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The art of brickmaking in Madagascar: A lifeline and its challenges

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ABSTRACT

Artisanal brick production provides a crucial livelihood for many families in Madagascar. This essay explores the historical context, socio-economic drivers, and potential environmental impacts of this widespread practice. It challenges the simplistic narrative that associates brickmaking solely with environmental degradation and highlights the need for more nuanced research to understand its drivers and long-term effects.

RÉSUMÉ

La production artisanale de briques constitue un moyen de subsistance essentiel pour de nombreuses familles à Madagascar. Cet essai explore le contexte historique, les moteurs socio-économiques et les impacts environnementaux potentiels de cette pratique. Il remet en question le récit simpliste qui associe la fabrication de briques uniquement à la dégradation environnementale et souligne la nécessité de recherches plus nuancées pour comprendre ses moteurs et ses effets à long terme.

INTRODUCTION

Since the British missionary James Cameron introduced open air clamp kiln technology to Madagascar in 1826, fired bricks have become one of the most popular building materials in the country (Leonardi 2003). Artisanal brick production occurs in the Highlands and in coastal areas, where differences in geology result in mineralogically distinct bricks. In the Central Highlands, thick, clay-rich lateritic soils offer an abundant source of raw material. As a result, brick production sites are widespread across the Highlands landscape, though their greatest density is near villages and urban areas (Grifa et al. 2017).

This essay explores artisanal brick production in Madagascar and the transformation of the landscape it entails (Figure 1). The economic, sociocultural, and environmental dimensions of this widespread, informal industry are poorly understood, though some have speculated on its drivers and impacts. Drawing from field research at rural and urban brick production sites in Madagascar, as well as laboratory analysis of raw materials and fired bricks, Grifa et al. (2017, 2021) offer a bleak assessment: "[Brick production] has remained unchanged for more than 200 years and even if new social and economic opportunities arose, this unvirtuous system slowly (but inexorably) contributed to the impoverishment of important energy sources and, above all, of natural resources (Grifa 2021: 1)."

However, the pervasive narrative about Madagascar, which assumes that population growth and poverty drive a downward spiral of forest clearance, environmental degradation, and ever deepening poverty, has drawn criticism. Notably, Scales (2011: 501) observes "[research] has…tended to lump Malagasy farmers together into a single category, ignoring the biophysical, political, economic and cultural diversity…[with] few attempts to understand the underlying factors driving land use." Given the current knowledge gap in Madagascar, it is premature to dismiss artisanal brick production as unsustainable in all contexts. Through personal observations and existing literature from Madagascar and elsewhere, I explore this informal yet vital industry and suggest areas in need of further research.

HISTORICAL AND GEOGRAPHICAL TRENDS

Demand for construction has made artisanal brick production an important income-generating activity in many Malagasy communities. As a Peace Corps volunteer (2017–2019), I lived near several brick production sites in the commune of Imerintsiatosika, a large, developing market center in the Central Highlands. During that time, I witnessed the rapid expansion of brick infrastructure in the form of new homes, tall, long walls enclosing property boundaries, and other structures. To meet demand, brick producers excavated an increasing number of pits within rice paddies and along the edges of valley bottoms (Figure 1). I returned briefly to Imerintsiatosika in August 2023 and the continued expansion of brick infrastructure and sediment extraction sites was evident. New neighborhoods of brick houses surrounded by brick walls stood on what was empty land on the outskirts of town just a few years prior.

