



Universidad
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TÍTULO

ENFORCEMENT ACTIONS AGAINST ILLEGAL TRADE OF
PAUBRASILIA ECHINATA
REVEALING FRAUDS IN BRASIL'S BOW MAKING INDUSTRY

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	Esta edición electrónica ha sido realizada en 2025
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Institución	Universidad Internacional de Andalucía
Curso	<i>Máster de Formación Permanente en Gestión y Conservación de Especies en Comercio: El Marco Internacional (2023/24)</i>
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Fecha documento	2025



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**Universidad Internacional
de Andalucía**

UNIA MASTER'S DEGREE IN
MANAGEMENT AND CONSERVATION OF SPECIES IN TRADE:
THE INTERNATIONAL FRAMEWORK (15th edition)

Academic year 2023-2024

Master Thesis

“Enforcement actions against illegal trade of *Paubrasilia echinata*:
revealing frauds in Brazil's bow making industry”

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To obtain the UNIA Master Title in Management and Conservation of Species in Trade:
The International Framework (15th edition)

Baeza April 2025

To my daughters

Zoê, Olivia, Sofia and Violet

Life, Tree, Wisdom and Flower

I hope I inspire you as much as you inspire me.

‘If you shake João Neiva, there will be bow blanks falling everywhere’.
W.Z.M.

There is nothing concealed that will not be disclosed or hidden that will not be known.
Luke 12:2-3

Acknowledgments

I would like to express my immense gratitude to everyone who contributed in some way to the completion of this work, especially to the Rectorate of the Universidad Internacional de Andalucía for granting a partial scholarship for the in-person course in Baeza between April and June 2024.

A special acknowledgment goes to my advisor, Dr. Margarita África Clemente Muñoz, for accepting the challenge of addressing such a complex topic, ‘espinoso’, as well as to my co-advisors, Dr. Isabel Rey Fraile and MSc. Claudia Maria Correia de Mello, for their suggestions and insights that helped improve the clarity of this text.

To the professors of the UNIA course, for their willingness to share their extensive knowledge with the students and for their patience in answering specific questions regarding the status of *Paubrasilia echinata* under CITES.

To my classmates, for the enriching environment filled with shared experiences, mutual support, and the valuable exchanges during lectures and group projects. A special mention to my dear friends Márcio Alexandre Duarte Pereira, Ana Isabel Branco Santos, Lillian Andrea Cendales Rojas, Angélica Murillo Vega, Pablo Ariel Siroski, Chantel Ronel Louw, Daniel de Man, and Nkeiruka Tessy Imogie - whom life will surely allow me to meet again.

I extend my gratitude to my colleagues at IBAMA who participated in the actions of Operation Dó Ré Mi - so many, on various occasions, who never hesitated to act. On behalf of all of them, I express my sincere appreciation to the former heads of DITEC/ES, DITEC/BA and DITEC/PE, Leticia Meneghel Fonseca, Luciano Bazoni Júnior, Livia Karina Passos Martins and Lisania Rocha Pedrosa, whose determination in combating environmental crimes was essential for the successful execution of fieldwork.

To my colleagues in the Working Group for the Establishment of the National Strategy for the Protection of *Paubrasilia echinata*, for their dedication in tackling the challenges presented to the group by IBAMA's Presidency. Special thanks to the coordinator, Claudia Maria Correia de Mello, for her consistency and decisiveness, her critical perspectives, and her immense support in my participation in this UNIA course and in the development of this thesis.

To my esteemed colleague Rafaela Campostrini Forzza, for her encouragement and support in activities related to Pernambuco in southern Bahia, as well as for reviewing this thesis and to my dear colleagues Conrado Locks Ghisi, Daniela Francisco, Caio Alvarez and Irene Costa Freitas for all the support and encouragement they provided.

Finally, to my partner, April Tubbs, whose love, encouragement, and care enabled me to pursue my goal of attending this course in such distant lands and successfully completing this thesis.

Enforcement actions against illegal trade of *Paubrasilia echinata*: revealing frauds in Brazil's bow making industry

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Abstract - Enforcement actions against illegal trade of *Paubrasilia echinata*: revealing frauds in Brazil's bow making industry.

Paubrasilia echinata has been considered endangered in Brazil since 1992 and since September 2007, included in Appendix II of CITES with annotation #10. After Federal Decree No. 750/1993, the exploitation of this species, endemic to the Atlantic Forest, has been formally prohibited in natural fragments in the country. However, the bow making industry uses it as the main raw material for making violin, viola, cello, and double bass bows. Although substitute species have been researched, none have been found with physical and mechanical properties equal to those of Pernambuco. Bows made from this species reach remarkably high values on the international market, especially in the United States of America and Europe, and are used by orchestras and musicians all over the world. Commercial exploitation involving *Paubrasilia echinata* over the last 25 years is strongly connected to the stringed instrument bow industry. Reviewing the administrative cases that IBAMA processed in this interstice, this thesis sought to put together the pieces of the puzzle by analyzing the data in an integrated way, highlighting the scheme of fraud and environmental illicit activities involved in this exploration, by demonstrating that the offenders act organized and in collusion over the last few decades to launder illegal wood, taking advantage of weaknesses in environmental legislation and the control systems of state and federal agencies. The main administrative infractions detected by IBAMA's environmental inspection are reported based on information contained in the citations, seizures and embargos terms, and inspection reports, as well as in the technical notes and reports issued by state agencies, available in the IBAMA administrative cases. The offenses and frauds were grouped according to the types of infractions pointed out in the reports, notes and fines: fraud in declared origin, illicit on transportation, storage of raw material without proven origin, illegalities in the commerce of bow blanks and finished bows, frauds involving donations, illegal logging in protected areas, embargo, suspension of activities and failure to compliance with Brazilian laws and procedures and obstruction of the work of public agencies. The descriptions of the cases and the discussions presented reveal the point of view of the environmental authorities expressed in the available documents as understood by the author of this thesis. After Operation Dó Ré Mi that started in 2018, a complex mechanism of laundering illegal wood from Bahia that fed the music industry in recent decades became evident. This scheme disguised the legality of thousands of bows made with illegally sourced wood, mainly from southern Bahia, which are now available for commerce in the international bows market.

Key words: Pernambuco wood; Bow making industry; Frauds; Illicits; Wood laundry.

Resumen – Acciones de fiscalización contra el comercio ilegal de *Paubrasilia echinata*: revelando los fraudes de la industria brasileña de arcos para instrumentos musicales

Paubrasilia echinata ha sido considerada en peligro de extinción desde 1992. A partir del Decreto Federal n.º 750/1993, la explotación de esta especie endémica de la Mata Atlántica está formalmente prohibida. No obstante, la industria de fabricación de arcos la utiliza como su principal fuente de materia prima para la confección de arcos de violín, viola, violonchelo y contrabajo. A pesar de que se han investigado especies alternativas, no se ha encontrado ninguna con las mismas propiedades físico-mecánicas que el palo de Brasil. Los arcos fabricados con esta especie alcanzan valores altísimos en el mercado internacional, especialmente en Estados Unidos de América y Europa, y son utilizados por orquestas de todo el mundo. La explotación comercial de *Paubrasilia echinata* en los últimos 25 años está estrechamente vinculada a la industria de arcos de instrumentos de cuerda. Al revisar los procesos administrativos tramitados en el IBAMA en este período, esta tesis buscó juntar las piezas del rompecabezas analizando los datos de forma integrada, revelando un esquema de fraudes y actividades ilícitas ambientales relacionados con esta explotación. Se demuestra que los infractores actuaron de manera organizada y en connivencia durante las últimas décadas para blanquear madera ilegal, aprovechándose de las debilidades de la legislación ambiental y de los sistemas de control de los organismos estatales y federales. Se describieron las principales infracciones administrativas detectadas por la fiscalización ambiental del IBAMA a partir de la información contenida en autos de infracción, términos de incautación y embargo, informes de inspección, así como notas técnicas y peritajes emitidos por organismos estatales disponibles en los procesos administrativos del IBAMA. Los ilícitos y fraudes fueron agrupados según los tipos de infracciones señalados en las multas: fraudes en los orígenes, ilícitos en el transporte, almacenamiento y comercialización ilegal de varetas y arcos acabados, fraudes relacionados con donaciones, extracción ilegal en unidades de conservación, embargos, suspensión de actividades, incumplimiento de las leyes y procedimientos brasileños y obstrucción de la acción del poder público. Las descripciones de los casos mencionados y las discusiones presentadas reflejan el punto de vista de las autoridades ambientales expresado en los documentos disponibles, según el entendimiento del autor de esta tesis. A partir de la Operación Dó Ré Mi iniciada en 2018, se evidenció un mecanismo de lavado de madera ilegal procedente de Bahía, que ha abastecido a la industria musical en las últimas décadas. Este esquema disfrazó de legalidad miles de arcos fabricados con maderas de origen ilegal, provenientes principalmente del sur de Bahía, que hoy en día se comercializan libremente en el mercado internacional de arcos.

Palabras clave: Palo Brasil; industria de arcos; Fraudes; Ilícitos; Lavado de maderas.

Acronyms (in Alphabetical Order):

AL – Alagoas State

ASV – Vegetation Suppression Area

ATPF – Authorization for Transport of Forest Products

BA – Bahia State

CEPLAC - Executive Commission of the Cocoa Farming Plan

CITES - Convention on International Trade in Endangered Species of Wild Fauna and Flora

CMB – Brazilian Mint

CNPJ – National Registry of Legal Entities

CONAMA – National Environmental Council

CPI – Parliamentary Inquiry Commission

CRV – Volumetric Yield Coefficient

CTF – Federal Technical Registry

DBH – Diameter at breast height

DEPOMA – Environmental Police Department of the Civil Police of Pernambuco

DOF – Document of Forest Origin

ES – Espírito Santo State

GIG – Internacional Airport of Rio de Janeiro – Galeão, in Rio de Janeiro (RJ)

GO – Goiás State

GRU – Internacional Airport of Guarulhos, in Guarulhos (SP)

GT-Pau-brasil – Working Group for the Establishment of the National Strategy for the Protection of the Species *Paubrasilia echinata*

IBAMA – Brazilian Institute of Environment and Renewable Natural Resources

IBGE - Brazilian Institute of Geography and Statistics

ICMBio – Chico Mendes Institute for Biodiversity Conservation

IDAF – Institute of Agricultural and Forestry Defense of Espírito Santo

IMA - Institute of the Environment of the State of Alagoas

IN – Normative Instruction

INCAPER - Capixaba Institute for Research, Technical Assistance, and Rural Extension

INEMA - Institute of Environment and Water Resources of Bahia

IPCI – International Initiative for the Conservation of Pernambuco Wood

IUCN - International Union for Conservation of Nature

LGPD – General Data Protection Law

LPCO – Licenses, Permits, Certificates, and Other Documents

MDC – Cubic meter of charcoal

NCM – Mercosur Common Nomenclature

PAU-Brasil – Brazil's Unified Authorization Platform

PBH – Perimeter at breast height

PE – Pernambuco State

PF – Federal Police

PL - Bill

PMA - Environmental Military Police

PR – Paraná State

PRF – Federal Highway Police

RAPP – Annual Report of Potentially Polluting Activities and Environmental Resource Utilization

RFB - Brazilian Federal Revenue Service

RJ – Rio de Janeiro State

R\$ -Brazilian real (1 R\$ approx. 0,15 euros)

SEI - Electronic Information System

SEMAD - State Secretariat for the Environment and Sustainable Development of Minas Gerais

SERPI – International Postal Shipment Sector

SINAFLOR – National System for Controlling the Origin of Forest Products

SISCOMEX – Integrated Foreign Trade System

SisDOF – Document of Forest Origin System

SISMAD – Contingent Sawn Timber Control System

SP – São Paulo State

SUDEMA - Superintendence for Environmental Administration of the State of Paraíba

UF – Federation Unit

UFES – Federal University of Espírito Santo

UHE – Hydroelectric Plant

USA – United States of America

USFWS – United States Fish and Wildlife Service

UT-IBAMA-Guarulhos – IBAMA Office at Guarulhos Airport (SP)

UT-IBAMA-Viracopos – IBAMA Office at Viracopos Airport (SP)

VCP – Internacional Airport of Viracopos in Campinas (SP)

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1. Introduction

The wood of *Paubrasilia echinata* (Lam.) Gagnon, H.C. Lima & G.P. Lewis is known as the ideal material for crafting bows for string instruments (Fomin et al, 2018), as it possesses unique characteristics such as resonance, density, durability, beauty, among other qualities that make it perfect for this use (Alves et al, 2008). Currently, most professional bows are made from Pernambuco wood, although this species is subject to international trade restrictions and is legally protected due to the risk of extinction (Fomin et al, 2018). Despite this, the global demand for bow production is estimated at 200 m³/year (CITES, 2007a), allowing an estimate that between 125 and 1,131 mature individuals - varying according to size - are being removed from the wild annually (Martinelli & Moraes, 2013).

In Brazil, it is known by several vernacular names, including Arabutá, Arabutã, Árvore-do-brasil, Brasilete, Brasileto, Ibirapita, Ibirapitã, Ibirapiranga, Ibirapitanga, Ibirapitinga, Ibirapuíta, Ibiripitanga, Ibiripitinga, Imirapiranga, Imirapitã, Imirapitanga, Muirapiranga, Orabutã, Pau-de-pernambuco, Pau-pernambuco, Pau-rosado, Pau-vermelho, and, most widely, Pau-brasil (Camargos et al, 2001). Internationally, it is commonly referred to as Brazilwood, Pernambuco wood, Brasilholz, Rotholz, Pernambouc, Bois du Brésil, Palo Brazil, among others (Alves et al, 2008).

This species is typical of the Atlantic Forest, one of the most threatened biomes in the world, and occurs in Seasonal Semideciduous Forests, Dense Ombrophilous Forests, and Restingas - environments that have been severely degraded since colonization up to the present day, leading to an intense decline in habitat quality (Martinelli & Moraes, 2013).

The species comprises at least three different morphotypes, which show variations in leaf characteristics - leaf formula, leaflet shape, and size - as well as in the anatomical structure of the wood (Martinelli & Moraes, 2013). These morphotypes are known as: Pau-brasil *folha-pequena* (small-leaf) or *folha-de-arruda*, found in dry restinga forests, tabuleiro forests, and rocky outcrops along the coast, from the southern state of Rio de Janeiro to the northern states of Bahia, Alagoas, Pernambuco, Paraíba, and Rio Grande do Norte; *folha-média* (medium-sized-leaf) or *folha-de-café* (coffee-leaf), predominantly found in the states of Espírito Santo and southern Bahia; and *folha-grande* (big-leaf) or *folha-de-laranja* (orange-leaf), extremely rare, occurring in restricted populations along the Rio Pardo Valley in Bahia (Rees et al, 2023).

By combining morphological and genetic data from the entire known distribution of *Paubrasilia echinata*, recent studies by Rees et al (2023) found evidence of at least five genetically distinct lineages, highly structured geographically. While some appear to correspond to the previously defined *folha-de-laranja*, *folha-de-café*, and *folha-de-arruda* morphotypes, it was discovered that individuals from northern Brazil exhibit leaf characteristics that overlap with the *folha-de-café* and *folha-de-arruda* morphotypes.

The use of this species for bow making dates back to the 17th century, but it became globally recognized in 1785 when François Xavier Tourte (1747–1835), a French watchmaker and expert in materials, perfected a reverse-curved bow model together with Italian violinist Giovanni Battista Viotti (1755–1824). This model established the total length of the violin bow, the usable length of the hair, and the width of the hair, setting a standard that became the reference for future generations of bow makers (Fomin et al, 2018).

In Brazil, there is no clear historical record of when the first bows for musical instruments made from Pernambuco were crafted. However, in the state of Espírito Santo (ES), the historical milestone for this activity was the establishment of the company by the German Horst Ewald Guenther John in the district of Santa Rosa, Aracruz (ES). The company was later relocated to the district of Guaraná, in the same municipality, in 1979, after a Pernambuco tree was discovered in that area (Marques, 2009). During this period, the first plantations of the species were reportedly established on the rural properties of the visionary German entrepreneur (Maranhão, 2016).

In the 1970s, encouraged by the Horst John, three bow makers were sent to Germany to learn the craft from foreign professionals (Maranhão, 2016). These bow makers later returned to Brazil and set up their own bow making workshops, some of which became exporting companies that still operate in the market today. New bow making schools emerged in the following decades in João Neiva (ES), Tatuí (SP), and Curitiba (PR), and today, a significant number of bow makers trained in these schools work primarily in the southeastern and southern regions of Brazil.

As an industry that consumes forest products from an endangered species, the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA) has monitored the activities of bow makers and bow making companies, particularly in Espírito Santo, in the districts of Guaraná and Jacupemba, in Aracruz, as well as in Linhares, João Neiva, Santa Teresa, and Domingos Martins. These areas are now marketed as the '*bow valley*' to promote the sector.

Until July 2006, these bow making companies maintained records of raw material use in the Contingent Sawn Timber Control System (SISMAD), and the movement and storage of native forest products were tracked through Authorization for Transport of Forest Products (ATPF) issued by Brazilian Mint (CMB).

In August 2006, with the publication of Normative Instruction No 112/2006 (IBAMA, 2006), ATPF was abolished and replaced by the Document of Forest Origin (DOF). Through a self-declaration process, all companies reported their inventories in the virtual credit system. It was up to environmental authorities to verify the consistency between the declared virtual stocks and the actual physical inventories in company yards, as part of their role in certifying these storage sites.

In 2009, IBAMA conducted a major operation in ES called '*Violin Bows*' inspecting 13 bow making companies, verified their inventory volumes and compared them to their declared storage sites. Companies were required to present documentation proving the origin of the wood and all purchase and sales invoices for materials. The final report highlighted numerous discrepancies and inconsistencies between the physical inventory and the virtual credits declared in Document of Forest Origin System (SisDOF). However, no administrative sanctions - such as fines, seizures, or embargoes - were imposed, and all discrepancies were resolved through administrative adjustments in the system.

At the time, it was believed that companies had sufficient stock of Pernambuco bow blanks in terms of quantity and quality to sustain the bow making industry for many years. Additionally, it was assumed that the plantations established by these companies in the late 1970s and especially in the early 2000s - many funded by foreign organizations such as the Internacional Pernambuco Conservation Initiative (IPCI) - would be capable of producing high-quality wood for violin bow production. Furthermore, it was thought that deadwood in pastures, stumps, roots, fence posts, and other reclaimed materials were being used by the industry in a noble effort to repurpose this scarce and valuable wood. Control over trade was minimal, as finished bows were exempt from ATPF and later from DOF requirements, and there were no international restrictions on the trade of these products. The industry also excelled in marketing its products, both domestically and internationally, portraying the activity as sustainable and emphasizing the cultural value of Pernambuco bows, which is considered the best wood for this purpose - not only due to over 200 years of tradition but also because advanced research demonstrated the superior sound quality they produced.

The situation began to change in October 2018 with the launch of Operation Dó Ré Mi. IBAMA's enforcement agents, including the author of this thesis, used simple tools - a 10x magnifying glass and a sharp knife - to inspect bow making companies in Espírito Santo, identifying wood species/genus through macroscopic analysis of secondary xylem. Paying close attention to the organization of storage sites and interviewing bow makers, the agents documented the characteristics required to produce high-quality export bows. During the initial phase, a large undeclared stock of hidden Pernambuco blanks was discovered on rural properties in João Neiva, along with a fictitious stockpile of Pernambuco logs at a major bow-exporting company in Santa Teresa. These initial frauds indicated deeper issues, prompting a broader investigation into how bow makers and companies were interconnected. The operation then focused on thoroughly assessing the declared origins of materials that had been used to establish initial SisDOF balances - even those previously adjusted administratively during Operation Violin Bows in 2009.

Step by step, shocking frauds were uncovered, exposing illegal exploitation within the Pernambuco supply chain for the music industry. The investigation revealed a large-scale laundering scheme that had placed thousands of bows on the international market over the past 25 years under the guise of legality.

The species was listed in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) on September 13, 2007, following a decision at Conference of the Parties 14 (CoP 14) in The Hague, Netherlands, under annotation #10, which included *'logs, sawn wood, veneer sheets, including unfinished wood articles used for making bows for stringed musical instruments.'* An exception was made to exempt musical instruments and bows made from this wood from requiring a CITES certificate for international travel (Ângelo, 2007).

Nevertheless, illegal Pernambuco exploitation for bow sales in the international market continued unabated, with minimal oversight from national and international authorities, as finished bows were exempt from DOF controls and customs regulations due to the exemption from CITES Permits.

The findings from Operation Dó Ré Mi led Brazil's CITES Management Authorities to propose at CoP 19 in 2022 in Panama an amendment in the species' protection status, moving it from Appendix II to Appendix I - where species truly at risk of extinction are listed. However, after intense lobbying by music industry stakeholders, which raised concerns among musicians and authorities particularly in Europe and the United States of America (USA), the proposal was not approved. Nevertheless, the Parties approved the revision to annotation #10 *"All parts, derivatives and finished products, except re-export of finished musical instruments, finished musical instrument accessories and finished musical instrument parts"*. This annotation is in force since February 23, 2023, now including finished products in export regulations - thus encompassing finished bows originated only from Brazil and excluding the need of CITES Permits for finished bows sold everywhere else in the world.

Domestically, IBAMA established a working group (GT-Pau-brasil) to assess the status of plantations, key stakeholders in the supply chain, verify declared stock origins for legally acquired pre-convention inventories, and integrate field data from Operation Dó Ré Mi with reports from other IBAMA units in different states dealing with the species.

Despite repeated attempts by the bow making industry to downplay IBAMA's actions - claiming excessive enforcement, measurement discrepancies, and using creative legal arguments to discredit the technical work conducted, particularly during Operation Dó Ré Mi - the GT-Pau-brasil continues to analyze data to determine if any legally acquired pre-convention inventories exist that were not tainted by wood laundering schemes. Meanwhile, the industry seeks academic support to sustain its narrative of sustainability. Despite the publication of technical reports on conservation efforts over the past two decades by IPCI (Gerberth et al, 2024), the reality remains that Pernambuco is being driven to extinction by an industry not typically associated with organized crime: classical music (Santana & Toledo, 2023).

The objective of this research is to synthesize information from IBAMA's case files involving fines, seizures, embargoes, requests, authorizations, technical analyses, and legal proceedings concerning *Paubrasilia echinata*, as well as related state agency cases. This thesis will systematically present the frauds and environmental violations involving Pernambuco from the author's perspective, considering administrative infractions and environmental illicit acts outlined in Federal Decrees 3.179/1999 and 6.514/2008 over the past 25 years.

The purpose of this study is not to judge the merit of the recorded infractions, nor to exhaustively identify all possible fraud that may have occurred during this period. Instead, it aims to reveal, in an accessible manner, by piecing together the puzzle, the truths that the music industry attempts to conceal - truths from a time when it generated millions of dollars in revenue from exporting bows at the expense of centuries-old native trees, cut down from the last remaining forests in the coastal plains of southeastern and northeastern Brazil.

2. Materials and Methods

A total of 346 IBAMA administrative cases involving actors linked to the custody chain of the species *Paubrasilia echinata* were identified in the interval of time between the years 2000 and 2024.

Through these cases, an additional 130 cases were found, either partially or entirely, involving the species in different Brazilian public institutions, including the Chico Mendes Institute for Biodiversity Conservation (ICMBio), the Federal Police (PF), the Federal Judiciary, the State Judiciary of Bahia, Pernambuco, and Espírito Santo, the Institute for Agricultural and Forestry Defense of Espírito Santo (IDAF/ES), the Institute for the Environment of Alagoas (IMA/AL), the Institute for the Environment and Water Resources of Bahia (INEMA/BA), the Superintendence for Environmental Administration of Paraíba (SUDEMA/PB), the State Secretariat for the Environment and Sustainable Development of Minas Gerais (SEMAD/MG), and the Municipality of Domingos Martins (PMDM).

A list of the cases involving actors connected to the species *Paubrasilia echinata* can be found in Annex 1.

Information from these 476 cases was accessed through documents processed in IBAMA's Electronic Information System (SEI), in accordance with the authorization granted by the President of the Institute under SEI Process No. 02026.001381/2024-67. Restricted information – those that should not be known by the general public, and confidential information – those that require access restrictions by law, were neither reported nor discussed in this thesis, although the case numbers were mentioned in Annex 1.

The main illegal activities and frauds related to *Paubrasilia echinata* were identified and categorized into groups as follows: fraud in declared origin, illicit on transportation, storage of raw material without proven origin, illegalities in the commerce of bow blanks and finished bows, frauds involving donations, illegal logging in protected areas, embargo, suspension of activities, failure to compliance with Brazilian laws and procedures and obstruction of the work of public agencies.

References for specific cases will include their corresponding case numbers from the Annex, presented in the tables or along the text as superscripts within parentheses after the mention of the facts.

The States where administratives infractions involving Pernambuco wood were recorded are showed in Figure 1.

Data on the commerce of bows and bow blanks were extracted from the invoices available in the cases analyzed.

The images included in this thesis were taken from administrative case files cited in each described situation – which do not mention the author of the pictures, or are photographs captured by the author of this thesis during enforcement actions in which he has participated as a federal environmental agent.

The coordinate pairs of the occurrences were extracted from administrative cases, processed, and saved in a spreadsheet to enable data reading in the QGIS 3.34.4-Prizren software, where all the maps presented here were created. In addition to the specific study data, geospatial databases from Brazilian Institute of Geography and Statistics (IBGE) were used for municipal and state boundaries, and from ICMBio for the boundaries of the Pau Brasil National Park.

Names of individuals involved, addresses, phone numbers, and other personal data, as well as facial features, have been deliberately omitted from descriptions or concealed in images in compliance with Federal Law 13.709/2018 – General Data Protection Law (LGPD).

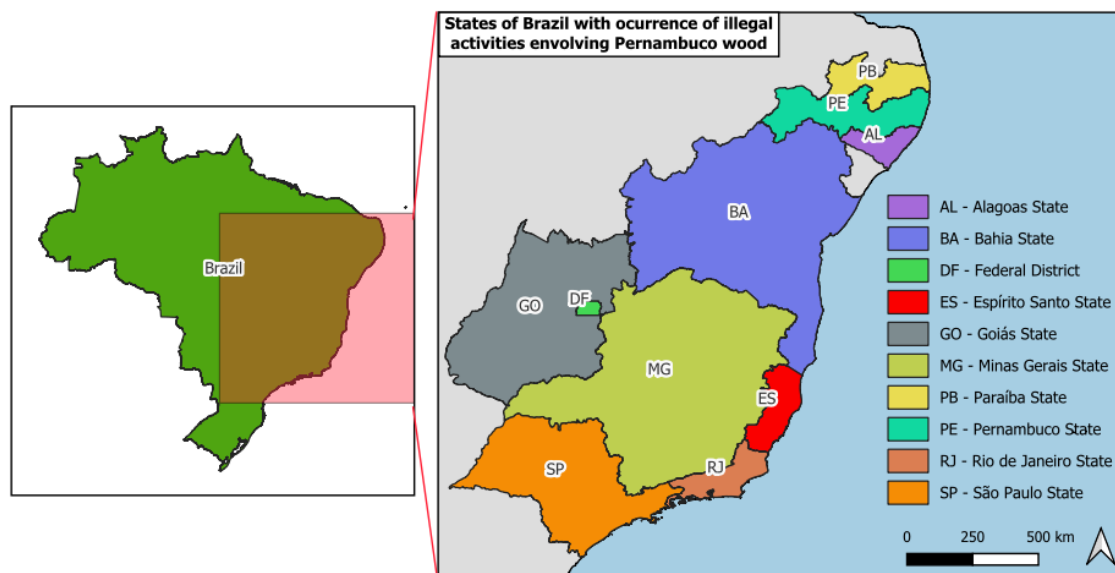


Figure 1 – Location of the Brazilian federal units where there are records of administrative infractions involving *Paubrasilia echinata*.

