

## FIRES IN THE CERRADO IN 2024: A SNAPSHOT FROM JANUARY TO SEPTEMBER

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### Introduction

The Cerrado biome is of extreme ecological and economic importance, playing a crucial role in water regulation (Sawyer et al. 2017), feeding the country's main river basins, and is the tropical savanna with the highest biodiversity in the world (Myers et al. 2000, Klink et al. 2005). The Cerrado has evolved in coexistence with fire, which naturally occurs largely during the transition period between the rainy and dry seasons due to lightning strikes (Simon et al., 2009; Pivello et al., 2021). However, human activity has modified this natural fire regime, resulting in increasingly frequent and intense fires, especially during critical dry periods (Bowman et al., 2011). Currently, the use of fire for agricultural activities, such as soil preparation for soybean cultivation (Gomes et al., 2019) and pasture management (Durigan and Ratter, 2016), significantly contributes to the increase in burned areas during the dry season. However, there are also increasing numbers of arson fires, generated with the intention of uncontrollably burning large

### Highlights

- 1. The area burned in September 2024 in the Cerrado** increased by 158% compared to the same month in 2023, totaling **4,37 million hectares burned**.
- 2. Most affected categories: The Savanna Formation** recorded a 103% increase in the area burned during the month, while the **Flooded Fields** experienced a significant increase of 421%.
- 3. Distribution by land tenure categories:** Private properties accounted for 49% of the burned area, while Indigenous Lands represented 27% and Conservation Units 14%, with 624 thousand hectares

areas, which are primarily responsible for the highest occurrences of fires at the peak of the dry season, with the greatest socioeconomic and environmental damages.

The interannual variability of rainfall and the intensification of drought, exacerbated by climate change (Hofmann et al., 2021), increase the vulnerability of the Cerrado to fires. The accumulation of dry biomass, combined with higher temperatures and lower relative humidity, facilitates the spread of uncontrolled fire, generating environmental, economic, and human health impacts (Pivello et al., 2021). Fires in the Cerrado, especially large-scale ones, alter vegetation and water cycling, can result in significant biodiversity losses, and directly affect local communities that depend on the biome for their livelihood, increasing greenhouse gas emissions and contributing to the worsening of climate change.

In 2024, the Cerrado is facing severe drought, and the continued inappropriate use of fire exacerbates the environmental crisis in the biome, creating a conducive scenario for large-scale fire occurrences. Understanding where and how fire occurs is essential for developing effective public policies for prevention and mitigation (Aruda et al. 2024). Inappropriate fire management, combined with pressure for agricultural expansion and worsening drought conditions and high temperatures, has caused significant transformations in the fire regime of the Cerrado, increasing the frequency and risks of catastrophic fires (Moura et al., 2019).

burned in September 2024.

#### 4. Municipalities with the largest burned areas:

The municipalities most affected in the month were **Lagoa da Confusão (TO)** with 293,261 hectares burned, **Cocalinho (MT)** with 181,646 hectares, and **Formoso do Araguaia (TO)** with 169,123 hectares.

#### 5. Increasing trend over the last five years:

From January to September 2024, the Cerrado experienced a 117% increase in the burned area, totaling 8.4 million hectares.

In this technical note, we present a detailed analysis of the burned area in the Cerrado for the period from January to September 2024, which stands out as the most critical in terms of fire incidence in the biome in the last five years. Our objective was to identify and compare the areas affected by fire in relation to previous years, the types of land use and cover most affected, and the stratification by the main land tenure categories. By indicating the most vulnerable locations, we hope to contribute to the development of more effective fire prevention and combat policies, ensuring the conservation of the Cerrado and the protection of its natural and social resources.

## Methods

The assessment of the dynamics of fire-impacted areas in the Cerrado biome was conducted using monthly burned area data provided free of charge by the Fire Monitor, an initiative of the MapBiomas network coordinated by IPAM ([www.ipam.org.br](http://www.ipam.org.br)). This data, available monthly on the MapBiomas platform ([www.mapbiomas.org](http://www.mapbiomas.org)), was generated from the classification of mosaic images from the Sentinel 2 satellite with a spatial resolution of 10 m, with acquisition and imaging intervals of every 5 days. These mosaics were then classified and validated according to the steps described by Alencar et al. (2022), generating monthly burned area statistics. The analysis covered the monthly burned area data in the Cerrado biome for the period from January 1 to September 30 of the years 2019 and 2024, allowing for a detailed

evaluation of changes and trends in the burned area over these periods.

The burned area data from the Fire Monitor was combined with the annual land use and land cover maps from Collection 9 of MapBiomas, considering the classes of Native Vegetation: Forest Formation, Savanna Formation, Grassland Formation, and Flooded Field and Wetland. Additionally, agricultural areas, including pasture and agricultural crops, were analyzed. The details of these classes can be found in the legend description on the MapBiomas platform (<https://brasil.mapbiomas.org/codigos-de-legenda/>).

