

# Race and the political ecology of education in Brazil: A spatial analysis of rural school closures

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## Abstract

Education and processes of agrarian change are deeply imbricated. While political ecologists have begun exploring education in earnest, questions of race have remained largely unexplored. In this article, we analyze the spatial linkages between education, race, and the permanence of the peasantry in the face of expanding capital. Our focus is the crisis of rural school closures in Brazil. Over the last twenty-five years, the state has closed more than 65% of Brazil's rural schools. Social movements argue that these school closures are differentially occurring in communities of color. To better understand the factors driving this crisis, we assembled a "big data" database, consisting of twenty-five years of municipal school records from every school in Brazil. Drawing upon advanced geospatial statistics and multiple linear regression techniques, we analyze both how these school closures are spatially patterned throughout Brazil, and the social, political, and economic factors shaping this crisis. Our results highlight land concentration and race as central

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dynamics in this crisis, underscoring the enduring impact that racial oppression and historical patterns of land inequality play in structuring the politics of knowledge and educational landscape in Brazil.

**Keywords:** social movements, race, Brazil, spatial analysis, *educação do campo*, GIS, agrarian change

## Résumé

L'éducation et les processus de changement agraire sont profondément imbriqués. Les écologistes politiques ont commencé à explorer sérieusement l'éducation, mais moins les questions de race. Dans cet article, nous analysons les liens spatiaux entre l'éducation, la race et la permanence de la paysannerie face à l'expansion du capital. Nous nous concentrons sur la crise des fermetures d'écoles rurales au Brésil. Au cours des vingt-cinq dernières années, l'État a fermé plus de 65 % des écoles rurales du Brésil. Les mouvements sociaux affirment que ces fermetures d'écoles se produisent davantage dans les communautés de couleur. Pour vérifier cette hypothèse, nous avons constitué une base de données "big data", composée de vingt-cinq années de registres scolaires municipaux de toutes les écoles du Brésil. À l'aide de statistiques géospatiales avancées et de techniques de régression linéaire multiple, nous analysons à la fois la répartition spatiale de ces fermetures d'écoles dans tout le Brésil et les facteurs sociaux, politiques et économiques qui façonnent cette crise. Nos résultats mettent en évidence la concentration foncière et la race comme dynamiques centrales de cette crise. Nous montrons l'impact durable de l'oppression raciale et des modèles historiques d'inégalité foncière dans la structuration de la politique de la connaissance et du paysage éducatif au Brésil.

**Mots-clés:** mouvements sociaux, race, Brésil, analyse spatiale, *educação do campo*, SIG, changement agraire

## Abstract

A educação e os processos de mudança agrária são processos profundamente imbricados. Embora os ecologistas políticos tenham começado a explorar seriamente a educação, as questões raciais permanecem em grande parte inexploradas. Neste artigo, analisamos as ligações espaciais entre educação, raça e a permanência do campesinato à expansão do capital. Nosso foco é a crise do fechamento de escolas rurais no Brasil. Nos últimos vinte e cinco anos, o estado fechou mais de 65% das escolas rurais do Brasil. Os movimentos sociais argumentam que estes encerramentos de escolas ocorrem de forma diferente nas comunidades de cor. Para entender melhor os fatores que impulsionam esta crise, montamos um banco de dados de "big data", composto por vinte e cinco anos de registros escolares municipais de todas as escolas do Brasil. Com base em estatísticas geoespaciais avançadas e técnicas de regressão linear múltipla, analisamos como esses fechamentos de escolas são espacialmente padronizados em todo o Brasil e os fatores sociais, políticos e econômicos que moldam esta crise. Nossos resultados destacam a concentração fundiária e a raça como dinâmicas centrais nesta crise, ressaltando o impacto duradouro que a opressão racial e os padrões históricos de desigualdade fundiária desempenham na estruturação da política de conhecimento e do cenário educacional no Brasil.

**Palavras-chave:** movimentos sociais, raça, Brasil, análise espacial, educação do campo, GIS, mudança agrária

## 1. Introduction

Despite more than a century of debate concerning the agrarian question (Bernstein 1996; McMichael 1997; Akram-Lodhi 2013), the spatial linkages between education, race, and the permanence of the peasantry in the face of expanding capital remain underexplored. In this article, we begin to address this absence by analyzing how race and space intersect with changes in the availability of educational opportunities and processes of political and agrarian change. Our focus is the crisis of rural school closures in Brazil. These are not isolated school closings, but rather a spatially extensive and intensive territorial process. For example, in 2016, alone, the government closed more than 11,732 rural schools. Expanding the temporal scale, it's clear this is a broader phenomenon: in the last 25 years, the state has closed more than 142,401 rural schools, meaning that 65% of them have been shuttered since 1995.

This article's theoretical contribution is to highlight three ways in which critical analyses of race can be illuminated through a political ecology of education framework. We understand the political ecology of

education to be a perspective "attuned to how the distribution of power and resources among interconnected political and cultural entities mediates pedagogical processes—from tacit to formal learning—affecting access and control of natural resources, interactions with the cultural landscape, and conceptions of nature-society relationships" (Meek 2020: 13). Earlier special journal issues on the political ecology of education have highlighted potential new directions for this area of inquiry, including an emphasis on place, post-humanism, scale, decolonization (Meek & Lloro-Bidart 2017; Meyerhoff & Thompsett 2017; Moore 2017). But questions of race, and how racial disparities and axes of power mediate access to knowledge, resources, and relations to the environment have remained largely invisible.

To address this gap, we begin with a literature review which makes three explicit contributions to the political ecology of education. First, we explore how a historical lens can illuminate racialized inequity from a political ecology of education perspective. The history of racial conceptions and relations in Brazil is fraught with institutionalized discrimination and slow violence (Winant 1992). Despite national level discourses of Brazil as a racial utopia, since colonization, whiteness has been historically tied to nationalistic visions of urban modernity (Degler 1971; Htun 2004). Second, we seek to highlight how race, education, and political processes of state-building intersect. In Brazil, education has long served as a central instrument of racial discrimination, being used by the national government as a form of whitening, "civilizing" rural areas, and producing the new "Brazilian" race—a nationalist racial imaginary that is inherently white and located in urban centers (Dávila 2003). Third, we demonstrate that a critical racial analysis can shed light on how grassroots social movements mobilize education as a tool to resist agrarian capitalism. Brazil is one of the epicenters of conflict between the expansion of agribusiness and peasant resistance (Fernandes 2000; Branford & Rocha 2002). Brazilian agrarian social movements are also at the forefront of advancing new forms of critical pedagogy, and they are integrating these radical pedagogies through movement-state partnerships (Fernandes 2000; Meek 2015a, b; Tarlau 2015, 2018). By attending to historical, structural, and grassroots processes, we seek to bring critical analyses of race squarely into focus within emerging political ecologies of education.

We next turn to explicating our research results, which inform three geographic questions concerning Brazil's school closure crisis.

*First, what is the spatial nature of these phenomena? Are these school closings concentrated in a particular area of Brazil, or are they evenly distributed across geographic space?*

The results of our geostatistical analyses highlight that the closure of rural schools is concentrated in several hotspots across the country. One of our key findings is that at the regional level, these hotspots geographically intersect with the territories of communities of color and with the presence of agribusiness. In the Central-West and Southern regions, where agribusiness is strongest, approximately 80% of schools have been shuttered. Similarly, in the North and Northeastern regions, which have the highest proportion of people of color, 60% of rural schools have disappeared.

*Second, does race play a role in explaining the spatial patterning of school closures? Are schools being closed primarily in Afro-Brazilian communities?*

Employing regression techniques, our team found that racial demographics are a very significant predictor of rural school closures at the municipal level. In agrarian communities with higher percentages of self-identified Black residents, there is a 175% increase in the incident rate of rural closures, suggesting that the closure of rural schools is a fundamentally racialized process. These communities of color are situated in the North, which comprises the Amazon, and the Northeast, regions that have long been at the center of territorial development.

*Third, do these patterns of school closings intersect with structural inequalities in land access? Does the historical concentration of land condition the school closures?*

One of our central findings was that land concentration is highly correlated with an increase in the rate of school closures. Our results show that a one-unit increase in the GINI index was associated with a 228% increase in the rate of school closure incidents. The GINI variable had the largest effect size, while controlling for other variables in the model. We interpret these results to suggest that municipalities with

high levels of land concentration are also those municipalities where there are elevated indices of school closures.

Critically engaging with these findings adds to intersectional analyses of the racial and geographical dimensions of educational exclusion. Our results suggest that an intersectional analysis needs to account for both the interplay between time and race, as closures are concentrated in long-standing communities of color. Similarly, we underscore the importance of integrating an analysis of agrarian political economy within an intersectional approach, as areas with high indices of land concentration are the most impacted by school closures.

