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Ethiopia, Factor 9: Water and Sanitation

Ethiopia: The empty water tower of Africa

Often hailed as the ‘water tower’ of Africa, Ethiopia serves as the source of fourteen major rivers in Africa, including the mighty Nile. In addition, Ethiopia boasts the greatest water reserves in Africa, estimated at over 130 *billion* cubic meters, or around 1,575 cubic meters per person per year (1, 2). Despite of the vastness of Ethiopia’s water reserves, geography often works against the Ethiopian farmer; terrain, remoteness, and climate all pose significant challenges to food production. Over half of Ethiopia’s population lives in water deficient areas with low rainfalls in central and eastern parts of the country, and even though the western third receives adequate annual rain, much of it occurs in short rainy seasons, and dry spells are common (28). Agricultural technologies are primitive, market access is weak, and government is all too often inefficient and ineffective, all of which are problems faced by a population reliant on subsistence agriculture. For much of the country, crop production is adequate for only 6-9 months of the year, and nutritional deficiencies are a significant cause of death. Each year, around 5-15 million Ethiopians need food aid (24), a testament to Ethiopia’s chronic food *in*security.

In addition, only about 3% of total water resources are used, and as a result, Ethiopia suffers from chronic water shortages, a situation only made worse with poor sanitation infrastructure and global climate change. While access to improved water (a water source protected from outside contamination) and sanitation (defined as a facility that hygienically separates human waste from human contact) facilities (3) is much easier in the cities (98% and 29% respectively), Ethiopians living in rural areas have a much harder time gaining access to both, with only 26% of rural homes having access to clean water, and only 8% of rural homes having access to improved sanitation sources (4). Ironically, Ethiopia, the so-called ‘water tower of Africa’, has a very large water problem.

The Family: The typical Ethiopian family consists of 6-12 people, including the mother, father, their children, extended family members, and for some, servants (5). Families, while still quite large, have been steadily decreasing in size over the years as women have fewer children: from 1990 to 2005, the total fertility rate has fallen by almost 20% (6).

The Ethiopian family’s diet is largely made up of cereals, tubers/root crops, beans, and oil seeds. While the country does have a large amount of livestock, consumption of animal products remains very low, as animals are used mainly for production of products such as milk, cheese, and wool rather than for their meat, particularly in mountainous areas where most of the land is unsuitable for traditional agriculture. Even though agriculture accounts for 46.3% of Ethiopia’s GDP and employs 80.5% of the country’s labor force (12), it is still highly dependent on subsistence farming, resulting in chronic malnutrition among much of the population. In spite of the wide range of crops grown in Ethiopia, families often rely and grow only on a few crops, creating a lack of food diversity. A particularly large, yet often overlooked problem, a lack of dietary diversity results in iodine, iron, and other vitamin deficiencies even when basic caloric needs are met. Because of this, more than 25% of women and 50% of children under 5 are anemic (a lack of red blood cells in the bloodstream). Organizations such as UNICEF estimate that 60-80% of health problems in Ethiopia can be directly traced to malnutrition and preventable diseases. For the typical family, there is often not enough food to go around, and the food that *is* around often lacks diversity and vital nutrients (8).

Education in Ethiopia has vastly improved in recent years, and children are much more likely to go to school and have basic literacy skills than their parents and grandparents: since 1974, overall literacy in

Ethiopia has more than quadrupled, from less than 10% in 1974 to over 40% today, and over 90% of 7-year olds are now enrolled in primary school. However, only around half of Ethiopian children finish primary school, and enrollment rates in secondary and post-secondary institutions are substantially lower. Women receive much less education than men: in 2007, the literacy rate for males was around 50%, and around 30% for females. Many poor, particularly rural families cannot even afford to send their children to school. In addition, schools, particularly rural ones, often lack basic materials such as paper, pencils, and textbooks, reducing the capabilities of teachers, who often have class sizes of over fifty students (7).

Access to adequate healthcare is difficult in Ethiopia, especially in rural areas. In 2005, it was estimated that more than half of the population lived more than 10 km (6.2 mi) away from the nearest healthcare facility. There is also a lack of trained medical staff: in 2010, Ethiopia had only 1,086 doctors, less than one per 10,000 people (9). In comparison, the US has 25 doctors per 10,000 people, more than 25 times greater than in Ethiopia. A brain drain of medical staff has also been occurring, and many newly-qualified doctors leave Ethiopia in search of better living conditions. In addition, the inefficient distribution of medical supplies and chronic under-funding of the healthcare sector makes access to healthcare services even more difficult. However, Ethiopia has made significant progress in providing adequate healthcare to its citizens, particularly in women and children's care: From 1990 to 2013, child mortality has more than halved; from 200 per 1,000 births in 1990 to 68 per 1,000 births in 2013, and by 2013, 93% of the population now lived within 7 km (4.3 mi) of a healthcare facility (10). However, many facilities lack access to clean water, and are unable to treat significant diseases or perform major surgeries (11).