To estimate the burned area distributed among different land tenure categories, various official databases with land tenure cuts were utilized and integrated, treating the overlaps as follows:

- **Indigenous Lands**, with information provided by FUNAI (National Foundation of Indigenous Peoples) ([www.funai.gov.br](http://www.funai.gov.br)), identifying and delimiting areas recognized as indigenous territories;
- **Federal, state, and municipal Conservation Units**, with data from ICMBio (Chico Mendes Institute for Biodiversity Conservation) ([www.icmbio.gov.br](http://www.icmbio.gov.br)), encompassing protected areas dedicated to biodiversity conservation and resource preservation;
- **Rural Settlements**, with data from settlements coordinated by INCRA (National Institute of Colonization and Agrarian Reform) ([www.incra.gov.br](http://www.incra.gov.br)) and state land institutes, including areas designated for agrarian reform, where farming families receive land for agricultural production and sustainable development;
- **Undesignated Public Forests**, with data from the National Forest Registry, managed by the Brazilian Forest Service ([www.gov.br/florestal/pt-br](http://www.gov.br/florestal/pt-br)), cataloging areas of public forests not yet assigned for specific uses;

- **Military Areas**, with information on areas controlled and administered by the Ministry of Defense and other military institutions, used for training and operations, and playing a role in the protection of certain territories;
- **Quilombola Territories**, with data provided by INCRA and the Palmares Cultural Foundation, identifying and delimiting areas inhabited by remaining communities of quilombos, recognized for their historical and cultural importance ([www.palmares.gov.br](http://www.palmares.gov.br));
- **Public Lands**, with information on federal and state domains present in the databases of INCRA and state land institutes, encompassing public lands not yet designated for specific uses, including areas for potential land regularization, environmental preservation, or other uses foreseen in public policies;
- **Registered Rural Properties in SIGEF**, with information from the Land Management System maintained by INCRA, including formally registered rural properties;
- **The CAR (Rural Environmental Registry)**, a database that gathers information on registered rural properties ([www.car.gov.br](http://www.car.gov.br)), aimed at monitoring land use and compliance with environmental legislation;
- Areas **without cadastral information**, which were not included in any of the aforementioned databases.

The data from CAR and SIGEF were grouped to represent **private properties**, divided into three categories: **small rural properties (SRP)**, with up to 4 fiscal modules; **medium rural properties (MRP)**, with areas between 4 and 15 fiscal modules; and **large rural properties (LRP)**, with more than 15 fiscal modules, all registered in SIGEF or CAR.

## Results and Discussion

### *Increase in Burned Area in September 2024 and Impacted Native Vegetation*

In September 2024, the Cerrado recorded a **158%** increase in the burned area com-

pared to the same month in the previous year, rising from 1.7 million hectares burned in September 2023 to **4.37 million hectares in September 2024**. In this context, **agricultural areas**, which include pastures and agricultural crops, recorded a **163% increase** in burned area, rising from 206 thousand hectares to 541 thousand hectares (Table 1 and Figure 1).

**The Savanna Formation**, which is the most representative native vegetation of the Cerrado, recorded a **103%** increase, with the burned area rising from 1.08 million hectares in September 2023 to **2.19 million hectares** in September 2024, re-

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presenting 50% of the total burned area in September in the Cerrado.

In contrast, the **Flooded Field** areas, which correspond to the seasonally flooded wetlands of the Cerrado, suffered the largest percentage increase among the analyzed native formations, with a growth of **421%**. The burned area in these areas rose from 218 thousand hectares in September 2023 to **1.14 million hectares** in September 2024, an alarming figure considering the high degree of endemism and the importance of these areas for biodiversity conservation and water resource regulation, alongside the occurrence of subterranean fires, which are highly im-

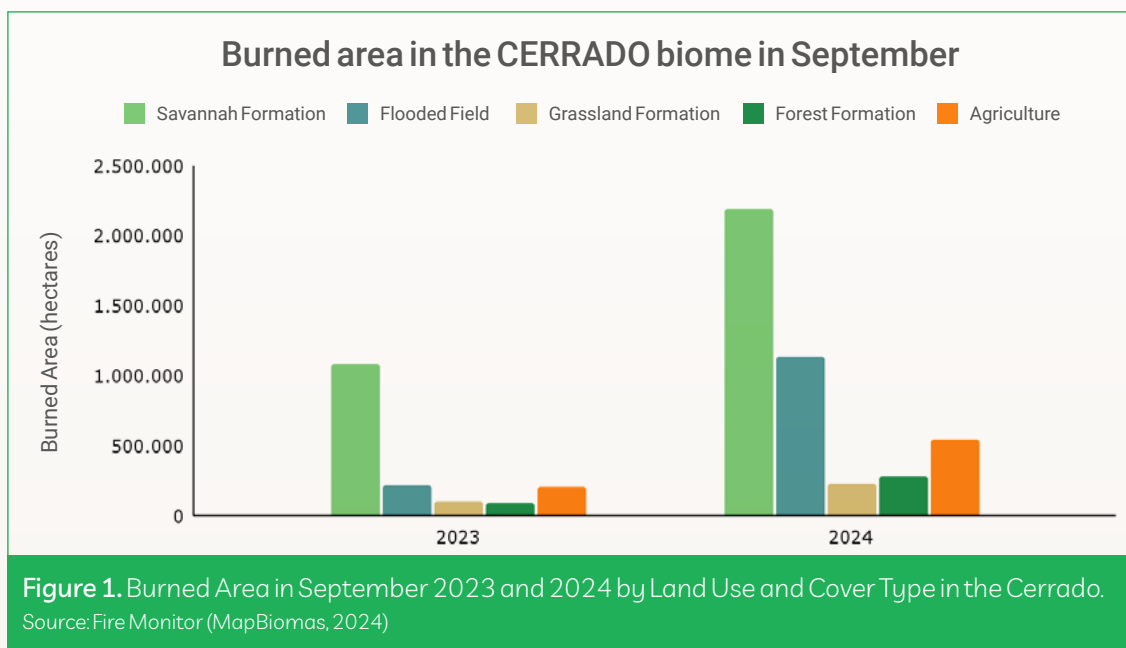
pactful, at the end of the dry season.

