Power and Nature in Unequal Societies: Examining Labor, Elites, and Environmental Racism in the Brazilian Sugar-Ethanol Industry

By

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Abstract

This dissertation examines the processes that facilitate and impede social equity and environmental sustainability in societies with deep socio-racial inequalities, such as Brazil and the US. I ask: how do labor, class, and race interact to shape outcomes for equity and sustainability in renewable fuels production? To answer this question, I conducted an extended case study of the Brazilian sugar-ethanol industry, which recently faced strong pressure to improve social and environmental standards. I conducted in-depth interviews with industry elites, such as mill owners and managers, and observed activities at mills. Rather than focus on grassroots actors, as is common in studies of social and environmental change, I study those who benefit from unequal relations: white elites. By viewing power and inequality from above, I was able to glean unique insight on how elites' attitudes toward race, labor, and class collided with state efforts to promote equitable and sustainable practices on mills.

The first empirical chapter examines the trade-offs that often characterize efforts to improve labor and environmental standards. I find that many cane elites responded to pressure to improve conditions for manual cane-cutters by mechanizing farming tasks. Mechanization, however, yielded environmental benefits, as machines rendered obsolete straw burning, a labor-saving practice that generates atmospheric and public health problems. In the second empirical chapter, I investigate the collective enterprise character of sugarcane elites, who view state efforts to reduce inequality as a threat to their class and racial position. Mechanization, in particular, animated an existential crisis for elites, who scrambled to purchase flat farmland and construct new mills, which were symbolic and material vehicles for conferring dynastic power and privilege. The third empirical chapter examines the role of colorblind racism in exacerbating racial and environmental inequalities in sugarcane communities. I find that elites use the framework of colorblind racism to defend why mechanization and the elimination of straw burning have been spatially and racially uneven, with burning eradicated in white-majority communities and persisting in black-majority communities.

Chapter 1

Introduction

From 2003 to 2014, high commodity prices buttressed an economic boom in Brazil. Unlike other BRIC countries, whose inequality sharpened during the boom, Brazil saw poverty and inequality diminish, while also growing the middle class (Neri 2010). For a nation known the world over for its inequality, this change was historic. The expansion of the center-left Workers Party (PT), punctuated by presidential victories in 2002, 2006, 2010, and 2014, drove the pro-poor policies that distinguished Brazil from their BRIC counterparts. Several policies underpinned this social change: wage increases, welfare spending, employment formalization, and better working conditions for marginalized people. However, in other areas, the contours of power remain unchanged. The incumbent industries associated with the commodity boom, such as agribusiness, mining, and construction, vastly increased their economic and political standing. Moreover, President Lula's (2003-2010) Faustian bargain with these sectors, who were integral to the PT's ruling coalition, later backfired as they turned against the PT and successfully lobbied to impeach President Dilma Rousseff (2011-2016) more than a year ago.

Contradictions and inconsistencies marked the PT's agenda for inclusive and sustainable growth (Carrillo 2014). On one hand, the PT's policies promoted demand-side growth, with the goal of spurring the creation of a 'new middle class' (Neri 2010). Lula saw that the limited income of the poor had long constrained Brazil's economic prospects, as spending by a narrow middle and upper class could not sustain growth or induce dynamism in the economy. On the other hand, economic and social organization in Brazil depended on access to a large pool of cheap workers, especially for agricultural and domestic work. For elites and the 'old' middle class, narrowing

inequality not only induced material change, such as the restructuring of economic activities, but also psycho-social effects, as social distance closed.

In this study of Brazil's recent New Deal-style project, I ask: how do labor, class, and race interact to shape outcomes for equity and sustainability? In answering this question, I illustrate the importance of historical context for understanding the uneven success of the Lula era. While the PT's policies sought to transform historical inequalities, especially for labor and race, these efforts provoked counter-responses from incumbent actors, such as elites, who worked to slow challenges to their wealth and privilege. Thus, a main goal of this dissertation is to examine the commodity boom within the history and structure in which it was nested. In the next section, I discuss the larger political framework that guided the economic boom: new developmentalism.

The Pillars of New Developmentalism

Many scholars considered Lula's growth strategy a 'new developmentalism', or a new developmental state (Ban 2013; Arbix and Martin 2010). There were three main pillars to this strategy: 1) promoting inclusive growth in the domestic economy, 2) engaging the international economy to underpin national development and to sustain long-term growth, and 3) state-market collaboration to successfully pursue objectives in the domestic and international arenas. Several authors elaborated on the theoretical architecture of new developmentalism. First, Bresser-Pereira (2009; 2011) emphasizes the importance of wage and monetary policies in macroeconomic strategy. He highlights how two interdependent dimensions – structural development macroeconomics and growth with domestic savings – differentiate new developmentalism from market orthodoxy and old developmentalism. On one hand, the macroeconomic strategies of market orthodoxy and new developmentalism share commonalities. The Cardoso administration,

emblematic of the orthodox era, created the macroeconomic conditions for Brazil's global growth in the Lula era. The 1995 Real Plan improved tax collection, reformed pensions, and targeted inflation, which influenced the financial and fiscal landscape that Lula inherited in 2003 when he assumed the presidency (Amann and Baer 2000). On the other hand, orthodoxy and new developmentalism diverge in the motivations that set macroeconomic policy objectives. While both stress the importance of positive trade balances, orthodoxy does so to repay creditors, whereas new developmentalism seeks to improve the state's fiscal capacity to finance a national development project. Further, orthodox strategies use central banks primarily to address inflation, whereas the new developmentalism collectively prioritizes inflation targeting, full employment, and wage growth that keeps pace with productivity (Bresser-Pereira 2004).

In this sense, structural development macroeconomics uses domestic savings to promote growth. This approach diverges from the old developmental state, which financed growth through foreign savings. The growth-with-foreign-savings model, in the mind of Lula's policy circle, was associated with the debt and inflation crises of the 1980s and 1990s. By financing the national project with domestic savings, Brazil could steer clear of the trappings that come with dependency on foreign creditors, something old developmentalism failed to avoid (Bresser-Pereira 2009).

Second, Sicsú, de Paula, and Michel (2005, 2007) focus on the importance of inclusive growth for new developmentalism. They emphasize that four conditions must co-exist for inclusive growth to materialize: 1) There must be a strong state and market, 2) High rates of growth can only be sustained through state-market collaboration and appropriate macroeconomic policies, 3) Social equity must be the goal for the national development project, and 4) Only high rates of growth can reduce social inequality. These authors challenge the thesis of the old developmental state, which is that rapid industrialization and capital accumulation alone will decrease poverty and inequality.

In the new developmentalism, state interventions seek to create a virtuous cycle in which high growth is coupled with equitable resource redistribution.

Third, Schutte (2012) argues that international insertion and global competitiveness are the best instruments for sustaining inclusive domestic growth. Through internationalization, Brazil can penetrate new markets and enhance their positioning on the global stage, a feat accomplished through active diplomacy and public-private participation in foreign relations. Moreover, state banks, particularly the BNDES (National Bank for Economic and Social Development), should be an important foreign policy instrument, particularly for underwriting and financing business expansion into new markets throughout the globe (Arbix and Caseiro 2011a). Whereas an export bias marked the old developmentalism, the new developmentalism embraces global trade.

To summarize, new developmentalism uses several mechanisms to pursue growth and equity. Macroeconomic policy collectively fights inflation, promotes wage increases in line with productivity, and prevents currency overvaluation to maintain the competitiveness of Brazilian exports. Pro-poor and pro-worker programs drive and sustain domestic spending and growth, while promoting social equity. The insertion of Brazilian firms in international markets ensures long-term opportunities for economic growth and stability. However, once these developmental state strategies were applied in real-world activities, contradictions and inconsistencies materialized. As the following section details, the sugar-ethanol industry, a preferred sector for the Lula government, exemplified the uneven success of new developmentalism.

Sugar-Ethanol as a Favored Industry under New Developmentalism

For a nation that has long been dependent on the performance of commodity exports, Brazil's developmental state activism, beginning with Getulio Vargas in the 1930s, sought to

expand the industrial base. In doing so, Brazil would be less vulnerable to global commodity prices, foreign creditors, and the need to import manufactured goods. While the old developmental state succeeded in creating new industrial sectors, such as aeronautics and automobiles, the new developmental state struggled to forge any new industrial paths.

An early goal for Lula was to diversify Brazil's technological capacity, yet the bulk of government support went to incumbent sectors, such as mining, soy, sugarcane, pulp and paper, petroleum, and gas. Large incumbent firms absorbed the near trillion *reais* that the BNDES disbursed from 2003 onward, with only a small fraction destined for innovative sectors (Tautz et al. 2010). Lula and the PT faced criticism for what some called the *reprimarização* of the economy: the return to dependence on the performance of mineral and agricultural exports (Filgueiras et al. 2010; Gonçalves 2010; Magalhães 2010; Mineiro 2010). Arbix and Caseiro (2011b) argued that it was a mistake for BNDES to subsidize business expansion in sectors where technological capacity is low, as it does not encourage a new path toward higher technological sophistication. Schutte (2012), however, defends Lula and the BNDES by stating that Brazil's future strength in the global economy lies in its natural resource endowments and that its potential role as a dual energy exporter – of oil and biofuels – will sustain long-term growth.

Lula's policies to expand the production and consumption of Brazilian ethanol in domestic and global markets thus favored the sugar-ethanol industry. High oil prices bolstered an eagerness to move away from fossil fuels, which helped justify Lula's support for the sugar-ethanol industry. Lula curried favor with the *usineiros* (mill owners), a conservative group that was not part of the PT's traditional constituency, which was much more likely to include black sugarcane farmworkers rather than white landowners. Yet, in the mid-aughts, Lula recognized common points of interest with the mill owners, as growing interests in renewable fuels throughout the

globe buttressed the prospects for Brazilian ethanol. The EU market, in particular, held symbolic and material importance. Lula worked in concert with UNICA, the flagship cooperative of mill owners, to publicly and privately lobby EU officials to institute quotas for Brazil's ethanol exports. In a speech meant to win support and trust from mill owners skeptical of his intentions, Lula called them 'national heroes' and glorified the contributions they made to Brazilian development [Folha de São Paulo 2007a]. Lula's traditional supporters were mortified.

Yet, at the same time, Lula and the PT implemented numerous policies that upended the prevailing way of organizing sugarcane activities on mills. Higher wages and stronger worksite protections for farmworkers raised labor costs. Campaigns to formalize employment and eradicate modern-day slavery disproportionately affected the sugar-ethanol industry. The prohibition of third-party outsourcing, a long-held practice, forced mill owners to treat migrant workers like farm employees, which meant providing benefits and protections. These pro-poor and pro-worker strategies challenged the viability of manual harvesting on mills and plantations. Thus, Lula's treatment of the sugar-ethanol industry was somewhat typical of the contradictions and inconsistencies of the boom period. On one hand, he designed policies meant to improve life opportunities and conditions for poor farmworkers, which directly threatened the power and authority of the mill owners. On the other hand, he made assurances to mill owners that their industry would thrive on the whole under his policies.

Case and Chapters

In this dissertation, I examine the changes that the sugar-ethanol industry underwent during the PT period (2003-2016). This industry is an ideal case for investigation, as it has long exemplified the contours of Brazilian life, including unequal relations for race, labor, and class.

Anthropologist Gilberto Freyre (1964 [1933]) contended that the sugarcane *engenho* (plantation) was a microcosm of economy and society in Brazil. Historian Sérgio Buarque (1936) argued that the patrimonial nature of Brazilian economics and politics has its roots in monoculture, in which familial enrichment was a major objective for growth and governance. Faoro (2012 [1958]) stressed that agrarian elites have long been the power center in Brazil's political economy, even as industrialization accelerated in the 20th century.

Scholars who study sugarcane societies (Rodney 1981; Tomich 2004) note the importance of the environment for anchoring social and economic relations. Not only do environmental resources, such as land, water, air, and flora and fauna, shape strategies for organizing labor and production, but they are also vehicles for power, privilege, and status. That is, one's relationship to the land and environment – who commands it, who toils on it, and who is exposed to toxic practices – often define race, labor, and class. This dissertation elucidates the key role that the environment plays in shaping and limiting how workers and cane elites adapted to the policies of new developmentalism.

Three empirical chapters comprise the dissertation. Each chapter examines a different dimension of the social, economic, and environmental changes that occurred in the sugar-ethanol industry during the PT era. I conducted 18 months of fieldwork in three states – São Paulo, Pernambuco, and Alagoas – where sugarcane production is a major economic activity. Each chapter is a stand-alone paper that investigates a sub-area of my research question. Each chapter details the methodology used for the specific question that the chapter addresses.

Figure 1 – The States of Pernambuco, Alagoas, and São Paulo in Brazil

In chapter 2, I investigate the widespread adoption of mechanical harvesting on mills. Not only did mechanization eliminate hundreds of thousands of cane-cutter positions, it also facilitated the end of pre-harvest straw burning, a labor-saving practice that emits CO_2 and increases rates of respiratory illnesses for farmworkers and neighboring communities. While mechanization on mills coincided with the rollout of high-profile ecocertification schemes[1], such as the Green Protocol, the National Commitment, and Bonsucro, I find that these schemes played a weak role in driving

[1] Ecocertification programs provide benefits to producers who voluntarily comply with environmental and labor practices that certifying organizations establish

mechanization on mills. Rather, labor market pressures, such as recruitment challenges, and public labor regulations, including wages and worksite protections, were the primary factors that drove mechanization. In other words, mills were likely to comply with voluntary ecocertification schemes because such programs required changes to labor and environmental practices that public regulations and labor market pressures were already coercing mills to undertake.

Chapter 3 focuses on how the newfound importance of flat farmland affected sugarcane elites. While some scholars of environment and development argue that the commodity boom spurred the largescale acquisition of farmland, this chapter shows that this process has been underway since 1990, after the collapse of the Institute for Sugar and Ethanol triggered marketization in the industry. In this sense, the commodity boom period was the tail end of a twenty-year process in which cane elites consistently purchased flat farmland that enabled increases in efficiency and productivity. This chapter emphasizes two points. First, I illuminate the role of farmland as the main source of family patrimony for sugarcane elites, as farmland is the principal vessel through which dynastic wealth, power, and privilege flow. New ecological and market conditions that required flat terrain animated an existential crisis for sugarcane elites, who scrambled to purchase land and construct new mills to fend off the threat of downward mobility and status loss. Second, elites' social interests guided investment decisions and state lobbying, thus reflecting the collective enterprise character that sugarcane business groups exhibit. Moreover, the embeddedness of elite kinship networks in industry and state guaranteed that economic actions and market governance would reflect the social sentiments of elites.

In chapter 4, I examine why the elimination of straw burning has been spatially and racially uneven, with burning eradicated in white-majority communities and persisting in black-majority communities. I argue that colorblind racism – an ideology that uses non-racial factors to justify, defend, and rationalize racial inequalities – plays an important role in exacerbating racial and environmental inequalities in sugarcane communities. Sugarcane elites discuss non-racial factors, such as market dynamics and topography, to defend exposing black farmworkers and black-majority cane communities to manual harvesting and straw burning. This chapter also outlines, on the one hand, the environmental politics and policies that elites use to preserve straw burning and, on the other hand, the discursive framework that elites utilize to rationalize why racial minorities should continue to disproportionately bear toxic burdens.

These three empirical chapters collectively illustrate the contradictions and inconsistencies of the new developmentalism in the commodity boom period. First, I show how pro-poor and pro-worker policies succeeded in making manual cane-cutting unviable on many, but not all, mills. By raising the regulatory floor and broadening life opportunities for cane workers, many mills were compelled to mechanize farming activities. Moreover, many cane communities, particularly in São Paulo, no longer are exposed to straw burning and its toxic effects. Second, I illustrate the importance of farmland as a social prize for sugarcane elites, who use land as a vehicle to preserve inter-generational wealth, power, and status. With elite social networks embedded in industry and government, the new developmentalism failed to insulate state actors from private interests. Third, I show how northeastern cane elites used colorblind racism to successfully defend the continued use of manual harvesting and straw burning, business decisions that run counter to the broader industry trend. In this sense, developmental state interventions, such as exemptions for labor and environmental regulations for northeastern mills, facilitated the preservation of racialized toxic

practices. Overall, these chapters demonstrate how the sugar-ethanol industry exemplifies the uneven success of Lula's new developmentalism. While the industry saw some real labor and environmental gains, such improvements co-existed with successful efforts to preserve the elite power structure and keep intact processes of environmental racism in the poorest regions of the country.

Chapter 2

When Farm Work Disappears: Labor and Environmental Change on Sugar-Ethanol Mills[2]

Abstract: What factors drive labor substitution in the biofuels sector? Can labor substitution engender positive environmental outcomes, such as decreasing carbon emissions? This paper examines the motivations and consequences of substituting machine harvesters for cane-cutters and ending field burning. Not only does this paper interrogate key claims from techno-optimistic and sociological theories of environmental change on how and why producers adopt new practices, but it also highlights the role of labor in processes of environmental change. Two main findings emerge. First, labor challenges with farmworkers, not environmental authority, were the primary motivations for changing production practices. Second, although new practices generated positive environmental effects locally, such gains are likely to vanish at the regional level since an expanding industrial sector, with its new employment opportunities, undergirded and made viable mechanization in the sugar-ethanol sector.

Introduction

What factors drive labor substitution in the biofuels sector? Can labor substitution engender positive environmental outcomes, such as decreasing carbon emissions? While the major debates on renewable fuels have focused on whether capitalist mechanisms offer possibilities for internalizing ecological costs, environmental scholars largely overlook the question of labor in spite of the fact that rural work is central to the farming activities that undergird biofuels production. For instance, throughout Latin America, Asia, and Africa, a large, seasonal workforce is traditionally necessary for the harvesting and planting of major biofuel feedstocks, such as sugarcane, oil palm, and jatropha.

The major political economic approaches to environmental change – ecological modernization theory (EMT), treadmill of production (ToP), and unequal ecological exchange – present competing viewpoints around biofuels. EMT proponents argue that biofuels are a low-carbon alternative to fossil fuels. Although biofuels have been associated with social and

[2] Adapted from the following article: Ian Carrillo. 2017. "When Farm Work Disappears: Labor and Environmental Change in the Brazilian Sugar-Ethanol Industry." *Environmental Sociology* 3(1):42-53.

environmental degradation, these scholars assert that a blend of environmental consciousness and market-driven signals can provide sufficient governance mechanisms for ending harmful practices (Mol and Spaargaren 2002; Mol 2010). In particular, EMT theorists argue that ecocertification schemes, which provide benefits to producers who comply with environmental and labor practices that certifying organizations establish, are an effective instrument for promoting sustainable production and consumption. ToP and unequal ecological exchange theorists counter that such 'green' profit seeking is only viable by creating new externalities that intensify extraction and pollution (Pellow and Brehm 2013; Bonds and Downey 2012; Hornborg 2009).

Recent changes in the Brazilian sugar–ethanol industry offer an opportunity to assess the role of labor within the political economy of environmental change. Over the last decade, many political and business leaders in Brazil saw the campaign to mitigate climate change as a growth opportunity for ethanol, arguing that it could help reduce the carbon footprint of energy and be a lucrative commodity that spurs development in rural economies. A twofold change in labor and environmental practices on sugarcane farms accompanied the expansion of ethanol. First, many growers stopped flash burning fields, a laborsaving technique that prepares cane for harvest by burning away straw, giving cane cutters better access to the stalk. This practice generates atmospheric pollution and is associated with respiratory diseases in local populations (Paraiso and Gouveia 2015). Second, growers widely substituted mechanical harvesters for cane cutters. With mechanization, the machine extracts all plant material in one action, thus rendering manual cutters obsolete. In São Paulo state, the biggest producing region in Brazil, the rate of mechanization increased from 32% to 84% between 2006 and 2014 (Canastat 2014; UNICA 2014). This shift from manual harvesting with burning to mechanical harvesting without burning reduces emissions

from 1.053 to 0.639 tons of CO2 per hectare, taking into account emissions from burning and the machines involved with harvesting, loading, and transport (Capaz, Carvalho, and Nogueira 2013).

EMT scholars assert that eco-certification schemes, voluntary agreements that rely on trade agreements, 'green' technology, and private authority, would propel this twofold change in the sugar–ethanol sector (Mol 2010). However, I argue that the labor–capital dynamic, rather than environmental authority, was the main factor that motivated mechanization and the end of field burning. Additionally, I show that the geographic scope of analysis is important for assessing environmental outcomes, which are mixed. At the farm level, the end of field burning results in atmospheric and public health benefits. At the regional level, however, these ecoefficiency gains are likely to disappear since an expanding industrial sector, with its new employment opportunities, undergirded and made viable mechanization in the sugar–ethanol sector. Such a finding is consistent with previous ToP research (York, Rosa, and Dietz 2003).

By examining the relationship between capital, labor, and ecology in the biofuels sector, I make two principal contributions to the EMT, ToP, and unequal ecological exchange approaches. First, I demonstrate that the EMT approach obscures the role of labor in environmental change, which prevents the framework from accurately explaining the motivations for organizational change on farms and what the consequences are for carbon emissions at the local and regional levels. This oversight represents a disconnect between the EMT approach and its major theoretical bases (liberal economics and modernization), which highlight labor-saving technology, labor flows between economic sectors, and income opportunities as drivers of change in economic and social organization. I show that these mechanisms are relevant for understanding why this case of 'green' profit seeking in the biofuels sector is unlikely to generate aggregate carbon savings.

