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## Guatemala: Water Scarcity and Its Effect on Agricultural Productivity, Household Income and Food Availability

On January, 1, 2017, Guatemala's population was estimated to be 16,856,938. 60 percent of the population depends on agriculture which makes up 25 percent of the country's Gross Domestic Product, with that percent on the rise (Corps of Engineers). The distribution of agricultural land is exceedingly uneven as 70 percent of the land is owned by three percent of landowners resulting in monopolization of the land and large underpaid workforce. The poor agricultural laborers contribute to the 80 percent of the population that lives below the poverty line and the 60 percent that live in abject poverty with the average annual income of \$3,904 (New Agriculturalist). The limited average income leads to rampant malnutrition throughout Guatemala. Guatemala is currently ranked fourth in the world for the highest chronic malnutrition; leading Latin America and the Caribbean for the highest rate of chronic malnutrition. Nearly half of Guatemala's children younger than 5 years of age exhibit stunted growth due to chronic malnutrition. The problems associated with poverty are partly caused and exacerbated by the chronic problem of poor water availability. There is no shortage of water in Guatemala. Eighteen major rivers from volcanic highlands flow through the country. The problem of water shortage stems from pollution, deforestation, uneven rainfall and population distribution, and poor water distribution on a government level culminating to water scarcity throughout Guatemala (Corps of Engineers). Water scarcity in Guatemala has decreased potential harvest and limited the income and nutrition available to the average family. This is a problem that is continuing to grow and affect the poor, especially in rural areas. The issues of population growth, pollution and unsustainable environmental practices continue to grow and needs to be addressed in order to improve food security in the coming decades.

The majority of the available water in Guatemala is surface water from rivers and lakes. Due to high levels of pollution some of the country's largest rivers and water supply sources have been rendered useless. The problem of polluted water has resulted in extremely limited available water in Guatemala. This, in turn, has led to a scarcity of clean water that can be used for agriculture. Consistent standards on dumping and sewage where none are in place would greatly assist in addressing this problem.. The few water treatment plants are barely functioning or shut down (Food Assistance). The opposition to reopening them is the cost. Therefore, more consistent standards and enforcement on pollution of these water sources would be beneficial in this particular field. Cleaning the abundant natural water in Guatemala would be a good first step in reducing water scarcity.

Another cause of water scarcity is deforestation. Deforestation contributes to accelerated soil erosion. Soil erosion also causes contamination and a lower quality of water. The erosion also causes streams and channels to be clogged which prevents water from moving downstream limiting natural irrigation and other water systems. The clogging leads to unstable and changing water patterns which harm the forestry and increase deforestation. Fixing the clogs is an expensive process, a challenge for poor municipalities which are typically affected by the erosion problems caused by deforestation.

Deforestation is a difficult problem to solve due to conservation not being a value of Guatemalan culture. This problem is especially prevalent in the poor regions where the population depends on wood for heat and fire because of limited or no access to electricity. Educating the rural Guatemalans on more sustainable environmental practices, to see the benefits of conservation to them would be another important step. Environmental groups from the United States have made efforts to work with municipal

government agencies of Guatemala, such as the National Institute of Forests and the Quiche Water and Sanitation Network, to promote these practices. (Guatemala).

Deforestation has also been linked to rain shortage. The unstable levels of water caused by erosion translates to unstable levels of rain. The erosion causes streams to dry up therefore causing less water to be absorbed into the air which leads to less rain. (Corps of Engineers). This especially becomes a problem during Guatemala's dry season (World Factbook). The problem becomes even worse when the dry season is coupled with natural disasters, such as an El Niño drought.

El Niño weather conditions, during the years of 2015 and 2016 have resulted in Central America's worst drought in 35 years (Food Assistance). Poor harvests yield low rates of production in agriculture, which leads to loss of jobs, followed by falling family incomes, further reducing food availability to a region with pre-existing food scarcity. Corn tortillas, consumed at every meal, are a staple in the Guatemalan diet. However, the recent drought has destroyed corn harvest by an estimated 80% with an estimated loss of 70% of the bean harvest from the 2013 cycle (Relief Web). The Guatemalan regions most affected are the northeast, north central, and the northwest regions. These areas combined are referred to as the "dry corridor."

The Guatemalan government is assisting the agricultural communities by applying alternative techniques such as raising drought-resistant varieties of corn and beans as well as utilizing additional alternate techniques such as terracing, which assists in conserving water while preventing erosion of soil. Due to the slow onset of complications and problems resulting from a drought, response to drought conditions is mistakenly not treated with the same urgency as other natural disasters such as floods, hurricanes and mud slides, that have immediate devastating impact. According to Jacob van Etten, from Bioversity International, "However, early action on drought through forceful responses could help secure millions of livelihoods and regional food security." (Innovative Drought)

Many world organizations are banding together in an attempt to assist Guatemala during this period of devastating drought. Some organizations, such as the Catholic Relief Services, have been very active in Central America for over 40 years and have assisted during drought conditions within the last decade by providing seeds to farmers affected by drought. More recently, the United States Agency for International Development and the Catholic Relief Services have developed a Food For Peace (FFP) project where mothers in Guatemala are taught to raise vegetables in home gardens to improve nutrition and the health of their families (Relief Efforts).

