's water efficiency and security as well as food security.

Third, the Nile Basin countries will need to address the difficult and unpopular subject of water pricing and draw their own conclusions which are socially, economically and politically sustainable.

10. The Nile Basin countries should learn from successful examples of other countries in Africa and elsewhere in the world and adapt best practices to their specific requirements.

The experience of other countries in water governance, conservation, river restoration, quality control, and River Basin management systems in Africa, as well as elsewhere in the world would be of help to the Nile River countries to expand their knowhow and enhance capacity to respond to their challenges collectively and constructively.

The Nile Basin Initiative in the past has undertaken a 'knowledge exchange study tour' to the Senegal River Basin to learn the role of the Senegal River basin organization (OMVS) and identify certain best

practices.

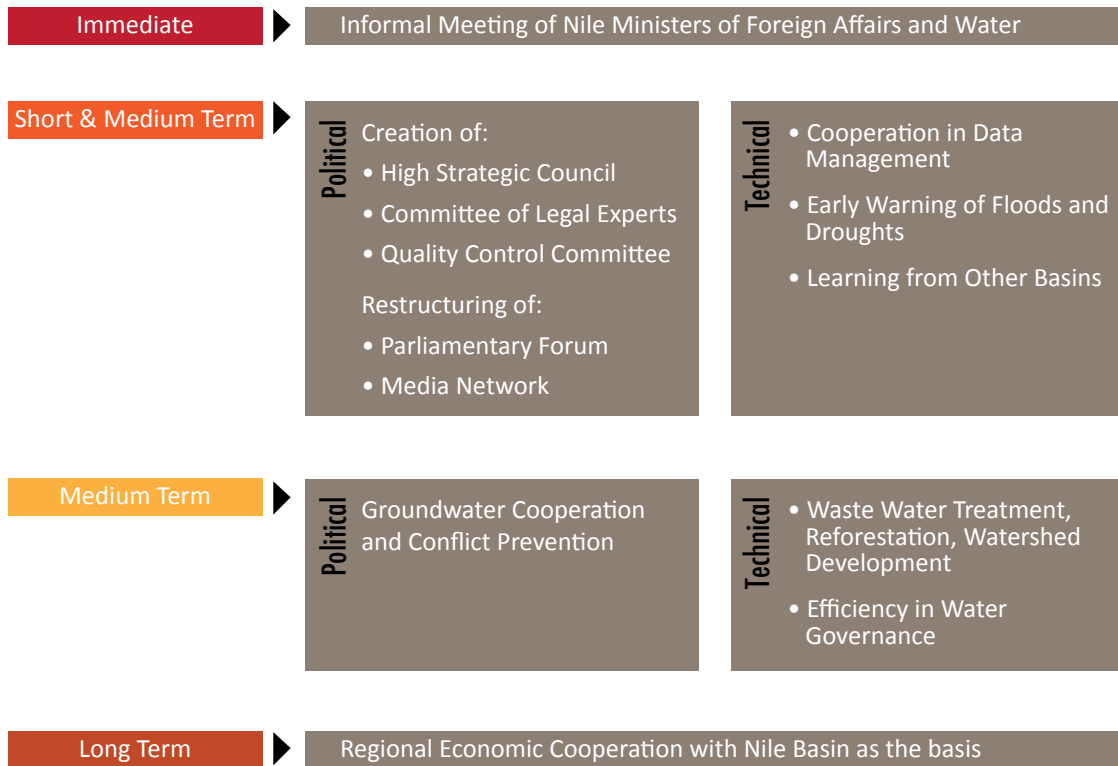
The Nile Basin countries may use the auspices of African Ministerial Council on Water or International Network of Basin Organisations to establish access to some of the countries and basins where they wish to undertake learning journeys.

They may also directly approach countries and regions known for best practices in different aspects of national governance or trans-boundary cooperation of water. For instance:

- ≡ Senegal River for trans-boundary water management
- ≡ Rhine River for trans-boundary water management
- ≡ Southern African Development Community for regional cooperation principles
- ≡ European Union (in context of Directive Framework 60) for cooperation in quality control
- ≡ South Korea for restoration of rivers
- ≡ Singapore for urban water management and waste water treatment
- ≡ Indus Water Commission for arbitration mechanism in case of disputes
- ≡ Israel for drip irrigation and mitigation of conveyance losses
- ≡ Mekong for cooperation in data management.

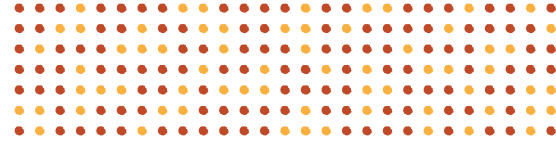
Many of the examples cited above are from developing countries. It is possible to consider other examples from which the Nile countries can benefit. It would be also helpful to learn about new technologies – in particular those using solar energy – in various aspects of water management.

Process for Enhanced Cooperation





PART 1
CHALLENGES

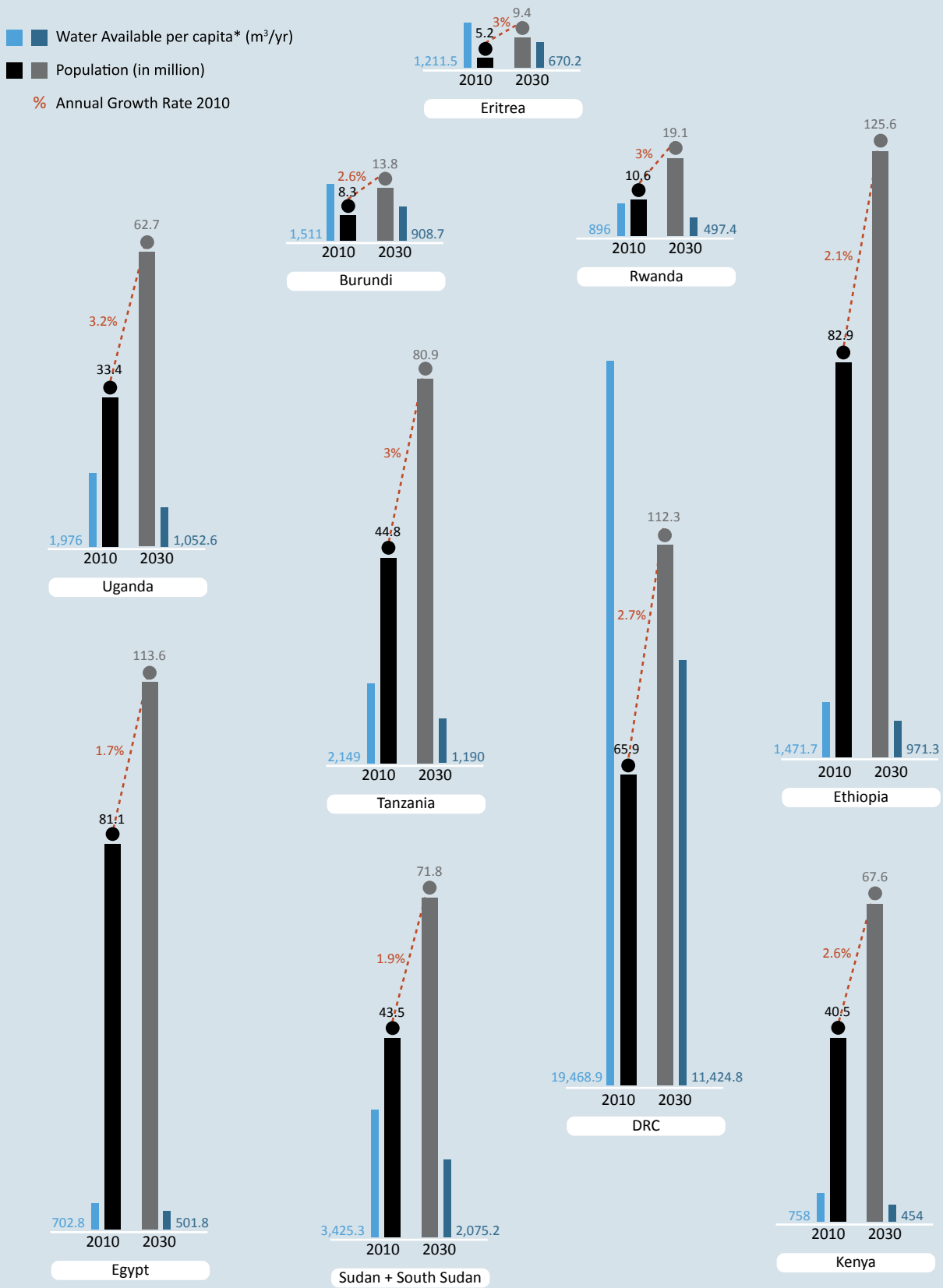


Water Resources of Nile Countries

Country	Total Renewable Water Resources (BCM/yr)	Nile Share in Total Water (BCM/yr)	Water to Non-Nile Basin (Internal and trans-boundary river basins) (BCM/yr)
Rwanda	9.5 <i>SW = 9.5</i> <i>GW = 7 (overlap of 7)</i>	3.47	6.03 (Congo basin, internal sources)
Burundi	12.54 <i>SW = 12.54</i> <i>GW = 7.47 (overlap of 7.47)</i>	3.37	9.17 (Congo Basin, internal sources)
Tanzania	96.27 <i>SW = 92.27</i> <i>GW = 30 (overlap of 26)</i>	6	90.27 (Congo basin, internal river basins)
Kenya	30.7 <i>SW = 30.2</i> <i>GW = 3.5 (overlap of 3)</i>	9.62 (including Mara River, Kenya/Tanzania)	11.08 (internal, sources) + 10 (from Ethiopia's Omo-Gibe basin)
Democratic Republic of Congo (DRC)	1,283 <i>SW = 1,282</i> <i>GW = 421 (overlap of 420)</i>	2.19 (to Semlike)	1,280.8 (Congo Basin)
Uganda	66 <i>SW = 66</i> <i>GW = 29 (overlap of 29)</i>	29.48 to Victoria Nile (4.83 - Uganda torrents to Lakes) + (Contribution from DRC, Kenya, Tanzania, Rwanda, Burundi = 24.65) 36.52 (retained in Uganda)	-
Eritrea	6.3 <i>SW = 6.2</i> <i>GW = 0.5 (overlap of 0.4)</i>	0.6 (from Tekeze)	5.7
Ethiopia	122 <i>SW = 120</i> <i>GW = 20 (overlap of 18)</i>	72.99	49.01 16.1 –to Omo-Gibe Basin 30.9– internal sources
Sudan + South Sudan	149 (Internal = 64.5) <i>SW = 84.5 + 62.5</i> <i>GW = 7 (overlap of 5)</i>	- 34.96 (retention in the Sudd and evaporation) 57 (to Egypt) 57.04 (retained in Sudan and South Sudan)	-
Egypt	57 <i>SW = 55.5</i> <i>GW = 1.5</i>	57	16 (reuse of water)

Abbreviations used: SW = Surface Water, GW = Ground Water

Changing Population and Availability of Water

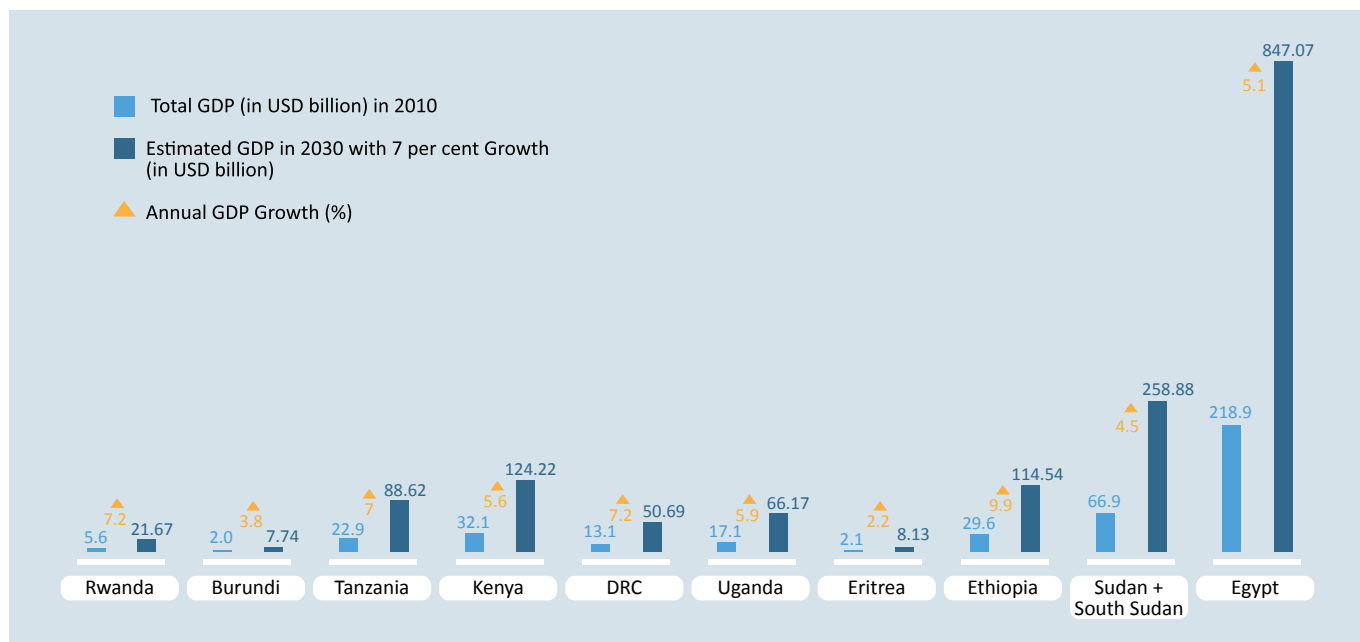


* There are limitations of using per capita availability of water in discerning future water availability

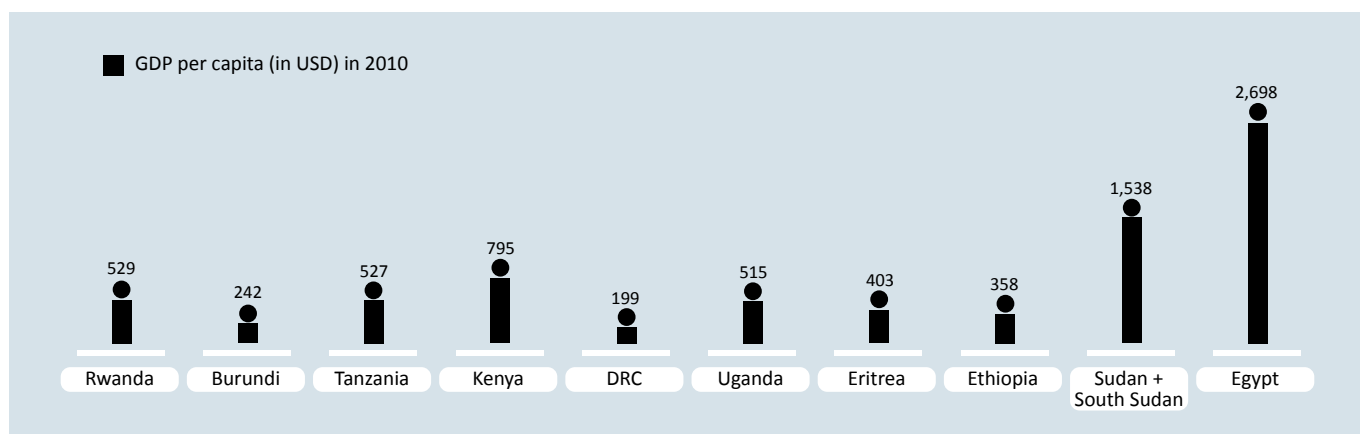
Per capita availability is generally calculated by dividing total annual renewable water resources with population. While this could provide an accurate picture for countries with no dependency on external water resources, it does not provide an accurate depiction for countries with trans-boundary water resources. Taking into account the dependency ratio of the countries provides a much more realistic depiction of future water resources. For instance, Uganda has a 40.9 per cent dependency ratio for its

total annual renewable water resources (Rwanda, Burundi, Tanzania, DRC and Kenya contribute runoff into Lake Victoria). This will be impacted when increased water demand in upstream nations results in reduced water runoffs into Uganda. Egypt which originally had a 98 per cent dependency ratio has been able to bring down its dependency by increasing alternate water resources but still has a 76 per cent dependency ratio (55.5 BCM out of 73 BCM).

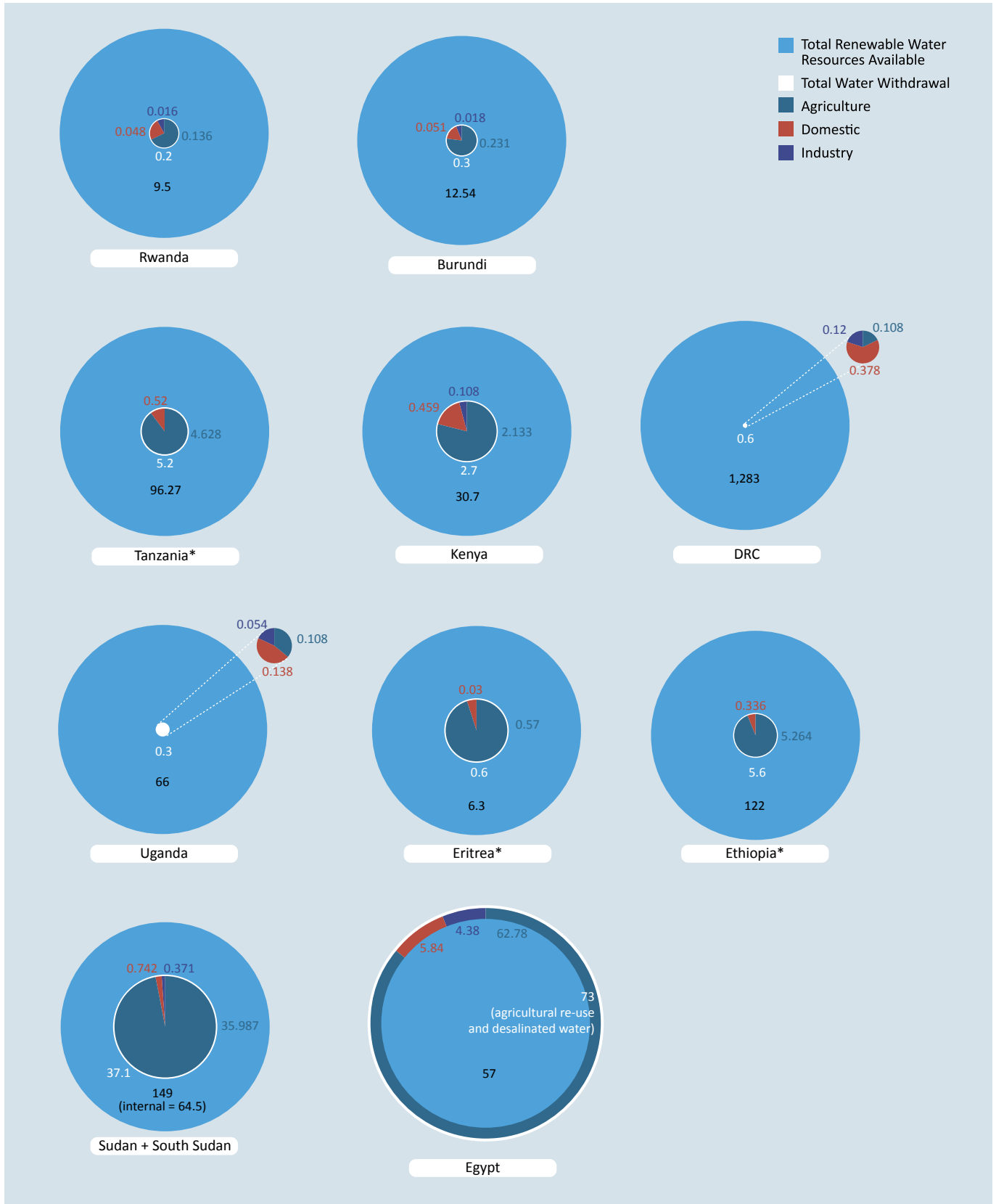
GDP Growth



Note: Annual Growth Rate of 7 per cent for 2030 has been used as it is a foreseeable sustainable rate of economic growth in the region.

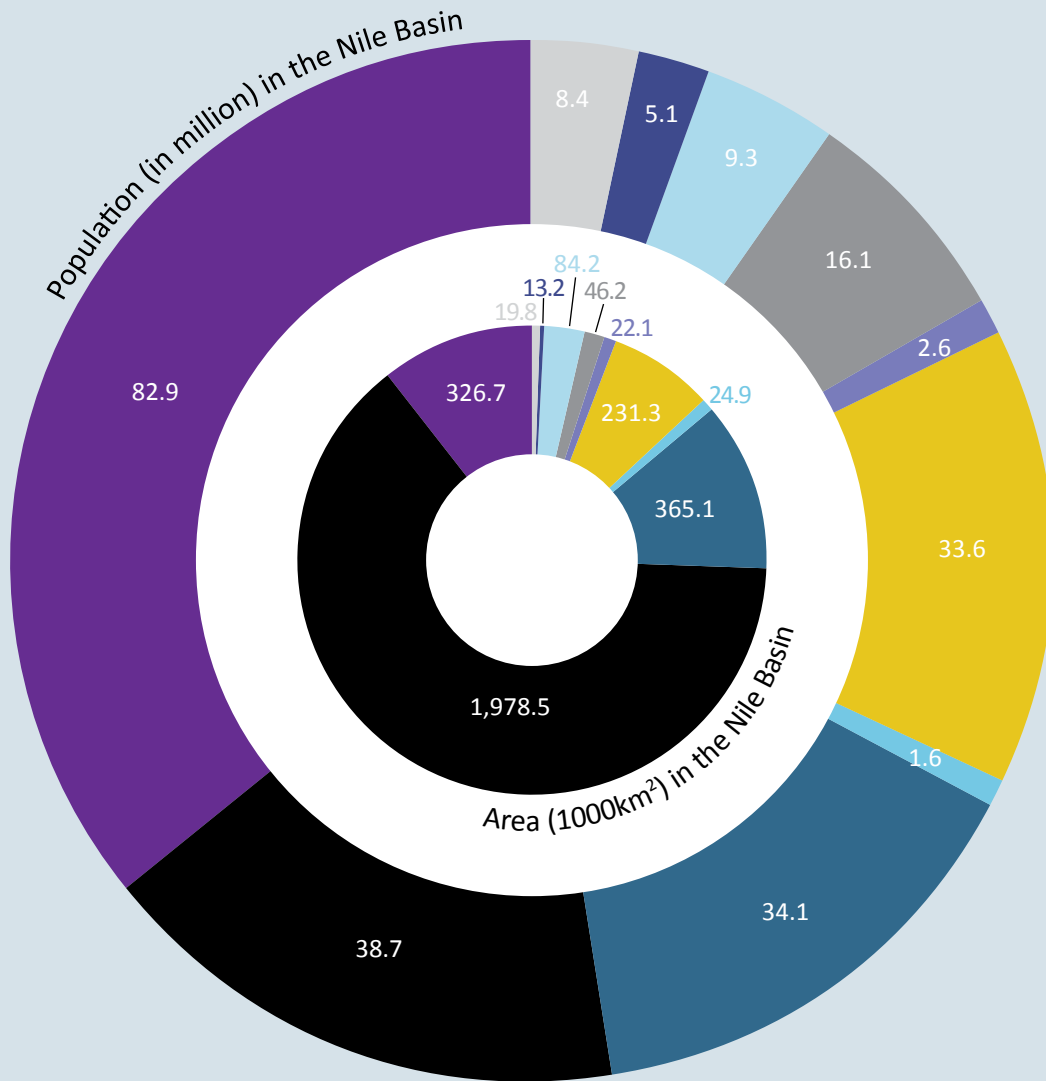


Water Withdrawals (BMC/yr)



* Figures for industry not available.

Population and Area of the Riparian Countries in the Nile River Basin



- Rwanda
- Burundi
- Tanzania
- Kenya
- DRC
- Uganda
- Eritrea
- Ethiopia
- Sudan + South Sudan
- Egypt



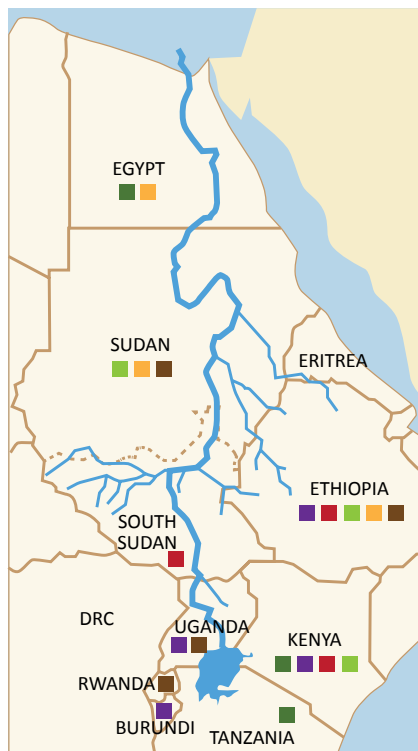
Challenge 1

CLIMATE CHANGE

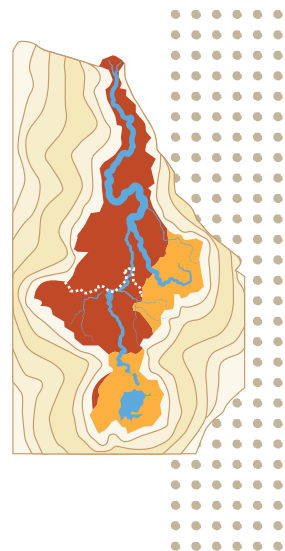
The impact of climate change can be felt across the basin. The most common hazard felt is the increasing instances of floods and droughts which lead to problems relating to land degradation, sedimentation, and desertification. Another significant problem is its impact on evaporation and evapotranspiration rates.

Rise in temperature due to climate change, increases evapotranspiration which reduces soil moisture levels. In areas where precipitation declines along with temperature rise, water availability decreases. The Nile Riparian countries which are located in the tropical – sub tropical sphere already face high water losses due to evapotranspiration and climate change could further aggravate this issue.

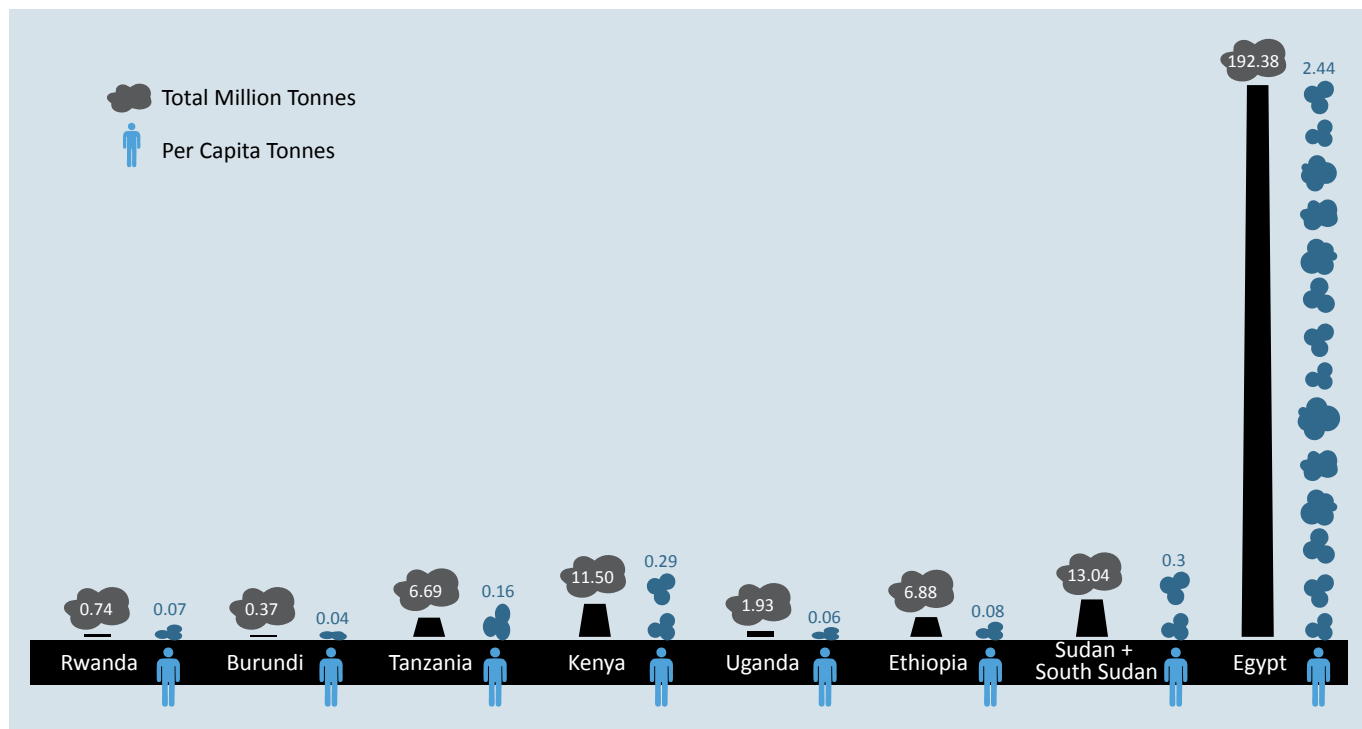
Impact of Climate Change



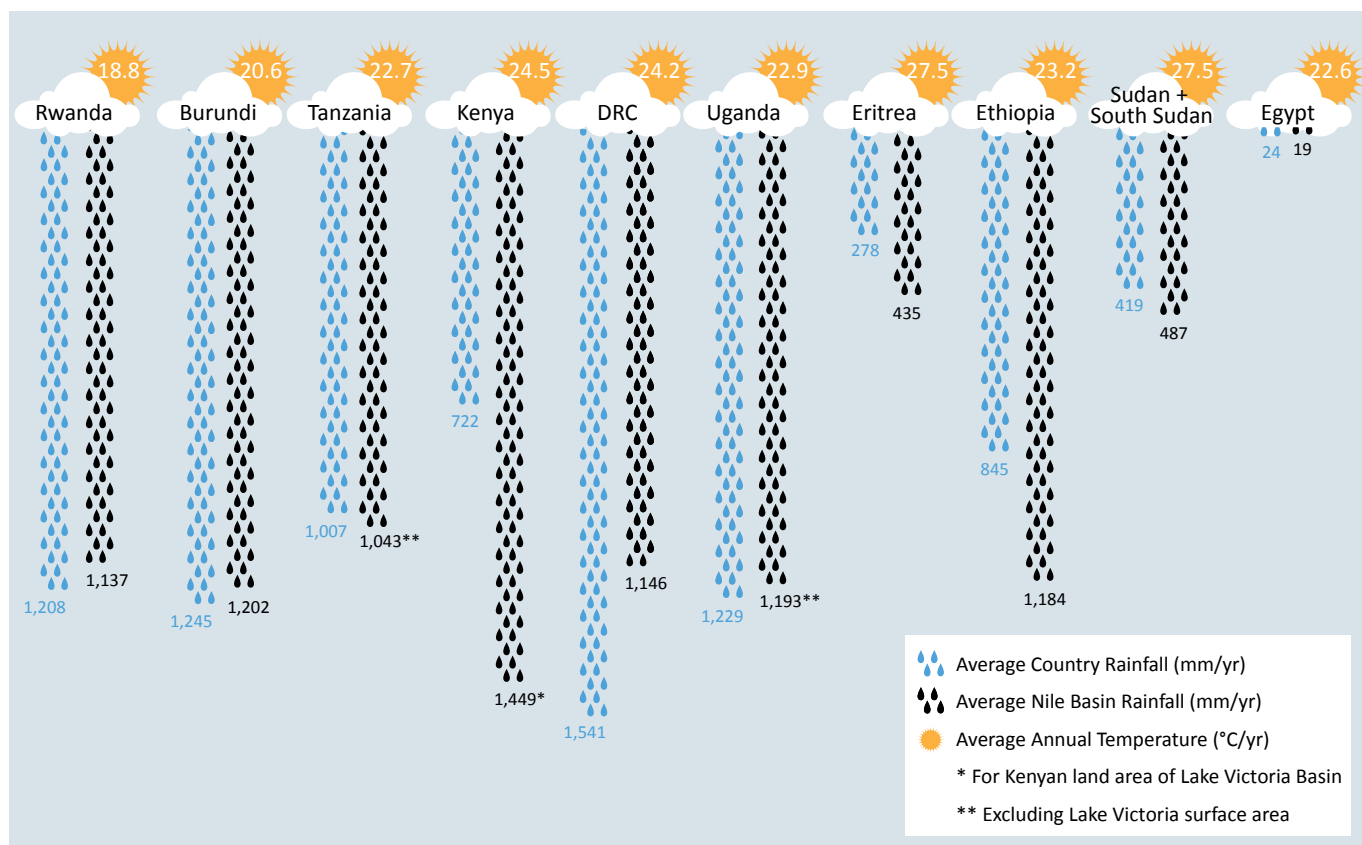
- Coastal Erosion
- Vector-Borne Diseases
- Forest Fires
- Food Insecurity
- Desertification
- Land Degradation



Carbon Dioxide Emissions in 2009



Climate, Temperature and Rainfall in the Nile Riparian States



Climate Change in the Nile Riparian Countries

Rwanda

- ≡ Rwanda has a tropical climate with four seasons: a short rainy season (mid-September to mid-January), a short dry season (till February), a long rainy season (mid-March to mid-June) and a long dry season (June to mid-September). The rainy seasons are primarily determined by the Inter-Tropical Convergence Zone (ITCZ).
- ≡ It has been observed that the Eastern part of Rwanda, being the precipitation-deficit region, has recently experienced lower rainfall than usual in the last 30 years.
- ≡ Recently, there has been a changing pattern in rainy seasons. At times, the total number of annual rainy days is reduced with short periods of more intense rainfall. Other times, frequent torrential rainfall on a daily basis exceeds the total monthly quantity. Also, there are times when there is a late onset of rainfall or an early cessation of the same.
- ≡ According to the Rwandan Ministry of Finance and Economic Planning, since 2002, there has been low food production due to irregular rain and dislocation of rainy seasons. In 2003 and 2004, the agricultural sector was significantly impacted due to inadequate and unreliable rainfall. From late 2005 to early 2006, there was a famine in the Eastern and Southern provinces due to irregular rainfall that caused harvest failure during farming season. In 2006 and 2008, Bugesera witnessed severe droughts.
- ≡ Rwanda is a fast warming country. In the last 50 years, there has been a 0.7°C to 0.9°C increase in temperature, thereby increasing the number of warm days.
- ≡ By 2050, it is estimated that there will be a rise of 2°C in temperature, especially in the east of Rwanda.

Burundi

- ≡ Burundi has a tropical highland climate with four seasons: a long dry season (June to August), a short wet season (September to November), a short dry season (December to January) and a long dry season (June to mid-September).
- ≡ In the last 65 years, it has been noted that there have been alternating rainfall periods of surplus and deficit every ten years.
- ≡ By 2050, it is estimated by some experts that there will be an overall increase of 3 per cent to 10 per cent in rainfall; however, there will be a decrease of 4 per cent to 15 per cent in May and October.
- ≡ By 2050, it is estimated that there will be an increase of 1.9°C rise in temperature.

Tanzania

- ≡ Tanzania has a tropical climate along its coast, and semi-temperate in the inlands.
- ≡ There have been seasonal shifts, such that some parts of Tanzania receive more rainfall in comparison to the rest of the country like the Central region, wherein there is less rainfall early in the season and stronger rains later in the season.
- ≡ By 2075, it is estimated that there will be an increase of 5 per cent to 45 per cent in rainfall in the Northern and South eastern parts, especially near Mt. Kilimanjaro. However, there will be a decrease of 5 per cent to 15 per cent in rainfall in the Central, Western, South western, Southern and Eastern parts of Tanzania.
- ≡ For the last 35 years, there has been a consistent rise in temperature.
- ≡ By 2050, it is estimated that there will be a rise in temperature by 1.5°C to 2°C.

Kenya

- ≡ Kenya has a tropical climate although 80 per cent



of it is arid and semi-arid, and drought prone.

- Kenya has disparate effects of climate change. For instance, in 2011, there were flash floods in Northwest Kenya and the Turkana region. On the other hand, major droughts occur every ten years, and minor ones every 3-4 years in the arid and semi-arid lands.

Uganda

- Uganda has an equatorial climate with small regional variations due to temperature and humidity.
- As a result of erratic rainfall, the North-eastern part of Uganda experiences droughts between October and December.
- As a result of decrease in rainfall over the years, Lake Wamala has shrunk by one metre in the last decade.
- Since the 1960s, a decrease in rainfall has been observed in the North and Northeast parts of Uganda.
- Since the 1960s, the mean annual temperature has risen by 1.3°C.

Eritrea

- Eritrea has a temperate climate on the Highland Plateau while it is hot and arid along its coast.
- As a consequence of climate change, there is expected to be a 29.5 per cent decrease in the runoff of River Mereb-Gash, which will impact the water flow into Sudan.
- By 2050, a 4.1°C rise in temperature is expected due to global carbon dioxide levels.

Ethiopia

- Ethiopia has diverse climatic zones that translate into varied vegetation zones. These include hot

arid, hot semi-arid, tropical with distinct dry winter, tropical monsoon with short dry winter, warm temperate rainy with dry winter, warm temperate rainy without distinct dry season.

