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IMPACTS OF CLIMATE CHANGE ON THE STRUGGLE FOR TERRITORIAL RIGHTS AND THE REPRODUCTION OF SOCIO-ENVIRONMENTAL CONFLICTS IN THE BAIXADA MARANHENSE REGION

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ABSTRACT

Based on the premise that socio-environmental conflicts in traditional communities are profoundly influenced by practices that contribute to climate change on both a local and regional scale, this article aims to reflect on the influence of climate change on the struggle for territorial rights and the production of land conflicts in traditional communities from Brazil to Maranhão, specifically in the municipalities of Baixada Maranhense. Following a systemic and multidisciplinary approach, the study used the database of the Pastoral Land Commission, the National Institute for Space Research, the Rural Environmental Registry, the Land Management System and the National Institute for Colonization and Agrarian Reform, in order to verify the correlation between the incidence of socio-environmental conflicts, deforestation and fires in Brazil and Maranhão, from 2010 to 2023. Specifically, 821 land conflicts were recorded in Maranhão, representing 5% of the occurrences in the country and 40% of the conflicts occurring only in quilombola communities in Brazil. The correlation of data demonstrated that practices that drive climate change at local and regional levels, such as deforestation, agricultural expansion and the exploitation of natural resources, not only directly affect the environment, but also intensify actions that produce and reproduce socio-environmental conflicts in quilombola communities, threatening their survival and their traditional ways of life.

Keywords: Territorial Rights. Climate Change. Quilombola Communities.

RESUMO

Partindo do princípio de que os conflitos socioambientais em comunidades tradicionais, são profundamente influenciados por práticas que contribuem para mudanças climáticas tanto em escala local quanto regional, o artigo tem como objetivo compreender e refletir acerca da influência das alterações climáticas sobre a luta por direitos territoriais e a produção de conflitos por terra em comunidades tradicionais do Brasil ao Maranhão, e de forma específica nos municípios da Baixada Maranhense. Seguindo uma abordagem sistêmica e multidisciplinar, o estudo utilizou a base de dados da Comissão Pastoral da Terra, Instituto Nacional de Pesquisas Espaciais, Cadastro Ambiental Rural, Sistema de Gestão Fundiária e Instituto Nacional de Colonização e Reforma Agrária, com a finalidade verificar correlação entre a incidência de conflitos socioambientais, desmatamento e focos de queimadas no Brasil e Maranhão, no período de 2010 a 2023. De forma específica foram registrados 821 conflitos por terra no Maranhão, representando 5% das ocorrências do país e 40% dos conflitos ocorridos somente em comunidades quilombolas do Brasil. A correlação dos dados demonstrou que as práticas que impulsionam as mudanças climáticas em nível local e regional, como o desmatamento, a expansão agrícola e a exploração de recursos naturais, não apenas afetam diretamente o ambiente, mas também intensificam ações que produzem e reproduzem os conflitos socioambientais nas comunidades quilombolas, ameaçando sua sobrevivência e seus modos de vida tradicionais.

Palavras-chaves: Direitos Territoriais. Mudanças Climáticas. Comunidades Quilombolas

INTRODUCTION

Human activities, primarily through greenhouse gas emissions, directly influence global warming, with the global surface temperature reaching 1.1°C higher between 2011–2020 than in the 1850–1900 period (IPCC, 2023). According to the Intergovernmental Panel on Climate Change (IPCC), the aforementioned result stems from the unsustainable use of energy, changes in land use, and consumption and production patterns between regions, countries and individuals. These factors have led to widespread adverse impacts at various scales, causing losses and damages to both nature and people. It is important to recognize that vulnerable communities that have historically contributed the least to current climate change are disproportionately affected

The IPCC (2023) report indicates that reducing deforestation and mediating conflicts could mitigate up to 5.8 billion tons of carbon dioxide annually worldwide. However, in Brazil, the failure to meet environmental targets, the weakening of environmental laws, and supervisory bodies have encouraged deforestation for land use in the Amazon, invasions of territories, illegal mining and logging, and the denial of traditions and rights of traditional peoples and communities (Costa & Silva, 2021).

In addition to the risks to human life and the environment caused by climate change, it is necessary to consider its potential impacts on cultural heritage, with an emphasis on native peoples. Climate change directly affects traditional communities that depend on natural resources, which are intrinsically tied to their identity, collective memory, values, and cultural reproduction (Costa & Silva, 2021). Thus, climate-related events compromise the economic, social, and cultural aspects of traditional communities, threatening their territories and ways of living, working, and socializing.

Following the premise that this process amplifies socio-environmental conflicts by transforming traditional communities' territories into disputed frontiers, Rapozo (2020) argues that this phenomenon institutionalizes violence in its multiple forms and reflects human rights violations materialized in an unequal struggle for economic, political, and social capital, often backed by state actions. In Brazil, these resistance movements are similar to what Almeida (1994) identified as "territorializing movements", that is, movements made up of socially and politically organized ethnic groups that demand recognition of their cultural differences and are strongly linked to the defence of their territorial rights. This is the case for several traditional Brazilian groups, including Indigenous peoples, quilombolas (Afro-Brazilian communities descended from enslaved Africans), rubber tappers, riverine communities, caiçaras (coastal traditional communities), and others (Almeida, 1994).

This approach recognizes that environmental problems cannot be understood in isolation from the political and economic context in which they arise, as they generate situations of injustice and rights denial (Anaya & Espírito-Santo, 2018). Considering this, the present article is based on the principle that socio-environmental conflicts in traditional communities are deeply influenced by practices that contribute to climate change at both local and regional scales. These conflicts often emerge from a combination of external pressures, such as agricultural expansion, logging, and large-scale infrastructure projects, which frequently harm traditional communities.

At the same time, this study aims to analyze and reflect on the influence of climate change on the struggle for territorial rights and the production of land conflicts in traditional communities from Brazil to Maranhão, with a specific focus on the municipalities of Baixada Maranhense. To achieve this, the research adopted an ecological study with a systemic and multidisciplinary approach, divided into two phases. The first phase was developed through a literature review of existing publications (books, articles,

theses, and technical reports) sourced from the CAPES (Coordination for the Improvement of Higher Education Personnel) journal portal, SciELO, and Google Scholar. The second phase employed Exploratory Spatial Data Analysis (ESDA) and Geographic Information System (GIS) tools for data collection, processing, overlay, correlation, and thematic map production.

Thus, the study is initially structured by presenting reflections on the influence of climate change impacts on the reproduction of socio-environmental conflicts in traditional communities, correlating the unique struggles for territorial rights from Brazil to Maranhão. Subsequently, it analyzes secondary data on land conflicts, deforestation, and fire outbreaks at national and regional levels, with a specific focus on quilombola communities, using data from the Pastoral Land Commission (CPT) and the National Institute for Space Research (INPE) from 2010 to 2023. Additionally, data on public and private rural properties from the Rural Environmental Registry (CAR) and the Land Management System (SIGEF) were used. Finally, the study assesses the correlation between non-titled/certified areas, overlapping properties, and the incidence of conflicts in quilombola communities in the municipalities of Baixada Maranhense.

