XINGU UNDER BOLSONARO

Xingu River basin deforestation assessment (2018-2020)

Near real-time deforestation radar monitoring system in the Xingu river basin (Sirad X)

'Observatório de Olho no Xingu'
of the Xingu + Network

REDE XINGU+

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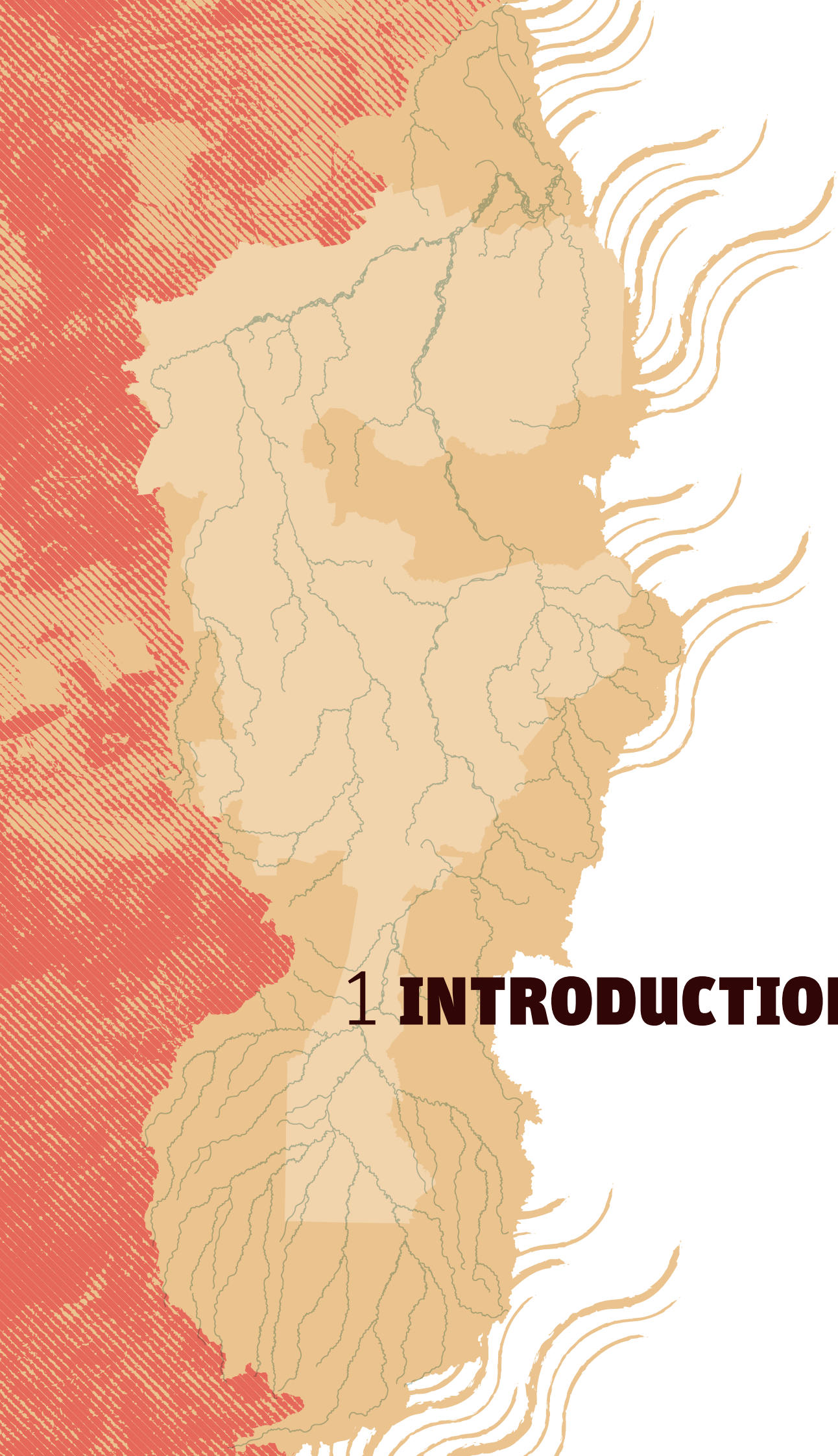


1 INTRODUCTION

1.1 **Xingu under Bolsonaro**

The Indigenous Lands and Conservation Unit of the Xingu River basin form a great corridor of protected areas, today one of the most effective barriers against deforestation in the Brazilian Amazon. While the territory, located between the states of Pará and Mato Grosso, has wide socio-environmental diversity, it is also one of the epicenters of illegal deforestation in the Amazon.

The results of three years of Sirad X monitoring, the near real-time deforestation radar monitoring system of the Xingu+ Network, reveal an intensification of conflicts and disputes over land and natural resources in the Protected Areas of the Xingu River Basin. The most critical cases were summarized in this Technical Note that systematizes the main results and describes the dynamics of deforestation in the region.

From the escalation of land grabbing in the Apyterewa and Trincheira Bacajá Indigenous Lands, where the invaders threaten to hunt [sic] the Indians, to the coordinated action of farmers who set fire to the forest, and the illegal online land allotment in Conservation Units, the state of affairs in the Xingu River Basin is devastating. From 2018 to 2020, period which coincides with the election and first half of the term of President Bolsonaro, 513.5 thousand hectares of land were deforested in the Xingu River basin. The deforested area is equivalent to almost five times the size of the municipality of Belém (PA), at a rate of 149 trees felled every minute.

Over the last three years, the advance of deforestation on two fronts, Novo Progresso and São Félix do Xingu, threatens the remaining forest of the Iriri State Forest, in Pará. Far from being an isolated fact, this could bring an end to the connectivity of the protected areas corridor of the Xingu River basin, further weakening the territory, today, the last barrier between the new arc of deforestation and the Eastern Amazon.

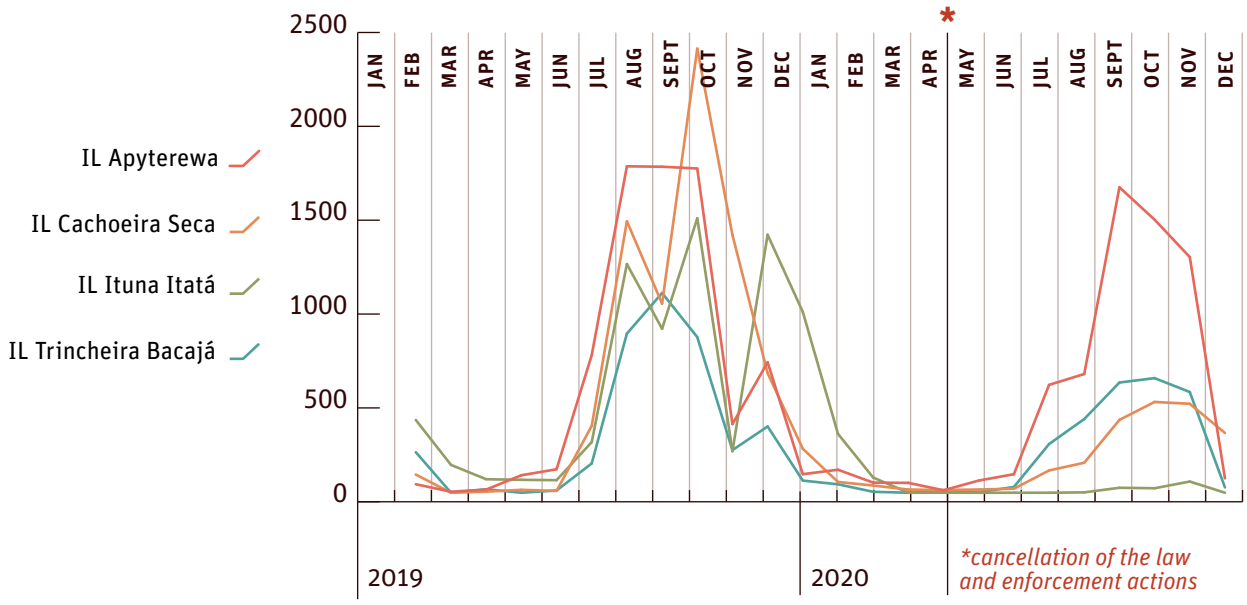
The National Institute for Space Research (INPE) estimates that 17% of the original extent of the Amazon has already been deforested, bringing the forest closer to a tipping point, calculated based on the loss of approximately 20% of the biome's vegetation, upon which degradation will reach a limit after which the forest will no longer be able to exercise its function of maintaining the climate, leading to a chain reaction in which the vegetation will become increasingly dry and vulnerable. The destruction of the Xingu Corridor can accelerate this process, and therefore its protection is fundamental for safeguarding the forest, its peoples, and the climate of the planet.

1.2 **Boycott to Protected Areas**

The advance of deforestation, land grabbing and illegal mining has placed the Apyterewa, Cachoeira Seca, Ituna Itatá and Trincheira Bacajá Indigenous Lands at the top of the ranking of the most deforested in the Amazon in 2020.

Operations carried out by Ibama between November 2019 and April 2020 in the Ituna Itatá, Cachoeira Seca, Trincheira Bacajá and Apyterewa Indigenous Lands managed to reduce deforestation. In March and April 2020, the Apyterewa, Trincheira Bacajá and Cachoeira Seca ILs decreased by 40%, 49% and 47%, respectively, compared to the same period in 2019. In Ituna Itatá, deforestation was zeroed after the actions of oversight.

In May 2020, however, deforestation at the Apyterewa and Trincheira Bacajá ILs exploded after the cancellation, not yet justified, of the inspection actions of the Brazilian Institute of the Environment and Renewable Natural Resources (Ibama) and the exoneration of the responsible inspectors.

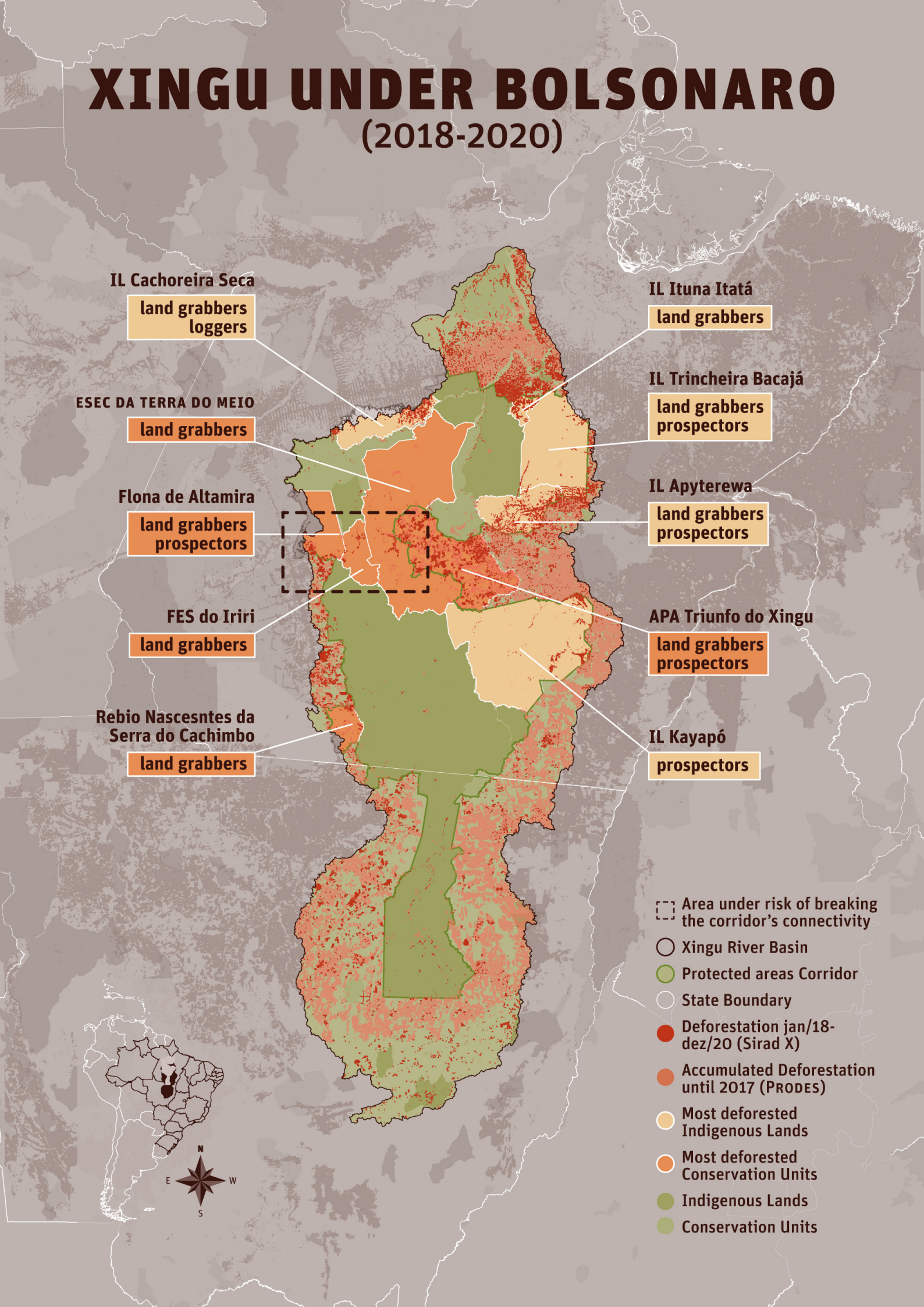


From 3 hectares deforested in May in Trincheira Bacajá, deforestation jumped to 411 hectares in August, an increase of 12,980%, in the following months, between September and December, another 1,847 ha were deforested in this IL. At Apyterewa, deforestation increased by 393% in the month following the suspension of operations, and continued to grow: between July and December, 5.8 thousand hectares were deforested, 1,287% or almost 14 times more than the total deforested between January and June.

The coordinators of the actions were exonerated by the Minister of the Environment, Ricardo Salles, and by the president of the environmental agency, Eduardo Bim, just two weeks after the operation carried out to combat illegal mining in the Amazon, in April. At the beginning of the same month, the then director of Environmental Protection, Olivaldi Azevedo, had been exonerated after the repercussion of a report carried by the program "Fantástico", on TV Globo (the most important TV channel in Brazil), about the action against illegal gold miners in Pará and to expose the way in which land grabbing in the region involves local and national politicians, aligned with the President of the Republic.

In July, the Ibama board of directors asked the internal affairs department to investigate the action of civil servants in April and May against illegal mining and land grabbing in Indigenous Lands in Pará. The request was made after criticisms expressed by mayors of the region, senators and even President Jair Bolsonaro (without a party) to the performance of the civil servants.

XINGU UNDER BOLSONARO
(2018-2020)



1.3 Protected Areas Corridor of The Xingu River Basin: diversity, water, and a shield against destruction

The Xingu River basin comprises an area of approximately 53 million hectares in the states of Pará and Mato Grosso and is home to a wide diversity of peoples and ecosystems, from dense forests and floodplains in the Amazon biome to areas of typical Cerrado vegetation. The basin contains one of the largest continuous mosaics of Indigenous Lands and Conservation Units on the planet: the Xingu Protected Areas Corridor.

With 23 Indigenous Lands and 9 Conservation Units, the corridor is considered one of the regions with greatest socio-biodiversity in the world, home to 26 indigenous peoples and hundreds of riparian communities. For centuries these traditional peoples have managed and protected their forests, which house a wide variety of plant and animal species, some of which are still unknown to science. With an area of more than 26.5 million hectares, the corridor has a crucial role in protecting the Amazon and the climate.

The region provides invaluable environmental services to the planet, from protecting rivers and springs to regulating the climate locally, regionally, and globally. Its vast forests represent one of the largest and most stable carbon reserves in the eastern Amazon, storing approximately 16 billion[1] tons of CO2. It is estimated that its trees release into the atmosphere, through evapotranspiration and the production of volatile organic compounds that act as cloud condensation nuclei, from 880 million to 1 billion 1 tons of water per day, a volume similar to what the Xingu River discharges into the Amazon River during the same period. Aside from maintaining humidity and temperature locally, this water contributes to the maintenance of the forest itself. It is transported by the so-called “flying rivers” to the central-west, southeast, and south regions of Brazil, providing rain for cities and rural areas, essential for the maintenance of agricultural activity.

