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Guatemala, Factor 9: Water and Sanitation

Guatemala's Guerra por Agua

Lake Atitlán is known as one of the most beautiful lakes in the world. However this jewel of Guatemala, is currently struggling to live up to its reputation. Lake Atitlán's beauty is marred by an increasing amount of algae blooms, causing the water to be greener in areas where the cyanobacteria is present in high concentrations. The thick colonies of bacteria float on the surface of the water, completely altering the appearance and clarity of the water. Besides visually displeasing, the growths present major risks to the environment, economy, and health of residents in the municipalities surrounding the lake. Children are especially at risk for contracting diseases. The systems in place to deal with water pollution are overwhelmed and ineffective at addressing the current situation, as well as being too expensive for communities to support. Action must be taken to reverse the effects of neglect inflicted on Lake Atitlán and serve as an example for other polluted water sources in the country.

Guatemala, a Latin American country neighbored by Belize, El Salvador, Honduras and Mexico, has an estimated population of 15,460,000, over half of which live in rural areas ("Guatemala"). The majority of the population is centralized in the southern, mountainous region of the country where the climate tends to be cooler than the lowlands, but conditions are still considered tropical ("Guatemala"). In Guatemala, 14.2 percent of the land is arable, 8.8 percent of which is permanently dedicated to producing staple crops like sugarcane, corn, bananas and coffee beans ("Guatemala"). Agriculture is very important to the economy, providing nearly a third of the work force with jobs ("Guatemala"). The average farm size ranges from about 1.5 to 6.1 acres ("Family Farming"). Often smaller farms are used to help sustain the families that own them, but many larger fincas, or plantations, exist to sell and trade produce for a profit. Despite the prominence of agriculture, other industries such as tourism and service are gaining greater influence in Guatemala's economy, providing significant income to areas that receive a lot of visitors, like Lake Atitlán ("Guatemala").

With the highest birth rate in Central America, Guatemalan women on average have two to three children each ("Guatemala"). The modern family diet is a mixture of Spanish and traditional Mayan dishes, consisting heavily of corn, beans, squash, papaya and plantains if available. If the family is fortunate they can afford to supplement their diet with meat from local fishing or hunting (Griffith et al). Due to unbalanced diets, 12.6 percent of children under the age of five are found to be malnourished and underdeveloped ("Guatemala"). Children not receiving the proper nutrients at a young age develop cognitive issues, which might affect how students learn. Guatemala has seen a dramatic increase in primary school enrollment, however, of those enrolled, only three quarters graduate from sixth grade and from there less than 40 percent continue their education ("Education"). There is also a noted gap between enrollment of children from rural and urban communities ("Education"). This education deficit leaves youths without the basic life skills to compete for work in communities increasing in urbanization, marginalization and unemployment ("Education").

Like nutrition and education in Guatemala, water quality and sanitation has advanced in the past decades, but is still lagging behind many other nations. Drinking water cleanliness has improved for 98.4 percent of the urban population and 86.8 percent of the rural population, yet 22.5 percent of urban areas and 50.4 percent of rural areas do not have access to sanitation facilities ("Guatemala"). Although these statistics may seem hopeful, they are considerably low compared to other developed countries like the United States. The US has nearly 100 percent improved access to sanitation plants for both urban and rural areas ("United"). Until communities are guaranteed a constant supply of safe drinking water, it will not matter

how much the conditions in Guatemala have improved. People are still being harmed by the uncontrolled dumping of untreated wastewater into one of Guatemala's largest freshwater sources.

For more than 70,000 inhabitants, Lake Atitlán serves as a source of drinking water, a staggering number bearing in mind the current environmental state of the lake (Ferrás et al). While the lake water was once safe to consume in the 1940's and 50's, population growth and boosted industrial activity has polluted the once pristine waters (Abbott). Thousands of liters of raw sewage enters the lake everyday without any treatment. Nutrients from the sewage, specifically phosphorus, sulfur and nitrogen, combined with the warm climate of Guatemala, provide the perfect conditions for exponential growth of cyanobacteria (Abbott). Cyanobacteria colonies not only make the water appear a blue-green shade, but use an exorbitant amount of oxygen to break down the sewage (Ferrás et al). Other heterotrophic organisms in the lake are deprived from the oxygen that the bacteria are consuming, which can be detrimental to fish populations that cannot survive in these conditions (Ferrás et al). Additionally, in the case of Lake Atitlán, the blooms are producing harmful toxins that can be deadly to both the animals in the lake and humans who come in contact with the toxins (Abbott). Cases of waterborne diseases have been recorded in high numbers among children (Marroquín). Despite living next to a large source of freshwater, families face the conflict of choosing between the lesser of two evils, dehydration or disease; many opting for the latter just to survive.

