

Environmental racism: history and concepts for science teaching

ABSTRACT

This text discusses environmental racism as a form of systemic violence that affects minorities by severing their relationship with nature, causing illness and death in complex ways based solely on racial criteria. The objective is to reflect on the knowledge historically produced regarding this concept in articulation with Science Education. Initially, the historical transformations surrounding the definition of environmental racism are analyzed, highlighting both the presence of the Black population's political struggle in its formulation and the veiled absence of the term *racism* within environmental justice studies. In the Brazilian context, the analysis draws on the concept of necropolitics to demonstrate how colonial legacies and the myth of Brazilian racial democracy erase racism in society, which in turn is reflected in an Environmental Education where racial issues are also absent. The hypothesis is that both the main strands of Environmental Education and the CTSA (Science-Technology-Society-Environment) and socio-scientific approaches fail to recognize racism as a central element for reflecting on Science Education and environmental issues. In light of this, the essay proposes the incorporation of Black and ancestral perspectives as pathways to contribute to reflection on this theme in the training of science educators.

KEYWORDS: Environmental racism; Racial issues; Necropolitics; Science education..

Paloma Nascimento dos
Santos
palomans@ufba.br
orcid.org/0000-0002-2480-4666
Universidade Federal da Bahia
(UFBA), Salvador, Bahia, Brasil

Racismo ambiental: história e conceitos para o ensino de ciências

RESUMO

Este texto discute o racismo ambiental como uma forma de violência sistemática que atinge minorias, afastando-as de sua relação com a natureza, provocando adoecimento e morte de maneiras complexas, baseando-se apenas em critérios raciais. O objetivo é refletir sobre o conhecimento produzido historicamente a respeito desse conceito em articulação com o Ensino de Ciências. Inicialmente, são analisadas as transformações históricas em torno da definição de racismo ambiental, destacando a presença da luta política da população negra para sua formulação, e a ausência velada da palavra racismo dentro dos estudos para a justiça ambiental. No contexto brasileiro, a análise se apoia no conceito de necropolítica para evidenciar que as heranças coloniais e o mito da democracia racial brasileira apagam o racismo em nossa sociedade, e isso se reflete em uma Educação Ambiental em que as questões raciais também estão ausentes. Parte-se da hipótese de que tanto as principais vertentes da Educação Ambiental quanto as abordagens CTSA (Ciência- Tecnologia-Sociedade-Ambiente) e sóciocientíficas não reconhecem o racismo como elemento central para pensar o Ensino de Ciências e questões ambientais. Diante disso, este ensaio propõe a incorporação de perspectivas negras e ancestrais como caminhos para contribuir com a reflexão sobre a temática na formação de educadoras e educadores das ciências.

PALAVRAS-CHAVE: Racismo ambiental; Questões raciais; Necropolítica; Ensino de Ciências.

INTRODUCTION

Listing environmental problems and offering a critical elaboration on them, one that considers historical, social, political, and economic contexts, constitutes a recurring activity in science classrooms. Topics such as the environment, sustainability, ecology, industrial accidents, mineral exploitation, deforestation, the climate crisis, and the emergence of the *Capitalocene* are part of an education in science that seeks to promote learning aimed at environmental justice.

Environmental justice is a principle that recognizes humanity in people through the right to and protection of the relationship between human beings and the environment, relying on laws, environmental regulations, and public health safeguards (Bullard, 1996). It is fundamental to ensure people's existence with themselves, the planet, and others who inhabit it. For this reason, it is an interdisciplinary principle that expanded from legal fields into education. To educate for environmental justice is to employ scientific and political foundations to understand the relationship between humanity and nature, including its multiple conceptions.

This diversity of concepts mobilized in the pursuit of justice, and the manner in which these discussions entered Science Education, are often unknown to students and teachers, who instead have greater exposure to Environmental Education. The latter can be defined as a field that encompasses educational processes linked to values related to the environment and humanity in all their complexity and breadth (Carvalho, 2009). Pedagogical practices and actions derived from Environmental Education are studied within Science Education by considering its macro-trends (conservationist, pragmatic, and critical), with the trend of Critical Environmental Education being the one that, in recent years, has articulated strategies committed to environmental justice (Layrargues, 2014).

Even so, if the purpose of these two broad areas is to guarantee the development of citizens' critical capacity within a school context, through popular, emancipatory problematization and critique of capitalism, why is environmental racism absent from environmental discussions in Science Education? Critical research employing a variety of methodological approaches in Environmental Education and Science Education (Trein, 2012; Guimarães, 2004; Luz et al., 2018; Silveira & Lorenzetti, 2021; Martins & Schnetzler, 2018) points to pathways for learning aimed at combating injustices, yet environmental racism remains absent as a concept operating within environmental issues.

The methodology of this text is based on the construction of a theoretical essay, which by its nature does not aim to produce an exhaustive survey or historical analysis (Adorno, 2022). A theoretical essay consists of a logical and reflective exposition in which argumentation develops from a hypothesis (Severino, 2016). The central hypothesis of this essay is that, as science educators, we do not know how to engage with environmental racism because we do not know it as a concept. From this hypothesis, the essay unfolds around three focal points: (1) a discussion integrating the genesis of the concept of environmental racism with the Brazilian context and the construction of environmental themes; (2) the silencing of environmental racism within Science Education; and (3) the possibilities of research and pedagogical actions grounded in black and afro-Indigenous theories, both Brazilian and Latin American, which represent radical

ruptures with this silence. Environmental racism is a form of violence that severs groups' relationships with nature, their lands, territories, cultural, religious, and epistemic practices, based solely on racial criteria. This violence bears characteristics akin to the biopolitical control project of necropolitics (Mbembe, 2018), a concept that helps us understand similarities and differences when analyzing a specifically Brazilian environmental racism and its absence from Science Education.

CONCEPTUALIZING ENVIRONMENTAL RACISM

In 1982, in Warren County, North Carolina (USA), trucks were dumping oil waste contaminated with polychlorinated biphenyls (PCB) along its roads. Historically, this region had been an area of tobacco and cotton cultivation and, prior to the American Civil War, had one of the largest free black populations in the area. Known as a region deeply marked by slavery, Warren County's population in 2020 was 18,642, with 48.54% identifying as Black or African American (US Census Bureau, 2020).

The state of North Carolina attempted to mitigate the impact of the waste disposal by purchasing land to build a landfill specifically designated for contaminated soil. The county's population, whose leadership included figures connected to the Civil Rights Movement, organized strategically to incorporate the racial dimension into their opposition to the landfill. This was not merely a protest against pollution—it was an environmental issue, but also a matter of Black rights, workers' rights, and the rights of Native Americans. During the protests and discussions, the term *environmental racism* was coined by Reverend Benjamin Chavis (Pulido, 2016), former head of the Commission for Racial Justice of the United Church of Christ. After the term's creation, its definition was systematized by Robert Bullard's studies (Bullard, 1993a; Bullard, 1993b; Bullard, 1996).

