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TIMBER INSPECTION IN SÃO PAULO TO COMBAT DEFORESTATION IN THE AMAZON

A FISCALIZAÇÃO MADEREIRA EM SÃO PAULO PARA COMBATER O DESMATAMENTO NA AMAZÔNIA

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Abstract
The Amazon region is one of the largest tropical forest reserves in the world, with illegal deforestation being one of the main risks to its preservation. The state of São Paulo is one of the main destinations for the timber taken from the region. Aiming to curb this activity, the state monitors the transportation and trade of timber, acting directly on the timber economic chain. This descriptive work, using a hypothetical-deductive method, analyzed the characteristics of this activity in the literature and in the occurrences

Resumo
A Região Amazônica é uma das maiores reservas de florestas tropicais do mundo, tendo o desmatamento ilegal como um dos principais riscos à sua manutenção. O estado de São Paulo é um dos principais destinos dessa madeira retirada da região. Visando coibir essa atividade, o estado realiza a fiscalização do transporte e comércio de madeiras, agindo diretamente na cadeia econômica da madeira. Este trabalho descritivo, utilizando um método hipotético-dedutivo, pretende analisar na literatura e nas ocorrências atendidas pelo Policiamento Ambiental do estado de

attended by the Environmental Police of the state of São Paulo, from 2018 to 2022. Identifying 2,470 in flagrante related to the transportation and trade of illegal timber, generating a total of 164,864 M³ of timber seized from 513 different species, of which 80% of the ten most seized have natural incidences in the Amazon region, and half of this timber is from endangered species. The main routes for this timber and the concentration of its trade were mapped, concluding that the inspection carried out by the Environmental Police of São Paulo and its Operational Planning are important and complementary command and control tools for the preservation and protection of the Amazon Rainforest, even though it is in the southeast region of the country.
Keywords: Amazon; Amazon rainforest; illegal timber trade; environmental inspection; environmental Military Police.

São Paulo, nos anos de 2018 a 2022, as características dessa atividade. Identificaram-se 2.470 flagrantes relacionados ao transporte e ao comércio de madeiras ilegais, gerando um total de 164.864 m³ de madeira apreendidas de 513 espécies diferentes, sendo que das dez mais apreendidas, 80% têm incidência natural da região amazônica, e metade dessa madeira é proveniente de espécies ameaçadas de extinção. Ao mapear as principais rotas dessa madeira e a concentração de seu comércio, conclui-se que as ações de fiscalização promovidas pelo Policiamento Ambiental de São Paulo e seu Planejamento Operacional são ferramentas importantes e complementares de comando e controle para a preservação proteção da Floresta Amazônica, ainda que estando na Região Sudeste do País.
Palavras-chave: *Amazônia; comércio ilegal de madeira; fiscalização ambiental; floresta amazônica; Policia Militar Ambiental.*

Introduction

Amazon accounts for way more than just one of the biomes within the Brazilian territory. It is a region rich in biological diversity and natural resources, as well as a center of cultural traditions and home to Indigenous communities. For the peoples who inhabit it, the forest is seen not merely as a source of resources or the "lungs of the planet", but also as a living entity imbued with cosmological significance. However, this biome struggles with serious threats, primarily due to the predatory exploitation of its resources, as in the case of illegal deforestation.

Deforestation in the area known as the Legal Amazon is a phenomenon frequently addressed by both national and international media, standing out as one of the main environmental challenges faced by the country. This issue directly affects Brazil's image abroad and undermines international investment. Moreover, the region is marked by other complex conflicts, such as illegal mining, land invasions, and longstanding social, religious, and cultural disputes, which hinder the establishment of effective governance capable of addressing local demands and ensuring forest conservation.

The high rates of deforestation have drawn global attention. In recent years, figures have exceeded 4,250 square miles (11,000 km²), representing an area of devastation equivalent to millions of soccer fields. Historically, the expansion of agriculture and livestock farming has been identified as the main cause of these losses. As a consequence, the illicit economic exploitation of timber extracted from these areas has also become apparent, with the wood, despite being illegally sourced, often entering both domestic and international markets. A significant portion of the timber sold belongs to species listed as endangered.

Despite the enforcement efforts undertaken, implemented controls have not been sufficient to halt the advance of deforestation. This highlights the need for broader measures by the State, encompassing both the areas where timber is extracted and the end consumers of forest products. Concern over this situation is shared globally, being the subject of international sustainable development goals, such as those outlined in the 2030 Agenda, which include the protection of terrestrial ecosystems and the fight against biodiversity loss.

As a signatory to these goals, Brazil relies on legal instruments to address environmental degradation. Among them is legislation that criminalizes environmentally harmful practices, including offenses against flora, such as the illegal extraction and sale of timber from the Amazon. In addition to criminal representation, the law establishes administrative sanctions, including fines proportional to the volume and species involved, particularly when endangered species are concerned.

At the state level, the regulation of such sanctions may vary, as in the case of São Paulo, where specific provisions ensure greater efficiency in processing violations. The role of São Paulo's Environmental Military Police, though physically far from the Amazon region, has proven paramount in combating the illegal timber trade, contributing significantly to the protection of the biome.

