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Haiti, Factor 6: Sustainable Agriculture

### Introduction:

The people in the US are fortunate enough to not have to worry about when their next meal will be, or if they will ever have enough food to feed their families. This is a growing issue with a number of developing countries all over the world. These countries lack food security, meaning they “do not have adequate physical, social or economic access to food”(Economic and Social Development Department, 2002). One of the things that leads to a country’s food scarcity, that have the potential to alter into famine, is natural disasters.

The four pillars that determine food security are food availability, physical and economic access to food, stability of supply and access, and food utilization. Food availability involves the “supply side” of food security and is determined by the amount of domestic food production, food stocks, and trading (Food Security Information for Action, 2008). The economic and physical access to food, is focused on incomes, prices, and markets in achieving food security. Food utilization has more to do with each individual, and how they find diversity in their diet, that ultimately shows good feeding practices. Developing countries are still classified as food insecure because they are unable to have an adequate access to food on a daily; “Adverse weather conditions, political instability, or economic factors [unemployment, rising food prices] may have an impact on [their] food security status” (Food Security Information for Action, 2008).

Haiti is a mountainous and densely populated country, which is about 27,750 square kilometers. It is considered as the poorest country in the western hemisphere. More than half of all Haitians, 55%, live on less than \$1.25 a day (Curnutte, 2011). Due to the economic struggle, families struggle to purchase a human’s daily needs: food, shelter, and clothing. Most of the country’s natural beauty is fading away. The land is ravaged by erosion, replaced with what was once beautiful forests. Consequently, crops drown and die due to excessive water. Rural households rely on agriculture for a significant portion of their income. Low agricultural productivity traps many families in a cycle of poverty.

Poverty will always be the thing that holds Haiti back from reaching economic stability and independence. According to the World Food Program, “Approximately 70% of the country’s poor live in rural areas, and two thirds of the population is estimated to be food insecure” (2013). Most houses in Haiti are one floor high, square-shaped, made of scrap material found near by, and with no running water or indoor sewage (visual geography, 2017). Haitians are hard working; “they aren’t lazy’ on the contrary, they are industrious and thrifty” (Johnson, 1950).

Haiti has been a long time victim of natural and manmade disasters including earthquakes, hurricanes, deforestation, and corrupt government. The major motivation for cutting down trees is the immediate need for charcoal, which “serves as the cheapest and main source of energy” (Foxx, 2012). According to Foxx, “reforestation is crucial because Haiti’s forests have decreased from covering 60% of the country in the 1920s to less than 2% today” (2012). Furthermore, reforestation offers a way of addressing climate change, reversing ecological damage, and lessening the impact of future natural disasters (Marcella, 2010). Due to their own socioeconomic standing, most Haitians are peasants and do not own land, which gives them little motivation to preserve it. The best way to reverse the self-destructive behavior of the

people and government, and promote reforestation, would be “to create immediate and self-sustaining economic incentives directly related to planting trees and environmentally friendly crops and plants” (Foxx, 2012).

Soil loss under current land management practices has “estimated to be 1,318 t km<sup>-1</sup> y<sup>-1</sup> by the World Bank” (Jolly et al., 2007). The overexploitation of land from agriculture and the associated soil erosion are contributing factors on low agricultural productivity; “found in Haiti, yields of maize, pigeon peas, and beans are 45%, 31%, and 70% respectively, of those in the adjacent Dominican Republic”(FAO, 2014). Because there is a direct correlation between the health of the soil and the production and yield of each individual crop variation in the harvest season, then Haiti’s livelihood depends on how well they treat their soil.

The average family in Haiti uses a little over a hectare (2.5 acres), and practices subsistence farming, which means that they grow their own food. Since each individual’s income is almost nothing, then almost every family isn’t equipped with the most up-to-date farming technology. Haitians are still stuck with using simple hand tools to cultivate and harvest crops. The significance of this misfortune is that it affects the number of crops a family can harvest in the most efficient way.

