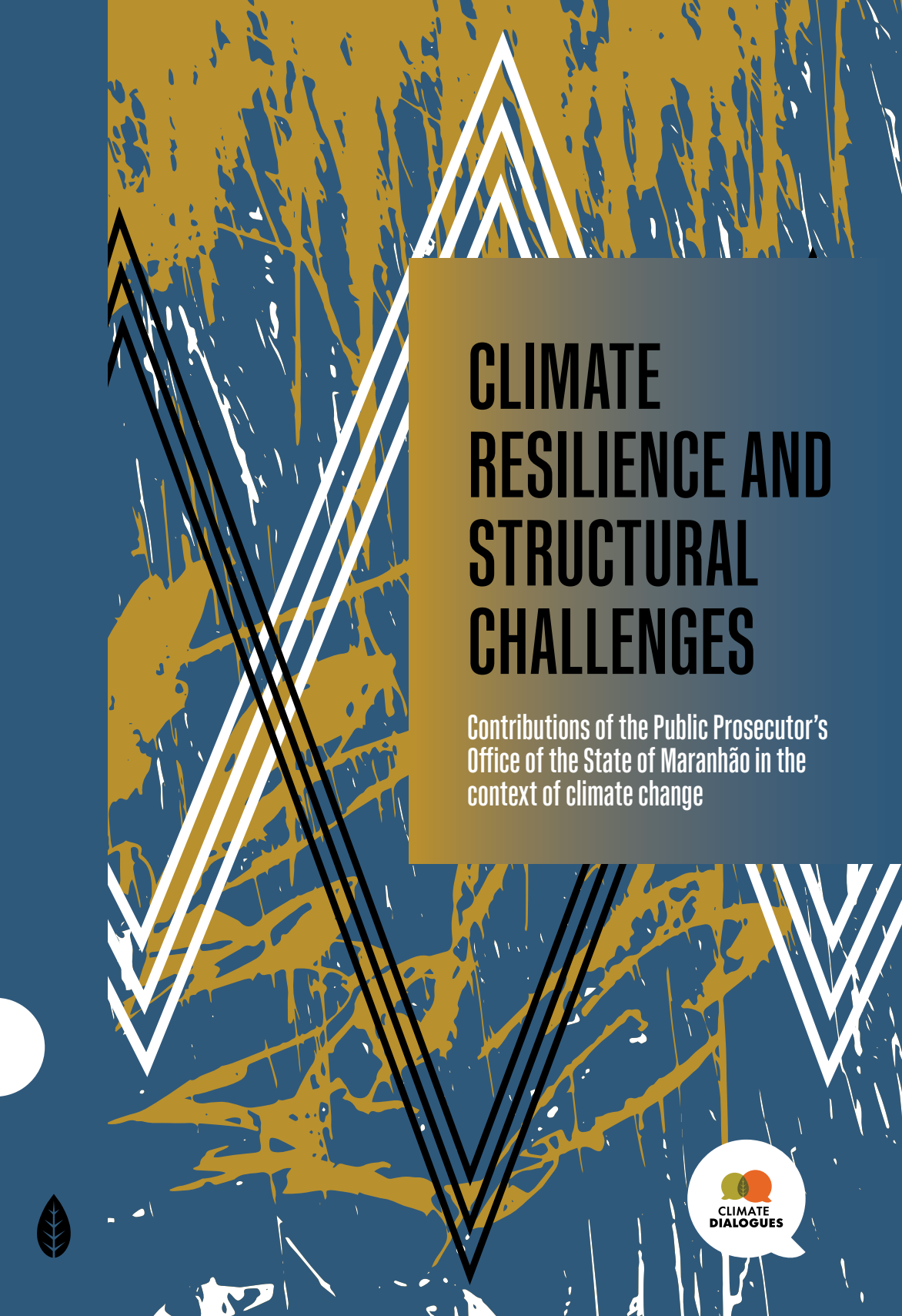
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RESILIENCE AND
STRUCTURAL
CHALLENGES
Contributions of the Public Prosecutor's Office of the State of Maranhão in the context of climate change
CLIMATE
DIALOGUES

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COMPONENT 3 TECHNICAL COMMITTEE | COPAÍBAS
HELIO HARA
PEDRO REISS
DANIELLE DE ANDRADE MOREIRA
RAFAEL CORRÊA

EDITORIAL COORDINATION AND EDITION
ANDRÉIA DE MELLO MARTINS
FUNBIO Project Manager

PREFACE
ROSA LEMOS DE SÁ
FUNBIO's Secretary General

DANILO JOSÉ DE CASTRO FERREIRA
Attorney General of the Public Prosecution Office of the State of Maranhão

FUNBIO/COPAÍBAS TEAM

ROSA LEMOS DE SÁ
Secretary General

MANOEL SERRÃO BORGES DE SAMPAIO
Program Superintendent

MARIANA MIGUEL DOS SANTOS
Portfolio Manager

PAULA CAVALVANTI CEOTTO
COPAÍBAS Program Manager

MANUELA TORRES TAMBELLINI
Programs Analyst

MARIANA MOREIRA DE MENEZES
Communications Analyst

MICHELLE DANTAS
Communications Analyst for the COPAÍBAS Program from 2021 to 2023

CONSULTANTS
NICIA COUTINHO
Harmonia Consultoria Ambiental

ISABELLE COSTA
ICOSTA Consultoria

COPAÍBAS
COMUNIDADES TRADICIONAIS, POVOS INDÍGENAS E ÁREAS PROTEGIDAS NOS BIOMAS AMAZÔNIA E CERRADO

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AUTORES

CLÁUDIO REBÊLO CORREIA ALENCAR
Prosecutor of the Public Prosecutor's Office of Maranhão (MPMA)

FRANCISCO TEOMÁRIO SEREJO SILVA
Prosecutor of the MPMA

LEONARDO SOARES BEZERRA
Prosecutor of the MPMA

LICIA RAMOS CAVALCANTE MUNIZ
Prosecutor of the MPMA

LUÍS FERNANDO CABRAL BARRETO JÚNIOR
Prosecutor of the MPMA

MARIA DE JESUS RODRIGUES ARAUJO HEILMANN
Prosecutor of the MPMA

THIAGO CÂNDIDO RIBEIRO
Prosecutor of the MPMA

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FUNBIO

Partnership

MPMA Ministério Público do Estado do Maranhão
ESMPMA

PARTICIPANTS

ÂNGELA KUCZACH
Rede Pró-UC and Coalização Pró-UC

ANNE CAROLINE NEITZKE
Federal Prosecutor of the Federal Public Prosecutor's Office

ANTÔNIO COELHO SOARES JÚNIOR
Prosecutor of the MPMA

ARTHUR LIMA SERRA
State Agency for Urban Mobility and Public Services

CARLOS HENRIQUE VIEIRA
Prosecutor of the MPMA

CRICIELLE MUNIZ
State Institute of Education, Science and Technology of Maranhão (IEMA)

DANILO JOSÉ DE CASTRO FERREIRA
Attorney General of the Public Prosecution Office of the State of Maranhão

ÉRICA ELLEN BECKMAN SILVA
Prosecutor of the MPMA

FELIPE NUNES
Observatório do Código (Legal Code Observatory)

FRANCISCO EDILTON LIMA DE OLIVEIRA
State Prosecutor of Maranhão

FREDERICO BIANCHINI JOVIANO DOS SANTOS
Prosecutor of the MPMA

GABRIELA CANTO PIRES SANTOS SAVIAN
Instituto de Pesquisa Ambiental da Amazônia (IPAM)

ISAYANA OLIVEIRA SILVA
Coroadinho Socioenvironmental and Climate Census Project

JADILSON CIRQUEIRA
Prosecutor of the MPMA

JOSÉ FRAZÃO SÁ MENEZES NETO
Prosecutor of the MPMA

JOSÉ LUCÍOLO GORAYEB SANTOS
Prosecutor of the MPMA

JÚLIA RAQUEL DE SÁ ABÍLIO MANGUEIRA
The Nature Conservancy

KARLA ADRIANA HOLANDA FARIAS VIEIRA
Prosecutor of the MPMA

LARISSA REBECA REGO SANTOS PAIXÃO
Public Prosecutor's Office of the State of Maranhão

LAYSE CAMPOS
Environmental School of Maranhão

LETICE CÂMARA FRANÇA
Public Prosecutor's Office of the State of Maranhão

LINDA LUZ MATOS CARVALHO
Prosecutor of the MPMA

LUANE LEMOS
Maranhão Port Administration Company (EMAP)

LUCIANE MARTINS DE ARAÚJO
Pontifical Catholic University of Goiás (PUC-GO)

LUCYLEA GONÇALVES FRANÇA
Federal University of Maranhão

LUIZ ANTÔNIO BRASI FILHO
Instituto de Manejo e Certificação Florestal e Agrícola (Imaflora)

MAÍRA LOPES DE CASTRO
Higher School of the Public Prosecutor's Office of Maranhão (ESMP/MA)

MARCO AURÉLIO AMARAL DOS SANTOS
Libertas Non-Governmental Organization (NGO)

MARILÉIA CAMPOS DOS SANTOS COSTA
Environmental Management Committee of the Public Prosecutor's Office of the State of Maranhão

PARTICIPANTS

MAURO ROBERTO CARRAMILO DOS SANTOS JÚNIOR
Coordination of the Maranhão State Forum on Environmental Education

MICHELLE DANTAS
Communications Analyst for the COPAÍBAS Program until 2021

RAIMUNDO NONATO MORAES ANDRADE
Environmental Advocate

RAPHAELL BRUNO ARAGÃO PEREIRA DE OLIVEIRA
Prosecutor of the MPMA

REGINA BARDALO MARTIS
Union of Public School Teaching Professionals of São Luís (Sindeducação)

ROBERTO MAURO GURGEL
State Education Council of Maranhão

TATIANA APARECIDA BALZON
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ-Brasil)

THAÍS EMÍLIA DE SOUSA VIEGAS
Dom Bosco Higher Education Unit

VALÉRIA CRUZ RIBEIRO
Public Prosecutor's Office of the State of Maranhão

VANESSA AGUIAR
State Agency for Urban Mobility and Public Services

VIVIANE CALDERONI
Instituto Igarapé

VIVIANE VAZZI PEDRO
Environmental Education Coordination, Maranhão State Department of Education

WARNER BENTO FILHO
World Wild Fund (WWF-Brazil)

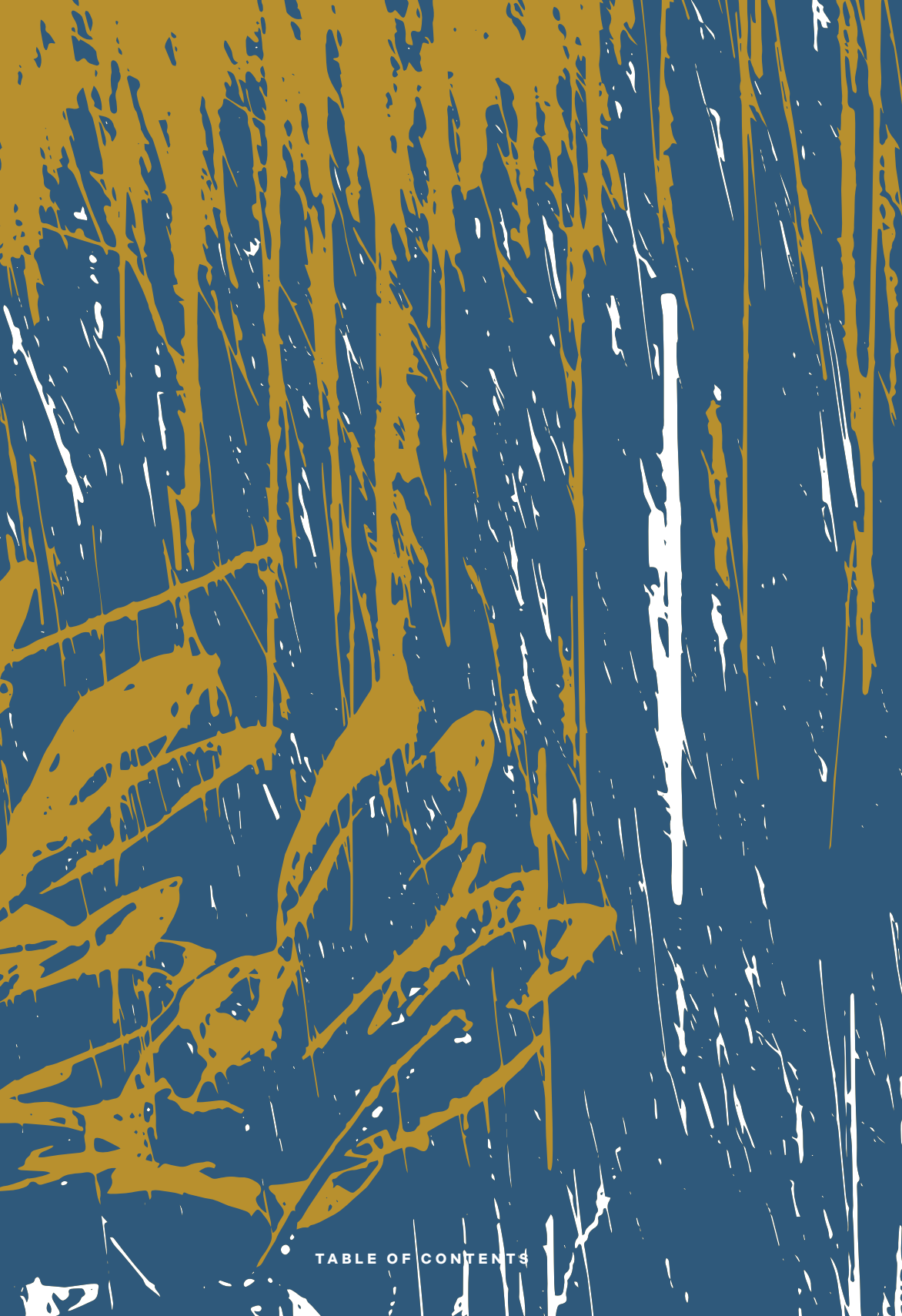
WYNGLEIDY NAYARA RODRIGUES DOS SANTOS
Public Prosecutor's Office of the State of Maranhão

CREDITS

GRAPHIC DESIGN
GISELLE MACEDO
Luxdev

REVISION
RACHEL VALENÇA
No Reino das Palavras

TRANSLATION
LARISSA STONER
Sunny Traduções



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A mosaic of landscapes, challenges, and solutions

For nearly three decades, FUNBIO has been fostering connections among diverse partners to help conserve our planet's future. Guided by this approach, the Climate Dialogues initiative, part of the COPAÍBAS program, brings together public attorneys and civil society to promote the convergence of diverse voices. These exchanges seek new pathways to mitigate climate change while advancing conservation and sustainable development in the Cerrado and the Amazon.

It was with great satisfaction that, in 2022, through the Climate Dialogues initiative, we signed a Technical Cooperation Agreement with the Office of the Prosecutor General, the Higher School of the Public Prosecutor's Office of the State of Maranhão (ESMP/MA), and the Environmental, Urbanism, and Cultural Heritage Division of the Maranhão Public Prosecutor's Office (MPMA). This partnership enabled a series of meetings marked by a diversity of actions, perspectives, ideas, and timelines. Although – or perhaps precisely because – these differences exist, they have sparked shared reflections that drive forward the urgent solutions needed to tackle Brazil's socio-environmental challenges. Challenges that are often as vast as the natural and social heritage that makes our country so unique.

Maranhão, a state where the Amazon and the Cerrado meet, stands out for its remarkable diversity of landscapes and its vast socio-environmental, cultural, and historical richness. This fourth publication from the Climate Dialogues initiative brings together articles by representatives of the Maranhão Public Prosecutor's Office (MPMA), offering insights, lessons, and experiences from across the complex mosaic that defines the state. The collection presents an overview of Maranhão's responses to the impacts of climate change, while also highlighting a range of proactive efforts led by the MPMA, which plays a central role in advancing the socio-environmental dialogue.

Since its founding in 1996, FUNBIO, a private institution dedicated to providing strategic resources for biodiversity conservation, has taken great pride in fostering meaningful partnerships. We are therefore pleased to feature the intellectual contributions of representatives from the MPMA in this publication, which stands as a testament to our collaboration. Through the articles gathered here, readers gain valuable insight into the MPMA's commitment and actions on critical issues such as illegal deforestation, wildfires, and waste management.

As Brazil prepares to host COP30, this publication is more than timely, it is essential reading for all those seeking to understand the many pathways available in an era when, we hope with optimism, solutions will outpace the challenges.

Climate resilience and structural challenges: *contributions of the Public Prosecutor's Office of the State of Maranhão in the context of climate change* is supported by the Climate Dialogues initiative, part of the COPAÍBAS Program, with support from the Royal Norwegian Embassy in Brazil and financial management by FUNBIO.

ROSA LEMOS DE SÁ
FUNBIO's Secretary General

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New pathways and the defense of social rights

Climate change stands as one of the greatest challenges of the 21st century. Alongside the pursuit of global peace and the fight against hunger and poverty, the effects of a warming atmosphere call for conscious and responsible action, especially in consideration of future generations.

Scientific consensus affirms that these effects are largely driven by human activity, closely tied to modern lifestyles. Fossil fuel consumption, deforestation, urban development, and solid waste generation all play a critical role and must be fundamentally reimagined.

History has tasked Environmental Law with establishing the foundations and guiding principles of what we now recognize as Climate Law. It has contributed core concepts such as the polluter pays principle, strict liability, precaution, prevention, and an intergenerational perspective. Within the framework of Climate Law, the principles of adaptation and mitigation introduce new and significant responsibilities for the Environmental Public Prosecutor's Office, whose trajectory is closely aligned with the broader development of environmental law in Brazil.

It was within the State Public Prosecutor's Office that specialized Environmental Prosecutor's Offices were first established, along with civil inquiries, public civil actions, and later, Regional Prosecutor's Offices and Specialized Task Forces. The Public Prosecutor's deep-rooted commitment to defending diffuse interests is intrinsic to its mission. Only an institution that is, by its very nature, permanent, unified, and indivisible, and whose foremost duty is to uphold the rule of law, can lead the way in developing a proactive, pioneering, and enduring institutional policy to defend the climate, safeguard the environment, and advance Climate Justice.

As one of the great challenges of modern law, climate justice must adopt both preventive and remedial measures to address the impacts of climate change, with a focus on reducing the disproportionate burden placed on vulnerable ecosystems and populations. These efforts should be carried out through transparent, participatory, and transformative processes, whether consensual or through litigation. This means the Public Prosecutor's Office must not only defend nature but also advocate for the most underserved populations, including quilombola communities, traditional peoples, and those in urban areas who are especially vulnerable to climate disasters such as floods and landslides, with the same dedication that has earned it the respect and recognition of Brazilian society.

In partnership with FUNBIO, the Public Prosecutor's Office of the State of Maranhão is proud to present this collective legal publication in the year Brazil hosts COP30. The work showcases the intellectual contributions of dedicated members of the State Public Prosecutor's Office, with a strong focus on deforestation. The authors address key issues such as babaçu palm forests, urban arborization, and permanent preservation areas, and conclude with a compelling account of the Office's engagement with the community of Piquiá de Baixo, in the Amazon region of Maranhão. These discussions are further enriched by reflections on wildfires, the

degradation of water resources, and solid waste management, always through the lens of the Public Prosecutor's role and actions.

Expertise without social engagement is knowledge without purpose. Justice that is disconnected from the people and indifferent to the most vulnerable risks becoming mere bureaucracy. The Public Prosecutor's Office stands apart from these dangers and continues to advance steadily as a true representative of society before all branches of government. In a democratic state governed by the rule of law, the path to defending social interests invariably runs through the Public Prosecutor's Office. This is the commitment we make to current and future generations.

This book embodies the commitment of the Public Prosecutor's Office of the State of Maranhão to a just environmental legal order, to the ecocentric defense of nature, and to the pursuit of environmental and climate justice. These are guiding horizons that, paraphrasing Eduardo Galeano, are like dreams: the farther we walk, the more distant they appear, and in that distance, we come to understand that the journey itself is the dream.

DANILO JOSÉ DE CASTRO FERREIRA
Prosecutor General of the Public Prosecutor's Office of the State of Maranhão

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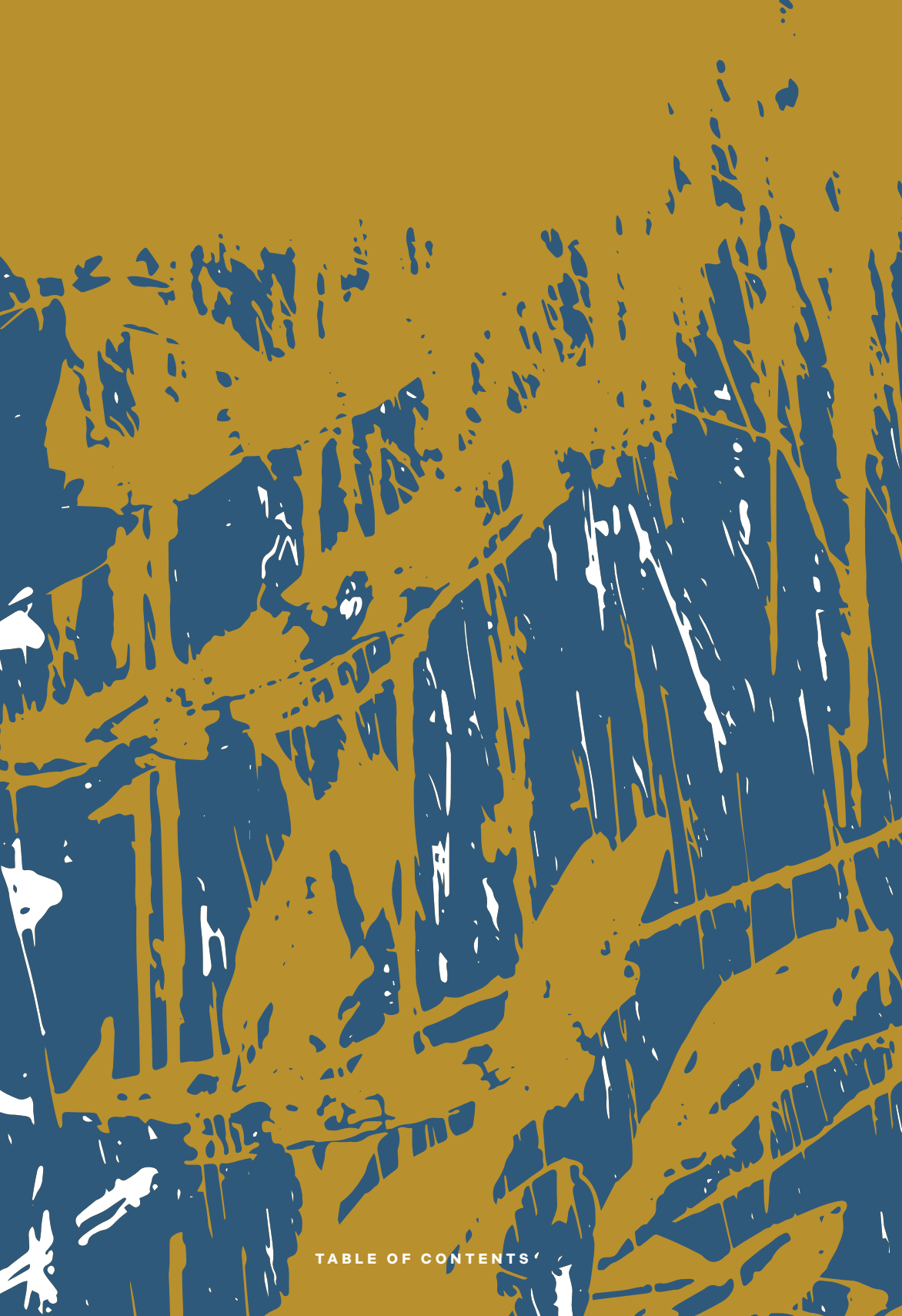

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Climate Dialogues

A gathering of voices for a new future is a call to action, an effort to build networks and co-create solutions. While each of us holds power individually, together we are far more capable of driving lasting transformation. This requires rethinking traditional communication models, decentralizing knowledge, and opening space for new perspectives to emerge.

It is in this spirit that Climate Dialogues was created, an initiative aimed at engaging professionals across the Brazilian justice system in addressing climate change and combating deforestation in the Amazon and Cerrado. By moving beyond routine competencies, Climate Dialogues invites participants to broaden their understanding of what can be accomplished collectively when faced with complex, systemic challenges.

The strategy was developed in 2020 by FUNBIO – the Brazilian Biodiversity Fund, a private, non-profit national financial and operational mechanism that works in partnership with government, the private sector, and civil society to direct strategic and financial resources toward effective biodiversity conservation initiatives[1]. In this context, strategic resources are also understood to include knowledge exchange and the strengthening of partnership networks.

In that same year, marked globally by the challenges of the pandemic, FUNBIO entered into a partnership with the Ministry of Foreign Affairs of Norway to implement the program Community, Protected Areas, and Indigenous Peoples Project in the Brazilian Amazon and Cerrado Savannah Program, known as COPAÍBAS.[2] The program seeks to reduce deforestation and related greenhouse gas emissions through strategies that promote the conservation of forests and native vegetation in the Amazon and Cerrado.

Structured around four interconnected action lines, COPAÍBAS is a strategic initiative focused on environmental protection and the promotion of sociobiodiversity. It brings together complementary efforts to elevate traditional knowledge and foster climate change adaptation. The first action line prioritizes strengthening protected areas in the Cerrado, recognizing their vital role in biodiversity conservation and climate regulation. Alongside this, the program supports the environmental and territorial governance of Indigenous Peoples, reinforcing their rights and expanding their autonomy over traditional lands.

A third action line promotes the dissemination of information about the risks of climate change and encourages the use of tools to combat deforestation and advance sustainable practices. Rounding out the program's strategy is a focus on enhancing the economic efficiency of value chains and local production systems, promoting the sustainable use of natural resources and valuing sociobiodiversity products as both a source of income and a pathway to environmental preservation.

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1 For more information about FUNBIO – the Brazilian Biodiversity Fund, visit: **funbio.org.br**.

2 For more information on the COPAÍBAS program, visit: **copaibas.org.br**.

By bringing together these dimensions, COPAÍBAS advances a development model that integrates environmental protection with climate resilience, rooted in the lived realities of the Amazon and Cerrado territories and communities.

Within this framework, the Climate Dialogues initiative forms part of the program's third action line, focused on raising awareness about the risks of climate change and promoting tools to support efforts to curb deforestation. The initiative aims to connect climate issues to the daily work of professionals responsible for upholding the rule of law, protecting human rights, and ensuring a healthy environment, with financing strategies serving as a foundation for innovation. By creating spaces for dialogue, knowledge exchange, and collaborative idea-building, Climate Dialogues fosters practical guidance and solutions, demonstrating how legal obligations and emerging opportunities can be more effectively applied in addressing the climate crisis.

By convening diverse actors and perspectives, Climate Dialogues enhances institutional coordination and fosters social engagement in developing concrete, sustainable responses to one of the defining challenges of our time.

Conceived as a multi-phase initiative with the flexibility to engage a broad range of stakeholders, Climate Dialogues identifies opportunities for partnerships and connections that bring visibility to key local challenges, paving the way for innovative and context-specific solutions. One such collaboration was developed with the Public Prosecutor's Office of the State of Maranhão.

The Brazilian Justice System

The Brazilian justice system comprises several public legal institutions, each with distinct responsibilities. Among them, the Public Prosecutor's Office plays a central role as an independent body tasked with upholding the law and safeguarding fundamental rights. It is responsible for monitoring the legality of public and private actions and for investigating and prosecuting violations of the law when necessary. To carry out its mandate, the Public Prosecutor's Office can initiate investigations and file civil lawsuits to protect essential collective rights, such as environmental preservation, cultural heritage, public health, and quality education.

In Brazil, the Public Prosecutor's Office has two main branches: the State Public Prosecutor's Office (*Ministério Público Estadual – MPE*) and the Federal Public Prosecutor's Office (*Ministério Público Federal – MPF*). Both are tasked with upholding the law, but they operate in distinct spheres. The MPE works at the state and municipal levels, while the MPF addresses issues of national scope. Each Brazilian state has its own State Public Prosecutor's Office, which considers regional characteristics and local impacts when overseeing public and private actions, ensuring that public officials comply with the law and that private actors do not infringe upon it.

Through the work of state prosecutors (*promotores and procuradores de justiça*), State Public Prosecutor's Offices promote social well-being across a wide range of areas, from child protection and violent crime to tax evasion, environmental licensing, and carbon markets. These issues are often complex, cross-cutting, and demand a plurality of perspectives.

To support these institutions in addressing the complexity of their roles, the initiative has established partnerships with several constitutional bodies, aiming to broaden access to information and foster exchange among diverse social actors.

One key outcome of these collaborations is the publication of books that reflect the perspectives and positions of public legal professionals with the authority to engage in climate-related issues.

These publications serve a dual purpose: to increase transparency around ongoing efforts and to contribute to the body of knowledge on emerging legal frameworks and innovations. They highlight both challenges and opportunities, while promoting wider dissemination and deeper reflection on these pressing topics.

Partnership with the Public Prosecutor's Office of the State of Maranhão (MPMA)

On September 1, 2022, a Technical Cooperation Agreement was signed between the Office of the Attorney General, the Higher School of the Public Prosecutor's Office of the State of Maranhão (ESMP/MA), the Operational Center for the Environment, Urbanism, and Cultural Heritage of the Public Prosecutor's Office of Maranhão (MPMA), and the Brazilian Biodiversity Fund (FUNBIO), with the goal of launching a joint effort to implement the *Climate Dialogues* initiative.

The partnership aimed to build institutional capacity and advance shared understanding on urgent issues related to environmental conservation finance, especially in the context of climate change and efforts to combat deforestation. A broad, participatory methodology guided the initiative, combining diverse strategies for engagement and knowledge generation. Activities included coordination meetings among partners, circular dialogue sessions, and, initially, experiential gatherings that were later adapted into immersive workshops. The project also involved publishing opinion pieces on the subject and fostering collaboration with other states through parallel events held during existing seminars and conferences.

The initiative also encompassed a coordinated and strategic institutional effort to raise awareness, deepen knowledge, and foster greater engagement among legal professionals on climate and environmental issues. This effort aimed to strengthen public policies and actions focused on protecting natural resources and the communities that rely on them.

Methodology

Each institution faces distinct challenges, whether due to structural limitations or the nature of their daily responsibilities. To better understand these dynamics, Climate Dialogues began with a series of interviews with professionals working in Maranhão. The questions explored climate-related concerns, awareness of existing financing mechanisms, preferred models for information sharing, and other relevant topics.

The insights gathered not only allowed the initiative to adapt its methodologies, but also contributed to the institution's broader strategic planning, highlighting key areas for reflection and action.

The partnership with the MPMA brought together environmental prosecutors to engage in collective dialogue and co-creation of solutions, supported by

FUNBIO through the COPAÍBAS program. The first phase consisted of circular meetings, so called because participants sat in a circle with no designated speakers' area, fostering an environment of horizontal exchange. All participants brought deep expertise in their respective fields, with the understanding that knowledge is not hierarchical but shaped by diverse experiences. Representatives from civil society organizations were also invited to share concrete, successful case studies to enrich the discussion.

Held between March 22 and April 26, 2023, the meetings explored a wide range of topics, including climate change, international commitments and pathways for transformation; territorial actions to combat deforestation; PADDD (Protected Area Downgrading, Downsizing, and Degazettement) in the Amazon and Cerrado and the legal responsibilities for impact mitigation; traditional, Indigenous, and Quilombola communities: economic alternatives, networks, and their role in conservation; value chains and economic alternatives in the context of territorial challenges; among others.

All the topics generated strong engagement, with in-depth discussions on local and regional realities and ways to surface and address pressing challenges. As the partnership progressed, and in the face of an ever-evolving context, the Public Prosecutor's Office of Maranhão (MPMA), increasingly committed to a strategic, participatory, and results-driven approach, brought a vital new dimension to the conversation: the often invisible structural fragility that persists across the state and its consequences for climate action, highlighting the urgent need for resilience in a time of rapid change. Building on this, our work together in 2024 focused on bringing visibility to these critical issues through real-world case studies, offering a more thoughtful and grounded view of the many stages involved in developing a meaningful climate agenda.

Focusing on local challenges and climate resilience

The first step was to review the First Revision of the 2021–2029 Institutional Strategic Plan, with a focus on the 2025–2027 triennial cycle, which guides the work of state prosecutors. Building on this foundation, prosecutors were invited to reflect on the Climate Dialogues discussions through the lens of their current mandates and the institution's strategic priorities.

The strategic plan was developed using a methodology proposed by the National Council of the Public Prosecutor's Office (CNMP), adapted to the specific context of the MPMA. It was shaped through a collaborative process, including workshops held in four regional hubs, which strengthened active listening and ensured broad regional representation. Integrating these perspectives into the development of new approaches made the process all the more robust.

This new strategic cycle stands as a tool for integrated management, designed not only to enhance institutional performance, but more importantly, to effectively respond to the needs of Maranhão's society. In line with its mission to defend the legal order, democratic institutions, and inalienable social and individual rights, the Public Prosecutor's Office aims to be a responsive institution, close to the public and firmly grounded in constitutional values. In this pursuit, transparency becomes an essential tool.

Within this framework, three strategic projects stand out as tangible expressions of the institution's planning objectives: Solid Waste Valorization, Combating Deforestation in the Cerrado Biome, and Sanitation for All.

The Solid Waste Valorization project promotes sustainability and the socio-economic inclusion of waste pickers through the implementation of reverse logistics systems focused on the circular economy. Currently active in 22 municipalities with populations over 50,000, the initiative has significantly increased the commercialization of recyclables, boosted state tax revenues (ICMS), and generated new employment opportunities. In addition to addressing improper waste disposal, the project strengthens interinstitutional collaboration and encourages the development of effective municipal policies for solid waste management.

In the field of environmental protection, the Combating Deforestation in the Cerrado Biome project addresses the ongoing loss of native vegetation, particularly in municipalities with high deforestation rates. The initiative aims to reduce illegal deforestation, strengthen environmental compliance through the Rural Environmental Registry (CAR, the acronym in Portuguese), and enforce environmental legislation, with an emphasis on preventive, solution-oriented action to protect Brazil's second-largest biome.