METHODOLOGY AND TECHNICAL PROCEDURES

The study proposes a detailed analysis of land conflicts, deforestation, and fire outbreaks in Brazil, with emphasis on quilombola communities, for the period 2010 to 2023. To this end, secondary data provided by the Pastoral Land Commission (CPT) and the National Institute for Space Research (INPE) were used, in addition to information on public and private rural properties extracted from the Rural Environmental Registry (CAR) and the Land Management System (SIGEF).

The methodology adopted in this research comprises an ecological study of systemic and multidisciplinary character, structured in four main phases:

A. Literature Review:

The first phase consisted of an exhaustive survey of existing literature on the topics addressed. For this, publications in books, scientific articles, theses, dissertations and technical documents related to the themes of land conflicts, deforestation and fires were consulted. The searches were conducted through the following databases and platforms: CAPES Journals Portal (Coordination for the Improvement of Higher Education Personnel), Scientific Electronic Library Online (SciELO) and Google Scholar.

The objective of this stage was to understand the state of the art regarding the relationship between territorial conflicts, climate change and environmental degradation, as well as to identify gaps in scientific knowledge that could be addressed by the study. Important references include the works of Acselrad (2004) on environmental conflicts and Becker (2005) on territorialities in the Amazon.

B. Collection and Analysis of Secondary Data:

Data on land conflicts were obtained from the Pastoral Land Commission (CPT), which maintains an information bank on occurrences of land disputes, violence against traditional communities and records of land grabbing (CPT, 2023). The collection of this data was carried out by consulting annual reports made available by the CPT, as well as by accessing its electronic database (https://www.cptnacional.org.br).

Information on deforestation and fire outbreaks were extracted from the National Institute for Space Research (INPE), using the PRODES (Monitoring of Deforestation in the Legal Amazon) and DETER (Real-Time Deforestation Detection) systems (INPE, 2023). This data was obtained in raster and vector formats, allowing its analysis in geoprocessing software for the identification of spatial and temporal patterns (http://www.obt.inpe.br/OBT/assuntos/programas/amazonia).

Data on public and private rural properties were collected from the Rural Environmental Registry (CAR) and the Land Management System (SIGEF), both managed by the federal government. Obtaining this information involved consulting open databases and processing shapefiles containing property boundaries, enabling the analysis of overlaps with conflict areas and deforestation (https://www.car.gov.br; https://sigef.incra.gov.br).

To ensure the integrity and quality of the collected data, cross-validation methods were applied, which consisted of comparing information from different sources to verify the consistency of records.

C. Spatial Analysis and Cartographic Production:

To integrate and interpret the collected data, Exploratory Spatial Data Analysis (ESDA) and geoprocessing using Geographic Information Systems (GIS) techniques werapplied (Goodchild, 2010). The processing and analysis were performed using software such as QGIS and ArcGIS, allowing the overlay of thematic layers and the identification of hotspots of conflicts and environmental degradation.

From the overlay of spatial information layers, thematic maps were produced illustrating the

geographic distribution of conflicts, the advancement of deforestation and the incidence of fires, with special attention to quilombola communities. Spatial analysis allowed correlating the dynamics of environmental changes with land conflicts, identifying patterns and trends throughout the studied period.

D. **Regional Focus - Maranhão and Baixada Maranhense:**

The study also included a specific approach to the state of Maranhão, emphasizing the municipalities of Baixada Maranhense, where quilombola communities face intense territorial conflicts. Baixada Maranhense is a region characterized by extensive floodplain areas, whose socio-environmental dynamics are strongly influenced by the water regime, rainfall seasonality, and extreme climate events.

The analysis considered the relationship between the advancement of agribusiness, the expansion of livestock farming, and the increase in land grabbing, identifying how these factors pressure quilombola communities and drive territorial conflicts. Data on deforestation, degradation of native vegetation, and land use changes were collected and analyzed, seeking to understand the correlation between these processes and the increase in land conflicts. The impacts of climate change were investigated based on events such as prolonged droughts and seasonal floods, which affect the subsistence of quilombola communities and alter the availability of natural resources essential for their survival.

Spatial analysis in the Baixada Maranhense region employed geospatial data to map areas most affected by territorial disputes, deforestation and fires, helping to understand the challenges faced by local traditional populations. Therefore, the study aimed to contribute to the understanding of the interrelationship between climate change and land conflicts, providing subsidies for public policies and mitigation strategies aimed at traditional communities at different scales.

IMPACTS OF CLIMATE CHANGE ON TRADITIONAL COMMUNITIES

The impacts caused by climate change vary according to the socio-environmental vulnerability of populations, tending to be more severe in urban areas affecting poor residents of risk-prone and environmentally fragile zones, as well as in rural areas impacting traditional communities and peoples (Pedroso Junior & Santos, 2021). Thus, mitigation and adaptation measures to climate changes in these areas are especially urgent, particularly considering that in recent decades, the risk of disasters and severe impacts in these territories has increased significantly, resulting from the growing frequency and intensity

of extreme climate events (IPCC, 2023).

However, addressing the social and environmental liabilities of these territories with consolidated occupation, especially by vulnerable populations, represents a major challenge. This is primarily due to the possibility of solutions being applied disproportionately to this segment of the population, thereby exacerbating the vulnerability of people who are already victims of a historical process of exclusion, socioeconomic and political inequality.

It is important to emphasize that the impacts of climate change on traditional communities are profound and multifaceted, threatening their food security, health, territory, and culture. The resilience of these communities depends on inclusive and adaptive public policies that respect and integrate their traditional knowledge into climate change mitigation and adaptation strategies.

Supporting this perspective, studies such as Magalhães and Miranda (2005), which analyze how climate change affects regional development in Northeast Brazil, highlight the impacts on traditional communities, particularly in the context of family farming and water security. Similarly, Vieira et al. (2015) discuss the direct implications on quilombola communities and other traditional populations, exacerbated by climate change. Following this line of thought, Lima et al. (2012) have compared the vulnerabilities and opportunities of indigenous communities in the Amazon in the face of climate change, emphasizing the role of traditional knowledge in adapting to new environmental conditions.

These references provided a solid foundation for the understanding of the impacts of climate change on traditional communities and underscored the need for adaptive policies that integrate traditional knowledge and the rights of these populations. Considering that climate change has significant impacts on traditional communities, including quilombolas, Indigenous peoples, riverine communities, extractivists, and other populations that depend directly on natural resources and environmental balance for their survival and cultural maintenance, it was highlighted these impacts in Table 01 below:

Table 1 | Environmental impacts caused by climate change in traditional communities.