1. ***Hercowitz 2015. Study for the measurement and valuation of socio-environmental services in the Xingu corridor, Instituto Socioambiental.***

1.4 Seeing through the clouds: the Sirad X monitoring system

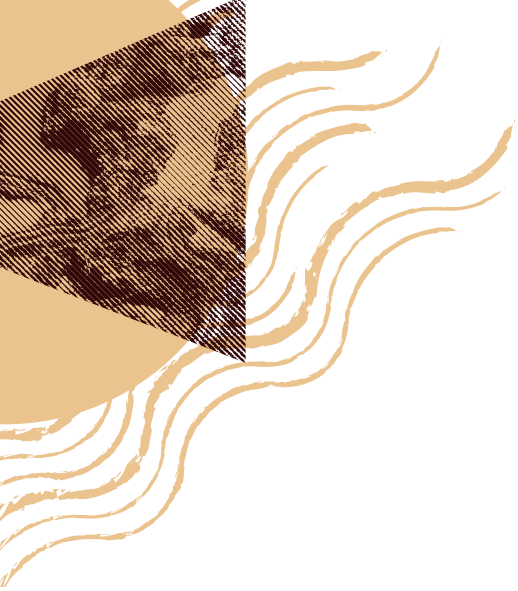
Since January 2018, the team in charge of Sirad X, the monitoring system of the Xingu+ Network, has been closely monitoring the evolution of deforestation in the Xingu River basin, particularly in the Indigenous Lands and Conservation Units that form the Xingu Corridor. It was three years of monitoring the territory by

means of optical satellite and radar imagery, technology that facilitates monitoring even during the rainy months in the basin, when the sky is overcast.

The development of this n**ear real-time deforestation radar monitoring system (Sirad)** came about in 2017, when the European Space Agency (ESA) started to acquire and share, free of charge, information about the Brazilian Amazon using the Sentinel-1 satellite. This satellite carries an orbital radar system that allows it 'to see' through clouds and generate high quality images. Traditional monitoring methods, such as the Landsat and MODIS optical sensors, use passive sensors that depend on sunlight reflection to capture images. When there are barriers, such as clouds, it is not possible to detect deforestation.

Sirad consists of a series of algorithms that process information from the Sentinel-1 satellite. It operates on a platform called Google Earth Engine (GEE), which quickly processes large amounts of information. A team of analysts carefully examines images of the Xingu River basin produced looking for visible signs of anomalies. Each deforestation polygon is evaluated according to its proximity to other areas of degradation and to the region's history, and, if necessary, people who know the location well are contacted to confirm deforestation. Field knowledge and ongoing communication with local indigenous and riparian partner organizations have been instrumental in validating the data produced and consolidated over the course of the last three years.

Every two months, the Xingu+ Network team prepare a bulletin with the main monitoring results. In each issue, data concerning the deforestation detected or recorded during the period analyzed and the details of the situation in critical areas of the Xingu River basin are published. [Access all issues of the Sirad X bulletin here]



2 MAIN RESULTS

Between 2018 and 2020, at least 513.5 thousand hectares of deforestation were detected in the Xingu River basin, which is equivalent to almost five times the size of the municipality of Belém, in the state of Pará. Of this total, 493.2 thousand hectares (96%) were deforested within the Amazon biome, **at an average rate of 149 trees felled every minute**.

DEFORESTATION IN THE XINGU BASIN BY PROTECTED AREA

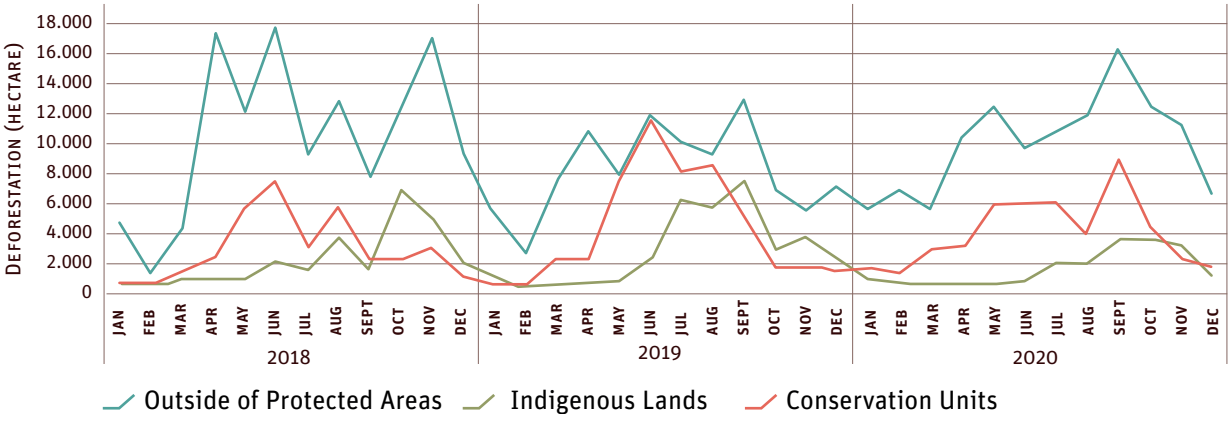


Figure 1: Graph of the distribution of deforestation per Protected Area in the Xingu River basin between January 2018 and December 2020.

Over the last three years, deforestation within Protected Areas has varied from 30% in 2018 to 34% in 2020, while destruction outside these areas has decreased by 7%. This process reveals the displacement of deforestation to indigenous lands and lands of traditional populations, a trend that became evident in 2019, Bolsonaro's first year in office, when there was a 38% increase in deforestation within the basin's Indigenous Lands (IL) and a 50% increase within the basin's Conservation Units (CU). These rates reflect the expectation, in that year, of the relaxation of environmental laws and the reduced funding of policies to combat deforestation, as well as a drastic reduction in inspection.

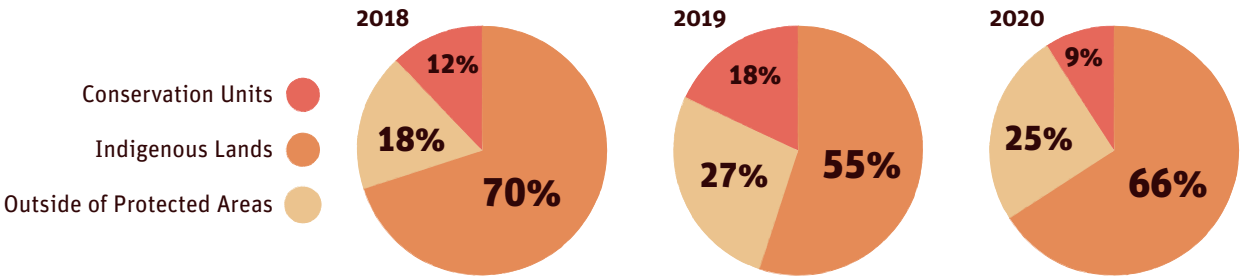
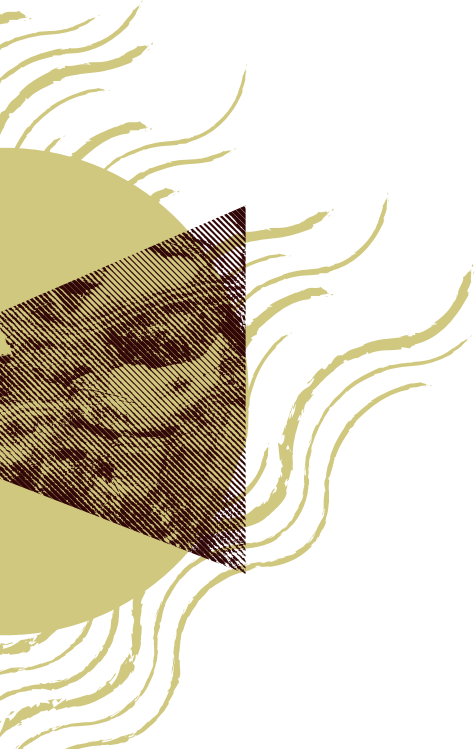


Figure 2: Proportion of deforestation outside and inside legally protected areas.

In 2020, the situation changed. Deforestation within Conservation Units and Indigenous Lands decreased by 6% and 49%, respectively, while it increased by 23% in adjacent areas. The reduction in deforestation within the Protected Areas occurred after a concentrated inspection campaign by IBAMA in Indigenous Lands in critical condition within the basin, such as the Cachoeira Seca and Ituna Itatá Indigenous Lands, whose rates dropped sharply in the beginning of 2020.



3 PARÁ

The basin's region located within the borders of the state of Pará stood out for its high deforestation rates during this three-year period, with 374.3 thousand hectares of deforestation, 73% of the total detected in the period. In this state, deforestation increased by 16% in 2019, a year marked by an intensification of conflicts and disputes over land in protected areas.

DEFORESTATION IN THE XINGU BASIN BY STATE

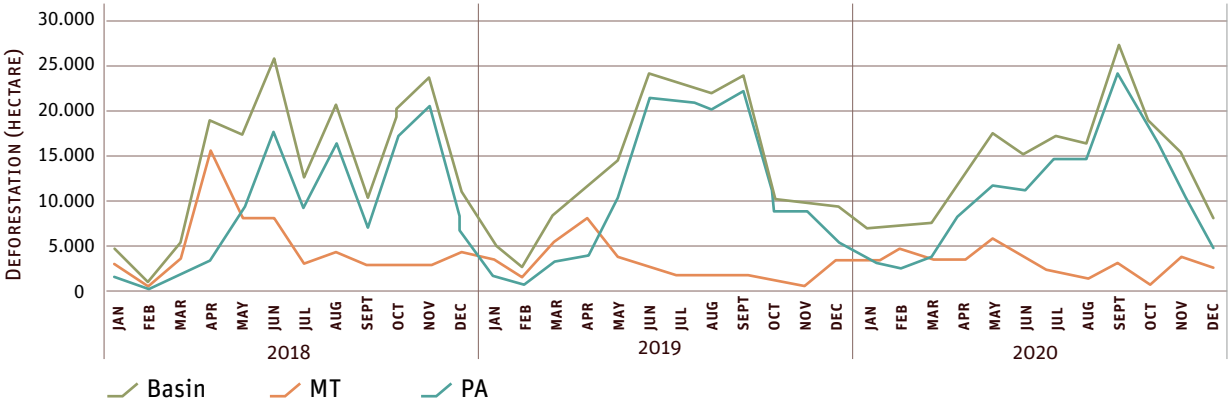


Figure 3: Graph of the distribution of deforestation per state in the Xingu River basin between January 2018 and December 2020.

Altamira and São Félix do Xingu concentrated 70% of the deforestation in the region of the Xingu River basin located within the borders of the state of Pará. Altamira, ranked first as the most deforested municipality in Pará, comprises some of the state's most intensely deforested areas. Located in the region of influence of major infrastructure works such as federal highways BR-163 and BR-230 (Trans-Amazonian Highway), and also the Belo Monte Hydroelectric Power Plant, the municipality comprises the western part of the environmental protection area APA Triunfo do Xingu, the most deforested Conservation Unit in Brazil.

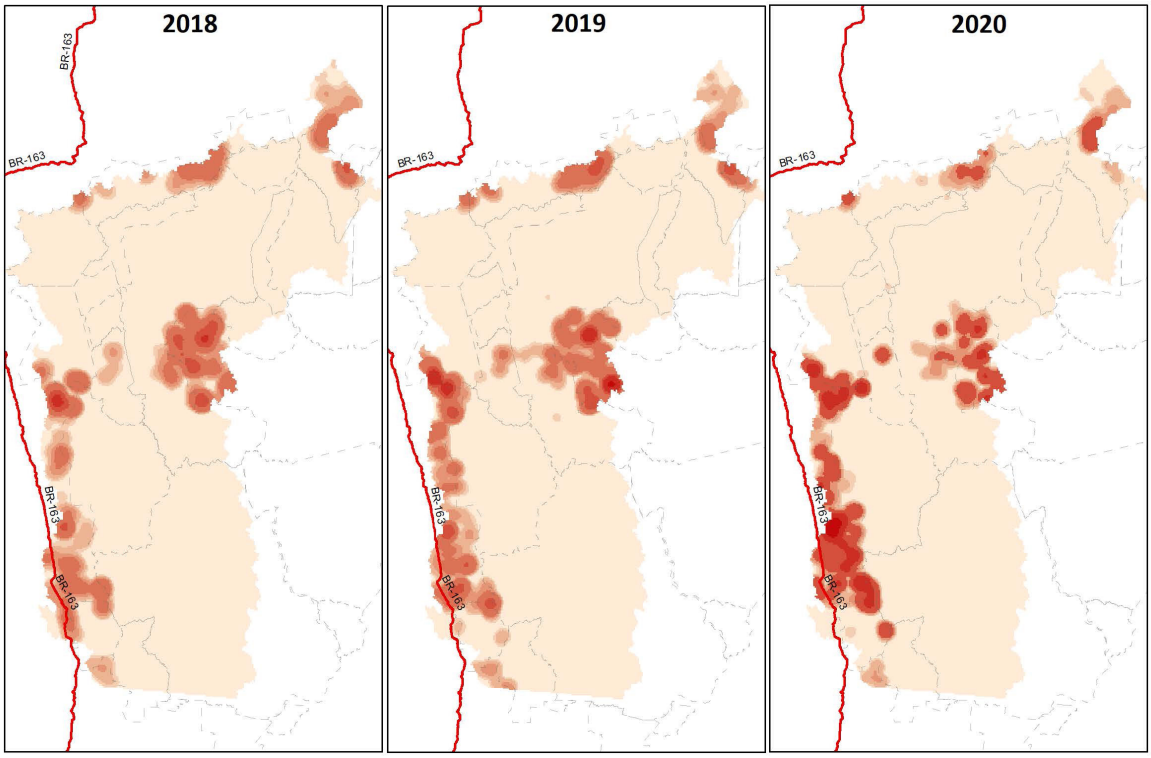


Figure 4: Density map of the deforestation in the municipality of Altamira over the three years of Sirad X monitoring.

These enterprises serve as drivers of deforestation in the Protected Areas Corridor of the Xingu River basin. Between 2018 and 2020, deforestation in the municipality of Altamira only increased: more than 150 thousand hectares were deforested during the period. The southwest of the municipality, in the region of the district Castelo dos Sonhos, concentrated the greatest intensification of deforestation, driven by the completion of the asphalt paving of the last stretch of BR-163 in early 2020.

MOST DEFORESTED MUNICIPALITIES IN THE PARÁ PORTION OF THE XINGU BASIN

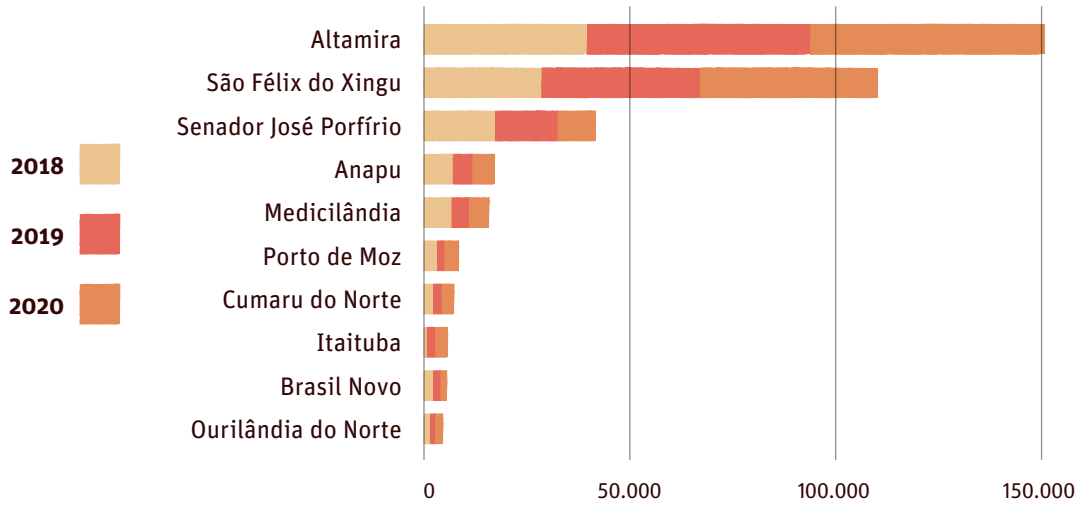
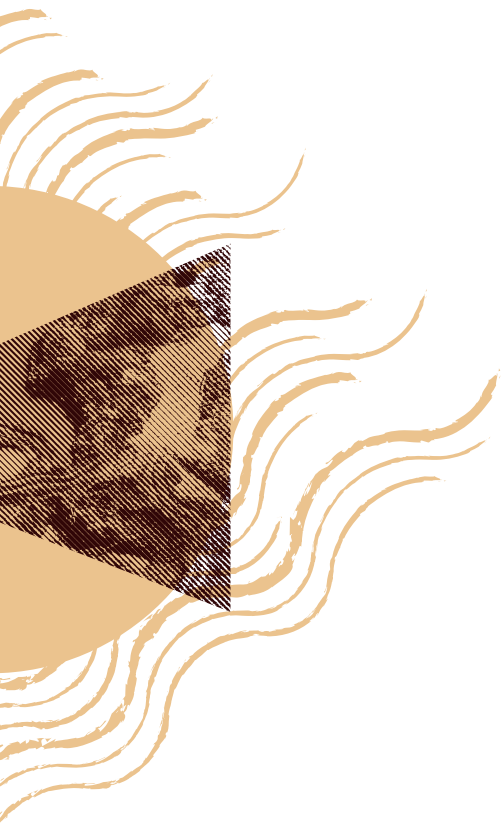


Figure 5: Graph of the most deforested municipalities in the region of the Xingu River basin located within the borders of the state of Pará between January 2018 and December 2020.