**The Grassland Formation**, composed of herbaceous and shrubby vegetation, experienced an increase of **118%** during the period. Meanwhile, the **Forest Formations**, which encompass areas of dense tree vegetation, recorded a significant increase of **214%**, rising from 89 thousand hectares burned in September 2023 to **280 thousand hectares** in September 2024. This increase is particularly concerning given the high sensitivity of forests to fire and the crucial role these formations play in environmental conservation, carbon storage, and the maintenance of ecosystem services within the biome.

Type of land use and cover burned	Area burned in September 2023 (hectares)	Area burned in September 2024 (hectares)	Difference between 2023 and 2024
Savannah Formation	1.075.498	2.188.007	103%
Flooded Field	218.351	1.136.860	421%
Grassland Formation	103.747	225.758	118%
Forest Formation	88.972	279.657	214%
Agriculture	205.796	541.032	163%
<b>TOTAL</b>	<b>1.692.364</b>	<b>4.371.786</b>	<b>158%</b>

**Table 1.** Burned Area in September 2023 and 2024 by Land Use and Cover Type in the Cerrado.

Source: Fire Monitor (MapBiomas, 2024)



### Increase in Burned Area in the Last Five Years

In addition to the significant increase recorded in September 2024 compared to the same month in 2023, the accumulated data from January to September also indicate a concerning trend of expansion of burned areas in the biome. The burned area in the Cerrado from January to September 2024 was 8.4 million hectares. This number represents an increase of 117% compared to the first nine months of 2023 (Figure 1) and is 65% higher than the average for the same period from 2019 to 2023, which was 5.6 million hectares (Table 2).

When comparing the average burned area in the previous five years (2019 to 2023) with the same period (January to September) in 2024, all types of native vegetation experienced an increase in burned area (Figure 2 and Table 2). The Savanna Formation recorded a 46% increase compared to the historical average, rising from 2.7 million hectares to

4 million hectares burned. This formation, which covers a large part of the Cerrado, was one of the most impacted, both in absolute and proportional terms.

Wet areas, mapped as Flooded Grasslands, showed a 53% increase compared to the historical average from January to September in recent years for the burned area in the same period in 2024 in the Cerrado, indicating a growing vulnerability of these seasonally flooded areas. Wetlands can have high flammability due to the large biomass production that, during dry periods, becomes fuel for fire, causing damage to sensitive communities that make up this type of vegetation, as they are not naturally adapted to cope with the impact of frequent fires (Garcia et al. 2021). Another risk associated with fires in flood-prone areas, such as grasslands and also floodable gallery forests and associated wetlands, is the occurrence of peat fires, or underground fires, which occur when the water table is

low and exposes the plant roots (fuel) to the spread of fire through air-filled spaces (and oxygen that allows fire to spread) instead of water. Underground fires cause high mortality rates in these ecosystems since they consume plant roots, soil, and the soil microbiota; they can burn for months and are difficult to combat due to their underground spread, posing even greater risks for firefighters.

The Grassland Formation experienced a 45% increase in the burned area in the biome in 2024 compared to the historical average over the last five years, highlighting the expanded impact on these open formations. Although fire plays a natural and, in many cases, beneficial role in maintaining biodiversity and the structure of the grassland formations in the Cerrado, as periodic fires reduce the dominance of certain species and allow for the coexistence of more non-woody species, it also prevents the accumulation of dry biomass that increases the risk of wildfires. However, the increase in the frequency and intensity of fires can have negative consequences (Zanzarini et al. 2022). When fire occurs uncontrolled or too frequently, it reduces the resilience of native species by not allowing enough time for recovery, and it facilitates the establishment of invasive plants, which alter soil structure and decrease its regeneration capacity, harming the original vegetation (Santín & Doerr, 2016). Additionally, the increase in burning in grassland areas can lead to soil degradation, loss of nutrients, and greater vulnerability to erosion.