- In the last 10 years, there has been an increase in rainfall during the wet season and decrease in rainfall during the dry seasons, thereby resulting in floods and droughts.
- By 2045-55, a 23 per cent rise in rainfall is expected during the wet season or a 15 per cent decline in rainfall during the dry season.
- By 2070, rainfall is expected to decrease in the North while the South may witness a rise in precipitation by 20 per cent. Also, rainfall will decrease during the growing season between February and May.
- It is estimated that climate change will reduce the annual runoff of River Nile tributaries Abbay and Awash by up to one-third.
- Ethiopia has a historical pattern of rainfall variability; therefore, it is uncertain whether rainfall variability is an effect of climate change or a general trend of the country.
- By 2050, a 1.7°C to 2.1°C rise in Ethiopia's mean temperature is expected.

Sudan and South Sudan

- Sudan and South Sudan have a varied climate, which is arid in the North and tropical wet-and-dry in the Southwest.
- Since the mid-1970s, the summer rains have reduced by 10 per cent to 20 per cent in Western and Southern Sudan.
- Studies in 2007 have suggested that there will be a decrease of 6mm of rainfall each month during the rainy season in the coming years.
- By 2060, it is estimated that there will be a 1.5°C to 3.1°C rise in temperature in August, and 1.1°C to 2.1°C rise in January.

Egypt

- ≡ Egypt has a semi-desert climate comprising hot dry summers, moderate winters and scanty rainy seasons.
- ≡ On average, Egypt receives 24mm of rainfall every year, of which the Northern coastal region receives some while the South receives almost none. In Cairo, it is driest in July and August with no rainfall and wettest in December with 5mm of rainfall.
- ≡ In the future, a steady rise in temperature with slight inter-modal variance is expected, causing summers to warm faster than winters.

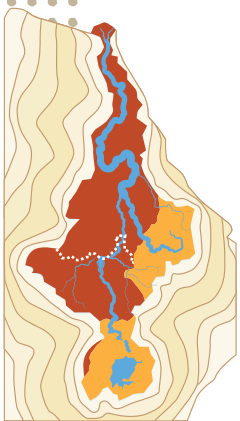
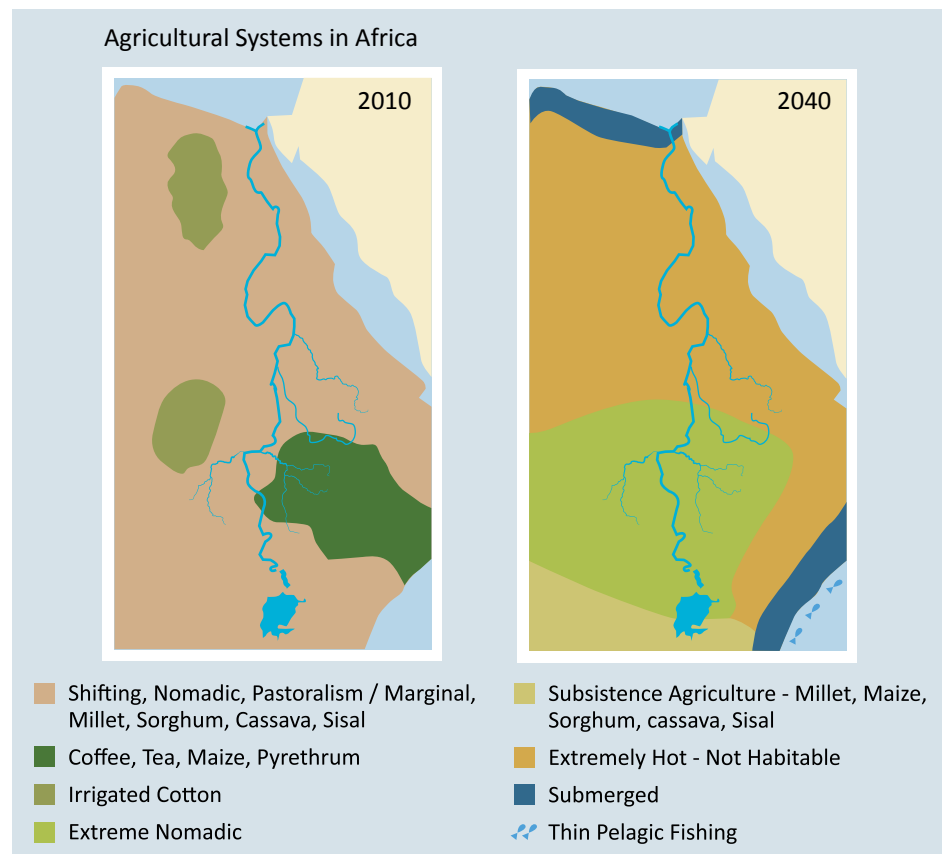


Challenge 2

EVAPORATION & EVAPOTRANSPIRATION

The River Nile is the longest river in the world with high inter-annual and decadal water resource variability as a result of several factors. One such factor is evapotranspiration - a natural and pertinent phenomenon across the Nile Basin, especially in Uganda, Ethiopia, South Sudan and Sudan. The Nile Basin's geographic location, varied climate and erratic weather patterns make it highly susceptible to evapotranspiration, which has a strong impact on the hydrology and variable flow of the Nile. Evapotranspiration is affected by a range of factors such as rising temperatures, humidity, direction and speed of wind, type of vegetation, and soil characteristics.

Climate Change in the Nile River Basin



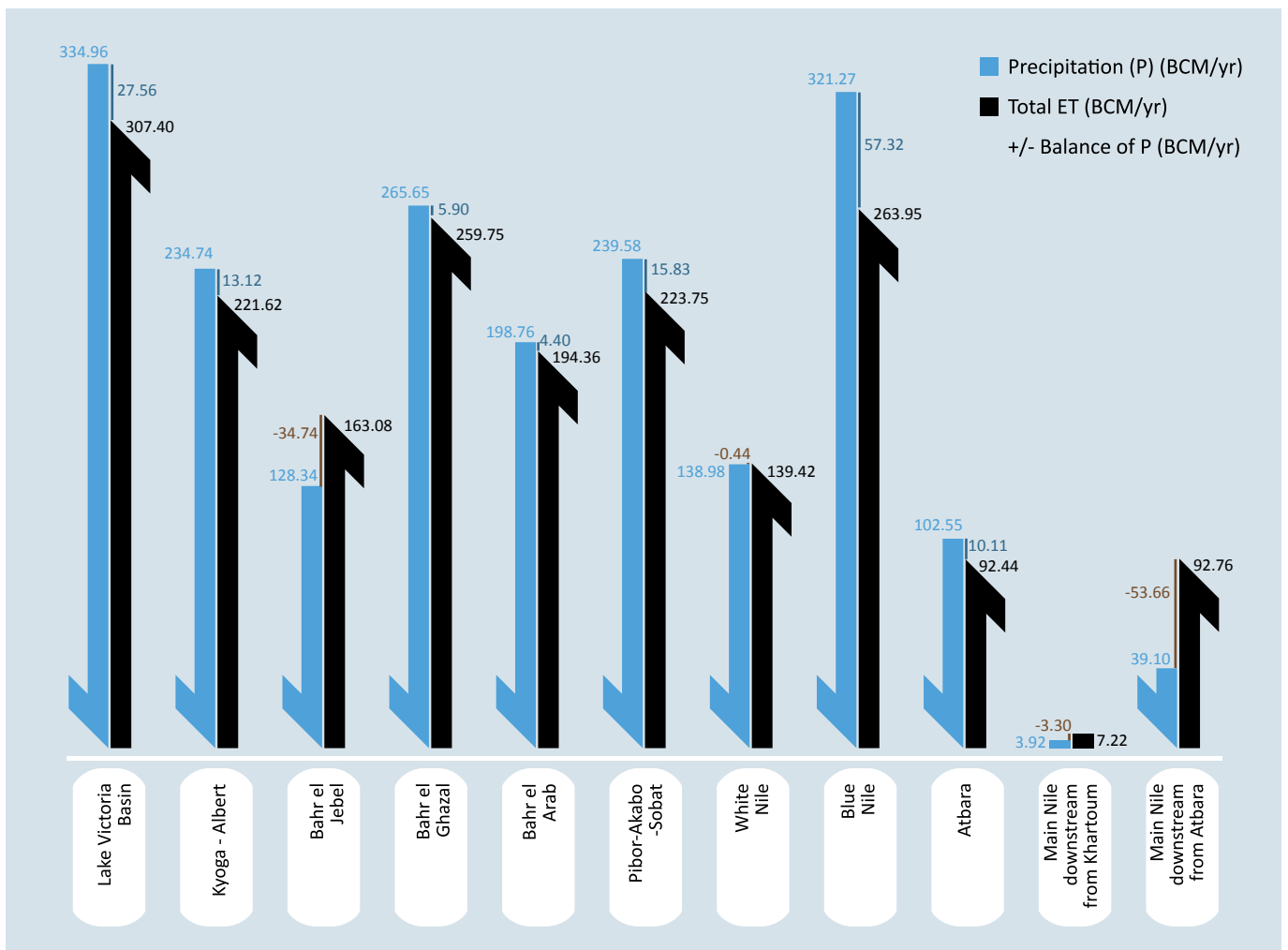
Evapotranspiration in the Nile River Basin

The annual rate of evapotranspiration over the Nile Basin is 11 per cent, with a monthly range of 9 per cent to 14 per cent. The most significant loss of water takes place through evaporation over the surface of water bodies such as rivers, lakes and swamps within the Basin. Interestingly, despite high evaporation rates, several sub-basins in the Nile Basin such as Lake Victoria, Baro-Akobo-Sobat and Blue Nile have a positive water balance as a consequence of higher amounts of rainfall than evapotranspiration. However, Bahr el Jebel has a negative water balance due to its location in the Sudd which also undergoes water

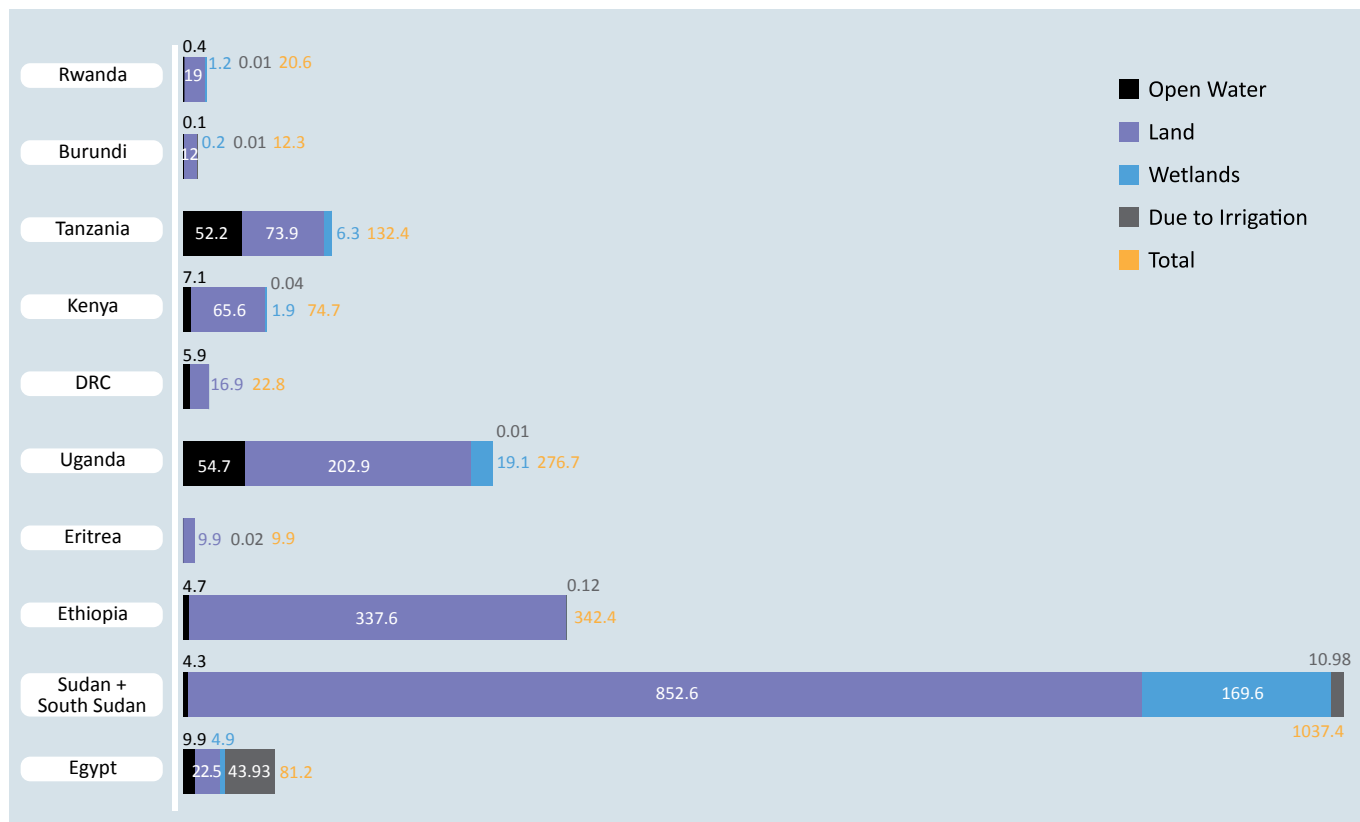
retention. Similarly, the White Nile from Malakal to Khartoum, the Nile after its confluence with the Blue Nile downstream of Khartoum and Atbara have negative water balances due to their geographic location in the arid and semi-arid regions of the continent.

The extensive evaporation over the Nile Basin results in large amounts of atmospheric water, much of which is re-precipitated within the Basin. The total precipitation across the Nile Basin is 2007.85 BCM, while the total evapotranspiration is 1965.75 BCM. An additional 8 BCM or so evaporates each year from direct runoff. The annual outflow of the Nile is less than 15 per cent of the total evaporated mass.

Total Annual Average Precipitation and Evapotranspiration (ET) in the Nile River Sub-basins



Evapotranspiration over Open Water, Land and Wetlands (BCM/yr)



Note: Additional evapotranspiration due to irrigation is high in Egypt and Sudan because they have large areas of land cultivated through artificial irrigation located in the Nile Basin.

Evaporation over Open Water Surfaces

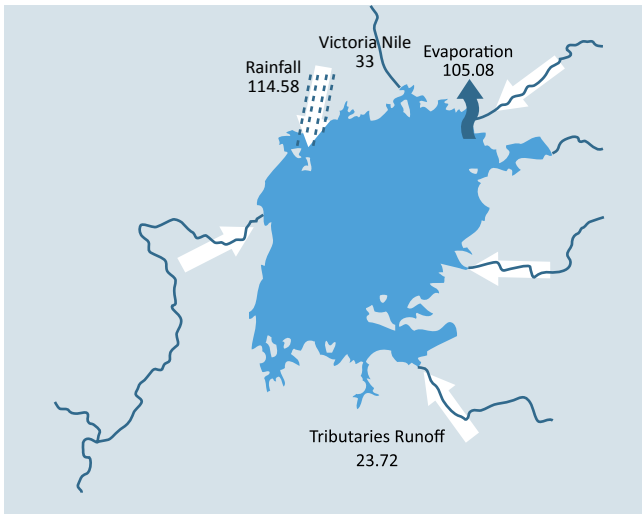
High evaporation rates over open water surfaces reduce the discharge of water downstream in the Nile River Basin. Evaporation is particularly high over Lake Victoria which feeds into the White Nile (Victoria Nile) at 105.08 BCM/yr (different sources suggest losses between 103 – 107 BCM annually). While 82 per cent of water entering Lake Victoria comes from direct precipitation, 80 per cent of the water leaving the lake is lost through evaporation.

Around 37.6 per cent of runoff or 9.21 BCM of discharge into Lake Victoria annually comes from Kenya with the major rivers being the Sio, Nzoia, Yala, Nyando, Sondu Miriu, Mogusi and the Migori. The Nzoia River Basin is the main tributary from the Kenyan catchment. The Nzoia River loses around

90 per cent of its inflow from precipitation due to evaporation.

The Kagera River originates from Burundi, and flows along Rwanda-Burundi border to the Rwanda-Tanzania border. It then heads into Tanzania and Uganda before draining into Lake Victoria. This is the largest stream that flows into Lake Victoria, contributing around 8.23 BCM of water to it annually. The Kagera catchment as a whole contributes 15.03 BCM of water per year. While the inflow through precipitation is high, averaging from 1000 mm to 1200 mm (it ranges from 1800 mm in the Western mountain ranges in the Rwanda Burundi highlands to 800 mm in the Eastern end of the basin), it is completely lost due to high evaporation averaging 1200 mm per year.

Water Balance of Lake Victoria (BCM/yr)



From Lake Victoria, the White Nile flows through Lake Kyoga into Lake Albert, from where the Albert Nile flows into Sudan. The losses due to evaporation from the surface of the lakes range from 8.2 BCM from Lake Albert to 2 BCM from the White Nile between Malakal and Khartoum per year.

The source of Blue Nile is Lake Tana which is the largest lake in Ethiopia containing a volume of 29 BCM of water per year. It loses 5.19 BCM of water per year due to evaporation.

The Toshka Lakes located in Egypt to the west of the Aswan Dam are shrinking in size and volume mainly due to their location in a hyper-arid zone where evaporation rates are very high. The estimated total surface area of the Toshka Lakes reduced to 937 km² in 2006 from 1541 km² in 2002, with one of the four Toshka Lakes completely drying up.

Evaporation over Reservoirs

Water losses have been noted over reservoirs built for water storage due to increased exposure resulting in high evaporation. The construction of Jebel Aulia Dam, 40 km upstream of Khartoum for storing water originally for Egyptian use, prior to the construction of the Aswan High Dam led to a loss of 2.5 BCM of

water due to evaporation. Lake Nasser, the reservoir of Aswan High Dam, led to a further loss of around 10 BCM resulting in a total loss of 12.5 BCM of water in Sudan and Egypt.

The plan for Merowe High Dam located close to the 4th cataract in North Sudan estimates a loss of 1.7 BCM of water due to evaporation.

The proposed dams in the Ethiopian highlands such as the Mendaya and Kardobi, as well as the Grand Renaissance Dam are expected to mitigate losses from evaporation as they are being constructed in a wet area.

The spread of water hyacinth, an aquatic weed which infests rivers, dams, lakes and irrigation channels, results in evapotranspiration losses 1.8 times higher than evaporation over open surface water.

Evapotranspiration over Land Surfaces

Evapotranspiration over land is noted to be the highest in the Blue Nile basin followed by the Bahr El Ghazal and the Sobat Basin with 263.95 BCM, 259.75 BCM and 223.75 BCM of water lost per year respectively. In terms of countries, Sudan faces the highest water loss due to evaporation, followed by Ethiopia.

Vegetation growth and evapotranspiration are positively related. The heat radiation from the sun also contributes heavily to the evaporation of soil moisture.

With the exception of Egypt, all Nile riparian countries observe the greatest loss due to evapotranspiration from non-agricultural land. While Ethiopia's evaporation losses from its non-agricultural land cover use are over 80 per cent, Egypt loses over 54 per cent of its water from its irrigated land. Rwanda and Burundi lose around 20.6 BCM and 12.3 BCM of water respectively due to evapotranspiration over its land, water and wetlands of which 25 per cent of it is lost over areas constituting rain-fed agriculture. Of the



non-agricultural land, central Uganda’s cattle corridor witnesses mean monthly evaporation rates between 125 mm and 200 mm.

Evapotranspiration over Wetlands

The rate of evapotranspiration from wetlands is high throughout the Nile Basin. This is because wetlands act like natural sponges and soak up water from various sources. Also, most wetlands are characterized by dense vegetation which adds to the increase in evapotranspiration.

Evapotranspiration over wetlands is recorded to be the highest in the Bahr el Jebel Basin with 163.08 BCM of water lost, followed by the main Nile at its confluence with Atbara.

Machar Marshes in the Sobat basin lose about 10 BCM of water when Sobat River’s Baro-Akobo tributaries spill off into the wetlands. If the Machar Marshes were to be disconnected from the Sobat River, the stream flow would increase by 0.83 BCM. However the diversion canal is estimated to save 4.4 BCM per year.

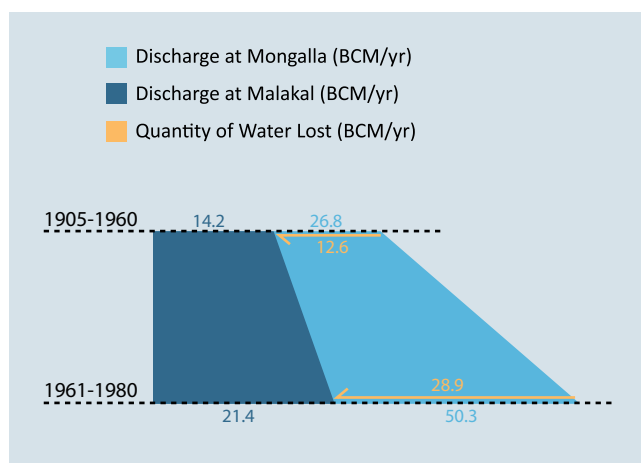
High Evaporation in the Nile River Basin

Countries	Regions
Sudan + South Sudan	Sudd, Bahr El Ghazal
Kenya, Uganda, Tanzania	Lake Victoria Basin
Ethiopia	Pibor-Akobo-Sobat, Blue Nile Region

The Sudd is a vast marshland known as one of the largest wetlands in the world, found at the lower reaches of Bahr al Jebel. The area is low lying and extremely flat with an average slope of about 10 cm/km and hence forms extended marshlands that span an average area of 30,000 km² – 40,000 km². Due to its flat nature, this area is extremely susceptible to

evaporation. It is understood that more than 50 per cent of the White Nile inflow into the Sudds is lost due to evaporation.

Average Annual Discharges at Different Locations in the Sudd Region



The difference in rainfall in the Sudd is between dry (930 mm/yr) and wet years (1,058 mm/yr) is only 14 per cent. However, the range of evaporation between dry years (1,460 mm/yr) and wet years (1,935 mm/yr) exceeds the differences in rainfall by 33 per cent. This also implies that evaporative depletion of the Sudd is very sensitive to both local and upstream rainfall patterns.

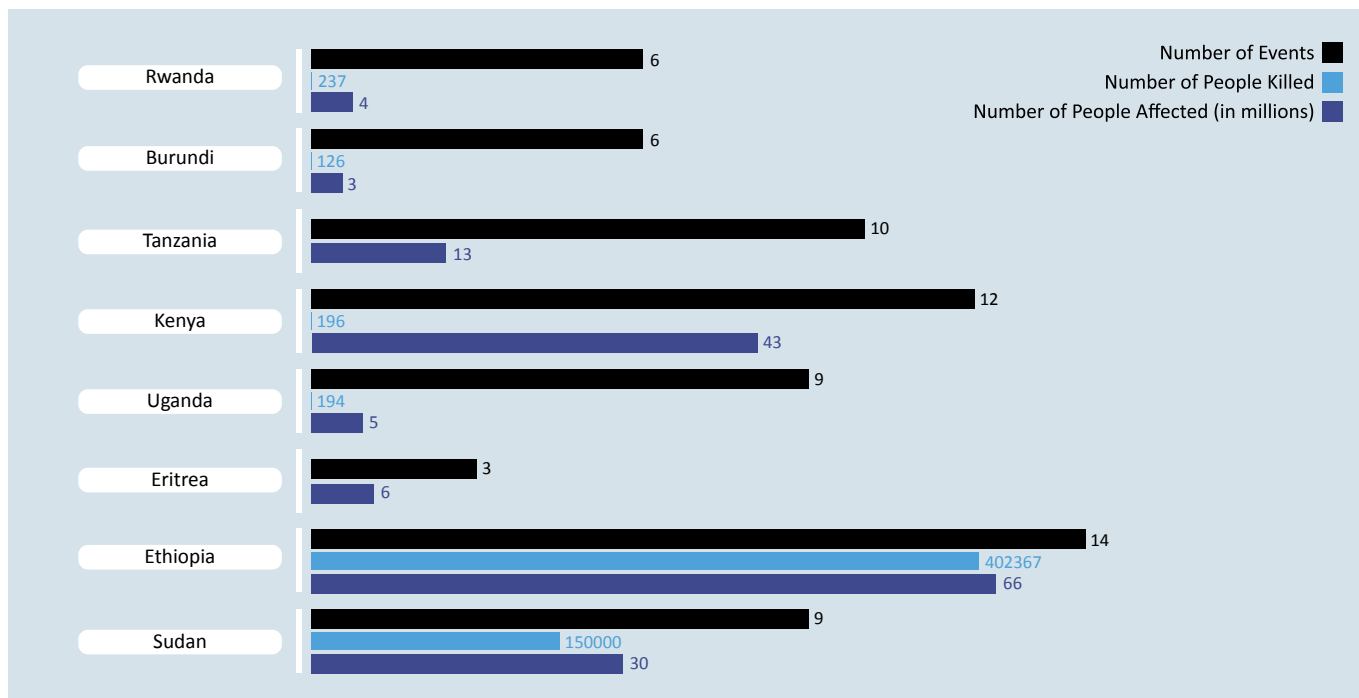
The wetlands of Lake Kyoga act as water storage reservoirs and are subject to high rates of evapotranspiration. 13 per cent of 29.4 BCM of the outflow from Kyoga at Kamdini is lost to evapotranspiration. It was noted that loss of water due to evapotranspiration increased by 0.8 BCM during the 1998-2003 period because of blockage caused by dislodged papyrus resulting in an increased surface water area.

The average rate of evapotranspiration in the wetlands of Kagera basin ranges from 1,424 mm to 1,862 mm while the average rainfall is between 1,000 mm - 1,200 mm.

Droughts

Droughts in the Nile River Basin have proved to be more fatal than the floods. Around 170 million people have been affected by droughts in the last century with half a million lives lost. Ethiopia, Tanzania and Kenya have witnessed the most number of droughts.

Damage by Droughts in the Nile River Countries (1900-2012)



ENSO

The El Niño/La Niña Southern Oscillation (ENSO) is a climate pattern that takes birth in the Pacific Ocean every four to five years. The ENSO has several effects, the strongest of which is its influence on rainfall variability along the tropical regions that leads to an increase in intensity of floods and droughts.

The Nile Basin countries impacted by ENSO include Rwanda, Tanzania, Kenya, Uganda, Ethiopia and Eritrea. ENSO episodes can lead to severe consequences such as loss of life, damage to infrastructure, crop failure, and hydroelectric power shortfalls. The strongest and most vivid ENSO episode in recent years took place in 1997-98 (El Niño) and 1999-2000 (La Niña).

The Sahara Desert

Western Egypt and parts of Sudan come under the Sahara desert area. They have high temperatures and very little or no rain leading to frequent droughts. The only permanent source of water is the river Nile. Other sources are the deep aquifers and oases. Egypt has been trying to divert some of the Nile waters to the desert region. The Toshka lakes formed from diverting high levels of water from Lake Nasser are being used for irrigation in this region but due to its natural climatic conditions, this region is highly drought prone.

The Sahelian Belt

On the South of the Sahara Desert lies the Sahelian region which includes Nigeria, Sudan, Senegal, Mauritania, Mali, Burkina Faso, Niger, Chad and some parts of Ethiopia. This is a semi-arid region which transitions from the desert areas of the North to the humid savannas of the South. This region is prone to frequent droughts and desertification. The Sahelian region was hit by a long period of drought between 1960 and 1980. There was very little or no rainfall, agriculture was hit badly and the Sahara Desert advanced 100 km into the Sahelian region. Over million people are said to have lost their lives due to this drought. Though the government took many new measures and there was foreign aid coming in, this region was hit by drought again in 1983-85.

More recently, drought hit the Sahelian region in 2010 where the temperatures shot up after a bout of heavy rain. Parts of Sudan (Dongola) saw temperatures as high as 49.7°C. Continuous droughts have led to high food insecurity in the region which caused riots in many parts, as well as cases of violence amongst pastoralists and livestock lifting. The situation was very serious in Darfur and the Kordofan states which were already facing a lot of disturbance due to infighting between the Sudanese Government and the tribes.

The World Conference on Disaster Reduction was held the by the United Nations General Assembly at Kobe, Hyogo, Japan in January 2005 which led to the signing of Hyogo Framework for Action 2005-2015, adopted by 168 countries. This framework entails the governments involved to frame specific guidelines to reduce disaster risk and vulnerability to natural hazards. Regular review reports are also to be submitted. Kenya and Ethiopia are highly prone to droughts and rank 5 and 6 among 162 countries while Sudan and Egypt are highly prone to floods.

Risk profile of the Nile River Basin Countries to Floods

LOW 1 2 3 4 5 6 7 8 HIGH

Countries	Vulnerability Risk	Mortality Risk
Rwanda	7	4
Burundi	7	4
Tanzania	6	4
Kenya	6	4
Uganda	7	4
Eritrea	8	4
Ethiopia	6	4
Sudan	6	6
Egypt	7	5

Floods and droughts lead to extensive land degradation. The intensity of the floods washes away most of the top soil and leads to erosion at the banks of water bodies. It also leads to loss of land at various places. Droughts lead to extreme loss of soil moisture due to which many nutrients which enrich the soil die. This in turn leads to crop failures which affect the whole eco-system.



Challenge 4

LAND DEGRADATION

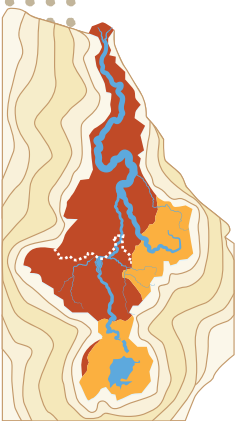
Land degradation is one of the challenges faced by several countries in the Nile River Basin. Land degradation comprises of any negative or undesirable change in the texture, content, moisture of land due to a combination of natural hazards and man-made activities. The African continent is characterized by 46 per cent of extreme desert and 11 per cent of land mass which is humid. Presently, in Africa around 250 million people are directly affected by land degradation.

In Rwanda, around 71 per cent of total land area is facing severe degradation and about 60 per cent of its forest cover has been lost in the last two decades partly due to genocide, displacement and repatriation. Similarly, more than 30 per cent of Burundi is severely or very severely degraded.

In Tanzania, widespread land degradation is found in the highlands, especially on the slopes of Mt. Kilimanjaro. Kenya faced about 30 per cent land degradation in 2002 and around one third of its population was directly dependent on degraded land by 2008. Land degradation in Kenya, affects 20 per cent of all cultivated areas, 30 per cent of forests, and 10 per cent of grasslands.

Uganda faces land degradation and erosion covering 60 per cent of its total land area, the majority of which is in the highlands of the South-west. Ethiopia also faces land degradation mostly in its highlands, especially in the Amhara region. It is estimated that Ethiopia loses 4 per cent of its GDP due to land degradation.

In Sudan, approximately 1.2 million km² of land has degraded in varying degrees. The most degraded zones are the arid and semi-arid regions in the Northern half of Sudan where 76 per cent of the country's population resides. In Egypt, the North-western delta faces highest degradation due to contamination and increased salinity.



Rwanda

Around 40 per cent of land in Rwanda is at high risk of erosion, 37 per cent requires soil retention measures before cultivation, and only 23 per cent is erosion free. Data from field research stations report soil losses between 35 - 246 tonnes per hectare annually, amounting to losses costing about 3.5 per cent of Rwanda's agricultural GDP. The Nyamitera River delivers 567,000 tonnes of particles in a matter of five flood days to Rwanda, of which more than half is the annual suspended sediment yield of its Nile Basin region.

Increasing use of land for tea cultivation is also leading to sedimentation in Rwanda. Tea plantations use fertilizers that cause soil degradation, water pollution and deforestation, which in turn results in soil erosion, floods and sedimentation in the valley.

Burundi

Deforestation, over grazing and agricultural expansion into marginal lands are the main factors leading to soil erosion in Burundi. The sediment yield of Burundi and its contribution to the Nile basin is presently unavailable. Sedimentation causes many problems in Burundi including blocking inlet channels of pump irrigation schemes, clogging hydropower turbine areas, corroding pumps among others.

Tanzania

The main type of erosion witnessed in the Lake Victoria Basin in Tanzania is sheet erosion where a uniform thin layer of top soil is washed away. In Tanzania, 61 per cent of land area faces soil erosion with a topsoil loss of 100 tonnes per hectare per annum.

Highest soil loss within the Lake Victoria Basin is from cropland which loses 93 tonnes per hectare annually, followed by rangeland losing 52 tonnes per hectare

each year. Additionally, there has been soil loss in Shinyanga, Dodoma, Morogoro, and Arusha. Also, Kagera Basin is vulnerable to soil erosion and leaching of nutrients due to its high population and poverty levels.

The Masalatu Reservoir constructed on Simiyu River receives an annual sedimentation yield of 406 m³/km² or 1.43 tonnes per hectare.

Kenya

The Nyanza province bordering Lake Victoria is undergoing rapid catchment deterioration due to frequent droughts, deforestation and old agricultural practices. This results in Kenya's high sedimentation load contribution to Lake Victoria Basin through its tributaries. 61 per cent of the basin area contributes to soil sedimentation at a rate of 43 tonnes per hectare each year, whereas the rest of the basin forms a sink area where sediments are collected.

Due to high sedimentation on the bed, the rivers Nyando, Nzoia and Sondu, and other tributaries emptying into Lake Victoria are prone to flooding. Surface runoff in wet season causes sheet, rill and gully erosion. Strong winds cause erosion in dry season. Nyando River experiences severe gully erosion due to heavy water runoff. The removal of the top soil is very high ranging from 90 tonnes per hectare annually in degraded areas, to 67 tonnes per hectare elsewhere.

Uganda

Major source of soil erosion to the Lake Victoria Basin is the Kibale River at 0.06 tonnes per hectare annually. Runoff in sub-catchment of Bukora is the main reason for causing soil erosion. Soil loss rates are the highest on bare soils, followed by annually cultivated land, degraded range lands and perennially cultivated land.

Lake Albert is also under threat of siltation due to



inflows from Kyoga Nile, as well as Semliki River which carries sedimentation from DRC. It is estimated that 4 per cent - 12 per cent of GNP is lost from environmental degradation, of which 85 per cent is through soil erosion, nutrient loss and crop changes. Also, the rate of soil fertility depletion in Uganda is one of the highest in Sub-Saharan Africa.

Ethiopia

There is high erosion in the Ethiopian Highlands. Around 1900 million tonnes of soil is eroded annually at an average of 100 tonnes per hectare. Also, up to one billion tonnes of top soil is lost each year. The Highlands face several types of soil erosion including sheet, rill, gully and wind. It also witnesses stream bank erosion, biological, physical and chemical degradation

Blue Nile is the major contributor of sedimentation during the flood season, contributing approximately 125 million tonnes, while the Atbara contributes roughly 50 million tonnes. The flows of the Blue Nile are unregulated until they arrive in Sudan leading to an enormous amount of sedimentation at the Roseires Dam. With increased deforestation and agricultural activities along the banks of the Blue Nile, there is a substantial amount of debris added to the flow which is carried downstream.

The proportion of runoff to sedimentation is higher for the Atbara River which is due to its geographic location in a drier region than the Blue Nile and also due to a relatively longer period of dry season followed by heavy rainfall in a relatively short period. Sedimentation peaks three weeks before rainfall peaks, as rainfall washes away soil loosened due to loss of moisture during the dry season.

A decline in crop yields has been witnessed at a rate of 1 to 3 per cent on cropland and 2.2 per cent in Ethiopian highlands. It is estimated that the cost of land degradation due to soil erosion to Ethiopia could be about \$2 billion in 25 years or \$80 million each year. About 80 per cent of the losses are from reduced crop production and 20 per cent from reduced livestock production. Soil nutrient depletion reduces crop production by about a million tonnes annually amounting to losses of around 14 per cent of agricultural contribution to Ethiopian GDP.

Sudan

Soil erosion is leading to rapid siltation and loss of functionality of reservoirs and irrigation schemes in Sudan. The small reservoirs get silted quicker. Irrigation schemes are witnessing major damage due to siltation which is leading to a reduction in water transported to crop lands. For instance, crop water

Sedimentation and Runoff in the Blue Nile and Atbara Rivers

Rivers	Total sedimentation/ Total Water Flow	Wet Months	Seasonal Variation
Blue Nile	125 million tonnes/ 48.279 BCM	June, July, August, September	Wet: Dry Aug: Mar 15237: 406
Atbara	50 million tonnes/ 8.62 BCM	June, July, August, September	Wet: Dry Aug: Mar 5126: 1

requirements are no longer met in the Gezira and Rahad irrigation schemes.

River bank erosion along the Blue Nile River has been witnessed with most affected areas lying downstream of Roseires Dam, Singa to AlSuki. River widening in the region also leads to bank erosion where irrigable land is lost as has been witnessed in the main Nile and Atbara River sections. Around \$1.5 million worth of economic losses have been witnessed via the loss of mature date palm trees as a direct result of bank erosion.

Egypt

The Nile Bank is witnessing bank erosion due to the corrosive action of sediment free waters as witnessed in Sudan past Roseires Dam. Agricultural land is depleting at a rate of 13,000 hectares on an annual basis due to bank erosion. Increase in coastal erosion and extensive erosion of the Nile Delta is being witnessed due to lack of sedimentation and increase in salinity levels.