## 2. Geography of racial demographics and epistemic injustice

To contextualize our analysis of race and rural school closures, it is critically important to have a basic understanding of how racial demographics are geographically distributed in Brazil. We argue that the geography of race is based in historical patterns of colonial plantation agriculture, but also structures the closure of rural schools, as well as the efforts of grassroots movements to mitigate this crisis.

As a starting point, the usage of "color categories" to differentiate identity groups is semantically and politically fraught. Brazilian censuses, such as those this research is based upon, have historically used *côr* (color) instead of race, or ethnicity, to differentiate social groups, and it was only in 1991 that the Brazilian census included the category *indígena*. Adding further confusion, the term "*pardo*" (loosely translated as "brown") has such divergent cultural meanings in Brazil—ranging from someone who is "half-black" to a "dark skinned brunette," that the term is near-meaningless (Marcus 2013: 1290). Similarly, the colloquial term *moreno* (broadly translated as "brown" or "tan") offers little purchase in terms of translation, and is not recognized in official Brazilian census categories, and remains as ambiguous as *pardo*. Even the terms *preto* (black) and *branco* (white) are neither legally binding nor binary in Brazil, and are rather quite arbitrary and flexibly adopted and deployed, carrying multilayered subtextual meanings, which are not easily translated into English (Marcus 2013).

Acknowledging the inherent ambiguities of color categories, the demographic census still provides an important orienting perspective on demographic distribution. Brazil's most densely populated region is the Southeast, containing 42.6% of the population, with the country's two largest urban centers of São Paulo and Rio de Janeiro. The Northeast is the second most populated (28.1% of the population), followed by the South (14.8%), North (7.6%) and Center-West (6.9%). The country's North region is home to the largest Indigenous population (1.6 percent), whereas the South contains the highest proportion of self-identified Whites (84 percent). The North also has the highest proportion of *pardo* (64 percent), and the Northeast the largest of blacks (8 percent). At a national scale the demographic breakdown consists of: white (53.8 percent), *pardo* (38.5 percent), black (6.2 percent), yellow (0.4 percent), Indigenous (0.4 percent), and undeclared (0.7 percent) (IBGE 2010).

Regional demographic patterns are intricately interwoven with historical legacies of colonialism, and the coloniality of knowledge. Patterns of colonial plantation agriculture, for example bananas, cocoa and sugar, were directly responsible for the distribution of Afrodescendant populations in the country's Northeast (Marcus 2013). This racialized patterning of colonial agriculture was structured by, and reciprocally reinforced, the coloniality of power and the geopolitics of knowledge production. Knowledge is fundamentally racialized, and colonialism inscribed whiteness as the default and unmarked identity associated with the production of knowledge. By associating whiteness with knowledge, and in turn with power, rural communities of color have long suffered an epistemic injustice that occurs alongside the subjugation and subalternization of rural knowledge and ways of being. The common conception that peasants are "devoid of knowledge" is a product of a racialized process of invisibilizing, of negating communities of color and the validity of their traditions and knowledge systems. As Santos (2002) argues, what the Western canon doesn't recognize as legitimate is negated and rendered invisible. We hold that the state's closure of rural schools is a clear example of the ongoing erasure of Black peasant epistemologies, and is a marker of coloniality. The threat, and experienced violence, of these school closures is significant because it often spells the death knell for agrarian communities of color.

In response to the elimination of rural schools, agrarian social movements are seeking to make visible other systems of knowledge and ways of being in the world that are grounded in the subaltern rationalities of people of color, women, non-gender conforming, and Indigenous peoples. These movements are actively developing endogenous education visions as a process of re-writing, from a subaltern position, the geopolitics of modernity-coloniality, and its system of epistemic violence (Porto-Gonçalves 2006). By advancing endogenous visions of education, which we will subsequently explore in greater detail, these groups are both resisting the disintegration of life that comes with the state's development projects, and seeking to engage in what Brazilian Amazonian scholar Porto-Gonçalves terms re-existence, lifting up the forms of knowledge and being in the world that have been subjugated.

## 2. Education, race and the agrarian question in Brazil

Brazil, for many academics and Brazilians alike, is a country where it does not make sense to talk about race. Since the 1930s, the country has been touted as a racial democracy. This idea, popularized by Gilberto Freyre, holds that Brazil is unique among former colonies in its racial harmony and acceptance of intermixing. However, beginning in the 1950s, the imaginary of Brazil as a racial democracy began to crumble, as the structural racial discrimination faced by Afro-Brazilians became increasingly more visible. We follow critical Brazilian scholars (Serrão 2022; Silva 2016; Guimarães 2001) in taking the position that Brazil is *not* a racial democracy. Rather, we hold that an analysis of the interconnections between race, education, and agrarian change illuminates how structural racism takes place at a territorial level. At the regional scale, our results highlight that longitudinal hotspots of school closures exist in the North and Northeast—areas that have the highest proportion of people of color, and greatest indices of agrarian inequality. At the finer geopolitical scale of the municipality, our analyses show that the closure of schools is predominantly occurring in rural communities of color who practice small-scale and subsistence agriculture. Rather than being experienced equally across Brazil's population, these results underscore the fact that knowledge and power are racialized and geographically situated in particular regions, such as Brazil's South. Similarly, our analyses highlight how grassroots visions of education, and associated subaltern forms of knowledge, contest these geographies of structural racism. To set the stage for presenting these results, we begin by revisiting the ways in which race becomes mobilized by the state as part of a broader process of modernizing the nation in the early 20<sup>th</sup> century.

Education has long served as part of the process of state formation, expansion, and consolidation. As Willinsky (1998) writes, from the very beginning of European colonialism, the practice of "studying, classifying, and ordering humanity within an imperial context gave rise to peculiar and powerful ideas of race, culture, and nation that were, in effect, conceptual instruments that the West used both to divide up and to educate the world" (p. 3). Thus, not only were schools used to control and "civilize" colonized populations, but the accumulation of knowledge during the colonial project directly influenced the rise of new academic disciplines and a conception of science and racial classification that continues to be influential today. The expansion of formal schooling in the colonies came in the late 19<sup>th</sup> and early 20<sup>th</sup> century, during a period of economic and social instability that led to decolonial struggles in Africa and Asia. In these latter contexts, expanding colonial education access was seen as a way to subdue the population, whilst producing new elites that could work with the European colonizers in modernization efforts (Furnivall 1948; Cooper 1997). Of course, the level of investment in education depended on the form of rule, direct versus indirect, which left distinct legacies in different countries. According to Tikly (2001), colonial education was also a key site for the spread of global flows and networks in the economic, cultural and public spheres, while also providing a "seedbed" for local resistance.

In the Brazilian context, the expansion of schooling did not happen during the colonial era, but during the first Brazilian Republic, after the overthrow of Emperor Dom Pedro II. Between 1917 and 1945, the Brazilian state engaged in a succession of school-system expansion programs aiming to provide public schooling to poor white and non-white students. In the 1930s, a group of intellectuals, the *Escolanovistas* ("New-Schoolers"), wrote the *Manifesto of the Pioneers of National Education*, a document that critiqued the traditional Catholic Church-run education system and declared free and public education to be the right

of all Brazilian citizens and the domain of the state (Plank 1996). These were more than efforts to provide basic education, but in the words of these educators to "perfect the race"—to create a healthy, culturally European, physically fit and nationalistic "Brazilian race" (Dávila 2003: 3). Race in this context was a metaphor for the past, present and future of the nation: Blackness was associated with the past—and morally, with unhealthiness, laziness and criminality. Racial mixture symbolized historical progress—a trajectory from blackness to whiteness, from the past to the future. Whiteness was associated with health, culture, science and modernity (*ibid.*, p. 6). Education reforms between 1917 and 1945 sought to privilege white, middle-class appearance, demeanor, habits and values. As Dávila (2003) argues, reforming the education system was the core strategy of pursuing a culturally and socially white nation. Our historical analysis of how race is connected to questions of power and state-consolidation underscores how the Brazilian state has deployed education as a tool to solidify structures of oppression, providing access to opportunities for knowledge production for white Brazilians, and exclusion to those opportunities, for communities of color.

Educational power is imbricated with flows of capital. By charting out the political economy of education (Carnoy 1985), political ecologists of education can illuminate how structures of oppression mediate the topography of education systems and uneven development (Smith 1984). During the two-decade-long dictatorship (1964-1984), the military regime invested in education as a tool for economic development in urban regions, but it primarily spent money on secondary and higher education in urban centers. Under this highly centralized system, local and state governments had little to no autonomy (Plank 1996). In 1971, with the Education Reform Law, some authority over primary and secondary education was ceded to state governments, but it was not until the Constitution of 1988 that complete authority over education was devolved to state and municipal governments. Nonetheless, twenty years of an urban-industrial economic policy had taken its toll on rural regions. While between 1980 and 1996 the percentage of students finishing fourth grade across Brazil rose from 50 to 75 percent and the percentage finishing secondary education from 17 percent to 25 percent (Reimers 2000: 67), the vast majority of the children left behind in this educational expansion were rural youth.