The current legal framework allows for enforcement at various stages of the timber supply chain, including transportation, storage, and sale. This means that even outside the Amazon, there is room for the identification and suppression of illegal activities linked to forest exploitation. Among the challenges faced by authorities is the practice known as "laundering", which consists of giving illegally sourced timber a veneer of legality, making it harder to trace and hold those involved accountable.

Some logging companies, in turn, contribute to this process by failing to properly update inventory control systems, enabling the creation of fictitious balances to legitimize the entry of illegal timber into the market. In light of this,

strict oversight of such establishments is essential to disrupt the cycle of fraudulent legalization and weaken the financial structure supporting environmental crimes.

Based on this context, this study aims to demonstrate the importance of enforcement activities in the state of São Paulo, particularly in lumberyards and in the road transportation of native timber, as an effective strategy to dismantle criminal networks engaged in illegal extraction in the Amazon. The analysis includes the use of operational intelligence technologies and strategic planning, in addition to presenting data on the incidence and trends of timber seizures in recent years.

To this end, a methodological approach was adopted that combines qualitative and quantitative elements, grounded in descriptive research with a hypothetical-deductive framework. The information was obtained through institutional databases and analyzed using geographic *software* tools, allowing for the creation of maps and charts that illustrate the results achieved.

The research is based on the premise that enforcement outside the Amazon territory is an effective environmental protection measure and that the coordinated efforts of state-level public authorities constitute a consolidated policy for combating environmental crimes. The continuation and enhancement of these actions are essential to ensure the conservation of Brazil's natural resources and the integrity of its tropical forests.

1 Methodology

This descriptive research adopted the hypothetical-deductive method, starting from a previously defined problem, as presented in the introduction. To this end, rigorous methodological requirements and scientifically validated criteria were followed (Gil, 2002). The approach is both qualitative and quantitative, as it seeks to understand the motivations, perceptions, values, and interpretations of the subjects involved, while also aiming to extract and systematize new knowledge (Oliveira, 2011).

1.1 Literature review

The literature review considered studies and articles related to the extraction and trade of illegal timber from the Amazon, including aspects concerning transportation and storage. The selection aimed to understand the economic, historical, and social contexts of the activity, as well as to analyze preventive and repressive measures adopted by the Environmental Policing Command of the State of

São Paulo (CPAmb – *Comando de Policiamento Ambiental do Estado de São Paulo*).

Searches were conducted in the Bibliographic Database of the University of São Paulo, through the Águia USP Integrated Search Portal. The following keyword combinations were used: "*illegal logging in the Amazon*"; "*illegal storage of Amazon timber*"; "*deforestation in the Amazon*"; "*timber trafficking in the Amazon*", and their equivalents in Portuguese. The "reviewed by peers" filter was applied in all searches, and the first five result pages sorted by relevance were analyzed, following a methodology similar to that of Marques (2018).

1.2 Area of study

The area of study is limited to the state of São Paulo, which has a territorial extension of 95,832.6 square miles (248,219.481 km²) and is divided into 645 municipalities. According to the Brazilian Institute of Geography and Statistics (IBGE, 2010), its estimated population in the 2022 Demographic Census was 44,420,459 inhabitants, representing approximately 17.89% of the Brazilian population. Although it is the 12th largest state in territorial area, São Paulo has the highest Human Development Index (HDI) among the federal units, with a score of 0.783 (IBGE, 2010). The territory is predominantly composed of the Cerrado biome in its central region, and the Atlantic Forest in the coastal and western areas.

1.3 Data collection

The data collection technique used in this study was secondary data analysis, as it involved information previously recorded by the Environmental Military Police through police reports and environmental infraction notices entered into the SIOPM WEBAIA system. According to Saunders and Thornhill (2007), in the classification of secondary data, this study used documentary data from public institutions, such as forms, reports, and meeting minutes.

Environmental police reports, from 2018 to 2022, that mentioned illegal timber seizures were selected. The compilation of the data provided by CPAmb resulted in ".xls" spreadsheet files, which allowed for the organization of the following information:

- Geographic coordinates (in decimal degrees, according to the SIRGAS 2000 datum), to identify the places of occurrence.
- Volume of timber seized (in cubic meters [m³]).

- Identified plant species.
- Legal statute corresponding to the offense.
- Date of the occurrence.

This methodology is consistent with that employed by authors who analyzed wildlife seizure data in federal units such as Bahia (Nascimento, Czaban, & Alves, 2015), Minas Gerais (Destro *et al.*, 2012), and São Paulo (Almeida & Calandrini, 2021).

Only public records involving flagrant offenses and seizures were considered, specifically those classified under Article 46, Sole Paragraph, of Law No. 9,605/1998 (Environmental Crimes Law), related to the transportation, storage, and commercialization of timber of illegal origin (Brasil, 1998).

1.4 Data processing

The data were organized into a spreadsheet using *Microsoft Excel 2010* (version 14.0.4760.1000), structured with the following columns: number of occurrences; date (day, month, and year); latitude and longitude of the location; scientific name of the timber species; and quantity in cubic meters (m^3). This structure enabled the identification of occurrences and the quantification of the seized species. The *Excel* "Pivot Table" feature was used to cross-reference the quantity and species seized, allowing for the identification of the main timber species being illegally traded in the state of São Paulo.