Sedimentation in Reservoirs

Sedimentation is the single greatest problem reservoirs face in maintaining their functionality for water storage, as well as for hydropower generation. Hydropower generation is reduced during peak sedimentation periods as debris gets caught in the turbines and need to be shut down for cleaning. Sedimentation stuck in the cooling mechanism of the hydropower plant leads to loss of efficiency in energy generation and also requires shutdown for repair. Also, silt adds to the wear and tear of the plant which decreases the lifespan of the machinery, depending on the abrasiveness of the mineral content in the silt. Hydropower generation is often stalled during floods to clean turbines and prevent damage resulting in very low power generation during flood season.

Sedimentation also leads to reduced water storage capacity which results in less water for irrigation and cost of construction to raise the dam to maintain storage capacity. Currently, the cost of clearing sedimentation is prohibitive at \$625 million (\$5 to clear 1 m³ of silt, about 125 MCM is being cleared per year).

Roseires Dam

The primary mandate of the Roseires Dam is to ensure that runoff levels are maintained to meet irrigation and water storage requirements. The Roseires Dam is losing considerable parts of dead water storage capacity, as well as live storage capacity. In 1966, its storage capacity was 3,329 MCM which has been reduced to 1,920.89 MCM as of 2007, leading to a 37 per cent decrease in storage capacity. The Roseires Dam's height has been elevated in order to mitigate losses in functionality and another elevation project is being currently discussed.

Aswan High Dam in Egypt

Aswan High Dam has 100 per cent trap efficiency of sedimentation which means that waters are almost perfectly sediment-free beyond the Aswan High Dam. Sedimentation transported to the reservoir and deposited there is practically negligible from December to June, peaking from July to September, reducing in October and November to none in December. Aswan High Dam is losing considerable part of live storage capacity, as opposed to dead storage capacity which was designed to absorb sedimentation. The reservoir's total operational span has been reduced to 362 years from an initial estimate of 500 years as a result of sedimentation.



Future Scenarios – Adopting Measures to Combat Soil Erosion and Land Degradation

Deforestation continues - No soil conservation measures employed

Ethiopian Highlands lose 1,900 million tonnes of soil annually, equalling 8mm of top soil loss, causing economic loss of \$2 billion in 25 years or 80 million dollars per year from losses in crop (80 per cent) and livestock (20 per cent) production.

Similar losses are witnessed in Rwanda and Burundi due to unabated deforestation in Rwanda (3.9 per cent) and Burundi (9 per cent) leading to complete loss of forest cover. Burundi loses all of its forest cover in a span of 11 years. This causes a catchment degradation leading to sediment heavy runoffs and high depositions in the NEL region. The Great lakes water levels fall due to rise in bed levels, causing flooding of banks, damage to settlements and cultivated areas.

Extensive farming in problem sites such as Kenya, Tanzania and Uganda leads to degradation of croplands causing loss in crop yields and eventually loss in crop lands due to severe soil exhaustion. Kenya which accounts for 90 tonnes/ hectare/ year of sediment loses croplands at the fastest rate; as 88 per cent of its land is prone to desertification this is alarming for Kenya's future food security as well as environmental sustainability. As Kenya's Nyanza province bordering Lake Victoria has the most irrigated crop cover this increases sedimentation loads to record levels.

Reforestation employed - No soil conservation measures employed

Uganda had lost one third of its forest cover in 15 years and despite strengthening of land policies to protect forest and wetland cover, it is still at risk of losing its cover in 50 years. Uganda loses almost \$200 million annually due to deforestation. In order to recover its economic and environmental losses it replenishes its forest cover to 20 per cent in 15 years (its 1990 levels). Replanted plantations reduce soil erosion and land degradation on achieving maturity but due to loss of biodiversity, soil erosion continues at lower levels.

Meanwhile extensively cultivated plantations such as rice on managed wetlands continue to degrade the natural water storage capacity of the Kyoga basin leading to a degraded river catchment of Kyoga Nile.

Sheet erosion in Tanzania continues at 93 tonnes/ hectare/ year from croplands till crop yields decline and soil is exhausted. Abandoned crop land contributes to higher levels of sedimentation to Lake Victoria.

Both Reforestation and soil conservation measures employed

Terraced cropping, slash and char methods of clearing forests which replenish soil naturally, reforestation along river banks and lake shores, managed wetlands, use of crops that retain soil such as Bananas which lead to 32 tonnes/ hectare/ year of soil loss as opposed to banana/coffee which loses 47 tonnes/hectare/ year prevent further damage to catchments areas.

Rwanda which lost 60 per cent of its lost forest cover replenishes its forests back to pre 1960s levels, thus remarkably reducing flood induced sedimentation of Nyamutora River from its current yield of 567000 tonnes in five days.

Farmers receive incentives to grow fruit bearing trees such as oranges and dates along the river banks in Ethiopia, Sudan and Egypt thus leading to a natural buffer for soil conservation dramatically decreasing soil sedimentation losses from the Blue Nile which increases the lifespan of Hydro power projects.

The impoverished subsistence farmers receive similar incentives to undergo mixed cropping and expand land holdings. Methods to replenish soil such as intercropping are widely practiced, thus replenishing the Nile River catchment.

Desertification in the Nile River Basin

East and South-east regions of Rwanda show increasing desertification trends due to increase in population and migration leading to over exploitation and degradation of land. People from densely populated provinces in the North, for instance Ruhengiri, Gisenyi and Byumba, and Butare and Gitarama in the South, are moving towards the least populated provinces in the East including Umutara, Kibungo, Kigali and Ngali in the South East.

In Burundi, the area of Imbo witnesses long dry spells leading to a gradual decrease in water resources, especially in the levels of Lake Tanganyika with a tendency towards desertification. Since 1999, there has been a strong variability of rainfall with a tendency for a long dry season from May to October (6 months) in the lower altitude outlying areas like Kumoso, Bugesera, and Imbo.

In Tanzania, the main reason for desertification is expanding agriculture rather than overgrazing by pastoralists. Around 33 per cent of Tanzania is affected by desertification. The coastal areas face pressure from intensive cultivation and fuel wood gathering.

In Kenya, 80 per cent of its area is estimated to be threatened by desertification with up to 30 per cent of the population affected by desertification and drought. Drought and increasing population are key factors that enhance desertification in Kenya. The Nyika Plateau and the Coastal Region are affected and threatened most by desertification. Also, the woodlands are prone to drought and desertification, primarily due to slash and burn methods of land preparation. Kenya's drylands occupy 88 per cent of the land surface area, and have a population of 10 million people. Approximately 50 per cent of livestock and 70 per cent of wildlife are located in these drylands.

In Uganda, the North-east, especially the Cattle Corridor has been witnessing overgrazing, soil compaction, erosion and the emergence of low-value

grass species and vegetation which have subdued the land's productive capacity, leading to desertification. Some dryland districts like Moroto, Nakasongola, Karamoja and Kakuuto in Rakai are experiencing desertification.

Around 71 per cent of Ethiopian land is prone to desertification including its highlands and lowlands. The Rift Valley suffers immense desertification and land degradation. Desertification threatens Ethiopia's agricultural productivity, wherein more than 80 per cent of the population depends on various forms of agricultural production. Also, 95 per cent of the farms are small-scale and depend on rain-fed agriculture.

Sudan and parts of Egypt are most prone to desertification in the Nile River Basin. Egypt has experienced accelerated desertification of rangelands in the last few decades. Presently, 45 per cent of rangelands are severely degraded, 35 per cent are fair, 15 per cent are good, and 5 per cent are excellent. It is reported that 11,000 hectares of land has been lost due to desertification. Parts of Western Egypt fall into the Sahara and are hot and dry areas which are extending into the mainland. Increasing evaporation has also led to drying out of one of the Toshka Lakes.

Egypt witnesses various forms of desertification such as:

- ≡ Degradation of irrigated farmland due to low quality water in irrigation
- ≡ Degradation of rain-fed farmland (Northern coastal belt and Northern Sinai)
- ≡ Degradation of rangeland (Northern coastal belt) through overgrazing, plant covers degradation
- ≡ Sand Encroachments from the Western desert on the Nile Valley land (Southern Egypt) and on the High Aswan Dam reservoir (in Egypt and Sudan).

In terms of desertification, Sudan is the largest and most seriously affected country in Africa. The arid and semi-arid lands cover an area of 1.78 million km², constituting around 72 per cent of the total area of the country. There is moderate to severe



land degradation in the desert and semi-arid regions in the Northern half of Sudan. The Western part of Sudan (in the Sahel region) is most prone to drought and increasing desertification, especially the states of Darfur, Kordofan, Khartoum and Kassala. The total desertification between Darfur and Kordofan is 22 per cent i.e. 200,000 km². A decline in precipitation has caused a stress factor on pastoral societies in these two regions, thereby contributing to conflict.

In northern Darfur, increasing population growth, lack of resources and environmental stress led to conflicts which were further sustained by political, tribal or ethnic differences. As a consequence of desertification in Darfur, there has been increased mortality due to famine and disease, a decrease in total water and land availability, quality of water and land (including fertility), production of major staple foods, and deaths of domestic animals. Therefore, there appears to be a correlation between land degradation and conflict in Darfur.

Since the 1930s, studies have suggested that there has been a 50-200km shift in boundary between desert semi-desert lands towards the south. This boundary is expected to continue to move Southwards due to declining precipitation. The remaining semi-desert and low rainfall savannah, which represent 25 per cent of Sudan's agricultural land, are at considerable risk of further desertification and could lead to a 20 per cent drop in food production.

Sand Encroachment

Instances of desert encroachment in Sudan are increasing, whereby the entire strip of the country along the Nile especially between Delgo and Karima in Northern Sudan is threatened. Sand dunes on the Eastern bank of River Nile in Sudan and encroachments in North-central regions can threaten the river's course. Sand encroachment is also affecting the productivity of soil which has been witnessed extensively in the Gezira scheme and also in some

areas of North Kordofan, North Darfur and Kannar in the Northern State, Sudan.

In the Dongola-Merowe region of Sudan, the area covered by sand dunes increased from 51.2 km² to 61.2 km² between 1976 and 1996 and decreased to 35.1 km² in 2000. This decrease could be attributed to an increase in the area covered by gravel and/or coarse sand. In Egypt, active sand dunes and encroachments occupy more than 16.6 per cent of the country's total land area. Sand encroachment in Egypt is further enhanced by the erratic rainfall, active winds, and scarcity of plant cover. Some inactive sand accumulations have been noticed in the Eastern side of the Nile delta and in the Sinai Peninsula.

Challenge 5

WATER QUALITY

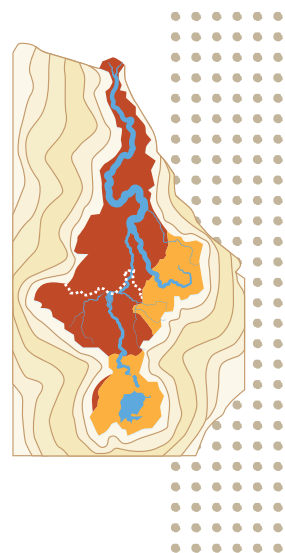
The Nile is highly polluted in some places. A common problem is faecal coliform bacterial contamination caused by lack of sanitation facilities and a high dependence on pit latrines. Agricultural fertilizers and pesticides discharge high concentrations of nutrients and phosphates that leak into ground and surface water. Chemicals from industrial waste, mining activities and domestic sewage are released into water bodies. Sedimentation and siltation caused by deforestation, land degradation and soil erosion impact overall water quality. Most significantly, poor planning practices, weak infrastructure and inadequate wastewater treatment systems add to the untreated water discharge. Water pollution leads to death and destruction, loss of livelihood and income, and health hazards.

Since pollutants in a river flow do not understand national boundaries, polluted water from one country flows into other countries. Water hyacinth has a tendency of spreading fast. Pollutant loads are carried along with runoff and sedimentation loads which lead to water quality deterioration further downstream, rendering it non-viable for drinking purposes.

Rwanda

The main sources of water pollution are domestic, commercial, industrial, agricultural activities, water hyacinth and mismanagement of wetlands. Due to increased population, and unsustainable agricultural practices, inadequate sanitation facilities, there is an extensive use of fertilizers and pesticides. Also, wastewater from rural towns and villages containing faecal pollution is left untreated, giving rise to water borne diseases.

In River Nyabugogo, there have been high rates of iodine at 7.62mg per



Dominant Pollutants

Country	Concentrations
Rwanda	High levels of iodine, copper, fluoride, ammonia, sodium, hexavalent chromium
Burundi	Arsenic, heavy metal pollutants in Kabarore mine region of Nwogere tributary of Kanyaru River
Tanzania	High Fluoride and salinity levels, mercury and other gold mining related pollution in Lake Victoria Basin
Kenya	High phosphates and nitrate levels as well as chemical pollution from pesticides.
Uganda	High levels of Nitrogen, Phosphorus, especially from Kagera. E-coli, Alkalinity levels in rivers feeding Lake Victoria Basin. Localized pollution from oil exploration in Kyoga-Edward basin. Zinc, copper, cobalt, nickel concentrations.
Ethiopia	Sedimentation – 140 million tonnes/ year
Sudan + South Sudan	Chromium in White Nile, organochlorine in fish stock of Lake Nubia
Egypt	Heavy metal and toxic organic compounds from industrial sources.

litre. Additionally, there are large concentrations of copper at 1.3mg per litre, fluoride at 1.85mg per litre, ammonia at 1.7mg per litre and sodium at 105.3mg per litre. Also, hexavalent chromium was found ranging between 0.09 to 0.28 µg per litre.

Although the Rwandan Ministry of Lands, Environment, Forest, Water & Mines (MINITERE) and Établissement Rwandais de Distribution de l'Eau, de l'Electricité et de Gaz (ELECTROGAZ) have laboratories in place for water monitoring, the data is insufficient. The water drinking standards have been defined but have not been adopted yet.

As a result of eutrophication by water hyacinth and agricultural pressure, Lakes Mihindi and Muhazi in Southern Rwanda are diminishing in size.

Burundi

Burundi suffers from bacteriological pollution from animal waste, organic pollution due to waste effluent from coffee processing plants, and industrial pollution

due to chemical fertilizers such as nitrates, phosphates and pesticides. Some of the causes of pollution are high demographic density, lack of latrines and waste dumping, and mining activities resulting in discharge of heavy metals and arsenic, especially in River Kanyaru's tributary, Nowgere.

Bujumbura accounts for 90 per cent of industries in Burundi. However, data regarding industrial pollution is unavailable and not much has been achieved in monitoring and managing water quality due to under-resourcing of laboratories.

Tanzania

The water quality in Tanzania is affected by natural factors and human activities. The former comprises high fluoride concentrations and salinity in natural waters. The latter includes discharge of municipal and industrial wastewater, run-off from agricultural lands, and erosion encompassing high concentrations of nutrients, pathogens, BOD and COD levels.

Additionally, gold mines in the Lake Victoria Basin contribute to heavy metal pollution.

Tanzania has no comprehensive national programme for monitoring the quality of water or pollution even though water utility companies are required by law to monitor the water source and quality of water they supply.

Kenya

Water pollution in Kenya is caused by point and non-point sources such as agricultural activity, urbanization, industry, leachates from solid waste tips, sediments, salts, fertilizers and pesticide residues. Additionally, municipal sewerage plants discharge untreated wastewater into watercourses, causing significant health hazards and localized eutrophication. Tanneries, pulp and paper mills, coffee processing factories, breweries and sugar cane processing facilities do not have effective wastewater treatment plants and their effluents contribute organic loads, heavy metals and other toxic substances.

The point pollution sources include sugar, paper, and fish industries, and also municipal sewage, oils and lubricants, marine workshops, petrol stations, human wastes and refuse from market and urban centres and fishing villages. The main non-point pollution sources comprise high nitrate, phosphate and pesticides from poor application of agricultural chemicals and soil erosion.

The Kenyan Lake Victoria Basin has a population of 12 million people and a low depth of approximately 6 metres, thereby causing an inability of catchment areas to perform purification of water. Although only 8 per cent of Lake Victoria falls into Kenyan territory, tributaries such as Sio, Nzoia, Yala, Nyando and Mara are already severely polluted and contribute further to the lake pollution.

Uganda

The increased demand and use of pesticides, fungicides, herbicides and fertilizers is impacting the water quality in Uganda. Agricultural practices account for 50 per cent of nitrogen and 56 per cent of phosphorus levels in Lake Victoria Basin. Additionally, the exploitation of petroleum threatens the overall ecosystems of Lake Albert and Edward Basins. The Northern end of Lake George, and its associated wetlands receive localized metal pollution from a former copper mine and tailings left after metal extraction. There is a high concentration of zinc, copper, cobalt and nickel in the lake.

The point pollutants comprise domestic and industrial effluents, sewage and municipal effluents, effluents from mining activities and breweries. The non-point sources include agricultural run-off and atmospheric deposition. The urban centres in Uganda contribute 77 per cent of the pollution into Lake Victoria. Kampala alone contributes about 65 per cent of Biochemical Oxygen Demand (BOD), 73 per cent of nitrogen and 73 per cent of phosphorus from all urban centres around Lake Victoria.

Some of the primary concerns for water quality include siltation, atmospheric deposition, industrial effluents, agricultural run-off, eutrophication, water hyacinth, discharge of heavy metals and residues from chemical herbicides and pesticides, wetland degradation, limited water quality assessment and monitoring, population pressure, and heavy metal discharge from copper mines.

If the present treatment plants in Kisumu performed optimally, the BOD loads could be brought down by 50 per cent. Water supply to both municipalities and villages is also affected by water hyacinth. In municipalities, water hyacinth interferes with the water-intake points causing blockage, which lowers the quantity of water pumped - in Kisumu the water supply has dropped from 20,000 m³ to 10,000 m³ per day. The Kagera sub-catchment has a total of



33 per cent discharge into Lake Victoria, thereby accounting for the highest total phosphorus and nitrogen concentrations into the Lake. Also, there are significant pollution loads from urban establishments.

The Mining Act 2003 prohibits mining activities from discharging toxic waste into water bodies. According to the Water (waste discharge regulations) Act of 1998, all industries are required to hold a waste discharge permit which requires them to install wastewater treatment equipment, monitor effluents by environment inspectors, and pay waste discharge fees. A statutory instrument dated 1999, defining the standards of water effluents to be discharged into water bodies, is also in place. All developments along the wetlands, lakeshores and river banks require environment impact studies to ensure water catchment conservation according to the National Environment (Wetlands, River Banks and Lakeshore Management) Regulation of 2000.

Ethiopia

In Ethiopia, the main industries are textiles, soft drinks, food, metals and tannery; however, most of these industries do not have any waste treatment facilities. The notable point pollutants are chromium, hydrogen sulphide, dyes and caustic soda. The non-point pollutants include domestic solid waste and effluents. Additionally, faecal pollution from cattle, pesticide and fertiliser run-off also contribute significantly.

Ethiopia has no national water quality monitoring scheme or national laboratories monitoring the Nile. Data regarding heavy metal concentrations and nutrient levels that cause eutrophication are unavailable. Available data on water quality is spatially and temporally limited but shows that water quality is generally satisfactory with the exception of high potassium and fluoride content. Ethiopia contributes 140 million tonnes of sediment to the Blue Nile annually owing to torrential rainfall

over a short period, highly erodible terrain and increased agricultural activity and habitation related deforestation in the Ethiopian Highlands.

Sudan

In 2002-04, a survey along the Blue and White Nile and their confluence in Khartoum was conducted to identify sources of water pollution. The results of this survey, though ten years old, are still relevant.

- ≡ There were high BOD values at the Blue Nile and the confluence
- ≡ There were high oil and grease values at the power stations on the Blue Nile
- ≡ There was an alarmingly high chromium (Cr+6) level in the White Nile
- ≡ The White Nile is more bacteriologically polluted than the Blue Nile
- ≡ Ethiopia contributes approximately 140 million tonnes of sediment load into the Nile which causes siltation of reservoirs and irrigation canals and blockage of hydro-electrical turbines
- ≡ Since 2004, Sudan has been using neo-nicotinoids for agricultural purposes, thereby causing problems related to pesticides.

In 1974, Sudan passed an Act on the application of pesticides; this act was updated in 1994. Unfortunately, the law is not followed by small and poor farmers, who often cause incidents of pollution due to unsafe application of pesticides. Several parts of the country have serious water quality problems; for instance, the Gezira region, Lake Nubia, and Eastern and Western parts of Sudan. Additionally, urbanization in cities like Khartoum and Wad Medani enhance pollution via sewage.

The Sudanese Ministry of Irrigation and Water Resources and the Irrigation Department conduct regular studies on sedimentation. The Permanent Joint Technical Commission for Nile Waters (PJTC) is responsible for co-ordination between Sudan and

Egypt in Nile water management. The National Water Corporation under the purview of the Ministry of Engineering Affairs caters to drinking water supplies and is supervised by the Minister of Irrigation and Water Resources. The Natural Water Directorate under the Ministry of Irrigation and Water Resources runs the Ground Water Wadi Directorate (GWWD) and Nile Water Directorate. GWWD's laboratories conduct tests from eight stations at three sites on Mongolla, Soba, and Dongolla thrice a year. Generally, water quality at the sites are satisfactory though high rates of ammonia and turbidity due to total suspended solids (up to 26950 mg/l) was found. A chemical analysis of industrial effluents and pesticide survey is needed to better understand these contaminants in the Sudanese context.

Egypt

Generally, the Nile waters that pass through Egypt undergo a process of cleansing as they pass through the reservoir of Lake Nasser. However, water quality is still a cause of concern because of agricultural drainage, industrial development, domestic and wastewater pollution.

Presently, the annual industrial water usage is 5.9 BCM, of which 550 MCM is discharged untreated into the River Nile. There are approximately 125 major industrial plants within the Nile Valley which contribute to heavy metal loads.

As a consequence of excessive use of fertilizers, estimated at almost 6.5 million tonnes each year, there is runoff and seepage into surface and ground water.

Also, upward seepage of sea water is leading to high salinity levels in the Delta. In the Delta region, the Rosetta Branch receives a higher concentration of organic compounds, nutrients and oil and grease than the Damietta Branch.

Currently, there is no toxicity study available, but BOD

levels are found to be highest from sugar and other agro-processing industries and chemical industries. It is well known that chemical, iron and steel industries dump toxic wastes but specific information regarding the effluent concentrations is unavailable.

In 1962, the Egyptian Ministry of Water Resources and Irrigation introduced a law catered to water quality management. The ministry set up 290 surface water locations for water monitoring purposes. It issues licenses for domestic and industrial discharge but the compliance inspections are under the purview of Minister of Health and Population. Furthermore, a ministerial committee was formed to intensify water pollution management and recommend remedial procedures, including industrial and domestic wastewater projects, networks for monitoring and controlling water quality, canals and agricultural drains management in the form of five year plans. In 2000-01, 34 industrial plants were monitored closely to prevent untreated discharge of about 100 MCM per year directly into the Nile to combat industrial pollution of the river.

Water Hyacinth

Water hyacinth, an aquatic weed found in tropical and sub-tropical regions is a cause of concern in the Nile waters. In addition to creating physical obstacles to irrigation, navigation and hydro-electric inlets, it also increases evapotranspiration. Generally, water hyacinth causes water to evaporate thrice as much as native vegetation does. The reasons for its rapid growth and survival are sedimentation, domestic and industrial waste.

Most of the Nile Basin countries witness cases of uncontrolled water hyacinth. Lake Victoria, Rwanda and Burundi's Kagera River, Tanzania's Pangani and Sigi Rivers, Kenya's Naivasha River, Uganda's Kyoga and Kwanja Rivers, Sudan and South Sudan's White Nile River, and Egypt's main Nile River and Northern lakes all suffer from water hyacinth infestation.



Quality Monitoring Stations

Country	Number of Stations
Rwanda	MINITERE's laboratory does basic testing, not capable of pesticide and heavy metal pollution testing. 2 monitoring stations on Nyabarongo and Rusumo Rivers, 13 functioning hydrologic stations. 3 laboratories in Kigali
Burundi	No national monitoring stations, Faculté de Sciences Agronomiques (FACAGRO), Institut National pour l'Environnement et la Conservation de la Nature (INECN), Regie de Production et de Distribution d'eau et d'électricité (REGIDESO) and municipal technical services conduct basic testing
Tanzania	LVEMP of Ministry of Water and Livestock Development has a water quality control procedure in place, water quality monitoring in Pangani, Rufiji, Dar es Salaam city also in place. Mara and Kagera monitored regionally via Nile Equatorial Lakes Subsidiary Action Program (NELSAP).
Kenya	Ministry of Water and Irrigation (MOWI) runs laboratories jointly with Lake Victoria Environment Management Program (LVEMP), 100 stations of LVEMP, Kenya Marine and Fisheries Research Institute's (KEMFRI) 18 stations, Lake Basin Development Authority (LBDA)'s 30 stations.
Uganda	Water Resources Management Department Data is of best quality, other main laboratories are Fisheries Resources Research Institute (FIRRI), Uganda National Standards Bureau (UNBS) and National Water & Sewerage Corporation (NWSC), some teaching and research institutes
Ethiopia	No national laboratories. 5 regional laboratories with limited testing capability in Gambella, Tigray, Amhara and Benishangul-Gumuz.
Sudan and South Sudan	Groundwater and Wadis Directorate main laboratory, lacking equipment for most testing, except heavy metals. 8 other laboratories conducting basic analysis.
Egypt	119 stations (1 at AHD, 21 on Nile monitoring industrial pollution, 13 in the Gulf of Suez and 84 along Mediterranean and Red Sea coasts)

The most serious incident of water hyacinth infestation was observed in the late 1990s. In 1995, 90 per cent of Uganda's coastline was blanketed by weeds. In 1998, approximately 20,000 hectares of Lake Victoria was covered in water weeds. In 2010, water hyacinth receded to cover 518 hectares of Lake Victoria due to conscientious efforts made by the Lake Victoria Environment Management Project. However, Lake Victoria's waters will always be at threat due to the inflow of water hyacinth through Kagera River and the presence of favourable nutrients that enhance the growth of the weeds. In sum, the flow of River Nile is

reduced by one-tenth due to water hyacinth in Lake Victoria.

Some of the consequences of water hyacinth include breakdown of hydroelectric stations due to choking of coolers and generators; decline of fishing industry because of lack of access to fishing grounds; health hazards such as spread of malaria, bilharzia, cholera and filariasis; economic impacts comprising high costs for manual removal of weeds; clogging of canals and rivers reducing water flow and increasing evapotranspiration; and difficulty in navigation on rivers.

Challenge 6

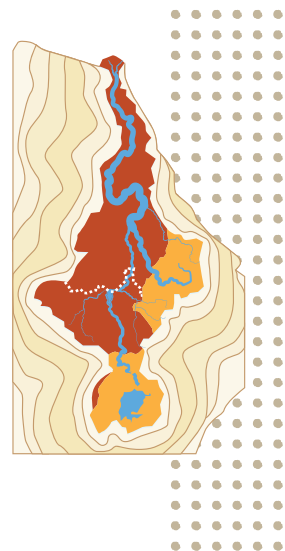
GROUNDWATER

Some countries of the Nile River Basin have several alternate sources of water, while others are heavily dependent on the Nile Waters. Other than the surface water from lakes and rivers of the Nile Basin, groundwater is a very important addition to the total availability of water. While the Nile Basin countries are still negotiating their share of surface water, they are yet to begin the debate on shared groundwater. The average groundwater recharge in the Nile River Basin is around 400 BCM a year while the seasonal storage and soil moisture averages 100-150 BCM and 30 BCM per year respectively.

The main problem with forecasting groundwater potential in the Nile River Basin is the absence of data and the relevance of different variables to calculate it. Other than the non-renewable groundwater which exists due to tectonic factors or fossil fuels in aquifers, renewable groundwater can be measured by interaction of various climatic features on the soil column. Factors to consider include the water retention capabilities of the soil column, groundwater runoff and its interaction with surface water.

Important issues in the Nile River Basin

The Need to Address Trans-boundary Aquifers: Most of the countries get their groundwater through direct precipitation/rainfall which recharge their aquifers or from fossil waters stored in their deep aquifers and through seepages or interaction with surface water. These aquifers extend across various countries. Currently, there is no law governing aquifers. This issue might crop up in the future as dependency of an aquifer of one country might affect the groundwater levels of the other countries involved. Also, pollution by a country might affect the groundwater in the shared aquifer.



Interaction between Surface Water and Groundwater: It is essential to understand the overlap between the groundwater and surface water and their effects on each other.

- ≡ Surface water pollution may also lead to groundwater pollution. This has been noticed in Lake Victoria where polluted water from the lake had seeped in as groundwater which was of poor quality and unsuitable for drinking purposes.
- ≡ In the coastal regions this overlap may lead to high levels of salinity.
- ≡ Lake Alemaya in Ethiopia is gradually losing surface water due to over-abstraction of groundwater from adjoining aquifers.

Weak Groundwater Infrastructure: Groundwater infrastructure requires a lot of improvement in the Nile River basin. This infrastructure needs to be planned and regulated, while existing systems need to be maintained and repaired from time to time. In Tanzania, over 90 per cent of piped systems failed due to unavailability of fuel to pump water out. In Kenya, Transparency International found cases where water was unaccounted for and meter readings were being tampered with. Groundwater monitoring systems are very new to these countries. Kenya installed 100 of these for the first time in 2003. Also, many countries lack deep wells and pumping systems and rely on shallow wells and boreholes.

Issues Related to Groundwater in the Nile Basin Countries

Rwanda	Pollution pesticides, garbage dumps, industrial waste
Burundi	Very Deep Aquifers difficult to access
Tanzania	Pollution gold mining, mercury levels. Threat of over exploitation
Kenya	Pollution - Shallow Groundwater industrial, agricultural waste. Treat from over exploitation
Uganda	Pollution proximity to lakes and wetlands
Eritrea	Florde high levels
Ethiopia	Lack of Modernization extensive groundwater storage capacity
Ethiopia	Lack of Modernization extensive groundwater storage capacity
Egypt	Pollution urbanization, industrialisation. 20% groundwater, below drinking water standards

Challenge 7

WETLANDS

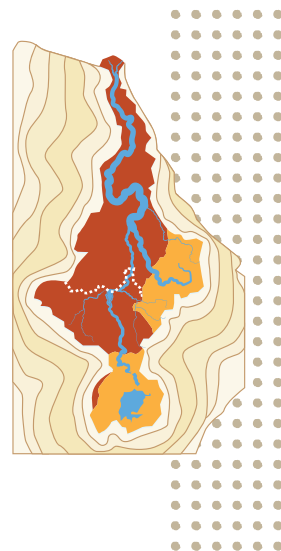
The wetlands in the Nile River Basin make up 3 per cent or 100,000 km² of total land area and are found mostly in Burundi, Uganda, Ethiopia, South Sudan and Egypt. The Sudd in South Sudan is the largest wetland, covering an approximate area of 30,000 to 40,000 km². The other significant wetlands include those that surround Lakes Victoria and Kyoga in Uganda; Lakes Manzala, Burullus and Bardawil in Egypt; Rivers Baro and Akobo and Lakes Tana, Turkana, Abijata and Shaila in Ethiopia.

Uganda

In 1964, the wetlands made up 32,000 km² of Uganda, which reduced to 26,308 km² or 11 per cent of total land area in 2005. However, due to careful precaution and conservation, the present wetland cover comprises 33,000km² or 13 per cent of Ugandan land area. The wetlands mostly exist around the equatorial Lakes Victoria, Kyoga and George, and are also found at higher altitudes including the Rift Valley.

The primary threat faced by Uganda's wetlands includes an increase in population and urbanization. In the absence of clear legislation, rich farmers acquire leases for up to 99 years and cultivate within wetlands. Although this may be productive in the short-run, it will be highly destructive in the future and lead to infertile land, over-drainage of water, pest invasion and water-borne diseases.

In 2005, Uganda developed the National Policy for the Conservation and Management of Wetland Resources in collaboration with the Wetland Inspection Division (WID) and National Wetlands Programme (NWP). The policies cater to drainage of wetlands, conservation and sustainable use of



wetlands, wetlands legislation and institutional arrangements, environmentally sound management and capacity building.

Ethiopia

The wetlands in Ethiopia cover 1.14 per cent of its total land area or approximately 13,699km². They exist mainly in the North-western and Western Highlands, Rift Valley and regions surrounding Lakes Tana, Turkana, Abijatta and Shaila, and Rivers Baro and Akobo.

The primary threats faced by Ethiopia include demographic pressure with a 2.1 per cent increase in growth rate, over-grazing, soil erosion and deforestation; urbanization and industrialization in the wetland areas; pollution due to fertilizers, pesticides and eutrophication; and water hyacinth especially around Addis Ababa, thereby resulting in loss of vegetation and habitat. The Ethiopians rely heavily on wetlands for several purposes, especially household necessities and food security. Gradually, this will take a toll on the wetlands and lead to over-exploitation.

Recently, Ethiopia has begun taking an interest in wetland conservation. The Nile Basin Initiative and Wetland Action are working on many projects related to the wetlands in Ethiopia for better data and analysis.

South Sudan

The Sudd is a vast marshland that covers an area of 30,000–40,000 km². It comprises heavy vegetation and bio-diversity, and is home to three kinds of tribes, namely the Nuer, Dinka and Shilluk. The Nuer and Dinka pastoralists rear cattle in the dry seasons and move to higher altitudes to cultivate sorghum during the wet seasons. On the other hand, the Shilluk tribe is sedentary and relies on cultivation and fishing for

their livelihood. The Sudd also supports five types of ecosystems including 100 mammals and 470 bird species, many of which are migratory. 1.2 million antelope also live here. The Sudd acts as a buffer zone, thereby reducing the flow of the White Nile and preventing floods.

It is estimated that the average amount of water flowing into the Sudd is approximately 33 BCM, of which only 16 BCM is released towards Sudan and Egypt. Most of it is lost to evaporation and absorption. Studies suggest that evaporation over the Sudd contributes only one per cent to the volume of moisture influx.

In order to bypass the slow pace of water in the Sudds and the large volume of evaporation, Egypt and Sudan started work on the Jonglei Canal in 1978. Jonglei Canal was envisioned to extend up to 360 km from Bor to Malakal, where River Sobat meets the White Nile. While, 260 km of Jonglei was built, further expansion was halted in 1984 because of the on-going civil war and other related problems. This project was scheduled to provide for an additional 4 BCM of water in the first stage and another 3 BCM in the second stage.

Egypt

The wetlands in Egypt cover 3 per cent of its total land area or approximately 33,450 km². They exist mainly around the Nile Delta surrounding Lakes Manzala, Burrulus and Burdawil, regions in the lower Nile Valley and Suez Canal, and around Lakes Oasis and Nasser.

The primary threats faced by Egypt include salinity, contaminated drainage since most of the wastewater flows through the Delta lakes before flowing to the sea, and demographic pressure causing over-exploitation.

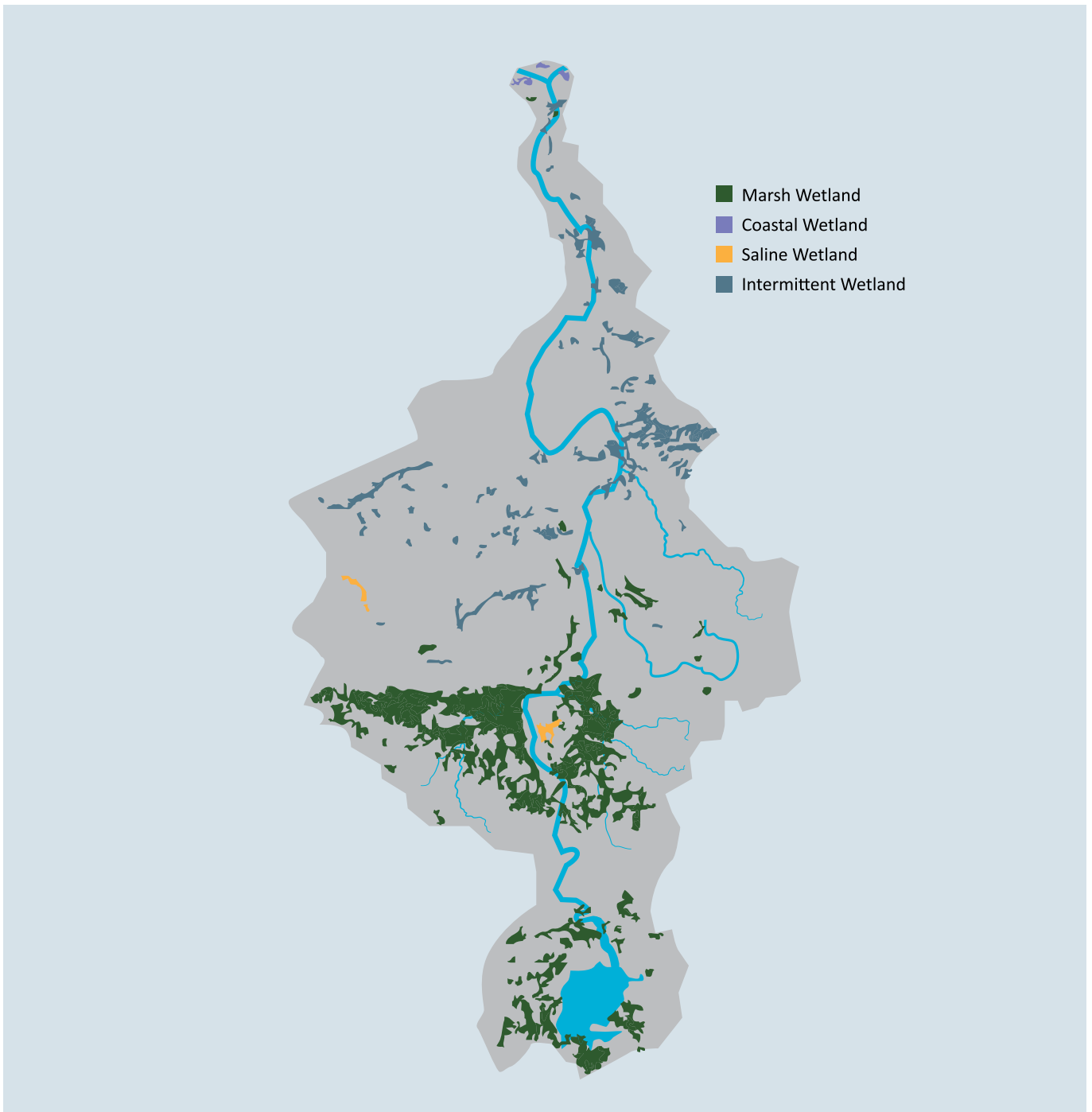
In 2005, Egypt came up with the National Wetland Strategy to take steps to protect its wetlands. By 2011, Egypt had successfully implemented re-plantation

of mangrove forests to balance the climate change taking place with the help of local committees. It now believes that Lake Burrulus and Burdawil should be replaced in the Ramsar Sites list of protected wetlands.

