



Water Sustainability in the Nile

World Expo 2020 in 2022 – Dubai, UAE

By: Rileigh Hanley



Figure 1 - Map of the Nile (13)

Background & Project Justification

- ❖ The Nile River stretches across 11 countries—Burundi, Democratic Republic of Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, South Sudan, Sudan, Tanzania, and Uganda. This River has become heavily polluted by wastewater and trash poured directly into it, as well as agricultural runoff and industrial waste, with consequences for biodiversity, especially fishing, and human health.(5) As the constant damage is done to the Nile, there is an increasing threat towards Environmental and Human Security.
- ❖ Today, the Nile is considered to be the main water source for millions of people in its surrounding countries. Canals bring water from the Nile to irrigate farms, and supports cities, agriculture, and fishing in many countries.(5)
- ❖ The 2020 World Expo in 2022 was held in Dubai, United Arab Emirates with a heavy focus on global innovations and policy when it comes to Environmental Security with a focus in Water Security and Sustainability.

Research Questions & Objectives

- ❖ How does the pollution of the Nile effect its surrounding countries and what innovations at the World Expo can be used to mitigate the long and short-term effects?
- ❖ What policy changes need to be made regarding the Nile River in order to ensure human and environmental security in the region?
- ❖ To research different innovations, perspectives and policies towards the threat, I attended conferences, presentations and exhibits at the Expo that emphasize global innovation in water sustainability and mitigation strategies.
- ❖ Out of the 11 countries the Nile stretches across, Egypt, Ethiopia, and Sudan were able to show insight of how these environmental hazards are affecting their countries and how the innovations shown could help mitigate those issues.

Methodology

- ❖ Observations were made by listening, documenting, photographing, and taking videos of the environmental innovations as well as conferences and Q&A portions of the events.

Insight of Surrounding Countries

❖ In **Egypt**, a major security threat is that they could be dependent to other countries as the water supply flows through in multiple countries. There is no policy or inter-continental law that determines the distribution or utilization of the water. Egypt has increased its diplomatic outreach amongst the Nile countries due to the creation of the Grand Ethiopian Renaissance Dam (GERD). They say due to climate change, over population and the GERD, Egypt is also facing an annual water deficit of around seven billion cubic meters and the country could run out of water by 2025, when it is estimated that 1.8 billion people worldwide will live in absolute water scarcity.(12)



Figure 2 – Flag of Egypt (8)

❖ In **Ethiopia**, they consider their country as the source of the Blue Nile. The negative impacts of the High Aswan Dam in Egypt, in relation to agriculture production and ecosystems sustainability were mentioned as the poor design of the dam has damaged the water quality, caused soil erosion and sedimentation issues. The dam construction could also eventually lead to sea level rising and delta land decreasing.



Figure 3 – Flag of Ethiopia (9)

