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Madagascar, Sustainable Agriculture
How can Madagascar Improve its Sustainable Agriculture?

Madagascar… A vast island of farmland and forest. With 587,041 square kilometers in size, it is the fourth largest island in the world. Over 71% of the island's land is used for agriculture and almost 22% is forest. Madagascar has many natural resources: graphite, chromite, coal, bauxite, rare earth elements, salt, quartz, tar sands, semiprecious stones, mica, fish, and hydropower. The country hosts a tropical climate along the coast, temperate inland, and arid in the south. Madagascar also has a narrow coastal plain and a high plateau and mountains in the center. The island's high biodiversity is due mainly to its diverse climate and terrain.

Madagascar is divided into six provinces, the capital being Antananarivo. The country is governed by a semi-presidential republic, meaning the president, the prime minister, and the cabinet exist alongside each other. Most of Madagascar's population lives on the eastern half of the island. The country's labor force is 13.4 million people, and 60% of the population is under 25. The life expectancy in Madagascar is 68 years.

The average family in Madagascar consists of 4.6 people. 70.7% of the population lives in poverty, but only 1.8% is unemployed. This is because the average hourly wage is $0.48. Because of this low income, more than 40% of women are married by the age of 18 and almost 13% by the age of 15. Women average 3.6 children. Most children are expected to have 10 years of education. Poverty also affects their access to health care. There are few skilled providers of health care in Madagascar which leads to lots of deaths in birthing.

The staple in the diet of Malagasy families is white rice. It is part of every meal, breakfast, lunch, and dinner. Unfortunately, white rice is low in nutrients. Moringa is a local tree whose leaves can provide more nutrients for families. Most vegetables lack a lot of nutrients, so most families don't incorporate these into their diet. Meat offers much more protein but is not something that families can expect at every meal.

Traditional agriculture varies from region to culture, to climate. Most cultures incorporate the slash-and-burn method to clear land for farming. This leads to deforestation which is a big problem in Madagascar. Some groups are more efficient than others in their farming methods. Different groups also grow different crops depending on where they are located. The Bestileos, Merina, Betsimisaraka, Tanala, Antandroy, and Mahafaly are the main farming groups in each climate.

The Bestileos is a group in the central highlands of Madagascar. They farm rice in valleys. They construct rice paddies on terraces going up the side of the valley. They have constructed narrow canals that cover long distances to irrigate their crop. Their practice is the most efficient method of farming in Madagascar. Before cultivating, the Bestileos repair their irrigation canals and spread manure over the fields. They then trample the fields with cattle. This trampling replaces the need for plowing. The Merina have a similar way of planting but live where the resources are more plentiful. This gives them less need for terracing and irrigation.

Along the eastern coast are the Betsimisaraka and Tanala. These groups grow rice and corn, and also use an irrigation system. The difference is that these people use a slash-and-burn method. They cut down small trees and brush to dry, and they burn the plants just before the rainy season. They farm the burned area for three years. After they have used it, it cannot be cultivated for another 10 to 20 years. These

people have been taught that this is the only way to protect against the drought that happens almost every three years.

In the arid, a slash-and-burn method is also used. Grassland is burned off for crops to be planted. Drought-resistant corn and sorghum are sown in the ashes of the grassland. The Antandroy and Mahafaly are located in the arid. While they practice this method, they also have permanent fields where they grow their primary food sources.

On the west coast, farming empty stream beds during the dry season is common practice. In the south and west, most families own zebu cattle. The cattle graze at will and dry grass is burned for new grass to grow. Fishing is common for farmers to practice on the side. Farmers often make fish ponds in the central highlands to raise their fish.

A family's level of food insecurity is related to their farming practices according to a study conducted by James P. Herrera and company. Large families with small amounts of land had higher food insecurity, and large families with large amounts of land had lower food insecurity.

The study conducted by James P. Herrera and company looked at the socioeconomic characteristics of families as well as their agricultural practices. The socioeconomic variables were the number of members in a household, their ages, education level, main activity, and material wealth. To estimate material wealth, they looked at the ownership of everyday household items. To find the agricultural practices, they asked what crops the families grew, what method they used for growing rice, and the possession of livestock. To estimate crop diversification, they asked how many crops the family grew in the last year and how many cash crops they grew.