My personal observations aside, the extent, rate of growth, and economic importance of artisanal brick production in Madagascar are not known. In Greater Antananarivo, Earth observation data show that nearly 14% of total urban land use (2.5% of total land area) is devoted to brick extraction (Dupuy et al. 2020). It is

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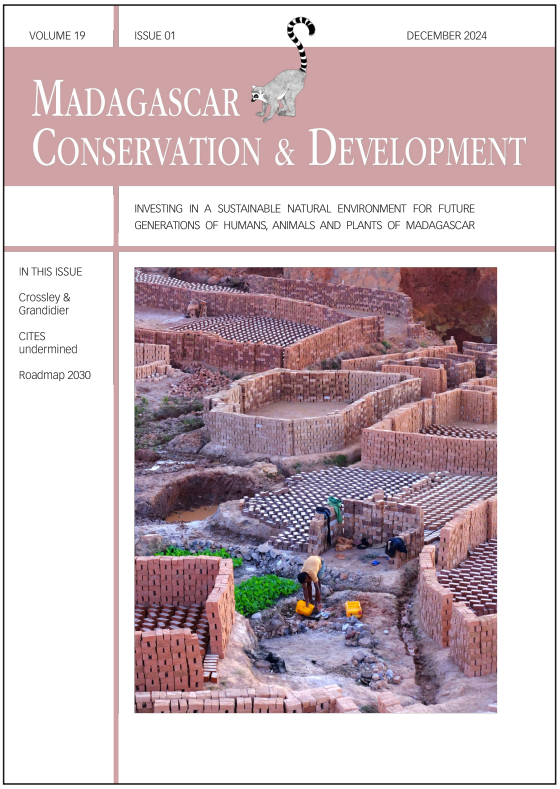

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Figure 1. Brick kilns firing. The smoke of burning rice husks fills the air. (photo Sam Feibel)

unclear, however, how much production occurs on agricultural land, which constitutes 44% of total land area. Reportedly, farmers in Antananarivo's agricultural floodplains often consider brickmaking the first step towards radical land use change, with some plots ultimately used for urban construction when the soil is exhausted (Aubry et al. 2012).

Outside Madagascar, researchers have used remote sensing and machine learning to identify brick production sites over large areas with high precision and accuracy (Lee et al. 2021). These techniques applied to historical imagery in Madagascar would provide insight into the growth patterns and environmental footprint of the industry and could be a basis for estimates of the industry's economic value. Interviews with farmers and brickmakers, covering a range of brick production sites, would complement remote sensing analysis, adding nuance and context to observed trends.

DRIVERS OF BRICK PRODUCTION

Artisanal brickmaking involves physically demanding, long hours. In Nepal's Kathmandu Valley, musculoskeletal injuries were found among brickmakers, including children, as were respiratory issues linked to smoke and fine particulate matter (Joshi et al. 2013, Sanjel et al. 2017). In Madagascar, I often observed small children involved in various stages of brick production—particularly when large families worked together to stack sun-dried bricks into kilns for firing. The health impacts of artisanal brick production have not been studied in Madagascar, but the laborious nature of the industry begs the question of why smallholders would choose to remove soil at great physical cost, rather than grow food in it. For this question, Bangladesh serves as a potentially instructive case study.

Urbanization in Bangladesh has driven high demand for bricks, placing a premium on soil from agricultural fields. Some farmers in the Dhaka and Jessore districts remarked that due to the excavation of soil for bricks on adjacent farm plots, their land was effectively elevated in relation to the surrounding land, decreasing their soil's capacity to retain water and fertilizer and pushing them to excavate their soil for brick production as well (Biswas et al. 2018). Other factors that drove farmers to sell soil included higher profits and faster cash returns compared to agriculture, low barriers to entry, and the ability to retain ownership of the land and perhaps grow crops there again in the future. Declining soil productivity and uncertainty in the profitability of rice cultivation due to fluctuating market prices, fertilizer availability, and climatic events also pushed farmers to sell soil (Biswas et al. 2018).

