Casey Baranski
North Huron Schools
Kinde, MI
Ghana, Water and Sanitation

Ghana: Securing the Water Supply

Albert Szert-Gyargi once said “Water is life and there is no life without water. If the water sources are contaminated, so is life.” With Ghana's population being 29,463,643 in 2018 it is the 49th largest country in the world by population, and 82nd largest country in the world by area. Its area is 92,099 square miles, almost the size of Oregon. Out of that population, 54.4% of it is urban, and 45.3% is rural. (worldometers.info). Ghana is a Unitary state which means it's governed as a single power with the central government being ultimately supreme and any administrative divisions exercise only the powers that the central government chooses to delegate. Like the United States, it runs on a Presidential system and Constitutional Republic.

A typical family living in the country of Ghana usually eats starchy staple foods in their main meals. “Fufu”, an extremely popular and common food in West and Central Africa, originated from Ghana and is made by pounding cassava and unripe plantains together. During this process, water is added gradually to mix all the ingredients together. Water, a very valuable and limited resource accessible to most people across the world in consumable sources, is not sanitized enough for the people of Ghana to drink without obtaining some sort of disease. Over 6 million people in the country don’t have access to safe water, while 18 million other citizens lack access to improved sanitation. Seventy percent of all diseases in Ghana are caused by unsafe water and poor sanitation. This is due to the fact, that the population of six million people (22%) rely on surface water for their daily needs (water.org).

Now you may ask “Why is their surface water so contaminated?”. There are many factors contributing to this cause, one of which is pollution. Around sixty percent of Ghana’s water bodies are polluted, with many in critical condition, as the Water Resources Commission (WRC) has said. “This water pollution is not just all going on in Ghana itself, it's also affecting all of Africa, especially in the south-western parts where illegal mining activities (galamsey) were widespread.” Galamsey, derived from the phrase “gather them and sell,” is a local Ghanaian term which means there is illegal gold mining taking place inside the country (ghana.gov.gh). Illegal mining didn’t just affect the water supply, it also resulted in serious degradation of vegetation. Degradation of vegetation has greatly affected the forests and surrounding bodies of water. The loss of forests has changed the atmospheric conditions and raining patterns of the affected areas throughout the country. Ghana’s water sources are now polluted with harmful chemicals that has resulted in paucity of raw filtered water and loss of higher percentage of arable farmlands that has reduced crop production (mobile.ghanaweb.com).

However, the government has taken some measures to solve this issue, like establishing nine small scale mining offices across Ghana which would provide extension services and education to prospective minors. Ghana’s government has also created the Constitution of Anti-Ministerial Task Force activities, which basically had paid off thousands of foreigners engaged in galamsey then deported them out of the country as a result (ghana.gov.gh). Lastly, they reserved small scale mining activities for only Ghanaians to give them the opportunity to engage in this activity. As a result, this issue has now been controlled, though the effects from it are still prevalent today. For example, in the East Akyem District, both the Densu and Ayensu rivers, have been greatly polluted due to Galamsey. They serve as raw water sources for communities around them but are still full of life threatening chemicals. Unfortunately, since the people of those communities don’t have alternative sources of water, they are still compelled to use the same polluted rivers without panic.

Galamsey hasn't been the only issue that has been polluting these rivers and water systems. Extreme amounts of garbage and human waste are dumped into the Densu River indiscriminately, despite persistent warning and education. This has then affected the Weija Dam which supplies water to most parts of Accra, the capital of Ghana. In the country there are around 14,000 deaths per year due to the contamination of drinking water caused by untreated sewage (indexmundi.com). These deaths are usually caused by waterborne illnesses including bacterial and protozoal diarrhea, hepatitis A, and typhoid fever. Illness can also be transported by just coming into contact with contaminated water. One leading infectious disease is schistosomiasis (Bilharzia) which is caused by infection from freshwater parasitic worms. These parasitic worms penetrate human skin to enter the bloodstream and migrate to the liver, intestines, and other important organs. They are introduced into freshwater from infected animal or human urine and feces.

