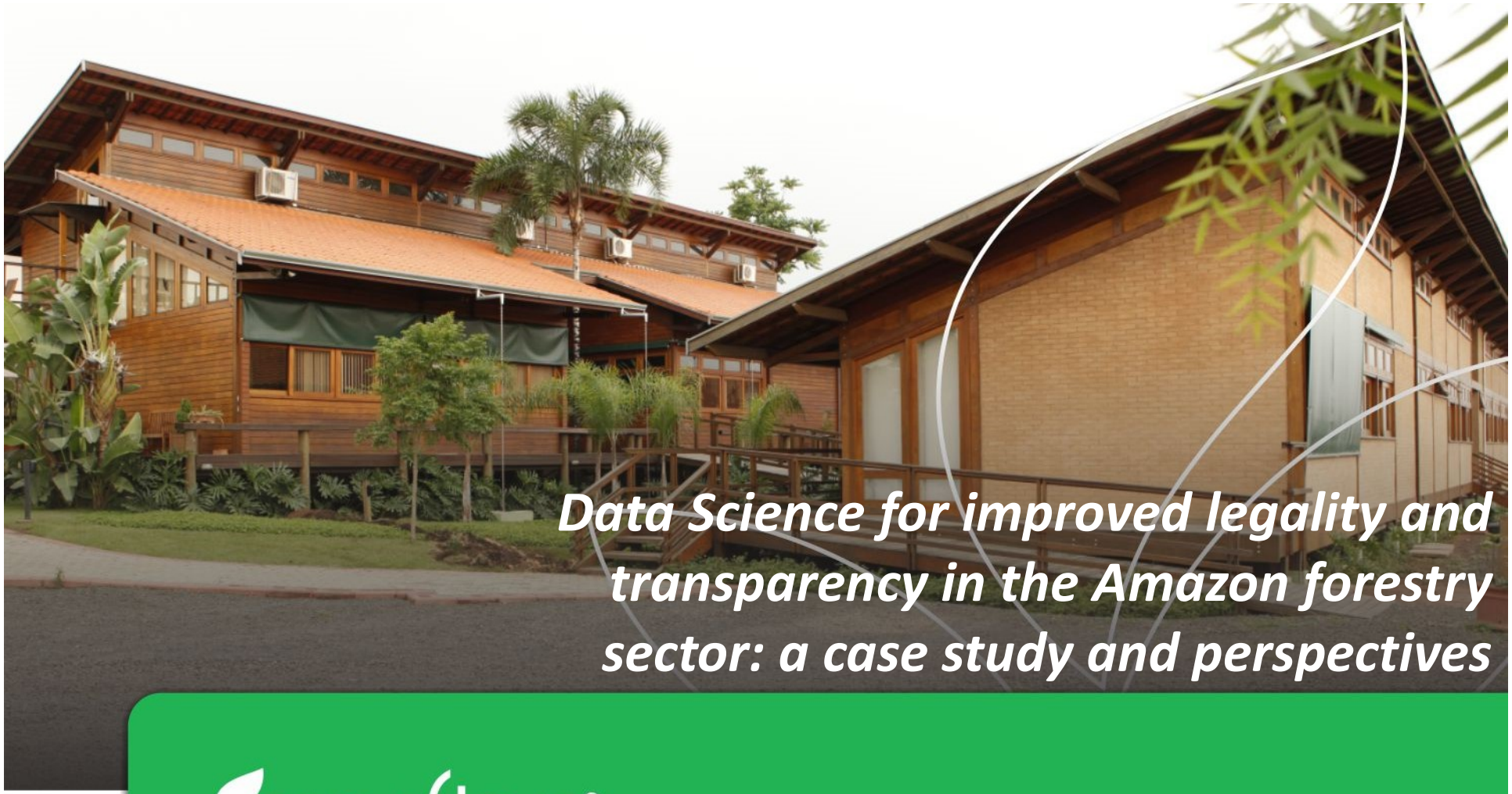


Data Science for improved legality and transparency in the Amazon forestry sector: a case study and perspectives

imaflora®

INSTITUTO DE MANEJO E CERTIFICAÇÃO FLORESTAL E AGRÍCOLA

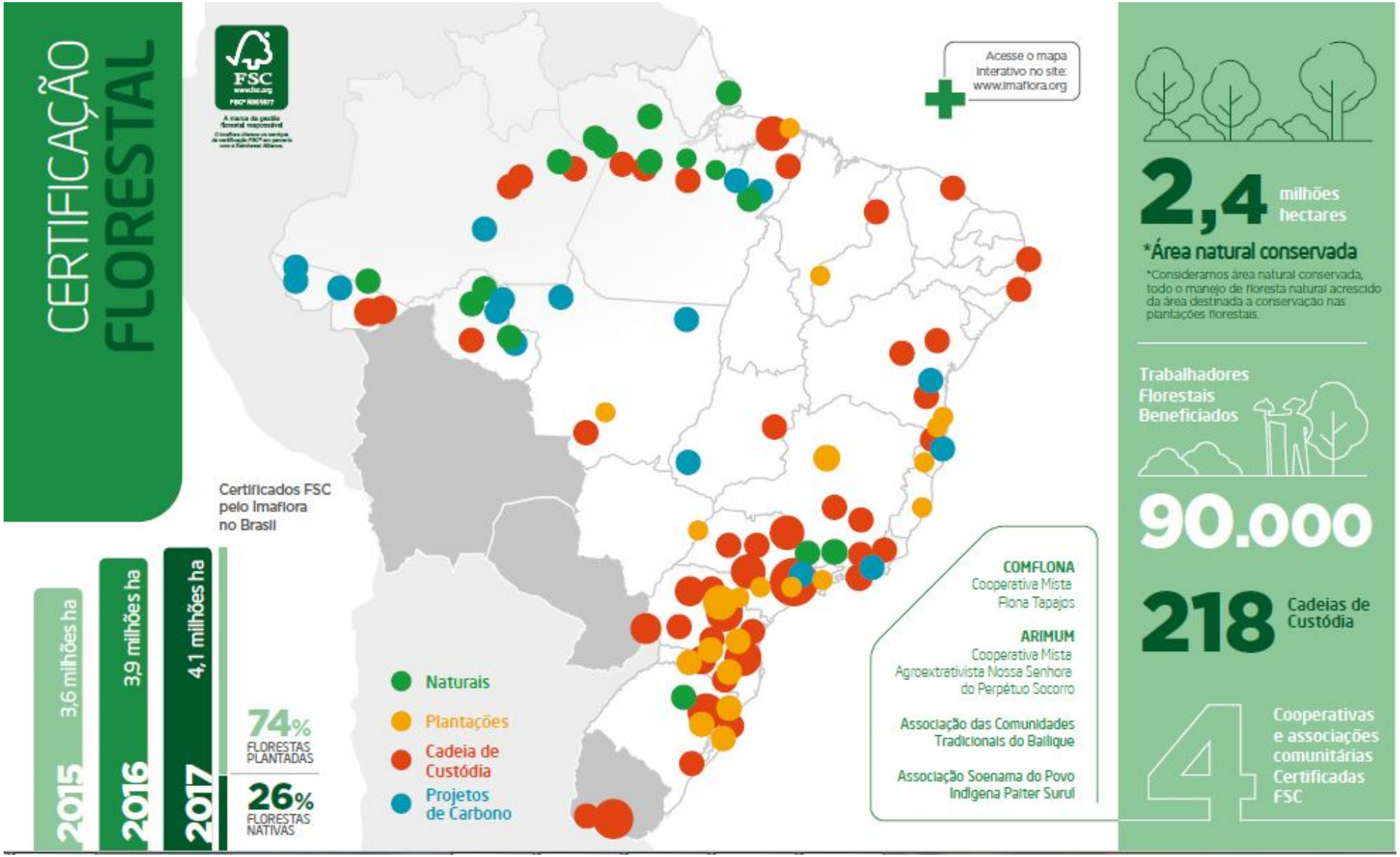
Marco W. Lentini e **Robson Feichas Vieira**