Initially, environmental racism was named to emphasize that it is a key factor in environmental decision-making and one carried out by governmental, legal, economic, political, and military institutions. For Bullard (1993a), naming racism is essential to identify which groups are most exposed to environmental and health risks. He also noted that communities living in high-pollution areas are those in precarious housing, with under-resourced schools, chronic unemployment, high poverty rates, and an overburdened healthcare system. When asking who these people are, the author highlighted that black and latin populations were those living in the most polluted areas of Los Angeles, while being excluded from environmental decision-making boards, commissions, and governmental agencies (or included only symbolically) (Bullard, 1993a). This situation marked the first phase in articulating environmental racism, grounded in U.S. perspectives and tied to a lack of social power, even though the term emerged from the political effervescence of the Civil Rights Movement and localized events that required small Black communities to organize.

The lack of social power expands the reach of environmental racism, as it intertwines with public policies and the State's relations with major corporations and industries. This amalgam privileges whiteness, enabling the transfer, exploitation, and seizure of Black territories—or keeping these communities at risk. Environmental racism occurs when decisions about land use are controlled by

the dominant white group, reflecting a social structure of power circulation. The commissions that plan, map, divide, and regulate environmental organization in cities, territories, and nations lack racial, ethnic, and gender diversity. This, too, is a significant feature of environmental racism practices (Bullard, 1993b).

Later, Bullard directed his critique toward researchers who reduced environmental justice to analyses of hazardous waste locations studied by sociologists (Bullard, 1996). He therefore offered a definition of environmental justice as “the principle that all people and communities are entitled to equal protection of environmental and public health laws and regulations” (Bullard, 1996, p. 493). Early studies on environmental racism sought to dismantle misconceptions equating environmental justice and environmental racism. Finally, a systematized concept of environmental racism emerged. For Bullard (1996, p. 497), environmental racism is “any policy, practice, or directive that differentially affects or disadvantages (intentionally or unintentionally) individuals, groups, or communities based on race or color.”

Environmental racism is but one dimension of a broader universe of struggles for socio-environmental justice known as environmental justice. Though conceptually distinct, the movement brings together Black groups, workers, traditional environmentalists, Indigenous peoples, and anti-pollution movements. The antiracist movement within mainstream environmentalism exposed the exclusionary white elitism of organizations fighting against pollution or in defense of natural resources. It was necessary to create spaces for local communities to voice their concerns and propose solutions, as their knowledge would organize a powerful grassroots environmental justice movement (Pulido, 2017).

During the 1990s and 2000s, key structural principles for environmental justice were consolidated. In 1991, the first National People of Color Environmental Leadership Summit took place, defining 17 principles for promoting environmental justice globally. The document begins with the phrase “*we, people of color*” (NPLC Summit, 1991), asserting its voice politically. These principles affirm the sacredness of Mother Earth, demand environmental justice policies for all peoples, defend diverse forms of life, and require protection from exploitation, contamination, testing, extraction, and production that threaten fundamental rights to clean air, water, land, and food. They also affirm the right of all peoples and communities to political, economic, cultural, and environmental self-determination. They guarantee the participation of racialized communities in all decision-making processes, including needs assessments, planning, implementation, monitoring, and evaluation. They affirm workers’ rights to environmental justice, ensuring they are not forced to choose between unemployment and unsafe living conditions (including home-based workers). They protect the rights of victims of environmental injustice and provide for compensation. They denounce acts of injustice by governments as human rights violations and recognize Indigenous peoples’ legal, natural, and political relationships with the land. The principles oppose destructive operations of multinational corporations, military occupation, repression, and exploitation of lands, peoples, cultures, and life forms. They defend the education of present and future generations with emphasis on social and environmental issues, grounded in experience and valuing cultural diversity, and call for consumption choices that minimize the use of Mother Earth’s resources. Such consumption should produce

minimal waste, consciously challenging and redirecting contemporary lifestyles to secure the health of the natural world for current and future generations (NPLC Summit, 1991).

It is important to understand more deeply the relationship between environmental racism and structural racism. Acknowledging this relationship highlights how environmental racism closely aligns with structural racism, especially through policies and practices that normalize and legalize racism. Racism should thus be defined as a system with an organized structure of policies, practices, and norms that confer opportunities to the dominant group while imposing violence and subordination on individuals, groups, or communities deemed inferior (Jones, 2002). Racism is therefore structural, as it sustains social inequalities and injustices and attributes value based on race. Structural racism both benefits and reinforces injustice, privileging some individuals and communities while disadvantaging others. The outcome is the dismantling of any notion of an equal society (including socio-environmental equality), as structural racism strips Black people of their humanity.

The environmental justice movement also prioritizes discussions of identity, diversity, and gender in articulation with environmental racism, given the recognized vulnerability of Black women and Black LGBT+ individuals in contexts of socio-environmental injustice. For these groups, Black feminist theories and critical race theories offer intersectional analyses (Crenshaw, 2015) to better understand how inequalities affect them. Intersectionality operates particularly through a contemporary perspective that conceives of the environment as the place where we live, work, and play. Thus, the environmental and social spheres are not separated; instead, attention is given to where people live, work, and play—and to who is excluded from this triad (Black working women). Moreover, who are those working in public and private spaces, impacted by environmental racism in their daily lives, and distanced from what constitutes them as subjects? (Pulido, 2017).

It was the year 2018 in Maceió, Alagoas capital, Brazil. More than 14,000 homes had to be evacuated because entire neighborhoods were sinking. For over 40 years, a mining company had illegally extracted rock salt, creating underground craters that cracked houses and businesses. The affected peripheral neighborhoods were turned into ghost towns, and the inequality produced by the displacement of families and businesses deepened. Organized resident groups denounced the incident as environmental racism. Where did it occur? What were the health impacts of the subsidence? What are the race and gender of the people who lost their homes and livelihoods?

Beyond the U.S. context, when we consider the close relationship between environmental racism and structural racism, it becomes clear that inequalities caused by environmental racism also manifest in Brazil. For Araújo & Silva Junior (2017), the deeply unequal local reality is a crucial starting point for reflecting on environmental racism within Brazilian injustices. Historically, the Black Movement, Indigenous peoples, and other social groups have denounced injustices such as the exploitation of Indigenous territories, recurrent accidents and contamination events, the exploitation of quilombos, the assassination of Black quilombola leaders, and the invasion of Black and Indigenous lands for monoculture or corporate ventures. In Brazilian cities, Black populations have been displaced to

urban peripheries and denied the possibility of living with dignity due to the violence perpetuated by environmental racism.

Mariana Belmont (2023) recalls our colonial history to stress that Brazilian environmental racism must be analyzed in light of the invasion of our lands and the violence inflicted by the enslavement of Black people. She asks: “What about the people living in favelas, on hillsides, by rivers, tracks, and reservoirs in small and large cities? What is the color of the bodies carried away by floods, buried by landslides, and affected by food scarcity in cities?” (Belmont, 2023, p. 17). Environmentalist movements in Brazil seldom engage with racialized discussions, and Brazilian environmental policies are not “blackened.” Learning about racialized environmental justice in schools is virtually nonexistent. This absence occurs because, despite being a majority Black country, Brazil does not consider race as a determinant in the struggle for environmental justice, due to the persistent myth of racial democracy. From this specificity, we may adapt the concept of environmental racism, originally rooted in the U.S. Black struggle, and transform the fight for environmental justice into one with Brazilian Black elements.