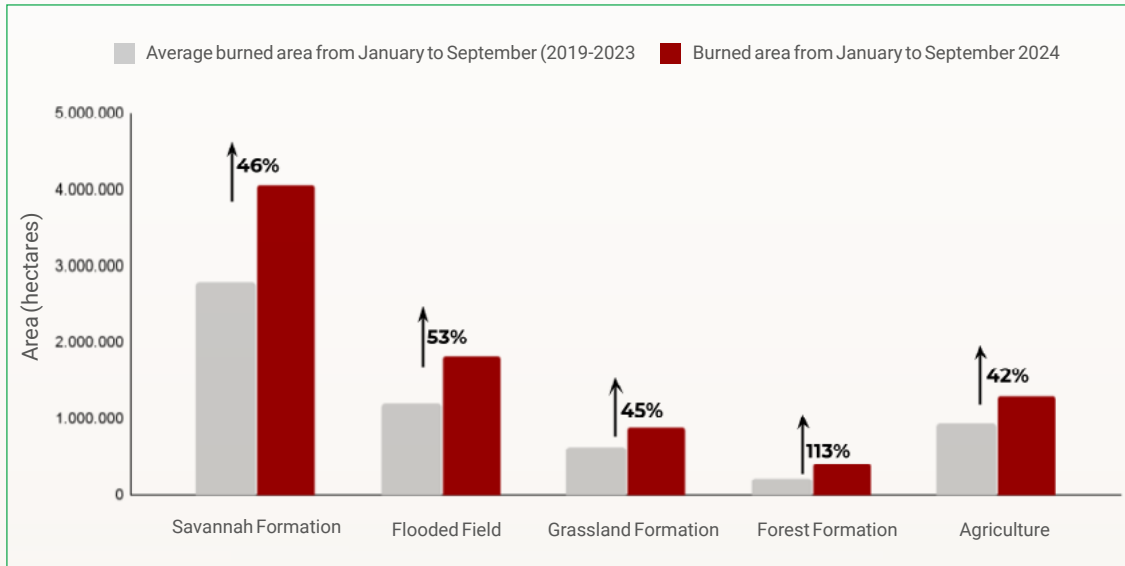
The worst impact, however, was seen in Forest Formations, which recorded a 113%

increase in the burned area in the Cerrado during the first nine months of 2024 compared to the average of the previous five years. The impact of fire on these formations is particularly severe, as most tree species in these areas lack adaptations to fire, resulting in high mortality rates for adult plants, even from a single fire event (Flores et al. 2021). These forests take longer to recover from incidents (Nóbrega et al. 2019). Forest species, such as those found in gallery forests and dense cerrados, have thinner bark and lower ability to resprout after fire events, making them more vulnerable (Hoffmann and Franco, 2003). Moreover, due to their higher density and biomass, fires in these formations become more severe and devastating, exacerbating biodiversity loss and compromising crucial ecosystem services, such as carbon sequestration and soil protection (Marques et al. 2022). The frequency and intensity of fires can hinder the recovery of these forest areas, promoting biological invasions, especially by exotic grasses, leading to loss of diversity and ongoing degradation of the biome (Durigan & Ratter, 2006).

Finally, agricultural areas, which include pastures and agriculture, saw a 42% increase in the burned area in the biome in 2024 compared to the average of the previous five years. Fire is commonly used in planted pastures as a management tool to remove dry biomass, control pests, and promote the regrowth of grasses for livestock feed (Garcia and Ballester 2016). However, excessive and uncontrolled use of fire can lead to soil degradation, nutrient depletion, drying up of springs, and increased vulnerability to erosion, as well as intensifying greenhouse gas emissions (Silva et al. 2020).

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**Figure 2.** Average burned area by land use and cover type from January to September for the period 2019 to 2023 and the total burned area for the same period in 2024 in the Cerrado. The percentage increase was calculated relative to the average of previous years.

Source: Fire Monitor (MapBiomass, 2024)

	Average burned area from January to September (2019-2023)	Burned area from January to September 2024	Percentage increase compared to the average (2019-2023)
Savannah Formation	2.768.895	4.045.107	46%
Flooded Field	1.179.457	1.805.241	53%
Grassland Formation	609.320	883.432	45%
Forest Formation	192.961	411.318	113%
Agriculture	913.050	1.299.925	42%
<b>TOTAL</b>	<b>5.663.683</b>	<b>8.447.582</b>	<b>65%</b>

**Table 2.** Average burned area by land use and cover type from January to September for the period 2019 to 2023 and the total burned area for the same period in 2024 in the Cerrado. The percentage increase was calculated relative to the average of previous years.