The Farm: On average, an Ethiopian farmer holds 1.2 hectares (3 acres) of land, but 55.13% hold less than one hectare (2.5 acres) of land (12). Most are subsistence farmers, growing mostly grains, beans and oilseeds, alongside cash crops such as coffee, cotton, and khat, an illicit amphetamine-like stimulant (13). Only around 15% of Ethiopia's land area is used for growing crops, mainly in the country's western half. On the other hand, 51% is used for grazing, mostly in the east, where the soil is unsuitable for agriculture and mass settlement (14). Livestock is an integral part of Ethiopian agriculture, and virtually every farm raises chickens. Many small farms also raise goats, sheep, donkeys, and cattle, which are used as a source of meat and cash. In addition, such animals are also used for transportation, fuel, power, and social status. However, raising animals often push local grazing lands to the limit, especially during the dry season. Most Ethiopian farms rely on unprotected wells and rainwater harvesting to obtain the much of their freshwater. The unpredictable nature of rain as well as pollutants and pathogens found in untreated well and spring water both reduce agricultural productivity. In addition, overgrazing, cultivation of slopes, outdated farming practices, strong winds, and increased khat cultivation have all increased soil erosion, reducing the amount of arable land available as well as its productivity (15).

Only 4-5% of Ethiopian farmland is irrigated as of 2010 (28). Ineffective irrigation for subsistence crops (irrigated farmland in Ethiopia is largely devoted to cash crops) has forced many Ethiopian farmers to resort to unpredictable rainwater harvesting, and has led to chronic water shortages in what would otherwise be productive areas. Limited access to fertilizers is also a significant problem- distribution of expensive chemical fertilizers is under a government monopoly and access is often limited, while natural fertilizers such as animal manure are largely used for fuel rather than fertilizer, further reducing productivity. Additionally, disease plagues humans, crops, and livestock alike, and the lack of adequate sanitation and health facilities in rural areas further reduces agricultural productivity.

The relatively inefficient and unpredictable nature of Ethiopian agriculture makes its people prone to famine and vulnerable to chronic undernutrition. More than 40% of Ethiopian children suffer from stunted growth, and two thirds of Ethiopian adults suffered from stunting themselves. Poor packaging and storage also results in significant amounts of waste when crops are transported, and poor transportation infrastructure makes such journeys far too long. Well over half of Ethiopia's population lives more than

one day's roundtrip walk to and from an all-weather road, further increasing inefficiencies and waste in an agricultural system that needs all the food it can get (19).

Barriers faced by the family: While the percentage of the population living in extreme poverty (less than \$1.25 a day) has decreased by more than 10% in the past 15 years, it still stood at a whopping 28.7% in 2012. One of the largest barriers to employment at a living wage in Ethiopia is being able to find a job in the first place. Even though the country has one of the world's fastest growing economies, it also has one of the world's fastest growing populations, and hundreds of thousands of jobs have to be created each year just to keep up with population growth. Unfortunately, this doesn't happen. Nearly a quarter of the population is unemployed, and in cities, the rate often reaches close to 50% (16, 17). In addition, the lack of a national minimum wage and the inability for most workers to collectively bargain severely hampers their ability to earn living wages, and most salaries are generally below subsistence levels (18).

Affects and trends of factor: Limited access to both clean water and proper sanitation facilities in Ethiopia is not only a serious impediment to the future growth of the country, but also severely lowers the typical Ethiopian family's standard of living. In places suffering from water scarcity, lower agricultural yields were directly correlated to increased levels of malnutrition and childhood stunting. The lack of adequate sanitation facilities also pollutes existing water sources and reduces worker productivity, further reducing agricultural yields. Access to improved water and sanitation is much easier in the cities than in rural areas. In addition, most of Ethiopia's farmland remains unirrigated, leaving most of the country's vast groundwater reserves untapped, and forcing farmers to collect most of their water through rainwater harvesting. As a result, there is often too little water for cooking, cleaning, and farming, resulting in reduced crop yields and malnutrition among much of the Ethiopian population.

However, the situation is showing signs of rapid improvement. Largely due to stable governance, relatively low corruption, and increased foreign aid after the collapse of the Derg regime in 1991 (29), access to improved water sources was only available to 52% of the population in 2012, it is nearly four times greater than where it had been in 1990, when only 13% of the population had access to an improved water source. A similar story can be seen in the realm of sanitation. Even though only a paltry 24% of Ethiopians had access to improved sanitation facilities in 2012, it is still an increase from 1990, when only 2% of the population had access to an improved sanitation facility. In addition, the disparities between rural and urban areas have been steadily shrinking since the 1990s, which means that today, rural Ethiopians, which still make up over 80% of the population, are more likely than ever to have access to improved water and sanitation facilities (20).

