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Guatemala, Climate Volatility

## **Coping With Climate in Guatemala**

Guatemala is a Central American country of 108,889 square kilometers, bordered by Mexico, Belize, the Gulf of Honduras, Honduras, El Salvador, and the Pacific Ocean (Central Intelligence Agency, 2021). Guatemala consists of three main regions. First, the fertile Pacific plain in the southern part of the country. Second, the central highlands to the north of the Pacific plain, which are largely volcanic with the exception of the series of mountain ranges and valleys in the north. Third, the northern lowlands known as the Petén region (Griffith, 2021). Of the land, 41.2% is agricultural. The population of approximately 17.5 million resides mainly in the Pacific plain or the volcanic region. Of that 17.5 million, 51.8% are urban and 48.2% are rural (Central Intelligence Agency, 2021). Many of the urban residents reside in the capital city of Guatemala City. The population consists of two main ethnic groups, the Ladino and the Maya. The Ladino, or people of mixed Spanish and indigenous heritage, are the majority of the population at 60.09% of the population. A further 38.5% of the population identifies themselves as Mayan (Sokolova, Saavedra Zepeda, & Nuñez, 2019).

The average family in Guatemala is 4.8 members. Many households include multiple generations, with 39% of the population living in multi-generational homes (United Nations, 2019). Housing quality and types vary widely between the urban and rural areas. However, the typical rural family will live in a house with an earthen floor, made up of adobe or planks, with a roof of thatch, tile, or corrugated metal (Griffith, 2021). A common occupation is agricultural work. The average smallholder farm will be 0.6 hectares. Family farms generate a gross annual income of \$6,722 (USD). However, 40% of smallholder income comes from off-the-farm or non-agricultural activities (Food and Agriculture Organization of the United Nations, 2018). Approximately two-thirds of the population live on under \$2 (USD) a day (United States Agency for International Development, 2018). The family will ideally eat three meals a day, largely consisting of corn tortillas (which make up approximately half of caloric intake for many Guatemalans), baked or roasted meat, and sugar-sweetened beverages (Ford, Martorell, Ramirez-Zea, & Stein, 2017). On average, Guatemalans attend 10.8 years of school. This results in a literacy rate of approximately 81.3%. However, this number disguises the disparities between the male and female literacy rates. While men and women attend approximately the same amount of school on average (10.9 years versus 10.6 years respectively), men have a literacy rate of 87.4% compared to the literacy rate of 76.3% for women (Central Intelligence Agency, 2021). Healthcare is also subject to disparities, especially between rural areas and urban areas. Healthcare infrastructure is concentrated in urban areas and inaccessible to many rural residents. Beyond physical access, healthcare is also unaffordable. Approximately 65% of costs are paid privately, mostly out of pocket (Sokolova et al., 2019).

Agriculture is an important part of the Guatemalan economy. Approximately 31.4% of the population is involved in agriculture. Agricultural activities contribute to 13.3% of the Gross Domestic Product (GDP) as of 2017. About three-quarters of exports are food-related. Main exports include bananas, coffee, raw sugar, cardamom, and palm oil (Central Intelligence Agency, 2021). Despite this, Guatemala faces high rates of malnutrition, with stunting (impaired growth and development manifesting itself in a low height-for-age) affecting 47% of the population (United States Agency for International Development, 2018). A part of this issue is that farmers usually keep about two-thirds of crops for home consumption, meaning farmers are heavily reliant on having a good yield for food security (Food and Agriculture Organization of the United Nations, 2018). However, climate shocks (severe climate events) have impacted the amount of crop yield, meaning crops that were previously relied upon for food by the

farmers cannot be eaten. It also means that there is less demand for seasonal farm labor, an income stream many poor Guatemalans rely on to purchase food (Pons, 2021).

Guatemala has the dubious honor of being ranked 9th by the Long-Term Climate Risk Index, as one of the top countries affected by climate change in the period of 1996-2014 (Kreft et al., 2016). The area is very vulnerable to a variety of climate factors due to its location next to the Pacific Ocean and in a very volcanic region. The World Bank (n.d.) has even ranked it 5th in countries most affected by floods, hurricanes, and earthquakes. However, the country has also been afflicted with a variety of other climate phenomena. Overall, about 48.8% of the population is exposed to five or more climate threats concurrently, from events with a major impact like hurricanes to lower impact events like floods or storms. Throughout the last several years, the usual dry season in Guatemala of July and August has gotten even drier and lasted longer (Lakhani, 2019). This crisis is being compounded by a variety of factors, like deforestation. Forests mitigate the impacts of climate change by reducing erosion, improving air quality, and maintaining biodiversity (International Union for Conservation of Nature, 2021). However, over the last 40 years, Guatemala has lost nearly half of its forests (Lakhani, 2019). This enables droughts and other events to continue.

