

FIRE IN BRAZIL IN 2024: THE LAND PORTRAIT OF THE BURNED AREA IN THE BIOMES

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Introduction

The year 2024 has been marked by an intensification of fires and wildfires in Brazilian biomes, particularly in the Amazon, the Cerrado, and the Pantanal. The use of fire, whether accidental or intentional, continues to be one of the main factors of environmental degradation, contributing to the loss of biodiversity, greenhouse gas emissions, changes to the natural landscape, and a decrease in air quality due to smoke generation (Barlow et al. 2020, Lapola et al. 2023, Tomas et al. 2021, Bonilla et al. 2023, Fuzessy et al. 2024). Furthermore, the impact of fire varies significantly among different land tenure categories, reflecting complex socioeconomic and territorial dynamics, such as certain agricultural practices, pressure for agricultural frontier expansion, land regularization, and the management of conservation units and indigenous lands.

Understanding where and how fire occurs is essential for developing effective public policies for prevention, mitigation, and control. The particular context of each biome in Brazil, combined with regional climate variations, results in varied responses in fire occurrence, both in terms of frequency and

intensity of fires (Brando et al. 2020). In the Amazon, for example, deforestation and the expansion of agriculture, particularly the use of fire in pasture management, drive a cycle of burning, resulting in widespread economic impacts and challenging the implementation of more sustainable practices in the region (Ribeiro et al. 2024, Silva et al. 2020). In the Cerrado and Pantanal, the use of fire is often linked to the management of pastures, including natural ones, while the Caatinga, Atlantic Forest, and Pampa suffer from fires of accidental origin or resulting from small-scale agricultural practices (Pivello et al. 2021). This diversity of situations requires a detailed and localized analysis to understand fire patterns and shed light on burning practices and the resulting wildfires, in order to implement specific and more effective fire control and management actions.

In this technical note, we present the burned area data from the Fire Monitor, an initiative of the MapBiomass network coordinated by IPAM (Institute for Environmental Research of the Amazon), stratified by the main land categories and by biome, with the aim of identifying differentiated patterns of fire occurrence throughout the time series from January to August, for the

years 2019 to 2024. These analyses seek to highlight the areas most impacted by fire, providing strategic information that can support decision-making regarding environmental and territorial management. By indicating the most vulnerable locations, we hope to contribute to the development of more effective policies for fire prevention and combat, ensuring the conservation of Brazilian biomes and the protection of their natural and social resources.

Métodos

To calculate the area affected by fire by land use category, data on burned areas from the Fire Monitor, an initiative of the MapBiomias network, were utilized. This data, available monthly on the MapBiomias platform (www.mapbiomas.org.br), is generated from the classification of mosaics of Sentinel 2 satellite images with a spatial resolution of 10m, which are revisited and imaged every 5 days. The method for defining the burned area uses high-performance algorithms and artificial intelligence applied to monthly mosaics built from the minimum NBR values of images available within a 30-day window. These mosaics are then classified and validated following the steps described in Alencar et al. 2022, in order to generate monthly statistics on burned area. This processing takes between 5 to 10 days after the end of each month, with data being reviewed and published between the 10th and 15th of the following month. For this technical note, we used data on fire scars and burned area from January 1 to August 31, from 2019 to 2024, allowing for a detailed and comparative evaluation of changes and trends in the extent of burned areas over these periods.

To estimate the burned area distributed among different land categories, various official databases with land use data were utilized and integrated, addressing overlaps among them in the following order: **Indigenous Lands**, with information provided by FUNAI (National Foundation of Indigenous Peoples) (www.funai.gov.br), which identifies and delineates areas recognized as indigenous territories; **Conservation Units**, with data from ICMBio (Chico Mendes Institute for Biodiversity Conservation) (www.icmbio.gov.br), which encompass protected areas aimed at conserving biodiversity and preserving natural resources; **Rural Settlements**, with data from rural settlements coordinated by INCRA (National Institute of Colonization and Agrarian Reform) (www.incra.gov.br) and state land institutes, which include areas designated for agrarian reform, where farming families receive land for agricultural production and sustainable development; **Non-Designated Public Forests**, with data from the National Forest Registry, managed by the Brazilian Forest Service (www.gov.br/florestal/pt-br), which catalogs areas of public forests not yet designated for specific use; **Military Areas**, with information about areas controlled and managed by the Ministry of Defense and other military institutions, which are used for training and operations, as well as playing a role in the protection of certain territories; **Quilombola Territories**, with data provided by INCRA and the Palmares Cultural Foundation, which identify and delineate areas inhabited by communities descended from quilombos, recognized for their historical and cultural significance (www.palmares.gov.br); or **The Rural Properties Registered in SIGEF**, The Rural

Properties Registered in SIGEF, with information from the Land Management System maintained by INCRA, include formally registered rural properties; **Public Land**, with information on federal and state ownership present in the databases of INCRA and the State Land Institutes, which encompass public areas not yet designated for a specific use, including areas for potential land regularization, environmental preservation, or other uses outlined in public policies; the **CAR (Rural Environmental Registry)**, a database that gathers information on registered rural properties (www.car.gov.br), aimed at monitoring land use and compliance with environmental legislation; and areas without cadastral information, which have not been included in any of these databases.