The factors driving farmers to produce bricks in Madagascar are not well understood. In the Central Highlands, bricks are made between the months of June and November, when rain won't destroy air-drying bricks or extinguish open-air kilns. During the dry season, valley bottom land cultivated for rice is left fallow (and available for brick production). This seasonality allows for livelihood diversification when farmers are not laboring in rice fields. Sun-drying molded bricks, stacking them into a furnace, and firing them takes on average twenty days to one month (Grifa et al. 2017). Motivated producers can fire bricks more than once during the dry season. One brickmaker I spoke with in August 2017 reported having worked with her family starting at sunrise six days a week for the two months prior, producing 100,000 bricks.

Because the simple clamp kilns used in Madagascar are not permanent structures, producers can fire bricks at the sites where they extract sediment. This capacity for opportunism, coupled

with the abundance of clay in many Highlands soils, means that brickmakers can turn sediment into a commodity across much of the landscape. The kilns consist of stacked bricks layered with fuel in an open-air environment and are energy-inefficient due to high heat loss (Grifa et al. 2017). In many countries, clamp kilns have been replaced with more thermally efficient technologies, but in India, for example, the former are still used to produce an estimated 20% of the 247 billion bricks made annually. Despite their relatively small contribution to total brick output in India, an estimated 70% of all kilns in the country are clamp kilns (Eil et al. 2020), testimony to the accessibility of this kiln technology to producers.

The most popular fuel used to fire bricks in Madagascar's Highlands is rice husk due to its widespread availability. Unlike wood, rice husk is an abundant, relatively cheap recycled agricultural byproduct with no major alternative uses (Grifa et al. 2021). In Imerintsiatosika, I was told that the price of rice husk varies slightly each year and is available at no cost some years. This may depend on the year's rice harvest, the demand for fuel to fire bricks, or other factors. The accessibility of rice husk—combined with a producer's ability to fire bricks where sediment is found—allows for opportunistic, seasonal brickmaking.

BRICK PRODUCTION'S IMPACT ON FOOD SECURITY AND THE ENVIRONMENT

Though no country-wide data are available, brick production has been labeled a major source of greenhouse gas emissions in Madagascar, with each kiln requiring around 10 tons of fuel (Grifa et al. 2021). Choice of fuel—rice husk, wood, or peat—impacts the environmental and economic sustainability of firing. In some regions of Madagascar, hardwood harvesting for brick kiln fuel may drive unsustainable deforestation in the same manner as charcoal production for cooking fuel. In August 2023, I met with brickmakers using wood from local forests to fire bricks outside the Southwestern city of Toliara. In the Highlands—on the other hand—where rice paddies abound, rice husks are an easily accessible fuel source.

When bricks are fired, the burning of organic matter that occurs naturally in clay deposits is another source of CO2 emissions (Grifa et al. 2017). The amount of organic matter in sediment deposits may depend on location, however, and whether that sediment comes from agricultural valley bottoms or grassy hillslopes. An estimated 79% of Madagascar's soils are oxisols, characterized by very low organic matter content (Paul et al. 2022).

While brick production and agriculture are seasonally complementary livelihood activities in Madagascar's Highlands, brick production may compete with agriculture when brickmakers permanently remove sediment from productive valley bottoms. In Greater Antananarivo, brickmaking is expanding rapidly at the expense of rice paddies, with soil excavation reportedly disrupting agricultural water management systems (Dupuy et al. 2020). However, farmers who rent their paddies to brickmakers have often been observed to repurpose the excavation pits later for agriculture (Grifa et al. 2017). In the floodplains of Antananarivo, a common strategy on small farm plots is the "bricks, rice, duck, fishing" system, in which smallholders engage in all four activities on the same plot over the course of a year. Aubry et al. (2012) suggest that this system of seasonal livelihood diversification becomes unsustainable after a few years, with soil becoming unsuitable for both cultivation and brick production, though evidence for this trend is localized and anecdotal.

The excavation of soil for brick production may not always diminish agricultural production, at least in the short term. Brickmakers do not exclusively excavate rice paddy soil. In the Highlands, they also dig laterally into clay-rich hillslopes, thereby expanding valley bottoms and creating more irrigable land for paddy rice and other crops. These hillslopes contain nutrient-poor, compacted soils and are often marginal agricultural land that is unutilized, grazed by cattle, or planted with hardy crops like cassava prior to their transformation for brickmaking.

