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Madagascar, Factor 6: Sustainable Agriculture

Madagascar: The Island of Unsustainable Destruction

Located off the southeastern coast of Africa and slightly smaller than the state of Texas, Madagascar is a country in huge trouble. Madagascar, also known as the Red Island, was once filled with tropical rainforests and home to countless species found nowhere else in the world. Today, the island nation is rated at number 107 of 109 countries by the food security index, making it the third worst country in the world in terms of food security (Food Security Index, n.p.). Over 95% of its population lives at or below the global poverty line of \$1.90 a day, the country is still recovering from a recent political crisis that has thrown the government into a state of disarray (Ackbarally, n.p.), and the unpredictable weather patterns destroy essential crops. Madagascar is in a state of continual destruction due to local subsistence farmers destroying the habitats using a method known as slash and burn agriculture. Slash and burn practices involve first cutting down the jungle in a designated area, then burning the remains to clear the land of any pre-existing plant life. This results in soil that can be used for a year or two of farming, but is then left devoid of nutrients, requiring the process to be repeated indefinitely. As it stands, over 80% of the original rainforest on the island has been destroyed due to the people populating the island. If no action is taken to remedy this rampant destruction, the island's rainforest could be completely obliterated within the next hundred years. With so many issues needing to be remedied, one could be forgiven for thinking that there is no hope for repairing this island nation's economy, environment, and government. Over 23 million people live in Madagascar, with a growth rate of about 2.58% a year (Africa::Madagascar, n.p.). The average Malagasy family is made up of 4.6 people (Demographic, n.p.), and only one in five Malagasy households have electricity. Over a quarter of all people living in the country are illiterate, and about 23 percent have no education whatsoever. Madagascar does not have many doctors, at 0.16 physicians per 1000 people. The rural people are slightly more disadvantaged than the urban society across the board, but neither group is doing particularly well. The average fertility rate is .5 more children than the ideal fertility rate described by women in the society (Rural, n.p.), illustrating a need for better family planning. The average subsistence family plot is 1.5 hectares, and the main crops include rice, cassava, and sweet potatoes (Agriculture, n.p.). Unfortunately for the environment, slash and burn agricultural practices are common, and are not strictly regulated due to the government's current level of disarray. Until the nation's government gets everything under control, there will be no slowing of the slash and burn practices that many inhabitants consider traditional. The biggest barrier to improved agricultural activity is economic; the extremely high poverty rates inhibit agricultural innovation and development. In addition, the naturally acidic soil prevents much of the land from supporting new plant life for more than a year or two, prompting farmers to move on into fresh territory. This means that unless something is done, the rainforests of Madagascar will be little more than ash covering the already acidic soil.

Sustainable agriculture would certainly improve productivity, as bringing more sustainable practices into the country would put an end to the environmental destruction and provide a more consistent source of food. As of 2016, slash and burn practices are widely used, depriving the soil of all of its nutrients before moving on to other areas in which to grow crops. The deforestation has gone on largely uncontrolled, to the point where almost 1.5% of the rainforests original span is destroyed every year (Deforestation, n.p.). Slash and burn practices are wreaking havoc on the environment, and there is a political controversy over whether to allow more rainforest to be turned into farmland or to maintain the environmental integrity of the island wilderness. The worst part about the usage of slash and burn is that it can be made unnecessary relatively easily with time. If the practice of rotating crops is taught and used correctly, the product of one

year's labor will replenish the soil with nutrients for the next year's crops. The real problem lies in the acidity of soil in rainforest climates. Most of the nutrients in the area are locked up in existing flora, making it difficult to grow anything intentionally (Rainforest soils). Burning the plant remains turns the land into little more than charcoal covered earth, but waiting to make sure that the plants decompose properly takes time. The Betsimisaraka and Tanala peoples also practice irrigated rice growing when possible (Wikipedia, n.p.). Luckily, irrigation is relatively soft on the environment in comparison to the slash and burn used by most (Environmental, n.p.). However, this method only works well when there is enough water to spread throughout the fields, which can be difficult due to the inconsistent rainfall on the island. Therefore, new methods of agriculture are needed to drastically increase food production on the island.