Rio de Janeiro, Summer School on Data Science, Feb 2nd, 2020

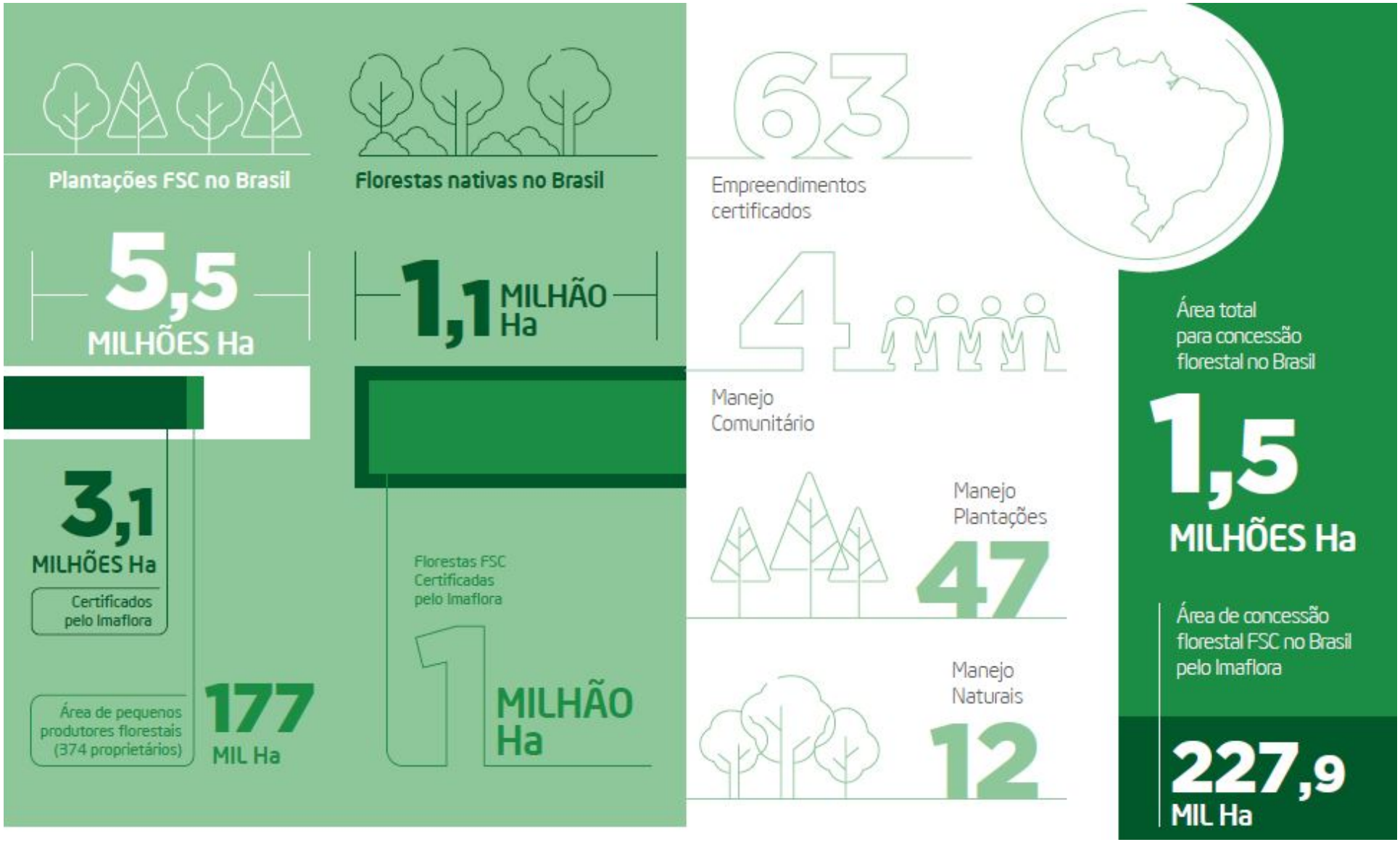
Outline

- *Presenting IMAFLORA*
- *Context of deforestation, forest degradation and illegal logging in the Brazilian Amazon*
- *Wood transactions official control datasets*
- *The 'timberflow' initiative: the Amazon wood reference platform*
- *Where to go now: perspectives and opportunities in terms of intelligence and data science*

IMAFLORA®, the Agricultural and Forestry Management and Certification Institute, is a Brazilian civil society organization, founded in 1995.



Balanço de 2017



Balanço de 2017

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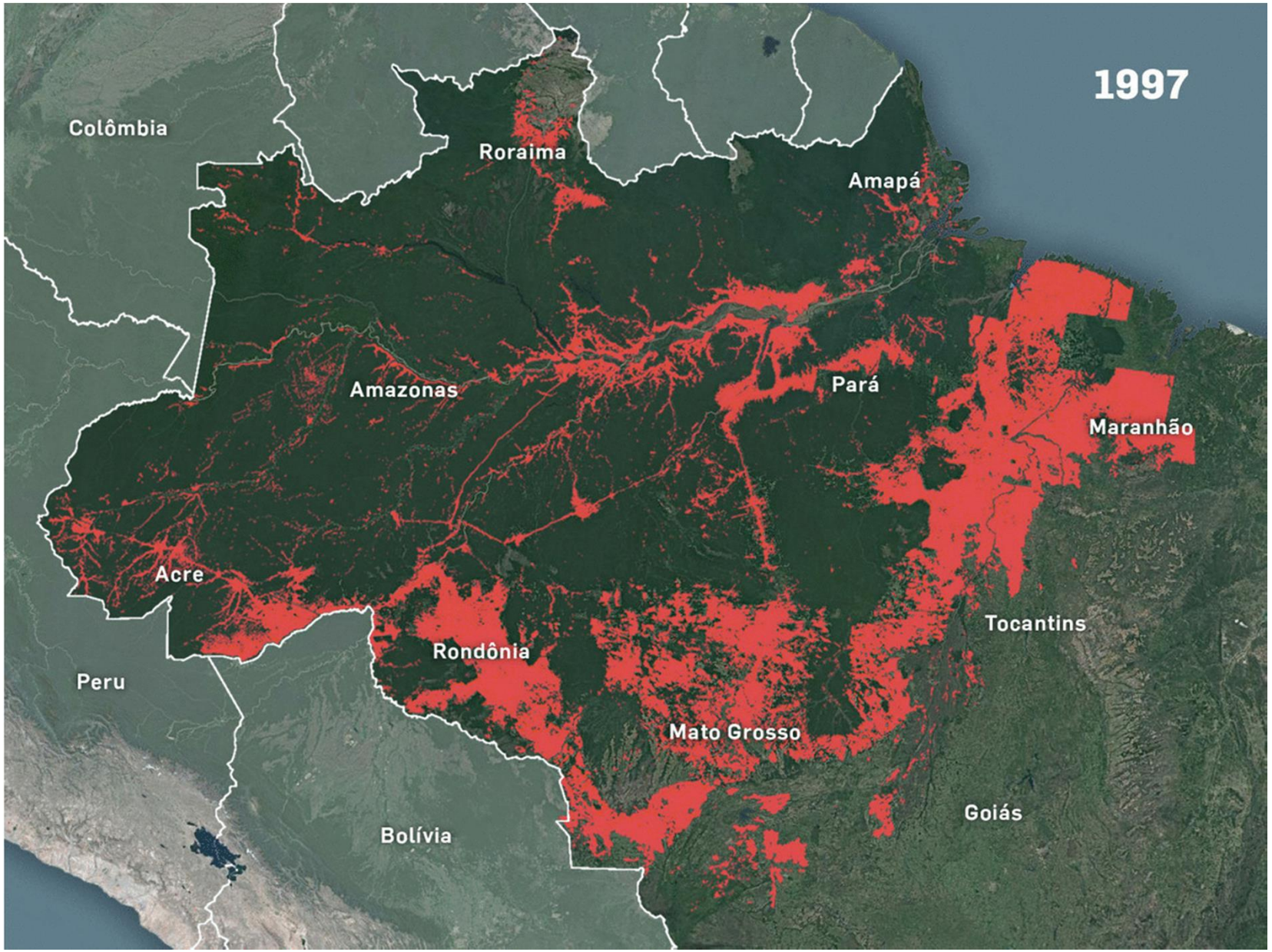
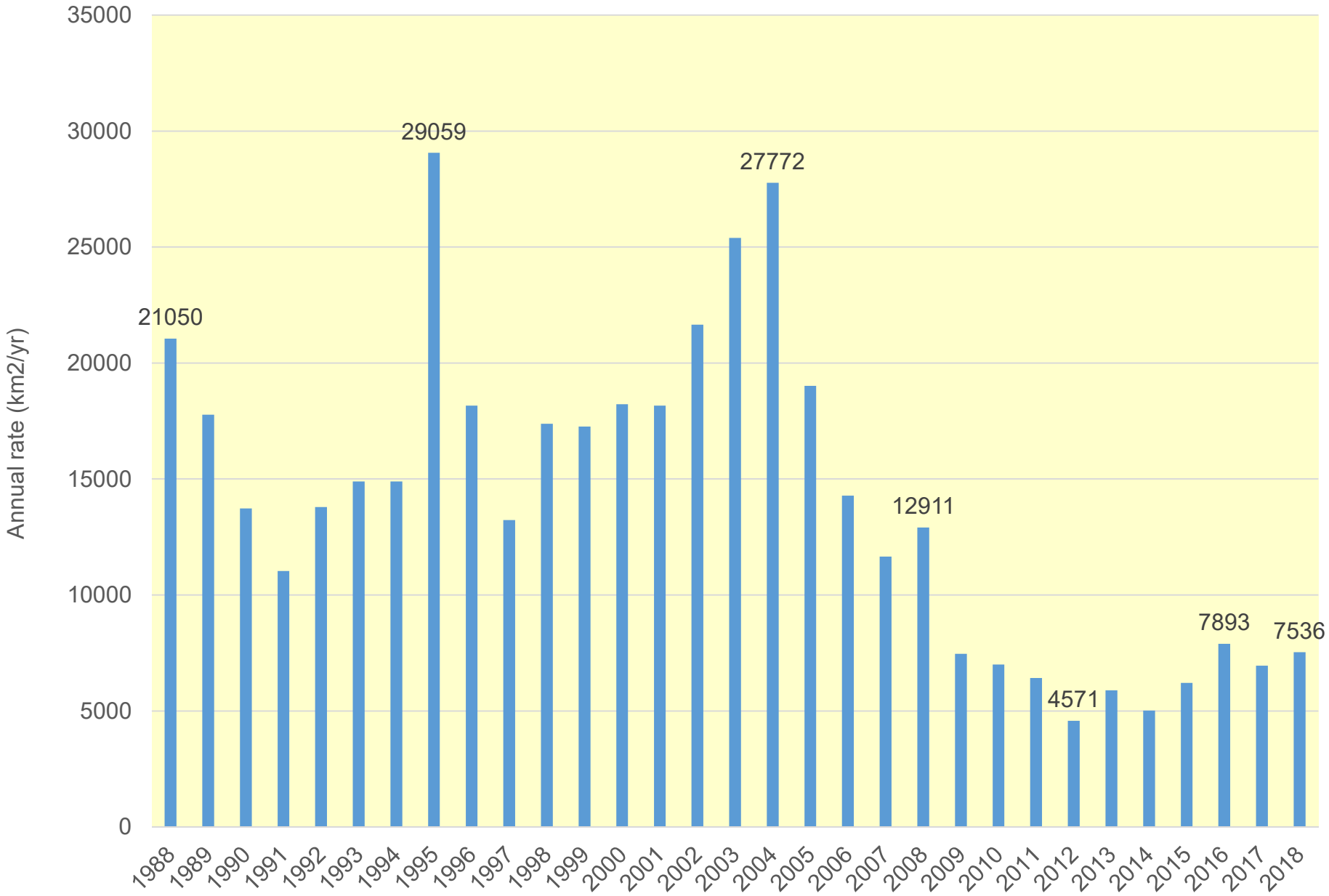
Context of deforestation, forest degradation and illegal logging in the Brazilian Amazon