For sociological approaches, this paper calls attention to a problematic tendency in the literature to overlook labor in developing nations. Unequal ecological exchange scholarship mostly focuses on the relationship between space and materiality, taking for granted the question of labor in the unequal ecological exchange process (Bunker 2005; Hornborg 2009; Prell and Sun 2015), whereas ToP scholars discuss labor almost exclusively in the context of wealthy, postindustrial nations (Schnaiberg 1980; Obach 2004). While I do not challenge any major claims, I stress that this oversight complicates the ability of environmental sociologists to confront and assess the tensions between ecology and development in low- and middle-income nations. This paper reconnects the sociological theories with their foundations in classical and development theory, which view labor as a key mechanism for expanding the capitalist footprint on the environment and driving global stratification. In doing so, I challenge environmental scholars to consider the relationship between labor, development, and environmental change in future scholarship.

Materiality and Labor in the Ecological Rift

The Legacy of Labor in the Foundational Theories of Environmental Change

Classical sociologists considered labor a lynchpin in the structuring and reproduction of human and nonhuman relations in capitalism. For Durkheim ([1893] 1984), a specialized division of labor is the outcome of population growth and competition over limited ecological resources. Weber (1930) asserted that the ways in which power and inequality shape the rationalization of material production and access to wealth creation, including ecological resources, continually influence the income opportunities that structure labor and class relations. For Marx ([1867] 1976), expanding materialist production and consumption structures the organization of labor and society. Moreover, from a Marxian perspective, labor is a key mechanism in the creation and maintenance

of the metabolic rift: ‘the material estrangement of human beings in capitalist society from the natural conditions of their existence’ (Foster 1999:383).

The modernization approach, which blended scientific positivism, human exemptionalism, and liberal economics, questioned the Marxian approach to labor, ecology, and development. This framework held that capitalist-driven technology could liberate human consumption from natural constraints, improve productive efficiency, and create more opportunities for profit reinvestment. Further, it stated that ‘modern’ societies could make political and economic investments in ‘pre-modern’ societies whose abundant pools of cheap labor and natural resources have competitive advantages that, if exploited, could activate the modernization process (Rostow 1960; Lewis 1954). This political–economic integration would diffuse scientific practices, customs, and values, while lowering production costs and enhancing the benefits of trade (Smith [1776] 2014; Ricardo [1817] 2004).

Pushing back on how the modernization approach interpreted global relations in capitalism, sociological theories of development sought to explain the systemic tendencies that drive global stratification and uneven development. Dependency theorists (Frank 1967; Beckford 1972) saw labor exploitation in peripheral economies as underpinning the maintenance of a global capitalist system that enriches core nations through the human and nonhuman plunder of poor nations. In a corollary, world systems theorists (Wallerstein 1979) stated that labor partially bound together the system of unequal exchange that reproduced the global stratification of wealth. In the periphery and semi-periphery, local captains of industry used coercive techniques to undervalue labor in extraction activities, thus capturing a disproportionate amount of wealth in the export sectors that integrated them in the global economy.

Trading Ecology for Labor

These preceding traditions viewed labor as a mechanism that, depending on the approach, could partially explain the destructive or constructive possibilities of capitalism. In the 1970s and 1980s, environmental theorists sought to build on classical theories by infusing a role for ecology, yet allowed the role of labor to diminish. The debate in the political economy of environmental change came to focus on whether capitalism is capable of overcoming the ecological rift: the 'overall break in the human relation to nature arising from an alienated system of capital accumulation without end' (Foster, Clark, and York 2010:18). Thus, the ecological rift, a modification of Marx's metabolic rift, refers to how capitalist growth and human consumption undermine ecosystem processes and exploit environmental goods without replenishment (York, Rosa, and Dietz 2003; Foster 2012).

ToP and unequal ecological exchange scholars draw from sociological and development theories to argue that capitalism is structurally incapable of neutralizing the ecological rift and that ongoing capitalist-driven ecological destruction reinforces global inequality. Taking a neo-Marxian perspective, ToP theorists assert that capitalism's need for compounding economic growth creates an unending search for profit opportunities in the global economy, placing a growing burden on ecosystems. Led by market actors and their state allies, this process extracts finite resources from and expels waste into ecological systems. This continuous system of withdrawals and additions is an essential feature to the relationship between capitalism and environmental change (Schnaiberg 1980; Schnaiberg, Pellow, and Weinberg 2000; O'Connor 1988). When ToP theorists do account for labor as a capitalist actor, it is often depicted on a static trajectory, singularly devoted to self-preservation (Schnaiberg and Gould 1994).

The unequal ecological exchange approach focuses on spatial inequalities in resource extraction and ecological degradation. Tracing its origins to the world systems and dependency traditions, this framework emphasizes how wealthy nations consume the majority of ecological resources and externalize a disproportionate amount of ecological costs onto peripheral nations (Bunker 1985; Jorgenson and Clark 2009). Rather than generating resource savings, technological advancements reproduce uneven development as new technical capacities accelerate the depletion and pollution of ecosystems in peripheral economies (Bunker and Ciccantell 2005).

The EMT framework pushes back on sociological explanations by stating that capitalism offers viable solutions for conquering the ecological rift, thus virtuously binding human consumption and ecosystem processes. EMT not only embraces the traits that embody modernization theory, but it also treats environmental consciousness as a key element of modernity (Foster 2012). According to Mol (1995, 41), ecological modernization involves 'the incorporation of nature as the third force of production [after labor and capital] in the capitalist economic process'. Several mechanisms enable this process. First, as globalization erodes public authority and regulatory capacity, private actors take a larger governing role and new institutional configurations emerge to promote environmental reform. For instance, trade agreements can bind market access to import requirements promoting social and environmental standards to induce compliance among global suppliers. Moreover, these agreements can deepen the modernization process, as economic and political fusion between 'modern' and 'modernizing' nations facilitates the diffusion of technology, values, and customs. Second, scientific inquiry identifies problematic areas in supply chains and steers production practices toward environmental sustainability. Finally, with scientific capabilities and heightened reflexivity, state and market actors deploy the technical tools and moral consciousness to internalize into production processes the environmental costs that

were formerly externalized (Huber 2008; Spaargaren and Mol 2008; Mol 1995; Spaargaren, Mol, and Bruyninckx 2000; Hornborg 2009; Buttel 2003).

Sociologists have extensively interrogated the EMT approach on theoretical, methodological, and empirical grounds. These challenges have been summarized before (Foster 2012; York, Rosa, and Dietz 2010) and bear not repeating in detail here. Such criticism falls into three general areas. First, evidence from EMT studies fails to take into account the inter-sectoral dynamics that are the basis for the growth and survival of capitalism (Hornborg 2009; Bonds and Downey 2012). Second, aggregate-level evidence refutes the predictions from the EMT model that high modernity is associated with a lower ecological footprint (York and Rosa 2003). Third, international relations and trade reproduce, rather than smooth over, spatial inequalities related to global income and ecological devastation (Jorgenson and Clark 2009; Jorgenson, Austin, and Dick 2009).

The Labor–Capital Dynamic of Environmental Change

I use the Brazilian sugar–ethanol industry as a case study to evaluate what factors drive labor substitution in the biofuels sector and whether such a strategy can reduce environmental externalities, thus narrowing the ecological rift. I argue that the labor–capital dynamic, rather than environmental authority, was the main motivating factor for mechanization and the end of field burning, changes that were associated with mixed environmental outcomes. This claim challenges key features of the EMT approach. For instance, I assess the role that labor-saving technology, labor flows between economic sectors, and new income opportunities, the factors that liberal economists theorized would motor the modernization process (Rostow 1960; Ricardo [1817] 2004), play in reducing and generating ecological costs across geographic space.

While this paper does not challenge any major claims from ToP and unequal ecological exchange research, I call attention to the literature's tendency to overlook or take for granted labor in developing nations. In the cases where ToP scholars examine labor, they largely do so in the context of wealthy nations where deep industrialization already materialized and where residents enjoy the privilege of considering how to slow the treadmill (Schnaiberg 1980; Obach 2004). This context does not reflect the sociopolitical reality of many developing nations, where citizens are eager to industrialize and boost their standards of living. For unequal ecological exchange research, the abundance and availability of cheap labor is never questioned (Jorgenson, Austin, and Dick 2009; Bonds and Downey 2012).

Given that these approaches largely use theories of dependency and world systems as their interpretive frameworks for global relations, it is not accidental that the research portrays developing nation labor as a passive element in the unequal ecological exchange process or a cog in the treadmill. Development theories assume that local and global elites exploit and coerce labor, who have little choice but to participate. Sugarcane plantations in peripheral economies were the archetype of such an arrangement (Frank 1967; Beckford 1972; Wallerstein 1979). For environmental and developmental theories, human and ecological plunder in the global periphery is viewed as either intensifying or continuing business-as-usual. However, as my data from Brazil show, such arrangements can be broken. When these moments occur, they challenge environmental scholars to consider the tensions between labor, ecology, and development.

Research Methods

I chose to focus on the Brazilian sugar–ethanol industry because recent regulatory and technological changes related to labor and environmental practices offered an opportunity to

interrogate theories of environmental change and examine the durability of the ecological rift. To do so, I collected and analyzed two types of data. First, I conducted a document analysis of news articles, government documents, and agricultural reports. Second, I utilized a multi-sited ethnographic method. This involved conducting 32 interviews with 61 individuals who oversaw and shaped labor and environmental practices on mills, including mill managers, agronomic scientists, consultants, and producer association officials. At nine mills, I observed the following farming operations: harvesting, planting, field cleaning, loading, unloading, and transportation.

Interviews and observations took place in the states of São Paulo, Pernambuco, and Alagoas. In these states, which accounted for 70% of all sugarcane in Brazil between 2000 and 2011 (MAPA 2012), mechanization is unfolding at different rates. In São Paulo, a first-mover, mechanization increased from 34% to 83% between 2006 and 2014 (Canastat 2014; UNICA 2014). Northeastern mills are mechanizing at a slower pace. By 2014, the rate was 5% in Pernambuco and 40% in Alagoas (Interview, AS1[3]; Simões 2015). I conducted fieldwork for 11 months in 2015.

Labor and Environmental Profile of Mills

Most sugarcane is grown and crushed on mills, an industrial unit that contains farmland and processing technology for sugar and ethanol. While arrangements vary, the tendency is for a mill to grow on its own land a majority of the cane it intends to crush, relying on small producers to supply the remaining amount. Mills that use manual harvesting methods burn away the straw on the sugarcane stalk because it vastly increases the productivity of cane cutters. A crew typically

[3] For the sake of brevity, I use the following numbering system for in-text citation of interviews: Agronomic scientist #1 = AS1, Agronomic scientist #2 = AS2…; Manager #1 = M1, Manager #2 = M2…; Consultant #1 = C1, Consultant #2 = C2…; Producer association official #1 = PAO1, Producer association official #2 = PAO2…. This numbering system is not continuous for throughout the dissertation. It resets with each paper.

burns a field several hours before a cutting team arrives for their shift. In the states of São Paulo, Pernambuco, and Alagoas, which accounted for 70% of all sugarcane in Brazil between 2000 and 2011 (MAPA 2012), mechanization is unfolding at different rates. In São Paulo, a first-mover, mechanization increased from 34% to 83% between 2006 and 2014 (Canastat 2014; UNICA 2014). Northeastern mills are mechanizing at a slower pace. By 2014, the rate was 5% in Pernambuco and 40% in Alagoas (Interview, AS1; Simões 2015).

The industry is one of the largest employers in Brazil. In 2006, the industry generated more than 3.6 million direct and indirect jobs (Dieese 2007). Realizing a sufficient workforce for every harvest period requires extensive labor recruitment, as the amount of labor needed for the harvest may double in size compared to the non-harvest period. Depending on its milling capacity, a mill may recruit between 2000 and 4000 workers to complete harvesting and planting tasks (Interview, M1; Interview, M2). Mechanization profoundly changes the labor profile of a mill, as cutting 3200 tons of sugarcane requires 75 workers with mechanization and 479 workers with manual techniques, taking into account loading, transport, cutting, planting, field cleaning, and human resources (Araújo 2015).

'Green' Technology and Labor Substitution

This section is comprised of four parts. The first part discusses how labor disputes in the 1980s prompted agronomic scientists to develop mechanizable sugarcane varieties. Second, I show how rising labor costs and more stringent worksite regulations motivated mechanization in the 2000s. The third part illustrates how difficulties with labor recruitment on mills further spurred mechanization. Fourth, I discuss the oft-inconsistent influence of environmental reforms in ending burning. Data show that, while environmental authority played a peripheral role, labor challenges

were the primary motivation for mechanizing and that an expanding industrial sector made mechanization viable in the sugar–ethanol sector. Overall, I underscore the importance of the labor–capital dynamic in the creation and maintenance of the ecological rift.

Varietal Development and the Seeds of Mechanization

The transition from manual to mechanical harvesting is not as simple as putting a machine in a sugarcane field. It involves modifying plant varieties that attend to the demands of mechanization by fostering key traits, such as erect stature and uniformity in plant height and width. Producers have to realign planting rows and select new cane varieties, which, due to the germination patterns in the sugarcane plant, must be done far in advance. In short, cultivating new varieties is a first major step in mechanizing the harvest. Thus, while it is important to understand why mechanization accelerated from 2006 onward, it is as important to comprehend why, 15 years earlier, agronomic scientists shifted their research programs from burned to unburned cane.

Producers are reluctant to manually cut unburned cane. Principally, manual cutting is more expensive since workers have to sift through straw and brush. Some expressed concerns about the danger of exposing workers to snakes and wild animals in the cane fields, which fire previously 'controlled' (Interview PAO1). One agronomic scientist elaborated (Interview AS2):

> "Let's say if you burn a field of cane, a good cane cutter will cut ten tons or twelve tons of cane per day. While if he goes into a field that's not burned, he won't cut three tons. So basically it's an efficiency issue. But cane cutting has always been very difficult work. And I think mechanization is progress in that sense …. But manual harvest of sugarcane was something we had to get out of because it's an inhumane activity. And people work to increase efficiency and everything, but when you look at it from a philosophical point of view, it's almost as if you're training athletes."

Starting in the early 1990s, public and private research institutions related to sugarcane began to develop mechanizeable varieties. One long-time scientst said that by 1992, he had shifted

the research program of his team toward harvesting strategies with machines and without burning, a decision announced to peers at an industry conference the same year (Interview AS3). Another veteran scientist elaborated (Interview AS2), "In the 90s people already saw that mechanization was coming on. In the 90s I think that all of our breeding program was conducted by, guided by mechanized harvests." Turning to the question of why, he continued, "The motivation always was to reduce labor costs. In the 1980s and 1990s, we did have some strong labor disputes within the industry …. Basically, Australia was always the benchmark. How they managed to harvest the cane with reduced labor costs."

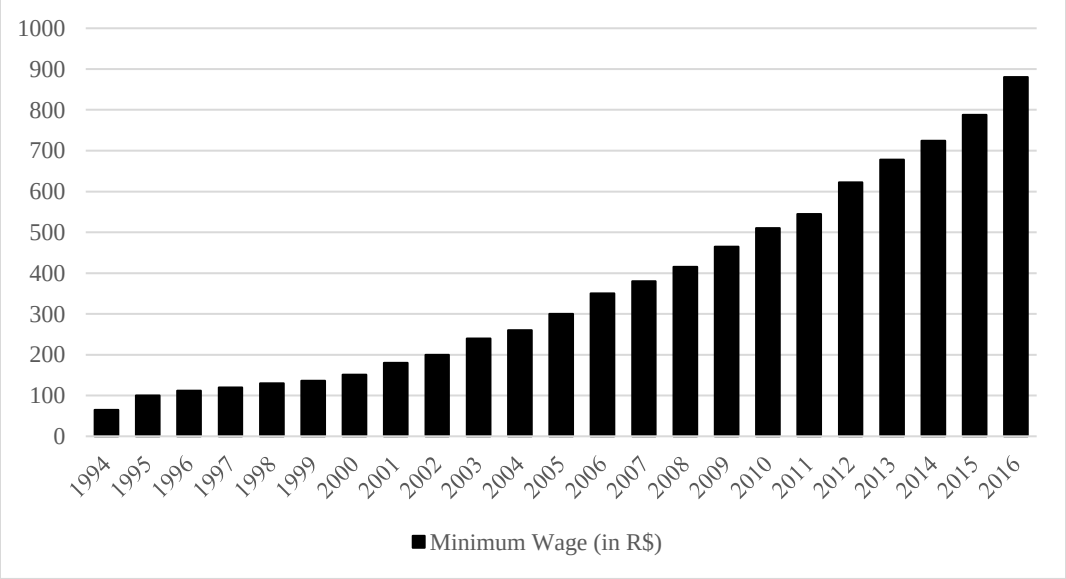
In the 1980s, a series of labor disputes in the state of São Paulo challenged business-as-usual practices. While workers had several complaints, payment systems were the primary issue. Laborers wanted a more precise, transparent system of payment, an ongoing problem in an industry in which producers routinely underpaid laborers for work completed. Further, workers felt that the prevailing payment model pushed them to their physiological limits (Alves 2006). High-profile strikes in 1984 and 1986, which resulted in severe police repression and several murders, were historic (Graziano 1997). While workers eventually won some concessions, they were arguably more symbolic than material. Nonetheless, the intensity of the labor disputes led scientists to recalibrate their vision for harvesting methods, a decision that would lay the groundwork for widespread mechanization by the mid-2000s.

Rising Labor Costs and Worksite Regulations

Labor costs and work regulations increased by the early 2000s, as the Workers Party candidate Luiz Inácio 'Lula' da Silva took the presidency and public policy shifted to the left. Key pillars of the Lula (2003–2010) administration's agenda for inclusive growth included increasing the federal minimum wage and employment formalization. The Lula era diverged significantly

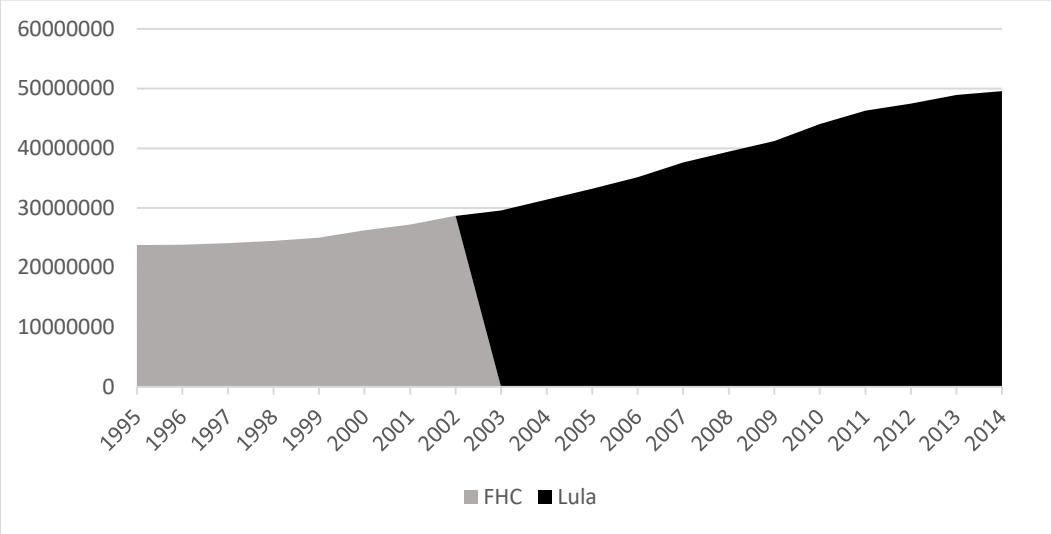
from the preceding era. As Figure 1 shows, from 2003 to 2015, the minimum wage rose from R$240 to 880 per month, a notable difference compared to the low, stagnated wages of the 1990s. Figure 2 illustrates that the number of formal jobs created in the Lula era increased by 172% compared to the FHC era. Moreover, from 2003 to 2012, the percentage of private sector workers with a formal work card rose by 53% (IBGE 2013). Employment with a formal work card offers key benefits, such as an official minimum wage, contributions to social security, unemployment insurance, an annual salary bonus, and holiday pay (Moraes, Oliveira, and Kretzmann 2012). In the poorer northeast, the rate of employment formalization outpaced the national rate (Araújo 2013).

Figure 1 – Increases in the Nominal Minimum Wage in Brazil, 1994-2016



Source: DIEESE - Pesquisa Nacional da Cesta Básica de Alimentos (2016)

Figure 2 – Creation of Formal Employment in Brazil, 1995-2014



Source: RAIS 2014

Many respondents found minimum wage requirements costly and unfair. From the perspective of interviewees, these wage laws unnecessarily infuse politics into an apolitical production process, since they do not reflect or accompany any rises in productivity. According to one consultant: "The big question today is how to resolve the minimum wage problem. Every locality is dealing with this problem. How do we get out of this problem? Mechanization." He continues: "The minimum wage is a political problem. But we can use science and technology to overcome it, since we can't use politics" (Interview C1).

Interviewees also viewed the obligations associated with employment formalization as cumbersome. Paid holidays, in particular, were a point of frustration. One consultant complained (Interview C2): "Workers should work during holidays, with fewer days off. Other sectors, such as the police, have to do this, so why not sugarcane workers?" A scientist stated (Interview AS1):

> "And, here in Brazil, I don't know if you know or if you've seen it, but the worker laws are violent …. You, in your country (the US), don't have these obligations, you don't have holidays. Here you have all of that. Everything costs money. There (the US) if you don't work, then you don't get paid. You can take a holiday, but you won't get paid. There, when you work a hard week, you don't take a holiday, you just do it again the following week."