In Imerintsiatosika, I often observed brickmakers planting rice, vegetables, and bananas within active excavation pits cut into hillsides. When I returned in August 2023, I noticed that an area where I used to play soccer at the edge of a hillslope had been transformed into a pit so deep that groundwater filled the bottom. I asked one of the men digging into the towering wall of sediment what would become of the hole once brickmaking eventually stopped at the site, and he replied "atao tanim-bary avy eo [it will be made into a rice paddy later]." I had no reason to doubt him, since the rice paddy just a few meters downhill from the new pit had itself been a brick production pit when I'd been there just a few years earlier. Analysis of satellite imagery and ground truthing could examine how such pits are seasonally cultivated, and how long they remain viable for alternating brick production and agriculture.

One study of smallholder livelihood adaptation in Zimbabwe —which occupies the same latitudinal range as Madagascar's Highlands and experiences similarly seasonal rainfall—highlights the complexities of the connection between artisanal brick production and food security. There, Pasipangodya and Mwenye (2020) argue that smallholders engage in seasonal non-farm activities such as brick production to improve food security through diversifying income streams. The study is a rare case that views artisanal brick production largely in a positive light, with diversification improving food security in the face of environmental risks such as increasing climate variability and water scarcity.

BRICK LANDSCAPES

> "Degradation occurs when a natural habitat loses value of every kind…Transformation, in contrast, involves a change in the currency by which a natural habitat is valued."
> — (Richard and O'Connor 1997: 407).

Anthropologists have long drawn attention to the rationality of smallholder livelihood adaptation strategies, exposing misplaced assumptions that unequivocally link land use choices (swidden agriculture, for example) with environmental degradation (Scott 1976, Dove 1983). In Madagascar, Kull (2000) argues that rationality, not poverty, drives land use decisions, noting: "Rarely would *tantsaha* (agriculturalists) continue practices clearly detrimental to their own livelihoods!" (Kull 2000: 434). Like the clearing of forest for agriculture, brick production should be seen as the outcome of a "change in currency" that Richard and O'Connor (1997) describe. Brickmakers in Madagascar adapt to highly localized conditions, where, among other factors not yet documented, access to markets, sediment, and fuel all play a role in the environmental impact and economic viability of production.

The ecological sustainability of many agricultural landscapes in Madagascar is uncertain. Many of Madagascar's natural valley bottoms were transformed for agriculture centuries ago. This

complicates efforts to understand the geomorphological and ecological impacts of sediment extraction for brickmaking, which have not been studied. In some cases, it has surely led to reduced agricultural productivity and harmful ecological impacts. In others, however, it may represent a more sustainable transformation of the landscape.

Today, Madagascar's transformed, "biocultural" landscapes harbor important agroecological diversity (Carrière et al. 2022), and what happens to them over the coming decades will determine the sustainability of human and nonhuman life across much of Madagascar far into the future.

CONCLUSION

Artisanal brick production is a vital livelihood activity for many Malagasy families. It also poses challenges that need to be addressed through targeted research. Interviews with brick producers would help build a basic understanding of the informal industry, illuminating how brickmaking compares to other income-generating activities, and how that may vary across geographic regions.

To understand the potential environmental impacts of artisanal brick production, future research should recognize the importance of context. Studies should account for differences in fuel availability and landscape characteristics between sites and should examine change in the extent of brick production through space and time. In addition to analyzing the spatial relationship between brick production and agriculture on the landscape, researchers should seek to understand brickmakers' perspectives on the economic, social, cultural, and environmental dimensions of their livelihood. This will give insight into the drivers of brick production as a livelihood strategy and inform assessments of Madagascar's construction industry as demand for housing continues to grow.

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