In Brazil, questions of the political economy of education overlap directly with the political economy of agrarian change. Brazil's geographic disparity in education provision is similar to its historically inequitable distribution of land (Plank 1987). The political economy of education financing in Brazil has traditionally been directed towards supporting urban centers. Rural municipalities in the country's impoverished north and northeast historically received a sixth of the resources of those in the urban south (Gadotti 1992). In 1990, a study found that per-pupil expenditures on state schools in the poorest northeastern states were only one-third of schools in the wealthy southern states (Reimers 2000). In rural regions, municipal governments ruled by entrenched land-owners that engage in explicitly clientelist practices (Tarlau 2013), are the bureaucratic overseers of the public schools. The Brazilian ruling class has governed both land and education towards a dual set of aims: maintaining a consolidated agrarian structure, and an educational system that explicitly valorizes urban areas. These objectives are interrelated as they preserve agro-industrial capitalism while shifting the peasantry to urban areas where they will not be a threat. However, critical pedagogues and rural social movements have fractured this larger project.

Paulo Freire (1921-1997) was an influential Brazilian pedagogue whose writings on critical consciousness and praxis continue to structure agrarian social action. Freire's work in Northeastern Brazil, and subsequently Chile, dealt extensively with questions of structural oppression, and the capacity of everyday people to transform the world through becoming literate and developing a critical consciousness. Many of Freire's works engage explicitly with questions surrounding the peasantry; for example, in *Cultural action for freedom* (1970), Freire mentions the peasantry more than 70 times, discussing peasant communities, peasant leaders, peasant consciousness, and peasant movements. In other works, such as *Education as the practice of freedom*, Freire discusses advancing literacy practices with peasant communities as part of a process of developing critical consciousness and transforming relationships between oppressed and oppressors (Conte & Santos Paulo 2021). While class was central to Freire's analysis and most prevalent

in his writing, questions of race were not entirely absent.<sup>2</sup> As critical pedagogue Michael Apple argues, Freire knew from his own experiences in Brazil's Northeast that oppression is "color-coded," and that in the struggles of Afro-Brazilians against domination, the politics of race were a central arena of contestation (Apple 2003). Freire's work has been a touchstone for grassroots rural social movements who have prioritized education as a tactic for advancing social change.

The Brazilian Landless Workers' Movement (MST) is an agrarian reform movement that has made education a central part of its struggle, and whose vision of education has been strongly influenced by Freire's understanding of critical consciousness and praxis. Through the 1980s, MST leaders who occupied land to win land rights also began to develop pedagogical activities for the children and literacy programs for the adults in its encampments. By the early 1990s, the MST had become a recognized educational actor in the Brazilian countryside, administering literacy programs and teacher training institutes for their activists, often in partnership with local universities and international organizations such as UNESCO and UNICEF. During the First National Meeting of Educators of Agrarian Reform (ENERA) in 1997, representatives from these international organizations encouraged MST activists to expand their educational program to include other populations, such as Indigenous groups, black communities, and rural workers. This was the moment that the concept of *Educação do Campo* (Education of the Countryside) entered the national debate. Over the next two decades, dozens of rural social movements, involving fisherfolk, small farmers, black rural populations, Indigenous peoples, and agricultural workers, came together to demand their right for *Educação do Campo* in their communities (for more detailed descriptions of these developments, see Tarlau 2015, 2018).

*Educação do campo*, which we describe as education originating from and being relevant to the countryside, is a means of valorizing agrarian identity, agroecological practices, and achieving food sovereignty. *Educação do campo* is a novel educational paradigm, that valorizes labor in the rural areas, and the workers as subjects, in addition to their particularities, contradictions, and cultures as forms of praxis. According to the *Dictionary of educação do campo* (Caldart *et al.* 2012), this educational proposal combines the struggle for education with the struggle for land, agrarian reform, the right to work, culture, and food sovereignty. It is based on the notion that the state should provide the resources for public education but not control the educational process. Given its focus on ensuring equitable access to quality education throughout the countryside, the *Educação do campo* movement is challenging the state, and its historical disinvestment in rural areas.

*Educação do campo* is diametrically opposed to rural education, which it sees as denigrating rural areas and encouraging rural students to migrate to the cities and abandon their rural identity. The paradigm of rural education is linked to the interests of agribusiness and agrarian capitalism, and consequently the strengthening of policies related to the loss of rural schools. In contrast, as a pedagogy, *educação do campo* emphasizes the value of alternative forms of knowledges, the importance of agrarian reform communities as learning laboratories, and critical place-based research. As opposed to rural schools, *escolas do campo* are spaces that valorize forms of peasant identity and livelihood assemblages as inherently dynamic. *Escolas do campo*—those of the rural areas—are those that are simultaneously *for* the rural areas. They integrate political leadership development (*formação*) alongside more conventional education opportunities. *Formação* involves a multitude of processes including consciousness-raising work, political education, and leadership development. In many *Educação do campo* programs, *formação* co-occurs alongside the education work, for example, the teachers receive additional training on political analysis in teaching training programs.

From a political ecology vantage point, education is a spatial arena of social struggle. Different visions of education—urban education, rural education, *Educação do campo*—are more than geographically explicit in their nomenclature. Rather, they index a set of overlapping cultural, political, and agricultural axes of difference. As opposed to a rural school, where peasant culture and forms of agricultural production are seen as backwards and urban society and mechanized monocultures are seen as signs of development, *Educação do campo* explicitly valorizes peasant traditions and agroecological practices. The social production of the school's spatiality; whether it is rural, urban, or *escola do campo*, is tightly intertwined with its vision of the

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<sup>2</sup> See Haymes (2002) for a detailed critical analysis of the presence and absence of race in Freire's writings.

land. *Educação do campo* is itself a spatial argument about education; it is spatial because rural space is understood as a space of territorial development that supports rural culture and not agribusiness. For the activists pushing *Educação do campo*, the spatial vision of the relation between the city and urban areas is not of strict delineation, or of hierarchy, but rather horizontal solidarity.

Similarly, the phenomenon of school closings in Brazil is at its core, spatial. Most often, the schools that are shut down are one-room schoolhouses with a multigrade classroom including first through fourth grade students. These schools are perceived as backwards, remnants from a previous era, and not consistent with the process of educational modernization. In the context of the movement for *Educação do campo*, in the early 2000s, leaders of rural social movements and allied professors began critiquing this negative characterization of multi-grade schooling, instead laying the blame for the quality of these schools not on the form of education, but the government's systematic underinvestment in these schools. A group of researchers in the Amazonian state of Pará, who formed GEPERUAZ (Group of Study of Research of Educação do Campo in the Amazon) in 2002, took a lead in the effort to defend multigrade schooling, publishing a series of articles and books about the daily reality of students and teachers in these schools, and the need to valorize and actively invest in them. Social movements of the countryside also mobilized to demand schools—multigrade or otherwise—in their communities. Over the next decade the Ministry of Education under the Workers Party (PT) government did implement several large-scale programs to support multigrade schooling, although the social movements were extremely critical of the largest of these programs, known as *Escola Ativa* (Tarlau 2017). This program was eventually replaced with another, smaller program, *Escola da Terra*, which allows social movements and sponsoring universities much more autonomy.

The closure of rural schools happens through a spatial process that is known as "nucleation" (*nucleação*). This "nucleation" or centralization process involves identifying rural schools that have low enrollment, and bussing the students to large, centralized ones, which receive students from the broader area. In these contexts, the schools that were not the sites of nucleation—that is, they didn't receive the incoming students—were closed. Moreover, if there are not enough schools in a region for this process of nucleation, then students are simply bussed to the nearest city. The result of this process is that large, age-graded schools are considered "modern" examples of educational excellence.

Scholars suggest that this policy of nucleation is closely linked to the agrarian question. Miguel Arroyo (2007) argues that the public policies of nucleation—which result in the displacement of children and youth from their social and cultural context—are manifestations of a public policy inspired by the demands of "modernization" of agriculture and agribusiness expansion. Arroyo's analysis is shared by the MST; following Erivan Hilário of the MST's education sector, "The closure of schools in the countryside can not be understood only as a tendency in education. What is at stake is the government's choice of a development model for the rural areas, which is agribusiness." We argue that at a broader level, what is at stake are conflicting spatial imaginaries. Spatial imaginaries are particular understandings of space, such as ideas about private property, which shape social life (Wolford 2004). Agribusiness envisions rural spaces as devoid of people. These are uniform spaces that have singular usages: production. A vision of space as empty, and homogenous, is necessary for agribusiness, because it legitimizes the consolidation of rural landholdings, and creates a spatial context in which a model of agriculture can be advanced that is based on high technology and low labor inputs. Agribusiness draws upon this spatial imaginary in shaping social life. By contrast, rural peasant movements, such as the MST, articulate an alternative spatial imaginary. Within their vision, rural spaces are produced through agrarian traditions. The communities inhabit these spaces might be invisible or illegible because they exist at a different scale of individual production, however, they are spaces that produce life.