3. Results

Accountability for environmental infractions in Brazil involves proving both authorship and the materiality of the damage caused to the environment. These elements are fundamental for the application of sanctions provided for in legislation, especially in Law No. 9,605/1998, known as the Environmental Crimes Law, and in the decree that regulates it.

Until July 22, 2008, the Environmental Crimes Law was regulated by Federal Decree 3,179/1999, which was revoked upon the publication of Federal Decree 6,514/2008. Environmental enforcement agents, in the exercise of police power, apply the administrative sanctions provided for in these decrees when authorship and materiality of environmental infractions are established.

Of the 476 cases analyzed in this thesis, 190 involve the application of the sanctions provided for in Article 2 of Federal Decree 3,179/1999 or, subsequently, with its revocation, in Article 3 of Decree 6,514/2008. These sanctions include simple fines, seizure of products and by-products involved in the infraction, partial or total suspension of activities, and embargo of construction work or activity.

Considering the data analyzed for this thesis, during the validity period of Federal Decree 3,179/1999, 23 administrative proceedings were identified to investigate the applied sanctions based on Article 32:

***Article 32.** Receiving or acquiring, for commercial or industrial purposes, wood, firewood, charcoal, and other products of plant origin without requiring the seller to present a license granted by the competent authority and without obtaining the accompanying document that must follow the product until final processing:*

Simple fine ranging from R\$ 100.00 (one hundred Brazilian reais) to R\$ 500.00 (five hundred Brazilian reais) per unit, stere, kilogram, MDC, or cubic meter.

Sole paragraph. The same fines apply to those who sell, offer for sale, store, transport, or keep wood, firewood, charcoal, and other plant-origin products without a valid license for the entire duration of transport or storage, granted by the competent authority.

After the publication of Federal Decree 6,514/2008, 162 administrative proceedings were identified to investigate the applied sanctions, based on Articles 46, 47, 66, 77, 79, 80, 81, 82, and 91 of the same decree:

***Article 46.** Converting wood from forests or other forms of native vegetation into charcoal for industrial, energy, or any other exploitation,*

whether economic or not, without a license or in violation of legal determinations:

Fine of R\$ 500.00 (five hundred Brazilian reais) per cubic meter of charcoal (MDC).

Article 47. *Receiving or acquiring, for commercial or industrial purposes, sawn or log wood, firewood, charcoal, or other plant-based products without requiring the seller to present a license granted by the competent authority and without obtaining the document that must accompany the product until final processing:*

Fine of R\$ 300.00 (three hundred Brazilian reais) per unit, stereo, kilogram, MDC, or cubic meter measured by the geometric method.

§ 1 Whoever sells, offers for sale, stores, transports, or keeps wood, firewood, charcoal, or other plant-based products without a valid license for the entire duration of the transport or storage, granted by the competent authority or in non-compliance with the obtained license, shall be subject to the same fines.

§ 2 A license is considered valid for the entire duration of the transport or storage when its authenticity is confirmed by official electronic control systems, including the authorized quantity and species for transport and storage.

§ 3 In cases of transportation infractions, if the quantity or species verified during inspection differs from that authorized by the competent environmental authority, the enforcement agent shall initiate an infraction notice considering the entire object under inspection. (Amended by Decree No. 6.686/2008).

§ 4 For other infractions provided in this article, the enforcement agent shall initiate an infraction notice considering the total volume of wood, firewood, charcoal, or other plant-based products that do not correspond to the authorization granted by the competent environmental authority, in terms of quantity or species. (Amended by Decree No. 6.686/2008).

Article 66. *Constructing, renovating, expanding, installing, or operating establishments, activities, works, or services that utilize environmental resources, considered effectively or potentially polluting, without a license or authorization from the competent environmental agencies, in non-compliance with the obtained license, or in violation of relevant legal and regulatory standards: (Amended by Decree No. 6.686/2008).*

Fine from R\$ 500.00 (five hundred Brazilian reais) to R\$ 10,000,000.00 (ten million Brazilian reais).

Sole paragraph. The same fines apply to those who:

I - Construct, renovate, expand, install, or operate an establishment, work, or service subject to environmental licensing located in a conservation unit or its buffer zone, or in legally established water source protection areas, without the approval of the respective managing authority; and (Amended by Decree No. 6.686/2008).

II - Fail to comply with conditions established in the environmental license.

Article 77. *Obstructing or hindering government action in the exercise of environmental inspection activities:*

Fine from R\$ 500.00 (five hundred Brazilian reais) to R\$ 100,000.00 (one hundred thousand Brazilian reais).

Article 79. *Failing to comply with the embargo on construction or activity and its respective areas:*

Fine from R\$ 10,000.00 (ten thousand Brazilian reais) to R\$ 10,000,000.00 (ten million Brazilian reais). (Amended by Decree No. 12.189, 2024).

Sole paragraph. The fines stipulated in the caput also apply to those who fail to comply with suspension or restrictive sanctions on rights. (Amended by Decree No. 12.189, 2024).

Article 80. *Failing to meet legal or regulatory requirements when duly notified by the competent environmental authority within the granted period, aiming at regularization, correction, or adoption of control measures to cease environmental degradation: (Amended by Decree No. 6.686, 2008).*

Fine from R\$ 1,000.00 (one thousand Brazilian reais) to R\$ 1,000,000.00 (one million Brazilian reais).

Article 81. *Failing to submit environmental reports or information within the deadlines required by legislation or, where applicable, within those determined by the environmental authority:*

Fine from R\$ 1,000.00 (one thousand Brazilian reais) to R\$ 100,000.00 (one hundred thousand Brazilian reais).

Article 82. *Preparing or presenting information, studies, reports, or environmental assessments that are totally or partially false, misleading, or omissive, whether in official control systems, licensing, forest concession, or any other administrative environmental procedure:*

Fine from R\$ 1,500.00 (one thousand five hundred Brazilian reais) to R\$ 1,000,000.00 (one million Brazilian reais).

Sole paragraph. When the infraction described in the caput involves movement or credit generation in an official control system for forest product origins, the fine shall be increased by R\$ 300.00 (three hundred Brazilian reais) per unit, stereo, kilogram, cubic meter of charcoal, or cubic meter. (Included by Decree No. 11.080, 2022).

Article 91. *Causing damage to a conservation unit: (Amended by Decree No. 6.686, 2008).*

Fine from R\$ 200.00 (two hundred Brazilian reais) to R\$ 100,000.00 (one hundred thousand Brazilian reais).

Of these cases, 57,9% resulted from infractions against Article 47, whose main sections include the primary criminal types identified by enforcement agents regarding administrative infractions involving actors associated with the species *Paubrasilia echinata*: Receiving or acquiring sawn or log wood without requiring the seller's license granted by the competent authority and without obtaining the accompanying document that must follow the product until final processing, as well as selling, offering for sale, storing, transporting, or keeping wood of native species in form of logs, sawn wood, mainly planks and bow blanks or finished products – bows - without a valid license for the entire duration of transport or storage, granted by the competent authority or in violation of the obtained license.

Among the 190 cases that involved administrative sanctions, 173 included fines and 17 involved only the seizure of products related to infractions.

Of the 173 applied fines, 26 were issued during the validity of Decree 3,179/1999, from January 2000 to July 2008, totaling R\$ 388,359.75.

Meanwhile, the 147 fines issued during the validity of Decree 6,514/2008 totaling R\$ 102,953,945.63.

In the State of Espírito Santo, administrative sanctions were imposed in 110 administrative proceedings - 57.89% of the cases with sanctions. In terms of fines, R\$ 99,756,566.85 were applied to administrative infractions that occurred in this state, representing 96.5% of the total value of fines imposed.

The State of São Paulo accounts for 39 (20.53%) of the recorded violations, of which 27 fines were issued by UT-IBAMA-Guarulhos and UT-IBAMA-Viracopos against individuals from Espírito Santo.

Bahia ranks third, with 25 administrative infraction cases, representing 13.6% of the recorded cases (Table 1).

Table 1 – Administrative proceedings involving the application of administrative sanctions to actors involved in the Pernambuco supply chain and the amounts of fines imposed between 2000 and 2024.

UF	No. of cases	% of No. of Cases	Sum of Fines (R\$)	% of Sum of Fines
Alagoas (AL)	7	3.68	425,624.12	0.53
Bahia (BA)	25	13.6	1,10,821.20	1.39
Distrito Federal (DF)	1	0.53	158,700.00	0.20
Espírito Santo (ES)	110	57.89	99,756,566.85	95.51
Minas Gerais (MG)	2	1.05	256,018.00	0.32
Parabíba (PB)	1	0.53	1,000.00	0
Pernambuco (PE)	4	2.11	19,835.51	0.02
Rio de Janeiro (RJ)	1	0.53	26,100.00	0.03
São Paulo (SP)	39	20.53	1,589,039.70	1.99
Total	190	100	103,341,705.38	100

Among the 173 fines imposed, only 29 (16.7%) were paid or converted into services, 7 (4 %) were cancelled, in some cases due to the defendant's death, and 5 (2.8%) expired due to the statute of limitations.

The volume of Pernambuco seized by environmental enforcement between 2000 and 2024 is available in **Table 2**.

Table 2 – Pernambuco raw material seized in environmental enforcement actions between 2000 and 2024 across different federal units.

UF	Logs		Planks		Bow blanks		Finished bows	Other pieces
	Volume (m³)	Quant. (units)	Volume (m³)	Quant. (units)	Volume (m³)	Quant. (units)	Quant. (units)	Volume (m³)
AL			11.09		1.50	6,997		
BA	73.97	356	3.83	337		1,902		0.71
DF							529	
ES	119.03	386	96.20	11,262	44.44	321,890	1,387	92.71
MG	0.04							
PE		15	30.80		0.70	12,537		
RJ						34		
SP						1,021	935	
Total	193.04	757	145.99	11,599	46.63	344,381	2,851	93.42

Based on the geographic coordinates available in the recorded infractions, a map was created plotting the locations of environmental violations linked to individuals

involved with *Paubrasilia echinata* between the years 2000 and 2024 (Figure 2).

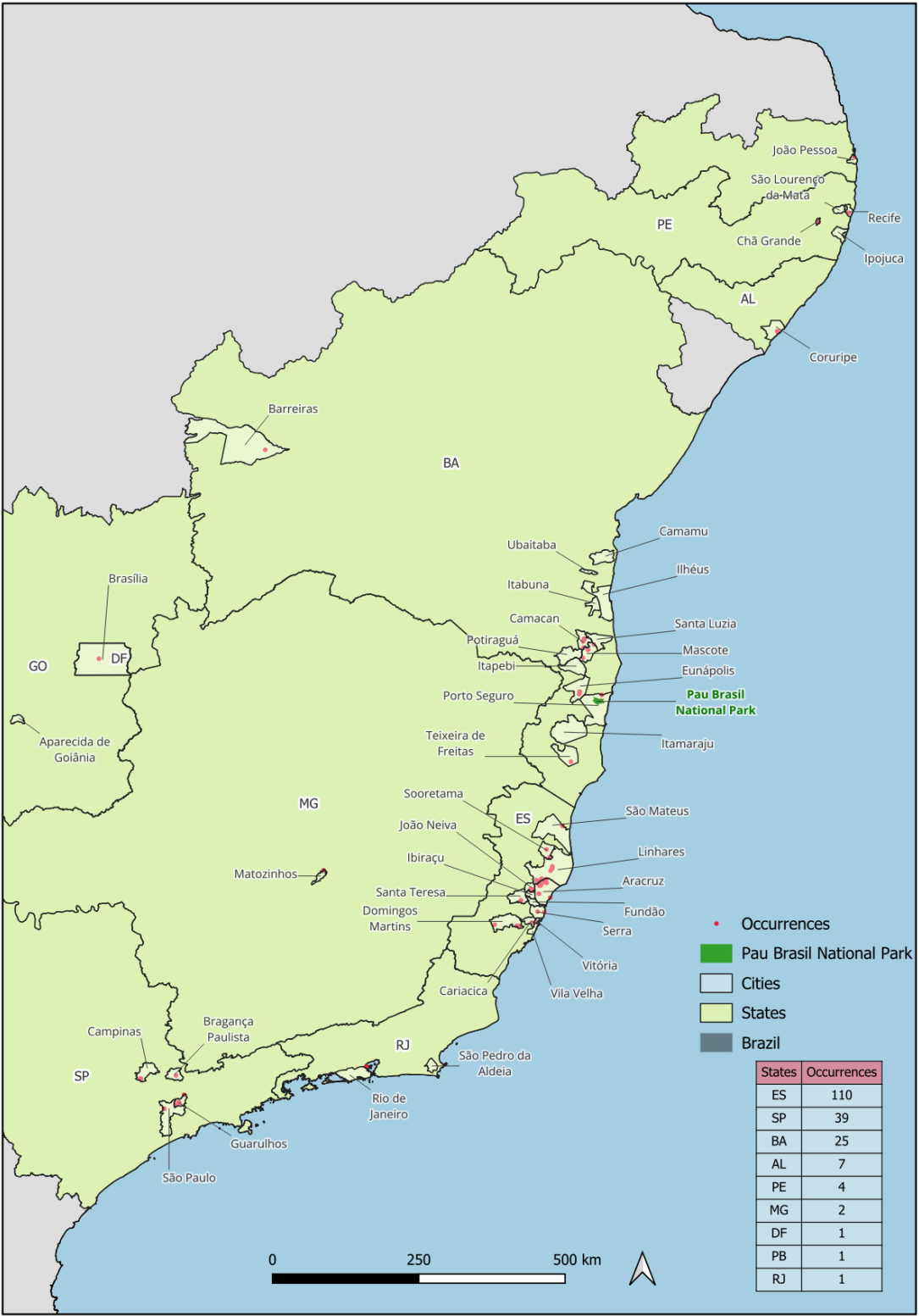


Figure 2 – Location of the municipalities where there are records of violations in the custody chain of *Paubrasilia echinata* and, in the red spots, records of administrative sanctions applied.

Fraud in Declared Origins

The decrees that served as the basis for IBAMA's administrative infractions - Federal Decree 3.179/1999 and Federal Decree 6.514/2008 - do not include the criminal offense of "fraud." Therefore, none of the administrative infractions imposed by IBAMA include fines for fraud.

However, in this thesis, the term is applied to any deceitful, misleading, or bad-faith acts intended to harm or deceive others or to evade a given obligation. In the analysis conducted, several deceptive and bad-faith actions aimed at misleading environmental enforcement were identified, particularly committed by bow-making companies and bow makers. For this reason, the term is used to describe the situations found in the administrative proceedings, with the author's conviction that these acts constituted fraud.

The bow making companies in Espírito Santo have registered stocks of Pernambuco in the SisDOF. These stock balances were self-declared in 2006, most of them based on reports issued by Institute of Agricultural and Forestry Defense of Espírito Santo (IDAF) for the utilization of devitalized wood and/or on ATPFs indicating the acquisition of wood from other companies or institutions. All these companies were fully operational in Aracruz, João Neiva, Santa Teresa and Domingos Martins, following inspections and yard adjustments carried out by IBAMA during Operation Violin Bows in May 2009.

There are records of authorization for the use of devitalized wood on seven different occasions. The authorizations issued in Espírito Santo, concentrated in three rural properties in Aracruz, were granted by IDAF/ES. Meanwhile, the authorizations for Ubaitaba and Potiraguá in Bahia were issued by IBAMA/BA (Table 3).

Table 3 – Authorization for the utilization of devitalized Pernambuco raw material

Date	Origin	Type of material	Volume (m ³)	Location of bow making company	Cases
March 2003	Barra do Riacho, Aracruz	Devitalized Logs	11	Jacupemba, Aracruz, later transferred to a company in Santa Teresa	265 & 470
July 2004	Ubaitaba	Posts and Stakes	5.388	Domingos Martins	72
September 2004	Córrego do Francês, Aracruz	Stakes	1.5	Jacupemba, Aracruz	384
May 2005	Ubaitaba	Posts and Stakes	11.075	Domingos Martins	73
June 2005	Aracruz	Stakes, Posts, and Root	8.3	Guaraná & Jacupemba, Aracruz	158 & 159
March 2006	Córrego do Francês, Aracruz	Stakes	2.5	Jacupemba, Aracruz	384
September 2006	Potiraguá	Posts and Stakes	2.5	Domingos Martins	72
Total			42.263		

Fictitious Pernambuco Logs

During the 1st stage of Operation Dó Ré Mi, IBAMA's inspection team located a stockpile of 'Pernambuco logs' (Figure 3 B), stored in the open air at a bow making company in Santa Teresa. The logs' declared origin was a single source: an 11 m³ donation from a regional pulp company occurred in 2003. IDAF/ES issued a report certifying that the wood came from devitalized 'yellow and red Pernambuco trees' that had been felled over 20 years ago ⁽⁴⁷⁰⁾. This stockpile had already been inspected by IBAMA in May 2009 during Violin Bows Operation (Figure 3 A). At the time, 4.741 m³ of logs were found stacked in the open air, but their species was not verified through wood anatomy analysis. Inside the company, there were 1.188 m³ of bow blanks.

However, during the inspection in 2018, IBAMA's team conducted a wood anatomy analysis and discovered that the logs were not Pernambuco. Out of the 145 logs, only one was actually Pernambuco. The remaining logs belonged to various species, including Ipê (*Handroanthus* sp.), Jutaí-peba (*Dialium guianensis*), Itapicuru (*Goniorrachis marginata*), Araribá (*Centrolobium tomentosum*), Braúna (*Melanoxylon brauna*), Pau-santo (*Zollernia* sp.), and even the exotic species Eucalyptus (*Eucalyptus* sp.). Given the fraud, the company was fined, and all available raw material on site was seized - 145 logs, 3,928 bow blanks, and 27 finished bows ⁽²⁶⁵⁾.



Figure 3 – A – Inspection of logs by IBAMA in the company's stockpile during the 'Violin Bows Operation' in May 2009 in Santa Teresa (ES); B – Fictitious Pernambuco logs found in the company's yard in Santa Teresa (ES) in October 2018 during the 1st stage of Operation Dó Ré Mi ⁽²⁶⁵⁾.

False Origins in Stumps, Roots, and Fences

In May 2020, an inspection found that the SisDOF balance of a bow blank seller in Aracruz was based on a report issued by IDAF/ES in June 2005, which authorized the use of 8.3 m³ of wood originating from 42 stakes and 2 fence posts (Figure 4 A) and a root (Figure 4 B). The root alone was attributed a volume of 1.2 m³ ⁽¹⁵⁹⁾.

The enforcement team returned to the rural property from which this material had supposedly been sourced. The fence was still in the same place (Figure 4 C).

With the fraud confirmed, the company was fined ⁽¹⁵⁸⁾, and all bow blanks found in the yard were seized: 26,489 pieces (Figure 4 D-E).

Another bow making company in Aracruz also took advantage of this same raw material source and, in September 2005, received authorization to utilize 2 m³ from these fences and roots.

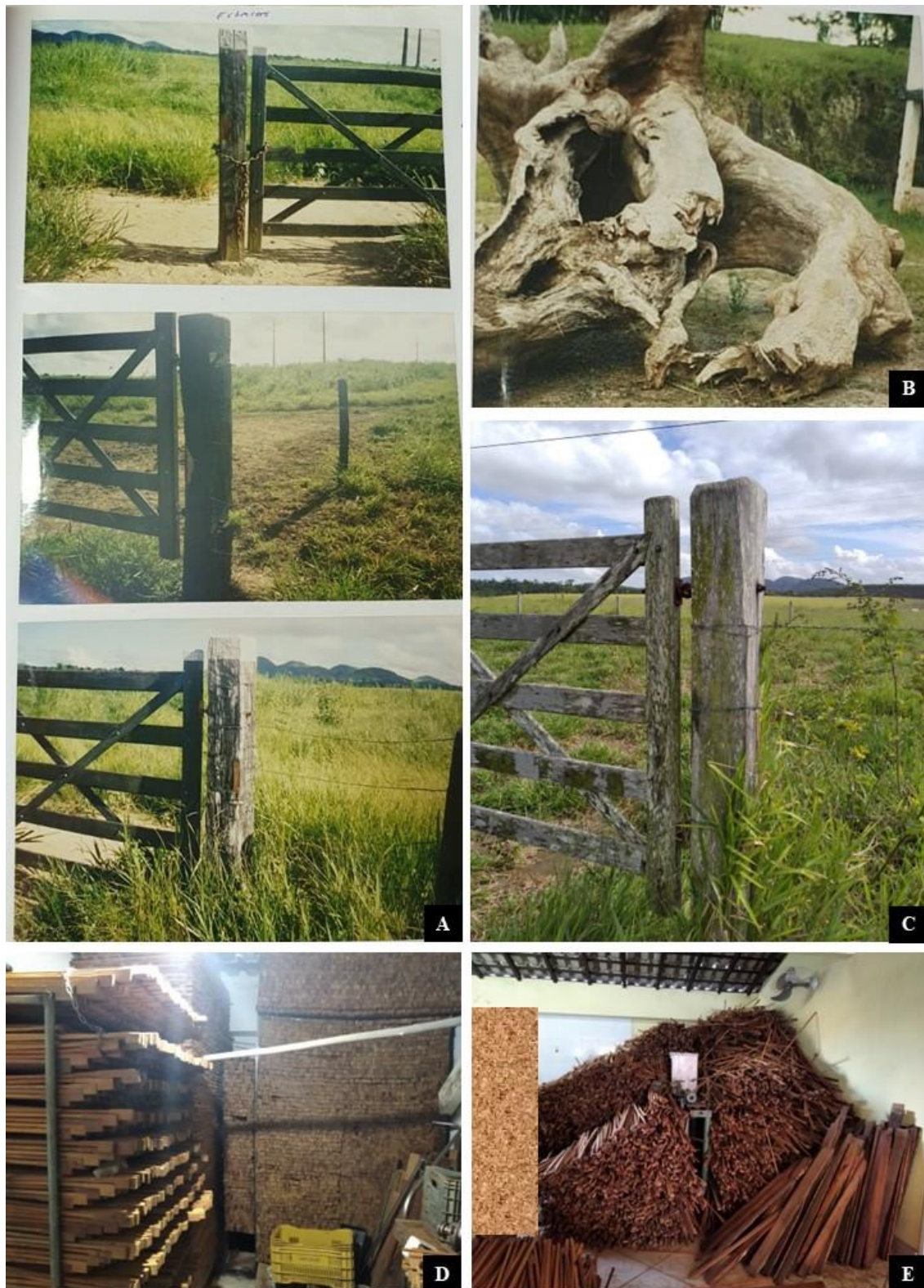


Figure 4 – **A** – Original images of fences mentioned in the IDAF Inspection Report from 2005 that led to the extraction of Pernambuco for bow making companies ⁽¹⁵⁹⁾; **B** – Root mentioned in the same report,

allegedly yielding 1.2 m³ of raw material for bow blanks production; **C** – Fence revisited in May 2020 at the same rural property in Aracruz (ES), proving that the posts had never been removed; **D** – Stock of bow blanks at a company in Aracruz (ES); **E** – Bow blanks counted during the 3rd stage of Operation Dó Ré Mi in May 2020 ⁽¹⁵⁸⁾.

Other Sources from Devitalized Wood

Based on inspection reports from IDAF/ES, three bow making companies located in Guaraná and Jacupemba received 23.3 m³ of Pernambuco in the form of posts, stakes, stumps, roots, and logs of devitalized wood between March 2003 and March 2006 (Figure 5) from rural properties in Aracruz. These volumes, which were allegedly ‘donated’ by the rural property owners, were used by these companies for the initial declaration of stock in their yard with the SisDOF in 2006.

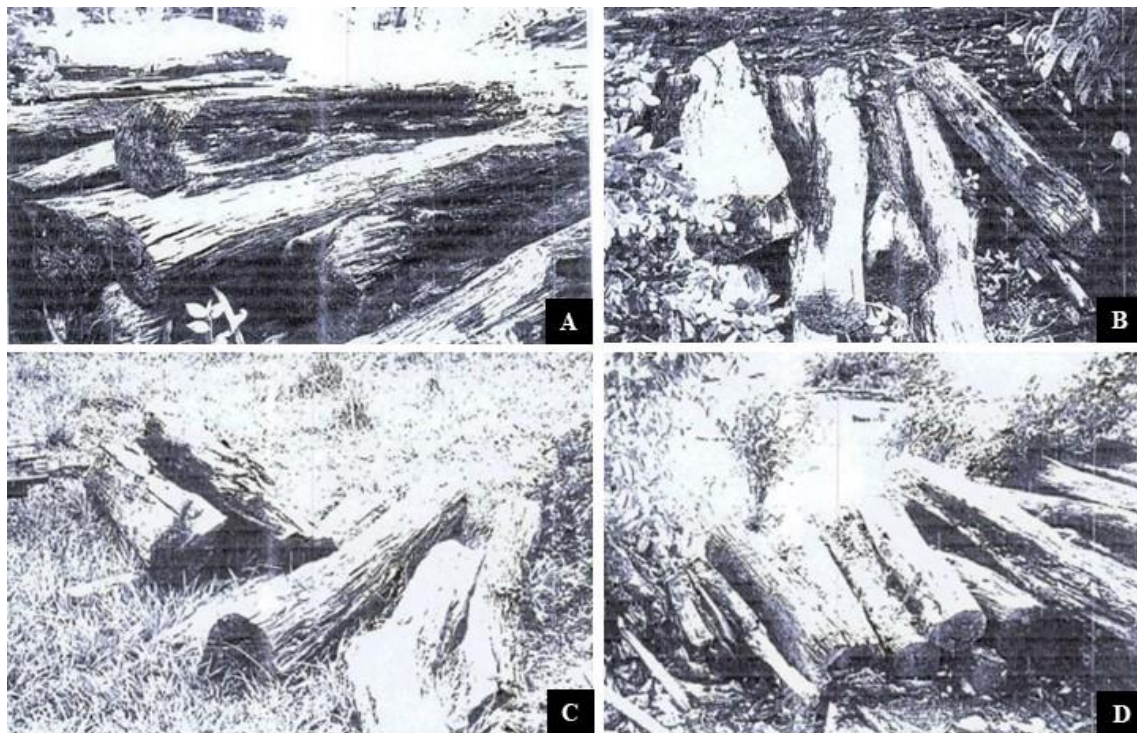


Figure 5 – A - D – Images of 20 fence posts on a property in Córrego do Francês, Aracruz (ES), mentioned in the IDAF Inspection Report, which authorized the use of 2.5 m³ of Pernambuco donated to a bow making company in Jacupemba, Aracruz (ES), for violin bow production ⁽³⁸⁴⁾

Inspection reports issued by IBAMA for devitalized wood inspected on rural properties in Ubaitaba and Potiraguá (Figure 6) led to the issuance of authorization of use and transportation documents for 18.963 m³ between July 2004 and September 2006 for a bow making company in Domingos Martins.

In total, 42.263 m³ of devitalized wood, stakes, posts, stumps, and roots had their use authorized by IDAF or IBAMA. None of these reports mentioned any anatomical verification of the wood being authorized to confirm that it was indeed Pernambuco. Nor was there any evaluation of the quality of these pieces for the bow making industry, given

their advanced state of deterioration due to exposure to the weather. No differentiated Volumetric Yield Coefficient (CRV) was issued for this devitalized material.