Food Security	**Biodiversity Loss:** Changes in rainfall patterns and temperatures directly affect biodiversity loss, agricultural production, and food gathering in traditional communities. **Decreased Agricultural Productivity:** Studies indicate that agricultural productivity in some regions of Brazil may decrease by up to 30% due to prolonged droughts and shifting climate patterns, directly impacting the subsistence of communities that rely on family farming.
Access to Water	**Water Scarcity**: Traditional communities face growing challenges related to access to potable water, especially in drought-affected regions, where water scarcity is exacerbated by climate change. **Contamination of Water Sources:** The intensification of extreme events, such as floods and droughts, can lead to the contamination of water sources, affecting community health and safety.
Displacement and Loss of Territory	**Risk of Forced Displacement:** Climate change increases the risk of displacement for traditional communities due to extreme events. The loss of territory can lead to the disintegration of cultural practices and traditional ways of life.
Health and Well-Being	**Increase in Diseases:** Climate change is linked to the rise of tropical diseases, such as dengue fever and malaria, which disproportionately affect communities in vulnerable areas. **Impact on Mental Health:** Food insecurity, territorial loss, and extreme weather events can elevate stress and anxiety levels, affecting the mental well-being of traditional communities.
Culture and Traditions	**Cultural Erosion:** Climate change threatens cultural practices that depend on specific environmental conditions, such as ceremonies, festivals, and traditional land management activities. **Rituals and Customs:** Ecosystem changes directly impact rituals and customs that rely on specific plant and animal species, compromising intergenerational cultural transmission.

Source: IPCC, 2023.

The preservation of traditional communities is both dynamic and historical, and their conditions for reproduction mostly depend on access to territory and natural resources. This being said, it is evident that anthropogenic actions, particularly those related to land and water use through deforestation, destruction of water sources, river siltation, large-scale projects, and indiscriminate use of agrochemicals, contribute to the reproduction of conflicts and accelerate climate change and its effects at different scales. This set of factors compromises not only natural heritage, flora, and fauna but also the cultural reproduction of Indigenous peoples and traditional communities, making the scenario even more complex.

The cultural heritage of traditional communities that inhabit and depend on these territories shows significant vulnerability to risks generated by socio-environmental conflicts, which are both caused and intensified by climate change (Costa & Silva, 2021). However, when aligning climate change, territorial rights, and the cultural rights of traditional peoples and communities, many studies indicate that socio-environmental conflicts in these spaces are reinforced by poorly designed policies currently in place for revenue distribution (Damonte & Glave, 2012), formal political participation, transparency, and territorial governance (Vergara, 2011). Following these different approaches, the following section analyzes the incidence of socio-environmental conflicts in traditional communities from Brazil to Maranhão.

TERRITORIAL RIGHTS AND SOCIO-ENVIRONMENTAL CONFLICTS IN TRADITIONAL COMMUNITIES FROM BRAZIL TO MARANHÃO

Traditional peoples and communities hold great significance in the Brazilian context, as they contribute to biodiversity preservation, traditional knowledge, and the promotion of sustainable development and the protection of historical and cultural heritage. “They are culturally distinct groups that possess their own social, cultural, and economic conditions, maintaining specific relationships with their territory and the environment in which they are embedded” (CIMOS, MPMG, 2014, p. 12). These peoples have distinct ways of being and living compared to mainstream society, leading them to self-identify as bearers of unique identities and rights.

The 1988 Federal Constitution, in Articles 215 and 216, grants traditional peoples the right to cultural recognition in all its diversity and forms. According to Chiriboga (2006), ethno-cultural groups have the right to belong to a specific culture and preserve it. Through the Decree No. 6,177 of August 1, 2007, it was determined to comply with the Convention on the Protection and Promotion of the Diversity of Cultural Expressions. From this perspective, territory plays an essential role in preserving the culture of these peoples by safeguarding traditional knowledge and both tangible and intangible heritage (Yoshida & Penna, 2021).

For quilombolas, land is essential to their existence, as it forms part of their sense of belonging and their individuality as community members. The recognition of quilombola lands occurs "through self-identification criteria, meaning land legitimacy must be established by the community's self-definition" (Castro, 2019, p. 47). According to Peralta (2012), in 1988, quilombola populations had their rights guaranteed by the Federal Constitution (CF/88) through Article 68 of the Transitory Constitutional Provisions Act (ADCT), which granted quilombola communities ownership of their ancestral lands.

The recognition of identity and collective land use among traditional Pan-Amazonian societies reflects a delicate process marked by social and political disputes over collective rights inherent to the ancestral way of life of Indigenous peoples (Rapozo, 2020). Historically, these peoples have faced large-scale economic projects that, in particular ways, demarcate specificities in terms of the commodification of the Amazon as a reserve of value. As a result, numerous conflicts stemming from movements for the judicialization of territorial oversight processes, as well as the redefinition of historically occupied areas linked to the traditional ways of life of these peoples and communities.

Socio-environmental conflicts are characterized by Lopes (2004) as a process of environmentalization of social conflicts, meaning the incorporation of environmental discourse and struggles, promoting the internalization of environmental rights and arguments. For the Pastoral Land Commission (CPT, 2023), conflicts are seen as acts of resistance and confrontation occurring in different rural social contexts, involving struggles for land, water, rights, and means of work or production.

Amid these processes, it has been witnessed in Brazil the production of socio-environmental conflicts that represent an explicit violation and disregard for traditional ways of life and forms of natural resource use tied to their complex political, territorial, and socioeconomic systems (Rapozo, 2020). Violence against Indigenous peoples in Brazil is often the result of a phenomenon that simultaneously suppresses and exposes political struggles and mobilizations in the Amazon, involving the expropriation of the conditions necessary to maintain their ways of life and social reproduction (Almeida, 1994).

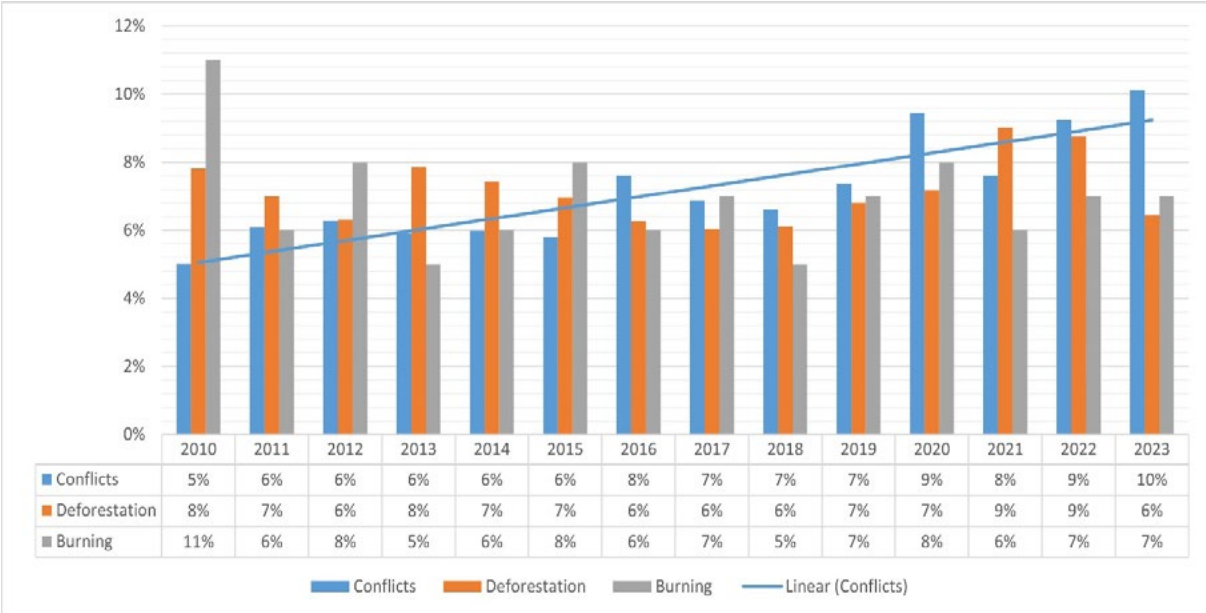
Socio-environmental conflicts, particularly in traditional communities, are marked by inequalities stemming from recurring economic and political power struggles, which extend into and reproduce themselves in legislative, executive, and judicial spheres, such as in territorial demarcation policies or judicial delays, facts that are a product of Brazil's oligarchic and patrimonialist political system (Rapozo, 2020).