One method of sustainable agriculture that could be applied to the island is the planting of cover crops. Cover crops are types of plants grown in off years to prevent soil erosion and revitalize the soil's nutrient content. Most cover crops do not need to be individually planted, so the effort required to maintain these crops would be fairly low. Studies have already been done in the region on the effects of planting Stain Pod (*Crotalaria grahamiana*), finger millet (*Eleusine coracana*), and Ulam Raja (*Cosmos caudatus*), and have shown that the usage of these species as cover crops resulted in decreased numbers of black beetles, a pest notorious for the destruction of rice in the area (Cover Crops, Entomological Society of Southern Africa). These intermediary crops, if used, have been shown to kill the beetles at the larval stage, ensuring they are never a significant threat to the food crops. This means that if these intermediaries are used in off years, more usable food will be produced by the farms already in place. With more usable food produced by existing farms, the necessity for more land will be alleviated significantly. If the attempts to curb slash and burn fail, teaching the farmers to use cover crops will at least ensure that the land will not be left completely useless to future agricultural endeavors.

Making the Malagasy farms sustainable would certainly increase the amount of food produced per year, while also causing less damage to the surrounding environment. Once the food problems are dealt with, the Malagasy people can begin reaching out to more developed countries, and start bringing money in from other nations, improving the economic status of the nation. Hopefully, the renewed interest in the island will cause the poverty rate to decline, which brings its own share of benefits. Smallholder farmers taking advantage of these newer farming methods will be able to grow more food than they need, allowing them to either store it for later or sell it at market. An increase in income would also allow farmers to update their practices to be more efficient for the land that they have. On a larger scale, more food would be able to be imported into the nation to cover for the nutrients that the common local food does not carry. Thus, not only the environment would benefit, but the Malagasy people would have access to more nutritious food as a whole. However, one of the most important things to consider when suggesting new ways to increase agricultural productivity is the method of spreading the new techniques. For this, a local approach is probably best.

In Madagascar, there exists a community nutrition program known as the *Programme National de la nutrition Communautaire*, or PNNC for short (Community, n.p.). Originating in 2001, the goal of the PNNC is to cut the malnutrition rate down to under 21% from its original rate of 42%. If we were to utilize this program as a way to inform local farming families about the benefits of more modern agricultural practices, we can accelerate the implementation of this plan, as people working in the PNNC are already trusted by the local population. Hopefully, the endorsement of the PNNC will help sway the opinions of farmers who are still uncertain about the usage of cover crops in their fields. Perhaps the PNNC could also help by handing out informational booklets on crop rotation in order to further educate people about the potential gains of sustainable agriculture. In addition to the cover crop education, the PNNC could teach the local slash and burn farmers about the potential of biochar, a form of burning wood in an oxygen-poor environment in order to create a substance that breaks down easily and is actually beneficial to the environment (Lehmann). Utilizing biochar instead of the ash produced by slash

and burn will replenish the earth's nutrients more thoroughly, making it possible to begin farming the same land for several years in a row. Keeping the same land fertile for long enough to begin crop rotation will be integral for the continued success of the country's farms, and this can be done through the joint usage of cover crops and biochar.

Also of note is the Mercy Ships organization, which worked in Madagascar alongside Targeted Aquaponics Growth (TAG) in order to train individuals in the usage and implementation of aquaponics (Mercy Ships). Aquaponics is a type of farming which combines aquaculture, a method of raising aquatic animals, with hydroponics, a method of raising aquatic plants (Aquaponics, n.p.). Aquaponics functions by using the fish and plants in a symbiotic environment, where the waste products of the fish are fed into a hydroponic system for the plants to utilize as nutrients. Mercy Ships trained 30 people in 2014 to be trainers in order to expand the aquaponic systems throughout Madagascar. While this program has already completed its 2014 goals, a similar program, if not with the same groups, could greatly benefit the Malagasy people. The aquaponic method uses only one tenth the water of soil based gardening, and is much less labor-intensive over time. Aquaponics would also appeal to the community that lobbied against GMOs, as it is nearly impossible to use artificial pesticides during the operation of an aquaponic farm (Benefits, n.p.). Aquaponics can also supply a wider variety of food in a smaller area, assuming the fish and aquatic animals are also used as food sources. While the benefits to such a system are numerous, education and implementation are still crucial. Construction of Aquaponic systems requires extensive setup, and is dependent on the farmer's knowledge of the requirements of keeping both the plants and animals alive in what is essentially a miniature ecosystem. Unfortunately, most plant farmers do not know how to effectively raise fish, and most aquaculture farmers don't know how to effectively raise plants. Thus, implementation would require trainers to teach the existing farmers how to build and run such a system, as well as providing the materials to create one. The 30 trainers taught by TAG are a good start, but a second program run there on a larger scale would be of great use. However, new types of farms cannot solve all of the ecological problems with farming in Madagascar.

