

AMAZON FIRES IN 2024: A POINT OFF THE CURVE?

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Introduction

In 2024, the Amazon faces one of the most severe droughts ever recorded, exacerbating an already alarming environmental crisis in the region. The combination of extremely low rainfall levels, elevated temperatures, and uncontrolled use of fire linked to agricultural activities is creating ideal conditions for the occurrence of wildfires, which are spreading rapidly and uncontrollably. Traditionally used to clear pastureland and newly deforested areas, fire, in times of extreme drought, easily escapes control, resulting in large-scale fires that destroy vast areas of forest and other types of native vegetation. Additionally, there are deliberate fires, where the intent is to allow the fire to spread. In any case, the use of fire, combined with drought, not only intensifies the risk of wildfires but also compromises the health of Amazonian ecosystems by reducing soil and plant moisture, making it even harder to combat them. This scenario reflects global climate change and the ongoing environmental degradation the Amazon has been suffering, putting one of the most important biomes on the planet at risk and increasing the vulnerability of the communities that depend on these natural resources.

In this technical note, we present a detailed

analysis of data from the Fire Monitor, an initiative by the MapBiomas network coordinated by IPAM, covering the period from January to August 2024, with a special focus on the month of August, which stood out as one of the most critical in terms of fire incidence. Our goal is to identify and compare the affected areas concerning previous years, with an emphasis on land use and land cover types, as well as the most impacted land tenure categories.

In August 2024, the wildfires intensified significantly, revealing an alarming increase in the burned area compared to the same periods in previous years. Data analysis shows that, in addition to traditionally affected areas, such as pastures and agricultural lands, there was an encroachment of flames into native forests and conservation areas, an outlier in the fire dynamics of the Amazon, exacerbating the loss of biodiversity and essential ecosystem services.

Furthermore, we observed that the most impacted land tenure categories include unallocated public lands and environmental protection areas, as well as private properties that still maintain significant vegetation cover. These findings underscore the urgent need to strengthen fire prevention and control policies, especially in the context of climate change,

which has made droughts more frequent and severe.

This comparative analysis not only highlights the severity of the current situation but also provides a solid foundation for the formulation of more effective public policies, taking into account the specificities of each type of land use and the vulnerability of different land tenure categories to fire.

Calculating the Burned Area

The assessment of the dynamics of areas affected by wildfires and forest fires in the Amazon biome in Brazil was conducted using monthly burned area data provided by the Fire Monitor, an initiative coordinated by IPAM (www.ipam.org.br) in partnership with the MapBiomias network (www.mapbiomas.org). These data follow the methodology for annual burned area mapping developed by MapBiomias Fire, which applies machine learning techniques as described by Alencar et al. (2022). However, for this specific analysis, we used monthly image composites (mosaics) generated from Sentinel-2 satellite data, which has a spatial resolution of 10 meters. The analysis covered monthly burned area data for the Amazon biome from January 1 to August 31 for the years 2019 and 2024, allowing for a detailed assessment of changes and trends in burned area over these periods.

The burned area data from the Fire Monitor were combined with land use and land cover maps from MapBiomias at the level 1 legend, divided into classes of native vegetation and agricultural use. At this legend

level, forest vegetation types are grouped into one class, savannas and native grassland areas into a second class called non-forest vegetation, and pasture and agricultural areas into a third class called agricultural use. A more detailed description of these three classes can be found in the legend description on the MapBiomias platform (<https://brasil.mapbiomas.org/codigos-de-legenda/>).

Finally, to calculate the amount of burned area concentrated in different land tenure categories, the following datasets were included: the Indigenous Lands database from FUNAI (National Foundation of Indigenous Peoples) (www.funai.gov.br), Conservation Units from ICMBIO (Chico Mendes Institute for Biodiversity Conservation) (www.icmbio.gov.br), rural properties registered in SIGEF (Land Management System) by INCRA (National Institute for Colonization and Agrarian Reform) (www.incra.gov.br), rural properties registered in CAR (Rural Environmental Registry) (www.car.gov.br), and Public Forests Not Allocated from the National Forest Registry managed by the Brazilian Forest Service (www.gov.br/florestal/pt-br).

Main Results and Discussion

Em In August 2024, there was a 54% increase in the burned area in the Amazon compared to the same period in the previous year, with a notable emphasis on forest fires, affecting an area of 685,829 hectares, which is 132% larger in August 2024 compared to the previous year. Regarding the area of forest vegetation affected by fire, August 2024 set a record in the Fire

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Monitor series. In contrast, non-forest vegetation, represented by savanna and grassland vegetation according to the level 1 legend of MapBiomass (MapBiomass 2024), showed an increase of only 6% between the two years. Agricultural areas, which include pastures and crops, experienced a 38% increase in the burned area between the two

years (Table 1 and Figure 1). The disproportionate increase in forest fires compared to other areas may indicate growing pressure on native vegetation areas, which are crucial for biodiversity and global climate stability, representing an outlier for the burned area in the biome among different types of land use and cover.