In Brazil, researches on rural conflicts conducted by the CPT from 2010 to 2023 cataloged 17,011 land conflicts, with 12% occurring in quilombola communities. According to CPT records from the last 14 years, 2,054 land conflicts in quilombola communities were recorded, with the highest occurrences in the Northeast (1,187 cases, 58%) and North (392 cases, 19%), followed by the Southeast (284 cases, 14%), Central-West (138 cases, 7%), and South (61 cases, 3%).

It is observed that the regions with the highest concentration of quilombola communities also have the highest incidence of land conflicts in these communities, given that quilombola territories coexist with the expansion of agricultural and economic frontiers. As a consequence of these conflicts, we may see water pollution, a breakdown in environmental governance, an increase in illegal plantations, changes in land occupation and tenure, loss of biodiversity and illegal exploitation.

The introduction of these activities into quilombola territories alters behavior, social organization, and self-perception among these populations, making it difficult to overcome the negative impacts suffered by these peoples boosting the advance of capital and increasing conflicts, especially over land. Consequently, Graph 01 below presents the percentage of land conflicts, fire outbreaks, and deforested areas recorded in Brazil from 2010 to 2023.

Graph 1 | Percentage of records of land conflicts, deforestation and fires in Brazil (2010-2023).



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Conflicts	5%	6%	6%	6%	6%	6%	8%	7%	7%	7%	9%	8%	9%	10%
Deforestation	8%	7%	6%	8%	7%	7%	6%	6%	6%	7%	7%	9%	9%	6%
Burning	11%	6%	8%	5%	6%	8%	6%	7%	5%	7%	8%	6%	7%	7%

Source: CPT, 2010-2023.

A positive correlation is observed between the incidence of conflicts and the dynamics of fire outbreaks and deforestation in Brazil. According to analysis conducted by the National Institute of Meteorology (INMET) on deviations in Brazil's annual average temperatures from 1961 to 2023, a statistically significant increasing temperature trend has been verified over the years, which may be associated with climate change due to global temperature rise and local land-use and land-cover changes.

The relationship between land conflicts, fire outbreaks, and deforestation is complex and multifaceted, involving economic, social, environmental, and political aspects. The conflicts over land in Brazil, especially in the Amazon, are deeply associated with the dispute over natural resources, such as timber and fertile land for agriculture and cattle ranching. According to Nepstad et al. (2008), fires in the Amazon are often associated with land conflicts, where land ownership is established through "productive use" of the land, which may include the practice of burning for land preparation. Concurrently, environmental legislation is frequently weakened or not enforced, facilitating the conversion of forests into agricultural land.

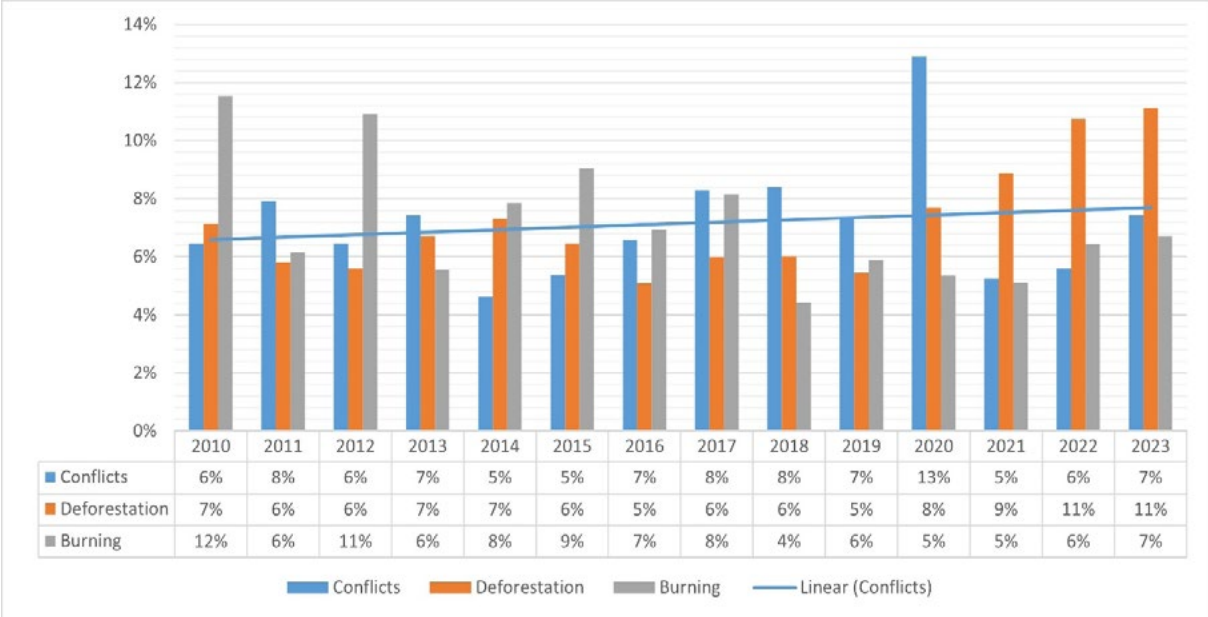
The relationship between these different factors influenced a 102% increase in socio-environmental conflict occurrences between 2010 and 2023, while in quilombola areas the growth reached 210%. This is due to the "dispute between very different territorial use and occupation projects, which occurs on lands lacking the implementation and/or guarantee of their constitutional purpose, producing environmental inequalities" (CPT, 2023, p. 30).

The expansion of conflicts over land -in quilombola communities has advanced significantly between 2018 and 2023. Among the federal units with the highest incidence of agrarian conflicts, the states of Amazonas, Mato Grosso, and Maranhão stand out (CPT, 2023). It is important to note that the series of political events (Operation Car Wash; impeachment of President Dilma Rousseff; Michel Temer-Jair Bolsonaro governments), which initiated in 2015, have created favorable political conditions for the strong resurgence of strategic economic interests linked to capitalist rural business. This process led to the intensification of deforestation and violence by landowners, land grabbers, and illegal miners, encouraged by the current government and represented by agribusiness interest groups.