*Educação do campo* is an inherently intersectional project. Rather than a singular spatial analysis of analysis of the uneven terrain of knowledge between rural and urban society, *Educação do campo* integrates concerns surrounding how social differences along racial, ethnic, gender, and ableist lines structure educational disparity, but also what an alternative vision of education looks like from that perspective. In *Educação do campo*,

...the student is not treated like a number, a student is not treated like a student, they are treated as subjects, subjects who bring history, who have differences. It is different to be a woman, or a man, black or white. [Educação do Campo] treats the student as a person, in their time, their age, their race, their history, their diversity, their moment of human formation. (Fernandes 2000: 20)

Similarly, *Educação do campo* is described as "an integral project, preoccupied with the questions of gender of race, of different cultures" (Kolling, Cerioli & Caldart 2002: 21). This is a project involving continuous critical self-reflection. *Educação do campo* is an intersectional movement, because the spaces that it pulls from are inherently heterogenous. Self-defined *quilombos* (descendants of escaped slaves), and other rural black communities are rural workers and, in some cases, members of agrarian reform movements, or inhabitants of agrarian reform settlements and encampments. As Gusmão (1990) suggests, the black peasantry shares common experiences with other peasant sectors (traditions of family farming, forms of social organization, broader rural cultural traditions) but is also characterized by its own ancestral and cultural history that distinguishes experiences of black identity. As Magalhães offers, "the rural subjects are not diverse because of being poor, or riverfolk, extractivists etc. The subjects of the *campo* have color/race. For a country that organizes itself around the aegis of racism this is not a trivial fact (2009: 120)." Rather than black identity being a subjectivity that is elided in the context of Brazil's purported post-racial state, race is an explicit axis of staging difference as a political concept. Race becomes employed within *Educação do campo* as part of a critical social construction that seeks to make visible the impact of social prejudice, history, and policies. Within the *Educação do campo* movement, race has been transformed from a biological category that structured racism into a dynamic identity that is socially constructed and politically mobilized within a historic and cultural context as part of a process of redressing historical process of marginalization.

Ethnicity intersects with race in the movement. Following Munanga & Gomes (2016), ethnicity captures the importance of historic and cultural traditions that characterize the black peasantry. For Cashmore (2000: 196 in Munanga & Gomes 2016: 57), this means that the black peasantry becomes an ethnic group in that it is a "conscious aggregation of people united by the proximity of their shared relations." Farias and Faleiro (2017) employ the phrase 'ethno-racial', because the black peasantry is defined by an assemblage of characteristics ranging from culture, hair texture, language, ancestry, and shared histories of marginalization. Gomes and Munanga (2016: 178) use the phrase ethno-racial to

...refer to the black segment of the Brazilian population, in the sense of its cultural dimension (language, tradition, ancestry) as well as racial (visible physical characteristics, such as skin color, type of hair etc.) as both are important and are connected. Both should be considered in conjunction (and not in a separate form) when we talk about the complexity of what it means to "be black" in Brazil.

Education has long existed in this context as a space for ethno-racial mobilization. As Silva and Barbosa (1997) suggest, education has become a pivotal space for not only denouncing the dehumanization of black subjects, but also developing a critical consciousness of the reality lived by these subjects. Education is epistemologically and ontologically central to black Brazilians, providing a means to construct forms of knowledge, tactics of resistance, and cultural expression that are inherently hybrid, having roots in Africa and experiences of racial inequality in Brazil. Walsh describes this as a search for a new educational system grounded in critical interculturality, that seeks to construct a new vision of education from the perspective of people who have suffered a history of submission and subalternization (Walsh 2009). *Educação do campo* becomes a project in constructing educational pedagogies and, in a broader sense, epistemologies, that are based in, and valorize, the lived experiences of black peasantry. *Educação do campo* is also part of a broader project of rejecting the myth of Brazil as a racial democracy, a fallacy which contributes to the ongoing invisibility of racial discrimination.

Our review of the literature on race, education, and agrarian change in Brazil builds upon many of the key elements of political ecology, and offers new insights into a political ecology of education. First, is the centrality of questions of power (Robbins 2004). Since colonial times, education has been linked to a process of state formation. Power exists in, and supports the consolidation of racialized projects. Here, we advance the theorization of the political ecology of education, by demonstrating that racial politics are key to understanding the development of national level educational policies. Core to our analysis of the literature is the centrality of political economy. The racialized distribution of power in Brazil has supported the allocation of funding towards white urban areas at the exclusion of rural spaces of color. Within political ecology, analyses often focus on questions of access to material resources, principally land. In our analysis of the literature, it is clear that structural inequities in terms of educational financing and access overlay neatly with similar inequities in terms of land access. In Paul Robbins' account of political ecology (2004), social movements are key actors in contesting questions of environmental degradation as well as reworking narratives of environmental change. Similarly, we argue that social movements are central to analyses of the political ecology of education. Social movements are often on the front lines of addressing structural inequalities in education, and involved in mobilizing critical pedagogies to raise critical consciousness about power and educational inequalities. They also work with students to develop the critical consciousness to transform these. In Brazil, we find that *Educação do campo* is an inherently intersectional movement, mobilizing around questions of racial and ethnic identity.

### 3. Methods and analyses

This article draws upon an explicitly quantitative "big data" database of municipal level school records from every municipality in Brazil between the years 1996–2021. Our primary data source was the Brazilian Educational Census (*Censo Escolar*), which is the country's principal instrument for collecting basic education statistics, and is administered by Brazil's National Institute of Educational Research (INEP). The School Census is a survey that is conducted annually by INEP in collaboration with the Departments of Education at the municipal, state and federal levels. This census gathers data on the gamut of the country's educational activities, ranging from "Basic Education" (*educação básica*) to professional education (*educação profissional*). It contains data on enrollment, teachers, teaching modalities, and school location, among more than a hundred other variables (INEP 2021b). These data play a crucial role in informing policy; results from the School Census inform the allocation of resources at the municipal level from the Fund for the Maintenance and Development of Basic Education (FUNDEB)<sup>3</sup>, which provides educational funding to the state and municipal governments.

To calculate the number of school closings at the municipal level, we created a relational database in Microsoft Access. The first step in building this database was to download the datasets of all years of the School Census that were available on the INEP website. After reviewing the extensive list of more than one hundred variables, we decided to extract out the following: year of the Census, "school variable" (described below), federal unit code (equivalent to state code), state acronym, municipality code, name of the municipality, and school code. "Municipality code" is the numeric code that identifies each municipality, used in various Brazilian censuses as well in terms of governmental administration. The municipality code served as the key for the relational database, enabling us to link diverse variables to the municipal level.

The "school variables" contained the core datasets that we based our analysis of school closures upon. We focused on three of the sub-variables within this dataset: 1) Operation status (Active, Paralyzed, or Extinct); 2) Location (Rural or Urban); 3) Type of Administration (Federal, State, Municipal, or Private).<sup>4</sup> Each of these sub-variables was numeric, and once we integrated these into the relational database, we were

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<sup>3</sup> Law nº 14.113/2020 and Decree nº 10.656/2021, New FUNDEB, were published, determining that the distribution of the fund's resources will be carried out according to the actual in-person enrollments reported in the most current School Census (INEP, 2021b).

<sup>4</sup> The school variable also contains other information such as characterization, physical infrastructure, equipment, human resources, school feeding (PNAE/FNDE) and school organization, among others.

able to use SQL (Structured Query Language) to pull select data that met specific criteria, such as "active//rural//municipal schools."

A critical piece of our methodology was distinguishing what constituted a "closed school." According to INEP, a school is considered Extinct when "The school has definitively closed its school activities." When a school is "Active," it is considered to be "functioning and carrying out school activities." And a school is "Paralyzed" when it is "with school activities definitely closed" (INEP, 2021b). It is worth noting that a public school is only considered "Extinct" when there is an act of closure issued by the Secretary of Education (INEP, 2021b). For Rural, Indigenous, and Quilombola Schools, Law No. 12,960/2014 was specifically enacted, which established:

The closing of rural, Indigenous and *quilombola* schools will be preceded by a statement by the regulatory body of the respective education system, which will consider the justification presented by the Secretary of Education, the analysis of the diagnosis of the impact of the action, and the statement of the school community.

We decided to mark a school as "closed" when it appeared with the variable "extinct" in the year analyzed, and that in the previous year their operating situation was as "Active" or "Paralyzed." That is, a school is considered "Closed" when it meets these two conditions (of being active or paralyzed in the previous year, and extinct in the following year).<sup>5,6</sup>

To calculate the number of school closures, we first calculated the number of rural municipal schools in each of the 5,572 municipalities in Brazil for each of the years of the census. For each municipality, we then subtracted the number of municipal schools for a given year from the number of active municipal schools from the previous year. This provided us with a change value, highlighting how many schools had been opened or closed. We spatially joined these change values to a shapefile of municipal boundaries, and used this data set as the base layer for our geostatistical analyses.

