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Colombia, Factor 5: Climate Volatility

Colombia: Feeding the Future and Sustaining Safe Water Despite Climate Change

In the past, Colombia's agriculture was blocked by guerrilla violence, rural displacement, and dangerous narcotic businesses. Now that Colombia has worked past those problems and established itself as a Presidential Republic (The World Factbook), a new, bigger, and more indiscriminate barrier is blocking their way: climate volatility. With a diverse geography, Colombia faces different risks throughout. But with increasing political stability, and a new drive to safeguard against a changing climate; water safety and agricultural production can be sustainable.

With a population nearing 50 million (The World Factbook), Colombia is the third most populous country in Latin America (Penarredonda). Of its large population, 76.72% of Colombians live in urban settings, leaving around 23.29% to live rurally (Colombia - Urban Population). Recent years in Colombia have seen rapid urbanization, but with the end of corrupt political instability and rural isolation caused by internal conflict, it is likely more Colombians will migrate back to rural areas and farm again (Ama).

Rural farming in Colombia is important; the economy has a large base in agricultural exports and overall, 37.5% of land is used for agricultural production (The World Factbook). High-value crops for Colombia include, but are not limited too, tropical fruit, coffee, and cocoa (Daniels). Not only are these crops important to Colombia, but to the world. As the world's second-largest coffee grower, Colombia produces 13-16% of the global coffee supply and is also the worlds third largest banana exporter (Colombia - Agriculture). Additionally, Colombia is the worlds second biggest exporter of cut flowers (New Agriculturist). Despite the emphasis and importance of farming in Colombia, farms are relatively small. The average coffee farm is 1.2 hectares (New Agriculturist), and during the 1980s, 80% of all agricultural land was occupied by farms smaller than 20 hectares (Colombia - Agriculture). In comparison, the average farm size in the United States is approximately 170 hectares (Agriculture 101).

The geography and climate of Colombia are very diverse allowing various crops to be grown. A tropical climate is found along the coast and in lower elevations, the Andes mountains are cooler, with variations in-between (The World Factbook). The majority of the country experiences an average annual temperature range of 24-28 degrees Celsius (Colombia). The variation in climate throughout the country allows for diverse agricultural production, but also a variety of distinctly different impacts due to climate change.

With a changing climate, it is important to consider the Colombian people's lifestyles. Most Colombian families have two to three kids (Colombia, Aspects of Culture), but, higher class families tend to have fewer kids than poor families. Nuclear families tend to live together, and while extended families are very important to life in Colombia, only poorer residents live in multigenerational households (Colombian Culture). As with family members, the typical housing situation of families varies depending on economic

standing. Urban housing tends to consist of apartments or single family homes, while in the rural regions tin hut “cambuches” are not uncommon (encyclopedia.com). While urban areas generally have access to basic necessities such as clean water, electricity, phones, roads, etc., rural areas have limited access (The World Factbook). A survey identified 11.5 million houses in Colombia without basic needs, of which 40% suffered from overcrowding and bad structure (encyclopedia.com). Specifically, 26.2% of the rural population lacks improved quality water sources and 32.1% of the rural population— 18.9% of the population overall— cannot access improved sanitation (The World Factbook).

The average monthly wage of 692 USD in Colombia is around half the global average, and the legal minimum monthly wage falls around 328 USD (Culture of Colombia). In addition, income inequality ranks close to worst in the world and while only 16.6% of the population is unemployed, over one-third of residents live below the poverty line (The World Factbook). Agriculture is an important form of employment, containing nearly 17% of the workforce while manufacturing is also a vital part of the economy and consists of 35% of the workforce (Culture of Colombia). All social classes will face the risks posed by a changing climate, but poor families will see the greatest consequences to their lifestyles.

Because Colombia is a large producer of tropical fruit, it is an integral part of the typical Colombian diet alongside bread, juice, eggs, meat, soup, rice, and potatoes (Colombia, Aspects of Culture). Most meats are cooked by grilling, and fruits are often drunk as juice (Colombia, Adoption Nutrition). Residents of big cities can easily access food at grocery stores and restaurants, while those living in isolated rural communities and in the Andes often rely on subsistence or communal farming (Parra-Staves).

While most economic classes attend eight years of elementary and six years of secondary education, it is not uncommon for poor students to drop out. University level education in Colombia is too expensive for anyone outside of the privileged (Colombia, Aspects of Culture). Overall, the educational system has lead to a very literate population. Healthcare is generally widespread as well, having improved in the past twenty years to cover almost everyone with, in necessary circumstances, financial aid (Health). However, alongside food and other basic necessities, rural citizens have limited access to education and healthcare.

Despite the many advancements over the past few decades, barriers still prevent access to some necessities. Rural and isolated mountain communities are hard to access because of insufficient roadways and remaining fear of past corruption and violence. Poor residents tend to remain poor, and hard to access areas tend to stay inaccessible, preventing advancement (Parra-Staves).