These databases have been grouped into nine classes including: 1. Sustainable Use and Strict Protection Conservation Units (UCs); 2. Indigenous Territories (TIs); 3. Non-Destined Public Forests at the state and federal levels (FPND); 4. Other Territories (OT) including federal and state Public Glebes, Military Areas, and areas without cadastral information; 5. federal and state Rural Settlements (AR); 6. Quilombos (QUI); 7. small rural properties, up to 4 fiscal modules (IRP), registered in SIGEF or CAR; 8. medium rural properties (IRM) from 4 to 15 fiscal modules, also registered in SIGEF or CAR; 9. and large rural properties (IRG) larger than 15 fiscal modules, registered on the same platforms, to assess the distribution of burned areas among different types of land tenure categories across the six Brazilian biomes (IBGE 2023). This analysis allows for a detailed understanding of the impact of fires and wildfires on various land tenure ca-

tegories in different biomes and their trends over time, identifying more vulnerable areas and supporting the formulation of public policies for fire prevention and management in the country.

Results and Discussion

The analysis of burned area distribution across the main land use categories in Brazil from January to August for the years 2019 to 2024 reveals distinct trends over the years. While the total burned area showed a gradual decline from 2019 to 2023, reaching a minimum in 2023, the year 2024 experienced an explosive increase, surpassing all previous years in the January to August period. Between January and August 2024 alone, 11,350,194 hectares were burned across the country, representing an 85% increase compared to the average of previous years and a growth of 116% compared to the same period in 2023 (Table 1). Practically all land use categories recorded a significant increase in the burned area; however, some stood out both for their absolute extent and for the relative growth of the area affected by fire.

Among the categories with the highest number of burned areas in absolute terms are Large Rural Properties (IRG), which cover properties larger than 15 fiscal modules, and Indigenous Lands (TI). The burned area in IRGs increased from 1,075,481 hectares in 2023 to 2,832,273 hectares in the period analyzed in 2024, an increase of 1,756,793 hectares, representing a 163% increase compared to the previous period (Table 1). Indigenous Lands also recorded a significant increase, with the burned area rising from 1,704,540 hectares in 2023 to

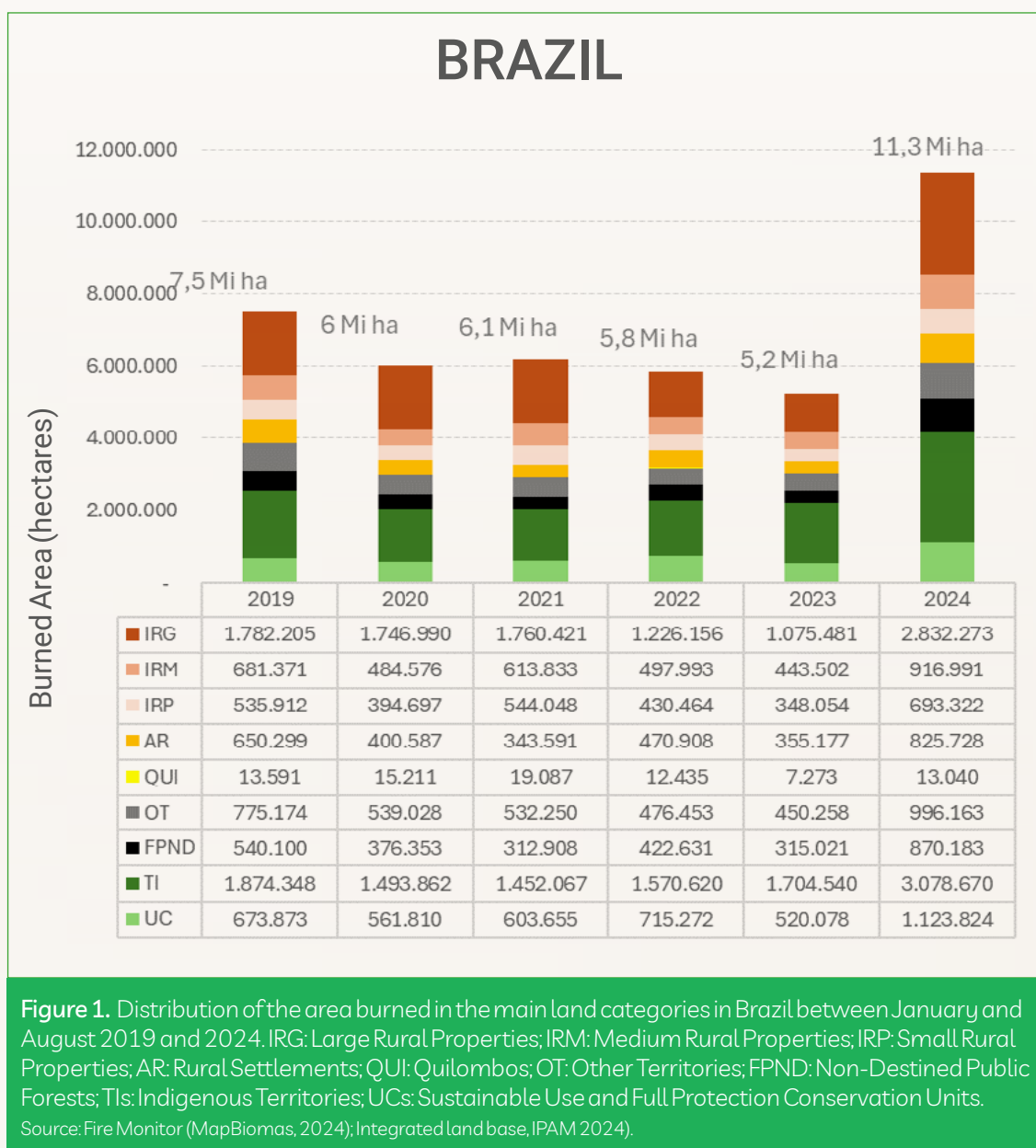
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3,078,670 hectares in 2024, representing an increase of 1,374,130 hectares, equivalent to an 80.6% increase (Figure 1, Table 1).