#### Problem #1: Greenhouse Gas Emissions

Climate change is the change in normal weather patterns in a particular region or across Earth as a whole. Greenhouse gases are the main contributor to climate change. They act as a “thermal blanket” by preventing the warm interior air from rising and combining with outside air, slowing down the natural heat loss process (NASA, 2017). According to the World Resources institute Climate Analysis Indicators Tool, agriculture is the leading source of greenhouse gas emissions in Haiti, which contributes 49% of total emissions (2015). People in Haiti are so uneducated, poor, and lack many basic resources, to worry about eliminating the emissions of greenhouse gases. Since only 2% of Haiti’s forest are present today due to deforestation, carbon dioxide has been released in the atmosphere at an exponential rate. Methane, compared to Carbon dioxide, is less abundant in the atmosphere, although, it does have a stronger warming effect, which may contribute more to the climate change in Haiti. It is released from poor manure management, farmers have a habit of leaving the manure from livestock in pastures. Rice is one of the most staple crops for the people in Haiti. Rice cultivation is another source of methane emitted, because of the decomposition of organic matter in the flooded and over-saturated soil. Prolonged water stagnation is caused from the irrigation in growing rice, due to the struggle in draining.

#### Solution #1: Alley Cropping

Alley cropping, also known as intercropping, is a type of agroforestry that involves planting trees within crop systems (MacFarland, 2017). Alley cropping has been shown to sequester significant amounts of methane gas, nitrous oxide emitted from the soil, and carbon dioxide. Methane uptake depends on more than the type of crop or tree planted or use of agroforestry; it also depends on the soil. In addition, the alley cropping system improves soil health and increases crop diversity, while also providing substantial profits to incentivize farmers.

Alley cropping also has the potential to reduce the nitrous oxide emissions from the soil. In research done by Amadi et al. (2016), agricultural lands that used shelterbelts showed nitrous oxide emissions that were four times lower than those in adjacent cropped fields without shelterbelts. However, some conflicting research done by Chikowo, Mapfumo, Nyamugafata &

Giller (2004) and Hall, Kaya, Dick, Skiba, Niang, and Tabo (2006) has reported increased nitrous oxide emissions when using agroforestry compared with other agricultural land (as cited in Kim et al., 2016).

The trees used in alley cropping are constantly pruned to minimize shading of the nearby crops grown between them, and to provide nutrient-filled, quick-decomposing leafy mulch, which can be mixed into the soil. They are capable of blocking out the wind, which has the likelihood of knocking the pollen off of the crops, and instead keeps them from breeding with each other. The nutrients that are added back into the soil, will later help increase crop yield and productivity. The choice of tree depends on the climate, soils, and competition with the main commodity crops (MacFarland, 2017). The higher the crop yield, the closer the Haitian people will be to becoming food secure.

Alley cropping is very labor intensive, so when implementing this new style of agriculture in Haiti, this could create more jobs to plant more of the already existing crops, as well as the trees that will grow in between them. One of the hardest things to get over when implementing this new agricultural practice, is to motivate the Haitian people to abandon their old techniques, and adopt something new that's foreign to them. Although, farmers will only be hurting themselves if they don't decide to switch to alley cropping, because they will continue to be more and more food insecure. The health of the soil will not improve on it's own if they continue on the path they're headed. If the soil isn't healthy enough, than a farmer won't grow enough crops to feed his family, or any cash crops to sell.

#### Problem #2: Soil Erosion from Deforestation

Deforestation is the main cause of soil erosion, because the tree's roots are what keeps it together. Soil erosion removes the valuable top soil, which holds the nutrients that would be provided for the crops. There will always be a direct correlation between poverty and the health of the soil in which they grow their crops. Meaning, as long as the people of Haiti aren't educated on how important it is to look after the health of the soil, so it eventually will have the ability to sequester carbon, provide nutrients to crops, and increase the crop yield.