Specifically in Maranhão, the State Constitution of 1989, in its Article 299, states: "The State shall recognize and legalize, in accordance with the law, lands occupied by remnants of quilombo communities" (ITERMA, 2023, p. 24). The struggle of quilombola remnants in Maranhão for territorial rights is provided for and protected by law. Thus, according to ITERMA (2023, p. 24), there is State Law No. 9,169 of April 16, 2010, which guarantees the titling of quilombola territories, and State Decree No. 32,433 of November 23, 2016, which regulates the aforementioned law.

Currently, "there are 269,074 self-declared quilombolas, or 3.97% of the state's resident population" (IBGE, 2022). Maranhão is one of the Brazilian states with the highest number of land conflicts due to the heterogeneity of its peasantry, capital concentration, social inequalities, and constant agricultural frontier expansion (Binkowski, 2018). Land conflicts in quilombola communities recorded by the CPT showed that in Maranhão from 2010 to 2023, there were 821 land conflicts in these communities, while 314,446 fire outbreaks and 27,731 km² of deforested area were recorded (Graph 02).

Graph 2 | Percentage of records of land conflicts, deforestation and fires in Maranhão (2010-2023).



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Conflicts	6%	8%	6%	7%	5%	5%	7%	8%	8%	7%	13%	5%	6%	7%
Deforestation	7%	6%	6%	7%	7%	6%	5%	6%	6%	5%	8%	9%	11%	11%
Burning	12%	6%	11%	6%	8%	9%	7%	8%	4%	6%	5%	5%	6%	7%

Source: CPT, 2010-2023.

Following a trend on a national scale, the aforementioned graph shows a positive correlation between land conflicts, the increase in deforested areas, and the incidence of fires in Maranhão. The number of fire outbreaks identified in Maranhão represents approximately 11% of the country's total records. Meanwhile, the state's average annual deforestation rate is 37% higher than the national average. Another notable point is that land conflicts in Maranhão account for 5% of the country's total records and 40% of conflicts occurring specifically in quilombola communities.

In 2020, Maranhão recorded 203 conflicts affecting 20,864 families affected and five murders due to rural land disputes, of which 106 of these conflicts (38% of the country's total) occurred in quilombola communities. Land conflicts, fires, and deforestation are interconnected in a cycle of environmental degradation and social violence. Land disputes often lead to illegal deforestation and the use of fires as a quick and cheap method to prepare land for economic use. In turn, increased deforestation and fires can intensify conflicts as land becomes scarce and pressure on natural resources grows. In a detailed analysis, Alston et al. (1999) showed that agrarian violence and land conflicts are exacerbated by unclear regulations and ineffective enforcement of environmental laws.

From Brazil to Maranhão, land conflicts are reproduced, often in a “legal” manner. In this context, land grabbing (grilagem) stands out, involving document forgery to legitimize irregular land possession, frequently associated with illegal deforestation, predatory resource exploitation, and even violent land conflicts (Oliveira & Feller, 2024). Currently, this practice involves two phases (Santos, 2023). The first phase relies solely on paper documentation (analog methods), while the second phase has developed with the automation of public services via the internet.

Taketa, Silva, and Santos (2023) have shown the implications of digital public services, such as the Rural Environmental Registry (CAR). The digitization of CAR has led to misuse of these tools, known as “digital land grabbing,” as it enables the illegal registration of private properties or possessions in undesignated public forests, indigenous lands, and fully protected conservation units. Although CAR has an environmental rather than land tenure purpose, Souza Filho, Sonda, and Lemos (2015) emphasized that the distinction is not always clear, particularly regarding legitimization and adverse possession claims.

Packer (2021) explained that CAR has been used fraudulently as a tool for land grabbing because it does not require proof of property ownership and is based on information provided by the applicant, with no deadline for state verification. According to Sauer (2024), land grabbing is one of the causes of socio-environmental conflicts, as it facilitates the “legalization” of deforestation, fires, and consequently, land appropriation.

Authors such as Zeng and Neelin (1999) and Yanagi (2006), when studying local-scale climate models, cite deforestation as leading to increased temperatures and reduced rainfall. When deforestation occurs over large areas, large-scale meteorological systems can also be affected (Filho, 2022). Nobre et al. (2009) warned that deforestation of 50% to 100% of the Amazon region could alter general wind circulation patterns, shifting the Intertropical Convergence Zone (ITCZ) hundreds of kilometers to the north, favoring El Niño events.

The report by Portner et al. (2022) states that if the integrity of the Amazon rainforest is compromised and the pressures of combined effects are not successfully addressed, withbregard ti deforestation and forest fires, studies indicate that there will be a reduction of more than 60%

of the area covered by the forest, leading to global warming of 2.5°C. In addition to the pressures on the forest, Indigenous peoples and traditional communities in the Amazon will face cascading impacts and risks from the combined effects of climate change and land use, making these populations more vulnerable to climate change.

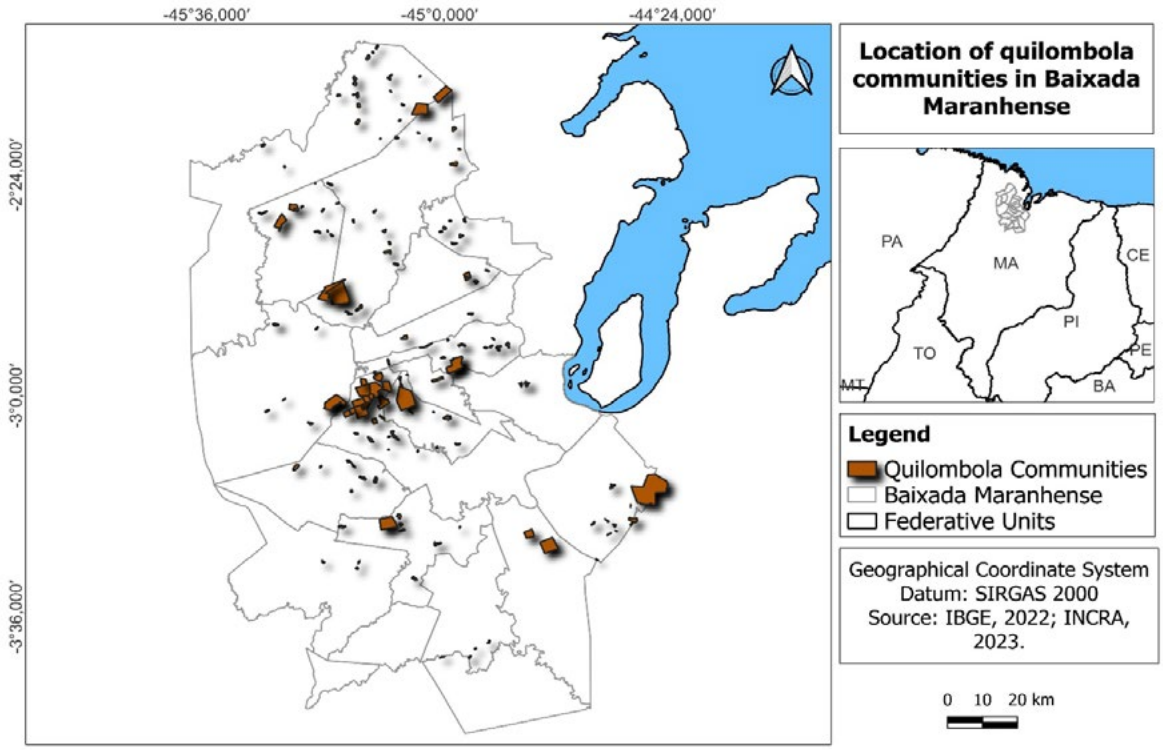
Considering these perspectives, the following section presents an analysis of the dynamics of socio-environmental conflicts in quilombola communities in the Baixada Maranhense region, based on data from public and private rural properties in SIGEF, in order to verify the influence of overlapping registered and untitled properties on conflict occurrences.