Figure 6 – A and B – Timber inspected at Fazenda Conjunto Bela Vista in Potiraguá (BA) – 14 m³ – in September 2006; C and D – Timber authorized for use – 2.5m³ at Fazenda Conjunto Bela Vista in Potiraguá (BA) in September 2006 ⁽⁷²⁾.

Material from Vegetation Suppression Area (ASV) for dam installation

In December 2004, 18 m³ of Pernambuco from an area cleared for the installation of a dam, authorized by IBAMA, were donated to 'bow maker' in Coruripe. The remaining volume was entered into the SisDOF in 2012, and in 2016, the bow maker obtained a favorable court ruling allowing him to export 20,000 bow blanks to Italy, forcing IBAMA to issue CITES Permits, considering the raw material as pre-convention ⁽³⁶⁵⁾. In 2019 an inspection of the Dó Ré Mi operation found that the bow maker's stock was almost exclusively composed of waste. This 'bow maker' received 10 CITES Permits for export, which covered the sale of 1,274 bow blanks to Italy, and also made sales of at least 310 bow blanks to other countries (China, Hong Kong, Argentina) declaring various products with different Mercosur Common Nomenclature (NCM) number. With bow blanks in his stock that did not meet the required quality for the bow industry export, IBAMA inspection found that the seller was issuing ideologically false DOFs, selling virtual credits. Analysis of the invoices issued showed that between 2013 and 2020, this seller sold 30,128 bow blanks to the bow industry in Espírito Santo.

Another fraud involving an area cleared for the installation of a hydroelectric project occurred at a Hydroelectric Plant (UHE) on the Jequitinhonha River in the municipality of Itapebi (BA) in 2003. Dry logs, showing signs of having been cut a long time ago, 'appeared' overnight in the wood storage area from clearing ⁽⁴⁶³⁾. This UHE sent 3 ATPFs

between September 2003 and July 2005, dispatching 11.33 m³ of Pernambuco logs to a sawmill in Aracruz ⁽¹³¹⁾, which were its only sources of Pernambuco. This sawmill, in turn, sold 29,815 bow blanks to 4 bow companies in Aracruz and João Neiva.

Origins in planted trees

There are 13 records of requests for the cutting of planted Pernambuco trees, of which 2 were authorized by IBAMA/PE, 10 were submitted to IDAF/ES, and one to INEMA/BA, as listed in Table 4.

Table 4 – Requests for authorization to cut planted Pernambuco trees.

Date	Place of plantation	No. of Trees	Age of trees (years)	Volume (m ³)	Bow making recipient	Status	Cases
August 1999	São Lourenço da Mata	01	25	Not informed	Domingos Martins	Tree cut. wood cracked, unusable.	192
November 2003	São Lourenço da Mata	02	30	5 st	Domingos Martins; Paris (France) & Bubenreuth (Germany)	Trees cut. ATPF for Domingos Martins & permits for France and Germany issued	192
May 2008	Guaraná, Aracruz	04	30	1.58	Guaraná, Aracruz	Trees cut. DOF not issued.	224 & 238
December 2008	Santa Rosa, Aracruz	29	10, 15, 20, 25 and 30	1.785 m ³ and 15 st of firewood	Guaraná, Aracruz	DOF issued. Used in research.	224 & 238
September 2012	Guaraná, Aracruz	01	Not informed	2	Guaraná, Aracruz	Fine and seizure.	87
October 2012	Domingos Martins	01	Not informed	2	Domingos Martins	Tree cut. DOF not issued.	85 & 471
January 2019	Fundão	111	17	16	Jacupemba, Aracruz	Fine and seizure. Technician fined.	88, 138 & 352
September 2018	Guaraná, Aracruz	09	20	3.52	Guaraná, Aracruz	Fine and seizure. Plantation embargoed.	188, 345 & 457
July 2019	Jacupemba, Aracruz	01	30	0.9	Jacupemba, Aracruz	Cutting not yet authorized. Technician	155 & 350

						fined by IBAMA.	
July 2019	Guaraná, Aracruz	01	22	0.358	Jacupemba, Aracruz	Unauthorized cutting. Technician fined by IBAMA.	151 & 351
February 2020	Pedra Azul, Domingos Martins	01	30	1.1	Santa Teresa	Fine and seizure.	262, 264 & 348
April 2021	Ibiraçu	03	Not informed	Unknown	Santa Teresa	Unauthorized cutting yet.	207
August 2022	Ilhéus	30	20	Unknown	Jacupemba, Aracruz	Unauthorized cutting yet.	

For research purposes regarding the quality of wood from planted Pernambuco trees, the felling of one and two trees was authorized in 1999 and 2003, respectively. These trees were planted at the Tapacurá Ecological Station in São Lourenço da Mata (PE) by Professor Roldão de Siqueira Fontes (Fontes, 1995). Due to cracking issues in the wood of the first authorized tree, which was intended for use at the International Pernambuco Meeting in Domingos Martins in 2001, two additional trees were authorized. In December 2004, part of this material (0.031 m³) was sent to a bow maker in Paris, France, and another part (0.0294 m³) to a bow maker in Bubenreuth, Germany, for research on the feasibility of producing bows with wood from planted trees. Additionally, 5 st of logs and branches were sent with an ATPF to a bow making company in Domingos Martins. There was no record of any return to the foundation that requested the cutting or to the environmental authorities of the studies that had been carried out with this wood, until very recently, when Gerbeth & Sabbag (2024) reported in a National Symposium on Ecology, Conservation and Sustainable Production of Pau-brasil held in Ilhéus (BA) that a viola bow had been made by the French *archetier* with the wood that had been sent to him in 20 years before.

In May 2008, authorization was granted for the cutting and use of 4 Pernambuco trees (1.58 m³ of logs and 10 st of firewood), dead or fallen, in a planting of approximately 30 years by a company in Guaraná, Aracruz. In December 2008, the same company obtained authorization for the cutting of 29 Pernambuco trees of different ages, from a plantation in the Santa Rosa district, with a volume of 1.78470 m³ of logs and 15 st of firewood, donated to Federal University of Espírito Santo (UFES) for research purposes (Marques, 2009).

In September 2012, IDAF approved the cutting of a planted Pernambuco tree used as an ornament (Figure 7 A) in front of a residence in the Guaraná district, Aracruz, providing authorization for the use of 2 m³ of firewood ⁽⁸⁷⁾. In 2015, a request was made to insert the virtual credits into SisDOF. An inspection of the cut and stored wood in a shed (Figure 7 B) was conducted, and a report was issued to authorize the use of the wood. In October 2017, a new forestry exploitation authorization was granted by IDAF for the

use of 2 m³ of firewood, and the following month, a third forestry exploitation authorization was issued, this time for 2 m³ of 'logs', instead of 'firewood'. A few days later, two DOFs were issued for the bow maker in Aracruz, each with 1 m³ of logs.



Figure 7 – **A** – Image of a Pernambuco tree planted in the district of Guaraná, Aracruz (ES), whose cutting was authorized by IDAF ⁽²⁴⁷⁾; **B** – Logs inspected by IDAF and donated to a bow making company in Aracruz (ES) for violin bow production ⁽⁸⁷⁾.

In October 2012, authorization was granted to clear a dead Pernambuco tree in a square in Domingos Martins (Figure 8). The authorization does not include documents related to the entry of the wood material into the SisDOF for the 2 m³ volume generated from the tree removal. Six years later, in 2018, the company that allegedly received the material as a donation requested the Municipal Environment Secretary to issue a DOF to cover the transportation, which had not been done ⁽⁸⁵⁾.



Figure 8 – **A** – Dead tree authorized for cutting in October 2012, with its wood allegedly donated to a company in Domingos Martins, without a DOF ⁽⁸⁵⁾; **B** – Image of the dead tree in September 2011 available on Google Maps.

In December 2018, a request was made to release the cutting of 93 planted Pernambuco trees, 17 years old, along a fence on a rural property in the Piranema Settlement in Fundão. The state agency authorized the cutting in January 2019, allowing the removal of 14 m³ of Pernambuco, which were transported to the bow maker's company in the Jacupemba district in Aracruz on January 1st, 2019. In August 2019,

another request was made to cut an additional 18 trees of the same age to the same property, generating 9 m³ of logs ⁽⁸⁸⁾. A state inspection report on August 20, 2019, indicated that 7 trees had already been cut, yielding 2 m³, and that 8 more trees were awaiting cutting with an expected yield of 1.5 m³ to 2 m³. On 16/08/2019, another 2 m³ were transferred to the same company through the SisDOF, bringing the total to 16 m³.

During the 2nd stage of Operation Dó Ré Mi, in September 2019, IBAMA inspected both the stumps of the cut trees and the remaining trees in Fundão, as well as the wood stockpile at the company. The remaining trees that had not been cut had crooked and low trunks (Figure 9 A). It was found that the heartwood of the logs was immature (Figure 9 B and C). At the company yard, most of the logs had supposedly already been processed into planks (Figure 9 D), while some remained as logs (Figure 9 E). Visibly, the logs were mixed: logs from the plantation with mature logs from native trees, and the processed wood was not recently cut from the plantation. The inspection team seized all the material indicated as originating from the Fundão plantation, fined the company ⁽¹³⁸⁾, and the technical manager responsible for the partially false, misleading, and omissive project ⁽³⁵²⁾.

In September 2018, the cutting of 9 Pernambuco trees on a rural property in Aracruz was authorized ⁽¹⁸⁸⁾ (Figure 10). The authorized volume for cutting and use was 3.52 m³. During the 2nd stage of Operation Dó Ré Mi, the inspection team visited the company in September 2019 and found no trace of separation between the wood from the plantation, neither in logs nor in planks. The stumps and roots had been removed and burned by the owner of the plantation. Pictures taken from IDAF/ES inspection in January 2019 show clearly two separated piles of logs: one from logs coming from the planted trees – immature heartwood and abundant sapwood (Figure 10 F) and another with logs remarkably similar to those ones from Bahia - mature heartwood, logs cut in half (Figure 10 G), which IDAF team didn't realize during the inspection. IBAMA fined the property owner and the environmental technician responsible for presenting a partially false and omissive study in the authorization process with the state agency, due to the explicit fraud on using plantation authorization to launder illegal wood. The plantation area was embargoed ^(345 457 475).



Figure 9 – **A** – Remaining tree in a plantation in Fundão (ES) with a low DBH and short commercial trunk; **B** and **C** – Stumps of 17-year-old trees cut in the plantation in Fundão (ES), without mature heartwood formation; **D** and **E** – Yard of a bow making company in Jacupemba, Aracruz, with piles of slats and logs supposedly originating from the plantation in Fundão (ES) ⁽¹³⁸⁾.



Figure 10 – A - C – Images of trees planted on a site in Aracruz (ES), authorized for cutting in September 2018 ⁽¹⁸⁸⁾; D and E – Stumps of planted trees, cut with authorization, inspected by IDAF in January 2019; F and G – Logs inspected by IDAF in January 2019 at the businessman's rural property – photos provided to the IBAMA team.

In July 2019, two requests were submitted to IDAF/ES for the cutting of ornamental Pernambuco planted trees. One of them, in Jacupemba, proposed obtaining 0.9 m³ of Pernambuco logs from one planted tree (Figure 11 A) that had a 1.5-meter trunk height ⁽¹⁵⁵⁾. The other, in the Guaraná district, involved cutting two 22-year-old trees: one Pernambuco tree (Figure 11 B) yielding 0.358 m³ of usable logs, and another Trumpet tree (*Handroanthus chrysotrichus*), yielding 0.326 m³ of logs ⁽¹⁵¹⁾. In both cases, IBAMA's inspection team fined the environmental engineer responsible for the preparation of the projects, which were deemed partially false, misleading, and omissive ^(350 e 351).



Figure 11 – **A** – Pernambuco tree planted in Jacupemba, Aracruz (ES), included in a cutting authorization request to the state agency, estimating a yield of 0.9 m^3 in logs ⁽¹⁵⁵⁾; **B** – 22-year-old Pernambuco tree planted in the urban area of Guaraná, Aracruz (ES), included in a cutting authorization request, estimating a yield of 0.352 m^3 in logs ⁽¹⁵¹⁾.

In February 2020, the cutting of a planted Pernambuco tree (Figure 12A and B) on a rural property in the Pedra Azul district in Domingos Martins was authorized ⁽³⁴⁸⁾. The tree was allegedly 30 years old. Initially, the authorized cut allowed for the use of 0.4 m^3 . A few weeks later, a new technical project was presented, and a new inspection report was prepared for the same tree. Without any technical explanation or justification, the volume of the same tree increased to 1.1 m^3 . The same happened for a Brazilian rosewood tree on the same property, which also doubled in volume, increasing from 1.1 m^3 to 2.56 m^3 .

The wood was transferred to a bow making company in Santa Teresa. IBAMA considered the operation of acquiring the tree fraudulent, used for laundering wood, fined the receiving company, and confiscated the wood ^(264 262). The technical manager responsible for the project, with false, misleading, and omissive information in the technical report presented to the state for the cutting of the planted trees, was also fined ⁽³¹⁾.



Figure 12 – **A** and **B** – 30-year-old Pernambuco tree planted in Pedra Azul, Domingos Martins (ES), yielding 1.26m³ in logs for a bow making company in Santa Teresa ^(348 264 262).

In April 2021, a new request was submitted to the state agency for the cutting of 3 planted Pernambuco trees on a rural property in Ibirapu ⁽²⁰⁷⁾, that would send logs to the same bow making company in Santa Teresa. No technical project was attached to the process, and there is no updated information regarding the approval of this request.

Illicit on transportation

Logs without documents of origin

In October 2000, 57 logs of Pernambuco, equivalent to 3 m³ (Figure 13 A – D), were seized while being transported on BR 367 in Porto Seguro (BA) without any documentation that would legalize the wood cargo ⁽³⁰⁴⁾. The logs seized were 1m long, the size used by the bow making industry.

In August 2020, 59 boards of Pernambuco (1.294 m³) and 41 pieces of Brazilian Rosewood (*Dalbergia nigra* - 0.479 m³) were found hidden among a load of timber that was detained by the Federal Highway Police (PRF) and seized by IBAMA. The discovery was only made at the time of unloading the cargo at the storage location (Figure 14 A and B).

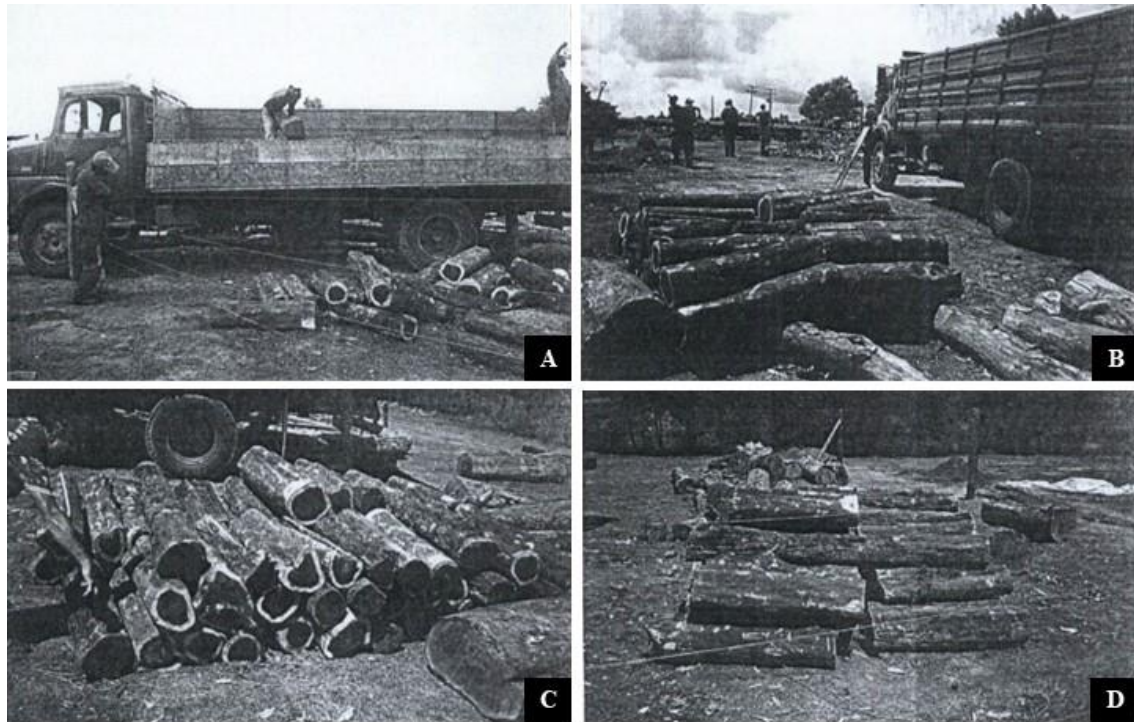


Figure 13 – A - D – Cargo with 57 Pernambuco logs seized during irregular transport on BR 367 in Porto Seguro (BA) in October 2000 ⁽³⁰⁴⁾.



Figure 14 – A and B – Cargo with 59 Pernambuco planks hidden among native wood cargo, seized in a truck in São Mateus (ES) in August 2020 ^(372 91).

Reverse Route

Records indicate that in 2002, three ATPFs were issued for the transport of 13 m³ of Pernambuco wood stumps and roots and 26 m³ of Brazilian rosewood (*Dalbergia nigra*) from a timber company in São Pedro da Aldeia (RJ) to another company in Mascote (BA) ⁽³⁵⁹⁾. Taking into consideration that Mascote is known to be the place where Pernambuco has been illegally explored for decades, these ATPFs are ideologically false - the documents are true, issued by a competent authority, but its content does not match reality. In other words, that transport never happened.

In 2006, three ATPFs were issued by a company in Aracruz, authorizing the shipment of 30 m³ of Pernambuco wood sawmill residue to a company in Bragança Paulista (SP). What was classified as residue later returned to the same businessman's yard - now under a different corporate registration - as fully intact, regular-quality Pernambuco wood bow blanks between September 2008 and July 2009. During this period, three DOFs from Bragança Paulista covered the transport of 16 m³ of Pernambuco wood from Bragança Paulista to Aracruz ^(60 42).

Storage of Raw Material Without Proven Origin

The bow making industry is directly linked to cases of seized Pernambuco logs, which are always found illegally stored in a standard length of 1 meter. In Table 5 we summarize the seizures involving logs. Since 2002, a total of 1,073 units have been seized, along with 208.1 m³ of logs. A small part of this volume is in planks or bow blanks - not separated in the survey conducted during the seizure.

The seizures took place in different municipalities. In Bahia: Porto Seguro, Eunápolis, Mascote, Camacan, and Teixeira de Freitas; in Espírito Santo: Linhares, Aracruz, João Neiva, Serra, Santa Teresa, and Domingos Martins; in Minas Gerais: Matozinhos and in Pernambuco: Chã Grande and Recife.

November 2002: 39 m³ of Pernambuco and Brazilian Rosewood were seized at a company's yard in São João do Paraíso, district of Mascote ⁽³³⁹⁾. The specific volumes of each wood type were not individually detailed in the inspection report.

December 2002: 25 m³ of Pernambuco logs were seized at a timber company in Eunápolis without ATPF coverage ⁽¹²⁵⁾.

May 2003: 12.5 m³ of Pernambuco logs, along with 14.25 m³ of slats and bow blanks, were found stored at a timber company in Serra owned by a foreign national. The fine and seizure were overturned in 2005, and the material was returned to the violating company⁽²⁵⁰⁾.

Also in May 2003, 19 m³ of Pernambuco were seized at a company and a rural property belonging to a bow maker in Domingos Martins ⁽⁸¹⁾. According to the inspection report, part of the material was hidden in the company's ceiling, in the vegetation near the sawmill, and in bags - both in the main house and in the barn of a neighboring property, which belonged to the brother of one of the company's partners. Part of the material (10 m³) was returned to the entrepreneur.

September 2003: 268 logs (14 m³) of Pernambuco were found stored in a reservoir at two rural properties in the district of Demétrio Ribeiro. The material belonged to a bow maker from João Neiva⁽⁴²¹⁾.

August 2004: 121 Pernambuco logs (9.58 m³) were seized in Teixeira de Freitas (BA) ⁽⁴⁰⁾.

January 2006: 52 Pernambuco logs were seized at a private residence in Eunápolis. The fined individual identified the supposed true owner of the timber, but that person was never located ⁽²⁵⁴⁾.

October 2008: 1.86 m³ of Pernambuco was seized in Camacan (BA). The farm owner initially claimed the wood came from vegetation cleared for Cacimbas-Catu gas pipeline installation and presented a receipt from the construction company as proof of origin ^(343 341). Yet, the construction company stated that the receipt was incorrect, and that no Pernambuco wood was found in the sampled suppression areas. Fifteen years later, during a follow-up investigation, the violator admitted to renting the space to two intermediaries from Espírito Santo, who used it to cut Pernambuco logs into violin bow blanks.

November 2010: Environmental Police Department of the Civil Police of Pernambuco (DEPOMA) discovered an unauthorized sawmill operating on a rural property in Chã Grande (PE). The authorities seized 15 Pernambuco logs, 0.5 *st* of slats, and additional wood strips ⁽¹⁸³⁾. At the time, the DEPOMA agent did not recognize that the so-called “*taliscas*” were actually bow blanks for crafting musical instrument bows.

July 2014: 67 Pernambuco logs were seized at a rural property in Camacan, along with 33 logs and 36 dozen Pernambuco bow blanks found in a carpentry shop operating illegally in the urban area of the municipality ^(201 203 204).

November 2015: 26 logs and 2 m³ of Pernambuco slats and bow blanks were seized at a rural property in Mascote. According to the inspection report, the property owner had rented space to an intermediary from Espírito Santo, who installed a circular saw on-site. The intermediary had already transported to bow making companies in Espírito Santo at least two shipments of Pernambuco bow blanks before IBAMA’s inspection ⁽⁴²³⁾.

October 2018: IBAMA’s environmental enforcement team discovered 20,747 hidden Pernambuco bow blanks at two rural properties in the district of Demétrio Ribeiro, João Neiva ⁽³⁷⁾, along with 0.231 m³ of logs ⁽³⁶⁾. The violator was fined R\$ 9,319,200.00, (equivalent to US\$ 2,505,161.00 at that time) and all bow blanks and logs were seized (Figure 15).

September 2019: 102 Pernambuco wood logs were found on a rural property in Linhares, hidden under shade cloth ⁽³⁵⁴⁾, belonging to a bow maker from Jacupemba, Aracruz (Figure 17).

November 2022: During the 2nd stage of Operation Ibirapitanga, 175 hidden Pernambuco wood logs (8.136 m³) were found on a rural property in Mascote ⁽³¹⁴⁾. Reports

suggest that this material was sold to a bow maker in João Neiva in partnership with a businessman from Santa Teresa.

In the same month, a repeat offender in Camacan was fined again during Operation Ibirapitanga for possessing 16 log remnants, 0.287 m² of slats, and 995 Pernambuco wood bow blanks, ready for sale in his carpentry shop ^(197 198 200).

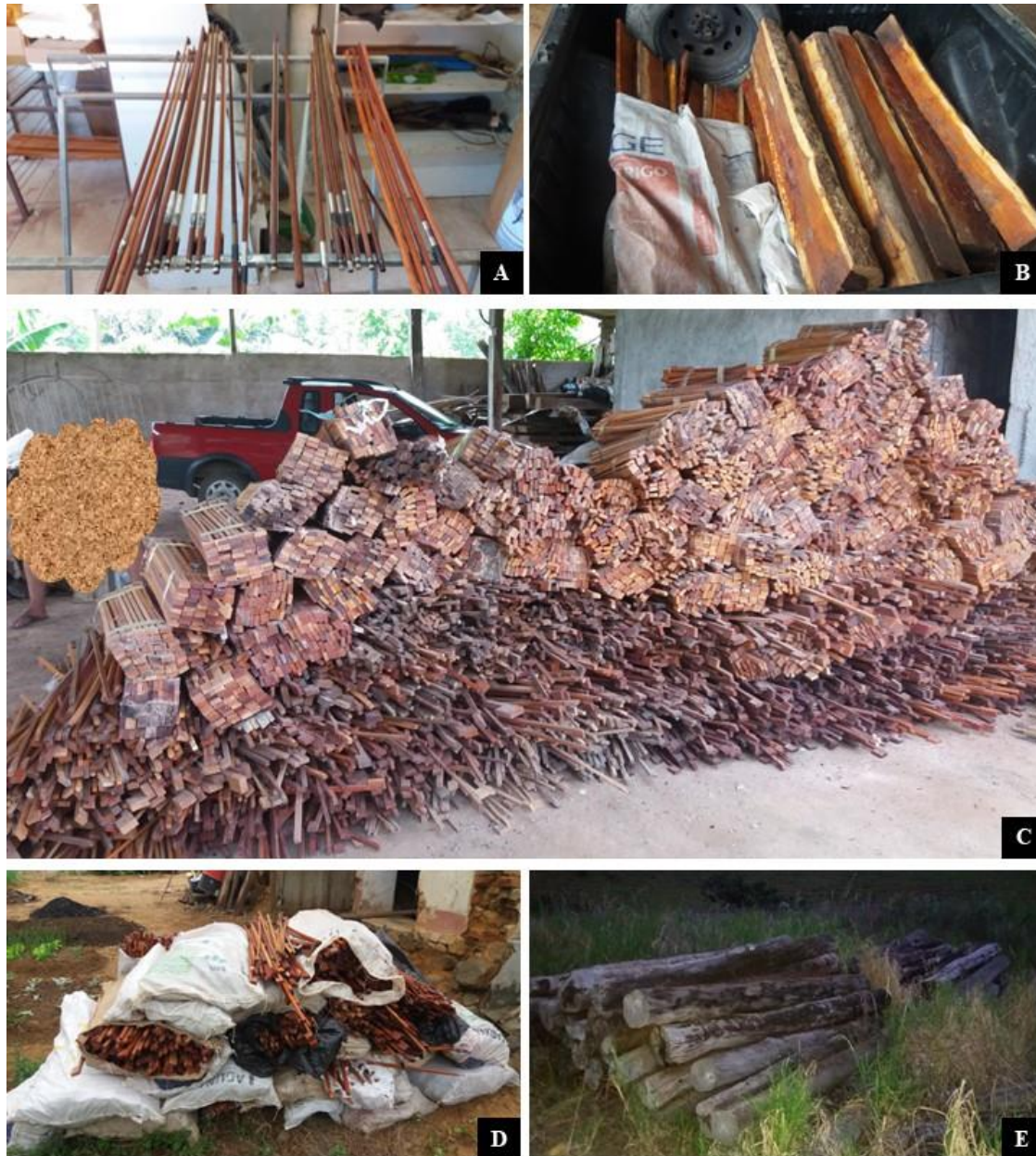


Figure 15 – A – Bows being prepared in a small workshop at the bow maker's home in João Neiva (ES); B – Car trunk filled with Pernambuco logs; C and D – Bow sticks hidden at two different properties owned by the bow maker's father in Demétrio Ribeiro, João Neiva (ES); E – *Astronium* sp. posts located on the family property, with an invoice issued in Goiás used to generate virtual credits in the SisDOF as if they were Pernambuco ⁽³⁷⁾.

In September 2019, IBAMA located 0.62 m³ of Pernambuco in planks and 214 ready-to-sell bow blanks hidden among the tool shelves in the storage area of a rural

property in Aracruz ⁽²⁸⁾ (Figure 16 A and B) In the Desengano district of Linhares, the inspection team found 27 planks and 165 bow blanks discarded in a coffee plantation ⁽⁴¹⁾ (Figure 16 C and D).