August	2023	2024	Difference between 2023 and 2024
Forest Veg.	295.777	685.829	132%
Non-Forest Veg.	213.141	225.300	6%
Agriculture	806.772	1.115.342	38%
Total	1.315.690	2.026.471	54%

Table 1. Burned area in 2023 and 2024 by type of use and cover in August 2023 and 2024.

Historical data on burned areas from the Fire Monitor reveal that the primary land use type that burned in the Amazon in August 2024 was agricultural areas, with 1,115,342 hectares burned (Figure 1). Within agricultural areas, pasture dominates, representing 99% of the burned area in the agricultural class in August 2024 (the burned area num-

bers by agricultural class are available on the [Fire Monitor Platform](#)). Regarding forest fires, the comparison of August with previous years in the Fire Monitor series shows a 179% increase above the average in the burned area affecting forests (the average burned area of forest vegetation from 2019 to 2023 was 245,749 hectares).



Figure 1. Burned area in August from 2019 to 2024 by land use and cover type.

There is a gradual increase in the proportion of burned area in forests since 2022, following a reduction in 2021. In August 2024, agricultural areas accounted for 55% of the burned area in the biome, followed by 34% in forest vegetation and 11% in

non-forest vegetation (Figure 2). Notably, there is a significant increase in the proportion of burned area in forest vegetation, which is 132% greater in August 2024 compared to August 2023, when this proportion was only 22%.

