Nile River Revival Action Plan (NRAP)

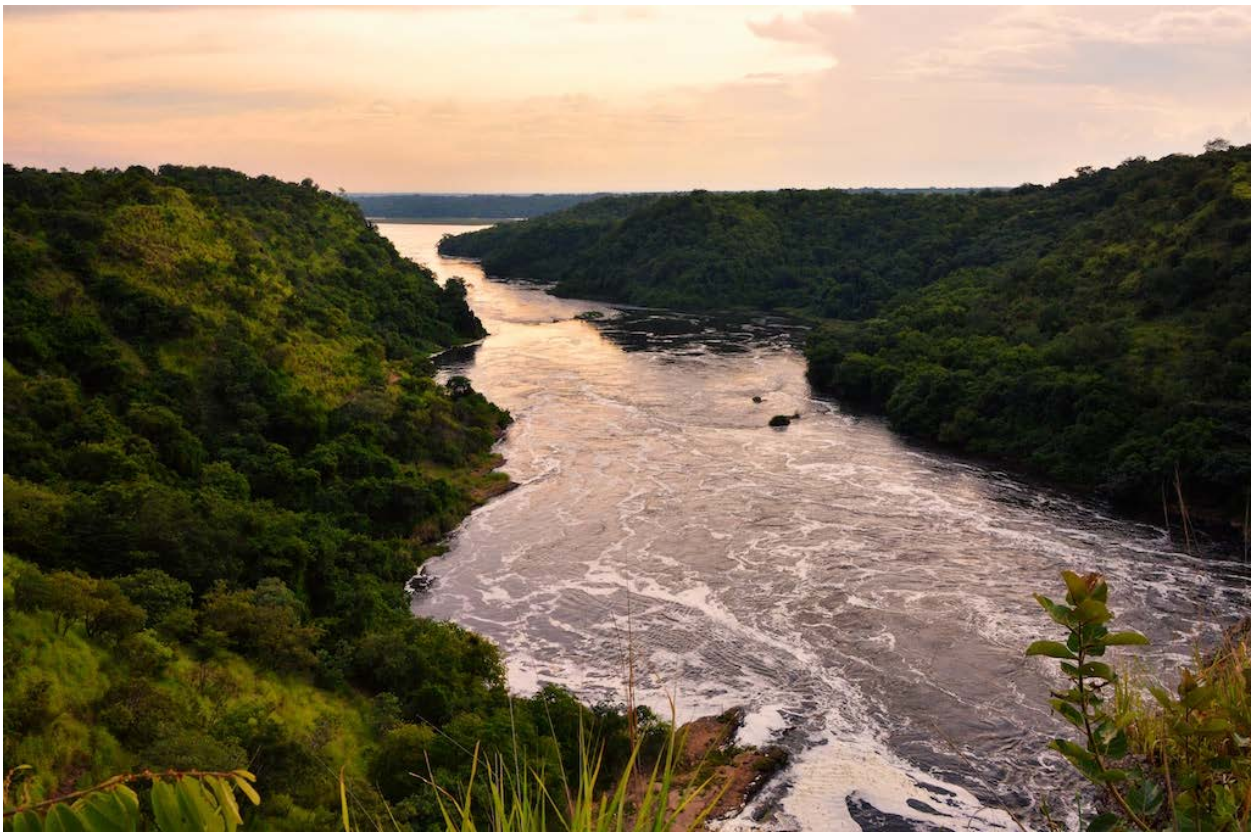

Figure 1: The Nile River in Uganda (Rod Waddington, 2014).

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Mission Statement

NRAP's mission is to exceed UNEP Global River Water Quality Standards by improving salinity, preventing further environmental degradation, and reducing heavy metal concentrations of the northern stretch of the Nile River running through Egypt by the year 2030.