Using ArcMap 10.5, we then conducted advanced geostatistical analyses of both the openings and closures of every rural and urban municipal, private, and state run school in Brazil for eight time periods.<sup>7</sup> We then employed the Getis Ord\* spatial statistic to identify "hotspots," or statistically significant spatial concentrations of rural school closures. The first step in this process was to conduct an analysis of the school closure data for spatial autocorrelation (Moran's I). This test explores whether there is statistically significant spatial clustering in a variable. In our study, municipalities with high degrees of school closures might be likely to have adjoining municipalities with similar trends. The results of this test indicated that the school closure data were spatially autocorrelated (Moran's I;  $Z=31.0$ ,  $P=0$ ), and that we should proceed with the hot spot analysis. Given the high P-value for this test, indicating statistically significant clustering, we then

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<sup>5</sup> This decision was made because we found through our triangulation of the data that the Census School Tables showed some educational institutions that had already been excluded in previous years (especially in Censuses prior to 2007). Thus, to obtain the correct number of closed schools without duplication, we used biannual comparisons to minimize the margin of error.

<sup>6</sup> Extensive triangulation was necessary to clarify data inconsistencies. For example, individual schools changed status from year to year; these changes could be in terms of location (from rural to urban or vice versa), in the type of operation (in activity, paralyzed, or extinct), in the municipality code (if a municipality was divided), or in administrative dependency (changing from a federal to a state, municipal, or private school). An example would be a school which in 2012 was state/paralyzed/urban but in 2013 might be registered as municipal/active/urban. In other words, the same school had changes in two variables (type of operation and administrative dependency).

On other occasions, schools that had been listed as rural became re-registered as urban. In this case, if the school had the variable "in activity" or "paralyzed" in the previous year, it was not counted as closed, even though the location variable had changed. Thus, if a given municipality registers as urban a school that was rural in the previous year, it does not mean this school has been closed. The fact that it no longer appears in the "rural" filter does not mean that it no longer exists.

<sup>7</sup> We divided the school closure data into eight time periods, corresponding to the federal election cycles (1994; 1998; 2002; 2006; 2010; 2014; 2016; 2020).

conducted the hot spot analysis (Getis-Ord\*). This test helped us to answer our first question: where are school closings concentrated? The findings from these analyses are presented and discussed below in the results section (Figure 3).

The second stage of our analysis centered on uncovering the factors driving the closures. We began by creating an extensive database of additional variables, which based upon our understanding of the literature, we believed to be potentially salient in structuring the spatial patterning of closures. Among the variables were municipal rates of illiteracy, post-secondary education, and number of courses associated with *Educação do Campo*; agricultural variables, including the GINI index of land concentration, the percentage of small-scale family farmers at the municipal level, the proportion of farmers who were landowners; and demographic data, including socioeconomic status and race.

Data were analyzed using the STATA Core (version 17) program. We began our analysis of these variables by first conducting a random effects negative binomial panel analysis; this is used when there are longitudinal data consisting of at least two time points (Baltagi 2021).<sup>8</sup>

Although the dataset we compiled for the hotspot analysis spanned twenty-five years (1994-2020), the multi-variate analyses were restricted to two periods (2006 and 2017), when the most complete observations were available. Because of restructuring at the municipal level, municipalities have been created and/or consolidated at various points in time. Those that did not exist in the 1990s naturally had missing data.<sup>9,10</sup>

#### 4. Results

We begin by presenting the descriptive results from our analyses. In the following tables, we have grouped and presented our findings geographically, underscoring the regional nature of the school closure phenomenon. Our choice to present the data by region is grounded in empirical observations and theoretically informed by trends in political ecology. Since Blaikie and Brookfield (1987) first described their focus on *regional* political ecology, the concept of the region has been extensively debated (Neumann 2010; Galt 2016; McKinnon & Hiner 2016). Regional disparities across variables as diverse as education level, economic productivity, and literacy are pronounced, as are rural school closures (Fernandes & Tarlau 2017).

In Table 1, we illuminate an alarming crisis facing rural communities. A staggering 65% of rural Brazilian schools have been closed in the last 25 years. Our framework recognizes the critical differences between *Educação do Campo* and rural education (Meek 2020), which underscore key questions of spatial justice. Table 1 shows a vaulted regional inequality in school closures: in the Central-West and Southern regions, for example, 80% and 83% of schools shut their doors. It is here that a political ecology lens focused on regional dynamics is illuminative: the Central-West and Southern regions of Brazil are where agribusiness has the most substantial degree of territorial control. Similarly, the North and Northeastern region, with high numbers of school closures (58% and 63% respectively) have the largest percentage of people of color (including peasants and Indigenous communities). Agribusiness has rapidly expanded into these regions over

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<sup>8</sup> There were three reasons we chose to conduct the random effects negative binomial panel analysis. First, there is minimal variation in the number of school closures within some municipalities (see Table 1), in other words, many municipalities have very few school closures. Given that there was minimal variation in the school closures, our second reason was that we found that the dependent, or outcome variable (school closure) was overdispersed ( $\bar{x} = 2.41$ ,  $SD = 8.19$ )<sup>8</sup>, which means that most municipalities had very few closures, but that those with more numerous ones were driving up the standard deviation. Third, we chose to conduct this panel analysis because we ran a non-significant Hausman specification test, which tests whether the random effects model is preferred over the fixed effects model ( $\chi^2(11) = 3.70$ ,  $p = 0.81$ ). Based on this, we can fail to reject the null hypothesis that the random effects estimator is constant and conclude that the random effects model is preferred (Baltagi 2021).

<sup>9</sup> This was not the case for the school closure data, as INEP had retrospectively updated their datasets so that new municipalities in older data sets had information based upon contemporary municipal codes.

<sup>10</sup> Although there was a total of 11,140 observations before analysis (N of 5,570 x 2 time periods, our final analytical sample consisted of 10,824 observations, which is smaller by 316 observations as we needed to complete a listwise delete, because data were missing for at least one co-variate for a municipality.

last few decades, principally with the assistance of international financial capital (Sauer 2018; da Silva & Bampi 2019). Importantly, these elevated regional indices of school closures overlap with high levels of grassroots political resistance. Regions where we see the largest degree of social mobilization against the closures of schools are exactly where there is the greatest precarity in educational infrastructure. For example, the Southeastern region, in which 59% of rural schools were closed, is one of the most urbanized regions, with an intense presence of agribusiness in rural areas, but also an extremely active presence of the Landless Workers Movement.

	<i>Rural Federal Schools Closed</i>	<i>Rural State Schools Closed</i>	<i>Rural Municipal Schools Closed</i>	<i>Rural Private Schools Closed</i>	<b>Total Rural Schools Closed</b>	<b>Total Rural Schools in Brazil between 1994 and 2020</b>	<b>% of Rural Schools closed relative to the total number of rural schools between 1994 and 2020</b>
<b>North</b>	15	2,515	20,195	116	22,841	39,354	58%
<b>Northeast</b>	85	1,996	65,996	1,130	69,207	109,474	63%
<b>Southeast</b>	1	5,618	12,242	131	17,992	30,531	59%
<b>South</b>	11	2,131	22,026	153	24,321	29,308	83%
<b>Central-West</b>	4	126	7,878	32	8,040	10,047	80%
<b>Total</b>	<b>116</b>	<b>12,386</b>	<b>128,337</b>	<b>1,562</b>	<b>142,401</b>	<b>218,714</b>	65%

Table 1: Rural School closures by type and region 1994-2020.

There is an institutional politics to the type of schools that are being closed. Interrelations between political institutions help to shape political ecologies (Hempel 1996). Our analysis offers a fine-scale reading of how school closures are differentiated institutionally. The Brazilian School Census codes schools as based upon four administrative categories: Federal, State, Municipal, and Private. Our results highlight that 90% of all rural school closures are occurring in municipal schools, 9% in state schools, and around 1% in Federal and Private schools (see Figure 1). Municipal schools are largely responsible for elementary education (*Ensino Fundamental*), state schools for secondary and vocational education (*Ensino Medio*) and the Federal Schools teach vocational material. Higher education is also federal. The private schools, by contrast, attend to each level, depending upon the interest of the specific institution.

By bringing the results from Table 1 and Figure 2 into dialogue, we observe that the local government's policies for rural schools over the last twenty-five years has been one of intensifying the process of school closures. Some of the central reasons for the closure of rural schools are the invisibilization of differences between schools of the countryside and urban schools, and the disputes identified above between the paradigms of *Educação do campo* and rural education. Urban education disavows the territorialities of peasant communities, preventing children and youth from having the opportunities to learn about their territories. The closure of rural schools, and in particular, those that focus on elementary education is a major impediment to these communities participating in and contributing to the agroecological development of their territories. These populations are then further condemned by the predatory development practices of agribusiness, which further deterritorializes them. The difference between the proportion of schools closed in elementary education (90%) with those closed in secondary education (9%) underscores the difficulty facing rural youth in receiving a basic education, and in turn being prepared for secondary, and ultimately

higher education. These stark realities underscore the need for policies that emphasize education of the countryside.