São Félix do Xingu, ranking second, also verified an increase in deforestation in 2020, 12% more than in 2019, and 51% more than in 2018. Altogether, 110 thousand hectares were deforested in three years, and from this total, 69% took place within Protected Areas, such as the environmental protection area APA Triunfo do Xingu, and the Apyterewa Indigenous Land. According to the Climate Observatory, the municipality of São Félix do Xingu is the top greenhouse gas emitter in Brazil, both due to the high rates of deforestation and a cattle population of more than 2 million head.



4 MATO GROSSO

The portion of the basin located within the borders of the state of Mato Grosso has had 139.1 thousand hectares of land deforested over the last three years, with 2018 being the most critical year, with 61.1 thousand hectares of forest cleared. This is mainly due to deforestation in four municipalities, which in 2018 showed high rates due to the clearing of large contiguous areas contributing 45% to total deforestation: Querência, Canarana, Paranatinga, and Marcelândia. In 2019, these municipalities showed a significant reduction in their rates (-62%), leading to a 38% reduction in deforestation in that portion of the state.

In 2020, there was a slight 6% increase in deforestation; União do Sul being the municipality with the highest growth, concentrating 23% of total deforestation. With over 9 thousand hectares of forest cleared in its territory, União do Sul had a 67% increase in comparison with 2019, and a 111% increase in comparison with 2018. In Feliz Natal and Querência, there was also an increase in deforestation, 13% and 77%, respectively, in comparison with 2019.

In contrast to the reductions in deforestation verified between 2018 and 2020, there was a 138% increase in the number of hotspots in the portion of the basin located within the state of Mato Grosso during the same period. This trend can be explained by the increased incidence of hotspots in forest areas, which often occur due to poorly managed burning practices in rural properties, which go out of control and advance into the forests.

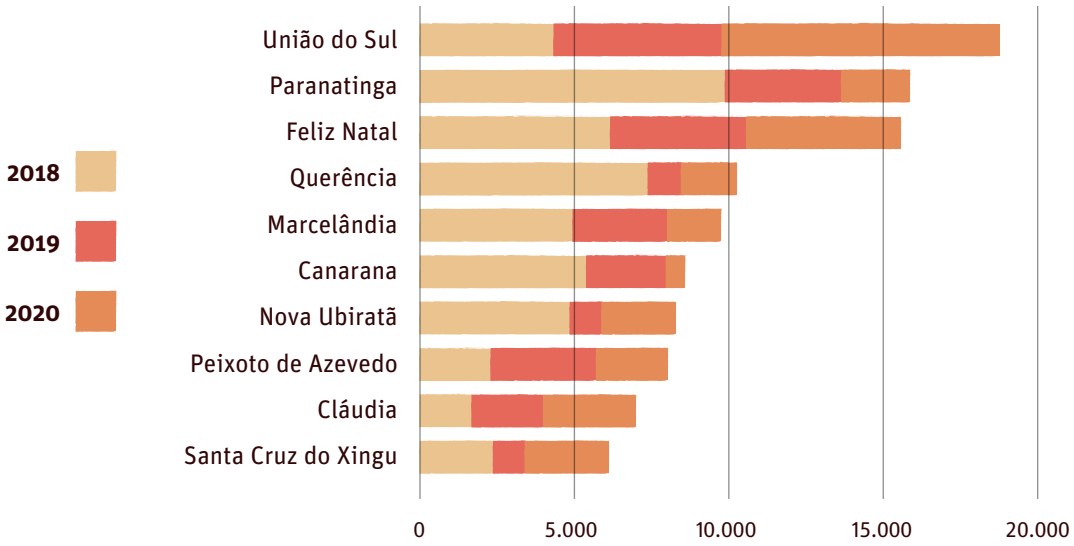


Figure 6: Graph of the most deforested municipalities in the region of the Xingu River basin located within the borders of the state of Mato Grosso between January 2018 and December 2019.

4.1 Illegal deforestation in Mato Grosso

It was also in 2018, consistent with the deforestation scenario, that the northern portion of the state had its highest rate of illegal deforestation: 71%, according to the forest-clearing data made available by the Mato Grosso State Secretariat for the Environment (SEMAS-MT).

In 2015, the state signed a commitment at the Climate Summit in Paris to stop illegal deforestation by 2020. Since then, the government of Mato Grosso has been committed to seeking partnerships and investments for implementing and strengthening command-and-control regulation. Part of the funds received were invested in real-time monitoring with high-resolution images through a $6 million contract.

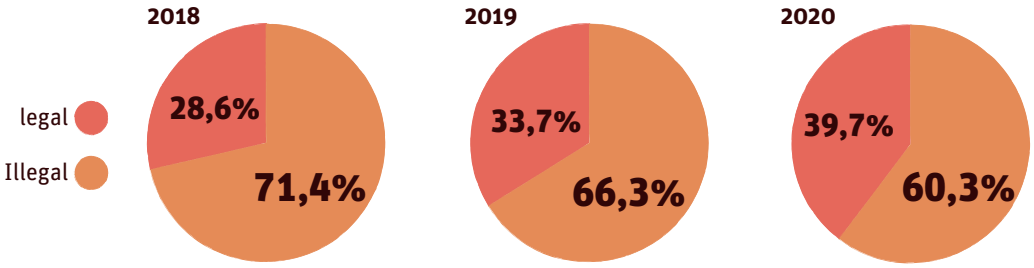


Figure 7: Variation in the percentage of illegal deforestation between 2018 and 2020 in the portion of the Xingu River basin located within the borders of the state of Mato Grosso.

In 2019 and 2020, the rate of illegal deforestation decreased by 43% in comparison with 2018. Nevertheless, illegal deforestation is far from null and still answers for more than half of the total deforested area in this portion of the state. Last year, illegality rates in some municipalities were even higher: União do Sul, the most deforested municipality in 2020, recorded 71% unauthorized deforestation. Querência, Canarana, Paranatinga, and Marcelândia had, respectively, 71%, 77%, 91%, and 100% illegality. The lack of effective measures for combatting deforestation shows that even a more modern monitoring system is not enough to fight illegal deforestation. Allied to this, the Federal Government's policies and actions granting amnesty to offenders only helped increase the sense of impunity.

Illegal deforestation in the Mato Grosso portion of the Xingu basin in 2020

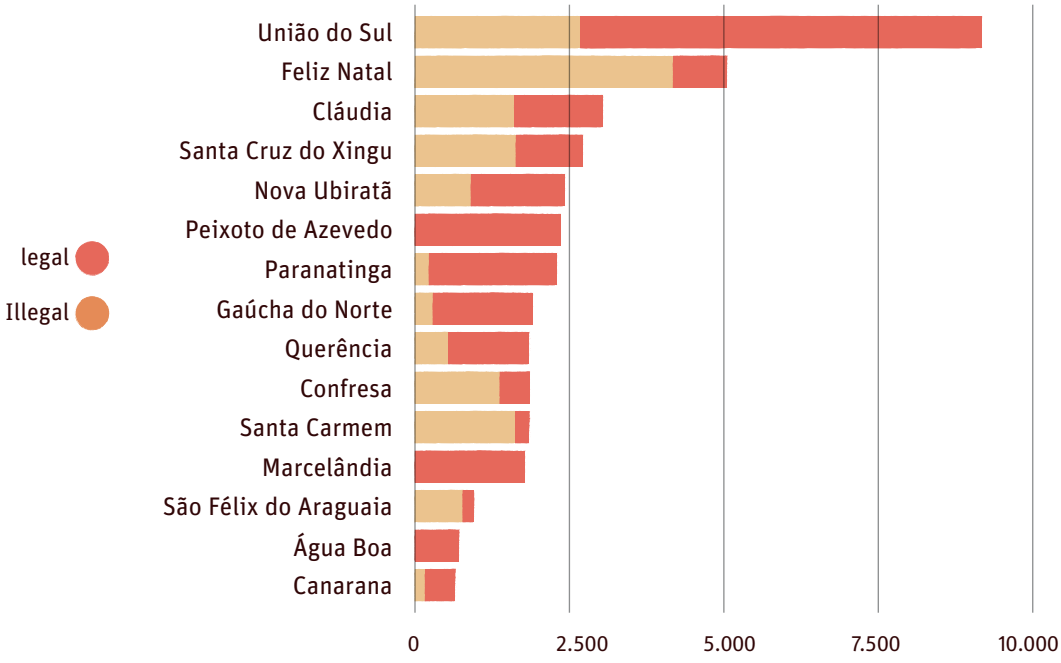


Figure 8: Ranking of the municipalities that most deforested in 2020 inside the portion of the Xingu River basin located within the state of Mato Grosso, and their part in illegal deforestation.

5 INDIGENOUS LANDS

In the three years of Sirad X monitoring, 66.5 thousand hectares of deforestation were detected in the Indigenous Lands of the Xingu River basin. As of October 2018, deforestation began to increase in some territories, such as in the Cachoeira Seca and Ituna Itatá Indigenous Lands. In 2019, this trend intensified in other areas and there was an explosion of deforestation, resulting from invasions, wood theft, mining, and land grabbing.

In the beginning of 2020, after concentrated inspections by IBAMA, deforestation declined, mainly in the part of the basin located within the state of Pará. As a result of the actions against deforestation conducted by the environmental agency, IL Ituna Itatá showed the greatest reduction, 93% less than in the previous year. In IL Cachoeira Seca, there was also a drop in rates in 2020: 72% less than in 2019 and 61% less than in 2018. However, after the dismissal of the inspectors, deforestation rose again in the second half of the year. At IL Cachoeira Seca, between September and December 2020, 1,744 hectares of forest were cleared in the territory of the Arara people, a 276% increase in deforestation in comparison with the first eight months of the year (between January and August). This increase in rates coincides with the withdrawal of one of IBAMA's field bases from the region in September last year, which confirms that the presence of inspectors must be permanent in order to guarantee effectiveness in these regions.

DEFORESTATION IN THE MOST DEFORESTED INDIGENOUS LANDS, BETWEEN JAN 2018 AND DEC 2020, IN THE XINGU BASIN

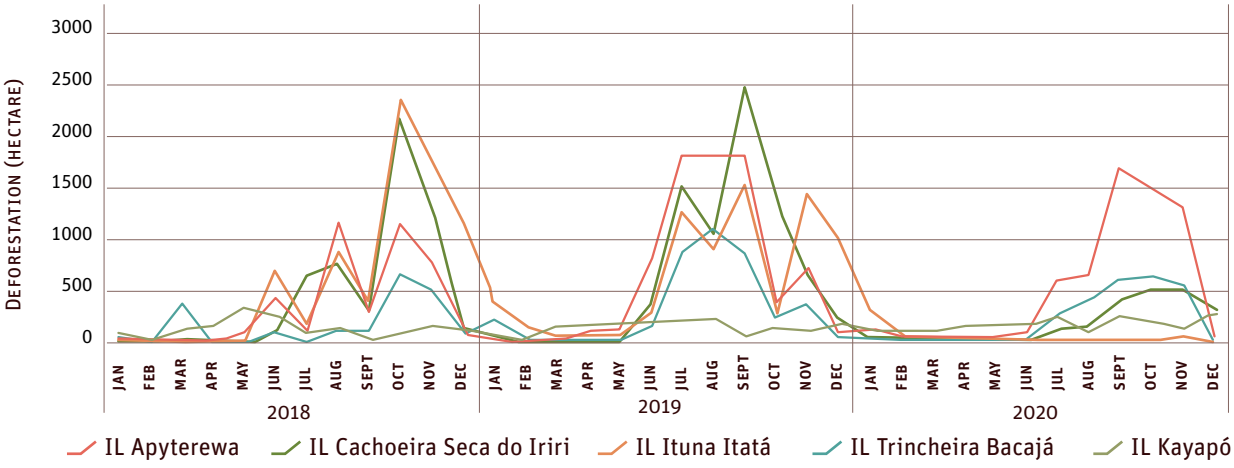


Figure 9: Graph of the monthly dynamics of deforestation in the five most deforested Indigenous Lands in the Xingu River basin between January 2018 and December 2020.

Similarly, the same occurred in ILs Trincheira Bacajá and Apyterewa. In both, deforestation recrudesced after IBAMA's inspections, which had been successfully combating deforestation within their territories, were called off in May 2020. Throughout the year, these two Indigenous Lands continued to endure invasions, conflicts, and threats.

Most deforested Indigenous Lands in the Xingu basin

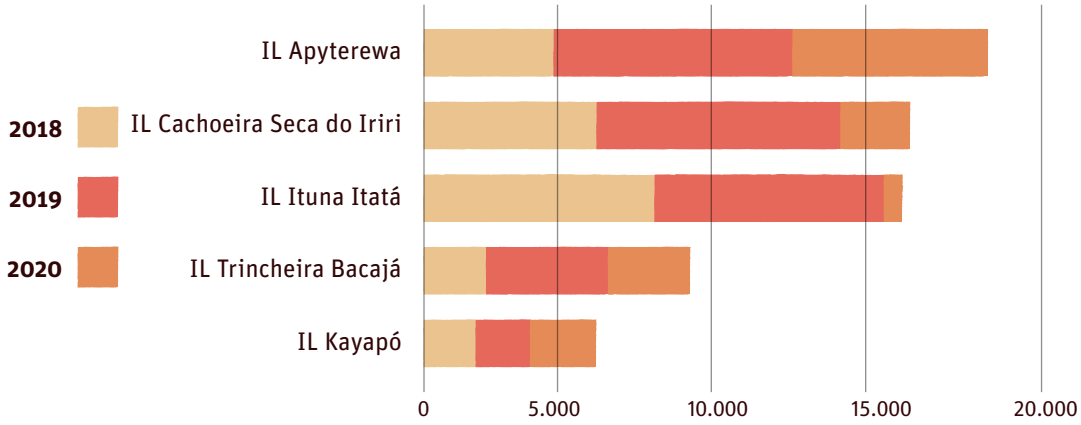


Figure 10: Graph of the most deforested Indigenous Lands in the Xingu River basin between January 2018 and December 2019.

In IL Apyterewa, the most deforested region during the three years of Sirad X monitoring, a land grabbing scheme was uncovered by which new invaders are installed inside the Indigenous Lands on lots sold, auctioned, or even donated irregularly by criminal networks. The point of logistical support is Vila Renascer, a village that emerged in 2016 within the Indigenous Land, exactly eleven years after its acknowledgement. In addition to the conflicts over land grabbing, the region has also endured, in the last two years, the advance of illegal mining with confirmation of illegal gold mines operating within the Indigenous Land. This Indigenous Land, which is home to the Parakanã people, is located within the area of influence of the Belo Monte Hydroelectric Power Plant. The removal of squatters and the implementation of a protection plan are among the hydroelectric power plant's environmental requirements, and should have been implemented in 2011, before its installation.

IL Kayapó stands out for the increase in the rates of deforestation in its territory: there was a 23% increase in deforestation between 2019 and 2020. In December 2020, 283 new illegal mining sites were detected, the second highest rate since May 2018, when 343 deforestation hotspots, equivalent to 343 hectares, were registered.