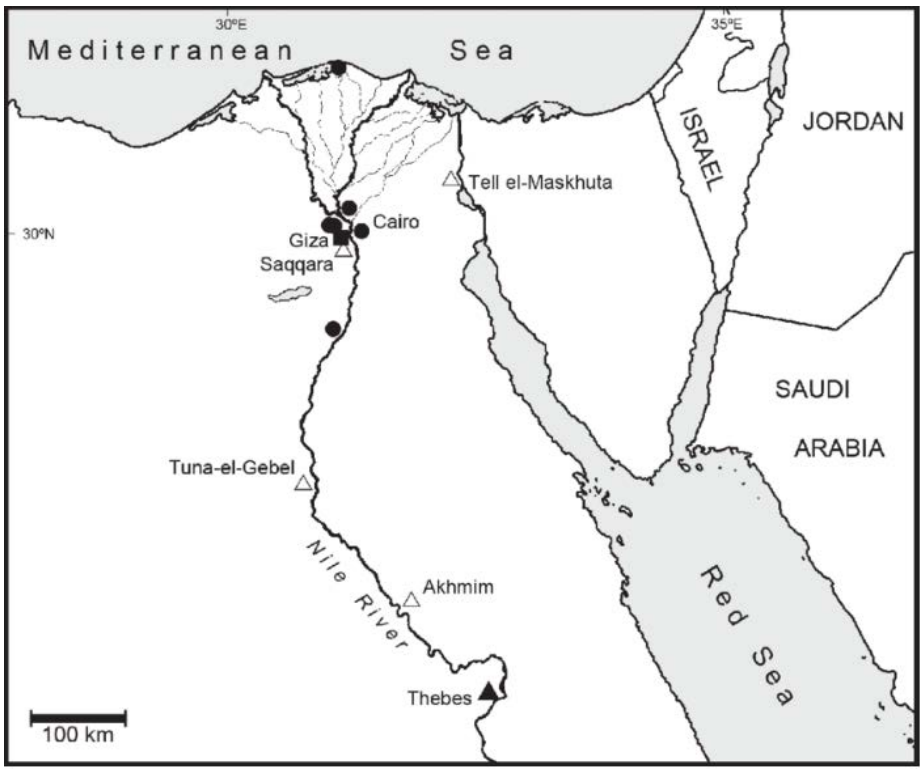

Figure 2: Northern Stretch of the Nile River running through Egypt (Woodman et al., 2017)

Background

The Nile Delta constitutes a great flood plain (about 20,000 km2) lying between longitudes, 29° 40′–32° 20′E and latitudes 30° 00′-31° 40′N (Geriesh et al., 2015).

Countries in the Nile Watershed:

Egypt
Burundi
Democratic Republic of the Congo
Eritrea
Kenya
Ethiopia
Sudan
South Sudan
Rwanda
Tanzania
Uganda

The availability of water of acceptable quality in Egypt is limited and getting even more restricted, while at the same time, the needs for water is increasing as a result of population growth, industrial development and cultivation of desert land (Wahaab and Badawy, 2004).

Water Resources:
Through the 1959 Nile Water Agreement with Sudan and the completion of the High Aswan Dam in 1968, a stable 55.5 billion m3/yr. was allocated to Egypt (Wahaab and Badawy, 2004). Additional input of water to the region is rainfall. Rainfalls play a minor role in Egypt's water resources, with average rainfall rates declining from 200 million m3/yr. at the Mediterranean Coast to 20 mm3/yr. in Cairo and almost zero in Upper Egypt (Wahaab and Badawy, 2004).

Industrial Pollution:
Egyptian industry uses [as of 2004] approximately 638 M. m3/yr (cubic meters per year) of water, of which 549 M. m3/yr. is discharged to the drainage system (Wahaab and Badawy, 2004). Industrial activities in the Greater Cairo and Alexandria regions use 40% of the total resource (Wahaab and Badawy, 2004). With rapid urbanization, industrial development and increasing water discharges, the drainage water has become drastically contaminated with toxic chemicals, heavy metals and pathogens (Appelgren et al., 2000).

Domestic Pollution:
As of 2004, no well-controlled sludge management program exists in Egypt (Wahaab and Badawy, 2004). This may, especially in urban areas such as Greater Cairo, lead to inadequate sludge disposal, cause general environmental problems and, in the worst case, eventually influence water quality in a negative way (Wahaab and Badawy, 2004).

Agricultural Pollution:
It is estimated that in Upper Egypt, approximately 4 billion m^3 of drainage water returns to the Nile every year (Wahaab and Badawy, 2004). This drainage water has a much higher salinity than the originally ingested irrigation water and contributes to an increase of salinity of the River Nile along its course from the High Aswan Dam to the Delta (Wahaab and Badawy, 2004).