An experiment conducted in Ghana tested 24 different families on their water quality and what percentage of the E. coli virus was present in the samples. Escherichia coli (E. coli) was quantified per 100 ml of water using the IDEXX Colilert system and multi-stage regression models which estimate cross-sectional association between water sources, sanitation, and socio-demographic factors (ncbi.nlm.nih.gov). The IDEXX system is a test that is used to detect the percentage of E. Coli in any type of water. Almost three quarters (74%) of the households have less than 2 E. coli/100 ml H2O. Tap water has significantly lower E. coli levels compared with surface water or rain water. However, well water had the highest levels of E. coli. Households with the water closet toilet have significantly lower E. coli levels compared with those using pit latrines or no toilets. Going to the toilet in the open is a major contributor to diseases such as Cholera. Cholera is a bacterial disease that is caused by drinking contaminated water. Cholera swept through the country in 2014 during an unfortunate flash flood that majorly contributed to sickness in over 30,000 people (wateraid.org).

Access to water and sanitation facilities is low in rural areas of Ghana. Only 50 percent of the rural population has access to water. Access to sanitation can be low as 42 percent in urban areas and 11 percent in rural areas. Traditional sources of water in many parts of rural Ghana are small ponds and unprotected wells, both of which are easily polluted causing infectious diseases that still impact the population today. To help with this problem the Oxfam Water for survival program is working with Water Aid UK to provide hand dug wells with pumps and constructing ventilated pit latrines (wateraid.org). Water and sanitation initiatives are accompanied by hygiene education activities to ensure that the health benefits for the country can be maximized with Water Aid UK and local partner, Rural Aid to help provide hand dug wells with pumps and construct ventilated pit latrines.

Technological advancements have been made within Ghana to give communities access to clean water. Some of these technological advancements already being used are fog catchers, solar crops, waterseers, and a small collection of papers called a water book. Other corporations have been in support with this prevailing problem too. Water Aid is also in cooperation with the United States and is helping communities and local government put long-term solutions in place that can withstand climate change and natural disasters. They are also connecting to the hardest-to-reach and most marginalized communities with local authorities to develop specific services for their needs. You can also make donations on the site to numerous water crisis's like Ghana's to help supply clean water to the people that live in the country. Water.org has also worked in Ghana to deliver access to safe water and improved sanitation with their direct impact model. The Helmsley Charitable Trust had been funding their project of constructing 61 water facilities and was completed in 2017 (wateraid.org).

Fog catchers are vast mesh nets that capture moisture from fog. The moisture then drips into collection trays after condensation. The largest of these projects is on the slopes of Mount Boutmezguida, a microclimate in Morocco where 6,300 liters of water can be harvested today. Atmospheric water is generally clean, does not contain harmful microorganisms, and is immediately suitable for irrigation

purposes. In a number of cases, water collected with fog harvesting technology has been shown to meet World Health Organization standards (UNISA, 2008, WaterAid). Construction of fog harvesting technology is relatively straightforward once the component parts and technical supervision is secured. The process is not labor intensive at all and only requires basic skills to build each net. Harvesting fog is particularly suitable for mountainous areas where communities often live in remote conditions. Though with every great advantage in a new piece of technology comes some disadvantages. Fog harvesting technologies depend on a water source that is not always reliable, since the occurrence of fog is uncertain. Further, calculation of even an approximate quantity of water that can be obtained at a particular location is difficult.

The cost to build these nets vary depending on the size, quality, and access to the materials, labor, and location of the site. Smaller models of fog catchers cost $75 to $200 to build. Larger models of fog collectors cost $1000 to $1500 and can even last up to ten years. On a large scale, a village project producing about 2,000 liters of water per day will cost about $15,000 (climatetechwiki.org). Multiple-unit systems have the advantage of a lower cost per unit of water produced, and the number of panels in use can be changed as climatic conditions and demand for water vary. Community participation throughout the country can help reduce the labor cost of building the fog harvesting system and is generally recommended that the local population is involved in the construction of the project. A community management committee could be set up and consist of trained individuals responsible for repair and maintenance tasks, helping to ensure the long-term sustainability of the technology.

A range of meteorological information is also required for choosing a site to implement a fog catcher, including predominant wind direction and the potential for extracting water from the atmosphere. A feasibility study (an assessment of the practicality of a proposed plan or method), and a pilot-scale assessment should be carried out to access the magnitude and reliability of the fog water source. Most of this information can be gained from government meteorological agencies but may require local meteorological stations and the use of a neblinometer (a device to measure the liquid water content) for collection of localized data. There are also other requirements for assessing fog harvesting sustainably including finding out global wind patterns, topography, relief in surrounding areas, altitude in which you place the nets, orientation of the topographic features, distance from the nearest coastline, space for the collectors, and an area with a crestline.