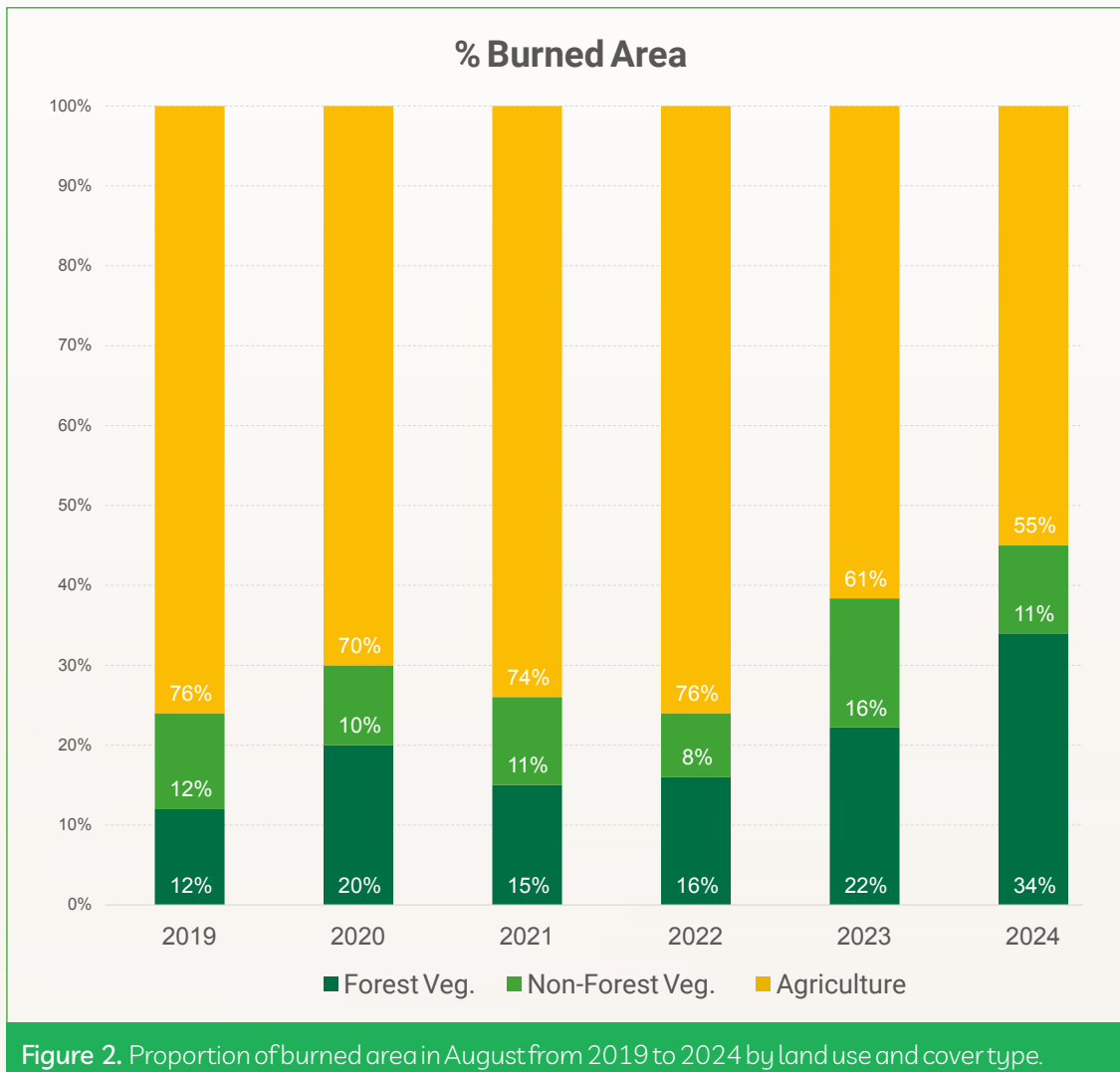


Figure 2. Proportion of burned area in August from 2019 to 2024 by land use and cover type.

In the comparison of burned area from January to August in the years 2019 to 2024 (Figure 3), it can be observed that most of the burned area (an average of 46%) typically occurs in August, mainly due to the dry season in the central-southern portion of the Amazon, which creates favorable conditions for the intensification and spread of flames.

It is noteworthy, however, that there was an increase in the burned area also observed in the early months of 2024, deviating from

the trend of the last five years. This situation was related to the burned area in northern Amazonia during this period, particularly in the state of Roraima, a region that experiences the dry season in the early months of the year. The burned area in the state was more concentrated in the savanna-type Amazon vegetation, which has grassland characteristics; therefore, non-forest vegetation accounted for 49% and 52% of the burned area in the Amazon in January and February 2024, respectively.

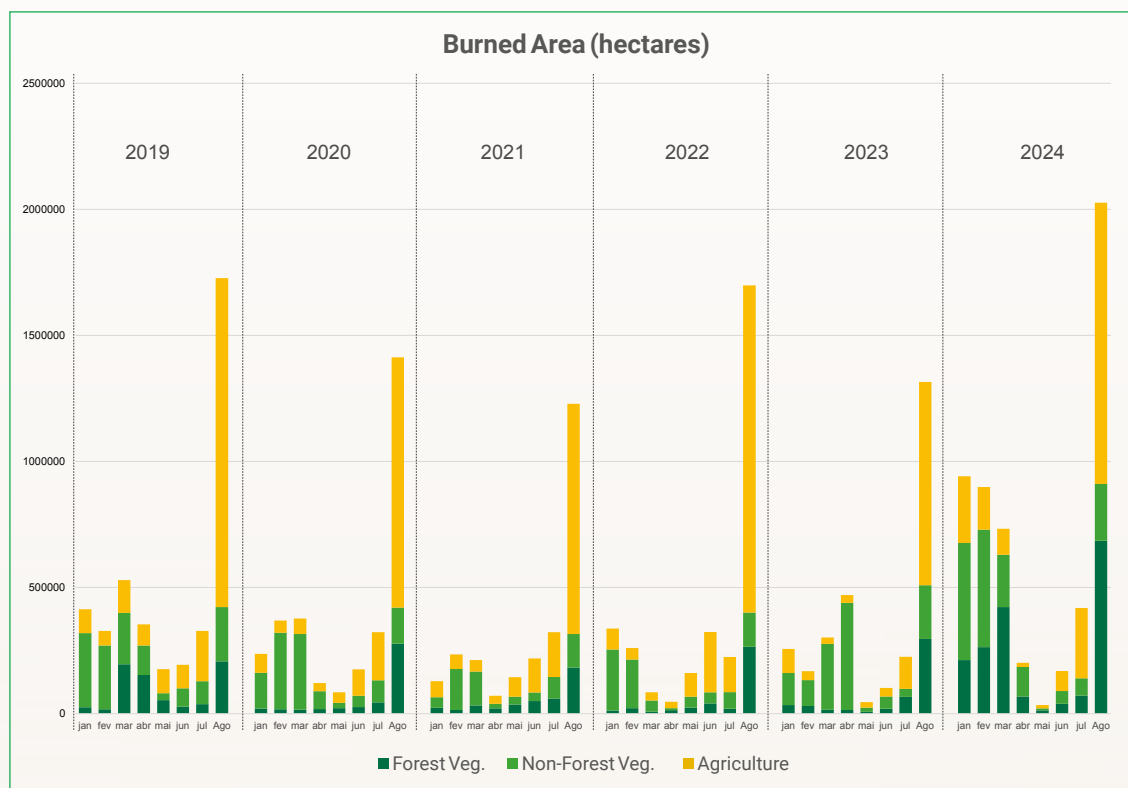


Figure 3. Burned area from January to August from 2019 to 2024 by land use and cover type.