Figure 16 – A and B – Pernambuco bow sticks and slats stored at an intermediary's warehouse in Aracruz (ES), who admitted sourcing material from southern Bahia and reselling to Espírito Santo bow making companies⁽²⁸⁾; C and D – Bow sticks and slats discarded in a coffee plantation on a rural property in Linhares (ES) ⁽⁴¹⁾.

Table 5 – Seized Pernambuco logs

Date	Municipality	Seized Material	Situation	Cases
October 2000	Porto Seguro	57 logs	Transported by truck without ATPF	304
January 2002	Eunápolis	1.83 m ³	Irregularly stored under the possession of the offender	318
November 2002	Mascote	39 m ³	Stored in a company yard	339
December 2002	Eunápolis	25 m ³	Stored in the company yard without ATPF coverage	125
December 2002	Aracruz	78 m ³	Stored in an archetaria company in Aracruz without proof of legal origin. Part of the material return to the offender	62
May 2003	Serra	12.5 m ³	Stored in a sawmill without origin documentation. Returned to the offender.	250
June 2003	Aracruz	5 m ³	Stored illegally in a sawmill with slats (8m ³) and bow blanks (1m ³)	375
September 2003	João Neiva	268 logs	Hidden inside a lagoon on a rural property owned by a bow maker with a company in João Neiva	421

August 2004	Teixeira de Freitas	121 logs	Stored in a residence in an urban area	40
November 2005	Aracruz	11 m ³	Stored in a bowmaking company without legal origin	382
January 2006	Eunápolis	52 logs	Stored in a residence in an urban area	254
October 2008	Camacan	1.86 m ³	The sawmill operating clandestinely on a rural property. Volume including logs, slats, and rods	341
November 2010	Chã Grande	15 logs	The sawmill operating clandestinely on a rural property	183
July 2014	Camacan	67 logs	Stored on a rural property	204
July 2014	Camacan	33 logs	Stored in a carpentry shop	201
February 2015	Mascote	26 logs	Stored on a rural property	423
October 2018	Aracruz	1.379 m ³	Stored in a bow making company without legal origin	143
October 2018	Matozinhos	0,04	Stored in a sawmill with 80 m ³ of <i>Dalbergia nigra</i> with no legal origin	468
October 2018	João Neiva	0.231	Hidden on a rural property with 20,747 bow blanks	36
October 2018	Santa Teresa	1 log	In between a fictitious stockpile of <i>Paubrasilia echinata</i>	265
September 2019	Linhares	102 logs	Stored on a rural property	354
September 2019	Aracruz	99 logs	Mix between native & plantation logs. 7.895 m ³ of slats seized at the bow making company	138
May 2020	Linhares	19 logs	Illegal sawmill in a rural property	255
May 2020	Aracruz	0.023 m ³	Seized with 26,489 bow blanks of illegal origin	158
October 2020	Recife	29.803 m ³	Volume in logs, planks and bow blanks were found under the care of a <i>luthier's</i> heirs.	276 and 278
May 2022	Domingos Martins	22 logs	Stored in the company without proven origin	77
November 2022	Aracruz	2.437 m ³	Seized cautiously in a bow making company	219
November 2022	Mascote	175 logs	Hidden on a rural property	314
November 2022	Camacan	16 logs	Stored in a carpentry shop	197



Figure 17 – A – 102 Pernambuco logs found in September 2019, hidden under shade cloth on a rural property in Linhares (ES) that belonged to a bow maker from Aracruz ⁽³⁵⁴⁾.

Storage of useless raw material

The bow making companies in Espírito Santo operated for many years without discarding unusable materials for bow production. Their yards are overflowing with rods that have minor defects - cracks, fissures, fractures, holes, knots, irregular grain, misaligned heads, rods that are too light, or with a low ‘Lucchi’¹ - sound transmission speed below the required standard for crafting high-quality bows, or other imperfections that fail to meet the demands of the international market. Some companies also store smaller residues, short pieces unsuitable for bow production. Others retain remnants of logs and slats that were not processed into rods due to irregular grain or other physical imperfections - cases where the investment in turning them into rods would not be worthwhile. A large portion of the material inventoried in the companies' yards, as shown in the Table 6, consists of waste, unsuitable for bow making.

As new good quality bow blanks enter the companies' yards, acquired directly in Bahia or from intermediaries who sell illegally extracted wood bow blanks door to door, the company keep an apparent accounting of the bow blanks with the documentation they have, burning – away from authorities' eyes, the unusable bow blanks (Figure 18).

¹ The speed of sound propagation through the bow blanks using the G. Lucchi Elasticity Tester. This device is produced and marketed by the Italian musician and bow maker Giovanni Lucchi and is widely used by musical instrument and bow makers worldwide. The equipment generates an ultrasonic pulse and has two probes: one that generates the signal and another that receives it (Longhi, 2009).



Figure 18 – **A** – Pernambuco bow blanks being burned in a wood-fired oven by a bow maker from Aracruz (ES). Image from video shown on ‘Fantástico’ on 12/4/2022 (Globo, 2022b); **B** and **C** – Pernambuco bow blanks located in an oven on a rural property owned by a bow maker from Aracruz (ES) in October 2020 (119)

The stocks of Pernambuco raw material were located with 8 bow makers and in 14 companies in the municipalities of João Neiva, Linhares, Santa Teresa, Domingos Martins, and especially Aracruz, in the districts of Jacupemba and Guaraná.

Table 6 presents the volumes found in companies in Espírito Santo and records of the quantities seized during the various stages of Operation Dó Ré Mi carried out in the state. The names of the companies and bow makers have been intentionally omitted and replaced with random codes - **A** for bow makers and **C** for bow making companies - in compliance with the General Data Protection Law (LGPD).

Table 6 – Stockpile of Pernambuco wood found in the main bow making companies during Operation Do Re Mi and seized material from each bow maker & company.

Location	Bow maker (A) or company (C)	Inspection date	Logs (m ³ or units)	Planks, boards, and shorts	Bow blanks/ finished bows	Situation	Cases
João Neiva	A1	10.23.2018	0.231 m ³		20,715 units	Volumes hidden in rural properties seized	34, 36 & 37
		11.30.2021			703 units	All bow blanks seized	1 & 32

João Neiva	A2	09.12.2019			3,297 units	471 bow blanks seized	271
		11.30.2021			2,159 units	All bow blanks and finished bows seized	270
Guaraná, Aracruz	A3	05.21.2020		3.71 m ³	1,661 units	All material seized	177, 178 & 179
Linhares	A4	10.17.2020			200 units	All bow blanks seized	29
Guaraná, Aracruz	A5	05.22.2020		1.583 m ³	3,064 units	Seizure of all material	308 & 309
Guaraná, Aracruz	A6	10.24.2020			251 units	Seizure of all material	465
João Neiva	A7	05.20.2020			93 units	Seizure of all material	305
João Neiva	A8	06.15.2021			24 units	Seizure of all material	184
Guaraná, Aracruz	C1	10.19.2018		8.703 m ³	36,395 units	18,084 bow blanks and 8.703 m ³ of planks seized for lack of legal coverage	100 & 104
		11.08.2022			12,237 units	Volume seized precautionarily	99
Jacupemba, Aracruz	C2	10.20.2018	1.379 m ³	1.657 m ³	24,493 units	Entire volume seized	143
		09.19.2019	99 units	7.895 m ³		Entire volume seized	138
		11.22.2023		1.592 m ³	19,290 units	Entire volume seized	132
Santa Teresa	C3	10.26.2018	0.092 m ³		3,955 units	Entire volume seized	265
		05.27.2021			2,244 units	All bow blanks seized	262
		11.08.2021			194 units	All finished bows found in the residence seized	316
João Neiva	C4	10.23.2018		0.324 m ³	2,187 units	All bow blanks seized	18
Guaraná, Aracruz	C5	10.19.2018			6,900 units	1,088 bow blanks seized	46 & 49
Guaraná, Aracruz	C6	10.18.2018		1.7191 m ³	128,563 units	18,386 bow blanks seized	61 & 63
		11.08.2022		0.969 m ³	77,352 units	All material seized precautionarily	54
Jacupemba, Aracruz	C7	09.11.2019	6.95 m ³		13,591 units	102 logs hidden in rural property; all bow blanks	354 & 356

						and finished bows seized	
Guaraná, Aracruz	C8	09.10.2019		10.543 m ³	222,754 units	No Pernambuco seizure	119
		11.08.2022		4.068 m ³	27.96 m ³ + 751 units	All material seized precautionarily	472
Guaraná, Aracruz	C9	09.10.2019			7,520 units	No Pernambuco seizure	119
		11.08.2022			2.704 m ³ + 73 units	All material seized precautionarily	473
Guaraná, Aracruz	C10	05.19.2020	0.0237 m ³	0.163 m ³	26,489 units	All material seized	158
		11.08.2022			2,319 units	All bow blanks seized	156
Guaraná, Aracruz	C11	05.19.2021			10,898 units	All bow blanks seized	247
		11.30.2021			7 units	All bow blanks seized	427
Domingos Martins	C12	09.20.2019		0.09 m ³	7,606 units	No Pernambuco seizure	82
		05.05.2022	0.3587 m ³	0.0563 m ³	7,057 units	Logs and planks seized	77
		06.24.2022		0.079 m ³	7,057 units	4,059 bow blanks and total volume of planks seized	75 & 76
		11.08.2022		0.07 m ³	2,975 units	All material of seized precautionarily	71
Guaraná, Aracruz	C13	11.08.2022			12,500 units	All material seized precautionarily	108
Guaraná, Aracruz	C14	10.20.2020	2.437 m ³	82.226 m ³	57,289 units	No Pernambuco seizure	224
		11.08.2022	0.9033 m ³	89.1315 m ³	1.4676 m ³	All material seized precautionarily	219

Yards without balance in the SisDOF

In 2020, a bow maker from Aracruz had all of their stock seized, as it was not registered in the SisDOF. The document presented to cover the material found in the yard was an ATPF from 2002 from a company in Eunápolis (BA), for which the artisan requested regularization in 2017 and 2018, 11 years after the implementation of the DOF.

In the same year, it was found that the oldest company in the bow making sector in Aracruz also did not have a balance in the SisDOF. Even though it had been inspected by IBAMA and IDAF several times between 2006 and 2012, there was no administrative

adjustment in the company's virtual yard with the system, which was initially declared as zero. This company continued exporting bows over the last almost two decades, without any reductions on the material sold or discarded due to the zero balance at SisDOF.

Unfolding of logs on rural properties

One of the dynamics detected for the unfolding of Pernambuco logs was the leasing of space on rural properties for the installation of machinery (band saw and circular saw).

Fines and seizures imposed by IBAMA in Camacan in October/November 2008 and in Mascote in February 2015 were against the property owners where logs, planks, and bow blanks were found. The person responsible for the installation of the machinery, purchase, unfolding of the logs, and transportation of the bow blanks to the 'capixaba' bow making industry sector, despite being identified, was neither located nor fined. During the 3rd stage of Operation Dó Ré Mi, a similar situation was found in Linhares.

The tenants, in addition to the rental value of the space, benefited from the leftover woods (logs, planks, and bow blanks) that were unsuitable for producing quality bow blanks but were used for other purposes on the rural property: charcoal, corrals, low fences, planters, and other artisanal objects, such as canes and toys.

Commercialization of bow blanks and bows

Pernambuco bows are considered finished products and are exempt from the requirement to issue a DOF for commercialization, according to item II of Article 49 of IN No. 21/2014 (IBAMA, 2014), both in the domestic and international markets. However, companies must deduct the sold bows from their virtual credit balances in the SisDOF.

On the other hand, bow blanks (or sticks) are considered sawn wood, according to the definition in the same regulation, requiring the issuance of a DOF to accompany the transportation of bow blanks in commercial transactions within Brazil, and a DOF export document for their commercialization abroad.

Between 2002 and 2022, records indicate the sale of 464,515 Pernambuco bow blanks in the domestic market, equivalent to an approximate volume of 69.678 m³. During the same period, 7,986 finished bows were sold within the country, with an estimated volume of 1.198 m³. Domestically, bow makers and companies traded a total of 70,875 m³ in bow blanks and bows (Table 7).

During this period, 45,163 bow blanks and 131,232 Pernambuco bows were exported, corresponding to an approximate volume of 6.774 m³ of bow blanks and 19.685 m³ of bows (Table 7). International transactions accounted for an estimated volume of 26.459 m³, averaging 1.26 m³ per year.

Table 7 – Pernambuco bow blanks and bows sold within Brazil and abroad from 2002 to 2022.

Year	Commerce within Brazil				Commerce abroad			
	No. of bow blanks	No. of bows	Estimated volume (m ³)		No. of bow blanks	No. of bows	Estimated volume (m ³)	
			Bow blanks	Bows			Bow blanks	Bows
2002	0	699	0	0.10485	0	496	0	0.0744
2003	1,400	344	0.21	0.0516	0	615	0	0.09225
2004	77,515	2	11.6273	0.0003	0	6,612	0	0.9918
2005	5,451	27	0.81765	0.00405	5,263	9,943	0.78945	1.49145
2006	203,470	0	30.5205	0	5,831	7,199	0.87465	1.07985
2007	2,140	182	0.321	0.0273	370	12,895	0.0555	1.93425
2008	26,667	6	4	0.0009	0	6,189	0	0.92835
2009	66,667	0	10	0	0	3,440	0	0.516
2010	20,000	153	3	0.02295	0	2,153	0	0.32295
2011	27,000	27	4.05	0.00405	300	2,777	0.045	0.41655
2012	0	2	0	0.0003	0	3,849	0	0.57735
2013	600	9	0.09	0.00135	26,300	3,219	3.945	0.48285
2014	0	17	0	0.00255	0	2,949	0	0.44235
2015	0	818	0	0.1227	433	7,128	0.06495	1.0692
2016	0	3,227	0	0.48405	0	3,684	0	0.5526
2017	16,076	569	2.4114	0.08535	1,914	9,147	0.2871	1.37205
2018	6,250	737	0.9375	0.11055	2,988	13,289	0.4482	1.99335
2019	3,953	457	0.59295	0.06855	1,135	13,624	0.17025	2.0436
2020	6,301	593	0.94515	0.08895	150	10,742	0.0225	1.6113
2021	1,025	106	0.15375	0.0159	37	11,092	0.00555	1.6638
2022	0	11	0	0.00165	442	190	0.0663	0.0285
Total	464,515	7,986	69.6773	1.1979	45,163	131,232	6.77445	19.6848

Before the species was listed under CITES, records show the export of 11,464 bow blanks, with 10,137 shipped to the United States of America (88,4%), 684 to Italy (5,9%), 553 to Germany (4,8%), 85 to China (0,7%), and 5 to France (0,04%).

Analyzing the annual sales data of bows and bow blanks, along with the trade values reported in invoices, we find that the bow-making industry sold a total of 648,896 units of Pernambuco bows and bow blanks between 2002 and 2022, with declared transactions amounting to R\$ 86,795,311.33 (Table 8), averaging R\$ 4.133.110,06/year.

Considering that the values declared in invoices are approximately 5 to 10 times lower than those observed in the market - based on prices listed on specialized musical instrument and accessory trade websites - it can be inferred that the Brazilian bow making industry transacted Pernambuco bows and bow blanks at estimated values ranging between R\$ 433,976,556.65 and R\$ 867,953,113.30 between 2002 and 2022, an average of R\$ 20.665.550,31/year to R\$ 41.331.100,63/year

It is important to note the absence of hundreds of invoice records for different years across multiple companies in the analyzed administrative cases. As a result, the data presented here is incomplete and represents only a portion of the volumes, quantities, and values traded.

Table 8 – Total number of bows and bow blanks sold per year and the total sum of commercial transaction values declared in invoices.

Year	No. of bow blanks (unit.)	Value of bow blanks declared on invoices (R\$)	No. of Bows (unit.)	Value of bows declared on invoices (R\$)	Total of bows and bow blanks (unit.)	Total value of bows and bow blanks declared on invoices (R\$)
2002	0	0	1,195	369,665.91	1,195	369,665.91
2003	1,400	7,000.00	959	493,860.30	2,359	500,860.30
2004	77,515	23,362.00	6,614	2,566,313.52	84,129	2,589,675.52
2005	10,714	470,436.42	9,970	4,147,131.95	20,684	4,617,568.37
2006	209,301	454,895.17	7,199	2,546,757.84	216,500	3,001,653.01
2007	2,510	37,851.24	13,077	3,525,266.65	15,587	3,563,117.89
2008	26,667	1,600.00	6,195	2,781,286.57	32,862	2,782,886.57
2009	66,667	5,000.00	3,440	1,309,449.92	70,107	1,314,449.92
2010	20,000	9,000.00	2,306	693,130.91	22,306	702,130.91
2011	27,300	27,600.00	2,804	954,097.31	30,104	981,697.31
2012	0	0	3,851	1,483,959.95	3,851	1,483,959.95
2013	26,900	1,455,535.29	3,228	1,182,159.75	30,128	2,637,695.04
2014	0	0	2,966	1,389,698.56	2,966	1,389,698.56
2015	433	11,394.84	7,946	4,589,435.88	8,379	4,600,830.72
2016	0	0	6,911	4,320,370.05	6,911	4,320,370.05
2017	17,990	142,576.86	9,716	5,774,216.42	27,706	5,916,793.28
2018	9,238	403,198.25	14,026	8,452,337.28	23,264	8,855,535.53
2019	5,088	105,837.60	14,081	11,168,402.37	19,169	11,274,239.97
2020	6,451	262,690.25	11,335	12,013,986.50	17,786	12,276,676.75
2021	1,062	67,750.00	11,198	13,224,223.57	12,260	13,291,973.57
2022	442	15,540.00	201	308,292.20	643	323,832.20
Total	509,678	3,501,267.92	139,218	83,294,043.41	648,896	86,795,311.33

After Pernambuco was included in Appendix II of CITES on September 13, 2007, the export of the species began to require the issuance of a CITES Permit for the commercialization of log and sawn wood shipments, including unfinished products like bow blanks, due to annotation #10.

A total of 45 CITES Permits were issued for Pernambuco, as shown in Table 9. Of these, 43 were for wood, with 39 Permits covering commercial transactions (T - trade), although some of these received the L (Law) code.

In 2013, 8.4 m³ of boards and planks – volume equivalent to 56,000 bow blanks - were exported to China with a CITES Permit. Additionally, 42,942 bow blanks were

exported with CITES Permits to Japan (60.5%), Germany (28.7%), Portugal (6.8%), Italy (3%), and Austria (0.4%).

Of these exported bow blanks, 27,274 were exported due to judicial decisions ^(363 365) that recognized the raw material as pre-Convention, despite an opposing opinion issued by the CITES Management authority in Brazil. This included one transaction with a trading company based in Japan (26,000 bow blanks) and ten registered transactions to Italy (1,274 bow blanks).

There is a single recorded case of the re-exportation of 316 bow blanks in 2018 to the USA, in which the bow maker claimed to have brought 400 sticks from New York to Brazil and was informed that it was misinformed about the need of a Permit to come back with them in case of return to New York City. This Permit was issued retroactively, after the bow blanks had been seized by the United States Fish and Wildlife Service (USFWS).

Table 9 – CITES Permits issued by IBAMA to *Paubrasilia echinata* between 2007 and 2024.

Year	Operation	No. of CITES Permit	Source code	Purpose of transac. code	Country	Product	Quantity
2010	Export	10BR005600/DF	W	S	The Netherlands	Leaf	9 unit.
2011	Export	11BR007393/DF	O	T	USA	wood	0,045 m ³
2012	Export	12BR009554/DF	W	S	Italy	seed	0,5 kg
2013	Export	13BR010064/DF	O	T	USA	wood	0,045 m ³
2013	Pre-convention certificate	13BR010660/DF	O	T	Japan	wood	4 m ³
2013	Export	13BR011828/DF	O	T	China	wood	8,4 m ³
2013	Export	13BR012386/DF	O	T	Germany	wood	0,011 m ³
2014	Pre-convention certificate	14BR015575/DF	O	T	Germany	wood	0,11 m ³
2014	Pre-convention certificate	14BR015936/DF	W	T	Germany	wood	0,033 m ³
2014	Pre-convention certificate	14BR016073/DF	O	T	Germany	wood	0,08 m ³
2015	Pre-convention certificate	15BR017879/DF	O	T	Germany	wood	0,036 m ³
2016	Pre-convention certificate	16BR019796/DF	O	T	Germany	wood	0,036 m ³
2016	Pre-convention certificate	16BR020408/DF	O	T	Germany	wood	0,376 m ³

2016	Pre-convention certificate	16BR022027/DF	O	T	Germany	wood	0,03 m³
2016	Pre-convention certificate	15BR018984/DF	O	T	Germany	wood	0,376 m³
2017	Pre-convention certificate	17BR024460/DF	O	T	Germany	wood	0,036 m³
2017	Export	17BR024743/DF	O	T	Portugal	wood	0,12 m³
2017	Export	17BR024977/DF	O	T	Portugal	wood	0,12 m³
2017	Export	17BR025441/DF	O	T	Portugal	wood	0,059 m³
2017	Pre-convention certificate	17BR025812/DF	O	T	Germany	wood	0,02 m³
2017	Pre-convention certificate	17BR025914/DF	O	T	Italy	wood	118 unit.
2017	Pre-convention certificate	17BR026018/DF	O	T	Italy	wood	56 unit.
2017	Pre-convention certificate	17BR026067/DF	O	T	Germany	wood	0,034 m³
2017	Pre-convention certificate	17BR026131/DF	O	L	Italy	wood	140 unit.
2017	Pre-convention certificate	17BR026130/DF	O	L	Italy	wood	140 unit.
2017	Export	17BR026612/DF	O	T	Portugal	wood	0,042 m³
2018	Pre-convention certificate	18BR027141/DF	O	T	Germany	wood	0,19 m³
2018	Re- Export	18BR027656/DF	O	T	USA	wood	316 unit.
2018	Export	18BR028172/DF	O	S	China	Wood piece	1 piece
2018	Pre-convention certificate	18BR028896/DF	O	T	Germany	wood	0,032 m³
2018	Pre-convention certificate	18BR029129/DF	O	L	Italy	wood	100 unit.
2018	Export	18BR029527/DF	O	T	Portugal	wood	0,095 m³
2019	Pre-convention certificate	19BR030508/DF	O	T	Germany	wood	0,018 m³
2019	Pre-convention certificate	19BR030509/DF	O	T	Austria	wood	0,023 m³

2019	Pre-convention certificate	19BR030510/DF	O	T	Germany	wood	0,036 m ³
2019	Pre-convention certificate	19BR030933/DF	O	L	Italy	wood	120 unit.
2019	Pre-convention certificate	19BR031876/DF	O	L	Italy	wood	150 unit.
2019	Pre-convention certificate	19BR031874/DF	O	L	Italy	wood	150 unit.
2019	Pre-convention certificate	19BR031875/DF	O	L	Italy	wood	150 unit.
2020	Export	20BR034005/DF	O	T	Germany	wood	0,363 m ³
2020	Export	20BR034132/DF	O	T	Germany	wood	0,03 m ³
2020	Export	20BR034616/DF	O	L	Italy	wood	150 unit.
2022	Export	22BR044139/DF	W	S	USA	wood	0,03 kg
2023	Export	23BR047020/DF	W	E	USA	Wood piece	8 pieces
2024	Export	24BR050044/DF	W	E	Portugal	Wood piece	1 piece

No Pernambuco bows have been legally exported since the entry into force of Normative Instruction No. 08/2022 (IBAMA, 2022) in June 1st, 2022, since every requirement for Licenses, Permits, Certificates and other Documents (LPCO) have been denied.

No CITES Permits have been issued for the export of bow blanks or bows since after the amendment in annotation # 10 that was approved at CoP 19 in November 2022 that entry in to force on February 23, 2023.

Illegality in the commercialization of bow blanks and bows

Commercialization of bows without legal origin

In 2017 and 2018, several export shipments of pieces and instruments made from Brazilian rosewood and Pernambuco were detected by X-ray at the SERPI from Correios in São Paulo, including bow blanks and bows of musical instruments made from *Paubrasilia echinata* (Table 10).

UT-IBAMA-Guarulhos team requested the senders to provide the origins of the marketed material. Common origins were presented: donation terms from IBAMA of material to an association of 'capixaba' artisans. Additionally, documents related to a judicial donation to a charitable association in Teixeira de Freitas, were provided. When the DOF and invoice from a bow blanks seller in Alagoas were presented, the documents had no relation to each other. Based on the data presented by these companies/bow makers, Operation Dó Ré Mi was conceived.

Some shipments inspected at that time were released by UT-IBAMA-Guarulhos after the businessman/bow maker presented documentation related to the company's DOF ⁽¹³⁹⁾. It is believed that he and his wife joined the company as partners to use the virtual credits available in the SisDOF to legitimize the stock of illegal wood they had already stored on their property.

Later, in 2021, a businessman with an embargoed company and no virtual balance in the SisDOF attempted to ship 208 bows with an A.T.A Carnet document issued by the National Confederation of Industry.

The bows to be exported originated from Aracruz, Domingos Martins, and Aparecida de Goiânia. The destination countries for these bows seized by IBAMA would be USA, Israel, Germany, and France.

Table 10 – Cases of seizures of finished Pernambuco bows without legal origin.

Date	Origin	Destination	No. of bows	Declared origin of raw material used in the manufacturing of finished bows	Cases
April 2017	Aracruz	West Palm Beach & Glendale, USA	180	2 donation agreements of wood from IBAMA to the artisans' association in ES; judicial donation agreement to the association in Teixeira de Freitas; Invoice for Ipê and Pernambuco wood	326
April 2017	Aracruz	Glendale, USA	28	2 donation agreements of wood from IBAMA to the artisans' association in ES; judicial donation agreement to the association in Teixeira de Freitas; Invoice for Ipê and Pernambuco sent to a third party not involved in the transaction	311
May 2017	Aracruz	Saarbruecken, Germany	4	2 donation agreements of wood from IBAMA to the artisans' association in ES	180
August 2018	Aracruz	Hampton, USA	49	Invoice and DOF from a bow blank seller in Coruripe that had no connection between them	357
April 2018	Aparecida de Goiânia	Tel Aviv, Israel	4	Declaration that the bow blanks were acquired from Coruripe, without DOF	165&166
September 2021	Domingos Martins	France	208	A.T.A. Carnet issued by the National Confederation of Industry; the company was embargoed and the SisDOF balance was cancelled	84
Total			473 bows		

Export of bow blanks with CITES Permit although no proof of legal origin

In March 2012, a luthier from Recife submitted a request for the export of 26,000 bow blanks of Pernambuco (Figure 19 A-D). The request was administratively denied by the CITES authority due to the lack of proof of legal origin of the material. The interested party had the support of an influential judge in Pernambuco, who attempted to interfere with the administrative decision of IBAMA. Once the case was judicialized, a favorable decision for export was made, which was realized in 2013, with the issuance of a pre-convention CITES permit for commercial export of 4m³ for trading company with address in Japan. The woods had no documented legal origin, were not in the SisDOF, and were exported through the port of Salvador.



Figure 19 – A - D – Pernambuco sticks exported to a trading company in Japan by a luthier from Recife, without any proof of the legal origins of the wood ⁽²⁷⁴⁾.