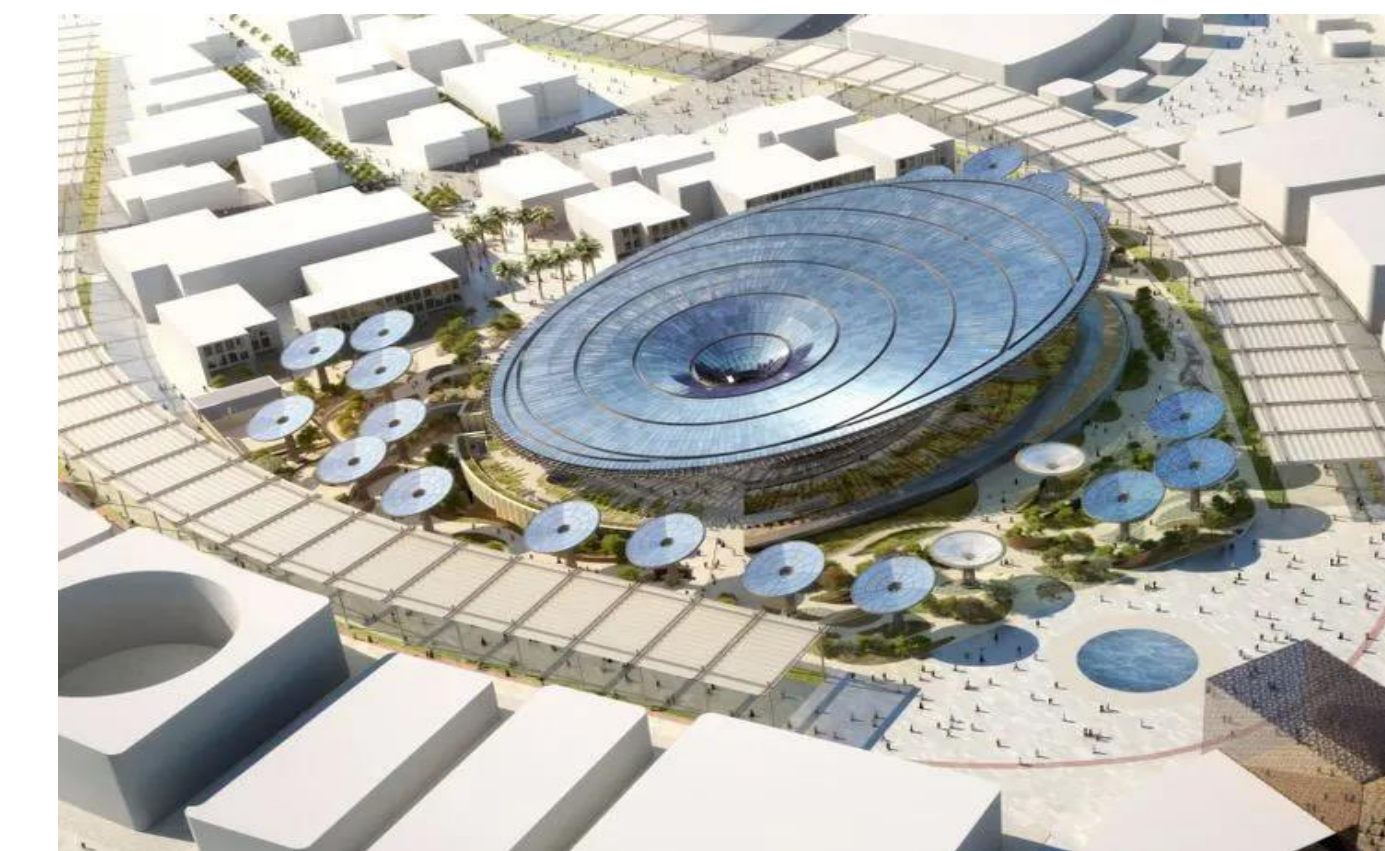
❖ In **Sudan**, pollution of the Nile is underestimated as the general population does not consider there to be a major problem. However, tensions grow over the GERD amongst the basin countries, as Sudan is collaborating with Egypt and creating economic and military alliances with Central and East Africa as well as the Horn of Africa.



Figure 4 – Flag of Sudan (10)

Innovations

Figure 5 – Terra Sustainability Pavilion Canopy is a giant collector of sunlight and water. Along with the e-Trees, it generates approximately 4GWh annually, which is enough to power the whole building. Falling rainwater is funneled into underground reservoirs and used inside the Pavilion for cooling, ensuring the comfort of visitors.(3)



Credit: 7



Figure 6 - Dubai Electricity & Water Authority (DEWA) Space-D program supports the Dubai Clean Energy Strategy's target of obtaining 75% of Dubai's total power capacity from clean energy sources by 2050. Used to study the impact of weather and climate change on energy infrastructure and water supply. It is also able to identify structural damage and the location of water reservoirs.(3)



Credit: 6

Figure 7 - Waste Shark sponsored by the European Union is an autonomous drone that eats litter, trash, microplastics, oils and invasive plants – produces no carbon emissions, is friendly to animals & humans and can clear 500 kg of debris everyday.(3)

Figure 8 - Eshara Air to Water Atmospheric Water Generators provide pure drinking water from the humidity in the air. Makes it a more eco-friendly solution by eliminating the need to make and dispose of plastic bottles, as well as removing the requirement for bottles to be filled from stressed natural resources or transported around the world. Also, a sustainable method of creating water where it is consumed ensures that much-needed global reserves are maintained.(4)



Figure 9 - Compressed Air Locomotive uses reciprocating engines powered from a reservoir of compressed air, 2 air tanks. They offer advantages over conventional steam locomotives of lower cost per unit, cleanliness, and decreased risk from fire or boiler explosion. They are able to run for 3 hours without stop.(3)

