

AMAZON ON FIRE DEFORESTATION AND FIRE IN INDIGENOUS LANDS

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Introduction

Indigenous peoples play a key role in forest conservation (Walker *et al.*, 2020). Year after year, the balance created by the traditional use of natural resources and the protection of territory, active or innate, limits transformation of the landscape and allows ecosystem services to be maintained.

Even the use of fire by certain Indigenous populations, especially those living in savanna vegetation areas (Falleiro *et al.*, 2016), to manage their production, hunting, and natural resources occurs on a small-scale (Falleiro, 2011; Welch *et al.*, 2013). It is false, therefore, that it is the Indigenous peoples who are responsible for the increase in fire observed throughout the Amazon region in 2019 and 2020.

However, even though a humid tropical forest such as the Amazon is not an environment where fire naturally spreads (Thonicke *et al.*, 2001), and fire use by Indigenous peoples is uncommon outside the transition area of the Amazon and Cerrado, and in the savannah (Falleiro *et al.*, 2016), forest fires have intensified in recent years (Brando *et al.*, 2020), driven mainly by land use change and climate change (Silvério *et al.*, 2013).

Highlights

- Indigenous lands are among the land categories with the least deforestation and fire in the Amazon;
- In 2020, only 3% of LIs are responsible for 70% of the deforestation and 50% of the fires, being tied to illegal activities by external agents;
- The area irregularly registered as private property within LIs increased 55% between 2016 and 2020, and the number of Rural Environmental Registry (CAR) records grew 75%;
- Hotspots in areas illegally registered through CAR within LIs increased 105% between 2016 and 2019; outside of such areas, the increase was 33%;
- Deforestation was 2.6 times higher and fire was 2.2 times higher within 5 km of illegal mining operations in the LIs with this activity, compared to areas outside this radius of influence.

The effect of fire is especially worrisome in the current context, as smoke aggravates the already critical scenario of the pandemic caused by the new coronavirus (Moutinho *et al.*, 2020), leading to respiratory diseases. The situation is even more complex when it comes to Indigenous peoples (Fellows *et al.*, 2020).

This technical note looks closely at the dynamics of deforestation and fire in Indigenous lands (LIs) in the Amazon between 2016 and 2020, to understand how the recent spike in these rates is reflected in these areas, and how illegal activities, such as land-grabbing, fuel this picture.

The results can support actions by government agencies that guarantee the integrity of these traditional territories and respect for the more than 430,000 Indigenous peoples (IBGE, 2010) in the region, who today face the negative consequences of actions by third parties in their communities (COIAB, 2020).

Method

Study area and data sources

To understand how illegal activities affect the lives of Indigenous peoples living in their traditional territories in the Brazilian Amazon, the records of the Rural Environmental Registry (CAR) which showed overlapping with Indigenous lands (LIs) were analyzed as an indication of land grabbing and illegal mining, as well as the occurrence of deforestation and hotspots in the LIs of the region.

The source of the CAR was the National Rural

Environmental Registry System (SICAR) database, extracted for February 2020 from the Brazilian Forest Service website in August 2020¹. The data on illegal mining were obtained for 2020 from the Amazon Socio-environmental Information Network (RAISG) in February 2021². The boundaries of the Indigenous lands were obtained from the National Indian Foundation (FUNAI), updated up to 2020³. The geographic limits of the other land categories, such as conservation units, including environmental protection areas, rural properties and settlements, undesignated public forests, and areas without registration information were used as described in Alencar *et al* (2020). For deforestation data, DETER alerts were extracted from the National Institute for Space Research (INPE) from 2016 to 2020⁴. For fire occurrence, hotspots were extracted from INPE's Burning and Forest Fire Monitoring Portal database in January 2021⁵.

Dynamics of deforestation and fire in Indigenous lands with overlapping CAR entries

The analysis of the dynamics of deforestation and fire in the Indigenous lands in relation to the CAR was done using the following steps: (1) the CAR database was treated so as to eliminate the overlap between records, without eliminating the scope of the registered area, thus avoiding duplicate results; (2) to calculate the area of CAR overlap in LIs, the overlaps between CAR records were also removed from the analysis, in addition to the overlaps of the CAR perimeter with conservation units and quilombola areas (CAR-PCT), therefore considering the overlaps between LIs and CAR settlement and individual CARs; (3)

1. CAR database available at <https://www.car.gov.br/publico/imoveis/index>.

2. RAISG database available at [em https://www.amazoniasocioambiental.org/pt-br/mapas/#!/download](https://www.amazoniasocioambiental.org/pt-br/mapas/#!/download).