The Brazilian context demands a discussion of environmental racism that accounts for the country’s vast territory, its Indigenous peoples, quilombola populations, and its socio-political and geographic diversity. Black and quilombola women researchers are central in organizations such as the Brazilian Network for Environmental Justice and the Working Group to Combat Environmental Racism, as well as other institutional and grassroots groups that analyze the political operation of environmental racism in Brazil. Cristiane Faustino, quilombola activist and researcher, emphasizes that criticizing environmental injustices and Brazilian environmental racism requires militant political action, since it is upheld by the State and by a white environmentalism (Faustino et al., 2013).

In Brazil, environmental policies must also be guided by an antiracist approach that informs educational practices concerning environmental issues. The myth of racial democracy, the whitening policies of public administration, and the ideology of Brazilian miscegenation suppress discussions about privileged groups and the whiteness of those in power. These privileged groups avoid addressing environmental justice through a racial lens because they benefit from its invisibility. Not all Brazilian environmental injustices are directly tied to racism, but regional origins (prejudice and violence against Northeasterners and Northerners and the exploitation or neglect of these regions), Brazilian labor structures and relations with nature (long workdays, precarious labor conditions for Black and Black women workers, the discourse of self-entrepreneurship, loss of labor rights, gig-economy exploitation), and other local, complex issues must also be considered. According to Pacheco and Faustino (2013), the main drivers of environmental racism in Brazil can be grouped into seven categories: (1) government entities (particularly in urban areas), (2) monocultures, (3) public policies and environmental legislation, (4) mining, prospecting, and metallurgy, (5) dams and hydroelectric plants, (6) logging, and (7) the chemical and oil industries.

Black, Indigenous, quilombola, fishing, riverside, and traditional communities require environmental justice not because they are isolated or numerically small groups (though socially treated as minorities), subordinated uncritically to an elite. While elites and inequalities do exist, these communities also organize, think, and fight to name and address environmental racism. Recognizing the specificities of

Brazilian groups means avoiding their folklorization and understanding their ethnic-racial diversity as human and historical dimensions. Ending Brazilian environmental racism requires politicizing the existence of groups affected by racist inequalities and valuing their proposals as pathways for promoting environmental justice (Pacheco & Faustino, 2013).

The concept of environmental racism has faced criticism, especially due to its breadth. For example, could any injustice be classified as environmental racism? If each social group has its own specificities, should environmental injustice and environmental racism be considered equivalent or overlapping concepts? Scholars have emphasized that the terms are not equivalent. A central rebuttal to such critiques is that the focus on environmental racism within the broader scope of environmental justice strengthens movements for equality and justice. Moreover, in addressing racism, whether in Brazil or globally, it is vital to highlight the historical violence suffered by Black people and other racialized groups. Neglecting this perspective contributes to historical, conceptual, and political erasure. Denying the relevance and applicability of environmental racism reproduces racist silencing, a recurring feature of our society. As Pulido (1996) argues, academic and political contexts generate multiple discourses on race and racism, often reducing the debate in ways aligned with white ecological and environmental projects. To avoid this, it is essential to incorporate the historical processes of racial formation (such as in Brazil) and the diverse manifestations of racism in different contexts, treating environmental racism through an interdisciplinary lens.

Ultimately, the impact of environmental racism within the environmental justice movement is undeniable. It displaces traditional, Western, and white conceptions of environment, nature, diversity, ecology, and environmental studies. In Brazil, to think and research environmental racism is also to investigate ancestry, the country's history built by Black and Indigenous hands, traditional knowledge, and ancestral understandings of nature, as well as Black and Indigenous cosmologies and myths, alongside traditional communities' practices of preservation and *bem viver* ("living well"). Recently, a political turn toward conservatism has produced discourses that deny race or openly propagate racism. While much has been said about activist movements, political collectives, and governmental institutions in the conceptualization of environmental racism, none of these advances would be possible without the simultaneous desire to educate society. The challenge, therefore, is to bring theoretical dialogue into Science Education, to center race, update pedagogical practices in Environmental Education, and bring into schools and universities the knowledge of Black, Indigenous, and quilombola scholars, in order to construct educational proposals genuinely committed to environmental justice.

Brazilian environmental racism is grounded in necropolitics, a concept developed by Achille Mbembe (Mbembe, 2018), since the power to decide who lives and who dies also includes neglect of socio-environmental injustices and the lack of care for racialized and marginalized groups. Necropolitics operates not only in colonial states and in contexts of war and extermination, but also in Brazil through inadequate sanitation and health care in urban areas, the assassination of quilombola leaders to silence land exploitation denouncements, the neglect of parks, squares, and Black cultural spaces, the banning of Black cultural activities, and even the overcrowding of subways during heavy rains in major cities.

Environmental racism is necropolitics in action, abandoning specific groups while securing the good life only for the dominant group.

The direct relationship between necropolitics and environmental racism in Brazil also echoes our colonial history. Colonial exploitation displaced communities to less productive, more distant, and environmentally vulnerable areas, severing their ancestral connections with land and nature. If a rock formation holds sacred meaning for a community, forcing them away from it and then dynamiting it to make way for an industrial development project on Indigenous or Black land, does this not exemplify necropolitical and environmentally racist action?

For Mbembe (2018), public policies themselves are necropolitical instruments, reflecting choices of exclusion through state-promoted segregation or explicit abandonment of vulnerable populations, even when those groups organize ongoing denunciations and creative forms of resistance to survive. The right to participate in decisions about their lives is a cornerstone of environmental justice. When such participation is denied to racialized populations in environmental matters, environmental racism operates through a necropolitical logic. Understanding environmental racism in this way also points to paths of transformative hope. Knowing who is killing us and how necropolitics acts environmentally reveals that these practices of death are deliberately slow. The struggles of land movements and a critical, political, Afro-perspective Science Education urge us to resist, to create interdisciplinary alternatives for social and environmental justice, and to employ science centered on ancestral knowledge and Black epistemologies.

ENVIRONMENTAL RACISM IN SCIENCE TEACHING

When considering Science Education, it is possible to identify the presence of environmental justice, but at what point do we begin to discuss environmental racism within Science Education? Before addressing this, it is important to situate Environmental Education as an autonomous field, particularly in relation to Science Education. This distinction is essential for understanding the theoretical and methodological reflections on educational practices concerning environmental issues. For Pierre Bourdieu (1990), a field is characterized by agents, capital, institutions, and disputes with very specific features. In this sense, Environmental Education is understood as a field that, although it dialogues with Science Education, has its own characteristics that justify its distinction and separation (Lima, 2005). Environmental Education emerged in Brazil through social movements, international legislation, educational policies, and research groups, shaping a body of knowledge distinctively its own.

Environmental Education brings together ethical, political, epistemological, and social dimensions aimed at understanding the relationship between society and nature. It therefore operates through interdisciplinarity and can mobilize other forms of symbolic capital by connecting with movements, collectives, Black environmental groups, Afro-Indigenous collectives, and quilombola communities, all of which may also engage with Science Education.