Improving access to clean water and sanitation facilities would both greatly increase Ethiopia's standard of living as well as speed up economic growth & development. By increasing access to improved water sources, farmers would be able to expand the amount of arable land, increasing overall yields, reducing malnutrition, dependence on foreign aid, and help secure the country's food supply. Improved sanitation would mean less polluted water, increasing the country's water supply; increased access to such facilities would also greatly increase lifespan and decrease mortality, particularly among children, who are especially susceptible to infectious diseases. This, combined with increased crop yields, has led to a healthier, stronger, and more productive workforce and population, speeding up economic development and ultimately creating a stronger, self-sufficient and more food secure Ethiopian nation.

Outside factors, however, threaten future progress. While the birthrate has decreased by more than 50% since 1990, Ethiopia's population is still rapidly expanding, and is expected to reach approximately 150 million by 2050, from 90 million in 2014 (21). Already struggling to feed its population, Ethiopia's agricultural sector will come under further strain in the coming decades, placing increased pressure on the country's water supply and infrastructure. Global climate change also threatens to shrink Ethiopia's water reserves, and with many of its farmers dependent on rain for much of their water, Ethiopia might not have

enough water for its crops, and therefore not enough food for its people (30). Climate change could have devastating effects on Ethiopia, potentially eliminating decades of progress in just a few growing seasons.

Solutions: In 2001, the central government released a National Water Strategy that called for a plethora of changes in Ethiopia's water, sanitation, and irrigation strategy, including a call for more decentralized decision making. Until 1995, the central government was responsible for all water and sanitation projects, which generated chronic inefficiency, 'solutions' ill-suited for actual situations, unrealistic project goals, and overly ambiguous plans (22). By shifting water and sanitation policy to local governments, the goal was for solutions to be tailored for local situations, removing much of the waste, inefficiency, and ambiguity that plagued previous public works projects in Ethiopia. From there, local governments, in particular the *woredas*, or districts, would carry out infrastructure projects, with rural irrigation and sanitation taking priority.

There are currently 550 *woredas* in Ethiopia, each with a population between 10,000 and 300,000. In a continuation of the decentralization of Ethiopia's water and sanitation strategy, the water desk of each district would lead in the financing, construction, implementation, and the maintenance of water and sanitation facilities. By having the district water desk take control rather than the central government, people can bypass much of the bureaucratic backlog that once plagued Ethiopian water management, and still does to a lesser extent. In addition, the districts would be able to create and use unique solutions based on their local situation, rather than having to adhere to plans from the central government, which might not have an accurate assessment of a local situation. Local residents would also be able to bring concerns to the district much more easily. Finally, financing projects would be much less challenging through a decentralized system, as access to the private sector and the over 500 local and international aid groups currently working in Ethiopia would be much simpler and less daunting through a local district rather than the national government.

An example of a successful practice that could be scaled up quite easily is the construction of urine-diverting dry toilets, or UDDTs. Unlike conventional toilets, UDDTs do not require water to operate, and are able to collect feces for use as fertilizer, and are able to reduce odor, groundwater contamination, and pathogen reduction much better than pit latrines (27). Such toilets would make a desirable interim as well as permanent solution in Ethiopia, as such toilets are able to create fertilizer, conserve water, and create healthier living spaces for all. Such toilets do not require pre-existing sewage, plumbing, and water works systems to function, which mean that UDDTs can be set up much more easily than conventional sewage systems, and can even be set up in urban settings such as multi-story apartment buildings and flats. By setting up UDDTs throughout Ethiopia, the spread of many waterborne diseases can be checked, fertilizer production would increase, dependence on expensive foreign n artificial fertilizers would decrease, and water would be freed up for food production, greatly increasing farmers' agricultural productivity and allowing their money to be spent elsewhere, such as toward their children's education (23).

A place where this has been already set up on a large scale in Ethiopia is at Adama University, where a toilet block consisting of 24 UDDT cubicles and 6 urinals were set up at the university, designed with a maximum capacity of 400 users. Constructed by the university and foreign aid groups, and supported by the Ethiopian government, planning began in 2008, and the toilet blocks were fully operational by June 2010. The first large-scale project of its kind, the Adama University UDDTs have proved the feasibility of such toilets, and the ability of the Ethiopian government, local authorities, and international organizations to work together on public works in Ethiopia. While a conventional low-flow toilet uses upwards of 2,500 gallons of water per person per year, a UDDT uses no water at all, and by installing UDDTs instead of conventional flush toilets, Adama University conserves more than 1 million gallons of water per year, while improving access to improved sanitation facilities at the same time. In addition, fields using fertilizer obtained from urine and feces collected in the Adama University toilets have proved to have yields 38% higher compared to when the field was treated with artificial fertilizers (26).