3. LIs limits available at <http://www.funai.gov.br/index.php/shape>.

4. DETER database available at <http://terrabrasilis.dpi.inpe.br/downloads>.

5. Hotspots database available at <http://queimadas.dgi.inpe.br/queimadas/bd-queimadas>.



the database was cross-referenced with the limits of the Indigenous lands, thus indicating the areas within these lands which did and did not overlap with the CAR; (4) only the area of the CAR that overlapped with the Indigenous land was analyzed, that is, the records that exceeded the limits of the Indigenous land were cut out and removed from the analysis; and (5) these data were combined with the data on deforestation and hot spots from 2016 to 2020, in order to generate annual statistics of forest loss and fire for the Indigenous lands with and without CAR overlapping.

Deforestation and fire in LIs with the presence of illegal mining

The quantity of existing illegal mining was calculated for each Indigenous land. For all the mines overlapping with the Indigenous lands, a radius of five kilometers was applied, which served to define the area of direct influence of this activity on the registered deforestation. These areas were superimposed on deforestation and hotspots from 2016 to 2020, thus generating annual data for the activity's surrounding.

Results

Indigenous lands in the Amazon have historically had low rates of deforestation and fire rates among land tenure categories in the region. This is an indication that the allocation of these areas to traditional populations, as governed by the Brazilian Constitution, has a positive effect on environmental and climate preservation, with benefits that are shared by all Brazilians (Ricketts *et al.*, 2010; Soares-Filho *et al.*, 2010) in addition to their social, cultural and historical importance.

In 2019 and 2020, deforestation increased in the region (Silva Junior *et al.*, 2021), and LIs accounted for the smallest share: in 2019, they accounted for 5% of all deforestation; in 2020, the rate was 3% of the total (figures 1 and 2).

The limited use of fire is another indication of the level of protection that Indigenous lands offer to the forest. It is among the three land categories that recorded the fewest hotspots in 2019 (7% of the total) and 2020 (8%), behind only conservation units and environmental protection areas (APA), and far behind settlements, rural properties and undesignated public forests (figures 1 and 2).

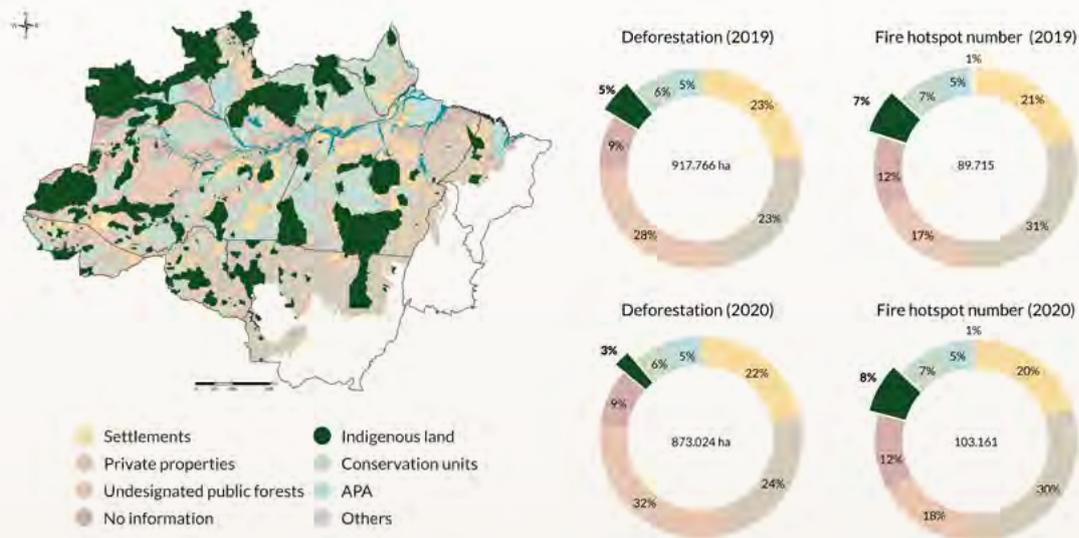


Figure 1. Percentage of deforestation and fire in Indigenous lands compared to other land categories for the years 2019 and 2020. *Source: IPAM, based on data from INPE.*

