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Irrigation Crisis in Ethiopia

Every three and a half seconds, someone, somewhere in the world, dies of hunger or hunger related causes. That's 25,000 deaths every day. Unfortunately, it is children that suffer this untimely and unfair end. Can you imagine waking up and not knowing if you have a meal today? What about having to alternate eating days with your siblings? Most Americans can't even comprehend the troubles that other countries are going through to sustain their people.

The Earth has a certain capacity of how many people it can support. Right now, the Earth is barely keeping up with the population. The land used for agriculture needs to become more productive if we hope to be able to feed everyone in the future. Ethiopia, for example, farms on dry ground and doesn't get rain nearly enough to sustain their crops. Other countries suffer from infertile land or severe flooding. In order to fix these problems, they need money that they don't have to buy machinery and materials necessary to increase their yield. Poverty is a downward spiral. In Ethiopia, the cycle starts off with a dry growing season. They don't make any money and they don't have enough food to support their families. The next growing season, they grow the same crops on the same fields because they don't know any better. The nutrients needed to grow these crops are no longer in the soil so, again, they have a small yield growing season. They also have an ineffective and inefficient agricultural marketing system. Pair this with underdeveloped production technologies and limited access to support services and what you get is poverty with no way out.

Ethiopia is one of the most poverty-stricken countries in the world. In 2000, 23% of the population made one dollar or less per day. This percentage is already great progress since 1995, when 31.3% made less than one dollar. However, one dollar is not enough to sustain anyone and great progress still has to be made. In 2000, 47.2% of children under the age of five were moderately to severely underweight in Ethiopia. This figure is extremely alarming and is up from 44.8% in 1998. In order to feed these children, they need to be educated in agriculture to make their fields more productive. Unfortunately, only 72.3% of children were enrolled in school in 2007. There are several other problems that center around poverty in Ethiopia. One hundred twenty-three children die by the age of five for every 1,000 live births. Only 63% of children are immunized against measles by the age of one. Seven hundred twenty women die in childbirth in every 100,000 live births. Six hundred forty-one in every 100,000 people have tuberculosis. HIV and AIDS have infected 2.2% of the population between 15 and 49 years of age. Only 42% of the population is drinking improved drinking water. As you can see, Ethiopia has many problems that need immediate attention. Poverty is like an infectious disease. Just as we cure disease, we don't treat the symptoms if we know how to eliminate the cause. We need to eliminate the cause of poverty in Ethiopia as well.

Ethiopia is a high, dry plateau divided by the Great Rift Valley. Every year, crops suffer from drought. If crops don't have enough water, they can't grow to have a high yield. Also, the same crops are planted on the same fields every year. In this method of farming, the nutrients that are taken out of the soil by the crops are not replenished by other crops; therefore, there are lower yields every year because the crops don't have the water or nutrients necessary to grow. It is extremely important for Ethiopian sustenance farmers to be productive on the land that they have. 80% of Ethiopians rely on agriculture as their main livelihood. More than half of those people have only 2.5 acres or less to cultivate. One third of these people have only 1.25 acres to cultivate. That isn't even enough to sustain one family for a year.

The main food production in Ethiopia is comprised of cereals, oil seeds, sugar cane, potatoes, qat, cattle, sheep and goats. Most of the time, these products are extremely expensive due to limited resources

and low yields. There are two harvests, Belg, which is from May to June, and Meher, which is from October to December. Double cropping greatly increases yields, but still is not enough. Agricultural production is solely responsible for fifty percent of the country's Gross Domestic Product, or GDP. Forty-six percent of the population is still undernourished. The Global Hunger Index for Ethiopia is 31, a number that falls into the category of extremely alarming. This is the worst possible category to be placed in. The Global Hunger Index is a scale that measures hunger and malnutrition using three key factors. One is the proportion of undernourished people as a percentage of the total population. The next is the prevalence of underweight children under the age of five. The third is the mortality rate in children under the age of five. The scale ranges from 0 to 100, though neither extreme has ever been reached. This is measured in 120 nations with data available and where the measurement seemed most relevant. Industrialized nations, such as the United States, haven't been measured. There are seven nations that fall into the category of extremely alarming. These are the Democratic Republic of the Congo, Eritrea, Niger, Liberia, Sierra Leone, Burundi, and Ethiopia.

I propose three areas of focus to fix this problem in Ethiopia. First, is the introduction of irrigation which is affordable and efficient. There are several methods of modern irrigation to choose from. They include flood or furrow irrigation, drip irrigation, and spray irrigation. The second is education on how to use irrigation systems and conserve natural resources. The third is genetically engineered seeds to reduce the impact of wide-spread drought.