6 CONSERVATION UNITS

More than 120.2 thousand hectares were deforested in the basin's Conservation Units between 2018 and 2020. Over the last two years, there has been a significant increase in deforestation within the CUs in comparison with the first year of monitoring: 50% increase in 2019 and 41% increase in 2020. In some territories, these rates were even higher in 2020, reflecting the strengthening of groups of invaders, land grabbers, and loggers, encouraged by the absence of effective measures to combat deforestation and punish offenders.

The Altamira National Forest (Flona), for example, saw a 29% increase in deforestation in 2020 compared to the previous year, and a total of 5.4 thousand hectares of forest were destroyed in its territory. The pressure on this CU happens on two fronts: illegal mining activity along its western and northwestern borders, and illegal occupations and land grabbing in its southwestern region. In 2020, illegal occupations advanced and, in a single year, 5.3 thousand hectares of forest were cleared, representing 98% of the total area deforested in the CU. It is worth noting that the deforestation detected in the National Forest is entirely associated with illegal activities, and not directly related to the currently suspended logging concession process initiated in 2016.

In 2011, the Flona suffered a reduction of 37,975 hectares in the southwestern border of its territory, due to a new interpretation of the CU's official decree of creation by ICMBio, which resulted in an area effectively smaller than the one initially planned. This happened despite the Federal Constitution guaranteeing that any change in the limits of Federal Conservation Units can only be carried out by law. In practice, the administrative redefinition of the limits of the National Forest created expectations in the region of further reductions, which has kept the area under increased pressure from deforestation and illegal occupation since.

Furthermore, the Altamira Flona, as well as the Iriri State Forest (FES), neighboring CU, is located in the region of influence of federal highway BR-163 and the increase in deforestation is also related to the completion of the asphalt paving of the highway in February 2020. The highway's Basic Environmental Plan (PBA), which should mitigate and contain the impacts related to illegal deforestation, was never properly executed and is currently at a standstill, with no legal justification.

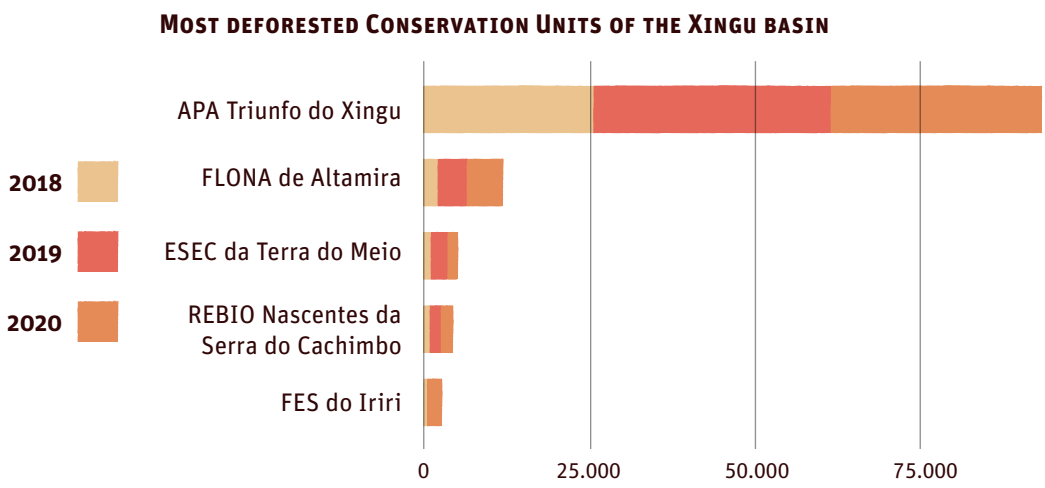


Figure 11: Graph of the most deforested Conservation Units in the Xingu River basin between January 2018 and December 2019.

The Iriri FES, ranking fifth among the CUs in the Xingu basin, saw a 366% increase in deforestation in 2020 compared to 2019, accounting for 1,905 hectares of felled forest. The largest part, 67%, occurred in May 2020, after the clearing of a large area, causing the month to record the highest rate of deforestation in the CU in the last 10 years. The deforested area, of more than 1,262 hectares, has no record in the Rural Environmental Registry (CAR) and is contiguous to the so-called "Ronzela" occupation, where there is a ferry that facilitates transit between the banks of the Curuá River.

This Conservation Unit was created for the multiple sustainable use of forest resources. This CU category requires that the possession and control of the area be public, except for what concerns the rights of traditional resident populations, thus not admitting private detention. Hence, the occupations inside the CU at the time of its creation should have already been evaluated for good faith and compensated. Yet, fourteen years after its creation, eviction from the Iriri FES has not yet taken place and the CU has been the target of invasions, illegal logging, and illegal mining activities.

7 WOOD THEFT IN THE EXTRACTIVE RESERVE RIOZINHO DO ANFRÍSIO

Located in the Xingu River basin, on the border with the Tapajós River basin, the Riozinho do Anfrísio Extractive Reserve (Resex) is part of the mosaic of protected areas of Terra do Meio, a set of Conservation Units and Indigenous Lands between the Xingu and Iriri rivers.

A center of territorial disputes, Riozinho do Anfrísio was decreed a Conservation Unit in 2004 after much resistance and pressure from the riparian communities and their partners. Even today, however, the Riozinho do Anfrísio Resex faces serious problems concerning its territorial integrity, such as land grabbing, invasions, mining, and theft of wood, which endanger the riparian communities, their ways of life, and, consequently, the management of the unit.

Around 2009, the Riozinho do Anfrísio Resex suffered an intensification of illegal logging, when exploration fronts operating in the Trairão National Forest (Flona) entered the Resex's territory in search of high-value tree species, such as the ipê. The efforts of the various ICMBio administrations managed to temporarily contain the invaders, who usually return shortly after the inspection teams leave. Currently, the biggest threat to the Resex is still the illegal action of loggers working in various groups. In turn, these groups are in connivance with mafias involving public servants, forest engineers, and land surveyors, who, based on fraudulent forest management plans, provide the documentation necessary to launder illegal timber.

Profits derived from illegal logging have attracted a variety of actors to the region of the Resex. Logging in the CU takes place mainly in its western region (Alto Riozinho), perpetrated by groups of loggers from the Areia Settlement Project (SP) region, in the municipality of Trairão (PA). Other groups have also engaged in intensive logging at the Resex, accessing it through other roads departing from federal highway BR-163, near the towns of Santa Luzia and Três Bueiros, south of Trairão, crossing the Trairão Flona and Jamanxim National Park, in order to reach the Resex. These are sawmill owners, farmers, and land grabbers, who, at times, either engage in mining, or in logging, depending on the current situation and the local trend.

The exploitation of hardwood has advanced over the territory in recent years, causing serious social conflicts, occupying and

degrading areas of traditional use (especially Brazil-nut groves) and intimidating riparian communities.

Between 2018 and 2020, monitoring by the Xingu+ Network detected more than 366 km of illegally built roads at Resex Riozinho do Anfrísio, and almost half of these stretches (46%) were created in 2020 alone. The roads constructed are used for yarding and hauling timber, and their extension brings loggers increasingly closer to riparian communities, such as the ones of Novo Paraíso and Morro do Anfrísio. In the mid-Riozinho region, between the communities of Bom Jardim and Boa Sáude, illegal logging sites were identified near the stretches of road constructed.

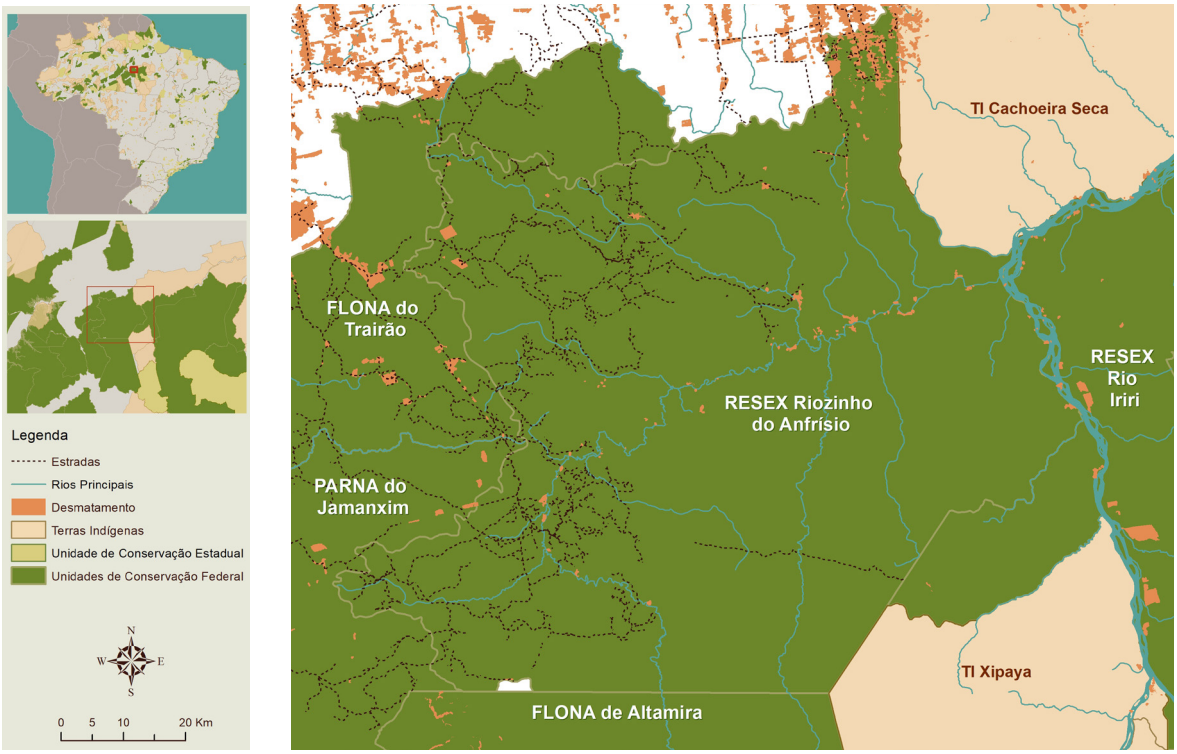


Figure 12: Network of roads constructed, until 2020, within the Extractive Reserve Riozinho do Anfrísio.

Criminals have used portable sawmills close to the riverbed of Riozinho do Anfrísio to make wooden planks, which facilitates the exploitation of various areas and makes inspection work more difficult, as they are more difficult to track down. As loggers advance over the territory opening roads, they dam streams with the so-called buchas (tree trunks used for makeshift bridges) causing environmental damage. These obstructions hold back the water creating small dams, which, upon bursting, release refuse and debris downstream, leading to fish mortality and worsening of water quality.

It is of the utmost importance that the agencies responsible for monitoring these illegal activities conduct field inspections and

install a permanent base to allow for greater control of the roads that provide access to the territory, and that police continue to investigate them with the objective of dismantling the criminal organizations that launder the timber extracted from this Resex.

8 ILLEGAL MINING

Illegal mining threatens the Protected Areas of the Xingu basin and the very survival of the indigenous peoples and riparian communities. As of 2018, there has been an expansion of mining areas, including the opening of new sites, within the Kayapó, Apyterewa, Baú, and Trincheira Bacajá Indigenous Lands, and in the Conservation Units Resex Riozinho do Anfrísio, Resex Rio Iriri, Serra do Pardo National Park, and the Altamira Flona.

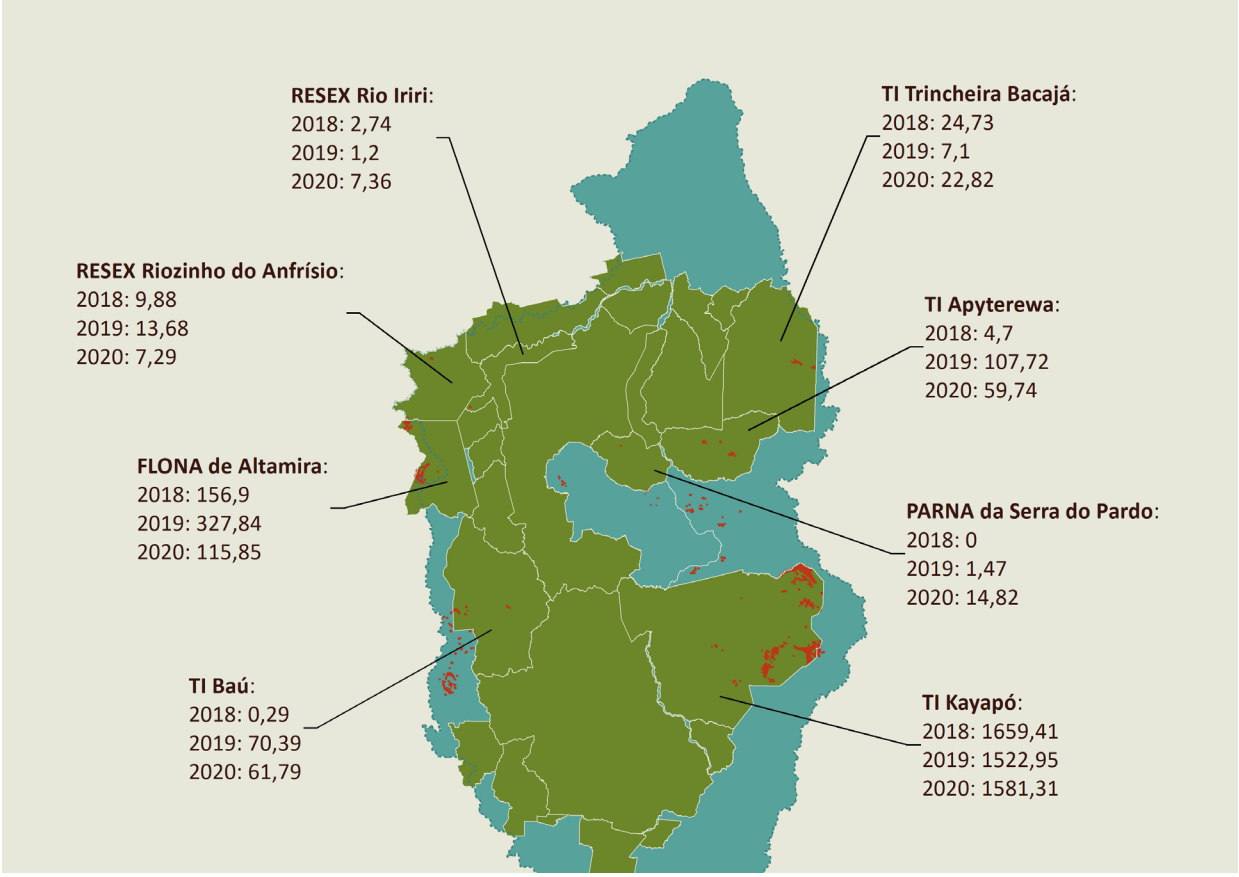


Figure 13: Map of the distribution of illegal mining areas, deforested between January 2018 and December 2020, within the Protected Areas Corridor of the Xingu River Basin.

The high price of gold in the international market encourages this high-risk activity and brings about significant social and environmental losses. Between 2018 and 2020, approximately 5,782 hectares of forest were cleared because of mining within the Protected Areas Corridor, compromising water quality in twenty sub-basins of the Xingu River. Illegal mining results in mercury contamination of aquatic fauna and endangers the health of indigenous peoples and traditional communities whose territories are the target of gold mining. We highlight in this section the escalation of illegal mining, over these three years, in two Indigenous Lands, Kayapó and Baú.

8.1 Kayapó Indigenous Land

The illegal mining activity in IL Kayapó began in the early 1980s, on the riverbed of the Arraias River, a tributary of the Fresco River. The mines remained active until the mid-1990s, when the activity decreased. During this same period, another area upstream of the Gorotire village, on the Fresco River, one of the main tributaries of the Xingu River near the city of São Félix do Xingu, became a hot spot for gold mining.

In 2014, a new mining front started to operate in the region of the Branco River, at the northeastern border of IL Kayapó. The activity started slowly, and gained momentum as of 2015, causing extensive and irreparable damage to the Branco River channel and to the populations of the villages near the gold mines. Starting in 2018, the gold mining activity decreased, but it migrated again to the Arraias and Fresco rivers, currently expanding rapidly.