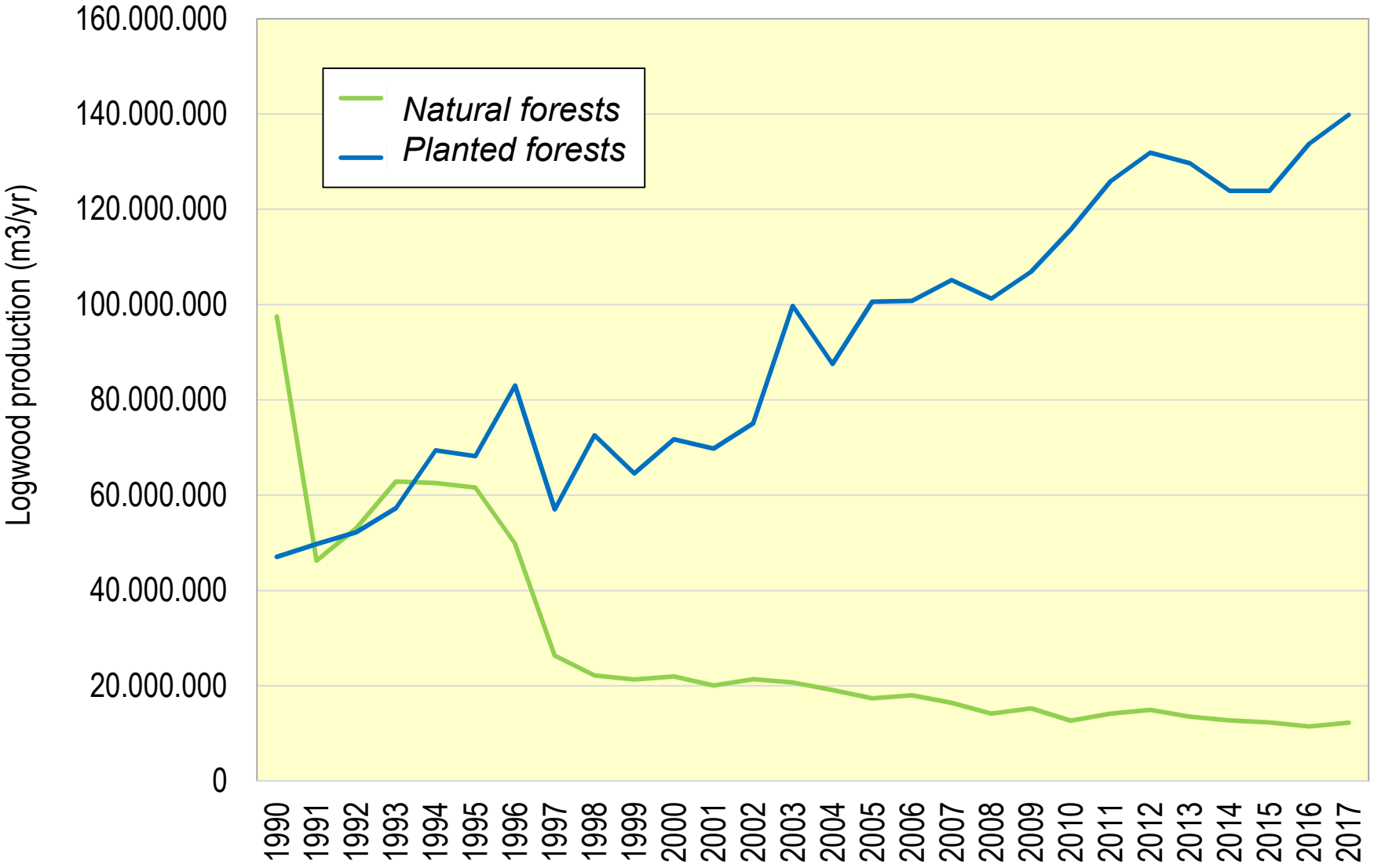
Source: Estadão



Source: Prodes

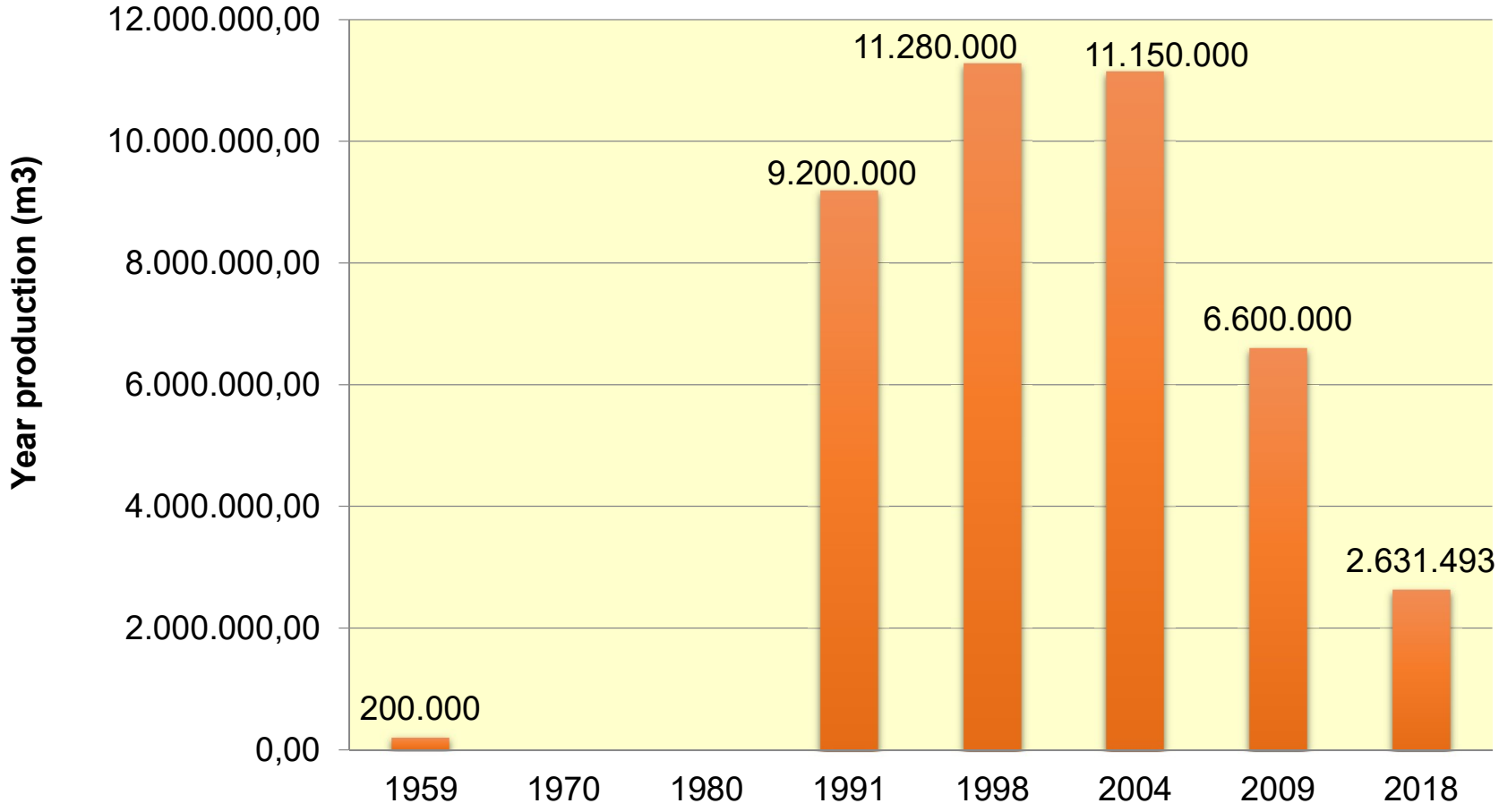
Source: GreenPeace

Evolution of roundwood production in Brazil



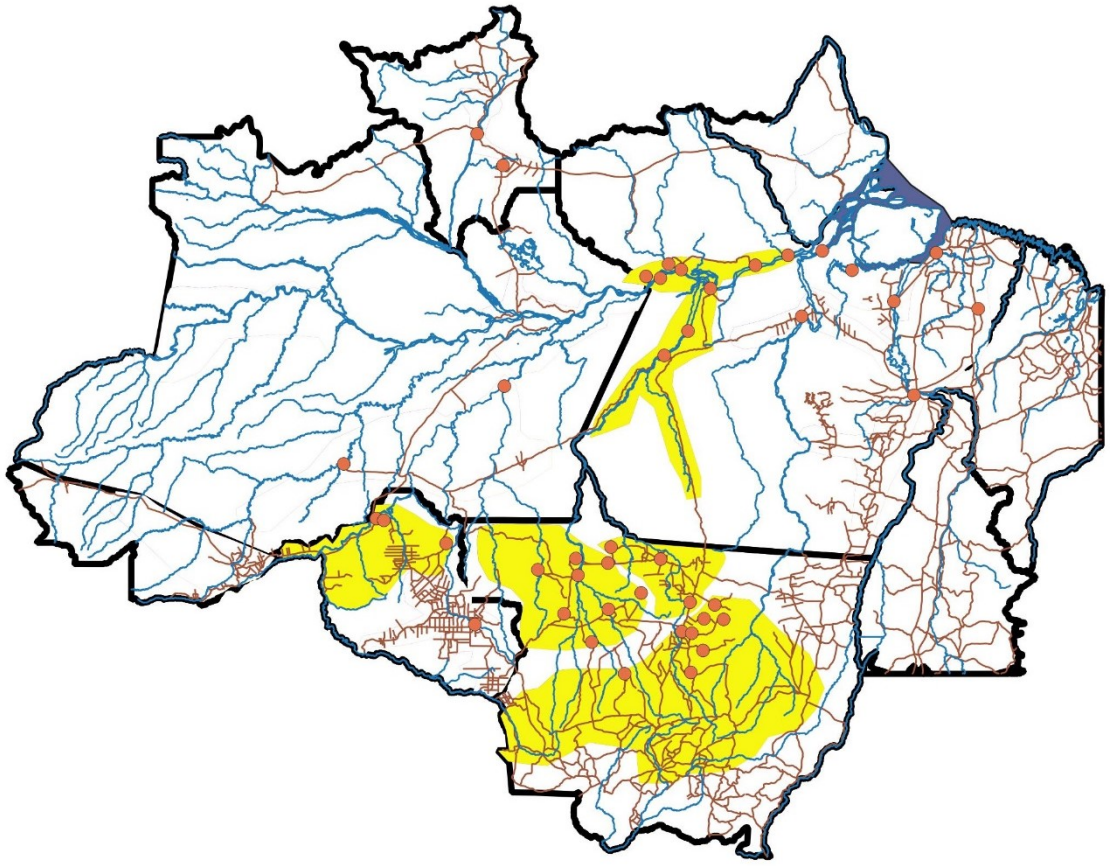
Source: SIDRA/IBGE (2018)

Evolution of logwood production from native forests in Pará state



Source of data: Knowles (1966), Uhl et al. (1997), Lentini et al (2003), Lentini et al. (2005), SFB e IMAZON (2009), IMAFLORA (2019)

The Amazon logging sector in 2018



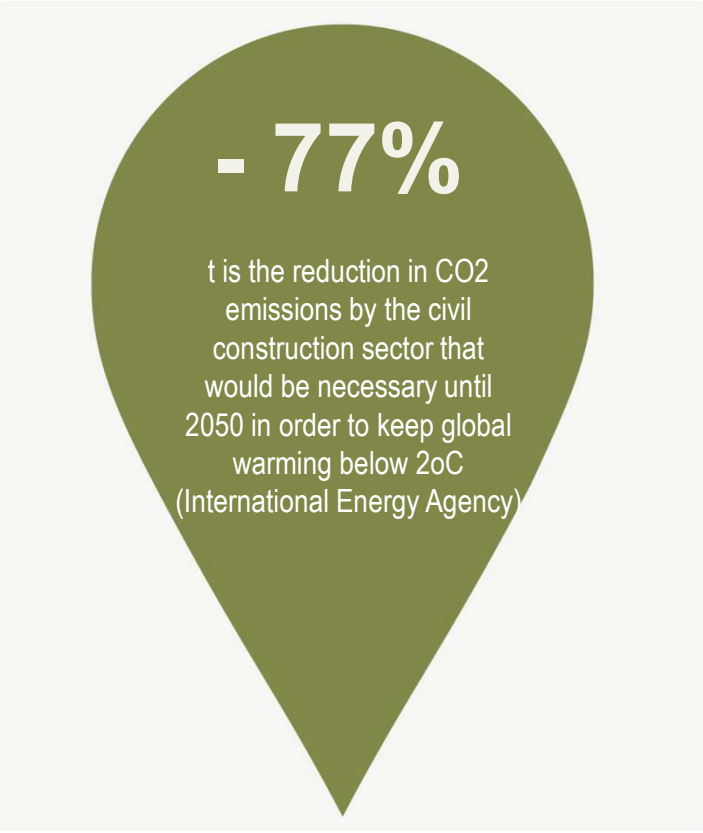
- Timber products from the Amazon subsidized the development of Brazilian civil construction
- The sector suffered a strong retraction, either for reasons of reputation or due to strong substitution by other materials
- The state of São Paulo has historically been the main consumer of wood from the Amazon
- The domestic market in the Amazon has developed and probably today has a fundamental role