Reductions in SisDOF in lower volumes for bow blanks exported

A bow making company in Aracruz was fined for entering false information into SisDOF ⁽¹¹⁵⁾, by reducing virtual credits in SisDOF at values lower than the actual volumes of bow blanks exported. The fine was issued after an analysis of the company's exports to Germany and Austria under CITES Permits, which concluded that the company recorded reductions in the system at volumes 10 times lower than the actual exported

amounts ⁽¹¹²⁾. The company was also fined for selling 4,674 bow blanks without a license or in violation of the obtained license ⁽¹¹⁴⁾.

Declaration of various products

The Mercosur Common Nomenclature (NCM) is a goods classification system used to standardize product identification in international trade. Musical instruments, their parts and accessories require the seller to declare in the invoice the NCM 9209.92.00. If the bow blank or a bow is made of Pernambuco wood, the NCM declared should be 920992.00 with highlight 01, manufactured with species listed in the CITES appendices, according to Article 22 of Normative Instruction No. 1702/2017 of the Brazilian Federal Revenue Service (RFB, 2017). In this situation, the export request in Integrated Foreign Trade System (SISCOMEX) acknowledges the need for administrative processing by IBAMA, with the request being processed through the PAU-Brasil platform for the approval or denial of the LPCO ⁽⁴⁷⁶⁾.

Several cases of orders of *Paubrasilia echinata* being sent abroad were detected by agents at IBAMA Office in Guarulhos (UT-IBAMA-Guarulhos) and in Campinas (UT-IBAMA-Viracopos) between March 2017 and January 2022 (Figure 20 A, B and C)). Nine shipments were blocked at the Post Office in São Paulo after the detection of bow blanks in packages via X-ray, and a shipment of bow blanks was dispatched from Viracopos airport in Campinas, as shown in Table 11.

Table 11 – Cases of seizures of Pernambuco bow blanks declared with an NCM code differing from the exported product.

Date	Declared origin	Destination	Declared NCM	Declared content	Material found	Cases
March 2017	Coruripe	Hong Kong	Not declared	Others	16 bow blanks of <i>P. echinata</i>	296
May 2017	Ipojuca	Bordeaux, France	92060000	Percussion instruments	400 bow blanks of <i>P. echinata</i>	172
May 2017	Aracruz	Bad Brambach, Germany	92021000	Played with a bow	50 bow blanks of <i>P. echinata</i>	209
May 2017	Eunápolis	Loomis, USA	44091000	Wood including the cues and strips	14 bow blanks of <i>P. echinata</i>	313
June 2017	Aracruz	Buenos Aires, Argentina	92029000	Other string musical instruments	5 bow blanks of <i>P. echinata</i> and 2 bow blanks of <i>Handroanthus</i> sp.	153
September 2017	Recife	Geneva, Switzerland	42211000	Clothing hangers	20 bow blanks of <i>P. echinata</i>	415
October 2018	Recife	Barcelona, Spain	97030000	Original works of statuette art	30 bow blanks of <i>P. echinata</i>	424

March 2020	São Mateus	Cheltenham, UK	44079990	Others	10 bow blanks of <i>P. echinata</i>	191
March 2020	Santa Luzia	Crema, Italy	Not declared	Gifts	52 bow blanks of <i>P. echinata</i>	380
January 2022	Rio de Janeiro	Crema, Italy	44011200	Non-protected wooden stick for crafts	285 bow blanks of <i>Dialium</i> sp. and 142 bow blanks of <i>P. echinata</i>	320
Total					1026 bow blanks	

The cargo manifest indicated various products, such as '*clothes hangers*', '*percussion musical instruments*', '*played with a bow*', '*original statuette art productions*', '*gifts*', '*woods including cues and strips*', '*non-protected wooden sticks for handicrafts*', and '*others*' (Figure 21), inadequate declarations for bow blanks of a CITES Appendix II species. The declared origins of the shipments were Recife and Ipojuca (PE), Coruripe at Alagoas State (AL), Eunápolis and Santa Luzia (BA), São Mateus and Aracruz (ES), and the destination countries included France, Germany, Italy, Spain, Switzerland, the United Kingdom, Argentina, Hong Kong, and the USA. A total of 1,021 bow blanks were seized, including 739 bow blanks of Pernambuco, 285 of Jutáí-peba (*Dialium* sp.) and 2 of Trumped-tree (*Handroanthus* sp.).



Figure 20 – **A** - In May 2017, an order of 400 Pernambuco sticks was being exported to France with NCM 92060000 declaring '*percussion musical instruments*' ⁽¹⁷²⁾; **B** - In March 2020, an order of 52 sticks was sent to Italy describing the products as '*gifts*' without a declared NCM ⁽³⁸⁰⁾; **C** - In January 2022, an order of 142

sticks of Paubrasilia echinata and 285 sticks of Dialium sp. was being exported to Italy with NCM 44011200 declaring 'non-protected wood stick for handicrafts' ⁽³²⁰⁾.

Figure 21 displays four examples of Brazilian Export Declaration forms (Forma 1000) for Paubrasilia echinata exports. Each form is labeled A, B, C, and D.

- Form A:** Export of 30 Pernambuco sticks to Spain (NCM 97030000) in October 2018. Declared as 'PRODUTOS ORIGINAIS DE ARTE ESTATUARE'.
- Form B:** Export of 400 Pernambuco bow blanks to France (NCM 92060000) in May 2017. Declared as 'INSTRUMENTOS MUSICAIS DE PERCUSSAO P'.
- Form C:** Export of 10 sticks to the United Kingdom (NCM 44079990) in March 2020. Declared as 'OUTROS'.
- Form D:** Export of 20 sticks to Switzerland (NCM 44211000) in September 2017. Declared as 'CLOTHING HANGERS'.

Figure 21 – A - In October 2018, an order of 30 Pernambuco sticks was sold to Spain with NCM 97030000 declaring 'original productions of statuette art' ⁽⁴²⁴⁾; B – In May 2017, an order of 400 Pernambuco bow blanks was sold to France with NCM 92060000 declaring 'percussion musical instruments' ⁽¹⁷²⁾; C – In March 2020, an order of 10 sticks was sold to the United Kingdom with NCM 44079990 declaring as 'others' ⁽¹⁹¹⁾; D – In September 2017, an order of 20 sticks was sold to Switzerland with NCM 44211000 declaring 'clothing hangers' ⁽⁴¹⁵⁾.

Wood trafficking in luggage

At International Airport of Guarulhos (GRU) there were three attempts to board with bows and bow blanks made of Pernambuco in travel bags, and one at GIG in Rio de Janeiro (Table 12).

In September 2021, a passenger was intercepted at GRU carrying 37 bow blanks of Pernambuco destined for Colombia. In the same airport, also in September 2021, a passenger was stopped at the X-ray with 208 Pernambuco finished bows while boarding for Switzerland ⁽⁸⁴⁾ (Figure 22 A and B). Seven months later, in April 2022, the same individual was caught again at GRU attempting to board for England with 114 finished bows and 120 bow blanks of Pernambuco in his suitcase ⁽³²⁷⁾ (Figure 22 C-G).

At Internacional Airport of Rio de Janeiro (GIG) in June 2022, an attempt was intercepted involving an Italian citizen traveling to Milan, Italy, with 70 bow blanks in their checked luggage, including 34 bow blanks of Pernambuco and 36 bow blanks of Jutai-peba (*Dialium guianense*).

Table 12 – Cases of Pernambuco wood smuggling at Brazilian airports

Date	Airport	Seized material	Document used	Destination country	Cases
07/09/2021	GRU	37 bow blanks of <i>P. echinata</i>	None	Colombia	385, 386 & 404
11/09/2021	GRU	208 finished bows of <i>P. echinata</i>	A.T.A. Carnet	Switzerland	84
12/04/2022	GRU	114 finished bows and 120 bow blanks of Pernambuco	None	England	327
16/06/2022	GIG	34 bow blanks of <i>P. echinata</i> 36 bow blanks of <i>Dialium guianense</i>	None	Italy	189 & 190
Total		513 bows/bow blanks of <i>P. echinata</i> and 36 bow blanks of <i>Dialium guianense</i> .			

Commerce of bows without LPCO approval

Between June and September 2022, 13 packages of Pernambuco finished bows were inspected and 458 bows were seized at the airports of Guarulhos and Viracopos (SP). By failing to report highlight 001 in NCM 92099200, the loads were not transferred to the PAU-brasil platform for export analysis by IBAMA (Table 13).

Table 13 – Cases of Pernambuco bow sales at Brazilian airports without LPCO approval

Date	Origin	Destination	Nº of seized bows	Cargo dispatch airport	Cases
June 2022	Aracruz	Tempe, USA	104	VCP	66
June/2022	Aracruz	Markneukirchen, Germany	25	VCP	120
June 2022	Aracruz	Baltimore, USA	08	GRU	226
June 2022	Aracruz	Baltimore, USA	12	GRU	231
June 2022	Aracruz	Baltimore, USA	13	GRU	227
June 2022	Aracruz	Baltimore, USA	15	GRU	228
June 2022	Aracruz	Baltimore, USA	19	GRU	233
June 2022	Aracruz	Baltimore, USA	21	GRU	229
June 2022	Aracruz	Baltimore, USA	22	GRU	230
August 2022	João Neiva	Markneukirchen, Germany	110	GRU	22
August 2022	Aracruz	Baltimore, USA	13	GRU	232
September 2022	Aracruz	Baltimore, USA	21	GRU	234

September 2022	Aracruz	Tokyo, Japan	75	GRU	235
Total			458		



Figure 22 – A - 208 Pernambuco bows seized in November 2021 from a passenger at Guarulhos International Airport in route to Switzerland. B - The document accompanying the cargo of 208 bows was an "A.T.A. – Carnet" ⁽⁸⁴⁾; C and D – X-ray images of the suitcases with bows and bow blanks (source: UT-IBAMA-Guarulhos); E and F – Bow blanks and finished bows seized in April 2022 from a bow maker caught in the act at Guarulhos Airport while attempting to board for England with 114 bows and 120

Pernambuco bow blanks without origin and commercialization documents; **G** – Price list found in possession of the luthier with values in Pounds for different models of bows sold by the company ⁽³²⁷⁾.

Intermediaries (stick sellers) trading bow blanks door to door

Two bow makers from João Neiva confirmed to IBAMA's inspection team the acquisition of Pernambuco bow blanks from vendors who passed through the region, bringing material from Bahia ^(213 271).

Two of these bow blanks vendors confirmed collecting material in Bahia, in the Coreia district of Potiraguá, and reselling it to bow making companies in Aracruz ⁽²⁸⁾.

A Pernambuco wood vendor from Aracruz was involved in the processing of logs on rural properties in Camacan and Mascote for the resale of bow blanks to companies in Espírito Santo^(423 341 342), although the fines had been issued only for the owners of the land.

Sale of virtual credits

A bow blank seller in Coruripe, who had received material in 2004 from vegetation clearance in a flooding area for the construction of a dam, managed to enter virtual credits into the SisDOF in 2012 through the Institute of the Environment of the State of Alagoas (IMA). In 2016, he obtained a judicial decision allowing him to sell 20,000 bow blanks to Italy.

During an IBAMA inspection in 2019, it was found that Pernambuco wood was stored in unfavorable conditions, exposed to the elements, and the stock was mainly composed of waste material (Figure 23). Nevertheless, the stick vendor continued selling raw material to the bow making industry in Aracruz, João Neiva, and Santa Teresa.

Considering the validity period of the issued DOFs, the vehicles used for transportation, their cargo capacity, and the physical degradation of the stored wood, IBAMA's inspection concluded that it was a fraudulent wood trade scheme. The aim was to allocate virtual Pernambuco wood credits to the yards of companies and bow makers receiving illegal material without proper documentation, constituting an explicit wood laundering operation ⁽²⁹⁵⁾.

In Jacupemba, a bow maker and his wife joined the corporate structure of an inactive bow making company, acquiring in 2017 the stock of virtual credits that the company still had in the SisDOF, as well as the physical wood stock, which was almost entirely composed of waste. IBAMA concluded that this operation sought to cover up illegal wood using the existing virtual credits in the system, thereby 'legalizing' the illegal wood stockpile the bow maker already had in his workshop ⁽¹³¹⁾.



Figure 23 – A – B – Storage of bow blanks and planks in precarious conditions in Coruripe (AL); C – D – Sticks in degradation, exposed to rain and ground humidity ⁽²⁹⁵⁾.

Cancelled CITES Permits

After detecting fraud at the source of a bow stick trading company in Aracruz in May 2020 during the 3rd stage of Operation Dó Ré Mi, the IBAMA president cancelled in May 2023 the five CITES Permits issued in favor of this company ⁽¹⁵⁷⁾.

Through these permits, a total of 1,950 Pernambuco bow blanks were shipped to Lisbon, Portugal, between June 2017 and October 2018 ⁽¹⁵⁸⁾. These bow blanks are being resold by a Brazilian resident in Portugal to European bow makers.

Frauds involving donations

Nineteen cases of Pernambuco wood donations to various entities were identified, mostly originating from IBAMA seizures. Exceptionally, the donated material came from environmental licensing cases in areas where Pernambuco wood populations required removal.

Part of the wood donated by IBAMA returned to the market as bow blanks and finished bows, which is prohibited under national legislation, especially Normative Instruction No. 57/2004 (IBAMA, 2004).

Donation to Capixaba artisans' association

In December 2005, IBAMA allocated 6 m³ of seized Pernambuco wood to an artisans' association in Espírito Santo, distributing it equally among six bow makers from Aracruz.

In 2013, another 6 m³ from the same seizure were donated to the same association, which this time distributed it among two bow makers from Aracruz. After confirming that bows made from this material were being sold, the administrative authority cancelled these two donation agreements in May 2020. During Operation Dó Ré Mi, the remaining material held by five of these artisans was seized.

Exchange of donated material

A church in Vila Velha received in May 2015 a volume of 0.746 m³ in bow blanks, 16 m³ in planks and logs, and 135 bundles of bow blanks. The church exchanged the donated wood material from IBAMA for granite. The person who received the exchanged material began offering the bow blanks (Figure 24) to companies in João Neiva and Aracruz ⁽³²⁹⁾.



Figure 24 – A – B – Woody material donated by IBAMA to a church in Vila Velha and informally passed on to a philanthropic entity in Aracruz, which was reported for offering bow blanks to bow making

companies in Espírito Santo ⁽³³¹⁾; **C – D** – Preparation of bow blanks in a sawmill operating without authorization ⁽²⁴⁵⁾.

Bow making companies acquiring donated material

In December 1999 and June 2000, 16.5 m³ of logs were transferred using ATPFs from two daycare centers in Eunápolis to a timber entrepreneur in the same city ⁽⁶²⁾.

This entrepreneur then created a company and, also using ATPFs, transferred wood in 15 operations between September 1999 and June 2004, totaling 175.22 m³ of Pernambuco wood in logs, planks, and bow blanks, to four bow making companies in Aracruz.

In September 2001, 10 m³ of logs were transferred, using ATPFs, from a religious charity association in Eunápolis to a bow making company in Domingos Martins ⁽⁸¹⁾.

In July 2006, a daycare center in Eunápolis transferred, using an ATPF, 13 m³ of Pernambuco wood logs to a company in Aracruz ⁽¹³⁰⁾.

Illegal Logging in Protected Areas

In 2015, ICMBio recorded illegal logging of native trees inside Pau Brasil National Park in Porto Seguro during an inspection operation, including 18 Pernambuco trees ⁽¹⁰⁷⁾. According to the former head of the national park, 51 Pernambuco trees were illegally extracted from the park between 2014 and 2016 (Faraco, 2022, personal communication).

In September 2021, IBAMA seized 13 Pernambuco logs inside the national park, but the loggers were not identified. In all cases, the one-meter-long logs found in the forest indicated that the intended destination of the material was the bow making industry (Figure 25).



Figure 25 – Pernambuco logs from trees cut down inside the Pau Brasil National Park in Porto Seguro (BA): **A** – December 2015; **B** – January 2016; **C** – on an uncertain date in 2016; **D** – September 2021 (Photos ICMBio).

Embargo, suspension of activities & failure to compliance with Brazilian laws and procedures

Activities utilizing natural resources in non-compliance with legislation and suspension of activities involving Pau-Brasil.

There are records of 26 cases that led to the embargo of activities based on Article 2 of Decree 3.179/1999 or Article 3, item VII of Federal Decree 6.514/2008. Another three cases involve companies whose activities related to Pernambuco were suspended based on Article 3, item IX of the same legal provision (Table 14).

Embargo or suspension occurred in only 15.3% of the cases involving administrative sanctions that were analyzed.

Among the entities that received embargo or suspension sanctions, 13 infractions - 7.5% of the infractions issued during this period - were based on Article 66 of Federal Decree 6.514/2008. These were due to the operation of potentially polluting activities or the use of natural resources without a license or authorization from environmental authorities or in violation of the license obtained.

Table 14 – Infractions that led to the embargo of activities due to the operation of establishments or activities utilizing environmental resources in violation of legal regulations or that resulted in the suspension of activities involving Pernambuco.

Date	Municipality	Situation	Cases
November 2002	Mascote	Raw material trader of plant origin embargoed for operating without registration with IBAMA	340
May 2003	Domingos Martins	Company fined for storing 19 m ³ of Pernambuco without proof of origin had its activities embargoed	81
June 2003	Serra	Timber company fined and embargoed for storing raw material without legal origin	250
June 2003	Aracruz	Sawmill had its activities embargoed after 14 m ³ of Pernambuco was found without legal origin	375
November 2008	Camacan	Illegal processing of Pernambuco logs on a rural property	341 & 343
July 2014	Camacan	Carpentry workshop processing Pernambuco logs. Logs were also found on the violator's rural property	202
February 2018	Linhares	Processing activities of donated Pernambuco were embargoed	245
October 2018	Jacupemba, Aracruz	Company fined for operating without a license. 10.528 m ³ of logs, slats, and bow blanks were seized in the yard	142 & 143
October 2018	João Neiva	Bow maker had 20,747 bow blanks and 0.231 m ³ of Pernambuco logs hidden on his father's rural properties	34
October 2018	Santa Teresa	The company operated with a fictitious stock of Pernambuco logs. Entire stock of bow blanks and bows was seized	266
September 2019	Coruripe	Bow blanks vendor's activities embargoed for providing misleading information in the SisDOF by maintaining virtual stock credits inconsistent with the system records	295
September 2019	Jacupemba, Aracruz	Bow maker had 102 logs hidden on his rural property	353
September 2019	Jacupemba, Aracruz	The company fined and embargoed for providing false information in the SisDOF by failing to update the stock balance of 1 m ³ of Trumpet tree wood used for violin bow production	362
September 2019	Jacupemba, Aracruz	Bow-making company engaged in laundering native timber logs using credits for plantation logs	138
September 2019	Domingos Martins	Bow-making company embargoed for providing misleading information in SisDOF by failing to record conversions and deductions for the volumes of bows sold	83

May 2020	Linhares	Woodworker processing Pernambuco logs on his rural property	256
May 2020	João Neiva	Bow maker producing bows from bow blanks without origin in a small workshop set up at his residence	305
May 2020	João Neiva	Bow maker producing bows from bow blanks without origin in a small workshop set up at his residence	215
October 2020	Linhares	Bow maker producing bows from bow blanks without origin in a small workshop set up at his residence	333
October 2020	Aracruz	Two companies owned by the same bow maker were fined and embargoed for failing to record conversions and the proper use of raw materials in SisDOF	118 & 124
May 2021	João Neiva	Bow maker producing bows from bow blanks without origin in a small workshop set up at his residence	185
May 2021	Aracruz	The company operated using bow blanks originating from fraudulent documents, including a false claim of plantation origin. Entire company stock - 10,878 bow blanks - was seized	247, 248 & 456
May 2021	Santa Teresa	Bow-making company operating with bow blanks of illegal origin	263
August 2021	Aracruz	The recipient of donated material was running a processing operation for bow blanks and selling them in the region	330
September 2021	Coruripe	Bow blanks vendor selling virtual credits to bow making companies	294
November 2021	João Neiva	Bow maker had all material seized—2,159 bow blanks—and activities embargoed for failing to prove legal origin	270
November 2021	João Neiva	Bow-making company using fraudulent documents to justify stock stocks had its activities embargoed	1
November 2022	Domingos Martins	The company fined for violating an embargo after its owner was caught exporting Pernambuco bows; activities were suspended, and the entire stock of the species was seized	71
November 2023	Jacupemba, Aracruz	The company had its Pernambuco-related activities suspended, and entire stock - 19,290 bow blanks - was seized after a review deemed its origins illegal	132
December 2024	Aracruz	The company had its Pernambuco-related activities suspended. All Pernambuco material in the yard -77,352 bow blanks and 0.969 m³ of slats - had already been seized preventively in November 2022	54 & 474

In November 2002, a timber trader had their activities embargoed in Mascote due to the lack of registration with the CTF under the category of trader of raw materials/products and by-products of flora origin ⁽³⁴⁰⁾. On the same occasion, they were fined for storing 39 m³ of Pernambuco and Brazilian Rosewood, which were seized ⁽³³⁹⁾. The activities were not unembargoed. The individual was identified as a partner of an American citizen who exported this material to the USA and as the owner of a timber company in Rio de Janeiro (CPITRAFI, 2003).

In May 2003, a bow-making company in Domingos Martins had its activities embargoed ⁽⁸¹⁾. On that occasion, agents from Environmental Military Police (PMA) found 19 m³ of Pernambuco in slats and bow blanks without legal origin, many hidden in the company's ceiling and in raffia bags on the neighboring property, which belonged to the brother of the company's partner. The embargo lasted almost a year and three months, and the activities were unembargoed in August 2004. Part of the seized material (10 m³) was returned to the businessman after the presentation of ATPFs. During the embargo period, the company continued conducting commercial transactions, issuing 15 invoices - 6 for incoming goods, with the return of consigned export bows, and 9 for outgoing sales, totaling 466 bows exported to the USA. In September 2019, the same company was embargoed again during the 2nd stage of Operation Dó Ré Mi for providing misleading information in the SisDOF, failing to register conversions or deductions for the volumes of bows sold. This embargo lasted 2 years and 23 days, ending when the individual obtained a court ruling to unembargo the activities ⁽⁴⁴⁶⁾. On September 11, 2021, while the company's activities were still embargoed, the individual was caught at GRU airport boarding a flight to Switzerland with 208 bows in his suitcase, carrying an ATA Carnet document ⁽⁸⁴⁾. Then, on April 12, 2022, the same bow maker was caught with 114 bows and 120 Pernambuco bow blanks in his luggage while boarding a flight to England without any documentation ⁽³²⁷⁾ but notes identifying the material's recipients. During a joint operation between IBAMA and the Federal Police in November 2022, the company's activities were suspended, and it was fined for violating the embargo.

In May 2003, in Serra, a timber company had its activities embargoed for storing wood without legal origin. The PMA team arrived at the location after seizing a container in a truck with undocumented native wood. At the time, the company's representatives attempted to deceive the environmental inspection by claiming that the Pernambuco logs in the yard were 'Angico.' Authorities seized 12.5 m³ of Pernambuco logs and 8.25 m³ of slats ⁽²⁵⁰⁾. The invoices from Camamu (BA) and Itabuna (BA) presented by the violator to prove the wood's origin were issued in the name of another recipient company in 1992, failing to convince the inspecting agent, who reported in his findings that there was "green" (freshly cut) wood in the yard. Nevertheless, the fine was cancelled in 2005 following a ruling by the Federal Prosecutor's Office, which determined that there was insufficient evidence - an explicit case of IBAMA's technical failure in exposing fraud. The company's activities remained embargoed for 2 years.

In June 2003, a sawmill in Aracruz had its activities embargoed after the discovery of 14 m³ of Pernambuco logs, slats, and bow blanks stored in the yard without proof of origin ⁽³⁷⁵⁾. The activities were unembargoed three months later. The owner of this company had already been fined in January 2002 for storing 1.183 m³ of Pernambuco logs without legal origin ⁽³¹⁸⁾.

In October 2008, illegal sawing of Pernambuco logs was discovered on a rural property in Camacan (Figure 26). Authorities seized 1.86 m³ of Pernambuco in logs, slats, leftover cuts, and 294 bow blanks. The violator claimed to have received the wood from the clearance area of the Cacimbas-Catu gas pipeline. However, the contractor responsible for the pipeline later confirmed that no Pernambuco was present in the sampled areas of that location. The sawmill's activities were embargoed ^(343 341), and the gas pipeline operator was also fined ⁽⁴⁰⁸⁾. Fifteen years later, when revisited by an IBAMA team, the owner of the fined area explicitly admitted that he had rented the rural property to two Pernambuco intermediaries from Espírito Santo for the processing of logs and the production of bow blanks for the bow making industry in Aracruz and the surrounding region. One of them, referred to here as B.C.L., was involved in the violation described above in June 2003 in Aracruz.

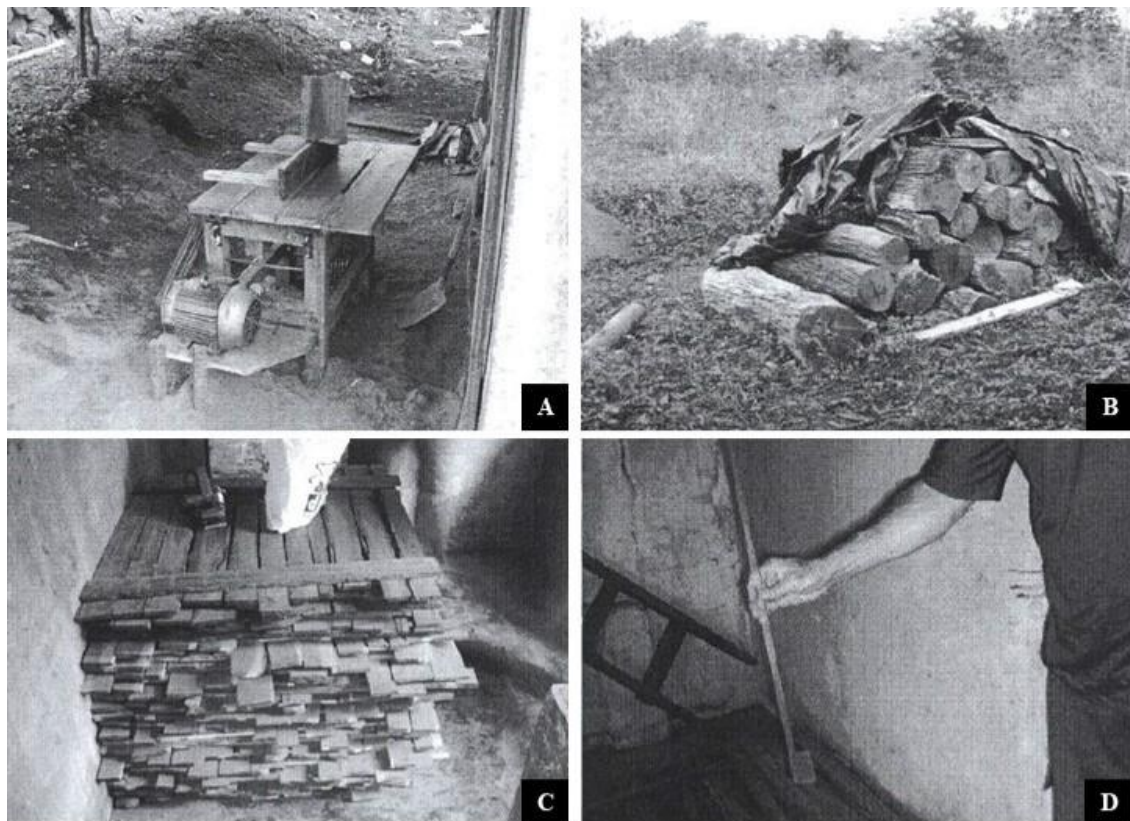


Figure 26 – Sawn mill processing logs illegally on a rural property in Camacan (BA) in October/November 2008. **A** – circular saw used; **B** – Pernambuco logs stored; **C** – Pernambuco planks stored; **D** – Reference bow blank used for making sticks ^(343 341).

