

AMAZON BURNING: LOCATING THE FIRES Technical Memo from the Amazon Environmental Research Institute (IPAM) September 2019

Ane Alencar, Paulo Moutinho, Vera Arruda, Camila Balzani & João Ribeiro

Introduction. The Brazilian Amazon is still on fire. The 2019 burning season, which captured the attention of Brazil and the world in recent weeks, is not over yet. Government action at the federal and state levels in the fight against wildfires is still essential, just as it is essential to curb the source that feeds it: deforestation. Failing immediate action, the whole region will continue to suffer from high numbers of outbreaks from September on.

The 2019 dry period has been more humid on average than the past three years. This rules out drought as the cause behind the explosion in the number of hotspots, as analyzed in a previous IPAM technical memo (Silvério et al. 2019).

But where is the deforestation to feed so many outbreaks taking place? This technical memo discusses which land use categories saw the greatest number of outbreaks along with the increase in deforestation in each.

Methodology. For hotspots (wildfires and forest fires), we used data from the AQUA Earthobserving satellite mission (used and developed in partnership with Brazil's National Institute for Space Research, INPE) collected from the Amazon biome between January 1 and August 29 of each year from 2011 to 2019. The location of the outbreaks were then sorted across eight land use categories (data sources for these categories are described in Annex 1; their distribution is explained in Annex 2). This allowed us to identify significant upward trends in each category. The distribution of outbreaks by land use category was also broken down for each state of the Amazon. Outbreaks examined in the analysis and presented here were restricted to the Amazon biome, following geographical limits defined by the Brazilian Institute of Geography and Statistics, IBGE (2018). For the indicative deforestation analysis, we used DETER/INPE data from between January 1 and August 20, 2019. It is worth noting that, due to technical limitations, DETER produces an imperfect snapshot of deforestation, undercounting its extent relative to the official deforestation numbers INPE releases annually via the PRODES project.

61 **2196-4150**

61 **2109-4150** SCLN 211 bloco B sala 201 CEP 70863-520 Asa Norte Brasília|DF **ipam.org.br**

Findings. Between January 1 and August 29, 2019, INPE detected 45,256 hotspots in the Amazon biome, the greatest number seen since 2010. The significant increase in outbreaks



compared to previous years occurred across practically all land use categories (Figure 1), especially on private property (PP), which covers 18% of the Amazon biome and where 33% of the total number of outbreaks were concentrated this year. These numbers are consistent with trends presented by the DETER/INPE system, which indicate that 28% of deforestation took place on private lands included in the Rural Environmental Registry over that same period.

Combined with privately owned (PP) hotspots and those occurring in environmental protection areas (APAs), a category of protected area that allows for more flexible land use, these two land use designations account for 39% of outbreaks. It is noteworthy that, on private property, deforestation and burning may be permitted as long as authorized by a competent government agency, usually State Secretaries of the Environment. That said, historically, a vast portion of deforestation, which becomes a source of kindling, is illegal. In the state of Mato Grosso, for example, estimates show that 85% of deforestation that took place between August 2017 and July 2018 was illegal (Valdiones et al. 2018).

The number of outbreaks was also high in undesignated public forests (UF), accounting for 20% of hotspots, and on unregistered lands (UL), which accounted for 10% (Figure 1). These categories do not have clearly defined land use governance and, combined, account for almost a third of the number of fires seen in the first eight months of 2019.

Undesignated federal or state public forests still need to be allocated to a protected land use category according to Law 112847/2006, known as the Public Forests Management Act, so by definition any deforestation or fire that occurs there is illegal in origin. These areas amount to 63 million hectares, or 15% of the region, and fires in these forests can usually be traced back to illegal deforestation and land grabbing (Azevedo-Ramos & Moutinho, 2018). This criminal practice is growing and feeds irregular land speculation, damaging Brazilian state property. Fires on unregistered lands (UL), which occupy 9% of the Amazon biome, are quite alarming on their own, as these exist in a state of limbo and are at the mercy of land grabbers.

Rural settlements (RS), which amount to about 33 million hectares, accounted for 18% of outbreaks (Figure 1). Preliminary analysis indicates that, in this case, fires are concentrated in a few settlement projects. This reinforces previously observed patterns of land use change in this category: between 2013 and 2014, about 50% of the deforestation in these areas was concentrated in just 2% of rural settlements in the Amazon (Alencar et al, 2016).