- The growth of the region's middle class in the coming years will create even greater pressure for wood


OUR HARDWOOD INDUSTRY IS DISINTEGRATING!
IT'S OK.. WE'VE GOT A PLAN!
RUE

CRÉDITO DAS FOTOS: IFT

Civil construction sector in Brazil: an opportunity for sustainable development

Brazilian housing deficit: 6 Mio units*
Estimate 20 Mio until 2024*
Investment needed: R$ ~18-20 billion/yr.*



* Source: VALOR ECONOMICO – 13/10/2014

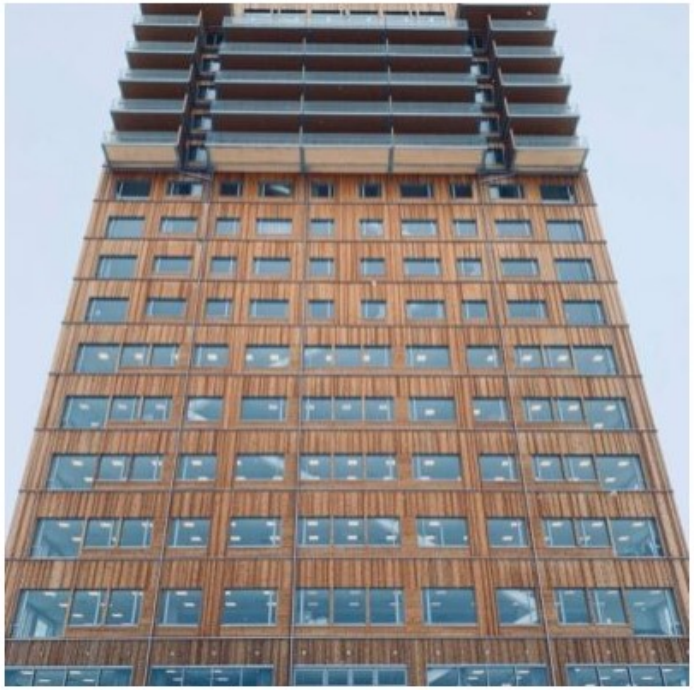
Lumber is the material with the lowest value of built-in energy

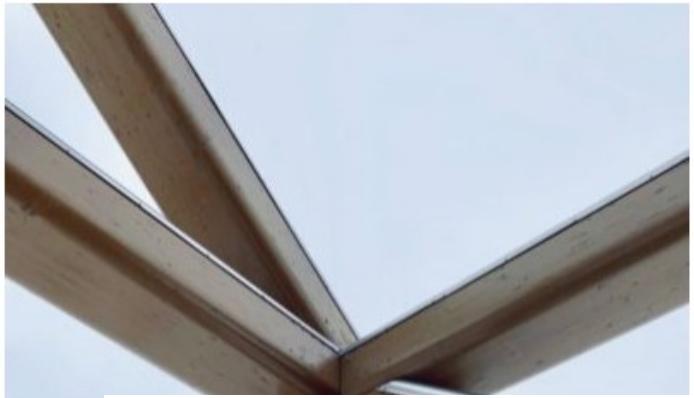
Sawnwood - 350 KWH/M³

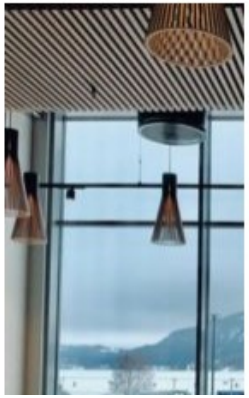
Cement – 1750 KWH/M³

LAROCA 2002

THE WORLD'S TALLEST WOODEN TOWER







Opened on 15 March, the Mjøstårnet, or the Mjøsa Tower in Brumunddal near Oslo, Norway, is with 85.4 metres currently the world's tallest wooden building.