New regulations also targeted the sugarcane industry, this time with more teeth than the legal changes that followed disputes in the 1980s. From 2005 onward, not only did public inspectors began to broadly enforce worker protections in the agricultural sector, but the judiciary also ruled that workers in supply chains were official employees rather than third-party laborers (MTE 2014; Coslovsky 2014). These regulatory changes required mills to use formal contracts, provide decent living and travel arrangements, and comply with standards on wage payments, working hours, and safety. An initial strategy of resistance by producers was to classify farmworkers as private contractors rather than employees. Producers additionally encouraged workers to form cooperatives, which would also have avoided classification as farm employees. However, inspectors and judges rejected these strategies and routinely held that producers must provide the legally mandated set of worker benefits and protections (Coslovsky 2014).

Producers pursued two related strategies to conform to the new reality. First, they sought to comply with new regulations by creating compliance departments, retraining human resources employees, and hiring private auditing firms (Coslovsky and Locke 2013). One scientist explained: "I think because of compliance issues these large companies do not want to be visited by the labor regulators or fined by the labor regulators. They have compliance departments and stuff like that …. I think today, let's say from when I started [in the 1970s] in the industry to today, it's just miles apart" (Interview AS2). Second, producers see shedding farm employees and shrinking the total workforce as a way to lower labor costs and to reduce the risk of violating regulations. One manager stated that 'onerous' worker laws were a major factor in pushing his company's multiple mills to adopt mechanization (Interview M3).

For many respondents, increased federal oversight generated strong resentment. Two mill managers argued that such state intervention poisoned the traditional relations between managers

and workers, created antagonism where none existed before, and propagandized the idea that employers are the enemy of the worker. They also mocked regulations for being both overreaching and futile. For instance, one told an anecdote about receiving a fine for a portable toilet in non-compliance with regulations, even though no workers used that toilet in the first place (Interview M4; Interview M5). In this sense, producers expressed nostalgia for a better past and frustration over weakened control of their operations. For them, mechanization was a way out of the dilemma.

Importantly, interviewees never discussed the most egregious labor violations – the deaths of cane cutters. Between 2004 and 2007, 20 cane cutters died on mills in São Paulo, due to illnesses induced by physical exhaustion, such as strokes and heart attacks (Portal Forum 2007). In one case that garnered international attention in May 2007, a cutter died after working 70 consecutive days. On the day he died, his work diary stated that he cut nearly 25 tons of cane (Folha de São Paulo 2007b). These deaths may have prompted the increased federal oversight about which producers routinely complained. Moreover, these deaths occurred in a time period in which Brazil was trying to promote the environmental and social sustainability of ethanol exports. The failure of interviewees to discuss these tragic events is likely due to a combination of embarrassment, combativeness to perceived unfair media treatment, or outright denial of responsibility. Nonetheless, the fact that discussion of worker deaths never emerged in interviewees does not exclude the possibility that they motivated mechanization and that subsequent pressure from labor and environmental groups pushed producers to accept voluntary anti-burning reforms between 2007 and 2009, which a later section discusses.

Challenges with Labor Recruitment

As explained earlier, realizing a sufficient workforce to complete planting and harvesting tasks every season requires extensive labor recruitment. Many respondents noted that recruiting this workforce became more difficult over the last decade and attributed widespread mechanization to challenges with contracting seasonal labor. While interviewees referred to this challenge as a 'labor shortage', the crux of the problem was that they had difficulties recruiting workers at the prevailing wage, while also competing in the labor market with other industries that offered more appealing conditions of employment. They pointed to three interconnected areas in which labor recruitment difficulties originated: (1) The presence of alternative employment opportunities for farmworkers in an expanding industrial sector, (2) the absence of labor in new cane frontiers, and (3) the general failure to produce a new generation of farmworkers.

First, the ability to recruit a seasonal workforce became more difficult over the last decade as workers who were traditionally prone to seek employment in cane found income opportunities in resource-intensive sectors associated with urbanization and industrialization. Respondents frequently stated that growth in construction, real estate, and manufacturing absorbed a significant number of cane workers. According to one scientist, "The boom in real estate development practically took away from the market all the workers that were available to work in cane. They began working in construction. The types of workers that had low levels of training, that worked before in cane, began to work making buildings" (Interview AS4). A producer association official noted that several large industrial projects "attracted a lot of [cane] labor during the construction phase, because there was a huge demand, such as for tasks like cleaning the land and others that didn't require much skill or training" (Interview PAO2). Indeed, between 2003 and 2012, the number of formal jobs in the civil construction sectors in Alagoas, Pernambuco, and São Paulo

increased by 395%, 405%, and 257%, respectively (CBIC 2015). Including formal and informal positions, the civil construction sector generated more than one million jobs in these states in the same time period (CBIC 2015; Dieese 2013).

Producers acknowledge that labor recruitment is easier when alternative employment is unavailable, but that conditions of full employment in the economy "produce labor scarcity for the sugar sector," as cane workers are highly employable in other sectors, such as civil construction, maintenance, cleaning and security (Interview C2). Further, producers recognize that potential farmworkers take into account the difficulty of cane work when structuring employment preferences, stating that "workers will go find more attractive employment elsewhere … which pushes the demand for mechanization" (Interview AS5). In northeast Brazil, where so-called Chinese levels of growth outpaced the national rate, urbanization and industrialization had dramatic effects on local labor markets (Carneiro 2012). These activities were part of a concerted effort by the Lula government and allied state governments to industrialize the northeast and to reduce inequality between national regions. For instance, in Pernambuco, two major projects reconfigured the economies of the northern and southern zones, which were traditional sugarcane areas. First, in the south, the construction of the new Suape port facilitated the arrival of dozens of industrial firms. Second, in the north, a new Fiat factory and a burgeoning industrial park diversified the regional economy.

Managers in the northeast pointed out how major projects were transforming the contours of the region and generating labor recruitment challenges on mills. One veteran manager argued that the recent arrival of many industrial firms made labor more expensive and difficult to contract, contributing to the recent closing of his mill (Interview M6). Another manager explained (Interview M7):

> "The tendency is more and more to reduce manual labor. This area [northern Pernambuco] is an industrial park. And there's Suape. Here [northern Pernambuco] is an automotive post….Now you have people studying and improving their capacity, and working in other areas. Cutting cane is a big sacrifice. Being a cane-cutter is a big sacrifice. And we're having a lot of difficulties getting workers. It's for this reason that our company is thinking of adopting a machine harvester for the next harvest…to try to resolve this problem with labor."

One manager articulated how the expansion of industrial jobs disrupts long-time tendencies in the farming economy and how the opportunity structure for income generation for younger workers differs from that of their parents (Interview M8):

> "Because, it's interesting. You have people that go to cut cane and earn R$1000 per month, working in just cane cutting. And then they go to work in Suape and earn R$2000 per month, in air conditioning. So, this inhibited the sugarcane economy a lot …. Because Suape had 50,000 workers …. And another thing that surprised the sector is the issue of farm labor. Working the land is so arduous. Nowadays the children of workers don't stay with their parents. They go to look for something better. They go to Suape. The majority of the 30,000 Suape workers that are from Pernambuco, maybe 15,000 in total, are children of small cane producers. So they don't stay in their parents' work. It's logical."

Second, respondents explained that 'labor scarcity' in traditional and expansionary areas was an important contributing factor to mechanization. The consensus among producers was that attending to the new demands of sugar and ethanol production in the center-south would be nearly impossible with a model based on manual labor. One producer association official explained, '…we were having a lot of difficulties continuing with a manual workforce. We had a prediction for growth, based on projections for the expansion of ethanol markets. And we wouldn't be able to realize a workforce to cut cane that corresponded with this expansion' (Interview PAO3).

Another manager, who oversaw his group's expansion into the new cane frontier, stated (Interview M3):

> "Some mills had the option [of choosing between manual and mechanical harvesting] …. And the labor here is disappearing. And we see…. Let me give you an example. In [the state of] Goiás, we had many problems hiring workers to work in cane. Well, to cut cane, it's very …. If we hadn't taken the option to completely

> mechanize, we would have a lot of problems because it's not easy to hire people to cut cane."

A producer association official echoed the idea (Interview PAO4):

> "What pushed mechanization was the expansion of cane to new frontiers, where you had very few workers to work in this [cane]. So, new frontiers, even in the state of São Paulo, but principally in Goiás, Mato Grosso, Mato Grosso do Sul, Minas Gerais. So, you didn't have the availability of workers for such a rapid expansion. They (new areas) began already mechanized."

Further, labor recruitment challenges intensified as northeastern companies entered the center-south and began installing mills. These northeastern groups initially secured labor by contracting and transporting farmworkers from the northeast who had previously traveled to work in the traditional cane areas of São Paulo. From the perspective of São Paulo producers, this shift in the migratory labor pattern amplified the difficulties of finding farmworkers (Interview M9; Interview PAO4; Interview AS4).

Finally, respondents discussed in general terms how there is a failure to produce a new generation of cane workers, particularly in the traditional areas of central São Paulo, Pernambuco, and Alagoas. One veteran manager explained that the viability of sugarcane in Brazil has always depended on the availability of an enormous pool of cheap labor. Now that such a pool is shrinking, producers are seeking new ways to maintain profitability and competitiveness (Interview M8). According to one producer association official in the northeast (Interview PAO5):

> "Each day that passes there is a decrease in cane cutters. Why? Because their activity, their job is very arduous. A very heavy job. And there is not a renewal of cane cutters. Nowadays, there are more old workers leaving cane cutting than there are young workers coming in to cut cane. The trend is going to be a drastic decrease in cane cutters to a very small number. So the machine comes in to substitute the workforce. But, it's not really to substitute the workforce. It's to… Let's see… The labor doesn't exist so you have to find a way to cut cane."

Others contend that fewer young workers are following the older generation into the sector. One manager complained that "nobody wants to work to cut cane anymore" since "everybody wants to

work with a computer" (Interview M6). Taking a broader lens, one scientist suggested that mechanization is part of a bigger process unfolding across Brazil where people are getting more education and better training (Interview M3). A producer association official elaborated (Interview PAO6):

> "The scarcity of labor is a very heavy factor. There is not a renewal of the life of the cane cutter. What happened with cane cutting before was that the older generation would leave, but they would first bring younger people with them. But today, with the different programs and means of communication that exist, it facilitates them to move around more. This really makes the renewal of labor more difficult. It reduces the supply of labor. And you have to cut cane with machines on account of this."

Some draw on gendered norms to claim that the younger generation simply does not have the will to work in cane (Interview M3):

> "It [mechanization] wasn't just because of competition between new [economic] projects. But more because of the fact that work in cane is really heavy. Mechanization was an option because of this shortage of labor. It's incredible because this country is still poor. But urbanization was really strong here. Today labor is no longer a fixture in rural areas… Go to any small city and you'll see all the young people with baseball hats and a cell phone in their hand. Hardly anybody has the strength to the cut cane. It's true!

By referring to the supposed lack of 'strength' in the younger generation, this manager is evoking a long-held notion of masculinity that you have to be macho to cut cane and to tolerate the working conditions (Alves 2008). In doing so, he shifts the onus from the idea that cane work is entered into when it is the only available option to the idea that young people are simply not macho enough to endure the work in the way that the older generation was.

Anti-Burning Environmental Reforms

Between 2007 and 2009, new forms of environmental authority arrived in the sugar–ethanol industry. While these reforms did not have identical goals, a shared objective was

eliminating manual harvesting and field burning. First, two tripartite accords called for mills to voluntarily mechanize and abandon burning. The Green Protocol, signed in 2007, was an agreement between producers, labor unions, and the São Paulo state government, which sets timetables for phasing out burning and manual harvesting (Secretaria do Meio Ambiente 2015). In 2008, the National Commitment, a certification scheme between producers, unions and the federal government, required compliance with environmental and labor standards (Secretaria Geral 2008). Second, in 2009, the Fuel Quality Directive bound market access with the EU to compliance with social and environmental standards on Brazilian sugar–ethanol mills (European Commission 2012, 2014). To facilitate compliance with EU requirements, the multi-stakeholder initiative Bonsucro was established to audit and certify global exporters (Bonsucro 2011). Mol (2010) holds up these institutional changes in the Brazilian sugar–ethanol industry as evidence to support the EMT hypothesis. He argues that new forms of environmental authority based on reflexivity, shared governance between the state and market, innovative technology, and enhanced trade, improved a supply chain that was rife with social and environmental problems, including worker deaths.

In spite of their high visibility, these environmental regulations rarely configured in interviewees' explanations for what drove mechanization and the end of burning. Few respondents spoke in detail about anti-burning legislation and those that did offered widely differing perspectives on the effectiveness of environmental regulation. This variance stands in stark contrast to the consistency and frequency by which respondents identified labor challenges as a motivating factor for mechanization and the end of burning.

Comments on environmental legislation fall into three general areas. First, two respondents argued that environmental legislation has no influence on ending burning. According to one manager in the northeast (Interview M10): "But it's not going to be a legal [environmental] issue

that ends burning. It's going to be a financial issue because labor costs are getting more and more expensive that you won't be able to cut cane manually. It's not going to be because of this kind of law. It'll be because of financial issues." Similarly, one manager who oversees multiple mills entirely dismisses the notion that environmental regulations influence the decision to stop burning. Moreover, he argues that there are no real negative effects of burning, asserting that any studies purporting to show harmful effects of burning, whether atmospheric or respiratory, rely on bad methodology that generates flawed results. He says that mechanization will nonetheless continue advancing at his mills for economistic reasons (Interview M5).

Second, one producer association official views environmental regulations through the prism of labor. He recognizes that anti-burning legislation may engender changes in harvesting practices on mills, but only because it amplifies the issue of 'labor scarcity' that mills confront. He elaborates (Interview PAO5):

> "Here in Brazil there exists a forestry code that says at a certain point, you're going to cut cane completely raw, without burning. You're not burning. It's going to be raw. So, you already are not going to have cane cutters to cut burned cane. How are you going to have cane cutters to cut raw cane, when you need at least twice as many people to do it? It's one of the points for why the mechanical harvester is entering the sector."

Finally, another producer association official robustly defended environmental authority, the only one among 61 respondents to do so, saying that such reforms were crucial for triggering widespread mechanization. According to the official, the conditions for mechanization were in place, but no catalyst had yet emerged to activate the full process. By voluntarily signing the Green Protocol, the flagship environmental accord, producers were able to uniformly resolve labor challenges, primarily by locking in a timetable for mechanization (Interview PAO4): "If you didn't have environmental legislation, you'd probably have a much slower adoption of mechanization. Because you didn't have workers and machinery prepared for this. It was done very quickly and

with losses in productivity …. But, what put the date on mechanization was the environmental question."

Conclusion and Discussion

This paper poses two basic questions: What factors drive labor substitution in the biofuels sector? Can labor substitution engender positive environmental outcomes, such as decreasing carbon emissions? For the first question, interview data show that labor challenges on mills, related to costs, regulations, and recruitment, were the main factors that drove mechanization and the end of field burning. Contrary to EMT predictions, environmental authority played a weak role, with the labor–capital dynamic being central to the labor substitution process.

The response to the second question depends on the geographic scope of analysis. At the level of farms and farming communities, strategies for labor substitution are likely to generate environmental and public health benefits, so changes on mills should not be labeled greenwashing. Ending burning not only reduces CO2 emissions, but also improves air quality and lowers incidence of respiratory disease (Paraiso and Gouveia 2015).

At the regional level, however, eco-efficiency gains are likely to vanish since an expanding industrial sector, with its new income opportunities for cane workers, undergirded and made viable mechanization in the sugar–ethanol sector. This claim rests on two grounds. First, between 2003 and 2013, carbon emissions increased in the industrial sectors in São Paulo, Pernambuco, and Alagoas, rising by 142%, 331%, and 191%, respectively (SEEG 2016). Such state-by-state measurements, based on IPCC criteria, take into account key inputs associated with urbanization and manufacturing activities, such as cement, electrical energy, metallurgy, freight transport, residential and commercial buildings, and other industrial processes.

Second, interview data show that this industrialization boom absorbed many workers that were prone to seek employment in cane, creating profound labor recruitment challenges that facilitated mechanization on mills. Respondents routinely recounted how they struggled to contract farmworkers who instead sought employment in civil construction, manufacturing, and supporting services for industrial activities, such as cleaning, security and food.

At an aggregate level, mechanization did not neutralize the ecological rift, as resource-intensive growth made feasible the end of burning on mills, a relationship the labor–capital dynamic binds together. Such an analysis fits with prior environmental sociological research. First, it follows Schnaiberg's (1980) claim that employment becomes more resource-intensive as workers move from the farming economy to the industrial economy. Second, this analysis conforms to the claim from York, Rosa, and Dietz (2003) that industrialization engenders CO_2 emissions at the aggregate level. Third, it is line with sociological research that challenges the EMT hypothesis on the grounds that 'green' capitalism does not internalize ecological externalities but merely spatially displaces them (Bonds and Downey 2012; Hornborg 2009).

The dual pursuit of labor and environmental reforms might interact in ways that complicate the direction of the association. For instance, labor reforms may induce positive environmental outcomes or environmental reforms may erode labor conditions. In this article, interview data show that environmental reforms played a weak role in driving mechanization. The wide disagreement among respondents on the role of environmental reforms and broad consensus on the influence of labor challenges signals the centrality of the labor–capital dynamic in motivating the end of burning. This claim conforms to previous findings showing that voluntary tripartite agreements and private auditing schemes, such as the National Commitment and Bonsucro, suffer from serious enforcement problems, with partnered mills routinely failing to correct violations and certifiers

very unlikely to ever revoke certification (Coslovsky and Locke 2013; Rodrigues 2012). However, it is possible that this view of environmental authority is unique to this sample group and that sampling other stakeholder groups, such as labor or environmental groups, may reveal new data that challenge this account.

The main theoretical and empirical contributions of this case study problematize EMT predictions on two grounds. First, it shows that key features of liberal economics and modernization theory – labor-saving technology, labor flows across economic sectors, and new income opportunities – are mechanisms for increasing carbon emissions. In many ways, this mirrors the treadmill process, which was "primarily an economic change theory, but one that had direct implications for natural resource extraction as well as for the opportunity structure for workers" (Gould et al. 2004, 297). While workers enjoy new income opportunities, the capital-intensity, and thus resource-intensity, of labor also increases. Second, it demonstrates that private governance plays a peripheral role in engendering the adoption of new environmental practices.

For sociological approaches, this case challenges scholars to consider the tensions between ecology and development in low- and middle-income nations. When hegemonic patterns are broken and workers exit exploitative regimes, it becomes clear that there is a mismatch between development theories and environmental change theories. On one hand, theories of dependency and world systems do not offer pathways for development, short of withdrawing from global capitalism. On the other hand, environmental change theories conclude that industrialization devastates ecological systems, a perspective that offers little for developing nations who are eager to industrialize and for developing nation laborers who are eager to move beyond arduous work in extractive economies.

Two additional issues merit discussion. First, I do not argue that one should discard efforts to achieve carbon savings in one sector if they result in higher emissions in another sector. Rather, I stress the importance of tracing the interconnectedness of mechanisms that generate environmental gains and losses across economic sectors. Such an approach may elucidate relationships not previously understood, while also revealing the complexity and scope of the challenges associated with mitigating climate change and pursuing development.

Second, mechanization is advancing unevenly in Brazil. In the center-south, manual harvesting is rare and used generally among small growers, whereas in the northeast, which has hillier terrain, many large mills and small growers continue to harvest manually. Mills with hilly land have responded to the new reality through different strategies, such as planting eucalyptus instead of sugarcane, selling farmland to real estate speculators, or continuing to plant cane with the hope that in the future, someone will develop a machine for such terrain (Interview M10; Interview M8; Interview C3). The uneven elimination of manual harvesting and straw burning is discussed in greater detail in Chapter 4 of this dissertation.

Chapter 3

Elite Embeddedness: the Influence of Social Structure on Market Governance and Economic Action

Abstract: This paper uses an embeddedness framework to examine the role of elites in motoring inequality. I ask: How does social structure influence market governance and economic action in processes of resource accumulation? My contribution to debates on embeddedness is twofold. First, I bridge the Granovetterian and neo-Polanyian approaches by showing how the embeddedness of social and kinship ties in the relationship between business groups and the state influences economic actions and market governance. In this way, the social structure shapes how the state manages fictitious commodities and institutionalizes the politics of the market. Second, I illustrate that social sentiments are critical for shaping economic decisions and policymaking. These social sentiments can be transmitted in close social networks, such as those that elites inhabit, and in business groups that have collective enterprise characteristics, such as sugarcane groups.

Introduction

The recent sharpening of inequality has led sociologists and economists to pay increasing attention to the mechanisms that drive disparities, such as corporate salaries, anti-union policies, skill-biased technological change, and tax policies (Mizruchi and Marshall 2016; DiPrete, Eirich, and Pittinsky 2010; Goldin and Katz 2010; Western and Rosenfield 2011; Piketty and Saez 2003). Heightened inequality has reinvigorated debates on patrimonialism (Lachmann 2011) and renewed focus on the actions and behaviors of elites, who disproportionately control resources and capital. For Khan (2012a:362), understanding these actors is particularly important for greater society, as "the distribution of power in their favor often means that elites are the engines of inequality."