In 1999, the Lake Manzala Engineered Wetlands

Project (LMEWP) was established; it is said to have been implemented at one-fourth the cost of a conventional treatment plant. Each year, approximately 5 BCM of untreated sanitary wastewater and 12-13 BCM of drainage water enter the Mediterranean Sea from Egypt.

Wetlands in the Nile Basin



Challenge 8

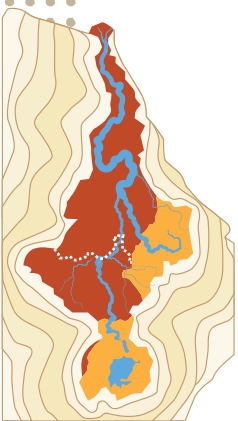
FOOD SECURITY

The Nile Basin countries depend on food imports to meet most of their staple requirements.

Eastern Africa

The countries in this area suffer from erratic rainfall, change in the duration of precipitation season and frequent droughts. Kenya, Ethiopia, Rwanda and Burundi are highly vulnerable to the vagaries of Climate Change. Uganda and Tanzania for now are less vulnerable to these factors and are thus able to produce surplus food which meets regional food import demands for staples. There has been a 22.5 per cent increase in net cereal production in recent years in Eastern Africa, due to favourable rainfall despite changing patterns of precipitation. Nevertheless, increase in cereal production does not directly result in food security in the region because of a number of reasons:

- ≡ Eastern Africa has a 90 per cent regional dependence on rain-fed agriculture. The only formally irrigated areas in the region are parts of Kenya such as the Nzoia River, a tributary of Lake Victoria Basin and Tana River in Eastern Kenya, as well as the Kyoga Basin in Uganda
- ≡ Low crop yields as well as low cropping intensity are witnessed in the region in general
- ≡ Post-harvest food losses due to lack of adequate storage facilities from bad weather and pests
- ≡ Localized food insecurity witnessed in Kenya, Uganda, Sudan, Burundi and Ethiopia for a number of area specific reasons ranging from drought to armed conflict



- ≡ Lack of access to food due to poor transportation and weak market integration
- ≡ Chronic food deficits due to import dependency as witnessed in Kenya and Ethiopia
- ≡ High prices due to general food scarcity and rapidly rising fuel prices.

Sudan and South Sudan

Since the 1950s, Sudan has been going through bitter civil and military conflict which culminated in the formation of South Sudan in 2011. The primary arable land of the country falls along the still disputed borders of the two nations, such as the Abyei and the Blue Nile region. Sudan has the potential to be a surplus food producer because of its well developed irrigation schemes along the Nile River, such as the Gezira scheme. However, South Sudan's infrastructural development is very low. In July 2012, South Sudan inked a bilateral agreement with Israel to improve its water infrastructure including irrigation schemes.

Egypt

Egypt is a hyper-arid country which imports a large portion of its food for consumption. Net cereal imports for Egypt have increased sharply from 33.7 per cent to 44 per cent in 2010-2011, predominantly owing to rapid population growth and limited room for agricultural land expansion within its borders.

Food Imports

Rwanda, Burundi, Kenya and Ethiopia have a food deficit both in terms of supply and nation-wide accessibility, even though Rwanda has seen a decreasing trend in dependency on cereal imports for food consumption in recent years. Ethiopia and Kenya lack sufficient supply and access largely owing to affordability issues; besides insufficient

transportation systems especially outside of urban and peri-urban areas. Uganda and Tanzania have sufficient food supply but suffer from economic food insecurity particularly amongst lower income groups who lack sufficient purchasing power. Expenditure for food imports is a great economic burden on the economies of all Nile countries as all these countries have low income with the exception of Egypt which is in middle-income group. While the countries have increased their raw food exports, their imports have increased at a faster rate.

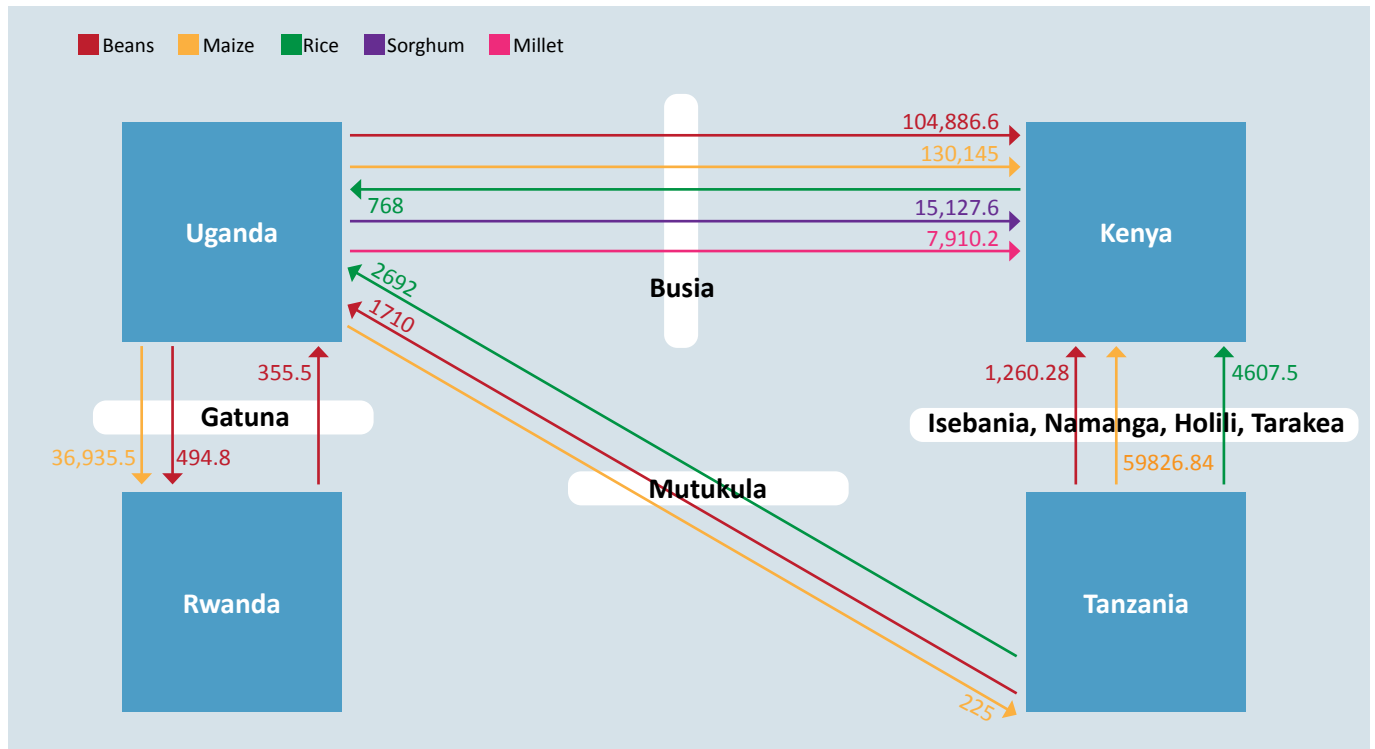
It is estimated that food demand will triple by 2050. The region's ability to meet its food demand will predominantly depend on increasing crop yields. This could be achieved through improving crop patterns using advanced seeds that are drought resistant and would prevent crop failure during insufficient rainfall. Also improved access to agricultural water is required through organised irrigation expansion, installing rainwater harvesting, water storage and advanced water efficient irrigation systems such as drip irrigation. The stabilizing of food prices, by sufficient local and regional food production will also aid in food security by making food more affordable for the populace. A reduction in dependence on imports for food will impact on both food prices and future food trade. The region has the potential to become food sufficient and perhaps a food surplus producer but achieving this potential will largely depend on increasing crop yields and irrigated crop areas.



Food Trade in Tonnes (2009)

Country	Imports	Exports
Rwanda	Palm Oil 23,905	Coffee 15,109
	Sugar 22,200	Tea 20,624
	Veg. Oil 10,882	Beverages Non-alcoholic 3,835
	Wheat 26,164	Beans 4,843
	Maize 52,957	Beer 2,285
Burundi	Wheat 24,485	Coffee 17,115
	Malt 12,685	Tea 6,454
	Veg. Oil 7,339	Fruits 23,072
	Rice 5,274	Sugar Raw 3,000
	Sugar Refined 8,274	Cigarettes 268
Tanzania	Wheat + Wheat Flour 826,300 + 47,912	Coffee 56,022
	Palm Oil 169,473	Tobacco 43,561
	Sugar 99,903	Cotton Lint 78,029
	Malt 29,614	Cashew 95,577
		Tea 30,438
Kenya	Maize 1,508,410	Tea 331,594
	Palm Oil 487,062	Coffee 59,991
	Wheat 781,717	Vegetables 52,085
	Sugar 143,186	Cigarettes 10,150
	Rice 159,287	Tobacco 22,043
Uganda	Wheat 412,999	Coffee 174,227
	Palm Oil 171,484	Tea 44,446
	Sugar Refined + Raw 78,708 + 51,943	Tobacco 30,096
	Beer 55,796	Oil Hydrogenated 30,193
	Rice 50,200	Sugar Raw 64,074
Sudan + South Sudan	Wheat 1,770,260	Sesame Seeds 125,097
	Sugar Refined + Raw 227,360 + 99,800	Cotton Lint 29,672
	Milk Powder 32,424	Vegetables 12,141
	Palm Oil 77,900	Sugar Raw 34,900
	Sorghum 300,809	Sheep Meat 1,731
Egypt	Wheat 4,059,930	Oranges 821,812
	Maize 1,935,440	Rice 560,430
	Soy Beans 548,680	Cheese 106,198
	Palm Oil 256,149	Grapes 135,586
	Meat Cattle 95,360	Onions 235,151

East Africa Cross-border Trade in MT (2009)



Future Exports of Virtual Water

Foreign Land Investments to Grow Crops for Exports

Increasing emphasis on agricultural expansion, demand on commercial agriculture, and increasing land investments for agriculture projects run by Asian investors is set to increase manifold in the Nile River Basin. Foreign investments are essentially focusing on sugar cane and rice, which are water intensive. For instance, water needed for sugarcane crops is 1500 mm to 2500 mm/hectares as compared to sugar beets which require 550mm to 750mm/hectare. Sugar beets are a prominent indigenous staple but sugarcane has been grown increasingly for exports rather than domestic consumption. This is also indicative of regional food security as a result of export-oriented crop productions.

5% of African agricultural land or 40 million hectare, was sold to foreign investors between 2000 to 2009. If all of this land were to be cultivated, it will require, 300 to 500 BCM of water, which is double of the agricultural water used in the continent in 2005, that is 184.35 BCM.

- ≡ Biofuel and edible crops for fuel will exert heavy demand on regional fresh water

Ethanol from sugar manufacturing industries and jatropha crop cultivation are the primary types of biofuel projects at the pilot stage in the region. Jatropha production projects have been piloted all over the Eastern African region, with governments contracting land to foreign investors.



Biofuel Production Plans and Land Allocated

Country	Planned Production
Rwanda	Plans 20 million litres production on 10,000 hectares (marginal land)
Burundi	No Data
Tanzania	641,179 hectares have been allocated by government for biofuel production
Kenya	23 million litres of ethanol, 34 MW from Tana integrated sugar project alone; at least 58,000 hectares allotted in 3 projects for biofuels and sugarcane (ethanol)
Uganda	75,000 hectares of prime forest land (mabira) has been allotted by the government
Sudan	\$1 billion ethanol plant in Kenana, annual 45 million litres capacity since March 2012, stalled in July due to low EU demand
South Sudan	No Data
Ethiopia	Future plans to produce 20 million litres; at least 55,000 hectares have been contracted by the government
Egypt	At least 50,000 hectares slated for biofuels production

Drivers of Food Insecurity

Low Yields

Crop yields are a significant factor in food insecurity in the region especially East Africa.

Land and Rainfall

The large potential for expansion of arable land in East Africa will be primary met by expanding cultivated land by clearing of bush areas. Between 1980 and 2000, cultivated land areas expanded by 50 per cent in East Africa. Another source indicates that potential arable land actually in use in the Nile region is much lower. In the Nile basin, the highest rate of potential arable land in use is in Ethiopia at 34 per cent and the lowest in Uganda at 13 per cent.

Shifting rainfall patterns and inadequate rainfall cause crop failure, having the most detrimental impact

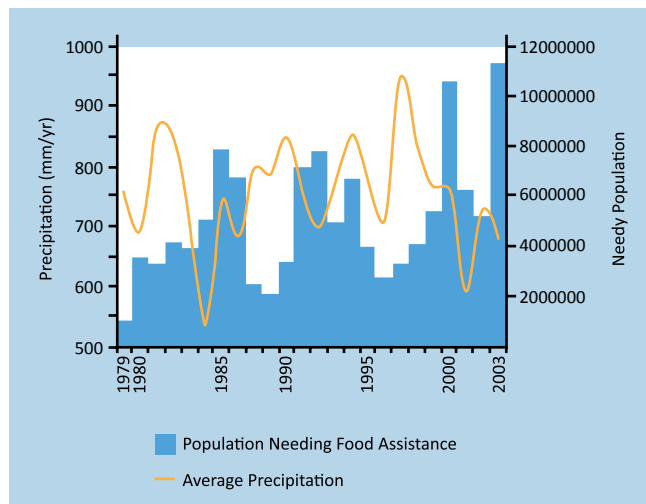
on food security. In 2003, precipitation in Ethiopia was at a record low of below 650 mm which led to over 11 million people being dependent on food aid. Rain-fed agricultural production accounts for 90 per cent of agricultural production and so droughts have a highly detrimental impact on regional food security. East Africa will experience both crop gains and losses as a result of climate change. Crop yields for staples such as maize and beans will double in the Highlands as rising temperatures will accelerate crop maturity. On the other hand, both dry and humid regions will witness crop losses with as much as 20 per cent crop yield losses predicted in the regions of coastal Kenya, Northeast and Northwest Tanzania and Central Uganda by 2050. Besides coastal Kenya, the other regions are in the Nile River Basin. Adapting agricultural systems, water harvesting, expanding livestock production in ASAL areas and keeping farmers abreast of modern and cost effective technologies via mobile phones and internet can help achieve food security in the region.

Average Yield (tonnes/ hectare) from 1998 - 2007

Country	Banana	Barley	Cassava	Coffee	Maize	Millet	Potatoes	Sorghum	Sugarcane	Sweet Potatoes	Tea	Wheat
Rwanda	-	-	5.72	0.70	0.80	0.80	8.22	1.00	27.66	5.72	1.26	0.76
Burundi	5.21	-	8.65	0.72	1.09	1.09	2.64	1.26	70.05	6.57	0.86	0.81
Tanzania	4.98	2.20	7.63	0.40	1.70	0.80	6.25	0.87	104.37	2.13	1.43	1.39
Uganda	4.56	-	12.78	0.69	1.64	1.57	6.90	1.45	87.98	4.37	1.77	1.74
Kenya	14.42	2.83	8.54	0.34	1.65	0.57	7.93	0.82	83.72	9.53	2.26	139.493
Sudan + South Sudan	32.51	-	1.73	-	0.82	0.27	16.89	0.63	92.70	13.39	-	2.40
Ethiopia	7.09	1.14	-	0.83	1.83	1.02	8.36	1.32	95.60	8.94	0.95	0.41
Egypt	39.58	2.43	-	-	7.74	-	24.18	5.71	118.67	27.45	-	6.39
World Average	15.6	-	10.1	-	4.73	0.86	15.1	1.39	67.02	11.6	1.1	2.72



Relationship between Precipitation and Food Aid - Ethiopia



Civil Conflict

The impact of civil conflict on food security is waning in Rwanda. But its impact is still experienced in a post-conflict Burundi that is facing more structural constraints in transitioning from conflict. The conflict over the new borders of Sudan and South Sudan is a major reason for crop failure and eventual food insecurity in the region.

There is a strong linkage between drought and civil conflict leading to food insecurity, as drought, low agricultural productivity and civil conflict together compound the instance of crop failure. Delayed or short rainfall season combined with escalating armed conflict in South Kordofan and Blue Nile states, which are usually net surplus producers, has cut the annual food staples production of Sudan by 50 per cent in 2011-2012 and could result in a food deficit of 2 million metric tonnes. A similar phenomenon was experienced in 2009-2010 prior to the cessation of South Sudan.

Fifteen years of Civil War paralyzed Burundi's economy with stagnant agricultural growth. Only 28 per cent of the population is considered food secure. Although Burundi's food production per person is high in the Nile river basin at 105.1 kg/person/year, the agricultural sector is hampered by poor farming

practices and rising food prices. Burundi's poverty rate is 68 per cent and chronic malnutrition rate is 60 per cent. Burundi is affected by the La Nina effect which has brought about drought conditions in Central Africa, worsening food security in the region. World Food Programme provided aid to 50,000 households in 2010. The country needs \$200 million in investment to boost its food security.

While Somalia is not in the Nile river basin, its fortunes are mixed with Ethiopia's food production and supply due to informal food trade across the Ethiopia-Somalia border. As Ethiopia has depended on food aid for over three decades and its government is in the process of employing safety-nets and work-for-food schemes to reduce dependency on food aid, illegal food exports to Somalia can pressurise supplies in Ethiopia.

Rising Food Prices

Rising food prices due to increasing food demand and decreasing production are strongly linked with poverty increase as escalating food prices reduce purchasing power. As the poor population of East Africa spends 50 to 70 per cent of their disposable income on food, rising food prices leads to reduced food consumption as well as fall in nutrition levels. Despite improving cereal production due to favourable rainfall in 2010-2011, food prices increased in Africa in conjunction with global food price. This increase for the second time since 2007/2008 has led to over 6 million people getting dependent on food aid in Kenya and Ethiopia alone.

Poverty and environment are locked in a vicious circle such that poverty is both the agent as well as the victim of environment degradation. World Food Programme statistics of 2006 showed that only 22 per cent of the Rwandan population was food secure; the remaining had little or no access to food supply. Over 45 per cent of the children under the age of five are undernourished. Subsistence, rain-fed agriculture,

erratic rainfall, low soil fertility, poor farming methods, high prevalence of HIV/AIDs are all responsible for food insecurity.

All Nile River basin countries classify as low income food deficit countries. Increasing food prices do not result in increasing food production in East Africa due to limited arable land availability, limited irrigation, high fertilizer prices, inability to get loans and insurance and low motivation to take risk due to poor returns on investment. Investment in irrigation expansion is prohibitive for the agrarian-based economies that rely on 95 per cent of their production on rain-fed subsistence crops. The Eastern Nile Subsidiary Action Programme has targeted 100,000 hectares of prime land for irrigation expansion in Egypt, Sudan and Ethiopia which will be developed as part of NBI. A similar wetland watershed irrigation project has been undertaken by Nile Equatorial Lakes Subsidiary Action Programme in Tanzania and better agricultural systems for water efficiency and cropping patterns that prevent land degradation are being applied in the Kagera River Basin, also by NELSAP in conjunction with Kagera River Transboundary Integrated Water Resources Management and Development.

Need for Irrigation Expansion

All of the above factors will lead to a demand in irrigation for achieving food security which will increase pressure on regional water resources. Currently, 95 per cent of the current production is from rain-fed agriculture and substantial irrigation is in place only in Egypt and Sudan.

In the countries belonging to the Nile basin, potential arable land is 54 million hectares. Except for Egypt, less than 10 per cent of it is irrigated. Total irrigated land is 6.5 million. Out of this, Egypt and Sudan account for almost 5.5 million hectares and all the remaining countries account for 1 million hectares. Total irrigation potential in the basin is almost 15

million hectares. Egypt and Sudan have irrigated 5.5 million hectares and can at best irrigate additional 1 million hectares each. Thus, all upper riparian countries have untapped potential to increase irrigated land by 7-8 million hectares.

International Food Policy Research Institute has calculated that it may cost about US\$ 29 billion to add irrigated area by 5 million hectares. At this rate, if the potential to irrigate 7-8 million hectares in upper riparian countries is to be tapped, approximately US\$ 50 billion of financial resources will be required. Ethiopia alone has the potential to increase irrigated area by 3.5 million hectares if it can raise US\$ 25 billion.

The challenge of food security is thus closely linked with the challenge of irrigation and resource mobilisation. It is not the only challenge in the Nile Basin. Other developmental challenges will also require billions of dollars in the next decade or so.



Irrigation Potential

Country	Total Area of Country (in million hectares)	Potential Arable Land (%)	Potential Arable Land (in million hectares)	Irrigated Area 2010 (in thousand hectares)	Irrigated Area as per cent of Arable Land	Water Withdrawal (agriculture) (in BCM)	Irrigation Potential (in thousand hectares)	Irrigation Potential as per cent of Arable Land
Rwanda	2.6	38.15	1	9	0.89	0.102	165	16.42
Burundi	2.8	37.33	1	104	10.05	0.231	209	20.11
Tanzania	88.6	10.25	9	381	4.19	4.425	2300	25.32
Kenya	58.3	8.97	5	140	2.67	2.165	540	10.33
Uganda	23.7	26.08	6	67	1.09	0.295	560	9.06
Sudan	250.5	6.87	17	1900	11.03	23	3000	17.42
Ethiopia	111.6	10.93	12	410	3.36	5.204	3700	30.57
Egypt	99.5	2.82	3	3500	124.68	44	4400	156.74
Country Total	637	8.58	54	6500	-	79.422	14900	-

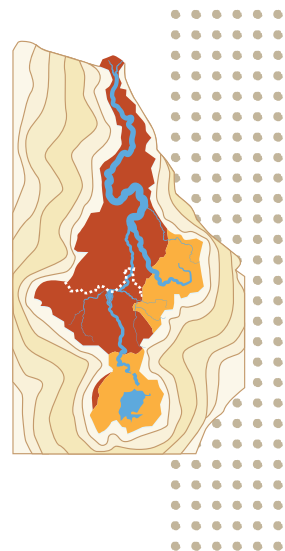
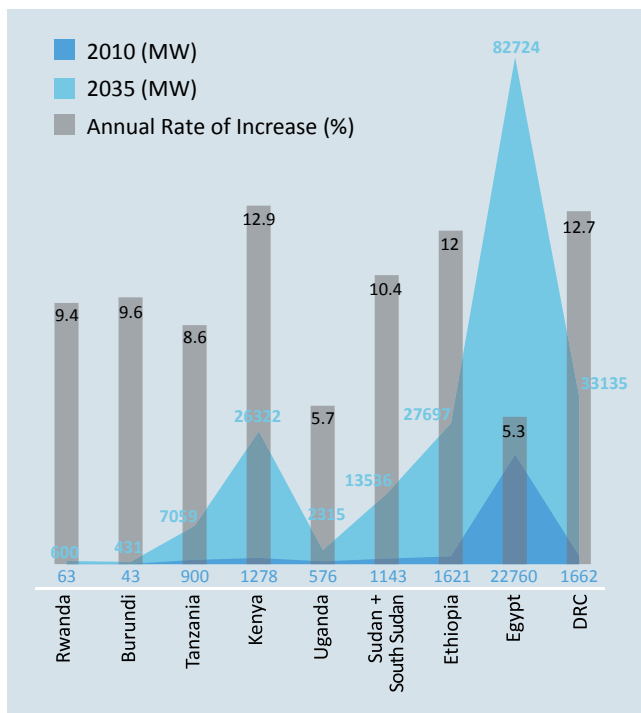
Challenge 9

ENERGY ASPIRATIONS

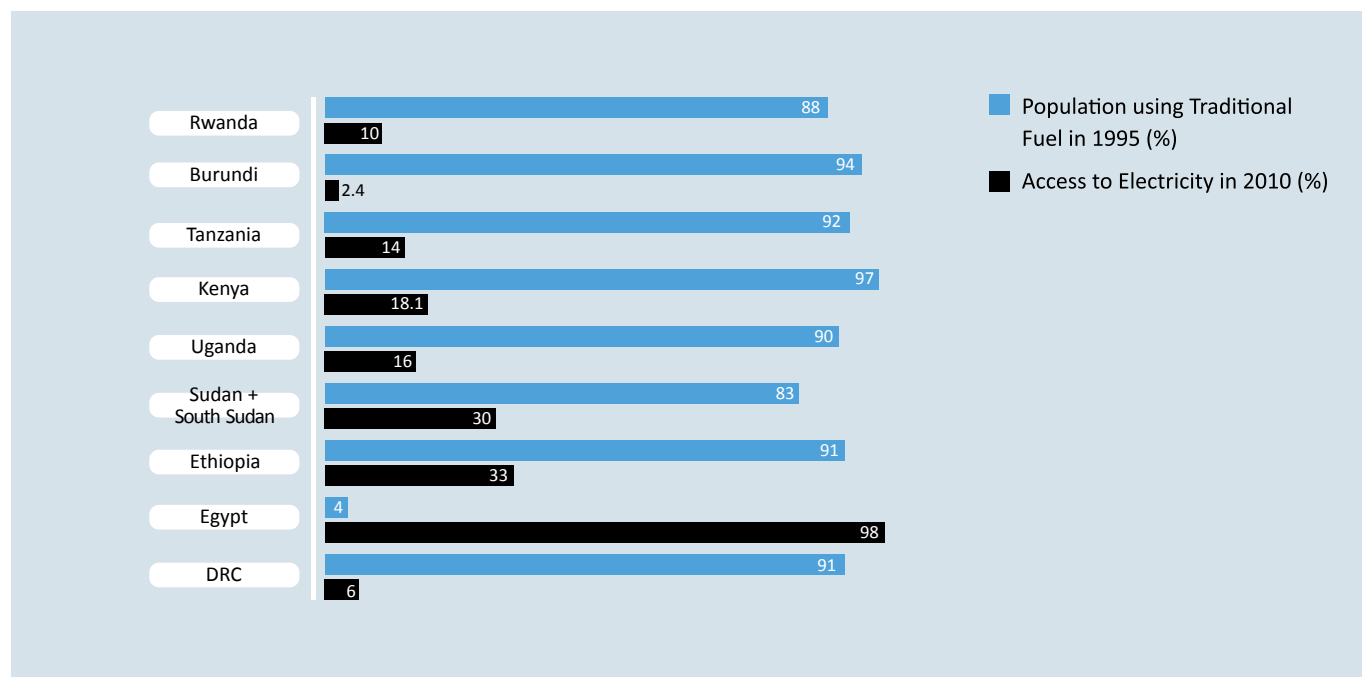
Economic Challenges

The Nile river basin countries have some of the fastest growing economies in the world, with the GDP growth rate of Rwanda, Ethiopia and Tanzania above 7 per cent. Uganda and Kenya are also experiencing rapid growth of 5.9 per cent and 5.6 per cent respectively. Ethiopia is projected to grow at a rate of 11-14 per cent in the coming years. The rest of the Nile riparian nations are looking to improve their current growth rates.

Peak Demand Forecast



Access to Electricity



To achieve a consistent and sustainable level of economic growth the countries will have to boost their industry, develop infrastructure and ensure food, water and energy security for the population. Some countries have detailed strategic visions for the next two decades, such as Kenya's Vision 2030, Tanzania's Development Vision 2025 and Egypt's National 2017 Plan. In order to achieve their objectives and satisfy their future demand the Nile riparian nations will have to boost their energy output and national connectivity. The peak demand forecast varies significantly with the rate of annual demand being 5.3 per cent in Egypt to almost 13 per cent in Kenya and DRC due to differences in population and economic growth rates.

Energy Sector Development

However, in order to meet their development needs, the development of the hydropower potential of the Nile River Basin has been of particular interest. The

countries have identified new hydropower options, as part of their national strategies and future plans. These new hydropower plants, both small and large scale, will serve to increase the installed capacity of each country, over the next 20 to 30 years.

Ethiopia is leading with plans to produce 16188.4MW of installed hydropower capacity. While Sudan, Tanzania and Uganda also have ambitious plans to increase future production, their combined capacity will be less than what Ethiopia is projecting.

The ambitious 5250 MW Grand Renaissance or Millennium Dam that Ethiopia has planned is estimated to cost US\$ 4.78 billion. Ethiopia is planning to fund the project itself, which is going to hugely increase the total future cost of their planned hydropower production.

Energy Supply Options

Power Options	Total Regional Potential
Hydropower excluding DRC	46,000 MW
Hydropower including DRC	150,000 MW
Petroleum (Egypt, Sudan, DRC, Uganda, Kenya) New petroleum reserves in Uganda and Kenya discovered in 2012 with further explorations ongoing, also Ethiopian oil exploration ongoing	624 Million tonnes 2.5 Billion barrels in Western Uganda, Estimated 10 billion Barrels in Western Kenya, Tullow's bloc
Natural Gas (Egypt, Ethiopia, Tanzania)	1,300 Metric Tonnes Oil Equivalent
Geothermal (Ethiopia, Kenya, Uganda, Rwanda)	2540 MW + 7000 to 10000 MW in Kenya
Coal (Egypt, Ethiopia, Kenya, DRC)	500 million tonnes
Methane	700 MW
Wind	1 million MW in Ethiopia alone, Kenya has the best potential sites in the world with wind speed of upto 11m/sec
Solar	Huge potential for rural electrification and off-grid, with irradiation levels in excess of 1800 kWh/m ² to 2800 kWh/m ² in hyper arid areas in Egypt, Ethiopia and areas around the Lake Victoria basin of Kenya and Tanzania

Note: Includes the 1870 MW Gibe III Dam in Ethiopia which is under construction and is projected to be ready by 2014.

Current and Future Hydro Power Production (Till 2040)

Country	Current Installed Capacity (MW)	Additional Planned Capacity by 2040 (MW)
Rwanda	85	173.5
Burundi	45	407
Tanzania	562	3487
Kenya	749.5	486-686
Uganda	380 + 250 from Bujagali (2012)	4368.5
Sudan + South Sudan	360 + 1250 from Merowe (2012)	3090
Ethiopia *	1840	16188.4
Egypt	2842	40

* Does not include Renaissance Dam

Regional Integration and Power Trade

The Nile riparian nations are expanding and developing regional interconnection projects to pool in their power supply and combat their mutual energy crises. These projects are being developed under the purview of Nile Basin Initiative's Regional Power Trade Project and funded by the World Bank administered Trust Fund for the NBI.

The Ethiopia Power Trade Project

- ≡ The 296 km, 230 kv line connecting Ethiopia and Sudan and Somaliland in the later stages, estimated to cost US\$ 59 million, was completed in early 2012
- ≡ In June 2011 Ethiopia started exporting electricity to Djibouti. Transmission lines to Sudan and Djibouti have been completed. Ethiopia has an initial commitment to provide 200 MW of electricity to Sudan, 200 MW to Djibouti and 500 MW to Kenya
- ≡ Kenya and Ethiopia signed a deal in December 2011 to purchase 400 MW of electricity at the rate of US\$ 0.07/ Kwh, to be fed into the Kenyan national grid. Construction of the interconnector will begin in 2013 and end by 2016 at a cost of US\$ 1.2 billion, funded by World Bank (WB), French Development Agency and African Development Bank (AfDB).

Nile Equatorial Lakes Interconnector Project

- ≡ The construction and upgrading of 769 km, 110 kV and 220 kV line, as well as the construction and reinforcement of 17 transformer stations, estimated to cost US\$ 240 million
- ≡ Projects of significance are the 28-MW Nyabaronga project (expected to be commissioned by 2013), three regional hydropower projects: 63-MW

Rusumo Falls project (shared with Burundi and Tanzania), 145-MW Rusizi III and 205-MW Rusizi IV project (shared with Burundi and the Democratic Republic of Congo).

All of these plans are likely to have a number of broad benefits for each country, such as:

- ≡ Increasing electricity output which will aid in industrial development
- ≡ Boosting the economy of the country
- ≡ Creating a potential for exporting energy and enhancing trade in the region, as well as internationally.

Financial Costs to the Economies of the Nile Riparian Nations

Total Future Cost of Hydro Power Projects

Country	Total Cost (USD million)
Rwanda	N/A
Burundi	430.5
Tanzania	4181.75
Kenya	N/A
Uganda	9105.48
Sudan + South Sudan	7531.97
Ethiopia	20769.16
Egypt	-
Total Cost - A	42018.86
Potential Cost of Other Dams - B	8000
Hidden Costs - C	10000
TOTAL COST (A+B+C)	US\$ 60 BILLION

Note: The costs of several dams that have been planned in each country are not known and the total in A only reflects the known costs of the planned projects.

The total estimated bill for these hydropower plants is approximately \$42 billion. This figure only reflects the known costs of future plans, some which may not materialize due to several factors, and does not indicate costing for plans where the feasibility studies are yet to be completed. Thus taking into account financial implications of these new plans and projects, the total energy bill to these Nile Basin countries, excluding DRC and Eritrea, could be \$50 billion. This amount does not include a number of hidden costs which could range from infrastructure development and future escalation of prices to re-location costs for communities living in areas where dams are proposed or ancillary costs such as health and environmental degradation. To account for all these different hidden costs another \$10 billion, at the maximum, is added to the energy bill. Thus, the total energy bill over the next 20-30 years is likely to be around \$60 billion. Examining future plans and projections, half this cost is likely to be borne by Ethiopia alone, and the other half of \$30 billion by the other countries.

A \$30 billion bill for Ethiopia alone is almost equivalent to its GDP for the year 2011. Its total

budgetary expenditure in 2010 was \$4.1 billion. Added to this is the \$4.78 billion for Grand Renaissance Dam. There are no internal resources currently available to fund large dam projects in Ethiopia with per capita income under 400 dollars (barely dollar a day income) and government budgetary outlay of 4 billion dollars. According to some media reports, Ethiopia can fund about 20 per cent of the cost of the Grand Renaissance and other dam projects. It has to depend on other sources, including China, multilateral organisations and donor funds for 80 per cent of the financial requirements. Currently, Ethiopia is one of the world's largest recipients of development aid. Between 2000 and 2011, US Government assistance was \$6.226 billion.

The other countries will have to budget around \$1 billion annually to fund their hydropower projects. For many of these countries, this exceeds their total annual expenditure (as per 2010 budget) and will put them in further debt. For example Uganda, which has some of the largest future plans, had 2010 expenditure of \$2.75 billion. Tanzania which has planned for over 20 hydro power projects saw a

Total Expenditure by Country

Country	General Government Total Expenditure (USD billion)	Total Government Gross Debt as per cent of GDP	How Much Each Country Will Spend Annually on Hydropower Projects (USD)*
Rwanda	1.39	23.92	NA
Burundi	0.735	47.52	NA
Tanzania	5.21	43.83	300 million
Kenya	9.66	50.54	NA
Uganda	2.75	25.36	700 million
Sudan + South Sudan	10.74	68.03	500-600 million
Ethiopia	4.1	36.70	1.5 billion
Egypt	66.79	73.77	-

*Calculated costs based on total costs and future plans.

2010 expenditure of \$5.21 billion. These costs do not include the current and future regional plans to build grids and regional power lines.

Dependence on External Funding

All these hydro power projects, while beneficial in the long run for boosting the economy and developing the country, will have severe financial implications for all the Nile basin countries.

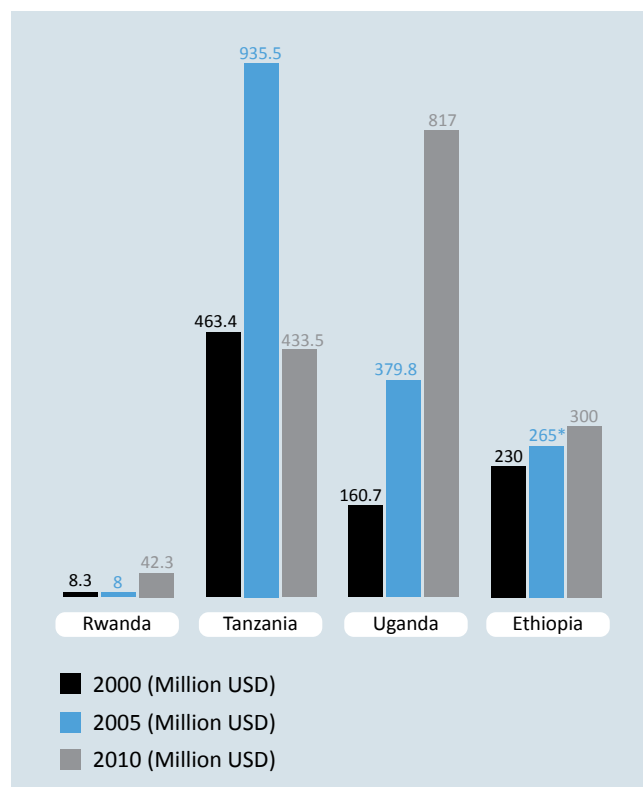
The regional interconnection projects are being funded by World Bank, African Development Bank and in the case of Ethiopian-Kenyan interconnection grid partly by the French Government. The global fiscal crisis has led to a considerable fall in investments in all countries since 2008. Thus, it is unlikely that the Foreign Direct Investment (FDI) in each country will be able to cover the costs of these plans or aid in any substantial manner. For example, the FDI for Uganda for 2010 was a little over \$800 million. In Ethiopia it was almost \$300 million for 2010, though it is almost half of what it was in 2006. For Tanzania the FDI in 2010 was \$433 million.