In percentage terms, Non-Designated Public Forests (FPND) showed the highest relative increase, with a 176% growth in burned area in 2024 (870,183 hectares) compared to the previous year (315,021 hectares) (Table 1).

The data indicate that the most affected land categories by the spread of fire in Brazil in the first eight months of 2024, highlighting the urgency of actions aimed at fire prevention, controlled use of fire to reduce accidents, combat its criminal use, and mitigate the impacts on Brazilian biomes and the population.



The analysis of burned areas across different land categories reveals a sharp increase for the period analyzed in 2024, especially in Large Rural Properties (IRG), Medium Rural Properties (IRM), and Small Rural Properties (IRP). In particular, IRGs more than doubled the burned area compared to 2023, reflecting a significant rise in the use of fire on large properties, possibly linked to agricultural practices, both due to the expansion of areas occupied by these activities and the way they are managed productively. Rural Settlements also recorded significant growth, with peaks in 2022 and 2024, surpassing 800,000 hectares of burned area during the period analyzed in 2024, showing a 132% increase compared to the previous year (Table 1). This increase may also be related to the extensive use of fire for pasture clearing and agricultural practices.

Non-Designated Public Forests (FPND) maintained relative stability in burned areas until 2021, but in 2024, there was a sharp increase, reaching approximately 870,000 hectares. This growth may be attributed to the indiscriminate use of fire in unregulated areas, making them more susceptible to land grabbing and illegal exploitation, with some of these areas being widely deforested from 2019 to 2022 (Alencar et al., 2022). The situation is worsened by the expansion of burned areas in Other Lands (OT), such as state and federal public lands, Military Areas, and regions without defined cadastral infor-

mation, highlighting the vulnerability of these areas. Together with the FPNDs, they are frequently targeted by illegal activities, such as deforestation and invasions.

The Conservation Units (UC), which should serve as barriers against the spread of fire, also recorded a significant increase in burned area, exceeding 1.1 million hectares burned from January to August 2024, a growth of over 116% compared to the same period the previous year (Table 1). Indigenous Lands (TI) maintained a relatively constant pattern of burned area from 2019 to 2023, with values ranging from 1.4 to 1.7 million hectares burned annually; however, they experienced a significant jump in 2024, surpassing 3 million hectares burned. This suggests an increased flammability of these territories, possibly caused by external fires and criminal arson related to the intensification of illegal activities and invasions, or, in some cases, by uncontrolled agricultural burns in these territories.

Such data demonstrate the growing pressure on public lands and reinforce the urgent need for effective management and protection policies for these territories, which are essential for environmental conservation, respect for the ways of life of indigenous peoples and traditional communities, their ancestral land rights, and the maintenance of essential ecosystem services for all forms of life on the planet.

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	Difference in burned area from 2023 to 2024	% Increase in burned area from 2023 to 2024
Conservation Units (UC)	603,746	116%
Indigenous Lands (TI)	1.374,130	81%
Undesignated Public Forest (FPND)	555,162	176%
Other Lands (OT)	545,905	121%
Quilombos (QUI)	5,767	79%
Rural Settlements (AR)	470,552	132%
Small Rural Properties (IRP)	345,268	99%
Medium Rural Properties (IRM)	473,489	107%
Large Rural Properties (IRG)	1.756,793	163%
Total	6.130,810	116%

Table 1. Difference between the burned area and the proportion of increase in burned area by land use category in Brazil from January to August 2024 compared to the same period in 2023.

Source: Fire Monitor (MapBiomas, 2024; Integrated Land Base, IPAM 2024).

The data also reveal a difference in the patterns of burned area by type of land category among Brazilian biomes (Figure 2). The Amazon, with a total of 5,401,135 hectares burned from January to August 2024, stands out for the large proportion of burns in Indigenous Lands (24%) and Non-Designated Public Forests

(16%), followed by Large Rural Properties (14%) and Conservation Units (11%) (Figure 2). This distribution indicates strong pressure on formally protected public areas, such as Indigenous Lands and Conservation Units, as well as those still in the process of designation, like FPND and other lands that include public

lands and areas without defined cadastral information. This scenario is likely caused by the illegal expansion of agricultural and logging activities, land grabbing, the advance of illegal mining, uncontrolled burning, and criminal use of fire.

In the Cerrado, with 4,075,573 hectares burned during the analyzed period in 2024, there is a predominance of burned areas in Indigenous Lands (40%), followed by Large Rural Properties (26%), Conservation Units (10%), and Small Rural Properties (10%). The burned area in this biome reflects the extensive use of fire in large properties, often related to agricultural management, including fire management in native pastures, which puts pressure on ecosystems already weakened by human activity, depending on how and when it occurs.

The Pantanal recorded 1,203,974 hectares burned from January to August 2024, with the majority in Large Rural Properties (74%). Conservation Units accounted for 14% of the burned area, while Small Rural Properties represented 4%. The predominant use of fire in large properties in the Pantanal is associated with pasture management and extensive livestock farming, primarily in native pastures, often affecting conservation areas.

