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The Effect of Malagasy *Tavy* on Food Security: A Case Study

The dry season has left a bed of kindling on the forest floor. From space, the darkened, discolored patches can be seen on the large island just off the east coast of the African mainland. For thousands of years, farmers have practiced *tavy*, a Madagascar-specific form of slash and burn agriculture in the interest of promoting their staple crop, rice. The rain forest ash is a potent fertilizer in a region without the capital for modern techniques. Nonetheless, slash and burn agriculture is rightly associated with unsustainable practices. Entering the modern age, the population of Madagascar has grown enormously, and subsistence farming has not kept pace. As a result, irresponsible practices have left millions in a precarious position: whether to destroy the forests to have food in the short term, or to come up with another solution to have food in the long term. By tradition and sheer necessity, small-scale farmers have so far resorted to increasing pressure on their environment. *Tavy* is not sustainable in the long run; an alliance of forces from within and without must work together to create an alternative that can increase subsistence level productivity and ultimately, food security in the region.

Around 2000 years ago, the first settlers arrived in Madagascar by boat; their origins are a mixture of Asian and African cultures. Possibly originating from islands in Polynesia, these tribes sailed along the Indian and African coasts, eventually arriving around the first century AD (“Background Note: Madagascar”). Additional migrations brought more people of African origin. New settlers generally did not intermingle with previously established tribes, and as a result, distinct ethnic and tribal groups emerged. These divisions still exist today, albeit to a lesser degree. The central highlands are inhabited by descendants of the original settlers; the Merina (3 million) and the Betsileo (2 million) tribes show more distinct Asian origins. The Betsimisaraka (1.5 million), Tsimihety (700,000) and Sakalava (700,000) tribes, each with dominantly African characteristics, settled on the coasts. In total there are 18 officially recognized tribes. Most importantly, these distinctions have created varying agricultural customs.

Tavy has been practiced continuously ever since the first people arrived on the island. Slash and burn techniques were imported from other regions, where they had been successful in preparing dense grasslands and woodlands for agriculture. Subsistence farmers, primarily on the coastal regions, first prepare a forest by cutting down trees and salvaging any useful building materials and fuel sources (Kremen). The burning of the remaining organic material released vital nutrients into the soil. In *tavy*, rainfall-irrigated rice paddies are planted. Traditionally, as little as a single crop was harvested from any particular year. After this harvest, the field was left fallow, and the forest was allowed to regrow, typically for 20 years or more. As the forest regenerated itself, nutrients were stored for the next burn. This cycle was repeated for generations or longer, creating an extremely sustainable technique.

Entering modern times, however, has created new complications. From 1970 to 1995, population doubled to over 18 million while per capita income fell by 40 percent (“Rural Poverty in Madagascar”). Much of the loss comes from coastal areas where *tavy* is practiced. The increased population density has strained sustainable subsistence practices. According to Minten and Dorosh, the Green Revolution that stimulated rice production in other regions passed over Madagascar (2), markedly decreasing relative land use efficiency. The concepts of intensive agriculture are foreign to this economy. To compensate, the total planted area is expanded. Greater areas of forest are burned annually, more rice crops are planted in succession, and the regeneration cycle is shortened considerably. Yet the increased pressure on the environment has not helped subsistence farmers gain ground. 2005 data published by the Madagascar National Institute of Statistics indicated 68.7 percent of the total population lived below the poverty level

(qtd. in “Rural Poverty in Madagascar”). The country is 80 percent rural, and conditions have generally been declining for this majority. Fully 76.7 percent of rural inhabitants live in poverty, while 52.1 percent of urban inhabitants meet the same criteria.

Continual forest destruction has a number of causes, all of which are augmented by these increased population and economic pressures. *Tavy*, when practiced in the traditional way clears small patches for rice production within large tracts of forest. After the farmer harvests his crop, he is obliged to leave that plot fallow until years of secondary growth completely overtakes it, thus regenerating the forest. Contemporary use of *tavy*; however, shows no such restraint: “In the fallow zone, the fallowing period was 8–15 years in the 1970s, decreased to 6–10 years in the 1980s and eventually reached 3–4 years at present”(Styger 260). Farmers burn large, contiguous swaths of forest and plant rice until yields eventually reach zero. They believe it is more economically feasible to coax the maximum amount of rice from a plot and move on.