Extended drought conditions have an enormous impact on crop growth, with it being harder than ever to predict weather conditions every year. In 2018 alone, crop failures caused by drought conditions have directly affected 1 in every 10 Guatemalans (Lakhani, 2019). This led to extreme food shortages for almost 840,000 people. The conditions caused by climate change and drought have been perfect for the growth of the rust fungus known as *la rolla*. *La rolla* has destroyed up to 80% of the coffee crop in some regions of Guatemala, destroying along with it a critical income stream for many peasant farmers. This impacts the whole economy of the region. Farmers rely on the income from exporting coffee, as it is a central cash crop. However, many seasonal workers also rely on working on the coffee farms, sending a ripple effect through the area. This is only the beginning. By 2050, it is estimated that climate change will lower crop yields by as much as 14% for both maize and beans (Castellanos, Thomas, & Dunston, 2018). Maize and beans are grown by many smallholder and subsistence farmers, meaning this decrease in crop yields will have a direct impact on the food security of many Guatemalan families. Inevitably, this will lead to more hungry children, continuing the cycle of hunger. Children need lots of nutrients while growing, and even one year of bad harvest can impact their growth and security. Sugarcane, a commercial crop, could decrease in yield by 35% by 2050. Similar to coffee, that decrease can send a ripple effect throughout local economies. Another impact climate change can have on agriculture is an increase in pests and diseases, like *la rolla*, that can devastate crops (World Bank, n.d.). With a decrease in crop yields, farmers may have to overextend the soil to make up for the gap. This can degrade the soil substantially, contribute to erosion, and in the long-term, lead to degraded crops and lower crop yields. All of this can contribute to food insecurity amongst Guatemalans. This is likely to have a disproportionate impact on indigenous Guatemalans, as they are the population most often reliant upon subsistence agriculture, rural, and below the poverty line. Even right now, indigenous Guatemalans have the highest rates of malnutrition (Lakhani, 2019). These impacts are going to get worse as climate change advances. However, mitigation is possible.

A crucial action to temper the effects of climate volatility is to diversify crop production. Having a variety of crops per farmer creates a 'buffer' against volatility (Sokolova et al., 2019). If one type of crop fails due to disease or poor growing conditions, having other crops can ensure that the family does not starve. By diversifying crops, livelihoods are also diversified, ensuring that economic activities that seasonal laborers and farmers rely on can continue, even if one valuable crop fails. New types of crops mean new types of labor and new times of the year when that labor can occur. This creates a longer time period of consistent work for seasonal laborers, improving job security. Adopting a variety of crops is also valuable for becoming resilient to climate phenomena. Different crops can thrive differently in different temperatures, humidity, and other growing conditions (World Bank, n.d.). If one time period-like the last

couple of years-is especially dry, the crops that thrive in those conditions can be planted over those that do well in wet conditions. Having a variety of seeds on hand for different potential climates can give farmers greater flexibility in a time of increasing volatility. Individual farmers should choose the seeds they feel are best for their own region and situation as regardless of seeds chosen, simply planting a wider range is an effective way of reducing the impact of volatility.

An option some farmers are adopting is growing ‘specialized’ crops. A trend in some high-income countries is a focus on fair-trade, organic, and otherwise ethical and non-mass-produced food. This is a growing market that farmers can take advantage of by growing crops like cocoa (Sokolova et al., 2019). Guatemala is an increasingly large producer of specialized crops like cardamom, which is a sector Guatemalan farmers can put focus on. Investing in growing these more niche crops can provide a unique and high-value income stream for farmers. This allows farmers to create a niche in a very crowded market and make a more sustainable market. This option does have its downsides. It requires a higher cost of entry due to buying the necessary equipment, seeds, and transport to the necessary markets. This can block many potential undertakers out of the market. In addition, higher profits does not necessarily mean more food security. In a 2018 case study of rural Guatemalan farmers, those who grew a non-traditional crop for export (broccoli) made 40% more in income than others in the same community who did not grow broccoli (Méthot et al., 2018). However, those broccoli farmers did not see an increase in food access. For growing specialized crops to be a true option further support must be in place to translate higher incomes into greater food access. Nonetheless, it is a promising approach.