The Haitian main source of energy is charcoal and firewood. Since most of the population is poor, this limits their option to look for an alternative source of energy. Their low socioeconomic status makes them have no choice but to cut down trees, for their way of survival.

Haiti has a long reputation of being a victim of powerful natural disasters. Since only 2% of Haiti's forests exist today, than they can no longer use that to protect themselves from the harsh weather. Hurricanes have the potential to destroy crops and wash away the valuable top soil. Furthermore, with Haiti's existing weather conditions, they are more prone to stay food insecure, because of the lasting effects of soil erosion.

#### Solution #2 Implementing Evergreen Conifer Trees with Alley Cropping

Evergreen conifer trees are able to grow in almost any different weather conditions, because they are spotted on different continents around the world. Pine trees in particular have a remarkable ability in preventing soil erosion because unlike other trees, their roots grow deeper into the soil, which can be useful in Haiti's landscape. With roots growing deeper into the soil, that offers more nutrients to be returned in the soil, ultimately improving the yield and productivity of various crops. It is mostly mountainous, and since it is important for the country to practice reforestation, this solution is multi purposed. By planting the Pine trees in the new

alley cropping technique, as well as planting the trees around a farmer's property, this will help shield Haiti from a future natural disaster. Their crops will be protected from any future mountain runoff that has the potential to flood the crops.

The pine needles that fall off of the trees help prevent the growth of weeds by suffocating them. The pine needles also help the soil sustain moisture. This can be made into a fertilizer to help out the soil. Evergreen Conifer trees have the ability to sequester so much carbon more efficiently than other trees, because it takes less time for them to grow, and have a long livelihood. According to a study conducted in Sweden, boreal plants (spruce, birch, rowan, and pine trees) showed a net intake in methane emissions in both laboratory and in situ conditions (Sundqvist, Crill, Molder, Vestin, & Lindroth, 2012).

Using Pine Trees in alley cropping could be a huge economic incentive for the people and Haiti as a whole. Compared to most other trees, pine trees only take 5 years to fully grow, grows at a rate of 2-3 feet per year, and has a lifespan of 300-500 year, depending on the species of Evergreen Conifer. The significance of this is that a farmer has the ability to remove a portion of the trees that have already been grown, and use them to produce numerous products that may be used in a person's daily life. Pine wood is a valued resource to produce: furniture, window frames, paneling, floors, roofing, paper, turpentine, and etc. These trees can be a long term solution for Haiti, in which they can make a profit all year-round. Farmers leave out some trees to sell for Christmas trees during the holidays, and having everyone do this could stabilize Haiti economically, and eventually, they could start to ship their Haitian-made products to the rest of the world.

### Solution #3 Incorporating Cash Crops with Alley Cropping

Later on, when all the people of Haiti can reap the benefits of alley cropping, they can start to incorporate various cash crops to grow, increasing each farmer's profit. The trend that is happening in Haiti right now, since majority of the population is poor, most of the crops that they grow are grown subsistently, while only a few other crops are grown to sell. It does not matter how much they grow if the soil that is in use does not have enough nutrients, and the mountains around them are eroding. It is important for the country to implement alley cropping first in order to replenish the environment that is now deteriorating.

Each of Haiti's main crops are grown in a specific type of landscape that will best the crop grow at its full potential. Coffee is the main cash crop in Haiti, and is grown in the mountains. Cotton is grown on the sea-level plains, and bananas as well as sugarcane is grown in irrigated plains. Rice is Haiti's primary crop to feed its population, and they are not able to meet the demands. Once alley cropping is put in place, the soil may have the potential to be healthier than it has ever been. If the Evergreen Conifer trees are planted in this as well, then it can help to sequester the methane from the atmosphere, from the decomposition of organic matter in rice fields. The methane is also released from poor drainage in the fields. By absorbing any gases that may be affecting the soil health, this can later increase the yield of all of Haiti's crops, morphing into a more sustainable and independent nation.

