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Costa Rica, Factor 6: Sustainable Agriculture

The Sour Side of the Pineapple: An Interpretation of Costa Rica's Pineapple Industry

Considering Costa Rica

Costa Rica is a developing but progressive country. It has a population of over 4 million people, and according to a 2013 study, 71% people were married or in a free union (*Richardson, 2012*), and had an average of 2.5 children. It is expected that Costa Rican children attend school from age 6 to 16 years, and the country has a 95% literacy rate to support this educational value. Religion is also a large part of the Costa Rican lifestyle, with 76% of Costa Ricans ascribing to Roman Catholic values (*CIA World Fact Book*), possibly because the country was once occupied by Spain until independence was granted in 1821. Costa Ricans are afforded a universal healthcare system (*Dos Santos, 2015*), and since their healthcare system was reformed in 1994, it has been declared to be the most effective healthcare system in Central America (*Pesec, 2017*). The Costa Rican diet relies on two main ingredients, rice and black beans- both grown locally, make up the staple ingredients of its national dish 'gallo pinto.' Local wild growing fruits provide vital nutrients and vitamins to round out the diet. Tortillas made of maize and sweets are also popular. Subsistence farming is practiced by the indigenous Bribri peoples particularly in the Limón province (*Posts, 2013*), however most of the country's subsistence farms are located in the Central Valley. Costa Ricans living in small towns access their food from local shops.

The 51 000 square kilometre eco-friendly paradise of Costa Rica is a top tourist destination in Central America, bordering Nicaragua to the north and Panama to the south. With warm weather, lush ecosystems and pristine beaches, travellers enjoy the *pura vida* lifestyle (meaning 'living the good life'), which contributes to the country's profitable tourism industry (*Pearson, 2016*). Costa Rica's geography is rich with diverse vegetation that blossoms in the country's many different landscapes. The Sierra Madre mountain range runs north-south down the centre of the country and is home to 7 active volcanoes (and many inactive ones), including the Arenal Volcano, which last erupted in 2000, killing one individual. Lake Arenal, located near the Arenal Volcano is the largest lake and source of freshwater in the country. However, most of Costa Rica's salt water is found on the pacific coastline to the west of the country. Some of Costa Rica's coast also borders the Caribbean Sea. Costa Rica is home to the mangrove ecosystem, the beach wildlife scene, the vegetation and organisms in tropical and cloud rainforests, and many national parks protect its diverse wildlife while preserving its environmentalist image to ecotourists.

Growing Pineapples in Costa Rica: Pros and Cons

Although Costa Rica's main industry is tourism, its GDP is also increasingly affected by agricultural contributions, specifically involving the production of bananas, palm oil, coffee, rice and pineapples as owned and developed by multi-national household brand name corporations such as Dole, Chiquita and Del Monte. Since 2000, for example, Costa Rica's pineapple production has increased by 300%, bringing in over \$485 million USD annually (*Martin, 2016*) and providing employment opportunities for local citizens. However, scientists have raised concerns that the negative effects of the pineapple industry are beginning to invade and influence Costa Rica's ecosystems, and affect the eco-friendly values that have drawn tourists to this destination. In addition, there is some concern for the health, wellness and safety of the plantation workers.

Considering agricultural concerns, pineapples are a particularly difficult crop to cultivate, and human manipulation with the agricultural process via the use of pesticides is necessary to grow a profitable crop. Two primary agrochemicals are in use: bromacil and paraquat. Paraquat is a herbicide that is used before harvesting as a defoliant in the pineapple industry, but in other circumstances, paraquat is also used as a plant growth regulator (*Watts, 2011*). Bromacil is also a herbicide used for targeting weeds, however in contrast to paraquat, it is non-selective (*CCME, 1999*). Using excessive amounts of these non-indigenous chemicals creates runoff into lakes, ponds, oceans and especially groundwater consumed by Costa Ricans. Other crops may not be able to be watered with ground water in areas affected by heavy pesticide use, and a costly solution may involve importing water from elsewhere in the country to sustain other agricultural industries.