While wood was one of the first building materials used by men, its use fell out of favour because of it being known as a fire hazard. However, with the downsides of building materials like bricks, concrete and metal becoming more evident, more and more people are turning back to wood. Not the type of wood that grows on trees, though, but engineered wood that is stronger and less flammable.

Designed by Voll Arkitekter, the 18-storey tower is made from lightweight, prefabricated materials, mainly glulam (glued laminated timber), CLT (cross-laminated timber) and MetsäWood's Kerto LVL (laminated veneer timber), produced in Finland. Kerto LVL is lightweight, strong, and uniform and has an "outstanding strength-to-weight" ratio.

floors, with offices and hotel facilities, are made of prefabricated wooden elements. The decks on the upper floors, however, where apartments are made of concrete. This is because the amount of swaying increases the higher you get in a building built of wood or concrete. The weight of the concrete makes the swaying slower and not as noticeable. The shafts for the elevators and staircases are made of CLT.

The tower, located next to the eponymous largest lake of Norway, was built according to strict fire safety regulations. Untreated solid wood creates its own fire-resistant surface because the outermost layer chars when exposed to fire, protecting against further fire damage. Massive wooden structures manufactured in large maintain therefore their load-bearing capacity in case of fire.

For more wooden buildings, click here.

By Els Zijlstra

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Wood transactions official control datasets and the 'timberflow' initiative: the Amazon wood reference platform

SINAFLOR - National system for controlling the origin of forest products

- *The Brazilian Forest Code - Law 12651 (2012)*
- *Instrução Normativa 21 (2014)*
- *System availability starting from Dec 1st, 2017*
- *Mandatory implementation from May 2nd, 2018*
- *Integration with DOF system*

DOF – Forest origin document

- Created in IBAMA's Portaria 253 (2006)
- *"It constitutes a mandatory license for the transport and storage of forest products of native origin, including native charcoal, containing information on the origin of these products";*
- IBAMA maintains the DOF system available on the internet for issuing the document;
- States can issue the document through their own control systems (according to art. 6º, § 2º, Resolução Conama 379, October 2006). This is the case of Mato Grosso, Pará and Minas Gerais States;

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MINISTÉRIO DO MEIO AMBIENTE

INSTITUTO BRASILEIRO DO MEIO AMBIENTE E DOS RECURSOS NATURAIS RENOVÁVEIS

DOCUMENTO DE ORIGEM FLORESTAL - DOF

Nº 21757447

1 - Emissor [redacted]			2 - Ibama/CTF
3 - Endereço	**EST VICINAL CURUA S/N - UMF II - CONCESSÃO**		**6674975**
4 - Bairro	**FLONA DE ALTAMIRA**	5 - Município **ITAITUBA/PA**	
6 - Origem	**- UMF II - FLONA DE ALTAMIRA**		7 - Coordenadas
8 - Endereço	----------		**55°10'11.4"W - 05°41'31.3"S**
9 - Bairro	----------	10 - Município **ALTAMIRA/PA**	
11 - Roteiro de acesso			
ATRAVÉS DA RODOVIA BR-163, ACESSA-SE A ESTRADA VICINAL CURUÁ ATÉ A UMF II.			
12 - Autorização **1015.2.2018.01681**		13 - Tipo **PLANO DE MANEJO**	

14 - Produto / Espécie	15 - Qtd.	16 - Un.	17 - Valor
Tora / Apuleia leiocarpa - garapa	**19,7598**	**M3**	**117,40**
Tora / Tabebuia serratifolia - ipê-amarelo	**12,2499**	**M3**	**117,40**
Tora / Tabebuia impetiginosa - ipê-roxo	**7,6984**	**M3**	**117,40**
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18 - Destinatário [redacted]			19 - Ibama/CTF
20 - Endereço	**ROD. TRANSGARIMPEIRA S/N - KM 03**		**7248607**
21 - Bairro	**MORAES ALMEIDA**	22 - Município **ITAITUBA/PA**	
23 - Destino	[redacted]		24 - Coordenadas
25 - Endereço	**ROD. TRANSGARIMPEIRA S/N - KM 03**		----------
26 - Bairro	**MORAES ALMEIDA**	27 - Município **ITAITUBA/PA**	
28 - Roteiro de acesso			

----------			

29 - Meio de Transporte	30 - Placa/Registro	31 - Município Origem	32 - Município Destino
Rodoviario	**EKH1593,JZY1340**	**ALTAMIRA/PA**	**ITAITUBA/PA**

Wood production chain

Forest

Harvesting

Log transportation

Sawmill

Processed wood

Wood transportation

Secondary Mill

Finished wood product

Harvesting and origin control systems (forest management licensing)

Transportation, selling and processing control systems (DOF e SISFLORA)

Fiscal and tributary control systems

IBAMA’s open data initiative

- Compliance with Law 12.527 (2011), also known as Access to Information Law (LAI);
- Both IBAMA's open data plan (PDA) for 2018-2019 and its revision for 2019-2021 are available at http://www.ibama.gov.br/dados-abertos;
- The data available includes DOFs for forestry products shipment issued since January 2007 in formats 4 different formats (html, csv, xml and json);
- Not all States have data covering whole period;

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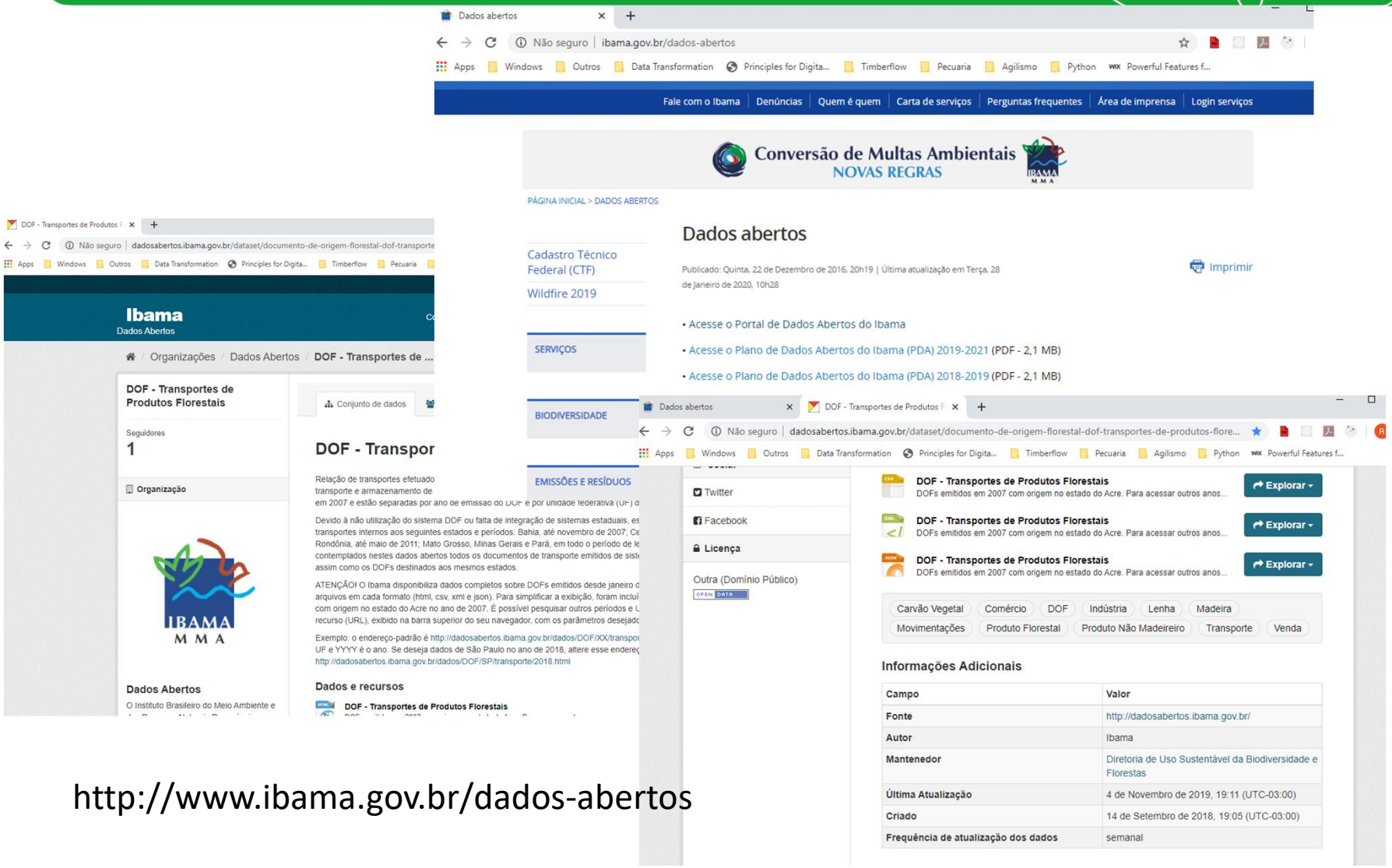
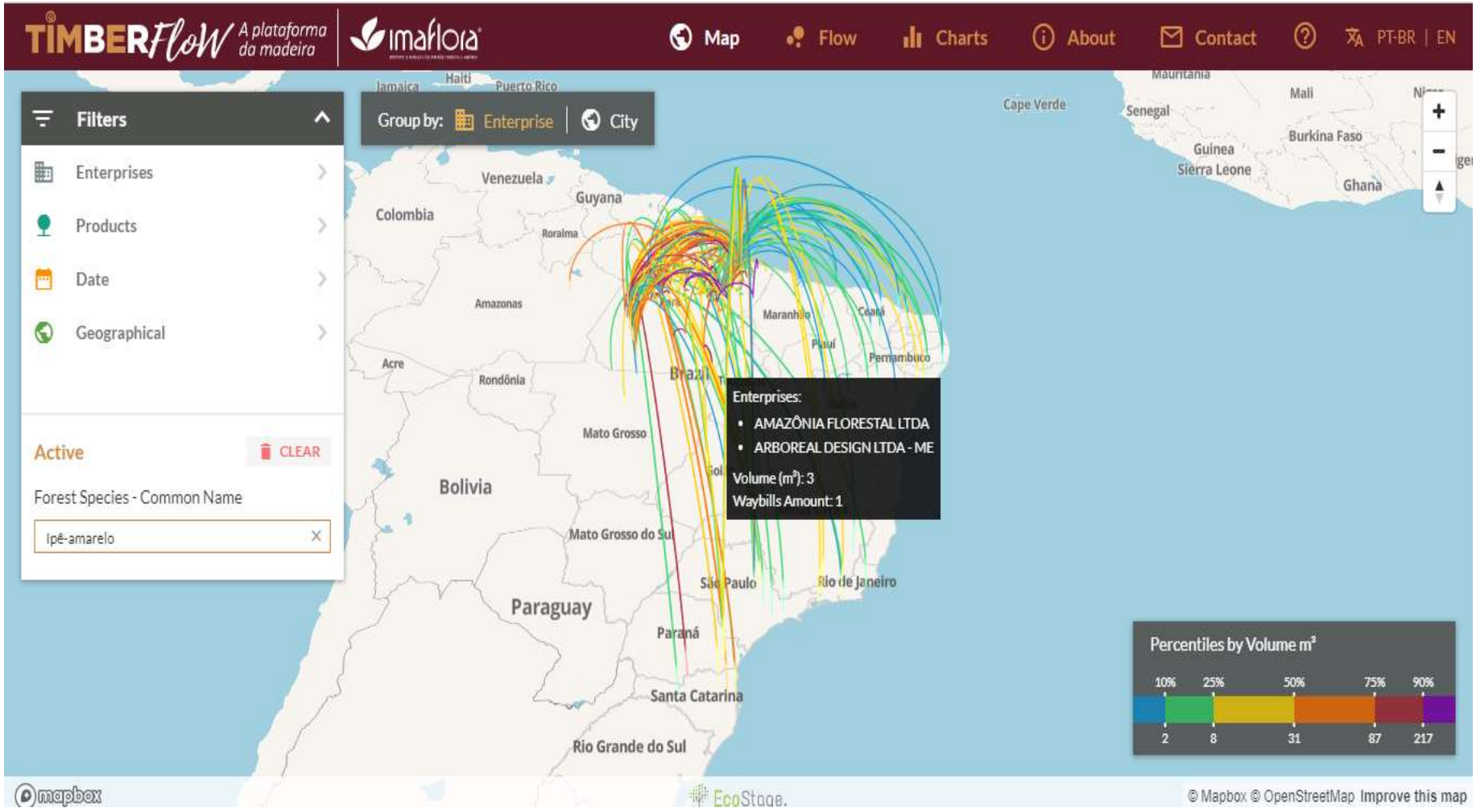