SOCIO-ENVIRONMENTAL CONFLICTS IN BAIXADA MARANHENSE

The Baixada Maranhense Geographic Microregion is bordered to the North by the Western Coast of Maranhão Geographic Microregion, to the West by the Gurupi and Pindaré Geographic Microregions, to the South by the Médio Mearim Geographic Microregion and to the East by the Rosário and Western Coast of Maranhão Geographic Microregions. The region comprises 21 municipalities: Anajatuba, Arari, Bela Vista do Maranhão, Cajari, Conceição do Lago-Açu, Igarapé do Meio, Matinha, Monção, Olinda Nova do Maranhão, Palmeirândia, Pedro do Rosário, Penalva, Peri-Mirim, Pinheiro, Presidente Sarney, Santa Helena, São Bento, São João Batista, São Vicente Ferrer, Viana, and Vitória do Mearim.

It is a region that stands out for its large number of quilombola communities (Figure 1). These communities emerged from strong colonization movements initiated by early settlers. According to ITERMA (2023), 39 quilombola communities have been granted land titles in the region. The area has a high concentration of land with unequal land ownership structures, which has leading to numerous conflicts, particularly related to the territorial expropriation of traditional peoples and communities.

Figure 1 | Quilombola Communities of Baixada Maranhense



Source: IBGE, 2022; INCRA, 2023.

The quilombola communities within the Baixada Maranhense have experienced different levels of land conflicts, whether due to actions by agribusiness and/or public and private projects. "The areas of agribusiness expansion in the state are those with the highest concentration of land conflicts, which links the conflicts to capital" (Sodré, Maciel & Júnior, 2016, p. 8).

From this perspective, of the 21 municipalities that make up the region, 15 municipalities registered 162 conflict occurrences cataloged by CPT between 2010 and 2023 (Table 01). Approximately 74.7% of the records were concentrated in 5 municipalities (Matinha/Anajatuba/ Santa Helena/Palmeirândia/Pedro do Rosário). The recorded occurrences represent 1% of total conflicts in Brazil and 20% of records in Maranhão.

Table 1 | Ranking of land conflicts in the municipalities of Baixada Maranhense, from 2010 to 2023.

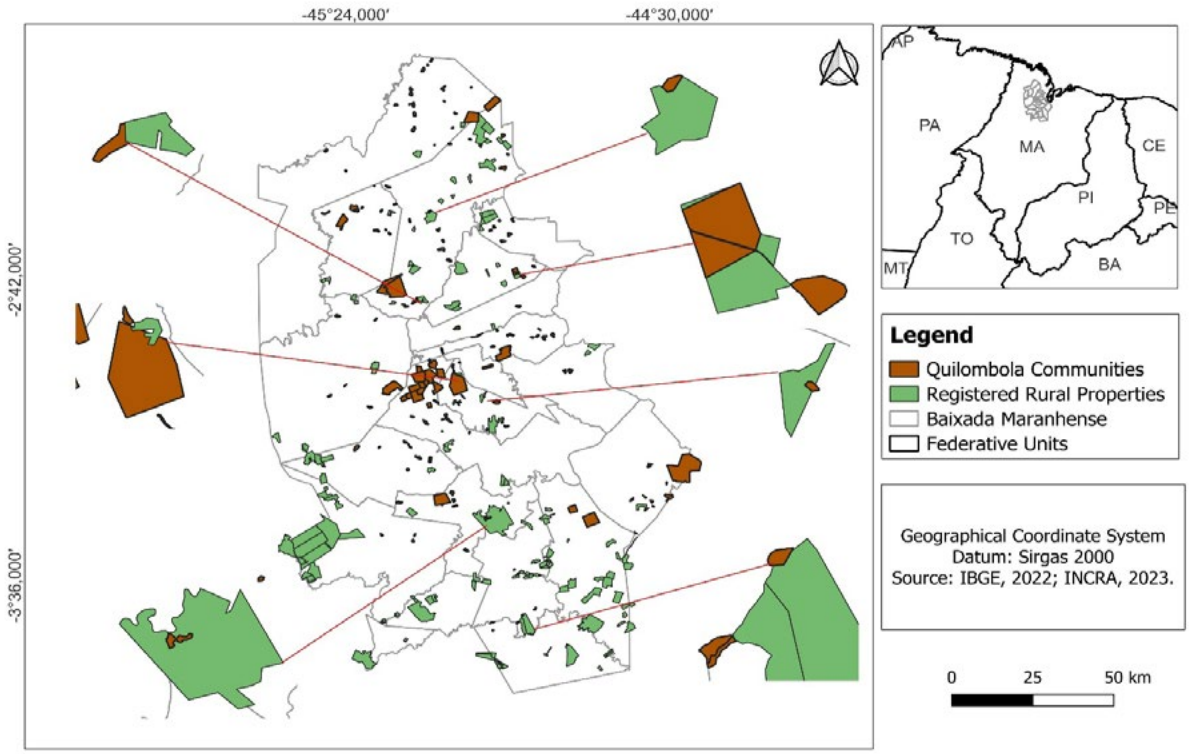
MUNICIPALITY	NUMBER OF CONFLICTS	OVERLAP OF AREAS
Matinha	51	Yes
Anajatuba	27	No
Santa Helena	16	Yes
Palmeirândia	15	No
Pedro do Rosário	12	No
Arari	10	No
São Vicente Ferrer	9	Yes
Cajari	7	No
Peri-Mirim	5	Yes
Monção	2	No
Olinda Nova do Maranhão	2	No
São Bento	2	No
Viana	2	No
Penalva	1	No
Presidente Sarney	1	No
Bela Vista do Maranhão	0	No
Conceição do Lago-Açu	0	No
Igarapé do Meio	0	Yes
Pinheiro	0	No
São João Batista	0	No
Vitória do Mearim	0	No

Source: CPT, 2023.

Records of conflicts in quilombola communities show an increase in occurrences. Among the factors influencing this phenomenon are the actions of agribusiness, real estate speculation, and industry, which is why these communities organize and fight for their lands. In this way, conflicts over land stem from several factors that rapidly penetrate rural areas, generating and reproducing social, economic, and territorial inequalities, the aim of which is the incorporation and appropriation of land under conditions of high land concentration.