Flood or furrow irrigation is the oldest method of irrigation. Prehistoric people used this same method of irrigation to water their fields. It remains, to this day, the most common method of irrigation. It is relatively inexpensive and easy. Essentially, it is pouring water directly on the fields. This method is also extremely inefficient. About half of the water that is used never actually gets to the crops. There are three new developments that modern farmers are using to make this method more efficient. Farmers are leveling fields because furrow irrigation uses gravity. Any hill, even a tiny one, gets missed by the water. By leveling fields, you ensure that the water you are using actually gets to all of the crops. Farmers are also using a method of surge flooding. This is releasing the water at pre-arranged intervals. This reduces the amount of runoff and therefore waste from the fields. The last is to capture and reuse the runoff from the fields. Farmers capture the runoff from the fields in ponds and then pump it back to the release point to use for the next irrigation.

Drip irrigation is where water is sent through plastic pipes with holes along the sides of them. These pipes can be laid along the rows of crops or even buried along their root lines. This method significantly reduces the amount of water wasted by evaporation. On average, ¼ of the water used is saved compared to traditional furrow irrigation.

Better yet, is spray irrigation. This is the most modern form of irrigation. It requires machinery to function, so it is more expensive. Spray irrigation uses a center pivot system that is similar to watering your lawn with a hose. Essentially, there is a long tube with holes along the sides of it that sprays water out the holes and out the end. Holding the tube are metal frames on rolling wheels that hold the water tube out into the fields. The metal frames are moved around by motors in a big circle. This creates a well-watered circle of land. These irrigated sections are easily spotted from airplanes; they just look like big green circles of well-grown crops.

The best method of irrigation is another type of spray irrigation. It is much more efficient. It increases efficiency from 60-90% over traditional spray irrigation. In this method, water is gently sprayed downwards from hanging tubes above the fields. This method is used in grocery stores to keep the produce healthy before you buy it. This method is also used in greenhouses. If you have ever put your hand under one of these, you have probably felt a cool mist and not much more. This method doesn't damage the crops at all because it is so gentle. This improved spray irrigation is so much more efficient

than traditional spray irrigation because there isn't a chance for water to evaporate. There is also less chance of the water being blown away by the wind.

All four of these irrigation methods have their pros and cons. I propose that Ethiopians try to use drip irrigation because it provides the greatest benefit relative to capital and operative costs. Flood irrigation is too inefficient to use widely. With a climate like Ethiopia's, it is essential to not expose water to the air for too long because evaporation rates are extremely high there. Traditional spray irrigation is just too expensive for its benefits to try to use widely. The more modern type of spray irrigation would be great to be able to use, but I'm not entirely convinced that it will pay for itself within a reasonable amount of time. Drip irrigation; however, seems to be the perfect balance between efficiency and affordability. I believe that with the proper funding, we can afford to help all sustenance farmers in Ethiopia increase their yields.

The type of drip irrigation that I propose is a new development in the world of irrigation. This form of irrigation is powered by the sun. It was developed by Carolina Barreto, a doctoral student at the University of Massachusetts in the solar energy engineering program, and Professor John Duffy, who teaches in the mechanical engineering program of the university. This system uses a 12-volt diaphragm pump that is connected to an array of photovoltaic cells. The solar energy reduces emissions caused by irrigation. It is relatively inexpensive when compared to the price of powering a gas pump and is easy to maintain. This is a great system to use in Ethiopia because there is sunshine for most of the year. When there isn't, there are often storms and rain, so there would be no need for an irrigation system at that point. In January of 2008, a prototype of this system was installed in Turripampa, Peru. There aren't any results available on this project. The solar powered drip irrigation system should hit the market soon.

In order for these irrigation systems to be effective and helpful, farmers in Ethiopia need to be able to learn how to use them. Education is a problem in developing nations. With only 72.3% of children enrolled in schools, the next generation can't be as efficient and educated as possible. For my second suggestion, I believe that we should set up educational programs for both children and adults. Obviously, public schooling is available for children. However, only some children are actually enrolled in these schools. We could suggest to the Ethiopian government that they should make it mandatory for children to be enrolled in schools, like it is in the United States. For adults, informational seminars should be available for those looking to be more efficient and profitable. In these seminars, adults would be educated on crop rotation, installment and maintenance of irrigation systems, and the use of genetically engineered seeds. One thing that is just as important as education is access to information. One of today's most valuable resources is the internet. In the United States, 69.83% of people are internet users. In Ethiopia, only 0.3% of people are internet users.