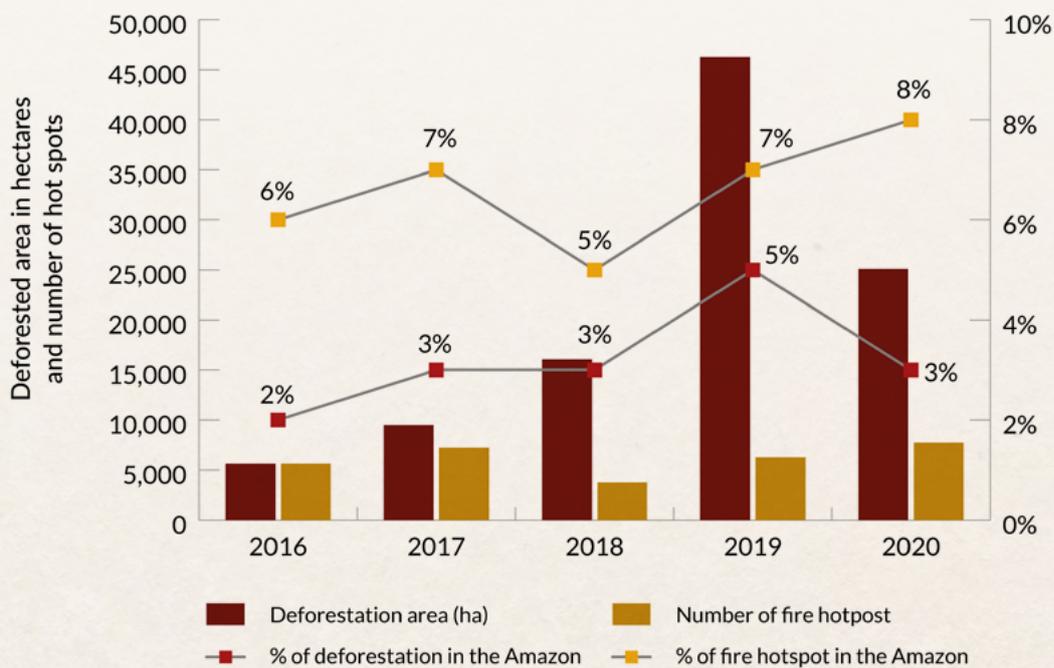


Figure 2. Annual distribution of deforestation and fire on Indigenous lands in the Amazon between 2016 and 2020 and proportion of deforestation and fire relative to the region's total. *Source: IPAM, based on data from INPE.*

On their own, these numbers would be sufficient to invalidate the mistaken idea that Indigenous peoples are responsible for the fires in the Amazon. However, a more detailed analysis of 2020 still shows that a good part of what happens in the Indigenous lands is not related to the way of life of the original populations, but rather to invasions and the improper use of their territories by third parties.

Of the 330 Indigenous lands analyzed, only ten of them, or 3%, were responsible for 70% of the deforestation and 51% of the fire in 2020 (figure 3 and 4). The Indigenous lands with the highest rates of deforestation are in the arc of deforestation, which runs from Rondônia, through Mato Grosso and up the central-western part of Pará, mainly in the Xingu basin (figure 3). Among the most affected territories are the Apyterewa, Trincheira Bacajá, Cachoeira Seca, Ituna/Itatá, and Kayapó Indigenous Lands, the five that recorded the most deforestation in 2020 (figure 3). These LIs are located in the region of the middle Xingu River, in Pará, and are undergoing invasions by external agents that range from small producers to large landowners; some even appear on the list of LIs with the most illegal mining.

The sub-basin of the Xingu, the north of Roraima, and the border between Pará and Amazonas contain the LIs with the highest number of hotspots in 2020 (figure 4). Many of these are located in or contain large areas of savanna vegetation, which enable the spread of fire (Pivello, 2011), an indication that helps to explain why the LIs with more fire do not necessarily have more deforestation.

Among the LIs that presented a high number of hotspots and that have large patches of savanna vegetation are Raposa Serra do Sol and São Marcos, in Roraima, with 83% savanna. The Indigenous Parks of Tumucumaque (AP, PA) and Xingu (MT), and the Kayapó (PA), Munduruku (PA) and Capoto/Jarina (PA) Indigenous lands also have large areas of savanna vegetation in their center, varying from 4% to 15% of these territories and being where fire is usually concentrated.

The Apyterewa (PA), Andirá-Maraú (AM, PA) and Cachoeira Seca (PA) Indigenous lands, which complete the list of the ten territories with the highest number of hotspots in 2020, do not have significant areas of non-forested vegetation, and the fire inside them is mainly related to deforestation.

6. Fire is present in the savanna vegetation formation (Mistry et al., 2005), but land use and climate changes are increasing its intensity and impact (Nóbrega et al., 2019). The Indigenous peoples management of the areas is crucial to maintain their traditional way of living, but also for the ecosystem balance in the region (Balee, 2006).



