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Somalia, Water Scarcity

**Treating the Brackish Situation in Somalia**

Drought in Somalia was nothing new, but missing five consecutive rainy seasons was extraordinary. Although the drought has ended as of 2024, rising global temperatures and the undeniable effects of climate change make another drought inevitable. Last year, Somalia was in its fifth consecutive rainy season without rain, and almost half of its population was on the brink of starvation ("Crisis in Somalia"). A clean and stable source of water could solve much in Somalia, but for a country with half its border surrounded by water, water is surprisingly scarce. Of course, this is sea water and too salty to drink, but using technology can solve that problem. Removing salt from water, called desalination, could be incredibly beneficial to Somalia and help aid in averting famine during times of drought.

According to The World Bank, Somalia has a population of 17,065,581. Roughly half of Somalians live in rural areas ("Somalia", CultureGrams). Many people in Somalia are impoverished, with around 69% of the population falling below the poverty line; Somalia also qualified for the Heavily Indebted Poor Countries Initiative back in 2020 ("The World Bank in Somalia"). Poor education feeds into the poverty that already runs rampant in Somalia, and without education, it is challenging to rise from poverty, effectively trapping much of Somalia’s impoverished population in a cycle. Only around 40% of the children in Somalia go to school ("Africa: Somalia"). Somalia’s lack of quality education is compounded by the majority of its population being young. Over 40% of Somalia’s population is under the age of fifteen ("Somalia", Britannica), and 75% of the population is under the age of 30 ("Somalia", UN). On top of all of this, Somalia also has a relatively low life expectancy of fifty years old ("Somalia", Britannica) because of factors like a high infant mortality rate and chronic malnutrition ("Africa: Somalia").

Somalia is a federal parliamentary republic ("Somalia", CultureGrams). In 2022 it had a presidential and parliamentary election, followed by a peaceful transition of power ("The World Bank in Somalia."). This is incredibly impactful for Somalia due to its recent past with an unstable government. One important thing to note is the unofficial government of Somaliland, which is not officially recognized as its own country ("Somalia", CultureGrams). Despite not being recognized by foreign powers, Somaliland runs itself and has a functioning independent government. Somaliland lies in the north of Somalia. Both in governance and socially, Somalia is a patriarchy. Its gender inequality places it as the fourth-lowest country for gender equality, and the rate of female genital mutilation/cutting in Somalia is extremely high, applying to approximately 99.2% of women aged 15–49 ("Somalia", UN). Somalia also, unsurprisingly, values male members as paramount, with extended family on the father’s side having priority over extended family on the mother’s side ("Somalia", CultureGrams). The young marriage of girls is also very common in Somalia. Women working is also less culturally acceptable in Somalia, with only 23.1% of women aged 15-64 working as opposed to the 73.6% of men aged 15-64 in the labor force ("Somalia", UN). Approximately 35% of the GDP from Somalia’s workforce is not even obtained within Somalia’s borders, instead being earned outside of the country ("Somalia", CultureGrams). That means that inside Somalia, their true GDP should be 35% less than the reported amount, as having 35% of their GDP made from outside of Somalia means that it is not the people living in Somalia who are making money.

Numerous factors, including a lack of a skilled labor force and famine, have stunted Somalia's economic growth ("Somalia", CultureGrams). Somalia’s GDP per capita is estimated to have been $502 in 2021 ("The World Bank in Somalia"). Herded livestock makes up 40% of Somalia’s GDP, and nomads living in rural areas herd these livestock ("Africa: Somalia"). Exports from Somalia include camel, goat, and sheep’s milk, ("Somalia", CultureGrams) cassava, maize, sugarcane, and vegetables ("Africa: Somalia"). Imported rice and local meats are the main urban diet. Rural, nomadic diets are usually comprised of goat or camel milk paired with grains bought using herd animals. Vegetables are usually a novelty ("Somalia", CultureGrams). As well as poverty, malnutrition is also rampant in Somalia, with almost a quarter of children under the age of five being underweight ("Africa: Somalia"). Food insecurity and poverty go hand in hand in the sense that impoverished people find difficulty acquiring enough food for their families to eat, and it is hard to rise from poverty when one is pouring all resources into trying to meet the bare necessities like food and water.