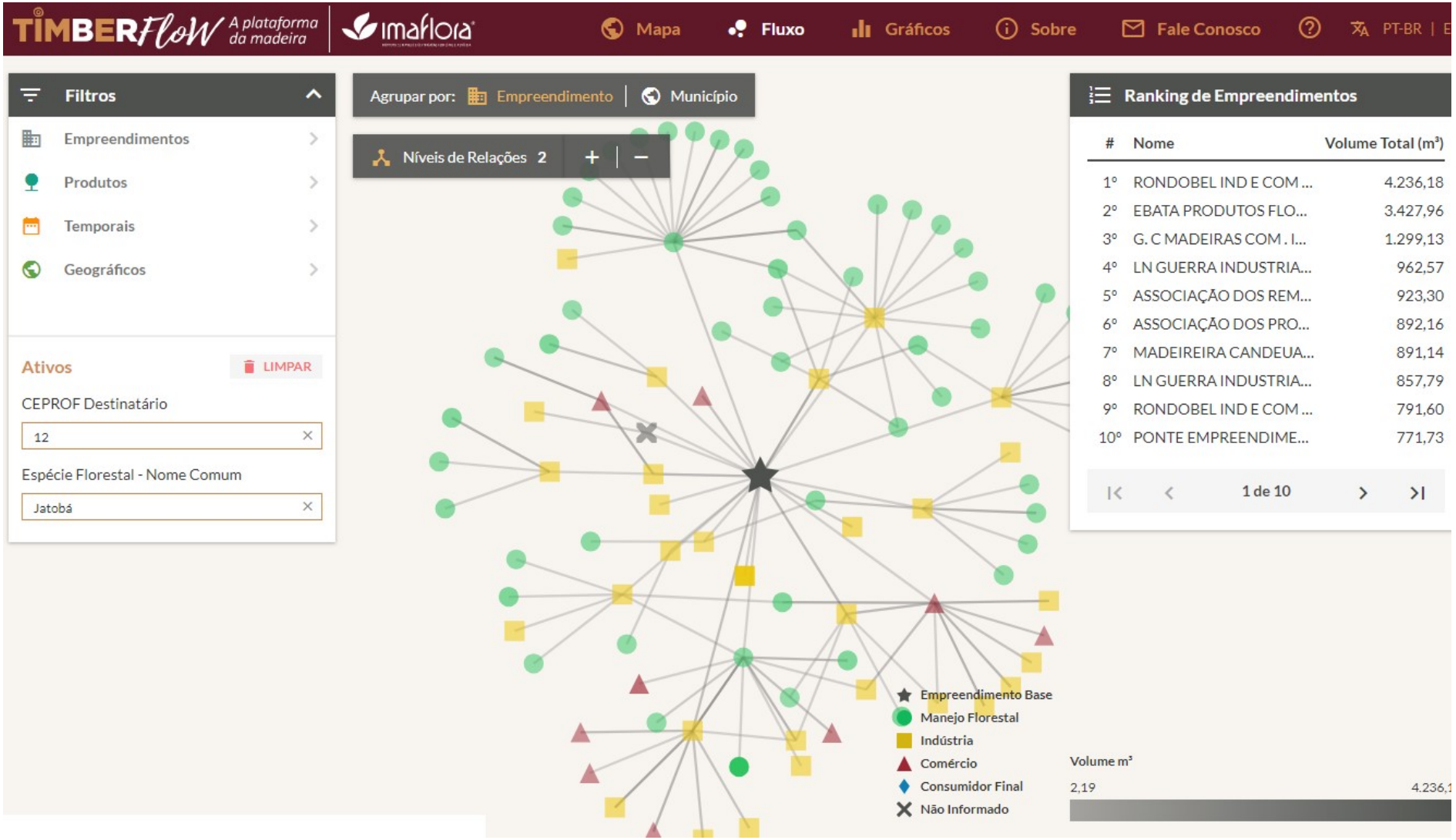
http://www.ibama.gov.br/dados-abertos

Timberflow – The timber platform

- Transparency initiative aimed at combating illegality in the forestry sector;
- Version 1.0 based on a 2017 dataset from the State of Pará;
- Provides map based visualization of forest products shipping orders (GFs);
- Displays transactions between every two companies and the user could filter data by company name and id, municipality, product, forest species or time period;

TIMBERFlow


TIMBERFlow A plataforma da madeira
imaflora
Map
Flow
Charts
About
Contact
PT-BR | EN
Filters
Enterprises
Products
Date
Geographical
Active
CLEAR
Forest Species - Common Name
Ipê-amarelo
Group by: Enterprise City
Enterprises:
AMAZÔNIA FLORESTAL LTDA
ARBOREAL DESIGN LTDA - ME
Volume (m³): 3
Waybills Amount: 1
Percentiles by Volume m³
10% 25% 50% 75% 90%
2 8 31 87 217
Venezuela
Guyana
Colombia
Roraima
Amazonas
Acre
Rondônia
Bolivia
Paraguay
Mato Grosso
Mato Grosso do Sul
São Paulo
Rio de Janeiro
Paraná
Santa Catarina
Rio Grande do Sul
Brazil
Maranhão
Ceará
Piauí
Pernambuco
Cape Verde
Senegal
Mauritania
Mali
Burkina Faso
Guinea
Sierra Leone
Ghana
mapbox
EcoStage.
© Mapbox © OpenStreetMap Improve this map