As such, one of the solutions to reduce land conflicts is to regularize land ownershop. However, this time-consuming procedure that hinders the progress of regularization processes. According to data from the Land Management System (SIGEF), an electronic tool of the National Institute for Colonization and Agrarian Reform (INCRA), 213 public and private rural properties were regularized, of which 159 were officially registered. Notably, there are 7 rural properties registered in SIGEF that overlap with portions of quilombola communities in the Baixada Maranhense region (Figure 02).

Figure 2 | Registered properties overlapping quilombola communities Source: IBGE, 2022; INCRA,2023.

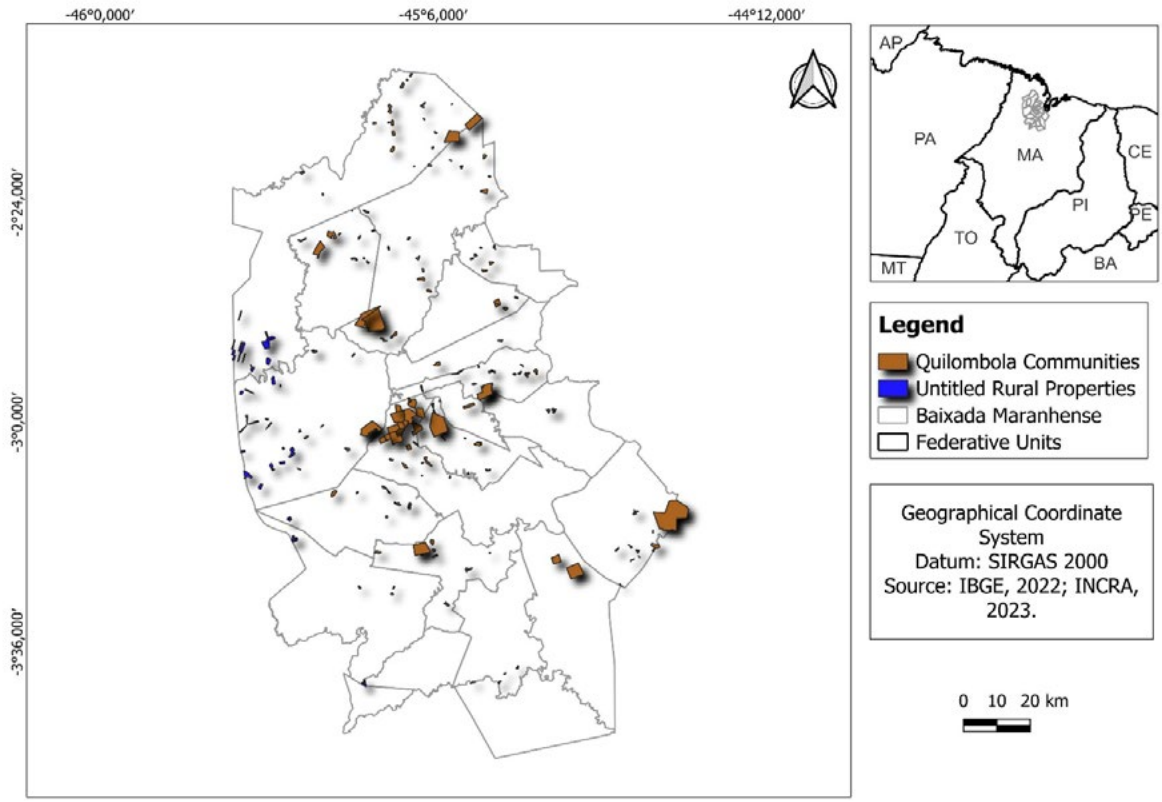


Source: IBGE, 2022; INCRA, 2023.

Land registers were found in only 02 of the 07 communities with conflict incidence (CPT, 2023). In particular, the communities of Bom Jesus in Matinha municipality and Cruzeiro in Palmeirândia. There is a positive correlation between land conflict occurrences in these communities and overlapping properties, considering the existence of territorial claim movements from both parties.

The communities that not accounted for by CPT as conflict areas are: Quilombola community Santa Rosa in Vitória do Mearim; Quilombola community Frechal in Cajari; Boa Vista community in Cajari; Quilombola community Benfica; Santa Maria community (both located in Pinheiro). It should be emphasized that conflict records are highly underreporting. At the same time, 46 untitled rural properties were recorded, in which it was observed that there was no overlap with quilombola communities, since these property areas do not contain quilombola communities located by the Brazilian Institute of Geography and Statistics - IBGE (Figure 3).

Figure 3 | Untitled properties.



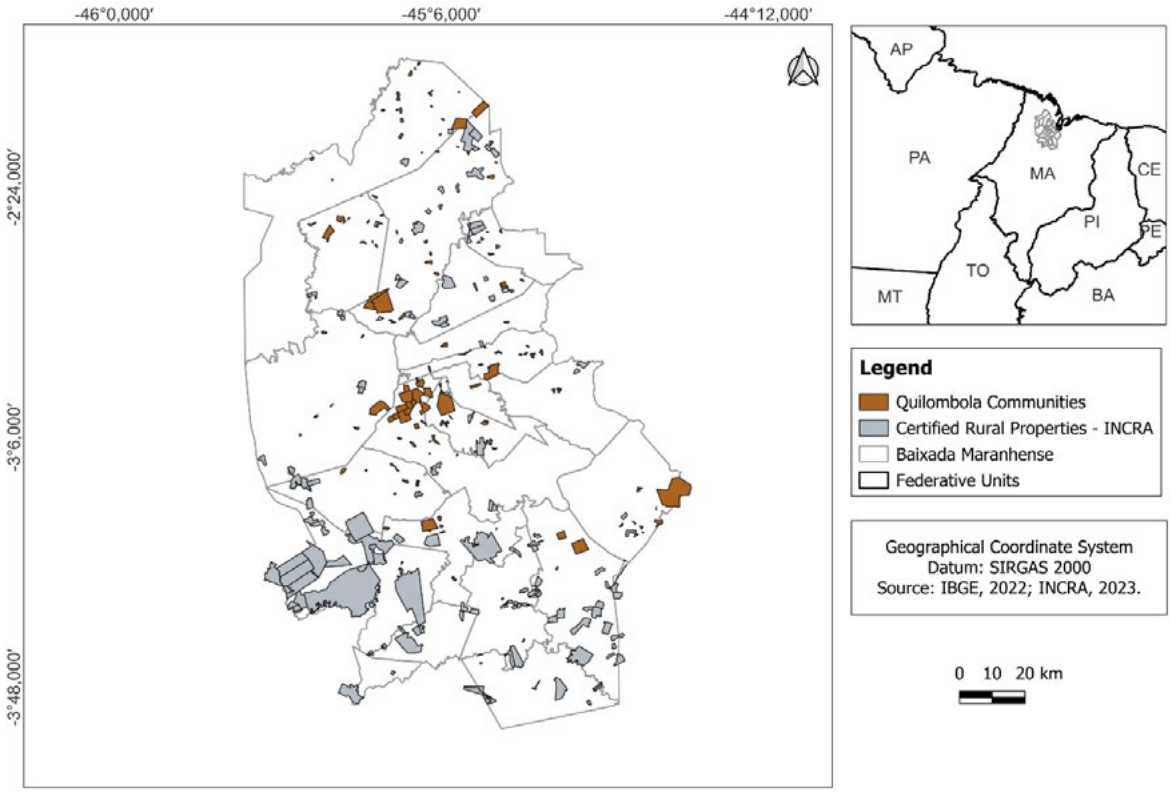
Source: IBGE, 2022; INCRA, 2023.