Somalia’s geography and geology add an additional layer of challenges. Somalia is on the east coast of Africa, just south of Yemen, and shares its western border with Ethiopia ("Somalia", CultureGrams). Somalia’s geography consists mostly of hills, plateaus, and flat land ("Africa: Somalia"). The southern part of Somalia is much more fertile than the north, though it is still possible to do some farming in the north (Aliprandini). For a country whose economy is mainly agriculture, not being able to farm efficiently in nearly half the country is not desirable. Although Somalia has some mineral deposits of tin, phosphate, gypsum, guano, coal, iron ore, and uranium, all possess low quality and are too low in quantity to actually benefit from mining ("Somalia", Britannica). A lack of natural resources is another factor that stunts its already fickle economy. Despite Somalia’s already low amount of vegetation, it is estimated that over the past 20 years, 20% of its forests have been destroyed ("Drought, High Temps"). At this point, it is widely accepted that deforestation is detrimental to the environment and contributes to climate change. Somalia is already suffering from ill effects caused by global warming, such as the most obvious example, the drought that took place last year.

Somalia is one of the world's hottest countries, with average temperatures reaching around 100°F from June to September. There are four climatic seasons annually, with two being rainy seasons dubbed the gu and the dayr, each followed by a dry season, the first, jilaal, and the second, xagaa ("Somalia", Britannica). Last year, Somalia missed the past five rainy seasons, putting the country into an extreme drought. Previously, people in Somalia would store rainwater in underground reservoirs called berkad to help them through drought, but because of the extended period for which the drought lasted, the use of berkad was not feasible ("Drought, High Temps"). Back in 2022, the article "Fears of Famine" described how "The United Nations is warning that a famine looms in Somalia's future. The country has not seen rain for the past three consecutive rainy seasons over a two-year period. Rain is expected this month but experts say the projected rainfall won't be nearly enough to end the drought." Somalia is no stranger to famines caused by droughts, but it was only back in 2011 that Somalia experienced a drought that led to famine ("Drought, High Temps"). In 2023, it was estimated in the article "United States Provide" that nearly seven million people in Somalia were facing the risk of starvation. Drought and food insecurity are also both driving factors in the number of refugees leaving Somalia, placing the country as the fourth-highest source of refugees ("Africa: Somalia"). It was no surprise that so many people were fleeing Somalia when their basic needs of food and water could not be met.

The problem is clear: drought in Somalia is inevitable. Yet, it is possible to use Somalia’s geography and location to acquire water. Somalia’s location has a hidden water source: the ocean. The only problem is the salt content of the water. However, there is a way to fix that. Water desalination is a technique in which the salt is removed from water to make it fit for human consumption. To be drinkable, water needs to have a 0.5% salt content or less, and seawater has a salt content of around 3.5% ("Drops to Drink"). Desalination is the process of removing salt from water, effectively cutting down the salt content of the water to make it suitable to drink. Britannica School describes how, currently, desalination is extremely energy-draining, meaning that it is extremely costly. The Britannica School then adds that despite the cost of desalination, it is still used in areas where sources of water are not economically available. In Somalia, the cost of desalination would most certainly be worth the water it would provide to citizens and the food it could help grow for Somalia.

There are two primary types of desalination technology: thermal-related desalination and membrane-based desalination (Sadrzadeh et al.). Currently, membrane-based methods are more widely used. In thermal-related methods, energy is used to evaporate water to remove it from the salt; one example of thermal-based desalination is humidification-dehumidification. The Lienhard Research Group describes the process of humidification-dehumidification by listing its materials and how they work to desalinate water: "Its basic components are a humidifier, a dehumidifier, and a heater. In the humidifier, air is humidified through direct contact with salty water. In the dehumidifier, hot moist air is put in indirect contact with cold salty water. This causes water vapor to condense, which produces a freshwater stream" ("HDH Desalination"). Most thermal-based desalination techniques are like to humidification-dehumidification with their use of evaporation. On the contrary, Membrane-based desalination uses membranes to remove salt and other minerals from water. Membrane-based desalination is generally more cost-effective than thermal-based desalination; it requires much less energy (Sadrzadeh et al.). Membrane-based desalination is likely the best option for Somalia: it is more cost-effective and requires less energy. Electrodialysis and reverse osmosis are the two most popular methods of membrane-based desalination.