Next, georeferencing of the occurrences and tree species was performed using Quantum GIS software, version 3.28.2-Firenze. The "SIRGAS 2000" datum and a coordinate system in decimal degrees were applied, with overlays on the map of the state of São Paulo, allowing for the analysis of the spatial distribution of the seizures.

2 Results and discussion

2.1 Forest management

Earth is heading toward a potential sixth mass extinction, in which up to three-quarters of all fauna and flora species could disappear within a few centuries. Anthropogenic actions have been the primary driving force behind this staggering prediction, particularly due to the destruction and conversion of natural *habitats* (ONU, 2022).

The change or conversion of *habitats* directly reflects how humans use and

occupy forest environments, which transforms both the landscape and the ecosystem services it provides, such as local temperature regulation, seed dispersal, and the maintenance of biodiversity. This dynamic does not unfold in a linear or isolated manner but rather as a truly complex system, characterized by uncertainty, self-organization, heterogeneity, and nonlinearity (Filotas *et al.*, 2014).

One emerging approach to dealing with the impacts on these landscapes is the relatively recent concept of landscape governance. This proposal shifts forest area management away from being the exclusive responsibility of the State, instead distributing this responsibility among multiple social actors, such as civil society and rural producers, to address the uncertainties and complexities of socio-environmental issues (Cordeiro-Beduschi *et al.*, 2022).

Discussions surrounding the functioning of landscapes and forests have expanded with the inclusion of new variables in the system, such as spatial and temporal scale. This has required joint action between governance structures and formal governments to address local issues that could potentially lead to global consequences, such as those associated with climate change (Cash *et al.*, 2006).

Thus, by thinking of forest and landscape governance as a complex socioecological system to which one-size-fits-all solutions ("silver bullets") do not apply, a broadening of the range of actors involved in the decision-making process becomes necessary. The greater the plurality of voices in the formulation of continuous and adaptive public policies, the higher the chances of success (Nagendra & Ostrom, 2006). In this regard, the role of institutions outside the Amazon region, such as the Environmental Military Police of the State of São Paulo, stands out as particularly important.

2.2 Timber as a natural resource and the DOF System

One of the main challenges faced by forest governance is ensuring the sustainability of the legal harvesting and commercialization of timber, a natural resource subject to regulation and control by environmental agencies. Such activity is considered legal when it complies with Article 36 of Law No. 12,651/2012 (Forestry Code):

> Article 36. The transportation, by any means, and storage of timber, firewood, charcoal, and other forest products or by-products from native forest species for commercial or industrial purposes require a permit from the competent SISNAMA authority, following the provisions of Article 35.

> Paragraph 1. The permit […] shall be formalized through the issuance of the DOF […].
> Paragraph 2. […] must be registered under the Federal Technical Registry […]
> Paragraph 3. […] it is mandatory to require the presentation of the DOF […]
> Paragraph 4. The DOF must include the specification of the material, its volume, and information on its origin and destination[1] (Brazil, 2012, free translation).

As established by legislation, timber must be accompanied by a *Documento de Origem Florestal* (DOF – Document of Forest Origin) throughout its entire custody chain—from extraction, through storage and transportation, to the final consumer. The document must mandatorily include information on the origin, destination, volume, type of product, and botanical group, enabling timber traceability and deterring illegal logging, especially in the Amazon context.

Established by MMA Ordinance No. 253/2006, the DOF is managed by the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA). The system encompasses all stages of the timber cycle, from logging to the final transformation of the product. Currently, only three states have their own systems integrated into the federal management structure: Pará and Mato Grosso (SISFLORA) and Minas Gerais (SIAM). In December 2022, IBAMA launched the DOF+ Traceability System, aimed at enhancing control mechanisms across the forest custody chain (IBAMA, 2023).

Although logging is an activity subject to licensing and potentially sustainable, it is essential to intensify command-and-control efforts to curb illegal practices. Given the high profitability of the illegal timber trade, the actions of enforcement agencies represent a strategic tool to dismantle the illicit production chain and discourage predatory exploitation.

2.3 The legal timber trade

The exploitation of native forest products, especially timber, constitutes a legal economic activity that generates public revenue and employment. When conducted following current environmental legislation, it may be considered environmentally sustainable.

[1] From the original: "Art. 36. O transporte, por qualquer meio, e o armazenamento de madeira, lenha, carvão e outros produtos ou subprodutos florestais oriundos de florestas de espécies nativas, para fins comerciais ou industriais, requerem licença do órgão competente do SISNAMA, observado o disposto no art. 35.
§ 1º A licença […] será formalizada por meio da emissão do DOF […].
§ 2º […] deverá estar registrada no Cadastro Técnico Federal […]
§ 3º […] é obrigado a exigir a apresentação do DOF […]
§ 4º No DOF deverão constar a especificação do material, sua volumetria e dados sobre sua origem e destino".

However, complying with the complex Brazilian legal framework for environmental protection—regarded as one of the most rigorous in the world—poses significant challenges. The first obstacle lies in obtaining the required environmental licenses, particularly in the Amazon biome, where 80% of the native vegetation must be preserved as Legal Reserve, as mandated by the Forest Code (Brasil, 2012). In addition, licensing must assess restrictions arising from Conservation Units, Indigenous Lands, the presence of endangered species, and include mitigation and compensation measures for environmental impacts.