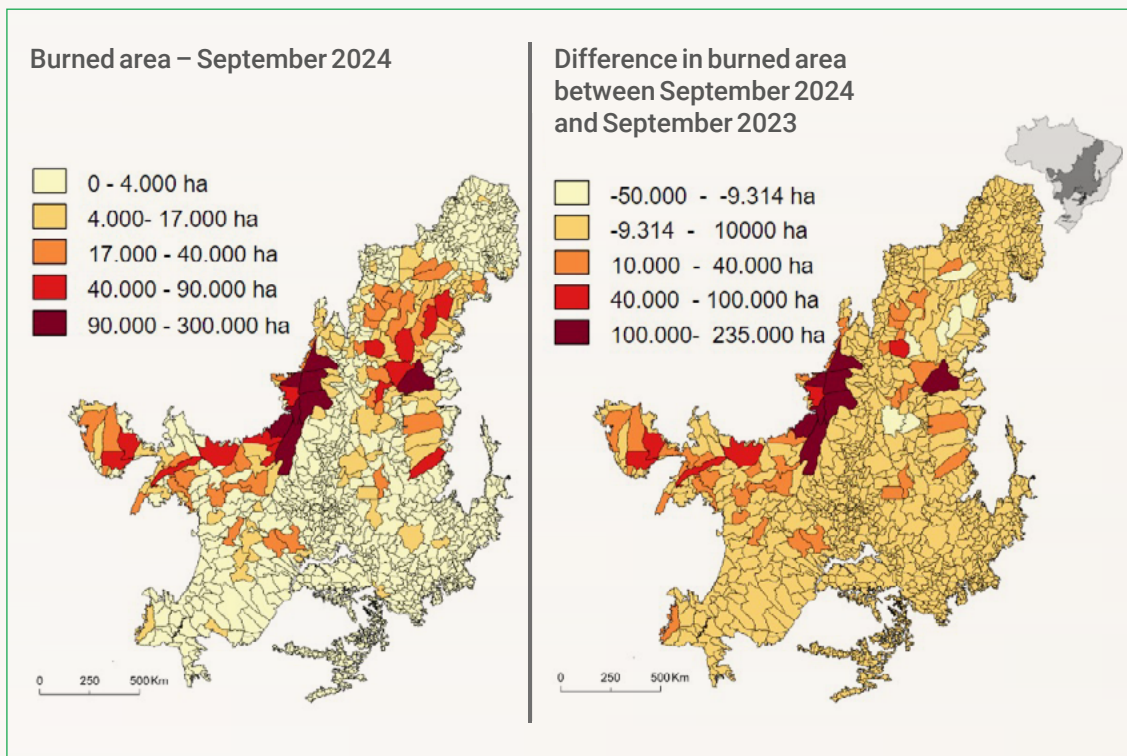
Source: Fire Monitor (MapBiomass, 2024)



## *Burned Area in September 2024 in the Municipalities of the Cerrado*

The municipalities with the largest burned areas in the Cerrado in September 2024 are located along the border with the Amazon biome in the state of Mato Grosso and in the Matopiba region, primarily in the states of Tocantins and Bahia (Figure 3 and Table 3). In the state of Mato Grosso, the municipalities of **Novo Santo Antônio** stand out, registering the highest percentage increase at 1861% (125,035 hectares), and **Cocalinho**, with a burned area of 181,646

hectares, representing an increase of 328%. In Tocantins, the municipalities of **Formoso do Araguaia** and **Pium** showed significant increases in burned area, at 1258% and 1021%, respectively, reflecting one of the most affected regions. The municipality of **Formosa do Rio Preto** in Bahia is also among the most impacted, with 137,326 hectares burned and an increase of 287%. These areas are among the most vulnerable in the Cerrado, reflecting the worsening fire situation in regions that are already facing strong pressures from agricultural expansion and prolonged drought.



**Figure 3.** Maps of the burned area in September 2024 (on the left) and the difference in burned area between September 2024 and September 2023 (on the right) in the municipalities of the Cerrado.

Source: Fire Monitor (MapBiomas, 2024)

Name of municipality	UF	Area burned in September 2024	% increase in burnt area from September 2023 to 2024
Lagoa da Confusão (TO)	TO	293.261	393%
Cocalinho (MT)	MT	181.646	328%
Ribeirão Cascalheira (MT)	MT	173.161	243%
Formoso do Araguaia (TO)	TO	169.123	1258%
Luciara (MT)	MT	151.537	491%
Pium (TO)	TO	146.721	1021%
Formosa do Rio Preto (BA)	BA	137.326	287%
Novo Santo Antônio (MT)	MT	125.035	1861%
Paranatinga (MT)	MT	100.341	386%
Rio Sono (TO)	913.050	1.299.925	42%

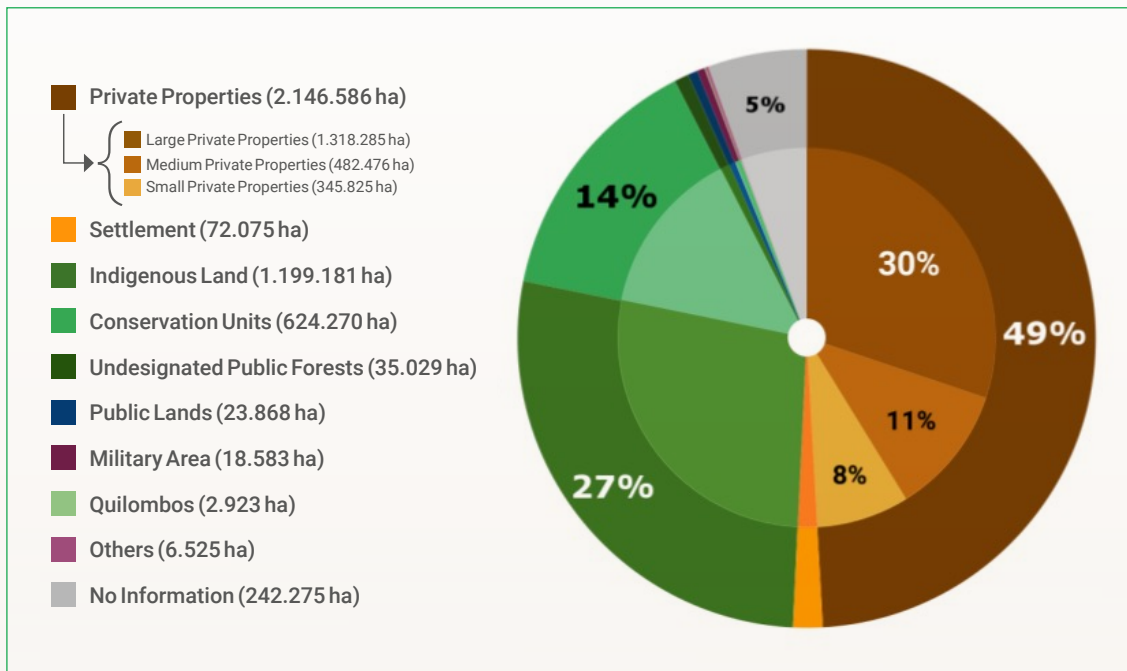
**Table 3.** Municipalities with the largest areas affected by fire in the Cerrado biome in September 2024. Source: Fire Monitor (MapBiomas, 2024)