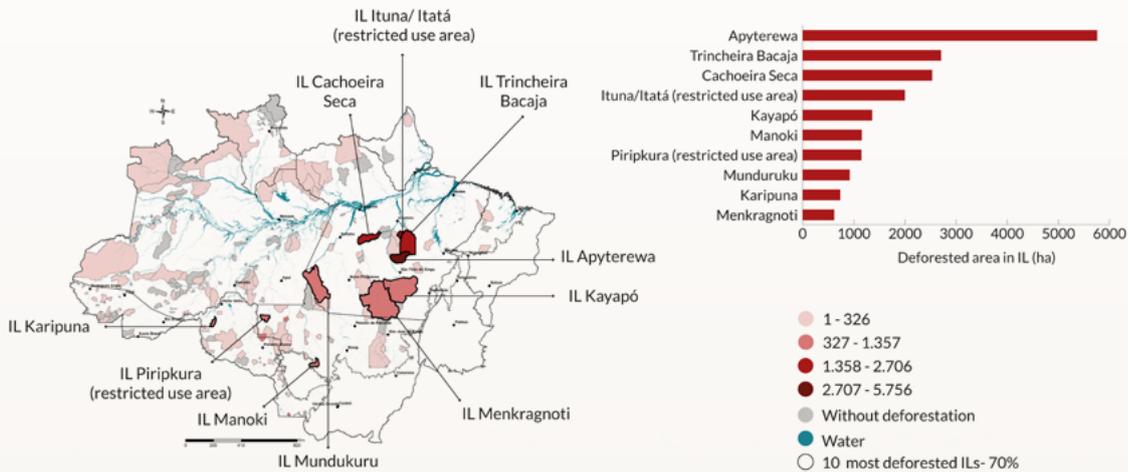


Figure 3. Indigenous lands with largest deforested area (ha) in 2020. Source: IPAM, based on data from INPE.

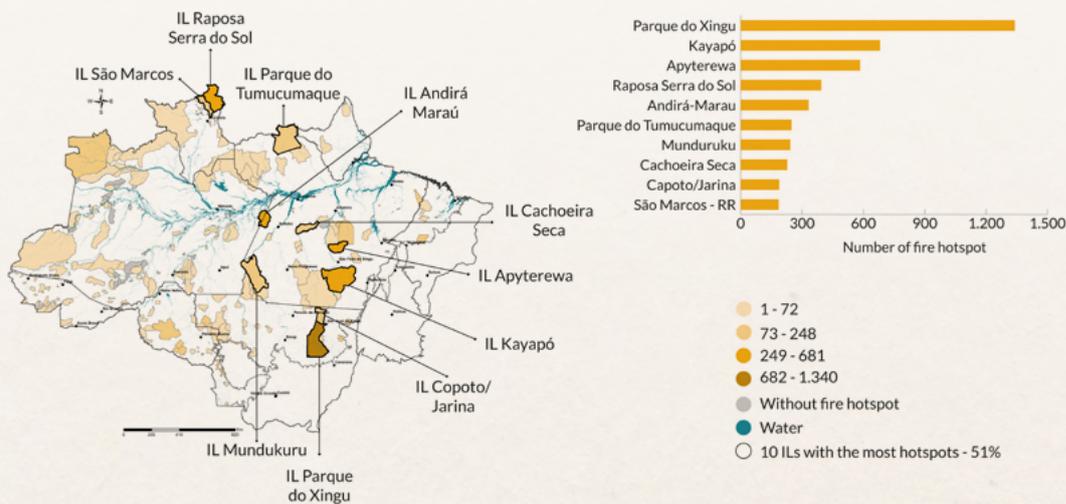


Figure 4. Indigenous lands with the most hotspots in 2020. Source: IPAM, based on data from INPE.

Several vectors can explain the distribution and concentration of deforestation and fire in the Indigenous lands of the Amazon. Some of them indicate the pressure on Indigenous lands, with illegal occupation and land grabbing.

The CAR, a self-reporting registry of rural properties, represents one of these important indicators of pressure. **Between 2016 and 2020, the area improperly registered within Indigenous lands in the Amazon increased by 55%:** if before there were about 2.3 million hectares declared as private property in lands designated for Indigenous peoples, in five years this area jumped to 3.57 million ha (figure 5A) -

almost six times the size of Brazil's Federal District. **The number of registrations increased 75% in the same period,** from 3,517 to 6,170 (figure 5B).

Only 3% of the CAR's overlap with LIs occurred in settlement projects. In 2020, the vast majority (75%) of CARs overlapping were small properties, with less than 100 ha, which together account for only 2.24% of the irregularly registered area. Large properties, with more than 1,000 ha, accounted for 7.11% of the registrations, or 439 records, but together they represented 88% of the overlapping of CARs with LIs, around 3.15 million ha (figures 5A and 5B) - an area larger than that of the State of Sergipe.