To date, climate change is already a major problem facing Colombia. Water shortages, erosion, rising sea levels, floods, and extreme weather events already plague the country (Côté). El Niño and La Niña are natural events raising the temperature of parts in the Pacific ocean, causing either droughts or heavy rainfall (Climate Change in Colombia). However, rainfall disasters in Colombia related to La Niña went up 16.1% between 1950 and 2007, climate change disasters in the country have worsened 2.4 times between 2000 and 2005 compared to events from 1970 to 1999; and the economy, infrastructure, and people of the country have faced the consequences (Côté). In 2010 and 2011 alone, La Niña rains caused

over six billion USD in damage to crops— especially coffee— and infrastructure (Daniels) and in 2015 with over 25% of towns facing water shortages, Colombia became the closest its ever been to a systematic energy blackout since the 1980s. The problem is only getting worse.

Future forecasts between 2071 and 2100 predict that one-third of Colombia will see a 10-30% increase in rainfall (Colombia). By 2030, snow- covered areas in Colombia are expected to vanish, by 2050, temperatures can increase by around two degrees Celsius, sea levels could rise nearly a meter and 80% of crops in 60% of current cultivation lands will be impacted (Daniels). Problems such as coffee rust, a disease responsible for killing coffee plants can escalate with favorable conditions (Penarredonda).

Both rural and urban settings will experience severe consequences. Major cities like Bogota and other residences in the Andes will see an increase in number and severity of water shortages as well as land erosion. Coastal areas, both urban and rural, will become victim to rising sea levels causing floods and threatening infrastructure and transportation, saltwater contamination of coastal freshwater aquifers, and a decrease in fishing resources because of coral bleaching (Côté). Damage to transportation will further limit rural residents access to any necessities, including their access to health resources that will become more important with an expected increase in waterborne diseases and heat stroke. Subsistence farmers in isolated areas are most at risk because excessive rainfall and landslides threaten their source of food (Daniels). While gender and age groups will be affected similarly, some marginalized populations are at risk. Past forced displacement disproportionately affected afro-Colombians and indigenous peoples; because of climate change the quality life of displaced and poor people will worsen, thus affecting these groups more than others.

Although Colombia faces massive disasters because of climate change, the causes are global. The build-up of greenhouse gasses in the atmosphere, mostly from fossil fuel burning and deforestation, blankets the atmosphere and prevents heat from leaving the earth and radiating into space (Climate Change Causes). Therefore, solving climate change permanently requires global collaboration, commitment, and efforts. Currently, this solution is not realistic in the immediate future, and the solutions presented here will focus on steps Colombia can take to minimize the effects of climate change in the foreseeable future. The three solutions discussed will concern improving transportation, sustaining access to clean and safe water, and protecting coffee crops.

The Colombian government is currently investing billions of dollars in road infrastructure projects in order to connect major cities and minimize commercial transportation costs (Stratfor). However, in addition to expanding roads, repairs and maintenance are lacking so much that cost efficiency still suffers. Road damages sustained from heaving rain and flooding is only getting worse with climate change (Stratfor). Colombia needs to invest in more extensive road maintenance and repair in order to avoid these inefficiencies. Either by investing more money into the upcoming road projects or transferring funds from some projects to repairs, the Colombian government must improve road maintenance. Unfortunately, funds involved in this project would need to be constant, Colombia would need to keep investing in road maintenance more so than currently. A loan, subsidy or other form of aid from the UN could help Colombia get a solid foundation and successful road system that will cut costs in the future, allowing them to repay the aid. Because Colombia is a country in recovery from past corruption and violence, it is

likely that most programs will require some form of external help to get started.

Another approach to roads should focus on improving rural roads. Because rural communities isolated in the mountains tend to be poor and lack access to basic necessities that urban dwellers have (The World Factbook), increasing transport opportunities into and out of these areas could be very beneficial for the residents. As aforementioned, the Colombian government is currently putting lots of money into improving road infrastructure, and increasing access to rural areas could also increase ability of rural farmers to grow commercially and sell their products in towns other than their local community, gain access to basic necessities, and leave areas suffering from climate change effects. However, there are many important considerations involving past problems and climate change resilience. Presently, many rural streets have police officers at various 'checkpoints' to ensure citizens of the safety that was desperately lacking not many years ago (Parra-Staves). Continuing this practice for multiple years is essential to getting residents to move back into agricultural regions and rural communities that have been abandoned. This will increase crops and potentially reduce the consequences of climate change on crops and food as production will be climbing. In regards to climate resilience, in the Andes mountains, it is paramount that roads have precautions against mudslides and flooding/excessive rainfall. Solutions to these problems include permeable pavement designed to withstand flooding, as for landslides, building structural supports into the mountain next to the road to prevent destruction and blockage. While these measures will be expensive, they will save from future costs as climate change worsens conditions. Again, subsidies or loans from associations like the UN could help Colombia begin these projects.