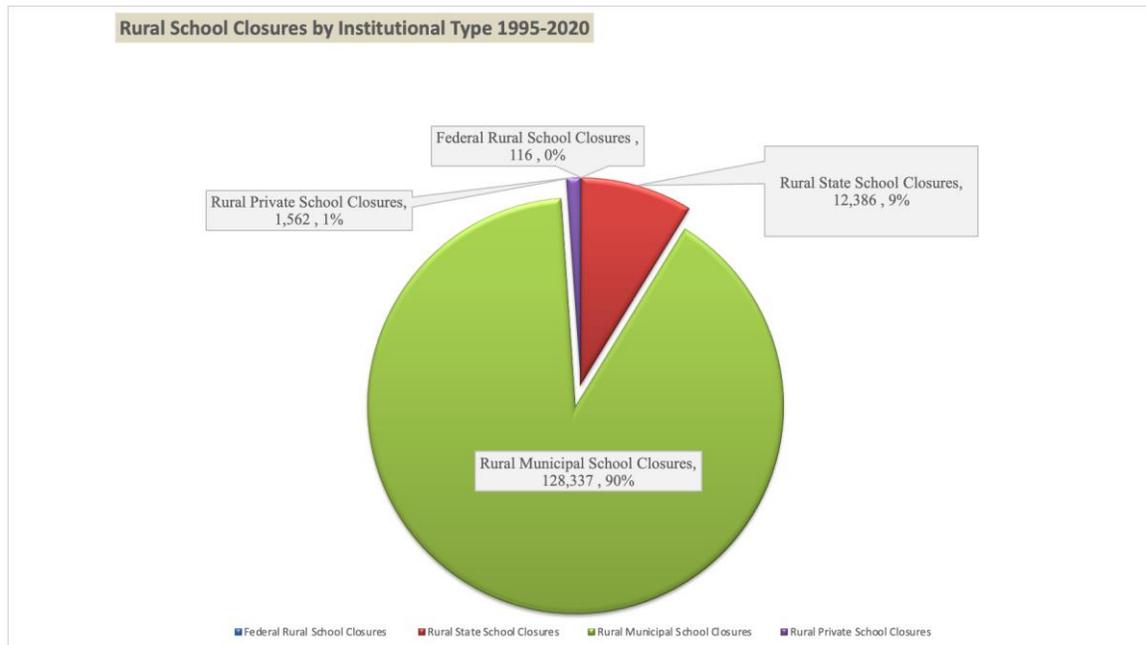


Figure 1: Rural School closure distribution by type.

Moving forward with our regional analysis, we present results on the number of school closures per region, as broken down institutionally. Reading Table 1 alongside Figure 2, we see that half of the elementary schools closed were in the Northeast. This is also the region that closed the most elementary schools in the last twenty-five years, as followed by the South and North regions. Taken together, the North, which comprises most of the Amazon, and the Northeast, are the regions with the largest number of peasant communities. The Southern region, where the peasantry has begun to be reterritorialized following a long process of migration to the cities, is also confronting the grave problem of rural school closures. The geographic ubiquity of this phenomenon highlights that in twenty-five years, public policies have not been able to prevent the process of rural school closures. We understand that the geographic ubiquity of this issues lies in the hegemonic model of agribusiness development that seeks to deterritorialize peasant communities among other traditional populations, in order to appropriate their territories and exploit their resources for export-oriented commodity production of commodities.

For a more detailed analysis of the territorial distribution of school closures, we present Table 2, where we can see at a finer scale, which states have the highest percentages of school closures. Rondônia, which is in the North region, on the western side of the Amazon is of immediate concern, having closed 89% of its schools. Those states with the second highest percentages in the country are found in the Southern region: Paraná, Santa Catarina and Rio Grande do Sul. This is followed by the Central-West region, which also has three states with high percentages: Mato Grosso, Goiás and Mato Grosso do Sul, which is the state that most closed schools in Brazil, that is, it closed 93% of its rural schools.

State acronym	<i>Rural Federal School Closed</i>	<i>Rural Estadual School Closed</i>	<i>Rural Municipal School Closed</i>	<i>Rural Private School Closed</i>	<b>Total Rural Schools</b>	<b>Total Rural Schools between 1996 and 2020</b>	<b>% of Extinct rural schools in relation to the total number of existing rural schools between 1996 and 2020</b>
RO	2	38	3,358	10	3,408	3,844	89%
AC	-	940	687	3	1,630	2,827	58%
AM	-	18	4,076	13	4,107	8,476	48%
RR	2	332	156	2	492	1,114	44%
PA	5	982	9,050	77	10,114	18,438	55%
AP	-	108	95	3	206	681	30%
TO	6	97	2,773	8	2,884	3,974	73%
MA	52	240	12,268	380	12,940	21,708	60%
PI	7	199	6,854	50	7,110	10,341	69%
CE	2	122	12,603	244	12,971	17,562	74%
RN	9	444	2,098	31	2,582	5,051	51%
PB	3	510	4,539	32	5,084	7,744	66%
PE	5	126	5,248	220	5,599	9,903	57%
AL	1	133	1,862	90	2,086	3,872	54%
SE	-	62	710	6	778	1,930	40%
BA	6	160	19,814	77	20,057	31,363	64%
MG	-	352	8,044	29	8,425	15,819	53%
ES	1	1,106	2,107	15	3,229	4,810	67%
RJ	-	255	585	44	884	2,885	31%
SP	-	3,905	1,506	43	5,454	7,017	78%
PR	5	200	7,702	27	7,934	9,374	85%
SC	3	1,152	5,806	69	7,030	8,305	85%
RS	3	779	8,518	57	9,357	11,629	80%
MS	3	15	885	4	907	973	93%
MT	-	29	3,451	10	3,490	4,643	75%
GO	1	56	3,542	17	3,616	4,316	84%
DF	-	26	-	1	27	115	23%
<b>Total</b>	<b>116</b>	<b>12,386</b>	<b>128,337</b>	<b>1,562</b>	<b>142,401</b>	<b>218,714</b>	<b>65.11%</b>

Table 2: Closed rural schools by state and school type between 1995 and 2020.

Next, we turn our attention to how questions of power and political economy shape the spatial patterning of school closures. While we know that the closing of rural elementary schools is inherently tied to questions of local power dynamics, and decisions made by municipal officials, it is crucial to remember that resources for education come from the Federal Government's Fund for the Maintenance and Development of Education and the Valorization of Education Professionals – FUNDEB. Therefore, the closure of rural schools must be analyzed in relation to questions of political economy and governance at each of the three levels: local, state and national.

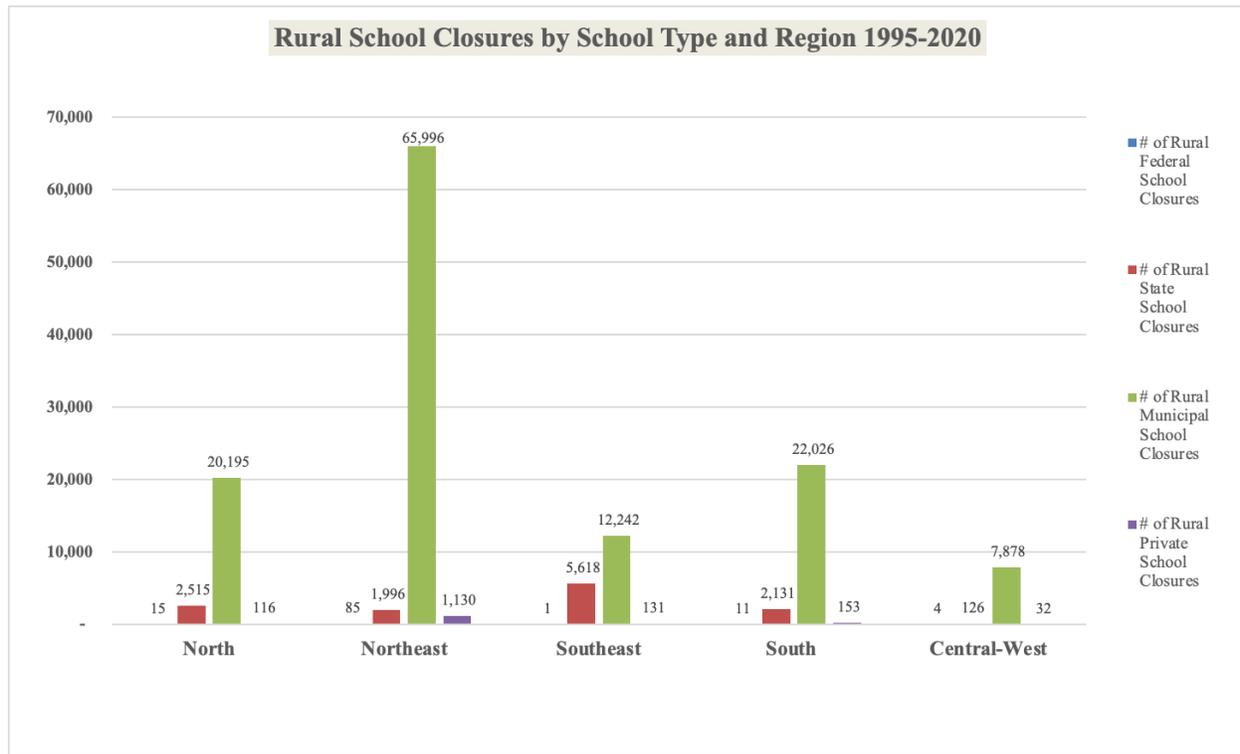


Figure 2: Rural school closures by type and region 1995-2020.