The capacity of the private sector in most riparian countries, is extremely under developed. Information on companies in the river basin region is not easily available as most do not list their annual turnover or number of employees or other details. Currently there are very few companies which have a turnover over a \$100 million, and they do not have the capacity to invest the billions needed for the future large scale dams and energy projects.

It would be unrealistic to expect that the hydro-power projects and dams will be funded by the domestic private sector in Nile basin countries such as Ethiopia, Uganda, Tanzania and Sudan where foreign direct investment is meagre and domestic business corporations are too small and weak to raise huge resources required for such projects. Thus countries will have to depend on a substantial amount of

foreign aid to supplement government spending to realise their future energy aspirations.

Foreign Direct Investment



*In 2006 the FDI for Ethiopia was almost \$550 million

Chinese Funding

China is emerging as a prominent player in renewable energy sector development in the continent, while expanding its foothold in the oil and natural gas sector. China is funding and constructing hydropower plants in Sudan, Ethiopia, Zambia, Ghana, Nigeria, Gabon, the Republic of Congo and Mozambique with a combined value of over US\$ 9.5 billion.

China's investment in hydro power in the Nile basin is concentrated in Ethiopia and Chinese companies are bidding for Karuma Dam in Uganda. It is not clear if China primarily wants to use power generated from projects funded by it in Ethiopia for its other projects in the nearby region such as oil and natural

Chinese Hydro Power Projects

Country	Project	Investor/ Project Cost
Democratic Republic of Congo	120 MW Imboulou Dam	US\$ 280 million
Ethiopia	300 MW Tekeze Dam	-
Ethiopia	Gibe III Dam	Chinese contractors building; Industrial and Commercial Bank of China funded US\$ 2.2 billion
Ethiopia	100 MW Amerti-Neshi Hydro Power Dam	Gezhouba Water & Power Company
Sudan	1250 MW Merowe Dam	US\$ 1.8 billion
Sudan	360 MW Kajbar Dam	Sinohydro (US\$ 705 million)
Sudan	420 MW El Shereik Dam	Gezhouba Corp (US\$ 711 million)

gas ventures in Sudan, South Sudan, Ethiopia and perhaps Kenya. If this is the case, a significant portion of electricity production is for the benefit of foreign investors and not for local population. This situation is comparable to investments in water infrastructure and irrigation for the benefit of Saudi, Indian and other Asian investors in agriculture who are provided inexpensive land, free water and access to local labour on disproportionately advantageous terms. It is unrealistic to expect that China alone would fund more than 20 per cent of the cost of dams and hydro-projects. As already discussed, domestic resource mobilisation can meet another 20 per cent financial needs. Thus, all Nile countries with plans for hydro-projects over the next two to three decades will depend on multilateral organisations and donor agencies for 60 per cent of the total \$50 billion requirements, amounting to \$30 billion, or between \$1-2 billion per year.

Other Foreign Energy Investment Projects in the Basin

Uganda's proposed Karuma Dam - the \$1.3 billion 700 MW hydropower project 80 km downstream of

Lake Kyoga on the Nile River has been stalled over disagreements regarding the scaling of the project. This is against Uganda government's removal of subsidies on power generation in February 2012. Allegations of corruption from within the nation, regarding the issuing of contracts are also stalling the project. German development agency (GIZ), World Bank and European Investment Bank are the financiers of the project who believe that the project should be downscaled to 400-450 MW, as the water flow at Karuma is insufficient to produce 700 MW. Uganda has set aside US\$ 521 million as part of its 2011-12, budget and another 300 million from its Energy Investment Fund at its Central Bank and is confident that it will be able to generate the remainder of funds. However there is a possibility that the project's cost could increase to US\$ 2.2 billion.

Kenya's power generation capacity is expected to increase annually by 8.4 per cent until 2016. There will a 6.4 per cent annual average increase in hydropower generation and 10.2 per cent annual average increase in renewable energy sources. Oil generated electricity is expected to decrease by 23 per cent annually as hydropower generation increases. Within the next few years, Kenya also plans to invest US\$ 1.4 billion to develop 280 MW of geothermal power plants and



produce up to 5 GW of geothermal power by 2030. Kenya is developing one of the world's largest wind farms that could produce as much as 300 MW of power in the Rift Valley region close to Turkana. In August 2011 the Italian government has committed almost US\$ 200 million to build the Kirandich dam in Baringo, Rift Valley region. The dam is currently in its Phase II of construction aimed at increasing water supply to 5.11 BCM/ year. It is expected to serve 150,000 people by 2030.

While the benefits of increasing energy output are numerous, there are several hydrological, ecological and socio-economic implications that need to be considered.

Some of the common key social and environmental costs that each country will be faced with are:

- ≡ Flow diversion of important rivers and streams, changes in the flow regime and changes in seasonal variation which will affect the water flow to downstream areas
- ≡ Increased sedimentation in downstream reaches, lakes, rivers and wetlands
- ≡ Changes in the habitat of surrounding areas which could affect indigenous communities
- ≡ Increasing incidence of cattle disease due to increased presence of Simulium larvae or the Black Fly insect and other vector borne diseases.

Challenge 10

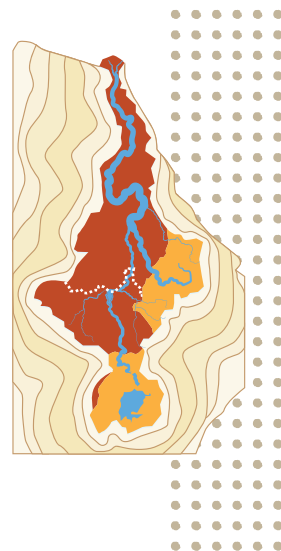
LEGAL & POLITICAL CHALLENGES

The Nile Basin Initiative has achieved considerable cooperation in the technical spheres. However, its proposal to introduce a Comprehensive Framework Agreement (CFA) has attracted differing political responses within the basin. The political unity of the Nile Basin is the greatest legal and political challenge before the riparian countries.

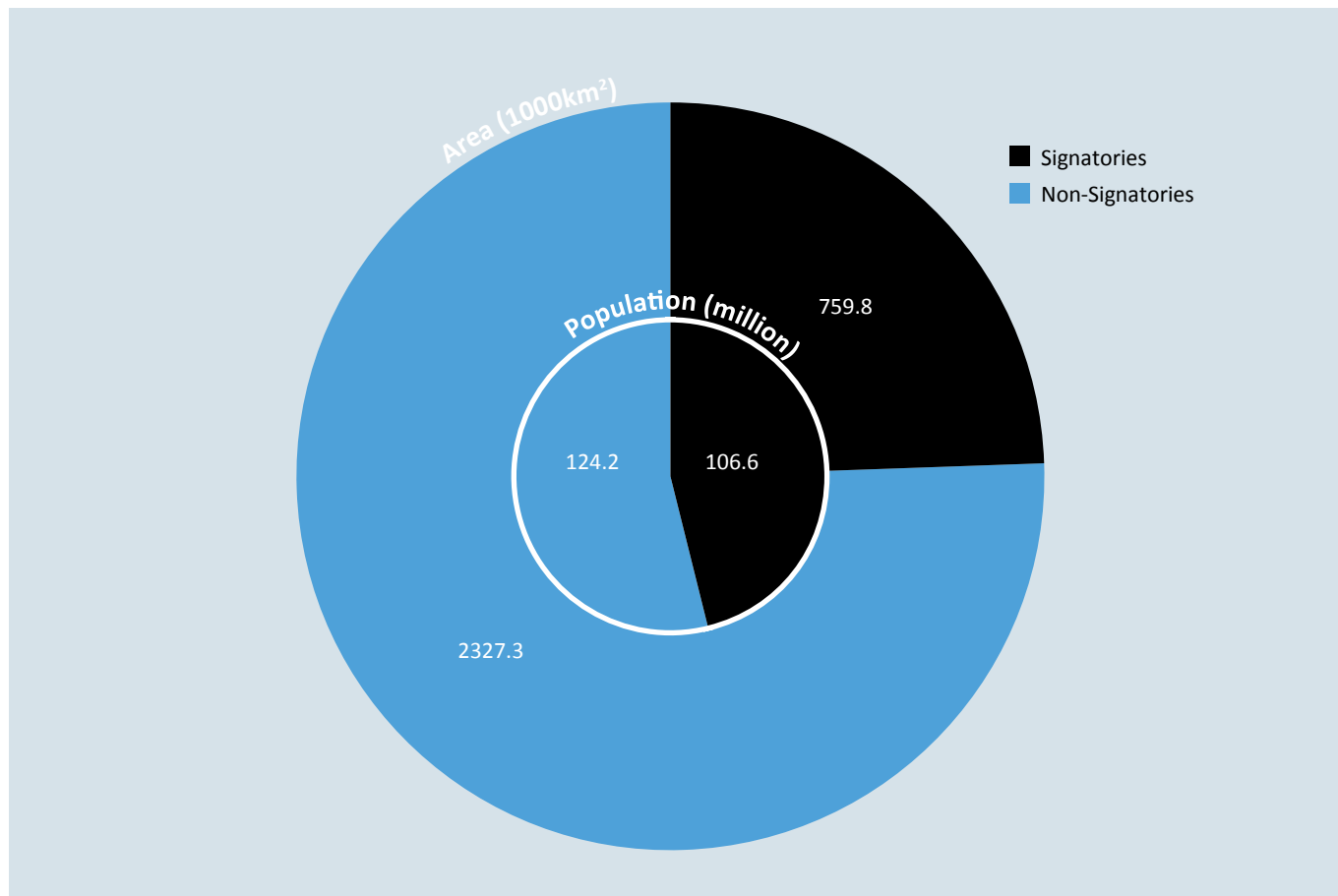
Egypt and Sudan claim that a treaty signed in 1959 giving them majority share in the Nile waters should be protected. It is a matter of debate if Republic of South Sudan would be bound by this treaty, as it is also considering signing the CFA. The upper riparian countries want to implement the CFA as soon as possible and so far six upper riparian countries have signed it: Kenya, Uganda, Tanzania, Rwanda, Burundi and Ethiopia. The remaining Nile Basin countries have not signed the CFA: Egypt, Sudan, Republic of South Sudan, and Democratic Republic of Congo.

The signatories to the CFA would like to ratify the same. Once the framework is ratified by six member countries, it can be implemented. The remaining four countries (five, if Eritrea is counted) would not like to sign the CFA unless it protects present uses and rights conferred by the 1959 treaty. This has created a political divide over Article 14 (b) of the CFA with the upper riparian countries insisting on the new treaty with territorial rights for the signatories to use water resources within their territory, and the lower riparians claiming historic rights restraining upper riparian countries from using Nile waters where flows might be to the detriment of the interest of the lower riparian countries.

From a legal perspective, the issue involves all the eleven countries in the Nile Basin. In reality, since almost 85 per cent of the flow is contributed by the Blue Nile, the conflict primarily concerns the Blue Nile countries. It is essentially a conflict between Ethiopia on the one hand and Egypt and Sudan on the other.



Population and Area of the Signatories and Non-signatories of the CFA



CFA in the Nile River Basin

Signatories: Kenya, Uganda, Tanzania, Rwanda, Burundi and Ethiopia

Non-Signatories: Egypt, Sudan, Republic of South Sudan, Eritrea, Democratic Republic of Congo

The White Nile countries are only notionally involved in the conflict, except when they want to take a political position.

Of all the eleven Nile countries, the two signatories to the 1959 treaty account for two thirds of area and population of the basin. However, the six CFA signatory countries expect them to accept equality in the sharing of waters. DRC which is not a signatory to either the 1959 treaty or the CFA has a marginal share of Nile water, as well as area and population in the basin.

Population and Area of the Signatories and Non-signatories of the CFA

The Nile riparian countries are committed to dialogue to find a solution to the political deadlock. However, this will require time. If the ratification of CFA is pursued in haste, Egypt and Sudan will not sign CFA. In this case, the Nile Basin will split with majority of the area and population remaining outside the CFA sphere. Thus, politically, the Nile Basin will shrink to a small size. In order to maintain the integrity of the Nile Basin at the level of its current size and strength, it is important to look for solutions as discussed in the Recommendations section of this report.

Moreover, the current political and legal discourse has been narrowly framed in the competing framework of the 1959 treaty and the CFA. In reality, many other treaties and conventions are directly relevant to resolving the political dispute. The most important instrument is a Framework for General Cooperation between Egypt and Ethiopia (1993) signed by Heads of States, and duly registered with the United Nations. Much important are the UN Convention on Biodiversity and the African Convention on Conservation of Natural Resources. Also, relevant are past treaties for understanding the context. It is therefore necessary to review historical treaties as applicable to the Nile Basin countries as well as other relevant legal instruments, particularly bilateral instruments between Egypt and Ethiopia, the two main protagonists, and multilateral legal instruments.

Treaties of the Past

During the 19th and the 20th century most nations of the Nile basin were either colonized or were under the control of a European power. Britain colonised Egypt until 1937 and Sudan until 1956. Britain realized that their economic stability depended on the control of Nile waters. Hence they either colonized the other riparian nations or entered into agreements/arrangements with the European powers that had a stronghold over these East African nations. Some of the agreements which were entered into during the time of the colonial power in the Nile basin are mentioned below.

One of the earliest agreements on Nile is *The Protocol between Great Britain and Italy for the demarcation of their respective spheres of influence in Eastern Africa of 1891*. It was signed between Great Britain and Italy acting on behalf of Ethiopia. Although Ethiopia was not colonized by Italy, the latter allegedly derived its powers to enter into agreements with Britain by virtue of the treaty of Wuchale. Through this treaty, Italy and the Emperor of Ethiopia, Menalik agreed that

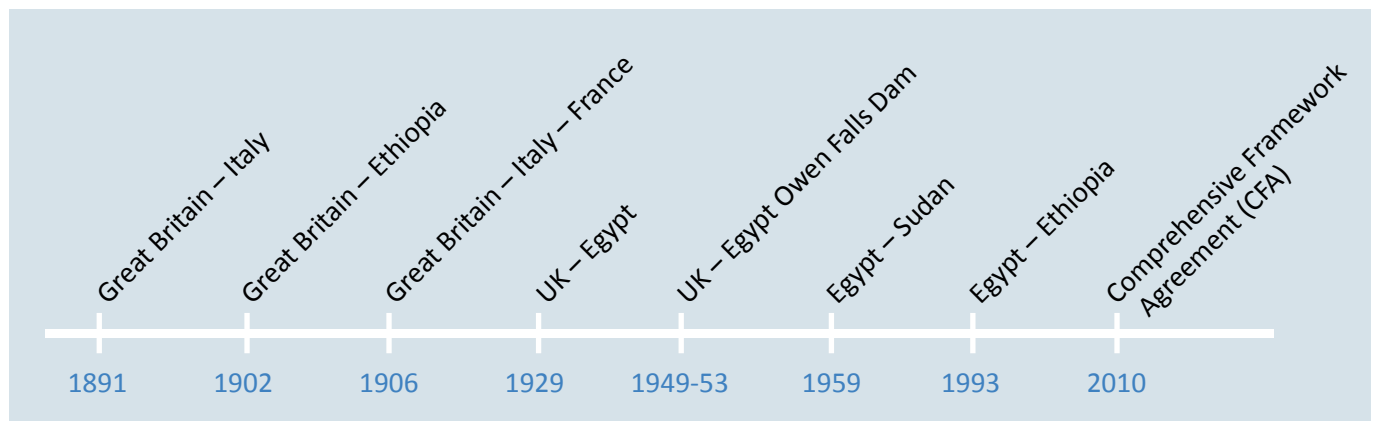
the foreign relations of Ethiopia would be controlled by Italy. Thus Italy, on behalf of Ethiopia entered into the Protocol of 1891 with Britain. In the protocol, it was agreed upon by Italy that it would refrain from constructing any work relating to irrigation that would have an effect on the flow of water into the Nile. In return, Great Britain recognized Italy's "sphere of influence" in Ethiopia. This Protocol is however not recognized by Ethiopia as it claims that that the Treaty of Wuchale did not grant actual authority to Italy to enter into any agreement on behalf of Ethiopia with Great Britain. Further, Italy was defeated by Ethiopia in 1896 and the treaty of Wuchale was renounced by Ethiopia. Hence, calling the protocol a mere tool of the colonialists, Ethiopia chose to be not bound by its terms.

In 1902, Britain entered into an agreement with Ethiopia. Article III of this treaty provided that "*His Majesty's the Emperor Menelek II, King of Kings of Ethiopia, engages himself towards the Government of His Britannic Majesty not to construct, or allow to be constructed, any work across the Blue Nile, Lake Tsana, or the Sobat which would arrest the flow of their waters into the Nile except in agreement with His Britannic Majesty's Government and the Government of the Soudan.*" The applicability of this treaty in the present context is still debated. Since Ethiopia was not a colony when this agreement was signed and it acted in its sovereign capacity, it is believed that the provisions of this Anglo Ethiopian treaty would be binding upon Ethiopia. However, some academicians dispute the applicability of this treaty. It is alleged that the treaty was entered into by Ethiopia under duress and it was never ratified by it. As Egypt and Sudan got into subsequent agreements, it is further alleged that the validity of this agreement got considerably diluted. Other reasons such as the British acceptance of Italian occupation of Ethiopia in 1935 are further cited to not recognize a treaty that affords unequal and inequitable rights over Nile to Egypt and Sudan.

In 1906, the British government entered into an agreement with Congo which was ruled by King



Treaties of the Past in Nile River Basin



Leopold of Belgium. Congo agreed to refrain from any construction which would reduce the flow of waters into Lake Albert unless with the permission of the Government of Sudan.

The European sphere of influence on Ethiopia by 1906 had become a bone of contention. Great Britain, France, and Italy wanted to clearly demarcate their interests in the state which was the source of Blue Nile. Hence they entered into a tripartite agreement. The agreement sought to maintain a “political and territorial status quo” over Ethiopia. The parties pledged non interference in internal affairs of the State and recognized the interests of Britain and Egypt over Blue Nile as paramount. The subsequent exchange of notes between Britain and Italy further purported to consolidate the British influence over Nile.

It is however pertinent to note the Exchange of notes between *His Majesty’s Government in the United Kingdom and the Egyptian Government in regard to the use of the waters of the River Nile for irrigation purposes of 1929*. Egypt recognizing Sudan’s need for development accepted the proposal for further utilization of Nile Waters by Sudan as long as it did not affect the “natural and historic rights” of Egypt over Nile. The agreement is alleged to be lopsided, granting supremacy of rights over Nile to Egypt. Through this agreement Egypt had a right to veto any projects undertaken in Sudan or other riparian

countries under the British control, which would adversely affect Egypt’s rights over Nile. The Nile nations calling it a “colonial relic” sought to dismiss this treaty in its entirety.

While Britain set about increasing its influence over Blue Nile, it also sought to control the White Nile. One such endeavour resulted in the *Exchange of Notes Constituting an Agreement between the Government of the United Kingdom of Great Britain and Northern Ireland and the Government of Egypt regarding the construction of the Owen Falls dam, Uganda, (1949-53)*. Ugandan construction of Owen Falls Dam was accepted as long as it did not affect Egypt’s rights under the 1929 agreement. By virtue of this arrangement Egypt was able to place an Engineer to monitor the project. The Ugandan government was to give all relevant information to the engineer with respect to the project.

Britain also controlled its interests in Tanzania, Burundi and Rwanda by getting into an agreement with Belgium. It is to be noted that while Tanzania was a British Mandate under the League of Nations, Burundi and Rwanda were under the control of Belgium. The agreement sought to regulate the use of transboundary waters within the three East African nations.

The most debated of all instruments on Nile however is the 1959 *Agreement between the government*

of the United Arab Republic and the government of Sudan for full utilization of the Nile waters. Once Sudan had attained independence in 1956 it wanted to do away with the agreement of 1929, as it had been entered on its behalf by its colonizers. Also, Sudan felt that the distribution of water was inequitable. In order to secure for itself a greater share of Nile water it decided to negotiate for a new agreement. Egypt's plan to build the Aswan Dam also required that the countries reach a consensus. Hence the two states decided to sign the agreement of 1959. The agreement recognized the 'acquired rights' of the states and also contemplated the division of the 'remaining benefits.' Any claims to the contrary by the upper riparian were to be handled jointly by the two states. However, it is to be noted that this agreement did not create rights or obligations on non-parties. Nevertheless, the Nile basin states objected to this agreement, mainly because it granted complete control of Nile to Egypt and Sudan. Almost 98 per cent of the river was allocated to the two states. Hence demanding equitable distribution of water, the aggrieved Nile riparians sought other forms of cooperation which would help them utilize the Nile resource.

Over the course of time, several negotiations and political dialogues took place with respect to Nile water sharing. While Egypt and Sudan based their claims on the previous 1929 and 1959 agreements, the other Nile basin countries refused to be bound by them or any other treaties which they claimed was of colonial import. The determination of whether the treaty provisions brought into existence by the colonial power is applicable at present is done on the basis of principles of customary international law on succession of treaties as well as the 1978 *Vienna Convention on Succession of States in Respect of Treaties*. In the case of decolonized states, the doctrine of "clean slate" is usually followed on the basis of the principle *res inter alios acta* (An agreement cannot effect those who are not privy to the same). Hence a decolonized state is normally not

Treaties Relevant to Nile River Basin

- ≡ Nyerere Doctrine
- ≡ Gabcikovo – Nagymaros case of International Court of Justice
- ≡ Rio Declaration
- ≡ United Nations Convention on Biological Diversity (UNCBD)
- ≡ UN Convention on the law of the Non-navigational Uses of International Water Courses 1997
- ≡ African Convention on Conservation of Natural Resources (ACCNR)

bound by an agreement/arrangement entered into on its behalf by their colonizer. In the case of the Nile basin countries, the situation seems particularly complex and the aforementioned rule cannot be applied in totality.

Also note that Tanzania chose to adopt the *Neyere* doctrine of state succession which gives an option to the state to decide whether to be bound by the colonial treaties. Tanzania thus refused to recognize the 1929 agreement, but agreed to enter to discussions with other Nile basin countries in the future. Kenya and Uganda made similar decisions.

South Sudan

In the case of state succession the doctrine of "clean slate" is applicable which gives the opportunity to a newly formed state to start afresh, without any treaty obligations. However, there are exceptions to the rule especially when the formation of a new state was due to secession. Article 34 of the Vienna Convention on succession of treaties states that "*any treaty in force at the date of the succession of States in respect of the entire territory of the predecessor State continues in force in respect of each successor state so formed.*" Hence, a newly independent state cannot evade its

obligations under the agreements that were entered into previously by the state from which it seceded. South Sudan however will not be bound by this rule as it is not a party to the Vienna Convention and this rule does not constitute customary international law.

Nevertheless it is to be noted that ‘territorial agreements’ may survive state succession. And treaties concerning water rights or navigation on rivers constitute territorial agreements as per the *Gabcikovo-Nagymaros* case of the International Court of Justice. Hence, it could be argued that South Sudan should respect the terms of the agreement of 1959 entered into by Egypt and Sudan.



Framework for General Cooperation between Egypt and Ethiopia in 1993

This framework was signed on the 1st of July 1993 in Cairo by the then President of Egypt Hosni Mubarak and the then President of Ethiopia Meles Zenawi. It entered into force on the same day by the signature of the parties. While the agreement is on general cooperation on matters of interest between Egypt and Ethiopia, “to promote their economic and political interests as well as stability in the region” it is to be noted that five out of the eight provisions of the agreement refers to “issue of the use of Nile waters.”

Through this framework the parties agreed to “refrain from engaging in any activity related to the Nile waters that may cause appreciable harm to the interests of the other Party” (Article 5). It is to be noted that the obligation to refrain from causing any trans-boundary harm is customary international law and is included under Principle 2 of the Rio Declaration of 1992, Article 7 of the 1997 Convention on Non-Navigational Uses of International Watercourses and several other multilateral and bilateral agreements including the draft Cooperative Framework Agreement of 2010. Therefore any unilateral action on the utilization of Nile waters which may cause harm to the other state will be a violation of customary international law, as

well as the rules under the framework. It is worth noting that Article 4 of the framework states “that the issue of the use of Nile water shall be worked out in detail through discussions by experts from both sides, on the basis of the rules and principles of international law.” This ensures that apart from no harm principle mentioned above, there is a range of international law provisions [including the principle of ‘equitable distribution’] that has to be looked into by the two countries when deciding upon the distribution of Nile Waters.

Through this agreement, the two state parties also agreed on taking measures with respect to the “conservation and protection” of Nile waters. They undertook “to consult and cooperate in projects that are mutually advantageous, such as projects that would enhance the volume of flow and reduce the loss of Nile waters through comprehensive and integrated development schemes” (Article 6). A natural corollary to this would be that the states agree to endeavour towards sustainable development and prevention of environmental damage through various measures of cooperation.

Further, Article 7 which states “The two parties will create appropriate mechanism for periodic consultations on waters of mutual concern including Nile waters in a manner that would enable them to work together for peace and stability in the region”, sought to reinforce the principle of cooperation amongst state parties which entails entering into diplomatic dialogue, negotiations, mediations and any other measures which would prevent states from taking any unilateral action affecting the interest of other states. While it is said that states have the right to utilize their resources within their territories without any interference from other states, it becomes slightly different in the case of shared watercourses. The obligation to constantly engage in dialogues and consultations arises with any action undertaken that could potentially harm the interests of other states. In this regard recourse could be had to the decision of the arbitral tribunal in the *Lac Lanoux*

case between Spain and France on the diversion of shared watercourses wherein “the obligation to negotiate” to resolve the dispute was stressed upon. It is noteworthy that the framework recognizes this obligation and promotes methods of consultations between the parties to ensure peace in the region. It further encourages the parties to “endeavour towards a framework for effective cooperation among countries of the Nile Basin for the promotion of common interest in the development of the Basin” (Article 8).

Thus it can be seen that while agreement of 1993 does not specifically point at methods or manner of cooperation, it does emphasise on the same and makes it obligatory on the part of both the nations to come to solutions that are mutually agreeable.

It is interesting to note that this agreement which embodies certain fundamental aspects of international law which would help towards resolution of any form of dispute or disagreement that may arise and that would threaten the stability in the region is referred to sparingly in most of the discussions on the legal regime relating to the Nile waters. The title of this instrument neither contains the word “treaty” nor “agreement” nor does the instrument have any provisions for enforcement. However, this is not sufficient ground to dismiss this instrument.

In order to determine the importance and the binding value of an instrument one needs to consider the intent of the parties while entering into the agreement. The intent may be realized through studying the Foreign Ministry statements regarding the same, as well as analyzing the subsequent conduct of the parties. Factors such as the signing of the document by the Head of the State as opposed to government departments as well its subsequent registration with the UN could also be indicative of the intent of the parties and the importance they give to the instrument.

In this regard it is to be noted that when counties get into bilateral or multilateral agreements/ treaties,

they are to register the same with the United Nations. This is the mandate of the UN Charter under Article 102 which reads as follows:

Article 102

- ≡ *Every treaty and every international agreement entered into by any Member of the United Nations after the present Charter comes into force shall as soon as possible be registered with the Secretariat and published by it.*
- ≡ *No party to any such treaty or international agreement which has not been registered in accordance with the provisions of paragraph 1 of this Article may invoke that treaty or agreement before any organ of the United Nations.*

This rule to register all treaties and international agreements came into existence in order to avoid the formation of secret alliances which was witnessed during World War II.

When, a state conveys to the UN Secretariat that the instrument constitutes a treaty or an international agreement under Article 102, the Secretariat, after scrutiny, proceeds with its registration. The Regulations to Give Effect to Article 102 of the UN Charter, developed by the General Assembly states under Article 1(2) that the treaty or an agreement can only be registered if it has “come into force between two or more parties thereto” and a treaty comes into force on the day it becomes legally binding on the parties. Hence, a registration of an instrument *inter alia* signifies that the parties consider the instrument as ‘not just a mere political commitment’ but an agreement with certain juridical value considered binding upon the parties.

When the registration is sought, the date as well as the manner in which the instrument entered into force for each party to the instrument has to be mentioned to the Secretariat. Further, Article 1(3) states that “registration may be effected by any party.” Therefore, it is common seen that request for registration is made by any one state to a bilateral



treaty or agreement which relieves the other from its legal obligation to register under Article 102 of the UN Charter. After the registration the Secretariat issues a certificate of registration in accordance with Article 7 of the regulations. It also publishes on a monthly basis the information regarding “statement of the treaties and international agreements registered, or filed and recorded, during the preceding month, giving the dates and numbers of registration and recording” as per Article 13 of the Regulations. The certificate and the monthly UN statement mentioned above are public documents.

In this case the Framework of Cooperation was signed by the Heads of the States as mentioned previously and the instrument was duly registered with the UN by Egypt on the 21st of September 2010. The reason for the seventeen year gap in registering the document is not clear. The examination of the certificate of registration issued by the UN as well as its monthly statement makes it clear that the agreement entered into force by the signature of both the parties on 1st July 1993. Hence it can be clearly inferred that both the parties to this agreement intended to be legally bound by the agreement. Ethiopia did not protest the registration by 21st September 2012; as a result the Agreement is binding on both Egypt and Ethiopia alike, as per the rules explained by the Treaty Section of the Office of Legal Affairs of the United Nations.

Thus, it could be argued that either of the parties could be in violation of the principles agreed upon in this framework when they refuse to enter into discussions/dialogues with the other party. Any action taken without such consultations and that which would harm the other party could also be regarded as a violation. This would give the necessary premise to the aggrieved party to invoke the agreement before an organ of the United Nations including the International Court of Justice as contemplated under Article 102(2).

Cooperative Framework Agreement

The Nile riparian countries opposed the 1929 and 1959 agreements which gave Egypt and Sudan supremacy over the utilization Nile resources. The growing population, changing climate and a need for development led many countries to look for avenues to tap the water resources of the Nile. This made the countries look for other arrangements by which there could be equitable utilization of water. Thus they agreed to sign the Cooperative Framework Agreement (CFA) of 2010. So far six countries-Burundi, Ethiopia, Kenya, Tanzania, Uganda, and Rwanda have signed the same. Ratification by six states would lead to its adoption. It is opposed by Sudan and Egypt. They entered into negotiations on the CFA. However on a disagreement on one of the clauses of the draft agreement [Article 14(b)] the countries decided to pull out of the negotiations. Egypt wanted its previous (historical) rights over Nile to be left untouched, while the other nations wanted a new arrangement. The disputed Article 14(b) is now included in the Annex of the CFA and it is to be resolved by the Nile River Basin Commission which would be constituted under the CFA. South Sudan’s assent with respect to the Framework is also highly debated.

In order to understand the “legal and institutional ramifications of the entry into force of CFA”, an extraordinary meeting of Nile Council of Ministers (Nile-COM) Ministers was arranged for at the request of Sudan and Egypt in Kenya on 27 January 2012. However, this meeting was attended by all other Nile basin countries except Egypt and Sudan. As a consequence of the same, all the members present expressed their discontent and decided that the ratification process which was delayed due to the political situation in Egypt should continue. They, however, decided to continue discussions with the three non signatory nations. In July 2012, Annual Meeting of Nile-COM was held in Kigali and the Nile Ministers have been meeting on different occasions, including on the sidelines of multi-lateral fora.

Nevertheless, formal or informal dialogue on legal and institutional ramifications of CFA has been insufficient and inconclusive.

CFA contemplates under Article 2 the “*use, development, protection, conservation and management of the Nile River Basin and its resources*” as well as the establishment of “*an institutional mechanism for cooperation among the Nile basin states*”. The agreement lists 15 principles under Article 3 which would guide the use of Nile by the states. It is important to note that most of the principles are also established principles of customary international law such as “equitable and reasonable utilization”, principle of no harm, principle of territoriality, peaceful settlement of dispute, prior notification of planned measures and community of interest. Other principles included within the framework are - exchange of information, cooperation, sustainable development, protection and conservation and environmental impact assessment. The social and economic value of water as well as the principle of water security wherein states “*have a reliable access to and use of the Nile River system for health, agriculture, livelihoods, production and environment*” is also stressed upon in this framework. It also recognizes water as a “finite and vulnerable resource” thus advancing toward sustainable development which ensures that economic development is not done at the cost of degradation of the ecosystems.

While the CFA is progressive and includes provisions which encourage parties to equitably utilize the Nile river without causing transboundary harm or adversely affecting the environment, a scrutiny of the provisions reveal that state adherence to this agreement as well as its implementation is a difficult task to achieve without the spirit of cooperation and the sincere commitment towards joint management of the Nile River. Further, some of the states have undertaken projects whose continuance is a clear violation of the provisions of this draft framework. It is to be noted that before the ratification of an instrument, a state is not bound by its provisions.

However a signature in itself signifies that the state cannot do anything that would “*defeat the object and purpose of the treaty*” as per Article 18 of the Vienna Convention on the Law of Treaties, 1969.

In this regard let us examine the provisions of the CFA. Article 4 of the CFA requires the Nile Basin States to “*in their respective territories utilize the water in an equitable and reasonable manner.*” This is to be achieved by taking into consideration 9 factors including:


- ≡ “social and economic needs of the basin states”
- ≡ “the population dependent on the water resources of each state”
- ≡ “the effects of the use or uses of the water resources in one Basin State on other Basin States”
- ≡ “the existing and potential uses of the water resources”
- ≡ “the availability of alternatives of comparable value to a particular planned or existing use” and the “contribution of each Basin States to the waters of the Nile River System”.

The states are under an obligation to consider all the factors, and any potential use should be based on consideration of the aforementioned factors taken together. Thus any project undertaken by a state for the utilization of Nile River should take into account all the aforementioned principles in order for it to be termed “reasonable and equitable utilization” under Article 4.

Further, provisions of the CFA such as Article 5 reiterates the principle of ‘no harm’ which is a well established principle of customary international law, wherein states are under an obligation to ensure that utilization of resources within their territory cause no significant harm to other basin states. If such harm is caused or is likely to be caused, measures to prevent/mitigate the harm should be taken as given under Article 11.

Article 6 incorporates the principle of cooperation





and sustainable development by ensuring that the states *“individually and where appropriate, jointly, to protect, conserve and where necessary, rehabilitate the Nile River Basin and its ecosystems”*. It lays particular emphasis on the protection and conservation of wetland as well as the protection and the improvement of “the quality of water within the river Nile”. This is in line with the obligation of the Nile Basin countries under international law embodied in treaty form as well as under customary international law. For example the Ramsar Convention on Wetlands to which all the Nile nations except Ethiopia, Eritrea and South Sudan are signatories to, is the international instrument for the conservation and protection of wetlands. It places an obligation on parties to designate the relevant areas in their countries as a wetland under the convention and work towards its protection. The Convention on Biological Diversity to which all Nile basin countries except South Sudan are a party to is another example of a treaty body which embodies the principle set in Article 6. The principles under the convention are also regarded as customary international law. Further, the Convention on the Law of the Non-Navigational Uses of International Water Courses (1997) also stresses on the protection of watercourse and ecosystem, as well as prevention of pollution. It can thus be noted that the obligations under Article 6 of the CFA is also indicative of the norms under international law which has to be adhered to by the state parties.

However, it would be pertinent to note that the Nile basin countries and especially the present state parties would find it difficult to implement and abide by this provision particularly under Article 6(1) (a) which makes it necessary for the states parties under this draft framework to take all measures appropriate towards the protection and improvement of water quality within the Nile River Basin. This entails a major responsibility of prevention as well as mitigation of pollution – industrial, agricultural or domestic that would affect the quality of Nile water. This form of prevention and even reduction is extremely difficult

and would certainly overshadow development projects.

CFA also enumerates Environmental Impact Assessments (EIA) under its general principles (Article 3(11)) and it is to be noted that EIA’s are recognized as part of the principle of cooperation. The 1949 Corfu Channel case at the International Court of Justice led to the establishment of the principle that the state parties are under a duty to inform other states of any environmental hazards that may be caused in their territory and which may adversely affect other states. This principle was later codified under Article 8 of the International Law Commission’s (ILC) draft articles on the Prevention of Transboundary Harm from Hazardous Activities 2001 which stipulates the duty of a state to inform the victim state when there appears to be a risk of significant transboundary harm. The International Law Association (ILA), a body established in 1873 mainly for the development of both public and private international law concluded in its report that the obligation of a state to inform the victim state of “new or increasing pollution” is a principle of customary international law. This principle of customary international law has evolved into the provision of Environment Impact Assessment found in several international instruments, now including the CFA. It is particularly important to note that the requirements of Environment Assessment have been incorporated by international organizations such as the World Bank for the purpose of funding projects.

A violation of this provision under Article 3 read with Article 6 could be alleged for example in the case of the Grand Renaissance Dam. While an International Panel of Experts for the assessment of the dam has been constituted, the environment impact assessment report is yet to see the light of day. In the absence of such an assessment, the move to go forward with such projects would be a clear violation of international law as well as provisions of the CFA.