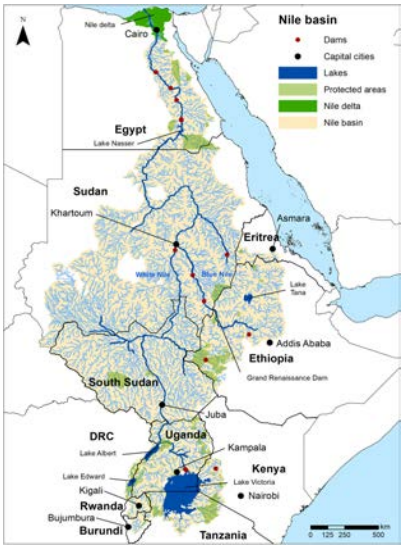

Figure 3: The Nile River Basin (nowater-nolife.org)

River Basin Management History

- 3000 B.C.E - Egyptian dynasty unfies lower and upper parts of Nile River (Carlson, 2013)
    - No other states/countries at the time to challenge Egypt's monopoly over the Nile

- 1882 - Egypt colonized by England (Carlson, 2013)
    - Creation of new states in Nile River basin
    - Competition for resources and land

- 1922 - Egypt gained independence (Carlson, 2013)

- 1929 - Exchange of letters between Egypt and Britain that recognize that Egypt has historical rights to the Nile and water will be shared between it and Sudan with primary allocation of resources going to Egypt (Ottaway, 2020).
    - Overlooks the interests of upriver countries who do not gain independence until the 1960s

- 1959 - Egypt and Sudan renegotiate the 1929 agreement to allot themselves more shares of the Nile in the same inequitable portions and again ignoring the interests of the upriver countries (Ottaway, 2020)
    - Allowed for the construction of three different dams

- Mid 1980s - Ethiopia faces devastating water crisis

- 1987 - Egyptians and Ethiopians begin to cooperate (Carlson, 2013)

- 1990s - Ethopian rains return and Egypt plans an expensive irrigation project

- 1999 - Cooperative Framework Agreement on water allocation established by upriver countries as they refused to accept the 1929 and 1959 agreements (Ottaway, 2020)
    - Egypt and Sudan refuse to sign

- 2010 - Ethiopia announces plans to develop Grand Ethiopian Renaissance Dam in which Egypt and Ethiopia failed to agree on details surrounding its implementation (Ottaway, 2020)
    - United States tries to mediate to which there was no success

Policies and Mandates in Place

The Nile Basin Initiative (NBI) is an all-inclusive basin-wide institution established on 22nd February, 1999, to provide a forum for consultation and coordination among the Basin States for the sustainable management and development of the shared Nile Basin water and related

resources for win-win benefits (NIB Corporate Report, 2020). At an early stage, the NBI identified water and watershed management – through an integrated approach – as being foundational to securing livelihoods and promoting development for the Nile countries (Nile Basin Initiative (NBI) Strategy towards Restoring the Nile Basin, 2015). Factors of success are based on (1) Intensive support to early stages (2) Work at the sub-catchment area as well as across the entire basin and (3) Long-term vision and investment (Nile Basin Initiative (NBI) Restoring the Nile Basin, 2015).