The Sanitation for All project focuses on one of the state's most critical structural challenges: the low rate of sewage collection and treatment. Targeting municipalities with populations over 100,000, the initiative seeks to expand building connections to public sewer systems, reduce diffuse pollution, and increase the use of existing infrastructure. It also reinforces oversight of public resource allocation, promotes public health, and supports more efficient environmental management.

This strategic plan, alongside concrete projects aimed at improving quality of life and protecting the environment, underscores the urgent need for foundational structural actions before more complex climate solutions can be effectively pursued. It is in this context that the reflections gathered in this book, written by state prosecutors, explore themes closely tied to institutional planning and the many intersections between climate and society.

Before advancing high-level climate strategies, it is essential to recognize that building climate resilience begins with ensuring the basic needs of the most vulnerable populations: access to clean water, adequate housing, healthcare, education, and food security. Without these fundamental conditions, communities are far less equipped to anticipate, prepare for, and respond to the impacts of climate change, whether in the form of severe storms, prolonged droughts, or rising sea levels.

Climate resilience is the ability of communities, ecosystems, and economies not only to endure adverse climate events but also to adapt with minimal disruption and recover effectively in their aftermath. Advancing resilience requires the integration of social justice, environmental protection, and strategic planning in a coordinated effort to make development genuinely sustainable and inclusive.

Achieving this demands a deep understanding of real-world cases, the actions taken, the legal processes involved, and the stories behind them. It requires recognizing socio-environmental conflicts, the territories affected, and the individuals and communities at their center. Building grounded solutions means engaging with these lived realities. To innovate in responding to the climate crisis, we must first understand the past, identify historical inequities and systemic gaps, and work to address them with a clear focus on improving quality of life.

Like the branching veins of a river in search of an outlet, solutions must extend outward, explore new pathways, often overlooked or underestimated, and reach the places where vulnerability is most severe.

To present these perspectives, the book is divided into two parts. The first, titled "Climate Change and Socio-environmental Impacts", features four articles that explore the relationship between society and the environmental and climatic challenges we face. It opens with an article by prosecutor Luís Fernando Cabral Barreto Júnior, who offers a comprehensive overview of the constitutional, legal, and jurisprudential protections surrounding the babassu palm (*Attalea speciosa*). He highlights its socio-environmental importance and the urgency of its preservation amid increasing land-use change. Approaching the issue from an ecocentric perspective, the article draws on the Bali Principles and the concept of climate justice, emphasizing the need for fair treatment of the populations and ecosystems most affected by climate change. It also outlines legal precedents for civil and criminal liability in cases of damage to babassu palms, signaling a new phase of climate litigation aimed at holding carbon emitters accountable. The article concludes with concrete proposals for public and societal action to protect the species and advance a participatory, equitable model of climate justice.

The following article, by prosecutor Cláudio Rebêlo Correia Alencar, highlights the urgency of understanding the causes and consequences of climate change, especially as extreme weather events become more frequent. This urgency is heightened in contexts of social exclusion, where historically oppressed and vulnerable populations are the most affected. The author underscores the presence of environmental racism and systemic inequities in the global production model, noting that countries contributing the least to greenhouse gas emissions are often the ones most severely impacted.

In response, Alencar argues that beyond mitigation, adaptation strategies are essential to prepare society for a "new normal." He identifies urban greening as an effective and multifunctional response, particularly in cities like São Luís (Maranhão), which suffer from limited green infrastructure and rising temperatures. Targeted investment in urban tree planting, especially in underserved neighborhoods, is proposed as a way to reduce disparities in access to ecosystem services and enhance quality of life. To achieve this, the author advocates for the adoption of Nature-based Solutions (NbS), such as rain gardens and permeable pavements, integrated into the city's Urban Tree Planting Plan, employing modern, accessible, and sustainable practices.

The third article, by prosecutor Licia Ramos Cavalcante Muniz, analyzes how the irregular occupation of Permanent Preservation Areas (APPs) contributes to the intensification of natural disasters in Maranhão, particularly along the banks of the Mearim River, and calls for a more strategic and preventive role for the Public Prosecutor's Office of Maranhão (MPMA). Drawing on Law Nº 12,608/2012 (National Policy on Civil Protection and Defense) and the National Pact for Sustainable and Disaster-Resilient Cities, signed by the CNMP and MPMA, the article advocates for the construction of safer, more resilient cities through integrated action across urban planning, environmental protection, and civil defense. The text critiques the reactive logic that often characterizes public responses, treating floods and disasters as unavoidable tragedies rather than foreseeable consequences of a negligent urban model, marked by weak planning, state inaction,

and uncontrolled land occupation. In contrast, it presents MPMA's commitment to the national pact as an institutional turning point, anchored in a coordinated, cross-sectoral, and evidence-based agenda. To break the cycle of preventable disasters, the article calls for the revision of master plans, stronger civil defense systems, and more rigorous control over land use in high-risk areas, with active engagement from civil society. It underscores that tackling climate disasters demands shared responsibility, institutional collaboration, and political will.

The chapter concludes with an article by prosecutor Thiago Cândido Ribeiro, who analyzes the case of the Piquiá de Baixo community in Açailândia (Maranhão) as a powerful example of the intersection between fundamental rights, such as access to adequate housing and an ecologically balanced environment, both guaranteed by Brazil's 1988 Federal Constitution, and the challenges posed by environmental degradation resulting from steel industry operations. According to the author, the residents' struggle against pollution led to their eventual resettlement in the newly established neighborhood of Piquiá da Conquista, in a process shaped by strong community mobilization and the active involvement of the MPMA. The MPMA played a crucial role in mediating conflicts, proposing Conduct Adjustment Agreements (CAAs), and monitoring the resettlement process to ensure that families were relocated with dignity. The Piquiá case demonstrates that securing complex rights is possible through collective engagement and structured, sustained action, pointing the way toward a more just and sustainable future.

The second chapter of the book, titled "Natural Resources and Their Uses: Actions in the Face of Structural Invisibility," focuses on the vulnerabilities in infrastructure related to the use and management of natural resources, as well as on the essential role of environmental assets such as water and forests, resources that, if mismanaged, can have significant consequences.

The chapter opens with an article by prosecutor Maria de Jesus Rodrigues Araujo Heilmann, who analyzes Law Nº 14,944/2024, which establishes the National Policy for Integrated Fire Management (PNMIF). The article places the policy in context, highlighting the rise in wildfires in Brazil over recent decades and their link to global climate change and unsustainable land use. The analysis begins with the legislative rationale, initiated in 2018, and incorporates data from sources such as UNEP, INPE, and Brazil's Federal Court of Accounts (TCU), all pointing to the urgent need for more effective wildfire management. The article also draws on international standards for wildfire response, including those outlined in UNEP's 2021 report "Spreading like Wildfire: The Rising Threat of Extraordinary Landscape Fires," and proposes adapting these guidelines to Brazil's specific context. It emphasizes the strategic role of the Brazilian Public Prosecutor's Office, under the coordination of the CNMP, in implementing the PNMIF. This role is structured around three fronts – strategic actions, enforcement, and institutional partnerships – and is consolidated in the 2024 National Strategic Plan for Prosecutorial Action on Combating Wildfires. The plan reinforces a commitment to environmental sustainability, public health, and compliance with the Paris Agreement, with the goal of mitigating the social, economic, and environmental impacts of wildfires across the country.

The second article, by prosecutor Francisco Teomario Serejo Junior, explores the serious degradation of water bodies in the Maranhão municipalities of Paço do Lumiar, Raposa, and São José de Ribamar, all located on São Luís Island. The author

describes how unregulated human activity, combined with the lack of structural public policies, has severely compromised both the quality and availability of local water resources. Among the main drivers of this degradation are the absence or inadequacy of basic sanitation, particularly sewage collection and treatment, and access to clean drinking water; irregular land use and deforestation of permanent preservation areas, including riverbanks and streams; the ineffectiveness of municipal environmental agencies, exacerbated by limited infrastructure, a shortage of qualified personnel, and lack of financial autonomy; and public disinformation, fueled by insufficient environmental education, which hinders the recognition of the environment as a fundamental collective right. The article also highlights the role of the Maranhão Public Prosecutor's Office, specifically the 10th Specialized Prosecutor's Office (1st Regional Environmental Prosecutor's Office), which has pursued proactive, non-judicial strategies to coordinate efforts among public institutions, private actors, and civil society in an attempt to curb and reverse the degradation. The piece concludes with a call for urgent, integrated action involving government, communities, institutions, and the private sector to preserve, restore, and ensure the sustainable management of water resources.

The final article in the book, by prosecutor Leonardo Soares Bezerra, explores solid waste management as one of the key environmental challenges in urban and tourist areas, particularly during large public events such as "Praia de Verão," held in the city of São Francisco do Maranhão. The author describes how the accumulation of waste materials, such as plastics, glass, paper, and food scraps, not only harms the environment and detracts from the landscape but also pollutes the soil, water, and air, while posing serious public health risks due to the proliferation of vector-borne diseases. Against this backdrop, the article highlights the pivotal role of the MPMA as both an oversight body and a driver of environmental policy. Through its efforts, the MPMA ensured the implementation of proper solid waste disposal measures in the city's urban areas, particularly along the banks of the Parnaíba River, resulting in a cleaner, safer, and more sanitary environment for tourists, residents, and local workers. The article also underscores the importance of environmental education, public awareness, and collaboration among civil society, businesses, and government as essential strategies for promoting sustainable practices and reducing environmental impacts.

We hope this book inspires concrete action, strengthens collaborative strategies, and fosters an increasingly effective network of environmental engagement across Maranhão.

Happy reading!

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Climate change and socioenvironmental impacts

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BRIEF ESSAY ON THE PROTECTION OF THE BABASSU PALM AND CLIMATE JUSTICE

BY LUÍS FERNANDO CABRAL BARRETO JÚNIOR[3]

This essay offers an overview of the constitutional, legal, and jurisprudential frameworks protecting the babassu palm, situating them within the Bali Principles and a broader understanding of climate justice. Adopting an ecocentric perspective, it underscores the socioenvironmental significance of this native species, drawing on historical and contemporary references that justify its legal safeguarding amid rapid changes in land use and occupation. The analysis also highlights judicial precedents concerning civil and criminal liability for the destruction of, or attacks against, this environmental asset.

The babassu palm and babassu groves as significant socioenvironmental assets

The State of Maranhão is the second largest in the Northeast and the eighth-largest in Brazil by land area. Throughout its extensive territory, babassu palms are found across all ecosystems, making Maranhão the federative unit with the highest concentration of this species nationwide.

The babassu palm is emblematic of the cultural and anthropological identity of Maranhão's people. Its presence is reflected in traditional architecture, tools, ornaments, cuisine, music, and various other cultural expressions, illustrating its deep-rooted significance in the daily lives and heritage of local communities.

It is quite likely that in 1843, when Gonçalves Dias wrote the *Canção do Exílio* ("Song of Exile"), he was alluding to a babassu palm, so endemic to the Caxias region.

According to César Marques[4], Claude d'Abbeville had already described the palm and its uses by Indigenous peoples, and in 1854, the president of the Provincial Assembly also referenced the babassu as an economically valuable resource for regional development.

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3 Public Prosecutor with the Maranhão State Public Prosecutor's Office, serving since 1996 in the 1st Prosecutor's Office for the Protection of the Environment, Urban Development, and Cultural Heritage in São Luís. He has coordinated the Office's Environmental, Urbanism, and Cultural Heritage Operational Support Center since 2004. He served as President of ABRAMPA from 2015 to 2019 and currently holds the position of Regional Director for the Northeast. He is also President of the General Council of the Latin American Network of Environmental Prosecutors and has been a member of the Environmental Commission of Brazil's National Council of Public Prosecutors since 2015. He is co-author of several legal publications, including Comentários aos acórdãos ambientais paradigmas do Supremo Tribunal Federal (Fórum), **Crimes Ambientais: Comentários à Lei nº 9.605/1998** (Livraria do Advogado), and **Gestão de Resíduos: Estratégias de atuação interinstitucional da ABRAMPA e do CNMP**. In 2023, he completed postgraduate studies in Climate Law at the Institute for Legal and Political Sciences, Faculty of Law, University of Lisbon.

4 MARQUES, César. **Dicionário Histórico-Geográfico da província do Maranhão**. 3rd edition. Academia Maranhense de Letras. 2008. p. 171.

In the *Album do Maranhão* (1950), Miécio Jorge devoted one of its opening pages to the babassu groves, documenting them through photographs. Toward the end of the same volume, there are records of babassu fruit, babassu oil, and babassu cake as export products of the Maranhão-based company Chames Aboud & Co.[5]

Although not the central focus of this essay, it is evident that the babassu palm, whether regarded individually or collectively as part of babassu groves, constitutes an environmental asset of such cultural significance that it merits recognition as both tangible and intangible cultural heritage of the State of Maranhão, in accordance with Article 216, items II and V of the Federal Constitution of Brazil.

Even if this recognition alone were not sufficient, and it certainly is, to guarantee the babassu palm meaningful protection under the constitutional rule of law and the principle of non-regression, its value as an environmental good is also broadly acknowledged.

In a 2010 publication[6], researchers from the Federal University of Maranhão provided a detailed account of the babassu palm's botanical characteristics and estimated that, in 1980, its vegetative cover in Maranhão spanned approximately 10.3 million hectares. They identified 28 distinct uses for the species, ranging from housing construction and artisanal tools to food-related applications, five of which are directly linked to the fruit itself. These uses depend on preserving the standing forest and are directly connected to the food and nutritional security of the broader population.

In addition to its social and nutritional significance, clearly tied to food security and aligned with the principles set forth in Article 2, §1, and Article 4, items II, III, and IV of Federal Law Nº 11,346/2006, babassu groves must also be understood from an ecocentric perspective. They serve essential ecological functions: regulating microclimates, preserving the genetic flow of fauna and flora, maintaining carbon stocks, and helping control synanthropic animal populations.

Currently, significant social conflicts have emerged surrounding the preservation of the species and its combined social and environmental relevance. These tensions range from urban real estate speculation pressuring for legislative changes, to the illegal clearing of vast rural areas for alternative land uses, and even disputes over coconut harvesting. In the *Mata dos Cocais* biome[7], for example, *quebradeiras de coco* (babassu nut breakers) often find themselves in direct competition with third parties who collect coconuts for supply to steel industries, undermining the sustainable and diversified uses of the babassu extractive chain.

These conflicts, which have a profound impact on traditional communities and ecosystems, must also be analyzed through a gender perspective, as women play a central role in babassu extractivism.[8]

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5 JORGE, Miécio de Miranda. **Album do Maranhão**, 1950. pp. 19/325.

6 PINHEIRO, Claudio Urbano B et ali. **Plantas úteis do Maranhão. Região da Baixada Maranhense**. FAPEMA, 2010, pp. 176-178.

7 MAGRI, Caio. Coord. **Combate à Devastação Ambiental e Trabalho Escravo na produção do ferro e do aço. Amazônia, Cerrado e Pantanal**. Fundação Avina. 2012, p. 34.

8 BUTTO, Andreia et outros. Coord. **Mulheres rurais e autonomia. Autonomia econômica das mulheres rurais nos Territórios da Cidadania**, Brasília, MDA. 2014, p. 102.

Given all these factors, the interpretation of constitutional and legal provisions relating to the babassu palm cannot be divorced from its environmental and social significance, nor from the framework of fundamental rights. A commitment to a critical epistemology requires us to reject the production of knowledge that contributes to social harm or deepens existing injustices.[9]

Under Article 129, item II of the Federal Constitution, the Public Prosecutor's Office is constitutionally mandated to safeguard Brazil's biomes and to combat social inequalities, an effort in which climate justice has become one of its most urgent and contemporary challenges.

The constitutional, legal, and jurisprudential protection of babassu palms

The first legal provision explicitly aimed at protecting babassu palms appears in State Law Nº 4,734, enacted on June 18, 1986. Introduced by the state legislature, the law was passed during a period marked by severe human rights violations, agrarian conflicts, and widespread environmental degradation.

The Constitution of the State of Maranhão, promulgated on October 5, 1989, makes express reference to babassu groves in Article 196, stating that their exploitation must safeguard both the environment and the species itself, while serving as a source of income for rural workers. The sole paragraph of the article further establishes that, on public and devolved lands in Maranhão, such use shall be limited to family- and community-based economies.

This constitutional provision establishes distinct treatment for public and private lands. On public lands, the exploitation of babassu palms must occur within a framework of family- and community-based economies. On private lands, administrative restrictions established by law uphold the principle of conserving both the palms and the broader environment. Consequently, the Constitution prohibits the clear-cutting of babassu groves and their complete replacement with monocultures.

In accordance with the legislative competence established under Article 24, item VI of the Federal Constitution, and incorporating State Law Nº 4,734/1986, the State Constitution affirms the validity of the rule that expressly prohibits the total removal of babassu palms. Where exceptions to this rule apply, private rural properties must preserve a minimum spacing of eight (8) meters between remaining palms. As such, since thinning is the only legally and constitutionally permitted technique under both the Maranhão State Constitution and State Law Nº 4,734/1986, it follows that clear-cutting and the wholesale elimination of babassu groves for any private activity are expressly forbidden.

The prohibition on the use of agrochemicals is explicitly stated in Article 1, item III, subitem (e) of State Law Nº 4,734/1986 and aligns with the food security principles discussed earlier in this essay.

Also noteworthy is State Law Nº 8,185/2004, which guarantees free access to public lands, along with other *babaçu livre* (free babassu) laws. However, the right

9 NETO, Agostinho Ramalho Marques. **A ciência do Direito: conceito, objeto e método**. 2nd ed. Rio de Janeiro, Renovar, 2001, p. 30.

of access to babassu, even on private lands, constitutes a legitimate administrative restriction intended to safeguard the rights to adequate food and work, and is, *mutatis mutandis*, comparable to the right of access to water. For this reason, State Law Nº 8,185/2004 falls short of upholding the principle of non-regression in environmental and social protection. While it ensures access for traditional populations to what is already guaranteed under the State Constitution, it should also have extended this right to private lands and defined consensual mechanisms between landowners and traditional communities to regulate such access.

Recognized by the Federal Supreme Court in ADI 3540[10] as a third-generation fundamental human right, the right to an ecologically balanced environment cannot be afforded a lesser degree of protection by subsequent legislation or judicial interpretation. The principle of non-regression is fully applicable.

The exceptions already provided for in State Law Nº 4,734/1986 are all based on legitimate social objectives. This means that, outside these parameters, the cutting of babassu palms also constitutes a breach of the constitutional principle of the social function of property, subjecting those responsible to civil liability under Article 14, §1 of Law Nº 6,938/1981.

As the Superior Court of Justice has repeatedly affirmed, those who unlawfully clear vegetation are deemed polluters[11]. Accordingly, every illegal removal of native vegetation entails cumulative obligations to repair the damage caused, including its material, collective non-material, and continuing dimensions.[12]

Such reparation must necessarily include compensation for climate damage, as every instance of vegetation suppression contributes to and intensifies the ongoing climate disruption.[13]

Lastly, underscoring the strength of the legal protections surrounding babassu palms, the Superior Court of Justice, in an opinion by the Honorable Justice Hermann Benjamin, recognized the preservation of babassu groves as a duty of significant environmental importance. For its clarity and juridical depth, we reproduce below an excerpt from the majority opinion in Special Appeal Nº 1,533,234.

The so-called true babassu (*Attalea speciosa* Mart. ex Spreng) is an oil-producing palm species found both in primary forests and in formations known as babassu groves, which are distributed across several Brazilian states, most notably Maranhão, Piauí, Tocantins, and Pará, with special emphasis on the region known as the Mata dos Cocais. In addition to its undeniable ecological and cultural significance, which grants it the status of an identity-defining species (here understood in its broader legal sense, beyond the strict botanical definition), more than 60 uses have been identified for babassu and related species such as tall and short *piaçava*. At least a dozen of these uses hold commercial value, including food, medicinal applications, domestic and industrial oil production, and biofuel. The babassu nut

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10 FEDERAL SUPREME COURT (STF). *ADI 3540-MC*, Reporting Justice: Celso de Mello. **Diário da Justiça**, Feb. 3, 2006.

11 SUPERIOR COURT OF JUSTICE (STJ). *Special Appeal N° 1,310,471 – SP* (2011/0293295-2).

12 SUPERIOR COURT OF JUSTICE (STJ). *Special Appeal N° 2,065,347 – PE* (2023/0105681-9).

13 Technical note authored by ABRAMPA and IPAM, coordinated by Alexandre Gaio (ABRAMPA and MPPR) and Paulo Moutinho (IPAM). Available at: **www.abrampa.org.br**.

also supports thousands of direct and indirect jobs through a widespread value chain rooted in family-based extractivism, beginning with the harvesting carried out by *quebradeiras de coco* (women babassu breakers) and extending to the refinement of extracted oil. Like carnaúba, buriti, and açaí, babassu enjoys the status of an iconic species, one that warrants elevated legal protection, whether or not it is found in primary forest. In environmental and forest law, this status sets it apart from common native vegetation. This sui generis protection is not contingent on current economic use; it also derives from the prominence of the species' intangible ecological and cultural values. The strict legal protection of babassu groves as forests under rigorous conservation is a matter of significant environmental interest, irrespective of their location, whether in Preservation Areas, Legal Reserves, or beyond. This protection extends to public and private lands alike, encompassing both isolated specimens, including those in urban areas, and entire landscapes such as the Mata dos Cocais, a uniquely Brazilian ecotone of open ombrophilous forest that serves as a transition zone between the humid Amazon basin and the semi-arid Northeast. These unique ecological characteristics must be preserved in accordance with Article 225, §1, item I of the Federal Constitution.[14]

Having established the robust constitutional, legal, and jurisprudential protections granted to the babassu palm, it is equally essential to underscore the criminal liability of those who seek to destroy this identity-defining species.

The recognition of its protection as a matter of significant environmental interest brings into effect the criminal offense defined in Article 68 of Law Nº 9,605/1998.[15] This offense encompasses both acts of commission and omission, whether proper or improper, as acknowledged by the Superior Court of Justice in Special Appeal Nº 1,032,651 – SC. While part of the legal scholarship classifies this as a crime of proper omission, citing its textual similarity to Article 135 of the Penal Code, which also begins with "Failing...to...", Article 68 is primarily aimed at individuals who have undertaken a duty of environmental relevance and, through their conduct, have assumed the role of guarantor, as provided in Article 13, §2 of the Penal Code. That said, the provision also applies to those who bear a general duty to act in the face of environmental harm.

Accordingly, co-authorship and participation are fully applicable. This is a formal offense, meaning that it does not require actual harm to any protected environmental asset for criminal liability to be established.

As such, it is not a subsidiary offense and may be prosecuted in concurrence with other environmental or common crimes, particularly those set forth in Articles 48 and 50[16] of Law Nº 9,605/1998. On this matter, the Court of Justice of the State of Maranhão has expressly upheld the possibility of such concurrence, both in relation to the offense under Article 50 and that under Article 34 of the same law. In the latter case, the reporting judge stated unequivocally: "The prin-

14 SUPERIOR COURT OF JUSTICE (STJ). Special Appeal N° 1,533,234 – SE. Judgment issued on Dec. 13, 2016.

15 Article 68, Law N° 9,605/1998: Failing, by one who has a legal or contractual duty to act, to fulfill an obligation of significant environmental interest.

16 COURT OF JUSTICE OF THE STATE OF MARANHÃO (TJMA). Criminal Appeal N° 0030395-70.2010.8.10.0001.

ciple of absorption does not apply between the offenses set out in Articles 34[17], sole paragraph, III, and 68 of Law Nº 9,605/1998, when committed as part of the same causal chain, as they affect distinct legal interests and constitute autonomous offenses."

In cases involving the clear-cutting of babassu groves, it is also possible to cumulatively charge a public official under Article 67 of Law Nº 9,605/1998 if they issue a license authorizing the removal of babassu palms, even outside designated legal reserves.

Regarding Article 68 of the same law, it is important to note that liability does not depend on whether the omission resulted in a concrete or abstract risk, as many obligations of significant environmental interest do not presuppose the existence of risk as a condition for their enforcement. Indeed, the Superior Court of Justice has consistently classified this offense as one of abstract endangerment.[18]

Depending on the nature of the obligation, the offense may be classified as instantaneous, when a specific deadline for compliance[19] has been established, or as continuing, in cases where the omission persists and can be brought to an end by the active conduct of the offender, such as in the storage of hazardous or harmful substances.

The offense is defined by general intent; the reasons behind the failure to fulfill an obligation of significant environmental interest are not subject to investigation.

From constitutional, civil, and criminal standpoints alike, the protection of babassu forests is among the most pressing priorities for environmental governance in the Amazon, the Cerrado, and the MATOPIBA region. To ignore this imperative is to incur grave and costly consequences, particularly for future generations.

At this stage, it is essential to recognize that Brazil's main contribution to climate change, and to the current climate instability, as evidenced by the succession of record-breaking hot months in recent Years, is driven primarily by deforestation and burning. While the combustion of fossil fuels such as coal and greenhouse gas emissions from improper solid waste disposal are also relevant sources, the protection of biomes remains the highest priority, especially with regard to maintaining protected areas such as State Parks.

Among them, the Bacanga and Mirador State Parks face mounting pressure from various economic sectors that either fail to grasp the urgency of the approaching climate crisis or choose to disregard it irresponsibly. Given its vital role in climate regulation, the Mirador State Park requires the full attention of Maranhão's society, along with broad and unrestricted transparency concerning any proposals to alter its boundaries.

Protected areas and native plant species such as the babassu palm demand a genuine and sustained commitment from public authorities and society as a

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17 COURT OF JUSTICE OF THE STATE OF MARANHÃO (TJMA). Criminal Appeal N° 0015480-69.2017.8.10.0001. Published on Sept. 30, 2022.

18 SUPERIOR COURT OF JUSTICE (STJ). Habeas Corpus N° 84,498 – MT (2007/0131144-9). Published on June 30, 2008.

19 GOMES, Luiz Flávio. **Crimes Ambientais**, São Paulo. 2011. RT. p. 68.

whole, so that the legal and institutional frameworks designed to protect them are not abandoned in favor of short-sighted interests.

Final Considerations

This collective publication marks the conclusion of a partnership project between the Brazilian Biodiversity Fund (FUNBIO) and the Public Prosecutor's Office of the State of Maranhão. It follows a similar initiative developed in collaboration with the Public Prosecutor's Office of the State of Pará and the Forum of State Environmental Prosecutors of the Legal Amazon.

The aim is to contribute concrete proposals and working strategies that lead to effective measures for the protection of Brazil's Amazon and Cerrado forests, with particular emphasis on the role of protected areas.

Within this framework, it is essential to emphasize the need to align environmental preservation policies with the principles of what is known as climate justice. This concept was introduced into international law through the Bali Principles[20], a document in which nations with the lowest carbon emissions, but among the most affected by climate change, demand differentiated and, therefore, fairer treatment.

Although mentioned in paragraph 14 of the preamble to the Paris Agreement, climate justice has yet to receive proper attention in Brazilian law, with the notable exception of the recent First Legal Seminar on Environmental Crisis Prevention and Management organized by the Federal Council of Justice[21]. In contrast, the concept has already gained significant traction in French legal discourse[22].

While the most prominent climate lawsuits to date have primarily targeted public authorities, a new wave of climate litigation is shifting focus toward the direct accountability of carbon-emitting corporations, in defense of underserved communities most impacted by the climate crisis.

Within this context, and under a framework of climate justice[23] understood as the adoption of preventive and remedial measures to mitigate the unequal effects of climate change on vulnerable ecosystems and populations, guided by an ecocentric approach to environmental protection and grounded in transparent, participatory, and either consensual or adversarial legal processes, we present a series of recommendations for action by public authorities and civil society, with a specific focus on the protection of babassu forests.

- Recognize the babassu palm as both tangible and intangible cultural heritage of the people of Maranhão and of Brazil, pursuant to Article 216, §1

20 For more information consult: **https://www.ejnet.org/ej/bali.pdf**.

21 For more information consult: **https://www2.cjf.jus.br/cjf/corregedoria-da-justiça-federal/centro-de-estudos-judiciários**.

22 **Le Changement Climatique, quel rôle pour le droit privé?** Coord. Mathilde Hautereau-Boutonnet, Dalloz Droit et Climat, Nicolas Kada, Ed. Dalloz.

23 **La Justiça Climatique**, Sabrine Lavorel, Ed. Charles Leopold Mayer.

of the Federal Constitution, including through the adoption of municipal legislation;

- Establish babassu extractive reserves on public and devolved lands in the State of Maranhão, and restrict babassu-related activities within strict protection protected areas;
- Amend the free babassu law to guarantee access for traditional communities to private lands for babassu nut collection, based on consensual agreements with landowners;
- Prohibit the use of whole babassu nuts as input for steel production or as a substitute for charcoal;
- Recommend that the state environmental agency deny authorization for clear-cutting in areas where babassu groves are present;
- Promote economic incentives for babassu-based extractivism, including mechanisms rooted in solidarity and circular economy models;
- Ensure permanent representation for organizations of quebradeiras de coco and traditional communities on State Councils for the Environment, Human Rights, and Water Resources, as well as on relevant Municipal Councils, selected autonomously by the communities themselves and not subject to competition from other environmental organizations;
- Guarantee the participation of traditional communities in all collective civil proceedings involving the suppression of native vegetation, either as optional co-plaintiffs represented by the Public Prosecutor's Office or through direct engagement in procedural steps such as preliminary hearings and evidentiary acts;
- Promote institutional debates on climate justice within the Public Prosecutor's Office and the Judiciary, including through their respective schools of higher learning and professional development.

URBAN FORESTRY IN SÃO LUÍS/MA: AN ALTERNATIVE FOR MITIGATING AND ADAPTING TO THE DAMAGES OF CLIMATE CHANGE AND ENVIRONMENTAL RACISM

BY CLÁUDIO REBÊLO CORREIA ALENCAR[24]

Extreme events driven by climate change have become increasingly frequent, provoking a range of responses from people, from efforts to understand and find solutions to denial of the scientific evidence. The most common and visible consequences include severe droughts, water scarcity, intense wildfires, rising sea levels, flooding, polar ice melt, catastrophic storms, and biodiversity loss.

In a very recent historical context, clear examples include the floods in Rio Grande do Sul, Brazil, in May 2024[25]; droughts in northern Brazil affecting the Amazon River and its tributaries[26]; the wildfire in Los Angeles, USA, in January 2025[27]; and the extreme heat in Europe that killed nearly fifty thousand people in 2023[28].

Despite contrary opinions that lack technical evidence, the scientific community is unanimous in identifying the cause of these events, while acknowledging other contributing factors, as climate change, driven by transformations resulting directly or indirectly from human activity, such as the use of fossil fuels, burning, agriculture, and fertilizer application, collectively known as the greenhouse effect.

Although multilateral political efforts have struggled to build effective solutions to this problem, including reducing emissions, developing mitigation techniques, and adapting to the new reality, scientists have developed promising alternatives to help ensure that human life can continue to exist on Earth for a little longer.

The United Nations (UN) has taken a leading role on this issue, bringing together its top experts and working to translate their conclusions into policies for countries to follow. However, greed, along with deep-rooted social

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24 Prosecutor at the Public Prosecutor's Office of the State of Maranhão. Holds a postgraduate degree in Climate Law from the Institute of Legal and Political Sciences at the Faculty of Law of the University of Lisbon. Specialist in Environmental and Urban Law from the Faculty of Law of the Higher School of the Public Prosecutor's Office Foundation.

25 O ECO. Mudanças climáticas intensificaram chuvas no Rio Grande do Sul, diz estudo. 3 jun. 2024. Available at: **https://www.oc.eco.br/mudancas-climaticas-intensificaram-chuvas-no-rio-grande-do-sul- diz-estudo/**.

26 BRASIL DE FATO. Seca no Norte, temporais no Sul: efeitos das mudanças climáticas seguem castigando o Brasil. Brasília, 29 set. 2024. Availabe at: **https://www.brasildefato.com.br/2024/09/29/seca-no-norte-temporais-no-sul-efeitos-das-mudancas-climaticas-seguem-castigando-o-brasil/**.

27 G1. Extremos do clima causaram incêndio recorde em Los Angeles: entenda. 9 jan. 2024. Available at: **https://g1.globo.com/meio-ambiente/noticia/2025/01/09/extremos-do-clima-causaram-incendio-recorde-em-los-angeles-entenda.ghtml**.

28 O GLOBO. Calor matou quase 50 mil pessoas na Europa em 2023, diz estudo. AFP, Barcelona, 13 ago. 2024. Availabe at: **https://oglobo.globo.com/mundo/clima-e-ciencia/noticia/2024/08/13/calor-matou-quase-50-mil-pessoas-na-europa-em-2023-diz-estudo.ghtml**.

inequalities and environmental racism, has undermined the feasibility of these efforts.[29]

This dynamic is particularly evident in cities, where exclusion and social inequality persist, and public services are provided differently depending on residents' economic status, reinforcing the high degree of stratification in our society.

In the search for solutions to the severe impacts of climate change, which are becoming more frequent each day, it is essential to adopt adaptation measures. Among these, urban forestry stands out, as it can contribute both to reducing greenhouse gas emissions (mitigation) and to minimizing the damage caused by extreme climate events.[30]

Climate Change

Causes

It is important to note that climate change has always occurred on Earth. Some of these changes were even responsible for the extinction of species (for example, the dinosaurs), leading to significant transformations of the planet. However, the transition from one phase to another was slow and hardly noticeable within a single generation. The world has always survived these shifts.

What has been happening on Earth over the past 150 years, however, is abnormal and extraordinary. The main driver is the so-called anthropogenic greenhouse effect, which adds to the natural greenhouse effect. Following the Industrial Revolution, humans began releasing millions of tons of carbon dioxide and other greenhouse gases into the atmosphere, doubling the amount of CO2 compared to the minimum levels of the past 700,000 years.

A significant portion of the sun's rays is naturally reflected by the atmosphere, helping to prevent the planet from overheating. However, with the accumulation of greenhouse gases (including water vapor, carbon dioxide, methane, and nitrous oxide), this natural protective barrier is weakened, allowing more solar radiation to reach the surface and increasing global temperatures.

