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Uganda: An Effort to Provide Potable Water for Volatile Rural Communities

Rachel looks at her husband in despair as she hears the community's water source is ruptured. The broken source (a borehole) remains unusable, as no one in the village is able to maintain it. As a subsistence farmer, water is like gold, in providing for her family and livestock. Because of the impediments, Rachel is forced each day to send her children on a 6-mile treacherous journey to acquire clean water. The children have no choice but to miss school and spend hours collecting water. Although their efforts are admirable, the precious resource is stretched beyond the family's limit. The family regularly struggles with health issues and activities like taking baths aren't feasible. Rachel and her family's narrative of journeying to distant places in the pursuit of clean water isn't unique to the subsistence farmers of the Kaliro District (Lifewater). The scarcity of potable water is continuing to disproportionately devastate the poverty-stricken regions with direct and costly implications for the people. Accordingly, ample national and international resources must be subsidized by NGOs and the international community to address this devastating issue.

According to the International Finance Corporation (IFC), nearly 90 percent of Uganda's 35 million people live in small towns and rural areas, and roughly two-thirds of them lack access to safe water. Poor sanitation worsens the problem. Waterborne diseases and infant mortality are widespread (IFC). A little larger than the average Ugandan family, Rachel's family consists of her, her husband, and her 5 kids. Most rural Ugandans stick to severe gender roles, where the mother tends to the children, prepares food, and cleans the house. The men and young boys do most of the farming and give direction to the women and children. Unfortunately for Rachel, her livestock had to be prioritized when distributing water. There wasn't enough water left at the end of the day to cook a meal for her family, and thus it would have to be eaten raw. Those in her community often faced the same problem, this was a perpetual difficulty in the rural communities.

As mentioned before like Rachel's kids, many students aren't even able to attend school due to familial obligations. UNICEF quantifies that "Only 1 in 4 children who starts primary school makes it to secondary school." However, the students who are able to attend school don't get an adequate education. Uganda's rural language policy enforces that schools teach in the dominant local language for the first three years of primary school. The fourth year of schooling transitions students from learning in their mother tongue to English. Medadi Ssentanda, a lecturer at Makerere University conducted a study on the success of the method employed by the Ugandan government. The team found that students "faced various challenges in learning and acquiring English" (Ssentanda). The paper concludes the curriculum is insufficient, repetitive, and holistically not successful in teaching rural students English. The rural schools aren't provided enough funds and aren't prioritized enough when allocating materials.

Thus, many rural people get stuck in a never-ending cycle of poverty and stifling farmwork. Without the means to acquire a satisfactory education, rural people are unable to obtain better work. Rachel's farm

houses goats and cattle. Their livestock in a normal year would be able to provide food and economic support for their family. However, because of a lack of clean water, their livestock faces malnutrition and various health problems. This problem isn't unique to them but is an epidemic ravaging the country.

Potable water remains a critical factor for food security in Uganda. While most of the agricultural production systems are rainfed, ever-changing factors such as climate change are ravaging agricultural production. Average monthly temperatures are rising in Uganda which translates into increased frequency, duration, and intensity of heat waves. This means less water available for crops to feed the rural population and to support livestock production. With the available crops, the government hasn't put in place a system to ensure the cleanliness of food and livestock. Especially in the southwest part of Uganda, subpar child feeding practices coupled with inadequacies with sanitation and hygiene environments create numerous nutritional deficiencies in children (Global Hunger Index).

Not only does a lack of potable water affect the Ugandan people, but it also affects the rural Ugandan economies. According to the Drop4drop organization, 24% of Uganda's GDP comes from agriculture. This division of the economy is reliant on accessible, clean water sources. A lack of clean water sources means farmers' crops and animals suffer. Thus, local communities would not have access to nutritious food. It is clear that clean water is a necessity for farmers who are crucial for local communities and local economics.

The struggling life of rural Ugandans has been increasingly evident despite the work from various non-governmental organizations such as UNICEF, Lifewater, and Water.org. While their efforts have been phenomenal, many rural families face incredible challenges regarding water sanitation and accessibility. To tackle this daunting problem, leaders must attack water sanitation problems head-on and start at the root of the problem; infrastructure. Like Rachel's community, many rural villages have underperforming water systems that communities don't know how to maintain, or the water systems become eroded, and no one knows how to fix them. The Ugandan government worsened this crisis when they decided to decentralize rural water systems in the early 2010s. Now the government allocates money to local governments who contract private operators in their region. Most of the contracts are weak and their infrastructure has underperformed (IFC).

To make the rural parts of Uganda more hospitable, we must do something to address this serious predicament. I believe utilizing solar stills is an easy and cost-effective method that will work best in decontaminating water in the long run. Furthermore, mechanisms like inexpensive rainwater harvesting systems are short-term effective mechanisms for harvesting and storing water for communities.

I also believe it's essential to recognize this is a multifaceted issue that necessitates complex resolutions. There is no magic bullet, but it is feasible to use the latest scientific findings and infrastructure that have shown success in other parts of the world to guide Uganda in the right direction. First, strategic rainwater harvesting systems must be installed on villager's houses and on general buildings. This will provide a temporary solution that will collect enough drinkable water for the rainy season and some of the dry season. As a more sustainable solution, however, the process of solar stills must be used to decontaminate water by harnessing the sun. Its cost-effectiveness and success make this a meaningful solution. Once this water is collected, however, it is not sufficient to just sporadically use it without structure. Local

governments must be educated on how to effectively portion the water for the people, livestock, and crops. The communities must also make a plan on how to keep the water safe after it is cured.