This article uses an embeddedness framework to examine how elites shape processes of inequality. Sociologists studying embeddedness have taken different approaches to understanding how individuals and networks influence business decisions and the state-market relations in which business operate. First, the Granovetterian approach focuses on how networks and social linkages within and between firms shape investment decisions, corporate pay, and economic performance

(Granovetter 1983, 1985, 2005; Mizruchi 1996; Burt 1982; Uzzi 1996; Smith-Doerr and Powell 2005). Second, neo-Polanyian scholars emphasize that social structures, rather than being tangential to the market, provide meaning and logic to economic activities (Block 1990; Evans 1995). Thus, a division within these viewpoints precludes our understanding how elite embeddedness shapes processes of inequality: the former challenges the notion of atomism yet keeps intact the existence of an autonomous market, whereas the latter denies the possibility of market atomism and autonomy (Krippner and Alvarez 2007).

However, recent scholarship suggests a convergence in these approaches. For instance, Granovetter (2010) suggests that social structure can provide a collective enterprise character to business groups, which can influence firm-level investment decisions and state policies for economic development. Moreover, past research has shown that social and kinship ties are important for interlocking directorates in South Korea, Japan, and Chile (Mizruchi 1996; Taira and Wada 1987; Kim 1997; Zeitlin, Ewen, and Ratcliff 1974). Recognizing the important complementarities between these approaches, Granovetter (2010:443) states that "the network overlap between the state and business has not been studied in careful detail."

This article responds to this call by asking: How does social structure influence market governance and economic action in processes of resource accumulation? To answer this question, I examine the recent surge in the largescale acquisition of farmland. According to Oxfam (2016), investors have acquired more than 81 million acres of global farmland, displacing traditional crops with cash crops and dispossessing peasants and small farmers of their land. Many scholars point to the Brazilian sugar-ethanol industry as an exemplary case of the so-called 'land grab' phenomenon (McMichael 2010; Fairbairn 2014). Using this industry as a case study, I argue that sugarcane elites accumulated farmland to maintain the viability of the main source of their family

patrimony: the sugar-ethanol mill. The social position of elites is traditionally vested in the profitability of mills, with state-market relations built to accommodate sugarcane. In this sense, the logic of the sugarcane elite is transmitted through the social and kinship ties that are embedded in the state and market. Moreover, with the mill conferring wealth, status, and power, social sentiments motivate business group decisions and state policies for mill profitability.

This paper's contribution to debates on embeddedness is twofold. First, I focus on the complementarities between the two embeddedness frameworks by showing how social networks not only influence the economic actions of business groups, but also the market governance that shapes business decisions. In doing so, I illustrate how the Granovetterian approach, with its emphasis on social ties and networks, can inform the neo-Polanyian perspective, which stresses market embeddedness, and state autonomy. Second, I illustrate the importance of social sentiments for shaping economic decisions and market governance. The social networks that bind together business groups and the state transmit social sentiments, which are reinforced by the collective enterprise character of business groups. By bridging these approaches, I elucidate the rationale and mechanisms that elites utilize in the state and market to accumulate resources.

Social Structure, Market Embeddedness, and State Autonomy

Embeddedness developed along two paths as a sociological project. First, the Granovetterian approach studied how norms, trust, and ties shape economic actions, thus challenging the theory that humans and firms are atomistic and governed by economistic incentives (Granovetter 1983, 1985, 2005; Burt 1983, 1992; Baker 1984; Uzzi 1996; Smith-Doerr and Powell 2005). Second, neo-Polanyian scholars interrogated the entire notion that an autonomous market exists, asserting that markets are fully submerged in social structures. Markets, rather than being

self-created entities, arise out of social relationships that furnish logic and meaning to economic activities (Block 1990, 2007; Block and Evans 2005; Evans 1995).

These trajectories created a dilemma for sociologists (Krippner 2001; Krippner and Alvarez 2007; Kaup 2015). On one hand, the Granovetterian and neo-Polanyian approaches are a two-pronged assault on neoclassical theory, illustrating how social relations influence economic activities at the atomistic and structural levels. They provide empirically-laden critiques of neoclassical assumptions about how humans and firms behave, while creating conceptual space for sociological investigation. On the other hand, these competing frameworks sow disunity *among* sociologists, as the divide between micro/meso and macro points of analysis are laid bare. The "the sharp edge of embeddedness" deftly cuts through neoclassical theory, but becomes "a blunt instrument" when turned against sociological theory (Krippner and Alvarez 2007:221).

However, as this article argues, there is conceptual space for these two approaches to complement each other. While the Granovetterian framework dismantles atomism by showing how social networks and ties shape economic actions, it overlooks how markets and the state are embedded in social structures. The neo-Polanyian approach emphasizes the co-embeddedness of states and markets, yet obscures how social networks and ties influence the types of embeddedness that materialize. Some research reveals this overlap. As Granovetter (2010) points out, past scholarship shows how the underlying social structure of business groups influences investment decisions and leads them to act like collective enterprises when shaping state-market relations. For instance, in South Korea, Taiwan, and Japan, social and kinship networks were embedded in corporate interlocks and state-government relations, thus shaping decisions for business growth and public policy (Taira and Wada 1987; Kim 1997; Dore 2000). In Chile, analyses of corporate boards revealed that the landlord class still controlled economic and political power, in spite of

claims that managerial capitalism had supplanted family capitalism. A key vehicle for infusing family interests into business and the state were kinecon groups, defined as: "a complex kinship unit in which economic interests and kinship bonds are inextricably intertwined" (Zeitlin, Ewen, and Ratcliff 1974, pp.109). Recognizing the possibilities for future research, Granovetter (2010, pp.443) states that "the network overlap between the state and business has not been studied in careful detail." In response to this call to research, this article bridges the Granovetterian and neo-Polanyian approaches to examine how social structure influences economic action and market governance. A look back at Polanyi's original use of embeddedness is instructive for so doing.

Fictitious Commodities and Social Sentiments

In this section, I utilize Polanyi's ideas of fictitious commodities and social sentiments to bring to light key features of embeddedness. First, I illustrate the importance of social sentiments for furnishing logic and rationale to economic decisions and market governance. Second, extending the work of environmentally-oriented neo-Polanyian scholars (Kaup 2015; Malin et al. 2017; Prudham 2013), I show that there is a mutually constitutive relationship between nature and social structure. I contend that social sentiments are critical for understanding, on the one hand, how elites shape nature to achieve economic and social ends and, on the other hand, how environmental limitations can threaten elites' social position.

In *The Great Transformation*, Polanyi described how in primitive societies kinship networks and forms of social organization underpinned the logic of production systems, exchanges of goods, and natural resource use. Any notion of a marketplace and the activities that generate goods could not be understood apart from the social system in which they were submerged. He

wrote (2001 [1944]:52): “The economic system is, in effect, a mere function of social organization.”

It is often argued that industrialization led to the creation of an autonomous market, which differentiated ‘modern’ societies from ‘primitive’ societies. Yet, neo-Polanyian scholars counter that, even in modern societies, markets are always “embedded in legal, cultural, and political frameworks that are critically necessary for economic activities to continue” (Block 2007:5). Polanyi made this point strongest in discussing how the state manages the three fictitious commodities – labor, land, and money – which the market does not produce but are fundamental to its ongoing viability. He explains why these commodities are a fiction (2001 [1944]:75-76):

> “Labor is only another name for a human activity that goes with life itself, which in turn is not produced for sale but for entirely different reasons, nor can that activity be detached from the rest of life, be stored or mobilized; land is only another name for nature, which is not produced by man; actual money, finally, is merely a token of purchasing power which, as a rule, is not produced at all, but comes into being through the mechanism of banking or state finance.”

For Polanyi, a major responsibility of the state is to regulate land, labor, and money, which it does, for example, by dispossessing land from peasants to create an available workforce, surveying and demarcating land property rights, setting exchange and interest rates, managing welfare programs, and instituting environmental protections, among other things. Block (2001:xxvi) states: “In short, the role of managing fictitious commodities places the state inside three of the most important markets; it becomes utterly impossible to sustain market liberalism’s view that the state is ‘outside’ the economy.”

Polanyi asserted that social sentiments were critical to groups’ interests and were an organizing logic for market embeddedness and state autonomy. Block and Somers (2014) note that Polanyi’s approach to class does not adhere to marxian or neo-classical interpretations, which explain human behavior through economistic motives. Rather, Polanyi (1968 [1944]) argues that

using an economistic lens to examine class interests obscures how the economic means that classes use may serve social purposes, which are likely to be the principal motivator. He states (41):

> "Purely economic matters such as affect want-satisfaction are incomparably less relevant to class behavior than questions of social recognition. Want-satisfaction may be, of course, the result of such recognition, especially as its outward sign or prize. But the interests of a class most directly refer to standing and rank, to status and security, that is, they are primarily not economic but social."

Polanyi stressed how social sentiments were coterminous with economic interests. Using the example of tariffs and protections, he argued that while these provided specific economic benefits, such as higher income, they also served key social ends (42):

> "The monetary importance of some typical interventions, such as custom tariffs, or workmen's compensation, should in no way be minimized. But even in these cases non-monetary interests were inseparable from monetary ones. Customs tariffs, which implied profits for capitalists and wages for workers, meant, ultimately, security against unemployment, stabilization of regional conditions, assurance against liquidation of industries, and, perhaps most of all, the avoidance of that painful loss of status which inevitably accompanies transference to a job at which a man is less skilled and experienced than at his own."

In arguing that all groups exhibit social anxiety, he challenges the marxian 'class conspiracy', which posits that incumbent groups only erect protectionist measures out of greed. While the desire for increasing wealth surely plays a role in rent-seeking and protectionism, the desire to possess a coveted social prize or to avoid the 'painful loss of status' shape the calculus of decision-making.

Polanyi also recognized that environment and social structure mutually constitute one another. He (2001 [1944]:75) argued that land was the "natural surroundings in which it [society] exists." Polanyi postulated that, were the market mechanisms granted full control over all natural inputs necessary for production, "Nature would be reduced to its elements, neighborhoods and landscapes defiled, rivers polluted, military safety jeopardized, the power to produce food and raw materials destroyed" (76). Given that nature provides society's subsistence, such market-driven destruction would also result in society's demise. For Kaup (2015:287), it is imperative to consider

"how the ecological conditions in which market societies exist can shape social change" and that "actors' different relationships with nature across time and space can affect how they perceive and pursue their interests and thus their preferred forms of market embeddedness."

For Polanyi, nature and social sentiment are critical for how systemic shocks shaped evolving forms of market embeddedness. He (1968 [1944]:39) contends that external shocks, such as "change in climate, in the yield of crops, or…the discovery of new methods of achieving the traditional ends", challenge the prevailing social order and threaten to undermine the status and security of different class groups. These shocks, whether industrial, agricultural, or climatic, compel elites and broader society to scramble to preserve economic resources and social standing.

In sum, social sentiments and fictitious commodities are important to social structure, market embeddedness, and state autonomy for a number of reasons. First, the coterminous relationship between social sentiments and economic interests shapes how elite individuals and networks perceive their interests and the interests of the business groups in which they are embedded. Second, social sentiments are important for furnishing the collective enterprise character of business groups, who view their activities as social rather than merely economistic and atomistic. Third, the collective enterprise character leads business groups to steer the state's management of fictitious commodities in their favor, to preserve social and economic interests. The elite networks that are embedded in the relationship between business groups and the state ensure that social sentiments are transmitted and institutionalized in the management of fictitious commodities.

The Empirical Puzzle: Elite Embeddedness and the Largescale Acquisition of Farmland

This article asks how social structure influences market governance and economic action in processes of resource accumulation. To answer this question, I examine the recent surge in the largescale acquisition of farmland. Many scholars consider the Brazilian sugar-ethanol industry to exemplify the so-called global 'land grab' phenomenon (McMichael 2010; Fairbairn 2014). Indeed, the amount of sugarcane farmland in Brazil increased from 4.3 to 9.1 million hectares between 1990 and 2010 (Mapa 2012). Using this industry as a case study, I argue that the social structure in which economic activities and market governance are embedded is a key driver of growth in farmland acquisition. I contend that a shock to the industry engendered marketization and threatened the profitability of sugar-ethanol mills, the main source of family patrimony for sugarcane elites. With their deep-seated fears of downward mobility and status loss animated, many elites scrambled to purchase farmland and construct new mills, which would preserve their economic interests and social position. In this sense, social sentiments shaped the economic outlook of sugarcane elites and their business groups.

The industry's social structure underpins three interrelated processes – expansion, innovation, and exit – that interact to motivate farmland acquisition. *Expansion* involves acquiring farmland in new territory, an action undertaken to continue business growth and to preserve status, wealth, and power for cane elites. Expansion is contingent on securing farmland and utilizing the newest agronomic practices. *Innovation* involves the creation of new agronomic technology, methods, and products that are necessary to minimize production costs and enable business growth. A critical feature of the innovation process is the interaction between business groups and the state to foster favorable conditions for developing new products and practices. Finally, *exit* involves the closure of mills who were unable to secure new farmland and adopt new technology and practices.

For owners of such mills, exit not only involves economic change, but also downward mobility and status loss that are highly visible to the public. Underlying these three processes is the family-oriented nature of the industry, in which the central production units – mills – are controlled by powerful families whose influence extends into the state.

Elite networks shape and are shaped by the processes of exit, expansion, and innovation. On one hand, elite shares the logic of sugarcane, with a view toward how the state should make available the land, labor, technology, and financial capital necessary for mill profitability to continue. The embeddedness of elite networks in the relationship between business groups and the state facilitates the institutionalization of cane interests. On the other hand, the close social distance in elite networks ensures that a mill's failure is a symbolic trauma felt by all members, who are then motivated to avoid a similar fate. Moreover, the creation of new technology and product development by innovation-oriented members of elite networks accelerates the consolidation of the ownership structure of the industry, with efficient mills absorbing inefficient mills.

Research Methods

I collected and analyzed two types of data. First, I conducted a multi-sited ethnography of the Brazilian sugar-ethanol industry. I interviewed 62 mill owners, managers, agronomic scientists, producer association officials, and consultants, most of whom come from elite cane families with business groups. I also observed activities at nine mills, where I focused on agricultural production related to harvesting, planting, transport, loading, and irrigation. Interviews and observations took place in the northeastern states of Pernambuco and Alagoas and the center-south state of São Paulo. While I focus on the experiences of business groups in Pernambuco and Alagoas, interviews and observations in São Paulo allowed me to understand the relationship between the northeast and

new regions for investment in the center-south. Second, I conducted a document analysis of government reports, company reports, and news articles, which provided information on farmland purchases, mill construction, and industry trends. Further, these methods were useful for "uncovering on-the-ground realities" and local/regional processes for farmland acquisition that largescale and quantitative datasets fail to capture (Edelman 2013, pp. 490).

This method of 'studying up' (Nader 1972) illuminates social processes among elite actors, which is particularly important in an era in which assets and business decisions are increasingly concentrated in fewer hands (Burawoy 2000). While this method limits the generalizability of my findings, it continues the tradition of sociological inquiry on how elites influence social mobility, opportunity hoarding, and corporate actions (Mills 2000; Domhoff 1978; Khan 2012b).

Social Structure and the Family Business of Sugarcane

Social structure has long underpinned the ongoing viability of sugarcane in Brazil. Stretching back to the 16th century, the traditional cane family followed a basic template. With his wife, the plantation or mill owner would raise several children who would grow up to defend the family's business interests and the larger sugarcane aristocracy from within key institutions: the state, the market, and the church. One son would enter politics to foster favorable regulatory and commercial conditions for the industry. Another son would take over running the mill or plantation to provide continuity in the enterprise once the patriarch retired. A third son would become a priest to offer a spiritual defense of the industry's ruling rationale, which relied on extreme socio-racial stratification. Thus, kinship and social ties crossed institutions and bound together the political, economic and moral dimensions necessary to support the long-term cohesion of the industry. It is

this structure that helps maintain what scholars have called the *açúcarocracia* [‘sugarocracy’] or the *oligarquia açúcareira* [‘sugar oligarchy’] (Tenório and Dantas 2009).

The social and kinship ties of sugarcane have featured prominently in sociological and historical accounts of uneven development in Brazil. According to Freyre (1964 [1933]). mills and plantations are units that represent a microcosm of broader Brazilian society. Buarque (1936) suggests that the patrimonial character of social, economic and political activities can be traced back to agrarian monoculture, by which a small ownership class saw familial enrichment as a major objective of economic growth and governance. Fernandes (1968) and Prado (1968) argue that elites’ social position posed major barriers to structural reform, as any diversification beyond monoculture would threaten the status, privilege and wealth that elite families derived from controlling and owning a commodity export platform.

Today, elites still view cane activities through the prism of family and invoke family when discussing multiple areas of the industry, such as technological change, capital migration, mill bankruptcies, and economic survival. One respondent from an elite family states: “I have roots in sugar, with very sugary blood. I have a responsibility to deepen technological and mechanical advancements in the Pernambuco sector, including social and environmental preservation. As a child of sugar, I am entrusted with this responsibility.” He continues: “We shouldn’t forget that our patrimony is in planted cane, in sugar. Not in machinery” (Interview PAO1[4]).

A former plantation owner, whose bankrupted unit merged with a mill, spoke of how technological change undermines family organization. He stated: “What is complicated here is planting cane. It is *complicated*. And if you can imagine structuring agricultural production (to

[4] For the sake of brevity, I use the following numbering system for in-text citation of interviews: Agronomic scientist #1 = AS1, Agronomic scientist #2 = AS2…; Manager #1 = M1, Manager #2 = M2…; Consultant #1 = C1, Consultant #2 = C2…; Producer association official #1 = PAO1, Producer association official #2 = PAO2…. This numbering system is not continuous for throughout the dissertation. It resets with each paper.

mechanize) in Pernambuco, it would be a war. It involves families, children, grandchildren, parents" (Interview O1). In this sense, he recognized that producers would need to adopt new technology to stay competitive, but saw that such industrial reorganization would inevitably push some elite families out of the industry. These respondents convey the uneasy relationship that cane elites have with economic and technological change. Moreover, by declaring a hereditary, and near cellular, association with sugarcane profitability, they echo Polanyi's claim that "the economic system is…a mere function of social organization" (2001 [1944]:52).

State, Markets, and Environment in Sugarcane

In the 20th century, the social structure of the sugarcane industry was institutionalized in the IAA (Institute for Sugar and Ethanol), which was founded in 1933 amidst a financial and commodity crisis. The IAA, headquartered in Pernambuco, was the main state instrument that regulated markets, preserved social relations, and managed technological change in sugarcane. The IAA's policies were explicit in their goal to protect and buttress the interests of northeastern cane elites, who disproportionately served as IAA presidents and administrators (Nunberg 1986; Lima 2014). The IAA utilized an array of interventionist policies, such as government purchase guarantees, price equilibrium policies, production ceilings, quota systems, and labor control, to preserve relations between the miller families, planters, and cane workers that comprised the social structure of sugarcane. Thus, the cane oligarchy used the IAA to embed its interests and ruling rationale into the management of fictitious commodities.

The IAA governed the sector until a presidential decree ordered its closure in 1990. Several domestic and international factors led to its demise. The combination of mill indebtedness to state-owned banks and a fiscal crisis of the federal government exposed the IAA's unsustainability. Low

oil prices and ethanol shortages resulted in diminished consumer interest in ethanol. High sugar prices contributed to the privatization of export agencies and made it difficult to continue justifying the IAA's subsidies. Finally, dynamic producers in São Paulo lobbied for the IAA's extinction on grounds that its protection of uncompetitive northeastern mills impeded the development of the national sector (Szmrecsányi and Moreira 1991; Vian and Belik 2003; Belik et al. 1998).

This shock exposed the industry to market forces at a historic magnitude. With protectionism stripped away, inefficient producers lost their "model of survival" and no longer enjoyed the privilege of ignoring cost minimization strategies (Shikida 2014:46). One mill manager stated (Interview M1): "When there existed government protection, until 1990 with [ex-president] Fernando Collor, when there were quotas and the government financed production, people got very comfortable. But when it was opened, it became very difficult to survive in our sector without technology." To paraphrase Polanyi, the IAA's closure threatened to destabilize regional conditions, liquidate an industry, and inflict the painful loss of status on cane elites. Respondents stated that the IAA's dissolution spurred a crisis of profitability on mills, which forced producers to embrace cost minimization logic by improving efficiency and productivity in the supply chain.

Mills began modifying seven overlapping areas of agricultural activities, which respondents routinely referred to as 'correcting' nature. First, agronomic scientists developed new varieties with greater height and width to amplify material content, sought new ways to guard against pests and plagues, and studied how varieties paired with soil types. They also started breeding new varieties that would conform to mechanization, a change that would require flat farmland.

Second, mills built irrigation systems to mitigate inconsistent rain patterns. Irrigation technology includes wheeled pivot irrigators and elaborate barrages that dam and pump water from adjacent rivers into sugarcane fields. According to one manager: “From the point of view of productivity, this [irrigation] was a powerful advance. This started about 1997 or 1999. It kept getting bigger every year from there. This system was a salvation” (Interview M2).

Third, producers changed planting methodologies to increase efficiency in harvesting. One strategy was to spatially arrange plant rows so that manual cutters could swipe the cane with their machete, and carry and place the stalks on uniform piles in a way that reduced body movement to concise tasks. Such a methodology minimized costs by coupling the bio-materiality of cane with the bio-physicality of the human body, thus infusing a Taylorist logic into cutting.

