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### **Ethiopia: Managing Food and Water Scarcity in Ethiopia**

Access to food is one of the greatest issues facing the world today. There are many causes and many solutions, some simple, others nearly unobtainable. Ethiopia is an example of a country with great water resources, but has multiple problems utilizing that water for food production. There are many different methods of using water resources, with varying efficiency and effectiveness. Choosing the right method can vary and change depending on location, crops and available water, among other factors such as family size and education. All these factors must be integrated and accounted for when trying to render aid. But, some issues must be handled on a smaller, more personal, level. For irrigation on any scale to work, the farmer must be implemented into the building process. Those who benefit most show the greatest interest in a project, and farmers would be gaining the most. They would not be building fortunes, nor would they deal with vast sums of money, but they would be gaining a stability in their lives that has been a distant dream for many people in Ethiopia. But for any aid to begin, one must first understand the people, their land, and their crops.

The typical rural Ethiopian family consists of five people: two parents, and an average of three children. They live in a 30-square-foot house, and many -75% of the rural population- share the same living quarters as the livestock. Most farm a plot of land less than two hectares (a metric unit of measure equaling 10,000 square meters, or 100-by-100 meter dimensions) in size, and 65% consume less than the World Health Organization's daily standard minimum of food (CIA). The typical family would have very little access to medical aid, as Ethiopia has only one doctor for every 100,000 people. (CIA)

Grains and pulses (beans) are the major staples of the Ethiopian diet, but local fruits, root crops, and oils supplement their diet. Crops vary depending on altitude and available water resources, but the major crops are as follows:

**Chief Grains:** corn, sorghum, millet, teff, wheat, and barley. These grains are used to produce a variety of bread and alcoholic beverages. Grains are grown in two main areas and are divided based on heat tolerance and water requirement. Corn, sorghum, and millet are grown in the warm lowland surrounding the mountains, with sorghum and millet being grown at lower altitudes in warmer climates, and corn being grown on the slopes of the mountains, so that it can get its required rainfall. Teff, wheat, and barley are grown in higher altitudes and in temperate climates. (Stallknecht, Gilbertson, Eckhoff)

**Pulses:** many varieties of pulses are grown throughout Ethiopia, in all climates and climate zones, ranging from over 3,000 feet in altitude down to sea level. Pulses grown in Ethiopia include: horse beans, peas, chickpeas, lentils, haricot beans, mung beans, and adzuki beans. (Gryseels, Anderson)

**Root crops:** the major root crop of Ethiopia is the indigenous *ensete* plant, also known as the *false banana*. This plant produces an inedible fruit and enough edible roots to surpass the food potential of grain crops. It is drought resistant and grows in a wide climate range, but it can take five years to fully mature. Because of this, crop rotation is necessary for a sustained harvest. Other root crops include taro, which is not widely grown, due to its dependence on lots of cool, running water; yams, which are widely grown throughout the area due to its adaptation to the local climate; and sweet potatoes, which grow widely in the highlands due to their ability to grow in poor soil. (CIA) (Gryseels, Anderson)

Oils: because of the Ethiopian Orthodox Church banning the consumption of animal fats on certain days, vegetable oils are widely used. Some varieties are: rapeseed, peanut, sunflower, and safflower. They are grown in a wide range of climates, soil types, and altitudes as a supplement to a grain diet. (CIA)

Now that we understand the crops, we must now learn about the land and its people. One of the main problems affecting food production in Ethiopia is lack of irrigation and water management. In the surrounding lowlands, lack of water kills the harvest, while in the central mountain range, heavy rains can wash away a field or drown crops. Lack of terracing causes severe soil erosion and can lead to landslides, ruining land that families depend on. And, in the places where terracing is present, the farmers have not been educated as to how to build more terraces or maintain the ones they have. This has led farmers to continue their traditional agricultural practices on terraces, which causes those terraces to collapse or fail to hold soil. (Gessesse, Klik, Hurni)

Another major issue is soil depletion. Government policy allows families to lease a small amount of land, so they cannot afford to let a field lie fallow and restore nutrients. Many do not have the knowledge or resources to plant “restoring” crops. The result is a vicious cycle: the soil is depleted, so the crop is small, what little there is goes to people, so the livestock must be sold to protect the investment. When the livestock are sold, the family does not have the draft power of that animal and the family is out of a major investment. Without money, the family cannot obtain any more land, so they have to work the same land year after year. As time progresses the yields shrink, as does the farmers’ ability to cope with the changes. (Gryseels, Anderson)

A third barrier is government policy. As previously mentioned, the policies in place do not allow for very much land to be leased per family, despite the leases lasting for at least 20 years (Gryseels, Anderson). Often, the lease is a gamble; the farmer may not know the condition of the soil and cannot know how the seasons will go for the next twenty years. One lean year is all it takes to push an entire community over the poverty line.