In the Caatinga, which had 51,652 hectares burned during this period, the area is distributed fairly evenly among Large Rural Properties (21%), Medium Rural Properties (21%), and Small Rural Properties

(18%), with Rural Settlements accounting for 8% of the burned areas. This pattern suggests a varied use of fire in rural properties of different sizes, reflecting both agricultural practices and the management of small family farms.

The Atlantic Forest, with 615,195 hectares burned, exhibited a large burned area in Large Rural Properties (33%) and Medium Rural Properties (22%), as well as a significant proportion in Small Rural Properties (20%) and Conservation Units (15%). The distribution of burned area is more diverse among land categories, highlighting pressures on rural properties and conservation areas in an already highly fragmented biome.

Finally, the Pampa recorded 2,701 hectares burned during the period, with most of the area concentrated in Large Rural Properties (35%) and Other Lands (34%), which includes Military Areas and areas without defined cadastral information, followed by Medium Rural Properties (18%) and Small Rural Properties (18%). The balanced distribution between large and small properties indicates the use of fire at different scales of rural production, often for pasture renewal and agricultural activities.

These analyses show the complexity of fire dynamics in Brazilian biomes, highlighting the need for specific control and prevention strategies for each biome, considering their particular vulnerabilities and pressures.

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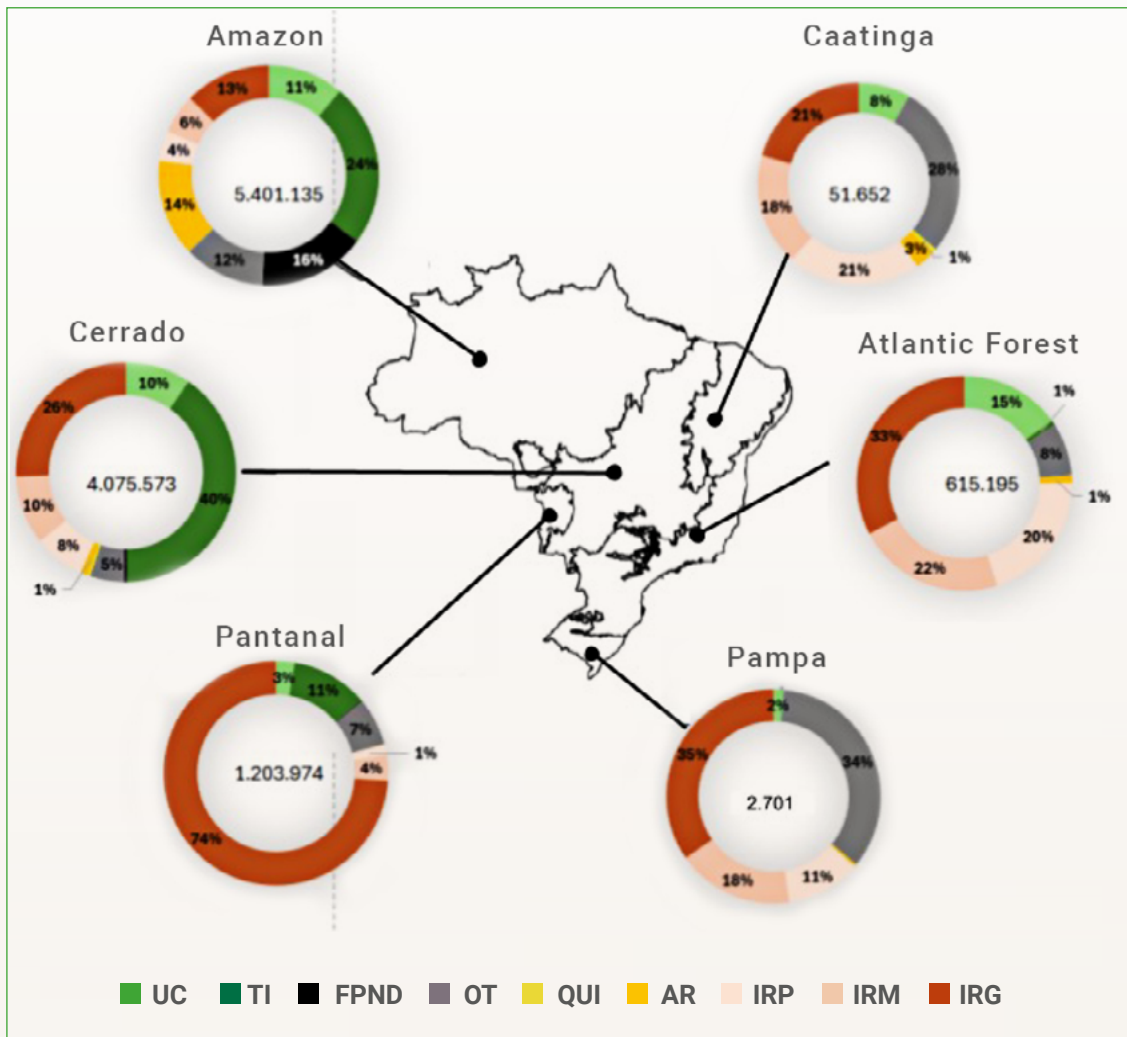


Figura 2. Distribuição da área queimada por categoria fundiária nos biomas brasileiros entre janeiro e agosto de 2024. IRG: Imóveis Rurais Grandes; IRM: Imóveis Rurais Médios; IRP: Imóveis Rurais Pequenos; AR: Assentamentos Rurais; QUI: Quilombos; OT: Outros Territórios; FPND: Florestas Públicas Não Destinadas; TIs: Territórios Indígenas; UCs: Unidades de Conservação de Uso Sustentável e Proteção Integral. Fonte: Monitor do Fogo, MapBiomas 2024; Base fundiária integrada, IPAM 2024.