In July 2014, a carpentry workshop illegally sawing Pernambuco to produce bow blanks for musical instrument bows was embargoed in Camacan ⁽²⁰²⁾. At the time, 33 logs,

84 slats, and 348 bow blanks were seized from the workshop ⁽²⁰¹⁾, along with another 67 logs hidden on a rural property in the municipality's interior ⁽²⁰⁴⁾. Despite the embargo, the business continued processing Pernambuco bow blanks, as confirmed in November 2022 during Operation Ibirapitanga, when it was fined for violating the embargo ⁽¹⁹⁹⁾. Authorities seized 995 Pernambuco bow blanks, along with remnants of logs and slats ^(197 198 200).

In February 2018, the operating activities of a wood processing facility in Linhares were embargoed ⁽²⁴⁵⁾. In theory, they were working with material donated by IBAMA to a church in Vila Velha (Figure 24).

In October 2018, during the 1st stage of Operation Dó Ré Mi, a bow maker from João Neiva was fined for running an unauthorized bow-making establishment, as he maintained a stock of more than 20,747 bow blanks and logs hidden on his family's rural property ⁽³⁴⁾ (Figure 15). The Pernambuco materials were not registered in the SisDOF and had no legal origin. The company's activities were embargoed, but the bow maker continued operating in the following years ⁽³³⁾. In 2021, he was fined again during the 1st stage of Operation Ibirapitanga, with over 700 bow blanks found both at his residence and at his father's home ^(32 e 1).

During the same phase of Operation Dó Ré Mi in 2018, the activities of a bow-making company in Santa Teresa were embargoed, as it had based its operations on a fictitious stock of Pernambuco logs ⁽²⁶⁶⁾ (Figure 3A and B). The embargo lasted only 163 days. Once lifted, this company began acquiring wood from Coruripe from a bow blanks seller who had rotten material (Figure 23), from the bow-maker in Jacupemba who had 102 hidden logs (Figure 17), and from a planted tree in Domingos Martins (Figure 12), with an inflated volume in logs, which also had not undergone the drying years required by the bow making industry. In May 2021, the same company was fined under Article 66 of Decree 6.514/2008 due to irregularities in its operations, linked to these ideologically fraudulent sources, and its activities were embargoed. Less than three months later, a new embargo was issued, this time including the commercialization of bows, as the company continued selling bows after the embargo imposed in May 2021. To date, the embargo on this company's activities remains in effect ⁽²⁶²⁾.

The activities of a bow-making company in Jacupemba, Aracruz, were also embargoed. The company operated without an environmental license and could not prove the origin of 10.528 m³ of Pernambuco, which was seized ^(142 143). The company resumed operations 45 days after being embargoed. In September 2019, during the 2nd stage of Operation Dó Ré Mi, the company's activities were embargoed again ⁽¹³⁸⁾, after it received 16 m³ of virtual credits in the SisDOF following an authorization issued by IDAF/ES for the harvesting of planted Pernambuco. The company used these virtual credits to cover illegal wood originating from Bahia ⁽¹³⁸⁾ (Figure 9). The embargo lasted only 174 days, during which, in theory, no bows were sold. Yet, the bow-maker continued selling bows to the USA under a different business registration. In November 2023, this company's

activities involving Pernambuco were suspended (Article 3, Section IX of Decree 6.514/08), and all raw materials of this species found on-site were seized: 19,290 bow blanks ⁽¹³²⁾. A review by the GT-Pau-brasil group of all the company's sources ⁽¹³⁶⁾ confirmed that they lacked legal backing. While active, this bow maker exported 12,334 bows to the USA, Japan, Portugal, Peru, South Korea, Hong Kong, and Taiwan, in addition to 101 bows sold on the domestic market.

In September 2019, the activities of another bow-making company in Jacupemba, Aracruz, were embargoed ⁽³⁵³⁾, and all bow blanks and bows in the company's yard were seized ⁽³⁵⁶⁾, following the discovery of 102 hidden logs on its rural property ⁽³⁵⁴⁾ (Figure 17). This was the most explicit case illustrating an illegal wood laundering scheme. The company's official wood sources were based on IDAF/ES reports attesting to the use of degraded wood from fences, fence posts, roots, and trees that had been dead, weakened, and exposed to the elements in pastures for decades (Figure 4 and Figure 5). The embargo on this company's activities remains active, but the applied fines have been cancelled following the bow-maker's death, and his son is pursuing legal action to recover the seized material ⁽¹⁸²⁾.

In May 2020, a clandestine sawmill processing Pernambuco logs on a rural property in Linhares was embargoed ⁽²⁵⁶⁾. It was cutting logs of illegal origin brought from Bahia. That same month, two small bow-making workshops located at the back of a residence in João Neiva were also embargoed ^(305 215), as they could not prove the legal origin of the bow blanks.

In October 2020, the activities of a bow-making workshop producing Pernambuco bows for musical instruments in a residence in Linhares were embargoed ⁽³³³⁾. A renowned bow-maker was producing bows on demand for a large company in Aracruz.

In May 2021, a bow-making workshop in a residence in João Neiva was fined and embargoed ⁽¹⁸⁵⁾.

During the same phase in May 2021, a bow-making company in Guaraná, Aracruz, was embargoed ⁽²⁴⁸⁾, and its entire stock of Pernambuco was seized: 10,878 bow blanks (Figure 27). The sources of the wood were deemed ideologically false ⁽²⁴⁷⁾, as acquisitions came from planted trees with inflated volumetric measurements (Figure 7) and from the rotten stocks in Coruripe (Figure 23). This same individual was later featured in a national television program burning Pernambuco bow blanks in a wood-fired oven (Globo, 2022b). Their activities with Pernambuco remain embargoed. During the time this company was active, 1,956 finished bows were sold to 20 different countries, besides Brazil.

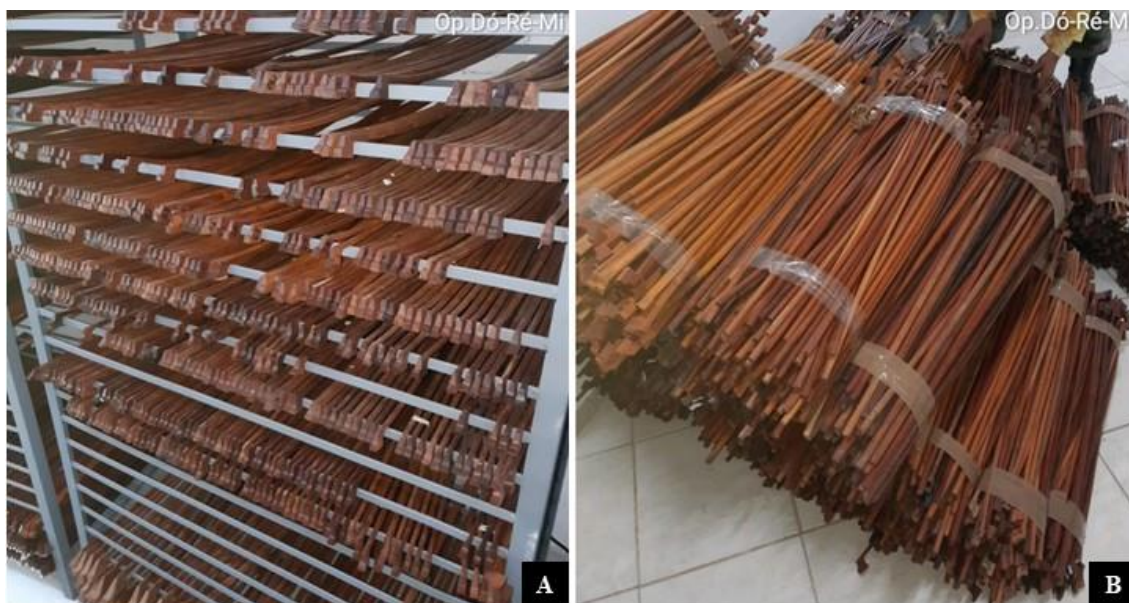


Figure 27 – A and B – 10,878 Pernambuco bow sticks seized in May 2021 from a company in Aracruz (ES) fined and embargoed for operating in violation of environmental regulations ^(247 248).

In September 2021, a Pernambuco stick seller in Coruripe was fined and embargoed ⁽²⁹⁴⁾. Despite having a stock of rotten raw material (Figure 23), he continued conducting commercial transactions with bow-making companies in ES, attempting to allocate virtual credits in the SisDOF to legalize bow blanks of illegal origin. His activities remain embargoed.

In November 2021, a bow-maker from João Neiva had his entire stock seized (2,159 bow blanks) after it was proven that the origins were ideologically false ⁽²⁷⁰⁾. He had obtained invoices from the seller in Coruripe. Part of this bow-maker's material had already been seized in 2019 ⁽²⁷¹⁾, at which time he informed IBAMA of two intermediaries supplying him with bow blanks.

In December 2024, one of the largest companies in Aracruz had its activities with the species *Paubrasilia echinata* suspended under Article 3, Section IX of Decree 6.514/08 ⁽⁴⁷⁴⁾. The entire stock - 77,352 bow blanks and 0.969 m³ of slats - had already been provisionally seized in November 2022 during Operation Ibirapitanga ⁽⁵⁴⁾, in collaboration with the Federal Police.

Embargo of Pernambuco Plantations

In July 2003, IDAF/ES fined and embargoed a 0.5-hectare area of Atlantic Forest belonging to a local bow maker due to deforestation of vegetation in the early and mid-stages of regeneration for the commercial planting of Pernambuco in the district of Santa Isabel, Domingos Martins ⁽²³⁾.

Reforestation projects involving Pernambuco trees in Aracruz for commercial purposes ^(187 188), which received authorization from IDAF/ES to cut nine planted trees in September 2018, generating a SisDOF credit volume of 3.53m³, were subject to fines and

embargoes imposed by IBAMA ⁽⁴⁷⁵⁾. The inspection considered the projects submitted to the state agency to be superficial, lacking reliable data, and inconsistent. The responsible parties were fined for providing false, misleading, and omitted information in an environmental administrative procedure, based on Article 82 of Decree 6.514/2008. The landowners were fined ^(457 475), as well as the technicians responsible for the projects ^(345 464).

Photos taken by IDAF/ES in January 2019 of the cutted logs clearly show that the businessman used the cutting authorization granted to him to conceal native trees (Figure 10 G) of illegal origin under the credits of legally authorized planted trees (Figure 10 F).

Bow making Companies Suspended Activities

Four bow making companies, located in Aracruz, Domingos Martins, and Santa Teresa, had their bow manufacturing and trading activities suspended with the species *Paubrasilia echinata* ^(132 71 262 474) based on Article 3, Section IX of Decree 6.514/2008.

Operation of two companies in the same physical yard

There are two business groups in Aracruz that operate their companies with two different National Registry of Legal Entities (CNPJ), active within the same physical yard. The separation of stock is precarious, sometimes carried out by an improvised fence ⁽⁴⁹⁾ or by a line painted on the ground ⁽¹²⁴⁾ (Figure 28). The use of bow blanks for making bows in the production line follows a single path, in such a way that it is impossible for the inspectors to separate which bow blanks came from which company, this condition being at the owner's discretion.

The invoices for the bows are issued by one or the other CNPJ, without control of the stock from which they actually came.



Figure 28 – **A** – Fence separating the timber stock of one company from the timber stock of the other company ⁽⁴⁹⁾; **B** – Line painted on the floor separating the stock of the two CNPJ's that operate in the same physical space ⁽¹²⁴⁾.

Failure to Comply when Notified

There are records of four fines issued based on Article 80 of Decree 6.514/2008, totaling R\$ 8,000.00 in penalties.

One of them was imposed on a lutherie company in João Pessoa for failing to comply with a notification regarding registration in the CTF in 2016 ⁽²⁶⁸⁾.

Another fine was applied to a bow blanks seller in Coruripe in 2017 for failing to comply with a notification requesting documents proving the origin of the stored raw material, copies of sales and export invoices, and CITES licenses ⁽²⁹²⁾.

In 2018, a Baptist Church was fined after receiving donated Pernambuco wood but was caught processing the material and accused of selling bow blanks in the Bow's Valley. The church was notified but failed to provide the requested documents and the inventory of the remaining material ⁽²⁴⁵⁾.

In 2022, a bow-making company in Jacupemba, Aracruz, was fined for failing to comply with a notification requiring the submission of invoices for bow sales ⁽³¹⁹⁾. The well-known bow maker apparently began selling bows under a different CNPJ after IBAMA embargoed the operations of his main company.

Presentation of False, Misleading, or Omitted Information in Environmental Procedures

There were 21 fines issued to individuals and companies for presenting false, misleading, or omitted information in administrative environmental procedures, based on Article 82 of Federal Decree 6.514/08, with total fines reaching R\$ 3,156,500.00.

Some fines were issued due to discrepancies between virtual credit balances in the SisDOF and the physical stock found in company yards ^(362 295). Another fine was imposed when a company failed to update its recorded volume of wood in the SisDOF, not reporting the processing of sawn wood into slats or accounting for the volumes related to violin bows sold ⁽⁸³⁾.

Underreporting of virtual credits for exported bow blanks shipments was also subject to fines for false information in the SisDOF ⁽¹¹⁵⁾.

Additionally, the transportation of 1 m³ of Pernambuco in a passenger vehicle with a load capacity lower than the declared weight/volume in the DOF, along with an expiration date incompatible with the travel route, was recorded as a violation ^(290 453).

Technical professionals responsible for commercial Pernambuco plantation assessment projects, which supported state agency evaluations for felling authorizations, were fined by IBAMA for containing various false data, especially for significantly overstating the usable wood volume from planted trees ^(31 345 350 351 352 464). Owners of commercial plantations who submitted projects with false or misleading information to the state environmental agency were also fined ^(457 475), as well as the owner of an ornamental tree harvested with an inflated volume ⁽⁸⁶⁾ and the company that harvested 17-year-old trees in Fundão but mixed them with logs from native trees ⁽¹³⁸⁾.

The declaration of NCM 9209.92.00 without the 001 designation also led to fines for bow making companies in Aracruz under Article 82 when attempting to export bow shipments via VCP Airport ^(66 121 122).

A company from Rio de Janeiro was fined under the same article for lacking registration in category 20-22 for flora import/export in the CTF when attempting to export bow blanks via VCP ⁽³²²⁾.

There was also a fine for false information in the annual report of potentially polluting activities and environmental resource utilization (RAPP) submitted to the CTF ⁽²²²⁾.

Omission to the Presentation of Information

The act of failing to present information, as described in Article 81 of Decree 6.514/2008, led to fines in four cases involving bow making companies in Aracruz. Two cases were due to the failure to provide information on the conversion and allocation of Pau-Brasil wood in the SisDOF, aligning with the physical operations conducted in the company's yard ^(118 124). The other two cases resulted from the failure to submit the Annual Report of Potentially Polluting Activities and Environmental Resource Utilization (RAPP) in the CTF ^(64 140). The total fines for violations of this article amounted to R\$ 84,100.00.

Incorrect indication of forest essence to circumvent environmental inspection

There is a record in an inspection report of an attempt by offenders to deceive environmental inspection in Serra in 2003, stating that the wood inspected in a truck and in a company's yard was 'Angico' (*Piptadenia* sp.) when in fact it was *Paubrasilia echinata* ⁽²⁵⁰⁾.

The opposite situation occurred in João Neiva in 2018, when the bow maker claimed to have acquired lighting poles made of Pernambuco in Goiás ⁽³⁷⁾, when in reality the poles were not made of Pernambuco but of 'Aroeira' (*Astronium* sp.).

There is also a record of the incorrect identification of Maçaranduba (*Manilkara* sp.) bow blanks, when in fact, the analysis of the wood anatomy indicated that they were Jutaí-peba (*Dialium guianense*) bow blanks ⁽²²⁴⁾.

Obstructing Public Authorities

Three fines were issued to offenders who obstructed the work of public authorities, based on Article 77 of Decree 6.514/08.

In October 2018, a bow maker from João Neiva was fined under this article for lies and omissions detected during an inspection of his workshop. He had hidden thousands of bow blanks and dozens of Pernambuco wood logs on his family's rural property ⁽³⁴⁾.

In September 2019, a bow maker from Jacupemba was fined for similar reasons after deliberately concealing 102 Pernambuco wood logs on his rural property. Upon discovery, he fled from the inspection and never provided explanations regarding the origin of the logs ⁽³⁵⁵⁾.

In both cases, the illegally sourced material was laundered under the guise of documentation presented to environmental agencies, such as records claiming the reuse of deadwood from fences, utility poles, stakes, and roots or donations from IBAMA to an artisan association.

In October 2020, the lawyer representing the daughters of a deceased *luthier* from Recife received a citation, in the form of a warning, for obstructing IBAMA's inspection efforts, attempting to prevent the removal of illegally stored Pernambuco wood from the family's residence ⁽²⁰⁸⁾.

4. Discussion

After the publication of IBAMA Normative Instruction No. 112/06 and the need to verify the self-declared virtual credits in the SisDOF, the inspection carried out in May 2009 to verify physical storage yards at companies during Operation Violin Bows failed to consider some crucial factors: the correct botanical identification of the species present in the yards and the quality of the wood stored in the companies.

Although the team included professionals with forestry engineering training, none of them were qualified to perform anatomical wood identification. As a result, only discrepancies in the volumes of stored material were identified. Some considerations were made regarding wood quality, as stated:

"We identified that the utilization rate is strongly influenced by the machinery used for processing, the quality of the material, and the artisan's skill, with no standardization among the inspected companies. Losses inherent to the process are not only linked to the waste generated during processing. During the conversion of planks into bow blanks, part of the material may be lost due to damage caused by wood-boring insects, knots, cracks, or grain reversal (a change in wood fiber direction that compromises its strength), which can cause plank fractures, leading to total or partial material loss. In the fine finishing stage of bow stick production, fractures may also occur during the bow bending process, resulting in total product loss." ⁽²²⁴⁾

Nevertheless, even though some criteria for raw material loss throughout the production process were observed, no classification of unusable discarded materials as waste was recorded, nor were the losses documented in the system. At the time, the exchange of bow blanks between companies - introducing new material into the process - was not identified, despite being an already common practice.

Discrepancies between the declared balance in the SisDOF and the actual volume found in storage yards were not subject to administrative sanctions under Federal Decree 6.514/08. No company was fined during that inspection, despite clear signs of irregularities in the storage yards that were punishable under existing legislation. Since violin bow blanks require very small amounts of wood - on average, 0.00015 m³ - the discrepancies found between virtual balances and physical yards were deemed negligible and resolved through administrative adjustments.

The documentation of origin presented by companies and bow makers was analyzed in a purely bureaucratic manner, without deeper investigations into the truthfulness of the information provided. There was no critical evaluation of the inspection reports issued by the state agency IDAF/ES, which authorized the use of deadwood, nor of the reports

issued by IBAMA in Bahia that approved the use of stumps, roots, and deadwood from illegal deforestation.

At the time, the prevailing understanding was that utilizing these pieces served a noble purpose, given the rarity and scarcity of Pernambuco wood. It was also assumed that companies had sufficient raw material in stock - enough bow blanks to supply market demands for decades to come. Additionally, existing commercial plantation projects were expected to supply the market once the trees matured for harvesting.

However, cargo seizures of bow blanks by UT-IBAMA-Guarulhos, in shipments transiting through SERPI in São Paulo - prior to Operation Dó Ré Mi - clearly demonstrated the total lack of control over the trade of this species. For bow blanks shipments, CITES Permits were mandatory, since they are considered unfinished products. For bow shipments, which were exempt from CITES controls due to annotation #10, authorities requested proof of the material's origin. The responses from bow makers and companies varied widely: invoices for wood sold to third parties not involved in the transactions; conveniently obtained statements claiming the raw material was purchased from a certain vendor years earlier and repeatedly used donation documents from IBAMA/ES from 2005 and 2009 for an artisan association or from the Bahia judiciary for daycare centers and charity - violating national regulations that prohibit the commercialization of donated materials.

These donation documents had lifetime validity, meaning they were not registered in environmental agencies' control systems and do not reduce their volume for losses, sold bows, or unusable wood due to breakage or defects.

Only from October 2018, with inspections conducted during the 1st stage of Operation Dó Ré Mi, did authorities begin uncovering fraud and illegal activities. A significant number of hidden bow blanks (20,747 units) were found on a rural property in João Neiva (Figure 15), along with a fictitious stock of Pernambuco logs at a company in Santa Teresa (Figure 3). In the latter case, the logs were left outdoors, exposed to the climate vicissitudes. Among the 145 stored logs, only one was Pernambuco wood, while the rest were different species, clearly exposing a fraud. Previous inspections had been carried out on the same stockpile, without noticing the discrepancy. Together with the fake logs, IBAMA seized 3,928 bow blanks and 27 finished bows. All from unknown origin.

While this fictitious stockpile was recorded as genuine Pernambuco wood, the businessman sold 3,458 Pernambuco bow blanks and bows under two different company registrations (CNPJs) to companies in the U.S., Japan, France, and the U.K. - notably to a company in West Palm Beach, Florida (USA), where he held a partnership.

The company filed a lawsuit to overturn IBAMA's penalties and seizures but failed in all Brazilian judicial instances ⁽²⁶⁵⁾. After IBAMA fines and seizures, this gentleman

founded an Association of Stringed Instrument Artisans and Companies United in the Preservation of the Atlantic Forest.

Reports dating back to 2002 already indicated illegal activities in the use of deadwood. IBAMA agents in Bahia documented a method used by criminals to cover up illegal logging in the Atlantic Forest:

"We report a recurring practice on cattle farms in the Atlantic Forest region, where deforestation advances every year. Landowners, aware of the prohibition, use extreme methods of devastation by setting fire to native forest areas. They then file complaints with the police and IBAMA, blaming hunters and vandals. Over time, they plant grass in the burned area, and in subsequent years, they submit applications to IBAMA requesting the use of dead forest products from the fire. This allows them to obtain permits. As a result, year after year, native forests and valuable wood species are disappearing, further threatening the already endangered Atlantic Forest and its wildlife" ⁽³⁴⁰⁾.

Dozens of IBAMA reports from 2001 and 2002 authorized the use of deadwood in rural properties, particularly in São João do Paraíso, Mascote. These reports facilitated the export of Pernambuco wood to a U.S. company, as investigated in the CPITRAFI (2003) and the CPIBIOPI (2006). Due to time constraints, investigations were not fully pursued, and most of the individuals involved continued operating in the Pernambuco wood trade. Coincidentally, a son of the main IBAMA employee responsible for issuing these 'technical reports' is currently the lawyer for some companies fined during Operation Dó Ré Mi.

It is evident that the industry acted in a coordinated manner to deceive environmental enforcement, operating on a "hit-or-miss" basis. The *modus operandi* was repeated as long as the attempts to justify the supposed reuse of wood from fences, fence posts, logs, stumps, and roots abandoned in pastures proved successful. This scheme was replicated multiple times by different actors in various locations. In Bahia, IBAMA reports facilitated the entry of dozens of cubic meters of Pernambuco into timber companies. These companies, in turn, transferred the wood using ATPF to bow making companies in Espírito Santo.

In Espírito Santo, IDAF/ES agents issued reports approving the use of stumps, fences, and roots. In 2004 and 2006, 4 m³ of wood from a property in Aracruz was authorized for a bow making company in Jacupemba (Figure 5). In 2005, another 8.3 m³ was approved from a rural property in Aracruz (Figure 4), benefiting two local companies. This company, which in theory had received the fences, fence posts, and roots (Figure 4-D), had already been inspected several times by IDAF/ES and IBAMA, and its balance in the SisDOF had been adjusted according to the count of bow blanks in the yard. Until

then, there had never been any questions regarding the quality of the wood from those fences and roots for the production of bows for export.

When IBAMA inspected this stock in May 2020, they found out that the supposed fence had never been removed - it was still intact on the same rural property. This discovery led to the complete seizure of all bow blanks found at the company: 26,489 bow blanks and 0.19739 m³ of Pernambuco planks. The company was fined R\$ 11,920,138.83 - the highest fine imposed during Operation Dó Ré Mi up to that point ⁽¹⁵⁸⁾. Upon analyzing invoices, authorities found that 6,220 bow blanks had been sold to seven companies in Aracruz and João Neiva between 2005 and 2007 and that 1,950 bow blanks had been exported to Portugal with CITES Permits between 2017 and 2018. Thus, at least 8,170 illegally sourced bow blanks were traded under the guise of legality. The company attempted to overturn IBAMA's fines and seizures in court but failed. Two years later, during the *Ibirapitanga* Federal Police operation, another 2,307 hidden bow blanks were found in the owner's home, leading to new administrative sanctions ⁽¹⁵⁶⁾. In response to these frauds, IBAMA retroactively cancelled the five CITES Permits issued to the Portuguese company in May 2023, but the bow blanks remain in Lisbon, being resold to European bow makers by the Brazilian citizen that runs that business ⁽¹⁵⁷⁾.

Regarding the company in Jacupemba, in September 2004, IDAF authorized the reuse of 1.5 m³ of fence posts, and in March 2006, an additional 2.5 m³ from the same property located in Córrego do Francês district. All were transported with IDAF Forest Control Permits and inspection reports signed by the same official from that institute. Below is an excerpt from the inspection report:

“According to the property owner, the posts had been in a pasture area and within his coffee plantation for over 20 years, intended for use as fencing. When he realized that the posts were made of Pernambuco, he decided to donate them, so they could be processed for the purpose of manufacturing violin bows.” ⁽³⁸⁴⁾

The case file contains no measurements of the fence posts, no wood identification by any technical means, and no assessment of their suitability for bow manufacturing. These posts, which had been exposed to the weather for over 20 years and were severely deteriorated, were donated to a professional bow making company for export by a renowned bow maker from Espírito Santo. These IDAF/ES reports justified 4 m³ of Pernambuco for bow blanks production - or at least, the documents provided the necessary volumetric coverage to legitimize this amount in bow blanks. Nevertheless, during the 2nd stage of Operation Dó Ré Mi in September 2019, 102 "fresh & green" Pernambuco logs were found hidden on this businessman's rural property, drying under a tarp (Figure 17). This clearly exposed the fraudulent scheme of using false origins - such as fences, stakes, old fence posts, and weathered useless logs to launder illegally sourced wood.