61 **2196-4150**

61 **2109-4150** SCLN 211 bloco B sala 201 CEP 70863-520 Asa Norte Brasília|DF **ipam.org.br** As expected, the large areas free from deforestation and away from the flames are those protected by indigenous peoples (where 6% of outbreaks took place in 2019, Figure 3) and conservation sites excluding APAs (7%), confirming that their conservation status has successfully spared them from burning (Soares-Filho et al, 2010). Were it not for these, the



outlook of deforestation and fire in the Amazon would be worse. However, beginning in August there has been a worrying increase in the number fires in protected areas, particularly on indigenous lands (ISA, 2019).



Figure 1. Distribution of the area occupied by each land use category in the Amazon biome, distribution of the number of hotspots and distribution of deforested area by land use category in the Amazon biome. IL - indigenous lands; CS - conservation sites excluding APAs; APA - environmental protection areas; RS - rural settlements; PP - private property; UF – undesignated public forests; UL - areas with no registered land data. Military areas and quilombos (Afro-Brazilian communities) were not included in this chart because they are not numerically significant. Source: IPAM

Comparing 2019 to the past

When comparing the number of hotspots in 2019 with the average number of hotspots between January and August from 2011 to 2018, the data show a significant increase this year across all land use categories (Figure 2). In absolute terms, the largest increase was on private property (PP) and on undesignated forests (UF), followed by rural settlements (RS) and unregistered lands (UL).

Despite being under environmental protection, conservation sites (CS) showed a surprising increase in the number of outbreaks in 2019. This year saw twice the number of outbreaks than the average number over the last eight years (Figure 2; Annex 2). These outbreaks were concentrated in specific areas, such as Jamanxim National Forest in the state of Pará.

As indicated in an earlier technical memo (Silvério et al., 2019), we again confirm a strong relationship between this year's intense burning season and deforestation, especially on private property (PP), unregistered lands (SI) and rural settlements (ASR) (Figure 3).

61 **2196-4150**





Figure 2. Number of hotspots recorded by land use category from January 1 to August 29, 2019 (red bar) compared to the average over the same period (January to August) for the previous eight years (2011-2018; gray bar). IL - indigenous lands; CS - conservation sites excluding APAs; APA - environmental protection areas; RS - rural settlements; PP - private property; UF - undesignated public forests; UL - areas with no registered land data. Military areas and quilombos (Afro-Brazilian communities) were not included in this chart because they are not numerically significant. Source: IPAM



Figure 3. Relationship between deforested area (in km²) and quantity of hotspots, aggregated by land use category in the Amazon biome. TI - indigenous lands; UC - conservation sites excluding APAs; APA - environmental protection areas; ASR - rural settlements; PP - private property; UF - undesignated public forests; UL - areas with no registered land data. Military areas and quilombos (Afro-Brazilian communities) were not included in this chart because they are not numerically significant. Source: IPAM



The distribution of hotspots in the Amazon biome by land use category in each state of the region indicated that Amazonas, Acre, Mato Grosso, Pará, Rondônia and Roraima were the hardest hit states, while Amapá, Maranhão and Tocantins recorded the lowest number of outbreaks (Figure 4). It should be noted that the number of outbreaks in some states correspond not only to the amount of deforested land but also to the specific type of forests encountered there. Additionally, in some states the burning season typically occurs in the last three months of the year.

In Mato Grosso, the increase in hotspots was significant on private property (PP), while in Pará there was a notable increase in fires in undesignated forests (UF), APAs and conservation sites (CS). In Acre, Amazonas, Rondonia and Roraima states, which make up the advancing agricultural frontier, the number of hot spots increased in all land use categories. There was a marked increase in fires on rural settlements (RS), private property (PP), undesignated forests (UF) and unregistered lands (UL) in these states. Also worth emphasizing was the considerable increase in fires on conservation sites (US) in Acre and Rondônia and on indigenous lands (IL) in Roraima.

Amapá, Maranhão and Tocantins showed no increase in the number of hot spots compared to the same period over previous years, probably due to differences in when the burning season tends to take place, which future analyses should take into consideration.