In 2019, 1,327 kilometers of illegal roads (of which 918 km were attributed to mining) and six airstrips were detected. In the beginning of 2020, new mining areas were discovered in tributaries of the Fresco River, in addition to the creation of another airstrip. In that year, there was a 23% increase in deforestation compared to 2019. IL Kayapó is the most impacted by mining in the Xingu basin, concentrating 82% of illegal mining within the Protected Areas Corridor. In just three years, between January 2018 and December 2020, 4,763 hectares of the Kayapó territory have been destroyed. This number is 31% higher than the total area deforested in the IL in the period between the 1980s and 2017.

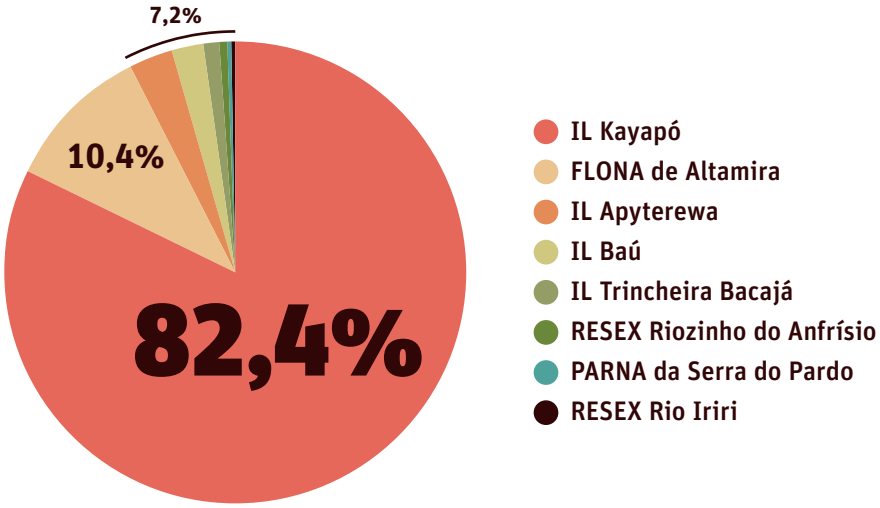


Figure 14: Graph of the percentage distribution of illegal mining areas deforested between January 2018 and December 2020 within the Protected Areas Corridor of the Xingu River Basin.

The mining activity is increasingly approaching the villages, jeopardizing the health of indigenous peoples and causing conflicts that range from the inadequate sharing of profits generated, to the promotion of prostitution, and intensification of violence caused by easy access to alcohol and other drugs. In December 2020, 283 new gold mining sites were detected, the second highest rate detected in the IL through the Sirad X monitoring. The increase in deforestation in IL Kayapó can be explained in part by the proximity of the villages to the cities Tucumã, Ourilândia do Norte, and Cumaru do Norte; ease of access to the IL through a network of illegal roads; the constant personnel changes in the Prosecutor General's Office, as well as in Federal Police delegates who work in the region, which makes longer-lasting investigations unfeasible.

8.2 Baú Indigenous Land

The mining sites located inside the IL Baú are old, with some of the areas having been deforested in the 1980s, before the demarcation of the Indigenous Land, officially sanctioned in 2008. These areas remained abandoned for many years, but in 2018, prospectors began attempting to resume mining activities. Ever since deforestation started being measured in 1988, until 2017, a little over 24 hectares were detected, whereas in only three years of Sirad X monitoring (from 2018 to 2020), mining areas have already exceeded 132 hectares.

In 2019, the already existing mines in the IL intensified their activities and deforestation was 70 times greater than the total registered in 2018. This was mainly due to an expansion of the Coringa gold mine, between the Coringa mining project and the Kamure village. A flight over the area in early April 2020 confirmed the presence of prospectors in the western and central regions of the Kayapó territory and surrounding areas. The flight monitored five illegal mining areas in the IL: the mines Nova Esperança, Novo Horizonte, Pista Velha, Pista Nova, and Coringa. That same year, new illegal mining sites emerged in three areas, all on the banks of the Curuá River, the main watercourse that crosses the Indigenous Land.

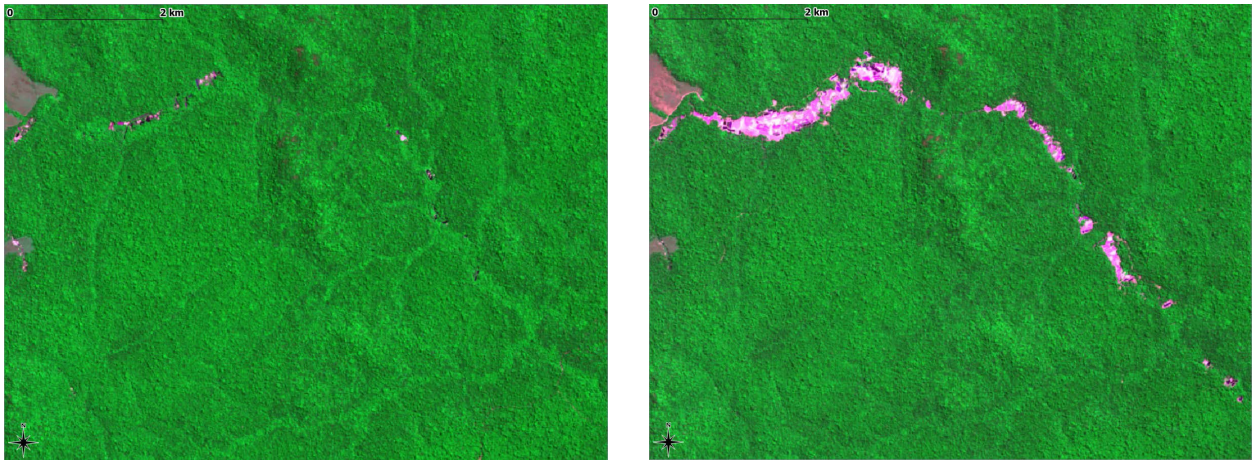
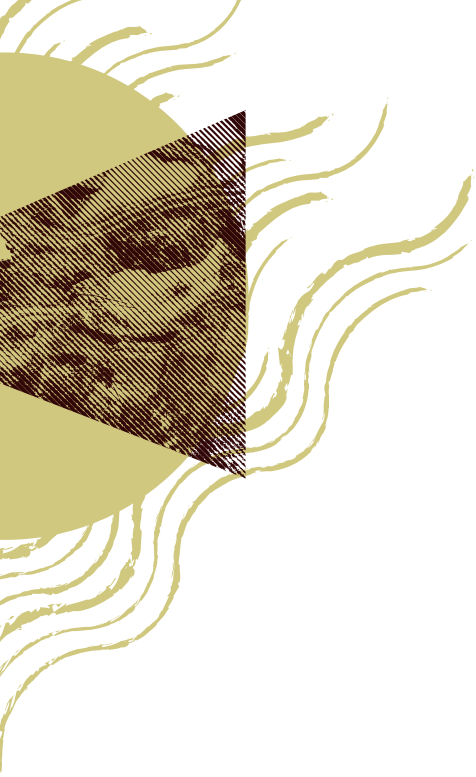


Figure 15: Expansion of the Coringa mine between August 2018 (first image) and August 2020 (second image). Sentinel-2 satellite imagery

The significant increase in the price of gold in international markets, coupled with the limitations of surveillance and repression operations against illicit activity, and the context of the Covid-19 pandemic, allowed the situation to spiral out of control. Communities have been reporting an increase in the constant movement of aircrafts in and out of IL Baú. The escalation in invasions can have serious consequences for the Kayapó, both in terms of threats to the integrity of their territories, as well as the pollution of rivers, and the destruction of their natural resources. An analysis carried out by the Public Prosecutor's Office in 2019 showed that the Curuá and Baú rivers are already contaminated with mercury, verified through tissue samples from three species of fish (piranha, hake, and mandubé) and river turtles (tracajás), collected in these rivers. The samples revealed mercury levels exceeding the tolerable daily intake established by the World Health Organization (WHO).



9 RURAL ENVIRONMENTAL REGISTRY (CAR) AND THE ONLINE LAND ALLOTMENT OF IRIRI STATE FOREST

The Iriri State Forest (FES) has been undergoing a systematic invasion by groups of land grabbers coming from the city of Novo Progresso, in the north of Mato Grosso, and from the region of São Félix do Xingu. In 2012, six years after the creation of the unit, 39 CAR records were found claiming land inside its borders, occupying 57,254 hectares. Today, the Iriri FES has 201 properties registered, totaling 396,882 hectares, which is equivalent to 90% of its territory. The CU is illegally being allotted online by means of the Rural Environmental Registry (CAR) and these records allow for and promote the illegal trade of its lands.

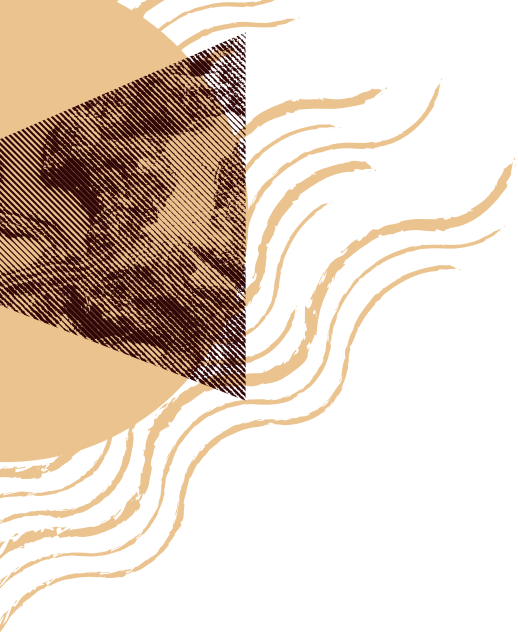
Furthermore, in the southeast of the FES, there is the registration of a homogeneous set of 53 properties, covering a total of 49,247 hectares, which were registered in 2014 under the Rural Environmental Registry system of the State of Pará (CAR/PA). Most properties registered have an approximate area of 1,000 hectares and bear similar shape, which indicates a joint and organized strategy for irregular occupation of public lands. At the time these records were filed, there was still no sign of occupation or anthropogenic activity in the area. However, in October 2018, an unfinished road was detected stretching from the Ecological Station (Esec) Terra do Meio towards the southeast of the Iriri FES, where a landing strip was built the following month, in November. In August 2020, the road was reactivated and finished, completing the access from the Iriri River, in the Esec, to the Cateté River, on the border between the two CUs.

Its forest resources and lands are coveted by two deforestation fronts, one coming from Novo Progresso, from the area of influence of federal highway BR-163, and another from São Félix do Xingu, which starts in APA Triunfo do Xingu and already invades the Ecological Station of Terra do Meio.

Figure 16: Deforestation and CAR (Rural Environmental Registry) records, incidents in the Iriri FES.

The Iriri FES is highly relevant in ensuring the integrity of the mosaic of Protected Areas of Terra do Meio, formed by Conservation Units and Indigenous Lands in the Xingu basin. This mosaic constitutes an effective barrier against the advance of deforestation in the eastern Amazon, protecting a continuous mass of 8.5 million hectares of forests in the interfluve of the Xingu and Tapajós rivers, in addition to being a territory traditionally used and occupied by various indigenous and traditional peoples.

The undermining of the management of Protected Areas by state government has as direct consequence the increasing activity of land grabbers, and there has been no sign of significant efforts in inspecting or evicting squatters. Records filed require an affidavit and proof of ownership and/or possession of the referred areas. Since they involve a Conservation Unit of public ownership and domain, these claims must be properly investigated by the environmental agency, in order to allow for the land regularization of the area with consequent removal of squatters. Furthermore, if claimers fail to prove ownership and/or possession of the aforementioned CARs, they must be held liable both administratively and criminally for the falsity of their claims.



10 TRIUNFO DO XINGU ENVIRONMENTAL PROTECTION AREA: LEADER IN DEFORESTATION

Between 2018 and 2020, the Triunfo do Xingu Environmental Protection Area (APA) lost 93,276 hectares of vegetation. This means that approximately more than **2 thousand trees were felled per hour within this CU**, concentrating, during this period, 18% of deforestation in the Xingu basin. These figures make this APA the most deforested Conservation Unit in the basin, and for over a decade, it has also been the most deforested one in all of Brazil. The magnitude of deforestation (with some records exceeding 1,400 hectares, or the equivalent to 805 thousand trees felled in a single undertaking) shows the power and capability of the groups involved in deforestation in this CU.

The APA is a Conservation Unit for sustainable use, which means that nature conservation in its territory must be compatible with the sustainable use of its natural resources. However, without a management plan or inspection, the CU has been heavily deforested in recent years.

The APA has already had almost 40% of its forest area converted to other uses, with livestock being the main activity driving deforestation in the CU. São Félix do Xingu, one of the municipalities that covers the APA, has the second largest cattle population in Brazil, and the protected area constitutes an enormous reserve of resources in view of the intensification of deforestation.

DEFORESTATION IN THE APA TRIUNFO DO XINGU

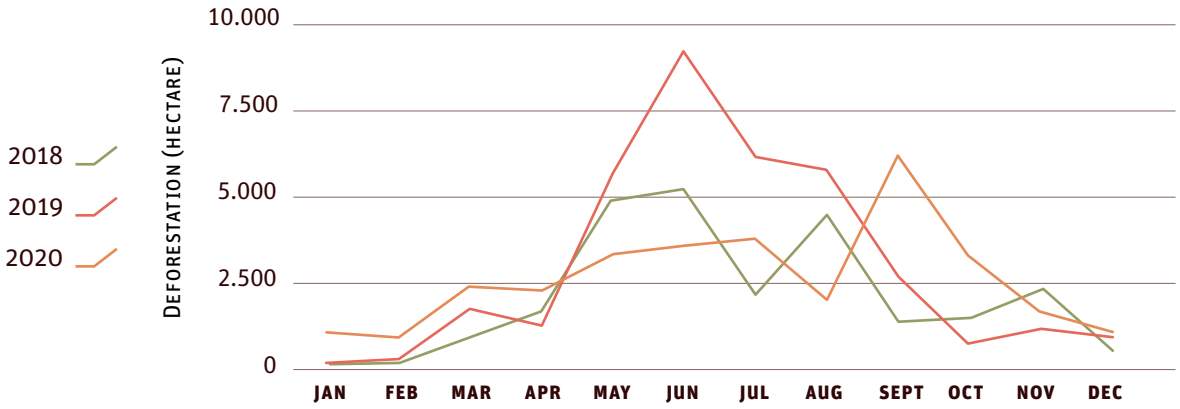
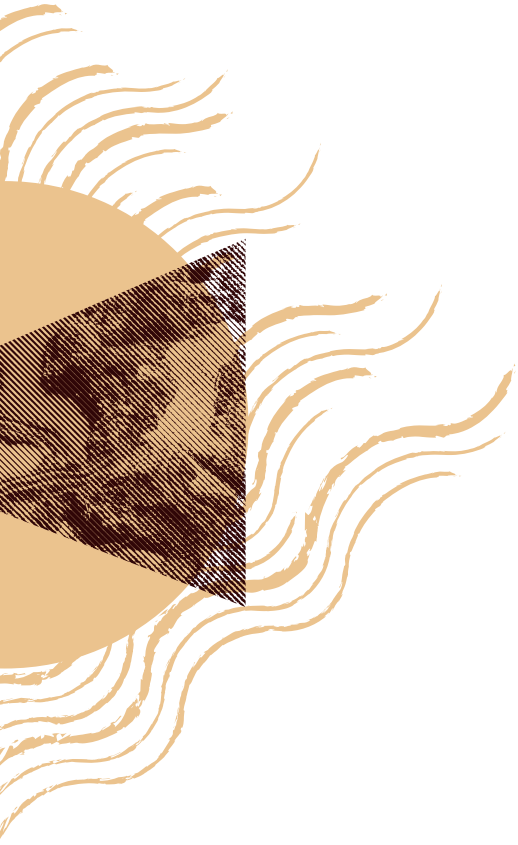


Figure 17: Graph of the dynamics of deforestation, between 2018 and 2020, in APA Triunfo do Xingu.

The APA maintains an intense pace of deforestation linked to land speculation processes. In June 2019, the Protected Area recorded more than 9,000 hectares of land deforested in a single month, the highest rate in the three years of monitoring. This increase occurred during a period of great expectation towards the sanctioning of Pará's new agrarian law (Law no. 8.878/2019), approved on July 8, after only 33 days of processing. According to the MPF, this new law facilitates the seizure of public lands, and, consequently, leads to the increase in violence in the countryside.

