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Costa Rica, Factor 5: Climate Volatility

### **Climate Volatility in Costa Rica**

Costa Rica is located in the southern part of Central America, with Nicaragua to the north, Panama to the south, the Caribbean Sea to the east, and the Pacific Ocean to the west. Costa Rica, in Spanish, translates to “Rich Coast”. The country has around 4.94 million people (FAOSTAT), and almost a quarter of them live in San Jose, the capital. Sixty-six percent of the Costa Rican population lives in urban areas, while 34% live in rural areas. Costa Rica has a total of 5.11 million hectares of land, with half being covered by forest, 40% of land having other uses, but only 10% of the total land is used for farming. In the agriculture industry, 86% of the workers are male but only 14% of workers are female. Following a short but deadly civil war in 1949, the country disbanded its army, becoming the first nation without an army to defend itself (Barash, 2013). This may put Costa Rica into a more vulnerable position if other countries in Central America should have war. Costa Rica has excellent environmental policies, and is the only country on earth to meet all five of the criteria for environmental sustainability. In the Environmental Performance Index (EPI) for 2012, Costa Rica ranked fifth in the world and also first in the Americas. The EPI ranks how well countries perform on high priority environment issues, such as protecting human health from the environment and protection of ecosystems. But, in 2014, Costa Rica suffered a big drop in their EPI ranking, so the Costa Rican media and NGOs used EPI findings to start a conversation about a better comprehensive approach for environmental management and to also improve national policy.

Recently (June 18-24), I traveled to Costa Rica in order to obtain first-hand experience with the culture and to understand the food security issues the country faces today. What I witnessed was extreme rainfall for the month of June. The Instituto Meteorológico Nacional (IMN) recorded more than 200 mm per square meter (8 inches) that fell over a 6 hour period from June 20-21. This was more than the average monthly rainfall for June for this region (QCostaRica). In addition, the region of Sarapiquí, Costa Rica received rain for 15 days straight, which caused major flooding for the Northern Zone and the north Caribbean coast.

*“By Monday afternoon, as the rains slowed down, some 145 communities were affected, forcing 458 people into shelters. Some remained behind to start cleaning up the mud brought into their homes by the water.”* (Rico, 2015)

Some parts of Costa Rica receive little rain, but the Central Cordillera Mountains, on the Caribbean coast, receives over 5,000 mm (196.9 in) of rain per year and some mountainous regions of Costa Rica can get an average of 6655 mm (262 inches) of rain per year! But some areas, such as Guanacaste, only receive an average of 889 mm (35 inches) of rain per year. But, in the last few years, Guanacaste has only gotten 254 mm (10 inches) of annual rainfall. This makes it very hard for the people there to grow their crops without irrigation. Education is important for helping people understand the process of irrigation, so they do not have to go around and water every plant individually, which would be very labor intensive.

In addition, with the respect to temperature, Guanacaste is in the absolute upper limits of where rice can be grown, which means that climate change plays a very big role in whether or not rice can grow. This region is where almost all the rice in Costa Rica is produced. Rice requires a temperature of 30 C (68 F) to grow, but cannot be more than 35 to 40 C (95 to 104 F) (Nagai and

Makino, 2009). Rice is very popular in Costa Rica. It is a big part of their diet and they eat it for breakfast, lunch and dinner. Any rise in temperature will prevent the rice from being able to be grown, and will affect many Costa Ricans' diets.

Subsistence farming is where a farmer grows just enough food for the farmer and family to survive ("Definition of Subsistence Farming"). The typical Costa Rican subsistence farming family is composed of seven members (two adults and five children). The five children consist of three boys and two girls (Wright, 1994). Their diet includes foods such as beans and rice, ceviches (a type of appetizer), gallo pinto (beans and rice mixed with scrambled eggs, beef, plantains, and tortillas), Sopa de Mariscos (a form of tomato soup with clams, mussels, shrimp, squid, fish, and vegetables), tamales, chicharones, coffee, various fruit drinks, and cerveza (beer). Many, if not all, subsistence farmers do not have access to education because they do not have enough money to send any one in their family to school. These subsistence farmers can only focus on growing just enough food so their family can survive, so even if they did have enough money to send someone to school, I believe they would not do so because they need all the money for clothes, a house, etc. Many subsistence farmers do not have access to health care because they are too poor (can not afford a phone to call someone about health care), live too far away from a hospital, or they are not educated enough to know how to get access to proper health care. Most subsistence farmers do not have good nutrition because they can grow just enough food for them and their family to subsist. Another reason why they do not have adequate nutrition is, in my opinion, they are too poor to purchase healthy foods and therefore many subsistence farmers suffer from food-related disorders because they eat little to no healthy foods but they can do nothing about it because they are too poor to afford health care.

