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## **Improper Water Resources are Impacting How Well Food is Grown in Sudan**

Throughout the world, there are many developing countries aiming to bring a better life to their people. Guyana, Macao, and Libya, some of the fastest developing countries, are diverting money to the improvement of life. This all includes infrastructure hearted projects allowing for expansion across the board (Nasdaq, 2021). The concept of going to a grocery and having everything at their fingertips is something that most people in developed countries know to be standard. In many places across the globe, there is all the potential to have this, yet there are a handful of factors, like improper water irrigation, interdicting them from reaching that ideal point. Over time, with the proper resources, this idealistic life can be reached, bringing better nutrition to the tables needing it most.

Nutrition is the sturdy, necessary foundation of the house called life. If it is not made right, an otherwise minute blemish could cause everything to crumble. Nutrition is a critical part of health and development. Better nutrition is related to improved infant, child and maternal health, stronger immune systems, safer pregnancy and childbirth, lower risk of non-communicable diseases (such as diabetes and cardiovascular disease), and longevity. Developing and under-developed countries across the globe have large sums of their population struggling to receive proper nutrition. This, in turn, has left 149 million children under the age of 5, too short for their age (stunted) (World Health Organization [WHO], 2021). In all humans, children in particular, a lack of proper nutrition will hold detrimental effects on the present, and future of the world

Composed of 718,723 square miles of desert-like land surrounded by a mountain range, Sudan is the seventeenth largest country in the world, directly behind Mexico and Indonesia. The majority of its land is used for agricultural purposes, made up by farms generally between 0.4 to 1.7 hectares, even though only fifteen percent of the land is truly arable. 0.4 to 1.7 hectares is approximately 1 to 4 acres. Due to this, over eighty percent of the land is used for permanent pasture. Its economy, ranked 72nd worldwide, is fueled by its oil production as well as gold and agricultural products like sugar cane, sorghum, and onions. When Sudan split as a result of its civil war, the economy took a large hit in the oil sector (Central Intelligence Agency [CIA], 2021).

Families, consisting of six members on average, often are tightly wound, with elders earning the utmost respect. Most people enter the workforce around age fourteen while seventy percent of children ages 6-13 undertake free, compulsory, primary education. (K12 Academics, 2021). Over half of all dwellings in Sudan are single room gottias, made by mud walls and a straw roof, while another third are menzils, houses with multiple rooms, and toilet facilities (Nations Encyclopedia, 2021). Due to this, only around seventy percent of the population has access to clean water, with under fifty percent having access to electricity. Due to its high price, healthcare is often seen as a luxury, with millions uninsured and relying on their own medicinal practices. (CIA, 2021)

According to the CIA Factbook, throughout the country of Sudan, 46.5% of the population falls below the poverty line leaving many in dangerous situations. As conflict rages in Sudan and the surrounding areas,

options to properly import food to the regions in need. Over the past couple of years, the number of people struggling with severe food insecurity has gone up by 335% in places like North Kordofan, a state near central Sudan (Voice of America [VOA], 2021). As more people struggle to gain necessary nutrition, options have been explored, yet in regions like North Kordofan, water resources are impeccably difficult to come by. Local agriculture would all but ensure access to fresh nutritious food, but it is practically impossible without proper irrigation methods. Places with the likes of North Kordofan continue to struggle even more to get enough food for their people, the desperate need for a solution is more prevalent now than ever.

The ongoing conflicts have turned highly populated regions into rows of starving people struggling to get a single meal. Conflict is a major determinant of poverty; and poverty remains the major cause of conflict. Armed conflict has affected over half of the countries in Sub-Saharan Africa within the past 20 years. Armed conflicts change power relations, create new economic incentives and reorder society, especially gender relations (Governance and Social Development Resource Centre [GSDRC], 2001). Conflicts rage constantly over water security in sub-Saharan Africa. Wars are fought in an effort to afford water to people of a region, but in the end, often the bloodshed and destruction outweigh the positive outcomes, leaving some people without water and others with barely improved supply.