The role of a *tavy*-based agricultural system in selected regions of Madagascar is profound. Into the 20th and 21st centuries, increasingly large tracts of primary growth tropical rain forest are destroyed. Even though the richness of the tropical rain forest biome may suggest similarly fecund soil conditions, the reverse is true. Most of the forest's biomass is actually contained within the trees themselves (Butler, “Why rainforest soils”). As these trees die and rot, their nutrients are quickly recycled into new growth by a well-developed association of bacteria, fungi, and animal decomposers. Consequently, soil quality is quite poor and acidic, rivaling that of many deserts. The gain from a round of *tavy* is ash capable of supporting *only a few seasons* worth of crops. A relatively new development is the conversion of fallow fields into pastures for grazing animals. It has become common practice to burn grazing grounds annually, in order to provide better grazing grounds (Kremen). As the herds scatter the remaining biomass, regrowth potential is diminished significantly and permanently.

The loss of biodiversity is an important source of concern for the entire world, but the local subsistence farmers share different opinions. In their traditional agricultural society, land ownership, not monetary income, is equated with wealth. *Tavy* is a primary means to this end. The rain forests are viewed as communal; a farmer can take from it as he wishes, as long as he allows others to do the same. This attitude is contrary to the policies of the current government, which views *tavy* and other forms of slash and burn agriculture as illegal. These conflicting viewpoints are an example of the clash between traditional and contemporary attitudes towards resource management.

Social distinctions are an important factor underlying agricultural practices. A typical family in one part of Madagascar differs substantially from another belonging to a different tribe. Similar drastic differences are found between urban and rural dwellers. In the areas where *tavy* is most prevalent, most notably on the eastern coast, the people live in large family units organized into villages. Focusing on the family unit, monogamy is most prevalent, with divorce a common alternative to polygamy (“IFAD's projects in Madagascar”). Traditionally, marriages are not registered with legal authorities; they are celebrated by local custom and recognition alone. In the same sense, official birth records are hard to come by, as maternity hospitals are very often distant and costly. Instead, most babies are delivered at home by an unregistered midwife. In this and many other rural areas, families with anywhere from five to fifteen (with a median of six to eight) children are common. Education is a prime concern for villagers seeking to leave their subsistence roots; however, traditional practices limit children's access to it. Legally, unregistered children do not have access to public schooling, nor do they have the right to vote. In the more urban areas of the central highlands, registration and due process are more prevalent, and education is more formal. As a result, social, economic, and political opportunities are disproportionately favored towards this region.

Initiatives by individual villages or local authorities have experienced varying degrees of success

in improving their standing. Although lacking formal education themselves, parents and village elders manifest their desire to provide a measure of schooling for their children. Realizing their children cannot move ahead without at least a basic education, informal schools staffed by local teachers have sprung up in some villages. This first step has not had great success; however, as the labor-intensiveness of subsistence agriculture limits the availability of teacher and student time. Teacher pay is irregular; in order to survive, they must farm their own plots of land (“IFAD’s projects in Madagascar”). Likewise, children must assist their own families. Naturally, if farming became more efficient or further incentives were created to support education, more time and effort could be devoted to these local schools.

Tavy remains a central element in the plight of subsistence farmers in Madagascar. There is a strong correlation between subsistence level agriculture and adherence to traditions both in Madagascar and many similar regions around the world. Bound to tradition, sons continue to labor with the same practices of their fathers. As a result, even government reforms cannot stop farmers from advancing into the forests, which the farmers view as their birthright. Especially in the coastal regions, the practice of creating temporary, rain-irrigated rice paddies following the disuse of irrigation systems (following flood or erosion, for example) is as popular as ever (“Irrigation project transforms”). Although the central regions have benefited from the greater relative stability of terraced paddies fed by elaborate, meticulously maintained irrigation canals for centuries, the coastal regions have been slow to transition permanently. Construction and maintenance of these more permanent systems requires time and capital most subsistence farmers cannot afford. The resulting poorer crop yields among coastal groups results in food shortages and an imbalance in purchasing power.