Nonetheless, forests exhibited the highest percentage increase in burned area among the types of native vegetation in the Amazon from January to August 2024, with a variation of 268% compared to the first eight months of 2023 (Table 2). The burned

area of non-forest vegetation was 31% larger over the same period, while agriculture recorded a 73% increase. In total, the burned area in the Amazon grew by 88% when comparing the analyzed months between 2023 and 2024.

January to August	2023	2024	Difference between 2023 and 2024
Forest Veg.	481.705	1.775.017	268%
Non-Forest Veg.	1.226.768	1.607.884	31%
Agriculture	1.176.942	2.039.528	73%
Total	2.885.415	5.422.429	88%

Table 2. Burned area from January to August in 2023 and 2024 by type of use and cover.

Among the land categories (Figure 4), Indigenous Lands account for the largest portion (24%) of the burned area in the Amazon from January to August 2024, with 1,300,646 hectares burned, marking a 39% increase (Table 3) compared to the same period in 2023, when 937,148 hectares were burned.

Rural Properties with CAR (Cadastro Ambiental Rural) and SIGEF (Sistema de Gestão Fundiária) recorded 23% of the burned area in the biome from January to August this year, with 1,233,888 hectares burned, representing a 77% increase compared to the 696,586 hectares burned in the same period in 2023.

Non-Destined Public Forests (FPND) occupy 16% of the burned area in the biome during this period and experienced a 175% increase in burned area, with 849,521 hectares burned, compared to 308,570 hectares burned in the same period in 2023.

Other Public Lands (120%), Settlements (144%), and Conservation Units (113%) also recorded significant increases in burned area.

Although they do not represent statistically significant areas for the proportion of burned area in the biome during this period, it is worth noting: 1) the 137% increase in the burned area in Quilombos, rising from 1,680 hectares burned in 2023 to 3,974 hectares burned in 2024; 2) the 117% increase in burned area in Military Areas during the same period, with 25,931 hectares burned in the first eight months of 2024 and 11,932 hectares burned in the same interval in 2023.

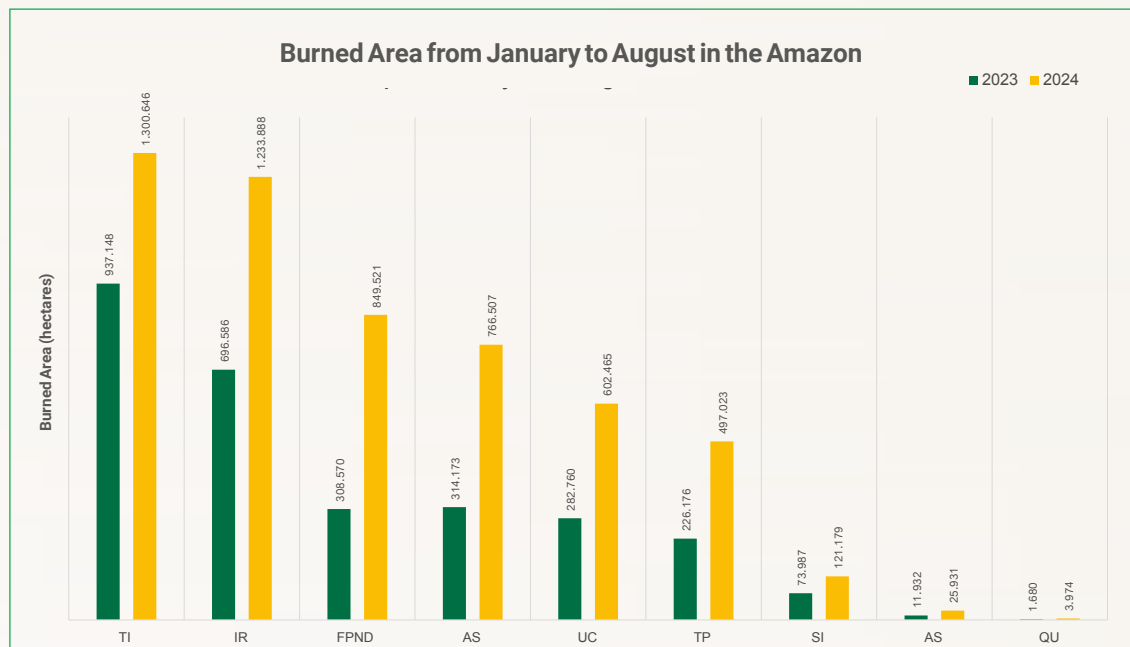


Figure 4. Burned area (in hectares) in the Amazon from January to August 2023 and 2024 in land categories: TI (Indigenous Land), IR (Rural Properties with CAR or SIGEF), FPND (Non-Destined Public Forests), AS (Settlements), UC (Conservation Units), TP (Public Lands), SI (No Information), AM (Military Area), QU (Quilombos).