Fourth, millers sought to increase efficiency in transportation, loading, and unloading. They did so by increasing the size of tractor trailers and modifying trailers so that less cane would fall out during transport, which permitted drivers to carry more tonnage in fewer trips. Producers also designed trailers to be hoisted and dumped at mills with less labor, waste, and time. The methods for loading/unloading with mechanical harvesting are more efficient than with manual harvesting, giving a competitive edge to mills with machine harvesting.

Fifth, producers searched for new ways to derive commercial value from all materials of the sugarcane plant, including straw, sucrose, and bagasse. The plant could offer opportunities for profit not only through sugar and 1st generation ethanol, but also an array of new products, such as animal feed, vinhasse, 2nd generation ethanol, and bioelectricity. Such products created new profit channels and converted former waste into commercial material. For example, vinhasse, a liquid by-product from the ethanol distilling process, became a fertilizer that increased yields.

Sixth, producers began creating infrastructure to mechanize agricultural activities, which involved developing mechanizeable varieties and new machinery for cutting, transport, loading, unloading, and planting. It also meant that producers needed to plant cane rows to conform to machine demands. The process of mechanization takes years of research and planning, as it requires changes in many areas of the supply chain.

Finally, flat farmland became the lynchpin that bound together this package of agronomic technology. Since the benefits that come from these agronomic methods can only be realized on farmland with flat topography, flat land became an imperative for millers who wanted to conform to the new technological paradigm. For instance, on hilly land it is impossible to use wheeled irrigation machines and mechanical harvesters. Additionally, new products, such as 2nd generation ethanol, can only be achieved through mechanical harvesting, which means that opportunities for new product development depend on access to flat terrain. Thus, in an era in which marketization forced sugarcane elites to respond to new economic and environmental pressures, it became clear that possibilities for survival hinged on the question of farmland. Further, it also became evident that environmental limitations would threaten the underlying social structure of business groups.

Exit, Expansion, and Innovation in Farmland Acquisition

The IAA's extinction was a shock that stripped away economic and social protections for northeastern elites. The subsequent marketization threatened their "standing and rank" and "status and security" (Polanyi 1968[1944]:41), while the market's new "ecological conditions" triggered social change and spurred elites to pursue a new form of market embeddedness to preserve their interests (Kaup 2015:287). As elites grappled with new pressures, a scramble for farmland ensued. Securing suitable farmland not only enabled the adoption of new technology, but also preserved

family patrimony. This section details how social structure undergirds three processes – expansion, innovation, and exit – that drove the largescale acquisition of farmland. In so doing, I show the importance of elite networks in state-market relations and how social sentiments shape economic decisions and market governance in processes of resource accumulation.

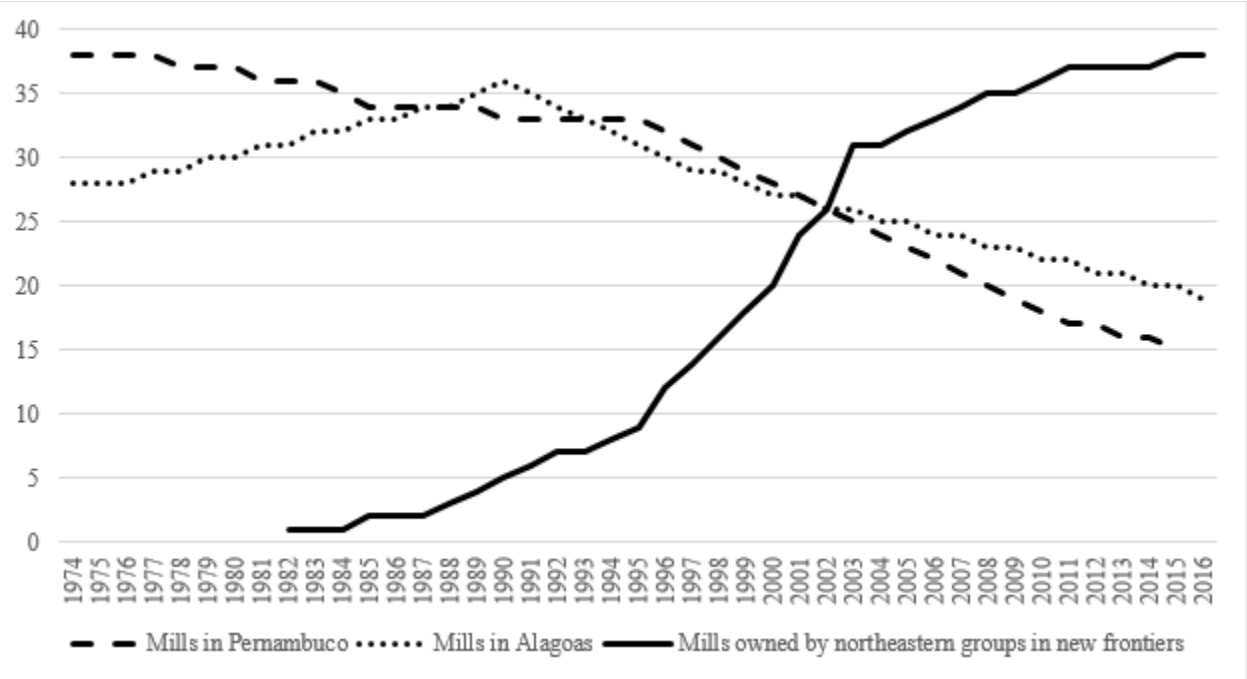
Expansion: New Territory and Status Preservation

Marketization exposed and intensified a long-time segmentation of the sector, with São Paulo producers operating with more efficiency and dynamism than their northeastern counterparts. Land endowments were critical to this division. In the center-south, expanses of flat land characterize the landscape, whereas in the northeast the farmland suitable for cane is restricted to a narrow strip skirting the coastline. Importantly, hilliness marks northeastern farmland, sometimes called a 'sea of hills' (*mar de morros*). With possibilities for growth limited in Pernambuco and Alagoas, business groups that wanted to adopt the newest agronomic methods to minimize costs faced a dilemma: stay in the traditional areas and confront a potential demise, or install operations in new frontiers under the new technological paradigm required for competitiveness.

As Figure 1 shows, northeastern groups installed 38 mills in new frontiers between 1982 and 2016. Producers primarily sited new mills in Minas Gerais, São Paulo, Mato Grosso do Sul and Goiás, but the states of Rio de Janeiro, Acre, Piauí, Tocantins and Sergipe also saw new investments. There were 17 groups responsible for this expansion, all of whom originated in the traditional areas of Pernambuco and Alagoas. In new frontiers, sugarcane replaced pre-existing agricultural practices, such as fruit, coffee, and cattle. Table 1 illustrates that investments rapidly accelerated following the IAA's closure, with northeastern groups constructing 35 mills between

1990 and 2015. The farmland that northeastern groups held in new frontiers increased 15-fold between 1982 and 2015, rising from 43,999 to 697,118 hectares. This expansion meant that these groups came to plant more cane in new regions than in Alagoas and Pernambuco, which held 566,559 hectares in 2015 (Conab 2015).

Figure 1 – Changes in Geographic Siting of Mills, 1974-2016



Author's calculations based on data from Lima (2014), Andrade (1989), Sindaçúcar PE (2016), Sindaçúcar AL (2016), and company reports

Table 1

Northeastern Groups and Farmland Acquisition, 1982-2015

Group Name	Number of Mills in New Frontiers	Amount of Farmland Acquired (in hectares)	Acquisition Years
Grupo Olho D'Agua	1	15,000	2002
Grupo Farias	5	115,000	1996, 1997, 2000, 2000, 2010
Grupo Carlos Lyra	2	54,000	1996, 2007
Grupo Tércio Wanderley	4	75,000	1994, 2001, 2005, 2008
Grupo José Pessoa – CBAA	6	107,000	1989, 1991, 1996, 2000, 2000, 2015
Delta Sucroenergia	3	87,999	1996, 2000, 2011
Grupo João Lyra	2	11,425	1988, 2001
Grupo Japungu	2	n/a	2001, 2003
Grupo Ipojuca	1	9,424	2003
Grupo João Tenório	1	14,000	2003
Grupo Toledo	1	9,600	2002
Grupo Toledo and Grupo Silveira Barros	1	n/a	2000
Grupo Silveira Barros	1	2,408	2001
Grupo Benedito Coutinho	3	86,000	1992, 1997, 2003
Grupo Olival Tenório	1	n/a	2003
Grupo Nivaldo Jatobá	1	n/a	1995
Grupo Matary/Família do Zeca Maranhão	2	42,000	1990, 2006
Grupo Tavares de Melo	2	68,262	1982, 1985
Total	38	697,118	

Author's calculations based on field interviews, industry reports, news articles, and company reports

For cane elites, these investments gave new life to business groups. Flat land, a scarce resource in the northeast, was key to unlocking business growth. "Today you can only survive if you're on flat land," one manager explained. He elaborated (Interview M2):

> "The state of Alagoas got completely full. There wasn't any more area for investments. The good areas for sugarcane… The good areas of Alagoas were already completely full of cane. There wasn't any way to grow. You can only grow vertically. Irrigation came in so that you could grow vertically. If you go to the center-west and the center-south, there's a lot of land available, with big potential for growth. A mill with 4 million or 5 million tons [of cane crushed]. So, you have all this potential. And good soil. Rain with regularity. It all contributed to the advance of cane in those regions."

Another veteran manager described the situation in the early 2000s (Interview M3): "The family groups were having a lot of difficulties, and there was a process of mergers and acquisitions,

adoption of larger economies of scale, search for sophisticated technology, and expansion of sugarcane territory." In this period of ownership consolidation, terrain became a variable that could trigger a cycle of success or failure for a business group.

While these groups sought out land for agronomic and economic reasons, social and kinship relations underpinned the rationale for territorial expansion. One producer association official, who hails from a miller family, explained what farmland acquisition meant for groups (Interview PAO2):

> "Basically the departure of mills to the center-south…these businesses in the northeast are basically family businesses. So, the families ended up getting bigger. You have an owner who has four sons, then those sons have however many grandchildren, then you end up with a lot of great-grandchildren. This was becoming unviable because there was very little business but a lot of heirs. So, this was one of the foundational motives for why these groups created other operations outside the state. But, also they had the philosophy of always working in sugarcane because they never invested in anything else, just sugarcane. Inside the family philosophy that they have, increasing the family patrimony is always a big issue."

All the groups that installed mills in the new frontiers trace their lineage back to a mill in which a family patriarch commanded a small empire. For instance, Grupo Carlos Lyra, from Alagoas, expanded into Minas Gerais and São Paulo, building four mills. The owner, Carlos Lyra, is a multi-generational miller and one of the state's wealthiest individuals. The group's new mills are inextricably viewed as inheritance platforms for heirs. A manager explained that the group built three mills for Lyra's son and daughter. There was ultimately a cessation in which these mills would stay with the son, under a new group called Delta Sucroenergia, and the daughter's patrimony would stay with the remaining mills in the larger Grupo Carlos Lyra (Interview M2). Carlos's brother João, who owns Grupo João Lyra, followed a similar path with his group.

Cautionary tales of evaporating dynastic wealth are common among the cane elite. Laden with social anxiety, these stories often frame narratives for business growth. Grupo José Pessoa,

which constructed six mills in new frontiers, is emblematic of how family relations underlie the rise and fall of sugarcane fortunes. José Pessoa, the director, describes his business trajectory as conforming to the saying 'rich father, noble son, and poor grandson.' He notes how the family patrimony, based on his great-grandfather's sugarcane empire, was squandered by heirs: "He [great-grandfather] was one of the richest men of his era. It's just that he had eight children and fifty grandchildren, who tore down everything he built… By the 1970s, the group was broken. There was nothing left" (Pinto 2007). Pessoa continues (Villela 2003):

> "Like in all families, the fortune gets divided between heirs who don't always have the vocation to provide continuity, so the business begins deteriorating and losing strength. When my turn came, as a great-grandson, the family entered a very big crisis, the family lost everything, and I had to restart from zero, as an 18-year-old."

Viewing ancestry as destiny, he sought to restore his family's patrimony. Rather than investing in the northeast, he built mills in the new frontiers where growth conditions were more favorable. Thus, as Polanyi stressed, social sentiments were coterminous with economic interests, with farmland acquisition enabling the social reproduction of the elite cane family.

Innovation: Technology and the State

Innovation sits at the nexus of expansion and exit, as bankruptcy and survival for mills often hinge on the use of innovative technology to confront changing ecological and market conditions. While millers and scientists develop technology to engineer ecosystem resources to enhance business growth, they also lobby the state to create a regulatory infrastructure that accommodates new agronomic methods and defends outdated practices. This section shows how the social and kinship ties that are embedded in the relationship between business groups and the state shapes technology and regulations.

There are three types of organizations that arbitrate political and scientific exchanges between business groups and the state. The first type – science, technology, and innovation (ST&I) organizations – engage in conventional research to make agricultural activities more productive and efficient on mills, such as developing new varieties and devising planting and harvesting schemes. These ST&I organizations routinely have partnerships with mills where they share knowledge and experiment with new varieties and production methods. Most ST&I organizations are public and comprise part of a federal university or a state government, yet still partially rely on royalties from mills for a funding source. While rare, other ST&I organizations are private companies that rely on consulting and technological exchanges with mills for financial sustainability. One director of a public ST&I organization stated that their biggest goal is to serve the 'society' of sugarcane groups, indicating that he views the industry as a collective enterprise rather than as an assemblage of atomistic firms (Interview AS1).

The second group – political-scientific organizations – searches for ways to use agronomic technology to resolve political and economic challenges. While not engaging in any research activities, these organizations schedule seminars which bring together industry stakeholders, such as mill owners and managers, agronomic scientists, consultants, government officials, and producer association officials. They also organize field days at innovative mills to share new best practices with industry peers. At these events, speakers discuss and debate the current political and economic problems the industry faces, what scientific capabilities exist to resolve such problems, and how public policy can facilitate solutions.

The third type – producer associations – undertake traditional lobbying activities at the state and federal levels to foster favorable regulatory and commercial conditions for business groups. These associations play important roles in engineering the macroeconomic conditions of

the industry, particularly for state and national taxes, labor and environmental laws, global trade agreements for sugar and ethanol, monetary policies, and energy policies. They also coordinate with state-owned banks to promote lending programs for growth and innovation. Thus, producer associations, with input and guidance from ST&I and political-scientific organizations, directly shape how the state manages and regulates the fictitious commodities of land, labor, and money.

The role of social and kinship ties in these organizational types vary. Whereas familial relations are weaker in ST&I organizations, they have a much stronger presence in political-scientific organizations and producer associations. The latter two types rely heavily on leveraging kinship ties to bring people together across the industry and to gain access to key figures in the government. Many leaders in these two organizational types come from miller families and, as such, have a deep understanding of the social structure in which the business groups are embedded. Further, multiple interviewees from producer associations came from miller families and, like other cane elites, had family members in key positions in the state government.

Although producers no longer enjoyed the IAA's protections, it does not mean that the state left them to compete in an autonomous market. Rather, mill competitiveness and profitability in an era of marketization still depended on the state as an instrument for subsidization and protectionism, albeit in new forms. Elites used the state to preserve outdated technology and promote new technology in three main ways. First, in the 1990s and 2000s, industry-friendly fiscal and regulatory policies allowed groups to invest in new technology to minimize costs and increase productivity. In Alagoas and Pernambuco, state governments provided widespread tax relief and below-market loans from state-owned banks that enabled mills to invest in new agronomic technology, including irrigation, farming machinery, and varieties. These fiscal policies also subsidized the expansion of groups into territories outside the northeast (Lima 2014; Carvalho

2009; Ramos 2011). In discussing the need for mills to develop technology and foster favorable commercial conditions, a producer association official stated (Interview PAO3): “At the end of the day, all this ends up in the hands of the government. The ones that have money can make the right investments, which means access to Bank of the Northeast, BNDES (National Bank for Economic and Social Development), all the official banks.”

Second, regional exemptions helped protect mill profitability. One exemption was the ‘American quota’, which was designated for the national industry but allocated entirely for northeastern groups. Producer associations successfully lobbied for this US export quota, which provides purchase guarantees with above-market prices (Interview PAO4). Producer associations also secured exemptions from national environmental regulations that prohibit straw burning for cane harvesting. Compliance with anti-burning laws requires mechanizing cane-cutting, which many mills would struggle to accomplish. One former mill owner and producer association president stressed that requiring northeastern mills to stop burning would render cane activities unviable (Interview O2). Importantly, these exemptions protect northeastern groups by allowing uncompetitive practices to continue. For example, the productivity and total costs of northeastern mills are 57 kg/hectare and R$100/ton, respectively, whereas São Paulo mills stand at 72 kg/hectare and R$89/ton (Conab 2015; Pecege 2016). These exemptions not only slow the process of mill bankruptcy, but also allow groups to generate capital to invest in new frontiers.

Third, the state became an instrument for innovation financing. For instance, the recent construction of a cellulosic ethanol plant in Alagoas, the first of its kind in Latin America, was made possible through social and kinship ties. A veteran producer association official recounted how he had connected his son, who works for a major Brazilian petrochemical company, with the state governor, a miller whose business group the producer association represented. After

personally arranging a successful meeting between the governor, cabinet-level officials, and company representatives, the state government and the company worked to secure financing and land for the plant (Interview PAO5). Local sugarcane groups, including the governor's mill, also formed partnerships with the plant as processors and raw material suppliers. While the company secured some private investment, most capital came from the BNDES and the National Innovation Agency (FINEP), which recently launched a multi-billion dollar initiative for sugarcane innovation. The project therefore resembled a mix of developmental state activism, patrimonialism, and pork-barrel spending. Noting its quick approval and construction, the official joked: "It was very un-Brazilian how quickly the plant materialized from the time of the meeting [with the governor]!" Importantly, this innovative product has the potential to spread into new frontiers, where partnering groups have operations. Thus, the facility in Alagoas is a key incubator in this stage of product development, a reality made by possible through the elite relations in industry and government.

This section shows how ST&I, political-scientific, and producer association organizations shape how business groups and the state approach technology and regulation. In the Granovetterian tradition of network embeddedness (Mizruchi 1996), a web of social and kinship ties interlocked these organizations, business groups, and the state, which enabled the favorable management of fictitious commodities. In the neo-Polanyian tradition (Evans 1995; Block 2008), the social and kinship networks embedded in the developmental state ensured that the bureaucracy, rather than working autonomously and insulated from private sector influence, would enact interventions that benefited the social and economic interests of business groups. Importantly, the linkages between network embeddedness and embedded autonomy were crucial for slowing mill bankruptcy and creating opportunities for business growth in a period of industry consolidation.

Exit: Social Structure and Expulsion from Sugarcane

Like expansion and innovation, social structure shapes how business groups fail, with failure also influencing how other groups perceive their own interests and possibilities for survival. Studies on cane societies in Brazil and the Caribbean note how a lost fortune for one elite family is a symbolic trauma for *all* cane elites, who know their status, wealth, and power are vested in the same collective enterprise (Albuquerque 2009; Rogers 2010; McGillivray 2009; Tomich 2004). Therefore, concentration in the ownership structure of the industry, with efficient mills consolidating inefficient mills and plantations, animates a deep-seated anxiety among elites, who fear the erosion of their social position will accompany business liquidation.

Elites consider mill closure an existential threat to the social structure. One consultant described the importance of cane viability for northeastern society: "Cane demands. Culture demands. The mills demand. It is bigger than just company relations. The *culture* demands" (Interview C1). Another manager stated: "We will not give up our activity in sugarcane. We have to maintain it, not just for us, but for humanity" (Interview, M5). One industry veteran, characterizing sugarcane business groups as a collective enterprise, declared that survival and social preservation went hand in hand: "We must continue the fight, and maintain our way of life…Our solidarity will get us through this ethical, moral, and financial crisis (Interview PAO6).

This section provides three examples of the interconnectedness between social and kinship ties, social sentiments and mill bankruptcy. The first is of a group who suffered a public and well-known decline, echoing the cautionary tale of evaporating dynastic wealth which so many cane elites feared. In this case, the group entered a crisis, with several brothers vying for control. Through poor management and family in-fighting, the group became unviable and the family's

multiple mills closed. One industry veteran contextualized the episode within marketization and industry consolidation (Interview C2):

> "You have some [mills] that grow and modernize, and, above all, have a professionalized management style. Because the majority of those [mills] that are in crisis are those that have a family-oriented management style. Here in Pernambuco you have [says group name] that is famous. A people that have mills in [names three municipalities]. So you have some groups where there was a family fight. There's three mills that have closed, that are in crisis. There are various mills that are in crisis because of family management. Groups that are a little bit stubborn, that don't modernize, that have old ways of doing things, from the older era. They save their money and live very well here, and in Europe. Their children live abroad. So, with this family-style management they don't invest, innovate or change. So the pressure to survive accelerates for them. And they don't have the state anymore to protect them, to be a protector of the sector, like the way things used to be."

The bankruptcy of the family group was a public spectacle. The shuttered mills, gutted and stripped of valuable material, sit off the highways and are a visible sign of patrimonial decline and a lost social prize.