One shift in the environment can cause a powerful cascade of effects. Many people have gotten illnesses contracted from drinking the water out of the lake or consuming fish in which the toxin has been concentrated (Abbott). As more and more inhabitants suffer from diseases related to the water pollution, fishermen have a harder time convincing buyers of the quality of their product (Abbott). Those buyers then have to spend more money on imported fish while struggling to attract tourists to their businesses because nobody wants to visit a filthy lake (Abbott). Economically, rural communities are hit the hardest. A fisherman's income is entirely at jeopardy if he cannot sell his product, and any effort to do so puts the fisher at risk of contracting the very diseases that are killing his business. Fishing has been a way of life for generations and for some families it is the only life they know. However, a lack of income is not the only way families are experiencing the effects of the pollutants. Women without access to electricity do all of their laundry along the shoreline of the lake and are constantly drawing on the lake as a resource to provide for their families (Abbott). A group of women from the town San Juan La Laguna were actually the first to report outbreaks of the blue-green bacteria (Abbott). Slowly, the contamination is seeping into every crevice of life around Lake Atitlán. Unless immediate action is taken to reverse the current state of the lake, conditions will continue to worsen and place greater hardship on the communities directly impacted.

Cleaning up Lake Atitlán is an enormous and potentially expensive project. It is clear that the first step is to stop the expansion of the cyanobacteria growth as soon as possible. One potential option to containing the bloom is the use of barley straw bales in small polluted areas. As the barley straw is decomposed in the water, the free radicals released are believed to inhibit the division of bacteria cells (Rajabi et al). Although the blooms will not decrease in size, the barley will help slow the rate of growth while other projects are being implemented (Rajabi et al). One such project is the establishment of buffer strips along the coastline and around the perimeter of farms to prevent fertilizer and other polluted runoff from entering the water system ("Vegetation"). A buffer strip consists of deep rooted plants that help filter out nutrients from sewage and fertilizers before they enter the lake ("Vegetation"). The buffer strips will not be able to sufficiently remove all of the pollutants in the ground water, but are a cost effective method that will positively impact the project ("Vegetation"). Until better plumbing systems can be put into place, the buffer strips will also be able to catch more of the polluted water that leaks out of the existing pipes before making it to a water treatment center. Both the barley straw and buffer strips are relatively simple solutions that do not require a substantial amount of funding. A long term solution for Lake Atitlán could be much more costly, such as the construction of efficient wastewater treatment plants (WWTPs).

Around Lake Atitlán there are already twelve WWTPs established (Ferráns et al). Even with all twelve plants, the amount of waste water produced in a single day is greater than what the plants can process (Ferráns et al). Roughly 55 percent of wastewater produced will be sent to be treated at one of the twelve plants, however due to leakage, only 20 percent will actually be treated before returning to the lake (Ferráns et al). The 20 percent treated still contain high levels of pollutants because the WWTPs handle waste poorly and the systems in place are flawed (Ferráns et al). Four of the WWTPs use activated sludge technology to sanitize the water. This process is very complex, requiring constant electricity and highly trained staff present at all times (Ferráns et al). These WWTPs place a large financial strain on the local communities. An additional problem contributed by Guatemala's election process, is that every three years local government officials are replaced. The staff at the wastewater treatment plants are no exception (Abbott). Inconsistent monitoring and changing of personnel cause frequent malfunctions and erratic treatment.

The operating WWTPs are not practical considering the current economic instability in the Lake Atitlán basin area. Constructing brand new facilities with state of the art technology is not feasible either. A more reasonable solution to wastewater sanitation are creating artificial wetlands, very similar to buffer strips but on a much larger scale and more effective. There are three basic stages of water treatment in constructed wastelands (*Constructed Wetlands*). First, any solids that cannot be broken down, like plastic, are removed through filtration (*Constructed Wetlands*). Next, the organic solids are separated during sedimentation, a simple process used in nearly all treatment plants (*Constructed Wetlands*). Gravity causes any solids to settle to the bottom of a septic tank to later be broken down by the microbes present (*Constructed Wetlands*). Finally, the remaining effluent reaches the actual wetland. Using a drainage system, the effluent is equally distributed across the wetland, passing through a media of rocks, soil, and roots (*Constructed Wetlands*). This media creates the ideal environment for microorganisms to readily absorb the undesired nutrients in the wastewater (*Constructed Wetlands*). Any deep rooted grasses native to the area could be effective for this process without having to introduce a foreign species ("Constructed Treatment"). In addition, an aeration system could be installed beneath the layer of rocks to force air into the aggregate and increase the activity of the microbes. Although the air would act as a catalyst for microbe activity, this is not a necessary step (*Blue Crane*).