### *Burned Area by Land Tenure Category in the Cerrado*

When analyzing the distribution of the burned area in September across the main land tenure categories in the Cerrado (Figure 4), it is observed that private properties account for the largest portion (49%) of the burned area between January and September 2024, totaling 2.1 million hectares. When examining by property size, the majority of the burnings

occurred in large private properties, which represent 30% of the total burned area in the Cerrado in September 2024, followed by medium properties (11%) and small properties (8%).

Indigenous Lands recorded 27% of the burned area in the biome in September, totaling 1.2 million hectares. Conservation Units were also affected, representing 14% of the burned area, with 624,000 hectares burned in September 2024.



**Figure 4.** Distribution of the burned area by land tenure category in the Cerrado in September 2024.

Source: Fire Monitor (MapBiomass, 2024)

There was an increase in the burned area in all types of land tenure categories, except for Settlements and Quilombos in the Cerrado, between January and September 2024, compared to the average of the last five years (2019-2023) (Figure 5 and Table 4).

**Indigenous Lands** were one of the most affected categories, with a **105%** increase, totaling **2.8 million hectares** burned from January to September 2024. This increase exposes the vulnerability of these territories, which contain large areas of conserved native vegetation that are being impacted by fires, often caused by the intensification of illegal activities, invasions, and arson. However, it is important to highlight that Indigenous communities in the Cerrado traditionally use fire in a controlled and sustainable manner as

part of their cultural land management practices. This traditional use, known as "management burning" or "cultural fire," serves to clear areas for planting, control pests, regenerate vegetation, and prevent fires, being an important practice for shifting cultivation and maintaining ecosystem balance (Welch et al., 2021). In some areas, **Integrated Fire Management (IFM)** has also been implemented, combining Indigenous traditional knowledge with conventional scientific techniques to prevent large-scale fires (Silva et al., 2021). However, the spread of fires in Indigenous Lands compromises not only the environmental integrity of these territories but also the cultural preservation and traditional way of life of the communities, who depend directly on these ecosystems for their survival and the maintenance of their ancestral territories.

**Conservation Units** recorded an **83%** increase in burned areas from January to September 2024 compared to the historical average. This increase is particularly concerning, as areas that should be protected against environmental degradation—where endemic species (which only occur in that environment) and threatened species are often concentrated—are being impacted. Generally, these areas in the Cerrado are more vulnerable, as the remaining native vegetation can accumulate large volumes of combustible material.

**Private Properties** increased their burned area by **42%** from January to September 2024 compared to the historical average, with **large properties** showing the most significant growth, registering an impressive 52% increase in burned areas. This increase reflects the extensive use of fire in agricultural activities, especially in pasture burning. The lack of proper management in these areas (with the accumulation of fuel over large stretches without the creation of firebreaks), or the use of fire without adequate control, exacerbates the degradation of the already fragile ecosystems in the Cerrado (Souza et al. 2023).

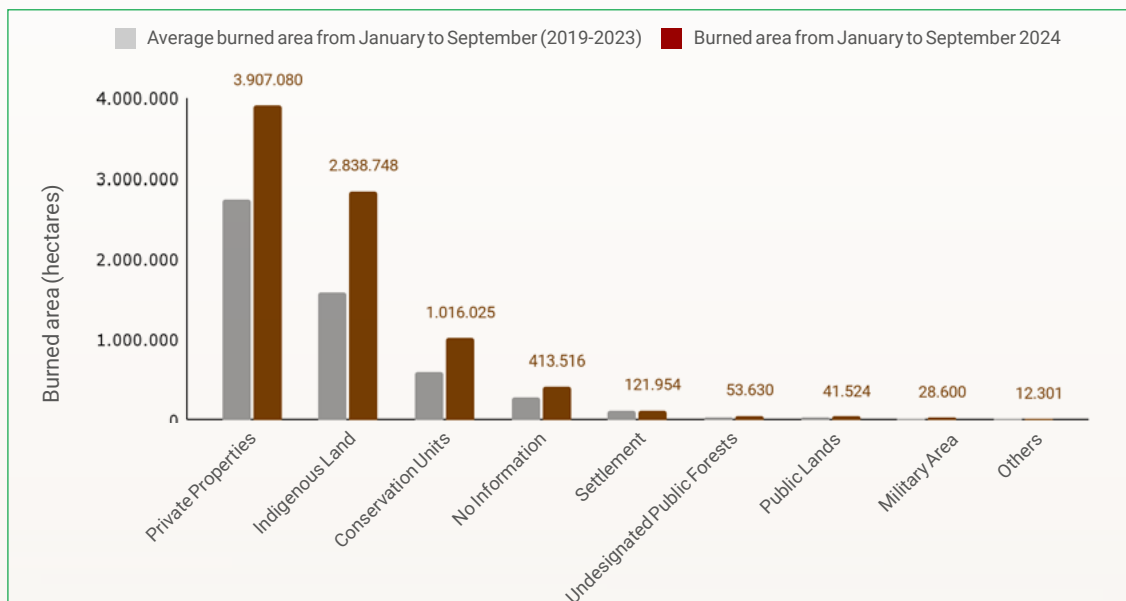
In the categories of **Unallocated Public Forests** and **Public Lands**, the **60%** increase in burned areas reinforces the growing pressure on public lands. These territories, often lacking adequate oversight, are being made vulnerable by illegal activities and the absence of effective management policies (Azevedo-Ramos et al. 2020). The protection and designation of these areas are essential for the conservation of natural resources and the maintenance of ecosystem services.