One way to relieve the external pressures on smallholding farmers is to improve irrigation and to adapt agricultural practices to cope with water shortages. Water scarcity in Ethiopia is a serious issue, but one that can be solved. Currently, Ethiopia has fourteen major rivers and nine large freshwater lakes. It receives between a minimum average of 74.93 centimeters and a maximum average of 100.1 centimeters of rainfall per year (Cheung, Senay, Singh). Despite the presence of large water reserves, very little work and few resources have gone into developing the country’s irrigation. Because of the lack of sustained water supplies, many crops fail every year, and the farmers have to wait another few months for the next crop to come to fruition. This gap in harvest means that the local farmers have to ration their food and go without proper nutrition until the next crop is ready to harvest.

Among those affected by water shortages, the rural poor are the most immediately affected by it, as they have no other source of food than what they can grow in their fields. Without the resources to put in irrigation systems, and with rainy seasons growing shorter, the situation is becoming more dire. But, lack of water is not the only cause of lessened weakening harvests. Annually, Ethiopian fields lose 1.5 billion tons of topsoil, due to lack of covering vegetation and poor cultivation on steep slopes (Tamene and Vlek).

The condition of the rural farmers has been getting slightly worse each year. Despite numerous projects to improve the amount of land that is irrigated and can be farmed, much is still in the hypothetical stage, so there is much talk, with little work actually being done (You). The potential for change is great: if an optimal amount of irrigation were put in place, then almost 36 million people could benefit and the economy could grow greatly (Tucker, You). But, all that is required now is the irrigation schemes, as water is already present. There are large water reserves available, but Ethiopia lacks the ability to put them to use. There are roughly 11.6 million hectares of arable land in Ethiopia, but only 717,795 hectares

are currently being used (CIA). Of those eleven million hectares, only 5% are being irrigated. While work is being planned, the lack of action is allowing the condition of the farmers to grow worse.

Irrigation schemes can be very easy to construct. One of the simplest and most effective ways to irrigate is to put a porous clay pot between two plants. When the pot is filled with water, the water is evenly distributed to both plants. Other methods, such as drip irrigation and sprinklers, are more expensive and can be more difficult to maintain, but ensure an even distribution of water. These methods use a small, continuous amount of water to reach each plant. But the main issue with implementing these simple schemes is traditional beliefs. Many cultures flood entire fields, as opposed to running water to each plant, maintaining that "if some is good, more is better" (Hillel). Initial progress would be slow, as farmers would be reluctant to give up traditional views. (Hillel)

If irrigation was implemented to its fullest potential in Ethiopia, then close to 2.3 million hectares of existing farmland would become exponentially more productive (World Bank). Crop failures would become a rarity and the population growth would be accommodated. Soil erosion would decrease greatly and soil quality would improve. The nation itself would be able to produce more exports and profits would grow. If Ethiopia would develop its infrastructure as well as increase food production, it would have the ability to export enough food to feed many parts of both Europe and Africa.

Widows and their families, who often cannot provide for themselves, and rely on hired labor, would, unfortunately, suffer initial losses associated with development, but the increased food production would be more than enough to compensate them for the losses sustained. Widows would be hit hardest by the expenses as many are already tight on money, as they often have to hire workers at a loss (Tucker). The main beneficiaries of increased irrigation would be the rural poor and the smallholder farmers, as they depend upon the fruit of their own fields for sustenance.

The only major factor that would stand in the way of irrigation would be finding the resources to employ a workforce and to fund materials. A large workforce would be available, and they would work for a very low price, but a skilled overseeing workforce would need to be imported at a steep price. Due to a lack of education, the Ethiopian workforce is largely made up of unskilled laborers, who would have little idea on how to build an effective and efficient irrigation scheme (Carter). With a combined effort of bringing in foreign engineers to guide construction and educate the public, irrigation efforts could spring up all over the country.

Other factors that may affect the rural farmers because of advances in irrigation would be soil salinization, a buildup of dissolved minerals that can sterilize a field, and a surge in malaria associated with large amounts of stagnant water that are a part of certain irrigation practices (Sommani, Harinasuta). Malaria and parasitic flukes often are spread due to irrigation, and both requires stagnant bodies of water. Malaria is transferred by mosquitoes, and flukes can be found anywhere human waste is used as a fertilizer (Esteban, Gonzalez, Bagues, Angles, Sanchez, Naquira, Mas-Coma). Preventative measures and medication can be distributed to deal with both of these diseases, and in conjunction with equipment and education, the risk of these diseases would be limited.