The second example involves owners of plantations who, in spite of its outdatedness and inefficiency, value the production model due to a nostalgic association with the sugarcane families of the past. While plantation owners hold privileged social positions as agrarian elites, they rely on mills to purchase their cane and lack the technology and capital to expand business operations. In a moment of marketization, mills saw incentives to seek out economies of scale by acquiring low-performing plantations. One respondent in Pernambuco, who went from being a plantation owner to a mill employee, saw his peers' technological achievements as a threat to his own viability. He recounted the experience of his plantation's closure (Interview O1):

> "I knew that cane was going to break, so we [other plantation owners] had to go looking for a new reality. I broke too. The cane planter doesn't have much of an outlook for using technology. So, with my cane, the productivity was 40 tons per hectare. Lower than the average productivity in the state. And in the mills where I worked, they had 70 tons per hectare. So, they were able to achieve more than me."

In neighboring Alagoas, millers and scientists suggested that plantation owners in Pernambuco cling to the model because of its social value and desirability, in spite of its antiquatedness and unviability as a long-term business model. One scientist (Interview AS2) stated: "…in Pernambuco, it is much more traditional, with plantations. So, their mentality is stopped in time. You have some mills that are innovative, like [names three groups]. But for many of them it's a question of locality. Pernambuco is more traditionalist."

The third example is of a former mill owner and producer association president who negotiated his exit from the sector and set a new business path. Hailing from a famous miller family, he recognized several ongoing challenges around land, labor, and technology that made competitive cane production difficult. He described how he exited the industry in spite of a deep vocation to the family group (Interview O2):

> "I started [my urban company] many years ago. My father said to me, 'You work here [the family mill] but you need to always be looking for businesses elsewhere.' Right? 'Growing cane is for today but not tomorrow.' That's what happened… And twenty years ago I founded this business here. A friend of mine sought me out, regarding a business of his. He asked to me get involved. He didn't have the money to make the business. So I got in, and three or four years later he had another business that was having problems and asked that I buy part of it. So I've had the business up to today…I don't have anything bad to say about the sector. I left the sector, but I really like the sector. I have good friends there."

This individual had exemplary foresight and resources to navigate his departure from the industry. Notably, advise from his miller father, also a known local figure, implanted the idea of diversifying business and investment as a way to mitigate the risks of running a business group with declining profitability.

Overall, marketization threatened to liquidate the patrimony of northeastern cane elites. For Polanyi (1968[1944]), mills represent more than economic ends: they are a social prize that signals status, power, and privilege. Some elites leveraged social and kinship ties to exit the

industry, investing in urban businesses that kept wealth and advantage intact. However, others experienced mill closure and plantation bankruptcy due to a combination of family disorganization and inability to innovate. This 'painful loss in status' and downward mobility were key social sentiments that motivated other cane elites to invest in new territories, which would preserve the family patrimony and, importantly, help them avoid befalling a similar fate as their peers.

Conclusion

This article examines the mechanisms and rationale that elites utilize when deciding to accumulate farmland. Evidence from the Brazilian sugarcane industry is twofold. First, cane elites use political and economic mechanisms to foster favorable regulatory, commercial, and technological conditions for farmland acquisition, which unlocks business growth. Second, the threat of losing the main source of family patrimony – the mill – spurs cane elites to acquire farmland not only to preserve the wealth and privilege that mill ownership confers, but also to avoid the shame of downward mobility and status loss associated with mill bankruptcy. By detailing how social structure underpins expansion, innovation, and exit, I show the importance of elite networks in state-market relations and how social sentiments shape economic decisions and market governance in processes of resource accumulation.

This article makes two contributions to sociological debates on embeddedness. First, I bridge the Granovetterian and neo-Polanyian approaches by showing how the embeddedness of social and kinship ties in the relationship between business groups and the state influences economic actions and market governance. In this way, the social structure shapes how the state manages fictitious commodities and institutionalizes the politics of the market. Second, I illustrate that social sentiments are critical for shaping economic decisions and policymaking. These social

sentiments can be transmitted in close social networks, such as those that elites inhabit, and in business groups that have collective enterprise characteristics, such as sugarcane groups.

The theoretical and empirical claims of this article are relevant for other areas of sociological inquiry. First, scholars of environment and development have recently focused on the largescale acquisition of global farmland. Most scholars studying the motivations behind farmland acquisition emphasize economistic factors, such as financialization and commodity prices (McMichael 2012; Fairbairn 2014). However, such economistic explanations overlook the social sentiments that influence the calculus of decision-making for agricultural businesses. While these studies recognize that farmland acquisition has sociological consequences, such as land dispossession and peasant displacement, they leave unexamined the sociological factors that propel farmland acquisition.

Second, in the still-forming literature on the sociology of elites, scholars have paid increasing attention to how the actions and behaviors of elites expand inequality. Khan (2012) notes that higher education and the corporate world are important spheres for understanding processes of social closure and opportunity hoarding among elites. Lachmann (2011) contends that the deep entrenchment of elite control over resources and politics in the US spells a return of patrimonial capitalism, with elite groups dominating the competition for public goods. This article sheds light on environmental resource accumulation in the Global South, a process and geographic area that studies on elites tend to overlook. In an era in which climate change and inequality are intertwined planetary issues, it is imperative to understand the sociological factors that guide elites' approaches to natural resource management, public policy, and business decisions.

Chapter 4

Elites Explanations for Environmental Racism: Using Colorblind and Systemic Approaches to Understand the Persistence of Inequalities

Abstract: Environmental inequalities remain highly racialized, with black and brown individuals and communities more likely to experience toxic exposure. This shows, on one hand, that the state's role in enshrining and defending inequalities diminishes its ability to effectively promote environmental justice and, on the other hand, that the environment is yet one more life dimension in which racial inequalities persist in the absence of overtly racist policies. This paper argues that systemic and colorblind racism play important roles in reproducing racial and environmental inequalities in sugarcane communities. Using the Brazilian sugarcane industry as a case study, I examine why the elimination of straw burning, a toxic practice associated with environmental and health problems, has been spatially and racially uneven, with burning eradicated in white-majority communities and persisting in majority non-white communities. This chapter shows the environmental politics and policies that elites use to preserve straw burning and the discursive framework that elites utilize to rationalize why racial minorities should continue to disproportionately bear toxic burdens. By using the systemic and colorblind racism approaches to understand environmental racism, this chapter contributes to debates in sociology of race and ethnicity and environmental sociology.

Introduction

As Chapter 2 describes, many mills in Brazil adopted mechanization over the last decade, thus ending the practices of straw burning and manual cane-cutting. However, this technological change was geographically uneven, with many more mills in São Paulo than the northeast having mechanized. In this chapter, I investigate why straw burning and manual cane-cutting – both inter-connected forms of environmental racism – persisted on mills in northeast Brazil. I ask two questions: 1) what mechanisms and strategies did sugarcane elites use to preserve straw burning on mills? 2) What role did race and racism play in shaping the logic and decisions of sugarcane elite to continue straw burning?

The systemic and colorblind approaches to racism are helpful for answering these two questions. Systemic racism (Feagin 2001, 2006) focuses on how the interaction between historical and present-day racial discrimination reproduces patterns of oppression, whereas colorblind

racism (Bonilla-Silva 2006) highlights how whites use non-racial dynamics to explain, justify, and defend existing inequalities. These approaches are ideal for studying the persistence of inequalities because they show, on the one hand, the structural, institutional, and psychosocial roots of the problem and, on the other hand, how the nonracial explanations that reproduce inequalities are grounded in systemic racism.

I use straw burning in the Brazilian sugarcane industry as a case study to examine how systemic racism and colorblind racism interact to reproduce environmental racism. Straw burning, a labor-saving practice for harvesting, is associated with health and environmental problems, including higher rates of respiratory illnesses for exposed farmworkers and neighboring communities (Cançado et al. 2006). In the last decade, the elimination of straw burning has been racially and spatially uneven, with burning eradicated in white-majority communities and persisting in majority non-white communities. This chapter examines the puzzle of why the sugarcane elite in the northeast continue to burn straw and cut cane manually, thus exposing non-white workers and cane communities to unsafe and hazardous working conditions and polluted air.

Based on a multi-sited ethnography of the Brazilian sugarcane industry, in which I interviewed elite stakeholders and conducted observations of harvesting activities at mills, I argue that systemic racism and colorblind racism were critical for the preservation of straw burning on mills for two reasons. First, systemic racism provided the structural, institutional, and psychosocial context in which elites devalued the lives of black rural workers, thus embedding racism into economic and environmental decisions. Second, colorblind racism was important for providing a nonracial discursive logic through which sugarcane elites could explain and rationalize the persistence of straw burning and manual harvesting.

This chapter makes three contributions to debates in sociology of race and ethnicity and environmental sociology. For the former, I show the utility of using the systemic racism and colorblind racism frameworks to understand and explain environmental problems. Although these two approaches have been among the most influential in sociology of race and ethnicity research, few studies have used these frameworks to study the problem of environmental racism. I also contribute to these approaches by extending their analysis into the Brazilian context. Brazil is an ideal country to study the interaction between systemic racism and colorblind racism, since racial inequalities have persisted in spite of the hegemonic dominance of colorblind race relations for decades. For the latter, I use sociological theories of race to understand environmental racism, which few environmental sociological studies have done. While quantitative studies have excelled at documenting the racialized distribution of toxic burdens (Mohai, Pellow, and Roberts 2009), they tend to overlook how the forces of racism shape decisions over siting, segregation, and poor regulatory enforcement. Leading race-oriented environmental scholars (Pellow 2005, 2016; Pulido 2016) have called for the use of sociological theories of race to better understand the qualitative mechanisms that reproduce inequalities. This chapter responds to this call by showing the racial lens elites use to determine who bears toxic burdens in the workplace and in communities. Overall, this chapter strengthens and affirms the systemic racism and colorblind racism frameworks, while also extending their utility into the environmental and Brazilian contexts.

Colorblind Racism and Systemic Racism: Complementary Approaches to Inequality

Colorblind racism and systemic racism have been dominant frameworks for understanding the mechanisms and logic that reproduce inequality and oppression. The colorblindness approach (Bonilla-Silva 2006) emphasizes how whites use nonracial factors, such as market dynamics and

culture, to rationalize existing inequalities, whereas the systemic racism framework (Feagin 2001; 2006) points to structures, institutions, and psychosocial behavior for explaining the persistence of white supremacy. Rather than competing with one another, these two approaches share complementarities that show how and why race is reproduced over time. In this section, I briefly review the central tenets of these frameworks, while also showing their importance for investigating environmental racism in Brazil.

Colorblind Racism

Skin color and race have long been intertwined in systems of discrimination that favor whiteness (Dixon and Telles 2017). While 'old fashioned' racism relied on color-specific rules for delineating racial boundaries, many scholars of race and ethnicity contend that such practices are outdated and that colorblindness now dominates race relations. Bonilla-Silva (2006:2) argues that colorblind racism is an ideology that explains racial inequalities "as the outcome of non-racial dynamics", such as "market dynamics, naturally occurring phenomenon, and blacks' imputed cultural limitations." An objective of colorblind racism is to deny that race and skin color influence discriminatory practices and inequalities today.

For Bonilla-Silva (2006), there are four frames of colorblind racism – abstract liberalism, naturalization, cultural racism, and minimization of racism – which collectively seek to explain away the significance of race in an effort to preserve the existing social order. The first frame, *abstract liberalism*, refers to the principles of liberalism, such as individuality, equality, economic liberty, and the idea of incremental human progress. While these principles originated to undermine feudalism and promote democracy, they also became instruments for capitalism and free trade in their endorsement of economic freedom, opportunity, and choice. For colorblind

racism, abstract liberalism thus permits an approach to race that uses the discourse of markets, economistic logic, and personal choice to mask over racialized group differences and to present the devaluation of non-white lives as simply a consequence of market dynamics.

The second frame – *naturalization* – posits that racial differences are phenomenon that occur naturally, rather than being outcomes of socio-historical processes and ongoing discrimination. Any group differences are explained as the accumulation of processes of self-selection and pursuing individual preferences, which one's membership in a racial and ethnic group may influence. This frame may also explain group differences, such as education outcomes or skill training, as natural or genetic. On one hand, the naturalization frame undermines the logic of colorblindness by treating racial preferences as biological and psychological attributes for humans. On the other hand, it upholds a key goal for colorblind racism: to defend inaction and ensure that no steps are taken to amend past wrongs.

Cultural racism, the third frame, uses cultural stereotypes to explain racial disparities in society. While color-conscious racism relied on biological claims of racial inferiority, the colorblindness framework points to alleged cultural deficiencies, such as a poor work ethic, lack of ambition, poor family planning, or dependence on welfare. With genetics-based arguments no longer socially or politically acceptable, culture-oriented statements are a preferred way of rationalizing group differences.

Finally, *minimization of racism* refers to the discursive strategy of downplaying the effects of present-day racial discrimination. While acknowledging that racism currently exists, this frame contends that any racist events are outliers and not evidence of any system of race discrimination in which society harbors unequal preferences for racial groups. Moreover, this frame recognizes

that there was racism in the past, but that such practices disappeared with the dismantling of state-sanctioned racism and the social unacceptance of interpersonal racism.

While an objective of colorblind racism is to offer frames for rationalizing existing inequalities, it also seeks to downplay how historical patterns of racial discrimination shape present-day inequalities. It is thus important to understand how the past shapes the present. The systemic racism framework provides an ideal lens through which we can study, on the one hand, how the accumulation of racialized practices throughout history created existing inequalities and, on the other hand, how race and racism are in a constant state of reinvention to preserve inequality.

Systemic Racism

The systemic racism approach is based on the idea that socio-historical processes created the institutions, structures, and psychosocial practices that uphold anti-black oppression. The framework not only illustrates the interaction between macro- and micro-level forces, but also how the accumulation of historical patterns provides an inertia that continues to generate racial inequalities. According to Phelan and Link (2015:314), systemic racism was "born of the economic advantages of slavery for whites when the nation [US] was founded, and since that time our major institutions have been pervaded by racial stereotypes, ideas, emotions, and practices, reproducing over time the socioeconomic conditions that undergird systemic racism."

In his approach to systemic racism, Feagin (2001; 2006) proposes five interconnected dimensions that show how anti-black oppression permeates the linkages between the past and present, and between individuals and institutions. First, *economic domination* refers to the practices, found throughout the Americas, in which European settlers exploited the land and labor of indigenous and African populations. Economic domination entails a transfer of wealth and

energy that unjustly generated substantial power and privilege for white populations. Inversely, this domination generated poverty and underdevelopment for exploited populations, who were never able to capture the benefits of their labor or use assets to build wealth. There are thus significant economic costs associated with being non-white in a society that structurally favors whites.

The second dimension, *alienated social relations*, refers to the asymmetrical relations of power between whites and non-whites. Through coercive means, whites are able to extract wealth and labor from non-whites, while also impeding non-whites from dedicating their life energy to the pursuit of their individual and group interests. In so doing, asymmetric power relations have the dual objectives of, first, alienating non-whites from control over their own bodies and social relationships and, second, using this alienation to allow whites to hoard wealth and status.

Third, *exclusion of opportunity* describes how whites used formal and informal mechanisms and policies to block paths to social mobility for non-whites. The denial of equal access to employment, housing, and education prevented non-whites from building wealth, status, and privilege as individuals and families. Unequal opportunities for civic participation and citizenship also resulted in whites having better access to the franchise and democratic representation.

Fourth, the *white racial frame* refers to a perspective and world outlook based on the idea that social organization should reflect the supremacy of whiteness. According to Feagin (2006:26):

> "The frame not only explains and interprets the everyday world but also implies or offers actions in line with the frame's explanatory perspective. A strong conceptual frame captures territory in the mind and makes it difficult to get people to think about that captured territory in terms other than those of the accepted frame. If facts do not fit a person's frame, that person typically ignores or rejects the facts, not the frame."

The white racial frame includes negative stereotypes of non-whites in media, education, and language, as well as positive portrayals of white peoples and culture. This frame tends to thrive in white socio-cultural contexts, regardless of class differences, due to the way in which whiteness transcends income and geographical markers.

The final frame, *rationalizing racism*, describes how whites justify, defend, and explain existing racial inequalities. Frames for rationalizing racism change over time and across societies, showing the capacity of hegemonic whiteness to evolve and adapt. For instance, during slavery in the US and Brazil, whites justified the socio-racial hierarchy on the grounds that a divine power intended whites to subjugate black populations, due to their alleged natural inferiority. In present day, such explicit biological and spiritual arguments are socially unacceptable, so whites are inclined to use non-racial arguments, based in economics or culture, to rationalize inequalities.

As Bonilla-Silva (2006) argues, colorblind racism is the newest discursive framework for rationalizing racism. However, to make sense of colorblindness it is imperative to understand how it is embedded in systemic racism. As Feagin shows, the historical accumulation of institutional, structural, and psychosocial practices continues to shape present-day inequalities. The complementarities between colorblind and systemic racism thus elucidate not only how the legacies of racial oppression influence existing inequalities, but also how adept whites are at creating new discourses and logics for downplaying the influence of race and racism over time.

Using the Colorblind and Systemic Approaches to Understand Environmental Racism in Brazil

This chapter asks two questions: 1) Why did sugarcane elites seek to preserve straw burning on mills, after mills elsewhere in Brazil abandoned the practice? 2) What role did race and racism play in shaping the logic and decisions of sugarcane elite to continue straw burning? The

colorblind and systemic approaches are helpful for answering these questions, as they provide an analytical lens for understanding the interaction between historical and present-day discrimination.

For two reasons, I argue that systemic racism and colorblind racism were crucial for preserving straw burning on mills. First, systemic racism provided the structural, institutional, and psychosocial context in which elites devalued the lives of black rural workers, thus embedding racism into economic and environmental decisions. Second, colorblind racism was important for providing a nonracial discursive logic through which sugarcane elites could explain and rationalize the persistence of straw burning and manual harvesting.

This examination of environmental racism in the Brazilian context makes two contributions to the systemic and colorblind approaches. First, unlike past research that uses these approaches, this chapter studies the problem of environmental racism. While past scholars used the systemic and colorblind frameworks to study past and present discrimination in a variety of life dimensions, such as policing, education, and housing segregation, they have overlooked the environment. However, as this chapter shows, investigating environmental racism contributes to the systemic and colorblind approaches. For the former, the problem of straw burning illustrates how land, environment, and climate fall under the purview of the five key dimensions: economic domination, alienated social relations, exclusion of opportunity, white racial frame, and rationalizing racism. Present-day straw burning is embedded in a system of race discrimination that is the consequence of the historical accumulation of practices and beliefs. The latter illustrates the discursive mechanisms and logic through which whites justify, defend, and explain environmental racism. Rather than relying on a race-conscious discourse, discussions of environmental inequalities use non-racial dynamics to explain the necessity and existence of such inequalities. This chapter makes

a novel contribution by showing how environment, land, and climate are key nonracial factors through which racial inequalities are reproduced.

Second, this chapter extends the systemic and colorblind approaches into the Brazilian context. The study of colorblind racial hierarchies pertains not only to the US, but also Latin America where national governments have long sought to downplay racial differences in multi-racial societies (Golash-Boza and Bonilla-Silva 2013; Loveman 2014). The pervasiveness of colorblindness in Brazil, commonly referred to as racial democracy, has arguably impeded projects for racial and environmental justice. It is worth considering how the inclination toward colorblind relations is a barrier to the development of race-conscious mobilization strategies to eradicate environmental racism. This puzzle has implications not only for multi-racial Brazil, but also the US, which is undergoing rapid ethnic diversification and has a population inclined to adopt colorblind relations (Bonilla-Silva 2003, 2004; Golash-Boza and Bonilla-Silva 2013). Márquez (2013) suggests that the multi-racialization of the US heightens the need for solidarity between black and brown populations, a stance that could also be applied in Brazil.

Research Methods

I use two methods of data collection. First, I conducted a multi-sited ethnography of the Brazilian sugarcane industry. I conducted semi-structured interviews with 62 owners and managers of mills, agronomic scientists, consultants, and producer association officials. I also observed farming activities, such as harvesting and planting, at seven mills and two plantations. I collected data in three states – São Paulo, Pernambuco, and Alagoas – which enabled me to comparatively examine how and why mills did or did not phase out straw burning. Second, I use

data from agricultural and demographic censuses to provide racial, employment, and economic profiles of municipalities involved with sugarcane production.

In Brazil, racial classifications are a contentious issue. Scholars have long debated if the three major categories – white, black, and *pardo* (brown/mixed-race) – should be studied in a binary (white and black/*pardo*) or ternary (white, black, and *pardo*) framework. Some contend that the *pardo* category is an 'escape hatch' from the black-white binary, enabling *pardo*-Brazilians to occupy an intermediary position. However, evidence is mixed on whether the *pardo* classification is associated with social mobility (Bailey, Loveman, and Muniz 2013). Researchers (Telles 2002, 2004; Loveman, Muniz, and Bailey 2012) have more recently moved toward a binary framework, which this paper utilizes by collapsing data into white and non-white (black/*pardo*) categories.

Systemic Racism and Colorblind Racism in Brazilian Sugarcane

In this section, I review the historical trajectory of Brazilian sugarcane to show how race and racism have been organizing principles in the industry's growth and development. I illustrate how the five dimensions of systemic racism – economic domination, alienated social relations, exclusion of opportunity, white racial frame, and rationalizing racism – have been key features of social, economic, and environmental relations in sugarcane. Rather than discussing each dimension separately, I provide a chronological account that encompasses each dimension and delineates the accumulation of unequal treatment. Moreover, I also detail how the sugarcane industry, and Brazilian society in general, transitioned from a race-conscious to a colorblind approach in race relations, which influences how whites rationalize and justify inequalities.