Food security is a secondary concern as runoff containing unknown levels of potentially hazardous pesticides is polluting the groundwater that local residents use for drinking and cooking. Some residents have resorted to purchasing potable drinking water, that adds financial challenges to a family struggling to nourish itself (*Boeglin, 2017*). It is a cycle for the people that are living in this situation that continues to lead (particularly) rural Costa Rica into systemic levels of poverty.

Finally, several factors have influenced the labour force of pineapple plantations, affecting the quality of life for local workers. Most pineapple plantations are located in the province of Limón; and in particular the towns of Guácimo, Siquirres and Picoí, near the Nicaraguan border. Although many Costa Ricans work in the pineapple sector, Nicaraguans also migrate to work in the plantations (*Boeglin, 2017*). Although some migrants have immigrated and are working legally, many Nicaraguans and their families travel to Costa Rica to work illegally in the pineapple industries and take advantage of Costa Rica's universal healthcare system (*Dos Santos, 2015*). This migration causes many issues for Nicaraguans and Costa Ricans alike in terms of labour laws and safe workplaces. Due to their illegal immigration status, Nicaraguans do not have the power to demand fair hours and salaries and safe workplaces, and since they make up a sizeable portion of the workers in the pineapple industry, their employment greatly affects the salaries and work conditions of all workers (*Boeglin, 2017*). Lower school enrolment has been reported for children living near pineapple plantations (*Richardson, 2012*), and may be due to a need for children to work to support the family. For Costa Ricans living in towns in rural Limón, their average salary is below the poverty line (*Richardson, 2012*). Out of the total number of employed Costa Ricans, 62% work in services, 29% in industry and 9% in agriculture (*Funk & Wagnall, 2016*); and nearly half of Limónian people living near a pineapple plantation reported that they themselves or a family member has worked in the pineapple industry (*Richardson, 2012*).

Consequences and Action Involved in Uprooting the Pineapple Industry

Rallies have been held to attempt to enforce stricter labour and environmental laws, however the large-scale pineapple production companies have not followed through on the contracts they signed with the Costa Rican government (*Arias, 2017*). Many Costa Ricans now believe that their government is hesitant to confront companies like Dole and Chiquita, in fear of completely losing the industry and the Costa Rican economy taking a huge toll (*Arias, 2017*). Until the parties involved come to an agreement, the issue will be as serious as it always was, however the environment in the affected areas will continue to deteriorate and the families working in the pineapple industry will continue to suffer. Improving the pineapple industry would show a two-fold effect. Costa Rica would begin to return to its eco-friendly oasis and the groundwater in the surrounding areas could eventually be useful again. Furthermore, Costa Rican families in the pineapple industry would see changes in their compensation as workers and labour laws would protect their rights and salaries.

Comparison of a Similar Canadian Environmental Concern

Labour shortages and working conditions may be difficult to resolve with large companies, but destruction of the environment will affect all stakeholders in the long run. In my home province of Manitoba, Canada, pesticide use is in effect to assist with the growth of grain products (i.e., wheat, canola and barley) on Canadian plains with short growing seasons and harsh winters. The runoff from pesticide use has been similarly leaching into Lake Winnipeg, Manitoba's biggest fresh water source. This topic has been discussed and supported by all levels of government and has been highly publicized in the media. I have been following this topic for five years, since the inception of a science fair project completed during my grade seven and eight school years. I believe that Costa Rica's environmental issue is very similar to Manitoba's environmental issue.

To elaborate, Lake Winnipeg in central Canada is the 10th largest lake in the world by surface area. Its watershed is the second largest in Canada, which covers portions of four different Canadian provinces and four different United States. It also has a drainage basin of almost 1,000,000 squared kilometres, which provides a home to more than 7,000,000 people, not to mention the many different ecosystems, and species of animals, plants and microorganisms that reside within these ecosystems. Since there are so many people living in proximity to Lake Winnipeg (residing in different jurisdictions and countries), and the body of water affects so many lives (in terms of fishing, tourism, real estate, natural resources), it is concerning that the lake received the title of "The Most Threatened Lake in the World" in 2013 by the Global Nature Fund (Turner, 2013). Many experts have recently prophesied catastrophe for Lake Winnipeg; proclaiming that the lake will die without intervention and change due to such concerns as algal blooms and zebra mussels, two invasive species.