Soil salinization is a crippling issue for many irrigation schemes, especially in ones where high volumes of water are used over long periods, with no water addition between them. When large quantities of water are moved over any distance, large amounts of salts and ions will be dissolved and carried by the water. When the water dries, the salts begin to cluster together and can sterilize a field. The solution to this problem is to use sparing amounts of water over long periods, keeping the ground continually moist to prevent ions in the water from killing the plants. (Hillel)

The increase in farm productivity will boost the economy and will bring in more jobs into the city, and those jobs will attract immigrants. Restrictive measures might have to be taken to prevent an

unmanageable amount of immigrants. But when the crops become more productive, more land can be acquired, and more land would require more hands. Those hands could be supplied by immigrants. Ethiopia could become one of the major cultural hotspots of Africa.

Some institutions have already placed investments into developing Ethiopian farming and irrigation. Groups such as World Bank, which recently agreed to a 70 million-dollar loan to be used in improving irrigation (World Bank), have contributed financially, but many organizations have avoided Ethiopia, due to the financial risk of developing farmland. Currently, twenty-nine large projects exist, but only ten have actually been funded (World Bank). In the past, African water projects have failed, due to bad design and poor execution (You). This pattern of costly failure has led many stakeholders to become weary of investing in the farmlands of Africa. Water projects have been attempted in Ethiopia, but most lost funding or failed due to the oppressive measures taken by the former Ethiopian government.

Numerous small-scale irrigation projects exist and are aimed at helping the rural farmer. They take both foreign and domestic expertise into account, as well as each farmer's situation and location. Large-scale irrigation is often destructive and costly, but small, farm-sized irrigation schemes, using local water resources, have a high rate of sustainability and success (Carter). However, large-scale irrigation also requires large water storage containers, such as dams, and greatly reduces the amount of available land (Carter). Another advantage that small-scale irrigation has over large-scale is the increase in soil salinity. When water crosses long distances through man-made channels, it partially dissolves and carries ions, such as chloride, from the concrete or soil that makes up the channel. Over time, ions build up to unsafe levels and can even sterilize a field. Small-scale irrigation crosses short distances and will not, in most cases, carry an excess of harmful substances from the irrigation channel (Grattan).

Small-scale groups, like Oxfam America, Agwater Solutions, and RiPPLE, have experience in working alongside farmers and in gathering information about local geography and water resources. If any irrigation effort is to be successful in the long run, the farmers must be taken into the equation and work alongside developers (Carter).

Another point to consider is the prevalence of corruption, such as bribes and extortion, in developing countries. There are many routes to working around corruption, some direct and others more complex. The Ethiopian government, or foreign representatives, could determine the set amount required to implement irrigation schemes and monitor expenses to ensure money goes where it needs to. A system of checks and balances could be integrated over a few years to ensure that corruption is rooted out, or a set monetary amount could be set and results ensured by a third party. Both would take time to be fully implemented and carried out, but laying a permanent framework ensures prevention of crimes in the future and across all facets of the government. (Gessesse, Klik, Hurni)

For small-scale irrigation to be able to even partially resolve this issue by 2015, immediate action must be taken by large financiers, such as World Bank, and by national, regional, and local governments. The cost of improving or constructing small-scale irrigation schemes would cost roughly \$600 per hectare, depending on local water resources and terrain, but the increase in production would be greater than \$400 per hectare in most areas (You). If implemented this year, most farmers would pay off their personal debts by 2014, with their food needs being taken care of in the next crop cycle. Most irrigation units would be manually run, also saving cost. If every current farm was irrigated, the cost would be roughly \$430,677,000, in U.S. dollars (You). Ethiopia has received over 3.5 billion dollars in lending from World Bank alone in the past four years ("Data Profile"). Most, if not all of that money has been stagnating in an Ethiopian bank account for years. With a fraction of this funding, the Ethiopian government could cover the entire cost of the operation, still leaving over 3.1 billion dollars for continual development.

For everything to come together and improve, people and organizations must get involved. As they would be gaining the greatest benefit from the efforts, local communities would need to commit the

greatest share of labor, but the national government and international organizations must provide the funds and the expertise in how to proceed. The local farmers would need to install the irrigation schemes that are designed by international experts and adapted to fit each situation. On-the-job training would be a key part in stabilizing the agricultural sector of the entire region. With local citizens being trained by international experts, they could use their combined education and local familiarity to expand upon the situation in their own areas and in surrounding countries. Sometimes it is necessary to both *give* a man a fish and to *teach* him how to fish. All these will collectively help improve the lives of many hundreds of farmers, even if only implemented in part. Education will improve the situation for many generations, as the knowledge received by the locals will be passed down. Improvements in agriculture and irrigation will allow for a comfortable stability in the region, as a food supply can solve many problems. Every improvement will aid in the situation, and Ethiopia may prosper because of it.

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