Environmental authorization may be issued by IBAMA (at the federal level) or by the State Secretariats for the Environment and must be integrated into the *Sistema Nacional de Controle da Origem dos Produtos Florestais* (SINAFLOR– National System for Controlling the Origin of Forest Products). States that do not follow SINAFLOR are required to ensure integration of their systems with the national database.

Generated by the system of the same name, the DOF may only be issued if it is linked to a valid environmental license registered with SINAFLOR. The authorization must be accompanied by a forest inventory containing detailed information on species, volumes, and timber yield, prepared by a qualified professional. Based on this inventory, timber credits are issued, enabling the subsequent issuance of DOFs.

For each harvesting operation, the entrepreneur must issue a felling declaration containing the volumetric and botanical information of the extracted trees. This data is entered into SINAFLOR and generates the available timber balance in the company's yard, which must match both the physical and virtual inventory in the DOF system.

Commercial transactions between companies require that both parties have yards authorized in the DOF system. The process takes place in four stages: (1) offer (originating company); (2) acceptance (receiving company); (3) issuance of the DOF (originating company); and (4) confirmation of receipt (receiving company). Failure to comply with these steps invalidates the DOF and renders the shipment illegal, subject to regularization by the competent environmental authority.

The only exception is the sale to the final consumer, in which case the DOF issued concludes the custody chain, preventing any further resale of the product, under penalty of illegality.

Since its creation, the DOF system has enabled real-time public queries, management reports, and field inspections using internet-connected mobile devices. Traceability and interoperability between systems are key factors in ensuring effective environmental control.

However, regulatory demands, combined with the complexity of the system, may encourage the growth of the illegal timber market. Thus, the success of forest control policy depends directly on the rigorous actions of enforcement agencies, including those operating outside the Amazon region, such as the Environmental Military Police of the State of São Paulo.

2.4 The commercial sector and its relationship with enforcement agencies

The timber supply chain, particularly that involving Amazonian timber, is frequently subject to oversight by environmental agencies and the Environmental Military Police. Given the predictability of these inspections, entrepreneurs in the industry often seek guidance from Environmental Policing authorities to clarify questions related to current regulations and inspection procedures, as well as to understand the proper organization and control of their timber inventories.

With the implementation of the DOF+ Traceability system, the Brazilian timber industry has entered the third phase of its forest control regime. Since the creation of the DOF in 2006, the system has been continuously improved, not only to suppress the transportation and trade of timber without valid documentation, but also to identify operations involving irregular timber balances, which may be used to legitimize products originating from illegal deforestation.

The initial phase of forest control, in effect until August 2006, was marked by a decentralized, physical system overseen by IBAMA. The documentation required for inspections was kept both in official agency offices and at the timber businesses themselves. During this phase, control was carried out through the *Autorização para Transporte de Produtos Florestais* (ATPF – Authorization for the Transportation of Forest Products), a printed form filled out by the entrepreneur. Although formally regulated, the model presented significant vulnerabilities, particularly concerning document authenticity and field verification, thereby hindering the effectiveness of environmental enforcement.

The second phase began in 2006 with the implementation of the DOF Legacy system, a nationwide digital platform that substantially modernized procedural oversight. The system became accessible via the internet, allowing for immediate document validation through barcode scanning. This innovation had a measurable impact on deforestation rates in the Legal Amazon, where the annual average of 7,045 square miles (18,250 km²) prior to the implementation of the DOF dropped to approximately 3,243 square miles (8,400 km²), a 53% reduction over the 16 years of the DOF Legacy system (INPE, 2022).

The third phase, launched in 2023 with the rollout of DOF+ Traceability, constitutes a functional and technological advancement over its predecessor. This new model incorporates an alphanumeric tracking code into the traditional DOF, enabling full identification of the product's forest origin. The code contains information such as the type of authorization (e.g., AUTEX), the issuing unit's code, the year and number of the authorization, and the specific log segment from which the batch originated.

Through the SINAFLOR platform, the system enables end-to-end traceability of timber from its source, including, for instance, the ability to verify the economic efficiency of the transportation route. Additionally, DOF+ records the movement of timber batches across different yards, allowing the identification of transport routes inconsistent with logical production and consumption patterns, such as the transport of timber from the state of São Paulo to Pará. In the event of irregularities, it is possible, through managerial action, to block all timber balances linked to an authorization with inconsistent origin data.

Command-and-control operations conducted by the Environmental Military Police of the State of São Paulo have played a decisive role in preserving the Amazon by curbing the illegal timber trade and promoting the accumulation of surplus balances in timber yards in São Paulo. Such actions reinforce the legality and transparency of the sector while simultaneously hindering the operations of irregular businesses, which are often engaged in related offenses such as money laundering and organized crime.

The coverage of the DOF+ Traceability system's functionalities, combined with technical expertise in timber enforcement, enables authorities to differentiate between legitimate enterprises and illegal or front operations. In doing so, the Environmental Military Police reinforces not only forest governance but also the broader mechanisms of environmental justice and economic competitiveness within the sector.