In addition, these home gardens are allowing Guatemalan mothers to directly sell some of their home grown vegetables directly to markets, providing additional family income. The FFP also distributes food vouchers to families, assists with nutrition to children, expecting mothers, and mothers who are nursing their infants. Additionally, the FFP provides assistance by improving current agricultural practices, diversifying crops, and by increasing families access to water as well as by improving families sanitary conditions (Home Gardens).

An emergency response plan was developed following visitation to the region by the several dignitaries who confirmed the status of the current low level food stock and loss of crops. There is a limited access to water for human consumption, which, as estimated by the response team, 23% of families in the region did not have drinking water (Food Assistance). The response team discussed the current food crisis status with community leaders and local authorities, advised the central government to declare a state of emergency and then advised the central government to coordinate and implement measures for humanitarian intervention to include the receipt of \$23.8 million in aid in order to provide training and technical assistance to families regarding soil conservation, establish rapid production of short cycle vegetables, training in reforestation by planting lumber trees and fruit trees for consumption, training in

rainwater collection as well as training in proper water use and prevention of water waste, use of steel-cement storage and use of drip irrigation. The response team was also concerned with putting an end to families implementing survival subsistence measures of selling assets such as tools, farm equipment and animals, further reducing the family's future productivity.

Roughly 60 percent of Guatemala's population lives in rural farming communities. A majority of the people depend on subsistence farming of Guatemala's major exports sugar, coffee and bananas (New Agriculturalist). These rural areas with low populations typically experience high water density. To the contrary, the urban areas, for example, Guatemala City, home to 20 percent of the nation's population are often located in parts of the county with some of the lowest water density. Guatemala City cannot rely on the surface water that is often contaminated. They are forced to seek groundwater options which are often difficult to pursue (Corps of Engineers).

This water concentration in farming areas where a large supply of water is necessary for the production of crops is beneficial, as the vitality of the agricultural economy is crucial to the the country as 25 percent of Guatemala's Gross Domestic Product comes from the agriculture industry. The main products from the industry are coffee, sugar and bananas (Guatemala). The rural farmers also raise livestock as a source of food as well as income. Even though the rural regions have the highest water supply density, as noted above, due to the deforestation erosion, supply is unstable and contamination is a constant issue.

Along with the poor population distribution, the government of Guatemala often has trouble distributing and managing the water. The local supply of water is the responsibility of each individual Guatemalan municipality. There is no national commission to standardize water treatment and supply throughout the country. Some municipal governments are stricken with corruption that also inhibits the equal distribution of water to the rural Guatemalan people. The creation of a national board that helps with water supply distribution among the municipalities would help create regulations and stability for the water supply. It is possible a nationally regulated board would also be less susceptible to corruption on a local level, like a municipal government would be, and would help even the supply of water to citizens.

The best way to handle the issues raised would be an educational movement, such as the one lead by the National Institute of Forests, to help water scarcity in Guatemala as well as other environmental problems. The major goal of an educational movement would be to teach Guatemalans the balance between using the trees for energy for heat and obliterating the environment. It would be impractical to expect Guatemalans to eliminate their reliance on trees for energy due to the limited reach of electricity throughout the country. Instead it would be most practical for teams from the National Institute of Forests to go to the regions of Guatemala that are most impacted by deforestation, a root of water scarcity problem. These teams would instruct the rural Guatemalans on how to best make use of the trees they cut down and the importance of gradual recultivation of the forests over time. They would stress the importance of being sustainable in environmental practices, the importance of conservation and the negative impacts on their community if these ideas are ignored. The education of Guatemalans, especially those in rural areas would not only help to reduce deforestation, water scarcity, it could potentially set off an entire cultural movement that changes the way Guatemalans view protecting their environment.

The water scarcity crisis in Guatemala is a product of many complex factors. These factors include naturally occurring weather patterns, such as El Nino; others are man-made, such as pollution and deforestation, which is part of a long-standing cultural mentality; and finally, poor water distribution on a government level. It would be impractical to think that an entire cultural mindset can be quickly changed to reduce water scarcity. That is why it is extremely crucial to identify the smaller problems and address them one by one. Working with the Guatemalan government to create sustainable logging practices to help combat deforestation and projects like small home gardens are important steps to be taking in order

to solve the larger problem. The sum of all the small steps being taken to eliminate water scarcity will culminate in a larger impact on a national level. By promoting and improving the the availability and quality of the water, the nation's agricultural industry will also improve. For a country that depends in so much on agricultural production, these steps will lead to the overall growth of the country. From this growth, better pay and better standard of living for the poor of Guatemala can occur, reducing the percentage of people who live below the poverty line.

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