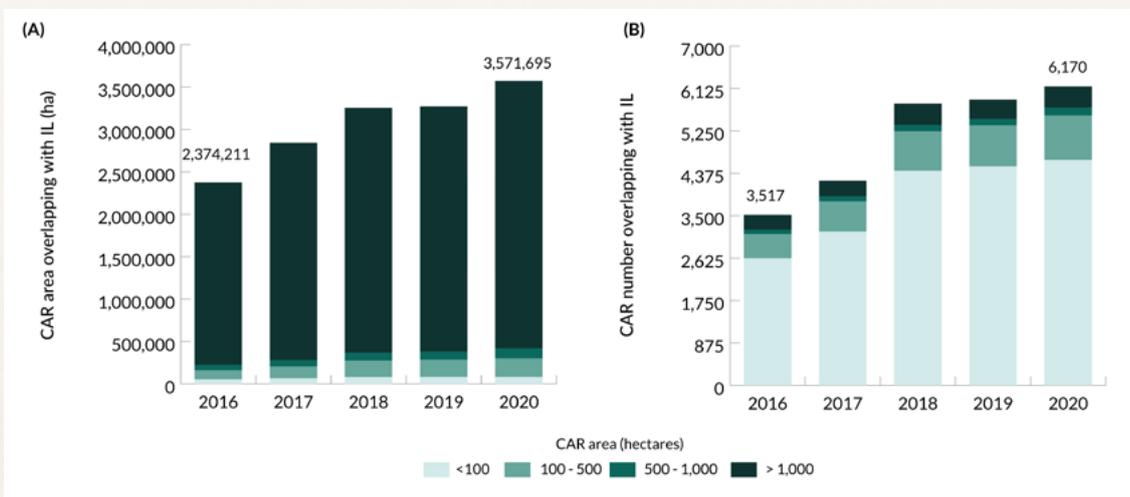


Figure 5. Area and quantity of CAR entries registered in overlap with Amazon Indigenous lands from 2016 to 2020. Source: IPAM, based on data from SICAR/SFB.

Pará, Mato Grosso and Amazonas are the States most affected by the improper registration of CARs (figure 6). The illegal occupation assumes very high proportions in some cases. Ituna/Itatá (Pará State) has 94% of its area with overlapping CARs and is among the Indigenous lands that

suffered the most deforestation in 2020. It is the only one among the ten most affected that is under study, with restricted land use, which reinforces the need to advance in the approval process. But, besides this extreme case, other Indigenous lands also present many overlapping

CARs, despite being declared or approved territories, as is the case of Seruini/Mariene (Amazonas), Manoki (Mato Grosso), Riozinho (Amazonas), and Kawahiva do Rio Pardo (Mato Grosso), which also presented extensive areas that overlap with the CAR

register (> 43%) (table 1). Trombetas/Mapuera (Amazonas, Pará and Roraima), in the northern channel of the Amazon River, and Apiaká do Pontal and Isolados (Mato Grosso) stand out for the size of the area registered as private.

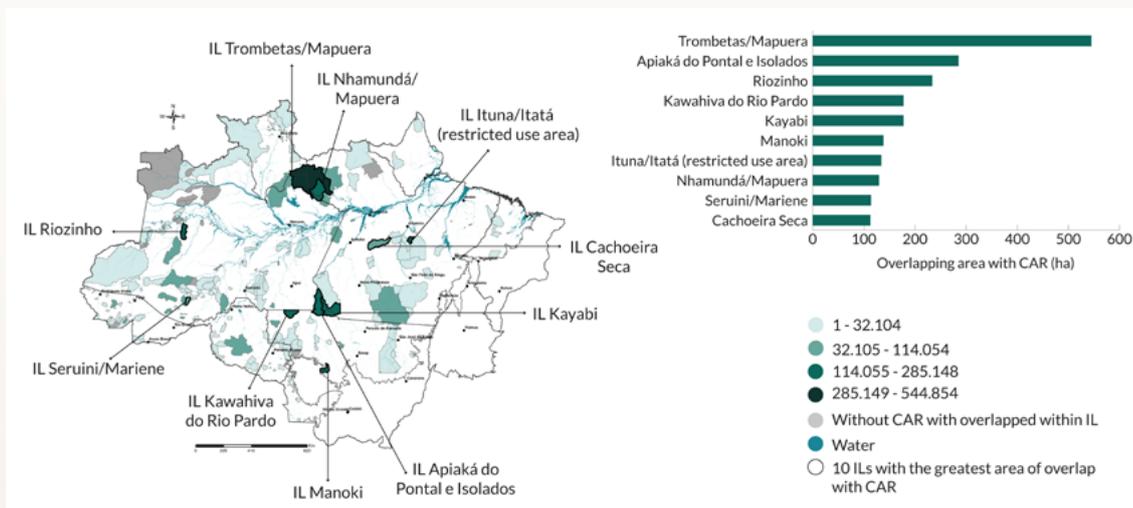


Figure 6. Indigenous lands with largest area of overlap with CAR entries in 2020. *Source: IPAM, based on SICAR/SFB data.*

Table 1. Characteristics of the 10 Indigenous lands in the Amazon with the largest area of CAR overlap in 2020. *Source: IPAM, based on data from SICAR/SFB, INPE and Funai.*