Land Category	Burned Area from January to August (hectares)		Difference between 2023 and 2024	Percentage of Burned Area in 2024
	2023	2024		
Indigenous Land	937.148	1.300.646	39%	24%
Private Properties (CAR/SIGEF)	696.586	1.233.888	77%	23%
Non-Destined Public Forests	308.570	849.521	175%	16%
Settlements	314.173	766.507	144%	14%
Conservation Units	282.760	602.465	113%	11%
Public Lands	226.176	497.023	120%	9%
No Information	73.987	121.179	64%	2%
Military Area	11.932	25.931	117%	0%
Quilombos	1.680	3.974	137%	0%
TOTAL	2.853.012	5.401.135		

Table 3. Burned area by land category in August 2023 and August 2024 in the Amazon.

Recomendações

Reducing fire becomes even more challenging in a time of climate crisis, where weather conditions are favorable for the spread of fire and large wildfires. Data for the month of August from 2019 to 2024 clearly demonstrate that actions to curb the use of fire for clearing and renewing pastures are fundamental to also reduce ignition sources for fires in adjacent forests, which are vulnerable due to drought and increasingly flammable. Prevention, awareness,

engagement, and accountability actions in this regard can also help reduce the burned area within rural properties, which hold a significant portion of the burned area in the region. Another area of action is combating crime and the use of fire directly in forested areas to prevent fire in these native vegetation areas from re-emerging as an outlier, implementing widespread communication of punishments for offenders to discourage this practice, which can contribute to reducing the areas of forest affected by fires, including those caused by individuals

who invade indigenous territories and conservation units. Finally, if these two fronts are successful, the third front, which is fire suppression, will increasingly need to be activated less often, because even with all existing contingents from all agencies and

levels of government involved or capable of acting against fires, it will be impossible to combat wildfires if the use of fire whether controlled or criminal is not reduced. In this sense, several action recommendations are necessary:

1. **Implementation of Stringent Measures to Curb the Use of Fire:** Intensify monitoring and the application of penalties to discourage the use of fire for clearing and renewing pastures. This action is crucial to reduce ignition sources, especially in areas adjacent to forests, which are increasingly vulnerable due to drought and heightened flammability.
2. **Strengthening Prevention and Awareness Actions:** Develop and expand educational and awareness programs for rural property owners and local communities about the risks of using fire and sustainable alternatives. Engaging these communities is essential to decreasing the burned area within rural properties, which represent a significant portion of the affected areas.
3. **Combating Environmental Crime and Publicizing Penalties:** Reinforce operations against illegal fire use, especially in forested areas, with a focus on widespread communication of imposed penalties. This can help discourage illegal practices that result in wildfires, thereby protecting indigenous territories and conservation units.
4. **Integration and Coordination of Fire Suppression Efforts:** Improve coordination among the various agencies and levels of government involved in fire suppression. With a reduction in the use of fire, whether controlled or criminal, the need for direct intervention to combat wildfires will decrease, allowing for more effective and efficient allocation of available resources.

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WHO WE ARE



O [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 goal is to consolidate, by 2035, a model of tropical development for the Amazon and the Cerrado through knowledge production, implementation of local initiatives, and influence on public policies, aiming to impact 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](#) é is an initiative of the MapBiomas network coordinated by IPAM, which consists of a monthly mapping of fire scars in Brazil, covering the period from 2019 and updated monthly. It is based on monthly mosaics of multispectral images from Sentinel 2 with a spatial resolution of 10 meters and a temporal resolution of 5 days. The Fire Monitor reveals almost in real-time the location and extent of burned areas, thereby facilitating the accounting of destruction caused by fire.



[The MapBiomas network](#) é is a multi-institutional initiative involving universities, NGOs, and technology companies, focused on monitoring transformations in land cover and use in Brazil to promote the conservation and sustainable management of natural resources as a way to combat climate change. This platform is currently the most comprehensive, up-to-date, and detailed spatial database of land use in any country available in the world. All data, maps, methods, and codes from MapBiomas are publicly and freely available.