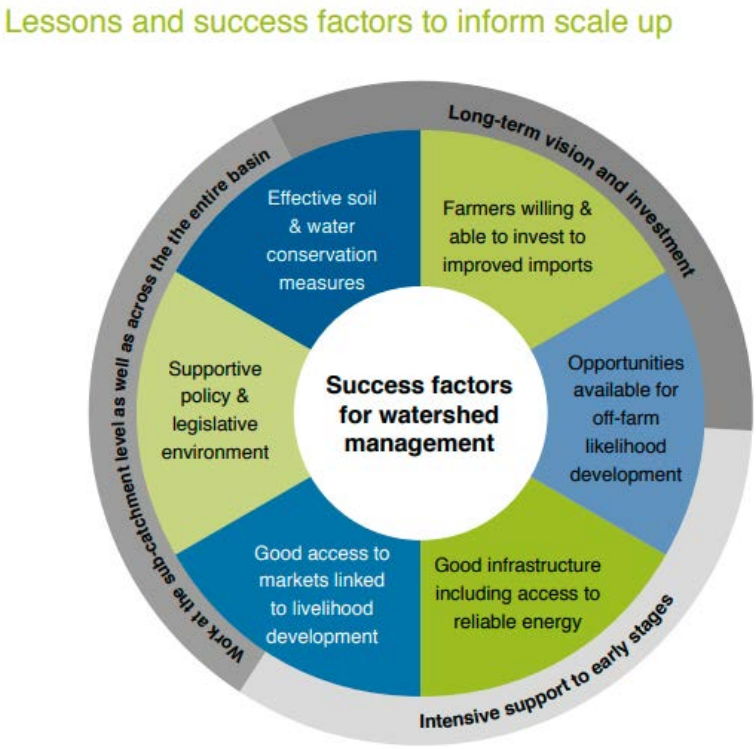

Figure 4: Nile Basin Initiative (NBI) Success factors for Watershed Management (2015).

NBI's strategy and action on watershed restoration has also been integral to the success of other NBI intervention areas (Nile Basin Initiative (NBI) Strategy towards Restoring the Nile Basin, 2015). In particular, by improving downstream water flows and quality, it has helped to protect and maximize the potential of development benefits from irrigation and hydropower (Nile Basin Initiative (NBI) Strategy towards Restoring the Nile Basin, 2015).

According to Water and Agriculture in the Nile Basin, a Nile Basin Initiative Report to ICCON, "The official Egyptian policy provides options to increase water availability in the Lower Nile sub-basin, including recycling shallow groundwater and drainage water and re-using treated wastewater (attia, 1997). Substantial increases are possible, but must be carefully regulated to control salinity, water-logging and water pollution. Water savings could be made by growing less water-demanding crops, such as reducing the current sugar cane and rice production, as 200,000 ha of sugarcane (requiring 12000 m3 of irrigation water per hectare) could be replaced with winter cropping of sugar beet (requiring only 1000 m3 per ha). The areas for rice which needs

8800 m3 per ha, could be halved from 600,000 ha to 300,000 ha, which is estimated as the minimum area required to control soil salinity (Appelgren et al., 2000).”

Problems

Table 1: Problems Facing the Nile River Delta and their Causes

Problem	Brief	Causes
1. Salinization	An increase in salinity in the water of the Nile River is leading to suboptimal soil quality and reduced accessibility to fresh water.	Parts of the Delta plain are lowering as sea-level is rising causing a combined dramatic increase in salinity in the Nile River. Dams along the river are trapping nutrient rich soil that could be beneficial for agriculture.
2. Environmental degradation	High risk infrastructure will dramatically change the river’s flow, blocking water that would otherwise flow down the Nile to countries that are dependent upon it including Egypt and Sudan, leading to potential water and food scarcity for millions.	The Grand Ethiopian Renaissance Dam (GERD), Africa’s largest hydropower dam, has been causing major disputes amongst countries along the Nile specifically surrounding the conflict of access to the Nile’s resources
3. Heavy metal pollution	The uncontrolled dumping of anthropogenic waste from different drains located along the Nile banks has significantly increased the Nile water contamination of heavy metals to the critical level (Shamrukh and Abdel-Wahab, 2011).	Heavy metal pollution in the Nile is mainly derived from multiple anthropogenic sources including industrial, agricultural and domestic effluents (Abdel-Satar et al., 2017).

Problem 1: Salinization

Increased human activity has created a fresh water crisis along the Nile River. Taking Egypt as an example, this issue has the potential to affect millions of people. With a total population of over 100 million people, most of Egypt’s population (close to 90 million) live near the Lower

Nile Valley and Delta due to its nutrient rich soil (great for agriculture) and fresh water supply (Ware, 2017).

This basin's soils have become less fertile and less capable of producing food and fresh water, and this situation will continue to deteriorate. The delta plain lies only one meter above sea level, and parts of the delta are lowering closer to sea level by 4 to 8 millimeters per year. Additionally, the sea levels are rising around 3 millimeters per year in the region. These parameters combined have led to an increase in the salinity of the water in the Nile River in the region, which is what has caused the deterioration in soil quality and the reduction of access to fresh water (Ware, 2017).

Dams along the river have made matters worse. They have altered the river's flow and trapped natural nutrient-rich sediment, which could be used for agriculture if allowed to flow downstream (Ware, 2017).