The Intergovernmental Panel on Climate Change (IPCC), which brings together thousands of scientists worldwide, has stated that global warming is driven by this human-enhanced greenhouse effect. According to its 2014 report, the Earth's average surface temperature was projected to rise by 1 to 3.5°C by 2100, the fastest rate of change since the end of the last ice age. The report also projected that the average sea level could rise by 15 to 95 centimeters by 2100, flooding many low-lying coastal areas. In addition, it anticipated shifts in rain-

29 For more information consult: **https://www.cnnbrasil.com.br/internacional/diversos-paises-nao-cumpriram-prazo-da-onu-para-novas-metas-climaticas/; e https://gauchazh.clicrbs.com.br/mundo/noticia/2025/01/na-posse-trump-confirma-plano-de-decretar-emergencia-energetica-para-ampliar-producao-cm65d77b70083015d4uhad1sv.html.**

30 VASCONCELLOS, Bruna Nascimento de. Arborização Urbana: essencial para a qualidade de vida da população. In: GÓES, Matheus Barreto de. **Pensando Sustentável: reflexões interdisciplinares para um futuro resiliente.** Guarujá/SP: Editora Científica Digital. 2024, pp. 34/45.

fall patterns, increasing the likelihood of droughts, floods, and severe storms in many regions.[31]

As mentioned, this human activity, which has drastically accelerated climate change, stems from multiple sources.

In recent years, the primary energy matrix for human society has relied on fossil fuels, which currently account for 75% of global energy consumption[32] (IPCC, 2022). The main sources include oil, natural gas, and coal, used in motor vehicles, thermoelectric power plants, and domestic applications. Additionally, coal is still used, for example, for artificial heating.

Petroleum is a mixture of carbon and hydrogen molecules formed from the decomposition of organic matter. It develops through the action of bacteria in low-oxygen environments. Over millions of years, this material accumulated on the bottoms of oceans, seas, and lakes. When subjected to pressure from movements of the Earth's crust, it gave rise to what we now know as petroleum.

Another significant source of greenhouse gas emissions is the destruction of forests and other types of vegetation, as well as changes in land use patterns, since the carbon stored in plants and soils is released into the atmosphere during these activities.

Compared to temperate forests, tropical forests are denser and show smaller seasonal fluctuations in carbon flux, making them crucial carbon reservoirs that contribute to stabilizing the global climate. They also harbor about 50% of the world's terrestrial biodiversity, which plays a fundamental role in regulating water resources and conserving soil. As the saying goes, nature is a perfect and interconnected system. According to the United Nations (UN), around 1.6 billion people depended on forests for their livelihoods in 2011.[33]

Deforestation and forest degradation release greenhouse gases (GHGs), particularly carbon dioxide (CO2), which contribute to climate change. According to the Intergovernmental Panel on Climate Change (IPCC, 2014), the Forestry and Other Land Use sector accounted for 12% of global emissions between 2000 and 2009, a significant share.

Beyond that, there are other equally important impacts, such as threats to wildlife, soil depletion, reduced water availability, and untreated solid waste, among others.

Consequences

Since the 1980s, scientific evidence pointing to the possibility of global climate change has sparked growing interest among the public and the scientific community alike.

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31 INTERGOVERNMENTAL PAINEL ON CLIMATE CHANGE. Climate change 2014: Impacts, Adaptation, and Vulnerability. 2014a, p. 174. Available at: **https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-PartA_FINAL.pdf**.

32 INTERGOVERNMENTAL PAINEL ON CLIMATE CHANGE. Climate Change 2022: Mitigation of Climate Change. 2022, p. 619. Available at: **https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_FullReport.pdf**.

33 For more information consult: **http://www.un.org/en/events/iyof2011/**.

In 1988, the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) established the Intergovernmental Panel on Climate Change (IPCC), as previously mentioned. The panel was tasked with providing scientific support for climate assessments and developing scenarios for future climate change. The IPCC is a scientific body under the United Nations that evaluates global knowledge on climate change. Its mission is "to assess the scientific, technical, and socio-economic information relevant to understanding the risks of climate change induced in human populations."[34]

This work is carried out with the participation of a large number of researchers from the fields of climate science, meteorology, hydrometeorology, biology, and related disciplines, who meet regularly every four years to discuss the most current and up-to-date scientific evidence. They also review state-of-the-art results from various models (atmospheric and coupled ocean-atmosphere models) with the goal of reaching a consensus on the latest climate change trends. As a result of these interactions, which typically take two to three years, the three Working Groups (WGs) that make up the scientific structure of the IPCC produce reports titled: "The Scientific Basis" (WG I), "Impacts, Adaptation, and Vulnerability" (WG II), and "Mitigation" (WG III). Each working group publishes a printed report containing between 700 and 900 pages of condensed information (IPCC 2001a, b).[35]

The IPCC reports, especially those from Working Group I on "The Scientific Basis," provide a comprehensive and up-to-date review of information and studies in areas such as climate science, oceanography, ecology, and other disciplines related to climate change. This information is presented to the scientific community, the general public, and especially to policymakers and decision-makers, who need it in a clear and accessible format. To achieve this, the IPCC is responsible for synthesizing the current knowledge contained in scientific reports about possible future climate changes for decision-makers. This synthesis is published as the Summary for Policymakers (IPCC 2001 c, d, e).[36]

According to Marengo and Soares[37], the First Assessment Report (FAR), published by the IPCC in 1990, marked the beginning of climate change research benefiting from global scientific collaboration. The Second Assessment Report (SAR), released in 1995 (IPCC, 1996 a, b), laid the groundwork for key negotiations that led to the adoption of the Kyoto Protocol in 1997. For this reason, the political relevance of these reports, particularly the Summary for Policymakers, is undeniable.

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34 MARENGO, J. A. **Mudanças Climáticas Globais e seus Efeitos sobre a Biodiversidade: caracterização do clima atual e definição das alterações climáticas para o território brasileiro ao longo do século XXI.** Brasília: MMA. p. 79.

35 MARENGO, José Antonio; and SOARES, Wagner Rodrigues. **Impacto das Mudanças Climáticas no Brasil e Possíveis Futuros Cenários Climáticos: Síntese do Terceiro Relatório do IPCC 2001**.

36 MARENGO, José Antonio. **Caracterização do clima no Século XX e Cenários no Brasil e na América do Sul para o Século XXI derivados dos Modelos de Clima do IPCC**. Relatório nº 1. CPTEC/INPE, São Paulo, Brasil, 2007.

37 MARENGO, J. A.; and SOARES, W. R. **Impacto das Mudanças Climáticas no Brasil e Possíveis Futuros Cenários Climáticos: Síntese do Terceiro Relatório do IPCC 2001**, p. 03.

According to Marengo (2006)[38], the Third Assessment Report (TAR) indicated that "there is new and stronger evidence that most of the warming observed over the past 50 years is attributable to human activities" (IPCC, 2001a), a fact already well known thanks to coverage in newspapers, scientific journals, and global media. One potential shortcoming of the TAR concerned research on changes in the frequency of extreme climate events. At that time, it was anticipated that the IPCC's Fourth Assessment Report (AR4), expected in 2007, would improve understanding of changes in climate extremes. This new report would incorporate models featuring interactive vegetation and better representations of clouds and aerosols, with greater focus on simulating extreme climate events and interdecadal variability.

The author also pointed out that since the publication of the IPCC's Third Assessment Report (TAR) in 2001, regional chapters with a majority of authors from the regions under analysis (Africa, Asia, Australia and New Zealand, Europe, North America, Latin America, the polar regions, and small islands) have been a particular feature of Working Group II, which focuses on Impacts, Adaptation, and Vulnerability[39] (IPCC, 2001b). The reports from the Working Groups provide an assessment of the state of the art in climate research, detection of climate change, attribution of physical causes, and the uncertainties surrounding projections for different climate scenarios.

The IPCC reports highlight these consequences, alongside what each of us can observe in practice. The main consequence, as noted in the introduction to this text, is the significant increase in the incidence of extreme weather events such as floods, storms, hurricanes, and droughts.

A study on climate change in Alaska[40] shows that it is rapidly and aggressively transforming the region's climate. According to the study's authors, the number of storms is projected to triple, increasing the risk of widespread flooding, landslides, and forest fires sparked by lightning.

This change is leading to higher volumes of rainfall over shorter periods, exceeding the capacity of drainage systems and causing floods that bring numerous challenges to communities: loss of life, building collapses, destruction of public infrastructure, disease outbreaks, among others. These consequences are even more severe in densely urbanized areas, due to soil impermeabilization and improper disposal of solid waste, which further complicate drainage.

Another serious consequence of climate change is the rise in sea levels. For example, a 50-centimeter rise in the Atlantic Ocean could erode up to 100 meters

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38 MARENGO, J. A. **Mudanças Climáticas Globais e seus Efeitos sobre a Biodiversidade: caracterização do clima atual e definição das alterações climáticas para o território brasileiro ao longo do século XXI**. Brasília: MMA. p. 80.

39 INTERGOVERNMENTAL PAINEL ON CLIMATE CHANGE. Climate change 2001: Impacts, Adaptation, and Vulnerability. 2001b. p. 17. Available at: **https://www.ipcc.ch/site/assets/uploads/2018/03/WGII_TAR_full_report-2.pdf**.

40 POUSOL, Basile, PREIN, Andreas F., MOLINA, Maria J. e MULLER, Caroline. **Dynamic and thermodynamic impacts of climate change on organized convection in Alaska**. Published February 8, 2021. **https://link.springer.com/article/10.1007/s00382-020-05606-7**.

of coastline on some beaches in northern and northeastern Brazil[41], with easily imaginable damage and losses to society.

Additionally, the loss of the planet's ice cover is another major consequence of climate change. Changes in the availability of water resources also result from climate change, driven by shifts in rainfall patterns that affect water flow and increase the risk of droughts or floods.

In the Amazon, for example, rainfall is projected to decrease by up to 20%[42], which would severely affect the entire life-support system of this critical environment, resulting in droughts like those seen over the past three years. Reduced river flow could also lead to saltwater intrusion at river mouths and worsen drinking water shortages in already water-stressed regions.

Additionally, research led by climate scientist Paul Durack of the Lawrence Livermore National Laboratory in California (USA), published in Nature, highlighted that climate change is intensifying the global water cycle. According to experts[43], since 1970, water near tropical regions has become saltier due to increased evaporation, while water closer to the polar regions has become less salty due to greater precipitation.

According to an analysis by IPAM, desertification is driven mainly by human activities and climate change. It is estimated that around 135 million people are at risk of losing their land because of this phenomenon. The United Nations Convention to Combat Desertification warns that Africa could lose up to two-thirds of its productive land by 2025, while Asia and South America could lose one-third and one-fifth, respectively. As a result, entire regions could become uninhabitable due to the escalating effects of climate change, combined with predatory farming practices, wildfires, overexploited water sources, and population surges.[44]

There are five key pillars considered essential for changing this reality, all of which require universal participation: personal and national commitment; public engagement; healthy habits; ecological awareness; and efficiency and innovation. In practical terms, the world has pointed to several actions: keeping fossil fuels in the ground; reducing methane emissions; transitioning to renewable energy; phasing out gasoline and diesel; planting more trees; removing greenhouse gases from the atmosphere; and providing financial support to poorer countries.

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41 MARENGO, J. A. et al. **Caracterização do clima atual e definição das alterações climáticas para o território brasileiro ao longo do século XXI**. Brasília: Ministério do Meio Ambiente (MMA), 2007, pg. 21. Available at: **http://mudancasclimaticas.cptec.inpe.br/~rmclima/pdfs/prod_probio/Sumario.pdf**.

42 EXAME. Chuvas na Amazônia diminuirão de 12% a 21% até 2050. Londres, 5 set 2012. Available at: **https://exame.com/mundo/chuvas-na-amazonia-diminuirao-de-12-a-21-ate-2050/.**

43 NICITOPOULOS, T. Climate Change Is Intensifying the Global Water Cycle. **Discover Magazine**. 2022. Available at: **https://www.discovermagazine.com/environment/climate-change-is-intensifying-the-global-water-cycle**.

44 For more information consult: **https://ipam.org.br/entenda/quais-serao-os-impactos-provaveis-destas-mudancas-no-nivel-global/**.

In contrast, major economic powers continue to promote drilling[45], refuse to sign treaties[46], withdraw from them[47], or fail to meet their obligations[48]. Ironically, these are the nations that emit the most greenhouse gases and are the least affected by climate change, while the most socioeconomically vulnerable populations suffer the greatest consequences.

Therefore, global warming brings numerous consequences. Simply reducing greenhouse gas emissions is no longer enough. It is essential to also mitigate its impacts and adopt adaptation measures to address this new historical context.

Environmental racism, gentrification in São Luís, Maranhão, and suggested actions

Environmental racism, gentrification in São Luís/MA

The process of discrimination and social inequality that disproportionately affects vulnerable and racialized communities, particularly in urban áreas, is known as environmental racism. It stems from structural racism within the urban context. According to Souza, it "refers to the built environment in cities and how human beings, urban infrastructure, and natural elements interact within this setting".[49]

This cycle is ongoing and must be broken. In Brazil, as in other countries with lower levels of social justice, there is no guarantee of adequate housing for all, especially for those in situations of socioeconomic vulnerability.

As a consequence, informal settlements, often located in high-risk areas, permanent preservation zones, and lacking basic infrastructure services such as sanitation, are the most affected by the extreme climate events discussed in the previous chapter.

According to IBGE (2022)[50], the city of São Luís, the capital of Maranhão, has a population of 1,037,775 residents spread across 300 neighborhoods, with 94% liv-

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45 ZERO HORA. Na posse, Trump confirma plano de decretar emergência energética para ampliar produção. 20 jan 2025. Available at: **https://gauchazh.clicrbs.com.br/mundo/noticia/2025/01/na-posse-trump-confirma-plano-de-decretar-emergencia-energetica-para-ampliar-producao-cm65d77b70083015d4uhad1sv.html#google_vignette**

46 For more information consult: **https://semil.sp.gov.br/educacaoambiental/prateleira-ambiental/o-que-foi-o-protocolo-de-quioto-e-o-que-e-o-acordo-de-paris/#:~:text=O%20Protocolo%20de%20Kyoto%20foi,Unidos%20n%C3%A3o%20ratificaram%20o%20Protocolo**.

47 For more information consult: **https://www.iberdrola.com/sustentabilidade/acordos-climaticos-internacionais**.

48 CNN BRASIL. Diversos países não cumpriram prazo da ONU para novas metas climáticas. 10 fev. 2025. Available at: **https://www.cnnbrasil.com.br/internacional/diversos-paises-nao-cumpriram-prazo-da-onu-para-novas-metas-climaticas/**.

49 SOUSA, B. D. de. **Racismo Ambiental e Direito à Cidade: desafios diante das mudanças climáticas**. Dissertation presented to the Graduate Program in Smart and Sustainable Cities at Universidade Nove de Julho. – UNINOVE. **Revista Direitos Culturais**, 19(48), pp. 41-61. Available at: **https://doi.org/10.31512/rdc.v19i48.1879**. Accessed on March 29, 2025.

50 For more information consult: **https://www.ibge.gov.br/cidades-e-estados/ma/sao-luis.html**.

ing in urban areas. Of this population, 58% identify as mixed-race (pardo), 26.4% as white, and 16.2% as Black. In terms of infrastructure, data from the Instituto Água e Saneamento[51] reveal significant shortcomings in the city. According to these figures, 92.76% of the population has access to a water supply, while 54.28% has access to sewage collection, with only 20.59% of that sewage being treated. Furthermore, just 12.87% of the city has a stormwater drainage system.

Within this context, the city of São Luís has around 20 neighborhoods identified as risk areas for flooding, landslides, or inundations, almost all of them stemming from unplanned urban growth.[52] It is evident that the city reflects a historical and systemic process deeply embedded in our social, political, and economic structures.

In this regard, Sousa[53] further observes that "we can, therefore, infer that structural racism intersects with environmental racism, considering that this dynamic of exclusion and marginalization represents historical patterns deeply rooted in society, particularly in Brazil".

In urban areas, this reality is even more devastating, with the creation of segregated spaces and gentrification processes that remove people from historically occupied territories to serve real estate speculation benefiting the elites. This disproportionately impacts Black and vulnerable communities. The few existing infrastructure works overwhelmingly serve the wealthiest areas of cities, and São Luís/MA is no exception.

Viana (2022)[54] highlights this issue clearly, stating: "the country's rapid urbanization, as described, occurred within this exclusionary, civil-patrimonialist framework, given that the reversal of residential patterns in Brazil took place between the 1940s and 1980s, before the establishment of the new legal–urban order. As a result, the urbanization process created divided, segregationist cities, marked by precarious settlements in urban centers. This led to a popular mobilization to create a new legal framework that could enable more equitable and democratic cities. The outcome was the new legal–urban order established by the 1988 Federal Constitution and the City Statute, as discussed in the previous section."

An Intervention Proposal

With the post-Industrial Revolution urban model, any element connected to the greenery of forests and natural landscapes within cities came to be viewed as an obstacle to development, a perception that still persists in many circles today.

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51 For more information consult: **https://www.aguaesaneamento.org.br/municipios-e-saneamento/ma/sao-luis**.

52 G1. São Luís tem 20 regiões com risco de inundações ou desabamentos; Veja lista. Maranhão, 21 jan. 2025. Available at: **https://g1.globo.com/ma/maranhao/noticia/2025/01/21/sao-luis-tem-20-regioes-com-risco-de-inundacoes-ou-desabamentos-veja-lista.ghtml**.

53 SOUSA, B. D. de. *Racismo Ambiental e Direito à Cidade: desafios diante das mudanças climáticas*. Dissertation presented to the Graduate Program in Smart and Sustainable Cities at Universidade Nove de Julho. – UNINOVE. **Revista Direitos Culturais**, 19(48), pp. 41-61. Available at **https://doi.org/10.31512/rdc.v19i48.1879**. Accessed on March 29, 2025.

54 BRASIL. Estudo Técnico Adaptação às mudanças climáticas na mobilidade urbana. Instituto de Políticas de Transporte e Desenvolvimento (ITDP Brasil), 2027, p. 18.

Following this model, most Brazilian cities were designed with green areas reserved exclusively for leisure, such as squares and parks, and with little urban tree cover beyond these specifically designated spaces. This mindset continues to prevail, making it essential to raise awareness about the importance of urban trees for human well-being, beyond the narrow justification of oxygen production alone.

In this context of climate change, as previously mentioned, it is no longer sufficient to merely reduce greenhouse gas emissions, in other words, fossil fuel use, to curb deforestation, or to properly dispose of and manage solid waste. Humanity now requires actions to mitigate the impacts caused by climate change, as well as to adapt our way of life to this new reality that is taking shape.

These mitigation and adaptation measures must be conceived and implemented within a broader context, given that everything is interconnected, considering not only the benefits for climate change but also for sustainable development, including socioeconomic aspects. To achieve this, it is necessary to engage with the United Nations Sustainable Development Goals (SDGs), encompassing equity, social justice, and poverty eradication, together with climate justice (SDGs 1, 10, and 13).

Regarding adaptation, the IPCC, in its Fifth Assessment Report (AR5), defines[55] it as a "process of adjustment to actual or expected climate impacts and their effects. In human systems, adaptation seeks to minimize or avoid harm while also taking advantage of beneficial opportunities. In certain natural systems, human intervention may help these systems adjust to anticipated climate change and its effects."

Although adaptation is a global effort promoted by the United Nations, its impacts are local, requiring tailored actions that address the specific needs, strengths, and priorities of each area. In this context, urban tree planting emerges as an effective measure, contributing not only to mitigation but, above all, to adapting to the climate changes that are already so evident in our time.

Main advantages:

- Reduces the greenhouse effect by storing carbon
- Improves thermal comfort by lowering the perception of heat through canopy shading[56]
- Increases soil permeability, reduces the impact of rainwater (preventing erosion), and helps recharge groundwater
- Decreases both air and noise pollution
- Supports wildlife by facilitating the movement of animals, including migratory species
- Enhances scenic beauty and promotes human well-being

55 BRASIL. ***E*studo Técnico Adaptação às Mudanças Climáticas na Mobilidade Urbana. Instituto de Políticas de Transporte e Desenvolvimento (ITDP Brasil)**, 2027, p. 18.

56 PAIVA, C. M. de S. **Arborização e Conforto Técnico no Espaço Urbano**. Available at: **https://pensaracademico.unifacig.edu.br/index.php/semiariocientifico/article/view/2844**. Access March 28, 2025.

Therefore, urban planning, including tree planting[57], is essential. This is underscored by Cecchetto *et al*.[58], who note that "adequate tree planting enhances the landscape and should harmoniously integrate all landscaping elements, prioritizing the use of native biome species, which gives urban green spaces a stronger sense of identity. For this reason, implementing urban tree-planting projects requires proper planning, with clearly defined objectives and qualitative and quantitative targets, since the lack of a structured plan makes both implementation and maintenance significantly more challenging."

Specifically in relation to São Luís, Maranhão, the city has tree cover along 32.3% of its public roads. By contrast, Goiânia, which ranks first in this category, has 89.3% green area coverage (IBGE, 2022).[59] The capital of Maranhão holds the 172nd position among the state's 217 municipalities.

It is worth noting that urban tree-planting rates tend to correlate with extreme poverty levels. The Southeastern region of Brazil, for example, has an average of 73.5% of its public urban areas covered with vegetation, while the North has just 36.7%. Extreme poverty in the Southeast is around 3.76%, compared to 14.41% in the North, highlighting what has been discussed here regarding environmental racism.

It is also important to consider the history of São Luís, Maranhão. Originally founded by the French, it later became the most "Portuguese" of Brazilian cities after being retaken, in an effort to erase its French heritage. According to Aragão, "this urban model featured narrow streets, irregular layouts, a lack of sidewalks, and attached buildings with no front setbacks. As a result, the urban design of colonial cities, not being planned to accommodate large trees, became an obstacle to urban tree planting during that period."[60]

Aware of this situation, several public institutions, including the Maranhão State Public Prosecutor's Office, through the Environmental Prosecutor's Offices of São Luís; the Municipality of São Luís, through the Municipal Urban Landscape Institute (IMPUR) and the Municipal Environment Secretariat (SEMMAM); and the State University of Maranhão (UEMA), through its Agronomic Engineering Program, joined with civil society, supported by the State Forum on Environmental Education, to develop a project titled Trees of Historical, Cultural, and Landscape Value of São Luís.

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57 BRAGA, Roberto. **Mudanças Climáticas e Planejamento Urbano: uma análise do Estatuto da Cidade**. Available at: **https://igce.rc.unesp.br/Home/Departamentos47/planejamentoterritorialegeoprocessamento640/md_roberto_artigos_artig_anppas.pdf**. Access on March 28, 2025.

58 CECCHETTO, C. T.; CHRISTMANN, S. S.; OLIVEIRA, T. D. de. **Arborização Urbana: importância e benefícios no planejamento ambiental das cidades**. Available at: **https://www2.ufrb.edu.br/petmataatlantica/images/PDFs/ARTIGO---ARBORIZACAO-URBANA-IMPORTANCIA-E-BENEFICIOS-NO-PLANEJAMENTO-AMBIENTAL-DAS-CIDADES-1.PDF**. Access on March 28, 2025.

59 For more information consult: **https://cidades.ibge.gov.br/brasil/ma/sao-luis/panorama**.

60 DUARTE, T. E. P. N., et alli ANGEOLETTO, F., SANTOS, J. W. M. C., SILVA, F. F. da, BOHRER, J. F. C., & MASSAD, L. (2018). Reflexões Sobre Arborização Urbana: Desafios a serem superados para o incremento da arborização urbana no Brasil. **Revista Em Agronegócio E Meio Ambiente**, 11(1), pp. 327–341. Available at: **https://doi.org/10.17765/2176-9168.2018v11n1p327-341**. Accessed on March 28, 2025.

The initial goal is to create an inventory of trees with particular historical, cultural, or landscape significance, to be conducted by UEMA through its Agronomy program. Surveys have already been carried out in six neighborhoods, identifying four trees for special protection. Additionally, scientific publications will be produced to catalog the city's tree species; the first edition, currently in press, has not yet been published. These materials will support both formal and informal environmental education efforts across various agencies and sectors. This work laid the groundwork for developing the Municipal Urban Tree-Planting Plan, which will address the issue more comprehensively and is currently in preparation.[61]

There are various techniques grounded in the principles of Nature-Based Solutions that can enhance the environmental quality of urban tree planting, such as rain gardens and permeable pavements. These approaches are fully compatible with, and recommended for, contexts like São Luís, Maranhão, and, in the long term, could even incorporate more advanced and complex concepts, such as sponge cities.[62]

Conclusion

The world has changed. Every day, we watch with alarm as the global media reports on extreme weather events, including floods, wildfires, droughts, and more.[63]

While the causes are varied, they are largely rooted in the use of fossil fuels. The most evident consequences, beyond those already discussed in the previous chapter, include rising temperatures, more severe storms, increased drought, sea-level rise, loss of species, growing poverty, and displacement.

It has also become increasingly clear how unjust the environmental damage caused by the global production system is, given that the countries emitting the most greenhouse gases are not the ones most affected by their consequences.

Environmental racism is strongly evident in the impacts of climate change, showing that historically oppressed and vulnerable populations are the ones who suffer the most. [64]

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61 On this theme, consult: Salmi, Frederico. Categorias sociopolíticas da ética climática: Plano Municipal de Arborização Urbana (São Paulo). **Caderno Metropolitano**, São Paulo, v. 25, nº 58, pp. 853-874, Sept/Dec 2023. Silva, Natália Huber da. **A importância da arborização urbana para cidades sustentáveis**. Available at: **https://www.ufsm.br/unidades-universitarias/ccne/2024/06/20/a-importancia-da-arborizacao-urbana-para-cidades-sustentaveis#:~:text=A%20arboriza%C3%A7%C3%A3o%20urbana%20ajuda%20a,a%20infiltra%C3%A7%C3%A3o%20desta%20no%20solo**. Access March 29, 2025.

62 MARCHIONI, M., RAIMONDI, A., SILVA, J. C. de A. da, YAZAKI, L. F. O. de L., VELASCO, G. D. N., BRAZOLIN, S., SILVA FILHO, C. A. da, & BECCIU, G. (2022). Soluções Baseadas na Natureza como instrumento de melhoria da arborização urbana, auxiliando na construção de cidades sensíveis à água e resilientes às mudanças climáticas. **Revista LABVERDE**, 12(1), pp. 12-44. Available at: **https://doi.org/10.11606/issn.2179-2275**. labverde.2022.189209. Access on March 28, 2025.

63 G1. São Luís tem 20 regiões com risco de inundações ou desabamentos; Veja lista. Maranhão, 21 jan. 2025. Availibe at: **https://g1.globo.com/ma/maranhao/noticia/2025/01/21/sao-luis-tem-20-regioes-com-risco-de-inundacoes-ou-desabamentos-veja-lista.ghtml**.

64 ARRUDA, C. R. D. M. S.; CALDAS, D. O. M. O racismo ambiental e os impactos da desordem urbana na efetivação do direito à moradia. **Revista Interdisciplinar de Direito**. v. 22. nº 1. Jan./Jun., 2024.

Therefore, it is important not only to adopt measures to mitigate climate change but also to develop adaptation strategies for this new reality, so that society is at least minimally prepared for the so-called "new normal."

In this context, urban tree planting, particularly in a city like São Luís, Maranhão, which suffers from a shortage of such services and lies almost on the equator with consistently high temperatures, can serve multiple purposes.

It can be argued that by prioritizing investments in urban infrastructure in the most underserved neighborhoods, a more equitable distribution of urban tree cover and its associated ecosystem services across different social classes can be achieved, helping to reduce social inequality in access to urban greenery in Brazilian cities.[65]

The first steps toward establishing technically sound urban tree planting in São Luís, Maranhão, have already been taken through the development of the Municipal Urban Tree-Planting Plan. It is recommended that modern, simple, and low-cost mechanisms aligned with the principles of Nature-Based Solutions (NBS), such as rain gardens and permeable pavements, be incorporated, given their significant positive impact.

65 DUARTE, T. E. P. N., et alli ANGEOLETTO, F., SANTOS, J. W. M. C., SILVA, F. F. da, BOHRER, J. F. C., & MASSAD, L. (2018). Reflexões Sobre Arborização Urbana: Desafios a serem superados para o incremento da arborização urbana no Brasil. **Revista em Agronegócio e Meio Ambiente**, 11(1), pp. 327–341. Available at: **https://doi.org/10.17765/2176-9168.2018v11n1p327-341**. Accessed on March 28, 2025.

OCCUPATION OF RISK AREAS, NATURAL DISASTERS, AND PROACTIVE ACTION BY THE PUBLIC PROSECUTOR'S OFFICE OF THE STATE OF MARANHÃO: PATHWAYS TO CLIMATE RESILIENCE

BY LICIA RAMOS CAVALCANTE MUNIZ[66]

Hydrological environmental disasters, such as floods, have become increasingly frequent and severe throughout Brazil. This trend is closely linked to the global climate crisis, improper urban land use, and the uncontrolled occupation of ecologically sensitive areas. In the state of Maranhão, the recurrent flooding of the Mearim River, particularly affecting municipalities such as Pedreiras, Trizidela do Vale, Bacabal, and others along its course – exposes the historical vulnerability of riverside communities and the shortcomings of preventive urban planning[67]. These events can no longer be regarded as isolated or purely natural phenomena, but must be recognized as socio-environmental disasters resulting from a complex chain of structural omissions and misguided territorial management decisions.

The recurrence of these events has consistently exposed not only deficiencies in risk containment and mitigation but also a culture of permissiveness regarding the occupation of Permanent Preservation Areas (APPs), in direct violation of the guidelines established by the Forest Code (Law Nº 12,651/2012)[68] and the City Statute (Law Nº 10,257/2001)[69]. The illegal appropriation of riverbanks and hillsides, combined with a lack of effective oversight, undermines not only environmental balance but also the fundamental rights[70] to adequate housing, security, and health for the affected populations.

In light of this scenario, this article aims to reflect, from a legal and institutional perspective, on possible pathways for a more proactive and strategic role by the Public Prosecutor's Office of the State of Maranhão (MPMA), considering the National Policy on Civil Protection and Defense (Law Nº 12,608/2012)[71] and its recent commitment to the National Pact for Sustainable and Disaster-Resilient Cities[72]. The proposal is not to offer a merely descriptive account, but rather

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66 Public Prosecutor of the State of Maranhão. City: Bacabal, MA, Brazil; Specialist in Constitutional Law from the University of Southern Santa Catarina (Unisul); Master's student in Law and Institutions of the Justice System (PPGDIR/UFMA).

67 BACABAL (Municipality). Bacabal reports families displaced by the Mearim River. Bacabal: Municipal Government, March 26, 2024. Available at: **https://www.bacabal.ma.gov.br/artigo/bacabal-ja-registra-familias-desabrigadas-pelo-rio-mearim**. Accessed April 2, 2025.

68 BRAZIL. Law Nº 12,651 of May 25, 2012. Provides for the protection of native vegetation. **Official Gazette of the Union**, Brasília, DF, May 28, 2012.

69 BRAZIL. Law Nº 10,257 of July 10, 2001. City Statute. **Official Gazette of the Union**, Brasília, DF, July 11, 2001.

70 BRAZIL. Constitution of the Federative Republic of Brazil of 1988.

71 BRAZIL. Law Nº 12,608 of April 10, 2012. Establishes the National Policy on Civil Protection and Defense. **Official Gazette of the Union**, Brasília, DF, April 11, 2012.

72 NATIONAL COUNCIL OF THE PUBLIC PROSECUTOR'S OFFICE. National Pact for Sustainable

to build, drawing on practical experience and existing legal frameworks, a repertoire of institutional actions geared toward fostering preventive public policies, addressing the structural causes of disasters, and promoting the dignity of victims.

By framing the irregular occupation of APPs as a key factor in the intensification of disasters, and by linking the legal obligations of public authorities with the active role of the Public Prosecutor's Office, this article seeks to contribute to the development of a climate resilience agenda capable of shifting the logic of delayed response toward a consistent policy of prevention and adaptation. Maranhão's reality offers fertile ground for this discussion, both because of its history of omissions and the transformative potential of coordinated and responsible action.

In this context, it is essential to begin the analysis by considering the legal, environmental, and social impacts of the irregular occupation of APPs, legally protected areas whose ecological functions have been systematically neglected. The uncontrolled appropriation of these buffer zones, particularly along the banks of the Mearim River, is a significant driver of worsening floods and at the same time underscores both the weaknesses of urban planning instruments and the urgent need for more proactive oversight, especially by the Public Prosecutor's Office. A critical examination of this issue should serve as the starting point for building an institutional approach that goes beyond merely reacting to disasters, instead tackling their structural causes and demanding normative and administrative alternatives to address them.

The Occupation of Permanent Preservation Areas and Their Impacts on Natural Disasters

APPs, as established by Law Nº 12,651/2012 (the Forest Code), are territorially defined spaces that serve an essential environmental function, ensuring ecological stability and protecting human populations, particularly in urban areas exposed to hydrological and geotechnical risks. According to Article 3, item II, of this legislation, these areas include, among others, riverbanks, steep slopes, and protective zones around springs and water sources.

The protection afforded to APPs is not merely the product of a conservation-oriented environmental policy but constitutes a rational land-use strategy aimed at ensuring collective safety, preventing disasters, and safeguarding fundamental rights such as access to safe housing and a balanced environment. When this precautionary rationale is disregarded, it paves the way for the establishment of urban settlements in high-risk areas, exposing entire communities to climate vulnerability, as has historically been the case in several municipalities within the Mearim River basin in Maranhão[73].

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and Disaster-Resilient Cities. Brasília: CNMP, 2024. Available at: **https://www.cnmp.mp.br**. Accessed April 5, 2025.

73 SOUSA, Antonio Jadson Rocha. **Impactos socioambientais provocados pelas inundações do Rio Mearim no município de Pedreiras, Maranhão**. Araguaína: UFT, 2021.

The experience in Maranhão demonstrates a pattern of informal urbanization and institutional tolerance for the occupation of APPs, whether due to ineffective oversight or failures in regulating urban land subdivision. This permissive approach to construction within protective buffer zones has led not only to human tragedies during flood seasons but also to long-term harm to public infrastructure, water quality, and regional biodiversity. In addition, these occupations undermine the soil's capacity for water absorption, contributing to erosion, river siltation, and the intensification of heavy rainfall impacts[74].

It is important to recognize that the precarious urban development occurring in high-risk areas reflects persistent socioeconomic inequalities that marginalize certain groups and force them into informal land tenure. However, this recognition cannot be used to justify public-sector inaction. On the contrary, it calls for a coordinated institutional response aimed at sustainable land regularization, dignified resettlement, and the environmental restoration of degraded areas[75].