For diversification to happen successfully, it is essential that farmers receive sufficient support. One project that has seen success is the development of community seed banks (Inter-American Development Bank, 2020). The project was implemented by the Commonwealth Copanch’orti’ in 2013. A variety of specific actions were implemented, including the development of a communal seed bank, along with training given in villages on topics like soil conservation and harvest methods. Overall, it saw success. Providing a variety of quality and diverse seeds-as well as, crucially, best methods for usage- to smallholder farmers can promote resilience. It can also be beneficial to create a national seed bank of native seeds. This is critical to retain biodiversity and to ensure that native plant species don’t go extinct during periods where they are not suited for the climate. They can be preserved for future times when they can be grown and flourish (World Bank, n.d.). Distribution of seeds and information should be a priority of the National Climate Change Programme, which is the government of Guatemala’s lead organization on climate change and adaptation. Another potential agent for dissemination is farmer’s groups and associations (Sokolova et.al., 2019). For them to be effective, farmer’s groups would need to be promoted. However, the benefits of farmer’s groups and associations are far-reaching. They can be an effective way to distribute knowledge of sustainable agricultural practices as well as physical seeds. They can also be beneficial as a way for farmers to share information between themselves and sharing trial-and-error best practices. Farmer’s groups can be an effective way of assuring, when conducting distribution, that distribution reaches all regions and farmers, regardless of size. It is especially important for reaching indigenous people and ensuring that they are equally included within the efforts. Regardless of the way chosen to distribute information, it is important to not further existing disparities. Joining and promoting farmer collectives is a way for farmers to fight climate volatility.

In order to maximize the benefits of any agricultural practice, reliable information and data is a must. Promoting, improving, and disseminating the contents of climate forecasts is an important part of that. Climate services- like forecasts based on El Niño (a fluctuation of warming and cooling of the Pacific Ocean’s surface, which goes on to impact weather patterns, especially in South America (National Oceanic and Atmospheric Administration, n.d.))- can provide information on rainfall, humidity, and so on that can greatly impact decision-making on which crops might be the most viable in the year (Pons, 2021). Access to that data can improve farmers' decision-making power and capacity for adjusting to volatility.

Fortunately, Guatemala has some of the infrastructures in place for climate forecasting. Unfortunately, that infrastructure has been neglected and is in desperate need of expansion. The World Bank (n.d.) notes that the number of weather stations in Guatemala has decreased in the last couple of years, largely due to lack of funding. It is critical for the Guatemalan government to fund those stations and others like them now in order to prevent losses in the future. One step Guatemala can and should take is partnering with the Food and Agriculture Organization of the United Nations (FAO). FAO has spent a considerable amount of resources investing in the development of climate monitoring systems and tools. The most efficient route is to utilize existing tools.

Climate monitoring systems are most efficient when they understand the unique interests and positions different farmers and sectors have. Different socio-economic statuses, crop types, and so on all impact the type of data needed. It also impacts the type of supports needed, another crucial part of climate-monitoring plans. Governments and other organizations must also work to provide supports for the adaptations different farmers might need in response to the data they receive (Pons, 2021). Providing financial assistance or training is important.

For any of these interventions to be adopted, it is critical for the government of Guatemala to invest appropriately in them. By demonstrating the importance of agriculture to the continued economic well-being of the country and the damage that climate volatility has on agricultural stability, the government can be persuaded to invest in these and other adaptations. 13.3% of the Gross Domestic Product (GDP) of 2017 can be attributed to agriculture (Central Intelligence Agency, 2021). Agriculture provides the central livelihood for over 30% of the Guatemalan population. The financial stability of the country is at stake. Guatemala has pre-existing infrastructure for many of these adaptations, they just need to be overhauled and adequately invested in.

Climate volatility is a problem that impacts and will continue to impact Guatemala. As climate change increases, so does the amount of volatility in weather Guatemala experiences. This volatility has a drastic impact on the food security of the population. However, there are ways of mitigating the effects of climate volatility. Two of the most urgent actions include diversification of crops and climate monitoring. While the only thing that can halt the advancement in volatility is halting climate change, Guatemalan farmers can adapt in the meantime in order to protect food security.

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