If the problem of salinization along the Nile river is not resolved, the land in the surrounding area may lose its supply of fresh water, and it may become unusable for agricultural purposes. Additionally, a lack of fresh water could lead to land erosion due to an inability for the land to replenish using sediment typically carried downstream by fresh water. This poses an additional threat to the millions of residents living along the river (Ware, 2017).

Goal:

The first goal of the NRAP is to achieve a reduction in salinity levels to reach levels of about 1702 mg/l by 2030. This reduction in salinity levels would allow the continuation of agricultural practices along the river, and ensure enough fresh water is available to the populations residing there. This would also reduce the threat posed by land erosion.

To achieve this goal, the NRAP will need to implement the following measures. The first is a cooperative agreement negotiated between countries served by the Nile river to abandon future projects for building additional dams, and to ensure no future plans are made to build more dams on the river. Such an agreement would prevent further trapping of sediment that is vital to regenerate the river banks. The second measure is to protect native vegetation that is still present on the river banks, and to implement projects to restore vegetation that has decayed or disappeared. The presence of vegetation along the banks will provide a buffer to protect populations from land erosion, and will help retain soils better so as to prevent future erosion.

Ensuring that river banks are protected from erosion (by preventing the building of future dams and by ensuring a thriving native vegetation) will in turn help reduce salinity levels in the waters and soils in nearby regions. Preventing land erosion will limit salt water intrusion caused by

rising sea levels by ensuring that the surrounding land does not become lower and closer to sea level than it already is (Queensland, 2014).

Testing for salinity in soils and waters will be conducted regularly in order to ensure that levels are in fact decreasing and that the measures are effectively working towards the overall goal. Testing will need to be done at various sites along the river and in different countries the river flows through. Samples of 500g of soil and 500ml of water will be collected at the various sites when testing is conducted. These samples will be sent to registered soil and water testing facilities for analysis. If insufficient decreases are noticed, additional vegetation restoration projects will be implemented in order to ensure the goal is reached by 2030 (Queensland, 2014).

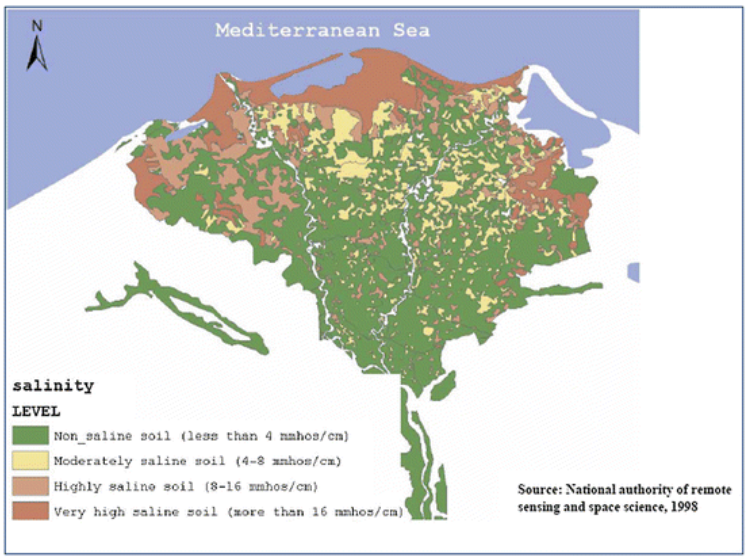

Figure 5: Salinity levels in the Nile River basin (National authority of remote sensing and space science, 1998).

Problem 2: Environmental Degradation

The Grand Ethiopian Renaissance Dam is a hydropower dam that Ethiopia has constructed on the Nile. According to Ethiopia the dam is needed to power the country's electricity needs, providing 6000 megawatts of power (Conniff, 2017), as well as an essential component when it comes to uniting the country's citizens (Moges-Gerbi, 2020).

The dam, however, has strained the relations between Egypt, Sudan, and Ethiopia as concerns over water and food scarcity are pressing. The GERD cannot operate until its main basin is filled and the length of time it takes to fill has been the major source of dispute. If the basin is filled in less time, it will be up and running for Ethiopia to utilize more quickly however, not without many negative implications for Egypt who will experience a dramatic shift in water flow and thus potential food and water shortages (Wheeler, Jeuland, Hall, *et al.*, 2020). Egypt also has

much less rainfall than upriver countries, heightening the risk of drought (Thompkins, 2010). Sudan has been consistently caught in the middle of the conflicting interests of Egypt and Ethiopia.