Electrodialysis (ED) is a membrane-based desalination method that utilizes ionization to selectively transport the ions in the water across different membranes that exchange ions (Gurreri et al.). One company, named Siemens, has made Electrodialysis more energy efficient than reverse osmosis ("Drops to Drink"). Though electrodialysis uses less energy than reverse osmosis, the membranes needed to make the system are also much more expensive than reverse osmosis membranes (Campione et al.). Few real electrodialysis plants have been installed yet (Gurreri). "Treatment of Water Using Electrodialysis" also mentions that "The raw feed water must be pretreated to prevent materials that could harm the membranes or clog the narrow channels in the cells from entering the membrane stack." The pretreatment of water before it can be desalinated through electrodialysis is inconvenient.

Reverse osmosis is another desalination membrane-based technique that utilizes high pressure to force salt water against membranes, allowing fresh water to pass through the membrane without the salt it contains ("Desalination"). In terms of energy, reverse osmosis requires around four-kilowatt hours, or 4 kWh per cubic meter ("Drops to Drink"). Reverse osmosis requires more energy than electrodialysis. Even though reverse osmosis requires more energy than electrodialysis, the way it requires pressure can be utilized in a wave-powered reverse osmosis system. Electrodialysis can also be used in a wave-powered desalination unit (Leijon); however, it is less common than wave-powered reverse osmosis, and there are more cases of successful wave-powered reverse osmosis units than there are wave-powered electrodialysis units. For these reasons, though electrodialysis is one possible solution, a wave-powered reverse osmosis system would be more practical. A wave-powered reverse osmosis system would use salt water to desalinate the water to make it drinkable and use the motion of the waves to power the system. Wave-powered desalination can be off-grid if the system is autonomous (Leijon et al.). Davies states how "Wave energy availabilities are compared to water shortages for a number of arid nations for which statistics are available. It is concluded that the maximum potential to correct these shortages varies from 16% for Morocco to 100% for Somalia and many islands". Having a maximum potential of 100% to correct water shortages in Somalia is huge, as many of Somalia’s problems, including food insecurity, stem from the water shortages caused by the drought. Davies mentions how an efficient desalination plant could irrigate a 0.8 km wide strip of land with waves at 1 meter, and with 2 meters, it is possible to irrigate a 5km strip of land. One company called Oneka specializes in wave-powered reverse osmosis; their biggest unit dubbed the Iceberg-class unit, can provide water for 100 to 1500 people per day depending on how much they consume. Oneka’s units are also extremely environmentally friendly; the anchors and hulls of their units double as an artificial reef suitable for marine life, and the waste brine from desalination does not affect marine life because of the slightly higher salt content in the brine than the ocean ("Our Wave-Powered Sustainable Desalination Solution"). Though the cost of such desalination technology depends highly on many factors, the ongoing benefits of having access to clean water likely outweigh the initial cost of the machinery.

One way to possibly fund a reverse osmosis system would be to divert funds from the Somalia Humanitarian Response Plan, or HRP, which, as of December 13th, 2022, was able to raise over 1 billion dollars (Lindemann). If some of those funds could be put towards a system that would not only provide drinkable water autonomously but also positively affect the environment, then it would greatly benefit the people of Somalia and would also align with the goal of the Somalia Humanitarian Response Plan: preventing Somalians from starving. Though it would take money from the Somalia Humanitarian Response Plan, it would still help achieve the same goal the funds were collected for in the first place.

Desalination would be very helpful to any coastal country suffering from drought, and it would be especially helpful to Somalia. Though it is costly, the cost is worth the throats it would quench, the bellies it would fill, and the people it would aid. Drought is inevitable, but famine is preventable. It just depends on whether people decide to prevent it. A hundred years ago, it would have been difficult to do anything to lessen the effects of five missed rainy seasons, but in 2024, with help from technology, we can help Somalia avoid famine despite its drought.

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