

Eryn Woernley
TST New Visions in Life Sciences
Ithaca, NY, USA
Haiti, Sustainable Agriculture

Haiti: Using Sustainable Agriculture to Help Farmers Prosper

While many countries face problems such as food insecurity, malnutrition, and water scarcity, over half of the people in the small country of Haiti are experiencing elevated levels of these problems. As the poorest country in the Western Hemisphere, Haiti has struggled with a corrupt and unstable government for many years. Originally a French colony, this Hispaniolan country was founded on slave labor. However, these slaves revolted and became a black republic. Soon after, a long period of political struggles ensued, including intervention from the United States, military rule and many revolts. Now, the government of Haiti has settled as a semi-presidential republic (Girault et al.). Many natural disasters such as earthquakes and hurricanes plague this country, adding to the problems it faces. The government has not been able to fully face these issues that afflict the country, perpetuating it further into poverty. A major problem that this country faces is food insecurity due to a lack of sustainable farming, which has been exacerbated by a lack of guidance from the government as well as little agricultural education.

Haiti is about the same size as the state of Maryland, yet the population is almost twice as large, at 11.4 million people. A recent trend of urbanization has led the population to become more centered around Haiti's capital, Port-au-Prince (Girault et al.). The climate in Haiti is generally tropical, but this changes with elevation; the terrain varies greatly, from mountain ranges to large plains. The houses are commonly made of mud or metal scraps, and have little electricity or running water (Girault et al.). The average household size is 4.4 people, mostly consisting of children and both parents or just the mother ("Household Size"). Their typical diet consists of beans, rice, yams, plantains and corn (Girault et al.). These foods are acquired from small local markets or homegrown and then cooked on charcoal or firewood stoves located outside of their homes. Most of the labor force works on family farms, and even kids will do small jobs to help support their families (Girault et al.). In 2018, Haiti's GDP per capita was about \$730 USD; 60 percent of the population is well below the poverty line ("Haiti- Economic Indicators"). This high level of poverty affects everyone in the country, from city dwellers to rural farmers.

As of the last study conducted in 2016, about 70 percent of Haiti's land is cultivated ("Haiti- Economic Indicators"). The main exported crops are Arabica coffee and sugar cane. However, many common subsistence crops include cassava, plantains, corn, yams and rice (Girault et al.). The average farm size is about 1 to 7 acres, and these plots are often passed down from generation to generation ("Haiti - Resilient Productive Landscapes Project"). While many people in Haiti are farmers, poor soil quality due to unsustainable practices has led to less nutritious food being available and thus a greater amount of food insecurity. The lack of sustainable agriculture has perpetuated this issue by leading to not only soil depletion, but also soil erosion, deforestation, and lower crop yields (Girault et al.). This trend has worsened over the years due to constant use by a gradually increasing population, so more resources are being depleted at a faster rate. This topic greatly affects everyone in the country, rural and urban; if

people are not able to grow an adequate food supply, then the food availability for everyone significantly decreases. This quickly leads to malnutrition and many other health problems that affect everyone from children to the elderly. This topic also greatly impacts the environment because constant farming of the soil leads to a decrease in soil diversity, and an increase in erosion and contaminated water. Unsustainable farming practices have additionally lowered the amount of biodiversity in many areas. Thus, it is a necessity that Haitians develop sustainable farming practices in order to protect the ecosystem and their food source.

One solution that has been implemented in Haiti is the use of agroforestry. Agroforestry is the practice of strategically planting trees in pastures or croplands in order to diversify the area. The aim of this system is to restore balance to the surrounding ecosystem, which will ideally result in higher yields at a lower cost (Gold). There are countless benefits of implementing agroforestry, from healthier lands to healthier people. When done correctly, agroforestry can greatly improve the economy of an area. By diversifying the crops grown, communities become more economically resilient and crop yields are significantly increased. This results in a greater amount of food becoming more accessible to local families, which will help to battle against malnutrition and other dietary diseases (Gold). Agroforestry also greatly enhances the environment through sustainable production. Air, soil, and water qualities are improved, along with the conservation of biodiversity (Gold). Different methods of agroforestry can target some or even all of these benefits, leading to an enriched environment and an improved quality of life.