The annual variation of burned areas in different land categories by biome between 2019 and 2024 also demonstrates distinct patterns, reflecting significant discrepancies in the use of fire in each territory.

In the Amazon, all land categories recorded significant annual variations, with a sharp peak in 2024. The most notable

increase in burned area between January to August 2023 and 2024 was observed in Non-Designated Public Forests (FPND), which saw a 175% increase (541,000 hectares), and Indigenous Lands (TI), which recorded an increase of 363,000 hectares burned (139%), practically doubling the burned area compared to previous years. Large Rural Properties (IRG) also showed

a substantial increase of 68%, following a similar trend as Other Lands (OT) and Rural Settlements (AR). Until 2023, rural properties maintained relative stability in burned area, but in 2024, all categories experienced a sharp growth. Conservation Units (UC) remained relatively stable throughout the series but also showed an increase in 2024.

In the Cerrado, the highest peak of burned area was recorded in 2019, particularly affecting Indigenous Lands (TI) and Large Rural Properties (IRG), which were the most impacted categories. In 2024, the largest proportional increase occurred in Non-Designated Public Forests (FPND), with a growth of 189% (12,182 hectares), followed by Indigenous Lands (TI), with an increase of 114%. There were also significant new increases in Large Rural Properties (IRG), with an additional 436,000 hectares burned (72%), and in Medium Rural Properties (IRM), with an additional 166,000 hectares burned (68%). These data reflect the ongoing role of these properties in the spread of wildfires. Conservation Units (UC) maintained a relatively constant pattern, indicating less variation in burned area over the analyzed period.

In the Pantanal, Large Rural Properties (IRG) were the land category with the highest incidence of wildfires throughout the entire historical series. This class of properties, which occupies an extensive area of the biome, recorded significant peaks of fires in 2020 and 2024, with the latter being the most severe, showing an impressive increase of 6,429% from 2023 to 2024, resulting in an additional 876,000

hectares burned. These data suggest intensive use of fire for agricultural management but also indicate that adverse climatic conditions, such as the extreme droughts of 2020 and 2024, significantly increased the biome's vulnerability to wildfires.

In the Atlantic Forest, fire concentrated mainly in Rural Properties of various sizes, Other Lands (OT), and Conservation Units (UC), with a relatively constant pattern over the years. However, in 2024, burned areas in these categories grew drastically, especially in Large Rural Properties (IRG), which recorded a 744% increase, with an additional 178,000 hectares burned. This increase was particularly notable in large sugarcane plantations that were burned almost simultaneously on August 23, resulting in more hotspots in the state of São Paulo than in the Amazon, reflecting an intensification of fire use in this biome.

In the Caatinga, the variation in wildfires was one of the most marked among the biomes, with peaks occurring in different years and land categories. The most notable peaks were recorded in 2019, 2021, and, in some categories, also in 2024. Other Lands (OT) and Rural Properties stood out as the categories with the largest burned area, especially in 2020, reflecting a diverse use of fire, without a clear pattern over time. Medium Rural Properties, in particular, showed an increase of nearly 6,000 hectares of burned area between 2023 and 2024.

Finally, the Pampa recorded the lowest burned area values among the biomes,

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but still showed notable peaks in 2022, primarily in Other Lands (OT), which include Military Areas, and in Large Rural Properties (IRG). Despite the low absolute values, these peaks indicate a significant incidence of fire use in certain land cat-

egories, associated with periods of prolonged drought, even in a biome less prone to wildfires. Among all biomes, the Pampa was the only one that showed a reduction in burned area across almost all land categories (Table 3).