The Public Prosecutor's Office, in carrying out its constitutional mandate to protect diffuse and collective interests, has the legitimacy to pursue actions aimed at preventing new illegal occupations, requiring the preparation and revision of master plans based on technical criteria, and promoting urban adaptation measures[76]. Its role in this area should combine both preventive and corrective strategies, holding the state accountable for omissions while advancing structural solutions. Addressing the irregular occupation of APPs is therefore a fundamental element of disaster prevention policy and should be prioritized in municipalities historically affected by flooding, such as those along the banks of the Mearim River[77].

Given that the occupation of APPs has been identified as one of the main factors intensifying hydrological disasters in urban areas, particularly along the banks of the Mearim River, there is a clear need to strengthen the legal framework governing the preventive and coordinated actions of federal, state, and municipal authorities in the face of environmental risks. In this context, the National Policy on Civil Protection and Defense, established by Law Nº 12,608/2012, stands out as a fundamental legal instrument for guiding both safe urban planning and the accountability of negligent public managers.

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74 DEL RIO, T. et al. Enchentes, mal-estar ambiental e as forças de interpretação na cidade. **Revista A588**, São Paulo, v. 8, nº 1, pp. 91-106, Jan. 2022.

75 MARICATO, Ermínia. As ideias fora do lugar e o lugar fora das ideias: planejamento urbano no Brasil. In: ARANTES, Otília; VAINER, Carlos; MARICATO, Ermínia. **A cidade do pensamento único**. Petrópolis: Vozes, 2006.

76 NATIONAL COUNCIL OF THE PUBLIC PROSECUTOR'S OFFICE. National Pact for Sustainable and Disaster-Resilient Cities. Brasília: CNMP, 2024. Available at: **https://www.cnmp.mp.br**. Accessed April 5, 2025.

77 SOUSA, Antonio Jadson Rocha. **Impactos socioambientais provocados pelas inundações do Rio Mearim no município de Pedreiras, Maranhão**. Araguaína: UFT, 2021.

The Natural Disasters Law and the Duties of Public Authorities

The enactment of Law Nº 12,608/2012 marked a regulatory milestone by systematizing the National Policy on Civil Protection and Defense (PNPDEC) and organizing the National System for Civil Protection and Defense (SINPDEC). At the federal level, it consolidated the principles of prevention, mitigation, preparedness, response, and recovery in the face of disasters. This legislation reframes disasters as no longer merely natural phenomena, but as the result of interactions among environmental, social, and urban factors, and therefore subject to prevention and qualified public management.

The legislation, through Articles 6 to 8, sets out a clear framework of responsibilities assigned to the federal government, states, and municipalities. Within this framework, municipalities, as the level of government closest to territorial realities, hold direct responsibility for identifying and mapping risk areas (Article 8, IV); prohibiting new occupations in these areas (V); adopting preventive measures, including the possible relocation of residents in hazardous situations (VII); and integrating civil defense actions into urban planning (III). However, in practice, there has been a systematic failure on the part of municipal authorities to fulfill these obligations, whether due to institutional weakness, a lack of political will, or administrative negligence.

The law also establishes the need for contingency plans and disaster risk reduction plans, as well as the creation of specific municipal funds to support prevention and response efforts. When properly implemented and operationalized, these instruments enable the development of local systems for rapid and effective response, integrating the sectors of health, social assistance, environment, housing, and urban infrastructure[78].

At the state and federal levels, responsibilities include providing technical and financial support, coordinating inter-institutional efforts, producing meteorological data and alerts, and formally recognizing states of emergency and public calamity. Coordinated action across all levels of government is therefore essential for the effectiveness of risk management policies[79].

For the State Public Prosecutor's Office, Law Nº 12,608/2012 serves as a direct source of legitimacy for overseeing the implementation of civil protection and defense policies at all levels. It is within its mandate, for example, to initiate proceedings to verify whether municipalities include risk area mapping in their master plans, as required by Article 42-A of the City Statute, whether they have effective contingency plans, whether they monitor irregular occupations, and whether they maintain structured alert systems and shelters for emergency response.[80]

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78 DEL RIO, T. et al. Enchentes, mal-estar ambiental e as forças de interpretação na cidade. **Revista A588**, São Paulo, v. 8, nº 1, pp. 91-106, Jan. 2022.

79 NATIONAL COUNCIL OF THE PUBLIC PROSECUTOR'S OFFICE. National Pact for Sustainable and Disaster-Resilient Cities. Brasília: CNMP, 2024. Available at: **https://www.cnmp.mp.br**. Accessed April 5, 2025.

80 PUBLIC PROSECUTOR'S OFFICE OF THE STATE OF SÃO PAULO. Resolution PGJ Nº 1,815/2024. Establishes the Special Project on Climate Emergencies and Disasters. **Official Gazette of the State of São Paulo**, São Paulo, March 5, 2024.

In the State of Maranhão, where cyclical flooding and the repeated forced displacement of riverside families occur[81], the urgency of applying the provisions of Law Nº 12,608/2012 in a binding manner is evident, establishing a clear standard for administrative accountability. In this scenario, the MPMA holds the institutional authority to enforce these legal obligations both judicially and extrajudicially, promoting Conduct Adjustment Agreements (CAAs), public civil actions, and recommendations aimed at strengthening municipal civil defense systems and protecting the fundamental rights of affected populations[82].

Beyond simply reacting to extreme climate events, it is essential to promote an institutional culture of prevention, grounded in risk assessment and the protection of the most vulnerable groups. Disasters are not inevitable – in most cases, they result from negligence. The Natural Disasters Law, by acknowledging this premise, provides the Public Prosecutor's Office with a robust legal framework to take action before harm occurs[83].

The National Pact for Sustainable and Disaster-Resilient Cities and the Proposed Role of the MPMA

In a context of increasingly frequent extreme events and heightened climate risks, the MPMA's adherence to the National Pact for Sustainable and Disaster-Resilient Cities, coordinated by the National Council of the Public Prosecutor's Office (CNMP), represents a historic opportunity to restructure its institutional approach to socio-environmental issues. The pact establishes a set of guidelines aimed at promoting preventive public policies, strengthening local governance, and fostering coordinated disaster responses, grounded in principles such as intersectorality, sustainable urban planning, environmental justice, and the centrality of human rights.

The agreed-upon document acknowledges that disasters are not merely natural events, but socio-environmental phenomena resulting from the combination of hazards (such as heavy rainfall, flooding, and landslides) with human, structural, and institutional vulnerabilities. For this reason, it sets out four strategic pillars: (i) risk prevention and reduction; (ii) preparedness and response; (iii) resilient and sustainable reconstruction; and (iv) evidence-based and territorially grounded action[84].

Building on these principles, it is proposed that the Public Prosecutor's Office of the State of Maranhão develop a proactive and continuous strategy that goes be-

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81 G1 MARANHÃO. Cheias do Rio Mearim desabrigam centenas de famílias em Pedreiras e Trizidela do Vale. **G1**, São Luís, 28 mar. 2024. Available at: **https://g1.globo.com/ma/maranhao**. Accessed April 5, 2025.

82 SOUSA, Antonio Jadson Rocha. **Impactos socioambientais provocados pelas inundações do Rio Mearim no município de Pedreiras, Maranhão**. Araguaína: UFT, 2021.

83 NATIONAL COUNCIL OF THE PUBLIC PROSECUTOR'S OFFICE. National Pact for Sustainable and Disaster-Resilient Cities. Brasília: CNMP, 2024. Available at: **https://www.cnmp.mp.br**. Accessed April 5, 2025.

84 Ibid.

yond emergency response, incorporating structural measures for disaster prevention and the development of safer, more inclusive cities. This strategy can be implemented through actions such as:

- Institutionalize specialized climate disaster units within the MPMA, coordinating Prosecutor's Offices with mandates in environmental protection, housing, urban planning, childhood, youth, and human rights;

- Map risk areas and identify municipalities most vulnerable to hydrological events, particularly along the Mearim River basin, in partnership with technical institutions such as the National Center for Monitoring and Early Warning of Natural Disasters (CEMADEN), the National Water and Basic Sanitation Agency (ANA), Civil Defense authorities, and universities;

- Require the establishment and operation of municipal Civil Defense councils, while overseeing the existence of municipal contingency plans, updated master plans, and dedicated budgetary funds for risk management;

- Promote interinstitutional public hearings in the highest-risk municipalities, involving public officials, community leaders, researchers, and technical agencies to build shared solutions and ensure transparency in resource management;

- Execute Conduct Adjustment Agreements (CAAs) to enable the safe and supported removal of irregular occupations in APPs, ensuring dignified resettlement in line with the guidelines of the United Nations Human Settlements Programme (UN-Habitat) and the jurisprudence of the Federal Supreme Court (STF) regarding housing and human dignity;

- Integrate climate and disaster prevention issues into the MPMA's strategic planning, promoting continuous training for its members and staff, and establishing indicators to measure institutional impact on this agenda.

It is worth noting that the pact itself emphasizes the importance of integrated action between the Public Prosecutor's Office and other branches of government and oversight bodies, encouraging the development of local resilience networks. This approach is particularly relevant in states like Maranhão, where social inequalities and weak public infrastructure heighten the population's vulnerability to climate risks[85].

By aligning its actions with the principles of the pact, the MPMA positions itself as a catalyst for sustainable public policies and territorial justice, helping to break the cycle of neglect, disaster, and invisibility that has historically af-

85 UN-HABITAT. **Urban Resilience Global Programme**. Nairobi: United Nations Human Settlements Programme, 2023.

fected riverside communities along the Mearim River. Addressing disasters as foreseeable tragedies requires more than post-event accountability: it demands a qualified institutional presence, an ethical commitment to human rights, and strategic action aimed at transforming these realities[86].

Conclusion

The recurring floods in Maranhão, particularly along the banks of the Mearim River, can no longer be regarded as natural misfortunes, but rather as extreme manifestations of a historically negligent urban and environmental model, one in which the irregular occupation of Permanent Preservation Areas, the lack of preventive territorial planning, and omissions in risk management form the backdrop for these predictable tragedies. Experience has shown that, in the wake of disasters, those most affected are always the same: the poorest, the invisible, those forgotten by the State. This reality demands a response that is consistent with constitutional guarantees of dignity, security, and a balanced environment.

Law Nº 12,608/2012, by establishing the National Policy on Civil Protection and Defense, provides a robust legal framework to require public authorities to go beyond emergency response and adopt structural measures for prevention, preparedness, and mitigation. However, its effectiveness depends on the institutional commitment of oversight bodies, particularly the Public Prosecutor's Office, whose mission to protect fundamental rights must increasingly incorporate disaster prevention as an expression of socio-environmental justice.

In this context, the MPMA's adherence to the National Pact for Sustainable and Disaster-Resilient Cities represents a concrete opportunity to move beyond a reactive approach and implement a strategic agenda to address climate vulnerabilities. The pact provides not only guidelines but also tools and targets for coordinated, cross-sectoral, and territorially focused action capable of driving effective public policies and ensuring that human rights remain central to risk management efforts.

Overcoming the persistent framing of disasters as predictable tragedies requires building a new institutional and social culture of prevention, rooted in valuing urban planning, promoting responsible land management, and prioritizing the fundamental rights of vulnerable populations. Local and state governments must assume leadership in implementing the policies established by Law Nº 12,608/2012, strengthening civil defense structures, revising master plans based on technical criteria, and ensuring effective control over the occupation of high-risk areas. At the same time, the active engagement of civil society is essential to monitor government actions, demand inclusive public policies, and foster a collective awareness oriented toward climate resilience. Confronting socio-environmental disasters can no longer be postponed — it is a task that de-

86 SOUSA, Antonio Jadson Rocha. **Impactos socioambientais provocados pelas inundações do Rio Mearim no município de Pedreiras, Maranhão.** Araguaína: UFT, 2021.

mands shared responsibility, interinstitutional cooperation, and the political will to break the cycle of vulnerability and neglect that has characterized daily life in so many Brazilian cities for decades.

THE CASE OF PIQUIÁ DE BAIXO: SOCIAL IMPACTS AND PATHWAYS FOR RECOVERING A COMMUNITY AFFECTED BY ENVIRONMENTAL DEGRADATION

BY THIAGO CÂNDIDO RIBEIRO[87]

The 1988 Federal Constitution[88] guarantees, among other rights, access to adequate housing and the enjoyment of an ecologically balanced environment. The interpretation and application of its provisions do not take place in a vacuum, but rather within a historical, political, and social context that shapes their effectiveness and reach.

Recognizing that constitutional norms safeguard fundamental rights goes beyond a strictly literal reading of the legal text. It requires an analysis that considers not only legal frameworks but also the people whose lives they impact, people who have a legitimate expectation of proper implementation and the guarantee of justice.

In this sense, a population living in an area directly impacted by the severe environmental consequences of industrial activity deserves careful and specific consideration, so that its problems are not addressed in a generic or superficial way. This is the situation in Piquiá de Baixo, a neighborhood in Açailândia, Maranhão.

In that community, residents have been directly affected by the intense presence of steel mills in their surroundings. As a result, the people of Piquiá fought to have their rights to adequate housing and a balanced environment upheld, which led to the creation of Piquiá da Conquista, a new neighborhood where the families affected by environmental damage were resettled. The name itself faithfully reflects the spirit of their struggle.

This paper analyzes the environmental impacts and the resettlement process of the residents of Piquiá de Baixo, highlighting both the community's struggle and the role of the Public Prosecutor's Office of the State of Maranhão (MPMA) in defending the environment and advancing socio-environmental justice on multiple fronts. It emphasizes the importance of mediation, social participation, and consensus-building in addressing the damage caused by pollution from steel industry operations in the area.

Historical Context of Piquiá de Baixo

The history of Piquiá de Baixo is deeply intertwined with that of the city of Açailândia, as the development of both is closely connected. The events that have unfolded in this region make it one of the central settings within the municipality, to the extent that it is impossible to discuss one without referring to the other.

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87 Public Prosecutor. Public Prosecutor's Office of Maranhão. Specialist in Criminal Sciences and Anti-Corruption Law from the Federal University of Maranhão (UFMA). Email: **candidoribeiro@mpma.mp.br**.

88 BRAZIL. Constitution of the Federative Republic of Brazil of 1988. Brasília, DF: Office of the President of the Republic. Available at: **https://www.planalto.gov.br/ccivil_03/constituicao/constituicaocompilado.htm**. Accessed May 5, 2025.

Açailândia is a municipality located in the southwestern part of the state of Maranhão, approximately 560 kilometers from the state capital, São Luís. According to the Brazilian Institute of Geography and Statistics (IBGE), its territory covers 5,805.159 km², with a population of 106,550 inhabitants[89].

The history of Açailândia began in 1958 with the construction of the BR-010 highway through the area that would later become the municipality. This development was largely driven by the mobilization of workers from the city of Imperatriz, Maranhão[90], to which Açailândia was originally administratively linked, until it eventually gained emancipation and was elevated to the status of municipality in 1982, through State Law Nº 4,295/1981[91].

Initially, its economy was characterized by agricultural production, livestock, and timber extraction. However, with the construction of the Carajás Railway and the North-South Railway[92], both launched during the 1980s, the steel industry was introduced to the region and soon assumed a leading role.

The construction of the railway in the municipality of Açailândia, Maranhão, enabled the establishment of a passenger and ore loading/unloading station in 1985[93], creating the conditions for the development of the region's current industrial hub. Like the railway itself, the passenger station not only spurred the municipality's economic growth but also facilitated its urban expansion[94], which can be seen in the community located near both structures, known as Piquiá de Baixo. According to Nascimento, Piquiá de Baixo emerged as a settlement in 1968, following the opening of the highway that now connects Açailândia to Santa Luzia. Its name derives from the fruit-bearing trees known locally as "Piqui" or "Piquiá," a popular fruit in the region[95].

The completion of the initial sections of the North–South Railway and the associated station transformed the original settlement into a neighborhood, which was later incorporated into the municipality's industrial hub[96]. This transformation was driven by the arrival of several companies linked to the steel industry, positioning Açailândia as a center for pig iron production and, later, for pulp and cement as well.

In 1988, Viena Siderúrgica and Companhia Vale do Pindaré were the first steel companies to establish operations in the municipality[97]. Today, the main compa-

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89 BRAZILIAN INSTITUTE OF GEOGRAPHY AND STATISTICS (IBGE). Brazilian Territorial Area 2022: Açailândia. Rio de Janeiro: IBGE, 2023.

90 FUNDAÇÃO VALE. Um olhar sobre Açailândia/MA: diagnóstico sócio-econômico. [s.l.: s.n.], 2007, p. 02. Available at: **http://www.fundacaovale.org/pt-br/a-fundacao-vale/como-atuamos/Documents/estrada-de-ferro-carajas/livreto_A%C3%A7ail%C3%A2ndia.pdf**. Accessed February 27, 2025.

91 MARANHÃO. State Law N° 4,295 of June 6, 1981. Provides for the creation of municipalities and other provisions.

92 Ibid. p. 02.

93 NASCIMENTO, E. M. Maranhão, **Açailândia e sua História**. Gráfica Brasil: Imperatriz, 2008.

94 Ibid.

95 Ibid.

96 Ibid.

97 ROCHA, M. R. V. S. SILVA, D. C. O. LOIOLA, E. Amazônia Oriental: impactos socioambientais em

nies active in Açailândia's industrial hub include Vale S.A. and Aço Verde do Brasil (AVB, formerly Gusa Nordeste), both involved in pig iron production and steel exports, as well as Suzano Papel e Celulose, Cimento Verde do Brasil (part of the same group as AVB), and the aforementioned Viena Siderúrgica[98], which has maintained its operations throughout this period.

The development of the Açailândia Industrial Hub spurred rapid economic growth and attracted migrants from various regions, leading to significant population growth[99]. Although this expansion might have suggested improvements in infrastructure, it actually created challenges in managing people, resources, and public services. The transformation of the Piquiá de Baixo neighborhood, directly tied to the surrounding industrial boom, illustrates this dynamic and is essential to understanding the resulting environmental and social impacts.

The Environmental Damage from Steel Industry Activities and the Impact on Piquiá de Baixo

Steel production has certain particularities that must always be considered when it is introduced into a specific area, including the need for a large operational footprint and the environmental consequences inherent to pig iron manufacturing.

Cardoso[100] explains that producing pig iron requires the reduction of iron ore in blast furnaces, a process involving the fusion of ore with coal, which results in the emission of carbon dioxide (CO_2) into the atmosphere, as well as the production of slag, ash, and wastewater containing heavy metals, sulfates, and other chemical compounds.

The production of pig iron in non-integrated steel mills using charcoal, like many industrial processes, relies on intensive consumption of raw materials and energy, and causes numerous environmental impacts. These include atmospheric pollutant emissions, the discharge of liquid effluents, the generation of solid waste, and the use of charcoal as a thermal reducing agent.

For these reasons, steel production is considered one of the most polluting and energy-intensive industries[101]. The introduction of mining and steelmaking activities into a territory creates direct competition with other uses of local natural resources and, in many cases, threatens other forms of production, partic-

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Pequiá de Baixo no Município de Açailândia-MA. **Acta Ambiental Catarinense**, Chapecó, v. 12, nº 1/2, 2015.

98 CARDOSO, L. V. O. **Impactos ambientais da indústria de siderurgia na região Pré Amazônica (Maranhão): caso Pequiá de Baixo**. 2024. 92 f. Dissertation (Master's in Law) — Graduate Program (stricto sensu) in Law, Catholic University of Santos, Santos, 2024.

99 Ibid.

100 CARDOSO, L. V. O. **Impactos ambientais da indústria de siderurgia na região Pré Amazônica (Maranhão): caso Pequiá de Baixo**. 2024. 92 f. Dissertation (Master's in Law) — Graduate Program (stricto sensu) in Law, Catholic University of Santos, Santos, 2024.

101 CAVALCANTI, P. P. S. **Gestão ambiental na indústria siderúrgica: aspectos relacionados às emissões atmosféricas**. 2012. 46 f. Undergraduate Thesis (Bachelor's in Metallurgical Engineering) — Polytechnic School, Federal University of Rio de Janeiro, Rio de Janeiro.

ularly those that depend directly on a healthy environment, such as agriculture, fishing, tourism[102], and related activities.

The blast furnace pig iron production process relies on two basic raw materials: iron ore and coal (either coke or charcoal). Iron ore consists of three components: the useful portion containing the iron; the gangue, which includes impurities of no direct value; and the sterile portion, which is the rock from which the ore is extracted.

The blast furnace is the primary piece of equipment used in iron metallurgy, where the reduction of iron ore oxides takes place through the application of a thermal reducing agent, which, as noted, can be either charcoal or coke. The main atmospheric emissions generated during pig iron production are particulate matter, with dust and particles released throughout various stages, from raw material handling to the reduction process within the furnace. These emissions can harm respiratory health, contribute to air pollution, and reduce visibility. Furthermore, the charcoal demand of steel mills exacerbates environmental problems, often leading to the deforestation of native forests to obtain this thermal reducing agent.

The combustion of charcoal, which may contain sulfur, along with the high temperatures involved in the reduction process, contributes to the formation of sulfur and nitrogen oxides, gases that are precursors of acid rain and can harm both vegetation and human health. Additionally, the incomplete combustion of charcoal leads to the formation of carbon monoxide, a toxic gas that binds to hemoglobin in the blood, impairing oxygen transport.

Furthermore, the use of charcoal introduces significant operational challenges due to the wide variability in its physicochemical properties, which depend on factors such as wood species, tree age, and the conditions of the carbonization process. This variability underscores the complexity of using charcoal as an energy source in steel production.

Given these considerations, it is evident that the main activities of the Açailândia Industrial Hub generate wood dust (from sawmills), ore dust (from mining), and blast furnace emissions (from steel production), all highly toxic compounds[103] that cause considerable harm to human health.

Exposure to these substances, which ideally should have been confined to the companies' operational areas, became unavoidable in Piquiá de Baixo. The presence of residents in close proximity to the steelmaking complex resulted in direct exposure to the chemical agents produced during the pig iron thermo-reduction process, putting the local population in direct conflict with the polluting industrial activities established there.

It is also important to note that the production scale of these companies plays a significant role in assessing their environmental and social impacts. For exam-

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102 MILANEZ, B. *et al*. Injustiça Ambiental, Mineração e Siderurgia. In: PORTO, M.F., PACHECO, T., and LEROY, J.P., comps. **Injustiça ambiental e saúde no Brasil: o Mapa de Conflitos** [online]. Rio de Janeiro: Editora FIOCRUZ, 2013, pp. 175-205. ISBN 978-85-7541-576-4. **https://doi.org/10.7476/9788575415764.0007**.

103 ROCHA, M. R. V. S. SILVA, D. C. O. LOIOLA, E. Amazônia Oriental: impactos socioambientais em Pequiá de Baixo no Município de Açailândia-MA. **Acta Ambiental Catarinense**, Chapecó, v. 12, nº 1/2, 2015.

ple, Rocha, Silva, and Loyola[104] report that Viena Siderúrgica reached an annual pig iron production of 500,000 tons, while Gusa Nordeste, prior to its incorporation by AVB, was already producing 53,000 tons per year.

Thus, the high production capacity of these steel plants, geared primarily toward exports, reveals a cost that goes beyond the simple economic valuation of inputs and products. It is essential to consider the profound environmental and social transformations resulting from this activity, which have directly impacted the population of Piquiá de Baixo living around these industrial facilities.

The continued development of the area attracted additional workers seeking employment both in the industries and in the surrounding service sector[105]. As a result, alongside the existing residents, these workers also settled in the area, despite the potential harm from exposure to toxic compounds emitted by the industrial activities. As more people established residence in Piquiá de Baixo in parallel with the industrial expansion, the neighborhood experienced unplanned and disordered growth[106], driven by the lack of urban planning for the region.

This conflict becomes even clearer when examining the Municipal Zoning Plan and the Participatory Master Plan[107] published by the Açailândia City Hall. The area of Piquiá de Baixo is classified as a Residential Zone, yet it is the only such zone located within the Municipal Industrial Zone, a clear inconsistency in Açailândia's planning, highlighting the evident shortcomings of the Master Plan when measured against local needs.

As a consequence of this lack of planning, residents have been directly exposed to emissions from the steel mills, leading to respiratory problems as well as eye and skin diseases, which have become the most common health issues. These impacts have been widely diagnosed, both clinically and through research, including the studies conducted by Valenti, Pozzi, and Busia[108] from the Istituto Nazionale dei Tumori in Milan, Italy.

The consequences of industrial activity are felt directly by the local population, as highlighted in a report by the Center for Ecologies, Epistemologies, and the Emancipatory Promotion of Health (NEEPS): Around 310 families in the district of Piquiá, located in the municipality of Açailândia/MA, have been experiencing a range of health problems due to the negative impacts of pig iron production by regional steel mills. Living on the slopes of one of the poorest neighborhoods in Açailândia, without basic sanitation or paved streets, these families are confined

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104 Ibid.

105 Ibid.

106 CARDOSO, L. V. O. **Impactos ambientais da indústria de siderurgia na região Pré Amazônica (Maranhão): caso Pequiá de Baixo**. 2024. 92 f. Dissertation (Master's in Law) — Graduate Program (stricto sensu) in Law, Catholic University of Santos, Santos, 2024.

107 AÇAILÂNDIA. Participatory Master Plan of Açailândia 2006/2015. Açailândia, 2015. Available at: **https://www.acailandia.ma.gov.br/publicacoes/ver/Plano-Diretor-Participativo-de-Acailandia-20062015_1**. Accessed March 8, 2025.

108 VALENTI, C., POZZI, P., BUSIA, A. et al. **Respiratory illness and air pollution from the steel industry: the case of Piquiá de Baixo, Brazil** (Preliminary report). Multidiscip Respir Med. Milão (ITA). n° 11, art. 41, Nov. 2016. **DOI: https://doi.org/10.1186/s40248-016-0077-9.** Available at: **https://mrmjournal.biomedcentral.com/articles/10.1186/s40248-016-0077-9#citeas**. Accessed February 25, 2025.

between the BR-222 highway, the Carajás Railway, and the steel mill yards. As a result of this and similar industries, the residents' backyards are covered in soot, and they report respiratory illnesses, allergies, headaches, and even the death of a child."[109]

In addition, another concern highlighted by NEEPES reinforces the severity of the situation in Piquiá de Baixo, this time regarding the community's water resources, as noted in the following excerpt: "[...] another serious problem in the region is the lack of proper disposal for steel production slag. Dumped in large open-air piles, the waste is drained into local water bodies, contaminating the Quarenta stream, which is used by the local population." [110]

An independent study carried out by medical professionals from the IRCCS Foundation (*Istituto di Ricovero e Cura a Carattere Scientifico*, or National Cancer Institute) in Milan, Italy[111], aimed at assessing the incidence of respiratory diseases, analyzed the clinical condition of 220 residents of Piquiá de Baixo. The researchers found that 28% suffered from some type of respiratory illness, emphasizing that the study group did not include workers directly employed by local industries, but only residents of Piquiá de Baixo.

The study identified a rate between two and six times higher than those reported in studies from other countries, which range from 4.6% to 14.5%, and which used comparable research methodologies[112].

Against this backdrop of rights violations, marked by poor urban infrastructure and environmentally harmful practices, the deterioration of the community's health conditions made it necessary to adopt measures to protect the residents of Piquiá de Baixo from the extremely high levels of pollution to which they were exposed. These measures included correcting industrial production standards at the steel plants and implementing the collective relocation of local residents.

Environmental protection and the concept of social and environmental justice

The case of Piquiá de Baixo illustrates the gap between the environmental protection enshrined in Brazilian legislation and its effective implementation in practice. Although the Federal Constitution and supporting legislation provide

109 Center for Ecologies, Epistemologies, and the Emancipatory Promotion of Health (NEEPES). MA — Pollution caused by steel industry activity threatens the existence of the Piquiá de Baixo community in Açailândia. São Paulo: Map of Conflicts' Environmental Injustice and Health in Brazil, 2018. Available at: **https://mapadeconflitos.ensp.fiocruz.br/conflito/ma-industria-guseira-contaminacao-da-agua-falta-de-seguranca-e-condicoes-improprias-a-vida-e-a-saude-dos-moradores-do-distrito-industrial-de-pequia-acailandia/**. Accessed May 6, 2025.

110 Ibid.

111 VALENTI, C., POZZI, P., BUSIA, A. et al. **Respiratory illness and air pollution from the steel industry: the case of Piquiá de Baixo, Brazil** (Preliminary report). Multidiscip Respir Med. Milão (ITA). Nº 11, art. 41, Nov. 2016. DOI: https://doi.org/10.1186/s40248-016-0077-9. Available at: **https://mrmjournal.biomedcentral.com/articles/10.1186/s40248-016-0077-9#citeas.**

112 Ibid.

robust mechanisms for environmental safeguards, the reality experienced by local residents, who are heavily affected by steel industry activities, reveals serious violations of these rights.

The 1988 Federal Constitution grants special protection to the environment through various provisions. To begin with, Article 5, section LXXIII, authorizes citizens to bring a citizen lawsuit to annul acts harmful to the environment. Article 23, section VI, establishes that environmental protection is a shared responsibility of the federal government, the states, the Federal District, and the municipalities. Article 129, section III, assigns to the Public Prosecutor's Office the duty of filing public civil actions in defense of the environment. Moreover, environmental protection is enshrined as a principle of Brazil's economic order, under Article 170, section VI.

Environmental safeguards gain even greater force in Chapter VI of Title VIII of the Constitution, particularly Article 225, which guarantees everyone the right to an ecologically balanced environment, a public asset for common use by the people and essential to a healthy quality of life.

It should be emphasized that the constitutional text goes beyond merely formal protection, placing on both public authorities and society the duty to defend and preserve the environment for present and future generations. In this regard, Marum argues that, regardless of whether the environment is classified as a social right or a fundamental right, it is inherently linked to values such as health, dignity, and quality of life – all of which are unattainable without an ecologically balanced environment[113]. This perspective reinforces the need for concrete and effective implementation of environmental legislation, particularly in contexts where environmental harm is evident, as in the case of Piquiá de Baixo.

At the infraconstitutional level, the Brazilian legal framework further reinforces this commitment. Law Nº 9,605/1998 (Environmental Crimes Law)[114] and Law Nº 12,651/2012 (Forest Code)[115] establish clear parameters for the protection of natural resources and penalties for conduct harmful to the environment. The National Environmental Policy (Law Nº 6,938/1981)[116] had already established, in its Article 2, the need to guarantee environmental quality as a prerequisite for human life.

Despite this legal framework, the reality faced by the community of Piquiá de Baixo reveals a scenario of disregard for these rights, as the environmental damage observed has led to direct consequences for people's health and lives. The

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113 MARUM, J. A. O. **Direito Ambiental sistematizado: para cursos e concursos.** 1 ed. Curitiba: Appris, 2023.

114 BRASIL. Law N° 9,605 of February 12, 1998. Provides for criminal and administrative sanctions derived from conduct and activities harmful to the environment, and other provisions. **Brazilian Federal Official Gazette**, Brasília, DF, February 13, 1998.

115 BRASIL. Law N° 12,651 of May 25, 2012. Provides for the protection of native vegetation. **Brazilian Federal Official Gazette**, Brasília, DF, May 28, 2012.

116 BRASIL. Law N° 6,938 of August 31, 1981. Establishes the National Environmental Policy, its purposes, and the mechanisms for its formulation and application, and other provisions. **Brazilian Federal Official Gazette**, Brasília, DF, September 2, 1981.

work of Valenti, Pozzi, and Busia[117] clearly demonstrates significant harm to the health of the local population, while Rocha, Silva, and Loyola[118] highlight major social problems stemming from this environmental degradation.

Brazilian legislation offers effective tools to combat and remedy environmental harm, covering measures from the prevention and control of polluting activities to holding parties accountable for damages caused. These instruments include public civil actions, citizen lawsuits, administrative sanctions, and criminal liability, as well as mechanisms for consensual dispute resolution.

The development of solutions for the Piquiá de Baixo case necessarily involves mediation, the active participation of the affected community, the companies in the mining supply chain, public authorities, hearings, public consultations, meetings, and the construction of agreements, sometimes documented in meeting minutes, sometimes formalized through Conduct Adjustment Agreements (CAAs).

In this way, the use of existing legal instruments, together with structural procedural techniques, ensured the protection of rights guaranteed by the Constitution through problem-focused dialogue and the building of solutions. This approach allowed the Public Prosecutor's Office and the Piquiá de Baixo community to create an alternative that could serve as a foundation for pursuing a dignified life for the population affected by pollution, while maintaining their commitment to environmental responsibility.

As the problem in Piquiá de Baixo is primarily environmental, with repercussions on health, housing, and sustainable development, it became necessary to reflect on the transformations driven by the local economy and assess whether a proposed solution would be both effective and feasible.

This reflection is based on the understanding that vulnerable communities like Piquiá de Baixo are more exposed to the impacts generated by economic dynamics. This reality not only compromises their access to basic resources but also makes them particularly susceptible to problems beyond their direct responsibility – including environmental damage.

This understanding was synthesized by Ulrich Beck in his Risk Society Theory, which highlights that vulnerable social groups are more susceptible to the consequences of environmental degradation than privileged groups, even when environmental harm is "equally" distributed[119] (Sarlet and Fensterseifer, 2021). In other words, this disparity is not limited to economic or social criteria but is also intrinsically linked to environmental conditions.

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117 VALENTI, C., POZZI, P., BUSIA, A. et al. **Respiratory illness and air pollution from the steel industry: the case of Piquiá de Baixo, Brazil** (Preliminary report). Multidiscip Respir Med. Milão (ITA). N° 11, art. 41, Nov. 2016. DOI: https://doi.org/10.1186/s40248-016-0077-9. Available at: **https://mrmjournal.biomedcentral.com/articles/10.1186/s40248-016-0077-9#citeas**. Accessed February 25, 2025.

118 ROCHA, M. R. V. S. SILVA, D. C. O. LOIOLA, E. Amazônia Oriental: impactos socioambientais em Pequiá de Baixo no Município de Açailândia-MA. **Acta Ambiental Catarinense**, Chapecó, v. 12, n° 1/2, 2015. CARDOSO, L. V. O. **Impactos ambientais da indústria de siderurgia na região Pré Amazônica (Maranhão): caso Pequiá de Baixo**. 2024. 92 f. Dissertation (Master's in Law) — Graduate Program (stricto sensu) in Law, Catholic University of Santos, Santos, 2024.