In addition to improving transportation and accessibility, protecting and sustaining clean water sources is imperative for Colombia. Educating citizens throughout the country on smart water usage, conservation and management as well as ways in which to combat climate change is an excellent first step (Water sustainability). Organizations such as the Bogota Water Supply Company and Conservation International Colombia, which are both involved in water management in the Andes, could be responsible for funding and providing these educational programs.

The biggest area of concern given current water shortages is the Andes mountains and its dependencies. The capitol city of Bogota, Colombia is home to eight million residents, all of which drink water that comes from the Andes (Managing...). The mountains are home to paramo ecosystems; wetlands with an important combination of spongey soil, vegetation, wet grasslands, and bodies of water that retain water (Managing...). These ecosystems are responsible for much of the water filtration and retention in the Andes mountains that not only supplies local communities, but also dependent cities throughout the country. These wetland systems will be vital as climate change escalates; they not only capture and retain water in droughts but act as flood buffers during extreme flooding and raining (Managing...). This is key to climate change in Colombia as it couples with, and worsens, the effects of El Niño and La Niña. Three steps to ensure the future of these ecosystems includes; protection, management, and education. In some South American countries these paramo ecosystems have been separated into conservation areas, restoration areas, or designated areas for natural resource use (Managing...). Continuing funding of these actions by the Bogota Water Supply Company and Conservation International Colombia as well as potentially the government, coupled with local volunteers will reduce water problems caused by climate change in these risk areas.

In addition to these efforts, it is very important to protect coffee from the dangers posed by climate

change, namely the increased vulnerability to coffee rust (Penarredonda). Organizations such as Cenicafe and Fedecafe are already investing in coffee sustainability in Colombia, but increased efforts are needed. In the past, coffee cultivation in Colombia relied on the species *coffea arabica* as it tastes better and can be sold at higher prices. However, *arabica* lacks resistance to the increasingly prevalent coffee rust disease responsible for killing trees (Penarredonda). In the past, hybrids between *arabica* and *coffea robusta*— a resistant species— produced more resistant trees, but the quality decreased. By the 1980s further hybridization increased the quality of the trees while retaining rust resistance, the new hybrid was called Colombia, but since introduction to commercial farming, even this tree is being overcome by coffee rust. Since, Cenicafe has been working tirelessly to improve the hybrids and incorporate more resistant genes, releasing Castillo and Cenicafe 1 species more recently (Penarredonda).

To further improve the sustainability of coffee agriculture in Colombia, continuation of these programs and engineering/hybridization of coffee plants is necessary. It is likely that Cenicafe will continue to provide the funding and research to increase resistance. However, it is important to maintain diversity in the coffee plant populations to avoid potential disaster caused by other diseases in the future. The biggest obstacle to protecting the coffee growing in Colombia is the farmers themselves (Penarredonda). Many coffee farmers, especially smaller and poorer farmers, are hesitant to switch plants. A regular plant can take two years to produce enough coffee for profit, and can be profitable for around eight years. Replacing plants is therefore inefficient and unrealistic if done all at once. Many farmers are also unlikely to accept new plants as they grow attached to the species they are used to farming (Penarredonda). Current subsidies and loans provided to farmers are helpful, but more money incentives and provisions for small farmers when transitioning to newer, more resistant plants, will likely increase the number who switch. Education and aid in how to grow and care for new plants efficiently and environmentally consciously could help hesitant farmers agree to switch over and overcome personal attachment to the old species.

Overall, the future of Colombia will be greatly impacted by climate volatility. Ideally, global collaboration would decrease fossil fuel use and deforestation, but in the meantime, solutions to the problems posed by climate change need to begin. Given the diverse geography and climate of the country, most plans of action will only work in specific geographical regions, a universal plan with specifics is unrealistic and inefficient. Because poor, rural families currently lack access to many basic necessities such as education, a variety of food, health care, and sometimes clean water, it is important to consider plans of action that will not only help the most people, but those at the most risk. Increasing access and transportation can decrease the severity of unpreventable climate volatility impacts by connecting at risk communities and providing a route of evacuation. By improving and maintaining water resources in the Andes, local isolated communities as well as residents of Bogota and dependent cities will be at a lower risk for water shortages as a result of climate change coupling with El Niño events. Protecting coffee agriculture in Colombia decreases the risk of losing an invaluable part of the economy and the lifestyle of small, poor farmers. Holistically, solutions to the negative effects of climate change on roads, water resources, and coffee farming is a solution to the immediate impacts of climate change in Colombia that will protect the people, their access to food, water, and their quality of life.

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An isolated, small rural community in the Andes at high-risk if water shortages become more common.

A photo of some fruit in a common example of a grocery store in Bogota.

All of the photos provided by and taken by the author.

Coffee beans collected in a typical basket for a relatively large farm.

A road leading to some larger rural communities relatively close to the city. While by rural standards, a well maintained and drivable road, it still is eroded by rainfall with potholes.

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Capitol city of Bogota, population of eight million who are dependent on water from the Andes mountains.