Ranking	LI Name	State	Status	LI area (in ha)	Área of CAR overlap (in ha)	% of LI area overlapping with CAR
1	Trombetas/Mapuera	AM, PA, RR	Legalized	3,970,078	544,854	14%
2	Apiaká do Pontal Isolados	MT	Delimited	982,753	284,416	29%
3	Riozinho	AM	Declared	366,167	231,777	63%
4	Kayabi	MT, PA	Approved	1,053,923	177,414	17%
5	Kawahiva do Rio Pardo	MT	Declared	409,762	176,226	43%
6	Manoki	MT	Declared	250,706	138,322	55%
7	Ituna/Itatá	PA	Under study	142,527	134,112	94%
8	Nhamundá/Mapuera	AM, PA	Legalized	1,049,011	129,806	12%
9	Seruini/ Mariene	AM	Legalized	144,886	114,018	79%
10	Cachoeira Seca	PA	Legalized	732,447	109,569	15%

The relationship between land misappropriation and deforestation is clear, and has intensified in the last two years. The percentage of deforestation in areas with CAR inside the LIs reached a peak in 2019, accounting for 41% of all land that was cleared on Indigenous lands (figure 7A) - between 2016 and 2019, the deforestation rate grew by 1,169% in the overlapping areas, while in the external areas without CAR, the increase was 651%. In 2020, the rate of deforestation in CAR areas fell to 23% of all the deforestation recorded in the LIs with overlap, but it is still higher than in previous years.

Some of the LIs with more CAR overlap area also emerged on the list of Indigenous lands with the highest deforestation rate in 2020, such as Ituna/Itatá and Cachoeira Seca, both in Pará (figure 3).

Regarding fire, nine percent of the hotspots recorded in the Indigenous lands happened in areas with CAR overlap in 2019, and six

percent in 2020. The rates are similar to the other three years analyzed (4% in 2016, 6% in 2017, and 9% in 2018), indicating that fire in LIs depends on factors other than deforestation, such as external ignition sources entering the territories, large areas of savanna vegetation in some of them, as mentioned previously, and very dry weather in certain years, which can cause fire to spread, even through the use in Indigenous productive practices, if there are not very strict control measures.

Despite this low average, the hotspots within the CAR overlap area increased 105% between 2016 and 2020, while the average increase for the rest of the Indigenous lands was 3.2 times lower, with a 33% growth between these two years. These results corroborate the argument that the CAR, despite having been created as a tool for environmental regularization, has been widely used to justify illegal activities, leading to forest clearing in the Indigenous lands.

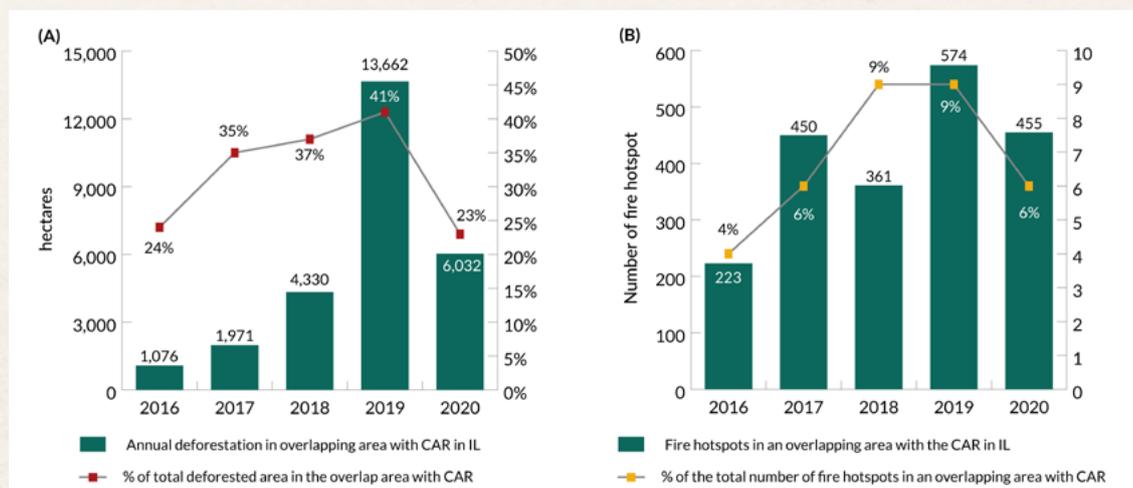


Figure 7. Dynamics of deforestation and fire in LIs between 2016 and 2020 in the area of overlap with the CAR, and (B) percentage of deforestation and fire in LIs registered in the area of overlap with the CAR. *Source: IPAM, based on data from INPE and SICAR/SFB.*

Deforestation and fire in areas near illegal mines in LIs

The occurrence of illegal mining also represents an important pressure vector that can result in deforestation and fire. Some of the Indigenous territories stand out for the historical presence of mining activities, as is the case of the Yanomami Indigenous Land, between Roraima and Amazonas (Ramos, 1993), and the Raposa

Serra do Sol IL, in Roraima (Voivodic *et al.*, 2018). The three neighboring basins of the Xingu (Schwartzman *et al.*, 2013), Tapajós and Madeira are also marked by the presence of illegal mining (Figure 8). In these basins, it is important to emphasize the role of mining, especially of gold, in the Kayapó, Baú, Munduruku, Apyterewa, and Trincheira Bacajá LIs, all in Pará. The last two are among the ten LIs with the most fire and deforestation in 2020 (figures 3 and 4).