### Conclusion:

My mission is to get the people of Haiti to become food secure. The factors of food security are: food availability, physical and economic access to food, stability of supply and access, and food utilization. Food availability involves the amount of food is available to be consumed, which is determined by the amount of domestic food production. If there's a high production of food, then

there's an opportunity to export some of the food for a profit. The economic and physical access to food is focused on incomes, prices, and markets in achieving food security. Food utilization has more to do with each individual, and how they find diversity in their diet, that ultimately shows good feeding practices. The people of Haiti need to be educated on the effects Greenhouse gases has on the environment around them, and if they don't decide to fix this problem, then Haiti will continue to be food insecure. Agriculture is the main source of income and emits the most Greenhouse gases in Haiti. The solution to their problem is adopting alley cropping, which is planting crops in between rows of trees. Alley cropping has been shown to sequester significant amounts of methane gas, nitrous oxide emitted from the soil, and carbon dioxide. In addition, the alley cropping system improves soil health and increases crop diversity, while also providing substantial profits to incentivize farmers. Alley cropping is very labor intensive, so when implementing this new style of agriculture in Haiti, this could create more jobs to plant more of the already existing crops, as well as the trees that will grow in between them. One of the hardest things to get over when implementing this new agricultural practice, is to motivate the Haitian people to abandon their old techniques, and adopt something new that's foreign to them. Although, farmers will only be hurting themselves if they don't decide to switch to alley cropping, because they will continue to be more and more food insecure. Evergreen conifer trees are able to grow in almost any different weather conditions, because they are spotted on different continents around the world, which means they would be the perfect tree to implement in alley cropping to prevent soil erosion because it the roots grow deep into the ground to hold the soil together. The farmers can benefit from growing Evergreen Conifer Trees by creating products that can benefit all of society. The trees themselves have the ability to sequester carbon dioxide, methane gas, and nitrous oxide. Since it only takes 5 years for the tree to grow at a substantial size, and has a lifespan of 300-500 years, this is a long term solution for the country. Incorporating various cash crops in alley cropping will increase the wealth of farmers, so they will be able to feed their families and provide a better life for their children. This solution won't be easy, but it is important for Haiti to not seek foreign aid from anyone, because that will only create a dependence, which will set the country back even further from achieving food security.

#### Work Cited

- ADOPTION AND MANAGEMENT OF ALLEY CROPPING IN HAITI . (April, 2004 ). ADOPTION AND MANAGEMENT OF ALLEY CROPPING IN HAITI . doi:10.18411/a-2017-023
- Bayard, B., Jolly, C. M., & Shannon, D. A. (2007). The economics of adoption and management of alley cropping in Haiti. *Journal of Environmental Management*, 84(1), 62-70. doi:10.1016/j.jenvman.2006.05.001
- Curnutte. (2011) Money. Retrieved from <http://ebookcentral.proquest.com/lib/vt/reader.action?docID=3040081&ppg=118>
- Economic and Social Development Department. (2002, July). Chapter 2. Food security: concepts and measurement[. Retrieved June, 2017, from

<http://www.fao.org/docrep/005/y4671e/y4671e06.htm>  
Edinburgh Research Archive. (n.d.). Figure 2f from: Irimia R, Gottschling M (2016) Taxonomic revision of Rochefortia Sw. (Ehretiaceae, Boraginales). Biodiversity Data Journal 4: e7720.  
<https://doi.org/10.3897/BDJ.4.e7720>.

Food Security in Haiti After the 2010 Earthquake: Analysis and Evaluation of NGO Relief Efforts. doi:10.3897/bdj.4.e7720.figure2f  
Figure 2f from: Irimia R, Gottschling M (2016) Taxonomic revision of Rochefortia Sw. (Ehretiaceae, Boraginales). Biodiversity Data Journal 4: e7720.  
<https://doi.org/10.3897/BDJ.4.e7720>. (august, 2014).