Election year	1994	1998	2002	2006	2010	2014	2016. Political coup	2018	Total	Total %
Term	1995 - 1998	1999 - 2002	2003 - 2006	2007 - 2010	2011 - 2014	2015	2016 - 2018	2019 - 2022		
north	5,995	5,513	4,103	2,037	2,179	732	1,232	1,050	22,841	16.04%
northeast	18,884	14,140	10,042	4,209	6,455	2,090	7,998	5,389	69,207	48.60%
southeast	4,476	3,050	3,791	1,827	1,805	920	1,455	668	17,992	12.63%
south	5,496	10,699	3,593	1,423	1,394	348	885	483	24,321	17.08%
center-west	2,799	2,816	1,406	419	297	61	162	80	8,040	5.65%
<b>Total</b>	<b>37,650</b>	<b>36,218</b>	<b>22,935</b>	<b>9,915</b>	<b>12,130</b>	<b>4,151</b>	<b>11,732</b>	<b>7,670</b>	<b>142,401</b>	
President :	Fernando Henrique Cardoso	Fernando Henrique Cardoso	Luis Inácio LULA da Silva	Luis Inácio LULA da Silva	DILMA Rouseff	DILMA Rouseff	Michel Temer	Jair Bolsonaro		
%	26.4	25.4	16.1	7	8.6	2.9	8.2	5.3		

Table 3: Rural schools closed by federal election cycle between 1994 and 2020.

Table 3 shows the importance of political change on the school closure crisis. It illustrates the election years, which federal government was in power, the percentage of schools closed by each government, and the total number of rural schools closed by Brazilian region. In the period from 1995 to 2020, Brazil lost 65.1% of its rural schools, without any government working to substantially slow the phenomenon. It was

only civil society actors, and in particular, Brazil's Landless Workers' Movement, which began a campaign denouncing this policy that affects millions of people. Of the 142,401 rural schools closed during the study period, 73,868, or 51.8%, were closed during the two administrations of the Fernando Henrique Cardoso (FHC) government. During the two administrations of the Luiz Inácio Lula da Silva administration there was a considerable decrease in rural school closures to less than half of the FHC administration: 32,850 schools were closed, or 23.1%. In the first term of the Dilma Rousseff government, the average annual number of schools closed decreased further to 3,588, whereas in the Lula government it had been 4,106 and in the FHC government it was 9,233 schools closed per year. In the second term of the Dilma government, which ended abruptly with Brazil's 2016 political coup, the number of school closures fell once again (4,151 or 2.9 %) and then rose sharply after the coup with the Temer governments (11,732 or 8.2%). Most recently, under the Bolsonaro government the number of school closures somewhat subsided from its immediate rise under Temer (7,670 or 5.3%).

Scaling out, we see that the school closures are a process whose ebb and flow has been marked by patterns of political change. From its high point under the conservative FHC administrations, the number of school closures began to fall during leftist President Lula's first term, and then dropped by more than 50% during Lula's second term. As Dilma, also part of the leftist PT party, took power the school closures began to rise, but then fell to their lowest levels in the twenty-five year study period. Of note, however, is that Dilma's second term was cut short by the 2016 political coup, and so while there was a marked decrease, these numbers need to be understood according to the curtailed length of her political tenure. Underscoring the impact of political change, following the coup, we see the number of school closures rise precipitously (11,732 or 8.2%), before falling somewhat under Bolsonaro (8,040 or 5.3%).

Figure 3 presents results from our geostatistical analysis of the school closures. These results are grouped according to the years of the Federal and state election. The first two maps in the time series refer to the periods in which more than half of the schools were closed. One of the central findings of this research is that the highest regional concentrations of school closures were in the Northeast and Southern regions. A marked difference can be observed when one contrasts the first three maps with the last five. What policies were adopted during this period, particularly in the southern region of Brazil? Similarly, this map opens questions surrounding the geographical ebb and flow of school closures: the Western Amazonian state of Rondônia, for example, was a persistent hotspot of school closures throughout the 1990s and early 2000s; however, in 2010, our results suggest that the state was no longer a significant site of school closures, and that until the present they have remained non-significant. What social, political, and economic changes took place in Rondônia during this period to effectively reverse what had been the highest level of school closures in Brazil (89%)?

We now turn from an analysis of the school closures themselves to the factors that are driving this phenomenon. In Table 4, we present the results from multivariate analyses of the factors predicting rural school closures.<sup>11</sup> One of our central findings was that land concentration is highly correlated with an increase in the rate of school closures. Our results show that a one-unit increase in the GINI index was associated with a 228% increase in the rate of school closures. The GINI variable had the largest effect size, while controlling for other variables in the model. We interpret these results to suggest that municipalities with high levels of land concentration are also those municipalities where there are elevated indices of school closures.

Our second primary finding was the effect of racial demographics on predicting school closures. As the proportion of Black residents in a municipality (both rural and urban) increases, the incident rate of rural closures increased by 175%. Our analysis of these results suggests that school closures are happening more, with statistical significance, in communities of color than in non-Black dominant communities. These results intersect with one of our secondary findings surrounding the linkages between the school closures and agrarian reform. Social movements, such as the MST have decried these closures as happening predominantly in communities where there are agrarian reform settlements. Our results support this, indicating that as the number of settled families increases the incident rate of closures increases by 6%. While the presence of

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<sup>11</sup> The type of analysis that we conducted was a negative binomial regression.

agrarian reform settlements is not as strong a predictor as communities of color, we interpret these results as indicating that the school closure crisis is one in which *escolas do campo* are in particular danger of closure.