Almost all households had grown crops in the last year. 75% of households grew rice and 76% grew vanilla. 50% of households only grew rice and vanilla. The harvest of those two crops did not significantly vary between households with a single-head female and other households. 76% of the households studied did not have enough food to feed their family in the last three years. They found that the most frequent cause was from the family having small land. Agriculture yield decreased the family's chance of food insecurity, but increased family size increased their chances.

Other than food insecurity, unsustainable farming practices can destroy natural habitats. "Unsustainable farming practices are reducing agricultural output, and causing the loss of natural habitats, species extinctions, and the deterioration of ecosystem services" (Herrera et al.). The most notable example of loss of habitat is the slash-and-burn technique practiced by farmers. Because it destroys vegetation and removes cover crops, it promotes erosion. The government of Madagascar declared the slash-and-burn method illegal, but it is still widely practiced. The government has offered assistance to teach groups who use this practice how to farm more efficiently.

The traditional way of inheriting land is that the parent divides their land among their children. As the generations continue, families will have less area to farm than their ancestors. Families will have to make more crops from less farmland. This means that families will have to stop traditional farming and learn new ways to farm efficiently. The slash-and-burn method makes the land unusable for years. Farmers who do this will have to be taught different ways so that more land is available to other farmers.

Government-protected areas of natural habitat prevent villages located nearby from expanding their cropland. They have had to change their land-use strategies because they cannot expand further. While it protects the natural habitat, it prevents villages from growing. Food insecurity will worsen as further generations get smaller areas of land. Large farms produce more crops than smaller farms, but as their

farm size increases, the productivity of the farmland decreases. If farmers could increase their farming efficiency, they could feed more families than their own.

If Madagascar can improve its sustainable agriculture, the country will be able to advance. The farmers will be able to produce more crops from less soil. The land will be able to support crops for longer periods without the need to stop harvesting the land for 10 to 20 years. More people will be supported by fewer farmers due to more available farmland. This would lower both the farming family's food insecurity and the consumers'. With sustainable farming methods, not every family would have to farm for money, they could get different jobs to advance the economy. Sustainable agriculture will provide more land without the need for deforestation and new jobs to the people of Madagascar.

The first step to improving Madagascar's sustainable agriculture should be to stop the implementation of slash-and-burn methods. The method provides fertility to the land for three years before the land isn't farmable for another 10 to 20 years. This method is a wasteful use of land that needs to stop. It leaves the soil without coverage, which will cause erosion. The best way to stop it is to continue the government's plan to teach groups how to farm more efficiently. Groups in similar climates can learn from the Bestileos' way of farming. The government can learn from the Bestileos and then teach the practice to other groups, or they can provide the Bestileos with financial support while volunteers from the group teach other groups their methods. Depending on the location, it may be better for the government to teach if it is far away. The Bestileos know their practice the best so they could teach groups that are located closer to them.

Some ethnic groups will have a harder time accepting the changes to their farming practices. The reason most groups haven't adopted more sustainable farming practices is because of tradition. Their parents taught them that the slash-and-burn method is the best way to provide nutrients to the soil and protect against drought. Hopefully, the Bestileos' teaching proves to be more effective than the traditional farming methods.

The next step in development is to implement crop rotation. Most ethnic groups in Madagascar plant multiple different crops. Rotating what crops get planted in each field can benefit the soil and the crops. This should be easy for some families to incorporate because they already plant more than one crop. If communities can positively advertise crop rotation, those families will implement this method in their farming. To advertise crop rotation, communities can use this information: Crop rotation returns nutrients to the soil without the use of fertilizers or other inputs. By rotating crops, pest and disease prevention is a natural cause. Pests and diseases in the soil lose their host because there is a new plant in their field. It increases your farm's biodiversity. Lastly, crop rotation will improve the soil's health. The biomass is the soil increases from different crop's root structures.

Other families may have a harder time accepting crop rotation because they only plant one crop. For them, initial expenses will have to be made to purchase new seeds and possibly more land. These families might not be willing or able to spend money on something that may seem minor. Another barrier is the climate and soil. Some climates and soils are only able to support one certain crop that has the right adaptations to survive. Crop rotation will not be possible in these places where only one crop can be grown.

Another step Madagascar can take to benefit farming is planting cover crops. During the off-season, fields might be left uncovered. This leaves the field open to erosion. Planting cover crops will prevent erosion. Other benefits include keeping living roots in the ground year-round, replenishing nutrients, weed prevention, and again will reduce the need for herbicides and fertilizer.