Article 10 hinges towards community participation in order to implement a project to utilize the Nile

waters. The people affected are to be a part of the process, and the projects undertaken should be consistent with the framework. This possibly was to ensure that the indigenous communities and the other thousands of people who may be displaced have an opportunity to voice their concerns. However, recent reports on displacement of people, mostly indigenous with no redressal mechanism, the massive harm on the environment and the ecosystems caused by the implementation of projects further point to the difficulty of States parties in adhering to the provisions of CFA.

The most contested of all the provision of the CFA is Article 14. Egypt and Sudan want the provision to recognize the “current uses and rights” of Nile basin states which the 6 upper riparian states refused to accept. It is to be noted that the upper riparian states seem to be advancing their arguments on the utilization of Nile waters and rejecting the claim of the lower riparians on one criterion alone and that is the economic and developmental needs of the upper riparian states. Other factors such as the existence of other sources of water in the upper riparian regions, the massive dependence of the lower riparians for the survival of its people is not taken into consideration.

The task of effective implementation of the CFA is given to the proposed Nile Basin Commission (NBC). However, there seems to be an uncertainty of the coming into existence of such a body as it is dependent on the ratification of the CFA, availability of resources, as well as the smooth transition of the responsibilities of the NBI to the NBC. The discrepancy in transition also arises when states such as Egypt and Sudan which are not parties to the CFA, are parties to the NBI. It could be thus inferred that it would take a reasonable amount of time for the NBC to come into existence and then formulate rules and procedure on implementation. Also, it seems that the states neither want to be bound by any other previous agreements/arrangements nor have they come to a conclusion on which principles of customary international law is applicable to them. This raises two important

questions:

- ≡ Under this uncertainty with neither a governing body in existence nor a legal regime agreed upon, can the states unilaterally move forward with the projects on Nile which would ultimately be in violation of the CFA?
- ≡ Further, when the NBC comes into existence and formulates rules, will and can the states halt the projects that have already significantly progressed but are in violations of the rules formulated by the NBC and thus in violation of the CFA?

In situations such as these, it seems more relevant to first enter into consultations, agree upon certain matters and then make progress. Any unilateral act without adequate consultations would only raise more disputes of a legal nature in the future.

Environmental Considerations

Projects undertaken by states in the Nile Basin often have an adverse impact on the environment. In many situations these are irreversible but also avoidable if due care is taken. In such cases while building of manmade structures may be important for the development of the state, its impact on the environment in the state as well as in other states should be taken into consideration. States should endeavour to safeguard the environment in good faith. Measures contrary to this would entail the violation of the tenets of various international instruments. The *Convention on Biological Diversity (CBD)* is one such important instrument. It entered into force in the year 1993 and encompasses principles of customary international law. Nine of the eleven Nile Basin States have ratified the CBD. They are Burundi, Democratic Republic of the Congo, Egypt, Ethiopia, Kenya, Sudan, Rwanda, Tanzania, and Uganda. While Eritrea has acceded to the treaty, South Sudan is not a party to the same. The ratification of a treaty signifies that the states have accepted to be bound by its provisions, the violation of which could lead to enforcement



proceedings as envisaged under the treaty.

Under the CBD, States have a responsibility to prevent transboundary harm and they should as per Article 5 *“as far as possible and as appropriate, cooperate with other Contracting Parties, directly or where appropriate, through competent international organizations...”* to realize their goals under the CBD. Further, while the CBD stresses on *“conservation and sustainable use of biological diversity”*, it also places an obligation on states to protect their indigenous populations in as far as it is compatible with the conservation and protection of biological diversity.

The CBD like the CFA also introduces the provisions for Environment Impact Assessment to *“inform other states about any activity that may have adverse impact on biological diversity and as far as possible minimize the adverse impact on biological diversity.”* It is also pertinent to note that Article 14 stipulates that the Conference of Parties established under this convention shall determine issues of the *“liability and redress”* as well as *“restoration and compensation, for damage to biological diversity”*. The various decisions of the Conference of Parties refer to the question of liability and redress, however there still exists ambiguity on the question.

Thus, any state alleging violations of aforementioned provisions by another state could take recourse to the CBD and approach the appropriate mechanism to resolve their differences. It is to be noted that when a dispute arises with respect to the provisions of this convention the parties are to endeavour to settle the same by means of negotiation, failing which they should resort to mediation. If the states fail to settle by these two means they may also choose to settle their dispute by arbitration and/or by approaching the International Court of Justice (ICJ). However, the option of Arbitration and the ICJ is available only if during the process of ratification of the CBD the states accepted the two forms of settlement. In the absence of such an option the states have to resort to the mode of Conciliation.

The *African Convention on Conservation of Natural Resources* 1969 is a regional instrument for the protection of the environment signed by fifty-three African nations. Majority of the Nile Basin countries including Egypt have ratified the instrument. Ethiopia and Burundi have only signed the same, whereas Eritrea and South Sudan are not signatories. This follows that while most Nile basin countries are bound to implement the rules under this convention, the countries that are only signatories to the instrument could also be taken to task if they go against the basic tenets of this convention.

This convention contains provisions similar to that of the CBD. However, it would be pertinent to note certain provisions of this convention such as Article V(2) which states that *“where surface or underground water resources are shared by two or more of the contracting States, the latter shall act in consultation, and if the need arises, set up Inter-State Commissions to study and resolve problems arising from the joint use of these resources, and for the joint development and conservation thereof”* and Article XVI(1) which states that *“the Contracting States shall co-operate : (a) whenever such co-operation is necessary to give effect to the provisions of this convention, and (b) Whenever any national measure is likely to affect the natural resources of any other State.”* Here again the convention makes it obligatory for states to enter into a dialogue when it comes to sharing of transboundary water. It also stresses on resorting to methods which would prevent transboundary harm.

This convention provides that in the event of a dispute the parties are to resort to negotiations or approach the *“Commission of Mediation, Conciliation and Arbitration of the Organization of the African Unity”*.

A revised version of this Convention came into existence in 2003. This however does not replace the earlier convention. Countries are bound by both the conventions. All the Nile basin countries are signatories to the revised convention except Egypt and South Sudan. The convention provides for

resorting to the Court of the African Union in case of any dispute.

Cultural and Human Rights Violations

Projects for the utilization of transboundary waters can result in displacement of people and the destruction of various cultural heritage sites. While some of these problems are inevitable, a state cannot in the pretext of economic development cause rights violations of its people nor be privy to the rights violation in another state. The States are to ensure that there is minimal loss and adequate compensation provided for in the event of any violation. In the absence of this, legal claims may arise against the violating state.

Several efforts have been undertaken by the international community to develop guidelines to prevent and mitigate the effect on displaced communities such as the UN guiding principle of Internal Displacement, World Bank Policy on Involuntary Resettlement, World Commission on Dams Guidelines for good practice.

However of particular importance at this juncture would be the African Charter on Human Rights also known as the Banjul Charter which is a regional instrument signed and ratified by fifty-three African nations and all the Nile basin countries except South Sudan. The Charter *inter alia* enumerates that the states shall guarantee the right to property to every citizen. A deviation from this principle would only be permitted if it is for public interest and done in accordance with the procedure established under law. Adequate compensation to 'dispossessed' people is also to be provided. The Charter guarantees the right to equality, right to development-economic, social and cultural for all as well as the "*right to a general satisfactory environment favourable to their development*".

In the case of the violation of the provisions of the Charter, an individual can approach the

African Commission on Human and Peoples' Rights established under the Charter subject to certain conditions laid down in the Charter such as exhaustion of local remedies etc. The African Commission on Human and Peoples' Rights is a body set up under Article 30 of the Banjul Charter and was established in the year 1987. The Commission monitors the implementation of the Charter in the African nations. It meets twice a year and looks into individual communications, as well as inter-state communications.

In instances when a state party alleges violation of the Charter by another state, it can refer the matter to the Chairman of the Commission as well as the Secretary General of the AU. The accused state has three months to provide an explanation. If a settlement is not reached, then the matter can be referred to the Commission. This is referred to as inter-state communication. This process has been used sparingly such as in the case of Democratic Republic of Congo versus. Burundi, Rwanda, and Uganda.

It is to be noted that the commission is a quasi-judicial body and its decisions are not binding upon parties. The inter-state communications procedure has only been used once.

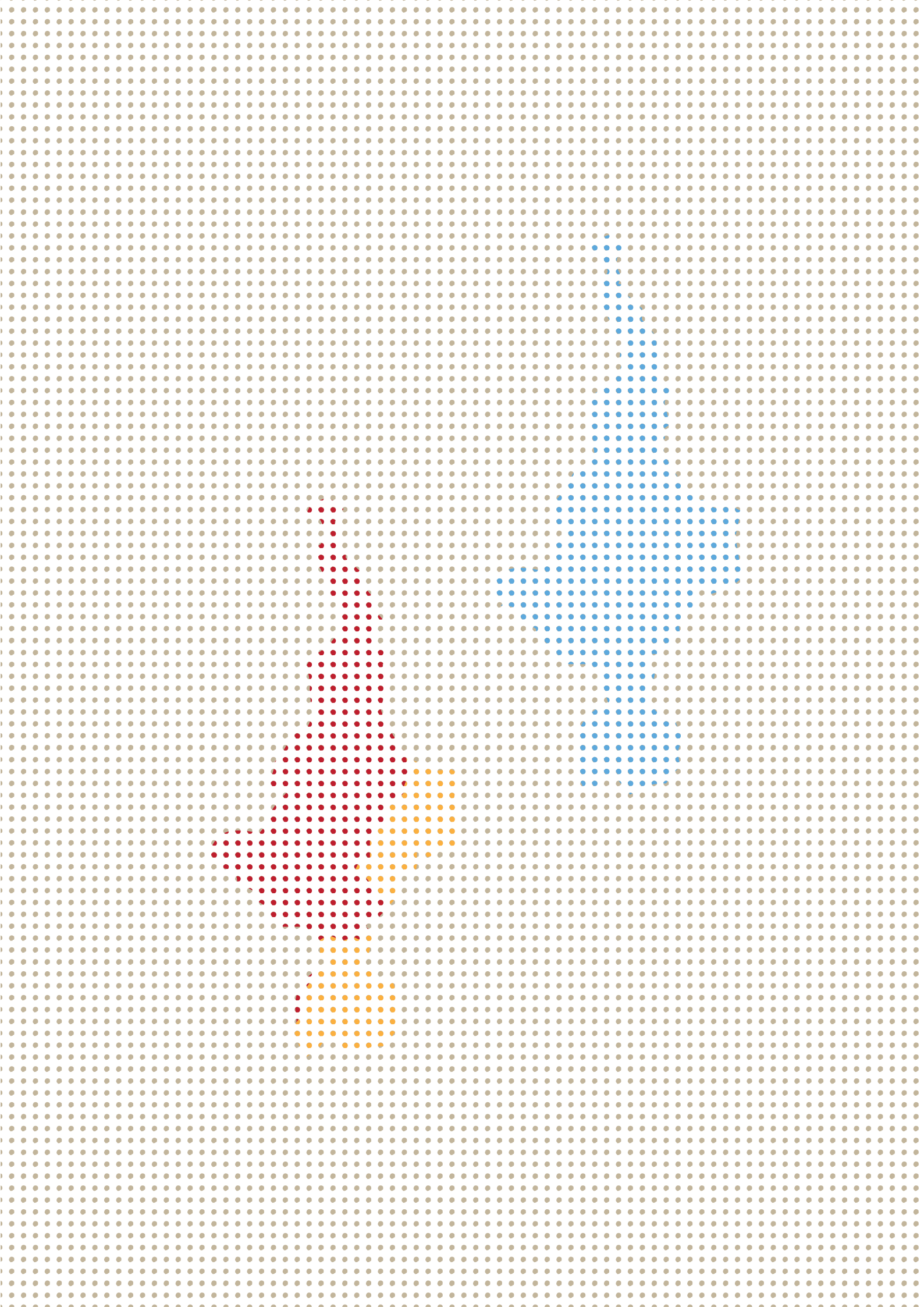
Also of interest is the African Union Convention for the Protection and Assistance of Internally Displaced Persons (IDPs) in Africa (Kampala Convention) which has provisions that obligate the states to protect, assist and provide for effective remedies to people who are displaced due to amongst other things development projects. This Convention although not in force currently will certainly have a bearing in the future on displacement caused by hydropower projects once it enters into force. It is also interesting to note that amongst the Nile basin countries Burundi, DRC, Ethiopia, Eritrea, Rwanda and Tanzania are signatories to the Convention while Uganda has signed and ratified the same.

When the question arises with respect to the protection of a world cultural heritage in a state, so



designated by the UNESCO under the Convention Concerning the Protection of the World Cultural and Natural Heritage, states have an obligation to ensure its protection. An intergovernmental committee under this convention called the World Heritage Committee can take a decision and direct parties to follow the principles laid down under the convention: It is to be noted that this convention has been ratified by all the Nile basin countries except South Sudan. Hence they are under the obligation to follow the same.







PART 2



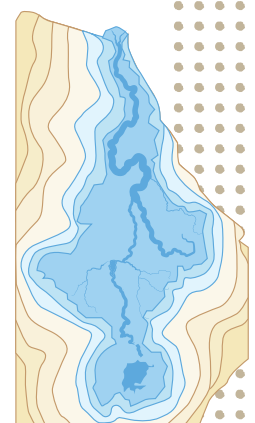
RECOMMENDATIONS

Recommendation 1

COORDINATION FOR WATER QUALITY

The debate about Article 14(b) of the Comprehensive Framework Agreement (CFA) of the Nile Basin countries has resulted in relative neglect of other important Articles over which there is no dispute but which might prove to be very challenging to implement. Article 6 of the CFA discusses “protection and conservation of the Nile River Basin and its ecosystems” which includes improving the quality of water, protecting wetlands, saving biodiversity, as well as restoration of depleted resources. The Article also advocates harmonizing regional policies across the basin to achieve this end. It appears that all countries in the Basin have no problem with this Article. It is therefore recommended that practical measures should be envisaged to implement ideas embodied in Article 6 in letter and spirit, irrespective of the future of the CFA itself. These include:

- ≡ *Co-ordination of Policies related to Managing Eco-systems:* Harmonization of policies needs to be undertaken at two levels. At the national level, individual countries need to streamline interaction between various departments responsible for water quality issues. At the regional level, countries in the basin need to adjust their policies together as they are all dependent on the same water sources and their choices are bound to have impact on the entire basin.
- ≡ *Setting Analogous Targets:* The Nile Basin countries need to identify similar ‘base line targets’ to achieve, in the context of water quality as well as protection of biodiversity. This will help the basin thrive in an equitable manner and lessons learned from the more successful experiments can be replicated elsewhere.
- ≡ *Sustainable Policies:* The Nile riparian countries face challenges of over-extraction, and ever increasing demand over finite resources, in their drive for growth and poverty alleviation. In such a scenario, the policies that are



made tend to be short term and insensitive to the ecosystems. The new policies formulated by the Nile riparian countries must be applicable in the long term, encouraging maximum utilization with minimum harm to the ecosystems.

- ≡ *Economic Valuation of Biodiversity*: It is difficult but helpful to evaluate direct and indirect returns from protecting eco-systems in monetary terms.
- ≡ *Polluters Pay*: The Nile River Basin countries need to pool internal and international funds to restore extremely depleted areas. Also, they need to set standards for industries in terms of pollution and periodically monitor them. The riparian states need to follow the 'polluters pay' scheme where industries which cause pollution beyond the permissible limit need to pay fines or restore the area themselves.

The Nile Basin countries share similar water pollution issues, such as - oxygen demanding substances, improper sanitation, nutrient runoffs from agricultural activities, and industrial and mining related water contamination. At present, water quality monitoring is highly inadequate within the region as a result of institutional and infrastructural gaps. National networks for water quality monitoring, cooperation and data management and regional development of hydrometric monitoring systems will assist in surpassing these gaps.

In order to combat water quality issues, the following measures need to be implemented:

- ≡ A comprehensive assessment of current hydrometric monitoring capacity of the Nile Basin should be undertaken to identify deficiencies and methods of addressing them
- ≡ Monitoring of oxygen demanding substances (COD and BOD), which warm water and reduce water transparency, undermining water quality as well as increasing sediment loads in the catchment of Lake Victoria. Additionally, monitoring contaminants which have bio-accumulation effects in water

bodies and affect transboundary water resources, including nitrates and phosphates

- ≡ Chemical contaminants from industrial and mining activities need closer monitoring as high levels of heavy metal substances like mercury, cadmium, lead, copper, chromium and polychlorinated biphenyls (PCB) are consumed by fish through irrigated water
- ≡ Point sites of pollution such as industrial sites need mapping and monitoring for implementation of regulations that are in place in all countries
- ≡ The control of pesticides and fertilizer levels in water bodies is needed. The monitoring of nutrient runoffs can help curb water hyacinth without having to resort to pesticide use.
- ≡ Nile Basin Initiative (NBI) has recommended that regional laboratories be used in the interim period until adequate water quality monitoring sites are developed in all countries.

Institutional and Legislative Frameworks

All Nile riparian countries have legislation in place for wastewater treatment. However, these legislations are highly variable and need to be standardized. Legislation has been standardized in the Rhine Basin by adhering to the European Water Directive which requires all European Union countries to adhere to water use, waste treatment and environment conservation guidelines. A Quality Coordination Committee which oversees the river's ecological health and water quality standards from its headwaters to the delta in all riparian countries will be required in order to standardize legislation in the Nile River Basin. This committee also needs to harmonize the benchmarking and regulation procedures and act as a medium for resolving disagreements or disputes that may arise between the nations over implementing water quality standards.

The establishment of the Nile Basin Commission

has been proposed under the auspices of the Comprehensive Framework Agreement. However, the establishment of such a body has been jeopardized due to disagreement over Article 14 (b) which deals with territorial and historical rights. It may be useful to examine if a special commission can be set up especially to address water quality monitoring and regulation issues. Without addressing the controversial quantitative aspects, such a Commission or a Quality Coordination Committee may introduce and implement an overarching regional water quality regulatory framework. It could also help manage accident control and pollution warning systems for all countries downstream of the accident site for efficient damage control measures.

The Nile Basin countries can learn from the International Commission for the Protection of the Rhine as well as the Danube Commission.

Expansion of Cooperation over Water Hyacinth in Lake Victoria Basin

The primary cause of eutrophication of water bodies is phosphorus leached from agricultural runoff. While Egypt and Uganda have an agreement to control water hyacinth infestation within the Ugandan territory, infestation of water hyacinth in Kenya and Tanzania was undertaken by the Lake Victoria Environment Management Project (LVEMP). A World Bank and Global Environment Facility funded project to save the Lake by curbing the infestation has been stalled particularly in Kenya and needs further effort in implementation. The use of herbicides reduces water drinkability so hyacinth has been cleared by equipment and through the introduction of the South American beetle *Neochetina* which feeds on the hyacinth. The introduction of an alien species is contested by Article 6 (b) of the CFA, and is the subject of debate amongst experts. The side effects of such measures need to be studied further in order to ensure the viability of this treatment which is hailed

as cheap and effective.

Wetlands

An integrated study of all the wetlands in the Nile River Basin is essential before any sort of policy action is taken or any project is chosen. For example, the Swedish Environmental Protection Agency has come up with the Swedish National Wetland Inventory. The work on this was started in 1981 and ended only in 2004. Each wetland has been assigned a certain conservation value depending on its size, diversity, degradation and dependency. This could be replicated in the Nile River Basin where there are many small wetlands at isolated places. While the Ramsar Convention has sites in the Nile River Basin considered as wetlands of international importance, the Nile River Basin countries need to first list out all the existing wetlands in the Nile River Basin and then plan their conservation.



Recommendation 2

AUGMENTATION OF WATER RESOURCES

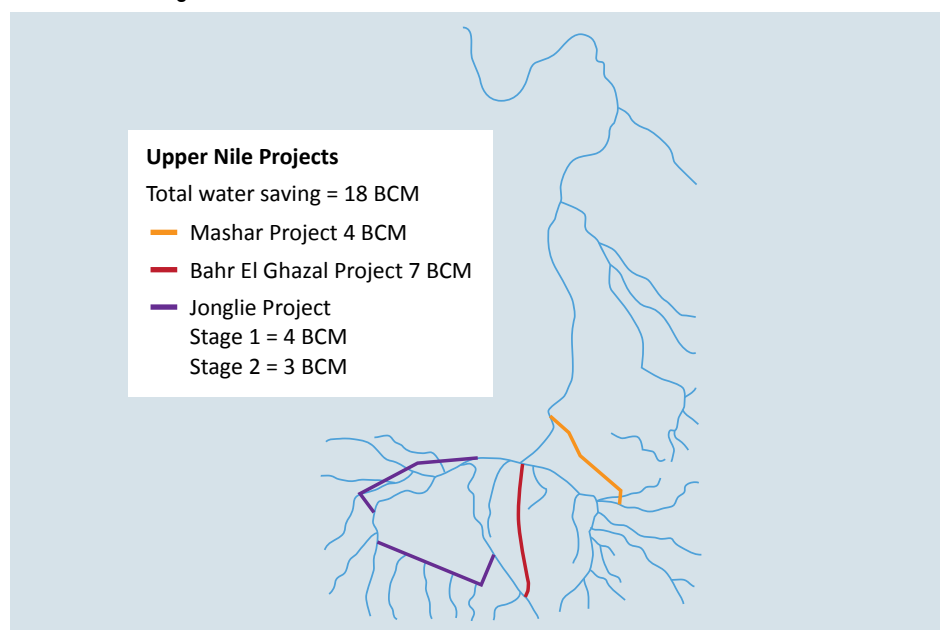
Egypt is stepping up on proposals to increase their supply through the use of diversion canals, wastewater treatment plants and agricultural re-use. The other Basin countries are looking at a mix of both supply and demand-side strategies. Most of the supply-side proposals have limitations as well as environmental repercussions but these proposals are aimed at saving 18 BCM of water for Egypt and Sudan.

A large quantity of water that reaches Egypt either gets evaporated or there is seepage in the swamps whether it is in the Sudds or the Machar Marshes. By addressing this problem, more fresh water can be created.

Supply-side proposals to create 18 BCM of water:

- ≡ Jonglei Canal Project: Stage 1 – 4 BCM, Stage 2 – 3 BCM
- ≡ Bahr El Ghazal Project: 7 BCM
- ≡ Mashar Project: 4 BCM

Watercourses Augmentation Ideas



Jonglei Canal

To bypass the slow flow of water in the Sudds and the large volume of evaporation, Egypt and Sudan started work on the Jonglei Canal in 1978. The Jonglei Canal was to extend for 360 Km from Bor to Malakal, where River Sobat meets the White Nile. After 260 Km of this canal was built, further expansion was halted in 1984 because of the civil war in what was then united Sudan. The project was scheduled to provide 4 BCM of water in the first stage and an additional 3 BCM in its second stage.

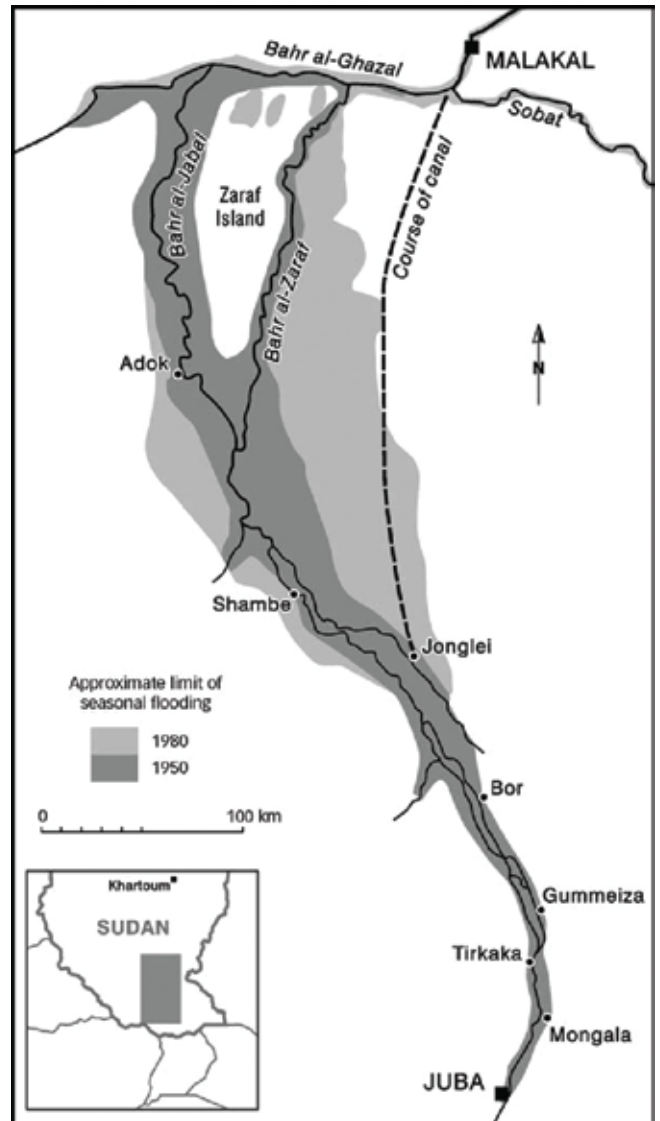
In 2005, talks about reviving this project began. If constructed, this canal is estimated to add around 5 BCM of water to Egypt’s current inflow. When the pact was signed, Sudan was one entity and now, with the formation of South Sudan, there is a change in the main stakeholder.

Proposed Jonglei Canal

When the idea of Jonglei Canal was being considered, the Sudanese Ministry of Irrigation and Water Resources came up with a detailed study listing the advantages of the project, primarily the creation of 4.7 BCM and 7 BCM of water in two phases. The other positive aspects of the project included:

- ≡ Creation of a road alongside the Canal which could be accessible throughout the year. This would significantly reduce transportation costs and help the industries cut costs. According to a report, “The dry season prices for materials currently stand at \$30 for a bag of cement, \$15 for a bag of sand, \$10 for bag of gravel, and \$4 for a cinder block (all prices in USD and attained from average market prices in Malakal). These prices are a 100 per cent higher than the prices of similar materials in Khartoum – also, keeping in mind that during the rainy season, material prices can go up by an additional 50 per cent when the materials are not available at all.”

Proposed Jonglei Canal



- ≡ Sudan is an importer of food. Its net cereal imports in 2010-11 were 26,000 tons. Today, South Sudan faces food security. The Jonglei Canal could help the situation in two ways. Firstly, it can create avenues for year-round irrigation facilities and secondly, it will lower transport rates for food imports.
- ≡ The Sudd is a flat, low lying area with stagnant water, prone to disease vectors. The creation of the Canal will increase the flow of water in the Sudd, which will help reduce the risk of epidemics.
- ≡ The Canal is also expected to reduce the flooding of the regions downstream by 10-20 per cent.

Also, this would help in increasing the grazing area during dry periods.

- ≡ There has been a great deal of negative press against the project because it will have an effect on the size of the Sudd. However, the Canal will also provide access to land areas which could not be utilized earlier. This study will become an important deciding factor in the constructing of the canal.

On the other hand, when the concept of Jonglei Canal was being considered, its impact on the environment and ecology was not considered to be significant. Studies suggest that the average area of the Sudd would shrink by 21-25 per cent and the flood plains by 15-17 per cent. It is important for South Sudan to undertake a comprehensive assessment.

Arguments against the Canal include:

- ≡ The loss of area might have an adverse impact on the bio-diversity and ecosystem of the Sudd region. While it will displace the tribes and their livestock, it will also have a tremendous impact on migratory wildlife. For example, the 1.2 million antelopes migrate to the flood plains every year.
- ≡ The reduction in the discharge will also affect the amount of groundwater storage in South Sudan and its flow to small lakes. This will impact fishing in the area, which is an important source of livelihood for the tribes.
- ≡ Several crops (including rice) are grown in the Sudd region and are dependent on flooding of the area. Also, the loss of water will hit the papyrus zone in the Sudd regions. The flooding also supports a particular grass which is important for feeding the migratory livestock.

The creation of Jonglei Canal will have an impact on the diversity of the Sudd but not on the hydrology or climate of the region. Studies suggest that evaporation over the Sudd contributes only one per cent to the volume of moisture influx. Also, the amount of groundwater storage potential in the Sudd

amounts to 0.18 BCM.

Bahr el Ghazal Project

This is another project related to creating a diversion canal in the Bahr El Ghazal Basin. This diversion canal is aimed by passing the swamps and joining the Bahr El Jebel at Lake No, thereby doubly augmenting water bypassing the swamps.

The Bahr el Ghazal discharges approximately 14 BCM of water into the streams, of which only 0.6 BCM reaches the White Nile at Lake No. According to studies, a diversion canal can save up to 12 BCM of water per year, of which 10 BCM would reach Aswan. Other studies suggest that potential water savings from this project could be around 7 BCM.

Machar Project

This project has been mentioned in public discourse but minimal research has been conducted so far, and there are no proper plans in place. Every year, 5 BCM of water is lost from River Sobat and its tributaries while it sustains the Machar Marshes. Around 10 BCM of water is lost due to evaporation in these swamps. A diversion canal would save 4.4 BCM of water that reaches the White Nile, 4 BCM of which will collect at Aswan. Studies regarding the effects of this canal on the Marshes are not readily available.

Furthermore, a study has been sanctioned by the Eastern Nile Technical Regional Office (ENTRO), the technical arm of the Nile Basin Initiative and funded by ADB called the Baro Akobo Sobat Development Programme in order to attract investments for development in the area. An integrated water resources management and development plan for the Baro Akobo Sobat sub-basins is included in the objectives of this study.

While the above are examples of creating more water flow to augment the current resources, there are also

many water saving schemes which can help save or re-use water which would otherwise go to the sea.

Non-conventional Resources

The best example of wastewater reuse can be taken from Egypt. In 2004, a holding company for water and wastewater was established to tackle the problem of wastewater in a comprehensive manner. The process involves treating sewage in a wastewater treatment plant; some treated water is used directly in a restricted manner depending on its quality while the rest is mixed with agricultural drainage and partly sent to the re-use drains. The left over water from this step is mixed with freshwater and routed to canals as well as the main river for unrestricted irrigation.

Currently, 16 BCM of water is generated from agricultural re-use in Egypt. This amount is expected to increase to 20.9 BCM by the year 2017.

Strategies for Augmenting Water Resources

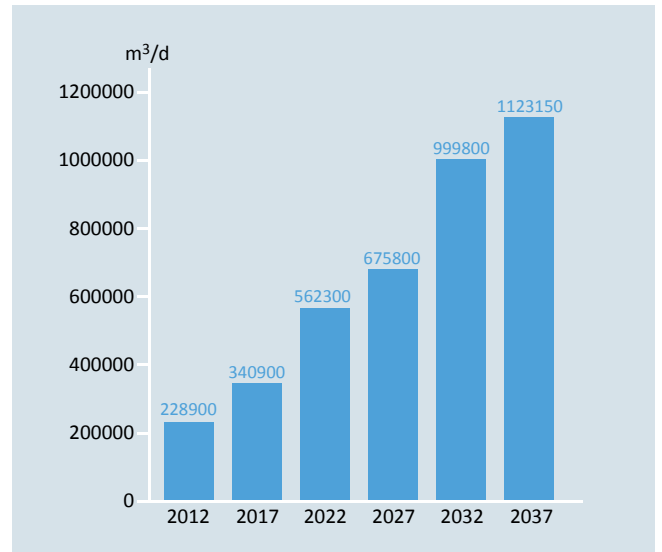
- ≡ Engineered Wetlands
- ≡ Rain capturing projects
- ≡ Desalination
- ≡ Solar powered desalination
- ≡ Soil conservation
- ≡ Watershed improvement
- ≡ Reforestation

Groundwater Resources

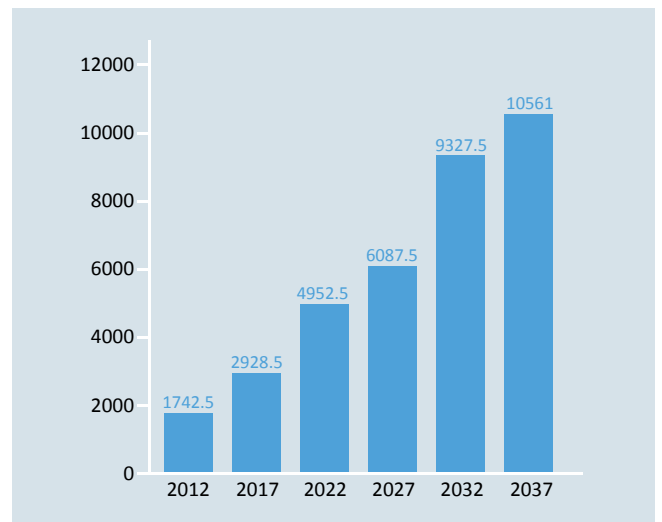
The total groundwater stored in the Nile River Basin is around 400 BCM. Many Nile countries have shared aquifers but no law or policy regulating their extraction. The UN General Assembly passed the Law of Trans-boundary Aquifers on 11 December 2011. According to this law, states are encouraged “to make

appropriate bilateral or regional arrangements for the proper management of their trans-boundary aquifers, taking into account the provisions of these draft articles”.

Total Capacity for the Desalination Plant for Red-Sea, Sinai and Marsa Matrooh till 2037



Total Investments Required for Desalination Plants till 2037 (in US\$)



Other than the regular groundwater extraction tools, Kenya has built sub-surface dams or sand dams. The SASOL Foundation began constructing subsurface dams in the Kitui District of Kenya in 1995, and over

400 have been constructed so far, with another 500 on the agenda. The subsurface dams are constructed to intercept the flow of groundwater and its runoff, to trap water in the aquifer upstream built through sedimentation. These dams would help groundwater storage in a big way, especially in arid and semi-arid regions.

Construction of subsurface dams along coastal tracts can prevent substantial fresh groundwater joining the sea without submerging any new land. This water could be diverted to canals to enhance the flows. These dams also prevent seawater intrusion along the coast, especially where there is intensive use of groundwater in the streambeds.





Recommendation 3

DEMAND MANAGEMENT

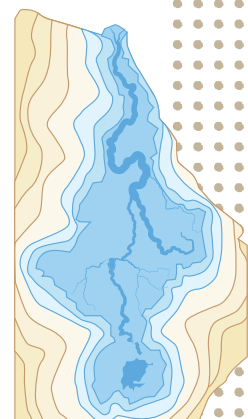
Egypt

Egypt's domestic demand is bound to increase due to its growing population and economic development. Improving institutional gaps and socio-economic barriers will enhance water accessibility and affordability, which is crucial for Egypt in the short-term.

Every year, Egypt is diverting 4.2 BCM of water to replenish the Toshka Lakes in order to reclaim land. In the future, it hopes to relocate half a million people and irrigate 420,000 hectares of this land. The collective canal projects (Jonglei, Bahr el Ghazal and Mashar) will save 18 BCM of water. Egypt's current food demand satiated through imports (virtual water) is enabling it to save 19.4 BCM of water. With time, Egypt's food demand and resulting need for water will only increase. Thus, solely addressing growing domestic demand with land reclamation projects such as the Toshka project and canal projects will prove insufficient.

Sudan and South Sudan

The Western and Northern parts of Sudan have a natural water scarcity due to aridity and low rainfall. On the other hand, most of South Sudan comprises the Sudd, which has adequate water storage capacity and if efficiently managed can be a source of development for the agriculture, domestic and livestock sectors.



Upper Riparian Nations

The upper riparian countries require water mainly for two sectors - agriculture and energy. Their domestic sector is being developed through groundwater usage with an increasing use of bore wells in the region. Ethiopia and Uganda are seeking to improve their agricultural sector for internal food security and exports.

The potential to garner substantial revenue from power trade is driving these nations to develop ambitious hydro-power projects with a secondary concern being their highly underdeveloped national power supply networks. Rwanda, Burundi, Tanzania and Kenya have comparatively modest plans for hydro-power.

Due to changing precipitation patterns and increasing cases of drought followed by flash floods, there are large-scale crop failures amongst all Nile Basin nations. This creates vulnerability for small-scale farms and rain-fed agriculture. Measures to address this regional vulnerability include formal irrigation projects to water large-scale foreign agricultural investments in Ethiopia, water-shed management in the Kagera River Basin, irrigation expansion in Kenya and wetland based agriculture in Rwanda, Burundi and Uganda. However, a regionally integrated framework for developing existing food supply networks will create the economic mechanisms needed to achieve long-lasting regional food security.

Regional Food Trade

To combat the challenge of food insecurity in the Nile Basin, we propose the formation of the Nile Basin Regional Food Trade Network.

The implementation of this Network will require the following actions:

- ≡ Formalization of informal food trade - Informal food trade has met the demand-supply gap for food in the region to a large extent by feeding millions of people in the region. Formalizing this trade system will go a long way in achieving enduring food security. For this purpose, an in-depth study of the informal food trade should be undertaken to understand its progression amongst the Nile Basin nations. The study should have a solid understanding of the existing demand and supply mechanisms, the resulting incidents of artificial local food insecurity experienced in supply regions and food accessibility issues experienced in the demand-oriented regions.
- ≡ Reducing artificial food security and increasing accessibility - Monitoring food trade to ensure uniform food availability and prevention of inflation in food prices during dry years is a must for ensuring food security in the region. Thus, a detailed exploration of solutions is required that seek to achieve uniform food availability in the region. Possible areas for exploring solutions include and are not limited to legal, financial and institutional frameworks, tariffs, food buffer stocks and early warning systems for food shortages in markets on a regional basis.
- ≡ Increasing agricultural output - It is crucial to increase agricultural output in addition to achieving market formalisation. Thus, a study of cropping patterns should be conducted to increase the number of crops grown in a year. Emphasis on growing drought resistant crops in marginal lands and water intensive crops in regions with sufficient rain-fall should also be emphasized. Lastly, an increase in crop yields to increase output for regional food trade must be enabled.
- ≡ Incentivizing and supporting agriculture - Farmers must be able to benefit economically by selling crops nationally and for international exports. The dilemma of food crops versus cash crops needs to be carefully examined and addressed.
- ≡ Integrating food security solutions to soil and water conservation practices - Soil and water

conservation measures as suggested in this report will help secure water supply while making agricultural usage more efficient as in areas that are dependent on rain-fed agriculture. This will reduce vulnerability towards drought induced crop failure.