The bow making company from Domingos Martins, which acquired 16.4 m³ of Pernambuco from utility poles and fence posts in Ubaitaba, submitted a request to the Forestry Directorate of IBAMA Headquarters in March 2005. The petition was rich in arguments advocating for the use of dead, degraded, and decommissioned wood from infrastructure in southern Bahia, repeating the same mantra widely used by the industry. Below is the full text of the petition's justification, with the requesting entity referred to simply as "association":

“Considering the indiscriminate deforestation of the Atlantic Forest biome;

Considering that Pernambuco is the primary wood for crafting bows for stringed musical instruments;

Considering that in 2002, the association, in partnership with international institutions, estimated the global production of 100,800 bows per year, with Brazil accounting for 10% of worldwide consumption;

Considering that in 2005, the association, in partnership with international institutions, estimated global production at 150,000 bows per year, with Brazil accounting for 8% of global consumption;

Considering that China, an industry only six years old, produced 25,000 bows in 2002 and now manufactures approximately 45,000 bows, many of which have serious defects in stores worldwide due to the use of freshly cut, green wood;

Considering that Brazil has been unable to control its borders and prevent the smuggling of Pernambuco, which is often exported under different names and sold illegally on the international market;

Considering the lack of international policies regulating the consumption of Pernambuco in the bow making industry;

Considering the significant availability of demolition materials, such as fence posts, beams, bridges, shipyards, fences, and houses—materials that are quite old and could be repurposed for crafting bows for stringed instruments;

Considering that reusing these demolition materials will significantly reduce illegal consumption and consequently curb the indiscriminate felling of Pernambuco in the Atlantic Forest biome;

Considering that using this material in the bow making industry will provide the only legalized source of raw material for manufacturing bows until commercial plantations reach harvest maturity;

Considering the national and international demand for a legal solution from the Brazilian government regarding the supply of raw material, as Pernambuco for bow making grows only from the northern state of Rio de Janeiro to the state of Rio Grande do Norte;

Considering that the establishment of such a legal raw material source will be an effective measure in regulating both domestic and international markets, thereby preventing illegal smuggling; Considering that this wood could be regulated through tracking chips supplied by the association, assisting in the control of raw material exports, finished product exports, and stock management; Considering that the reuse of this material would be authorized by this agency upon request, requiring identification of the property where the demolition material is located, access maps, material type, number of pieces, dimensions, and volume, all of which would be inspected by the agency...”⁽⁷²⁾

In August 2005, IBAMA's forestry directorate stated that the exploitation and commercial use of dead and degraded trees was not permitted under CONAMA Resolution 278/2001, but that wood from decommissioned infrastructure could be utilized.

Between October 2005 and June 2006, the businessman exported 9,855 Pernambuco bow blanks to the USA. under ATPF permits – one year before Brazil propose the species for appendix II at CoP 14, when the subject was already being discussed within Brazilian stakeholders and government entities. This person participated in meetings about the subject, representing a bow makers association, to discuss the situation of the species. There are the ones who think he might have precautionary sent almost 10.000 bow blanks abroad to escape more strict controls of a CITES species.

In October 2006, he received authorization to use 43 pieces (2.5 m³) of previously used wood from a farm in Potiraguá. After ATPF were discontinued in August 2006, the use of this material was authorized without the need for a DOF permit for transport, as per Article 9 of Normative Instruction No. 112/2006 (IBAMA, 2006). The same actor was caught in 2003 by PMA agents with hidden material on his company and in a rural property in Domingos Martins ⁽⁸¹⁾.

In Bahia, the association, led by the bow maker from Domingos Martins, financed a technical study and the gathering of raw material from different properties, supposedly to give a “noble” purpose to wood from illegal deforestation that had been abandoned in pastures and rural properties. Yet, none of the reports analyzed contained any assessment of the proper botanical identification of these grey, charred, weathered stumps, nor any evaluation of their suitability for making high-quality musical instrument bows - an industry with extremely rigorous standards for raw material selection. Twenty years after this request, inspections conducted during Operation Dó Ré Mi left no doubt: the documentation claiming the “noble reuse” of dead trees and decommissioned infrastructure was merely a cover for illegally harvested native trees in southern Bahia, as shown in Figure 17.

The same bow maker who signed the above petition with so many considerations was caught twice at Guarulhos Airport in 2021 and 2022 without legal documentation for the commercial transport of finished bows and bow blanks in his luggage (Figure 22A, C, D, and F).

Another significant case stands out for having introduced a large number of Pernambuco bow blanks into the international market without any proof of legal origin. In October 2012, a *luthier* from Recife submitted a request to IBAMA to export 26,000 bow blanks to Japan, without providing any documentation proving the origin of the raw material. Due to this lack of documentation, the CITES management authority refused to recognize the material as pre-Convention. This same *luthier* had previously attempted to "legalize" 3 m³ of Pernambuco in 1999 but was denied authorization due to a lack of proof of legal origin.

In a romanticized legal petition, the *luthier* argued for the approval of his export request, stating that:

I - That the petitioner, currently 84 years old, has been practicing the craft of an artisan since the age of 15, for nearly 70 years.

II - That between the years 1952 and 1987, over more than three decades, he acquired Pernambuco logs through purchase, which were found among truckloads of various other wood species destined for bakery ovens, paper manufacturing companies, and other industries that operated on firewood.

III - That at that time, the trade of wood from various species occurred without any prohibition from public authorities, likely because most industrial machinery relied on firewood for fuel. As evidence of this, one could observe the long lines of trucks loaded with wood, parked and waiting to unload at factories and industries of all kinds. By picking through these truckloads of mixed wood, the petitioner managed to collect 4 cubic meters of Pernambuco over the aforementioned period.

IV - Given this widely permitted trade in wood of all species, many landowners across Brazil, from north to south, deforested forested areas, including portions of the Atlantic Forest, for commercial purposes. This is a fact! This scenario of deforestation only began to change with the modernization of Brazil's industrial and manufacturing sector in the 1980s, when machinery transitioned to electric power, as well as with the promulgation of the 1988 Constitution, which brought significant advancements in the protection of flora and fauna.

V - It is important to clarify that the wood acquired by the petitioner did not come from any area where logging was prohibited. Additionally, every time he salvaged Pernambuco logs from those

truckloads—logs that would have inevitably turned to smoke in bakery ovens—he acted in complete good faith. In fact, from 1988 (the year the Federal Constitution was enacted) to the present day, he has never acquired another Pernambuco log.

VI - Furthermore, it is imperative to clarify the purpose of acquiring these logs so that the petitioner's intent with their subsequent sale can be properly understood. The petitioner, an artisan specializing in the art of lutherie (a professional who builds, restores, and tunes musical instruments) and archetierie (a professional who crafts bows for stringed instruments), has been deeply knowledgeable about the beauty and quality of the species popularly known as Pernambuco since his youth, particularly for making bows for stringed instruments. Pernambuco bows are internationally recognized for their superior beauty and quality, which is why the petitioner allocated almost all of the Pernambuco wood he acquired (4 cubic meters) for the production of bow kits (semi-finished bows).

VII - Based on the above, it is clear that the petitioner's intent, over the 35 (thirty-five) years in which he acquired the wood as described, was to breathe new life into those pieces of wood that, though named after Brazil, would have been reduced to mere smoke in the ovens of bakeries and factories in the state of Pernambuco. In this noble endeavor to transform, he wasted not a single piece of wood, producing 26,000 kits (small sticks) for making bows for stringed instruments, while the remaining wood was used for teaching his students at the Luthier and Archetier Training School of ... - a renowned social inclusion program through music in the city of Recife, PE.

VIII - That at this stage in life, at 84 years old and suffering from serious health problems, he wishes to sell the fruits of his craft to a Japanese buyer who will undoubtedly spread throughout the Oriental world what has been painstakingly created by a humble Northeastern artisan. This would give his work a fate far different from what will happen upon his passing- everything will once again turn to smoke. The good judgment of this agency's members must not allow this to happen!!' (279)

No investigation was conducted into the material's true origin, and it was highly unlikely that the wood had been scavenged from bakery furnaces. The analysis conducted by Operation Dó Ré Mi was chirurgic:

"The production of a bow stick is not an act of maximum wood utilization without waste, as implied in the petition. On the contrary, it is an extremely rigorous selection process that requires the highest

quality wood, eliminating significant amounts of raw material due to physical imperfections, knots, cracks, inappropriate density, misalignment of wood rays, grain incompatibility for bow curvature, and other factors. Producing an export-grade bow stick necessarily involves discarding a large quantity of unsuitable wood. The petition naively portrays Pernambuco bow blanks as artisanal pieces made from random scraps of wood that would otherwise be burned. Equally misleading is the claim that the Oriental market would recognize the hard work of a humble craftsman. In reality, the intended exports consisted of raw sticks with no artisanal input beyond simple circular saw cutting. These were not finished bows but raw materials likely to be processed and resold to skilled professionals in Europe." ⁽²⁷⁹⁾

After the luthier's death, an additional 31 m³ of Pernambuco was found at his family residence - likely more, since some of his stock had been lost in a fire a few years before. This illegal storage led to fines against the *luthier's* family ⁽²⁷⁶⁾. Clearly, the *luthier* had misled Brazilian environmental authorities and the judiciary, allowing 26,000 bow blanks of undocumented origin to enter the Asian market.

As tree-cutting permits for plantation-grown Pernambuco began to be issued, the same deceptive tactics were used to mislead public officials. The number of permit requests increased as initial operations succeeded in obtaining environmental approvals.

The first known case of a fraudulent permit request for a planted Pernambuco tree with commercial purposes was in 2012, filed by a citizen in Guaraná, Aracruz, to cut down an ornamental tree supposedly obstructing wall construction (Figure 7 A). The application claimed that 2 m³ of firewood would be produced from the tree cutting.

However, IBAMA's report concluded that the tree was unsuitable for bow making due to its low diameter, poor trunk form, and lack of silvicultural management - confirming the fraudulent nature of the request. From the IBAMA report ⁽⁴⁵⁶⁾, we have a summary:

"There was no presentation of a technical project signed by a qualified professional for the authorization of the cutting. There was no measurement of the tree; there was no consideration of the intended use for the tree in question. There was no assessment of diameter, height, wood quality, nothing. The year of planting was not provided, nor was the age of the tree estimated. It was not planted for commercial purposes. The only two photos of the tree in the process give us a clear idea of what it is: a solitary tree, with a small diameter (thin), low trunk, branched at less than 2.5m, grown in an open area. Therefore, it is not necessary to see the wood to conclude that the heartwood was immature, that it certainly has a large knot due to the branching at a

low height, and that the grain will be irregular due to this knot. This material would not be suitable for the violin bow industry, due to the misalignment of the fibers, the knots, the lack of silvicultural treatments, the low density due to the incipient cernification process, low speed of sound impulse transmission, among other fundamental requirements for producing bows with the quality required for the export market.”

The authorization process at IDAF/ES, without any technical analysis, approved the cutting by granting authorization for the use of 2 m³ of firewood, originating from the commercial trunk logs, limbwood and branches. In 2015, a request was made to insert virtual credits into SisDOF, and the reference contact phone number in case of approval was a bow maker from Aracruz, for whom there was a "Commercial Operation Declaration" in which the tree owner "donated" the wood material. An inspection was carried out on the cut wooden material (3 logs) stored in a shed (**Figure 7 B**), and a verification report was issued to authorize the use of the wood, without any measurement or assessment of the wood quality for its intended purpose.

In October 2017, a new forest exploitation authorization was granted by IDAF, allowing the use of 2 m³ of firewood, and the following month, a third forest exploitation authorization was issued, this time for 2 m³ of 'logs'. Once the virtual credits were included into SisDOF, the logs were donated to this bow maker in Guaraná. The method was adjusted: instead of firewood, logs were used, allowing for the transformation into bow blanks within the SisDOF. This change was necessary because, under IN No. 21/2014 (IBAMA, 2014), the item "firewood" could not be converted into bow blanks. Hence, the reason for changing the item from firewood to logs. The CRV of logs to bow blanks is 45%, according to the same regulation.

A few days later, two DOFs were issued to the bow maker from Aracruz, with 1 m³ of logs each. The 2 m³ of logs would yield a volume of 0.9 m³ of sawn wood - bow blanks - in SisDOF. In this operation, considering the average volume of a violin bow stick at 0.00015 m³, the bow maker received virtual credits to cover 6,000 bow blanks.

From the investigation process that visited the owner of the first planted tree, whose cutting was authorized by IDAF/ES, we extract the following excerpt from the report (names intentionally omitted):

"At the time of the inspection, Mr. ... confessed to the three IBAMA environmental analysts present that the felled tree had a volume much lower than the 2 m³ recorded in the system, that the bow maker was actually interested in the virtual credit generated by the tree's cutting, and that all negotiations were conducted by his son, who lives in the house where the felled tree was located. He merely signed several documents on different occasions, which he found strange,

but given his son's assurances that nothing would go wrong, he ended up signing everything that was requested of him." ⁽⁸⁶⁾

Other cases of tree-cutting authorization followed to benefit a company in Aracruz: 9 trees were cut in September 2018, yielding 3.52 m³ for a company in Guaraná; 93 trees were cut in January 2019, yielding 14 m³; and 18 trees were cut in August 2019, which were supposed to yield 9 m³ for a company in Jacupemba—but only 7 trees (2 m³) were actually cut. Finally, another tree-cutting authorization was granted in the district of Pedra Azul, in Domingos Martins, generating 1.1 m³ in logs, benefiting a company from Santa Tereza. The same company is pressuring for the approval of another request for the cutting of planted trees, awaiting IDAF's decision to authorize the cutting of three more planted Pernambuco trees in Ibirapu ⁽²⁰⁷⁾

Regarding the requests to cut 111 planted Pernambuco trees (17 years old) along a fence on rural property in the Piranema Settlement, Fundão, the state agency authorized the cutting and transport of 16 m³ of logs ⁽⁸⁸⁾. During the 2nd stage of Operation Dó Ré Mi, the IBAMA inspection team, in September 2019, examined both the stumps of the felled trees and the remaining trees in Fundão, as well as the stock of wood stored at the company. The Fundão stumps showed that the tree cores were immature, lacking the reddish heartwood characteristic of the species (Figure 9 B and C). The remaining trees exhibited typical characteristics of open-field plantations without silvicultural care: short, twisted commercial trunks with irregular grain, making them unsuitable for bow manufacturing (Figure 9A).

At the company's yard, a large portion of the material supposedly originating from the authorized plantation cut had already been processed into planks, which were stacked in the yard, while another portion remained in log form (Figure 9 D and E). Eight months had passed between the initial cutting authorization and the processing of the logs into planks, which is not standard practice in the bow making sector, as it requires a minimum drying period of several years in log form before being cut - to prevent cracks, splits, and fissures in the wood that would render it unsuitable for bow making. Furthermore, in the stacks of unprocessed logs, the inspection team observed logs with reddish cores and little sapwood, mixed with pale yellowish logs with abundant sapwood (Figure 9 E). The inspection team found sufficiently strong evidence to conclude that this was a case of fraud and seized all the material claimed to have originated from the Fundão plantation, fining the company ⁽¹³⁸⁾

The acquisition of the plantation trees was intended to obtain virtual credits in the SisDOF to cover wood of illegal origin. With the 16 m³ of logs obtained, the company could cover 48,000 bow blanks. In this case, IBAMA's inspection team also fined the environmental engineer responsible for drafting the project, which was deemed partially false, misleading, and omissive ⁽³⁵²⁾. Samples of the wood were collected for stable isotope analysis by the Federal Police forensic team, which may confirm that the material stored at the company did not originate from the property in Fundão.

Other two requests submitted to IDAF/ES in July 2019 were awaiting approval for the cutting of planted trees to be transferred to the same company involved in the previously mentioned fraud. In one case, in Jacupemba, 0.9 m³ of Pernambuco logs would be obtained from a planted tree (Figure 10 A) with a trunk height of 1.5 meters ⁽¹⁵⁵⁾. In another case, in the Guaraná district, two 22-year-old trees were to be cut: one Pernambuco tree (Figure 10 B), yielding 0.358 m³ of usable logs, and one Trumpet tree (*Handroanthus chrysotrichus*), yielding 0.326 m³ of logs ⁽¹⁵¹⁾. The company would have credits to cover 3,774 bow blanks. In both cases, the IBAMA inspection team fined the technical professional responsible for drafting the projects, which were deemed partially false, misleading, and omissive ^(350 351). So far, IDAF/ES has not authorized the cutting of these trees.

Regarding the authorization for the cutting of 9 trees in September 2018 on a rural property in Aracruz, the following analysis was extracted from the environmental inspection report concerning the opinion issued by the state agency that authorized the cutting - names intentionally omitted:

"There is not a single measurement in the report; not a single line is written about verifying the planting age; there is no mention of process No...., which supposedly recorded Mr. ...'s 'reforestation projects'; this report contains no measurements whatsoever (diameter or perimeter of the trunk at breast height - DBH or PBH - or even an inference about the tree's height); there is not even a suggestion regarding the intended use of the mentioned material; there is no mention of the term 'violin bow'; no discussion about the quality of the wood, growth, branches, low trunk, crookedness, subspecies or planted variety, heartwood maturation, or wood quality. Nothing.

In the photo, all the trees are standing; none have fallen. There are no exposed roots from fallen trees (in the case of an alleged windstorm); no fallen branches are visible. Nothing. Nothing. Nothing.

The technical opinion that recommended the authorization for cutting the nine trees said nothing relevant to the intended use of this Pernambuco - an endangered species listed in Appendix II of CITES. These factors did not move the authors of the opinion to conduct a thorough technical analysis." ⁽¹¹⁹⁾

According to the owner, the harvest was supposedly due to strong winds, which had allegedly knocked down some trees. However, in the inspection photos that approved the cutting, all the trees were still standing. The authorized volume for the cutting and utilization of the 9 trees was 3.52 m³. During the 2nd stage of Operation Dó Ré Mi, the

inspection team visited the company in September 2019 and found no evidence of separation of the wood from the plantations, neither in log nor plank form. The wood had already been processed into bow blanks and mixed with the other bow blanks in the company's yard. That picket the agent's curiosity: 20 years of planting, and the bow maker never separated his products to assess their quality?

Later, in 2020, after a full analysis of the two CNPJs related to the business group, IBAMA's team visited the rural property where the trees had been harvested. The stumps had been deliberately removed, grubbed and burned. According to the owner, this was because they were interfering with a neighboring papaya plantation. The report stated that the removal of stumps and roots from the planted trees constituted destruction of evidence, a strong indication that this same company was engaging in wood laundering.

The 3.52 m³ of logs received from the planted trees generated 1.584 m³ of virtual credits in the company's SisDOF account, which could cover approximately 10,560 bow blanks. The images obtained by IBAMA team from IDAF inspections taken in January 2019 of the cut logs is an evidence that the company was laundering logs, by mixing logs from plantations (Figure 10 F) with logs from mature trees (Figure 10 G), illegally obtained.

In addition to issuing fines for irregularities at the company's yard, IBAMA fined the landowner, who was also the wife of the bow maker and a manager at her husband bow making companies ⁽⁴⁵⁷⁾, as well as the environmental technician responsible for submitting a partially false and misleading study as part of the authorization process at the state agency ⁽³⁴⁵⁾. The plantation area was embargoed until a complete and in-depth technical study could be provided by a qualified professional, addressing the silvicultural activities of Pernambuco on the property. This study needed to clearly indicate the number and ages of the planted trees, their morphotypes, dendrometric data demonstrating the evolution of the planted forest, along with individual tree markings, DBH (diameter at breast height), tree height, and commercial trunk height, among other factors. The study also had to propose best silvicultural management practices to ensure the production of high-quality wood for future use in bow making for musical instruments.

In February 2020, the authorized cutting of a 30-year-old planted Pernambuco tree in Pedra Azul district was initially expected to yield 0.4 m³ of wood. A few weeks later, a new technical project was submitted, and a new inspection report was issued for the same tree. Without any technical explanation or justification, the volume of the same tree suddenly increased to 1.1 m³. The same happened with a Brazilian rosewood (*Dalbergia nigra*) tree on the same property, supposedly of the same age, whose volume also doubled from 1.1 m³ to 2.56 m³. This tree in particular had a trunk growing at a 45-degree angle.

All the wood obtained from this authorization was transferred to a bow making company in Santa Teresa - the same company previously caught with fake Pernambuco

logs during the 1st Operation Dó Ré Mi (Figure 3). IBAMA classified the tree acquisition as fraudulent, used for wood laundering, fined the recipient company, seized the wood material ^(347 262), and fined the technician responsible for the project due to false, misleading, and omissive information in the technical report submitted to the state for the cutting of the planted trees ⁽³¹⁾. The owner of these trees is the father of an employee from IBAMA/ES.

Regarding the April 2021 request submitted to the state agency for the cutting of three planted Pernambuco trees on a rural property in Ibiracu - which did not specify the trees' ages or the requested volume ⁽²⁰⁷⁾- the technicians responsible for the project's analysis expressed uncertainty about authorizing the request due to IBAMA's requirements and the previous actions that resulted in fines for companies and technicians involved in earlier approvals. The same contracted technician who signed this request had already been fined for a similar case in Domingos Martins, and the intended recipient of the wood was again the bow making company in Santa Teresa. There was no information available on whether this request had been approved, despite the company's lawyer having already contacted IDAF/ES to inquire about the delay in approval.

The authorized cases of planted tree cutting consistently show inflated wood volume estimates for weak, twisted trees with short commercial trunks, including all sorts of limbwood - all in pursuit of virtual credits to cover a greater number of bow blanks. Regardless of how much usable wood each log from a plantation could produce, the key for the fraudsters is that each cubic meter of logs uploaded in the system could cover for approximately 3,000 bow blanks.

From an analysis of IDAF's inspection reports, it is evident that no evaluations were made regarding silvicultural practices, the accuracy of the declared planting age, the height of the commercial trunk, the grain quality of the authorized wood, the maturity of the heartwood, or its suitability for high-quality bow production for export. Additionally, there were no assessments of the authorized volumes, nor any questioning of the inclusion of limbwood and firewood in the authorized volumes, despite the explicit fact that these logs were acquired by bow making companies, where branches do not yield high-quality bows. There was also no concern for the minimum drying period of logs.

All Pernambuco tree-cutting authorizations granted by the state agency show clear indications of having been carried out solely to generate virtual credits in the SisDOF, ultimately covering up illegally harvested wood obtained by extractors operating in southern Bahia.

A report recently discussed at the 78th meeting of the Permanent Committee (CITES Secretariat, 2025) indicates that there are several Pernambuco plantations in the country, many of them encouraged by IPCI, Executive Commission of the Cocoa Farming Plan (CEPLAC), Capixaba Institute for Research, Technical Assistance, and Rural Extension (INCAPER), among other institutions. Some of these plantations are registered

with state agencies. However, none are registered at National System for Controlling the Origin of Forest Products (SINAFLOR). Among the challenges for regulated trade, the report notes that greater integration between state agencies and IBAMA would facilitate the regularization of these plantations, along with technical support for rural producers to complete the registration process at the federal level.

Espey (2025), on an account of his experience with the Pernambuco planting projects, defended the bow makers from ES, stating that the existing plantations are sufficient to sustainably supply the entire global demand for bows. Without knowing the full extent of the illicit activities and frauds under investigation in the administrative proceedings ongoing at IBAMA and the Federal Police, he claims that the federal agency needs precise information about the plantations, as some of its sources may have misled them or were simply misinformed. Apparently, the bow makers involved in the crimes and administrative infractions revealed in this thesis, who guided the expeditions of the renowned bow maker in Brazil, did not confess their crimes involving wood laundering to the very person who helps finance their activities.

Regarding the possibility of using plantation-grown wood for high-quality bow production, three studies have evaluated plantation-sourced wood. Franco & Yojo (2008) analyzed wood from 25-year-old planted trees in Moji-Guaçu (SP), comparing it to wood from native Pernambuco trees, two species of Trumpet tree (*Handroanthus ochraceus* and *Handroanthus impetiginosus*), and two species of Maçaranduba (*Manilkara longifolia* and *Manilkara elata*). They found that plantation-grown wood, when compared to native wood, exhibited lower density at 15% moisture content, higher radial and tangential shrinkage values, a higher volumetric shrinkage coefficient, lower bending strength in the green state, higher shear rupture stress, similar Janka hardness values, and a low sound radiation damping coefficient. They concluded that native Pernambuco and Trumpet tree have similar values for many of the studied physical, mechanical, and acoustic properties, making them desirable for bow production. However, the values presented by planted Pernambuco were not suitable for making musical instrument bows.

Marques et al. (2012) evaluated only the apparent specific gravity and shrinkage of wood from Pernambuco trees aged 10, 15, 20, 25, and 30 years from plantations in the Santa Rosa district, Aracruz. They concluded that 30-year-old wood is as dimensionally stable as wood from native forests. Schimleck et al. (2013), analyzing the same woods harvested in Aracruz in 2008 from the Horst John company plantation, found that the extractive content in the plantation-grown wood was low - 5.7% for 25-year-old trees and 12.7% for 30-year-old trees. According to the authors, this was expected, as few samples contained heartwood. However, some samples from 25 and 30-year-old planted trees exhibited very low logarithmic decay² ($\tan \delta$), comparable to values observed for native wood, despite having a low extractive content. They considered the results from plantation samples promising in terms of quality and noted that an important issue for the

² Logarithmic decay ($\tan \delta$) is related to the internal friction coefficient, which is responsible for the viscoelastic dissipation of energy within the material in the form of heat (Franco & Yojo, 2008).

future will be an adequate rotation scheme in plantations, long enough for trees to accumulate extractive levels close to 20-22%.

The lingering question is: if plantation-grown wood possesses the same exceptional qualities as native Pernambuco, as the industry tries to make the journalistic and musical communities believe - although this is not confirmed by academic research - why aren't companies using plantation-sourced wood to manufacture bows? Why are they covering up illegally acquired native logs under the guise of virtual credits obtained from planted trees?

The pattern of donation documents is remarkably similar. Donated material is accompanied by documents with no expiration date, is not recorded in raw material control systems, and is not accounted for as it is used. Even if the environmental agency requests information about how the donated material was used, control is weak. Under the guise of donation documents, there exists a real opportunity for wood laundering.

Brazilian regulations prohibit the commercialization of donated wood, and this prohibition is explicitly stated in the donation terms. It was found that bows were being exported under the guise of donated raw materials, as seen in the cases listed in Table 10.

In 2004, a donation from a ASV of 18 m³ of Pernambuco were transferred to a bow maker from Coruripe, without ATPF, under the pretence that the material would be used for a nonprofit social project run by a charitable association of artisans. However, the bow maker later managed to register 12 m³ in the DOF system in 2012 through the Alagoas state environmental agency (IMA/AL).

In 2016, despite IBAMA refusing to recognize the material as pre-convention under CITES, the bow maker obtained a court ruling allowing him to export 20,000 bow blanks to Italy, forcing IBAMA to issue CITES Permits ⁽³⁶⁵⁾. Between 2017 and 2020, 10 CITES permits were issued to this actor from Coruripe (Table 9), which exported 1,274 Pernambuco bow blanks to Italy for four different recipients. The last of these permits was canceled three months after its issuance, so it is unclear whether the transaction involving 150 sticks actually took place ⁽²⁹⁵⁾.

After Operation Dó Ré Mi's 2019 inspection, which found that the bow maker's stockpile was almost entirely wood waste, IBAMA documented sales of bow blanks without DOF, sales with incorrect NCM declarations, and exports to China, Hong Kong, and Argentina with false material descriptions - listing the wood as "*mixed wood*," "*maçaranduba*," or even "*bacchette in legno per finiture interne di imbarcazioni*." Obviously, Pernambuco bow blanks, sold with nicknames.

It was also found that domestic sales of bow blanks were used to transfer virtual credits to companies and bow makers in João Neiva, Aracruz, and Santa Teresa, as the remaining stock held by the bow maker was in extremely poor condition ⁽²⁹⁵⁾. Between 2013 and 2020, approximately 32,070 sticks were sold on the domestic market – or at

least their credits, as believed by IBAMA's enforcement authorities. Some of these transactions are recorded only in issued invoices, without the corresponding DOFs having been issued ⁽²⁹⁵⁾.

In December 2005, 6 m³ of seized Pernambuco was allocated to an association of artisans in Espírito Santo and equally divided among six *archetiers* from Aracruz. In 2013, another 6 m³ was donated to the same association, which this time distributed it between two *archetiers* from Aracruz. Given the findings of bow sales made from this material during packages inspections by UT-IBAMA-Guarulhos in 2017/2018, the administrative authority decided to revoke the donation agreements in May 2020, considering the explicit prohibition on the commercialization of donated wood material. During Operation Dó Ré Mi, the remaining material held by five of these artisans was seized.