To implement covering fields with crops during the off-season, Madagascar's Food and Agriculture Organization (FAO) can assist farms. The FAO has three main goals in Madagascar: "Sustainable and income-generating intensification of agricultural production as well as nutrition promotion and education; Governance and sustainable management of natural resources; Strengthening households' resilience to shocks and natural hazards in the context of climate change adaptation" (*Food and Agriculture Organization (Madagascar)*). Providing farms with information on how to cover fields and what crops to use falls under the category of sustainable agricultural production and nutrition promotion and education.

Because this step will most likely cost the most, there will need to be a way to provide low-income families with enough money to buy the cover crops. Not only could they provide money for cover cropping, but also for crop rotation. My plan to provide low-income families with money is microlending. Microlending is a method in which small loans are given to small businesses or low-income individuals who don't have access to conventional banking services. Families can use the money to plant cover crops as well as rotate crops. The hope in providing these microloans is that the families' income will increase and they will be able to pay off the loan within five years.

Before my plan to improve Madagascar's sustainable agriculture is complete, it must be decided who is loaning the money and how much money each family will receive. First, we shall settle the amount of money that we will loan. The FAO will visit families to inform them of what crop to cover their fields with and how to do so. Once that is decided, the FAO will be able to estimate how much money the family will need to be loaned based on their income and their fields' needs. Now that that's settled, who will provide the money? Usually, in microlending, "lenders are individuals who pledge a certain amount of money to loan out to a deserving entrepreneur in another country" (Brock). The FAO is not only located in Madagascar but in many countries, including the United States. If the FAO seeks funds in the United States, they will surely obtain enough money to get the families in Madagascar started.

Madagascar has many problems as a country: a high poverty rate, a small income rate, a short life expectancy, early marriage, and poor health care. Of all these problems, their sustainability in agriculture is perhaps the most important one to fix. Solving Madagascar's problem of using unsustainable farming practices, will improve the situation of all their problems. Madagascar's low income will be improved by the increased yield from their fields. With families making more money, young marriages won't be required anymore. As generations continue, some children will get jobs other than farming to grow Madagascar's economy. Some will end up in the healthcare field. As Madagascar's health care continues to grow, its life expectancy will increase.

By following the plan I have laid out, Madagascar will be able to improve its sustainable agriculture. Once groups have accepted the farming methods of the Bestileos, they will be able to implement much more sustainable practices. First is to implement crop rotation and then cover cropping. The largest barrier the people of Madagascar will face is the cost. To overcome this barrier, the FAO will use microlending. By seeking lenders in the United States, they will raise enough money to support low-income farmers.

In order for the plan to work, communities, the government, and the FAO must all do their part. If one fails, the success of their efforts will be diminished. If all three succeed, the future of Madagascar will brighten. Madagascar's rich, diverse, and bountiful land is something to be cherished. By using sustainability in agriculture, those resources will last for many years to come.

Works Cited

Brock, Thomas. “Microlending: Definition, How It Works, Risks & Rewards.” Investopedia, https://www.investopedia.com/articles/personal-finance/040715/what-microlending-and-how-does-it-work.asp.

“Crop Rotations.” Rodale Institute, https://rodaleinstitute.org/why-organic/organic-farming-practices/crop-rotations/.

Food and Agriculture Organization (Madagascar). development aid, https://www.developmentaid.org/donors/view/145156/food-and-agriculture-organization-fao.

Herrera, James P., et al. “Food insecurity related to agricultural practices and household characteristics in rural communities of northeast Madagascar.” *Springer Link*, 24 June 2021, https://link.springer.com/article/10.1007/s12571-021-01179-3.

Old, Bethany, and Nancy Raposa. “Chronic Malnutrition in Madagascar: A Problem Landscape with Local Solutions - Duke Lemur Center.” *Duke Lemur Center*, https://lemur.duke.edu/chronic-malnutrition-in-madagascar/.

“Photos of Madagascar - The World Factbook.” *CIA*, https://www.cia.gov/the-world-factbook/countries/madagascar/#environment.

“Traditional Agriculture in MADAGASCAR.” *WildMadagascar.org*, https://www.wildmadagascar.org/overview/loc/36-agriculture.html.

“What is Sustainable Agriculture?” *Union of Concerned Scientists*, 10 April 2017, https://www.ucsusa.org/resources/what-sustainable-agriculture.

Vinje, Eric. “How to Do Crop Rotations in Your Home Garden in Four Steps.” Planet Natural, 3 October 2022, https://www.planetnatural.com/crop-rotation/.