A typical subsistence farm in Costa Rica is 10 hectares (25 acres). But, for a small portion of subsistence farmers, this is not enough because they have large families and lots of mouths to feed so they need bigger farms but do not have enough money to buy more land. Typical crops grown by a Costa Rican farmer include coffee, bananas, cocoa, sugar, corn, rice, potatoes, citrus fruits, yucca fruit, vegetables, pineapples, tobacco, hemp, and vegetable oils. Rice can be a problem because in the Guanacaste region, rice is in its absolute upper limits of where it can grow, so if global warming causes even the smallest rise in temperature in this region, many subsistence farmers will have a big part of their diet to disappear. Many of the farmers are too poor to buy seeds for an alternative to rice, so they will likely have to ration out food portions or start eating less food.

Different farmers have different agricultural practices. Some of these practices include using crop breeding to create a larger yield, having biodiversity of crops and using this to their advantage, using pesticides to kill off pests that eat the crops, or organic farming, and using machines to do all the work instead of humans.

Some major barriers to agricultural productivity includes drought, which prevents the crop from growing because it has insufficient water, pests that eat the crop which can lead to a smaller yield, diseases that kill a plant and is practically impossible to control, and natural disasters, including fires. These are devastating to any farmer because all the crops are destroyed and it will take a while for crops to grow back even if there is enough rain. Some of these barriers, such as pests, are somewhat easy to control, because things can be done to repel them but it is impossible to tell whenever pests will attack the crops. Fires can sometimes be controlled but other times they cannot. One way to prevent a fire from starting is to farm in an area where there is a good amount of rain and there is a little to no fire hazard.

Climate volatility affects agricultural productivity because some crops grown in Costa Rica, such as bananas and rice, are “on the border” of being able to grow because the temperatures there are getting too high for the crops, and in turn, poses a major threat to farmers who make their living off these two very popular foods in Costa Rica. Climate volatility plays the so-called “bad guy” role in Costa Rica when it comes to the most popular crops in the country. Climate Volatility is becoming more of a threat because many countries around the world are spewing carbon dioxide into the air at a really fast rate. More carbon dioxide in the air increases the greenhouse effect, which heats up the planet. I believe this factor is nicknamed a “bad guy” because if the temperature in Costa Rica rises just a little, bananas might not be able to grow and rice will definitely not be able to grow. If this happens, the price of bananas in Costa Rica and possibly around the whole world will rise because the number of bananas being produced has gone down, making them hard to find and, also, they will likely not be grown there ever again because it is too hot. With rice, on the other hand, if the temperature rises even a few degrees, the price of rice will rise more than bananas because it will no longer be able to be grown and almost everyone in Costa Rica will be affected because it is a part of everyone’s diet and is eaten for breakfast, lunch, and dinner.

The current status of climate volatility is a threat because if global warming heats up the atmosphere and global temperature rises just a degree or two, a few of the most popular crops in Costa Rica will not grow and this will force farmers to find another way of life. This can be very difficult. This situation is about to become severe because almost every single country that manufactures goods in a factory has not gotten the message that carbon dioxide being pumped into the air increases pollution which, in turn, accelerates global warming and makes the planet hotter. These countries that casually pump carbon dioxide into the air need to know that it really hurts the environment, affects global temperature, and even hurts themselves. I believe that the environment is being degraded because there is proof that excess carbon dioxide in the air can and will increase global temperatures. Carbon dioxide (CO<sub>2</sub>) is capable of increasing temperatures because it allows the sun’s solar radiation to pass through and heat up the earth’s surface. Secondly, the earth’s surface transmits a part of that radiation back into space as thermal radiation. Next, some of the thermal radiation is absorbed in the atmosphere by carbon dioxide molecules and is then diverted back to the earth’s surface which provides more heat sources (Colleen, 1998). I believe we can at least reduce the amount of carbon dioxide into the air so farmers do not have their whole lives ruined. This can be accomplished by slowing down the rate at which trees are being cut down (plants give off oxygen and take in carbon dioxide), planting more trees, and set a limit of how many trees can be cut down in a particular area. I think that developing countries are disadvantaged because they are not pumping the carbon dioxide into the air but are victims of those who are pumping excess carbon dioxide because they are recording much higher temperatures and food shortages for something that other countries are doing.