Since the 1500s, anti-black racism buttressed cane profitability by determining labor costs, labor availability, the distribution of risks, and exposure to negative externalities, among other

things. In this sense, it is impossible to disentangle racism from capitalist logic in sugarcane. On plantations, elites commanded a 'laboring landscape' in which the land, animals, and slaves were viewed as equal production inputs (Rogers 2009, 2010). Discussing how the codification of unequal relations made their existence appear natural, novelist José Lins do Rego (2013 [1932]:108) recounted childhood memories from his family's plantation:

> "My understanding of life at that time made me accept all this as part of God's plan…They [slaves] had been born like this because God had wanted it that way just like God had wanted us to be born white and to rule over them. Did we not also rule over the cattle, the donkeys, the fields, and the forests?"

Author Julio Bello (1938:217), a peer of Lins do Rego, wrote that "few things were so appealing to my sensibility as seeing an old slave…Seeing them I remember with intimate nostalgia those I knew as a child…bound to the service of the *engenho* [plantation] like oxen and donkeys."

The abolition of slavery in 1888 existentially challenged race-conscious mechanisms for unequal treatment. However, the legacy of slavery remained salient in sugarcane, as a new mechanism – sharecropping – became the dominant labor regime. While some newly freed slaves worked as sharecroppers on plantations and mills, others scattered to urban areas and the northeast backlands. Abolition also undermined the prevailing racial order. Anthropologist Gilberto Freyre (1964 [1933]), whose family owned a plantation in Pernambuco, sought to redefine race relations in post-slavery Brazil by arguing that miscegenation created a single Brazilian race. In this so-called racial democracy, past race consciousness gave way to a citizenship-based national identity. With national leaders adopting this viewpoint, the state worked to create and embed a new racial perspective, one based on colorblindness (Skidmore 1974), in economic and environmental activities. However, critics countered that racial democracy's colorblind discourse was flawed in its ahistorical and apolitical logic, which camouflaged the historical legacies and present-day effects of systemic racism (Nascimento 1978).

In the 1950s, two inter-related changes for labor and environmental practices occurred that influenced the relationship between colorblind racism and environmental racism. First, mills and plantations began to burn straw to enhance productivity and efficiency in cane-cutting (Rogers 2010). A decade later, burning became common practice in the northeast and in São Paulo state, which emerged as the main cane-producing state (Alves 1991). Second, labor migration substituted sharecropping as the mechanism for providing seasonal workers for harvest. State efforts to modernize the sugarcane industry in the 1970s, through the National Ethanol Program, crystallized a migratory system for the northeast and São Paulo. Producers in Pernambuco and Alagoas relied on an internal migration in which seasonal labor came from the northeastern coast and hinterlands, whereas São Paulo producers depended on a cross-national migration in which workers came from the northeastern hinterlands and other poor areas (Graziano 1997). In migrant-sending regions, the population prone to migrate was primarily black and mixed-race, had ancestry in slavery, and lacked year-round opportunities to sustain their livelihood. Extensive institutional neglect and under-investment in migrant-sending regions contributed to entrenched under-development and poverty (Furtado 1959; Alves and Novaes 2007). Thus, the exclusion of opportunities, which accumulated over history, shaped economic decisions related to labor availability, wages, and employment choices, creating a landscape in which sugarcane migrants, rather than exercising self-selection, were steered into work on mills and plantations.

The state's new approach to colorblindness underwent a charged moment in the 1960s and 1970s. On one hand, the military dictatorship (1964-1985) was eager to minimize discussions on race, and embraced the racial democracy discourse that reified the concept of a single Brazilian race. The dictatorship censured and exiled race scholars and activists, and also excluded census questions on race (Caldwell 2006; Daniel 2006). On the other hand, racial activism increased, as

more activists challenged the racial democracy framework and pushed Brazilians of African descent to self-identify as black. They argued that the *pardo* identity obscures and erases historical and ongoing anti-black racism, which *pardo*-Brazilians are likely to experience even if they do not self-identify as black (Caldwell 2006). A popular saying – 'If you want to know who's black, just ask a doorman or a policeman' – encapsulates how colorblind relations mask overt racism.

Table 1 – Socio-Racial Characteristics of Migrant-Sending and -Receiving Municipalities

	Number of Municipalities	Percentage of non-white (black and *pardo*) population	HDI
Migrant-Sending Municipalities[5]	1405	68%	0.58
Migrant-Receiving Municipalities – São Paulo	500	32%	0.74
Migrant-Receiving Municipalities – Alagoas	55	69%	0.57
Migrant-Receiving Municipalities – Pernambuco	54	66%	0.60

Source: MTE/CAGED 2017, Atlas do Desenvolvimento Humano 2013

In the 21st century, socio-racial lines remain critical to the economic organization of sugarcane. First, seasonal workers originate in municipalities that are poor and majority non-white. As Table 1 shows, migrant-sending municipalities have an average non-white population of 68% and an average HDI of 0.58. Second, the socio-racial characteristics of cane municipalities vary by region. São Paulo municipalities have a majority white population and a relatively high HDI, whereas northeastern municipalities are majority non-white with a low HDI. Overall, a spatial and socio-racial relationship exists between migrant-sending and migrant-receiving communities. In São Paulo, cane municipalities that are majority-white with a relatively high HDI traditionally rely on a migratory workforce that originates from municipalities with non-white majorities and a low

[5] I include the Polígono das Secas region, which includes select municipalities from the states of Alagoas, Ceará, Minas Gerais, Paraíba, Pernambuco Piauí, Rio Grande do Norte, and Sergipe. I also include Maranhão state and Vale do Jequitinhonha, which are important for migrant labor (Alves 2007; Reporter Brasil 2014).

HDI. However, in Pernambuco and Alagoas, municipalities are likely to rely on seasonal laborers who migrate from municipalities with similar socio-racial and developmental profiles.

In sum, this historical trajectory shows how the five dimensions of systemic racism shape current inequalities in sugarcane. First, with economic domination, we see that mill and plantation owners consistently exploited the labor of black rural workers through different regimes, such as slavery, sharecropping, and seasonal migration. By undervaluing the market price of their labor, white sugarcane elites were able to unjustly accumulate profits, privilege, and status, while also impeding workers from capturing the benefits of their labor to build assets, wealth, and social status. Second, alienated social relations in sugarcane activities meant that black rural workers confronted unequal power relations that prevented them from dedicating their life energy to the pursuit of individual and group interests. With power asymmetries alienating workers from exercising control over their own bodies and social relationships, white sugarcane elites were able to unfairly accumulate asset-generating wealth and power over the course of history. Third, the exclusion of opportunity has permeated the sugarcane industry for more than five centuries. While slavery and sharecropping were blunt forms of discriminatory exclusion, the regime of migratory labor is also heavily dependent on the exclusion of opportunity, as under-investment and the lack of employment choices steer workers into sugarcane activities. Fourth, the white racial frame has continually been present in cane, with elites treating extreme racial hierarchies as a combination of divine intervention and nature's intent. In doing so, negative stereotypes of black rural workers flourished, as whites perceived them as uneducated, unskilled, and best suited for brutal work. Fifth, we see that the logic for rationalizing racism changed over time in order to adapt to new social and economic conditions. Although initially grounded in a race-conscious approach for more than four centuries, in the 20th century a framework of colorblindness became the dominant

way of explaining racial differences. Moreover, we see that racism was an organizing principle in the management of environmental and natural resources, such as farmland and climate. In a later section, I focus on how sugarcane elites use colorblind racism to frame present-day environmental problems on mills and plantations. The next section details the social and environmental consequences of straw burning and manual cane harvesting.

Relationship between Labor, Health, and Environment

Straw burning buttresses the profitability of sugarcane production, with the ability to externalize costs onto workers, communities, and the environment a central feature of the financial calculus for mills and plantations. In the straw burning process, there are two ways in which people and ecosystems act as deposits for waste and dumping. First, burning imposes physical costs on workers by facilitating speed increases in cane-cutting. Epidemiologists and social scientists show that workers must cut ten to twelve tons daily for cutting to be profitable, which inflicts intense body stress. For example, on a typical day a cutter loses eight liters of sweat, walks 8.8 kilometers, makes 133,332 machete strikes, and does 36,630 body twists (Alves 2006). Moreover, it is common for full body cramps to paralyze the worker (Verçoza 2016). Cutting can even be fatal. Between 2002 and 2006, 20 cane-cutters died in São Paulo from heat exhaustion, strokes, and heart attacks. In one case, a worker died after cutting 27 tons of cane on his 70th consecutive workday (Folha de São Paulo 2007b).

Second, burning causes air pollution for workers and communities. Epidemiologists (Cançado et al. 2006; Paraiso and Gouveia 2015; Lopes and Pesqueiro 2006; Ribeiro and Pesquero 2010) show that populations exposed to burning have higher rates of respiratory illnesses, such as asthma and bronchitis. These illnesses, more frequent during harvest, tend to harm the life course of children and the elderly. The state sanctions this toxic practice through lax regulations that

tacitly value the economic viability of cane over the health and safety of workers and communities, who in turn subsidize cane profitability by becoming human sinks for environmental externalities.

In interviews, multiple managers acknowledged that exposure to burning and mill pollution is very unpleasant and cause respiratory problems at least once per harvest season. Moreover, not a single manager I met lives in the community where the mill is located. Rather, he and his family live in the nearest urban area, such as Recife or Maceió, where they keep a house, school their children, and structure their social lives. While some managers kept small apartments on-site at mills, where they spent considerable time during harvest season, their families and social worlds were geographically removed from the pollution that the mills generated.

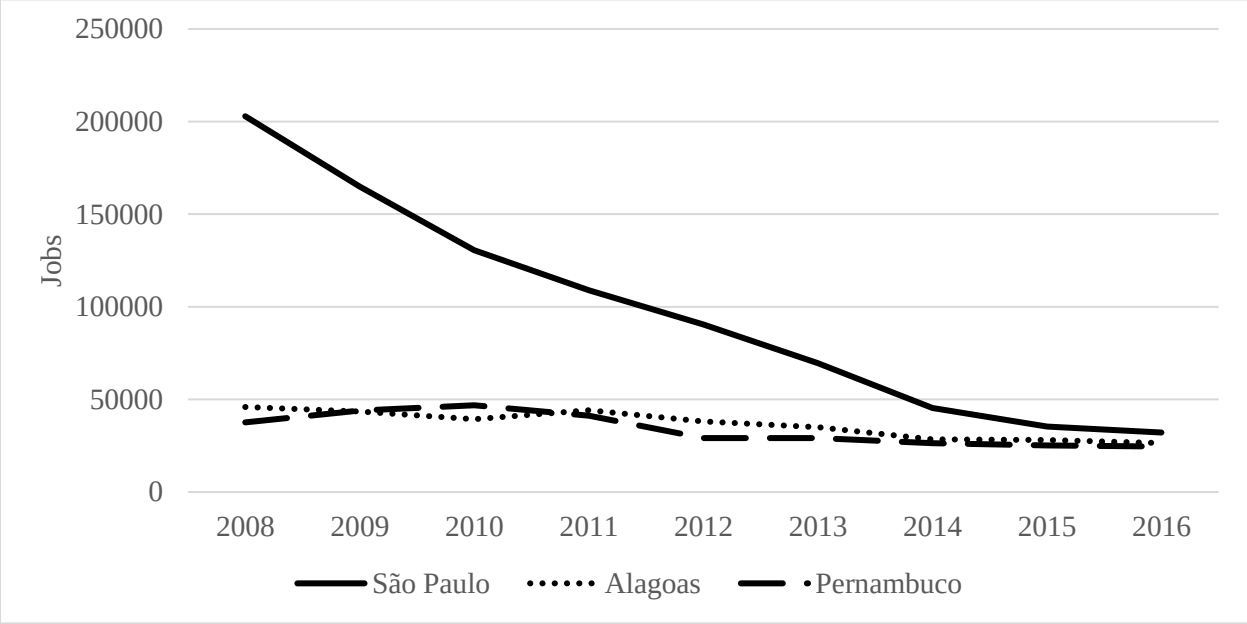
Since 2006, many mills have mechanized the harvesting process. Mechanization renders straw burning unnecessary since the machine extracts all plant material, including straw, in a single action. Along with health benefits, mechanization also generates carbon savings. The substitution of machines for manual cutters reduces emissions from 1.053 to 0.639 tons of CO_2 per hectare, taking into account emissions from burning and the machines involved with harvesting, loading, and transport (Capaz, Carvalho, and Nogueira 2013). Mechanization also changes the labor profile of mills and plantations. For example, cutting 3,200 tons of cane with manual methods requires 479 employees, whereas mechanical methods require only 75 employees (da Araújo 2015). Machine harvesting also lowers cutting costs from US$6.47 per ton to US$1.54 (Interview M1[6]).

[6] For the sake of brevity, I use the following numbering system for in-text citation of interviews: Agronomic scientist #1 = AS1, Agronomic scientist #2 = AS2…; Manager #1 = M1, Manager #2 = M2…; Consultant #1 = C1, Consultant #2 = C2…; Producer association official #1 = PAO1, Producer association official #2 = PAO2…. This numbering system is not continuous for throughout the dissertation. It resets with each paper.

Table 2 – Rates of Mechanization in São Paulo, Pernambuco, and Alagoas[7]

	São Paulo	Pernambuco	Alagoas
Area of harvested cane (hectares)	5,518,893	301,480	294,055
Sugarcane as percentage of total harvested crops	69%	91%	82%
Percent of area mechanizeable[8]	90%	n/a	n/a
Percent of area mechanized	84%	3%	19%

Figure 1 – Formal Sugarcane Jobs in São Paulo, Pernambuco, and Alagoas (2008-2016)



Source: MTE/CAGED 2017[9]

Phasing out straw burning and phasing in mechanization has been a spatially and racially uneven process. Table 2 shows that mechanization varies widely by state. In São Paulo, where cane communities are majority white with a relatively high HDI, mechanization increased from

[7] Unless indicated otherwise, data in this figure was elaborated by author from: SIDRA 2017; IBGE 2010, 2015; Atlas do Desenvolvimento Humano 2013; Conab 2017; Canastat 2017

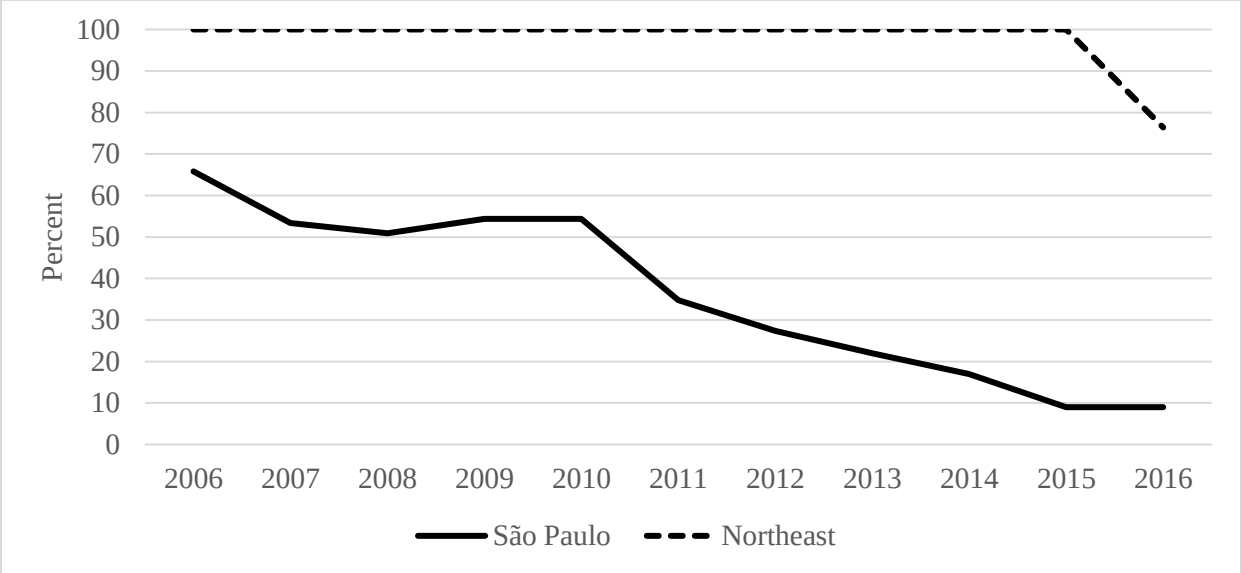
[8] Torquato et al. 2008

[9]This is a conservative estimate that only includes employment accounted for in the CAGED/MTE datasets. While formalization has increased, third-party outsourcing and informalization are common, meaning that the census fails to capture the sector's full employment profile. Due to the dataset's design, this figure does not include key activities, such as transportation, loading, and dormitory services. Others (Sindaçúcar-AL 2015; JC Online 2016) give higher estimates, such as 70,000 each in Alagoas and Pernambuco. Nonetheless, even with generous estimates, northeastern cane employment has consistently declined, having employed nearly 500,000 workers in 1990 (Queiroz 2016).

32% to 84% between 2006 and 2014 (Fredo et al. 2015). In the northeast, where communities are majority non-white with a low HDI, mechanization has proceeded more slowly, standing at 19% in Alagoas and 3% in Pernambuco (Conab 2017). While São Paulo has more flat land, terrain suitability alone does not explain the uneven elimination of burning, which I explain in more detail later. Finally, mechanization is also associated with job loss on mills, as tasks for cane-cutting, transportation and loading are restructured. Figure 1 illustrates variation in cane employment by state. São Paulo lost nearly 170,000 workers, an 84% decrease. Pernambuco and Alagoas, meanwhile, experienced a 38% decline, representing about 32,500 workers.

As a result of this labor and technological change, the environmental racism gap (Pulido 2016) – the disparities in environmental harms between whites and non-whites – has grown. Figure 2 shows that, before 2006, mills in São Paulo and the northeast burned straw at relatively similar rates, thus exposing workers and cane communities to similar levels of toxicity. However, the uneven advancement of mechanization amplified racialized patterns in the distribution of environmental harms, with race becoming a much stronger predictor for exposure to straw burning.

Figure 2 – Percent of Sugarcane Acreage Harvested with Straw Burning, 2006-2016



Source: Canastat 2017; Conab 2017

In sum, mechanization sharpened the spatial and socio-racial differences related to labor, health, and environment. In São Paulo, mills in white-majority communities harvest with capital-intensive methods that do not rely on burning, thus improving environmental and health outcomes. In the northeast, mills in majority non-white communities harvest with labor-intensive methods that depend on seasonal workers and straw burning, which sustains social, environmental, and health problems. The next section details the policy and regulatory mechanisms that northeastern cane elites used to preserve straw burning on mills.

Environmental Politics and Policies for Straw Burning

This section examines the policy tools and political mechanisms that sugarcane elites utilized to maintain pre-existing production methods. By engineering regulatory and commercial conditions for production, cane elites were able to steer governance toward their interests. Two factors – farmland suitability and new forms of protectionism – are important for understanding how elites use nonracial dynamics, such as markets, environment, and employment, to frame colorblind racism.

Farmland in the northeast, much less so than São Paulo, struggles to accommodate mechanization. Echoing many of his peers, one producer association official discussed the importance of the northeast's topography for mechanization (Interview PAO1):

> "The topography in Alagoas has a lot of declivity. You have cane that just doesn't work for the machine. You have machines that can load cane well on hilly areas, but to cut it is impossible. In Alagoas, 60% of the area is mechanizeable, but the other 40% can't be. And you have parts scattered but they are not big, so you would have to cut the cane, then transport the machine and do this constantly. And it just does not work economically."

With flat land in the northeast confined to pockets, the economies of scale normally associated with mechanization are limited. A manager at a São Paulo mill put it bluntly: "You must have

realized that if mechanization was required in Pernambuco, cane would be finished. They don't have conditions for it because of the topography, as much as the planting as the harvesting. The north of Alagoas is practically the same." I will elaborate on this point later.

Two new forms of protectionism allowed northeastern sugarcane producers to circumvent the environmental barriers that impeded mechanization. In doing so, mills were able to continue burning straw and cutting cane manually, in spite of the method's low market competitiveness and high environmental and social costs. First, northeastern mills and plantations secured exemptions from national anti-burning legislation until 2031 (Interview M2), which many respondents justify by claiming that "the northeast region is distinct from other regions in the country" (Interview AS3). One official used topography to defend the exemption, saying that "the government has a high tolerance for states in the northeast because of the difficulties with machines" (Interview PAO1). A former mill owner and producer association president discussed differences in magnitude as a reason to continue burning in the northeast (Interview O1):

> "However, the big difference is that they [São Paulo] have a timetable to stop burning cane. And here [Pernambuco], I think that you *have* to burn cane to survive here. It's just that the harvest in São Paulo represents today in Brazil 450 million tons of cane. We're 15. So the effect on the environment with 15 is very little. And I believe that here if you can't burn cane anymore, I think that you practically eliminate the culture of sugarcane here…But they're 450 million tons, and we're only 15…They're burning much more than we are here."

According to one mill manager in Alagoas, exemptions for anti-burning legislation preserve the social order that underpins the economics of northeastern sugarcane (Interview M3):

> "There is an exception for the northeast, saying that 'the northeast is different'. The northeast has a big unemployment problem. And it has a lot of small properties and family farmers. So, the same small grower cuts cane with his own family. So, if that law was initiated, what would happen? There would be a fusion of properties. The small growers would not be able to burn, and their productivity would fall, from 8 tons to 3, and from there he would not be able to maintain his properties. So, to avoid all this, to avoid a situation where the mill owned all the property, where there was high unemployment and lots of people moving to cities, they

> decided ‘no, the northeast can burn cane. There is no limitation to cane burning.’ So we are working to reduce costs and deal with social problems. The worker laws are really strong, and demands for us are very big, but it won’t be obligatory for us to stop burning cane in 2018. This was abolished for the northeast.”