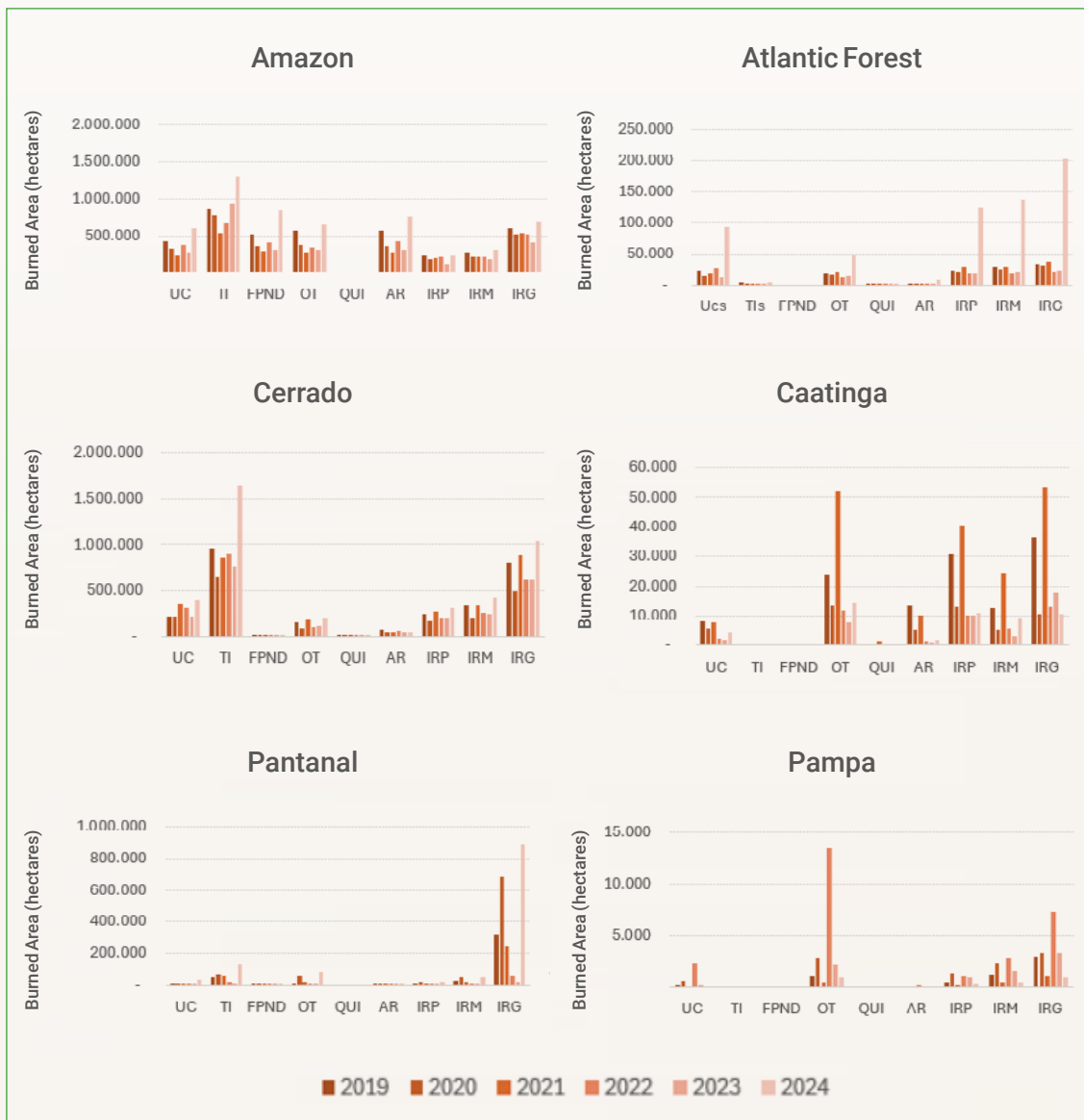


Figure 3. Evolution of the burned area by land tenure category in the Brazilian biomes between January and August 2024. RG: Large Rural Properties; IRM: Medium Rural Properties; IRP: Small Rural Properties; AR: Rural Settlements; QUI: Quilombos; OT: Other Territories; FPND: Non-Destined Public Forests; TIs: Indigenous Territories; UCs: Sustainable Use and Full Protection Conservation Units. Source: Fire Monitor, MapBiomias 2024; Integrated Land Base, IPAM 2024.

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Land Category / Biome	Proportion of increase in burned area between 2023 and 2024					
	Amazon	Cerrado	Pantanal	Caatinga	Atlantic Forest	Pampa
Conservation Units (UC)	113%	78%	813%	102%	714%	-77%
Indigenous Lands (TI)	139%	114%	11.832%	164%	819%	
Non-Destined Public Forests (FPND)	175%	189%	23.381%			
Other Lands (OT)	106%	81%	13.378%	92%	238%	-59%
Quilombos (QUI)	137%	59%		624%	74%	
Rural Settlements (AR)	144%	33%	1842%	53%	211%	-90%
Small Rural Properties (IRP)	99%	53%	2.644%	8%	579%	-66%
Medium Rural Properties (IRM)	85%	68%	2.297%	179%	549%	-70%
Large Rural Properties (IRG)	68%	72%	6.429%	-41%	744%	-71%
TOTAL	87%	85%	5.522%	22%	570%	-67%

Table 2. Proportion of increase in burned area between periods by land ownership category by biome from January to August 2023 to 2024.

Source: Fire Monitor, MapBiomias 2024; Integrated land base, IPAM 2024.

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Land Category / Biome	Difference in burned area between 2023 and 2024 (ha)					
	Amazon	Cerrado	Pantanal	Caatinga	Atlantic Forest	Pampa
Conservation Units (UC)	319.705	171.788	28.492	2.151	81.740	-132
Indigenous Lands (TI)	363.498	873.951	132.477	20	4.183	
Non-Destined Public Forests (FPND)	540.952	12.182	2.029			
Other Lands (OT)	332.039	91.559	82.668	6.912	34.045	-1.318
Quilombos (QUI)	2.294	3.223		204	45	
Rural Settlements (AR)	452.334	12.470	429	613	4.787	-82
Small Rural Properties (IRP)	117.335	104.818	17.275	837	105.580	-576
Medium Rural Properties (IRM)	144.060	166.658	42.637	5.969	115.263	-1.098
Large Rural Properties (IRG)	275.907	436.265	876.549	-7.396	177.790	-2.323
TOTAL	2.548.124	1.872.913	1.182.557	9.311	523.434	-5.528

Table 3. Difference in burned area between periods by land ownership category by biome from January to August 2023 to 2024.

Source: Fire Monitor, MapBiomias 2024; Integrated land base, IPAM 2024.

The dramatic increase in burned area in 2024, especially in sensitive land categories such as Indigenous Lands, Conservation Units, and Non-Designated Public Forests, highlights an escalation of environmental pressures and underscores the urgent need for more effective fire prevention and control policies across all biomes. Furthermore, the disproportionate growth of burned area in Brazilian rural properties, especially large ones exceeding 15 fiscal modules, indicates a more intense use of fire in agricultural practices, but also a possible difficulty in controlling fire in large properties, particularly in the Cerrado and Pantanal, where more open ecosystems favor the spread of fire and make it harder to combat effectively and quickly.