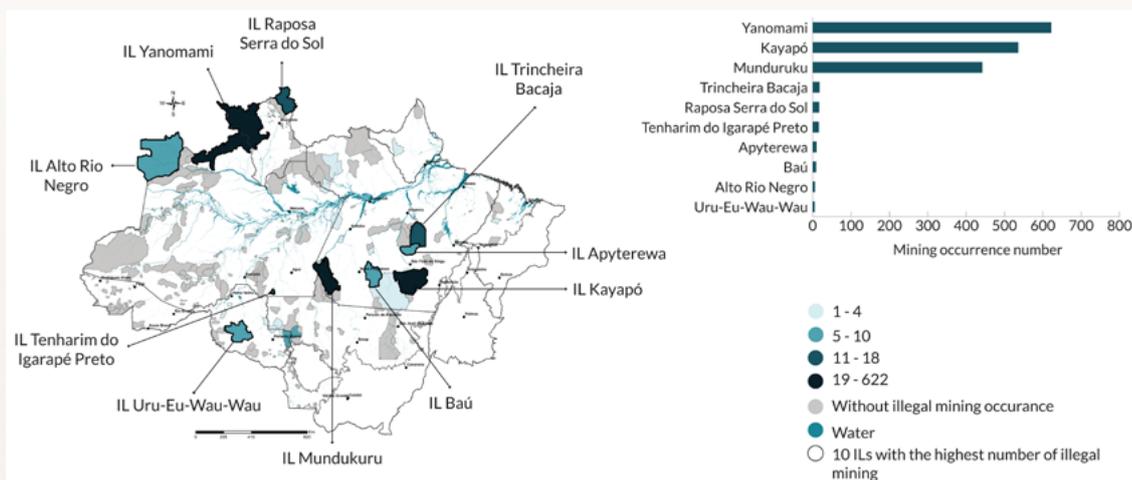


Figure 8. Indigenous lands with highest rates of illegal mining in 2020. *Source: IPAM, based on RAISG data.*

In the area of influence of illegal mining, defined by a radius of five km from its central point, deforestation and the number of hotspots were higher overall in 2019 and 2020 than in the other years analyzed. **In the case of deforestation, the area of forest cleared in the vicinity of mines within Indigenous lands was on average 142% greater in 2019/2020 than in the first three years of the analysis (2016 to 2018).** The number of hotspots was also higher in 2019

and 2020 compared to the other years - with the exception of 2017, a year with many fires in the Amazon caused by extreme drought (Brando *et al.* 2020) (figure 9). **Compared to areas outside the area of influence of illegal mining, in the LIs that have illegal mining, deforestation and fire were 2.6 times and 2.2 times higher, respectively, within 5 km, which shows the concentrated impact of this illegal activity.**

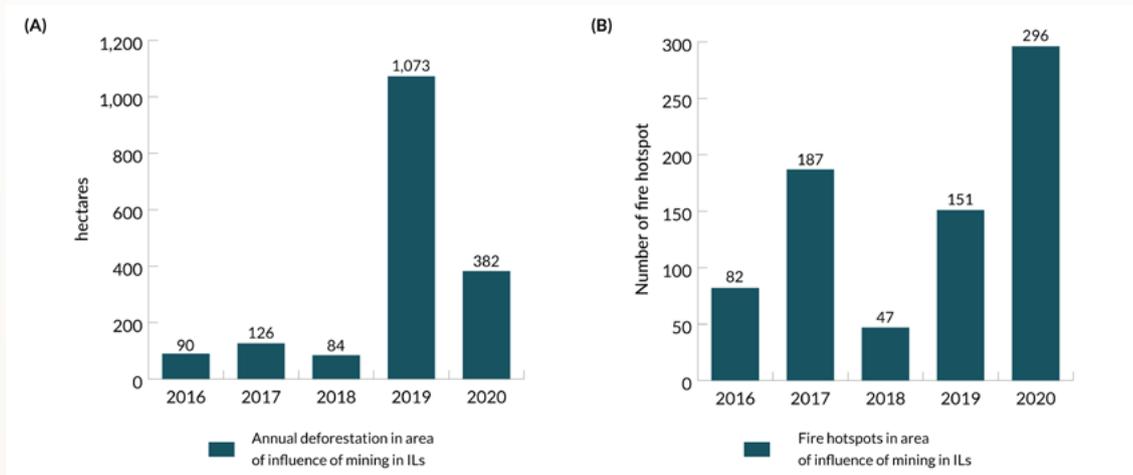


Figure 9. (A) Area deforested and (B) number of hotspots in the area of influence of the mines (5km) between 2016 and 2020. *Source: IPAM, based on data from INPE and RAISG.*