An aquatic ecosystem is considered in a state of eutrophication when there are excess amounts of nutrients built up in the ecosystem. This problem usually occurs with an abundance of human activity, specifically from the runoff of phosphorus and nitrogen, two components of fertilizers. The fertilizers and other nutrients are carried away from farmers' fields, golf courses, individual homes through fecal matter and even with the erosion of the soil in the surrounding areas into Lake Winnipeg's large drainage basin and eventually directly into Lake Winnipeg. Although many believe that the excess phosphorus and nitrogen now contained in Lake Winnipeg would be good for the lake (because it will stimulate more plant growth), an opposite problematic result occurs. The overload of phosphorus and nitrogen causes an overgrowth in plants and microscopic organisms, in specific, blue-green algae, or Cyanobacteria. The delicate balance of the ecosystem is thrown off because of the blue-green algae invading the surface area of the lake.

Blue-green algae is a species that grows quite aggressively, and creates algal blooms as it multiplies, covering the surface of the lake. This excess growth at the surface of the lake allows less sunlight to penetrate to the other aquatic plants that inhabit the floor and rocks of the lake. Since the plants living below the umbrella of blue-green algae do not receive an adequate amount of sunlight, they are not able to perform photosynthesis in order to create energy for themselves as well as release oxygen and glucose which are vital components of cellular respiration, a process necessary for consumers to obtain energy. The lack of dissolved oxygen left in Lake Winnipeg's water is a condition known as Hypoxia, which means that there are no longer adequate oxygen levels in the water for it to be life-sustaining.

Bioremediation: A Solution for All

The condition of hypoxia could lie in the future for many of the rivers, streams and other bodies of water that are located near the pineapple plantations in Costa Rica if some of the challenges that the agriculture sector is currently facing are not alleviated. In my opinion, the most promising solutions for Manitoba

and Costa Rica will have the least drastic effect on their natural environments, while still solving the issue effectively. Improvements to the chemical runoff concern may be alleviated through the use of a technique called bioremediation. Bioremediation is the use of organisms or vegetation to breakdown chemical pollutants in the ecosystem. For example, in Manitoba a method I have proposed to better the state of lake Winnipeg involves the use of two wetland grasses, indigenous to Manitoba: Canadian Wild Rye and Tufted Hair-grass. When planted in controlled environments, my studies have suggested that these grasses are able to absorb and retain phosphorus from Lake Winnipeg. When the grasses eventually die and decay, the phosphorus is released from the plants back into the lake, so the plants have to be removed and replanted on a yearly basis. The decomposing plants that now contain excess amounts of phosphorus could be processed and used as fertilizer in phosphorus-lacking farms in Manitoba or elsewhere.

I believe a similar method could be used in Costa Rica with the leaching of pesticides into the ground-water. Although much more research would be needed, a few select species of the grasses native to Costa Rica could be planted around the perimeters and throughout the pineapple plantations to help take in and control the amount of pesticide that leaches into the groundwater. With this method, there is a risk for the species to become invasive, however this can be controlled and potentially eliminated by planting only species that are indigenous to Costa Rica, monitoring the plantations thoroughly and removing the species for use elsewhere once they begin to die and decompose. This solution could be scaled up to all plantations where pesticides are used in the country. The solution would also create many job opportunities for Costa Ricans to be involved in the planting of these species, the monitoring and testing at the plantations and then the removal and recycling of the plants when they begin to decompose. Costa Rica has a good track record for recognizing the effects of tourism and human exposure to the delicate ecosystems in this country. However, major corporations and non-government organizations may be involved in funding workers' salaries and other costs incurred with studying and obtaining the plants, planting them and then recycling them.

Conclusion

Having traveled to several beautiful countries (including Costa Rica) and several regions around Canada and the United States, I have become aware of the devastating effects of human development on the environment. Writing this paper and attending this conference has increased my awareness of the problems involving overuse of pesticides and fertilizers as a problem that exists in my country, also exists around the world. Further exploration of bioremediation processes, which could include planting local species to absorb excessive amounts of chemicals from entering water sources, could reduce the amount of chemicals entering an ecosystem. These processes would help to ensure that a varied and valued number of food sources (e.g., pineapples) are grown in ways that maintain environmental resources for future generations.

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