It is worth noting that, although enforcement actions may initially generate unease, a significant level of cooperation has been observed among business owners in São Paulo, who recognize the benefits of distancing themselves from illicit actors. This collaboration reflects a strong alignment between Environmental Policing practices and the principles of Community Policing, fostering a model of environmental public security grounded in legality, transparency, and respect for natural resources.

2.5 Criminological theories

The development of an effective system for controlling environmental crimes, such as the illegal extraction and trade of timber, requires a multidisciplinary approach grounded in a range of criminological theories and criminal policy models. Among these, this study highlights the Economic Theory of Crime and the Situational Crime Prevention model, both of which offer theoretical support for the administrative and preventive efforts of the Environmental Military Police of the State of São Paulo.

The Economic Theory of Crime, developed by Gary Becker (1974), applies economic reasoning to criminal behavior, viewing crime as the outcome of rational decisions based on a cost-benefit analysis. From this perspective, criminal conduct is seen as a rational choice made by the person when the expected utility of the offense outweighs the gains from lawful activity (Becker, 1974). Posner (2007) reinforces this view by asserting that crime occurs when its anticipated benefits surpass its expected costs. Accordingly, individuals tend to continue engaging in unlawful conduct as long as the marginal return exceeds the marginal cost (Barbosa, 2019).

This approach, also known as rational choice theory, assumes that individuals act rationally by weighing the benefits of illegal actions against the risks of punishment. This rationale is particularly relevant to profit-driven offenses such as timber trafficking, where offenders carefully assess the potential financial returns in light of the probability and severity of punishment (Ehrlich, 1973; Almeida & Guanziroli, 2013).

Becker (1968) emphasizes that, in the absence of significant costs or real risks of punishment, the rational tendency is to opt for illegal activities, particularly when they yield higher profits than the legal alternatives. Within this framework, increasing the costs associated with criminal behavior, including moral, logistical, and legal costs, is essential to discouraging its practice.

To deter high-profit crimes such as timber trafficking, it is therefore necessary to raise their economic costs through administrative and criminal sanctions, including steep fines and asset seizures. Such measures, by rendering the crime economically unviable, function as preventive mechanisms against illegal deforestation (Molina & Gomes, 2011). Accordingly, enforcement actions focused on the transportation and commercialization of timber become strategic tools that directly alter the economic incentives underlying criminal activity, encouraging offenders to abandon such behavior.

In the field of crime prevention policy, the Situational Crime Prevention model emerges as an effective and complementary approach to traditional repressive strategies. Among the various models of criminal response, including the classical, neo-classical, and situational approaches, the latter proves particularly well suited to the operations of the Environmental Military Police, especially in secondary prevention efforts and the curbing of illegal timber trafficking.

Secondary prevention targets contexts where crime is already occurring, focusing selectively on groups or territories at elevated risk of involvement in criminal activity. This type of intervention is guided by general prevention principles and supported by statistical data (Molina, 2013).

Situational prevention, in turn, is premised on the idea that crime is a rational, selective, and instrumental act wherein offenders seek out favorable opportunities (specific locations, timing, or vulnerable targets). The intervention, therefore, seeks to neutralize these opportunities by modifying the environment, reducing the attractiveness of the offense, and increasing the perceived risk (Molina & Gomes, 2011).

Unlike primary prevention, which addresses the social and structural roots of crime, situational prevention focuses on the specific conditions that facilitate its occurrence. Its objectives are short-term and pragmatic, aiming at the immediate containment of crime through targeted and effective actions (Molina, 2013).

Situational techniques include: (1) increasing the effort required to commit the offense; (2) increasing the perception of risk; (3) reducing the expected rewards; and (4) strengthening internal deterrents, such as guilt (Molina & Gomes, 2011). Among these, a technique that stands out in the operations of the Environmental Military Police is the enhancement of perceived risk through formal surveillance, such as roadblocks and inspections at lumberyards and during timber transport.

The effectiveness of this model also relies on the intensive use of police intelligence and information and communication technologies to identify patterns, locate crime "hot spots", and strategically mobilize personnel. As a result, police operations become increasingly selective, coordinated, and evidence-based.

The integration of the Economic Theory of Crime with the Situational Crime Prevention model thus supports a dual approach that simultaneously increases the certainty of punishment and reduces the economic appeal of environmental crime. This promotes rational deterrence among offenders and enables more effective protection of natural resources.

As argued by Beccaria (1974) and later reaffirmed by Molina and Gomes

(2011), it is not the severity of punishment that determines its effectiveness, but rather its certainty and inevitability. The perception of imminent and unavoidable punishment exerts a stronger influence on the behavior of potential offenders than harsh but uncertain sanctions. The concrete risk of detection is, therefore, a critical factor in promoting compliance with legal norms and ensuring environmental protection.

2.6 Inspection of timber transportation and storage in São Paulo

The institutional mission of the Environmental Military Police of the State of São Paulo is the protection of natural resources, including those of forest origin. Within this context, the inspection of native timber represents a recurring and high-priority activity in the force's operational agenda.

Despite such efforts, the illegal timber trade continues to persist in consumer markets, largely sustained by a scheme known as "laundering". The practice consists of mixing illegally sourced timber with legally documented products, thereby obscuring the traceability of its origin and undermining the enforcement of administrative and criminal penalties. To carry out this scheme, offenders frequently operate through shell lumberyards and manipulate the DOF system by failing to reconcile virtual balances with physical stock, enabling the fraudulent accumulation of credits and the redistribution of those credits to other lumberyards, thereby simulating legality.