119 SARLET, I. W. FENSTERSEIFER, T. **Curso de Direito Ambiental**. 2. ed. Rio de Janeiro: Forense, 2021.

Sarlet and Fensterseifer, in their interpretation of Risk Society Theory, explain that privileged groups can postpone the impacts of environmental damage, as they have access to areas with infrastructure that better supports human well-being. In contrast, less privileged residential zones are often located near industrial sectors, directly receiving emissions harmful to human health.[120]

The case of Piquiá de Baixo exemplifies this dynamic. The evident social inequality and the environmental impacts suffered by the population call for a solution that integrates both social and environmental dimensions, which are intrinsically connected to the problem's context.

In this regard, Ribeiro emphasizes that adopting a social and environmental justice perspective makes it possible to analyze the entire production cycle in order to identify the impacts generated by processes that exploit natural resources, and how these impacts affect different segments of society[121]. In general, individuals and social groups who are already in more vulnerable socioeconomic positions tend to bear the greatest burden of environmental risks. This burden reveals that the roots of the issue go beyond strictly environmental factors, and any solution that fails to address this connection would be insufficient or even ineffective.

To identify such situations, one only needs to look at the reality of major Brazilian urban centers, where the poorest populations live in the most degraded areas, areas that are therefore less targeted by real estate speculation, often near landfills, with contaminated water resources, in industrial zones with high levels of pollution, or in environmentally protected or high-risk areas, such as permanent preservation zones and protected areas.

In these contexts, poor social groups face a kind of double rights violation: both in relation to their social rights and in their right to live in a healthy, safe, and ecologically balanced environment.

Considering these points, it is evident that the issue of social and environmental justice is directly applicable to the case of Piquiá de Baixo. The residents, almost all of them low-income, were exposed for years to pollutants emitted by steel plants, bearing the burden of environmental damage, harm to their health, and violations of their right to adequate housing. This dynamic illustrates the unequal distribution of risks and benefits, in which a small minority profits from economic gains while the majority of the local population suffers the consequences of environmental degradation.

In this context, the struggle for the resettlement of the Piquiá de Baixo community also represents a pursuit of social and environmental justice. It is an effort to correct a historical distortion, reclaiming the rights to adequate housing and a balanced environment as a means of repairing the social and environmental injustices endured by this population.

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120 Ibid.

121 RIBEIRO, W. C. **Justiça espacial e justiça socioambiental: uma primeira aproximação**. Estud. av, São Paulo, v. 31. nº 89. pp. 147-165, Jan-Apr 2017. DOI: **https://doi.org/10.1590/s0103-40142017.31890014**.

Social impacts on the right to housing

According to the expert report by Ulisses Brigatto Albino, dated 2007 and attached to Compensation Lawsuit Nº 2301-25.2005.8.10.0022[122], the area of Piquiá de Baixo is unfit for sustaining human life. The report highlights the presence of soot emissions, metallic residues, noise, gases, and iron oxidized by water from the blast furnaces. As described in the report: "The emissions of soot, water containing metallic residues, and noise are certainly harmful to human health. The living conditions of the residents, along with their habits and traditions, make the situation even more critical. Domesticated animals, such as chickens and pigs, feed on insects and debris containing traces of metals that can be carried by rainwater as it flows through the company's yard before reaching the backyards. At the time of the inspection, the wind was blowing from east to west, affecting many homes in this region with gaseous discharges. The cooling water from the blast furnaces leaves the company yard heated and containing dissolved materials; there is a strong smell of oxidized iron. Considering that it is not only iron present in the processed ores, this water can indeed contaminate the backyards of homes and the people living there, especially children. Furthermore, after passing through these backyards, the water reaches the Piquiá stream, carrying metals and raising the temperature of the water."[123]

Feeling firsthand the harms caused by the steel industry, even when accompanied by economic growth, jobs, and the prospect of a new life, the residents of Piquiá de Baixo began a social mobilization to transform their reality.

The Maranhão Public Prosecutor's Office (MPMA), in continuous dialogue with the Piquiá de Baixo community through its residents' association, the *Associação Comunitária de Moradores de Piquiá* (ACMP), and in partnership with the *Justiça nos Trilhos* Association (JnT), worked to support the relocation of residents from an environmentally degraded area to a location with adequate housing and healthy living conditions.

It is important to highlight that this represented a significant and complex decision, especially in light of the area's historical context. Discussions between residents and the companies involved who arrived first; the rights to housing, health, and an adequate environment; and the potential compensation owed to the area's residents, all of these issues are deeply connected to the lived history of those who have resided (and still reside) in Piquiá de Baixo.[124]

Faced with the collapse of livable conditions in that area, the residents decided to leave and seek housing in a location suitable for human life. The Associação Comunitária de Moradores de Piquiá (ACMP) formalized a project that led to the

122 AÇAILÂNDIA. Compensation Lawsuit. 2nd Civil Court. Environmental Expert Report, pp. 07–27 of Movement ID 92245067. Case N° 0002301-25.2005.8.10.0022. Filed in 2005. Plaintiff: Edvard Dantas Cardeal. Defendant: Gusa Nordeste S/A. Ruled on December 17, 2013.

123 Ibid. pp. 15-16.

124 ASSOCIAÇÃO COMUNITÁRIA DOS MORADORES DO PIQUIÁ. As denúncias e resistências da comunidade de Piquiá de Baixo. In: **Justiça nos Trilhos**. Açailândia, Feb. 27, 2024. Available at: **https://justicanostrilhos.org/piquia-de-baixo-uma-historia-de-luta-resistencia-e-esperanca-rumo-ao-reassentamento-e-a-reparacao-integral/**. Accessed February 25, 2025.

resettlement of Piquiá de Baixo, creating what would become known as *Piquiá da Conquista*[125]. This initiative was based on the guidelines outlined in the document Guidelines for the Resettlement of Piquiá de Baixo, authored by the ACMP itself in 2010. Beyond the residents' own organizational efforts, the ACMP received crucial support from the Maranhão Public Prosecutor's Office, through the 3rd Specialized Public Prosecutor's Office of Açailândia (3ª PJESP), which, among other responsibilities, is tasked with protecting the environment.

According to Justiça nos Trilhos and the records of the Public Prosecutor's Office itself, the MPMA has been working for at least 12 years to support the resettlement of the Piquiá de Baixo community. The office has assisted residents in engaging with other government agencies and the companies involved in the case, as well as monitoring the resettlement construction project in partnership with the Associação Comunitária de Moradores de Piquiá (ACMP) and the Justiça nos Trilhos Association (JnT).

The final project involved the construction of housing for 312 families, carried out by the company CAP Engenharia, based in São Luís, in an area located along the BR-222 highway, next to the Parque Novo Horizonte neighborhood and across from the Valle do Açaí neighborhood. The area now known as Piquiá da Conquista was acquired through financial resources provided by companies affiliated with the Iron and Steel Industry Union of the State of Maranhão (SIFEMA)[126].

To formalize the contract with the company responsible for the work, the ACMP had the support of the Federal Savings Bank (Caixa Econômica Federal, CEF), with the agreement signed between CAP Engenharia, CEF, and the ACMP itself. During the ACMP's initial discussions with the Municipality of Açailândia, Justiça nos Trilhos reported that the community requested funding from the "Minha Casa Minha Vida" program, under the "Entities" modality, with the necessary complementary resources provided by the companies and other public entities involved[127].

The allocation of these resources was formalized through two Conduct Adjustment Agreements (CAAs), signed under the jurisdiction of the 3rd Specialized Public Prosecutor's Office of Açailândia on October 29, 2019, and May 10, 2021, respectively. The first CAA, dated October 29, 2019, was an agreement between the municipality of Açailândia and the residents of Piquiá de Baixo, which resulted in the deposit of R$ 1 million in financial compensation for mineral exploitation. The second CAA, dated May 10, 2021, established the commitment of the munic-

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125 JUSTIÇA NOS TRILHOS. Piquiá da Conquista: entrega de chaves marca vitória histórica contra a poluição industrial. In: **Justiça nos Trilhos**. Açailândia, Oct. 22, 2024. Available at: **https://justicanostrilhos.org/piquia-da-conquista-entrega-de-chaves-marca-vitoria-historica-contra-a-poluicao-industrial/**. Accessed on March 21, 2025.

126 MARANHÃO STATE PUBLIC PROSECUTOR'S OFFICE. Administrative Procedure SIMP Nº 3652-255/2019. Administrative Procedure Nº 04/2019-3ª PJE/Açailândia. Order: 212019-3ªP-JEACD. Subject: Monitoring the resettlement project of the Piquiá de Baixo community. Açailândia, 2019.

127 JUSTIÇA NOS TRILHOS. Piquiá da Conquista: entrega de chaves marca vitória histórica contra a poluição industrial. In: **Justiça nos Trilhos**. Açailândia, Oct. 22, 2024. Available at:**https://justicanostrilhos.org/piquia-da-conquista-entrega-de-chaves-marca-vitoria-historica-contra-a-poluicao-industrial/**. Accessed March 21, 2025.

ipality of Açailândia and the state of Maranhão to deliver five public facilities to the Piquiá da Conquista neighborhood: a Primary Health Unit (UBS, the acronym in Portuguese), a public square, a covered sports court, a municipal market, and a school covering daycare through high school. This agreement was signed under the supervision of the Maranhão Public Prosecutor's Office and was later tendered through the State Government Secretariat (SEGOV/MA), currently in its final stages of completion.[128]

These negotiations ultimately resulted in the resettlement project for Piquiá da Conquista, which was overseen by the ACMP through a self-management model[129]. It is also worth noting that the basic urban and housing design was developed with the assistance of an independent technical advisory group (Usina CTAH) and submitted to the Federal Savings Bank (CEF) in December 2013. The project was later selected to receive funding from the "Minha Casa Minha Vida" program on December 31, 2015, under the approval of the Ministry of Cities.

However, despite the regularity of the preparatory work, Justiça nos Trilhos documented that construction on the resettlement only began in November 2018 and faced numerous challenges before being completed: a budget shortfall caused by outdated budget approval dates (April 2017); the delayed release of funds to start construction (November 2018); federal government spending restrictions (2019); a 124-day work stoppage due to the Covid-19 pandemic (2020); and another suspension in October 2020 due to lack of funding.

Meanwhile, the social mobilization led by the residents of Piquiá de Baixo gained international recognition. Justiça nos Trilhos reports that the situation in Piquiá de Baixo was cited in the report *Empresas y Derechos Humanos: Reforzar las normas y garantizar reparación* by the International Federation for Human Rights, published in March 2014.[130]

The case was also highlighted at the 28th Session of the United Nations Human Rights Council, through an initiative by VIVAT International, and was brought before the Inter-American Commission on Human Rights in Washington, D.C.

Additionally, in 2019, residents of Piquiá de Baixo participated in the Forum on Business and Human Rights in Geneva. That same year, in December, Baskut Tuncak, the UN Special Rapporteur on the "Implications for Human Rights of the Environmentally Sound Management and Disposal of Hazardous Substances and Wastes," visited the Piquiá de Baixo community[131] to personally assess the case.

Finally, in September 2020, during the 45th Regular Session of the Human Rights Council (HRC) in Geneva, Switzerland, allegations of human rights violations in Brazil, including the situation in Piquiá de Baixo, were presented, according to Justiça nos Trilhos, by Mr. Marcos Orellana, the United Nations Special Rapporteur on the "Implications for Human Rights of the Environmentally Sound Management and Disposal of Hazardous Substances and Wastes."

128 Ibid.

129 Ibid.

130 Ibid.

131 Ibid.

This presentation in Geneva was covered by the Brazilian media between late 2020 and early 2021, which helped advance negotiations with the CEF[132]. As a result, the project transitioned from a self-management to a co-management model, with a company contracted to carry out a global construction contract and provide independent oversight. In addition, an extra financial contribution was secured, later assumed by Vale S.A.

The construction was completed in 2024, with the handover of houses to the original residents of Piquiá de Baixo taking place on October 25, 2024[133], during an event held in Piquiá da Conquista. The ceremony was attended by representatives from the Maranhão state government, the Ministry of Cities, the municipality of Açailândia, the Maranhão Public Prosecutor's Office (MPMA), and, most importantly, the residents themselves, the true protagonists of this struggle.

This event represented a milestone in more than 20 years of struggle by the Piquiá de Baixo community, even though some issues still need to be resolved, such as improving drainage in Parque Novo Horizonte and undertaking the environmental restoration of Piquiá de Baixo. Nevertheless, despite the remaining challenges, the completion of the construction and the delivery of new homes to families who had endured pollution for so long embodied the realization of a collective hope that the residents of Piquiá de Baixo were finally able to achieve.

Final considerations

The case of Piquiá de Baixo underscores the complex relationship between economic activity, environmental degradation, and social rights. In this context, the MPMA played a crucial role in defending the environment and seeking reparations for the affected community.

Throughout this case, the MPMA acted on multiple fronts, pursuing extrajudicial solutions and serving as a mediator between the community, the companies, and public authorities to negotiate agreements. The CAAs were essential tools in this process, setting out commitments and deadlines for the implementation of mitigation and compensation measures.

In addition, the MPMA closely monitored the resettlement process of the Piquiá de Baixo community, from the earliest discussions to the handover of the new homes. Oversight of the quality of the housing, the infrastructure provided in the new neighborhood, and adherence to established deadlines were essential to ensuring a dignified resettlement that truly met the needs of the population.

Recognizing that it was possible to achieve such a complex right, built on a foundation of collective struggle and strengthened by the decisive action of the MPMA, also represents the fulfillment of justice and the construction of a pathway for restoring a community affected by environmental degradation, while safeguarding fundamental rights.

132 Ibid.

133 Ibid.

Access to adequate housing and a balanced environment are rights as essential as the rights to life and health, all guaranteed by the 1988 Federal Constitution. Ensuring an adequate minimum standard of existence is intrinsically tied to the coexistence of these rights.

The long struggle of the Piquiá de Baixo community, combined with the work of the Public Prosecutor's Office and other institutions, shows that realizing complex rights, such as the right to adequate housing and a balanced environment, fundamentally depends on social mobilization and the presence of mechanisms for participation and oversight.

Finally, the case of Piquiá de Baixo reminds us that the pursuit of social and environmental justice is an ongoing process that demands the engagement of all sectors of society. The experience of this community demonstrates that unity and collective organization have the power to transform realities and build a fairer, more sustainable future.

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BURNING PRACTICES AND THE NEW NATIONAL POLICY ON INTEGRATED FIRE MANAGEMENT

BY MARIA DE JESUS RODRIGUES ARAUJO HEILMANN[134]

Federal Law Nº 14,944/24, which establishes the National Policy on Integrated Fire Management (PNMIF)[135], originated from discussions on Bill Nº 1,818 of 2022 (Federal Senate) and Bill Nº 11,276 of 2018 (Chamber of Deputies). Its main objective is to regulate Article 40 of Law Nº 12,651/12and to introduce into national legislation a set of measures to combat forest fires, which have become a major concern due to their impacts on quality of life, the environment, and the global climate.

According to the Explanatory Memorandum (EM Nº 00047/2018 MMA)[136] from the Ministry of the Environment, then led by Minister Edson Gonçalves Duarte (2018-2019), in a message forwarding the bill to then-President Michel Temer, the primary goal of the PNMIF was to promote interinstitutional coordination across three dimensions of integrated fire management; reduce the incidence and damage of forest fires nationwide; recognize the ecological role of fire within ecosystems; and respect traditional knowledge and practices associated with fire use. [137]

According to the Ministry of the Environment (MMA)[138], using data from 2017 collected by the National Institute for Space Research (INPE), "INPE's monitoring system detected more than 106,000 heat spots between September 1 and 27 alone, the highest number recorded since 1998, the year INPE began monitoring

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134 State Prosecutor of final level (criminal area) at the Public Prosecutor's Office of the State of Maranhão, currently serving as an Auxiliary Prosecutor at the Higher School of the Public Prosecutor's Office. Holds a Ph.D. in Law and Political Science (with a focus on Administrative and Environmental Law) from the Faculty of Law of the University of Barcelona (Spain), revalidated at the Federal University of Minas Gerais (Brazil). Master's degree in Legal and Political Sciences from the Faculty of Law of the University of Lisbon (Portugal), revalidated at the Federal University of Pernambuco (Brazil). Specialist in Law, State, and Society (Federal University of Santa Catarina, 1999). Professor at the Federal University of Maranhão (UFMA), teaching courses in Administrative Law; Environmental Law and Social Responsibility; and Foreign Trade Law at the São Luís campus. Member of the Human Rights and Biodiversity Studies Research Group (GEDH-BIO) at UFMA. Email: **mjheilmann@mpma.mp.br**.

135 According to its summary, Law N° 14,944/2024 introduces amendments to Laws N° 7,735 of February 22, 1989 (which governs IBAMA), N° 12,651 of May 25, 2012 (the Forest Code), and N° 9, 605 of February 12, 1998 (the Environmental Crimes Law).

136 BRAZIL. Federal Chamber of Deputies. Draft Bill: Establishes the National Policy on Integrated Fire Management/Explanatory Memorandum N° 00047/2018 MMA. 2018. Available at: **https://www.camara.leg.br/proposicoesWeb/prop_mostrarintegra?codteor=1703491&filename=Tramitacao-PL%2011276/2018**. Accessed on March 3, 2025.

137 "The PNMIF aims to promote interinstitutional coordination for integrated fire management, including actions for the gradual replacement of fire use in rural areas, the appropriate use of prescribed and controlled burns, and the prevention and combat of forest fires, with the goal of reducing the incidence and damage of forest fires in the country and restoring the ecological and cultural role of fire. (Draft Bill, ibid.)

138 Explanatory Memorandum N° 00047/2018 MMA.

heat spots in the country. The previous monthly record was 94,000 heat spots, registered in September 2007."[139]

Therefore, it is clear that this is both an environmental and social issue, which had been growing and worsening since 2007, with serious consequences. For this reason, specific legislation was necessary to guide the planning, implementation, and nationwide control of burning practices. In this context, the MMA stressed the importance of "not only strengthening and preparing local, regional, and national institutions, but also establishing specific regulations to ensure the conditions for decision-making and for implementing integrated fire management actions, based on cooperation and coordination among the federal government, states, the Federal District, municipalities, civil society organizations, and private entities."[140]

During the Senate's consideration of the PNMIF Draft Bill (Bill Nº 1,818 of 2022), the Committee on the Environment (CMA), in its Opinion (SF) Nº 3 of 2023, emphasized the complexity of the issue of burning practices, noting that these are global events that demand the implementation of a national policy focused on both preventive and reactive measures, as highlighted *in litteris*: "The control of forest fires requires the adoption of preventive and reactive measures to minimize potential damage to human lives, fauna, flora, ecosystems, private property, among others. **The issue of fires, which in 2020 severely impacted the Pantanal biome, is not exclusive to Brazil, and even in developed and well-structured regions such as California, Portugal, and Australia, fire has periodically caused disastrous impacts on the environment, human life, and people's property**" (emphasis added by author).[141] The Opinion further states that, in the CMA's view, the bill "can contribute to Brazil's development in combating forest fires, as well as mitigating the impacts of environmental disasters resulting from these events." [142]

In summary, Law Nº 14,944/2024, enacted based on the full text of Draft Bill Nº 1,818 of 2022, sets forth the objectives and guidelines of the National Policy on Integrated Fire Management (PNMIF), its guiding principles, and other technical definitions. It establishes a national coordination body, creates management tools for fire handling, and upholds respect for traditional fire use by regulating its proper application. Finally, among its technical definitions, the law includes the concept of *integrated fire management* (Article 2, XI), defined as: "A planning and management model that incorporates ecological, cultural, socioeconomic, and technical aspects in the execution, integration, monitoring, evaluation, and adaptation of actions related to the use of prescribed and controlled burns, as well as the prevention and combat of forest fires, with the aim of reducing emissions of particulate matter and greenhouse gases, conserving

139 Ibid.

140 Ibid.

141 BRAZIL. Federal Senate. Committee on the Environment (CMA). Opinion (SF) N° 03, 2023. p. 05. Available as PDF at: **https://legis.senado.leg.br/sdleg-getter/documento?dm=9357217&disposition=inline**. Accessed on March 3, 2025.

142 Ibid, p. 06.

biodiversity, and reducing the severity of forest fires, while respecting traditional and adaptive fire practices."[143]

Burning practices and their relationship with climate change

Burning practices and forest fires across various regions of Brazil have, over recent decades, caused serious environmental problems with significant economic and social impacts. Climate change and land-use change have both contributed to these harmful effects on human health and to broader threats to the planet's sustainability.

In this study, we use the term *burning practices* (*queimadas*, in Portuguese) in a broad sense, meaning "the action of fire on grassland or forested areas, whether caused by natural events or by humans, either accidentally or intentionally" [144], a definition similar to that of forest fires. It is worth recalling that in 1988, the National Environmental Council (CONAMA) issued Resolution Nº 11, which was only published on August 11, 1989, to regulate *management burning* within Protected Areas. [145]

Article 3 of the Resolution provides: "The use of fire as an element of ecological management in grasslands, savannas, and other types of savanna ecosystems adapted to periodic fires must be preceded by environmental impact studies, indicating the necessary precautions, and carried out in a way that ensures the burning remains under control." [146] It is also worth noting that the new Brazilian law (Nº 14,944/24) chose to adopt the term *forest fire* (*incêndio florestal*, in Portuguese; Article 2, I), defining it as "any uncontrolled and unplanned fire affecting forests and other forms of vegetation, whether native or planted, in rural areas, which, regardless of the source of ignition, requires a response."[147]

It is also worth noting that since the Earth Summit (Rio-92), the term *forest fire* has been used, as adopted by Agenda 21, to refer to "uncontrolled fire in forests or any other type of vegetation."[148] Thus, whether described as a forest fire or as a

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143 BRAZIL. Law N° 14,944 of July 31, 2024. Establishes the National Policy on Integrated Fire Management and amends Laws N° 7,735 of February 22, 1989, N° 12,651 of May 25, 2012 (Forest Code), and N° 9,605 of February 12, 1998 (Environmental Crimes Law). Available at: **https://www.planalto.gov.br/ccivil_03/_ato2023-2026/2024/lei/L14944.htm**.

144 KRIEGER, M.G. et al. **Dicionário de Direito Ambiental: terminologia das leis do meio ambiente**. Rio de Janeiro: Lexikon. 2008. p . 268.

145 BRAZIL. National Environmental Council (CONAMA). Resolution N° 11. Available as PDF at: **https://conama.mma.gov.br/?option=com_sisconama&task=arquivo.download&id=75**. Accessed on March 4, 2025.

146 Ibid.

147 BRAZIL. Federal Law N° 14,944 of July 31, 2024, which establishes the National Policy on Integrated Fire Management and amends Laws N° 7,735 of February 22, 1989; N° 12,651 of May 25, 2012 (Forest Code); and N° 9,605 of February 12, 1998 (Environmental Crimes Law). Available at: **https://www.planalto.gov.br/ccivil_03/_ato2023-2026/2024/lei/L14944.htm**. Accessed on March 4, 2025.

148 KRIEGER, M.G. et al. **Dicionário de Direito Ambiental: terminologia das leis do meio ambiente**.

burning practice, the issue has received significant attention as one of the problems being intensified by global climate change.

According to a 2021 report published by the United Nations Environment Programme (UNEP) in partnership with GRID-Arendal[149], titled *Spreading like Wildfire: The Rising Threat of Extraordinary Landscape Fires*, scientific research has shown that climate change and land-use change are worsening forest fires[150].

The findings showed that fires have caused serious health and environmental problems, as well as disrupting the lives and livelihoods of communities severely affected by these events. One example highlighted in the report is Portugal, where in 2017 two major fires resulted in extensive material losses and tragic loss of life. On June 17, 66 people (31 women and 35 men) died while attempting to evacuate the village of Pedrógão Grande, in the Leiria district of central Portugal. On October 15, new fires broke out in the central and northern regions, burning several hectares of land across numerous villages and causing 51 additional deaths (17 women and 34 men). There were also 138 deaths reported due to smoke inhalation during the October 2017 wildfires.[151]

These two events, attributed to climatic factors, were linked to an exceptionally dry winter and spring that year, with virtually no rainfall during the period of the first fire. In the second case, conditions were worsened by Tropical Storm Ophelia, which approached the Portuguese coast bringing hot, dry air from North Africa, fueling fires that burned vast areas. Eight separate fires, each exceeding 10,000 hectares, destroyed more than 200,000 hectares in less than 24 hours, a historic event for the European continent.

Another major damaging event occurred in Brazil in 2020, in the Pantanal region of Mato Grosso[152], partly due to the severe drought of 2019, which increased vegetation flammability and was compounded by the absence of a contingency plan. This led to multiple fires that "consumed almost one-third of the biome – approximately four million hectares (Figure 4.3; Libonati et al. 2020a)." The report also notes: "Large areas of Indigenous lands and converted lands were extensively burned, devastating the habitat of many threatened species. Protected areas, such as the Encontro das Águas State Park, which has the world's high-

Rio de Janeiro: Lexikon. 2008. p. 164.

149 GRID-Arendal (Global Resource Information Database) was established in 1989 by the Norwegian Ministry of the Environment to support environmentally sustainable development, in collaboration with the United Nations Environment Programme (UNEP) and other partners. It is headquartered in Arendal, Norway. See: Grid-Arendal, a UNEP partner. Available at: **https://www.grida.no/about**. Accessed on March 4, 2025.

150 UNEP. United Nations Environment Programme. (2022). **Spreading like Wildfire: The Rising Threat of Extraordinary Landscape Fires. A UNEP Rapid Response Assessment**. Nairobi. Available at: **https://www.unep.org/pt-br/resources/relatorios/fogo-sem-controle-crescente-ameaca-de-incendios-atipicos-em-ambientes**. Accessed on March 4, 2025.

151 Ibid, p. 56.

152 This area encompasses the midwestern region of Brazil and extends into parts of Bolivia and Paraguay. The Pantanal is an important biome, considered the largest tropical wetland in the world, covering approximately 15 million hectares. It holds the highest concentration of wildlife in South America and serves as a critical migratory route for various species of terrestrial and aquatic birds. Ibid., p. 72.

est density of big cats, were completely burned (Libonati et al. 2020b). It will take several months to assess the full extent of plant and animal losses in the area, but there are already signs that the impact will be extensive and long-lasting, raising concerns that this biodiversity hotspot may not fully recover from these extreme fires (Mega 2020)."[153]

In addition to these burning events, other forest fires were analyzed in the report Spreading like Wildfire; however, they will not be detailed in this article in order to keep its scope concise. The report underscores the urgent need to mitigate risks and to develop forest fire management strategies globally, tailored to the specific conditions of each region where these fires occur.

It is also worth noting that in 2024, there were significant records of forest fire outbreaks in Brazil, according to satellite data from INPE's *Queimadas* Program. As shown in the graphs below, the regions most affected were the Legal Amazon and the Central-West, which encompass the Amazon, Pantanal, and Cerrado biomes:

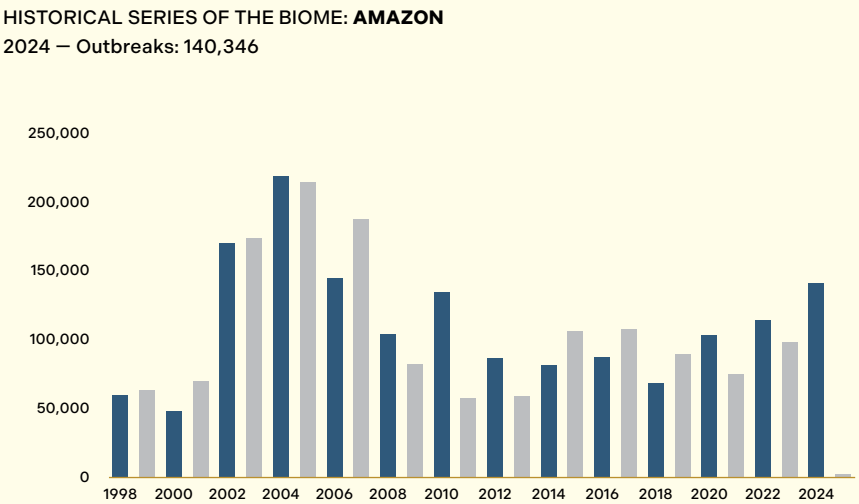


Figure 1: Historical series of total active fire outbreaks detected by satellite in the Amazon. Source: INPE. *Queimadas* Program. Monitoring of Active Fire Hotspots by Biome.

153 Ibid, p. 72.

HISTORICAL SERIES OF THE REGION: **LEGAL AMAZON**
2024 — Outbreaks: 192,700

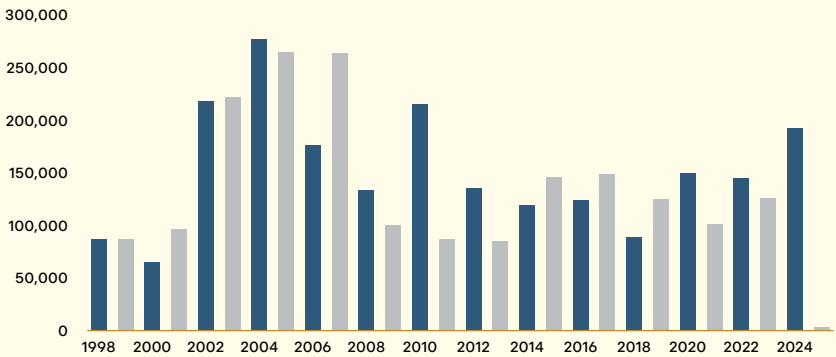


Figure 2: Historical series of total active fire outbreaks detected by satellite, from 1998 to 03/May. Source: INPE. *Queimadas* Program. Monitoring of Active Fire Hotspots by Biome.

HISTORICAL SERIES OF THE STATE: **PARÁ**
2024 — Outbreaks: 56,070

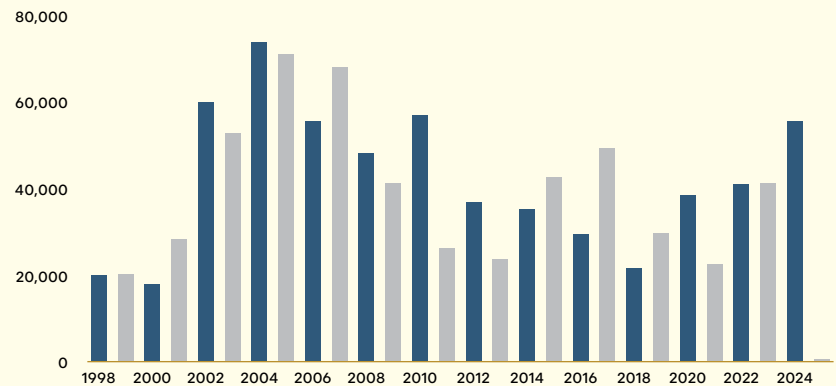


Figure 3: Historical series of total active fire outbreaks detected by satellite, from 1998 to 03/May. Source: INPE. *Queimadas* Program. Monitoring of Active Fire Hotspots by Biome.

HISTORICAL SERIES OF THE STATE: **MARANHÃO**
2024 — Outbreaks: 22,879

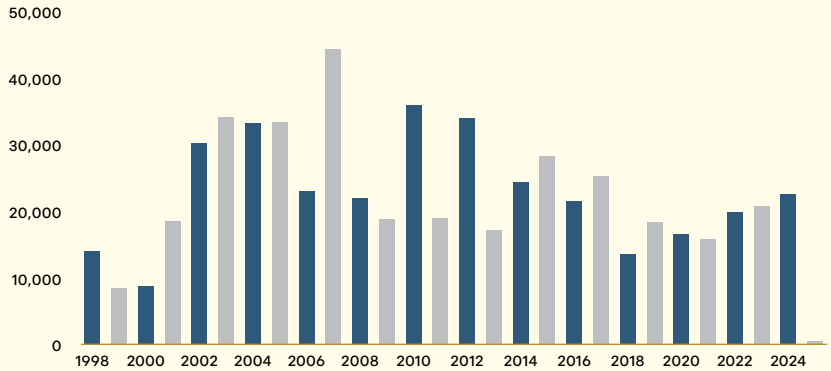


Figure 4: Historical series of total active fire outbreaks detected by satellite, from 1998 to 05/May. Source: INPE. *Queimadas* Program. Monitoring of Active Fire Hotspots by Biome.

Within the Legal Amazon region, the state of Pará recorded the highest number of forest fires (56,070), followed by Amazonas (25,499), Maranhão (22,879), Tocantins (17,251), Rondônia (10,692), Acre (8,658), Roraima (5,358), and Amapá (2,014). It is important to note that Maranhão and Tocantins encompass other biomes, so these figures do not exclusively reflect data from the Amazon biome.

HISTORICAL SERIES OF THE BIOME: **PANTANAL**
2024 — Outbreaks: 14,498

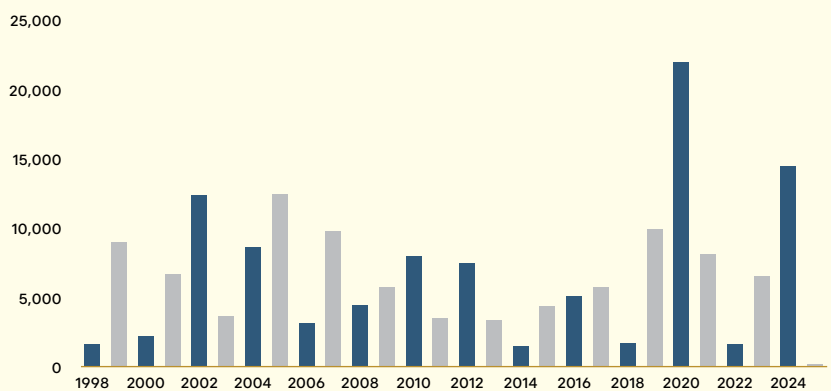


Figure 4: Historical series of total active fire outbreaks detected by satellite, from 1998 to 03/May Source: INPE. *Queimadas* Program. Monitoring of Active Fire Hotspots by Biome.

HISTORICAL SERIES OF THE REGION: **MIDWEST**
2024 — Outbreaks: 70,303

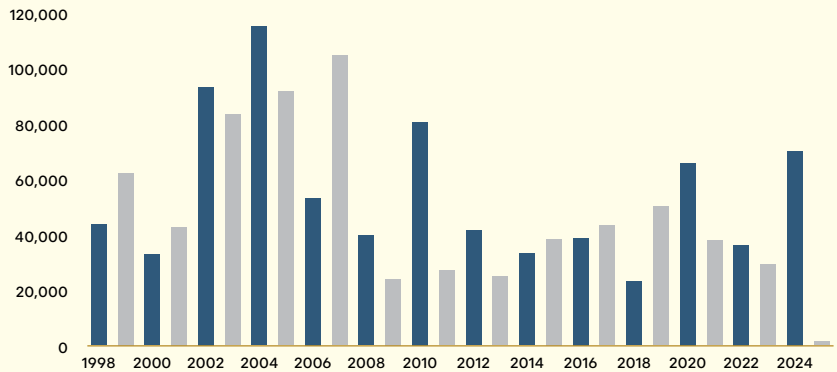


Figure 6: Historical series of total active fire outbreaks detected by satellite, from 1998 to 03/May. Source: INPE. *Queimadas* Program. Monitoring of Active Fire Hotspots by Biome.