61 **2196-4150**





Figure 4. Number of hotspots recorded by land use category from January 1 to August 29, 2019 (red bar) compared to the average over the same period (January to August) for the previous eight years (2011-2018; gray bar) in each Amazonian state. IL - indigenous lands; CS - conservation sites excluding APAs; APA - environmental protection areas; RS - rural settlements; PP - private property; UD - undesignated public forests; UL - areas with no registered land data. Military areas and quilombos (Afro-Brazilian communities) were not included in this chart because they are not numerically significant. Source: IPAM

61 **2196-4150**



Conclusion. The results of this study reinforce the conclusions of another technical memo IPAM published earlier this August which demonstrated that deforestation - not the severity of this year's dry season - drove a significant proportion of this year's fires and contributed to a particularly intense burning season. The primary indicator that this is the case is the high proportion of outbreaks on private property (PP) and in rural settlements (RS), likely due to forest clearing and land use change. The high proportion of fires on undesignated public forests (UF) also suggests the involvement of land grabbers and criminal interests tied to land speculation. Additionally, the results presented in this memo demonstrate that this process of deforestation followed by wildfires affects the majority of states in the region and a vast expanse of territory. These problems are not unique to any specific jurisdiction but appear to affect the whole region.

It is critical that state and federal governments continue their firefighting efforts in the short term to mitigate damage to the countryside. These efforts are also critical to preserving the public health of rural and urban inhabitants of the Amazon. Presidential decree 9992/19, released by the federal government on August 29, 2019, prohibits all burning of crops and forests for 60 days. If effective, the measure is expected to bring about a reduction in outbreaks over the next two months. However, it is crucial that both state and federal governments initiate a structured and long-term plan to combat illegal deforestation, which is responsible for much of the increase in fires and burning. Putting out fires without a long-term plan will not yield lasting results, and this year's situation would become commonplace in future dry periods. We must also warn that the combination of continued high deforestation rates and severe drought sometime in the future could result in an even more explosive situation than that of this year.

These results, which indicate that most outbreaks are concentrated on private property (PP), underline the urgency of seeking full implementation of environmental legislation such as the Brazilian Forest Code. Agencies responsible for enforcement must be strengthened and appreciated for their role in combating deforestation and illegal burning. As for land reform-established rural settlements (RS), which traditionally lack technical assistance and expertise, it will be critical to reinforce best practices and treat the locations where outbreaks have been concentrated separately from the rest. Such patterns usually indicate misuse of the property, including by third parties (Alencar et al. 2016).

Further, it will be necessary to resume public education campaigns and policies to prevent burning. Techniques that prevent fire from escaping from areas where its use is authorized should draw on past experiences counteracting "mutual" or "community" burning, which allows fires to spread over a larger area. This would help stop fires from accidentally reaching neighboring areas or preserved forests. In the long-run, however, the goal must be

61 **2109-4150** SCLN 211 bloco B sala 201 CEP 70863-520 Asa Norte Brasília|DF **ipam.org.br**

61 **2196-4150**



to free the Amazon from the use of fires for livestock and agricultural management. There are an abundance of well-known, alternative soil management practices and techniques that can and should be encouraged.

Finally, it is important to note that deforestation and fires in undesignated forests and unregistered lands, which account for 30% of all outbreaks, must be immediately investigated by law enforcement agencies, particularly the Federal Police. Removing trees from public forests is a grave offense against the public interest. Fire in these areas carries a high cost for governments and for all Brazilians. The Brazilian government must immediately execute an aggressive and well-organized command and control strategy in these regions.

References

Alencar, A.; Pereira, C.; Castro, I; Carsoso, A.; Souza, L.; Costa, R.; Bentes, A.;J.; Stella, O.; Azevedo, A.; Gomes, J.; Novaes, R. Desmatamento nos Assentamentos da Amazônia: histórico, tendências e oportunidades. IPAM, 2016.

Azevedo-Ramos, C.; e Moutinho, P. No man's land in the Brazilian Amazon: Could undesignated public forests slow Amazon deforestation? Land Use Policy, v. 73, pages 125-127, 2018.

Roman, C. ISA mostra Terras Indígenas mais afetadas por incêndios na Amazônia brasileira. Instituto Socioambiental, 2019. Accessed August 30, 2019.

Silvério, D; Silva, S.; Alencar, A.; e Moutinho, P. Amazônia em Chamas – nota técnica. Instituto de Pesquisa Ambiental da Amazônia, 2019.