In order to combat this type of offense, the Environmental Policing Command's Strategic Planning (PlanOp) was introduced in 2020. This biennial administrative document is designed to guide the operational activities of the Environmental Policing Command through the definition of priority areas, thematic lines, and operational goals (CPAmb, 2020). The PlanOp outlines three strategic axes for the 2022–2023 biennium: (a) Ichthyological Fauna; (b) Terrestrial Fauna; and (c) Flora, the latter subdivided into five thematic lines, among which "Native Timber" is particularly prominent. The strategy encompasses two main areas of action: (1) inspection of lumberyards; and (2) inspection of native timber transportation.

It is important to emphasize that the PlanOp does not restrict enforcement efforts but rather establishes minimum structural parameters to ensure the effective protection of natural resources. For the first year of the plan's implementation, the target was set at 648 inspections, covering both the timber trade and transportation.

Enforcement takes place in two modalities: (a) in transportation, through tactical roadblocks on highways and secondary roads, involving vehicle inspections and verification of cargo against the DOF; and (b) at lumberyards, through audits of registered facilities, assessing species consistency, woodcut, physical volume, and the stock balance recorded in the system. Clandestine businesses that are not formally registered are also subject to inspection.

In both modalities, any discrepancies between physical and digital inventory, whether excess or shortage, result in the issuance of an infraction notice and the seizure of irregular material. This measure is intended to prevent both the circulation of illegally sourced timber and the perpetuation of laundering practices through the reuse of invalid credits within the DOF system.

The enforcement actions implemented in the state of São Paulo have a deterrent effect on the illegal timber supply chain originating in the Legal Amazon by hindering undocumented interstate trade and preventing the fraudulent reintegration of such products into the commercial circuit through both punitive and operational measures.

In terms of training, a key initiative is the implementation of the Professional Specialization Course in Timber Activity Inspection, comprising 47 hours of classroom instruction and held on a semiannual basis. The program is designed to strengthen the technical expertise of environmental military police officers, thereby enhancing the effectiveness of enforcement efforts.

2.7 Timber inspection results

Based on data collected from the Environmental Policing Command Database, it was possible to identify the number of occurrences involving violations in the transportation, storage, and sale of timber, as well as their geographic distribution, the volume of timber seized, and the species involved, which facilitated the development of a dispersion map illustrating the locations of the occurrences, along with a thematic map indicating their frequency, visually reproducing the *hotspots* of this criminal activity—a technique previously applied to map wildlife trafficking in the state of São Paulo (Calandrini & Almeida, 2022).

Furthermore, the results made it possible to rank the most frequently seized timber species and their geographic origin, identifying those most commonly associated with illegal transport, thereby supporting further strategic analysis for command-and-control operations and guiding inspection efforts.

2.7.1 Occurrences Involving Illegal Timber

An analysis of the five years, 2018 to 2022, revealed a total of 2,470 occurrences in which the Environmental Military Police responded to criminal offenses defined under Article 46, Sole Paragraph, of the Environmental Crimes Law, which were directly related to the transportation, storage, and commercialization of native timber without authorization from the competent authority (Brasil, 1998), meaning timber of illegal origin, and the distribution of these occurrences over the analyzed period is presented in Table 1

Table 1. Annual number of incidents involving illegal timber

Year	2018	2019	2020	2021	2022
No. of occurrences	499	367	382	549	673

Source: prepared by the authors.

As observed, although there was a decline in the number of offenses recorded under this legal classification between 2019 and 2020, a significant increase has been noted since, coinciding with the implementation of the Operational Planning strategies for the 2020–2021 and 2022–2023 biennia, which reinforces the idea that such operational management tools have a strong impact on enforcement outcomes and can also be illustrated graphically to facilitate interpretation, including the visualization of a trend line.

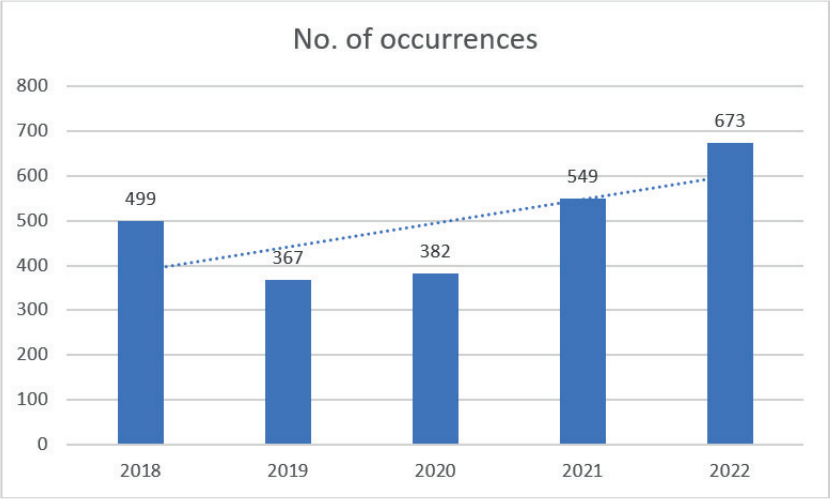

Chart 1. Annual number of incidents involving illegal timber.
Source: prepared by the authors.