In recent times, the last half-century in particular, established trends have progressed much more rapidly and with greater, sweeping repercussions. More proactive government policies aimed as regulation of key agricultural products have been met with mixed results. During the 16 years under President Didier Ratsiraka (term: June 1975-October 1991), the country underwent reformation to a highly centralized revolutionary socialist state (“Background Note: Madagascar”). Centralization of key export crops such as cloves and vanilla eliminated bargaining at the production level. The following international market slump (in part from the invention of artificial vanilla from a petroleum derivative) significantly reduced the economic viability of these crops. More significantly, during this time, rice production decreased relative to both land usage and population growth. Beginning in 1972, Madagascar became a net rice importer; in ten years time, more than 200,000 tons were imported yearly (Metz). Under new economic reforms, though, this reversed dramatically. By 1989, the rice import deficit had decreased 70 percent, with an accompanying increase in rice cultivation to some two-thirds the country’s total cultivated land area. This trend, if continued, would result in greater rice production, leading to a more favorable import-export balance. Nonetheless, the diminishing returns on this may prove more costly for the economy as a whole unless more comprehensive reforms are implemented.

Increased pressures from the growing population have augmented infrastructure and trade shortcomings. As is the case with most countries experiencing crushing poverty, policy generally favors the urban elite, which pay the majority of the taxes and wield the majority of the political power. As a result, major cities reap much of the benefits. In the countryside, where there is less money and less power, the citizenry is oftentimes neglected. In Madagascar, with different tribes divided among regions, sharp ethnic divisions are also prone to occur. The rural poor are in every sense disadvantaged; political and economic representation are reduced due to unfavorable educational and vocational opportunities (Metz). Relatively speaking, markets are much more plentiful in urban than rural areas. Poor roads limit rural access to markets, and therefore, a channel for goods. This discourages the proliferation of cash crops and handicraft production in coastal regions remote from the capital and other major commercial centers. This sector is a prime example of resource underutilization.

One of the issues plaguing subsistence farmers is the monopoly of certain traditional crops in the

variegated regions. Culturally, rice plays the dominant role throughout many aspects of the Malagasy economy. It is the catalyst of *tavy* and is the most widely planted crop overall (Metz). Next is cassava (manioc, whose roots are made into tapioca). High in starch content but less widely planted, cassava is less common in the regions where *tavy* is widespread. The emphasis on starch heavy crops has thus somewhat created nutrition shortcomings. Some half of Malagasy children display chronic malnutrition (“Rural Poverty in Madagascar”). As a staple, the traditional rice crop is generally poor in nutrients. Supplemental foods are much rarer, as most efforts at increasing Madagascar's agricultural output focus on staple crop production. Projects to remedy this, such as the promotion of family vegetable plots, take a backseat to the more economically significant rice.

Movement towards intensifying current agricultural processes is a priority. Less than 2 million hectares (about 3.2 percent) of Madagascar's total land area is under permanent cultivation (Metz). This includes permanent rice paddies and to a lesser degree, established orchards. Irrigated rice plots are typically less than half a hectare each in the central highlands; a direct comparison cannot be made with the less developed coastal regions in terms of irrigation capacity. In total, about 16 percent of cultivated land is supported by any type of irrigation. Through intensification, plot densities can be increased in many parts of the country, depending on local water availability.

Irrigation and the establishment of permanently cultivated fields may provide the greatest long-term boost to productivity. On the small-scale subsistence level, government-funded hydro-projects may not be viable. More moderate proposals oppose *tavy* by promoting local water management practices. In order to create permanent agricultural gains, permanent solutions must be a priority. A recent successful effort was put forth by the Agricultural Fund for International Development. It focused on intensifying rice production in the Mandraré basin, the driest part of the island. Starting with micro-level local initiatives, farmers were introduced to more efficient techniques and water management (“Irrigation project transforms”). Adding to that were additional projects focused on diversifying the local crop to cassava, maize, and vegetables. Equally important, transportation infrastructure development needed to be addressed. Says Andrianainasoa Rakotonratsima, project director, “The region was completely cut off. It took about 12 hours to drive the 120 kilometres from the regional capital, Taolagnaro [Fort-Dauphin], to the inland basin, and the area was shockingly poor” (“Irrigation project transforms”). The Mandraré basin project also improved highways, allowing access to export markets. The localized success of this effort may be applied to other impoverished regions.