Among the beneficiaries of these agreements was an *archetier* from Jacupemba, in whose possession 102 newly cut Pernambuco logs were found hidden on a rural property (Figure 17). This same individual had also received devitalized wood from pastures and wood from structures (fences, stakes, and posts) on two separate occasions, based on reports issued by IDAF/ES (Figure 4 and Figure 5).

Another donation case stands out, as it involved decayed raw material, unusable for bow making. The donation was originally made to a church in Vila Velha, which exchanged it for granite with a businessman from the bow-making valley. This individual, who intended to formalize the donation through a non-profit organization created for the rehabilitation of drug users, repeatedly contacted IBAMA/ES to expedite the issuance of an official donation document for the material he had received under custodial care ⁽³³¹⁾. Even though the material was entirely decrepit, useless for bow making (Figure 24 A and B), the donation document held value due to its potential to indefinitely legitimize wood of other origins.

There is no doubt that donation-based documentation served merely to create an appearance of legality for any and all wood present in the yards of bow making companies and *archetiers* in the region.

Regarding the stockpiles of unusable material in the yards of large companies, it became evident that these were indeed unusable materials, as indicated by the characteristics of the bow blanks: many had knots, misaligned heads, fractures, fissures, cracks, and numerous pieces had already been turned, showing visibly irregular grain. The following explanation was extracted from an inspection report:

"The companies in Aracruz maintain a stockpile of Pernambuco that has already been evaluated and reviewed by specialist bow makers in terms of stick quality. These bow blanks, due to minor defects—such as misaligned fibers, fissures, fractures, cracks, knots, irregular grain, incompatible density, or sound propagation velocity

below the values required by the demanding international market - are set aside, accumulating in large quantities at the company's premises to justify their virtual balances in the SisDOF.

This material, which has no commercial value and has already been discarded in the production line, is not removed from the SisDOF system. It only serves to allow inspectors to continue recording volumes of useless material, while business owners and bow makers voraciously exploit every illegally harvested log from natural environments and seek sources of virtual credits in the SisDOF - either through transactions that exclusively involve virtual credits or by obtaining new credits through fraudulent studies and reports that authorize the use of wood from planted origins, which is unsuitable for high-quality bow production." ⁽¹¹⁹⁾

During the 4th phase of Operation Dó Ré Mi, two bow making companies in Aracruz, both belonging to the same family group, were notified and given a six-month deadline to present:

"A technical study, conducted by a properly qualified professional, that carries out a thorough assessment of the entire stockpile of Pernambuco wood present in these companies' yards, separating the unusable wood for bow making from that which is still suitable for this purpose. The evaluation must be based on clear and reproducible technical criteria for assessing the wood material for its intended use, and these criteria must be submitted for prior review by IBAMA's technical team." ⁽¹⁸¹⁾

The response from the technician hired by the company did not present technical criteria for classifying the bow blanks or selecting those suitable for bow production. Instead, it clearly demonstrated the company's intent to retain the unusable material in its yard, as inferred from the technical report. Based on a sample study of 250 bow blanks randomly selected from 23 stacks, the report stated:

"The quantity of wood with some imperfection was recorded to more accurately determine the percentage of sticks/bow blanks that may not be suitable for making standard-size violin or double bass bows. However, according to the company and professional bow makers, these bow blanks can still be used for making smaller bows for students or even for crafts. The 3.51% of pieces with some imperfection do not need to be removed from the physical and virtual stock, as these pieces may have alternative uses (such as crafts and smaller bows) and will be gradually removed from both physical and virtual inventories as they are utilized.

There is no IBAMA regulation that mandates the removal of non-perfect wood from physical and virtual inventories. Wood with cracks, micro-cracks, knots, or holes is allowed to remain in stock.

The evaluations of the bow blanks for the inventory assessment regarding which percentage of pieces are suitable or not for producing standard bows were conducted by professional bow makers working for the company, as they have the greatest expertise in determining bow blanks quality for standard bow production. According to the company, pieces with small holes are not intended for professional musicians, but can be used by amateurs and students, with a lower price than a professional bow. If a stick has a crack in the body, and it is at the end, it can still be used to make smaller bows. However, if the damage is at the head of the stick, it may not be possible to use the piece for musical bow production, limiting it only to crafts."

The response failed to define technical criteria for classifying bow blanks, listing only superficial reasons for deeming pieces unusable: cracks, small holes, knots, and short length. However, these are not the only criteria that determine whether a bow blank is suitable for bow production.

Maintaining stockpiles of unusable bow blanks is a key component of the wood laundering scheme used by bow making companies. Reducing the inventory of residual wood (unusable for bow production) would mean a reduction in the virtual credits associated with it.

There is no specific regulation for the bow making sector outlining strict selection criteria for wood used in bow manufacturing, nor any guidelines on what to do with unusable wood.

Normative Instructions No. 112/2006 (IBAMA, 2006) and No. 21/2014 (IBAMA, 2014) were omissive regarding the disposal of industrial waste from bow production. While they define *Wood Industry Waste for Industrial Use* and *Wood Industry Waste for Energy Use*, these definitions apply to sawmills and charcoal-producing industries, but do not clearly cover residual materials discarded in the bow making production line for export.

In October 2018, IBAMA's environmental inspection documented a case that became emblematic for the continuation of Operation Dó Ré Mi. 20,747 Pernambuco bow blanks were found hidden on two rural properties in Demétrio Ribeiro, district of João Neiva (Figure 15 C and D). The bow maker in question kept only a few dozen bow blanks in his backyard workshop in the city (Figure 15A) and concealed a small-scale bow trade, issuing only occasional invoices.

The day after the inspection of his workshop, he was caught loading Pernambuco logs into his car (Figure 15 B) on his father's property. To the state environmental agency, he had claimed that his raw materials came from used Pernambuco utility poles acquired in Goiás - for which he already possessed a technical verification report from IDAF, issued in October 2013, stating that the poles could be used to manufacture violin bows. But later on that same day the poles were found intact on his father's property, and wood anatomy analysis revealed that they were actually *Astronium* sp. (Figure 15 E).

Through illicit means, he actively transported wood from southern Bahia and was maneuvering to obtain yard approval in SisDOF, using fake invoices from the utility poles as the supposed source. He was fined R\$ 9,319,200.00, the second highest fine issued in six years of Operation Dó Ré Mi.

Large bow manufacturers and independent bow makers alike know they operate illegally. They acquire Pernambuco "off the books" from intermediaries who purchase it in Bahia and deliver it directly to them.

Recently, a journalist published a WhatsApp conversation from a group chat between bow makers, where a Curitiba-based bow maker said, somehow, the truth:

"We, artisans, need to stick together. Those of us in bow making know there are two businesses: one is selling bows, and the other is selling wood. Let's be honest - it's about selling raw Pernambuco, selling bow blanks. So, to IBAMA, we're all traffickers, part of a criminal gang, whether actively or by complicity. One way or another, we all buy illegal wood. If we want to survive, we need to work with IBAMA to eliminate the wood traffickers, because they are ruining our business, whether it's big industry or small producers like us. To IBAMA, we're all criminals. And to be honest, they're right. We're a divided group, and if we stay that way, we'll all go down." (Toledo, 2022)

In 2019, IBAMA identified several intermediaries of Pernambuco - individuals responsible for purchasing the wood at its source, transporting it to the "bow valley," and selling the bow blanks to companies and bow makers in the region.

One of these intermediaries confessed that he and his sons would drive to southern Bahia, to the district of Coréia in Potiraguá (BA), to collect the wood. He confirmed that he sawed the planks into bow blanks and sold them to bow making companies in Aracruz.

At the rural property of another intermediary, located in the district of Desengano in Linhares, IBAMA's inspection team found 27 planks and 165 bow blanks discarded in a coffee plantation. It appeared that the violator disposed of the material after receiving a phone call from IBAMA inspectors the previous day. His phone number had been provided by a bow maker, who had identified him as a stick seller ⁽⁴¹⁾

Illegal trade of Pernambuco bow blanks, which are classified as sawn wood under IN 21/2014 (IBAMA, 2014), led to the seizure of shipments at GRU, VCP and GIG airports - all of which were destined for European countries. None of the shipments had a CITES permit. To evade customs inspections, the exporters did not declare the correct NCM 92009200 with designation 001, which would have classified the material as a CITES-listed species. Instead, they falsely declared the goods under various product descriptions, such as '*Clothes hangers*', '*Percussion musical instruments*', '*Played with a bow*', '*Original artistic statue productions*', '*Gifts*', '*Woods, including blocks and moldings*', '*Unprotected wooden rods for crafts*' and '*Others*'. Given the general difficulty customs agents face in identifying wood species, and the lack of X-ray equipment at border inspection units, this intentional misclassification strategy is often successful.

Another common smuggling method involved passengers stuffing their luggage with Pernambuco bow blanks, without any commercial documentation or mandatory CITES Permits. In September 2021, a passenger was caught at an X-ray checkpoint transporting 37 Pernambuco bow blanks. The month before, she had informed IBAMA that she had produced 350 Pernambuco bow blanks from reclaimed fences on her family's rural property in São José da Vitória (BA) and had applied for a permit to transport them to Colombia. Her request was denied ⁽⁴⁰⁴⁾ but this did not stop her from attempting to smuggle part of the material in her luggage. Later, IBAMA inspectors visited her family home and seized an additional 271 bow blanks and remnants of sawn wood ⁽³⁸⁵⁾.

The following week, at the same airport, another passenger was caught at the X-ray checkpoint with 208 Pernambuco finished bows while boarding a flight to Switzerland ⁽⁷¹⁾. The bows were supposedly accompanied by an "A.T.A. Carnet" issued by the Federation of Industries of ES (Figure 19 B). The cargo was considered to have no legal origin, even though the passenger was a businessman in the bow making industry and the owner of a bow production company in Domingos Martins. At that time, there were no virtual Pernambuco credits available in the SisDOF, and his company had been under embargo since September 2019.

Seven months later, in April 2022, the same individual was caught again at Guarulhos Airport attempting to fly to England, this time with 114 bows and 120 bow blanks (Figure 19 C-F). The items were hidden in suitcases checked under the names of 'mules' - his company employees - and had no documentation, invoices, or CITES Permits ⁽³²⁷⁾. The bow maker was also found with five sales receipts for bows and a price list for different bow models, with prices listed in British pounds (Figure 19 G). He was arrested by the Federal Police in *flagrante delicto* for smuggling.

At Galeão Airport (RJ), in June 2022, an Italian citizen was caught attempting to board a flight to Milan, Italy, with 70 bow blanks in his checked luggage (Globo, 2002). Among them were 34 Pernambuco bow blanks and 36 Jutaí-peba (*Dialium guianense*) bow blanks. A forensic analysis by the Federal Police confirmed the species, and the individual was also arrested in *flagrante delicto* for smuggling, under Article 334-A §3

of Decree-Law 2.848/1940. These are the only prisons related do *Paubrasilia echinata* illegal activities in the last 25 years for the crime of smuggling, as defined in Article 334-A of the Penal Code

In March 2022, the same individual's company in Rio de Janeiro had attempted to export 442 bow blanks - 285 of Jutáí-peba and 157 of Pernambuco - as a shipment from Viracopos Airport. The shipment was falsely declared as "*unprotected wooden rods for crafts*" and labelled as the species 'Angico' - *Piptadenia suaveolens* ⁽³²¹⁾

Following the publication of Normative Instruction No. 08/2022 (IBAMA, 2022), which took effect on June 1, 2022, LPCO analysis became a requirement for the export of finished bows. Four companies from Espírito Santo had their shipments detained, at Viracopos and Guarulhos airports. These shipments declared the NCM 92009200 code but omitted designation 001, which would have included CITES-listed species – such designation would obligate the shipment to be cheked and analised by IBAMA trough PAU-Brasil platform.

As a result, the shipments bypassed IBAMA's LPCO review process, which determines whether the export request should be approved. 445 finished bows were seized. Some companies appealed to the Federal Court against the fines and seizures, arguing that their shipments had been dispatched before the regulation took effect. In three cases, the court ruled in favor of the companies, and IBAMA was ordered to return the seized bows ^(231 232 233)

The historical record of Pernambuco cases indicates that the rampant illegal exploitation of native trees in southern Bahia for musical bow production has been ongoing for decades. In October 2000, authorities intercepted an illegal shipment of 57 Pernambuco logs on BR 367 in Porto Seguro, close to the so expected and recently created Pau Brasil National Park (Figure 13A-D). In a 2002 enforcement report, 39 m³ of Pernambuco and Brazilian rosewood were seized in São João do Paraíso, Mascote ⁽³³⁹⁾. This wood had no documentation proving legal origin, and it was clear that the destination of these 1-meter-long logs was the bow making industry. These logs would later be "laundered" using any available official documents, including wood utilization reports from fences and deadwood, donation and auction documents or planted tree authorizations.

Even specially protected areas under conservation units were not spared. IBAMA and ICMBio fines and inspection reports document tree theft from Pau Brasil National Park in Porto Seguro ⁽¹⁰⁷⁾. In the Discovery and Monte Pascoal National Parks, there are no longer any recorded natural populations of *Paubrasilia echinata*, despite being historically natural distribution area.

Meanwhile, the illegal extraction, transportation, storage, and processing of logs continue across Ilhéus, Eunápolis, Teixeira de Freitas, Potiraguá, Camacan, Mascote, and Itamaraju - with 1-meter-long logs consistently seized, clearly intended for the bow making industry.

The fines imposed on actors involved in the Pernambuco wood supply chain - totaling R\$ 103,341,705.38 (Table 1) - are, in most cases, not paid. Many are still awaiting a first-instance ruling by administrative authorities. However, in general, these authorities have upheld the enforcement efforts, confirming the citations applied, including their assessed values, as well as the seizure records.

During Operation Dó Ré Mi, field agents applied fine calculations based on the number of units of bow blanks/bows found in irregular situations, as permitted under Article 47 of Decree 6.514/2008. This approach was taken because the volume of individual sticks is around 0.00015 m³, meaning that using cubic meters to determine fines would result in negligible amounts, failing to fulfill the punitive and educational role that such sanctions should have. Given that the trade of bows and bow blanks is based on unit sales, fines related to the offenses described in Article 47 of Decree 6.514/2008 were set at R\$ 300 per bow/bow blank involved in the violation. Additionally, when the affected species was considered endangered - such as *Paubrasilia echinata*, under Article 60, Section II of the same decree - an extra 50% was added to the fine, bringing the total to R\$ 450 per infringing bow or bow blank. This explains why the fines imposed during Operation Dó Ré Mi were significantly higher than those from previous enforcement actions. Even so, these fines remain well below the market prices of bows and sticks.

According to Fomin et al. (2018), a Pernambuco bow blank costs between \$60 and \$300 in the USA and between €30 and €290 in Europe - equivalent to approximately R\$ 340 to R\$ 1,710 in the USA. and R\$ 185 to R\$ 1,785 in Europe at current exchange rates.

Recently, Decree 12.189/2024 repealed Section II of Article 60 of Decree 6.514/2008, eliminating the provision that allowed for increased fines when environmental infractions involved endangered species - a significant setback for environmental enforcement.

During this same period, companies declared a total of R\$ 86,765,311.33 in bow and bow blanks sales on their invoices (Table 8). Nevertheless, these figures do not reflect the actual volume of bow sales, as IBAMA did not have access to all invoices issued by these companies - an estimated of only 50% to 60% were reviewed. Furthermore, companies reported product values on invoices that were five to ten times lower than actual market prices. Consequently, the estimated revenue from these sales ranges between R\$ 433,976,556.65 and R\$ 867,953,113.30 - significantly surpassing the total fines imposed by environmental enforcement agencies in the same period.

The inclusion of the species in CITES as of September 13, 2007, following its approval at CoP 14 in The Hague, Netherlands, does not appear to have provided the necessary protection against the impacts of international trade on natural populations. In the original proposal submitted by Brazil (CITES, 2007a), the inclusion of all parts and derivatives was proposed, without exceptions. Nonetheless, the Secretariat's preliminary assessment of the proposal already recommended that the species should include an annotation exempting finished bows and general finished products (CITES, 2007b).

Annotation #10, which was approved at CoP 14 - covering only logs, sawn wood, veneer sheets, including unfinished wood articles used for the fabrication of bows for stringed musical instruments - exempted finished bows, allowing bow trade to continue at a rapid pace. Between 2007 and 2022, records indicate the export of 106,711 bows without the knowledge of Brazilian administrative authorities, as bows, in addition to being exempt from a CITES Permits, are also exempt from the as finished products.

On the other hand, bow blanks - considered sawn wood - were exported during the same period to five countries, totaling 42,942 units, with CITES Permits. However, no Non-Detriment Findings (NDF) or Legal Acquisition Findings (LAF) were issued, even for the type 'export', instead of pre-convention permit. There are also no records indicating that these exports were questioned by the CITES administrative authorities of the five importing countries.

Since the species was included in CITES, Brazilian authorities believed that the stocks present in the 13 bow-making companies in Espírito Santo were pre-Convention and legally acquired, especially after the report issued during "Operation Violin Bows," which justified the issuance of permits. In cases where the administrative authority was not convinced of the legal acquisition of pre-Convention materials - specifically involving actors from Coruripe and Recife - Federal Justice ordered that pre-Convention certificates be issued.

Only after the first field reports from "Operação Dó Ré Mi" were forwarded to the CITES Management Authority in Brasília did the denial of pre-Convention CITES Permit requests begin, as suspicions arose regarding existing stocks and the legality of the volumes recorded in SisDOF. The only certainty since then is that bow making companies documents are pre-Convention; the same cannot be said for the stored wood.

Following the publication of Normative Instruction No. 08/2022 (IBAMA, 2022), which took effect on June 1, 2022, no LPCOs applications for the export of *Paubrasilia echinata* bows have been approved, since the exporting companies have not been able to prove the legal acquisition of pre-Convention raw material.

The presentation of the Brazilian proposal for the inclusion of the species in Appendix I (CITES, 2022) caused great turmoil in the classical music world - especially in Europe and the USA. Many voices opposed the restrictions that such an amendment to the appendices would bring, raising concerns about border crossings for orchestras and musicians, the need to prove the legal acquisition of string instrument bows, and the difficulty of determining whether bows carried by musicians are pre-Convention or not (Simões, 2022).

Even though the species is threatened with extinction - having been listed since 1992 in the Official List of Threatened Brazilian Flora (IBAMA, 1992) and classified as "Endangered" in the International Union for Conservation of Nature (IUCN) Red List in 1998, a status typically qualifying for Appendix I in accordance with Article 2 of the Convention - the proposed text contained a formal error that hindered the approval of the

proposal. The original submission included an annotation for the species, whereas Appendix I does not allow annotations for flora species.

During the conference, it was decided to discuss the matter in a small working group, which evaluated the possibility of amending Annotation #10, a modification that was later approved in the plenary session.

With the amendment of Annotation #10 at CoP 19, which came into effect on February 23, 2023, no CITES Permits have been issued for the export of *Paubrasilia echinata* bows or bow blanks.

Today, the export of *Paubrasilia echinata* bows and bow blanks is halted in the country, at least through legal channels.

Currently, a bill (PL) proposed by a congressman from Espírito Santo - PL No. 3284/2024 - is under consideration in the House of Representatives. The bill aims to establish a national policy for the conservation of Pernambuco, seeking to map, monitor, and conserve native populations, develop *in situ* and *ex situ* conservation strategies for all known lineages, promote research on the species' genetics, ecology, and sustainable management, foster environmental education, encourage sustainable management and responsible economic exploitation, combat illegal exploitation, trafficking, and irregular trade, support and promote conservation and sustainable use programs, and develop genetic certification systems to ensure the authenticity of the wood used (Melo, 2024).

The bill stipulates the exclusive use of trees cultivated in agroforestry systems or sourced from registered and licensed commercial plantations, which would, to some extent, curb the exploitation of ornamental trees for commercial purposes, as pointed out in this thesis. It also stipulates a prohibition on the extraction or use of wood from trees under 30 years old - which appears to be a response to the felling of young trees aged 17 to 20 years that has occurred thus far (Table 4) and has been definitively linked to schemes for laundering and legitimizing illegally sourced wood.

However, the referenced bill does not provide a technical justification for selecting a minimum tree harvesting age of 30 years. It is essential to establish an objective and scientifically grounded criterion to ensure that planted trees are suitable for use in the bow-making industry.

Franco and Yojo (2008) reported that reforested Pernambuco trees exhibited small diameters and natural defects, such as non-linearity and the presence of knots. They also noted that the age of the Pernambuco stand in Mogi-Guaçu (SP), where the material was collected - approximately 25 years - was considered too low for timber extraction. They argue that a distinctly differentiated heartwood, characterized by its reddish coloration, was not observed. Additionally, they found that linear shrinkage (the reduction in dimensions due to moisture loss) was high, especially in planted wood, indicating that Pernambuco wood requires special care in the drying and stabilization process.

The bill also establishes as criteria for the exploitation of planted forests or the trade of any artifacts made from the species the requirement to ensure the traceability of the wood from extraction to the final product. However, it does not specify how this should be implemented.

It is observed that the Brazilian bow making industry has migrated to work with Ipê - Trumpet tree (*Handroanthus* spp.) bows ^(59 102 117 129 267) which has characteristics similar to Pernambuco (Longhi, 2005; Longhi, 2009; Fomin, 2017).

Species of this genus were included in Appendix II of CITES as of November 25, 2024, but are not subject to the same restrictions applied to Pernambuco, given the possibility of acquiring legal wood originating from Sustainable Forest Management Plans in the Amazon Rainforest.

This substitution will lead to new challenges for environmental inspection, given the need for training of environmental and customs agents for the separation of these species in company yards, in pieces of sawn wood from boards and bow blanks, and also in finished bows in shipments sent abroad, in non-destructive inspections.

Conclusions

1. Despite all the protection provided by Brazilian legislation to the species *Paubrasilia echinata*, which is endemic to the Atlantic Forest, the extraction of native Pernambuco trees in southern Bahia has remained highly active over the past 25 years, primarily supplying the bow-making industry.

2. The lack of control by environmental agencies over finished products, such as musical instrument bows, is likely one of the reasons why Brazil has flooded the international market with thousands of illegally sourced products disguised as legal, without truly knowing how many bows were being produced by the bow-making industry.

3. The exception granted in Annotation #10 when the species was included in CITES Appendix II in 2007 - exempting finished products from the Convention's controls - also led to a complete lack of regulation over the trade of finished bows in export and re-export transactions.

4. Bow making companies accumulate thousands of bow blanks that are useless for bow production and are reluctant to present criteria for defining which woods are suitable for making bows. Given the specificity of this issue, it is quite plausible that a dedicated regulation for the sector should be pursued. It is necessary and urgent for environmental agencies to assess this matter and establish rules and procedures for the disposal of unusable materials from the bow making industry.

5. The actions of Operation Dó Ré Mi clearly demonstrated that donations of Pernambuco wood, whether in the administrative or judicial sphere, were ultimately

transferred to the bow making industry. The donation agreements do not expire and do not account for losses or usage deductions. These documents have been used as mean to launder wood indefinitely.

6. Except for a couple of authorizations for tree harvesting for scientific research purposes, all other authorizations for the cutting of planted trees – from commercial plantations or ornamental trees - were improperly used to acquire virtual credits in the SisDOF, facilitating the laundering of illegally obtained logs, planks and bow blanks.

7. The legislation governing the authorization process for cutting planted trees does not include an evaluation of the intended use of the harvested wood. There is a pressing need to regulate the harvesting of planted trees by establishing strict technical criteria for issuing cutting authorizations, considering not only the age of the plantation and volumetric measurement of usable wood (trunks and limbwood) but also the wood's potential for musical instrument bow production. The quality of the wood must be a mandatory factor to be assessed before a harvesting authorization is granted.

8. All the administrative violations and frauds detailed in this study provide clear evidence that the entire supply chain of musical instrument bows made from *Paubrasilia echinata* in Brazil is thoroughly tainted by fraud and irregularities.

9. Every company and bow maker inspected over the last 25 years have been fined at least once by IBAMA. The sanctions imposed on companies in Aracruz, João Neiva and Domingos Martins in the early 2000s, where hidden logs were discovered without legal documentation, triggered a desperate search for official documents of any kind - ATPFs, judicial or administrative donations, auctions, or authorizations for the use of devitalized wood - to create a façade of legality for the illegally sourced material that continued to enter the sector over the following two decades.

10. Illegal wood was disguised as legal, and exports continued uninterrupted, expanding rapidly until 2021, when the results of Operation Dó Ré Mi began to be systematically forwarded to IBAMA Headquarters in Brasília.

11. The data analyzed in this time frame represent only a small fraction of what occurred - only the portion that was discovered, identified, and warranted enforcement action by environmental agents, meeting the legal requirements for determining authorship and material evidence. How many more trees were extracted, cut into logs, split into bow blanks, stored, transported, and clandestinely delivered to the bow making industry - ultimately crafted into bows and sold in European, North American, and Asian markets - we will never truly know.

12. For more than two decades, thousands of violin, viola, cello, and double bass bows of uncertain legality entered the market, exploiting the weaknesses in control

systems and the inability of state agents to oversee all areas, correctly identify species, act in a coordinated manner, and piece together the puzzle.

13. Working behind the scenes in collusion, Brazilian bow making companies and bow makers manipulated the systems and institutions, sought out the necessary documents to give a semblance of legality to their illegal transactions, and reaped enormous profits at the expense of this species, which holds immense cultural and environmental significance for the country.

14. It is impossible to fully dismiss the possibility that state agents and foreign actors were complicit - either through action or omission - in the illegal activities described in this thesis. This level of detail was not explored in the present analysis but should undoubtedly be the focus of future research, particularly as investigations of Operation Ibirapitanga advance within the Federal Police and as international consumers of Pernambuco bows begin to take an interest in the true origins of these products.

15. There is an urgent need for the international community to take a stance and implement greater protection for *Paubrasilia echinata*, given the impact that international trade continues to have on the natural populations of this species.

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Annex 1 – List of identified cases involving actors linked to the custody chain of the species *Paubrasilia echinata*

No. of reference for the cases	Institution	Cases
1	IBAMA	02009.000160/2022-18
2	IBAMA	02009.002011/2021-11
3	IDAF/ES	0990/2018-DOF
4	Justiça Estadual/PE	0002246-71.2011.8.17.1250
5	Justiça Estadual/ES	0002280-92.2021.8.08.0006
6	Justiça Federal/SP	0002843-59.2018.403.6119
7	Justiça Federal/PE	0003060-76.2019.403.6181
8	Justiça Estadual/ES	0003285-86.2020.8.08.0006
9	Justiça Estadual/ES	0003404-62.2020.8.08.0006
10	Justiça Estadual/ES	0003643-51.2020.8.08.0006
11	IDAF/ES	3166/2018 SIMLAM
12	IDAF/ES	87601869 SEP
13	Justiça Estadual/PE	0053834-22.2016.8.17.2001
14	Justiça Estadual/BA	00661-1997-492-05-00-0RT
15	IBAMA	00807.009566/2022-35
16	IBAMA	02001.014637/2022-12
17	IBAMA	02001.019022/2022-82
18	IBAMA	02009.000039/2019-91
19	IBAMA	02009.000040/2019-15
20	IBAMA	02009.002028/2005-40
21	IBAMA	02026.006120/2018-95
22	IBAMA	02027.004091/2022-01
23	IDAF/ES	25425340
24	IBAMA	02009.000367/2021-10
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