The above measures will help develop regional food security, conserve water and soil resources, and efficiently tap into the precipitation of the region without over-dependence on surface water and groundwater abstraction. This will free up surface water, such as water resources augmented from canal and rainwater harvesting projects, as well as groundwater abstraction for domestic and municipal uses. This will aid in socio-economic development of the region.

Water withdrawal and use in the Nile basin is predominantly for agriculture. Agricultural sector is experiencing difficulties with adequate and timely water supply for crops owing to erratic rainfall and shift in seasons. Secondly, the domestic water sector is predominantly non-piped. Major cities with water supply systems, whether public or public-private partnerships, have had difficulties with expanding operations with increase in demand, as well as reducing losses from unaccounted for water. Moreover, water systems have been prone to vandalism and water thefts which add to the difficulties in upgrading and expanding infrastructure adequately. Peri-urban and poor neighbourhood dwellers have difficulties with access to water supply which can be witnessed in all Nile riparian states. The industrial sector's capacity to treat waste water before discharging it into water bodies, which are also sites of agricultural and domestic water abstraction is another matter of major concern in the region.

Drip Irrigation

Drip irrigation comprises small amounts of water that trickle slowly into the soil through emitters, wetting

the soil without runoff. The emission rate of water ranges from about 2 to 9 litres per hour.

Of several types of drip irrigation, the main include traditional drip irrigation (varying in type and quality), bamboo drip irrigation and solar drip irrigation. Of these, solar drip irrigation is a solar-powered pumping system combined with drip irrigation, thereby providing water automatically and facilitating instant absorption into the plant roots.

Most of agricultural sector in the Nile Basin is rain-fed and drought has impacted it in several ways for decades now, especially in the arid region. In traditional small-scale agriculture in the arid areas, irrigation can take up to several hours a day as water is hauled from local sources. The new system replaces manual irrigation with a solar-powered pump that delivers water from the rivers to drip irrigation systems.

Solar-powered pumps save hours of labour daily in rural areas that rely on traditional water hauling by women and girls. Also, they allow production of market garden vegetables during the dry season. Despite being durable and immune to fuel shortages, they are cost-effective and worthy in the long run in comparison to the traditional diesel-powered generators.

In flood irrigation, most of the water is unused by plants and it seeps back to the source. On the other hand, drip irrigation uses less water, of which almost all of it is absorbed by the plants reducing wastage. Also, since drip irrigation increases crop yields with less water, farmers tend to expand their acreage or open new crop land, thereby actually using more water than they would otherwise.

Some other ways to improve water efficiency in agricultural sector include:

- ≡ Understand water deficits arising from higher evapotranspiration than precipitation. For instance Rwanda's Irrigation Master Plan studied the relationship between precipitation and evapo-



transpiration (P/PET) in order to determine areas with higher evaporation which would require irrigation projects for agricultural expansion in order to find the most viable uses of these projects.

- ≡ Use 'Water Footprint' concept as a tool to calculate real water use in agriculture and industrial products. Identify economic costs of efficient and inefficient water use. Determine whether water footprint calculated is environmentally and economically sustainable in the long run.
- ≡ Construct anti-salinity barrages to improve the quality of water in the river.
- ≡ Employ integrated management of agricultural sector and ecosystem conservation.

Drought Resistant Crops

Maize is the most widely grown staple crop in Africa, especially in southern and eastern countries. Water Efficient Maize for Africa (WEMA) is a public-private partnership coordinated by the African Agricultural Technology Foundation (AATF), a non-governmental organization based in Nairobi that works to support poor farmers in sub-Saharan Africa. Some of the countries where WEMA is being used include Tanzania, Kenya and Uganda.

In Makutupora, Tanzania, maize has not been widely cultivated due to prolonged droughts and arid conditions over the years. WEMA has introduced a maize variety called Situka which can be grown in arid conditions and could be ready for harvest in 75 days, unlike the regular 90 days. Additionally, it is expected to increase yields by 50 per cent compared to the non-drought tolerant maize seeds. Currently, more varieties of maize are being tested, and it is estimated that it will eventually be sold at 200 Tanzania shillings (\$0.13) per kilo.

The International Maize and Wheat Improvement Centre (CIMMYT), a Mexico-based organization and

the International Institute of Tropical Agriculture (IITA) are creating varieties of drought-tolerant maize for farmers.

Research collaboration between Kenya Agricultural Research Institute (KARI) and the Drought Tolerant Maize for Africa program, under CIMMYT led to two drought-resistant maize varieties; KDV1 and KDV4. These maize varieties are open-pollinated wherein the plants are allowed to cross pollinate, and tend to have a greater adaptation to a harsh environment. The seeds are said to mature within a span of 2.5 months despite little rainfall.

Uganda's National Agricultural Research Organization is trying to develop a new breed of hybrid Maize that is drought resistant and resistant to pests as well. Also, many multinational companies produce drought resistant maize. However there are apprehensions regarding high cost of using fertilizers and chemicals, the possibility of no second harvests and other concerns.

Besides maize, drought resistant rice is also being developed in Africa, Asia and internationally. Some of it could be grown in the Nile Basin.

Water Pricing

Pricing of water is an important part of demand management, though it is controversial. In many countries, civil society opposes taxing a fundamental necessity, whereas the government says that it will help them deal with the problem of distribution. However, this is one way to generate funds for expanding and improving water supply systems. Water pricing strategy should consider the following parameters:

- ≡ Efficiency in water usage in irrigation, as well as industrial and municipal sectors
- ≡ Use of meters to the maximum extent
- ≡ Consultations with users, such as farmers while

determining prices to make this difficult issue more palatable

- ≡ Use of accrued revenue directly for improving the water supply system so that those responsible for paying prices feel motivation to do so
- ≡ Regulation of groundwater extraction by licensing, metering and pricing of bore wells.

The overall success of any pricing policy depends on good governance of the sector, mitigating corruption and arbitrary behaviour by officials and community education.

Reducing Unaccounted for Water (UfW)

In several countries in the Nile Basin, a significant portion of water is lost in conveyance. These include pipeline leakages, irrigation leakages, as well as water thefts. It is difficult to obtain reliable statistics of conveyance losses, which range from 30 to 50 per cent in different cities across the Basin.

In several countries water thefts have increased since the drought of 2011. For instance, disconnection of taps by thieves who collect and sell water, mugging and some thefts of water have become common occurrences in urban slums. As water theft is viewed as a petty offense, there is little judicial consequence to these actions.

Thus, improvement of water infrastructure to improve demand management will also require:

- ≡ Setting up water efficiency standards for water supply systems in the industrial sector
- ≡ Upgrading and modernizing water supply and distribution systems particularly as a buffer during droughts and periods of water scarcity
- ≡ Improving energy efficiency in water pumping for urban domestic pipelines
- ≡ Minimizing non-revenue water such as controlling illegal connections, conveyance losses, unbilled water connections. In major cities with pipelines

suffering from undetected leaks, the installation of remote sensing technologies to detect leaks could prove beneficial by reducing water losses

- ≡ Encouraging partnership between the government, municipal authorities and the civil society in order to increase community's water efficiency and security, as well as food security.



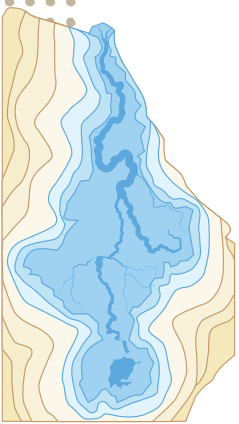
Recommendation 4

MANAGING ENERGY RESOURCES

Resolving the existing energy crisis has become imperative to the Nile Riparian countries to reverse years of underdevelopment and poverty. The Nile waters hydro power potential is perceived as a panacea in the coming years that can propel them towards economic growth and development. As the region reacts to variable climatic conditions alternating between droughts and flash floods, large scale water storage is considered to be the ultimate solution for consistent power production and water and food security. However, this is only part of the solution, as the region needs to work towards achieving the most viable and sustainable mix of energy alternatives.

The region will have to ensure that a project in any one country does not have a negative or undesirable impact in other countries. To resolve the energy crisis the following overarching steps will have to be considered by the riparian states:

- ≡ Policy coordination at the regional level ensuring that practices catering to social and economic resilience are implemented
- ≡ An independent or coordinated environment impact assessment to assess projects before they are finalized and to monitor their impact periodically
- ≡ Regional integration of policies for renewable energy with corresponding tax laws and encouragement of multilateral management of resources as opposed to unilateral development mechanisms
- ≡ Corresponding financial commitments by all parties to ensure their joint involvement in making trans-boundary projects successful
- ≡ Integrated power grids of various capacities to help make the region stronger – bringing in money to the countries that possess energy resources, while sustaining requirements of the neighbouring states.



In order to achieve policy coordination and integration at the basin level, the following sequential approach would be helpful:

- ≡ Preparation of a State of the Basin report
- ≡ Identification of priority issues in energy sector
- ≡ Scenario building taking into account economic, social and environmental issues
- ≡ Drafting of basin wide plans
- ≡ Mobilisation of investment
- ≡ Implementation.

Grand Renaissance Dam

Ethiopia’s construction of a dam in the Benishangul Gumuz region on the Blue Nile river near the border with Sudan, known as the Grand Renaissance Dam (GRD) with a reservoir having about 66 BCM capacity, has generated controversy. Ethiopia, Egypt and Sudan have set up an International Panel of Experts to study the impact of GRD. The panel consists of technical representatives of the three countries and independent experts from outside the Nile Basin. There are two dimensions of this project. If the reservoir is too large, it may obstruct flow of water. On the other hand, in some respects the GRD project will benefit Sudan and Egypt. Firstly, it is believed that the construction of this dam will help Sudan trap excessive sedimentation that it encounters and which costs several million dollars to clear. Secondly, the cost of generating power in Ethiopia can be lower than in Sudan and Ethiopia can benefit from power markets in Sudan and perhaps even Egypt. Thirdly, if a coherent water sharing agreement is signed between the three countries, the Dam can help secure a consistent supply of water for agricultural production in the winter months.

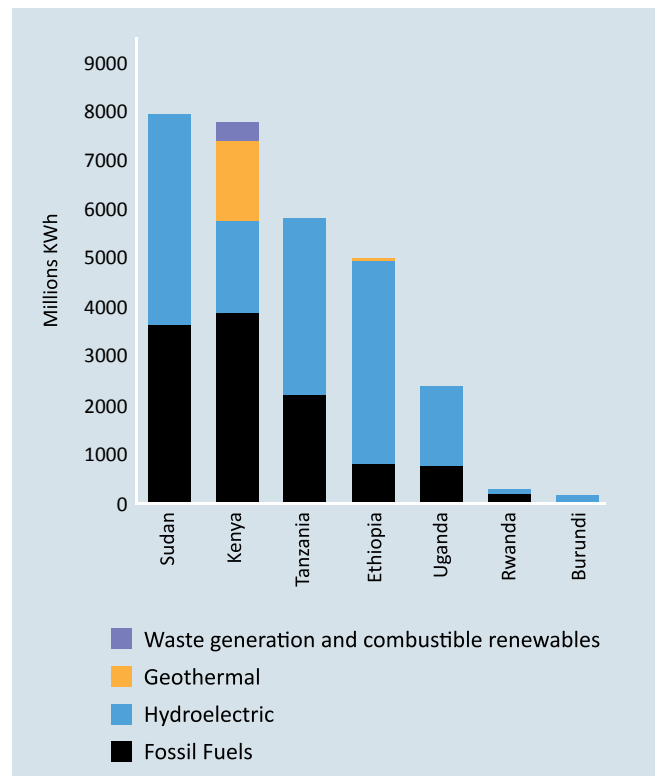
In order to increase cumulative benefits from the GRD, joint ownership through joint investments can be developed to transform the dam into a joint project by the three states, Ethiopia, Egypt and Sudan.

The terms of co-ownership may include:

- ≡ Construction costs and future maintenance costs of the dam, turbines and the reservoir
- ≡ Power trade rates for the investing countries, and the possibility of subsidies for developing industrial clusters
- ≡ Future expansion of power exports beyond the three nations to other Nile riparian states, as well as building a potential for power trade to other MENA and African states
- ≡ Managing impact of climate change on the dam
- ≡ Managing the issue of settlement of communities affected by the project
- ≡ Jointly managing the ecological impact of the dam to maximize benefit-sharing from the project as well as to conserve the Nile River for the future.

Reducing Dependence on Hydro Power

Current Energy Mix



It is essential that hydropower development in the region does not undermine the catchment and thereby adversely affect the availability of water resources in the future. Sole reliance on hydropower is also discouraged by the fact that it has limited scope for reducing prices in the near future whereas significant progress has been made in making wind and geothermal energy cost-competitive.

It is imperative that energy sources that are not water dependent be developed to benefit the region in much the same ways as hydro projects are developed. Energy sector can provide lucrative returns as well as sustainable growth for resilient development by employing a three tier approach to sustained growth:

- ≡ Energy exports from hydro power, wind and in the long-term geothermal energy
- ≡ Development of national energy sources through wind energy and geothermal energy in addition to hydro power for industrial and tourism sectors
- ≡ Micro power generation proliferation through solar energy and micro-hydro power plants for rural and domestic off-grid distribution.

Power generation projects and distribution channels are developed to cater to potential buyers. Currently, the interconnection grids, as well as mega hydro power projects are being developed in the Nile region to meet the trans-border demand for power. National domestic demand is largely biomass, with over 80 per cent of the domestic sector yet to be weaned off firewood and charcoal. The growth of industrial clusters, ports, tourist attractions will increase national demand and so the grids must be developed keeping in mind the geographic distribution of future growth sites to keep down costs in power infrastructure expansion.

The Nile Basin Discourse (NBD) has recommended inclusion of wind and solar energy in addition to hydropower into the Nile Basin Initiative (NBI), to ensure greater access to electricity. The NBD has asked development partners and international

financial institutions to include rural electrification projects in their major interconnection of power lines.

Governments could offer incentives to diversify investments in renewable energy sectors. These could include:

- ≡ Offering feed-in tariffs to guarantee competitiveness for cost efficient renewable production
- ≡ Grid extensions based on region-wise household demand distribution
- ≡ Attracting investors by mitigating exploration risks by pre-drilling geothermal wells
- ≡ Privatization of public power generation and distribution companies to increase efficiency of the energy sector.

Wind Energy

Wind energy and hydropower are complimentary as wind speed is low during wet seasons, but high during dry season which allows reservoirs to recover. Thus, the symbiotic relation of hydropower and wind energy can be jointly harnessed by the Nile riparian states to mitigate the energy crisis in the region. Wind energy can be developed in combination with hydropower projects to ensure consistent power supply despite recurring droughts and the volatility of rainfall levels. Egypt, Ethiopia and Kenya have significantly large capacity for wind energy development. Coastal wind energy can be developed in Kenya and Tanzania via technology transfer and cooperation with Egypt, which has large-scale plans of its own, so as to decrease the pressure on hydropower generation in all three countries. Moreover, wind energy plants can be connected to interconnection grids in addition to the hydropower dams for which they are currently built in the Eastern Nile region, as well as the Nile Equatorial Lakes interconnection grid.

Wind energy is a proven cost effective renewable technology with the global demand for wind turbines

rising to 40 GW in 2011, with global installed capacity reaching 237 GW. On the African front, as of 2011, the total wind power installed capacity was 1093 MW.

Egypt had the installed capacity of 550 MW thus leading MENA in wind generation. Kenya's Lake Turkana Wind Power Project will hopefully generate 20 per cent of Kenya's power. The site has some of the best wind resources in Africa, at 11 meters/ second, in the same direction year round. The project will sell power to Kenya Power at 0.10 cents/ Kw which will make it the cheapest source after geothermal energy in Kenya. Kenya is expected to have a wind power installed capacity of 2036 MW by 2030 to meet its development needs.

Ethiopia has the potential to produce 1 million MW of power from Wind Energy according to the Hydro China Company survey of the country's wind energy potential. Ethiopia's Ashegoda Farm begun producing 30 MW in early 2012 as a test and is expected to produce 120 MW, with the country slated to have functioning installed capacity of 171 MW by 2013. Six projects totalling 945 MW of installed wind power capacity have been announced by Ethiopian Electric Power Corporation which recognizes the potential of wind power for sustaining power generation during dry season. The country's gargantuan hydropower potential is seasonal and will require large reservoirs to produce power round the year.

Geothermal Energy

Geothermal energy has the third largest potential for the energy sector in the region after hydropower and wind energy. Currently, geothermal energy is Kenya's cheapest source of power at 0.08 cents/ Kwh with the country ranking seventh in global geothermal energy installation capacity. As of 2011, Kenya was exploiting only 198 MW out of a total potential of 7000 to 10,000 MW. An additional 280 MW will be commissioned in 2013 in Olkaria, whereas drilling in the Menengai Field Phase I for 400 MW is

ongoing. Project development activities have been commissioned for 800 MW in the Bogoria – Silaki block. 5000 MW of this potential can be exploited with the help of foreign private investments making their entry to Kenya by 2030. 1600 MW is expected to be generated by 2016. The government sponsored 84 MW Olkaria project is the first privately run geothermal project in sub-Saharan Africa. Kenya's liberalized energy policy is attracting private foreign investments in companies looking to earn carbon credits in the geothermal energy sector, besides wind energy. There is scope for regional exploration and development of geothermal energy in the Rift Valley region spreading from Ethiopia and South Sudan into Kenya and Tanzania.

Solar Energy

Solar energy offers the perfect solution for household and rural areas energy needs because it surpasses the need for national grid connection. The Nile basin has the best solar energy influx in the world with annual daylight hours averaging from 2500 to 3100. 80 per cent of the region's population resides in rural areas off the grid. Solar energy can be used in the rural areas to heat water, pump water and for purification purposes. It is also used to light lamps as an alternative to kerosene and for charging mobile phone and laptop batteries. Some schools and villages are also being electrified. The first photovoltaic cell factory was built in Kenya in late 2011 and is slated to produce 30,000 PV modules annually for the micro-generation, off-grid market.

Regional Power Trade

The International Interconnection Projects developed in the Nile Equatorial Lakes Basin and Eastern Nile Region respectively are exemplary in their ability to regionally connect most of the Nile riparian nations. Care must be taken to include South Sudan to the power grid, either through Uganda and Kenya's grid



or through Ethiopia and Sudan's grid.

However international interconnection projects will likely serve to fulfil only the power demand in industrial and municipal clusters close to the border, but do little to tap into the potentially enormous demand for power within each respective nation. Existing infrastructural and financial gaps will make it difficult for individual nations to tap into their national domestic and municipal demand on their own. However, if tackled at a regional level by collectively seeking funding, availing technical know-how and building capacity support, all nation states can together help their municipal sectors decrease their reliance on traditional fuel sources by increasing accessibility to cleaner and cheaper forms of energy sources.

We recommended that above mentioned large-scale wind energy projects be developed in conjunction with hydro power to meet large-scale industrial supply and power export needs. However, at the national level, local power potential could be tapped into by developing potential for micro-hydro, wind, solar and/or geothermal sources to produce power for connecting to national grids. These national grids expand the nexus of already developing international grids. Thus a combination of large-scale and small-scale power production and the wider integration of the nation states will serve to meet both the development challenges of the region, as well as support their economic goals for growth.



Recommendation 5

DISASTER MANAGEMENT

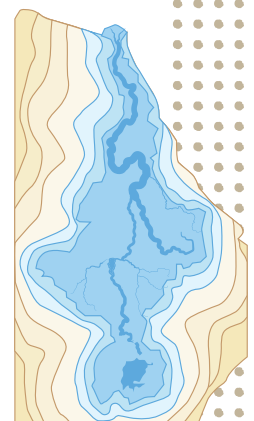
Disaster management in Africa is most required for droughts and floods. Of the total disaster affected people of Africa, 78.9 per cent are affected by drought, despite the much higher occurrence of other disaster events such as floods and epidemics. The need for flood and drought management will increase as number of people living in the disaster prone areas is increasing. It is necessary to install warning, as well as response systems.

Warning Systems

- ≡ Developing regional or local climate change models: Configuring Global Climate Change models to accurately predict local/regional extreme weather phenomena such as droughts, floods
- ≡ Effective early warning systems incorporating technical monitoring and prediction service, as well as risk knowledge to communities
- ≡ Dissemination of data such as warnings to those at risk, sharing hydrological data throughout the year to facilitate disaster preparedness.

Response Systems

- ≡ Flood control techniques such as constructing drainage systems and floodways and management methods like incorporating “urban greening” such as wetlands and environmental buffers
- ≡ Land use planning for flood avoidance
- ≡ Collaboration in the area of flood water harvesting for water-intensive agriculture and other forms of livelihood activities such as aquaculture
- ≡ Effectively utilizing flood deposits that is fertile/nutrient-rich silt to boost agricultural production.



Early Warning Systems in the Nile River Basin

ENTRO and KDMC

The Eastern Nile region (primarily Egypt, Ethiopia and Sudan) has always been prone to extreme floods and droughts. Floods are most prominent between July-September, and impact urban centres like Khartoum, as well as tributaries of the Baro-Akobo-Sobat River.

NBI's Eastern Nile Technical Regional Office (ENTRO) in Addis Ababa is coordinating the Eastern Nile Flood Preparedness and Early Warning Project (FPEW) by facilitating meetings and information sharing sessions among Ethiopia, Sudan and Egypt regarding river flows, flooding, flood risk maps, weather patterns and emergency preparedness. The objectives of the project are "to establish a regional institutional basis; to strengthen the existing capacities of Eastern Nile countries in flood forecasting, mitigation and management; to promote regional cooperation and last but not least, to enhance the readiness of Eastern Nile countries for implementation of the subsequent phases of the project." As of now, Ethiopia has created its first National Forecasting Centre, while Egypt and Sudan have improved their existing centres; also, 18 manual rain gauges have been installed at the headwaters of Lake Tana which is the source of the Blue Nile.

According to NBI's Draft Inception Report (2007), Kenya has the most significant drought forecasting facility within the Basin i.e. the Kenyan Drought Monitoring Centre (KDMC). It was established in 1989 and charged with predicting and mitigating the adverse impacts of extreme climatic events on water resources, agricultural production and food security. The Centre reportedly serves several countries including Burundi, Ethiopia, Eritrea, Rwanda, Sudan, Tanzania and Uganda.

Kenya also has a meteorological department within

the Ministry of Transport and Communication. The Department is responsible for flood and drought forecasting and has been collaborating with the Office of the President in setting up a flood warning system for the Nzoia River, financed by the World Bank and implemented under community based modalities.

Although, Ethiopia has a National Disaster Prevention and Preparedness Commission, the literature available is not clear. Similarly, Uganda has a preparedness and management policy that promulgates an integrated, multi-sector approach while calling for a comprehensive and effective early warning system.

The Famine Early Warning Systems Network

Types of Flood Forecasting and Early Warning Systems Models

- ≡ MIKE 11 Hydrodynamic model plus GIS
- ≡ CARIMA Model
- ≡ Finite Element Surface-Water Modelling System (FWSWMS)
- ≡ USGS/FEWS NET Geo-spatial Flow Model (GeoSFM)
- ≡ Galway Flow Forecasting System (GFFS)
- ≡ High resolution Regional Model (HRM)
- ≡ Regional Spectral Model (RSM)

The Famine Early Warning Systems Network (FEWS NET) is a USAID-funded activity that coordinates with international, regional and national partners to provide early warning and vulnerability information on food security issues. In countries such as Haiti, Afghanistan and the United States and within Africa and Central America, professionals identify, monitor and analyse relevant data and information pertaining to impacts on livelihoods and potential threats to food security. Upon recognizing the issues, FEWS NET assists decision-makers in mitigating food insecurity.

For instance, there are monthly food security updates and alerts, regular food security outlooks and briefings, and support for response planning efforts. Moreover, there is a focus on capacity building, improving networks, and creating consensus regarding food security problems and solutions.

The African Risk Capacity

The African Risk Capacity, ARC, is a ground-breaking project of the African Union (AU) designed to improve current responses to drought related food security emergencies and to build capacity within AU member states to manage drought risks.

This African-owned, AU-led financial entity will use advanced satellite weather surveillance and software - developed by the UN World Food Programme (WFP) - to estimate and trigger quick-disbursing funds to help African countries hit by severe drought, implement effective and timely responses to assist those affected.

Hyogo Framework for Action 2005-2015

The Hyogo Framework for Action 2005-2015 was adopted by 168 countries. This framework entails the governments involved to frame specific guidelines to reduce disaster risk and vulnerability to natural hazards. While the Hyogo framework has urged signatories to collect data, set targets and also set up disaster management policies, it has a long way to go to achieve sustainability and reduce vulnerability in disaster prone countries. The Nile River Basin needs to integrate this data into their development and be prepared to face future problems. They could use examples from other countries and build their skills in this department. They need to be a part of the post 2015 resolution to avert/manage any future disasters.

Drought Monitoring Centre (DMC) - Climate Prediction and Applications Centre (ICPA)

The Drought Monitoring Centre, based in Nairobi, Kenya was established in 1989 by twenty four countries from Southern and Eastern Africa as an effort to combat disasters caused by climate change. Of the ten countries that the Centre caters to, eight are located in the Nile River Basin. These include Rwanda, Burundi, Tanzania, Kenya, Uganda, Eritrea, Ethiopia and Sudan.

The Centre has publicised its functions on its website:

- ≡ Acquisition of climate and data from remote sensing
- ≡ Development and archiving of national and regional climate databanks including calibration of remote sensing records
- ≡ Data processing and developing basic climatological statistics required for baseline risk scenarios and other applications
- ≡ Monitoring, prediction and early warning information provision of space-time evolutions of weather and climate extremes over the sub-region
- ≡ Mapping of hazards, climate risk and extreme climate events
- ≡ Networking with World Meteorological Organization (WMO), national meteorological and hydrological institutions, as well as regional and international centres for data and information exchange
- ≡ Capacity building in the generation and applications of climate information and products
- ≡ Applications of climate tools for specific climate sensitive sector risk reduction, environment management, and sustainable development, including integration of indigenous knowledge
- ≡ Monitor, assess, detect and attribute climate change and associated impacts, vulnerability, adaptation and mitigation options
- ≡ Develop relevant tools required to address the

regional climate challenges through research and applications in all climate sensitive socio-economic sectors, including addressing linkages with other natural and man-made disasters

- ≡ Networking and exchange of information regarding disasters in the sub-region.

The Centre provides information in the form of:

- ≡ Ten day, monthly and seasonal climate/weather bulletins
- ≡ Climate watch/El Niño updates
- ≡ Annual climate summaries.

World Meteorological Organization

The World Meteorological Organization (WMO) involves national meteorological and hydrological services in regional and sub-regional cooperative projects such as the operation of Drought Monitoring Centres in Africa (DMC-Nairobi, DMC-Harare). In particular, WMO promotes research on the interactions between climate, the hydrological regime and drought in the context of climate variability, change and water resources scarcity. With a view to developing appropriate response strategies, WMO's efforts in drought forecasting and mitigation are supplemented by public awareness and education and training activities.

In 2009, the WMO announced it would soon be able to learn about the onset of a drought two to three weeks after it starts, thereby giving a heads-up to plan relief. Presently, drought indices only indicate drought when they are in the midst of it; the Standardized Precipitation Index (SPI) uses mean rainfall over a long-term period of at least 30 years as a variable to develop an early warning scale. Droughts begin when the SPI is consecutively negative for 2-3 weeks, and can predict the intensity of the drought; the higher the number, the more intense the drought.

Through WMO, there is global availability of real and near-real-time weather and climate information which

is essential for early warning activities. In this regard, WMO and its 189 Member States and Territories operate a unique worldwide system for collection, processing, distribution and exchange of weather information and warnings.

National Initiatives

Rwanda

Due to floods in the Northern, Eastern and Western parts of Rwanda, the government has streamlined their policy by establishing National Disaster Steering Committee (NDSC) and bringing the Ministry of Disaster Management and Refugee Affairs (Chair), Ministry of Defence (Vice Chair), Ministry of Local Government, and Ministry of Internal Security together to manage disasters better. Fatal landslides have damaged roads and devastated several crop fields in many districts especially Musanze, Nyabihu, Rubavu, Rulindo, Ngororero, Muhanga, Nyamagabe, Karongi, Nyagatare, Bugesera and Kayonza in the past.

In recent times, Rwanda has experienced climate change causing erratic rainfall and periods of drought. As a result, its Infrastructure Minister has suggested that there be a system of continuous early-warning advisories to reduce the impact of droughts and floods, and go beyond early-warning systems. Such a system is currently in its early stages and is slowly taking shape.

Kenya

Arid and Semi-arid Land (ASAL) Drought Management was a four-year project (2011-2015) under the Kenya Rural Development Programme (KRDP) funded by the European Union. KRDP/ASAL Drought Management is a successor of the EU-funded Drought Management Initiative (DMI), which was implemented from 2007-2011. The project built on the activities of DMI, which

supported on-going efforts towards consolidation and institutionalization of drought management structures and functions in the country and increase the capacity of ASAL communities to effectively manage drought and improve resilience.

Ethiopia

The Ethiopian Government's new National Meteorological Agency (NMA) website offers high-quality data, including nearly 30 years of rainfall and temperature records on a 10-day timescale, incorporating measurements from 600 rain gauge stations, temperature data from 300 weather stations and satellite estimates of land temperatures using moderate resolution imaging spectro-radiometer (MODIS) technology. The information is country-wide and geographically precise, and culled from local records and combined with satellite measurements. The data available online is at a resolution of 10 km by 10 km, making it accessible at the level of districts, zones and regions, or any point defined by users. Additionally, the website includes statistical tools to help analyse the data. It is freely available for farmers and may enable them to spot trends in changing weather patterns to improve their crop yields. At the moment, Ethiopia's weather stations are unevenly distributed throughout the country and found mostly in cities and towns along the roads.

Presently, NMA operates 1,200 conventional monitoring stations and 25 automatic stations, as well as an upper-air radiosonde instrument in Addis Ababa that monitors the surroundings for 20 vertical kilometres. It integrates the data with satellite images it receives every fifteen minutes from a European Union meteorological satellite; therefore, the Agency offers regularly updated short- and longer-term weather forecasts. In the future, NMA plans to install a radar system in Bahir Dar City (580 km northwest of Addis Ababa) to improve data collection capacity to better read and monitor the country's atmosphere.

Enhancing Response Capability to Disasters

A status report by the African Union Commission (AUC), United Nations Office for Disaster Risk Reduction (UNISDR) and World Bank (WB) suggested the following constraints limiting disaster risk reduction:


- ≡ Translating existing regional political commitments to national strategic and adequately resourced actions
- ≡ Institutional and legislative frameworks are fragmented across various statutes and lack comprehensiveness
- ≡ Lack of risk assessment and risk mitigation measures in post-disaster emergency response
- ≡ Dominance of agency centred mechanisms and lack of decentralized community based mechanisms
- ≡ Inadequate financing of disaster risk reduction
- ≡ Lack of information and dissemination amongst public and national authorities
- ≡ Overall lack of capacity for implementing disaster risk reductions mechanisms.

There is a need to address the above constraints by taking the following steps:

- ≡ Identification and assessment of disaster types and risks on a region-wide basis
- ≡ Understanding the risks posed by disaster towards development initiatives in the region
- ≡ Although hazard monitoring capacities have improved, it has not led to averting risk
- ≡ Enhancing public knowledge access
- ≡ Improving institutional capacity through comprehensive legislation, its implementation and adequate access to finances

- ≡ Integrating risk reduction with post-disaster emergency response
- ≡ Development planning should be informed by risk reduction information.

Community Involvement



Local governments and the communities play a big hand in disaster management. It is essential to understand their point of view regarding disasters, as many of them are man-made or occur due to mismanagement. Involvement of women in skill and capacity building programmes is especially important. In developing countries like those of the Nile River Basin, the gender roles are such that it is the duty of women to fetch and store water. They have been doing so for centuries. They know how the water system works, the leaks involved, and the timings. So teaching them how to manage will go a long way in terms of local level capacity building.

Such programmes require replication all over the Nile River Basin to build water management skills. Also, field visits and exchanges between the countries themselves need to be conducted so that there is exchange of expertise, skill development as well as ideas. For example, Egypt is a regional expert in desalination and agricultural reuse. It has also done considerable work in delta management and wetlands conservation for disaster risk mitigation and water quality conservation. Such exchanges will propagate the growth of the region as a whole. Capacity building requires standardizing at a regional level to ensure the many benefits of sharing a trans-boundary water source, and should be prioritized in the policies of individual countries as well.



Recommendation 6

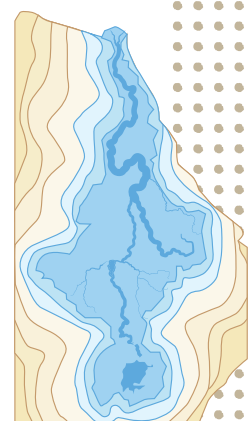
FINANCIAL MEASURES

Huge Requirements

The Nile Basin countries require more than US\$ 100 billion for the development of hydropower and irrigation. If the requirements for water conveyance systems, quality control and improvement, disaster management, development of drought-resistance crops, research and development are taken into consideration, capital requirements for water and related sectors would be a few hundred billion dollars. It is estimated that the Nile riparian basin will require US\$ 60 billion to fund all planned hydropower projects in the basin (not including Grand Renaissance Dam) as explained in the first part of this report. Also, irrigation expansion will require almost US\$ 50 billion, also as explained earlier in this report. The requirements of a few hundred billion dollars in water, hydro-power, irrigation and related sectors have to be seen in the context of the problems of poverty and low development, which would also need hundreds of billions of dollars of investments for health, education, infrastructure and other needs.

Specifically, the Nile river basin will require continued funding for development projects in the future that will fall under the following broad categories:

- ≡ Energy infrastructure – Dams, renewable energy, trans-boundary grids, rural electrification
- ≡ Irrigation projects – Irrigation canals, rehabilitation of old systems, drip irrigation expansion, rainwater harvesting, water storage for agriculture, and climate change adaptation measures
- ≡ Water supply systems – Population and urbanization is increasing demand for piped water supply at a faster rate than supply systems expansion. The challenge for most Nile riparian states, with the exception of Egypt and Sudan, is to not only to meet the MDG goals for water, sanitation and



power, but also to maintain price of water at the minimum, while striving to maximize service

- ≡ Water quality - Improving water quality monitoring to include all forms of pollution including concentrations and source point identification, developing water treatment infrastructure that targets pollutant sources, effectively standardizing and implementing water policies from the grassroots to the regional level
- ≡ Disaster response systems - Wider and comprehensive dissemination of warning, response systems, emergency supplies and transports systems
- ≡ Catchment rehabilitation, wetlands conservation, reforestation, soil and bank erosion mitigation
- ≡ Maintaining progress already made in providing necessities to the people - Infrastructural investments will need to focus on maintenance, rehabilitation of old and non-operational infrastructure, efficiency gains and further expansion
- ≡ Information management of water systems - Data collection and management systems for hydrometric, climatic, groundwater related and other data.

The huge financial requirements will place different burdens on the nations in regions. Egypt and Sudan are the only countries in the region that can be categorized as middle-income and is thus in the stronger position to financially support and honour its debt than other nations which are low-

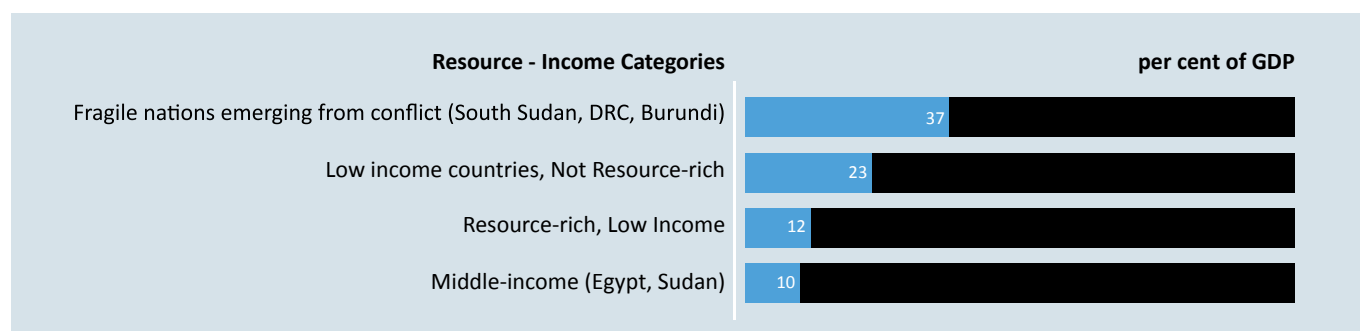
income. Although resource rich countries earn more revenue than resource poor nations and are in a better position to support their infrastructural development, it has been found that this is generally not the case. In practice, repaying debt along with governance challenges hinder revenue allocation for infrastructural development in resource rich nations as well.