The trends for climate volatility are worsening because more and more carbon dioxide is being pumped into the air but countries are doing little to slow down or stop their carbon dioxide emissions. Trends for climate volatility are measured by how badly it affects the environment. I believe these trends do not indicate in any way that the situation is changing at all. The situation for a rural farm family in Costa Rica that makes their living growing crops is worsening because as carbon dioxide emissions keep on increasing, the temperature is going up while the ability to grow certain crops are decreasing. In addition, El Nino and La Nina are factors affecting the climate in Costa Rica. This makes it hard for them to continue with their livelihoods.

Resolving this factor would be very difficult or it could take a very long time, but, if resolving climate volatility was possible, it would increase the amount of food the average farm family could grow, and they will not ever again have to worry about the possibility of their crops not

growing because it is too hot. Also, removing the threat of climate volatility will preserve the environment sustainably because the environment will now be able to stabilize itself and can start growing trees to give off more oxygen and less carbon dioxide. This will also benefit smallholder farmers in Costa Rica because they can now grow their crops without worrying that they will not grow as well or not be able to grow at all.

Pollution affects climate volatility in a negative way because the more pollution that is being pumped into the air, the more climate volatility becomes a threat. This is the case because pollution and climate volatility are linked in a way that if pollution increases, the threat of climate volatility increases. Urbanization will affect the farm family because as cities get more crowded, there will be a greater need for people to find a place where not many other people live, and will likely find a home on a farmers property, which will decrease the amount of crops that farmer grows.

I recommend one way to reduce climate volatility is to manufacture goods that produce less carbon dioxide at factories which will reduce pollution and make climate volatility less of a threat. The second way to reduce this factor is to plant more trees because trees give off oxygen and take in carbon dioxide, which means that more trees equals more oxygen and less carbon dioxide. Finally, the last way to reduce this factor is to stop cutting down trees because this has a negative effect on the environment and the surrounding area. One thing the Costa Rican government has vowed to do is become carbon neutral by 2021. One way to scale this up is to convince the Costa Rican government to try to become carbon neutral by 2019, because the sooner pollution is stopped, the better. But, a barrier to this includes not having enough money to switch from a carbon-producing factory to a cleaner, more environmentally friendly alternative, such as solar power. One possible way to overcome this barrier is to raise taxes, which would give the government just enough money to build the solar panels need. After they have the solar panels built, they can set the taxes back to normal! Since Costa Rica is a third world country, they do not have nearly enough money to build so many solar powered factories and would have to borrow money from other countries to build them but would eventually have to pay those other countries back. Another barrier is there are no carbon-neutral countries yet, so the Costa Rican government has nobody to look to for help in this situation. The way to overcome this barrier is to set their own way of becoming carbon neutral so other countries can follow what Costa Rica did.

I believe that the United Nations should get involved because they are one of the most powerful groups in the world. One way for them to aid the Costa Rican government in trying to reduce climate volatility is to set a year when everything I listed should be completed in a satisfactory way. Lastly, I believe that the rural farm families should be given an incentive to plant more trees.

As previously mentioned, it appears that global climate change has affected the amount of rainfall in the Guanacaste region of Costa Rica. Normally, they receive 889 mm (35 inches) of rain per year, but in the last few years it has dropped to only 254 mm (10 inches) of rain per year. This can have a major impact on agricultural systems in general and rice production in particular. Because Costa Rica is a fairly small country, like the size of West Virginia, it should not be difficult to get water from the central part of the country, which gets over 5080 mm (200 inches) of rain per year, to the fairly dry areas of the country like Guanacaste. One solution to the threat of low rainfall for agricultural production in Guanacaste and other low rainfall areas of Costa Rica is to utilize a water delivery system similar to the one for agricultural production in California. I propose a way to do this is to dig canals from the central part of the country that gets lots of rainwater to the areas with little rainfall to help aid farming. This kind of technology is a good solution because some areas of Costa Rica get lots of rain while some parts get very little and it is important to get ample amounts of water there in order to aid farmers in that area. Since

Costa Rica is a small country, the cost should not be very high for digging the canals. But, since Costa Rica is a third world country, it may be difficult to pay it all themselves, so they should ask for help from the United Nations and other private corporations. Also, I think that the Costa Rican government should add a water treatment plant so they can recycle their water in the major cities of the Guanacaste region. Wastewater could be used to support the agricultural region of Guanacaste.

Lastly, I believe Costa Rica is facing many challenges of global climate change. This could affect agriculture in the region and the livelihoods of many farmers. Changes need to be made in order to address these concerns. These changes include getting more people involved in preserving the environment and setting an incentive for everyone who participates in preserving the environment. The final change needs to be teaching people who think global warming "isn't real" about proven facts that global warming is happening and the events that occur when damage happens to the environment.

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