In addition, small and medium-scale irrigation projects could be implemented with relative ease to increase the amount of accessible water reserves as well as the amount of arable land in the vast ‘water tower’ of Africa. Relatively simple irrigation systems such as reservoirs, canals, deep wells, and rainwater storage & management would be able to conserve & expand water reserves, ensure that water would be available year-round (not just during the rainy season), and limit soil erosion & degradation (25, 28), increasing productivity, arable land, and sustainability in Ethiopian agriculture. Such projects have already been implemented throughout central Ethiopia, where 47% of the country’s population lives, 39% of crop output is produced, and where soil degradation and water shortages severely limit productivity. The projects also stress the importance of listening to local farmers’ input as well as implementing both traditional and modern irrigation techniques to fit the unique geography of Ethiopia, of which unmodified western irrigation systems are often ill suited for (24). Studies suggest that such projects could irrigate over 5 million hectares (12.4 million acres) of farmland, increase Ethiopian economic output by over \$686 million USD, and ensure food security for up to six million families within two decades (28).

Local authorities, the central government, and foreign organizations all serve crucial roles in the successful implementation of UDDTs and local irrigation networks across Ethiopia. After the need for new facilities is brought within a community, a solution would be planned by local authorities in conjunction with foreign aid groups such as the GIZ, the organization that helped design, build, and fund Adama University’s UDDTs. From there, the central government would help support infrastructure projects, fund them, and set long-term strategic goals. Expected to decrease in the near future, the central government plans of its own to increase its own funding for projects in Ethiopia in an effort to make the country more self-sufficient (31). Finally, local authorities and foreign aid groups in conjunction with the central government itself would instruct locals on how to use and maintain new infrastructure such as UDDTs and small-scale irrigation networks through hands-on instruction as well as public awareness-raising campaigns (26), and show local builders how to construct, and maintain such projects on their own, reducing future long-term dependency on foreign aid and assistance. Already successfully being carried out with the Adama University UDDT project, such instruction and public awareness-raising would help ensure that development would continue even as foreign aid to Ethiopia decreases, and that through the efforts of the people themselves, new infrastructure would be able to make long-lasting improvements to the livelihoods of the Ethiopian people.

Ethiopian families would also take an active role in improving access to clean water and sanitation. By becoming more active in their local district and neighborhood council, families would be able to work directly with local officials to directly create an effective water strategy for their own community. Families would also take an active role in the implementation of such water policy, and would aid in the financing, construction, and maintenance of new facilities. Finally, families would have to educate themselves on proper hygiene, sustainable farming practices, and the use of new equipment such as rainwater harvesting basins and UDDTs, which can be notoriously tricky to use & maintain at first, and can be rendered useless with incorrect usage and poor maintenance.

Ethiopia has made much progress in the fields of water, sanitation, and food security, but it can-and *must*-make even more in the future if it is to meet the goal of providing access to clean water, adequate sanitation, and food to *all* of its people, not just the privileged and powerful. This must all be done in the face of a fast growing population and the ever-looming threat of potentially catastrophic climate change.

By continuing to transfer governance to local authorities and water desks rather than the central government, people would be able to better voice their concerns and actively implement solutions. The construction of UDDTs would drastically increase access to improved sanitation for millions of Ethiopians without increasing water consumption, freeing Ethiopia’s water supply for crops, livestock, cleaning, drinking, and more. At the same time, waste from UDDTs could be used as natural fertilizers,

increasing agricultural productivity as well as reducing farmers' dependence on expensive foreign synthetic fertilizers, furthering sustainable and secure agricultural development in Ethiopia. The expansion of small and medium-scale irrigation to farms throughout Ethiopia would allow farmers to further tap the rich water reserves of the 'water tower' of Africa, free up the time previously required to walk the long distances to rivers, streams, and wells, generate the money needed to send their children to school, increase the amount of arable land in Ethiopia, and reduce the unpredictability and waste that currently plagues Ethiopian agriculture, all of which is needed to help the country become more self-sufficient in food production and feed its ever-growing population.

However, improving access to clean water and sanitation is just one part of many steps that need to be taken to guarantee food security to the Ethiopian people. In a way, Ethiopia is like a seed; when a seed is first planted, it cannot grow to its fullest potential unless it is watered. When the Ethiopian nation is fully watered, it too, like the plant, will finally be able to grow to its fullest potential.

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