The high rates of deforestation detected in the APA can be attributed, mainly, to the lack of governance in the territory. In fact, fourteen years after its creation, this APA still does not have a public management plan or zoning, basic tools essential for territorial control by the state, and does not count on the permanent presence of inspection agents within its borders. The lack of governance at the unit also affects neighboring territories, such as Esec Terra do Meio, and Parna Serra do Pardo, both CUs of Integral Protection, where most deforestation is concentrated in the vicinity of the APA.



11 Persecution of indigenous people: invasions escalate in the Trincheira Bacajá Indigenous Land

Invasions in IL Trincheira Bacajá were seriously intensified in 2019, when in August, the Indigenous Land had its highest rate of deforestation: **1,115 ha in a single month**. Since its ratification in 1996, there has never been a deforestation rate of such magnitude. In the same month of August 2019, Xikrin leaders were threatened with death by a group of invaders in the southeastern region of the IL who threatened to "hunt [sic] the Indians". During this same period, the reactivation of a road stretching from ILs Apyterewa and Araweté Igarapé Ipixuna was identified, which grew 40 km into the territory of the Xikrin at its southwest border. Until December 2020, 706 hectares were deforested along this road inside IL Trincheira Bacajá, which indicates an attempt to consolidate a new invasion front.

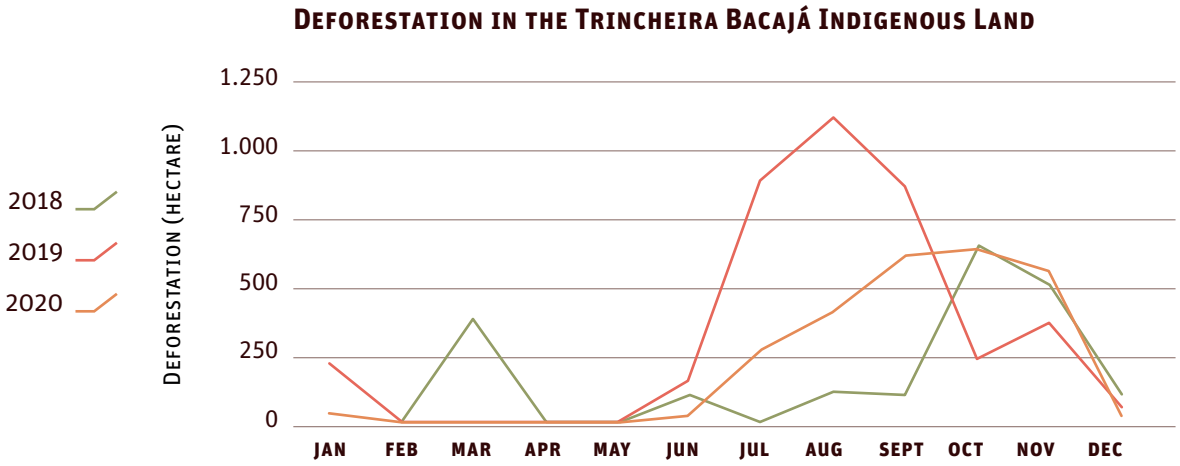


Figure 18: Graph of the dynamics of deforestation, between 2018 and 2020, at IL Trincheira Bacajá.

There are at least three active invasion fronts and most likely coordinated, increasingly closer to the villages. In the north and northeast, 3,794 hectares of land were deforested during these three years, in the southwest region, 854 ha, and in the southeast, the most intensely deforested region and the stage of conflict between invaders and indigenous people, 3,861 ha of forest were destroyed.

In June 2020, a request was made for the removal of the invaders from Trincheira Bacajá as one of the emergency measures requested in the Claim of Non-Compliance with Fundamental Precept (ADPF) submitted by APIB (Brazil's Indigenous People Articulation) to the Supreme Federal Court (STF). This type of action seeks to prevent or repair damage to some basic principle of the Constitution resulting from an act or omission by the State. Still, illegal activities in the area continue. From July to December 2020, another 2,530 ha of land were deforested in the IL.

In November 2020, a letter signed by indigenous leaders of ILs Trincheira Bacajá, Apyterewa, and Cachoeira Seca, denounced the increasing invasions and demanded curbing measures be taken, such as the removal of invaders, installation of barriers at the entrance to the invasions, seizure of cattle, destruction of buildings, and seizure of equipment used in illegal activities.

The expectation of regularization of land grabbed is an important factor in attracting invaders, and is supported by the speeches of public authorities in favor of the reduction of the size of indigenous territories, as well as the ineffectiveness of actions to combat deforestation in progress. The presence of invaders and prospectors, aside from violating the territorial integrity of the ILs and representing environmental and cultural losses to their

peoples, also puts the health of the indigenous population at risk in the context of the Covid-19 pandemic. The first outbreak of contamination among the Xikrin occurred precisely in the villages near the invaded areas, after a local inspection action aimed at removing the squatters. This action was carried out by the Indians without the participation of any inspection body, generating exposure to the virus, contamination, and spread of the disease in the villages.

In August 2020, the Bebô Xikrin do Bacajá Association (ABEX) forwarded a complaint to FUNAI and the MPF about IL invasions, highlighting the risk of Covid-19 contagion and increased conflicts, as invaders approached the villages. In their denunciation, the Mebengokré-Xikrin people warned:

With the onset of the new coronavirus pandemic, in March this year, there was a decrease in inspection and territorial monitoring actions in the Amazon region. For us, the effect of this decrease was the intensification of the invasion in the southern portion of our land. From March to June, an illegal road was constructed near the Kenkro village and the invaders are once again approaching the villages. This is their strategy to take ownership of our land, to take away our land. The damage to our people is extraordinary. We are losing forest animals, plants and trees, remedies from the bush that we have knowledge of, medicinal vines, embiras used by our women for body painting, water springs, and so on. This is very serious. The invaders are stealing the forest. As in the previous year, people in the Kenkro village have been hearing, since the middle of this month, the noise of the chainsaws of the agents of invasion. It is possible to see the smoke of the forest fires and deforestation from many villages in our territory.

IL Trincheira Bacajá is also among the seven Indigenous Lands of ADPF 709 that must undergo squatter eviction as a measure to contain the spread of Covid-19 among its indigenous peoples. There has already been **an injunction on July 8, 2020, confirmed by a panel comprising all the justices of the STF on August 5, 2020**, ordering an emergency measure for the containment and isolation of invaders with regards to the indigenous communities, or an alternative measure able to avoid contact, as well as the **development of a plan for evicting squatters**.

Recently, men and women from the villages near the areas of invasion reported receiving threats from invaders who act to impede indigenous people from accessing their traditional areas, such as the Brazil-nut groves.

12 IMPACTS OF FEDERAL HIGHWAY BR-163

The paving of BR-163, known as Cuiabá-Santarém, provided that Protected Areas be created in the region in order to contain indirect deforestation associated with the asphalting of the highway, since the highway was built in the border zone between the Xingu and Tapajós river basins, breaking ecosystem connectivity, and directly impacting the traditional populations of these territories. However, the Conservation Units have not been fully implemented, nor have the other impact mitigation and compensation measures been effectively executed. Currently, the BR-163 region is one of the main epicenters of deforestation in the legal Amazon, inside and outside CUs, and continues to be the stage of conflicts over land tenure and the uncontrolled exploitation of its natural resources among land grabbers, prospectors, indigenous peoples, and traditional communities.

According to the Sirad X monitoring, deforestation in **the 100-km area of influence of BR-163 affecting the Xingu basin increased 121% between 2018 and 2020**. In November 2019, the Federal Government started the completion of the paving of the 51-km stretch between Sinop (MT) and Mirituba (PA), the last to be paved. Along this stretch, more than 36 thousand hectares of land were deforested during 2019, 40% more than in the previous year.

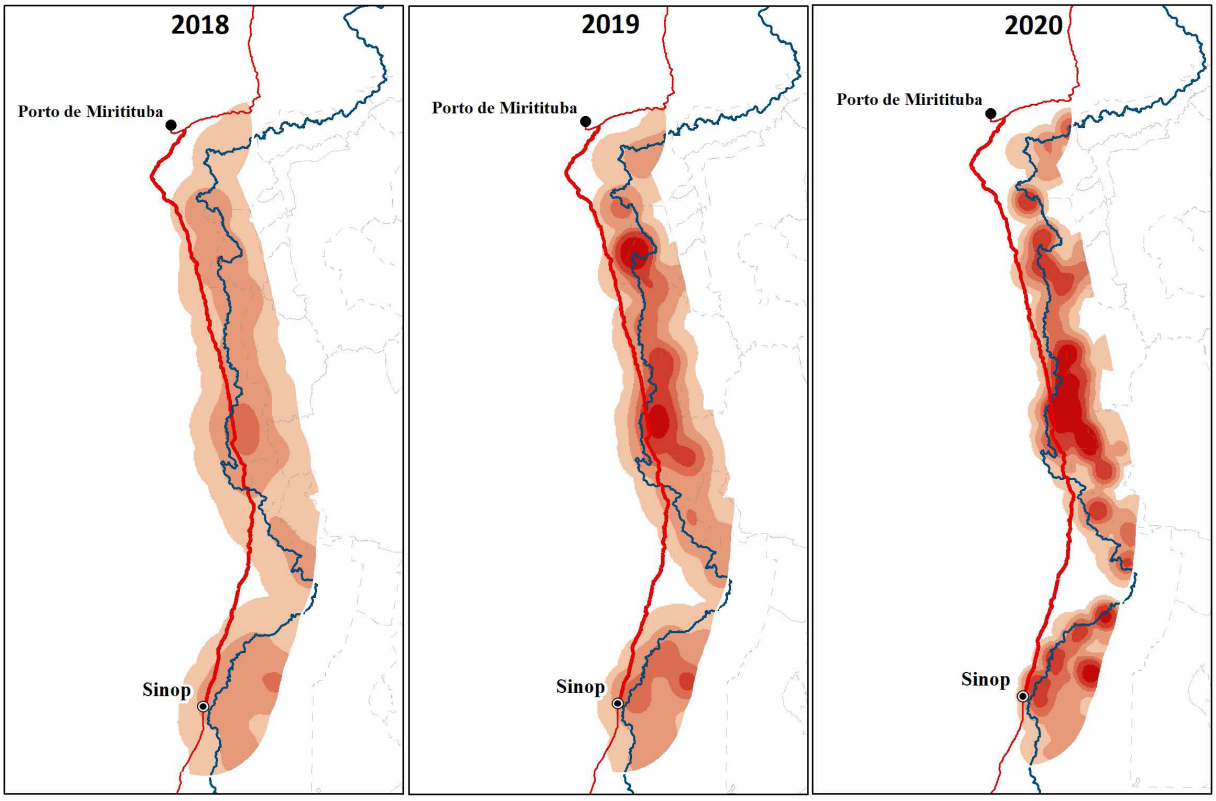


Figure 19: Deforestation in the 100-km area of influence of the right verge of BR-163, affecting the Xingu basin.

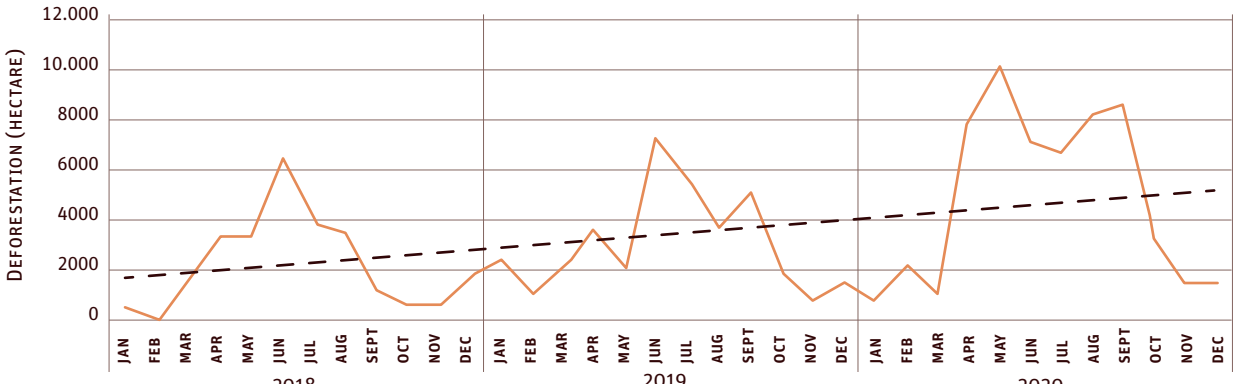
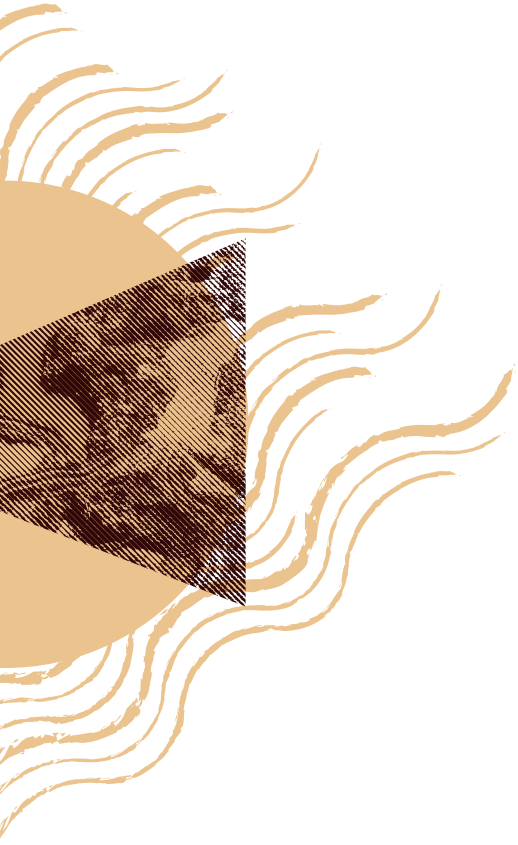


Figure 20: Density of deforestation in the 100-km stretch on the right verge of BR-163, affecting the Xingu basin, during the 3 years of monitoring.

Without proper land regularization, the scenario is aggravated by land grabbing. **In 2020, the year after paving was completed, deforestation was 58% higher than in 2019 in the 100-km stretch along the road between Sinop and Mirituba affecting the Xingu basin**. Between February and April 2020, large areas were cleared near IL Baú, amounting to more than 3.4 thousand hectares of deforestation in a single undertaking. Altogether, another 121.7 thousand hectares of forest were cleared between 2018 and 2020 in the area of influence of BR-163. The lack of state action in the region contributes to the intensification of conflicts and calls into question the viability of the enterprise's private concession without first resolving its environmental liability.



13 FIRE AND DEFORESTATION

13.1 Increase in hotspots in forest areas

Fire is widely used as an agricultural practice for cleaning and preparing the soil before planting, or for renewing the pasture. Still, fire is, in many cases, the final stage of the deforestation process, when used to clean up the remains of vegetation left in recently deforested areas. Used as an accessible and low-cost tool, the practice of burning, carried out indiscriminately, without monitoring and adequate management, brings a series of damages to biodiversity, ecosystem dynamics, and air quality, aside from also releasing greenhouse gases that contribute to global warming.

85% of the hotspots that occurred in the Xingu basin between January 2018 and December 2020 were concentrated in the period from July to October, peaking in September. The fire season coincides with the driest months, which further contributes to its spread. In these three years, the number of hotspots has increased by 199%.

Correlation between Deforested Area (SIRAD X) and number of hotspots (NPP-375), from jan 2018 to dec 2020

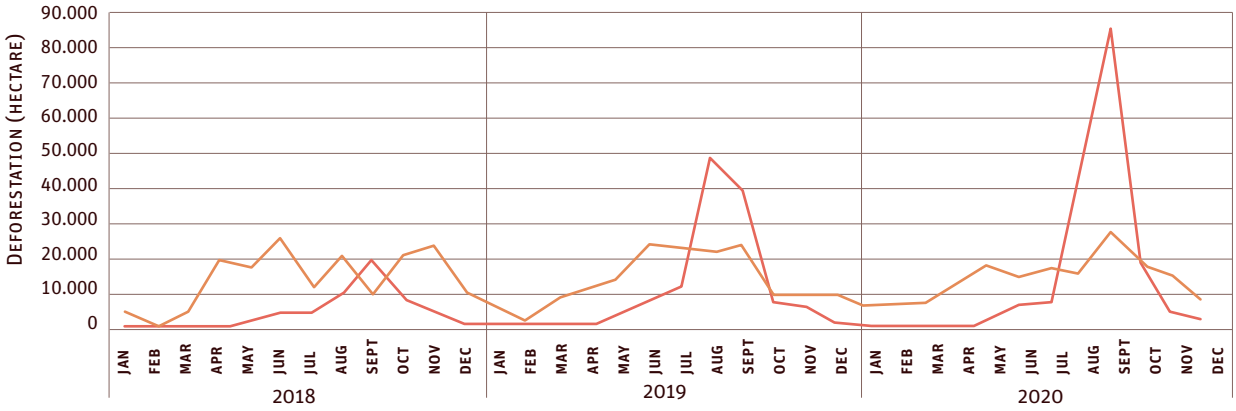


Figure 22: Graph of the monthly evolution of deforestation (SIRAD X) in hectares and number of hotspots NPP-375.