Recommendations

The year 2024 was critical for most biomes, with peaks in burned area primarily in Large Rural Properties (IRG) across nearly all biomes, reflecting the impact of intensive fire use for agricultural expansion. Indigenous Lands (TI) were also heavily affected in the Amazon and Cerrado. These patterns demonstrate the need for differentiated fire management policies tailored to each biome and land category, considering the specific characteristics and trends of each region.

Controlling fire in Brazilian biomes requires actions that involve operational intelligence, management, prevention, and control. These data reveal that the practice of fire use in privately used areas, whether rural properties or settlements across the country, needs to be approached from the perspective of Integrated Fire Management

(IFM). Similarly, the extensive burned areas within the country's protected areas, particularly Indigenous Lands and Conservation Units, require preventive actions in the fire use processes by communities and protection of these territories from wildfires originating from surrounding areas and criminal fires linked to invasions and illegal practices by external groups within these territories.

Integrated Fire Management is a strategic and coordinated approach that aims for the controlled and planned use of fire as an environmental management tool, for fire prevention, and for the conservation of ecosystems (Schmidt et al., 2016). IFM seeks to balance the need to reduce the incidence of uncontrolled fires with the maintenance of ecological processes that depend on fire, using it safely and sustainably while always aiming to reduce the excessive accumulation of flammable biomass. Furthermore, it stipulates when fire should not be used. IFM is a crucial approach for Brazil, which is not only covered by ecosystems that are sensitive to fire, such as forests, but also by other types of ecosystems—representing at least one-third of Brazil's native vegetation—that are adapted to and depend on disturbances associated with fire, thereby benefiting from management applied with the correct frequency, intensity, and timing, aligning more closely with their natural regime.

To effectively reduce and control the use of fire and wildfires, it is essential to implement a set of integrated strategies. Intensifying oversight and rigorously applying penalties are crucial measures to curb the criminal use of fire, especially in areas near forests that are vulnerable due to drought

and increased flammability. Concurrently, it is necessary to strengthen prevention and awareness actions by developing educational programs aimed at rural property owners and local communities regarding the risks of indiscriminate fire use and promoting sustainable alternatives. Community engagement and the involvement of rural producers are fundamental to reducing the burned area within rural properties, which represent a significant portion of the affected areas.

Moreover, it is imperative to intensify the fight against environmental crime, focusing on repressing the illegal use of fire in areas of native vegetation and widely disseminating information about the penalties applied, as well as increasing these penalties to protect Indigenous Lands, Conservation Units, and other sensitive areas such as Non-Designated Public Forests and other public

lands. The integration and coordination among various agencies and government levels should also be improved to optimize the use of available resources, including federal and state government agreements, reducing the need for emergency interventions and allowing for a more efficient allocation of fire combat efforts.

Finally, considering that each Brazilian biome: a) presents a specific scenario concerning the burned area and its distribution across the main land categories, as analyzed in this technical note; b) has unique characteristics of its respective ecosystems and the socio-biodiversity they host; c) and that their conservation depends on the level of protection they are subjected to, with adequate management, monitoring, and oversight, as well as actions benefiting areas of native vegetation in varying proportions within private rural properties, we propose the following recommendations:

— Amazon

The increase in burned areas across different land categories in the Amazon raises significant concerns that reflect the challenges of managing and conserving the biome. There has been a substantial increase of 175% in the burned area of Non-Designated Public Forests from January to August 2024 compared to the same period in 2023, indicating a critical vulnerability in this land category. The lack of designation and effective management makes these forest areas more susceptible to invasions, land grabbing, and illegal deforestation that result in wildfires. This scenario highlights the urgent need for public policies that promote the use and protection of these areas, in addition to implementing stricter oversight mechanisms. The regularization of these areas creates legal frameworks for the protection and management of the territory; therefore, accelerating the designation process for Non-Designated Public Forests and other public lands for conservation can not only reduce the burned area but also promote sustainable use and long-term protection of the Amazon.

Cerrado

The Cerrado continues to be one of the biomes most affected by fire, with a significant portion of the burned area occurring on private properties, especially in Large Rural Properties, which account for 40% of the burned area during the analyzed period in 2024. This scenario highlights the urgent need to strengthen fire control policies and promote sustainable agricultural practices. The approval of the PNMIF (National Policy for Integrated Fire Management) represents an important advance in this context, aiming for the controlled and planned use of fire, thereby reducing the risk of wildfires and protecting sensitive areas. Integrated Fire Management (MIF) is especially relevant in the Cerrado, where the traditional use of fire for pasture management and agricultural expansion have posed threats to the biome's balance. However, for this policy to be effective, it is crucial to intensify monitoring and oversight actions, particularly in large properties and protected areas.