One popular method of agroforestry used is alley cropping. For this technique, wide rows of trees are planted with companion crops in between them. These crops are usually nitrogen-fixing plants, such as soybeans or other legumes (McClintock). The trees planted are often native trees or cash crop trees, which farmers can then use to increase their profits. Many Haitian farmers still use monocropping, or cultivating only one crop on large plots of land, which has led to many issues. Alley cropping can help reduce these issues, including low soil fertility and soil erosion. The strong roots of the trees will help to keep the soil in place and prevent erosion and runoff sediments from further contaminating the water. The leguminous crops will additionally increase the soil fertility while providing sufficient food and a source of income for the farmers (McClintock). From 1987 to 1991, the Pan American Development Foundation (PADF) implemented one of the most extensive alley cropping projects in Haiti. They provided over 200,000 farmers with native fruit tree seedlings in order to encourage the use of this farming technique. Farmers were encouraged to strategically plant their trees in order to maximize their success. Haiti's lands are very mountainous, so farmers commonly planted on their crops on sloped areas. They would often place woodlands towards the top of the slope; these trees could serve multiple purposes, from firewood to fodder. Then a contour hedgerow with legumes would be planted below these trees. More rows of trees, such as fruit trees, would be intercropped with the legumes towards the bottom of the slope. The steeper the elevation, the closer the rows need to be planted together to prevent further erosion. Then at the bottom of the plot, farmers would plant their field crops or home gardens (McClintock). Just by following this pattern of planting, significant direct and indirect improvements were seen. One study conducted in 1988 compared the differences in plots that used alley cropping compared to plots that did not. They found that the growth and yield was visibly higher with alley cropping, and that the soil quality and water retention was significantly increased. The hedges slowed soil erosion by catching the loose dirt that fell from above, and the signs of erosion was lesser in the areas where the hedgerows had been planted; the traditionally farmed plot showed none of these benefits (Bannister and Nair). This technique of alley cropping would greatly benefit Haiti, as it targets many of the problems within their agricultural industry.

Another type of agroforestry that has been implemented around the world is forest farming; this is where a specialty crop is grown under the protection of a forest canopy (Gold). One common crop that is grown using this method is coffee. Given that Arabica coffee is Haiti's main cash crop export, this growing technique could be implemented by the Haitian farmers in order to increase the sustainability of their farms (Girault et al.). By planting native trees on coffee plantations, the coffee plants now have a form of shade that will help contribute to biodiversity. Native trees will help to increase the soil quality and attract native animals, such as pest eaters. This will then benefit the crops even more by eliminating harmful insects. Not only does the ecosystem benefit from this technique, but so does the farmer; their coffee yield will increase with greater soil quality and customers are often attracted to sustainable products (Mendez). In one study conducted in Guatemala, researchers compared sun grown coffee to coffee grown with native shade trees. The results showed a significant increase in biodiversity of the area. There was a 30 percent increase in avian abundance and 15 percent more species overall in the shaded coffee than the sun grown coffee. Additionally, with an increase in birds, there was a decrease in large arthropods by 64 to 80 percent. This high predation level will reduce the numbers of pests and lower insect damage to coffee plants. This will lead to a decrease in the need for chemical insect repellents, saving time and money for the farmers (Greenburg, et al.). Thus, it is abundantly apparent that by using shade trees when growing coffee, both the farmer and the land directly benefit.

While all of these methods would work great in theory, they are not possible to implement without the farmers' willingness to change. Ultimately, these solutions will fail if the farmers are not directly involved with the process or are not educated on the science behind these techniques. Past forceful approaches have left many Haitian farmers wary of outside help and reluctant to accept it. In the 1980s, USAID lead a program that attempted to prevent the African swine fever from coming to Haiti by eradicating all of the native pigs. This forceful approach resulted in disastrous impacts on Haitians, leaving them bitter and wary of outside aid. Another program forced rural participation in soil conservation projects, but largely failed because the locals were not included when planning the projects, and land rights were infringed on. This only further upset the residents (McClintock). Many aid projects have failed in the past because they did not take into consideration the thoughts of the people, which is the most important aspect of all projects.

Not only have past experiences stymied these projects, but additionally many socio- economic factors, such as age and gender, have prevented adoption of these sustainable methods. One study showed that if farmers were over the age of 51, there was a decrease in the probability of them adopting agroforestry. It additionally showed that male farmers were more likely than females to better maintain hedgerows for alley cropping. The number of workers also significantly impacted the likelihood of a farmer to manage these agroforestry structures (Bayard, et al.). Other factors that greatly influence the conversion to agroforestry include per capita income and education. The same study found that organized and trained farmers were more likely to view alley cropping positively. Their level of education on the subject of agriculture significantly impacted the farmers' views on alley cropping. Researchers additionally found that families with higher incomes were more likely to adopt alley cropping on their farms (Bayard, et al.). Thus, in order to effectively implement agroforestry projects in Haiti, these factors need to be taken into great consideration.