There are a multitude of environmental implications that stem from the Grand Ethiopian Renaissance Dam that should not go without consideration. The dam will create both upstream and downstream consequences by altering the flow of water, affecting both aquatic life and the river ecosystem. The dam will exacerbate the effects of climate change by heightening evaporation rates, disrupting wildlife migration, and increasing greenhouse gas emissions (Stahl, 2017). The worsening of climate change and the limiting of resource access by millions may outweigh any foreseen benefits.

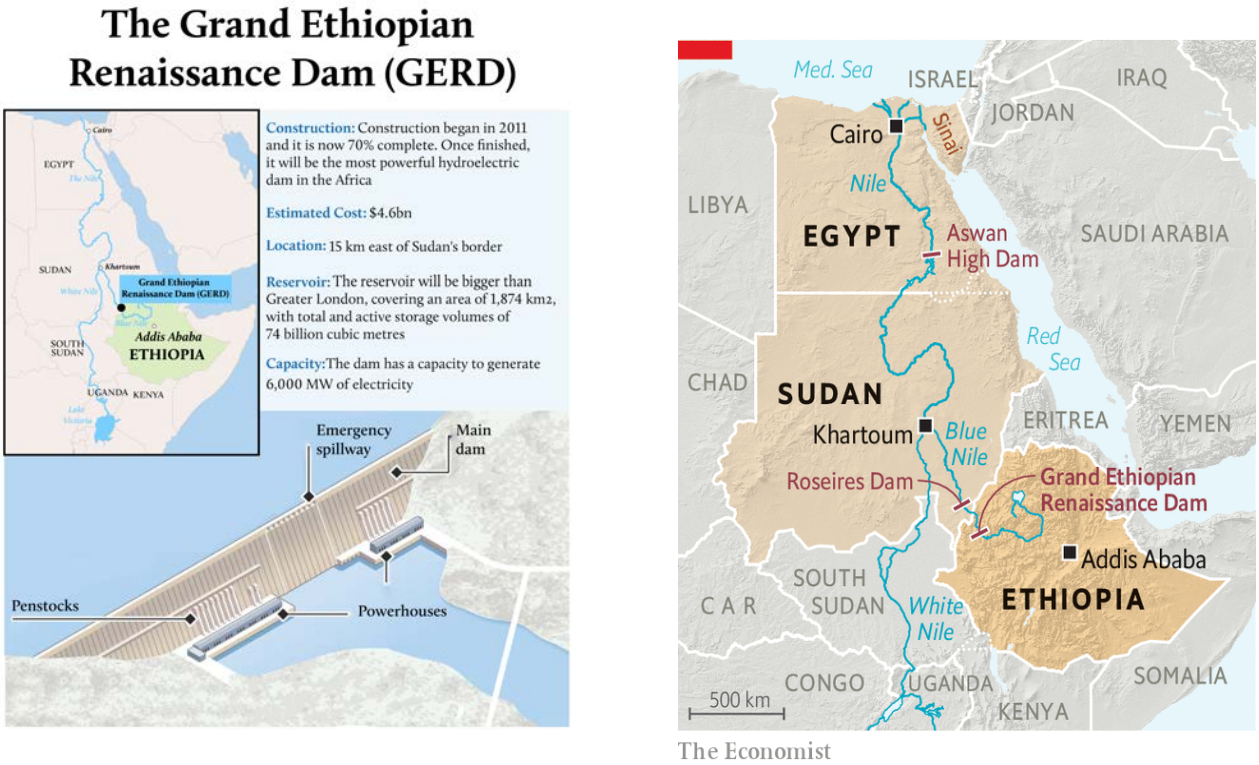

Figure 6: a) FAQ about the Grand Ethiopian Renaissance Dam (Middle East Eye) b) The GERD controversial build (The Economist)

Goal:

The first goal of NRAP to help alleviate this extreme issue is to re-initiate an equitable water sharing agreement not only between Ethiopia and Egypt but amongst all of the countries within the Nile River basin. Although Egypt and Sudan have previously failed to sign any agreement of this sort, at this point it is critical. The agreement will set clear boundaries as to what is

acceptable for Nile River development while ensuring that each country receives a fair distribution of the river's resources. This agreement will also reduce the potential for environmental ramifications by limiting the anthropogenic influences allowed along the river. In the current state, many countries feel they may be more entitled to the river's resources than other countries therefore, some sort of access agreement is necessary to avoid conflict and uphold peaceful contact.