TIMBERFlow A plataforma da madeira
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Mapa
Fluxo
Gráficos
Sobre
Fale Conosco
PT-BR
Filtros
Empreendimentos
Produtos
Temporais
Geográficos
Ativos
LIMPAR
CEPROF Destinatário
12
Espécie Florestal - Nome Comum
Jatobá
Agrupar por: Empreendimento | Município
Níveis de Relações 2
Ranking de Empreendimentos
Nome Volume Total (m³)
1° RONDOBEL IND E COM ... 4.236,18
2° EBATA PRODUTOS FLO... 3.427,96
3° G. C MADEIRAS COM . I... 1.299,13
4° LN GUERRA INDUSTRIA... 962,57
5° ASSOCIAÇÃO DOS REM... 923,30
6° ASSOCIAÇÃO DOS PRO... 892,16
7° MADEIREIRA CANDEUA... 891,14
8° LN GUERRA INDUSTRIA... 857,79
9° RONDOBEL IND E COM ... 791,60
10° PONTE EMPREENDIME... 771,73
1 de 10
Empreendimento Base
Manejo Florestal
Indústria
Comércio
Consumidor Final
Não Informado
Volume m³
2,19
4.236,1

TimberFlow 1.0 limitations

- Difficulties in upsizing the platform for data from all Brazilian States and other (different) datasets;
- Platform strongly linked to the State of Pará data model (SISFLORA / PA);
- User interface vastly compromised by dataset increase (grows from about 1million records to over 30 million);
- Network diagrams gets really confusing

Timberflow 2.0 Development

- Version 2.0 built in partnership with ICMC / USP São Carlos, with data from all over Brazil (DOF/IBAMA, SISFLORA/PA and SISFLORA/MT)
- Aggregation of data at the municipality level;
- Data sanitize: compatibilization of product names, forest species names, municipality names, volume conversions to cubic meters in all three datasets;
- The interface shows a heat map over the map of municipalities in Brazil, the user chooses between Source or Destination of products from/to municipalities;

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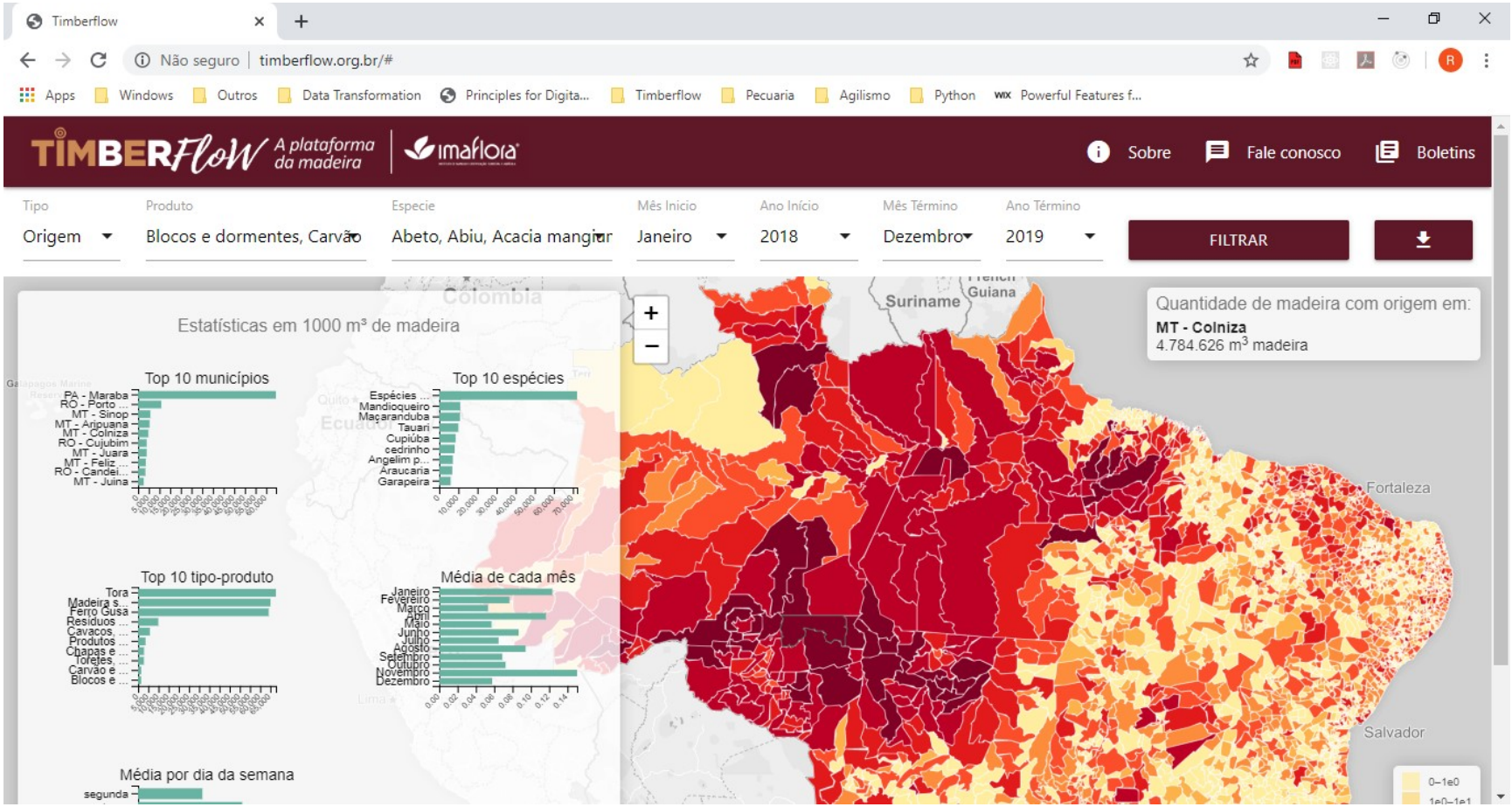

http://timberflow.org.br

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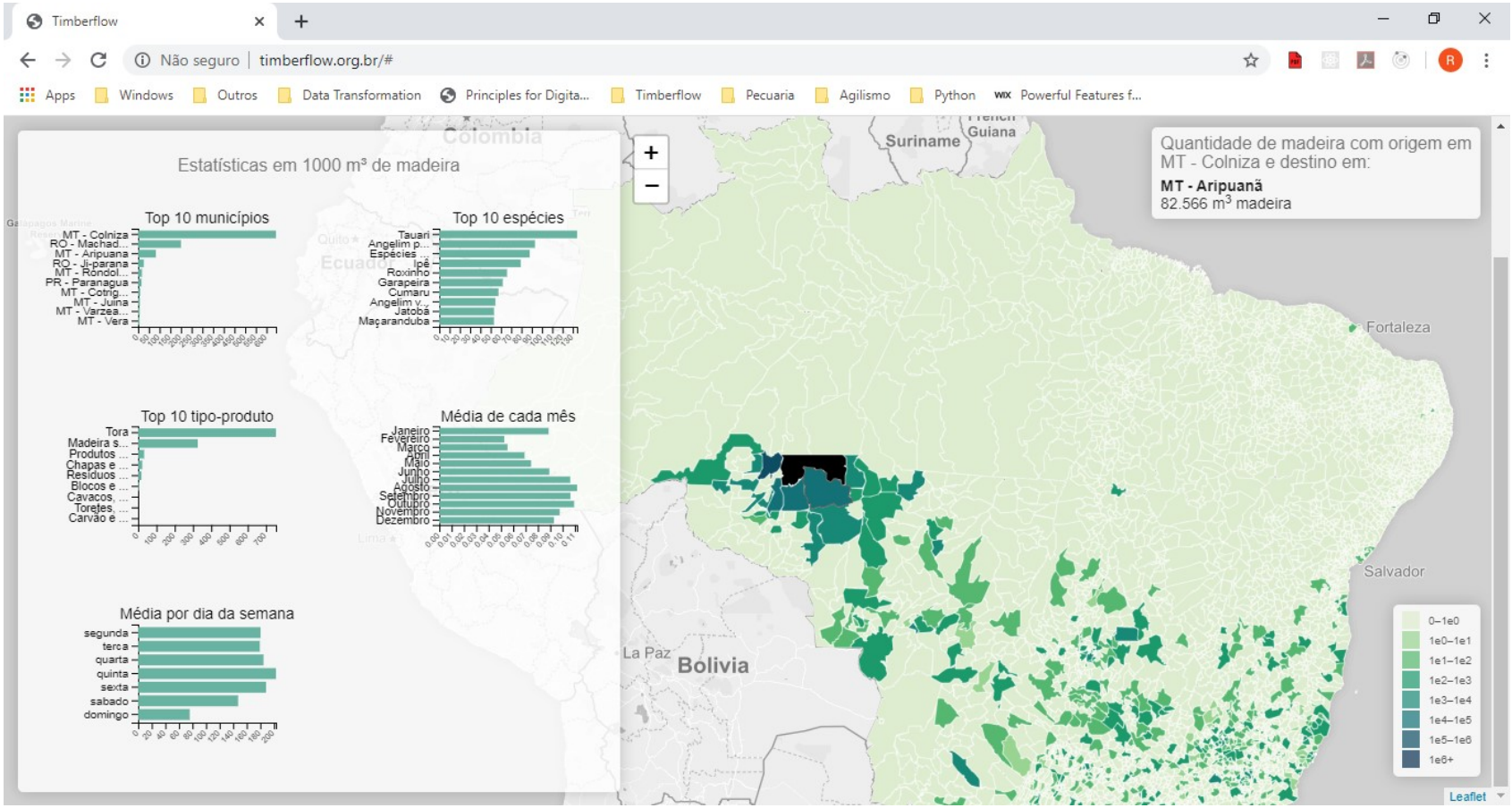

http://timberflow.org.br

Other contributions of Timbeflow v.2.0's Development

- IBAMA's data download and sanitization is now automated;
- EDA is very consistent;
- Improved application performance and robust Frontend / Backend architecture;
- Source code for the application and EDA is high quality and shared among partners;
- Strengthening of the partnership and collaboration between IMAFLORA and ICMC/USP São Carlos;