Agroforestry projects that are implemented in Haiti need to address key factors in order to truly be successful. The biggest factor that will determine whether or not a project fails is farmer education. Without a focus on the education of future and present farmers, these agroforestry techniques will not be used properly and effectively, and will not be carried on into future generations. Aid organizations need to provide training to farmers in order to inform them of the environmental benefits, as well as teach them how to properly manage the land. Aid groups can also focus on programs that already provide farmers with basic training and help them expand the information that is taught to encompass agroforestry (Bayard, et al.). Another factor that would help encourage farmers to adopt sustainable methods would be to provide economic incentive. Most Haitian farmers have low income, so economic incentives can have a big impact on the probability of them adopting agroforestry (Bayard, et al.). Incentives could consist of directly giving money to farmers to fund sustainable structures, or it could be simply educating farmers on the economic benefits of agroforestry. Either way, this is a powerful motivator when it comes to adopting new farming techniques. These projects can be funded and implemented by the Haitian government or aid organizations such as the UN. In the past, organizations such as CARTIAS, USAID, and the World Bank have worked to provide Haitian farmers with the means to adopt agroforestry (McClintock). All of these factors are very important in the success of these solutions, and if they are implemented correctly by aid organizations, they have an opportunity to make a large impact on Haiti and its people.

While Haiti is a struggling country, an increase in sustainable agricultural practices can significantly assist in increasing food security. Through the implementation of agroforestry, many of Haiti's issues can be addressed, from economic to environmental. Alley cropping with nitrogen-fixing plants and cash crop trees can greatly impact soil and crop quality. Not only will soil erosion decrease, but farmers will also benefit from an increase in crop yields. With better yields, farmers will have more food for their families and to generate a larger income. This will benefit the whole community, as its source of food and income will become more stable. Additionally, using shade trees on coffee farms rather than sun growing coffee can significantly improve Haiti's ecosystems while benefiting the farmers at the same time. All of these solutions will greatly help the environment and assist in restoring the natural flora and fauna. Native trees will attract birds, which will help protect the coffee plants by eating pests. However, there are many socio-economic factors to consider when attempting to implement these programs of sustainable agriculture. It has been found that past negative experiences with aid organizations, age, gender, and education levels all impact the probability of farmers adopting agroforestry. To address these issues, aid organizations need to create education programs for farmers, as well as provide financial incentives. Haiti has had a long and difficult path, but with these implementations, this country can start a new journey towards a more stable and sustainable future.

Works Cited:

- Bannister, Michael E. and Nair, P. K. R. "Alley Cropping as a Sustainable Agricultural Technology for the Hillsides of Haiti: Experience of an Agroforestry Outreach Project." *American Journal of Alternative Agriculture*, 1990, <https://www.jstor.org/stable/44507078>. Accessed 29 Aug. 2020.
- Bayard, Budry, et al. "The economics of adoption and management of alley cropping in Haiti." *Journal of Environmental Management*, July 2007, <https://www.sciencedirect.com/science/article/pii/S0301479706001319>. Accessed 29 Aug. 2020.
- Girault, Christian et al. "Haiti." *Encyclopedia Britannica*, 5 Feb. 2020, <https://www.britannica.com/place/Haiti>. Accessed 27 Feb. 2020.
- Gold, Michael. "Agroforestry." *Encyclopedia Britannica*, 15 Dec. 2017, <https://www.britannica.com/science/agroforestry>. Accessed 25 Aug. 2020.
- Greenburg, Russell, et al. "The Impact of Avian Insectivory on Arthropods and Leaf Damage in Some Guatemalan Coffee Plantations." *Ecological Society of America*, 2000, <https://repository.si.edu/bitstream/handle/10088/7947/57720d41-5ce8-4c26-921e-60cc8c1c5106.pdf?sequence=1&isAllowed=y>. Accessed 29 Aug. 2020.
- "Haiti- Economic Indicators." *Trading Economics*, Feb. 2020, <https://tradingeconomics.com/haiti/indicators>. Accessed 27 Feb. 2020.
- "Haiti- Resilient Productive Landscapes Project (English)." *World Bank Group*, 31 Jan. 2018, <http://documents.worldbank.org/curated/en/468931518469626680/pdf/Haiti-PAD-02092018.pdf>. Accessed 27 Feb. 2020.
- "Household Size and Composition Around the World 2017." *United Nations*, 2017, https://www.un.org/en/development/desa/population/publications/pdf/ageing/household_size_and_composition_around_the_world_2017_data_booklet.pdf. Accessed 5 Feb. 2020.
- McClintock, Nathan C. "Agroforestry and Sustainable Resource Conservation in Haiti: A Case Study." *North Carolina State University*, <https://projects.ncsu.edu/project/cnrint/Agro/PDFfiles/HaitiCaseStudy041903.pdf>. Accessed 27 Feb. 2020.

Mendez, Lola. "Sustainable Coffee in Costa Rica." *Overture*,
<https://www.overtureglobal.io/story/sustainable-coffee-in-costa-rica>. Accessed 27 Feb. 2020.