Importantly, mills still use black smallholders as a way to distribute risks and costs. While most processed cane is grown on land that mills control, mills have seasonal contracts with smallholder farmers who can supply additional cane. Mills prefer not to control their entire cane supply so that they can more easily respond to price fluctuations from year to year and because smallholder farmers have lower labor costs, due to the self-exploitation associated with family labor. When prices are high, mills buy more from smallholders. However, when prices are low, mills discard smallholders who are left with sugarcane crops but no buyer. In this sense, systemic racism continues to underpin risk mitigation and the management of production costs.

Export quotas are the second form of protectionism for northeastern mills. Following a wave of neoliberal restructuring, a 1996 federal Law 9.362 allocated the ‘American quota’ to producers in the north and northeast regions. With Alagoas and Pernambuco accounting for 84% of this quota (Branco 2014), mills are ensured a market for their goods, even as they continue with production methods that are neither price competitive nor environmentally friendly. The American quota pays upwards of 150% over the market price, in addition to being tax-free. For instance, in 2006, the US paid US$420 per ton even though the international price was US$280 (Sindaçúcar-AL 2006). A producer association official asserts that the northeast was awarded these quotas for “internal socio-economic reasons” (Interview PAO3). Another producer association president stated that the “American quota also works to attend to the social demands of the northeastern states” and stressed that the inability to mechanize and stop burning was a positive attribute, as it is labor-intensive and thus generates more jobs (AFCP 2012). These protectionist policies are important for offsetting non-competitive practices: northeastern mills have a productivity of 57

kg/hectare and total costs of R$100/ton, whereas São Paulo mills stand at 72 kg/hectare and R$89/ton (Conab 2015; Pecege 2016)

In sum, environmental politics and policy were critical instruments for preserving straw burning and manual harvesting in the northeast. By steering environmental governance in their favor, mills were able to keep the regulatory and commercial landscape that accommodated their economic interests. As economic pressures and farmland unsuitability amplified the low competitiveness of northeastern producers, cane elites opted to capture the state to relieve pressure rather than change production methods or transition to new crops that could be grown competitively in the region. Moreover, non-racial factors, such as market dynamics, technology, and topography, were key for creating the conditions in which colorblind racism could flourish, which the following section explains in more detail.

Explaining and Rationalizing Environmental Racism in Brazilian Sugarcane

In this section, I answer the question: What role did race and racism play in shaping the logic and decisions of sugarcane elite to continue straw burning? I show that elites used colorblind racism to justify, defend, and explain why processes of environmental racism should persist. The pervasiveness of systemic racism in the sugarcane industry, with institutional, structural, and psychosocial dimensions still firmly racialized, permitted colorblind racism to allow inequalities to persevere. This section illustrates how cane elites used the four frames of colorblind racism – abstract liberalism, naturalization, cultural racism, and minimization of racism – to rationalize and perpetuate systemic racism. My evidence shows that colorblind racism manifests in three inter-connected ways: 1) to erase race and racism from present conditions, 2) discriminatory attitudes that justify the subjugation of black rural workers, and 3) using precarity and hunger as weaponized tools to preserve a workforce.

First, cane elites are eager to deny the presence of racism in current relations. While they acknowledge the industry's roots in slavery, they contend that racist thoughts and actions ended with abolition in 1888. One mill manager explained the historic and contemporary position of the industry (Interview M3):

> "Alagoas society, being northeastern, doesn't have a positive view of the sector. Why? We came from the sector that came from colonization and slavery. [Our mill] was founded in 1925… But, it was a merger of various plantations that existed in this region. And then there was a big crisis that diffused the sector, and [our mill] was formed. In 1925. So, it didn't come from slave labor or anything like that. Society thinks this structure, of slavery, still exists. They are misinformed with this. It is one of the fallacies of the sector that needs to be confronted more… So, there still exists this thing here which society doesn't fully understand. They think that sugarcane is something super-antiquated. But using technology is not antiquated. The generation of energy. The generation of alimentation."

The manager uses the *minimization of racism* frame to absolve the mill of any race-conscious sins, thus downplaying the historical legacies of systemic racism. However, this mill, like many others, extensively used sharecropping for decades. Such practices endured in the northeast until the 1990s, when more than 40,000 sharecropper homes were vacated and destroyed (Carvalho 2009). Moreover, some deny the existence of modern-day slavery in cane, even though between 2003 and 2013 federal task forces liberated about 10,700 individuals, the majority of whom were black northeasterners (Interview PAO2; Reporter Brasil 2011, 2014).

While industry officials attempt to minimize racial patterns in rural labor management, they also construct a narrative in which the *industry itself* is the target of discrimination. The above manager states that society wrongly believes that legacies of slavery continue to shape the socio-economic organization of sugarcane. A producer association official (Interview PAO5) argued that the "sector was always discriminated against, but today the stigma is decreasing." Another consultant (Interview C1) stated that "the sector receives too much criticism and discrimination", and that society ignores its contributions to Brazilian culture and development. A producer

association official (Interview PAO3) elaborated: “Historically the cane sector was stigmatized. There were a lot of prejudices against cane, under an antiquated and long-passed concept, like plantations. Prejudices around the monopolization of the culture. But we don’t impede anything here. There are other crops. We are an agro-industry.” Thus, the erasure and minimization is two-fold. Not only do cane elites obscure past and current racialized practices, they also invert the relationship by positioning themselves as the oppressed rather than oppressors. In doing so, they make claims reminiscent of reverse racism, arguing that they are the ‘real’ victims of unequal treatment.

Second, discriminatory attitudes that justify the subjugation of black rural workers are pervasive among white cane elites. Rather than use race-conscious discourse related to biology or divine intervention, as was common in the past, elites now frame their views along the lines of skill training and preparation. In an era of free labor and colorblindness, cane elites rationalize the domination of dark-skinned rural workers by claiming that they are fatalistic, unambitious, undisciplined, and incapable of life planning. One consultant explained (Interview C2):

> “In Brazil, tales of suffering are appealing. Success is routinely shamed, and profit is seen as a shameful pursuit, from the perspective of low-skilled workers…Rural workers have little comprehension of the future. Rural workers can’t even comprehend months ahead of time. For them, daily or weekly time horizons are more manageable… The worker is scared of being the boss because his team is his brother, his neighbor, his cousin…Workers can’t align behavior with cognition. They routinely do things that they know are wrong. For instance, they are like a diabetic eating sugary products, knowing he shouldn’t. Their behavior overrides comprehension. He just does what he likes.”

This quote is emblematic of the cultural racism and naturalization frames. For the former, the consultant demonstrates a widely held view that black rural workers suffer from a cultural deficiency in which they lack skills for long-term planning and the capacity to suppress short-term impulses. This so-called deficiency also questions rural workers’ ability to understand the profit-

making and entrepreneurialism inherent to capitalism. For the latter, the contention that workers are fatalistic assumes that they will make no effort to improve their life condition and consider their impoverishment an unchanging 'natural' condition. Ironically, for the five centuries of legal slavery and sharecropping, sugarcane profitability was fundamentally dependent on black workers *not* pursuing their individual or group interests through asset-generating activities, which the industry achieved through economic domination, exclusion of opportunity, and social alienation.

Such cultural racism is grounded in how cane elites perceive the precarious lives of blback rural workers. Employment dependency and food insecurity, both of which have racialized legacies, are the main prisms through which elites interpret the relationship between cane and the precarity of rural workers. While the state and industry used slavery and sharecropping to ensure that black workers were captive to sugarcane, elites now argue that they have a social obligation to provide jobs to rural laborers who lack income-generating opportunities. A producer association official pointed to market dynamics in his explanation of this arrangement (Interview PAO1):

> "[There's the] issue of employment in this [northeast] region. It is one of the poorest regions of the country. You have low income, few industries, low industrialization. And the population grows. No matter how, it grows. And for this reason you need to generate jobs. So, sugarcane generates jobs. The majority of sugarcane jobs are seasonal. You are going to have the biggest supply during the milling period, for 6 or 7 months. In these months you bring people from the *agreste* or the *sertão* [hinterlands], where the supply [of jobs] is much lower. When they come to the sugar zone, they get remuneration that justifies living here for 6 or 7 months. They have income that allows them to live better here than if they were back home. This is a fact."

One scientist discussed how cane mitigated the region's lack of job opportunities (Interview AS3): "And we have a lot of workers that, because of the peculiarities of the sugar zone in the northeast, where there is sugarcane, they don't have other options for employment." Another producer association official offered a glowing assessment (Interview PAO3): "Men need work. And his

dreams, they originate in the stability of his employment. Without employment, it's difficult for him to have access to citizenship. And I think that cane is disposed to generating this employment."

A mill manager described how over time the state government failed to invest in alternative employment, which created a situation in which workers disproportionately looked to the cane industry for income-generation. However, the prospect for widespread unemployment looms, with mechanization possibly on the horizon. He explains (Interview M1):

> "For Alagoas, the sector is very important because it gives a lot of employment, and the state is very poor. There are very few factories. And for this the relationship [with the state government] *was* good. It's still good, it's just that…mills are needed. And as we move forward with mechanization, the state needs to develop other areas that can assume the workforce. If not, we will have a really big crisis. And so the government is starting to… The last government started to do a really big project to irrigate the *sertão*, but now they need to develop fruticulture to be able to absorb this workforce. Alagoas is still not able to make this type of migration. So, employment is still very dependent on mills."

Thus, a paradox exists in which the sugarcane industry is, on one hand, the biggest employment generator in the region and, on the other hand, a last resort option due to an absence of opportunities for many rural workers. Many industry officials fail to recognize how these scenarios go hand-in-hand and treat this paradox as if it were an accident of history whereby chronically low industrialization and resistance to urbanization were existentially separate from mills' need for seasonally available rural workers and small planters to harvest and supply cane.

These responses exemplify the abstract liberalism frame, which uses the principles of individualism, freedom, and economic liberty as a way to justify and defend existing inequalities. By pointing to market dynamics and employment to rationalize the benefits of straw burning and manual harvesting, respondents leave unquestioned why migrant-sending regions and cane communities lack other income-generating opportunities. For cane elites, the decision to seek cane employment is perceived as a simple cost-benefit analysis for securing income and food.

Moreover, the abstract liberalism frame reveals how the financial calculus of sugarcane production continues to be based on the exclusion of opportunity. As long as black rural workers and cane communities are deprived of life opportunities, cane elites can continue to evoke the cost-benefit logic inherent to abstract liberalism, which posits that manual harvesting is simply the economically sensible thing to do in a scenario of scarcity. In this sense, colorblind racism is embedded in market dynamics and shapes what are considered economically optimal choices.

Finally, respondents discussed how issues of hunger and food insecurity motivate rural workers to seek cane employment. The weaponization of food and hunger has longed marked the livelihoods of populations prone to work in sugarcane. In the 1930s, geographer Josué de Castro observed in a nutritional study of northeastern workers that "the only way feed oneself worse than this is to eat nothing" (quoted in Rogers 2010:88). Further, sharecropping was based on a social contract in which the sharecropper exchanged labor for food security and housing (Dabat 2007).

One mill manager and former plantation owner explained how food and precarity historically underpinned cane profitability (Interview M4): "During the period of slavery, the millers didn't have to pay anything to anybody. The slaves worked for free, just for food." He shifted to the sharecropping period: "Because in those days the rural workers received…they didn't receive anything. You didn't have any worker obligations or any respect for the workers." Finally, in discussing his perspective on current production, he states that manual harvesting simply does not compensate the investment, as wages make the activity unviable by absorbing too much profit. A mill owner and ex-president of a producer association echoed the sentiment (Interview O1):

> "But these people (in the northeast) have to have a job, and sugarcane helps labor a lot. It employs a lot of people that don't have any training. Right? But, it's not just cutting cane. You have cane cutters. You have people working in fertilizer. You have transport. You have drivers. You have machine operators…Whether you want it or not, it [sugarcane] exists here… What Pernambuco has is a population of

> 9 million or 8 million people, and these people need to eat. Perhaps not three times a day, but at least two times. You have to eat to not die."

These two respondents convey their view that hunger continues to anchor wage levels and labor availability. They use the frames of abstract liberalism and naturalization to justify the persistence of manual harvesting and straw burning. On the one hand, abstract liberalism uses the language of economic freedom and market logic. By discussing hunger and precarity, respondents frame the issue of cane employment as a simple 'choice' of where workers can secure access to calories so as not to starve. The populations that are prone to seek employment in cane are disproportionately non-white and live in areas with the highest levels of extreme poverty and chronic malnutrition and hunger in Brazil, thus making them more likely to acquiesce to the toxic conditions of cane work (Monteiro 2003). On the other hand, elites view food insecurity in migrant-sending and migrant-receiving regions as a natural condition, where it is inconceivable that black rural workers could ever secure year-round life opportunities. In this sense, the state of hunger and the reproduction of hunger are seen as 'natural' processes for black rural workers, rather than the consequences of socio-historical processes and ongoing systemic racism. The statement that 'the northeast is different' embodies the uncritical claim that poverty and hunger are central to the region's unchanging identity and condition. As interviewees themselves noted, the sugarcane industry has long used hunger and precarity as a weaponized tool for labor control. While past justifications for this practice relied on a race-conscious logic, the current logic of colorblindness contends that hunger and poverty are an accident of history for which the sugarcane industry bears no responsibility.

Overall, a confluence of factors – dependence on cane employment, food insecurity, and low worker training – underpin the colorblind racism that enables the persistence of straw burning in the northeast. Industry officials are eager to divorce present conditions from their racial

foundations in slavery and sharecropping. In this region, colorblind racism seeks to achieve three objectives in its preservation of manual harvesting: 1) Deny that race and racism shape the economic organization of sugarcane production, 2) Use nonracial, yet racialized discriminatory beliefs to continue subjugating black rural workers, and 3) Weaponize hunger and precarity as a way to maintain social and racial control.

Conclusion

This chapter asks two inter-related questions: 1) what mechanisms and strategies did sugarcane elites use to preserve straw burning on mills, after mills elsewhere in Brazil abandoned the practice? 2) What role did race and racism play in shaping the logic and decisions of sugarcane elite to continue straw burning? To answer the first question, I illustrate that the sugarcane elite used new forms of protectionism, such as export quotas and exemptions from environmental laws, to subsidize the ongoing profitability of cane production. While mills elsewhere in Brazil adopted mechanical harvesters to reduce production costs and improve labor and environmental outcomes, northeastern elites opted to capture the state to preserve antiquated practices. For the second question, evidence shows that sugarcane elites use colorblind racism to explain, justify, and defend processes of environmental racism, such as straw burning and manual harvesting. Elites use a variety of nonracial factors, such as market dynamics, technology, farmland, and environment, to rationalize the racialized distribution of toxic burdens.

This chapter makes three contributions to debates in sociology of race and ethnicity and environmental sociology. In the former literature, I illustrate how systemic racism and colorblind racism are useful for understanding and explaining environmental problems. Few studies have used these landmark theories to research environmental racism. Not only do I show that systemic racism is a core feature in the management of environmental and natural resources, but also that

colorblind racism can justify and reproduce toxic inequalities. Further, I affirm and strengthen these two approaches by extending their analysis into the context of Brazil, which has long used a racial democracy framework to camouflage and perpetuate racial inequalities. For the latter, I elucidate the qualitative mechanisms and logic that power elites use to racially distribute toxic burdens. In doing so, I move beyond the quantitative documentation of environmental inequalities, and use sociological theories of race to pinpoint the forces of race and racism that shape processes of environmental injustice and racism.

Chapter 5

Conclusion

The new developmentalism of the PT era (2003-2016) relied on several inter-connected mechanisms for pursuing growth with equity and sustainability. First, macroeconomic policy collectively combats inflation, promotes wage increases in line with productivity, and prevents currency overvaluation to maintain the competitiveness of Brazilian exports. Second, policies that favor workers and poor populations, such as welfare and wage increases, among others, drive and sustain domestic spending and growth, while also promoting social equity. Third, the deep engagement of Brazilian firms in international markets creates opportunities for long-term growth, which ensures economic stability and finances projects for national development.

The sugar-ethanol industry was a preferred sector for Lula and new developmentalism. Ethanol, in particular, held promise for the center-left PT and the conservative agribusiness constituency, as high oil prices and concerns about climate change spurred global interest in renewable fuels. Once new developmentalist policies were translated into action on mills, however, several contradictions and inconsistencies materialized. On one hand, an industrialization boom and pro-worker policies undermined the prevailing way of organizing sugarcane activities, as seasonal farmworkers became harder to recruit and more expensive. In response, mills widely adopted mechanization. On the other hand, Lula worked with the *usineiros* (mill owners) to expand ethanol markets in Brazil and abroad. However, in this market expansion, the industry's ownership structure consolidated, with some sugarcane elites pushed out of the sector as their inefficient mills went bankrupt. Thus, the PT period was transformative for both workers and elites.

Importantly, the dramatic changes of this era had been percolating since the 1990s, with new developmentalist policies providing a highly visible push. In particular, the extinction of the Institute for Sugar and Ethanol in 1990 changed the ecological and market conditions of mill profitability and productivity, as new cost minimization strategies demanded flat terrain. By the early 1990s, mechanization was slowly becoming a reality, as many sugarcane groups constructed new mills on flat land. Thus, the groundwork for deep technological and agronomic change had already been laid once Lula implemented new developmentalism in the mid-aughts. Moreover, for those northeastern mills seeking to slow bankruptcy and liquidation, efforts to enact government protectionism also had been underway since the 1990s. While Lula and the PT acquiesced to their demands, including exemptions to national anti-burning laws and preferential treatment in the 'American' quota, this protectionist framework was a legacy of the Cardoso administrations that Lula inherited.

By examining how power and nature interact to shape the influence of class, race, and labor on outcomes for equity and sustainability, this dissertation reveals new directions for research on developmental state activities. While each chapter offered suggestions for future research in environmental sociology, economic sociology, environmental justice, and sociology of race, this study of how on-the-ground realities shape and are shaped by national policies highlights areas that conventional research on developmental states overlooks.

First, proponents of Brazil's new developmentalism argued that investing in incumbent sectors was strategic, as they possessed a competitive advantage that industry and government should jointly exploit (e.g. Schutte 2012). This dissertation marshals evidence that challenges this argument. That is, enriching incumbent sectors undermines the fundamental goal of developmental state activism, which is to forge a new technological path and, inevitably, to challenge incumbent

actors. Moreover, state interventions for northeastern mills also had the effect of perpetuating the very types of economic activities – low technological sophistication, labor-intensiveness, and sensitivity to commodity prices – that developmentalism is meant to challenge. In this case, the mechanisms and processes that enabled the preservation of non-competitive practices were grounded in race-conscious legacies and colorblind race relations. Yet, maybe it was necessary for Lula to take this path because he faced a dilemma in which it was politically impossible to promote social equity *and* existentially challenge powerful stakeholders? Perhaps in a political system like Brazil, where legislating requires multi-party coalitions, the only feasible path was to promote social equity through incumbent sectors? However, the 2016 impeachment of Dilma should illustrate the limitations of such a strategy.

Second, this dissertation elucidates the need to include discussions of race in developmental state activism, especially for multi-racial societies like the US and Brazil. Literature on the racial state demonstrates that the state upholds both racialism and capitalism. Developmental state scholars rarely, if ever, discuss how race interacts with industrial transformation and technological change. While they are comfortable acknowledging that developmental state activism seeks to overcome racialized legacies in monoculture and low-industrialization, rarely discussed is how those legacies shape the type of industrial change that materializes or influence the uneven dissemination of developmental state achievements, such as industrial or medical technology.

Finally, the environment is largely absent in developmental state literature. Debates on the environmental state have long centered on the state's role in fomenting sustainability. Chapter 2 reviewed these different positions where, on one hand, the treadmill of production camp argues that the state engages in growth machine politics that contribute to ecosystem degradation and, on

the other hand, ecological modernization theorists contend that the state can prod businesses to adopt sustainable practices. Although the environmental and developmental state literatures do not engage each other, there are ripe areas for dialogue, especially for the case of Brazil in which new developmentalist policies favored the sugar-ethanol industry.

In contributing to these two research canons, this dissertation suggests that Brazil would be wise to begin making aggressive investments in wind and solar. Doing so offers multiple possibilities for development and environment. First, wind and solar construction and maintenance provide opportunities for employment, skill-upgrading, and decarbonization. Fusing these activities together creates a virtuous cycle for developmental and environmental outcomes. Second, for solar, the possibility of selling unused energy back to the grid is an income-generating activity that would benefit many residents throughout Brazil. In particular, for residents of the northeastern sugar zones, *sertão*, and *agreste*, where sun is abundant and income is low, solar offers opportunities for reliable energy and income generation. In these communities, where many former and current cane workers live, solar can also offset the effects of mechanization in sugarcane activities. Finally, from a political economy perspective, large-scale investments in solar and wind can undercut the political and economic power of sugarcane elites, who captured nearly *all* spending on renewable energy under new developmentalist policies. Sugarcane elites, who long benefited from bailouts, tax breaks, and favorable industrial policies, consistently impede the hallmarks of a developed society: democratic participation, strong public goods, industrial transformation, and racial and environmental justice. By investing in wind and solar, the Brazilian government can diversify the power center of the national political economy, while also creating an infant industry with a strong future in the global economy.

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