Rainwater harvesting (RWH) systems are widely employed around the world for their simplicity and efficacy. Using rainwater as a source of potable water is effective as there is a zero percent risk for contaminated water. Unlike getting water from streams or rivers. First, the RWH system requires a house to be fitted with gutters on the roof, so instead of the water falling into the ground, the water is redirected through piping. The water then undergoes a first filtration process to eliminate large contaminants. The water then goes through a second filtration process to remove small contaminants like debris and sand-like particles. The water is finally left in a storage tank where it can be easily accessed for daily use.

The RWH system has already been implemented in rural areas of Brazil and has shown exponential success. Only 28% of Brazil's largest cities have access to potable water. The semi-arid Brazil region is home to 18 million, half of whom live in rural communities. While the rainfall is irregular in this area, the program has already shown tremendous success, and the government has financially backed the project. The RWH project has "allowed residents to practice agriculture, provide water for livestock, and improve sanitary standards at facilities such as rural schools" (Cleanawater). The benefits the rural people have seen from the RWH system are invaluable. Not only has their water and sanitation improved, but they have also seen improvements in many other aspects of life. Because they didn't need to trek for hours to reach water, students were able to attend school, crops flourished and both food scarcity and diseases decreased.

The RWH system will be particularly fruitful during Uganda's wet season from March-May and September-November. During the perpetual rainy season, the average rainfall is anywhere from 4-12 inches. The total annual rainfall is around 31.5 inches. By collecting the vast quantity of free water during this time, it may be possible to prepare for the dryer season. The beauty of Uganda's climate is there is often never a completely dry month. Even in the dryer seasons, it rains at least once a month. Thus, even after the rainy season if a storage tank runs dry then a village can count on the tank to fill up at least partially in the month. In conclusion, RWH systems will be particularly fruitful during the wet season, and less reliable during the other months, but can still provide greater relief.

Implementing solar stills is a long-term solution that relies on the sun; therefore it is a more advantageous solution for Uganda. According to the weather and climate organization, Uganda averages about 200 hours of sunlight each month, making this a pertinent solution. A solar still consists of 2 water containers with a piece of glass on top. Filthy water is placed in one container, while the other container remains empty. The solar still sits in the sun and absorbs the sun's energy, as the energy is absorbed it heats the water. The temperature rises and the liquid water evaporates towards the glass "ceiling", leaving all the filth in the original container. The pure water droplets end up in the second container and are safe for consumption Researchers estimate that the purifications system will only cost about $1.60 per square meter (Sciencing).

Through governments and NGOs working together, they've been able to implement this filtration process not only in Uganda but also in other countries. The Waterschool has already begun to implement this filtration process in rural Uganda. The program emphasizes its success because they tackle potable water

challenges at the point of consumption, and thus decreases the chances for re-infection. They champion this method because of the relative ease of setup and its cost-effectiveness. Rajasthan India is a region where only 44% of water is safe for consumption. While not blessed with potable water, it is blessed with abundant solar radiation. Because it is economical and easy to construct and maintain, solar stills were a game-changer in providing water for Rajasthan's people. The program was highly successful and continues to provide clean water for the people.

While RWH and Solar Stills will address the need for more clean water, it doesn't contribute to the sustainable use of water. The communities in Uganda faced one of the most severe droughts in 2017, and with recent developments in the climate crisis, there is no sign of a better future. Thus, perhaps the most viable solution for Uganda's water crisis is to use water conservation techniques. Avoiding wasteful water practices is important in warranting that rural communities have enough water for themselves, livestock, and crops. Even though the government has attempted to implement water conservation strategies, such as mulching, grass strips, and retention ditches, many Ugandan farmers remain oblivious of them.

Thus, in a cooperative effort, the government and NGOs must work together to better educate communities. Educating the rural population of Uganda is one of the most essential steps in implementing solutions. Some villagers may not agree with the lifestyle changes solutions may bring, and therefore must be corroborated that the solutions will bring only benefits. Educating the rural population can be tough. However, if the Ugandan government reallocates funds they will be able to pay for teachers, who can educate villagers throughout the process. Teachers will be vital in educating communities about proper sanitation practices, how to maintain the new water sanitation methods, and the benefits of the system. This will ensure the long-term success of the new methods.

In Uganda, with clean water, food security will increase. Furthermore, quality of food will rise because watering crops with potable water ensures safe and nutritious food. Also, with more clean water, the quantity of food will increase as more farmers can sustain their farms. Thus, more people will be able to buy enough healthy food to lead an active lifestyle. Finally, within local economies, with clean water more farmer's produce will prosper. Thus, local economies will be more financially stable, leading to more availability to purchase and sell food.

So much has been learned by governments and nonprofit organizations, as they've devised systems to make communities more prosperous. When Rachel found out Lifewater's water committee was coming to her town to replace their clean water system, she felt relieved. Her children would be able to attend school again, and she wouldn't have to worry about carefully rationing water for her family and livestock. I believe the assistance of multiple levels of government and international organizations will better water and sanitation in Uganda and enhance the people's food security and quality of life.

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