2.7.2 Crime Geolocation

Based on georeferenced incident data, two maps were generated: one displaying the density and spatial distribution of such incidents across the state and the other transforming these data points into a heat map that visually highlights the hotspots of crimes related to timber trafficking in the state of São Paulo.

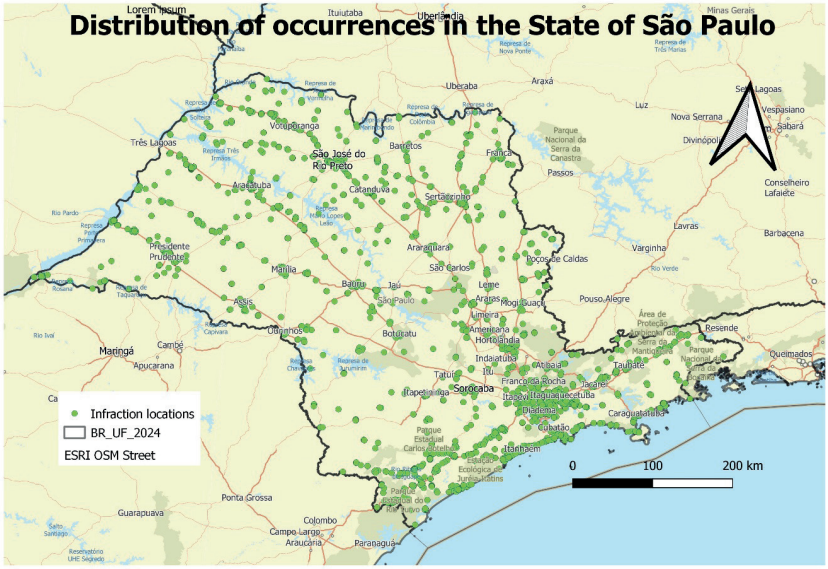

Figure 1. Geographic distribution of incident locations.
Source: prepared by the authors.

As shown, there is a clear correlation between timber-related incidents and major urban centers, as evidenced by the high concentration of occurrences located in the metropolitan and coastal regions of São Paulo, and it is also possible to identify the state's primary timber transport routes, particularly the federal highways BR-116—known as Rodovia Régis Bittencourt in the southern region and Rodovia Presidente Dutra in the northeast—as well as the main state highways that cross the territory, with these patterns becoming even more evident in the heat map (Figure 2).

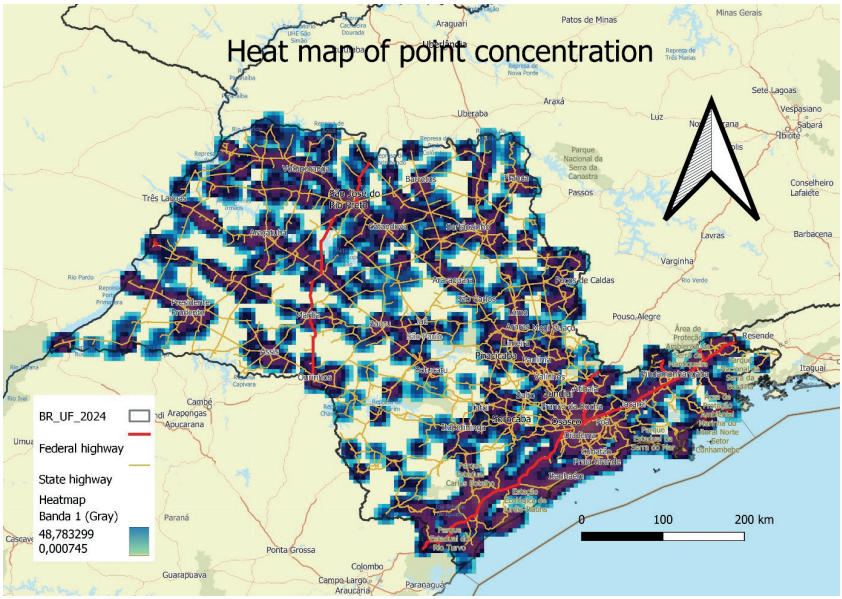

Figure 2. Heat map of incident locations.
Source: prepared by the authors.

As demonstrated in Figure 1 and reinforced in Figure 2, there is a strong association between the state's major road corridors and the irregular transportation of timber which underscores the critical importance of monitoring this criminal modality and highlights São Paulo's role as a key transit route along the South–Southeast axis for timber originating from the Legal Amazon while the largest volumes of consumption of this natural resource are concentrated in the state's major urban centers.

2.7.3 Most Frequently Seized Species

Based on the data on timber seizures during the study period, it was possible to identify both the volumes and the species involved, as over the five-year analysis, a total of 164,864 m³ of timber was seized, comprising 513 different species, with their annual distribution presented in Table 2.

Table 2. Volume of timber seized (m³)

Year	2018	2019	2020	2021	2022
Volume of timber seized in cubic meters (m³)	17,770	6,387	17,184	41,688	81,835

Source: prepared by the authors.

