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Madagascar, Factor 11: Malnutrition

Madagascar: An Interdisciplinary Approach to Achieving Nutrition Stability

Madagascar, a unique island country off the east coast of Africa, currently ranks fourth in the *Global Chronic Malnutrition* table (10 Facts About Hunger In Madagascar). Located 20 degrees south of the equator, Madagascar is characterized by its tropical climate, high temperatures, and humidity. Due to recent changes in global temperature and weather patterns, periods of both flooding and drought have exacerbated the struggle to produce food in this unforgiving landscape. Weather isn't the only issue impacting malnutrition in Madagascar. Political instability is increasingly creating an unsafe environment for civilians and damaging relations with countries that provide important imports to this island nation. The society struggles with chronic malnourishment. One-third of the population qualify as malnourished, and as of 2011, 50% of children ages 5 and below had anaemia (Nutrition Landscape Information System). A country can not be expected to make advancements in healthcare, education, and policy when the next generation is struggling to meet their basic needs. It is imperative to take action, to teach farmers how to properly grow and market their crops, and to create a healthy country that can compete in domestic and foreign markets.

The majority of the Malagasy people are subsistence farmers, with roughly 80% of the population living off of their own crops and land to feed their families (Food & Daily Life). The Malagasy often have large families with an average household of six children but take up little space, often occupying just one or two rooms.” (Food & Daily Life). Madagascar has only 36.4% urbanization (The World Factbook), meaning nearly 65% of the country is categorized as rural. Of the roughly 24.9 million people living in the country, nearly 90% of the population lives at or below the international poverty line of 1 USD per day (Nutrition Landscape Information System). Climate could be contributing to their poverty. Very arid conditions to the southwest and tropical conditions in the northeast above the mountains mean that both areas are less productive than they need to be to support the population in those regions. Periods with low crop yields resulting from the poor growing conditions increase the country's dependence on foreign resources, preventing citizens from making the most profit possible off of their land or producing the food they need.

Rice is Madagascar's most widely consumed crop, making it the staple grain in most meals (Food & Daily Life). The Malagasy also produce and consume cassava, maize, and sorghum. Despite this dependence on subsistence farming, they use poor agricultural practices such as “slash and burn” (Food & Daily Life) resulting in mismanaged resources and ultimately unsustainable farming. Of the 587,041 sq. km. of land, 71% is used for agricultural purposes; 64.1% of that is used as pastureland (The World Factbook). Even though almost three-quarters of Madagascar's land is being dedicated to food production, by late 2017, the Malagasy were still relying on external support to feed themselves (Food and Agriculture Organization of the United Nations). It is outrageous that so much of Madagascar's land is dedicated to food production

and still the country imported 388,000 tons of rice in 2013 (<http://ricepedia.org/madagascar>).

As of 2016, 33% of the population were malnourished (Nutrition Landscape Information System). Madagascar currently ranks as having the 18th highest population growth out of 234 listed countries (The World Factbook). As their country of 25 million continues to grow by 2.5% annually, the amount of malnourished citizens increase exponentially. This will be detrimental as they are already struggling to feed the citizens they have. What has happened and what can be done to guide this country towards stability, and even more importantly sustainability?

The strains of rice currently used in Madagascar struggle to thrive in an environment that's constantly plagued by mudslides, locust swarms, cyclones and droughts. By incorporating more weather tolerant strains of rice, yields would increase dramatically, because the new plants are more likely to withstand conditions that would slow growth (Drought Tolerance Improvement in Crop Plants: An Integrated View from Breeding to Genomics). A 2001 study found that "A rice gene encoding a calcium²⁺-dependent protein kinase (CDPK), OsCDPK7, was induced by cold and salt stresses" and that "OsCDPK7 was shown to be a positive regulator commonly involved in the tolerance to both stresses in rice." (Saijo, Yusuke, et al.), showing that this proteins' presence is directly correlated with how well it can tolerate drought. Scientists have also made significant headway in discovering how to breed more and more flood and/or submergence tolerant strains of rice, going as far as isolating the gene responsible for this, as in Perata and Voeselek's study, which finds that "a large portion of this variation in submergence tolerance can be explained by one locus (*Sub1*) on chromosome 9." ("Submergence Tolerance in Rice Requires Sub1A, an Ethylene-Response-Factor-like Gene.").

In this field, researchers are continuously developing new strains of crops that resist damage and produce high yields. For example, a study done by Japanese researchers resulted in "strains of rice that are resistant to drought in real-world situations. Published in *Plant Biotechnology Journal*, the study reports that transgenic rice modified with a gene from the *Arabidopsis* plant yield more rice than unmodified rice when subjected to stress brought by natural drought." Though the complications in selling this new rice, they explain, is that it is genetically modified (GM), and to make it widely available to countries with GM regulation, it has to be organic ("Drought Resistant, Higher-Yielding GM Rice Developed by Japanese Researchers."). Madagascar is one of these countries.