Improved Policy Around the World

- ❖ The Great Green Wall – An African project is under way to create an 8000 km band of fertile land and forest, 15 km wide, across the continent, restoring soil and groundwater. The Wall promises to be a compelling solution to the many urgent threats not only facing the African Continent, but the global community as a whole – notably climate change, drought, famine, conflict and migration.(3)
- ❖ Rotterdam, The Netherlands is 6 meters below sea level, is threatened by floods, built waterways into the streets. Innovative water collection and drainage systems have been designed so the city can adapt to changing climates.(3)
- ❖ 'I Am the River, the River is me' – In March 2007 legislation was passed in Aotearoa/New Zealand recognizing the Whanganui River, as a legal person, an invisible and living whole. A duty of care, based on indigenous values, has been created to provide for the well being of both the River and its people.(3)
- ❖ In 2007 one woman sparked a national movement when her home village of Modbury, UK became the first place in the world to ban plastic bags. Today, plastic bag use has fallen by 85% across the UK.(3)
- ❖ Underwater Forests – Seaweed Farming for Climate Mitigation: Giant kelp farms such as Rongcheng, China, capture carbon, deacidify the water, provide ecosystems for other marine life and can be used as biofuel to reduce the need for fossil fuels.(3)



Figure 10 – Great Green Wap Map (11)

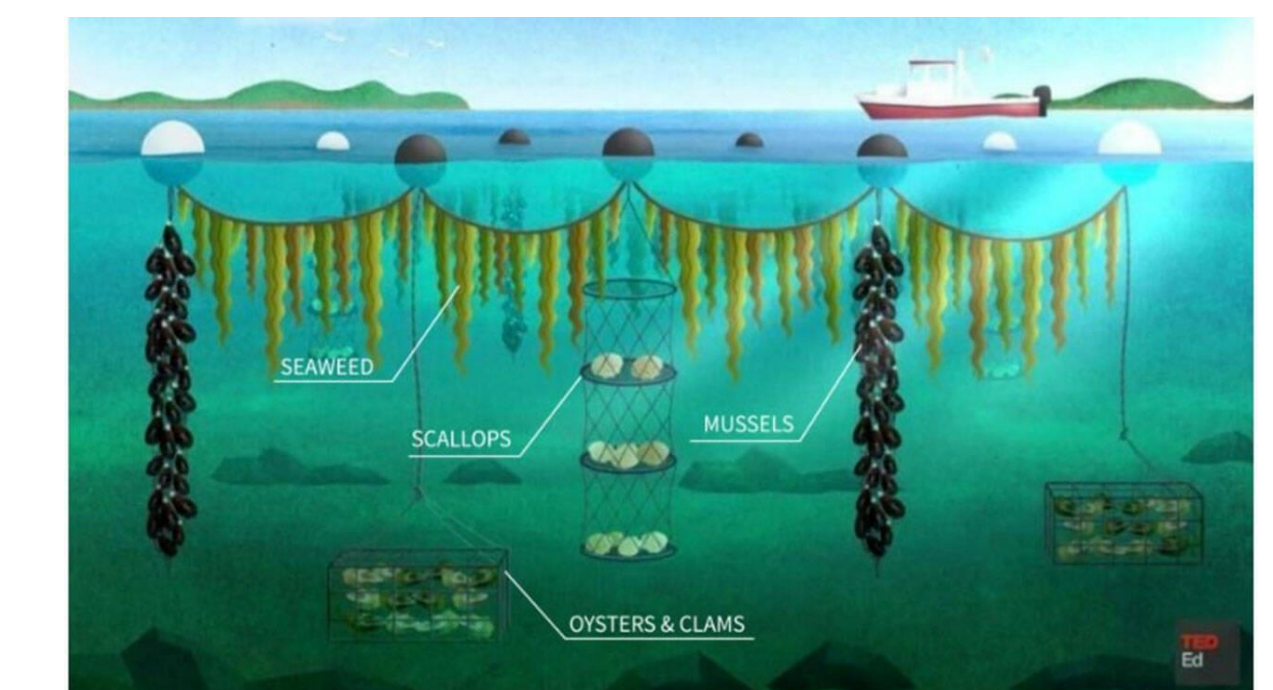


Figure 11 – Seaweed Farming Diagram (1)

Conclusion

How to improve the short-term effects:

- ❖ Improved membrane and filtration technology can now be used to remove all dangerous microorganisms, metal and chemical contaminant, as well as diseases like cholera and typhoid – making filthy water immediately drinkable.(3)
- ❖ Installation of Air to Water Generators to provide pure drinking water and lessen the amount of plastics being used and therefore being thrown into the Nile.
- ❖ Use of a Water Shark to scan the surface of the River to collect debris.