Lastly, it is important to highlight data for Brazil, broken down by major biomes, indicating that the highest number of forest fires occurred in the Amazon (140,346), followed by the Cerrado (81,468), the Atlantic Forest (21,328), the Caatinga (20,235), the Pantanal (14,498), and the Pampa (424), totaling 278,299 forest fire outbreaks in 2024.

HISTORICAL SERIES OF THE COUNTRY: **BRAZIL**
2024 — Outbreaks: 278,299

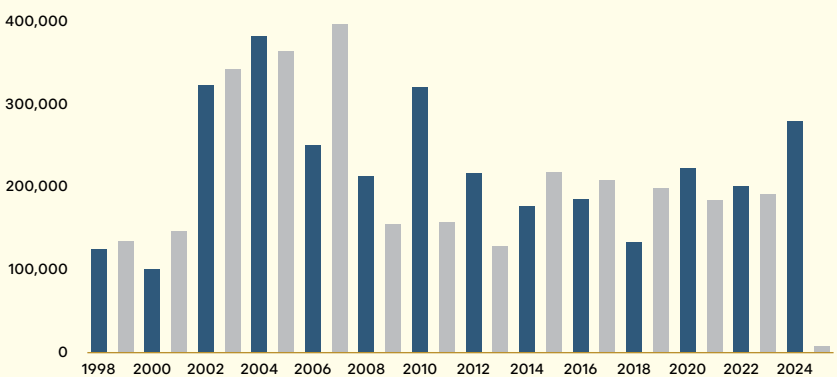


Figure 7: Historical series of total active fire outbreaks detected by satellite, from 1998 to 03/May. Source: INPE. *Queimadas* Program. Monitoring of Active Fire Hotspots by Biome.

Brief analysis of the change in the pattern of forest fires and ways for management to act

One relevant aspect highlighted in the Spreading like Wildfire: The Rising Threat of Extraordinary Fires report relates to the factors that influence forest fire outcomes and the corresponding management actions. According to research by the Global Resource Information Database (GRID/Arendal) included in the report's analysis, the factors influencing a fire are biological, meteorological, physical, and social. Based on an understanding of how a fire develops, it has been observed that climate change has been contributing to more frequent forest fire outbreaks, compounded by the impacts of demographic shifts, as follows: "A forest fire **results from a complex interaction of biological, meteorological, physical, and social factors that influence its likelihood, behavior, duration, extent, and outcome (i.e., severity or impact)**. Changes in many of these factors are increasing the global risk of forest fires (for example, climate change is increasing the frequency and severity of weather conditions favorable to forest fire outbreaks, and demographic changes in high-risk regions are increasing their potential impacts)"[154] (emphasis added).

As alternatives for the management or technical handling of fires, governments should develop a set of actions, with support from environmental protection agencies and the general public. The main measures include[155]:

- restricting activities that could trigger accidental fires;
- managing vegetation and plant debris (the fuel for forest fires) to reduce fire risk before a wildfire occurs;
- managing forest fires through firefighting and control efforts once they break out;
- relocating threatened populations and assets during a wildfire;
- implementing long-term, risk-sensitive land-use planning that takes multiple hazards into account.

In short, the coordinated management actions that can be adopted to mitigate the risk and impact of forest fires involve three scientifically recognized management models: fuel management, fire management, and the relocation of affected communities. Nevertheless, these measures cannot fully eliminate all risks, as "management options at critical moments **such as fuel management (reducing combustible materials before a forest fire occurs), fire management (fighting the fire after it has started), or relocating people threatened during a forest fire (for example, evacuation)** can help mitigate some of the economic, environmental, or social impacts of forest fires, but it is impossible to eliminate all risks for every fire. As a result, communities often need to learn to live with the residual risk of forest fires." [156]

154 Ibid, p. 08.

155 Ibid, pp. 08-10.

156 Ibid, pp. 08-10.

Some conclusions were identified in the United Nations/GRID-Arendal report Spreading like Wildfire: The Rising Threat of Extraordinary Fires, based on scientific evidence showing that:

- around the world, fire regimes (the characteristic patterns of fire over time and space) are changing due to climate change, land-use change, and population shifts;
- changes in land use and population can both increase and decrease the risk of forest fires;
- climate change across different regions has led to numerous environmental transformations that can heighten the frequency and severity of dangerous fire-weather conditions including increased drought, higher air temperatures, low relative humidity, dry lightning, and strong winds, resulting in hotter, drier, and longer fire seasons;
- the growing frequency and severity of these hazardous conditions has been drying and igniting vegetation that would not normally burn, for example in tropical rainforests, ice sheets formed over years in extremely cold regions with greenhouse gas retention (permafrost), or wetlands.

In another respect, several recommendations[157] were set out in the aforementioned UNEP-GRID report, which deserve to be highlighted given their relevance and alignment with the objectives of Brazilian Law 14,944/2024:

- **Recognize and address the impact of climate change on the prevalence and behavior of forest fires**

  According to the Intergovernmental Panel on Climate Change (IPCC), its report already indicated that weather patterns conducive to forest fires, hot, dry, and windy conditions are becoming more frequent in some regions of the world, with a tendency to persist and intensify due to higher levels of global warming.

- **Improve understanding of forest fire behavior across different ecosystems and under a changing climate**

  Further research on the impacts of climate change will help produce more reliable data on how to manage wildfires in different countries and regions. This includes working on forest fuel management, in other words, addressing the factors that trigger more severe ignition, to establish effective fire prevention protocols and reduce gaps in wildfire preparedness and response.

  Moreover, it is important to understand how existing forest fire management practices might encourage or inhibit harmful wildfires, and how they could contribute to developing new standards for decision-making and management systems.

157 Ibid, p. 12.

Data collection and analysis are valuable tools for monitoring changes in fire activity, evaluating ecosystem responses to shifting fire regimes, and improving climate models.

- **Promote an integrated approach to fire management**

The rise in forest fires calls for new policies and incentives that foster integrated fire management strategies.

- **Support and incorporate Indigenous, traditional, and contemporary fire management practices into government policies, programs, and practices**

Recognizing the valuable role that Indigenous and traditional knowledge can play in shaping land management practices to prevent and mitigate forest fires, supporting these traditional practices can be an effective way to reduce wildfire risk.

- **Strengthen international and regional cooperation on forest fires**

It is well established that the greatest potential for improving national policies lies in continuous international interaction and exchange. In this regard, adopting environmental protection agreements and treaties, engaging in joint problem-solving, and sharing experiences in forest fire management and research among countries are consistent and effective strategies.

- **Rebalance investments from reactive suppression toward proactive mitigation and fire management**

Investing in activities that reduce forest fire risk offers a strong economic and social return, as they help minimize the potential impacts of wildfires. Over the long term, prevention and precautionary measures are more cost-effective than depending on reactive firefighting and post-disaster recovery efforts.

- **Invest in building the capacity of communities and local authorities**

In areas prone to forest fires, it is essential to train municipal public agents in comprehensive fire management. Communities themselves should also be involved, so they can understand and accept the residual wildfire risk. This will strengthen coordination among key stakeholders and build their capacity to prepare for, respond to, and recover from forest fires. Key stakeholders should be engaged throughout the entire fire management process.

- **Improve firefighter safety**

Fire management agencies should take steps to ensure safe working practices for firefighting personnel in every aspect of wildfire response. This includes understanding and mitigating smoke inhalation risks, minimizing the potential for life-threatening entrapments (e.g., burns), and ensuring firefighters have access to adequate hydration, nutrition, rest, and recovery between shifts.

- **Promote data collection and information on the gender dimension of forest fires**

As a final recommendation, the report noted that collecting sex-disaggregated data can help identify patterns for future analysis, including nation-

al, regional, and global trends. According to researchers, understanding gendered perceptions of risk can support policymakers in developing more effective and robust approaches to forest fire management and enhance the safety of all members of society. Strengthening gender awareness also helps make firefighting a more inclusive profession. Female firefighters face numerous challenges, from gender discrimination and sexual harassment to poorly designed protective equipment and clothing that place them at higher risk of injury.

Considerations prior to the enactment and application of Law 14,944/2024

Before the bill that established the National Integrated Fire Management Policy (PNMIF), the Federal Court of Accounts (TCU)[158] had already highlighted the urgent need to monitor compliance with its own recommendations, set forth in Ruling Nº 2,516/2011. In that first ruling, under Process TC 028.459/2010-5, the 8th Secretariat for External Control (Secex/8) of the TCU prepared an Audit Survey Report (RLA) to gather a broad diagnostic assessment from the agencies responsible for coordinating, planning, and overseeing forest fire activities. This included collecting information and data on the actions of federal agencies and other entities involved in the prevention and combat of forest fires and burnings.

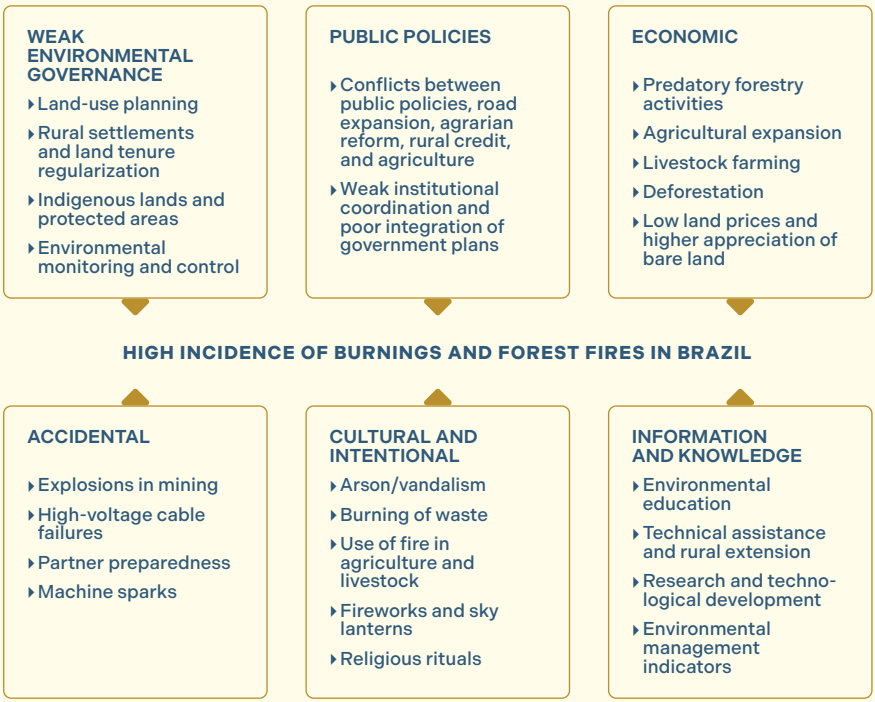
The purpose of the audit was to conduct a comprehensive assessment of the agencies involved and identify the "main causes and vulnerabilities contributing to the high incidence of burnings and forest fires in Brazil, as well as to assess the level of integration among the public agencies involved."[159]

The report, prepared at the initiative of Reporting Minister Aroldo Cedraz, ultimately identified six categories of causes explaining the high occurrence of burnings and forest fires in Brazil, as illustrated in the figure below[160]:

158 Through Ruling N° 1,382 of 2013, issued in plenary session, in Case N° TC 038.494/2012-4.

159 TCU. Audit Survey Report. Interested party: Federal Court of Accounts (Tribunal de Contas da União). Case N° TC 028.459/2010-5. GROUP I – CLASS V – Plenary. Reporting Minister Aroldo Cedraz. p. 06.

160 Ibid, p. 17.



Source: TCU. Case N° TC 028.459/2010-5. Nature: Audit Survey Report. Interested party: Federal Court of Accounts (*Tribunal de Contas da União*). p. 17.

- **Economic:** Causes linked to predatory logging, livestock farming, agricultural expansion, deforestation, and the higher market value of cleared land compared to native forest;

- **Public Policies:** Conflicts among public policies (such as road expansion, agrarian reform, rural credit, and incentives for agriculture and livestock), along with weak institutional coordination within the federal government and poor integration of government plans;

- **Weak Environmental Governance:** Deficiencies in land-use planning; rural settlements and land tenure regularization; management of Indigenous lands and protected areas; insufficient environmental monitoring and control; lack of data on burned areas; weaknesses in environmental licensing and enforcement;

- **Information and Knowledge:** Absence of environmental management indicators such as air and soil quality, burned area measurements, biodiversity indexes, and regional carrying capacity; insufficient research and technological development on alternatives to fire use; lack of producer access to technical assistance, rural extension services, and environmental education;

- **Cultural and Intentional:** Use of candles in religious rituals; fireworks and sky lanterns; use of fire in agriculture and livestock; burning of wast e and crop residues; arson, pyromania, and vandalism;

- **Accidental:** Explosions in mining operations; high-voltage cable failures; firebreak preparation; sparks from machinery.

In his opinion, Minister Aroldo Cedraz explained the motivation for the SECEX/8th Audit, which aimed to collect information and data from public agencies and other entities involved in environmental preservation. According to his reasoning: "regarding how the institutional framework established to address this issue functions, the preventive measures adopted, the existing logistics for combating burnings and forest fires, and the level of coordination among the actors involved, including at the state and municipal levels, thereby enabling improvements in government actions targeting this sector."[161]

In addition, the widespread incidence of burnings and forest fires throughout the country was explained, in the words of Minister Cedraz, by "the constant news reports indicating that burnings and forest fires were spreading across the entire national territory, particularly in the North, Northeast, and Center-West regions, and affecting protected areas with great intensity. To demonstrate the scale of the problem, I presented data from the National Institute for Space Research (INPE), which showed that in June 2010 alone, the number of fire outbreaks in the states of Maranhão, Tocantins, and Piauí increased by 402%, 952%, and 1009%, respectively, compared to the same period in 2009."[162]

In the end, several recommendations were directed to federal agencies through TCU Ruling Nº 2,516/2011, as mentioned above. However, they were not implemented satisfactorily, either due to their complexity or because "the issue of preventing and combating burnings in the country has still not achieved a priority status on the Federal Government's agenda, unlike the efforts to combat deforestation."[163]

Lastly, an important contribution was highlighted in the Audit Survey Report (RLA) regarding the implementation of the first phase of the National Integrated Plan for the Management of Forest Fires and Burnings, which took place in the state of Roraima over a 60-day period, from February 8 to April 8, 2010, and was later extended to the states of Amapá, Pará, Maranhão, Mato Grosso, Mato Grosso do Sul, and Bahia. According to data gathered by the TCU's Secex/8 technical commission from the Ministry of the Environment (MMA), a group of public agencies participated in this effort, coordinated by the Multi-Agency Integrated Operational Coordination Center (CIMAN), "with the purpose of planning and executing joint monitoring, enforcement, prevention, and firefighting actions to address forest fires caused by burnings that occur every year during Roraima's low-rainfall season (MMA, 2010). CIMAN adopted the American Incident Command System

161 Ibid. p. 01.

162 TCU. Case N° TC 028.459/2010-5. Opinion of Reporting Minister Aroldo Cedraz. p. 02.

163 TCU. Case N° TC 038.494/2012-4. Opinion of Reporting Minister Aroldo Cedraz. p. 01.

(ICS) model, which standardizes procedures and defines the organizational structure of the agencies involved, facilitating unified command and optimizing the use of available resources."[164]

New features and instruments introduced by Law 14,944/2024

From its inception, Law 14,944/2024 was designed to establish coordinated planning to promote interinstitutional cooperation (Art. 6), define principles and guidelines (Arts. 3 and 4), outline the objectives of the PNMIF (Art. 5), and create specific operational instruments (Art. 8), detailed in sections (Arts. 9 to 29). It also sets limits on the use of fire (Arts. 30 to 39); establishes rules for integrated fire management in protected areas through integrated fire management plans for Indigenous lands and territories occupied by traditional peoples and communities (Arts. 40 to 43); encourages the gradual replacement of fire use by identifying and promoting alternative technologies (Art. 44); and regulates accountability for unauthorized fire use (Art. 45).

The bill emerged from concerns raised by heat-spot data provided by INPE, which showed "a high incidence of heat spots between August and October, with September standing out, particularly in the Amazon and Cerrado biomes (DUARTE, 2018)."[165]

In line with the principle of cooperative federalism, the law establishes that the National Integrated Fire Management Policy will be implemented by the federal government, states, Federal District, municipalities, civil society, and private entities, operating cooperatively and in coordination with one another (Art. 1, sole paragraph). Within this framework, the state and Federal District interinstitutional bodies for integrated fire management are to coordinate with the National Integrated Fire Management Committee and should preferably include the participation of state and district environmental agencies, civil protection and defense bodies, and state and district wildfire response institutions, including the Military Fire Departments of the states and the Federal District.

Another relevant aspect of the text concerns the list of general and specific environmental principles established in the law under Article 3[166], which include

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164 The actions were carried out through the Multi-Agency Integrated Operational Coordination Center (CIMAN), composed of IBAMA, ICMBio, the State Civil Defense Coordination of Roraima (CEDEC/RR), the Roraima State Military Fire Department (CBM/RR), the Federal District Military Fire Department (CBM/DF), the Independent Environmental Policing Company (CIPA) of the Roraima State Military Police (PM/RR), and the State Foundation for the Environment, Science and Technology of Roraima (FEMACT). TCU. Audit Survey Report. Op. cit., p. 09.

165 BRAZIL. Federal Chamber of Deputies. Bill: Establishes the National Integrated Fire Management Policy/EM N° 00047/2018 MMA. 2018. Available at: **https://www.camara.leg.br/proposicoesWeb/prop_mostrarintegra?codteor=1703491&filename=Tramitacao-PL%2011276/2018**. Accessed on March 3, 2025.

166 "Art. 3. The principles of the National Integrated Fire Management Policy are: the shared responsibility of the Union, the states, the Federal District, and the municipalities, in coordination with organized civil society and representatives of productive sectors, in creating policies, programs, and plans to promote integrated fire management;

the social function of property and the promotion of sustainable use of natural resources, among others.

As for its guidelines, Law 14,944/2024, in Article 4, states that the National Integrated Fire Management Policy shall be governed by integration and coordination among public and private institutions, as well as public and private policies related to fire management; participatory and shared management among federal entities, society, Indigenous peoples, and traditional communities; implementation of actions, techniques, and fire management methods; prioritization of investments in studies, research, and sustainable projects for both fire management and the recovery of areas affected or destroyed by burnings; techniques for the gradual replacement of fire use in agrosilvopastoral practices; assessment of the climate change scenario; valuing traditional and adaptive fire use practices and the conservation of natural resources by Indigenous peoples; and environmental education.[167]

It can be seen that the objectives of the PNMIF are closely intertwined with the responsibilities of interinstitutional governance for integrated fire management as set out in Article 4.[168] Regarding the instruments established by the law (Art. 8)

II– the social function of property;
III– the promotion of the sustainability of natural resources;
IV– the protection of biodiversity and ecosystem services;
V– the promotion of an integrated, intercultural, and adaptive approach to fire use;
VI– the recognition of fire as an integral part of ecological, economic, and sociocultural systems;
VII– the replacement of fire use in environments sensitive to such action, whenever possible;
VIII–the replacement of fire use in agrosilvopastoral practices with sustainable practices, whenever possible;
IX– the reduction of threats to life, human health, and property;
X– the recognition and respect for sociocultural autonomy, the valuing of agency, and the protection and strengthening of the knowledge, practices, wisdom, and systems of sacred, traditional, and adaptive fire use, as well as the forms of natural resource conservation by Indigenous peoples, quilombola communities, and other traditional communities;
XI– the promotion of actions to address climate change."

167 Art. 4 (excerpt)
I– the integration and coordination of public and private institutions, civil society, and public and private policies in promoting integrated fire management;
II– participatory and shared management among federal entities, organized civil society, Indigenous peoples, quilombola communities, other traditional communities, and the private sector;
III– the implementation of actions, methods, and techniques for integrated fire management;
IV– the prioritization of investments in studies, research, and scientific and technological projects aimed at integrated fire management, the recovery of areas affected by forest fires, and sustainable techniques for the gradual replacement of fire use in agrosilvopastoral practices, considering ecological and socioeconomic relevance;
V– the assessment of climate change scenarios and the potential increase in the risk and severity of forest fires;
VI– the valuing of traditional and adaptive fire-use practices and natural resource conservation by Indigenous peoples, quilombola communities, and other traditional communities, in order to promote dialogue and exchange among traditional, scientific, and technical knowledge;
VII — the implementation of awareness-raising and environmental education actions on the environmental and public health impacts resulting from the indiscriminate use of fire.
(BRAZIL. Law 14,944/2024)

168 See also Articles 5 and 6 of Law 14,944/2024.

to implement the guidelines and other objectives of the PNMIF, these include: integrated fire management plans; forest brigade programs; the National Fire Information System (Sisfogo); financial instruments; incident management tools; the Federal CIMAN; and environmental education.

A brief analysis of these instruments is presented below:

Integrated Fire Management Plans (PMIFs)

These plans will include information on areas with recurring forest fires, types of vegetation, and priority areas for conservation, along with other details to be defined by the National Integrated Fire Management Committee (COMIF). The plans may cover the following activities: a) prescribed burning[169]; b) controlled burning[170]; c) traditional and adaptive fire use[171]; in addition to operational plans for the prevention and suppression of forest fires.

The National Integrated Fire Management Committee recently issued COMIF Resolution Nº 2[172], dated March 21, 2025, which regulates Integrated Fire Management Plans and establishes measures for the prevention and preparedness of forest fires on rural properties.

Article 5 of this resolution states that Integrated Fire Management Plans (PMIFs) may include one or more Operational Plans for the Prevention and Combat of Forest Fires (PPCIF), developed for each fire season to cover the entire area of jurisdiction or territorial subcategories with specific legal characteristics within the PMIF's scope. Such plans are mandatory for protected areas deemed to be at risk.[173]

Forest Brigade Programs

These refer to a set of actions aimed at training, equipping, and organizing human resources to implement integrated fire management plans, operational plans for the prevention and combat of forest fires, and to carry out operational activities for environmental protection (Art. 11 of Law 14,944/2024). Forest brigades operating in protected areas, including Indigenous territories, traditional and quilombola communities, and conservation areas, must coordinate with the Brazilian

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169 Prescribed burning refers to the planned, monitored, and controlled use of fire, carried out for conservation, research, or management purposes in designated areas and under specific conditions, with predefined objectives in an integrated fire management plan (Art. 2, III of Law 14,944/2024).

170 Controlled burning is the planned, monitored, and controlled use of fire for agrosilvopastoral purposes in designated areas and under specific conditions (Art. 2, II of Law 14,944/2024).

171 Traditional and adaptive fire use is an ancestral practice adapted to current territorial, environmental, and climatic conditions, employed by Indigenous peoples, quilombola communities, and other traditional communities in their activities of physical and cultural reproduction, related to agriculture, hunting, extractivism, culture, and worldview, as part of their territorial and environmental management (Art. 2, IV of Law 14,944/2024).

172 Ministry of the Environment and Climate Change/National Integrated Fire Management Committee. COMIF Resolution N° 2, dated March 21, 2025. **Official Gazette of the Union (DOU)**, published on 03/24/2025, Edition 56, Section 1, p. 71. Available at: **https://www.in.gov.br/en/web/dou/-/resolucao-comif-n-2-de-21-de-marco-de-2025-619293012**. Accessed on April 16, 2025.

173 It should be noted that the PPCIF is annual and must be included in PMIFs under public sector responsibility.

Institute of the Environment and Renewable Natural Resources (Ibama), state environmental secretariats, or other competent state agencies in these functions.

The law allows for the creation of voluntary or private forest brigades to operate in areas other than those intended for the protection of federally managed protected areas, Indigenous lands, quilombola territories, and other areas under federal oversight. It is worth highlighting that Article 7 of COMIF Resolution Nº 2, dated March 21, 2025[174], provides for the support of voluntary brigades in protected areas considered at risk, which experience recurring fires within their boundaries and immediate surroundings. The involvement of these voluntary brigades should encompass prevention, preparedness, and firefighting actions, with engagement from local communities.

It is necessary for these groups to register with the Military Fire Department of the federative unit in which they will operate, subject to the department's approval. This agency will be responsible for establishing regulations governing the accreditation and activities of voluntary or private forest brigades, as well as safety requirements such as standardized uniforms and identification of vehicles used in their operations (Art. 11, §§ 2 and 3). In addition to this registration with the Fire Department, the law provides for the creation of a National Forest Brigade Registry to be implemented by the Ministry of the Environment and Climate Change (MMA); however, as of the conclusion of this study, there is no information indicating that the registry has been established.

National Fire Information System (Sisfogo)

Sisfogo was established by Law 14,944/2024 and is integrated into the National Environmental Information System (Sinima). It was created as a tool to manage information on forest fires, controlled burning, and prescribed burning across the country (Arts. 15 and 16).

Sisfogo will be updated with information provided by agencies or entities of the federal government, states, Federal District, and municipalities involved in integrated fire management, and it will allow public consultation of its data. The system must include records of controlled burning permits issued by state and district environmental agencies, which may also use Sisfogo to issue and manage these permits and to record forest fire occurrences. The law requires states and the Federal District that maintain their own systems for registering controlled burning permits and forest fire incidents to integrate their databases with Sisfogo (Arts. 17 and 18).

Among the information and data managed by the National Fire Information System are: cataloging records of forest fire occurrences; records of authorizations and implementation of controlled and prescribed burning; forest fire alerts; information and data on the human and material resources of agencies and entities involved in forest fire prevention and response; spatial data on burnings or

174 Art. 7 The Integrated Fire Management Plan is mandatory for protected areas considered at risk, which experience recurring fires within their boundaries and immediate surroundings and which hire forest brigade members or receive support from voluntary brigades. It must include prevention, preparedness, and firefighting actions with the involvement of surrounding communities. (COMIF Resolution N° 2, dated March 21, 2025).

fires, including coordinates recorded as points, lines, or polygons; and other data and information defined by the National Integrated Fire Management Committee.

IBAMA, through its specialized centers, will provide the means to implement Sisfogo, offering a standardized, computerized, and secure system to enable information exchange among the institutions that make up the National Fire Information System.

Although Sisfogo has not yet been implemented, according to a statement from the Ministry of the Environment and Climate Change, COMIF, through its collegiate body, approved in a deliberative meeting on April 9, 2025, the creation of two working groups, one to regulate mandatory preventive measures for rural landowners, and another to develop a draft resolution for structuring the National Fire Information System. This system is considered an integrated platform for high-quality information, aimed at strengthening the management and control of fire-related data throughout the national territory.[175]

Financial instruments

These are intended to support the implementation of the PNMIF, with the goal of restoring areas affected by fires. Funding sources include budget allocations from the federal government, states, the Federal District, and municipalities earmarked for integrated fire management; public funds for reimbursable and non-reimbursable financing; payments for environmental services and for reducing emissions from deforestation and forest degradation, conserving forest carbon stocks, sustainable forest management, and enhancing forest carbon stocks (REDD+); fiscal and tax incentives, such as exemptions, differentiated rates, and compensations to be established by specific legislation; credit lines and targeted financing from public and private financial institutions; and resources from international cooperation.

The shortage of financial resources makes it difficult to efficiently implement programs and integrated fire management plans. As a result, the PNMIF relies on adequate funding to promote incentives and investments in actions, studies, research, and scientific and technological projects (Arts. 21 and 22).

In addition, to support the federative entities, the Union will transfer resources it collects or controls for integrated fire management, distributing them preferentially to those that:

- have an interinstitutional integrated fire management body;
- implement a forest brigade program;
- have a multi-agency integrated operational coordination center; and
- use Sisfogo, or their own system integrated with it, for issuing and managing controlled burning permits and recording forest fire occurrences (Art. 23).

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175 Cf. Ministry of the Environment and Climate Change (MMAMC). FIRE COMBAT: National Integrated Fire Management Committee creates Technical Chamber for Interfederative Coordination. The collegiate body also discussed a draft resolution for authorizing controlled burning and approved the creation of two working groups. Published on April 11, 2025. Available at: **https://www.gov.br/mma/pt-br/noticias/comite-nacional-do-manejo-integrado-do-fogo-cria-camara-tecnica-para-articulacao-interfederativa**. Accessed on April 19, 2025.

Incident Management Tools (IM)

An innovation introduced among the PNMIF instruments is the use of incident management tools. Specialized literature defines these as "the process that manages the entire life cycle of incidents, with the primary objective of restoring IT services to users as quickly as possible,"[176] or describes them as "Incident Management is responsible for addressing exceptions that cause failures in the normal operation of services, or any unplanned interruptions reported by IT teams or IT service users."[177]

In this way, the incident management tool will be used for multi-agency operational response applicable to all types of incidents and events that require an integrated organizational structure to support the response needs of fire management plans, and it must be standardized at the national level (Art. 24).

The principles governing the use of this tool include: adoption of common terminology; span of control; modular organization; interoperability and integrated communications; an event action plan; functional organizational structure; coordinated and unified action; standardized facilities; and integrated resource management (Art. 25).

Federal Multi-Agency Integrated Operational Coordination Center (CIMAN Federal)

CIMAN Federal was restructured under Law 14,944/2024 with an operational role, linked to the National Integrated Fire Management Committee, and is responsible for monitoring and coordinating forest fire control and response actions. It will be coordinated by IBAMA, with its organization, composition, and functioning to be defined by an act of the federal Executive Branch.[178]

It is worth noting that before Law 14,944/2024 came into force, CIMAN had operated since 2010 in a non-institutionalized manner but in an "integrated and coordinated way, bringing together, in a situation room during the critical dry season, the federal institutions involved in monitoring and combating burnings and forest fires."[179] Only in 2016, with the issuance of Decree Nº 8,914 of November 24, 2016, was CIMAN formally established as a *consultative* and *deliberative* collegiate

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176 BAILÃO, Fabiana S. **Implementação do Processo de Gerenciamento de Incidentes: um Estudo de Caso em um departamento de TI de uma Universidade Pública** (Dissertation). Volta Redonda. 2018. p. 34. Available at: **https://app.uff.br/riuff/bitstream/handle/1/9444/Dissertação%C3%A3o%20Fabiana%20da%20Silva%20Bail%C3%A3o.pdf?sequence=1&isAllowed=y**. Accessed on May 3, 2025.

177 FREITAS, M. A. dos Santos. **Fundamentos do gerenciamento de serviços de TI** – 2ed. Rio de Janeiro: Brasport, 2010 *apud* BAILÃO, Fabiana S. **Implementação do Processo de Gerenciamento de Incidentes:** (...). 2018. p. 34.

178 Currently, Decree N° 12,173 of September 10, 2024, has restructured the National Integrated Fire Management Committee as a consultative and deliberative body of the National Integrated Fire Management Policy, as well as the Federal Multi-Agency Integrated Operational Coordination Center, in accordance with Articles 6, 26, and 27 of Law N° 14,944 of July 31, 2024. Its role is to monitor and coordinate forest fire control and response actions, among other responsibilities detailed in Chapter III, Article 9 of the aforementioned decree.

179 CIMAN-INPE. 2023. Available at: **https://terrabrasilis.dpi.inpe.br/queimadas/portal/ciman/index.html**. Accessed on May 3, 2025.

body, with the following responsibilities: monitoring the status of burnings and forest fires in the country; promoting, within a single situation room and under unified command, the sharing of information on ongoing operations; seeking joint solutions for forest fire control; and making information available to the public through CIMAN Virtual, an online platform intended to ensure transparency and public access to ongoing actions.

Thus, its range of activities was expanded under Article 27 of Law 14,944/2024, without prejudice to other duties assigned by the National Integrated Fire Management Committee, to include:

- monitoring the status of forest fires throughout the national territory;
- promoting, within a single situation room and under unified command, the sharing of information on ongoing operations;
- integrating the efforts of institutions involved in monitoring and combating forest fires nationwide;
- coordinating and planning forest fire response actions that exceed the capacity of state institutions, in order to promote the creation of mutual support protocols and technical and financial cooperation among participating institutions;
- ensuring transparency and public access to information on major forest fire response operations across the country;
- presenting an annual report on the forest fire situation in the national territory, with recommendations for improving prevention and response efforts;
- Finally, the law emphasized environmental education as a key instrument of the PNMIF, in line with Article 225, § 1, VI of the 1988 Federal Constitution, which provides for promoting environmental education at all levels of education and raising public awareness for environmental preservation.

Accordingly, environmental education has been established as an essential and permanent component of the National Integrated Fire Management Policy and must be integrated, both formally and informally, across all levels and types of governance and management instruments associated with this policy (Art. 29). Its goal is to encourage the dissemination of knowledge about the environmental and public health impacts of the indiscriminate use of fire, while also educating and informing the population about the risks of causing forest fires and their consequences, including the need to learn to live with the residual risk of wildfires.

Given the extensive scope of topics addressed by Law 14,944/2024, Chapters VI (On the Use of Fire), VII (On Integrated Fire Management in Protected Areas), VIII (On the Gradual Replacement of Fire Use in Rural Areas), IX (On Accountability for Irregular Fire Use), and X (Final Provisions) will not be analyzed in this study.

The role of the Public Prosecutor's Office in ensuring the effectiveness of Law 14,944 under the PNMIF framework

The role of the Public Prosecutor's Office in the context of the new National Integrated Fire Management Policy gained momentum after a landmark meeting held on September 11, 2024, coordinated by Counselor Ivana Cei, who chairs the Environmental Commission (CMA) of the National Council of the Public Prosecutor's Office (CNMP). The meeting brought together 53 members from across the country, representing various state Public Prosecutor's Offices, the Federal Public Prosecutor's Office (MPF), and the Labor Public Prosecutor's Office, to discuss strategic approaches to be adopted, with input from specialists from different regions of the country.[180]

At the meeting, ongoing institutional initiatives were discussed, notably:

- strategic actions and experiences in tackling burnings and forest fires across Brazil;
- the coordination of preventive and repressive measures to combat the fires that have devastated forests in various regions of the country;
- the activities of the Climate Change and Biome Protection Working Groups;
- gathering information from different units and branches of the Public Prosecutor's Office that already have initiatives in place or are at more advanced stages of implementation, with the goal of launching a unified national response;
- an overview of judicial and extrajudicial proceedings filed by the Federal Public Prosecutor's Office in 2023 and 2024 related to climate change, forest fires, and burnings, as well as state-level cases concerning prevention and accountability for forest fires;
- the "Pantanal Alerta" program of the Public Prosecutor's Office of Mato Grosso do Sul (MPMS);
- the efforts of environmental prosecutors from the Public Prosecutor's Office of São Paulo (MPSP) to address forest fires and burnings;
- the initiatives of the Public Prosecutor's Office of Tocantins (MPTO) in fire prevention and response;
- and, among other strategies, the announcement of the launch of the National Strategic Action Plan of the Public Prosecutor's Offices to Combat Forest Fires and Their Impacts, to be rolled out in September 2024.