The second goal is to initiate an alternate development proposal to Ethiopia that would allow for a separate electricity supply that would not obstruct the resources of Sudan and Egypt. Electricity could be harnessed from an alternative energy source such as solar or wind. Solar and wind are both cheap renewable energy sources which would mitigate environmental impact as well as provide realistic alternative options.

The final goal is to aid Egypt in developing better water management strategies for agriculture and domestic consumption. Managing the resources that they have will allow for less hostility and mitigate the existential concern of the GERD.

Since the problem facing these countries is rather urgent, reaching these goals by 2025, the latest 2030, would be most ideal. A compromise and legal agreement would yield numerous benefits the sooner it is implemented.

Problem 3: Heavy Metal Pollution

Ismailia Canal represents the most distal downstream of the main Nile River. Thus its water contains all the proceeds pollutants discharged into the Nile. Ismailia Canal has many sources of pollution which potentially affects and deteriorates the water quality of the canal (Geriesh et al., 2008).

(1) The first source is the upstream portion of the Ismailia Canal (from Cairo to Abu Zaabal, western side) including the largest industrial zones in the region (Shupra El-Kheima, Musturod, Abu Zaabal industrial zones), which include the activities of petroleum, petro gas, iron and steel, Abu Zaabal Fertilizers Company, Alum (Aluminum Sulfate) Company, detergent industries and electric power station (Goher et al., 2014)

(2) The second source is the water treatment plants which caused dramatic changes in its water quality by throwing waste water rich with Aluminum, Iron and Manganese (Goher et al., 2014). In addition to waste disposals, seepage from the villages and septic tanks, distributed very close to the canal course and the agricultural effluents, are the major sources of contamination (Goher et al., 2014).

The increase of metal concentrations in the water during hot seasons (spring, summer) may be attributed to the liberation of heavy metals from the sediment to the overlying water under the effect of both high temperature and organic matter decomposition due to the fermentation process (Ali and Abdel-Satar, 2005).

Goal:

The NRAP will need to initiate a vital clean-up of current major industrial discharges in the chemical, textile and food processing sectors, resulting in an increased availability of surface water resources without high treatment costs (Wahaab and Badawy, 2004). To identify industrial enterprises in the public sector, which urgently need to reduce their discharge of untreated wastewater (Wahaab and Badawy, 2004). As well as encourage the benefits of monitoring through monthly water sampling, which will provide a considerable source of important information to EEAA and other water managing authorities to support planning of future measures (Wahaab and Badawy, 2004). Wastewater sewage plants should require a considerable input of new equipment, training of personnel in operation and maintenance, and introduction of better management to finance the water and wastewater services now provided free of charge (Wahaab and Badawy, 2004). These goals may help to achieve a metallic water pollution (HPI) value of (Cd < 1) by 2030 (Abdel-Satar et al., 2017).

Figure 7: Nile Basin Initiative (NBI) Strategy towards Restoring the Nile Basin (2015).

Summary and Conclusion

NRAP aims to address sources of contamination and degradation in order to provide cleaner water for the major countries which use the Nile as their primary source of water, in order to advance healthy living and enhance public and ecological health. Working with key stakeholders, our mission is to exceed UNEP Global River Water Quality Standards by improving salinity, preventing further environmental degradation, and reducing heavy metal concentrations of the northern stretch of the Nile River running through Egypt by the year 2030. This plan will be presented to the United Nations Environment Program (UNEP) for implementation of projects that can help towards achieving its goal.

A summary of the goals mentioned in this plan are listed below:

- To create a cooperative agreement negotiated between countries served by the Nile river to prevent the building of additional dams along the river
- To protect and restore native vegetation along the river banks
- To re-initiate an equitable water sharing agreement between Ethiopia and Egypt as well as all of the countries within the Nile River basin
- To initiate an alternate development proposal to Ethiopia that would allow for a separate electricity supply that would not obstruct the resources of Sudan and Egypt
- To aid Egypt in developing better water management strategies for agriculture and domestic consumption
- To initiate a vital clean-up of current major industrial discharges in the chemical, textile and food processing sectors.

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