The Effectiveness of U.S. Development Aid in Supporting Agriculture and Food Security in Haiti: A Case Study of USAID's Haiti Feed the Future West/ WINNER Project.  
doi:10.3897/bdj.4.e7720.figure2f

Foxx, R. M. (2012). Behavioral Interventions. TE TERRE A FATIGUE 'THE EARTH IS TIRED': REVERSING DEFORESTATION IN HAITI. doi:10.1107/s0108768104025947/bm5015sup1.cif

Gorrell, M. G. (2011). Information Standards Quarterly, 23(2), 31. doi:10.3789/isqv23n2.2011.07

Johnson, J. W. (n.d.). Self-Determining Haiti. Retrieved July, 2017, from  
[http://windowsonhaiti.com/windowsonhaiti/haiti\\_oc\\_series\\_03.shtml](http://windowsonhaiti.com/windowsonhaiti/haiti_oc_series_03.shtml)

Kelley, M. N. (april, 2001 ). Figure 2f from: Irimia R, Gottschling M (2016) Taxonomic revision of Rochefortia Sw. (Ehretiaceae, Boraginales). Biodiversity Data Journal 4: e7720.  
<https://doi.org/10.3897/BDJ.4.e7720>. Assessing the Investment Climate in Haiti: Policy Challenges. doi:10.3897/bdj.4.e7720.figure2f

Kennedy, N., Amacher, G. S., & Alexandre, R. (april, 2016). Journal of soil and water conservation. Adoption of soil and water conservation practices in central Haiti.  
doi:10.3403/30197441

MacFarland, K. (2017, March). Alley Cropping: An Agroforestry Practice. Retrieved from  
<https://nac.unl.edu/documents/agroforestrynotes/an12ac01.pdf>

McClintock, N. C. (n.d.). Agroforestry and sustainable resource conservation in Haiti: A case Study. doi:10.2172/437680

Michel, R. 2001. Informations sur les technologies traditionnelles en Haiti. Retrieved from  
[http://www.haiticulture.ch/Env\\_techno.html](http://www.haiticulture.ch/Env_techno.html)

Moore, K. M. (n.d.). Graphic technology. Variable data exchange. Reconstructing Agricultural Production for Food Security in Haiti. doi:10.3403/30197441

Murray, G. F. (1991). The Tree Gardens Of Haiti: From Extraction to Domestication.  
doi:10.18411/a-2017-023

Nair, P. K. (1993). Alley cropping. An Introduction to Agroforestry, 123-139.  
doi:10.1007/978-94-011-1608-4\_9

NASA. (2017). A blanket around the Earth. Retrieved from <https://climate.nasa.gov/causes/>

SHANNON, D. A. (n.d.). Retrieved July, 2017, from  
<https://portal.nifa.usda.gov/web/crisprojectpages/0202107-alley-cropping-agroforestry-and-sustainable-agriculture-for-subtropical-and-tropical-conditions.html>

Sundqvist, E., Crill, P., Molder, M., Vestin, P., & Lindroth, A. (2012). Atmospheric methane removal by boreal plants. Geophysical Research Letters, 39(21).  
Doi:10.1029/2012GL053592

Sustainable Development. (n.d.). NATURAL RESOURCE ASPECTS OF SUSTAINABLE DEVELOPMENT IN HAITI . Retrieved July, 2017, from  
<http://www.un.org/esa/agenda21/natinfo/countr/haiti/natur.htm>

Visualgeography. (2017). Haiti - Houses Retrieved from  
<http://www.visualgeography.com/categories/haiti/houses.html>

United Nations Albania, MDG Achievement Fund, & Ministry of Health Ministry of Food, Agriculture and Consumer Protection. (n.d.).

World Food Program. (2013). Global food security update. Issue 9.  
<http://documents.wfp.org/stellent/groups/public/documents/ena/wfp255327.pdf>