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### Decreasing Malnutrition in Guatemala Using Hydroponics

“Why is it that a fertile and agriculturally productive region that can produce a variety of foods is the very same region where child stunting has reached a staggering rate?” (“Malnutrition in a Land of Plenty.”) Achieving the Millennium Development Goals (MDG) in Guatemala and around the world will require specific solutions for eradicating the undernourishment of children. Breaking the cycle of poverty and malnutrition is essential to meet the specific Millennium Goals: 1-eradicating extreme poverty and hunger, 4-reduce child mortality, and 5-to improve maternal health. In a tropical land with plentiful water and resources, children go to bed with hunger pangs and struggle to complete daily tasks. Thirteen percent of children under the age of 5 in Guatemala are underweight. Chronic malnutrition in Guatemala is a prevalent problem. Children are not receiving the nutrients required to promote brain development and physical growth. About 46 percent of all children worldwide under the age of five suffer from chronic malnutrition. “Research based on studies of thousands of children in four countries (Ethiopia, India, Peru and Vietnam) found that at the age of eight, children who are stunted due to chronic malnutrition are 19 percent more likely to make a mistake reading a simple sentence like “I like dogs” or “The sun is hot” than they would have been expected to do had they not been stunted” (Burkle and Eileen). Without proper brain development and physical growth, the child has no chance of prospering and escaping from the horrors of poverty and chronic malnutrition. While Guatemala has plenty of fertile soil and access to water, small farmers are not able to plant their crops because a small part of the population owns most of the land. Also, farmers are not able to meet the required rent. This makes it almost impossible for people living in rural Guatemala to produce enough food for themselves and for their families. A vicious cycle is created which continues for generations. It is time to change the pattern through implementation of creative food production methods.

Most families in rural Guatemala struggle to get by. Rural Guatemalan families are, on average, made up of about four people. They are subsistence farmers at best. They receive little to no education because they do not have access to a school, nor do they have the money to attend a school. In addition to not being educated, families have no access to health care services. Mothers do not even recognize that when their children are malnourished, they are at great risk of death. Rural families have suffered from chronic malnutrition for so many years that they just think of it as normal. Also in a study done by Save the Children, it was found that literacy rates drop by twenty percent when children are malnourished. The effects of malnutrition hit even deeper too. Malnutrition in children and adults affect the economic growth and prosperity of the nations government. When the economy is bad it makes it even harder for people to make money to buy food from the market, seeds, or animals.

Not all parts of Guatemala experience the same struggle with hunger. For example, in urban areas some people have a well balanced diet which is mostly based on corn and beans. The corn is commonly used to

make tortillas, a main staple food of Guatemala as well as in many other southern countries. In addition to corn and beans, people have access to squash, chillies, tropical fruit, cocoa, and wild game. Rice has also become a main part of their diet when it was introduced to them by the Spanish in the 16th century. However in rural areas of the country, hunger and malnutrition is where the major problem exists. They too depend largely on corn and beans because it is about all they can afford. "Just three years ago, one quetzal — about 15 cents — bought eight tortillas; today it buys only four. And eggs have tripled in price because chickens eat corn feed" (Rosenthal, Elisabeth.). It is said that a child can eat eight tortillas and some beans and be full, but they are not well nourished. The food that they can afford is not enough. Corn tortillas and beans do not provide the children with all the nutrients that they require. In addition, infants are not usually breastfed for the first six months after they are born. By not being breast fed the infants are also not receiving the proper nutrients that they require. Instead infants are often fed coffee, with small amounts of solid foods. Researchers worry that the caffeine found in the coffee can have effects on the child's iron status. They also believe that it can affect the child's growth, development, sleeping patterns, and nutritional habits ("Guatemala - Diet."). It is very important for children to receive the required nutrients in the early stages of their lives, or it can leave a negative impact on them for the rest of their life if it does not kill them first.

Small subsistence farm families in Guatemala struggle each year to produce a crop yielding them with enough grain to feed their family and to pay for must need items. Most often they plant corn (maize) each growing season. The problem though is that they are being pushed off of the land to make way for sugar cane farms. Sugar cane farmers are willing, and able, to pay double of what the corn farmers are for rent. Guatemala has plenty of fertile farm ground to be farmed, but only about 2.5 percent of the population controls and owns 65 percent of the arable land. This makes it hard for small farmers to find good and fertile soil to farm (Teffer, Peter, Mr.). Also because they struggle to grow enough crops just for themselves, they can not handle raising any livestock. So where do these farmers plant their crop? Anywhere they can. In an article written by the New York Times on a small Guatemalan farmer, they watched as he harvested his corn crop for the median of a highway as trucks and cars sped by him. He said "We're farming here because there is no other land, and I have to feed my family," said Mr. Alvarado, pointing to his sons Alejandro and José, who are 4 and 6 but appear to be much younger, a sign of chronic malnutrition" (Rosenthal, Elisabeth.). This is just one example of the lengths these people go to in order to try to provide for themselves and their children. This is happening all throughout the country and needs to end.

While rural families struggle to produce food, there is no way for them to improve their methods of farming. One major barrier for improving their farm practices is the amount of land available. Instead of improving, they are becoming worse because of the fact that they have no land to farm. They are also not able to become employed anywhere because they live in rural villages where there is no employment opportunities and they do not have the means to move to a larger city and hold a steady job. Another problem that they face when not producing enough corn or other crops is that they have no income. If they are not even able to produce enough food to eat then there is no way that they are going to have any extra to sell for a profit. It is a vicious cycle and it is only getting worse. If land was available to them it would be a completely different story.