How to improve the long-term effects:

- ❖ Installation of solar panels and rainfall collection structures to collect both energy and clean water.
- ❖ Use of Satellites to detect water reservoirs and study climate change.
- ❖ Implementation of seaweed farming to capture carbon, deacidify the water, provide ecosystems for other marine life and can be used as biofuel to reduce the need for fossil fuels.(3)

Policy changes :

- ❖ Currently there is no policy or inter-continental law that determines the distribution or utilization of the water of the Nile, so the countries surrounding the Nile need to come to an agreement of the use of their sections of the River to combat the tension rising in the region.
- ❖ Ban the use of plastic bags
- ❖ Create restrictions of companies and farmers for the dumping of industrial waste, chemicals and pesticides.

References

1. Dennison, J. (2022, March 11). Seaweed Farming. Vashon. Retrieved April 6, 2022, from <https://www.vashonbeachcomber.com/news/seaweed-farming-comes-to-the-shores-of-vashon/>
2. Dubai Electricity and Water Authority. (2021, January 21). Mohammed bin Rashid launches DEWA's space programme Space-D. DEWA Official. Retrieved April 6, 2022, from <https://www.dewa.gov.ae/en/about-us/media-publications/latest-news/2021/01/mohammed-bin-rashid-launches-dewas-space-programme-space-d>
3. Dubai World Expo 2020 (2022). [Sustainability Pavilion]. Dubai, United Arab Emirates. 1 October 2021 – 31 March 2022.
4. Eshara Water. (n.d.). Sustainable Drinking Water from the Air. Atmospheric Water Generator. Retrieved April 6, 2022, from <https://esharawater.com/>
5. Farid, F. (2020, March 20). The Mighty Nile, Threatened by Waste, Warming, Mega-Dam. Phys.org. Retrieved April 6, 2022, from <https://phys.org/news/2020-03-mighty-nile-threatened-mega-dam.html#:~:text=Despite%20its%20importance%2C%20the%20Nile,and%20human%20health%2C%20experts%20say.>
6. McCarthy, J. (2019, March 4). A plastic-eating 'shark' drone is cleaning the UK coastline. Global Citizen. Retrieved April 6, 2022, from <https://www.globalcitizen.org/en/content/wasteshark-plastic-pollution-robot/>
7. Saint-Gobain. (2021, October 5). SAINT-GOBAIN UAE SHOWCASES SUSTAINABILITY AT WORLD EXPO 2020. Retrieved April 6, 2021, from <https://www.saint-gobain.com/en/news/saint-gobain-uae-showcases-sustainability-world-expo-2020>
8. Smith, W. (n.d.). Flag of Egypt. Encyclopedia Britannica. Retrieved April 6, 2022, from <https://www.britannica.com/topic/flag-of-Egypt>
9. Smith, W. (n.d.). Flag of Ethiopia. Encyclopedia Britannica. Retrieved April 6, 2022, from <https://www.britannica.com/topic/flag-of-Ethiopia>
10. Smith, W. (n.d.). Flag of the Sudan. Encyclopedia Britannica. Retrieved April 6, 2022, from <https://www.britannica.com/topic/Sudan-flag-of-The-UNCCD>
11. UNCCD. (2020, September 7). Africa's Great Green Wall: Close to 18 million hectares of land restored | Africa Renewal. United Nations. Retrieved April 6, 2022, from <https://www.un.org/africarenewal/web-features/africa-great-green-wall-close-18-million-hectares-land-restored-back-health>
12. UNICEF. (n.d.). Water Scarcity in Egypt. UNICEF Egypt. Retrieved April 6, 2022, from <https://www.unicef.org/egypt/documents/water-scarcity-egypt>
13. Wikimedia Foundation. (2022, April 5). Nile Map. Wikipedia. Retrieved April 6, 2022, from <https://en.wikipedia.org/wiki/Nile>

Acknowledgements:

Faculty Mentor Dr. Aaron Clevenger & the Office of Undergraduate Research