Resource Mobilisation

Egypt, Ethiopia, Rwanda, DRC, Kenya, Tanzania and Uganda among 17 African nations were identified as attractive markets for attracting Foreign Direct Investment (FDI) in June 2011 in a well-reputed report. From its findings it can be gauged that the most lucrative attractions for FDI continue to be natural resources. A small domestic market, under-developed human capital and high levels of bureaucracy are the chief barriers to investments in non-mineral sectors. Egypt conventionally is the primary destination in the Nile Basin for foreign direct investment. Kenya is facing potential decline in investments due to high levels of bureaucracy although recent oil discoveries are expected to bring in investment.

FDI can be significant in ensuring sustainable growth and development, but it is also prone to market forces with investors and buyers looking for lucrative deals around the world. It is therefore necessary to invest in human capital, reduce bureaucratic obstacles and promote the domestic private sector.

Infrastructural Costs



An increase in regional trade in food and other agricultural produce as well as livestock sector is also needed which can be achieved by removing transport and tariff barriers, while at the same time protecting local growers by developing regional cooperative markets and free-trade zones, as is being pioneered by the Eastern African Community. Helping each other develop human capital via capacity building, technical assistance and joint development projects for infrastructural growth is also crucial.

Ensuring sustainable development for infrastructure will require a vibrant public-private partnerships and regional investments to buffer critical development initiatives such as water and sanitation and power projects, as well as climate change mitigation and conservation projects. Conversely, while some countries in the region have done a great job in attracting FDI, for instance Kenya and Rwanda, efforts need to be made to provide a stable economic environment to continue to attract FDI. Some of this can be done by developing a regional financial nexus by building on the NBI Secretariat's financial disbursement model, which disburses funds to regional, sub-regional and national projects under the ENSAP and NELSAP.

Regional Cooperation

A regional institution that has the support of all riparian nations can overcome national limitations by supporting capacity building for the overarching benefit of all riparian states. Such an approach to integrated trans-boundary water resources management and environment conservation is attractive for foreign investors and aid donors. It has been practised in the Senegal River via its River Basin Organisation, Senegal River Basin Authority. The countries focused on developing the country with the weakest environmental and water management capacity (Guinea), by disbursing the majority of the funding received by the Global Environment Facility

to close critical knowledge gaps in the upper basin in Guinea, build and upgrade hydrological and climate data, as well as to harmonize Guinea's legislation with Senegal River Basin Authority and the regional water strategy. Funds were similarly pooled at the regional level for the multi-sectored, multi-phase International Development Agency funded projects. The Senegal River Basin Authority is extraordinary for taking fiduciary responsibility on behalf of its riparian nations, which have provided strong incentives to ensure the proper use of funds and resources.

As discussed in the context of energy future, joint investments and joint management of hydro power projects by the concerned countries can help pool and rationalise resources. Such joint efforts also make it viable to attract international funding, especially from multilateral organisations.

Assistance from Multilateral Organisations

If the Nile countries are together and create a common market or even an economic union, underpinned by economic efficiency within each country, they will attract multilateral investment and aid. It can come in various forms.

- ≡ *Grants and soft loans* - The Nile basin countries can approach the World Bank, UNDP, Global Environment Facility, EU, bilateral donors and newly emerging economies such as China, India and South Korea.
- ≡ *Technical Assistance and Information Exchange* - It is offered to train civil servants, judiciary and law enforcement authorities, parliament and legislative bodies, professional associations and revisers of legislative texts. Such assistance can be developed through existing initiatives such as the Nile-TAC and the Nile Basin Capacity Building Network to transfer capacity from one country in the region to another or from external sources. For instance, technical experts within the region could help spread know-how in water monitoring

systems, agricultural reuse, wetlands conservation, irrigation measures and other crop yield increase solutions in countries that lack such capacity.

≡ *Twinning* of ministry officials to exchange beneficial practices has been done between EU member nations and candidate nations. Even though this is limited to EU candidate countries, it is possible to solicit cooperation from EU if a special and collective request is made by the Nile Basin countries.

≡ *Special Emphasis on Financially Fragile Nations* - Some vulnerable nations such as Burundi, DRC, South Sudan and Eritrea may require additional capacity building support in developing water supply and sanitation, infrastructure and technical skills training. Special consideration for them will help plug obstacles in regional mainstreaming in integrated water resources management of the Nile river basin.

A large number of donors led by the World Bank, UNDP and national development cooperation agencies have been involved in developing the Nile Basin for over two decades. The risk of political fragmentation of the Basin can discourage some donors from continuing to support the development of the Nile Basin with enthusiasm.

Emerging Donors

China's loans for infrastructural projects have been at the centre of much academic and media discourse. Chinese infrastructural projects have been considered as commercial investments as they are loans not grants or aid. While China's presence in Africa attracts the most attention, there has been an increasing presence of India, Korea, Turkey, Brazil and Venezuela as donors among the non-OECD countries.

Estimates indicate that these donors currently disburse \$10-15 billion of aid per year, or 7-10 percent of global official aid. In contrast to traditional donors

whose aid is expected to remain constant over the medium term, the total aid from emerging donors is forecast to double in the next five years.

Evaluating official development assistance (ODA) from emerging donors is extremely challenging because emerging donors unlike DAC member have no framework or any obligation to provide their assistance related information publicly. Thus estimates regarding total aid flows from emerging donors range from \$11 billion to \$41.7 billion, that is, 8 to 31 per cent of global ODA.

Emerging donors boost new sectors and offer broader sources of finance, more appropriate expertise, technology and training, low cost and quickly developed infrastructure, more affordable generics, machinery and consumer goods. China is perceived to be superior in infrastructural development; Brazil has provided expertise in agriculture and agro-processing and India in skills and services.

Emerging donors have focused on trade and investments and while there has been some concern that it is predominantly focused in extraction based economies, it has been noted that Africa's manufactured goods are finding a larger market in developing countries. Africa exported 18.2% of its manufactured products to China and emerging partners in 2000 which increased to 34% by 2009.

Comparative Advantage of Emerging Donors

The prevalent perception among African countries (40 out of 51 surveyed countries) according to the 2011 African Economic Outlook is that emerging donors grant them the freedom to use funds based on their development needs in keeping with their own policy objectives without added criteria such as emphasis on poverty reduction, transparent governance and aid accountability, amongst others.

However, it has been noted that the emerging donors

have just as much as of an interest in ensuring return on investments and have become aware of the risk of incurring losses while working in a volatile political environment. On the other hand, traditional donors have concerns that the role of emerging donors will undermine development policy objectives such as aid effectiveness, will show less concern to environment conservation and labour standards. At the recent High Level Forum on Aid Effectiveness in Busan, traditional donors succeeded in persuading emerging donors to sign up to a new global partnership.

The mutual dependence on the Nile River means that the Nile riparian nations have a mutual long-term stake in ensuring each other's wellbeing. Preventing unsustainable demand in the future will require that development initiatives be well balanced to support all water resources. This is only possible with politics of addition, where short term compromises are made to harness the potential of each country in the region in the long run. The tendency to divide the Nile Basin by hastening political processes without including all countries on terms that are acceptable to all can drive away external players and also threaten intra-regional transfer of resources and knowhow to the detriment of weak and poor population in all countries in the Nile Basin. Nile Basin countries require several hundred billion dollars for their development, a few hundred billion dollars for water, agriculture, power and related sectors and almost one hundred billion dollars for power and irrigation alone. If compared to national income, exports and level of foreign direct investments, far too much is at stake. The challenge is so enormous that it is difficult to meet even under the best circumstances. A sincere political commitment can help make it somewhat feasible to address.





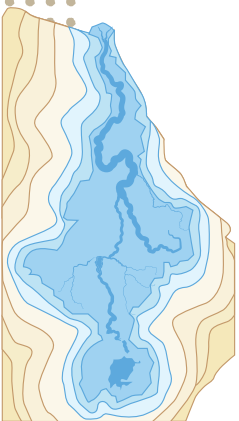
Recommendation 7

LEGAL & POLITICAL SOLUTIONS

Committee of Legal Experts

There are a number of legal instruments in the Nile Basin, which elude consensus in understanding about their application. The primary among these are:

- ≡ Comprehensive Framework Agreement (CFA), which has been signed by six countries and not signed by four countries, accounting for majority of the area of river basin and population due to discord over Article 14 (b), and also the spirit of which, particularly Article 6, has already been violated by the signatories of the Agreement
- ≡ 1929 and 1959 Agreements on allocation of water share between Egypt and Sudan, which are not acceptable to other countries on the grounds that they were signed when the opponents to these treaties in the Nile Basin were colonized and the application of these agreements to Republic of South Sudan in the context of the laws on state succession
- ≡ Bilateral treaty between Egypt and Ethiopia, signed by Heads of States of two independent and sovereign states in 1993, who are main protagonists in the Nile dispute, and the question of how it relates to other treaties in the Nile basin
- ≡ The application of the Convention on Biological Diversity (CBD) to the Nile Basin countries, and especially CBD signatories in the Nile Basin to examine impact and implications for ecology
- ≡ The relevance of African Convention on the Conservation of Nature and other African continental, regional or sub-regional legal instruments such as COMESA and EAC instruments to the Nile basin countries.

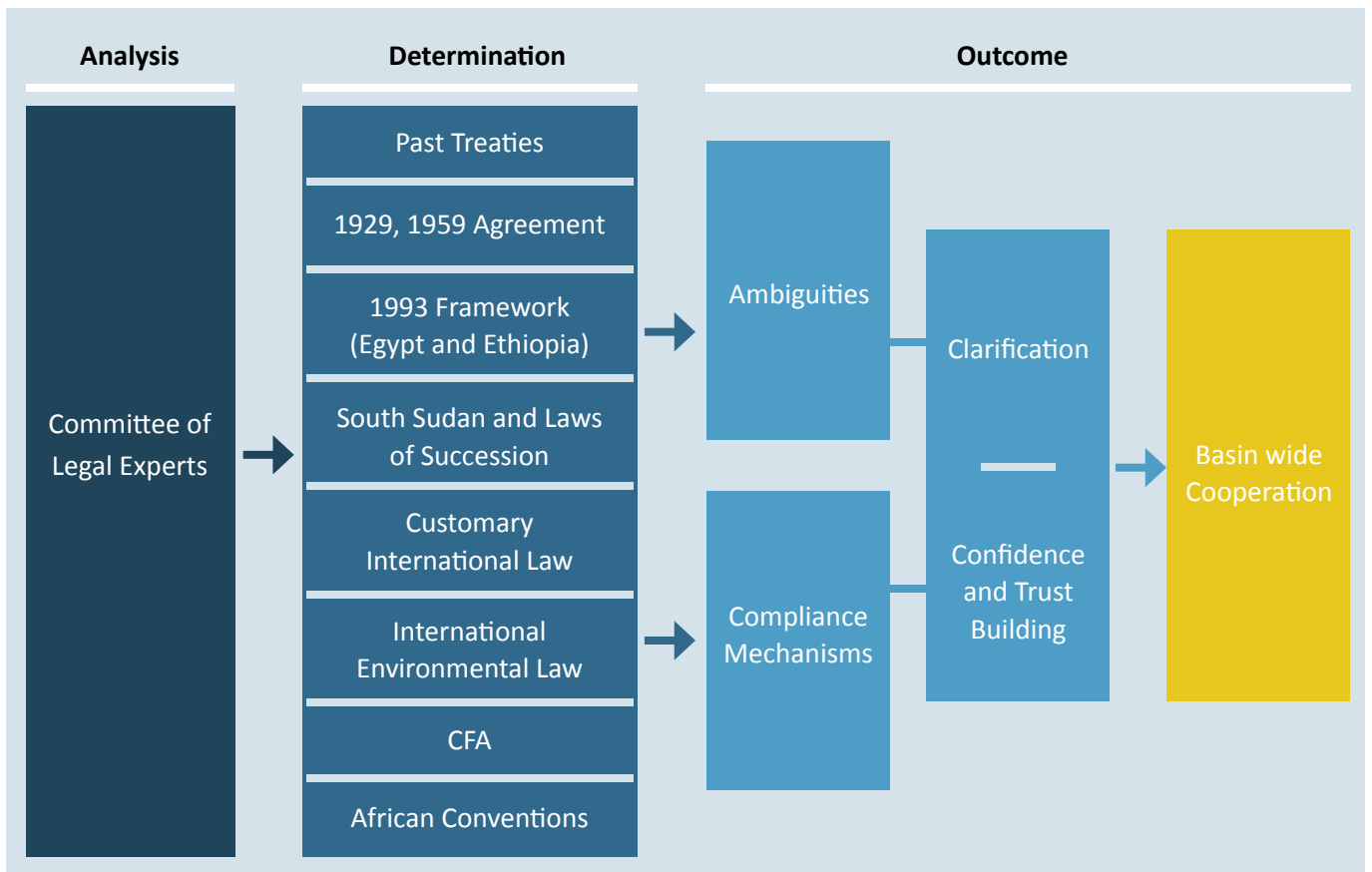


Much of the current discourse concentrates on the 1959 treaties and the draft CFA, but other bilateral treaties, such as the 1993 accord between Egypt and Ethiopia, or multilateral conventions such as the UN Biodiversity Convention or the African Convention on the Conservation of Nature may prove to be more pertinent and useful.

It is therefore proposed that an independent committee of legal experts be set up which would have a twofold function. One would be to perform a legal appraisal of all the relevant instruments including the 1959 Agreement, 1993 Agreement, and CFA as well as the principles of customary law. This exercise should aim to reduce legal ambiguities and pave a way to reconcile all the competing positions of law that have been advanced thus far by the upstream and downstream countries. The second function of the Committee would be giving practical suggestions for increasing state compliance with

the relevant treaties by those countries that have already signed any such treaties. This would be a great confidence building exercise which will help the non-signatories to sign such a treaty. It is pertinent to note that a similar exercise has been successfully undertaken previously under the aegis of the United Nations Economic and Social Council (ECOSOC) and Economic Commission for Europe to produce a guide to implementing the Convention on the Protection and Use of Transboundary Watercourses and International Lakes signed in Helsinki on the 17th of March 1992. The task was assigned to the legal board and the working group on integrated water resource management “to provide, respectively, legal explanations of the conventions provisions and practical advice on their implementation.” It helps the non-parties to make decisions relating to issues of ratification or accession. It also addresses the difficulties that would arise for both parties and non parties during accession or ratification.

Proposed Committee of Legal Experts



Proposed Changes to Article 14(b) of the CFA

During the negotiations for the CFA, it was proposed and accepted by all the Nile basin countries except Egypt and Sudan that Article 14(b) should read as “*not to significantly affect the water security of any other Nile basin States*”. The two lower riparian countries wanted the Article to read as “*not to adversely affect the water security and **the current uses and rights** of any other Nile Basin State*”. No consensus has been reached on the letter and spirit of Article 14(b) until today. The herculean challenge to resolve the deadlock over this issue is underway. Several diplomatic processes have been initiated thus far, but have failed to resolve the deadlock. Suggested below is an alternative to the proposed text of Article 14(b) to resolve this deadlock.

“not to significantly harm **current and future uses and rights** and water security of any other member states.” where water security is defined as “the right of all Nile Basin States to reliable access to and use of the Nile River system for health, agriculture, livelihoods, production and environment.” (Article 2(f)).

The inclusion of “current uses and rights” should address the needs of Egypt and Sudan. The use of “future uses and rights” should address the needs of the upper riparian countries, while recognising the future needs of the lower riparian countries as well.

This formulation is not coined by Strategic Foresight Group. We have learnt in the course of confidential consultations from highly placed political sources in upper as well as lower riparian countries that such a formulation has been part of inter-ministerial discussion. It is also learnt that a consensus in principle on such a formulation was achieved by all countries including the main protagonists. Why this agreement was not converted from ‘in principle’ to a legal undertaking is not known.

If this precise wording is no longer acceptable, it may

be possible for the Committee of Legal Experts to construct alternative wording. The essential basis for any agreement has to be recognition of the needs of all countries to ensure water security for their people at present and in future.

Neutral Third Party or Arbitration Council

It is proposed that in the event that the differences amongst the Nile Basin countries seem to become irreconcilable, the help of a neutral party such as the World Bank could be taken. The World Bank has often played an important role in fostering cooperation in cases of transboundary waters. It either helps towards resolution of disputes amongst the Riparian state parties or plays a ‘facilitative role’ to strengthen regional cooperation. It helps in initiating dialogues between the Riparian Nations and uses ‘quiet diplomacy’ to initiate basin cooperation.

The World Bank has been involved with the Nile region for several years and in this regard it has been closely coordinating with the Nile Basin Initiative. It has also been funding various hydro projects in the region. However, it is suggested that in case of a deadlock the countries may ask for the World Bank to increase its role from being a facilitator to a mediator, as seen in the case of the Indus water dispute between India and Pakistan. The World Bank offered its ‘good offices’ to the two parties and after 9 years of negotiations, an agreement was signed between India and Pakistan. It is said that the World Bank’s mediation efforts were successful due to its involvement at the highest level with the governments. This helped them to constantly engage with the parties and ‘apply pressure’ when required. Thus the World Bank facilitated the parties to come to an agreement on water sharing. The Indus Water Treaty that was signed between the two parties included the involvement of the Bank in case any future disagreements would arise. Under the Treaty, the Bank can appoint a neutral expert and even suggest members to the Court of Arbitration established under the treaty. The role of the Bank

in this case was described as “proactive, neutral, pragmatic and fair.”

Thus in the case of the Nile Basin, considering the World Bank’s neutrality as well as expertise in dealing with transboundary water issues as mentioned above, it may benefit the Nile Riparians to make use of the ‘good offices’ of the World Bank as was done in the case of the Indus Water dispute.

If for any reason the World Bank is not acceptable, it may be possible to form a Committee of Donors, such as the Paris Club, which can be requested to identify a neutral expert or an arbitration council in case of future disputes and disagreements. It might be also possible to request a Quartet comprising of the World Bank, EU, UNDP and African Development Bank (or African Union) to operate to support the Nile Basin in its efforts for cooperation, conflict resolution and confidence-building. The Quartet can arrange to provide a neutral expert or an arbitration council in response to specific demands from the riparian countries.

Regional Economic Cooperation

The Nile Basin countries can consider establishing Nile Regional Economic Community (REC). Water is required for irrigation (agriculture), hydro-electric dams (industry), urbanisation, trade, transit and other economic needs. If cooperation in water is integrated into broader regional economic cooperation, it will be possible for parties to appreciate the development needs of one another.

The role of an REC in Africa has been such that it has helped to develop a level of trust between the countries by working towards economic, as well as political integration. The Southern African Development Community (SADC) for example was established to focus on areas of “transport and communication, agriculture, energy and human development”. However, over the course of time, its role expanded into “attracting investment into

natural resource management, sharing of energy, conflict resolution to cooperation.” SADC now has a mandate on Water. In the case of SADC, REC was established first and the vision for water was a result of economic cooperation. In the case of Nile Basin, cooperation in the water sector has already been launched in the form of the Nile Basin Initiative, but it can be expanded to cover other aspects of regional integration. Whether a region starts with water or adds water at a later stage in its continuum to evolve a process of cooperation, it is important to note that water is an integrated part of regional economic dynamics, and not a resource to be utilised in isolation.

The Nile member countries are already members of two regional economic bodies. Countries such as D.R. Congo, Egypt, Ethiopia, Eritrea and Sudan are members of the Common Market for Eastern and Southern Africa (COMESA), while Tanzania is a member of the East African Community (EAC). Rwanda, Burundi, Kenya and Uganda are members of both the organizations. South Sudan has given its application to join the EAC. Thus, the Nile member countries have been positively disposed towards institutionalised economic cooperation in Africa. They can draw from their experience of the two bodies, or indeed their analysis of regional cooperation agreements in other parts of the world, to envisage, shape and structure a regional economic cooperation agreement in the Nile Basin.

The main difference between Nile REC and COMESA and EAC is that the latter two are driven by trade and industry agenda, whereas the Nile REC could be driven by water cooperation agenda.

One option could be to use COMESA for resolving differences and promoting economic cooperation, instead of creating a new body. COMESA comprises of 19 member countries including 9 of the Nile basin countries: Burundi, D.R. Congo, Egypt, Ethiopia, Eritrea, Kenya, Sudan and Uganda. The mission of COMESA is to “endeavour to achieve sustainable economic and social progress in all Member States

through increased co-operation and integration in all fields of development particularly.... environment and natural resources.” The members felt that one of the key impediments in achieving their goal of economic development was the conflict that existed in several member states. Hence it began to address issues of peace and security in the region since 1999. COMESA now has a peace and security mandate which would allow it to work on conflict resolution, as well as conflict prevention in members countries when required. This is in consonance with the COMESA treaty which recognizes the need *“to co-operate in the promotion of peace, security and stability among the Member States in order to enhance economic development in the region”* (Article 3(d)). It also lays down its fundamental principles as *“Maintenance of peace and security through the promotion and strengthening of good neighbourliness and the peaceful settlement of disputes among the Member States, the active cooperation between neighbouring countries and the promotion of a peaceful environment as a pre-requisite for their economic development”* (Article 6(i) (j)).

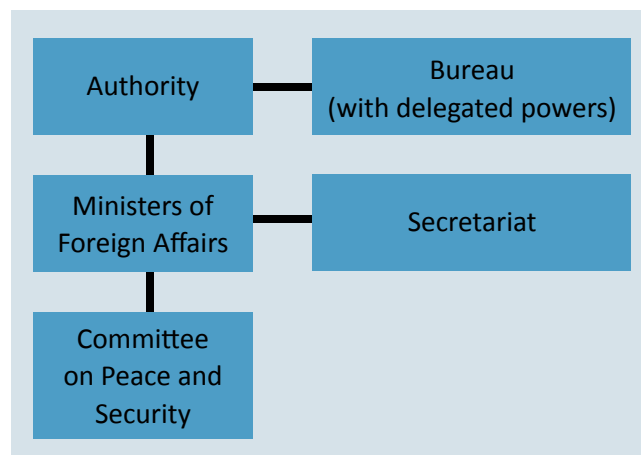
The COMESA has institutional structures that help it to realize its goal of fostering peace in the region. The Nile Basin countries could make use of the organizational units of the COMESA to resolve their differences.

COMESA Institutional Structures

The COMESA Authority consists of Heads of States and Governments and is the highest decision making authority on peace and security issues. It can delegate its functions to the Bureau which can carry out conflict prevention through ‘preventive diplomacy’. The Bureau has safeguards in place to prevent any conflict of interests by ensuring the members whose countries are under discussion do not participate in the process of preventive diplomacy.

The COMESA Ministers of Foreign Affairs meet once a year to discuss matters of peace and security and

COMESA Structure



to consider recommendations by the Committee on Peace and Security. The Committee comprises of senior officials in the Foreign Affairs Ministry of the Member States. The Ministers consider matters relating to peace and security and decide on the best possible involvement of the COMESA. The recommendation and decisions of the ministers are considered by the COMESA Authority which makes decisions on the same.

The Nile Basin countries may request the possibly inclusion of their issues in the agenda of the COMESA Ministers of Foreign Affairs who could recommend the mode of involvement of the COMESA with respect to the issue.

It is pertinent to note the two institutional structures which are within the COMESA. The Nile Basin Countries could benefit greatly by the utilization of these processes.

A Committee of Elders was constituted in 2006 and they act as “peace envoys” for the region. It comprises of 8 elders who have the capacity to go on fact finding missions, as well as engage in preventive diplomacy.

In the context of the Nile basin where at the moment the three countries Ethiopia, Egypt and Sudan are at loggerheads over the draft CFA, a Committee of Elders may greatly help towards creating a possible channel by which the nations may resolve their issues.

The Elders can help towards trust and confidence building amongst the nations. The countries can take the help of this Committee which can work towards understanding the positions of the countries and create a space for a discussion or dialogue. This would be well within the mandate of the Elders which includes engaging in preventive diplomacy. It will be easier for the three states to accept the role of the Elders as they comprise of distinguished members from both Nile, as well as from non Nile basin countries. However, in case the neutrality of the committee is questioned, the task could be undertaken by only the committee members of the non Nile basin countries such as Zimbabwe, Mauritius and Seychelles.

An interesting aspect of the COMESA is its Inter-Parliamentary Forum. It provides for the interaction of COMESA Parliamentarians with governments. Its role includes:

“(i) Providing an oversight body to ensure implementation of international instruments and peace agreements

(ii) Exchange visits to learn and capacity building on matters of peace and security

(iii) Providing linkages with existing structures at national assemblies and with other regional initiatives

(iv) Research and advocacy on issues of peace and security.”

It would be pertinent to engage this institutional structure in order to sensitize the parliamentarians of the Nile basin countries about the issues pertaining to the Nile. This would be of great help when processes such as ratification of the CFA or the harmonization of the transboundary river management policies at the domestic level, is undertaken.

The Nile countries can also examine how to use the EAC and its experience in transboundary water management. The EAC whose members are Kenya, Uganda, Tanzania, Rwanda and Burundi was constituted to “explore areas of future cooperation”.

EAC aims at political and economic integration in the region, as well as resource management.

The treaty of establishment of the East African Community under Chapter 19 Article 111 and 114 provides for the ‘joint management and utilization’ of transboundary natural resources. It also provides for ‘joint development’ and harmonization of policies to manage the transboundary resource sustainably.

According to Article 111.2(c), 2(d) member states are *“to ensure sustainable utilization of natural resources like lakes, wetlands, forests, and other aquatic and terrestrial ecosystems and to jointly develop and adopt water resources conservation and management policies that ensure sustenance and preservation of ecosystems.”*

The EAC Protocol on Environment and Natural Resources Management under Challenge 3 Article 13 on management of water resources states that *“The partner States shall develop, harmonise and adopt common national policies, laws and programmes relating to the management and sustainable use of water resources and shall utilize water resources, including shared water resources, in an equitable and rational manner”.*

The EAC has also developed guidelines for carrying out Environment Impact Assessments as well.

Over the years, the EAC has sought to further the ideals codified in its founding treaty on transboundary water. Its structural processes such as the secretariat and specialized institutions such as the Lake Victoria Basin Commission (LVBC) has been instrumental in promoting sustainable management of transboundary waters.

Sub Regional Initiatives

In the case of the Nile basin there are examples of sub-regional forms of structural formation which could help in the broader process of cooperation. For example Burundi, Rwanda and D.R. Congo established

a river basin authority to manage Lake Kivu and River Rusizi. The three countries recently signed MoUs on the privatization of power plants in order to better manage their resources.

Another such endeavour is the creation of *International Panel of Experts for Grand Renaissance Dam* jointly by Sudan, Egypt and Ethiopia. The building of Grand Renaissance Dam by Ethiopia attracted several objections from Egypt and Sudan. They feared that the dam would adversely affect the flow of water and would create problems such as “shortages in water, power and farmland”. Being the downstream countries, this would have a devastating impact upon them. Ethiopia stressed upon the fact that the dam was not only important for their development, but would be mutually beneficial. However, the downstream countries were not satisfied by the assurances of Ethiopia. Hence, they began discussions to constitute a technical tripartite committee consisting of international experts, as well as experts from the three states. While Egypt and Ethiopia agreed on the same in September 2011, Sudan gave its approval in October 2011. The formulation of the terms of reference (ToR) for the establishment of the Panel of Experts which would evaluate the impact of the dam was done through ministerial meetings between the three states. The committee was constituted by the end of February 2012 and it known as the Panel of International Experts for the Grand Renaissance Dam. The Panel began its work on 15th of May 2012 and is to give its evaluation within 6-9 months of its constitution. The Panel visited the site for the second time on 8th October 2012. The Panel consists of 10 members of which six are from Ethiopia, Egypt and Sudan. The other four are from Britain, France, Germany and South Africa. They were chosen for their expertise in, amongst other things, the field of transboundary water, hydro projects and environment.

It is pertinent to note that the three countries have previously endeavoured to work together. For example, Egypt and Ethiopia have signed several

MoUs since 2010, including on water which led to the establishment of a Technical Advisory Committee for cooperation in water resources and irrigation which would work on the implementation of this MoU. Egypt on the basis of this understanding agreed to give training to a chosen number of Ethiopians on irrigation technology. Further, Egypt, Sudan and Ethiopia through the Nile Basin Initiative have sought to cooperate on programmes to foster cooperation. The Eastern Nile Subsidiary Action Program (ENSAP) is an initiative which comprise of the sub-group of Egypt, Ethiopia and Sudan and the Eastern Nile Technical office is the executive wing of ENSAP, which helps with the process of implementation.

However, it is the tripartite meeting of ministers, as well as the formation of the technical committee which is often referred to as a shining example of regional cooperation which would help the countries in the future as well. This is rightfully so as the parties were able to reconcile considerations of individual advantage with collective needs of the basin states.

Nevertheless, in order for the Panel to function effectively and foster the process of cooperation, it is pertinent that all parties give to information in a transparent manner and uphold the principle of mutual accountability. The process becomes functional if there is trustworthy information sharing. The countries must ensure a smooth functioning of the process and do everything within their power to help the Panel produce a credible report.

Changing Media Rhetoric

Media can play a strong role in narrowing the trust deficit that exists between the Nile Riparian countries. Presently, there exists a massive information gap which leads to various speculations which might be largely untrue. The Nile Riparian countries need to strengthen their media foothold to achieve the following:

- ≡ Dialogue between the countries on a more

transparent plane, where all the countries involved have access to free flowing information so that there does not exist any communication gap

- ≡ Creating awareness and sensitizing the citizens on water related issues which will increase their involvement and support to the cause
- ≡ Increasing access to information regarding new technologies from the world outside, as well as successful schemes in the riparian states
- ≡ Attracting investments for projects in the water sector
- ≡ Reaching agreement on reducing mutual hatred and hostile sentiments towards one another
- ≡ Reaching agreement on not spreading rumours against one another
- ≡ Exchange of media persons to check and verify facts related to issues of misunderstanding.

There is already a Nile Media Network which facilitates interaction between journalists in the Nile countries. It can be strengthened to expand its role beyond mere seminars and conferences to include some of the functions identified above.

Nile Parliamentarians Forum

It is proposed that Nile Parliamentarians Forum be organised by the NBI, which is within its mandate. There have already been two such meetings organised previously by the NBI. However, both meetings witnessed participation of Parliamentarians, civil society members, diplomats, development partners and the media. It was not an exclusive gathering of MPs alone which made the meeting lose its specificity. There needs to be a reformed approach when organising such a Forum. It is important to recognise that only the Parliamentarians represent people as they are elected by the masses and they have access to the government. They can introduce legislation in the Parliament and they can question the government in the Parliament. The Parliamentarians can build

another layer of communication which is not governmental, yet has a high political access. Further, some of the MPs eventually become cabinet ministers. The exposure that they gain by being involved in the Nile discourse would certainly help when they join the cabinet. The advantage of the utilization of the specific strengths of the Parliamentarians is very different from the strengths of the members of the civil society. Hence the NBI should focus on exclusive interaction between the MPs and refrain from diluting it with all types of civil society members and professionals. Also, the Forum cannot be reduced to one or two meetings a decade where the participants are nominated by the Speaker of the Parliaments of the Nile basin countries, irrespective of their interest in the issue.

The formation of a Nile Parliamentary Group in each Parliament of the Nile Basin Countries comprising of enthusiastic MPs would be ideal along with a network of Nile Basin MPs drawn from members who are active in the issue. Both the national groups and the network at the basin level could develop programs which harness the specific strengths of MPs, as mentioned previously.

Learning from other Transboundary Organizations

An analysis of River Basin management systems in Africa, as well as globally would be of help to the Nile River countries to expand their knowledge in the water sector, as well as to keep abreast of the development in the river basins.

The Nile Basin Initiative in the past has undertaken a 'knowledge exchange study tour' to the Senegal River Basin to learn from the Senegal River Basin Organization (OMVS) and identify certain best practices. This was hailed to be an important undertaking to help NBI-ENTRO towards effective management of the transboundary river.



It is suggested that such a process of learning could be undertaken through the increased participation of the Nile Basin countries in the organizations below.

African Ministers Council on Water (AMCOW)

The African Ministers Council on Water was set up in 2002 for the “effective management of water resources” in the continent. It aims to increase intergovernmental dialogue on water, as well as regularly review, monitor and analyse progress of various projects. With regular involvement and participation in AMCOW, the Nile Basin Countries could benefit from this continental exchange. AMCOW aims to work out a peer review mechanism once it starts receiving regular reports from its member countries. This would help the Nile Basin Countries to learn from other countries in the same continent which might face similar issues.

Involvement with AMCOW will also help the states to attract foreign investments for their water projects. One of the projects of AMCOW was setting up of African Water Facility to streamline resources and mobilize investments in collaboration with the African Development Bank. The African Water Facility’s current three year strategic plan aims to mobilize resources for projects and investments by ensuring sustainable and effective governance policies conducive to implement these investments and promote water knowledge.

AMCOW has been accorded the status of a “Specialized Committee for Water and Sanitation in the African Union”. In 2008, at the AU summit at Sharm El-Sheikh, it was recognized that water and sanitation are important entities and their objectives need to be realized as soon as possible. AMCOW was assigned to prepare its implementation strategy.

International Network of Basin Organizations (INBO)

INBO was established in 1994 to integrate various

agencies which work on river basin organizations throughout the world to making sharing of interests and experiences easier. Its subsection African Network of Basin Organizations (ANBO) was established in 2002. In 2005, the Nile Basin Initiative, specifically ENTRO, expressed interest in joining the network and held an observatory status.

The Nile Basin Initiative can benefit from joining INBO, specifically its African wing, ANBO, which will help it create a larger network and encourage capacity building on an international level as it encourages twinning and conducts regular bilateral exchanges. ANBO is also aiming to develop a list of performance indicators for management of African Basins which will help the Nile Basin to understand its position and evaluate its performance. ANBO is also looking at strategic partnerships with AMCOW, as well as the African Union which will help in various aspects such as support for funding or for seconding ANBO projects.

Learning Journeys

Besides going through established institutions, Nile Basin countries can also design and structure ad hoc “Learning Journeys” to different transboundary water sharing institutions on their own, with the help of donors or international organisations for the purpose of learning best practices.

Conclusion: High Strategic Council and Informal Retreat of the Nile Ministers of Foreign Affairs and Water

The dialogue between Nile member countries has been primarily conducted by Ministers of Water and Irrigation, supported by technical experts from their ministries and legal experts from the ministries of foreign affairs. However, the relevance of the Nile River is not confined to water alone. The Nile River is a lifeline of the 11 countries. Its future will have

significant impact on agriculture, irrigation, electricity generation, industry, trade, urbanisation, migration and social stability. The decisions for seeking common ground and compromises between sovereign states in the basin would touch upon strategic ministries such as finance, foreign affairs, agriculture and others, which are beyond the domain authority of ministers of water and irrigation. The only leaders who have an overview of different needs and jurisdiction over all ministries happen to Heads of Government. Therefore, outstanding and any issues in the Nile basin, which are core to the future of states in the basin, can be most effectively addressed directly by Heads of Government. It is therefore necessary to have a mechanism in the form of the Heads of Government at the Summit level. It should be possible for the Summit to take place on an annual basis as has been proved possible in many parts of Africa and Asia.

An Annual Summit may not be sufficient to address various core issues and make progress at a fast rate. The Heads of Government may therefore designate Ministers of Foreign Affairs or their trusted political aides as Special Envoys to meet from time to time in the course of the year as and when required.

The High Strategic Council can receive political input from the Nile Parliamentarians Forum and also utilise such a Forum to mobilise support for difficult decisions taken by the High Strategic Council in national legislatures.

The High Strategic Council will be supported by the Committee of Legal Experts and Quality Coordination Committee and receive input from such committees as well as provide political guidance to them through the Ministers of Foreign Affairs or Special Envoys.

The High Strategic Council will receive input from the Nile Council of Ministers (Nile-COM), which in turn obtains support from the Nile Technical Advisory Committee (Nile-TAC) of the Nile Basin Initiative.

A critical question is how to initiate the process of

cooperation recommended in this report. Several proposals made here are politically challenging. They have potential for huge benefits, but also require high degree of political understanding and compromise. This can be best done in an informal meeting of Ministers of Foreign Affairs and Ministers of Water and Irrigation of all Nile countries. The meeting should be an informal gathering or a retreat and the venue could be outside of the Nile basin. In a formal meeting the ministers are bound to present the positions of their countries and there is less flexibility. They are usually accompanied by senior civil service officers and they present papers which are prepared by these civil servants. In an informal meeting there is a lot of flexibility. Ministers can interact with each other in an open manner without being disturbed by the civil servants. They can have discussions without being bound by treaty obligations. This makes it possible to reach common ground.

It is also important that the participants in this meeting are not merely Ministers of Water and Irrigation but also Ministers of Foreign Affairs, since the latter seem to command greater political authority in Nile countries than their counterparts in Water Ministries. As Ministers of Foreign Affairs have a wider perspective of political, economic and social issues, they are in a much better position to form a view on ideas that can change dynamics on the basis of a common position. However, it is also important that the Ministers of Water and Irrigation are part of this retreat since they have domain expertise.

Once a common position is identified, the ministers can channelize it into official processes and convert it into an intergovernmental treaty or a MoU. Or they may choose to recommend a summit of Heads of Government to take a final decision on their proposals. This method of informal interaction has been used by several countries around the world to resolve disputes in difficult situations. It is recommended that the leaders of the Nile Basin Countries consider this approach to examine proposals put forward in this report.





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