Thus, the question arises: is reflection limited only to ecology and the environment, or does it also include aspects of environmental justice? Has the

curriculum evolved to accompany conceptual and scientific shifts? Have teaching materials, curricula, educational policies, and legal directives related to environmental themes been racialized? Is environmental racism recognized as a concept within Environmental Education and Science Education?

In Brazil, Environmental Education developed alongside ecological studies in the second half of the 20th century. Its main themes were postwar environmental impacts, the establishment of ecological studies, critiques of increasing pollution, and the relationship between population growth and hunger. Conferences organized by bodies such as the United Nations in the 1970s and 1980s are often cited as key milestones for global Environmental Education. However, it is important to note that, in local contexts, events led by Black, Indigenous, and Black women leaders also produced letters and documents demanding governmental commitment to Environmental Education. In Brazil, by the late 1970s, extension courses and projects had been created to associate Science Education with Environmental Education. At the time, debates emerged as to whether Environmental Education should exist as a separate discipline or be incorporated throughout the curriculum, ultimately affirming its interdisciplinary character (Amaral, 2001).

A study by Ivan Amaral (2001) was one of the first to examine the emergence of Environmental Education over the decades. He found that in the 1970s (analyzing São Paulo's Basic Education policies), the environmental themes discussed revolved around the relationship between humans and the environment, prioritizing geoscience content and an anthropocentric approach: the environment adapts to human presence and use, reflecting a utilitarian view. In health-related courses, such as Health Programs, discussions acknowledged socioeconomic and cultural factors but remained utilitarian in their treatment of environmental issues and health disparities. In the 1980s, however, a significant methodological shift occurred: education began emphasizing critical citizenship, prior conceptions of students, and the incorporation of their daily lives through constructivist perspectives. During this decade, Environmental Education began to portray humans as natural beings, while highlighting science and technology as both effective tools for environmental control and drivers of environmental crises. In the 1990s, the National Curriculum Parameters (NCP) consolidated interdisciplinarity by including the environment as a transversal theme in Basic Education, integrating social issues into curricula. The NPC aimed to form environmentally responsible citizens through awareness of human participation in natural phenomena, recognition of cause-and-effect relationships, and appreciation of natural and sociocultural diversity. However, this discourse often reduced environmental responsibility to micro-level actions linked to economy and consumption—without broader political, social, racial, or philosophical critique, and focused heavily on global and Brazilian environmental accidents (Amaral, 2001).

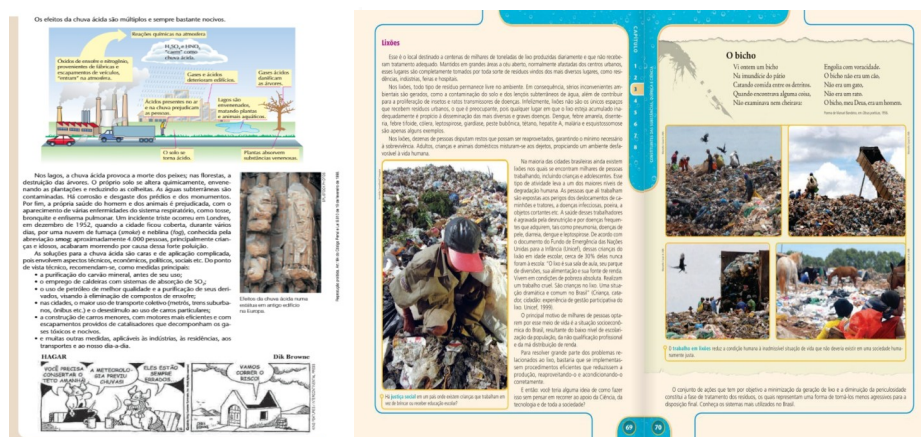
More than two decades later, various studies have further mapped trends in Environmental Education in Brazil (Kato, Kawasaki & Carvalho, 2020; Kawasaki, 2019; Carvalho & Megid-Neto, 2024; Reigota, 2007; Lorenzetti, 2008; González-Gaudio & Lorenzetti, 2009; Kawasaki et al., 2009). All suggest that Environmental Education remains a developing field, hybrid, lacking solid theoretical foundations, and relying heavily on references from Science Education, education, and the

humanities rather than its own. It is as if Environmental Education functioned as an applied branch of other disciplines, albeit an interdisciplinary one. A persistent limitation is the lack of political discussion within Environmental Education, mirroring the same absence in Science Education. Because Environmental Education grew out of ecological and environmentalist movements rather than from the educational field itself, it continues to face challenges in proposing pedagogical strategies. Still, it has been more successful than Science Education, for example, in addressing critiques of capitalist modes of production (Compiani, 2017). Today, Environmental Education is primarily characterized by critiques of the duality between economic development and environmental preservation—yet with little questioning of capitalist structures or racial perspectives, such as environmental racism.

Environmental justice is absent from Science Education, and therefore so is the concept of environmental racism. In examining environmental topics in textbooks, one finds that while interdisciplinary debates appear, these are often framed as unit themes or supplementary texts—except in Biology textbooks, where Ecology serves as a field in which such issues are addressed in more depth (Figure 1).

Figure 1

Example of the presentation of acid rain, waste, and the Anthropocene in Chemistry textbooks.



Quando se iniciou o Antropoceno?

Há uma enorme discussão sobre o que marcaria historicamente e geologicamente o início do Antropoceno. Há quem defenda o advento da agricultura como marco inicial dessa época. De fato, as técnicas agrícolas são até hoje fatores de acentuada alteração ambiental, mas discute-se a intensidade dessas alterações, ocorrida há 12 mil anos. Ademais, segundo essa ideia, o Antropoceno se superporia ao Holoceno.

Outro grupo de cientistas prefere estabelecer como marco a Revolução Industrial do início do século XVIII, mais precisamente a invenção da máquina a vapor, que representou uma nova maneira de transformar a energia para obter trabalho. A máquina a vapor demandava o uso intensivo de combustíveis de origem natural (carvão mineral, por exemplo). Foi nessa época que se deu a maior mudança da curva de crescimento populacional humano e na demanda geral de recursos.

Há, contudo, um ponto discutível: as alterações provocadas pela Revolução Industrial ficaram por quase 100 anos restritas à Europa e à América do Norte, estendendo-se depois à China, Índia e outros países. Essa restrição compromete a definição de uma única data, resgatável globalmente, como marco inicial do Antropoceno.

Finalmente, há um grupo de cientistas que propõe o ano de 1950, logo após a Segunda Guerra Mundial, como início para o Antropoceno. Esse ano marca o começo da chamada **grande aceleração**, caracterizada por uma mudança nítida nas curvas dos indicadores antrópicos em função do tempo.

Alguns pesquisadores propõem um indicador único para validar o Antropoceno como uma nova categoria estratigráfica: a presença de micropásticos incorporados a camadas de sedimentos, podendo alterar a estrutura das rochas a serem formadas pela consolidação desses sedimentos.

Estudos indicam que as camadas de gelo e sedimento depositadas recentemente contêm fragmentos de materiais artificiais produzidos em abundância nos últimos 50 anos: concreto, alumínio puro e plástico, além de traços de pesticidas e outros compostos químicos sintéticos. Mesmo em lugares remotos do planeta, como a Groenlândia, os sedimentos acumulados de 1950 até os dias atuais apresentam concentrações de carbono, resultado da queima de combustíveis fósseis, e de fósforo e nitrogênio, usados como fertilizantes na agricultura, muito mais elevadas que nos últimos 11.700 anos, de modo geral. Há pelo menos um exemplo de plásticos incorporados a rochas ou plastiglomerado (Fig. 2.8).



