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Climate Volatility

Climate in Ethiopia: The Real Problem

Ethiopia has become accustomed to functioning through natural disasters such as drought and flooding but climate change has meant that these events are becoming increasingly severe, therefore, causing concerning challenges for the resilient country. Its agricultural sector accounts for 80% of Ethiopia's employment and 90% of exports (Tesso). According to the United Nations' annual report, "From some research estimates, the overall economic impact of climate change on the agricultural sector could be up to 10 percent of GDP" (Tesso). Given an economy based so heavily on domestic agriculture, climate volatility presents a potentially disastrous threat to Ethiopians.

Despite its sometimes cruel weather events, Ethiopia is a beautiful tourist destination. One of the world's oldest civilizations, it has much to offer in the form of ancient ruins and historic sites. Widely diverse in geography and climate, it possesses a large gradient in elevation across the nation. Despite lying in a largely tropical area of the world, mountainous areas can be quite temperate in climate ("Ethiopia").

All in a day's journey, one may find the temperate conditions of the highlands to the tropics of the wet lowlands. In addition, each season brings almost entirely different weather conditions. More specifically, there are four distinct seasons in each year:

➤ *Gu'* - The main rainy season, from late March up to early June. ➤ *Hagaa* - Dry and windy with some clouds but rarely rain, late June to early September. ➤ *Deyr* - Small rainy season between late September and early December. ➤ *Jilal* - Hot, dry season between late December and early March.

While the specific times of each season vary year to year, but stay mostly the same ("Drought and Floods").

In the typical dry season, crops can be very difficult to plant and maintain without the use of expensive pump irrigation. In severe drought, even humanitarian aid reaches the people in cities irregularly, as trucking water for miles into the country is not particularly viable in those situations ("Drought and Flooding").

Issues of climate volatility are especially problematic for the typical family in Ethiopia. The

average family diet is largely plant based, consisting of items such as potatoes and other tubers ("Federal Democratic Republic of Ethiopia."). With such a large portion of the Ethiopian typical diet based on agriculture, it is of dire importance to consider how climate volatility affects it.

According to the FAO, environmental factors such as this are a major component of food security issues in Ethiopia ("Floating Garden Agricultural Practices in Bangladesh").

The issue of climate in Ethiopia remains one of the country's most severe issues, impacting life for all citizens. As agriculture contributes to about 43% of Ethiopia's GDP, unpredictable drought and flooding are a defining issue for the country. Since the 1970's, the severity and frequency of these droughts have increased substantially; resulting food shortages have affected millions of people. Tesso writes, "The frequency of nationwide droughts causing severe food shortages increased from once every 10 years in the 1970s and 1980s, to every three years now" (Tesso).

Climate change in Ethiopia reduces overall air quality and leads to respiratory and cardio-vascular diseases, especially in urban areas. Children, pregnant women, and the elderly in less-developed countries such as Ethiopia are at the greatest risk for these diseases. Respiratory diseases are not the only threat. In 2017, due to outbreaks of measles (among other diseases), women and children were at the greatest health risk, according to the UN (Tesso).

In Ethiopia, breastfeeding is common but usually cut short due to cultural differences and the like. Children don't often get the nutrition they need to stay healthy and thus half of all children in Ethiopia are stunted. While the percentage of stunted children has decreased in recent years, vitamin deficiency and other malnutrition still remains prominent.

Due to Ethiopia's diverse climate, people in some areas are affected by climate volatility more than others. In most cases, floods cause an issue in the lowlands where water accumulates at river banks after extended periods of rainfall. While most flooding takes place during the rainy season, some takes place during the months of August and September. A study in the area of Gambella (one of the aforementioned lowland regions) indicated that the area was at high risk for flooding due to its lack of policies and poor preparation. As a result, a major flood in 2008 was devastating to the region and fully demonstrated the extent of the region's flood risk (Simane).