180 CNMP. Environmental Commission of the CNMP promotes national strategic action to discuss initiatives against forest fires in Brazil. Published on September 12, 2024. Available at: **https://www.cnmp.mp.br/portal/todas-as-noticias/17862-comissao-de-meio-ambiente-do-cnmp-promove-acao-nacional-estrategica-para-discutir-iniciativas-contra-incendios-florestais-no-brasil**. Accessed on May 3, 2025.

Indeed, the National Strategic Action Plan of the Public Prosecutor's Offices to Combat Forest Fires – and their impacts – was widely publicized and published in September 2024. It proposes the adoption of a "coordinated approach for the entire Brazilian Public Prosecutor's Office and its branches in combating forest fires (...) which affect multiple biomes in Brazil and have serious impacts on public health and the national economy."[181]

The plan incorporates successful prevention and firefighting experiences from various Public Prosecutor's Offices, such as initiatives implemented by state Public Prosecutor's Offices, the Federal Public Prosecutor's Office (MPF), the Labor Public Prosecutor's Office, the Public Prosecutor's Office of the Federal District (MPDFT), the Public Prosecutor's Office of Mato Grosso do Sul (MPMS), the Public Prosecutor's Office of São Paulo (MPSP), and the Public Prosecutor's Office of Tocantins (MPTO). The experiences, practices, and strategies of these bodies are integrated into this national plan[182], along with others that may emerge.

The strategic plan also offers a diagnostic overview of the four main causes of forest fires in Brazil, identifying: human activity; climate change; lack of monitoring and enforcement; and the fire triangle[183].

The plan sets out six objectives[184]:

- To prevent, combat, and mitigate forest fires effectively throughout the national territory, with sustainable medium- and long-term strategies.
- To ensure the preservation of biomes, fauna, flora, soil, and water resources, and compliance with environmental laws, promoting accountability for violators and the restoration of degraded areas.
- To protect all forms of life and public health, by mitigating the impacts of forest fires and burnings on air quality and reducing health risks for affected populations.
- To strengthen integrated action within the Public Prosecutor's Office and encourage interinstitutional coordination.

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181 CNMP. CEI, Ivana L. Franco. **Plano Estratégico Nacional de Atuação do Ministério Público no Combate aos Incêndios Florestais e seus Impactos**. Brasília. 2024. p. 04.

182 Ibid.

183 **Human activity:** Burning for clearing agricultural land, illegal deforestation, releasing sky lanterns, vandalism, and cultural practices involving fire. Climate change: Prolonged drought increases temperatures, wind speed, and decreases air humidity, creating favorable conditions for the spread and loss of control of fire. **Lack of monitoring and enforcement:** Insufficient infrastructure and capacity to monitor high-risk areas effectively and in real time. **Fire triangle:** The occurrence of fires depends on a combination of three factors: a) favorable climate; b) available fuel; c) an ignition source. This reality must be considered by those involved in prevention, early detection, and rapid response actions. Ibid., p. 06.

184 Ibid. p. 07.

- To ensure the protection of fundamental rights across all prosecutorial activities.

- To promote sustainability in all forms of action.

It is also worth noting that the document **recommends initiating structural administrative procedures** to monitor policies related to fires in urban, rural, and protected areas, as well as targeted enforcement procedures, among other lines of action.[185]

Lastly, strategic lines of action were defined for the Public Prosecutor's Offices, as follows:

- Identifying high-risk areas and actively monitoring them through the Rural Environmental Registry (CAR);

- Developing training and awareness programs to encourage the creation of community brigades and to promote a standardized program for training and accrediting forest brigades, aligned with the work of state military fire departments, the Ministry of the Environment, and state and municipal environmental agencies, in order to integrate resources and enhance the effectiveness of actions;

- Preventive agreements and recovery projects: encouraging environmental enforcement agencies to develop action plans for repairing and mitigating damage caused by deforestation and burnings in protected areas, with clear targets and monitoring indicators, and to enter into Conduct Adjustment Agreements (CAAs);

- National and State Fire Committees: monitoring the implementation of the National Integrated Fire Management Committee created by Law 14,944/2024;

- Protected areas: entering into Conduct Adjustment Agreements (CAAs), if necessary, with protected area managers to ensure prevention, early detection, rapid response, and firefighting for burnings and forest fires;

- Municipalities: entering into Conduct Adjustment Agreements (CAAs), if necessary, with municipal public managers in line with the guidelines established in the Strategic Action Plan[186];

- Planning for the health and safety of public workers involved in firefighting and for victim assistance networks: urging public entities to develop specific contingency plans for workers directly engaged in firefighting efforts

185 Ibid. p. 07.

186 See p. 13 of the Strategic Plan.

(brigade members, civil defense personnel, environmental enforcement agents, and others exposed to these high-risk environments).

In the area of **enforcement actions**, the Strategic Action Plan recommends: investigation and prosecution through a coordinated investigative approach to fires, encouraging the creation of a joint task force composed of the Public Prosecutor's Office, Federal Police, IBAMA, Environmental Military Police, Civil Police, Technical-Scientific Police, Fire Department, and environmental forensic experts to investigate and hold accountable those responsible for intentional fires; the use of technology for monitoring and firefighting, including promoting the *Radar Ambiental* app provided by the National Ombudsperson's Office of the CNMP and other ombudspersons' offices within the various branches of the Public Prosecutor's Office; and recovery and mitigation measures to restore degraded areas and monitor air quality, including promoting and overseeing health assistance programs and establishing medical programs for communities most affected by air pollution, with a focus on respiratory and cardiovascular diseases.

Regarding **partnerships and institutional integration**, the plan recommends establishing partnerships with research institutes (such as INPE and universities), IBAMA, the Chico Mendes Institute for Biodiversity Conservation (ICMBio), federal and state police forces, and other agencies involved in combating burnings, to promote joint operations. It also calls for coordination among state, federal, and labor Public Prosecutor's Offices, as well as emergency actions to address forest fire outbreaks.

Other proposals suggested in the strategic action plan include promoting the creation of technical standards that define measures and establish minimum criteria for preventing and addressing forest fires in protected areas; monitoring the implementation of financial instruments under the National Integrated Fire Management Policy[187]; advocating for the implementation of the Mutual Aid Plan (PAM) as a key pillar of forest fire response; and fostering a culture of prevention to support the dissemination and application of Law Nº 14,944/2024 through awareness campaigns and by engaging rural landowners and rural unions to adopt preventive practices.

In the state of Maranhão, the Public Prosecutor's Office supported the creation of the Strategic Committee for the Prevention and Combat of Illegal Deforestation, Illegal Forest Exploitation, and Forest Fires (CEDIF-MA) in 2023. That same year, State Decree Nº 38,427 of July 20, 2023, was issued, prohibiting the use of fire for soil management and the clearing of agricultural areas throughout the state from July 11 to November 30, 2023, except as allowed under federal law. In 2024, a new state decree was issued prohibiting the use of fire for land clearing and management from August 1 to November 30, 2024.

Other initiatives supported by the Public Prosecutor's Office include monitoring burnings through the *Maranhão Sem Queimadas* (Maranhão Without Burnings) program, coordinated by the State Secretariat for the Environment and Natural Resources (SEMA) in partnership with the Maranhão State Military Fire

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Department (CBMMA). Its actions, including brigade training, equipment donations, educational campaigns, and capacity-building activities, are directed toward municipalities with the highest rates of burnings, with the program now in its sixth edition.

Final considerations

This article was prepared for the COPAÍBAS Program (FUNBIO)/Climate Dialogues, a partnership between the Higher School of the Public Prosecutor's Office of the State of Maranhão (ESMP/MA), the Operational Center for the Environment, Urbanism, and Cultural Heritage (CAO-UMA), and the Brazilian Biodiversity Fund (FUNBIO), with the aim of fostering new perspectives on issues related to climate change and the prevention of burnings and forest fires.

The issue of uncontrolled fire is at the core of the scientific debate on how climate change, combined with improper land use, has worsened forest fires in recent decades. Fire outbreaks have devastated vast areas of rural properties, destroying biomes and species of fauna and flora, and even claiming human lives. These events vary from one territory to another, depending on the climatic conditions of each region, whether within Brazil or across other continents.

In this context, data were collected from the report *Spreading like Wildfire: The Rising Threat of Extraordinary Fires in Wildland Areas* by UNEP/GRID-Arendal (2021), which were analyzed in item 2 of this study. Additionally, satellite data from INPE's Queimadas Program were used to highlight the most devastated regions of Brazil, namely the Midwest and the Legal Amazon, including a survey of the number of fire outbreaks that affected the Pantanal-Cerrado and Amazon biomes in 2024, the year Law Nº 14,944/2024 was enacted on July 31, establishing a new framework for environmental management under the National Integrated Fire Management Policy (PNMIF).

From the analysis of changes in forest fire patterns and management approaches, it was also possible to understand international standards regarding technical fire management alternatives, the conclusions drawn from the Spreading like Wildfire report, and the recommendations set out in that document to help guide national policies on integrated fire management.

On another front, the analysis of Law Nº 14,944/2024 was contextualized from its original proposal, noting that the explanatory memorandum from 2018 had already justified the need for more direct regulation of fire management practices, since, despite existing programs and plans implemented by federal agencies, these had not provided an effective response to combat fires. Accordingly, an analysis of the law's background was presented in item 4 of this study, highlighting relevant initiatives to diagnose the high incidence of burnings and forest fires in Brazil, for example, the Audit Survey Report prepared by the 8th External Control Secretariat (Secex/8) of the Federal Court of Accounts (TCU) under Case Nº TC 028.459/2010-5. Through Ruling Nº 2,516/2011, numerous recommendations were issued to federal agencies, which were later reviewed in 2013 with the issuance of a new Ruling Nº 1,382 under Case Nº TC 038.494/2012-4.

It is worth noting that this article examined key aspects of Law Nº 14,944/2024, without addressing all of its chapters. Essentially, it connected five structural pil-

lars of the law: its principles and guidelines, objectives, interinstitutional governance, and the instruments of the PNMIF.

Finally, the article explored the role of the Brazilian Public Prosecutor's Office in addressing the problem of burnings, coordinated by the Environmental Commission of the National Council of the Public Prosecutor's Office (CNMP), with the aim of ensuring integrated and collaborative action across three dimensions: strategic lines of action, enforcement measures, and partnerships and institutional integration. In addition, other proposals were highlighted in the National Strategic Action Plan of the Public Prosecutor's Offices to Combat Forest Fires, published and publicized in September 2024.

Thus, the strategic action plan encompasses the six objectives highlighted in this article, while also drawing on the successful prevention and firefighting experiences of various State, Federal, and Labor Public Prosecutor's Offices, in support of human health and environmental sustainability, and aligned with the Paris Agreement's goals to reduce global warming and address the prevalence and behavior of forest fires across Brazilian territory. This, in turn, will help lessen the social, economic, and environmental impacts of forest fires.

WATER BODIES OF THE MUNICIPALITIES OF PAÇO DO LUMIAR, RAPOSA, AND SÃO JOSÉ DE RIBAMAR: DEGRADATION AND DETERMINING FACTORS

BY FRANCISCO TEOMÁRIO SEREJO SILVA[188]

The state of Maranhão is located in Brazil's Northeast region. According to data from the Brazilian Institute of Geography and Statistics (IBGE), it spans a territorial area of 329,651.495 square kilometers, is divided into 217 municipalities, and has an estimated population of 7,010,960 (2024). Its urbanized area totals 1,544.71 km² (2019), and its Human Development Index (HDI) was 0.676 in 2021.

Based on IBGE estimates (2024), Paço do Lumiar has a population of 152,306, Raposa 32,054, and São José de Ribamar 257,414. Their respective urbanized areas (2019 Census) are 38.76 km², 8.94 km², and 54.12 km². As for access to drinking water, the 2017 Census recorded data only for São José de Ribamar, indicating a coverage rate of 60.978%. There is no current data available on sanitation services.

This article aims to examine the condition of the hydrological system in the municipalities of Paço do Lumiar, Raposa, and São José de Ribamar, and to identify the key factors contributing to its degradation. It is an exploratory and descriptive study based on a literature review and document analysis. The article begins by outlining the territorial configuration of São Luís Island, emphasizing the hydrographic network of the region, particularly within the municipalities studied, and drawing attention to the risks and consequences that may arise from the neglect or misuse of water resources. The first section of the opening chapter describes the state of collapse of the municipalities' water systems. The second section identifies a range of contributing factors behind the deterioration of the region's water bodies. The third section discusses the role of the State Public Prosecutor's Office in the environmental sphere, focusing on its efforts to prevent and address environmental degradation and to ensure the implementation of restoration or remediation measures.

In conclusion, the article presents key findings and proposes a set of measures deemed essential to ensure the preservation of environmental resources, particularly the region's water resources.

Hydrographic complex and the risks and consequences of lack of caution

São Luís Island, also known as Maranhão Island, is located in the central portion of the Maranhão Gulf, the largest indentation along the state's coastline, between its western and eastern shores. The island forms part of a complex estuarine

188 Public Prosecutor, head of the 1st Regional Environmental Prosecutor's Office of the State of Maranhão; holds a Master's degree in Law and the Affirmation of the Vulnerable; specialist in Tax Law and Procedure; currently pursuing a specialization in Environmental Law.

system composed of bays, estuaries, and several islands. It is made up of four municipalities: Paço do Lumiar, Raposa, São José de Ribamar, and São Luís. Covering an area of 969.832 km², the island had an estimated population of 1,442,927 in 2020, according to the Brazilian Institute of Geography and Statistics (IBGE), with a population density of 1,487.81 inhabitants per square kilometer and a GDP of R$ 36.96 billion.[189]

The city of São Luís, capital of the state of Maranhão, was founded on September 8, 1612, by the Frenchmen Daniel de La Touche and François de Rasilly. It was established on a promontory extending into the estuary formed by the Anil and Bacanga rivers.[190] On the opposite side of the island, the villages of São José de Ribamar and Paço do Lumiar were founded in 1627 and 1761, respectively. Historical accounts show that both settlements underwent periods of dissolution and reorganization before ultimately achieving political emancipation, São José de Ribamar in 1952 and Paço do Lumiar in 1959. The municipality of Raposa emerged as a settlement in the 1950s, but it only gained political autonomy in 1994.[191]

The municipalities in focus are each traversed by a network of rivers and streams. In Paço do Lumiar, the main waterways include the Paciência and Santo Antônio rivers, the latter also known by various names such as Antônio Esteves River, Mata River, Ubatuba River, São João River, Pindaí River, and Cururuca River, which flows into the Bay of Curupu. The city of Raposa contains several water bodies within its territory, including the Combique, Braço do Curupu, and Nunca Mais streams (igarapés), as well as the Paciência River. In São José de Ribamar, the hydrographic system includes the Paciência, Saramanta, Prata, Itapiracó, Santa Rosa, and Miritiua rivers, along with a wide network of streams, such as Combique, Iguaíba, Grande, Pindoba, Cristóvão, Cajueiro, Maiobão, Genipapeiro, Cohab, Cohatrac, Gangan, and Turu, among others, covering a total area of 145.7 km².[192]

It is evident that the combined territory of these three municipalities encompasses a substantial portion of the Maranhão Island watershed, which in itself highlights the strategic importance of this hydrographic complex.

Law Nº 9,433 of January 8, 1997[193], which established the National Water Resources Policy, does not provide a formal definition of a watershed. However, it is generally understood as a drainage area within a given territory, encompassing one or more **main rivers and their tributaries**. The waters within a watershed

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189 MARANHÃO INSTITUTE FOR SOCIOECONOMIC AND CARTOGRAPHIC STUDIES – IMESC. Encyclopedia of the Municipalities of Maranhão: Maranhão Island/Maranhão Institute for Socioeconomic and Cartographic Studies – IMESC. – São Luís: IMESC, 2021. 8 vols. (278 p. : ill.) ISBN 978-65-87226-26-2.

190 Idem.

191 Idem.

192 Monteiro, F. H. B., Santos Júnior, M. S., Gonçalves, P. P., Vieira, L. K. N., Silva Neto, M. C. da, Lindoso, T. C., Pinheiro, N. C. A. (2020). ANÁLISE DAS CAUSAS DA DESATIVAÇÃO DO SISTEMA CURURUCA DE CAPTAÇÃO SUPERFICIAL EM PAÇO DO LUMIAR, MARANHÃO. **Interfaces Científicas — Saúde E Ambiente**, 8(2), pp. 49–62. **https://doi.org/10.17564/2316-3798.2020v8n2p49-62**.

193 BRAZIL. Law N° 9,433 of January 8, 1997. Establishes the National Water Resources Policy. Available at: **https://www.planalto.gov.br/ccivil_03/leis/l9433.htm**.

flow in the same direction, following the natural contours of the land toward the area's lowest point.

In technical literature, a watershed is defined as "a topographically defined area drained by a watercourse or a connected system of watercourses, in which all outflow converges at a single exit point."[194] It is also considered a territorial unit for the management of water resources (Article 1, items V and VI, of Law Nº 9,433/97). Water use within a watershed is ideally prioritized to benefit the populations who live and work within its boundaries.[195]

Water is a natural resource essential to life on Earth. It is not subject to exclusive individual ownership, as it has a diffuse nature and is considered a public good for common use (Article 1, I, of Law Nº 9,433/1997). Among its defining characteristics is its limitation: it is finite and exhaustible. Given this paradox of being both vital and limited, there is a non-negotiable need for its management to be guided by strict standards and robust frameworks to ensure its effective protection and preservation. Water governance must be carried out in full compliance with the principle of participation, thereby strengthening the democratic process (Article 1, VI, of Law Nº 9,433/1997).

In discussing the water cycle, Altair Sales Barbosa[196] notes that water that once existed, or still exists, in certain regions of the planet may disappear due to natural causes or as a result of human activity. He stresses the importance of understanding what occurs "above our heads and beneath our feet." Above us lies the atmosphere, composed of several layers. Barbosa emphasizes the troposphere, the lowest atmospheric layer, which extends up to approximately 10 kilometers above the Earth's surface. He explains that various phenomena can alter air circulation within the troposphere, particularly changes in ocean currents, which in turn directly influence atmospheric currents. Ocean currents themselves may shift in direction and temperature due to natural events, such as the warming of ocean waters (El Niño) or their cooling (La Niña). Barbosa also highlights the significant impact of human actions, such as deforestation and expanding urbanization, which often involves paving large areas. This disrupts soil transpiration and water infiltration, giving rise to heat islands and low-pressure zones, with potentially unpredictable consequences for local and regional climates. Turning to what lies beneath our feet, Barbosa describes a complex structure composed of tectonic plates and the Earth's internal layers. Within these plates lies the Earth's mantle, which contains plumes and superplumes responsible for generating convection currents. These currents, whether warm or cold, rise toward the crust and alter ocean temperatures, thereby influencing the behavior and composition of marine currents.

To explain the reduction in flow, or even the disappearance, of watercourses in certain areas, Altair Sales Barbosa offers insights into the hydrosphere, which includes water vapor, groundwater, glacial ice, ocean water, and surface water

194 MACHADO, Paulo Affonso Leme. **Direito de acesso à água**. São Paulo: Malheiros, p. 18. 2018.

195 Idem.

196 BARBOSA, Altair Sales. **Ciclo da água. Dicionário de agroecologia e educação**. pp. 226-229. 2021.

confined to land channels. He explains that 97.2% of all water on Earth is found in the oceans, 2.15% is frozen in glaciers over continental landmasses, and only 0.83% is present in rivers, lakes, and underground aquifers. Barbosa cautions that river systems are dynamic and respond to both natural changes and human interference. He notes that urban paving reduces surface runoff; the removal of native vegetation significantly lowers groundwater levels, key to sustaining river flow year-round; and that climate change affects the overall availability of water. He emphasizes that groundwater represents the world's primary reservoir of fresh water, fed directly by precipitation that infiltrates the soil and fills voids in sediments and rock layers. He further explains that the longevity of rivers depends on groundwater from both the water table and deeper aquifers (such as artesian wells). In regions where rivers rely solely on the water table, deforestation can cause them to dry up entirely. Prolonged droughts can have the same effect. Ultimately, Barbosa concludes that the elimination of the water table leads to the disappearance of the river.

Planet Earth has been increasingly affected by climate change, largely driven by a range of human-induced factors. It is well established that the late 19th and early 20th centuries, marked by the rise of the industrial era, ushered in the most profound and transformative phase of human impact on the planet. Natural resources began to be exploited at an unprecedented pace and scale, as if they were limitless. The notion that the environment should be protected and preserved is relatively recent, gaining international momentum with the Stockholm Declaration.

This growing recognition of the need to safeguard environmental quality gave rise to a series of international and national regulations aimed at placing effective limits on economic and social development to ensure planetary sustainability. Yet, even the most robust legal frameworks remain aspirational if the rights they establish are not effectively implemented. In this regard, the absence, or severe deficiency, of public services and policies, particularly those related to environmental education, continues to hinder the practical application of legal mandates aimed at preserving natural resources in everyday life.

The health of the hydrological system in the municipalities of Paço do Lumiar, Raposa, and São José de Ribamar

Despite Brazil's extensive legal framework for environmental protection, widespread disregard and damage to natural resources continue to occur at various levels. This remains a concerning reality throughout the country. The state of Maranhão is no exception, with numerous instances of environmental degradation documented across its territory. This study, however, is limited to the municipalities of Paço do Lumiar, Raposa, and São José de Ribamar, focusing specifically on issues related to their hydrological systems.

The natural resources that make up our planet form a complex and interconnected system, whose balance depends on the harmony between its elements. This interdependence makes it essential that any use of these resources be guided by a strict commitment to their preservation, i.e., through rational use that prevents their depletion or the loss of their essential properties. Un-

fortunately, this principle is often overlooked, leading to significant and lasting damage to the planet.

Surface and groundwater bodies, in particular, have been severely impacted by human activity.[197] The improper use of water resources – including harmful interventions such as course diversion, landfilling, the discharge of untreated sewage, and the deforestation of riparian vegetation – undeniably contributes to environmental degradation and disrupts climate balance.

The water resources of the municipalities of Paço do Lumiar, Raposa, and São José de Ribamar are in urgent need of attention. Many rivers and streams (igarapés) are heavily silted; others are polluted; and the natural wealth they once sustained has largely disappeared. This undeniable reality calls for immediate action and concrete measures aimed at reversing the current trajectory, toward the restoration and long-term preservation of the region's hydrological systems. A notable example is the contamination of the Cururuca River, caused by the direct discharge of untreated sewage from a residential condominium. This led to a court ruling holding both the municipality and the sanitation service provider accountable for the environmental damage.[198]

In light of this situation, and understanding that environmental issues must be addressed as a priority by both the State (through its institutions and agencies) and the society it serves, the Public Prosecutor's Office of Maranhão, recognizing the region's environmental challenges and seeking to ensure a more consistent and specialized response, established the 10th Specialized Prosecutor's Office (1st Regional Environmental Prosecutor's Office) through Resolution Nº 134/2023-CPMP[199]. This office has jurisdiction over the judicial districts of Paço do Lumiar, Raposa, and São José de Ribamar.

Factors contributing to the degradation of water resources in the municipalities of Paço do Lumiar, Raposa, and São José de Ribamar

The region encompassing these three municipalities faces a range of environmental challenges, with the degradation of local water resources being particularly acute.[200] Based on over a year of experience leading the 10th Specialized Prosecutor's Office (1st Regional Environmental Prosecutor's Office), it is clear that this deterioration results from a combination of actions and omissions. Contributing factors include the absence of effective public policies, the failure of public authorities to exercise their regulatory and enforcement powers, a lack of collective

197 ROCHA, Manuela Costa da, et al. Saneamento e qualidade das águas na bacia do rio paciência, Ilha do Maranhão, Brasil. **GEOTemas**. Pau dos ferros, RN, Brasil, v. 11. pp. 01-25, 2021.

198 PJE Nº 0869796-23.2022.8.10.0001.

199 Resolution Nº 134/2023-CPMP established the 10th Specialized Prosecutor's Office (1st Regional Environmental Prosecutor's Office), with jurisdiction over the judicial districts of Paço do Lumiar, Raposa, and São José de Ribamar, which form part of the Ilha Judicial District.

200 MARANHÃO INSTITUTE FOR SOCIOECONOMIC AND CARTOGRAPHIC STUDIES – IMESC. Encyclopedia of the Municipalities of Maranhão: Maranhão Island/Maranhão Institute for Socioeconomic and Cartographic Studies – IMESC. – São Luís: IMESC, 2021. 8 vols. (278 p. : ill.) ISBN 978-65-87226-26-2.

awareness among residents regarding the environment as a fundamental right, and the irresponsible conduct of certain private developers.

Health is a fundamental social right (Article 7, caput, of the Federal Constitution), and it is the State's duty to ensure it through appropriate social and economic policies (Article 196, caput). Article 225 of the Constitution further affirms that an ecologically balanced environment is a right of all, a public good essential to a healthy quality of life, and a responsibility shared by the State and society. Yet despite these constitutional guarantees, environmental protection often remains more a legal ideal than a practical reality.

The populations of the municipalities examined in this study lack access to several basic and fundamental rights, many of which are directly tied to the imbalance of the region's water systems. Ultimately, water quality is shaped by both the natural conditions of a watershed and the extent of human intervention within it. [201]

When it comes to public sanitation policy, particularly the provision of drinking water and wastewater services, attention has been given, albeit insufficiently, only to urban areas. According to data from the service provider operating in the region, the municipalities of Paço do Lumiar and São José de Ribamar have approximately 60% coverage for potable water and just over 30% for sewage services[202]. In the municipality of Raposa, the situation is even more critical. Responsibility for these services lies with a local public authority – the Autonomous Water and Sewage Service (SAAE). However, this municipal agency suffers from a severe lack of infrastructure. As a result, the population has no access to a sewage network, and the provision of drinking water remains inadequate.

In the area of solid waste collection and management, another critical dimension of basic sanitation policy, significant inefficiencies persist. A particularly troubling issue is the widespread presence of informal dumping sites, commonly referred to as "mini-dumps" (*lixinhos*, in Portuguese) which stem both from a lack of environmental awareness among residents and from ineffective waste management by local authorities. Although a formal agreement exists for the disposal of waste at a sanitary landfill located within the São Luís metropolitan area, the collection and handling of solid waste still require major improvements. Key challenges include irregular service delivery, the absence of policies to include waste pickers in the management process, and a lack of relevant municipal regulations. Selective waste collection is not yet integrated into community practices. Most municipalities lack specific local legislation on the matter, and municipal administrations have failed to implement programs, projects, or awareness campaigns to promote it. In Paço do Lumiar and São José de Ribamar, a few voluntary drop-off points (eco-stations) for solid waste do exist, but they are limited in number, often poorly located, and underutilized, many residents are unaware they even exist. Additionally, there is no municipal legislation defining large generators of

201 WETTERS, M. L. de F. F., BONI, S. da S. N., PINHEIRO, N. C. A., & BONI, R. C. (2020). **Avaliação do abastecimento de água do Maranhão através do Sistema Nacional de Informações sobre Saneamento. Interfaces Científicas — Saúde E Ambiente**, 8(2), pp. 39–48. **https://doi.org/10.17564/2316-3798.2020v8n2p39-48**.

202 SIMP Nº 003443-506/2022.

solid waste. Although reverse logistics is regulated at the state level, it has yet to be implemented in these municipalities.

The vast majority of neighborhoods lack adequate drainage and stormwater management infrastructure. This recurring deficiency has prompted numerous formal complaints from residents of the three municipalities to the Environmental Prosecutor's Office overseeing the matter.[203]

These persistent shortcomings in basic sanitation policy, particularly the absence or inefficiency of stormwater systems, directly contribute to the ongoing degradation of the region's water resources.

Irregular land occupation is another significant factor contributing to the degradation of water resources in the region studied. Many population clusters have formed through unregulated settlements, often involving the extraction or alteration of natural resources without any adherence to environmental preservation or conservation standards. These settlements frequently arise along the banks of rivers, streams, and mangroves, leading to severe degradation through deforestation of riparian vegetation, landfilling of riverbeds, and the discharge of untreated sewage.

Throughout the region, it is common to find homes built on riverbanks or even within rivers, streams, and mangrove areas[204]. In many cases, this results from a lack of awareness about the environmental harm being caused and its long-term consequences, a clear indication of the absence of environmental education. In other cases, such actions are driven by the expectation of impunity and the pursuit of economic advantage. Residents of these settlements are often neglected by public authorities[205]. They are rarely provided with policies that ensure access to dignified housing in appropriate locations or with infrastructure and public services in the areas they occupy. As a result, they remain in conditions of vulnerability and risk. This is, undeniably, a structural and systemic issue in urban development, one that must be addressed through targeted actions and specific strategies within the context of urban planning and management.

At the same time, it is important to note that even when land use and occupation occur in accordance with legal regulations, the mere issuance of an environmental license by the competent authority does not, by itself, guarantee that water resources will be safeguarded against potential pollution. Ensuring such protection requires continuous, effective, and rigorous oversight by environmental agencies throughout the implementation of any given project.[206]

In recent years, there has been a clear trend toward the expansion of the real estate sector in the region[207], particularly through the development of large-

203 1st Regional Environmental Prosecutor's Office of the State of Maranhão.

204 ROCHA, Manuela Costa da, et al. Saneamento e qualidade das águas na bacia do rio paciência, Ilha do Maranhão, Brasil. **GEOTemas**. Pau dos ferros, RN, Brasil, v. 11. pp. 01-25, 2021.

205 SALGADO NETO, José Bello. **Riscos e políticas públicas do habitat nos manguezais em São Luís do Maranhão**. São Luís: Editora UEMA, 2015.

206 BIM, Eduardo Fortunato. **Licenciamento ambiental**. 6 ed. Belo Horizonte: Fórum, 2024.

207 Given the planned construction of a coastal highway connecting all the municipalities on the island, as announced by the State Government, and the high volume of real estate development pro-

scale residential projects such as subdivisions and horizontal and vertical condominiums. These developments generate a range of environmental impacts that are interrelated and cumulative. For example, deforestation associated with new construction alters natural drainage patterns, necessitating the collection and redirection of rainwater to nearby water bodies. They also require the collection, treatment, and discharge of wastewater, often into the same bodies of water.

As outlined in a technical report prepared by the Civil Engineering Team of the Public Prosecutor's Office of the State of Maranhão in Administrative Procedure Nº 227802024 (SIMP 003130-507-2024)[208], the ongoing urbanization of Brazilian cities has led to significant environmental and social consequences, including a decline in quality of life. These impacts include increased frequency and severity of flooding, reduced water quality, and a rise in solid waste entering local waterways.

While the environmental licensing process requires a series of documents and actions from developers, generally fulfilled to secure approval, the actual implementation of projects often fails to comply with the conditions that justified the license. As a result, harmful practices have been observed, including the removal of riparian vegetation, silting of rivers and streams, and the discharge of untreated sewage, primarily due to the region's insufficient and limited wastewater infrastructure.

These longstanding issues have persisted without the adoption of effective policy solutions, leading to a steady decline in water quality and the continued degradation of local water resources.

What is increasingly clear is the imminent risk of collapse of the hydrological systems in the municipalities under study, a crisis largely driven by the absence or inaction of public authorities. This absence is evident not only in the failure to provide essential services, programs, and strategic actions, but also in the lack of regulatory oversight and enforcement through the exercise of police power.

What explains the lack, or inefficiency, of municipal environmental oversight? The answer is simple: a lack of structure. This includes insufficient staffing, both in number and qualification, inadequate material resources, and, most critically, the absence of financial autonomy[209].

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posals submitted to municipal planning departments.

208 As cities urbanize, common impacts include: 1– increased peak runoff—up to 7x higher (Leopold, 1968)—due to surface impermeabilization and drainage infrastructure; 2– higher sediment loads from exposed soil and solid waste; 3– deterioration of surface and groundwater quality from runoff, solid waste, and illegal sewage connections; and 4– aquifer contamination.

209 The municipal environmental departments of Paço do Lumiar, Raposa, and São José de Ribamar suffer from significant structural deficiencies, both in staffing and material resources. It was only following action by the head of the 1st Regional Environmental Prosecutor's Office that the Municipal Environmental Council of Paço do Lumiar was reactivated and its Municipal Environmental Fund established. In the municipality of Raposa, the Prosecutor's Office also prompted action, leading to the ongoing process of formalizing the environmental department and initiating the creation of both the Municipal Environmental Council and the Environmental Fund. In all three municipalities, the equipment necessary for fulfilling institutional responsibilities is either lacking or severely limited.

The structural and financial deficiencies of municipal and even state environmental agencies are both stark and troubling. In response, the 1st Regional Environmental Prosecutor's Office has opened administrative proceedings to advocate for the proper structuring of municipal environmental departments. During meetings held to assess the capacity and functioning of these agencies, it became evident that they lack the equipment, personnel, and resources necessary to fulfill their mandates. In two of the three municipalities under the jurisdiction of the 1st Regional Environmental Prosecutor's Office, there was no Municipal Environmental Council or Environmental Fund in place. In the third, although both had been formally established, the council was inactive. This institutional fragility is a key factor behind the serious and ongoing failure to protect the region's water resources, and the environment as a whole.

Problem-solving approaches as a strategy to reverse the degradation of water resources in Paço do Lumiar, Raposa, and São José de Ribamar

While judicial action by the Public Prosecutor's Office plays a vital role in addressing the absence of public policies and enforcing fundamental social rights, it should be viewed as a last resort. Preferably, solutions should be pursued through consensual and collaborative means, involving all relevant and directly affected stakeholders.

This refers to the problem-solving principle guiding the work of the Public Prosecutor's Office[210], an approach that goes beyond merely obtaining outcomes, aiming instead for solutions that effectively fulfill the underlying objectives and generate meaningful impact.