As to be expected there are advantages and disadvantages to implementing wetlands. One positive for the Lake Atitlán area is that the constructed wetlands could potentially be linked to the twelve existing sanitation plants that already have sedimentation tanks in place (Ferráns et al). By repurposing the systems already available, no space has to be wasted while cutting down on construction costs as well. Once built, artificial wetlands require less capital and energy to maintain, decreasing the financial pressure placed on communities responsible for funding the operation of the plants ("Constructed Treatment"). Locals could even be hired to manage the simpler mechanics of the wetlands with less training ("Constructed Treatment"). On the downside, it is common for the aggregate in wetlands to become clogged by solids, leading to polluted water running over the rocks in small rivers, instead of through the rocks (*Constructed Wetlands*). This makes the filtration and sedimentation stages crucial to the entire process. It should also be considered that Lake Atitlán is surrounded by mountains, creating steep slopes that may result in decreased efficiency of the system if construction is not carefully advised by experts and engineers. Lastly, as important as preserving the water quality and environment is, the artificial wetlands should not take away land from individuals without consent from both parties and fair payment, as land is a valuable resource in Guatemala.

So many factors play into the revival of just one lake, and every lake is different, Lake Atitlán can still be used as a model for Guatemala to further improve water quality throughout the entire country. Considering Lake Atitlán's location in the southern region of the country, surrounded by a mix of urban and rural communities comprising the majority of the population, the lake reflects a fairly accurate

depiction of the average Guatemalan. The cost-effective solutions that would be put into effect at Lake Atitlán emphasize simplicity and sustainability in their practice. Such values should be carried through to any future programs. It is important to first focus efforts in one area, such as Lake Atitlán. Citizens must be convinced that the new systems are trustworthy and are meant to aid the people, not take advantage of them. That is why the first two stages of treatment previously listed, placement of barley straw bales in the water and planting buffer strips around at risk areas, are essential to starting the process. These two straightforward suggestions could easily incorporate community members. Once involved, they take ownership in the project and there is the opportunity to further educate the individual about water sanitation. Habitants around Lake Atitlán realize the importance of the health of the lake to their livelihood and have already started clean up initiatives to remove trash from their waters and surrounding area (“Lake”). The interest exists to rescue Lake Atitlán, something that could spread across all of Guatemala once the first effort is made.

Although cheaper than the construction of past facilities, artificial wetlands will still be a huge task to tackle financially, especially for Guatemala, a country gripped by poverty and corruption. Guatemala’s government ineffectively handles cases of corruption and often is the source of dishonest behavior. Funds that should be used to serve the public are often diverted to personal use (“Corruption”). That is why it is necessary to involve outside organizations to help fund and organize the building of the wetlands. Such organizations could include USAID or the World Bank. However, while USAID or the World Bank could help create life changing improvements in the Lake Atitlán area, there are still other polluted lakes in Guatemala that need the same attention. Through education, people could not only realize the importance of rescuing their water sources, but what they can do to aid the process as individuals. The more vocal and prominent the public is in the conservation of Lake Atitlán, the faster change will come to the area and beyond.

Water is Earth’s most precious resource. If it is not treated as such and serious problems are continuously ignored, it will be impossible to provide safe drinking water. Improving conditions at Lake Atitlán is just the start for Guatemala as it is not the only lake suffering from the mishandling of pollutants and chemicals in the country. However this is not just a problem Guatemala faces and the story of Lake Atitlán is not a unique situation. Many lakes around the world are on track to reaching the level of pollution as Lake Atitlán, are already there, or unfortunately have been suffering from worse conditions for many years. Yet all of these lakes can be saved, resulting in a more healthy life for the local people. Safe drinking water should be a top priority not only for world leaders and scientists, but every citizen of the world, considering that preserving water purity could easily be equated to preserving the future of Earth itself.

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