Floods also bring risk of heavy landslides in regions adjacent to mountains or on steep elevation grades. In these regions, humanitarian response is urgently needed following periods of rain. One of the most prominent forms of aid is in the form of nutritious foods to supplement the loss of

agricultural production during the rainy season.

Despite varying degrees of impact, a solution that can meet the needs of all Ethiopians is in order. The two major issues of flood and drought must be addressed. While these two events may seem to be opposites, they are in fact compliments of one another. A two part solution utilizing floating gardens in tandem with irrigation systems can respond to Ethiopia's needs. As far back as the time of the Aztecs, floating gardens and irrigation systems have been used to combat drought and flooding. Chinampas, or floating gardens, are a method of cultivating land that leads to very healthy soil and mitigates the need for fertilizer. In addition, these Chinampas have an overwhelmingly positive effect on biodiversity. Mexico City's own Chinampero system accounts for more than 2% of the world's biodiversity, with hundreds of species living there alone. During the rainy season, water is diverted into canals in conjunction with dams to combat flooding ("Chinampas of Mexico").

The second component of these floating gardens is water retention. Deep canals can combat flooding and act as a place for water to divert to. However, that alone will not solve Ethiopia's problems. Canals coming from these gardens must be directed to some of Ethiopia's irrigation reservoirs such as the Alwero. Similar processes were also used in Aztec civilizations on a much smaller scale. Water was collected manually and stored for use in the inevitable dry seasons ("Chinampa").

Technology like this is currently being used in areas like Bangladesh, a country with a similar climate to Ethiopia's. Both countries experience monsoon season brought upon by proximity to the Indian Ocean and they both experience a dry season ("Climate Data for Ethiopia."). The solution is being successfully implemented there, which means it has promise for Ethiopia ("Floating Garden Agricultural Practices in Bangladesh").

This solution benefits domestic agriculture in Ethiopia as well as exports. As food security is made sustainable within the population, there will be more food to export for the economy's benefit. In addition, the construction of these floating gardens is cost effective, using common materials such as water hyacinth in the case of Bangladesh. The common water hyacinth is not native to Ethiopia; it has been considered an invasive species since its first appearance in 1965. This could potentially be a major benefit to Ethiopia, as the recycling of the invasive species from the afflicted Lake Tana could slow its spreading.

In regards to the sustainability of this proposal, Chinampas have been known to adapt to urbanization and climate change very well. They also require little to no maintenance in regards to fertilizer and are extensively biodiverse. Mexico City's Chinampas alone contribute to two

percent of the world's biodiversity ("Chinampas of Mexico City Were Recognized as an Agricultural Heritage System of Global Importance.").

Maintaining this project, however, would be a large responsibility for the communities of Ethiopia. With the vast array of problems the country faces in addition to climate volatility, outside organizations would need to step in to maintain and fund the project. Organizations like the World Food Programme would be ultimately necessary to the proper execution of this project.

In addition to the amount of man-power needed, Ethiopians and organizations must be trained to properly implement the solutions outlined herein. However, being an ancient technology, the chinampas are some of the least complex options in the world. In fact, these floating gardens are sometimes implemented on a smaller scale as household projects all over the world. According to Permaculture, "chinampas can be created by constructing simply walled earthen mounds separated by canals, a la a series of close-knit swales and berms, as the chinampa maze. In this case, though, the water flow moves in, filling the chinampa canal to a set water level before being passively fed to the next canal and the next and ultimately back into the natural flow of water." Essentially, the natural flow of water is all that is needed to hydrate the soil and maintain the chinampas. During the Ethiopian rainy season, the flow of rainwater would be diverted into these "chinampa mazes.

Ethiopia's people cannot simply amend all of its existing challenges at once or on their own. With the help of external beneficiaries and organizations such as the UN, Ethiopia can see growth in its economy and developments in society. Most importantly, Ethiopians can learn to live without limitations and truly thrive in their country.

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