There are several programs already in place in Ethiopia, one of which is the Millennium Development Goals. One of their goals is to cut extreme poverty and hunger in half by the year 2015. This goal is still a long way from being reached in Ethiopia. Another program is through the International Rescue Committee. The IRC is drilling five boreholes, or large wells, and rehabilitating two in the Miesso District of Ethiopia. Two more boreholes are being drilled in the Boke District. The IRC is also funding water quality testing that will continue after the project is officially finished. Forty-five refuse pits, which are similar to landfills, and 2,000 latrines are being built. The IRC is educating the community awareness in the use and maintenance of these. Lastly, they are training 176 members of Environmental Health Management Committees. These members will be in charge of developing and organizing a network of community volunteers to train and educate the public on hygiene promotion and environmental sanitation. This program directly benefits 39,483 residents of the Boke and Miesso districts, the two districts hit the hardest by drought. It also indirectly benefits 244,533 people in surrounding areas. The main focus of this operation is to increase the quantity of improved drinking water and to reduce environmental contamination and the risk of disease. There are also Food for Work programs for adults. These are where adult workers are paid in food for their work on schools, roads, bridges, etc. Food for Education programs

are where children are provided with food when they attend school. This is beneficial in multiple ways. It provides malnourished men, women and children with meals. It also improves the condition of communities. It also helps long-term in that children will be able to make educated decisions when they are older that will be beneficial to themselves, their families and the environment.

There are also some programs that center specifically on irrigation. One of these is the A Glimmer of Hope foundation. In areas where the foundation has given irrigation tools, farmers have doubled, tripled and quadrupled their annual earnings. They are able to plant different crops in the two growing seasons, such as tomatoes and corn, because they don't have to rely on the rainy seasons anymore. Many farmers are using this surplus income to buy machinery and supplies for their farms which increases their profits even more. There are several cases of farmers being able to branch out and offer jobs to others in their communities as well. So far, A Glimmer of Hope has been able to fund 33 projects in Ethiopia.

What I want to do in Ethiopia is similar to what A Glimmer of Hope foundation is doing. However, I want to do this on a much larger scale. My proposition is also similar to the International Rescue Committee's plan, only centering on irrigation. In my program, we would be able to provide farmers with traditional drip irrigation systems for as little as $700 per acre. These systems will cost between $875 and $1750 per farmer. Though there currently isn't a cost estimate available for a solar powered drip irrigation system, some inferences can be made about the price. The start up cost will be more than that of a traditional drip irrigation system; however, the maintenance cost is much less. Because you don't have to pay for fuels to run the pump, the system should pay itself off in a few years.

As in all cases, large-scale projects need large-scale funding. This funding would require international support. Countries around the world would have to be on board with this proposal. It would not be easy to gain support of these countries, nor would it be easy to start this program and keep it running. We would need government support and support from individuals. However, I feel that it is our obligation as privileged citizens to help the underprivileged to have access to the same technologies that we have access to. It would be nearly impossible to be able to fund enough money for every farmer to have a drip irrigation system; however, if we could have one or two in each community, the systems would be able to benefit the entire community.

Thirdly, in the cases where we are unable to fund enough money to pay for an irrigation system, we would provide the farmers with genetically engineered seeds. Monsanto, an agricultural science and technology company, is currently working on wheat seeds that will be able to tolerate drought and require less fertilizer to grow. These seeds are a new development, and unfortunately, eight years from now is the earliest they will be able to reach growers. These seeds would benefit entire communities as well because they will have a ripple effect. The seeds will help the farmer, who will then reinvest his or her money into new tools and equipment or labor.

Currently, there isn't an aid program like this in another developing nation. Irrigation in the United States has benefited farmers tremendously, though. Education has generally been effective where ever it has been implemented because there are no drawbacks to it. Genetically engineered seeds have so far been a technology that has been used almost exclusively in industrialized nations. These three components haven't been combined in a single aid program so far.

In summary, food security plays an important role in every human's life and is essential to the advancement of any society. One of the major factors of food security is access to water for crops. Irrigation is essential in parts of the world where rain is inconsistent. The Earth can only sustain as many people as the land can grow food for. If we are ever to eradicate extreme hunger and poverty, the land has to be as productive as possible. If we could install drip irrigation systems in certain parts of Ethiopia, Ethiopians would have the resources necessary to feed all of their people. One of these resources is a

quality education. Education is just as important as the irrigation systems themselves. With the proper education, Ethiopians could dramatically increase the production level of the land they have to cultivate. *Irrigation and education paired have the power to eliminate hunger from Ethiopia.* If hunger is eliminated in Ethiopia, the other problems that they have will be solved more easily. People will make more money, so they will be able to afford better health care, reducing the spread of disease. Health care will also reduce the deaths of women during childbirth and children under the age of five. They would be able to afford and have access to vaccines that they previously couldn't. Irrigation is a serious problem that needs to be addressed as soon as possible. Every day that we wait, 25,000 people die of hunger or hunger related causes. The worst part is, every one of those deaths is avoidable with the right steps. With help, we can give undernourished children a chance to live. We can increase the life expectancy of people in developing countries. We need to work together to make sure that no person goes hungry.

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