When analyzing the relation between fire and Sirad X's deforestation polygons, we observed that in these three years, the greatest increase in the number of hotspots occurred in primary forest areas, varying from 28% in 2018 to 43% of total hotspots recorded in 2020. These hotspots affecting primary forests are considered forest fires, which start with uncontrolled fires in adjacent areas subjected to the deforestation process.

Xingu Basin – Proportion of hotspots in forests and deforested areas per year

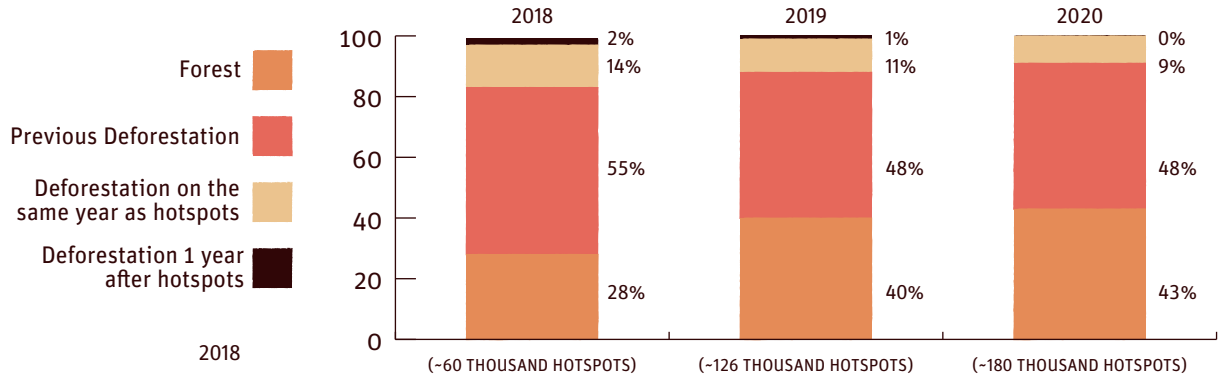


Figure 22: Graph of proportional occurrence of hotspots in the Xingu basin in relation to the forest areas, areas deforested before the year of the hotspot, areas deforested in the same year the hotspot occurred, and areas deforested one year later.

It is also possible to note that the number of hotspots occurring in deforested areas in the same year of the occurrence of the fire increased by 93% between 2018 and 2020, however, its proportion decreased over the three years analyzed to the detriment of the increase in hot spots in forest areas. In 2018, approximately 14% of hotspots occurred in areas that were deforested in 2018. After a reduction in 2019 to 11%, only 9% of hotspots in 2020 had a direct relation with the dynamics of deforestation in the year. Looking at the basin as a whole, this shows a tendency of control loss in the use of fire in recently deforested areas and in already established agricultural areas over areas of natural vegetation such as forests.

Forest fires were less frequent due to the forest's resistance to fire. However, the fragmentation of vegetation due to deforestation, severe drought events, and the recurrence of fire in already burned areas, have resulted in an increase in the edge effect that makes forests more vulnerable and less capable of regeneration.

12.2 Increase in hotspots in forest areas is greater outside the Corridor

Over these three years, there was a greater incidence of hotspots in forest areas outside the Protected Areas Corridor of the Xingu River basin. In the table below, it is possible to observe that in 2020, 75% of all hotspots registered outside the Corridor during the year happened in forested areas.

Outside the corridor	2018	2019	2020	%	2018	2019	2020
Forest	3.010	13.074	25.277		50%	69%	75%
Previous deforestation	1.625	3.737	6.718		27%	20%	20%
Deforestation during the year	1.238	1.911	1.541		21%	10%	5%
Deforestation after one year	157	144	-		3%	1%	0%
Overall Total	**6.030**	**18.866**	**33.536**				

Table 1: Number and percentage of hotspots in relation to their occurrence in forest or deforested areas over the 3 years of monitoring, considering the areas outside the Xingu Corridor

13.3 Inside the Corridor most hotspots occur in deforested areas

We observed that inside the Corridor, the largest proportion of hotspots occurred in areas already deforested (55% in 2020), while the occurrence in forest areas was 35% in 2020. However, the incidence of hotspots in forest areas showed the largest increase over the three years, 274% more in 2020 when compared to 2018. This shows the same trend found in the entire basin, that of an increase in forest fires caused by uncontrolled fires from adjacent deforested areas.

With the advance of deforestation, the desiccation of forests, and temperature increase, uncontrolled fires have become increasingly more frequent. As a result, fires give way to a continuous process that gradually intensifies due to fire recurrence in increasingly degraded forests.

INSIDE THE CORRIDOR	2018	2019	2020	%	2018	2019	2020
Forest	13.808	37.659	51.616		26%	35%	35%
Previous deforestation	31.698	56.598	80.130		59%	52%	55%
Deforestation during the year	7.415	12.320	14.829		14%	11%	10%
Deforestation after one year	651	1.403			1%	1%	0%
Overall Total	**53.572**	**107.980**	**146.575**				

Table 2: Number and percentage of hotspots in relation to their occurrence in forest or deforested areas over the 3 years of monitoring, considering the areas inside the Xingu Corridor

13.4 Wildfires and prescribed burns in the same year

An interesting way to visualize the relation between deforestation and fire is to distribute the hotspots in a matrix chart categorized by colors, where the number of hotspots that occurred according to their month of occurrence in relation to the month of deforestation occurrence is shown in each cell. The color of the cells is related to the number of hotspots, green for low values, yellow for intermediate values, and red for high values.

The matrix chart below shows the values of hotspots that occurred in deforested areas, distributed according to the month of their occurrence in relation to the month deforestation occurred. The matrix chart is divided into nine blocks, covering the distribution of hotspots in relation to deforestation between 2018 and 2020.

The cells highlighted in the diagonal represent values of hotspots that occurred in the same month deforestation occurred, in other words, hotspots that are directly related to deforestation. For every year, most hotspots occur after deforestation occurs (region above the diagonal, in the upper/right part of the blocks in the matrix chart).

Month of occurrence of the hotspot (rows: Month of occurrence of deforestation)

Month of occurrence of deforestation		2018											
		f2018_01	f2018_02	f2018_03	f2018_04	f2018_05	f2018_06	f2018_07	f2018_08	f2018_09	f2018_10	f2018_11	f2018_12
2018	d2018_01	2			2	1	4	9	1	5	4	1	2
	d2018_02	3	2			10	4			1	5	3	
	d2018_03	23	1		2	14	265	242	46	33	92	5	4
	d2018_04	2			3	45	49	282	190	83	285	20	65
	d2018_05	1				18	20	89	147	144	194	18	31
	d2018_06					5	16	42	459	549	78	19	4
	d2018_07							13	161	347	117	41	26
	d2018_08			1			1	23	196	509	231	82	64
	d2018_09						1	1	104	227	133	36	6
	d2018_10	1					2		25	308	432	241	36
	d2018_11							1	10	73	336	540	45
	d2018_12						3	1	3	10	38	163	59
2019	d2019_01	1				1	33	11	3	10	4	15	46
	d2019_02					3		1	4	15	5	3	
	d2019_03							1	3	13	5		2
	d2019_04	2							3	15	5	3	
	d2019_05							3	12	21	7	4	2
	d2019_06							1	13	30	14	6	1
	d2019_07							3	14	55	20	8	3
	d2019_08					1	1	1	20	36	33	12	
	d2019_09							1	12	32	32	26	4
	d2019_10	1				1	1	1	9	14	15	26	2
	d2019_11							1	8	9	18	21	6
	d2019_12	1				1			3	12	10	7	6
2020	d2020_01						1	1	5	6	5	4	
	d2020_02						1		1	48	4		
	d2020_03					1		1	3	9			1
	d2020_04	1		1			1		7	19			1
	d2020_05								2	20	1	1	
	d2020_06						3	1	9	23	2	1	
	d2020_07							2	14	58	10	9	
	d2020_08							2	17	38	7	2	
	d2020_09						1	1	13	58	12	18	1
	d2020_10	2							5	22	29	34	5
	d2020_11								1	18	14	11	4
	d2020_12	1						1	2	9	2	6	

Month of occurrence of deforestation		2019											
		f2019_01	f2019_02	f2019_03	f2019_04	f2019_05	f2019_06	f2019_07	f2019_08	f2019_09	f2019_10	f2019_11	f2019_12
2018	d2018_01							2	48	18	15	8	2
	d2018_02					1			3	15	3		
	d2018_03	6	2			26	105	8	34	14	3	3	
	d2018_04	26	17	2	19	136	317	600	132	51	23	33	25
	d2018_05	15	5		5	294	687	278	259	49	35	25	7
	d2018_06	7	3	1	16	79	270	449	856	212	29	53	10
	d2018_07	19	7		36	70	10	82	443	125	6	14	2
	d2018_08	13	20	17		23	19	105	419	204	29	42	10
	d2018_09	11	3				10	12	231	56	29	21	1
	d2018_10	9	1	3	3	72	255	267	175	86	53	80	8
	d2018_11	25	7	3	1	27	57	55	83	73	70	93	59
	d2018_12	17	4	2	3	118	239	168	44	51	94	79	53
2019	d2019_01	20	7			201	456	457	246	79	41	34	53
	d2019_02	1	7		1	139	435	155	85	46	19	14	16
	d2019_03	1	4			5	38	207	396	61	66	50	3
	d2019_04				2	6	49	502	455	82	100	73	56
	d2019_05						4	210	724	125	73	74	41
	d2019_06						2	109	1759	121	81	41	5
	d2019_07						2	42	1287	327	129	109	23
	d2019_08							34	718	345	149	134	13
	d2019_09		1			1	6	2	443	455	234	257	43
	d2019_10							3	29	109	86	150	39
	d2019_11	1					5	4	16	41	79	242	52
	d2019_12		2				3		11	157	20	90	86
2020	d2020_01								4	219	19	11	12
	d2020_02						1	12	25	82	1	8	9
	d2020_03							4	5	16	1	1	2
	d2020_04	1					1	9	35	10	2		1
	d2020_05	1				4		9	47	35	4	4	
	d2020_06							2	36	7	3	2	
	d2020_07					2	1	5	66	40	16	8	7
	d2020_08						1	13	95	38	13	5	
	d2020_09		1					17	150	86	22	27	8
	d2020_10							3	75	41	27	35	5
	d2020_11							2	14	20	20	17	5
	d2020_12							3	8	3		2	1

Month of occurrence of deforestation		2020											
		f2020_01	f2020_02	f2020_03	f2020_04	f2020_05	f2020_06	f2020_07	f2020_08	f2020_09	f2020_10	f2020_11	f2020_12
2018	d2018_01							4	27	86	83	2	4
	d2018_02								33	3			2
	d2018_03	1				2		5	55	118	5	1	1
	d2018_04	6			6	6	28	62	139	154	43	72	105
	d2018_05		1			78	708	87	709	158	33	39	44
	d2018_06					15	31	245	1029	670	61	39	57
	d2018_07				2		3	50	530	175	60	22	58
	d2018_08	11				3	89	66	720	367	247	54	2
	d2018_09		3				1	35	224	193	84	7	3
	d2018_10					59	31	33	234	309	372	36	11
	d2018_11		1		2	23	23	37	308	401	358	34	19
	d2018_12	11	8		59	52	61	26	66	153	143	42	30
2019	d2019_01	1	2	2	16	72	31	43	30	97	48	14	13
	d2019_02	2	4		14	29	37	9	33	32	31	9	5
	d2019_03	11	9	1	16	58	131	100	275	126	12	207	66
	d2019_04	40	17		5	92	494	26	167	140	29	111	56
	d2019_05	15	7		3	45	166	33	771	272	39	10	8
	d2019_06	6		2		49	240	229	1259	604	55	18	4
	d2019_07					10	15	82	1178	677	117	11	12
	d2019_08					111	293	138	727	443	114	27	12
	d2019_09	1				3	19	19	370	536	181	15	8
	d2019_10	2			1	2	3	10	67	130	95	19	2
	d2019_11	1		2	1	5	17	54	162	111	100	14	4
	d2019_12	6			13	18	48	182	348	109	63	11	7
2020	d2020_01	5	1		5	2	32	262	329	150	18	6	7
	d2020_02	3	1		14	70	194	264	333	148	40	56	9
	d2020_03	1		1	4	15	92	133	432	126	62	315	101
	d2020_04	1			3	5	138	93	1258	167	61	70	20
	d2020_05					4	40	141	1548	136	46	137	51
	d2020_06	1					3	204	950	132	39	85	26
	d2020_07				1	1	1	93	1047	295	148	126	48
	d2020_08	2			1	3		114	1318	268	86	39	28
	d2020_09	1					4	58	1113	1054	296	30	4
	d2020_10						3	10	86	481	415	67	31
	d2020_11					2	1	21	52	65	143	72	57
	d2020_12						5	14	20	12	10	12	22

Table 3: Distribution of hotspots in deforested areas distributed by month of occurrence: Hotspots x Deforested areas. The distribution occurs in 9 blocks, from the upper left to the lower right we have: a) Hotspots 2018 / Sirad X 2018; b) Hotspots 2019 / Sirad X 2018; c) Hotspots 2020 / Sirad X 2018; d) Hotspots 2018 / Sirad X 2019; e) Hotspots 2019 / Sirad X 2019; f) Hotspots 2020 / Sirad X 2019; g) Hotspots 2018 / Sirad X 2020; h) Hotspots 2019 / Sirad X 2020; i) Hotspots 2020 / Sirad X 2020.

The matrix chart shows this distribution trend for the most part over these three years, but looking closely at the distribution of the hotspots of 2020 in relation to the deforestation polygons of 2020, it is possible to notice an increase in the occurrence of hotspots preceding deforestation, with emphasis on the high number of hotspots (1,113) in August 2020, which occurred in an area that would only be deforested in the following month (September 2020).

Also in 2020, it is possible to notice that the largest number of hotspots in areas deforested within the same year occurred in August 2020 in areas cleared three months earlier, in May 2020.

MONTH OF HOTSPOT OCCURRENCE

MONTH OF DEFORESTATION	f2018_01	f2018_02	f2018_03	f2018_04	f2018_05	f2018_06	f2018_07	f2018_08	f2018_09	f2018_10	f2018_11	f2018_12
d2018_01	2			2	1	4	9	1	5	4	1	2
d2018_02	3	2			10	4			1	5	3	
d2018_03	23	1		2	14	265	242	46	33	92	5	4
d2018_04	2			3	45	49	282	190	83	285	20	65
d2018_05	1				18	20	89	147	144	194	18	31
d2018_06					5	16	42	459	549	78	19	4
d2018_07							13	161	347	117	41	26
d2018_08			1			1	23	196	509	231	82	64
d2018_09						1	1	104	227	133	36	6
d2018_10	1					2		25	308	432	241	36
d2018_11							1	10	73	336	540	45
d2018_12						3	1	3	10	38	163	59

Table 4: Distribution of the hotspots of 2018 affecting polygons Sirad X 2018 (Table 3 block a). The diagonal represents the number of hotspots strictly linked to the deforestation process of 2018. Areas to the right of the diagonal represent the number of hotspots that occurred in areas with deforestation recently detected in the year.