Another technology that can help to provide sanitized water to the people of Ghana is a device called WaterSeer. WaterSeer is a device that has the structure of a giant pipe and works by deriving moisture from the air and extracting the water out of it. It is designed with a thin solar module specifically to run the device for 24 hours per day (waterseer.org). Considering Ghana has a warm, sunny climate year-round, this really couldn't become a problem. It is also implemented into the ground due to its natural cooling. This natural cooling brings the ambient air close to its condensation point. Then this air moves into an active cooling condensation chamber before it is used for different purposes. The water collected in WaterSeer is ready for use once filtered from the air and can be transferred into a larger storage reservoir. The water is clean, fresh, cool and free of pollutants, particulates, and contaminates. It also exceeds the EPA standards for water purity and is cleaner than tap water.

WaterSeer is sustainable, leaving nature's aquifers and water resources untouched. It can supply an endless amount of water either powered by the sun or by wind. The wind model works in the same way as the sun model of WaterSeer though at the top of the device there is a turbine like structure that turns to power the structure. The device can work for many generations and cost a lot less than many other water models that are in use right now. The structure only costs $134 and can produce as much as 11 gallons of water per day, even in arid regions it still only costs the same amount. For every WaterSeer sold for $134, the team behind WaterSeer plans to donate a WaterSeer to a family in the developing countries across the world. If you do decide to buy one yourself, and maybe have a defection in the product, they have 90-day

warranty and can be refunded if you change your mind overtime.

There is also a simple solution that does not cost much at all and can provide water for years and years to come. This object is called the drinkable book. No, it is not an actual book made of water, although the pages inside the book have the ability to filter water even in the worst of conditions (waterislife.com). You may ask yourself "How can pages filter water if they get ruined instantly when they get wet?". These pages inside the book are not paper but are impregnated with silver. Silver is an effective antimicrobial that has been used to destroy bacteria for many generations. Theresa Dankovich from Carnegie Mellon University used the idea to launch the concept of the drinkable book that could both encourage proper sanitation practices and purify water. During her PhD at Mcgill University, Dankovich successfully created a page made of cellulose and impregnated with silver nanoparticles. Following a postdoctoral stint at the University of Virginia, she was also able to combine the paper with relatively inexpensive copper nanoparticles. "The paper is really thick and sturdy, it has less than one weight percent of silver in it", explained by Theresa Danovich, speaking at the 250th ACS National Meeting & Exposition at Boston, US.

The filter pages are able to bring the level of E. coli in treated water down to less than 10 colony-forming units (CFU) per 100ml from an initial value approximately 200,000 CFU per 100ml. Further field testing campaigns with the non-profit organization, WATERisLIFE, in northern Ghana and Bangladesh suggest that the silver-doped paper can remove up to 99.9% of the E. coli bacteria present in a sample. One page can theoretically filter one person's water for up to four years and resembles a thick coffee filter (washingtonpost.com). Each page can be torn out to be used for filtration but is also embossed with informative sanitary advice for local communities. Dankovich said the microbes are killed when they absorb the silver or copper ions from the nanoparticles in the paper. "Only a few milligrams of silver are needed to be highly antibacterial". On a wide scale picture this could possibly solve numerous water crisis around the world. It's cheap, innovative, and extremely easy to use while also providing education to the person that uses it.

Overall, there are many ways that we can help developing countries in need of filtered water, and proper sanitation methods that can lower the risk of disease and increase the population inside it. Whether it's using fog catchers, WaterSeer, or the drinkable book, to help this problem; these options help to provide clean, sanitized water for many generations to come. By 2030 I hope to see more technology for proper sanitation being used and created around the world. This is the start of a new light shining its way through to happier, healthier lives. Albert Szert-Gyargi once said "Water is Life" and "There is no life without water", the most valuable resource in the world makes us who we are today, all life in this world is composed of water and need to ingest it to survive. With the population increasing rapidly, we're going to need a lot of this valuable resource to fulfill our needs. With new technology being created from this generation, there is no doubt in my mind we'll be able to achieve the goal of providing clean drinkable water to the numerous citizens across the globe.

Resources

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