Being landlocked with the exception of its northeastern border, most of Sudan has little to no access to desalination, one of the popular options for creating a sustainable and healthy water supply. Desalination, also called desalting, is the removal of dissolved salts from saline water as well as other waters. This process renders water that is otherwise useless to humans fit for consumption, irrigation, industrial applications, and various other purposes. However, existing desalination technology requires an impeccable amount of energy, usually in the form of fossil fuels, therefore making the process very expensive. If proper By desalinating what otherwise would be useless water, the population could flourish.

The Nile, stretching into the heart of Sudan, is the main water source for the country, and arguably its lifeline (CIA, 2021). Although it supplies the land directly alongside itself easily, western regions of Sudan struggle to get proper water, whether from local sources or importing via aqueducts or other methods. By creating canals to stretch through the country, places with adequate farmlands but inadequate water resources can be turned into prosperous agricultural communities.

Using the Nile as a source, water could be diverted all across Sudan, where it then can be held in reservoirs. However, this all is not as simple as it sounds in writing. Sudan would require foreign aid in order to create and maintain these projects into the foreseeable future. They would need materials, and a great sum of money to build, run and maintain these facilities. One of the largest reservoirs in the world, Lake Volta, cost over 250 million dollars to construct. Several precautions will be necessary before this can be placed into action. Although the Nile is freshwater, it carries with itself large amounts of salt. Along the Nile, the fertile land is constantly in danger from salt. The salt in the Nile can seep into the soil, rendering it useless for farming, but the Nile itself protects the land from this. The Nile floods annually retract salt from the precious land, while saturating the lands, making way for the next year's crop (Reference, 2020). Canals diverted from the Nile will not come with the same saving touch. In order to prevent this from happening, the canals will require separation from land they cut through until the water reaches a reservoir. Once at the reservoirs, it will require proper sanitation as well as decreased salt levels, before it can be put to use in the dry, yet fertile farmland. Future retrofitting of these facilities could also provide a healthy amount of renewable energy for Sudan via hydroponics. This would then create an

opportunity to avoid use of fossil fuel as an energy source for energy intensive desalination. Although this is a large effort, including movement, security, and regulation of water resources, it is an effort that must be taken to bridge the gap between Sudan being a developing country and a developed country.

Although the movement of water through canals and other methods will be very beneficial, it could prove to be a great challenge to touch the far reaches of Sudan. In order to solve this, the focus has to be placed on the ground below Sudan. In the last decade, scientists have discovered vast aquifers beneath the infamously dry continent of Africa, one hundred times larger than the amount of surface water (British Broadcasting Company [BBC], 2012). Toward the western and northern reaches of Sudanese territory, the Nubian sandstone aquifer sits underneath the soil. With a storage capacity of 503 km<sup>3</sup> and an annual recharge rate of 0.381 km<sup>3</sup>, it would prove to be extremely beneficial for the western agricultural sector. Along the southern border, and stretching north, the Um Ruwaba aquifer could greatly benefit the starving states like North Kordofan to slow, and turn around, the increase of people struggling to feed their families. Although significantly smaller than the Nubian sandstone aquifer, at only 22 km<sup>3</sup>, The Um Ruwaba has a faster recharge rate, 0.581 km<sup>3</sup> annually (Fanack Water, 2018).

The struggle with water in Sudan has only been increased by ongoing conflict plaguing the region, spreading food insecurity across the country. In many places across the globe, there is an abundance of fertile land, capable of large crop yields, but without proper irrigation. With improved water sources, Sudan could turn its agricultural sector into a flourishing commerce. By desalinating what otherwise would be useless water, populations could flourish, with the ability to drink and farm more, and more successfully. Not only will it improve Sudan as a country, but will improve the everyday lives of its people. Many organizations across the globe, like Pure Water for the World, are pushing to create this, a better life for all people. Pure Water for the World partners with rural and underserved communities, where there are high incidences of waterborne diseases and a scarcity of aid. They work to establish comprehensive safe water solutions that include the essential tools and education to serve all community members, provide water, sanitation and hygiene, creating their acronym “WASH”. They further provide education and capacity building programs, training other organizations to accelerate access to safe water and sanitation for all (Pure Water for the World, 2021).

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