Figura 2.8 Amostra de plastiglomerado em rocha formada por sedimentos de origem mineral e material plástico, encontrada na praia de Kailua, no Havaí, em 2016.

Source: (Santos & Mol, 2011; Lopes & Rosso, 2020; Feltre, 2016)

As research in Science Education evolves, either by embracing new educational perspectives or adopting specific pedagogies in curricula (including textbooks and legal documents for basic education), it becomes evident that social themes connected to the environment are gaining visibility. Yet often, whether in research, textbooks, or classroom activities, discussions of urban waste, for example, are limited to environmental impacts, recycling movements, the chemistry of materials, and separation processes. What remains unaddressed is the racialized dimension: the fact that waste collectors and those living among waste are overwhelmingly people of color. The absence of racialization means that the lack of selective waste collection is not identified as environmental racism, though it contributes to the illness of Black populations through exposure to pests and other hazards in underserved neighborhoods.

Discussions on environmental themes within Science Education, including acid rain, the greenhouse effect, waste, and climate change, also fail to consider environmental racism. One example is nutrition: many curricula and textbooks address it through biochemical, metabolic, and ecological perspectives (emphasizing human-environment relationships). However, they rarely problematize how environmental racism and racism in general intersect with hunger, lack of access to water, exposure to pesticides, land grabbing, or the dispossession of Indigenous, quilombola, and Black territories.

In recent years, floods have become frequent in Brazil's major urban centers, with the media often portraying them as natural disasters. Yet studies (Severo et al., 2020; Loureiro, 2007; Gonçalves, 2019; Machado, 2020) point out that these floods are socio-environmental disasters linked to urbanization and public policies. Where do floods cause the most deaths? Who inhabits high-risk areas? What color are the bodies of those affected? Such questions are absent from Science Education. The necropolitical dimension of environmental racism (Mbembe, 2018) makes it clear that Brazilian society allows certain groups to die in floods, while others are protected in upscale neighborhoods.

Another important point is that curricula and teaching materials generally highlight large-scale environmental disasters, such as Chernobyl, Bhopal, and Minamata, while neglecting everyday Brazilian cases marked by racism. For example, the contamination of rivers and lands in the Amazon due to illegal mining and agribusiness, or the flooding caused by the construction of hydroelectric dams, often displaces Indigenous and Black communities. These cases, although widely documented in activist and journalistic work, are rarely incorporated into school Science Education.

This absence is also reflected in national guidelines and official documents. The transversal theme "Environment" in the National Curriculum Parameters and the "Environment" competency in the National Common Curricular Base (NCCB) fail to explicitly address race. Although the NCCB emphasizes socio-environmental responsibility and sustainability, it does not incorporate the concept of environmental racism. By doing so, it disregards the racial dimension of environmental injustices, contributing to the silencing of the issue in schools.

Another way to interpret this silence is to consider that Environmental Education and Science Education themselves were structured by colonial, Western, and white perspectives. Epistemologies centered on Indigenous and

Afro-diasporic knowledge are marginalized, if not erased, within curricula. Afro-Brazilian and Indigenous epistemologies, however, offer ways of conceiving nature and the environment based on relational, ancestral, and cosmological perspectives. In addition to addressing environmental racism, Science Education could be enriched by these epistemologies, breaking with Eurocentric perspectives and making space for other ways of knowing.

Thus, the absence of environmental racism in Science Education reflects not only a conceptual omission but also an epistemological one. It reinforces structural racism, silences Black and Indigenous communities, and weakens the potential of education to critically address socio-environmental injustices. Bringing environmental racism into Science Education means revising curricula, textbooks, and pedagogical practices. It means racializing debates on acid rain, waste, climate change, floods, and nutrition. It means asking who suffers most from environmental problems and why. It means recognizing that science itself is political and racialized.

NEW AND ANCESTRAL PERSPECTIVES

The debate on environmental injustices and racism in Science Education is still limited or absent, but there are voices that have brought new theoretical frameworks and engaged in a process of theoretical-methodological creation to contribute to antiracist Science Education and ensure learning about socio-environmental rights. Again, similar to what was said regarding Environmental Education, the incipience and novelty of these discussions highlight the limitations of a field in (re/construction) whose theoretical foundations are counter-hegemonic, having been developed by Black, Latin American, and Brazilian people, as well as Indigenous peoples and members of traditional or quilombola communities.

The aforementioned Critical Decolonial Environmental Education presents itself as a comprehensive alternative that includes non-Western rationalities, ontologies, and epistemologies, such as Amerindian, Black, and Brazilian Indigenous perspectives. From the theoretical framework of decoloniality, it critiques conservative and pragmatic Environmental Education, which is based on modern/colonial rationality. Critical Decolonial Environmental Education serves as a critique of a modern, singular, universal, sufficient, and definitive environmental vision (Andrade, 2024). Due to its breadth, it may also encompass other counter-hegemonic epistemologies.

Countercolonial thought enters the discussion on environmental injustices because its creator, Antonio Bispo dos Santos (Santos, 2015), known as Nêgo Bispo, was a quilombola thinker who developed countercoloniality from ancestral practices such as fishing, cassava processing, and quilombola people's relationship with the territory. He developed the concepts of confluence (relationship and law of coexistence with nature) and biointeraction (the relationship with nature is fundamental for the maintenance of life, cultures, communities, and identities). Countercoloniality critiques urbanization and exploitative capitalism, arguing that both alienate people from their roots, commodifying existence. Nêgo Bispo points to alternatives through emphasis on traditional knowledge, the oral and circular transmission of such knowledge, and the reevaluation of human relationships with

the land and the sacred to recognize multiple ways of living (Santos & Pereira, 2023). As a quilombola perspective, countercoloniality integrates environmental racism concepts with issues of territory and cultural and popular resistance. Nêgo Bispo uses numerous examples from the relationship between quilombos, land, culture, and colonization. He compares colonization to the training of oxen, subjugation, control, and death, discusses cities as artificial spaces, calls for the invention and modification of words introduced through colonization, presents quilombola community and ecological practices as contrary to those of the dominant system, and uses rivers and their confluences as a metaphor (Santos & Pereira, 2023).

Afroperspective approaches to food provide resources for Science Education by recovering ancestral and Black knowledge about botany, our relationship with the land and food cultivation, food preparation by Black and female hands, the role of peasant agriculture, and the movements of rural workers in discussions on food security, pesticides, and agribusiness in Brazil. Environmental racism, in this context, can be reflected in discussions about food, not only what and how people eat, but also when minority populations in Brazil have access to food. It involves notions related to our dietary history, Indigenous and Black influences, the colonial process, and recent discussions about unconventional edible plants (UEP, PANC in Brazil), which can be reinterpreted as *non-colonized* edible plants (Oliveira, 2018).