Hotspots that happened in deforested areas in the same year were mapped by month:

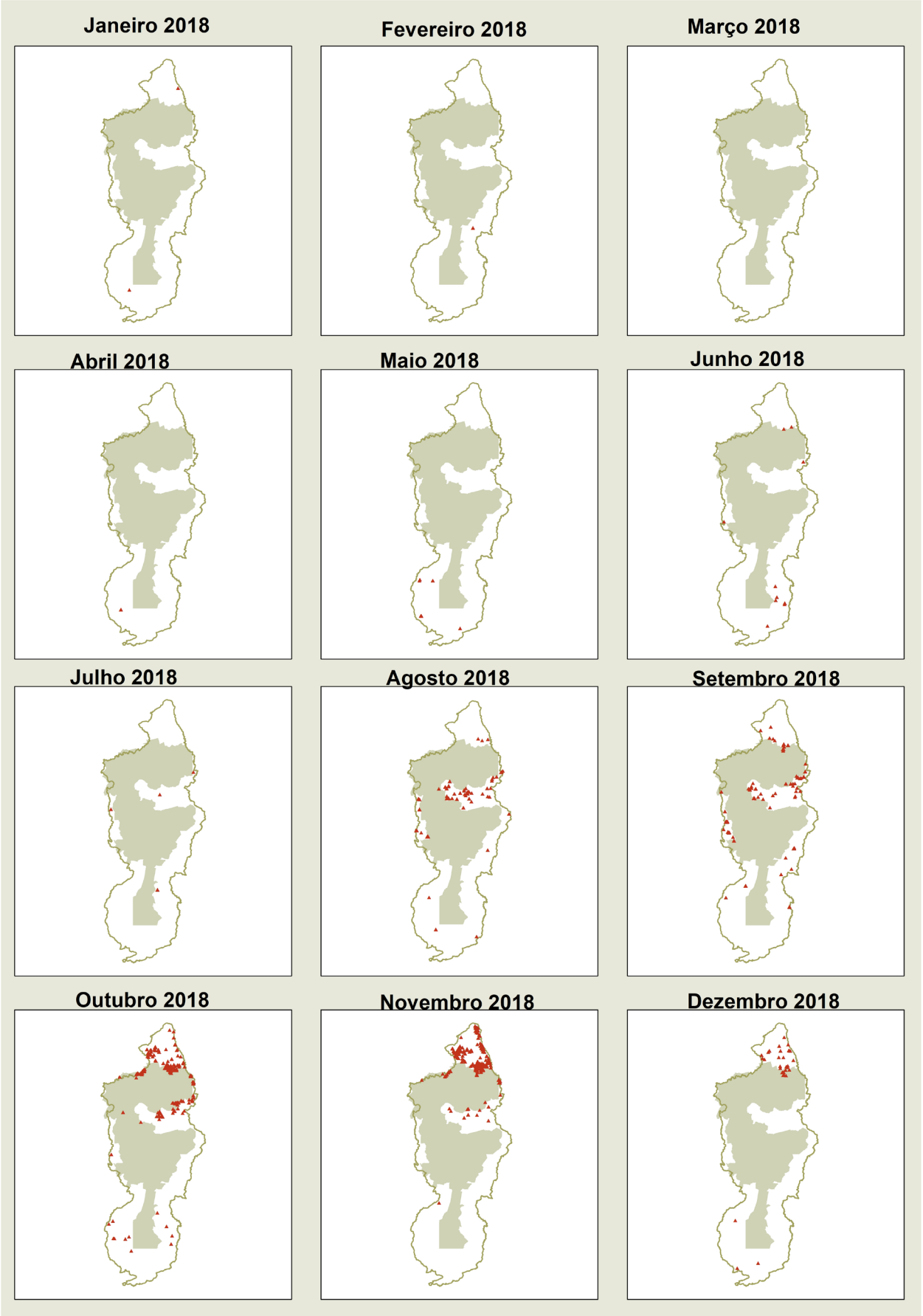


Figure 23: Hotspots in deforestation areas Sirad X in 2018, distributed by month.

2019	2019											
	f2019_01	f2019_02	f2019_03	f2019_04	f2019_05	f2019_06	f2019_07	f2019_08	f2019_09	f2019_10	f2019_11	f2019_12
d2019_01	20	7			201	456	457	246	79	41	34	53
d2019_02	1	7		1	139	435	155	85	46	19	14	16
d2019_03	1	4			5	38	207	396	61	66	50	3
d2019_04				2	6	49	502	455	82	100	73	56
d2019_05						4	210	724	125	73	74	41
d2019_06						2	109	1759	121	81	41	5
d2019_07						2	42	1287	327	129	109	23
d2019_08							34	718	345	149	134	13
d2019_09		1			1	6	2	443	455	234	257	43
d2019_10							3	29	109	86	150	39
d2019_11	1					5	4	16	41	79	242	52
d2019_12		2				3		11	157	20	90	86

Table 5: Distribution of the hotspots of 2019 affecting polygons Sirad X 2019 (Table 3 block e). The diagonal represents the number of hotspots strictly linked to the deforestation process of 2019. Areas to the right of the diagonal represent the number of hotspots that occurred in areas with deforestation recently detected in the year.

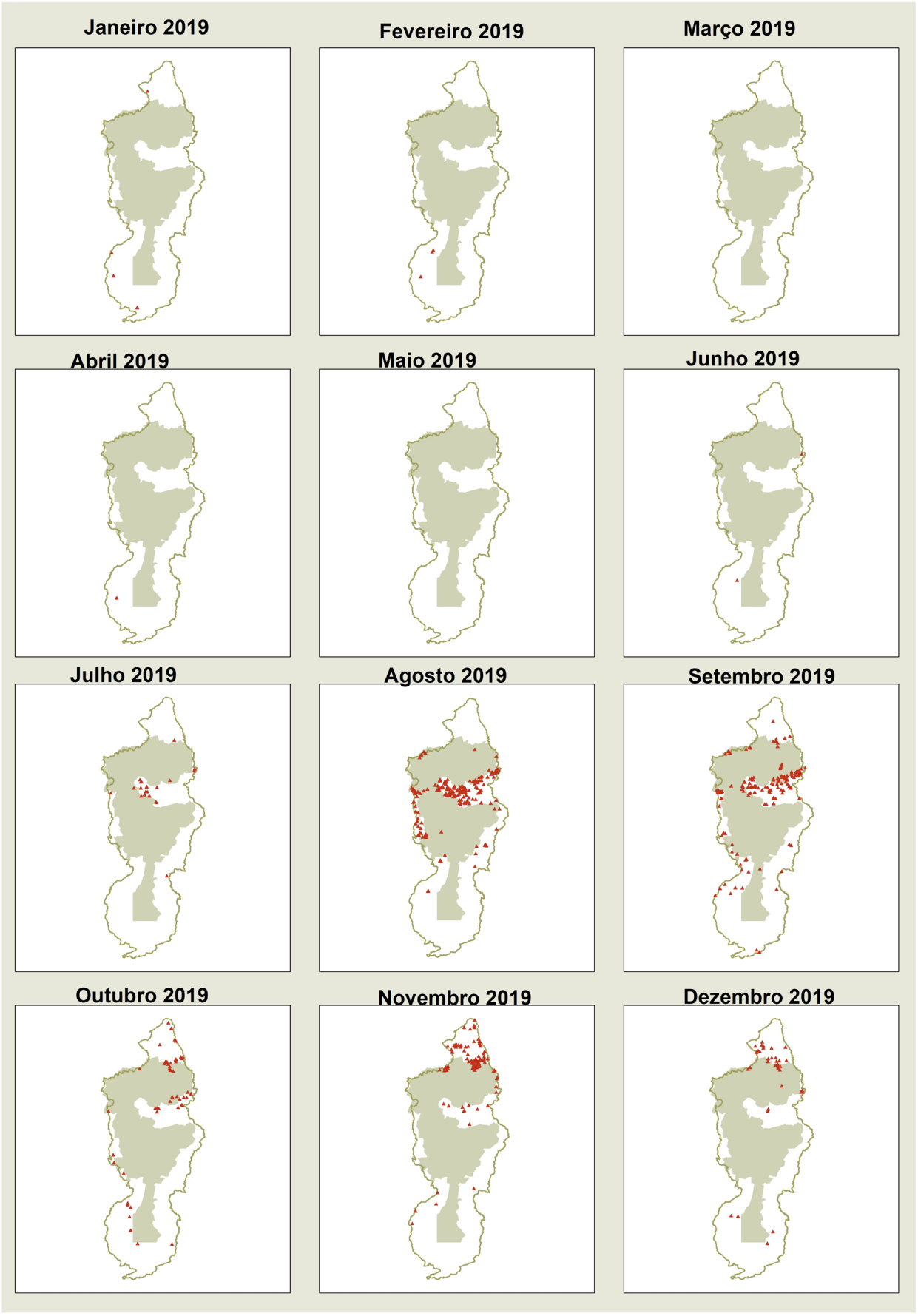


Figure 24: Hotspots in deforestation areas Sirad X in 2019, distributed by month.

2020	2020	f2020_01	f2020_02	f2020_03	f2020_04	f2020_05	f2020_06	f2020_07	f2020_08	f2020_09	f2020_10	f2020_11	f2020_12
	d2020_01	5	1		5	2	32	262	329	150	18	6	7
	d2020_02	3	1		14	70	194	264	333	148	40	56	9
	d2020_03	1		1	4	15	92	133	432	126	62	315	101
	d2020_04	1			3	5	138	93	1258	167	61	70	20
	d2020_05					4	40	141	1548	136	46	137	51
	d2020_06	1					3	204	950	132	39	85	26
	d2020_07				1	1	1	93	1047	295	148	126	48
	d2020_08	2			1	3		114	1318	268	86	39	28
	d2020_09	1					4	58	1113	1054	296	30	4
	d2020_10						3	10	86	481	415	67	31
	d2020_11					2	1	21	52	65	143	72	57
	d2020_12						5	14	20	12	10	12	22

Table 6: Distribution of the hotspots of 2020 affecting polygons Sirad X 2020 (Table 3 block i). The diagonal represents the number of hotspots strictly linked to the deforestation process of 2020. Areas to the right of the diagonal represent the number of hotspots that occurred in areas with deforestation recently detected in the year.

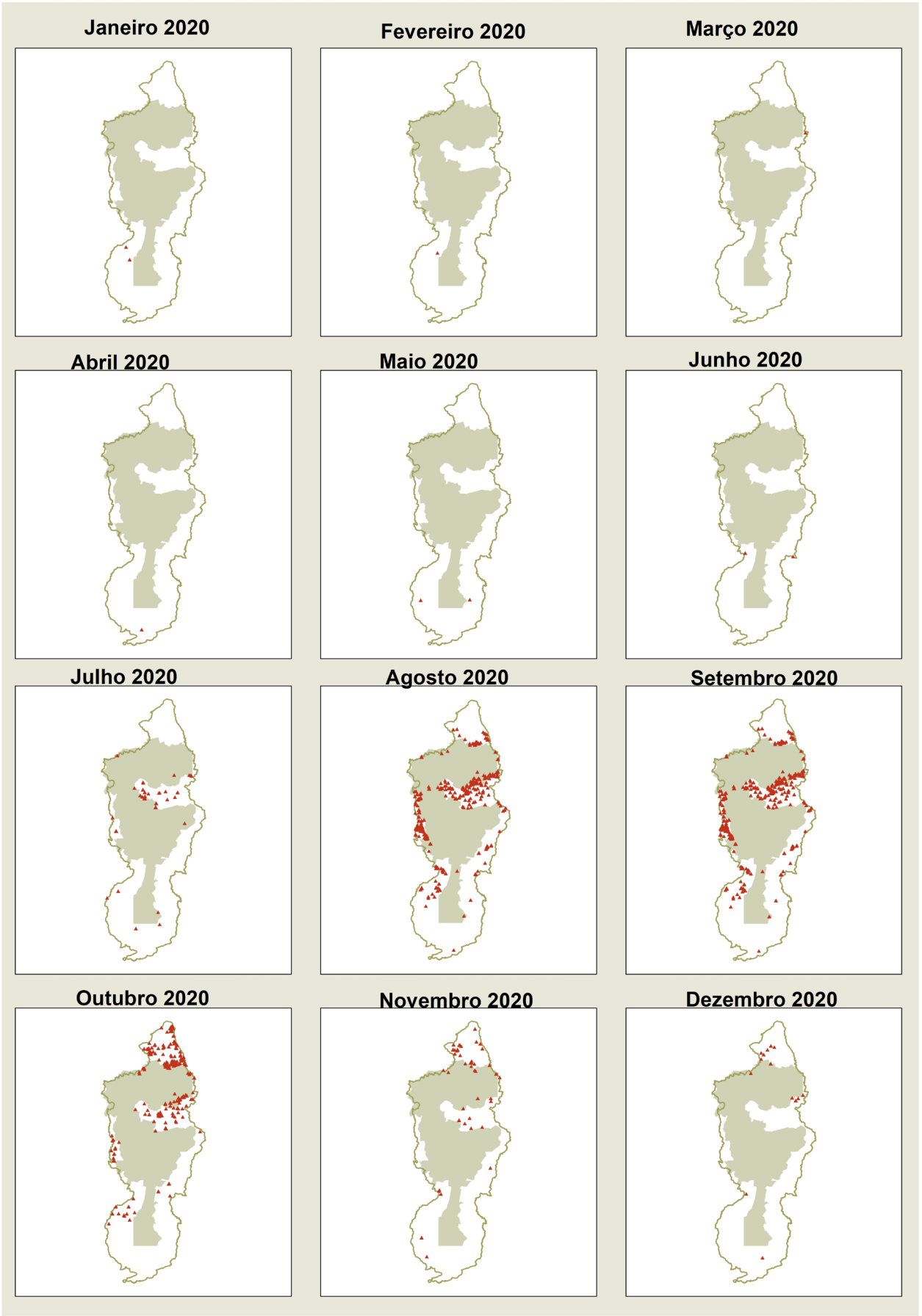


Figure 25: Hotspots in deforestation areas Sirad X in 2020, distributed by month.

14 Conclusion

Through Sirad X monitoring, it was possible to closely monitor the evolution of deforestation in the Protected Areas and their surroundings in the Xingu basin over the last three years, a period in which there was a transition of government and changes to the environmental policies.

Between 2018 and 2020, there was an increase in deforestation inside the Indigenous Lands and Conservation Units, evidenced mainly in the year 2019, due to the upsurge in invasions of Protected Areas, and the recrudescence of illegal mining.

Currently, the Xingu is the most threatened basin in the Brazilian Amazon, with record-breaking deforestation in recent years impacting its protected areas, such as the Environmental Protection Area (APA) Triunfo do Xingu and the Indigenous Lands (ILs) Cachoeira Seca, Ituna Itatá, and Apyterewa. The region of the basin located within the borders of the state of Pará concentrated the highest rates of deforestation, mainly attributed to the role played by the municipalities of Altamira and São Félix do Xingu. Altamira comprises heavily deforested areas due to pressure from large infrastructure projects such as the Belo Monte Hydroelectric Power Plant, and São Félix do Xingu is the municipality that emits the most greenhouse gases in Brazil, both due to the high rates of deforestation as well as its cattle population, which is the largest in the country.

Government rhetoric advocating the reduction of the size of Protected Areas, expected legalization of criminal activities, such as mechanized mining within Indigenous Lands (Draft Law 191/2020), along with the drastic reduction in inspection procedures, all played a part in attracting invaders to ILs Apyterewa, Cachoeira Seca, Ituna Itatá, Trincheira Bacajá, and Kayapó.

The expected regularization of land grabbed (Draft Law 2633/20 and Draft Law 510/21) has also driven invasions in the CUs Altamira Flona, Iriri FES, Esec Terra do Meio, and APA Triunfo do Xingu. Without a management plan or zoning, APA Triunfo do Xingu stands as the most deforested Conservation Unit in all of Brazil in the last ten years, being the epicenter of pressure and threats to Protected Areas in its surroundings. The intensification of deforestation in these areas has compromised the integrity of the Xingu Corridor as a whole and currently jeopardizes the maintenance of its connectivity.

The mosaic of Protected Areas that make up the Xingu Corridor plays the important role of maintaining biodiversity and forest resilience by ensuring the continuous flow of animal and plant species from Mato Grosso to Pará. The Xingu continues to be a true barrier against the advance of deforestation, fire, and the degradation that threatens biodiversity, climate regulation, and also the way of life of indigenous peoples and traditional populations living in its territory. The Amazon may reach a tipping point, giving way to drier, more vulnerable vegetation, losing the capacity to continue exercising its functions. In the context of a climate emergency, protecting the Xingu is, ultimately, protecting ourselves.

Xingu under Bolsonaro

Xingu river basin deforestation assessment (2018-2020)

Near real-time deforestation radar monitoring system in the Xingu river basin (Sirad X)

'Observatório de Olho no Xingu' of the Xingu + Network

REDE Xingu+