Britaldo Soares-Filho, B; Moutinho, P.; Nepstad, D.; Andersond, A.; Rodrigues, H.; Garcia, R.; Dietzsch, L.; Merry, F; Bowman, M.; Hissa, L.; Silvestrini, R; e Maretti, C. Role of Brazilian Amazon protected areas in climate change mitigation. PNAS, v. 107, no. 24, pages 10821-10826, 2010.

Valdiones, A.; Silgueiro, V.; Bernasconi, P.; Thuault, A.; e Cardoso, B. Análise do Desmatamento na Amazônia Mato-grossense (Prodes 2018). Instituto Centro de Vida, 2018.

61 **2196-4150**

IPAM Amazônia

Annexes

Annex 1. Land use categories and geographic databases referenced in this technical memo.

Land use category	Geographic database used				
Private Property (PP)	Rural Environmental Registry - Brazilian Forest				
	Service, 2018, as well as the Land Use Management				
	System (SIGEF-Incra), 2018				
Rural Settlements (RS)	Incra, 2018				
Undesignated public forests (UF),	Brazilian Forest Service, 2018				
type B					
Indigenous lands (IL)	Funai, 2018				
Conservation Sites (CS) and	Ministry of the Environment, 2018.				
Environmental Protection Areas					
(APA)					
Quilombos (QI)	Fundação Palmares, 2018				
Military Areas (MI)	Brazilian Forest Service, 2018				
Unregistered lands (UL)	Territories not registered in any official government				
	database				

61 **2196-4150**



Annex 2. Absolute number of hotspots recorded between January 1 and August 29, 2019 compared to the average number of hotspots during the same period from 2011 and 2018. Results broken down by land use category in the Amazon biome, including the proportional increase in the number of outbreaks in 2019 compared to the average over 2011-2018. Source: IPAM, via AQUA satellite data.

Land use category	Number of hotspots 2019	% of hotspots by category in 2019	Average number of hotspots between 2011 and 2018	% increase in hotspots on average 2011-2018
IL	2,956	7%	2,006	47%
CS	3,255	7%	1,603	103%
ΑΡΑ	2,537	6%	1,053	141%
RS	8,212	18%	4,745	73%
РР	14,839	33%	9,412	58%
UF	8,885	20%	3,926	126%
UL	4,352	10%	2,868	52%
Other	220	0%	117	89%
TOTAL	45,256	100%	25,730	76%

LI - indigenous lands; CS - conservation sites excluding APAs; APA - environmental protection areas; RS - rural settlements; PP - private property; UF - undesignated public forests; UL - areas with no registered land data; others - military areas and quilombos (Afro-Brazilian communities).

61 **2196-4150**



Annex 3. Distribution of hotspots recorded between January 1 and August 29, 2019 by land use category and state. Source: IPAM, via AQUA satellite data.

	RO	AC	AM	RR	PA	AP	то	MA	MT	Total
UL	846	442	840	92	687	3	17	95	1330	4,352
UF	1681	575	2002	1347	2828	1	3	8	440	8,885
PP	1594	860	1903	900	2358	14	67	146	6997	14,839
RS	1038	709	2780	1237	1750	1	11	130	556	8,212
APA	0	8	42	21	2331	0	0	135	0	2,537
CS	1192	306	168	200	1244	5	0	7	133	3,255
IL	194	108	361	803	679	0	0	37	774	2,956
Others	5	0	2	11	178	1	0	23	0	220
Total	6,550	3,008	8,098	4,611	12,055	25	98	581	10,230	45,256

IL - indigenous lands; CS - conservation sites excluding APAs; APA - environmental protection areas; RS - rural settlements; PP - private property; UF - undesignated public forests; UL - areas with no registered land information; "Others" – military areas and quilombos (Afro-Brazilian communities).

61 **2196-4150**



Annex 4. Area of each land use category in the Amazon biome.

Land use category	Area in the biome Amazon (km²)		
Indigenous lands	1,061,656.13		
Conservation sites (excluding APAs)	880,544.95		
Private property	766,502.96		
Undesignated public forests	604,343.61		
Unregistered lands	357,272.61		
Rural Settlements	331,105.57		
Environmental protection areas (APAs)	164,956.76		
Military areas	26,731.84		
Quilombos (Afro-Brazilian communities)	5,614.45		
TOTAL	4,198,728.88		

61 **2196-4150**