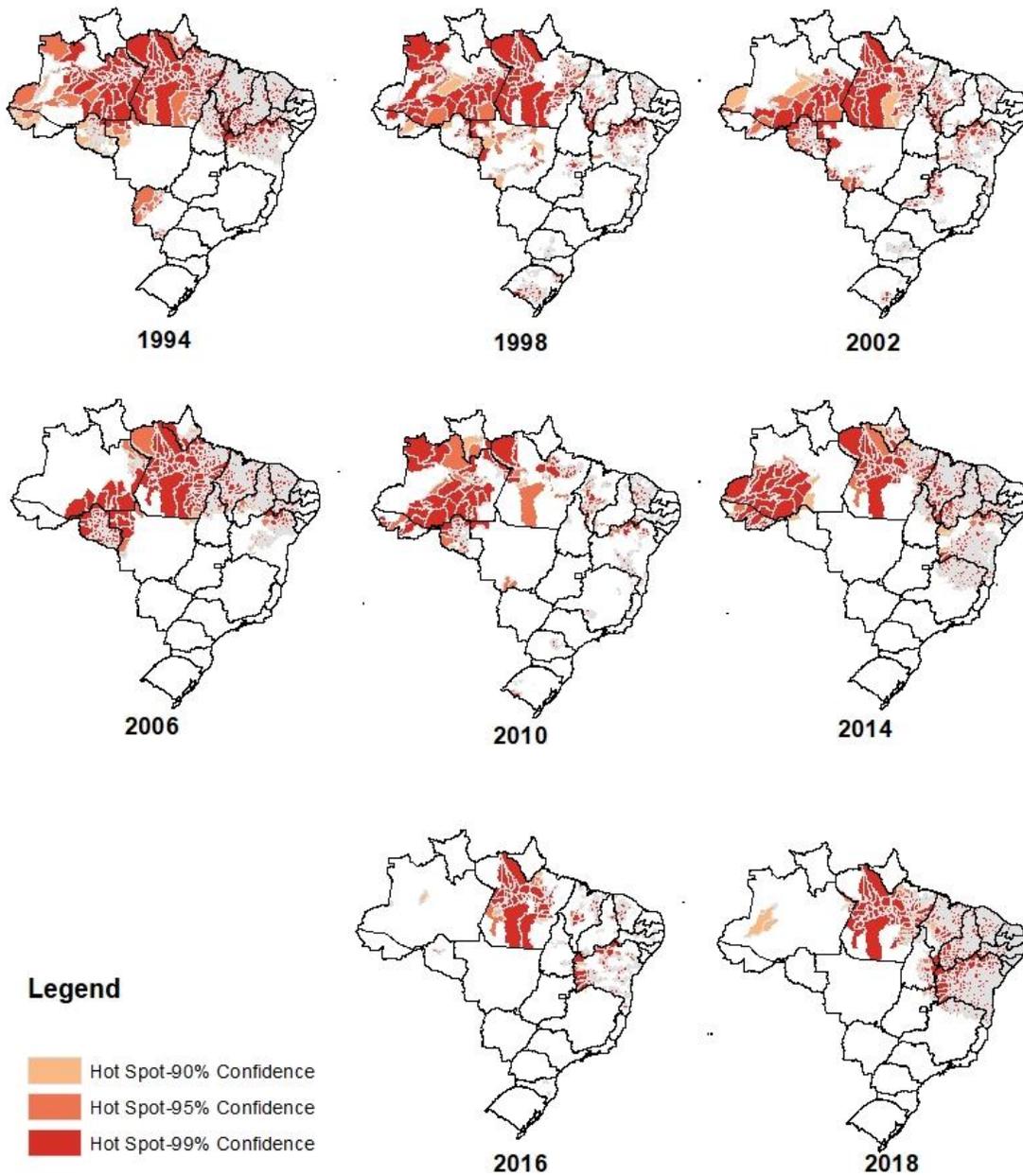


Figure 3: Hotspots of rural municipal school closures grouped by election cycles.

Our third key finding surrounds the dynamics of agrarian transition. There are three sets of results that we thematically understand to be associated with the broadscale transition from family farming to agrarian capitalism.

- First, our analysis shows there is a statistically significant relationship between the percentage of the municipality covered by small landholdings (>200 ha) and the incident rate of school closures.
- Second, our results indicate that as the proportion of farmers who are not landowners increases, the incident rate of closures decreases by 31%.
- Third, we found that as the proportion of non-subsistence farming (i.e. corporate agriculture) in a municipality increases, there is a 38% percent decrease in the rate of school closures.

These statistical results might seem contradictory to the narrative analysis we've developed. However, our interpretation is that many small landholdings (those of less than 200 ha) are in a process of agrarian transformation from small family farms to small commercial ones characterized by the intensification of wage labor, mechanization, and ranching activities. These farms are frequently not run by individuals who own the land, and are not producing for subsistence, but for commercial markets. Our reading is in line with a robust literature on processes of class differentiation, which discusses the dissolution of the peasant class alongside the transition from family farming to agrarian capitalism (McMichael 1997, 2012; Bernstein 2004, 2008). In the broader metropolitan region of São Paulo, for example, small farms are increasingly becoming capitalized, relying upon wage labor, and growing ornamental plants with intensified production. As small farms transition from family owned to commercial, there is less of a need for schools for rural students. An increase in small farms, run by non-landowning individuals, that engage in commercial production is associated with a transition to agrarian capitalism, a process of depeasantization, and the ensuing closure of rural schools.

A final finding of note is that in our model the incident rate of closures for 2017 is 0.88 times the incident rate for 2006 (the reference group), indicating that there is a significant decrease in the incident rate of school closures in the later year. In reviewing the data, we believe this to be because there are many more municipalities that have zero closures.

Although we see marked differences in terms of the changes in rates in school closures during the different political periods, the political ideology of the winning party, whether right, center, or left was not a statistically significant variable. Our interpretation is that there are other political and power dynamics more salient in impacting school closures than those at the federal level. For example, the rural schools that are principally being closed are those offering basic education; these are under the administration of municipal administrations. While these local administrations are impacted by state and federal level policies, they can make independent decisions, about school closures and other matters. Future research would benefit from exploring at the local level how municipal political change, in particular, for elections that were tightly contested, translates into school closures. One hypothesis to explore in the future would be whether in municipalities with close elections, clientelism and vote-buying are factors that can predict the decrease in school closures.

	<b>Incident Rate</b>			
	<b>Ratio (IRR)</b>	<b>SE</b>	<b>95% C. I.</b>	
GINI	3.28**	1.15	1.65	6.51
Small land holdings (Percent area of landholdings under 200 ha)	1.01***	0.01	1.00	1.04
Urbanization	0.49***	0.06	0.39	0.63
Proportion of Black residents	2.75***	0.4	2.06	3.66
Political elections				
Left	(reference)			
Center	0.98	0.08	0.84	1.15
Right	0.96	0.06	0.85	1.09
# of Settled Families	1.06***	0.01	1.01	1.9
% Illiterate Farmers	1.32	0.24	0.92	1.88
% non-Land owning Famers	0.69**	0.1	0.52	0.91
Subsistence Agriculture	1.08	0.1	0.9	1.29
Non-subsistence Agriculture	0.62*	0.16	0.37	1.02
Year variable (Differences between 2006 and 2017 school closures)	0.88***	0.01	0.86	0.9
Wald X2 (significance of overall model)	695.26 (12)***			
N (groups)	5412			
n(obs)	10,824			
Time	2			

Note. \*\* p < .01, \*\*\* p < .001

Table 4: Negative binomial panel data analysis predicting rural school closures.

## 5. Conclusions

The politics of knowledge have long been at the core of political ecology. For example, as Roderick Neumann argues in the opening to the now-classic work *Making Political Ecology*, "The environment and how we acquire, disseminate, and legitimate knowledge about it are highly politicized, reflective of relations of power, and contested" (2005: 1). Yet despite this focus on the politics of knowledge in political ecology, the role of education in forging and disseminating this knowledge was largely unexplored by political ecologists for several decades. In this article, we have sought to contribute to further developing the political ecology of education as an area of inquiry. Our contributions are theoretical and methodological in nature.

First, our analysis of rural school closures in Brazil has illuminated the importance of considering race from a political ecology of education perspective. As educational scholars and activists know all too well, race is a variable that plays an inordinate role in structuring access to educational resources, opportunities, and knowledge. When explored from a political ecology perspective, our analysis highlights that race is also a factor that structures pedagogical content. The *Educação do Campo* movement in Brazil is intersectional at its core, tying together the knowledges of Brazil's black, Indigenous, and peasant communities through a

dialogue of knowledges (*dialogo das saberes*) (Martinez-Torres & Rosset 2014). Similarly, our empirical results underscore that the racial inequity that has long structured Brazil's educational system is a key factor in the unfolding crisis of school closures. As our results highlight, race is a statistically significant factor in predicting Brazil's rural school closures. Unsurprisingly, from a political ecology perspective, questions of racial and agrarian justice are intertwined. In our analysis, the GINI index had the strongest effect size in predicting school closures; for every one unit increase in the GINI there was a 228% increase in school closures. Our analysis of these empirical results suggests that agrarian structures of inequality are not never exclusively about material territory; rather they are about controlling the landscape of ideas. When structures of agrarian land concentration and racial injustice overlap, our results suggest that this becomes a political ecology of education characterized by crisis—school closures, rural dispossession, and the arrival of agrarian capitalism are often in process.

Our article offers political ecologists of education an overlapping set of intersectional lenses. First, we suggest attention must be paid to how histories of structural violence condition the racialization of space and education. Colonialism, which was predicated upon plantation agriculture, structured racialized geographies of labor, power, and knowledge production—not just in Brazil but throughout the colonial world. These racialized geographies of production became only further entrenched in Brazil following independence. Second, our results underscore the importance of considering land itself from an intersectional perspective. The concentration of land was a highly significant factor in predicting municipalities with elevated indices of rural school closures. From an intersectional political ecology of education perspective, it becomes clear that just as land is racially concentrated in White hands, so too is knowledge. Third, we explore how intersectionality can structure resistance in the educational sphere. *Educação do Campo* synthesizes concerns about how the convergence of racial, ethnic, gender, and ability conditions inequities in education, and what a endogenous visions of education might look like when grounded from that subaltern vantage.

Methodologically, this research has helped advance the toolkit that political ecologists of education can mobilize to analyze how questions of knowledge production structure access to and control over the natural environment. Through combining advanced geospatial analyses and multi-linear regression techniques we were able to answer a fundamentally spatial question about Brazil's rural school closure crisis: where are the closures happening, and is there a spatial logic to their patterning? Our results demonstrate that these closures are clustered in a statistically concentrated pattern—with hotspots in the North, Northeast, Center, and South. By analyzing the descriptive statistics associated with these closures, we were able to identify non-statistically significant patterns associated with the ebb and flow of political change. While the school closures were highest during the conservative regimes of the late 1990s, they decreased substantially during the leftist presidencies of the 2000s, only to increase again after the coup of 2016. What other factors could be responsible for explaining this patterning? Continuing to explore this question will help shed light on the contemporary face of the agrarian question in the 21<sup>st</sup> century.

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