The theory and practice of *Buen Vivir* (Acosta, 2019) can be understood as a philosophy that is fundamentally South American and rooted in Indigenous and environmentalist movements from Bolivia and Ecuador. It offers a critique of neocolonialism and extractivism based on Andean Indigenous thought from the Quechua and Aymara peoples and has a methodology that marginalizes traditional worldviews, relying on the concepts of *sumak kawsay* and *suma qamaña* (living in fullness and living well, respectively). It presents a theoretical alternative for Science Education practices because its foundations are based on understanding that humans are part of nature, should organize themselves in communal and solidaristic life models sharing resources, decolonize thought, and value ancestral and local knowledge as alternatives to the capitalist model, proposing an economy based on reciprocity and care rather than profit and accumulation (Acosta, 2019). *Buen Vivir* is embedded in the constitutional documents of Bolivia and Ecuador. Applied to Science Education for Youth and Adult Education, Nunes et al. (2021) developed activities based on *Buen Vivir*, offering pedagogical workshops where students wrote about hunger, territory, medicine, and botany. Stories about teas and affectivity, prior knowledge about plants, the web of relationships among living beings in the forest, and readings about the Ticuna people were revisited. The colonial plantation system was discussed, and reflections were produced on local food culture and the culture of Brazilian Indigenous traditional communities. This research brought political, environmental, and social reflections to Science Education based on collective memory, emancipation of the oppressed, and integration of scientific and traditional knowledge (Nunes et al., 2021).

The Amerindian philosophy of Ailton Krenak (Krenak, 2019; Krenak, 2020a; Krenak, 2020b) contrasts with the conservative and pragmatic orientation of Environmental Education and is fertile for discussions on environmental injustice, environmental racism, and Science Education, especially because it is developed by an intellectual thinking from Brazilian Indigenous cosmologies. By asking, “What if

the threats [environmental] also revealed the strength of our bonds?” (Krenak, 2020, p. 16), he presents an analysis for times of crisis, reflecting on the human-environment relationship without denying the sensitivity that connects us to the land. Elements of nature such as rivers, trees, and animals are central to environmental problematization, and there is a particular emphasis on containment: urbanization and colonialism do not kill a river, but a road can imprison it. In his worldview, Krenak develops the following principles: equality and social justice should be granted to all forms of life; power relations and privileges exercised by white men over nature (colonization, exploitation, and extractivism) must be contested; positivism must be criticized; the defense of the marginalized and a refusal to think the world from dominant interests (Inocêncio, 2023).

Krenak does not separate humanity from nature and argues that such separation causes environmental destruction and collapse. He proposes education that incorporates Indigenous knowledge to learn to live harmoniously with nature and to offer solutions to global crises by questioning the model of progress. Krenakian thought links to environmental racism, especially in defending and preserving Indigenous ways of life, summarized in his expression “postpone the end of the world.” Postponing the end of the world does not mean solving problems and crises simply to avoid death (which can connect to necropolitics), because in the Western perspective, the end of the world is a distant apocalyptic event used as a form of control. For Krenak, the end of the world is continuously constructed by humanity and its disconnection from nature. Postponing the end of the world means questioning the current Western life model focused on economic progress, reconnecting with the planet and other life forms, not seeing oneself as superior or separate from Earth, valuing Indigenous wisdom, and recognizing the role of Indigenous peoples in sustainable coexistence with nature. Active hope is central to Krenak’s philosophy, as postponement of the end of the world cannot occur without spiritual and collective reconnection.

Krenak’s ideas can inspire scientific practices and Science Education committed to environmental justice through dialogue between scientific and traditional knowledge. He critiques the traditional subject-object scientific model, proposing interdisciplinary and relational approaches as a counterpoint to modernity. He also argues that Science should incorporate ancestral knowledge, learn Indigenous management techniques, and care practices of Indigenous peoples. From the spiritual connection Indigenous peoples have with the land, Krenak suggests that science should include cultural and spiritual dimensions (Krenak, 2019; Krenak, 2020a; Krenak, 2020b). In research, Krenakian thought values collaborative methodologies in which Indigenous communities are not treated as objects—a critique echoed by Nêgo Bispo. Indigenous communities are seen as authors and producers of knowledge and are responsible for promoting environmental education that values socio-environmental issues.

Science and art can also intersect to address environmental racism through Carolina Maria de Jesus’ book *Quarto de Despejo* (Jesus, 2014). In the context of her work, environmental racism is indirectly evident in the narrative. The book tells the life story and struggles of a Black woman living in a São Paulo favela. Conditions of extreme poverty, lack of sanitation, precarious housing, and scarce resources are present, along with the spatiality of the room as both prison and productive

space, beyond all forms of violence. Environmental racism is not explicitly stated, but poverty, unhealthy living conditions, and abandonment of urban peripheries can be analyzed through an environmental racism lens. Carolina Maria de Jesus' work is a testimony to how environmental racism manifests in urban peripheries, where lack of access to basic rights and exposure to adverse environmental conditions are exacerbated by racial and social discrimination. Careful representation of the author in her multiple dimensions is also a racial discussion. She was not simply a favela writer; she lived in adverse conditions but should be recognized as a professional writer. The stereotype of the Black favela woman affected the editing and promotion of her books and career, and critiquing the racism in these discourses can also provide elements for a necropolitical analysis, beyond Science Education specifically (Miranda, 2013)

FINAL CONSIDERATIONS

This essay sought to demonstrate how environmental racism was conceptualized in the United States and how, when transposed to the Brazilian context, it requires dialogue with structural racism and necropolitics in order to account for its specificities. In Brazil, environmental racism is not only a matter of ecological impacts or environmental laws; it is fundamentally tied to colonial legacies, the myth of racial democracy, and the silencing of race in public policies, education, and environmental struggles.

Within Science Education, the absence of the concept of environmental racism is evident. While Environmental Education and Science Education have advanced in addressing issues of sustainability, environmental justice, and the critique of capitalist modes of production, they have not incorporated race as a central category of analysis. Curricula, textbooks, and teaching practices continue to present environmental issues in de-racialized terms, thereby silencing the lived experiences of Black, Indigenous, quilombola, and other racialized communities most affected by environmental injustices.

To incorporate environmental racism into Science Education is to recognize that science is not neutral. It is to affirm that the environment cannot be understood solely through ecological or utilitarian perspectives, but rather through historical, political, racial, and epistemological lenses. It is to acknowledge that necropolitics operates in Brazil through environmental policies that decide who can live and who must die, and that education plays a role in either reproducing this violence or resisting it.

The challenge, therefore, is to bring Black, Indigenous, and quilombola epistemologies into Science Education, breaking with Eurocentric paradigms and valuing ancestral knowledge and practices of *bem viver*. Research and pedagogical proposals need to be committed to environmental justice and to the fight against racism in all its forms. By naming and studying environmental racism, Science Education can contribute to building an education that not only explains the world but also transforms it, an education that resists necropolitics and affirms life.

NOTES

This text was translated into English at an A-level by a professional translator and then reviewed and refined using artificial intelligence via Chat Generative Pre-Trained Transformer tool. The use of this resource fully complied with the ethical guidelines set forth in the “Guide for the Ethical and Responsible Use of Generative Artificial Intelligence at the Federal University of Bahia,” the institution with which the author is affiliated.