A multilateral solution and implementation is necessary to rescind environmental degradation and improve food security. Increased productivity would likely come from a number of sources. In addition to greater output per hectare, supplemental income may play a greater role in elevating living standards. Traditionally, women have attended to other duties while their husbands worked the fields during the most labor-intensive seasons (“IFAD's projects in Madagascar”). Activities such as basket and mat weaving have been practiced for centuries. Although established gender roles generally limit the frequency of women's trips to market, an expansion of these opportunities may be a potential source of steady income. Where capital-intensive inputs are hard to come by, light industries may not be a viable alternative in the foreseeable future for these rural areas. However, the household production of handicrafts for market is a conduit for increased overall productivity of the subsistence farm. In order to make the most of this, better means of transportation, especially better roads, are necessary in the underdeveloped coastal regions. Increased attention to such infrastructure is vital to future development. Here is an opportunity for foreign investments in money and technology.

Beyond household level initiatives, the agricultural sector as a whole would benefit from alternate means of income. Access to international markets remains an acute issue to the country. Although rice is the primary staple crop, a number of cash crops are also grown. Madagascar's favorable climate for a variety of crops is key to a favorable trade balance. A priority to achieving a high growth economy is the

promotion of Foreign Direct Investment (*Madagascar Action Plan 2007-2012*). Recently, Madagascar has been doing poorly, with an FDI of USD 85 million in 2005. Ranked 131st on the World Bank's "Doing Business Indicator," there is substantial room for improvement. As a result the government has established the Economic Development Board of Madagascar in 2006. To fulfill their role, they must give the EDBM the powers to effect economic reform and negotiate on an international level. Access to foreign investments and markets gives subsistence farmers incentives to act on a more global perspective. Nonetheless, this proposal is far from comprehensive. The Madagascar agricultural ministry must hold the powers to delegate the Action Plan's projects to local leaders. The problem is fundamentally on the household level; the solution must rest at or as close to that level as possible. Here, production quotas should be discarded in favor of land development goals such as irrigation availability.

Although the diverse array of organizations supporting a multifarious collection of programs in Madagascar may have different ultimate objectives, any contented effort to improve the country's well-being has effects on the small-scale subsistence farmers. Such programs include ecotourism, bio-prospecting fees, carbon credit trade (Rhett, "Funding Conservation in Madagascar"). Well sponsored conservation programs generally also provide funds for local development. For example, the Swiss company Givaudan sent a team to Madagascar in search of exotic fragrances. With 40 good products as a result, they promised a percentage to conservation and local development. Such programs are fundamentally opposite from *tavy* and are representative of steps forward. Although the corporate sponsorship route does provide an infusion of cash into the local economy, long term and truly sustainable programs must push further. The direct benefits of biodiversity may be obvious to certain industries, but a more diversified portfolio of organizations is essential to development.

Madagascar's diverse history suggests a sundry future to come. For thousands of years, *tavy* created a sustainable lifestyle among Madagascar's subsistence farmers. Only recently has the practice evolved beyond its means. The result is a substantial population dependent on the island's most volatile resource. This population's rapid expansion places further strain on Madagascar's economy and ecosystem. Because state initiatives primarily target urban areas, funding for provincial programs tend to lack the full weight of governmental support. Legally, a ban on all forms of slash and burn agriculture has been in effect for decades. Nonetheless, *tavy* continues to be practiced. Without more initiative on the subsistence farmer level, it appears the practice cannot truly be eradicated. In order to reverse these centuries old traditions, however, input is requisite from organizations from around the world. Direct and indirect foreign investments will provide the capital necessary to set up permanent operations in currently impoverished regions. As irrigation water supplants fire ash as the primary means to keep fields fertile, less rainforest need burn each year. In addition to intensification, diversification creates new sources of wealth for the largely single-crop economy. Opening access to larger markets provides a springboard to the expanding economy. These projects need not restructure the country's economy in the same way as a past socialist revolution. In supporting the subsistence farmers, the best parts of a traditional lifestyle can be conserved. Additionally, a direct result of the end of slash and burn is the maintenance of Madagascar's amazing biodiversity. The island's rainforests are home to numerous endemic plant varieties and the well-known lemurs. A successful food security program *will* combat *tavy*. Many existing and proposed efforts push for improved agricultural robustness. The monetary cost of such programs is surpassed by their potential returns. Food security for this body of people begins with the end of destructive practices; *tavy* jeopardizes more than the forests.

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