In this context, the Prosecutor, whether acting as a Promotor or State Attorney, must adopt a participatory management process in resolving demands, fostering dialogue and collaboration among public agencies, private entities, and civil society. The exchange between public institutions and their engagement with civil society is essential for achieving transformative and inclusive results.

Given the Public Prosecutor's Office's traditionally litigation-based approach, the idea of a resolute, extrajudicial model of action may seem distant. However, it is both viable and capable of delivering highly effective outcomes. This approach has been increasingly supported by the National Council of the Public Prosecutor's Office (CNMP) [211].

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210 SILVA, Francisco Teomário Serejo. **Ministério público resolutivo: agente de transformação social inclusiva** (Resolute Public Prosecution: An agent of inclusive social transformation). São Luís, 2024. Master's Dissertation. (p. 26, 2024), emphasizes: "With the aim of building a fair and equal society, the 1988 Federal Constitution shaped the Public Prosecutor's Office as a political agent of inclusive social transformation. To effectively fulfill this accountability, it was granted the power and duty to employ all necessary and legitimate means to do so satisfactorily and faithfully (BRAZIL, 1988)."

211 CNMP Resolution N° 118/2014; CNMP Resolution N° 179/2017; CNMP Resolution N° 181/2017; CNMP Resolution N° 205/2019; CNMP Recommendation N° 54/2017; CNMP Recommendation N° 57/2017; CNMP-CN General Recommendation N° 02/2018.

Litigation often runs counter to the urgency required to prevent or halt ongoing environmental degradation, due to its bureaucratic and adversarial nature, which typically delays meaningful responses.

In contrast, the 1st Regional Environmental Prosecutor's Office has adopted a dialogical and participatory approach, prioritizing engagement with stakeholders directly involved in regional environmental issues. Key priorities have included ensuring that environmental agencies are equipped with financial autonomy and adequate infrastructure, and advancing environmental education policies that reach the entire population.

Final considerations

It is evident that human activity, whether characterized by a disregard for environmental regulations or by a lack of awareness of the vital role environmental assets play in sustaining life on Earth, is a major driver of environmental degradation. This underscores the urgent need for a comprehensive environmental education policy, supported by the broadest possible institutional engagement, to ensure full community participation. Only through the development of collective environmental consciousness can meaningful protection of natural heritage, and specifically the hydrological systems of these municipalities, be achieved.

The water resources of Paço do Lumiar, Raposa, and São José de Ribamar are deeply degraded, with severe consequences for public health and the environment. These impacts extend to the climate, with far-reaching social and economic repercussions. At the core of this crisis lies the absence and inefficiency of public policies, particularly in the areas of basic sanitation and infrastructure.

In addition to a widespread lack of public understanding of the environment as a fundamental right, largely due to the absence of environmental education, it is evident that the failure of municipal authorities to fulfill their regulatory responsibilities has significantly contributed to the degradation of water resources caused by human activity.

The municipal agencies tasked with environmental protection lack the structural capacity and financial autonomy needed to carry out their duties effectively. These deficiencies severely limit their ability to implement policies, programs, and actions at the scale required for meaningful environmental protection. In this context, the intervention of the Public Prosecutor's Office is essential to help overcome this structural deficit and promote lasting solutions.

It is essential that efforts to address environmental challenges, including the restoration and remediation of degraded water bodies in the municipalities of Paço do Lumiar, Raposa, and São José de Ribamar, be accompanied by measures to ensure financial autonomy and adequate infrastructure for municipal environmental agencies. It is evident that the effectiveness of these initiatives is directly linked to the institutional capacity of the bodies responsible for their implementation.

THE ROLE OF THE PUBLIC PROSECUTOR'S OFFICE OF THE STATE OF MARANHÃO IN PROMOTING AND MONITORING THE PROPER DISPOSAL OF SOLID WASTE ALONG THE BANKS OF THE PARNAÍBA RIVER, IN THE URBAN AREA OF SÃO FRANCISCO DO MARANHÃO, DURING THE EVENT KNOWN AS "PRAIA DE VERÃO"

BY LEONARDO SOARES BEZERRA[212]

Solid waste management has become a key issue in discussions on sustainability and environmental protection, particularly in urban areas where dense populations and concentrated economic activity generate large volumes of waste. Solid waste refers to all discarded materials that cannot be immediately reused or repurposed, requiring treatment, recycling, or appropriate final disposal to prevent environmental degradation and risks to public health.[213]

Waste produced during public events and in tourist areas, such as plastics, glass, paper, and food scraps, presents a major challenge for environmental management. The accumulation of waste in crowded spaces not only harms the visual landscape but also degrades soil, water, and air quality, contributing to pollution and threatening local biodiversity. Inadequate waste disposal can also lead to public health concerns, including the spread of diseases transmitted by vectors like flies and rodents that feed on organic matter, and the contamination of water sources by toxic substances.[214]

Gomes and Pereira[215] argue that sustainable waste management requires the active cooperation of all sectors of society, including citizens, businesses, and public authorities. They emphasize that addressing the solid waste problem involves more than implementing recycling policies; it also demands a broader range of measures, such as reducing waste generation and promoting clean technologies. The integration of these efforts has the potential to make waste management more efficient, sustainable, and environmentally responsible.

The issue of solid waste pollution is also extensively discussed in the literature. Mendes[216] highlights that the presence of waste in natural environments, such as rivers and beaches, not only compromises aesthetics and local biodiversity but can also have severe impacts on flora and fauna, especially due to plastic ingestion by marine animals and the contamination of aquatic ecosystems. The

212 Public Prosecutor of the State of Maranhão, Head of the District of São Francisco do Maranhão. E-mail: **leonardobezerra@mpma.mp.br**.

213 SOUZA, Francisco José de. **Gestão de resíduos sólidos urbanos: desafios e perspectivas**. Rio de Janeiro: Editora FGV, 2018.

214 MENDES, Maria Clara. A sustentabilidade e a gestão de resíduos sólidos. **Revista de Meio Ambiente**, v. 23, nº 2, pp. 45-60, 2020.

215 GOMES, Raquel Silva; PEREIRA, João Carlos. **Gestão integrada de resíduos sólidos no contexto urbano**. São Paulo: Editora Atlas, 2017.

216 MENDES, Maria Clara. A sustentabilidade e a gestão de resíduos sólidos. **Revista de Meio Ambiente**, v. 23, nº 2, pp. 45-60, 2020.

author further underscores the impact on nearby communities, which often face heightened public health risks due to the spread of vector-borne diseases carried by mosquitoes and rodents.

In this context, raising awareness and promoting environmental education are key to changing behaviors and improving waste management practices. According to Silva and Oliveira[217], it is essential to implement educational campaigns that engage the public and encourage active community participation in the proper disposal of waste. They highlight the importance of incorporating these topics into school curricula and community-based initiatives to strengthen environmental citizenship and foster social responsibility.

Effective solid waste management, as outlined in Law Nº 12,305/2010[218], involves regular and efficient collection, the provision of appropriate waste bins, recycling efforts, and proper sewage disposal, critical components for safeguarding public health and safety in these areas. Oversight and support by public authorities, such as the Public Prosecutor's Office of the State of Maranhão (MPMA), play a vital role in ensuring the implementation of these practices. By pursuing both judicial and extrajudicial measures, these institutions work to promote proper waste management in everyday contexts and during specific events, contributing to improved environmental quality and, consequently, a better quality of life for the population.

For this reason, it is important to highlight the role of the MPMA as both an oversight authority and a promoter of environmental policy, in accordance with the Brazilian legal framework. The MPMA played an active role in the planning and implementation of the National Solid Waste Policy in the city of São Francisco do Maranhão during the *Praia de Verão* (Summer Beach) event.

Role of the Public Prosecutor's Office of the State of Maranhão

Every year, during the months of June and July, a large sandbank naturally forms in the waters of the Parnaíba River – the river that marks the political boundary between the states of Maranhão and Piauí. This sandbank appears parallel to Policarpo Freire Avenue.

To organize the use of the area, the Municipality of São Francisco do Maranhão authorizes, coordinates, and promotes the installation of temporary stalls. These structures operate as bars, restaurants, music stages, and recreational spaces for sports and leisure activities.

The event, known as *Praia de Verão* (Summer Beach), draws residents of all ages as well as tourists, primarily seeking leisure and entertainment. While the event generates income and employment, it also leads to environmental impacts due to the high concentration of people and economic activity. One of the main

217 SILVA, Laura; OLIVEIRA, Roberto. **Educação ambiental e gestão de resíduos sólidos**. São Paulo: Editora Educacional, 2019.

218 BRAZIL. Law N° 12,305 of August 2, 2010. Establishes the National Solid Waste Policy; amends Law N° 9,605 of February 12, 1998; and provides other provisions. **Official Gazette of the Union**: Section 1, Brasília, DF, Aug. 3, 2010.

challenges is the generation of various types of waste, including glass, plastics, paper, organic food waste from restaurants, and refuse from chemical toilets.

In 2022, a significant accumulation of both organic and inorganic waste was observed at the site, along with the presence of birds of prey. The organic waste consisted primarily of sewage and food scraps, while the inorganic waste included glass bottles, aluminum cans, and plastic materials. In light of this situation, the Public Prosecutor's Office of the State of Maranhão, through the São Francisco do Maranhão Prosecutor's Office, initiated Case File Nº 000132-072/2022 to investigate reports of waste buildup and the absence of regular waste collection along the sandbank of the Parnaíba River, in the area known as *Praia de Verão*, adjacent to Policarpo Freire Avenue.

As an extrajudicial measure, the Prosecutor's Office issued Ministerial Recommendation REC-PJSFM – 1/2022[219], which reads as follows: "It is recommended to the Honorable Mayor of São Francisco do Maranhão, Maranhão:

- Within 24 hours, adopt urgent measures to clean the area, including the collection of plastic waste, paper, bottles and glass items, and shards of glass. Additionally, conduct an electrical safety inspection of the power supply system serving the stalls and stage located on the sandbank and riverbank of the Parnaíba River, in the urban area of São Francisco do Maranhão, as these installations may collapse or come into contact with water. Cleaning must also include the dock area along Policarpo Freire Avenue, and should be carried out daily, given that part of the waste is being carried away by the river's current;

- Within 72 hours, install waste bins or containers throughout the area to ensure the proper storage of waste until daily collection, preventing exposure or disposal into the river. Guidance must also be provided to stall operators and visitors;

- All projects and modifications must comply with municipal, state, and federal health and sanitation regulations."

The municipality, through Official Letter Nº 77/2022[220], stated that "waste collection is carried out every two days and always takes place after events. Trash bins have been placed near the stalls, and stall operators have been instructed to properly dispose of the waste generated at their stalls and from products sold along the beach."

However, the cleaning measures adopted proved insufficient in light of the scale of the event and the high number of attendees. Photographic evidence submitted with the case shows a significant accumulation of waste, as well as the presence of birds of prey, even in the vicinity of the event's entrance gate.

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219 BRAZIL. Public Prosecutor's Office of the State of Maranhão. Ministerial Recommendation REC-PJSFM – 1/2022. Prosecutor's Office of São Francisco do Maranhão. São Francisco do Maranhão, 2022.

220 SÃO FRANCISCO DO MARANHÃO (Municipality). Official Letter N° 77/2022. São Francisco do Maranhão: Municipal Government, 2022.

Inspection Report Nº 24/2022[221], prepared by the technical team of the Public Prosecutor's Office, presented the following conclusions under section "4. Observed Conditions":

- Inorganic waste, particularly plastic bottles, was found at the site;
- No waste collection points were observed, contrary to the information previously reported;
- Regarding the presence of sewage, a muddy puddle was identified which, based on its visual characteristics and odor, appeared to contain sewage, although a more thorough analysis would be required to confirm its origin and composition;
- It is known that during the upcoming rainy season, the river will rise and cover the entire sandbank, creating a clear risk that the waste observed will be carried into the river.

Another important aspect of the event's infrastructure relates to the electrical installations, as a temporary power grid was set up on-site, along with sound systems, a stage, and lighting structures. However, during the event, the water level of the Parnaíba River frequently rises, at times partially submerging the stage used for musical performances. This creates a concrete risk of electric shock to performers, swimmers, and anyone near the stage or in contact with the water, posing a potentially fatal hazard. The situation thus represented a serious violation of public health, environmental, and safety regulations.

Given the inability to resolve the issue through extrajudicial means, the State Public Prosecutor's Office filed a lawsuit. Civil Action Nº 0800468-88.2023.8.10.0124[222] was brought against the Municipality of São Francisco do Maranhão, in its capacity as both the provider of urban sanitation services and the organizer of the event.

The lawsuit sought to compel the municipality to submit a comprehensive solid waste management plan, carry out proper site cleaning, collect and correctly dispose of waste and sewage, install clearly visible trash bins, and present a layout plan for the placement of stalls. It also required the submission of hydro-sanitary and electrical plans for the stage, sound, and lighting installations, all located in a public urban space equipped with infrastructure provided by the municipality.

In essence, the civil action was grounded in the constitutional right of all individuals to an ecologically balanced environment, as enshrined in Article 225,

221 BRAZIL. Public Prosecutor's Office of the State of Maranhão. Inspection Report N° 24/2022. Prosecutor's Office of São Francisco do Maranhão. São Francisco do Maranhão, 2022.

222 MARANHÃO. Judiciary. Court of Justice of the State of Maranhão. District of São Francisco do Maranhão. Case N° 0800468-88.2023.8.10.0124. Civil Action. Public Prosecutor's Office of the State of Maranhão vs. Municipality of São Francisco do Maranhão. São Francisco do Maranhão, 2023. Available at: **https://pje.tjma.jus.br/pje/ConsultaPublica/DetalheProcessoConsultaPublica/listView.seam?ca=eec8958dc293552aa07013d762595fec4d57a03ed2a1323a**.

caput, of the Federal Constitution (FC)[223]; the municipality's duty to enforce environmental regulations, particularly in matters of local interest such as urban sanitation, under Article 30, item V, of the FC; and the obligations established by Law Nº 12,305/2010, which created the National Solid Waste Policy. This law assigns multiple responsibilities to municipalities concerning the management of solid waste within their jurisdictions, including the development of Municipal Integrated Solid Waste Management Plans. For specific activities, Articles 20 and following of Law Nº 12,305/2010 require the preparation of Solid Waste Management Plans.

Finally, with regard to the responsibilities of waste generators and public authorities, Articles 25 and following of Law Nº 12,305/2010 clearly define the obligations of municipal governments and those engaged in economic activities.

The Public Prosecutor's Office of the State of Maranhão requested the granting of urgent preliminary relief and its confirmation at the conclusion of the proceedings, as follows: "That the Municipality of São Francisco do Maranhão, the respondent, be required to submit, within 30 days, and effectively implement during the event, a Solid Waste Management Plan that meets the minimum requirements set forth in Article 21 of Law Nº 12,305/2010. The plan must address adequate site cleaning, waste collection, proper disposal of the sewage identified in the 'muddy puddle' described in the report, installation of clearly visible trash bins, and a layout for stall placement. It must also include hydro-sanitary, electrical, and structural plans for the stage, sound, and lighting installations, all signed by a qualified technical professional and accompanied by a Technical Responsibility Annotation (ART) duly validated by the Regional Council of Engineering and Agronomy of Maranhão (CREA/Maranhão)."[224]

The Court of the District of São Francisco do Maranhão granted the request for urgent relief with the following orders[225]:

- Submission, within 30 (thirty) days, of a Solid Waste Management Plan, in accordance with the minimum requirements set forth in Article 21 of Law Nº 12,305/2010 (National Solid Waste Policy), addressing the proper cleaning of the sandbank area (*Prainha*) located alongside Policarpo Freire Avenue in this municipality;

- Submission, within 30 (thirty) days, of a layout plan for the arrangement of stalls, along with hydro-sanitary, electrical, and structural plans for the

223 BRAZIL. Constitution (1988). Constitution of the Federative Republic of Brazil. Brasília, DF: Federal Senate, 1988.

224 MARANHÃO. Judiciary. Court of Justice of the State of Maranhão. District of São Francisco do Maranhão. Case Nº 0800468-88.2023.8.10.0124. Civil Action. Public Prosecutor's Office of the State of Maranhão vs. Municipality of São Francisco do Maranhão. São Francisco do Maranhão, 2023. Available at: **https://pje.tjma.jus.br/pje/ConsultaPublica/DetalheProcessoConsultaPublica/listView.seam?ca=eec8958dc293552aa07013d762595fec4d57a03ed2a1323a**.

225 TJMA. Available at: **https://pje.tjma.jus.br/pje/ConsultaPublica/DetalheProcessoConsultaPublica/documentoSemLoginHTML.seam?ca=903dc96a843684f480f3f841adfb198573c8d258c436479a15a04b2eaca08e121f6be304123692056d1685e066320483262024f1606651ce&idProcessoDoc=90610370**.

stage, sound, and lighting installations related to the event known as *Festival de Verão*, all signed by a qualified technical professional and accompanied by a duly validated Technical Responsibility Annotation (ART) from the Regional Council of Engineering and Agronomy of Maranhão (CREA/Maranhão);

- Execution of cleaning and waste collection services, as well as the proper disposal of sewage accumulated in the "muddy puddle" at the site, within the same timeframe;

- Full implementation of the Solid Waste Management Plan and all supporting technical plans during the *Festival de Verão* event.

On the merits, the court upheld the preliminary injunction and granted the claims in full, issuing a decision with resolution on the merits and ordering the Municipality of São Francisco do Maranhão to:

- Submit, within 45 days, a Solid Waste Management Plan that meets the minimum requirements outlined in Article 21 of Law Nº 12,305/2010 (National Solid Waste Policy), including provisions for the proper cleaning of the sandbank area (Prainha) located alongside Policarpo Freire Avenue;

- Submit, within 30 days, a layout plan for the arrangement of stalls, as well as hydro-sanitary, electrical, and structural plans for the stage, sound, and lighting installations related to the annual Festival de Verão event, all signed by a qualified technical professional and accompanied by a duly validated Technical Responsibility Annotation (ART) from the Regional Council of Engineering and Agronomy of Maranhão (CREA/MA);

- Carry out regular cleaning and waste collection, as well as ensure the proper disposal of sewage at the specified location, within 30 days;

- Implement the Solid Waste Management Plan and all related technical plans during the Festival de Verão event.

The Municipality of São Francisco do Maranhão appealed the decision[226] to the Court of Justice of the State of Maranhão. However, the appeal was denied, as ruled on February 3, 2025, in accordance with the following summary: "Environmental law. Civil appeal. Solid waste disposal. Obligation to act. Penalty. Adjustment.

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226 MARANHÃO. Judiciary. Court of Justice of the State of Maranhão. Civil Appeal — Case Nº 0800468-88.2023.8.10.0124. Judgment issued on Feb. 3, 2025. Reporting judge not identified. Summary: Environmental law. Civil appeal. Solid waste management and safety at public events. Appeal denied. São Luís, 2025. Available at: **https://pje.tjma.jus.br/pje/ConsultaPublica/DetalheProcessoConsultaPublica/documentoSemLoginHTML.seam?ca=28f75783fbb9dbe05256f5c71542406243d1d534caa01a5f6a54b3a82a52e17a662a6c2300f677c4890177dcd4cf122776627065bcfb6c4c&idProcessoDoc=145604183**.

Proportionality. Reasonableness. Partial relief denied. Administrative and environmental law. Civil appeal. Solid waste management and safety at public events. Appeal denied.

I. Case Overview

- Civil appeal filed by the Municipality of São Francisco do Maranhão against a decision that upheld a public civil action brought by the State Public Prosecutor's Office. The ruling required the preparation and implementation of technical plans related to environmental management and safety for the *Festival de Verão* event, as well as the adoption of cleaning and solid waste disposal measures at the event site.

II. Legal Issues

- The issues under review were:
  - whether the judicial orders violated the principle of separation of powers;
  - whether the obligations imposed disregarded the principle of the "reserve of the possible," in light of the municipality's financial constraints.

III. Grounds for the Decision

- There was no violation of the separation of powers, as the Federal Supreme Court's case law acknowledges that the Judiciary may impose measures to ensure the protection of fundamental rights – such as the right to an ecologically balanced environment – without infringing upon administrative discretion."

- The measures adopted by the municipality were insufficient to meet the legal requirements, as demonstrated in the case records, thereby justifying judicial intervention to ensure the fulfillment of constitutional obligations.

- The principle that public authorities are only obligated to act within the limits of available resources (*reserva do possível*, in Portuguese) is not applicable in the absence of documentary evidence substantiating financial incapacity. The lack of effective action reflects administrative omission that compromises fundamental rights.

IV. Decision and Holding

- Appeal denied.

Holding:

1. The Judiciary has the authority to order administrative measures to ensure the protection of fundamental rights, such as the right to an ecologically balanced environment, when public authorities fail to act.

2. The principle that public authorities are only obligated to act within the limits of available resources cannot be invoked without objective, documented evidence of financial incapacity to fulfill constitutional obligations.

Relevant legal provisions cited:

- Federal Constitution of 1988: Articles 23(VI) and 225;
- Law Nº 12,305/2010 (National Solid Waste Policy): Articles 7, 8, and 21;
- Brazilian Code of Civil Procedure (CPC/2015): Article 497.

Key case law cited:

- Federal Supreme Court (STF), RE 684.612, Reporting Justice Ricardo Lewandowski, Full Bench, judgment of July 3, 2023[227];
- Superior Court of Justice (STJ), REsp 1.367.549/MG, Reporting Justice Humberto Martins, Second Panel, judgment of September 2, 2014.[228] [229]

Conclusion

The case is currently in the judgment enforcement phase[230], with a court decision upholding the environmental protection measures. The Praia de Verão event is expected to take place again in July 2025. Thanks to the proactive role of the Public Prosecutor's Office of the State of Maranhão, in promoting and overseeing the proper disposal of solid waste along the banks of the Parnaíba River in the urban area of São Francisco do Maranhão, the event will be held in a clean, safe, and ecologically balanced environment. This will provide better conditions for tourists, residents, and local workers, ensuring health and safety protections for all.

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227 BRAZIL. Federal Supreme Court. Extraordinary Appeal N° 684.612. Reporting Justice: Ricardo Lewandowski. Full Bench. Judgment issued on July 3, 2023. Available at: **https://www.stf.jus.br**. Accessed on: May 6, 2025.

228 BRAZIL. Superior Court of Justice. Special Appeal N° 1.367.549/MG. Reporting Justice: Humberto Martins. Second Panel. Judgment issued on September 2, 2014. Available at: **https://www.stj.jus.br**. Accessed on: May 6, 2025.

229 MARANHÃO. Judiciary. Court of Justice of the State of Maranhão. Civil Appeal — Case N° 0800468-88.2023.8.10.0124. Judgment issued on February 3, 2025. Reporting judge not identified. Summary: Environmental law. Civil appeal. Solid waste management and public event safety. Appeal denied. São Luís, 2025. Available at: **https://pje.tjma.jus.br/pje/ConsultaPublica/DetalheProcessoConsultaPublica/documentoSemLoginHTML.seam?ca=28f75783fbb9dbe05256f5c71542406243d1d534caa01a5f6a54b3a82a52e17a662a6c2300f677c4890177dcd4cf122776627065bcfb6c4c&idProcessoDoc=145604183**.

230 Judgment Enforcement Case N° 0800869-53.2024.8.10.0124.

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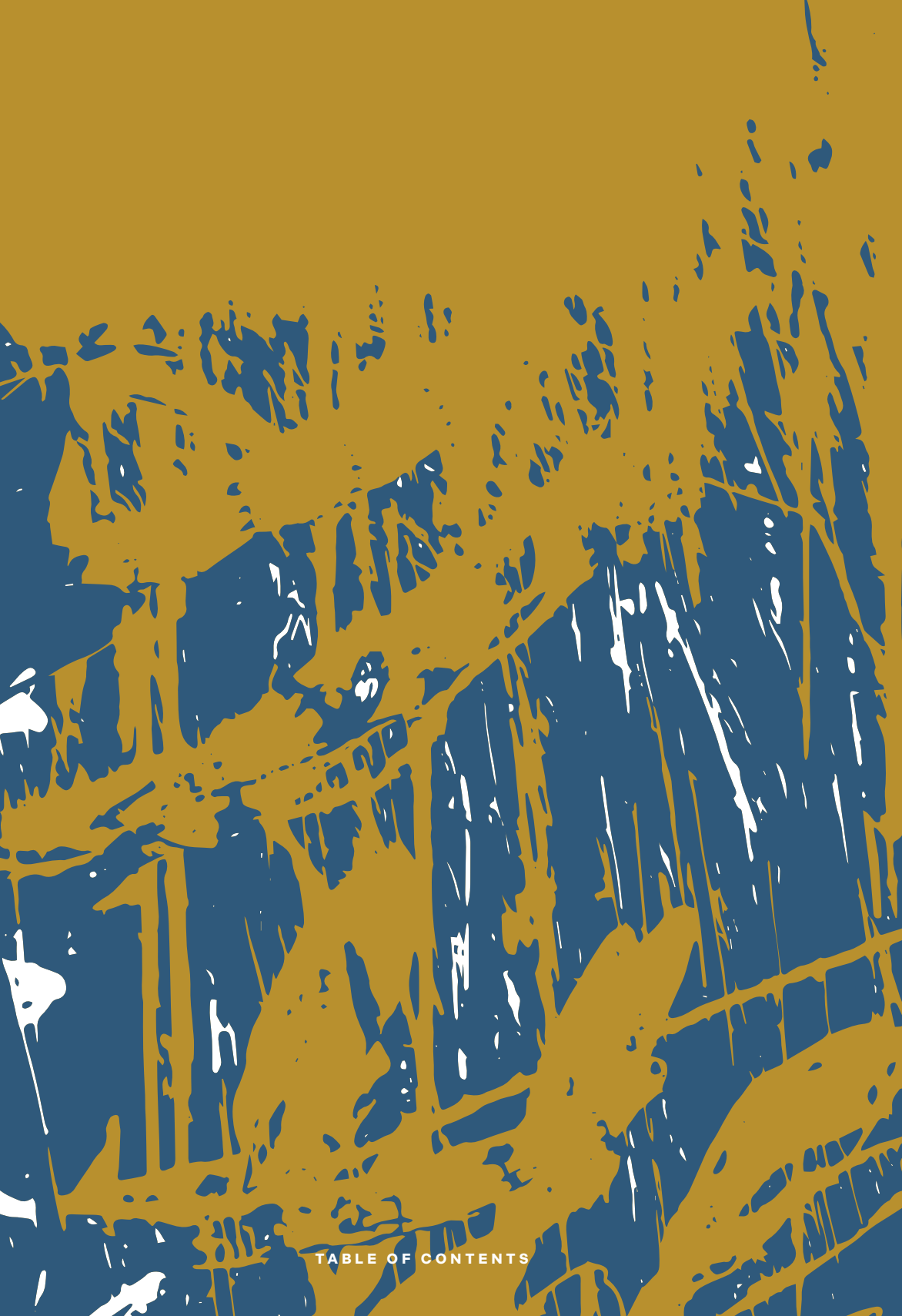

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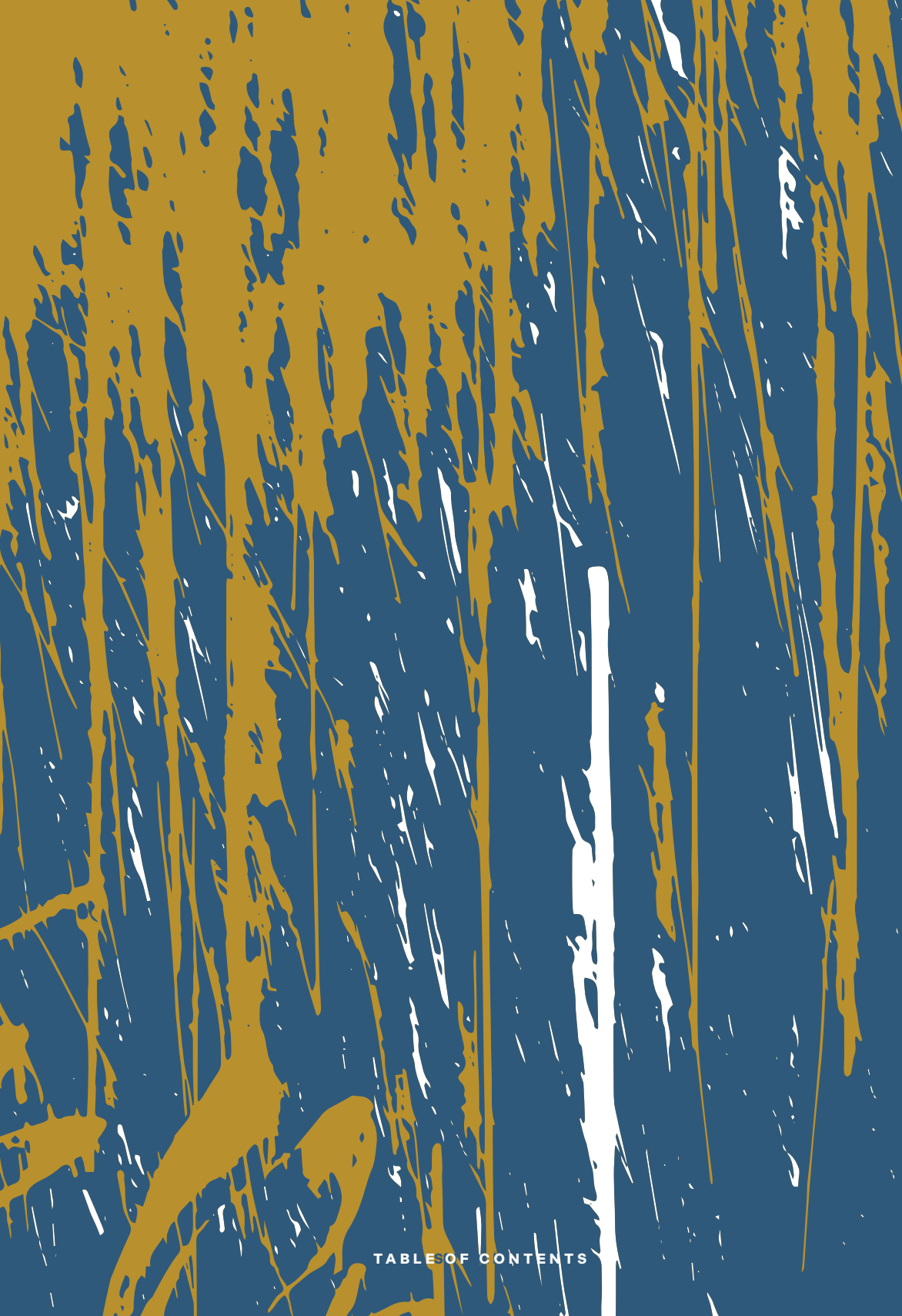
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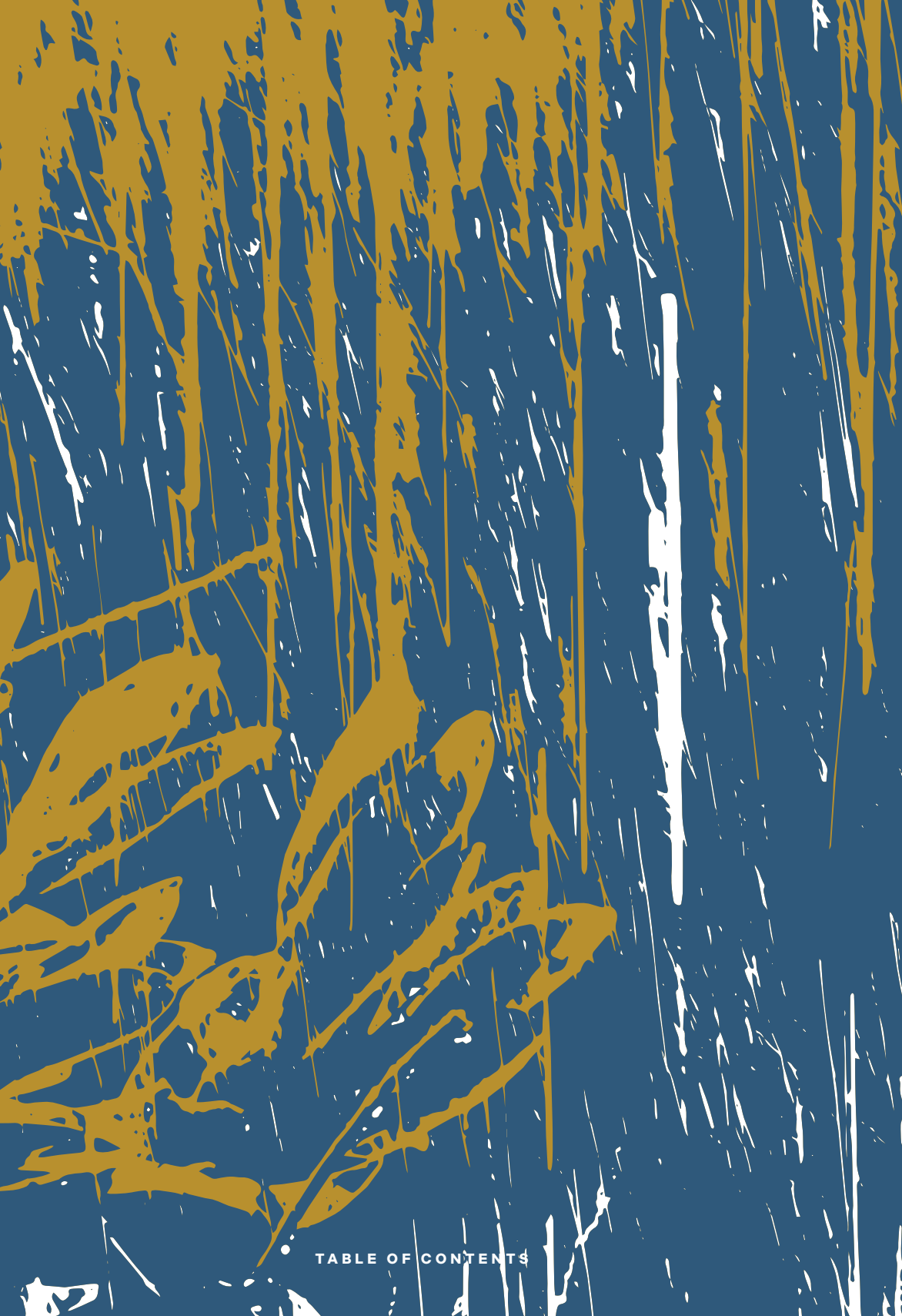
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