REFERENCES

- Acosta, A. (2019). *O bem viver: uma oportunidade para imaginar outros mundos*. Editora Elefante.
- Adorno, T. W. (2022). O ensaio como forma. In T. W. Adorno, *Notas de literatura* (W. L. Wirzbicki, Trad., pp. 9–40). Editora UNESP. (Obra original publicada em 1958).
- Almeida Bizarria, F. P., de Oliveira, B. G., Barbosa, F. L. S., & Oliveira, M. S. (2023). Da Educação Ambiental crítica à Educação Ambiental decolonial: Revisando concepções em narrativas à luz da racionalidade ambiental. *Revista Brasileira de Educação Ambiental* (RevBEA), 18(3), 172–195.
- Amaral, I. A. (2001). Educação Ambiental e ensino de ciências: Uma história de controvérsias. *Pro-Posições*, 12(1), 73–93.
- Andrade, D. F. D. (2024). Conservacionista, pragmática, crítica, pós-crítica e decolonial: Itinerários epistêmicos da Educação Ambiental pelas dimensões do pensamento. *Ciência & Educação (Bauru)*, 30, e24047. <https://doi.org/10.1590/1516-731320240047>
- Andrade, M. F. D., & Moraes, L. R. S. (2013). Contaminação por chumbo em Santo Amaro desafia décadas de pesquisas e a morosidade do poder público. *Ambiente & Sociedade*, 16, 63–80. <https://doi.org/10.1590/S1414-753X2013000200005>
- Araújo, B. E. (2021). *A obra Quarto de despejo: Diário de uma favelada de Carolina Maria de Jesus como caminho para abordar o tema racismo ambiental na educação em Ciências* (Trabalho de Conclusão de Curso, Universidade Federal de Santa Catarina). Florianópolis, SC.
- Araújo, C. A., & da Silva Junior, M. G. (2017). Impactos do racismo ambiental no município de Goiânia-GO. *Revista UniAraguaia*, 12(2), 233–244.
- Belmont, M. (2023). *Racismo ambiental e emergências climáticas no Brasil*. Instituto de Referência Negra – PEREGUM.
- Bispo, A. (2015). *Colonização, quilombos: Modos e significados*. Instituto Nacional de Ciência e Tecnologia de Inclusão no Ensino Superior e na Pesquisa.

Bourdieu, P. (1990). *Os usos sociais da ciência: por uma sociologia clínica do campo científico* (L. Wacquant, Org.; D. Pacini, Trad.). Editora Unesp.

Bourscheid, J. L. W. (2014). A convergência da Educação Ambiental, sustentabilidade, ciência, tecnologia e sociedade (CTS) e ambiente (CTSA) no ensino de ciências. *Revista Thema*, 11(1), 24–36. <https://doi.org/10.15536/thema.11.2014.24-36.183>

Bullard, R. D. (1993). Anatomy of environmental racism and the environmental justice movement. In R. D. Bullard (Ed.), *Confronting environmental racism: Voices from the grassroots* (pp. 15–39). South End Press.

Bullard, R. D. (1993). The threat of environmental racism. *Natural Resources & Environment*, 7(3), 23–56. <https://www.jstor.org/stable/40923229>

Bullard, R. D. (1996). Environmental justice: It's more than waste facility siting. *Social Science Quarterly*, 77(3), 493–499. <https://www.jstor.org/stable/42863495>

Carvalho, I. C. D. M. (2009). Educação Ambiental. *Educação e Realidade*, 34(03), 11-15.

Carvalho, I. C. M., & Megid-Neto, J. (2024). *Estado da arte da pesquisa em Educação Ambiental no Brasil (1981–2020): Meta-análises e narrativas de um campo complexo e plural*. EdUFABC.

Compiani, M. (2017). Utopias e ingenuidades da Educação Ambiental? *Ciência & Educação (Bauru)*, 23(3), 559–562. <https://doi.org/10.1590/1516-731320170040001>

Crenshaw, K. (2015, September 24). Why intersectionality can't wait. *The Washington Post*.

Faustino, C., Pacheco, T., Porto, M. F., & Malerba, J. (2013). O mapa como espaço de cidadania: Reflexões e continuidades. In M. F. Porto, T. Pacheco, & J. P. Leroy (Eds.), *Injustiça ambiental e saúde no Brasil* (pp. 255–276). Editora Fiocruz.

Feltre, R. (2016). *Química*. Editora Moderna.

González-Gaudiano, E., & Lorenzetti, L. (2009). Investigação em Educação Ambiental na América Latina: Mapeando tendências. *Educação em Revista*, 25, 191–211. <https://doi.org/10.1590/S0102-46982009000300010>

Guimarães, M. (2004). Educação Ambiental crítica. In M. Guimarães (Ed.), *Identidades da Educação Ambiental Brasileira* (pp. 25–34). Ministério do Meio Ambiente.

Henderson, S., & Wells, R. (2021). Environmental racism and the contamination of black lives: A literature review. *Journal of African American Studies*, 25(1), 134–151.

Inocência, A. F. (2023). Política das alianças afetivas: contribuições das cosmologias ameríndias de Ailton Krenak para uma Educação Ambiental Decolonial. *Revista Brasileira de Educação Ambiental (RevBEA)*, 18(7), 121-137.

Jesus, C. M. de. (2014). *Quarto de despejo: Diário de uma favelada* (10ª ed.). Editora Ática.

Jones, C. P. (2002). Confronting institutionalized racism. *Phylon*, 50(1-2), 7-22. <https://doi.org/10.2307/4149999>

Kato, D. S., Kawasaki, C. S., & de Carvalho, L. M. (2020). O conceito de ecossistema como delimitação espaçotemporal nas pesquisas em Educação Ambiental: implicações para o ensino de Ciências/Biologia. *ACTIO: Docência em Ciências*, 5(2), 1-23.

Kawasaki, C. S. (2019). *Cartografando o campo da pesquisa em Educação Ambiental: Convergências e controvérsias na construção de um território híbrido* (Tese de Doutorado). Universidade Estadual Paulista "Júlio de Mesquita Filho".

Kawasaki, C. S., et al. (2009). A pesquisa em Educação Ambiental nos ENPECs: Contextos educacionais e focos temáticos. In *Anais do 7º Encontro Nacional de Pesquisadores em Educação em Ciências*. Universidade Federal de Santa Catarina.

Krenak, A. (2019). *Ideias para adiar o fim do mundo*. Editora Companhia das Letras.

Krenak, A. (2020). *Do tempo*. N-1 edições.

Krenak, A. (2020). *O amanhã não está à venda*. Companhia das Letras.

Layrargues, P. P., & Lima, G. F. D. C. (2014). As macrotendências político-pedagógicas da Educação Ambiental brasileira. *Ambiente & Sociedade*, 17, 23-40.

Lima, G. F. C. (2005). *Formação e dinâmica do campo da Educação Ambiental no Brasil: emergência, identidades, desafios* (Tese de Doutorado). Instituto de Filosofia e Ciências Humanas, Universidade Estadual de Campinas.

Lopes, S., & Rosso, S. (2020). *Ciências da Natureza: Evolução e universo*. Editora Moderna.