It is important to highlight that according to IBGE and INCRA, Baixada Maranhense has approximately 168 communities without demarcation of their recognized territorial boundaries. Through spatial analysis of data regarding quilombola communities and rural properties, it is observed that in properties certified by SIGEF (Figure 04), overlap with registered properties, specifically: Tanque de Valença Community in Matinha; Quilombola Community of Outeiro in

Monção; Castelo Community in Monção. These are being overlapped by the following properties, respectively: Tanque de Valença property; P.A. Diamante Negro/Jutahy; P.A.E. Santa Cruz Imperial.

The certified properties represented are made up of both registered and titled properties, since both variables are listed as certified rural properties. It should be noted that this combined classification accounts for 10 overlaps with quilombola communities.

Figure 4 | Certified properties.



Source: IBGE, 2022; INCRA, 2023.

In total, there are 07 communities overlapping with registered properties and 03 with titled properties, among the quilombola communities that recorded the highest occurrences of land conflicts. Throughout the historical series, the Tanque de Valença and Bom Jesus communities, located in the municipality of Matinha, along with the communities of São Caetano, São José de Bruno, Itapera, Jacuíca, Contenda, Preguiça Velha, and Graça, formed the areas with the highest number of recorded land conflicts, 51 in all. Matinha was the municipality with the highest incidence of conflicts in the Baixada Maranhense region during the analyzed period.

It should be noted that no land conflicts were recorded by the CPT (Pastoral Land Commission) in 6 municipalities of Baixada Maranhense between 2010 to 2023, being those: Bela Vista do Maranhão, Conceição do Lago-Açu, Igarapé do Meio, Pinheiro, São João Batista, and Vitória do Mearim. Given this scenario, there is a clear need to formulate and implement public policies aimed at territorial development as an instrument to reduce socioeconomic disparities, while also aligning nature conservation and cultural heritage preservation with the population's quality of life.

The factors driving the production and perpetuation of these conflicts are directly influenced by climate change. This phenomenon in itself exacerbates the problems faced by quilombola communities, such as irregular rainfall, prolonged droughts, and floods. The recurrence of these events affects agricultural production, food security, and water availability, forcing communities to adapt their ways of life amid a context of increasing vulnerability. Table 2 illustrates how these practices influence the occurrence of socio-environmental conflicts, exacerbating the vulnerability of communities to climate change.

Table 2 | Factors that influence the production of conflicts in traditional communities in Baixada Maranhense.

Deforestation and Environmental Degradation	Deforestation, driven by agricultural and livestock expansion, leads to biodiversity loss and depletion compromise of the natural resources on which quilombola communities depend. This degradation directly affects soil quality, water availability, and traditional cultivation cycles.
Agribusiness Expansion	The advance of agribusiness, often accompanied by the intensive use of pesticides and monoculture, not only degrades the environment but also threatens the livelihoods of quilombola communities, which rely on family-based and sustainable agriculture.
Infrastructure Projects	The construction of infrastructure projects are practices that often disregard the territorial rights of quilombola communities. These activities can cause forced displacement, pollution of rivers and soil, and the destruction of areas of cultural and historical value.

Source: Research Data, 2024.

The resistance and struggle of quilombola communities to secure their territorial rights and maintain their traditional practices are often the basis of socio-environmental conflicts. Attempts to resist the invasion of their lands by external agents, such as farmers and companies, generate ongoing tensions. Finally, conservation strategies must align with the paradigm of environmental justice, understanding well-being as part of the livelihoods of traditional communities.

Environmental and development policies must recognize cultural diversity, citizens' rights, and social inequalities, which must take priority over economic and/or biological indicators. Promoting well-being involves a commitment to social and cultural plurality and legal rights, aiming to build a more egalitarian, just, and diverse society (Anaya & Espírito-Santo, 2018).

In summary, the practices that drive climate change at local and regional levels, such as deforestation, agricultural expansion, and natural resource exploitation,not only directly affect the environment but also intensify actions that produce and reproduce socio-environmental conflicts in quilombola communities, threatening their survival and traditional ways of life.

FINAL CONSIDERATIONS

This present study hypothesized that socio-environmental conflicts in traditional communities are deeply influenced by practices contributing to climate change at both local and regional scale. Thus, this research aimed to analyze how climate change influences the struggle for territorial rights and the occurrence of land conflicts in traditional communities in Brazil, with an emphasis on the state of Maranhão, particularly in the municipalities of Baixada Maranhense.

When analyzing socio-environmental conflicts in Brazil, Maranhão, and Baixada Maranhense between 2010 and 2023, it was found that practices driving climate change at a local and regional level, such as deforestation, wildfires, agricultural expansion, and natural resource exploitation, not only directly affect the environment but also intensify actions that generate and perpetuate socio-environmental conflicts in quilombola communities. These practices compromise food security, threaten biodiversity, and endanger the survival and traditional ways of life of these populations (Little, 2002; Milanez & Torres, 2021).

In this context, conflicts over land, fires, and deforestation are interconnected, each fueling and exacerbating the other. It is therefore crucial to understand that socio-environmental conflicts stem from one of the forms of violence institutionalized by the ineffectiveness of the state, as well as the institutional fragility of entities monitoring violations of traditionally occupied territories (Porto-Gonçalves, 2006). This situation directly affects the struggle for territorial rights and the cultural integrity of traditional peoples and communities, reinforcing the need for more effective government intervention (Santos, 2007).

To mitigate the impacts of socio-environmental conflicts on traditional communities and combat climate change, an integrated approach is proposed that considers social, economic, and environmental aspects, along with robust governance to mediate conflicts and protect natural resources. Some specific solutions include:

A. Implementation of land regularization programs and protection of territories occupied by traditional communities.

B. Strengthening environmental control institutions to combat illegal deforestation and fires.

C. Promotion of low-impact agriculture and community-based natural resource management.

D. Training local leaders in conflict mediation and sustainable project management.

To illustrate the feasibility of the proposed approaches, successful case studies can be analyzed, such as:

A. **A. Chico Mendes Extractive Reserve (Acre)** – A participatory management model that combines environmental protection with community economic sustainability (Benatti, 2003).

B. Kalunga Quilombola Territory (Goiás) – A successful case of land regularization and natural resource management (Little, 2002).

C. Community Forest Management Project in Pará – A strategy that promotes sustainable use of the forest as an alternative to illegal deforestation (Almeida, 2019).

These initiatives demonstrate that it is possible to reduce the impacts of climate change and territorial conflicts through integrated actions involving communities, government, research institutions, and civil society. In this way, the implementation of solutions based on public policy integration, active community participation, and sustainable practices can significantly contribute to reducing socio-environmental conflicts and preserving the traditional ways of life of affected populations.

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