Since Guatemala has such a problem with malnutrition, I have chosen malnutrition as my factor.

Malnutrition affects children, adults, and the country's economy in every way possible. It affects their agricultural productivity because they do not have the energy to plant their crops and harvest them. They also can not find any farm land to plant their crops. Also because they can not plant any crops there is no way for them to raise livestock. Since they are not able to produce any food, they become even more prone to malnutrition. When families are not able to feed themselves it affects not only them but future generations to come. There is no way to avoid malnutrition if they can not produce food. Malnutrition is seen all over Guatemala today. About 46.6 percent of all children under the age of five suffer from chronic malnutrition in Guatemala ("Child Malnutrition in Latin America and the Caribbean."). This means that almost half of the children are malnourished and that if they are not provided with food this number will only grow and slowly the population will begin to decrease in the country. Teams are trying to help reduce this number by bringing in food for the people in Guatemala, but there is too many that need help. Often girls are forgotten about and the boys will be fed because they will be the ones to help on the farm when they grow up. This means that more girls are falling victim to malnutrition and it is proving fatal. Also support teams will often have to stop providing food and nourishment to one child due to the fact that there is another child in worse condition. This means they once again take away the vital nutrients that the child needs.

If malnutrition in Guatemala was to become almost non-existent, it would not only help the people themselves but also the country. When people are too poor to buy food or other goods there is no money flowing through the government. This causes the government to be very unstable. If people could grow their own food and raise their own animals they would be able to sell excess crops or bring their livestock to market. This would boost the economy and rejuvenate the economy which, in the long run, will help everyone. Just look at the United States. Even when we hit a small recession, things are much harder for everyone. People may lose their jobs and then they have no way to provide for their families. Imagine that but even worse all of the time. Also the population can affect the amount of people that are suffering from malnutrition. More people mean that more food is required, but if there is not enough land in the first place then how will it be able to provide for even more people? The answer is, it will not be able to.

I believe that Malnutrition in Guatemala can be reduced and ultimately solved by providing people with hydroponic fodder systems. The hydroponic fodder systems would allow families in rural areas to come together and produce a large amount of feed in a small area all year round. The fodder systems would allow them to produce enough feed to sustain livestock such as a small herd of goats providing meat and milk, rabbits providing meat, or chickens providing meat and eggs. From these animals the families would be able to provide enough food, at a relatively low cost, to help meet their nutritional needs. They could also sell any extra animals or products from the animals to make a profit.

A hydroponic fodder system involves placing seeds into trays or channels in which water is allowed to pass over intermittently to keep seeds moist for germination and growth. Seeds are first soaked in a mixture of water and bleach in order to inhibit fungal and bacterial growth. Once seeds sprout, they have enough energy packed into them which allows for "turf" or "fodder" to develop within 5-7 days. At that point the fodder is rolled up and fed to livestock or used for people. Fodder has been shown to contain valuable nutrients and more protein than traditionally grown crops. Fodder is easy to digest and a fresh food source regardless of climatic conditions. Growing fodder in a greenhouse situation also would allow for control of pests and factors related to weather. More livestock (rabbits/poultry) can be supported on

fodder than in-soil crops. Energy for pumps can be off-grid by utilizing wind, solar, or geothermal sources.

Hydroponic fodder systems do not have to be a commercially made item that is purchased. They can be made from just about anything that can hold water. Commonly they can be made from old plastic containers or plastic tubes. This makes it possible for a lot of people to be provided with systems at a very low cost. People in Guatemala could also be provided with an actual commercially produced system in which they could then form a co-op with other area families. At first they would have to be provided with the seed that is needed to grow the fodder, but after the families get set up and have been running for a while they will be able to grow their own seeds. They would be able to feed animals and then from the animals they would be able to spread the manure on land that is not necessarily suitable for farming such as the median of the highway that Mr. Alvarado is farming. From these crops they could produce their own seeds. If they are not able to produce seeds then they could still be provided by outside sources until they are able to be self-sufficient. Initial investment will pay off through increased health and nutrition.

Providing education for setting up and operating hydroponic systems could be the responsibility of government entities or outside organizations. Seed banks and tool loan programs could be established through the International Fund for Agricultural Development (IFAD) or the World Bank. Skills obtained by Guatemalans through these educational programs would allow people to expand job opportunities and help pull communities out of poverty. According to IFAD, “small-scale farmers are able to oversee funding for technical and other assistance to rural development projects. In the process, they become the drivers of their own development.” This demand-driven approach ensures long-term sustainability for project investments. (IFAD)

In a country blessed with fertile lands and excellent growing conditions malnutrition and hunger should not exist. Unfortunately for many Guatemalans it still does. My suggestions for unique growing alternatives on a small land footprint increase hope and opportunity for the subsistence and smallholder rural families. Education and implementation of hydroponic systems will provide success for meeting Millennium Goals to reduce issues related to malnutrition. Fodder systems are relatively easy to organize and establish. They would require minimal outside investment and assistance for initial execution. The original investment is recouped in healthier people and a more productive economy. According to IFAD, “Ultimately, nutrition is a sound investment choice for national development. Sustained investment in nutrition-related services will have high returns in terms of a stronger and healthier population that will be more productive and better able to withstand shocks.” Guatemalans are hopeful people and I see the hope that hydroponic fodder systems and education related to this technology can bring to the people of Guatemala by improving nutrition and the quality of life. Improving nutrition and breaking the cycle of poverty while having control over food supply will benefit this part of the world and the people who call it home.

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