In contrast, other land tenure categories showed reductions in burned areas during the analyzed period. **Settlements** recorded a decrease of **3%**, and **Quilombos** areas experienced a **33%** reduction in **burned areas**.

However, the overall data highlight that the intensification of fires in the Cerrado affects nearly all land tenure categories. This scenario necessitates the adoption of more effective public policies, which should include not only the prevention and control of fires but also support for populations that depend on the Cerrado for their survival, ensuring the sustainability of the biome and combating climate change.

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**Figure 5.** Average burned area by land tenure category from January to September 2019 to 2023 in the Cerrado and the total burned area during the same period in 2024.

Source: Fire Monitor (MapBiomas, 2024)

Land Category	Average burned area from January to September (2019-2023)	Burned area from January to September 2024	Percentage increase compared to the average (2019-2023)
Indigenous Land	1.385.795	2.838.748	105%
Large Private Properties	1.558.847	2.362.205	52%
Medium Private Properties	614.167	895.231	46%
Small Private Properties	496.189	649.644	31%
Conservation Units	555.648	1.016.025	83%
Undesignated Public Forests	33.441	53.630	60%
Settlement	125.542	121.954	-3%
No Information	278.980	413.516	48%
Public Lands	26.004	41.524	60%
Military area	8.613	28.600	232%
Quilombos	17.406	11.644	-33%
Other	6.783	12.301	81%
<b>TOTAL</b>	<b>5.107.415</b>	<b>8.447.582</b>	<b>65%</b>

**Table 4.** Average burned area by land tenure category from January to September 2019 to 2023 and from January to September 2024 in the Cerrado. The percentage increase is calculated in relation to the average of the previous years. Source: Fire Monitor (MapBiomas, 2024)

## Recommendations

Reducing the occurrence of fires in the Cerrado is an increasingly challenging task amid the climate emergency, which intensifies conditions conducive to the spread of fire. The results presented indicate the urgency of implementing specific management policies for each land tenure category, taking into account the characteristics and vulnerabilities of each area in order to curb the degradation of the biome. The new **National Integrated Fire Management Policy (PNMIF, Law 14,944/2024)** aims precisely at the application of different management techniques for each sociocultural, economic, and environmental context. This allows for more strategic and effective planning to meet local needs and specificities.

**Private Properties** were responsible for a significant portion of the burned area in 2024, highlighting the importance of strengthening fire prevention policies and promoting more sustainable agricultural practices. The adoption of **Integrated Fire Management (MIF)** is a fundamental recommendation in this context. This policy, proposed by the **PNMIF**, also seeks to understand the dynamics of fires in the landscape, recommending the controlled and planned use of fire to minimize the risk of uncontrolled fires and protect vulnerable areas, especially those with forest vegetation. In the Cerrado, the illegal use of fire in private areas, particularly during critical dry periods, has been one of the main threats to the ecological balance of the biome, second only to deforestation. The intensification of fires in these areas is a clear signal that the current model of agricultural management needs to be reasses-

sed to minimize environmental impacts and avoid further damage to biodiversity and essential ecosystem services.

In **Indigenous Lands** and **Conservation Units**, which also recorded a significant increase in fires in September, it is essential to intensify support for the responsible agencies and engage communities in practices associated with Integrated Fire Management (MIF), including fire prevention and control. Local communities, including Indigenous peoples and traditional communities, possess ancestral knowledge of fire use in some of these territories, but they also need training, equipment, and adequate resources to implement MIF, combining traditional knowledge with modern techniques to promote sustainable fire use and ensure the conservation of their territories. Proper fire management, when carried out in a controlled and integrated manner, is crucial for conserving ecological processes and regenerating plant species, as well as ensuring the cultural preservation and traditional way of life of these communities.