As a direct reflection of the number of recorded incidents, a corresponding increase in the volume of timber seized can be observed. This reinforces the conclusion that increased enforcement efforts, particularly the application of operational intelligence strategies, resulted in not a linear but an exponential rise in operational outcomes during the years 2021 and 2022 (Graph 2).

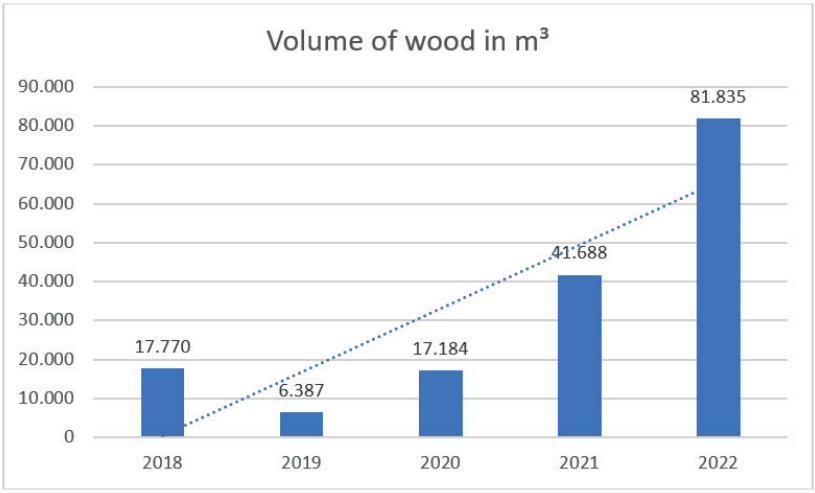

Chart 2. Volume of timber seized (m³)
Source: prepared by the authors.

Table 3 presents the ten most frequently seized timber species and their respective volumes during the study period with the top two species *Dialium guianense*, commonly known as jataipeva, and *Apuleia leiocarpa*, known as garapa accounting for 63,848 m³ and 14,082 m³ respectively and together representing nearly half of the total volume of timber seized in the state while the combined volume of the ten most frequently seized species totals 107,905 m³ amounting to more than 60 percent of all timber seized drawn from over 513 identified species.

Table 3. Volume of timber seized (m³)

Position	Scientific name*	Common name	m³
1.º	*Dialium guianense**	Jataipeva	63,848
2.º	*Apuleia leiocarpa**	Amarelão, Garapa	14,082
3.º	*Gochnatia polymorpha*	Cambará	6,024
4.º	*Allantoma lineata*	Ceru	4,800
5.º	*Apuleia molaris**	Muirajuba	4,342
6.º	*Abarema jupunba*	Ingarana	4,166
7.º	*Carapa spp.*	Andiroba	2,893
8.º	*Qualea spp.**	Mandioqueira	2,685
9.º	*Amburana cearensis**	Cerejeira	2,563
10.º	*Goupia glabra*	Copiúba	2,502

* Species classified as threatened with extinction, following MMA Ordinance No. 148/2022.
Source: prepared by the authors.

It is important to emphasize that, among the ten most frequently seized timber species over the five-year analysis period, only two are not primarily native to states within the Legal Amazon: *Amburana cearensis*, which still occurs in northern Tocantins (Coradin, Camillo, & Pareyn, 2018), and *Gochnatia polymorpha*, which is commonly found in Brazil's South and Southeast regions.

As for the remaining species, although some—such as *Apuleia leiocarpa*—can still be found in the state of São Paulo, their origin, highest population density, and in some cases even their endemism are associated with the Amazon region, as is the case with *Carapa spp.* and *Allantoma lineata*.

Another striking aspect of the data concerns timber species classified as threatened with extinction: among the ten most frequently seized species, half are listed as endangered, not including others identified in the study, such as *Swietenia macrophylla* (mahogany), *Cedrela fissilis* (cedro-rosa), and *Mezilaurus itauba* (itaúba), which together account for over 172 m³ and are all highly valuable species at significant risk of extinction due to illegal deforestation.

Conclusion

Based on the results and discussions presented, it is evident that the inspection of timber yards and the transportation of wood in the state of São Paulo, conducted by the Environmental Military Police, is an effective tool in supporting efforts to combat deforestation in the Amazon region, given that between 2018

and 2022 alone, 2,470 incidents related to the transport and trade of illegal timber were recorded, resulting in a total of 164,864 m³ of wood from 513 different species, 80% of the ten most frequently seized of which are naturally found in the Amazon, and half of which consist of species threatened with extinction.

Thus, the hypotheses tested in this study were confirmed, as environmental inspection—even outside the Amazon territory—proved to be an important tool in discouraging illegal deforestation by acting directly on the economic chain of the timber trade, weakening organized crime (economic theory of crime), as well as highlighting the importance of the creation of the Strategic Planning Public Policy developed by the Environmental Policing Division of São Paulo (situational crime theory), considering the significant year-over-year increase in operational results aimed at protecting timber originating from the Legal Amazon since the policy was implemented.

Although located outside the Amazon region, the state of São Paulo is a major consumer of Amazonian timber; therefore, maintaining and expanding enforcement actions across its timber supply chain remains an effective command-and-control strategy for curbing illegal practices associated with this natural resource, with intelligence-led operations continuing to play a key role in strengthening the positive results seen in recent years.

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