The government of Madagascar has negatively impacted food security in several ways. Legislation banning GM products in the country was intended to protect the environment from the effects of gene pool pollution which would decrease biodiversity. While this is an understood risk by the Malagasy government, they have failed to consider the socio-economic considerations of this legislation (Binimelis, Rosa, and Anne Ingeborg Myhr.), which prevents farmers from using the crops that would thrive in Madagascar. The aforementioned Japanese study found that the "Development of this drought-tolerant rice through the Ubi:AtGolS2 transgene should have significant economic and environmental benefits in low-input agricultural systems like Latin America and Africa" (Selvaraj, Michael Gomez, et al). The

unintended consequences of not fully analyzing the effects of this legislation have resulted in increased food insecurity.

A second contributing factor to this instability was the governmental struggle in Madagascar that had been preventing other countries from helping in the effort to modernize the Malagasy. The coup d'état of 2009 that took place in Madagascar led to the military-supported takeover by Andry Rajoelina (Army-Backed Madagascar Leader Cements Grip). Violence and political unrest within the country prevented the U.S. and E.U. from interacting with the Malagasy on a governmental level. However, they still provided humanitarian aid where they could (Madagascar: Government), for example, the U.S. Agency for International Development has been providing comprehensive aid to Madagascar for 33 years ("Madagascar."). This struggle also disrupted trade. In 2009, Madagascar lost 56% of its imports coming from the U.S. (Andriamananjara, Soamiely) as well as the temporary loss of economic support from the E.U. and U.S.. Knowing that rice is one of the country's largest imports, a cessation of government interaction with key trade partners for almost 4 years slowed growth substantially. Thankfully the country's political situation has begun to stabilize from its previous economic condition under the current term of President Rajaonarimampianina.

Malagasy governmental assistance hasn't been the most effective way of helping the Malagasy farmers. However several nonprofits and charities have found success with those that they've worked with. By creating a larger awareness campaign for the issues in Madagascar, the nonprofits will be better funded to support the Malagasy farmers. Groups such as CARE, an international organization dedicated to improving the state of living in countries across the world, have already begun to reach out and join in the effort to help the Malagasy. Through classes that the organization teaches about sustainable agriculture in Madagascar (alongside the Food and Agricultural Organization, a subset of the United Nations), they've been able to raise the annual income of the farmers that participated in the workshops by 40 dollars (Ejanoch.). While that amount seems low, it is actually a 9.3% increase from their average, per-capita, annual income of 430 dollars. (Harvey, Celia A., et al.). These results are a promising prospect for the future of farmers and families across the country.

An increased number of humanitarian groups setting high standards for the quality of social work done in the country, as well as international pressures on the Malagasy government to contribute to this effort is pushing them in the right direction. If the government were to take further initiative to help its people by implementing similar programs across the country, the amount of food available to the public will show an increase. As farmers begin to learn new farming practices, they will decrease erosion and nutrient loss for future harvests. While humanitarian groups can provide a substantial amount of assistance to the rural Malagasy farmers, the true area of improvement is with the Malagasy government itself. It needs to reevaluate its GMO legislation and balance the risks to the environment with the benefits to its citizens, in this case increasing available food.

While the country's concern for environmental safety is appropriate, many other countries have found ways to balance the environmental and socio-economic aspects of legislation. The Netherlands for

example, “includes concepts like the benefit to society, the contribution to economy and well-being, health (human rights and labor conditions), food supply (food security and fair trade), cultural heritage, freedom of choose, security (environmental and food), biodiversity and environmental quality” (Binimelis, Rosa, and Anne Ingeborg Myhr.). A reevaluation of this legislation with a better understanding of the societal impact is in the government’s best interests. Increased production on farms will affect Madagascar’s economy by decreasing the amount of imports that come into the country. This will narrow the trade deficit between imports and exports coming through the country. Bolstering farmers to support themselves financially, in addition to participating in trade domestically and internationally, benefits all portions of the society and the land they live on.

The Malagasy have been living in poverty for far too long, and for such a large portion of the population to go malnourished is a true travesty. With the addition of governmental and humanitarian aid to move forward to face the ever-present challenge of food security that presses upon all social levels of Madagascar’s people. Increasing yields while maintaining a nutritional balance is vital to the progression of Malagasy society. Although the country is currently planted in a plethora of momentary troubles, asserting itself into stability through clear and swift, declarative action will move the society to a more prosperous economic and subsequently, nutritious life where there is access to food regularly, and the people can focus on other areas of growth.

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