Lorenzetti, L. (2008). *Estilos de pensamento em Educação Ambiental: Uma análise a partir das dissertações e teses* (Tese de doutorado). Universidade Federal de Santa Catarina.

Luz, R., Vianna Prudêncio, C. A., & Nasser Caiafa, A. (2018). Contribuições da Educação Ambiental crítica para o processo de ensino e aprendizagem em ciências visando à formação cidadã. *Investigações em Ensino de Ciências*, 23(3).

Martins, J. P. D. A., & Schnetzler, R. P. (2018). Formação de professores em Educação Ambiental crítica centrada na investigação-ação e na parceria

colaborativa. *Ciência & Educação (Bauru)*, 24, 581–598.
<https://doi.org/10.1590/1516-731320180030004>

Mbembe, A. (2018). *Necropolítica*. N-1 edições.

Miranda, F. R. (2013). *Os caminhos literários de Carolina Maria de Jesus: Experiência marginal e construção estética* (Dissertação de Mestrado). Faculdade de Filosofia, Letras e Ciências Humanas, Universidade de São Paulo, São Paulo.
<https://doi.org/10.11606/D.8.2013.tde-13112013-100432>

Moreira, I. N. S. (2020). *Racismo ambiental como questão bioética para o ensino de Ciências: Construção de uma proposta colaborativa de formação inicial de professores à luz da Teoria Ator-Rede* (Dissertação de Mestrado), Instituto de Ciências Exatas e Biológicas. Universidade Federal de Ouro Preto.

Nascimento, C. de F. (2023). *Racismo ambiental no ensino de Química: Produção de recursos didáticos acessíveis para alunos com deficiência visual* (Trabalho de Conclusão de Curso, Instituto Federal do Rio de Janeiro). Duque de Caxias, RJ.

National People of Color Environmental Leadership Summit. (1991). *We, the people of color: Principles of environmental justice*. Washington, DC.

Nunes, P., Giraldo, P., & Cassiani, S. (2021). Decolonialidade na educação em ciências: O conceito de bem viver como uma pedagogia decolonial. *Revista Interdisciplinar Sulear*, 7(2), 199–219.

Oliveira, B. P. T. de et al. (2018). Narrativa midiática e difusão sobre plantas alimentícias não convencionais (PANC): Contribuições para avançar no debate. *Cadernos de Agroecologia*, 13(1).

Pacheco, T., & Faustino, C. (2013). A iniludível e desumana prevalência do racismo ambiental nos conflitos do mapa. In M. F. Porto, T. Pacheco, & J. P. Leroy (Eds.), *Injustiça ambiental e saúde no Brasil: O mapa de conflitos* (pp. 73–114). Editora Fiocruz.

Pereira, Z. M., & Santiago, L. M. P. (2024). Racismo ambiental: levantamento e análise da produção acadêmica (2013 a 2023). *REAMEC – Rede Amazônica de Educação em Ciências e Matemática*, 12(1), 1–25.
<https://doi.org/10.26571/reamec.v13.17843>

Pulido, L. (1996). A critical review of the methodology of environmental racism research. *Antipode*, 28(2), 142–159. <https://doi.org/10.1111/j.1467-8330.1996.tb00519.x>

Pulido, L. (2016). Environmental racism. In *International Encyclopedia of Geography: People, the Earth, Environment, and Technology* (pp. 1–13).
<https://doi.org/10.1002/9781118786352.wbieg0453>

Prudêncio, C. A. V., & Dos Santos, M. (2024). Racismo ambiental: uma proposta de sequência de atividades a partir de uma perspectiva CTS. *Odeere*, 9(1), 10.

Reigota, M. (2007). O estado da arte da pesquisa em Educação Ambiental no Brasil. *Pesquisa em Educação Ambiental*, 2(1), 33–66.

Ribeiro, B. C., Caporlingua, V. H., & Parga-Lozano, D. L. (2024). A Educação Ambiental crítica decolonial para o enfrentamento do racismo ambiental na América Latina. *Historia Ambiental Latinoamericana y Caribeña (HALAC) - Revista de la Solcha*, 14(2), 326–361. <https://doi.org/10.32991/2237-2717.2024v14i2.p326-361>

Santos, A. B., & Pereira, S. (2023). *A terra dá, a terra quer*. Ubu Editora.

Santos, W., & Mol, G. (2011). *Química cidadã*. Editora Nova Geração.

Severino, A. J. (2016). *Metodologia do trabalho científico* (24ª ed.). Cortez.

Silva, L. H. P. (2012). Ambiente e justiça: Sobre a utilidade do conceito de racismo ambiental no contexto brasileiro. *E-Cadernos CES*, 17. <https://doi.org/10.4000/eces.1123>

Silveira, D. P., & Lorenzetti, L. (2021). Estado da arte sobre a Educação Ambiental crítica no Encontro Pesquisa em Educação Ambiental. *Praxis & Saber*, 12(28), 88–102. <https://doi.org/10.19053/22160159.v12.n28.2021.11609>

Silveira, D. P., da Silva, J. C. S., & Lorenzetti, L. (2023). Possibilidade de aproximação entre educação CTSA e Educação Ambiental crítica: Uma análise nas atas do ENPEC no período 2011–2019. *Indagatio Didactica*, 15(1), 11–26. <https://doi.org/10.34624/id.v15i1.32108>

Souza, G., Silva, R., Oliveira Júnior, J. M., & Mendonça, N. (2016). Chuva ácida: Estudo de caso na Região Metropolitana de Belém/PA. *Anais do V Simpósio de Estudos e Pesquisas em Ciências Ambientais na Amazônia*.

Stortti, M. A. (2019). Diálogos entre a Formação Inicial Docente em Biologia e a temática da Justiça, conflitos e Racismo Ambiental. *REMEA-Revista Eletrônica do Mestrado em Educação Ambiental*, 36(2), 60-82

Trein, E. S. (2012). A Educação Ambiental crítica: Crítica de quê? *Revista Contemporânea de Educação*, 7(14). <https://doi.org/10.20500/rce.v7i14.1673>

US Census Bureau. (2020). *P2: Hispanic or Latino, and not Hispanic or Latino by race*. Census State. <https://data.census.gov/table/DECENNIALPL2020.P2?q=p2&g=050XX00US37185>

Received: Feb. 18, 2025

Approved: July 18, 2025

DOI: <https://doi.org/10.3895/actio.v10n2.19577>

How to cite:

Santos, P. N. dos (2025). Environmental racism: history and concepts for science teaching. **ACTIO**, 10(2), 1-23. <https://doi.org/10.3895/actio.v10n2.19577>

Copyright: This article is licensed under the terms of the Creative Commons Attribution 4.0 International Licence.



Recebido: 18 fev. 2025

Aprovado: 18 jul. 2025

DOI: <https://doi.org/10.3895/actio.v10n2.19577>

Como citar:

Santos, P. N. dos. (2025). Racismo ambiental: história e conceitos para o ensino de ciências. **ACTIO**, 10(2), 1-23. <https://doi.org/10.3895/actio.v10n2.19577>

Direito autoral: Este artigo está licenciado sob os termos da Licença Creative Commons-Atribuição 4.0 Internacional.