Discussion

The invasion of Indigenous lands in the Amazon has intensified and, with it, increased deforestation and fire. If before the correct destination of these territories to the original peoples brought at its core the recognition of their fundamental rights over the lands they traditionally occupied, which translates into environmental conservation, today the illegal occupation of these lands and other illegal activities threaten their integrity and the safety of those who live there.

This is a movement observed in the majority of the Indigenous lands in the region (83%) - of the 330 analyzed in this technical note, 275 have unauthorized CARs within them. In some cases, the abuse is overt and clear, as is the case for lands that had most of their areas allotted in the National Rural Environmental Registry System by private individuals, as if they were “no man’s land”, or for the 439 CARs with more than 1,000 hectares each, which irregularly take for

themselves almost 3 million hectares.

The weakening of Indigenous policies and inspection and control bodies in the last two years stimulates invasions, as well as deforestation and mining. An example was the attempt to split FUNAI between the Ministry of Agriculture and the Ministry of Women, Family and Human Rights, an action that raised harsh criticism and resulted in the retreat of the Indigenous ministry to the Ministry of Justice. Another unremedied blow is the budget reduction of the Indigenous body, which in 2019 lost 23% of its budget compared to 2013, an amount that already represented a minuscule 0.02% of the Union’s budget (INESC, 2020).

The environmental agenda has also been dismantled in recent years. Part of the enforcement and control functions of the Ministry of Environment were transferred to the Ministry of Agriculture (Fearnside, 2019; Ferrante and Fearnside, 2019); the resources allocated to the area were also

shrunk (INESC, 2020). These changes come in addition to government rhetoric that attempts to discredit national research institutions that are fundamental to combating deforestation in the Amazon region (Barretto Filho, 2020).

The publicized intention of the federal government to no longer approve Indigenous lands encouraged illegal activities and occupations, as happened with the Ituna/Itatá IT, which has more than 90% of its area covered by CAR entries in an irregular manner and appears as one of the most deforested LIs in recent years.

In addition to these initiatives by the executive branch, a series of legislative maneuvers that confront the traditional use of Indigenous lands have been encouraged, such as Bill 191, from 2020, which seeks to regulate the exploitation of mineral, hydric and organic resources in Indigenous areas. The combination of factors has led even ratified Indigenous lands, such as Cachoeira Seca and Apyterewa, also in Pará, to suffer intense external pressure.

It is fundamental to remember that, in addition to deforestation and fire, the invasions also threaten the health and safety of the Indigenous populations (Fellows *et al.*, 2021, in press) by bringing diseases into these regions, including the new coronavirus (CIMI, 2020).

In order for these territories to continue to fulfill their function as home to Indigenous peoples in the Amazon and as important barriers against deforestation and fire (FAO & FILAC, 2021; Nepstad *et al.*, 2006; Walker

et al., 2020), and for these territories to remain intact so as to guarantee the way of life of Indigenous peoples, it is essential that invasions be quickly and efficiently curbed. In this context, some actions are urgent, among them:

- **Suspension and annulment of all CARs on Indigenous lands**, including the banning of new registrations in these territories, with wide dissemination of these measures to society;

- **Respect for the International Labor Organization (ILO) Convention 169**, highlighting the rights of Indigenous peoples to free, advanced and informed consultation regarding the use, management, and conservation of their territories;

- **Removal of miners from Indigenous lands**, socio-environmental recovery of the areas affected by mining activity and annulment of PL 191, from 2020, which aims to open the Indigenous lands to any type of economic exploitation;

- **Creation of a buffer zone** of 10 kilometers between Indigenous lands and areas of mining exploration or high-impact enterprises;

- **Technical and financial strengthening of IBAMA and the Federal Police**, including destruction of material, in order to better combat new illegal mines, remove invaders and curb illegal logging;

- **Support for Indigenous fire brigades** and prioritization of the actions of fire prevention brigades (such as Prevfogo) in Indigenous

territories – such actions should be adapted to the diverse cultural realities of the region;

- **Creation of a specific group that represses threats to the Indigenous lands**, with representatives from the Indigenous organizations and FUNAI, IBAMA, Federal Police and Federal Public Ministry in an equal manner; and

- **Prohibition of any illegal activity or the installation of high-impact enterprises** in areas where autonomous peoples live in voluntary isolation.

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