Pantanal

No In the Pantanal, 79% of the burned area from January to August 2024 occurred on rural properties, of which 74% correspond to Large Rural Properties. The significant increase in fire between the years 2023 and 2024 is also due to the extreme drought affecting the biome, which exacerbates the intensity and spread of wildfires. The year 2024 has proven to be drier compared to 2023, and since 2018, the Pantanal has been experiencing prolonged drought periods. Furthermore, conditions of high temperatures and strong winds have made it challenging to combat the fires. To improve fire management in the Pantanal, it is essential to implement integrated management practices that take into account the specific environmental conditions of the biome, especially in years of extreme drought. It is recommended to create prescribed burn plans during strategic periods, under controlled conditions, to reduce combustible biomass and thus decrease the risk of uncontrolled fires in Large Rural Properties, which represent the majority of the burned area. Additionally, it is crucial to strengthen oversight and promote training for rural property owners on sustainable management practices, combining the use of fire with other soil and water conservation techniques. Encouraging the restoration of degraded areas and creating containment strips are also important measures to prevent the spread of fire and protect local biodiversity. The integration of these actions, along with climate monitoring and efficient communication between government agencies and local communities, can significantly reduce the impacts of wildfires in the Pantanal, promoting more sustainable land use.

Caatinga

To address the issue of fire use in agricultural practices in the Caatinga, it is essential to promote the adoption of more sustainable agricultural techniques, such as integrated soil management and agroecology, which replace slash-and-burn practices with those that preserve soil fertility and structure. Implementing training programs for local producers, focusing on alternatives such as no-till planting and the recovery of degraded areas, can reduce dependence on fire and its negative impacts. Additionally, economic incentives and supportive policies for the transition to these sustainable practices are essential to ensure the environmental resilience of the biome and the economic sustainability of communities that rely on agriculture for their livelihood.

Atlantic Forest

The significant increase in fire occurrence in the Atlantic Forest deviates from the historical pattern, as the use of fire for sugarcane harvesting in the Central-South region and as a systemic practice in agriculture is no longer common. It had the second-largest increase in burned area among the biomes for the analyzed period in 2024, with a rise of 570% compared to the same months of the previous year. In this timeframe, Indigenous Lands in the biome saw an increase of 819% in burned area; Large Rural Properties, 740%; and Conservation Units, 714%. Of the total area burned from January to August 2024, the majority occurred on private properties (75%), followed by Conservation Units (15%). Although the proportion of the increase in Indigenous Lands is significant, the total area burned in this category was relatively small. It is noteworthy that the biome has a small proportion of protected areas within its territory (less than 15%), and 80% of the remaining native vegetation is located on private properties. Therefore, fire represents a threat to both remnants on public lands (Conservation Units and Indigenous Lands) and in private areas.

Pampa

The burned area in the Pampa from January to August 2024 was 2,701 hectares, one of the lowest observed in the past six years for the same period. Unlike the rest of Brazil, the effects of the El Niño climate phenomenon resulted in excessive moisture throughout the biome, due to increased rainfall.

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Consequently, wildfires, which are already infrequent and of small extent under normal conditions, have been minimal in 2024.

To prevent fire in the Pampa, it is recommended that efforts be directed toward locations where the largest wildfires historically tend to occur: in private areas, Large Rural Properties, and in public areas, Military Areas and Conservation Units. In these locations, management actions should be recommended, particularly for grassland and wetland vegetation, using methods compatible with each type of ecosystem to prevent the excessive accumulation of dry biomass, which can become fuel during subsequent dry periods, as well as the implementation of firebreaks (safety strips) and constant monitoring. These measures can reduce the Pampa's vulnerability to future uncontrolled fire events, such as those observed in 2022.

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WHO WE ARE



[IPAM \(Institute for Environmental Research of the Amazon\)](#) is a scientific, non-governmental, non-partisan and non-profit organization that has been working for the sustainable development of the Amazon since 1995. Our aim is to consolidate the tropical development model for the Amazon and the Cerrado by 2035, through the production of knowledge, the implementation of local initiatives and influencing public policies, in order to have an impact on economic development, social equality and environmental preservation. Our mission is to promote science, education and innovation for an environmentally healthy, economically prosperous and socially just Amazon and Cerrado.



[Geodatin](#) is a technology company and partner of the MapBiomas network, which provides geoprocessing and remote sensing solutions. Its work is essential for the detailed mapping of burnt areas and land use cover in Brazil, with a special focus on the Caatinga biome. Through its expertise, Geodatin helps to provide accurate and up-to-date data, which is fundamental for environmental monitoring and conservation policy planning



Geokarten is a technology company that is a partner of the MapBiomas network, with expertise focused on mapping and monitoring the Pampa biome. Its work provides accurate data for analyzing land use cover and burnt areas, supporting the conservation and sustainable management of this biome.

TECHNICAL NOTE

09/26/2024



[SOS Mata Atlântica](#) is a partner organization of the MapBiomias network, aimed at the conservation and recovery of the Atlantic Forest. Its collaboration strengthens the work of monitoring vegetation cover, specifically in one of Brazil's most threatened biomes, aligning efforts to preserve biodiversity and combat climate change.



[The Fire Monitor](#) is an initiative of the MapBiomias network coordinated by IPAM, which consists of a monthly mapping of fire scars for Brazil, covering the period from 2019 onwards, and updated monthly. It is based on monthly mosaics of Sentinel 2 multispectral images with a spatial resolution of 10 metres and a temporal resolution of 5 days. The Fire Monitor reveals the location and extent of burnt areas almost in real time, making it easier to account for the destruction caused by fire.



[The MapBiomias network](#) is a multi-institutional initiative involving universities, NGOs and technology companies, focused on monitoring changes in land cover and land use in Brazil in order to seek conservation and sustainable management of natural resources as a way of combating climate change. This platform is today the most complete, up-to-date and detailed spatial database of land use in a country available in the world. All MapBiomias data, maps, methods and codes are made available publicly and free of charge.