Climate volatility plays a large part in the sustainability of crops, especially on the coast. Rain is infrequent and unpredictable from year to year, meaning that a particularly bad storm can and will cause a family to go without food at times. This is not helped by the aforementioned slash and burn farmers, as the decreased vegetation in the area lends the land to being more susceptible to the weather and additionally prone to erosion. The rainy season in Madagascar is also during the hottest part of the year, resulting in high levels of humidity and evaporation of otherwise usable water. The northern and western sides of the island are the wettest, while the eastern side of the island is prone to tropical monsoons from the Indian Ocean (Weather, World Travel Guide). This means that the eastern side, being both dry and prone to storms, is incredibly difficult to grow food on. Breeding more resilient plants better suited to the local soil conditions could go a long way towards resolving the incapability of using farmland for more than a couple years in a row. However, doing so would take quite some time due to the illegality of genetically modified organisms in the nation. The fastest potential method to do so would be crossbreeding, which would take years to properly implement, and even longer to show any clear benefits. Some sort of governmental intervention could help the rural and urban poor to find the money to invest in changing their farming practices, but isn't likely due to the lack of money. Unfortunately, there isn't much that we can do about the weather, though ideally subsistence farms would have a layer of thick jungle between them and the ocean, to form a sort of windbreak against the tropical storms. Aquaponic systems are better than traditional farms in harsh weather, but this is more due to their smaller space requirements than anything mitigating the effects of the environment itself.

Based on my research, the first thing that needs to happen is a revision of current farming practices. Introducing more nutritious crops and promoting more modern farming methods such as aquaponics, cover crops, crop rotation, and biochar will go a long way towards that goal. After that, Madagascar needs to begin promoting the ecotourism industry, attracting people from around the world to discover the

biodiversity on the island. When money begins to come in from tourism, the people will be able to invest more in agricultural improvements, making more food on less land, and bringing other aspects of the modern world to the island nation. This can include electricity, public education, and widespread knowledge of how to stay healthy and free of common illnesses. Hopefully, these changes will ensure the future of the island as a country. Stabilizing the government would also help with any large scale change that would go into the implementation of this plan. In 2009, a group of people began protests, marching to the presidential palace, resulting in military action against them. This resulted in more than 50 people killed outside the palace, and sparked a movement for new leadership. On March 8th, soldiers at a military camp mutinied, pledging support to the leader of the movement, Andry Rajoelina. By March 17th, control of the government had shifted to Rajoelina. During this time, all environmental concerns were pushed aside by both sides, allowing farmers who wanted to seize extra land illegally do so without fear of legal repercussions. Once the government gets organized, it should be able to crack down on the people who are destroying the environment for farmland. Hopefully, the Malagasy government recognizes how essential the environment is to the future of their nation.

If there is to be change, however, the whole nation needs to take action. The Malagasy government needs to crack down on slash and burn agriculture, and ensure that the environmental damage does not spread irreversibly. In order to accomplish this, the Malagasy government needs to spread the word about the effectiveness of crop rotation, cover crops and biochar, and possibly even begin to help the people by preparing certain designated areas for agriculture. This will serve not only to improve the production of food, but it also has potential to help the new government gain stronger support from the population by demonstrating that they have a plan for improving agriculture in the country. Education will, of course, be necessary for the greatest effectiveness, as many people in the area are not already familiar with the more modern forms of farming (Rakotofala, n.p.). Having the government's support on that will be essential, as there is no better way to get information out to the people efficiently. The PNNC should be utilized while getting the information out to the people, as their word is trusted by most. If the Mercy Ships and TAG organizations are willing, they can also provide significant help spreading information about these more efficient forms of farming. Subsistence farmers just need to focus on using these agricultural advances to provide enough crops for themselves, and a little more to be sold at the market to others. Once crops begin growing sufficiently, coastal communities can begin to advertise their ecological diversity, and begin drawing attention to Madagascar as a tourist destination. The revenue from the tourism will be distributed amongst the people involved in the tourism industries, and the government can redistribute this additional revenue where necessary for the continued success of Madagascar as a nation.

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