**Integrated Fire Management** is an approach that combines various actions and activities, such as fire suppression, prescribed and controlled burns, environmental education, recovery of degraded areas, and training and capacity-building. Prescribed burns are only recommended and authorized in areas with fire-adapted vegetation for the purposes of environmental conservation and fire prevention, ensuring that fire is applied strategically and at the most appropriate time. This practice prevents the excessive accumulation of fuel (dry biomass), which increases the risk of lar-

ge-scale fires during prolonged dry periods. In the Cerrado, where many ecosystems are fire-adapted, this practice is crucial for maintaining ecological balance and preventing uncontrolled fire spread. The adoption of MIF actions in federal Conservation Units and in the State of Tocantins, as well as in Indigenous Lands in recent years,

has shown effective results in reducing the occurrence of fires and firefighting costs (Santos et al. 2021; Mistry et al. 2018; Baradas et al. 2021).

To confront fires more effectively, we propose a set of integrated strategies based on the PNMIF, including:

1. **Intensification of Anti-Deforestation Efforts and Institutional Strengthening:** Combating deforestation is essential, as it exacerbates climate change, increasing the risk of fires in the Cerrado. Supervision needs to be rigorous, including scrutiny of the quality of authorizations for the suppression of native vegetation (ASV), focusing on the most sensitive areas that are susceptible to fire during the dry season, and ensuring the application of severe penalties in cases of irregularities. Furthermore, it is crucial to strengthen and allocate adequate budgets to environmental agencies at all levels—federal, state, and municipal—to enable the effective implementation of Integrated Fire Management actions, as well as fire prevention and control initiatives. Strengthening these institutions, combined with increasing penalties for environmental crimes, especially illegal burns, is vital to protecting the most vulnerable areas of the Cerrado.
2. **Integrated and Sustainable Fire Management in the Cerrado:** Fire management in the Cerrado must be integrated and sustainable, prioritizing the controlled and regulated use of fire. It is crucial to strengthen the role of local communities, ensuring their active participation, respecting traditional practices and knowledge, and enhancing techniques whenever necessary or possible. Effective regulation of fire management, combined with low-impact agricultural practices such as swidden farming (roças de toco), is fundamental for maintaining the ecological integrity of the Cerrado (Borges et al. 2023).
3. **Protection of Native Areas:** Maintaining, creating, and expanding conservation units, legal reserves, and permanent protection areas, protecting ecological corridors, and ensuring the demarcation of traditional peoples' territories are essential for conserving the remnants of native vegetation in the Cerrado. These actions help protect against fires and ensure the conservation of biodiversity and ecosystem services, such as water regulation and carbon sequestration.

4. **Awareness Campaigns and Co-Creation of Solutions:** Developing awareness campaigns and community engagement initiatives that promote the co-creation of solutions to address climate change and fires in the Cerrado is fundamental. These programs should be built in partnership with family farmers, Indigenous communities, and traditional communities, integrating local and scientific knowledge to promote the responsible use of fire. Additionally, it is crucial to offer training and capacity-building that encourage Integrated Fire Management and the formation of firefighting brigades, strengthening sustainable practices and collective monitoring of territories. The active participation of these communities is essential to protect the biome and ensure the sustainable permanence of traditional peoples and family farmers in the Cerrado.
5. **Financial Incentives:** Implement significant incentives that encourage the conservation of native vegetation, including forest assets, and help prevent deforestation or degradation of native environments, such as CONSERV and the Law on Payments for Environmental Services. These mechanisms reward rural producers, family farmers, Indigenous peoples, and traditional communities for their contributions to the preservation of native vegetation. In addition to promoting biodiversity conservation and the provision of ecosystem services, these incentives also play a crucial role in reducing fires in the Cerrado, fostering a sustainable relationship between agricultural production and environmental protection.

Moreover, it is necessary to improve coordination between government levels, especially between federal and state levels, to optimize available resources and ensure an efficient response in combating fires. The articulation between these levels is fundamental to integrate efforts in supervision, prevention, and control, ensuring greater reach and effectiveness in Integrated Fire Management (MIF) actions.

Inadequate fire management not only com-

promises agricultural productivity but also contributes to environmental degradation. Therefore, the use of sustainable management techniques is essential to ensure the long-term viability of productive areas. Strengthening supervision, combined with expanding awareness and prevention policies, is vital to reducing the negative impact of fires in the Cerrado and ensuring the conservation of this biome, which is fundamental for environmental balance and water security in Brazil.



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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.



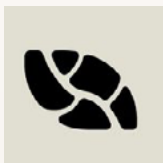
[The Fire Monitor](#) is an initiative of the MapBiomass network coordinated by IPAM, which consists of a monthly mapping of fire scars for Brazil, covering the period from 2019 onwards, and updated monthly. It is based on monthly mosaics of Sentinel 2 multispectral images with a spatial resolution of 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.

# TECHNICAL NOTE

10/15/2024



[The MapBiomas 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 MapBiomas data, maps, methods and codes are made available publicly and free of charge.



[The Biota Cerrado Network](#) is a network of more than 100 researchers from 40 Brazilian and foreign universities, as well as environmental management institutions and NGOs. Coordinated by the UnB (University of Brasilia), the Biota Cerrado Network is mainly funded by the CNPq (National Council for Scientific and Technological Development) and CAPES (Coordination for the Improvement of Higher Education Personnel) and works on issues such as Integrated Fire Management and public engagement with science.