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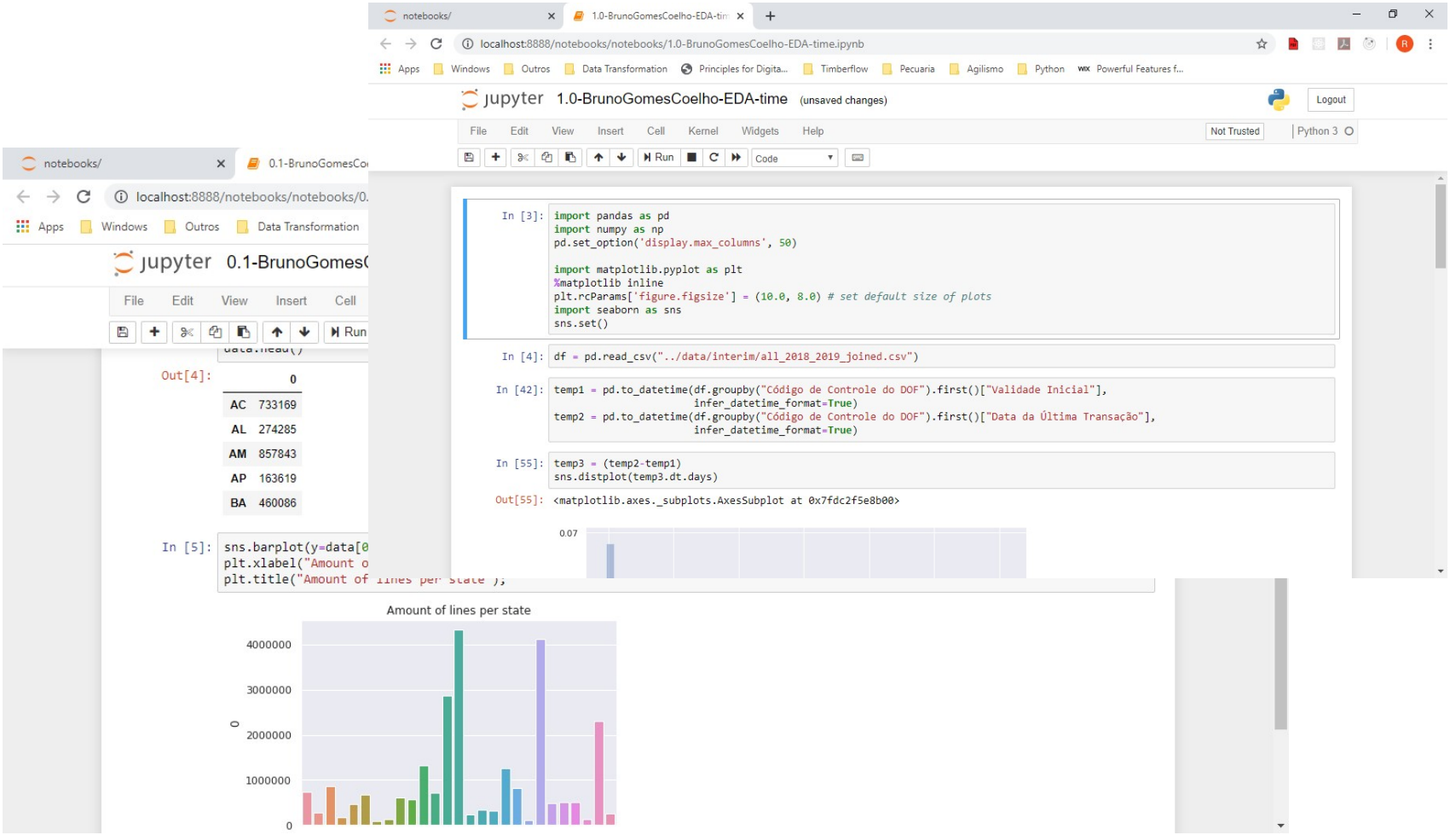

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Where to go now: perspectives and opportunities in terms of intelligence and data science

New opportunities for the Amazon forest sector

- Agenda and political priorities in the states more focused on forest production and improved legality
- Scarcity of resources for enforcement activities, which means that more intelligence is necessary
- Growing trend of using timber in civil construction markets internationally and even in Brazil as a solution for the climate agenda
- Increasing area under forest management in the Amazon in forest concessions (perspective of 5 million hectares in the next 2-3 years)
- Increasing interest in legality from timber buyers (including reforms in the Chinese Forest Act)

Perspectives for improved intelligence regarding forestry and land use/land use change data

- Improved understanding of timber production chains
  - Variation of timber stocks in the mills over time
  - Mapping the connections between different companies supplying wood products in the production chain
  - Determining the mass balance variation in different portions of the supply chain
- Improved integration of forestry transaction datasets with georeferenced data on land use and land use change
  - Deforestation, forest degradation, land use and zoning, supply chains, etc.
- Improved integration of forestry transaction datasets with data on trade for other commodities
- Better prediction of the logging sector evolution over time

Timber stocks in the sawmills

Logwood

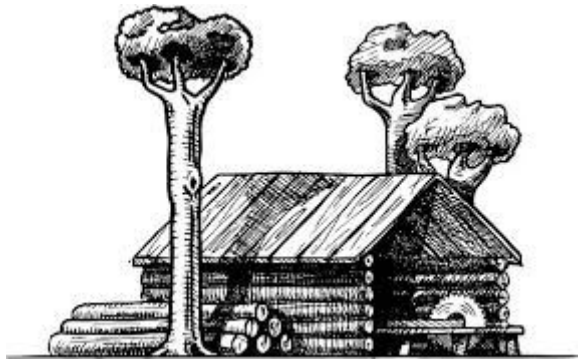
Sawnwood

Average efficiency = (y m3 sawn wood) / (x m3 logs)

2016

2017

2018

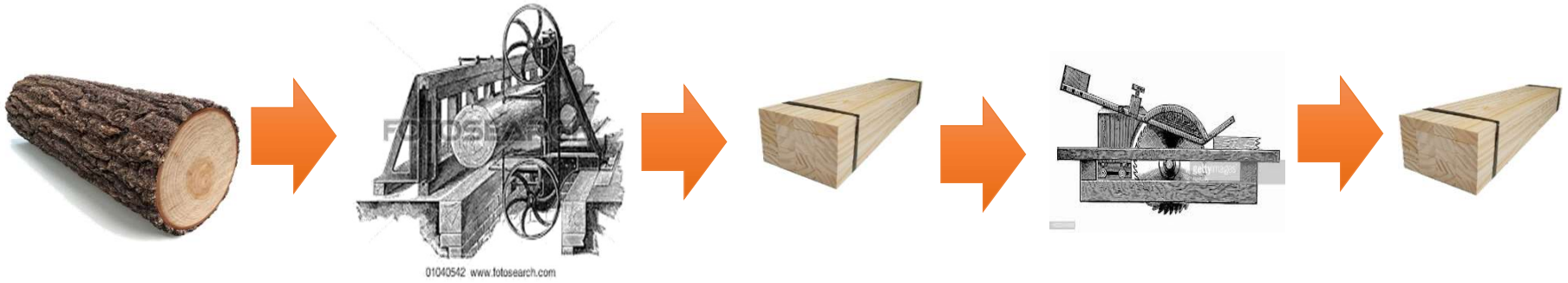


2016

2017

2018

Mapping the connections between different companies supplying wood products in the production chain

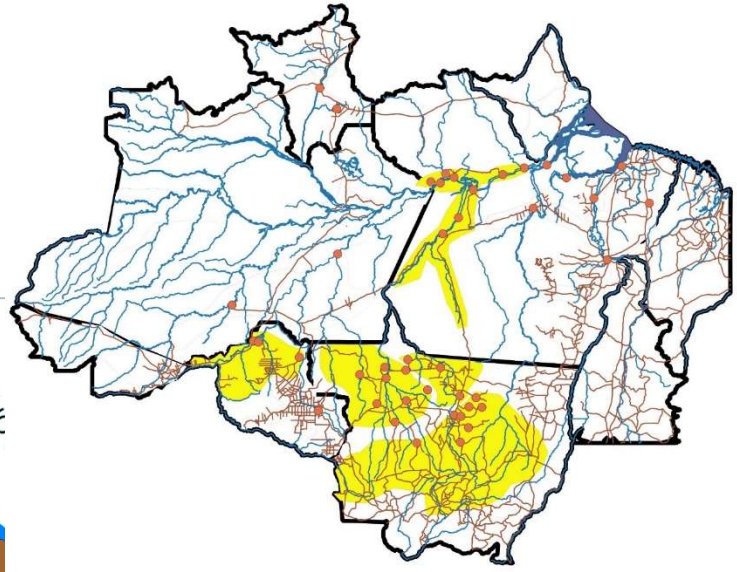


Mill A *Mill B*

Determining the mass balance variation in different portions of the supply chain

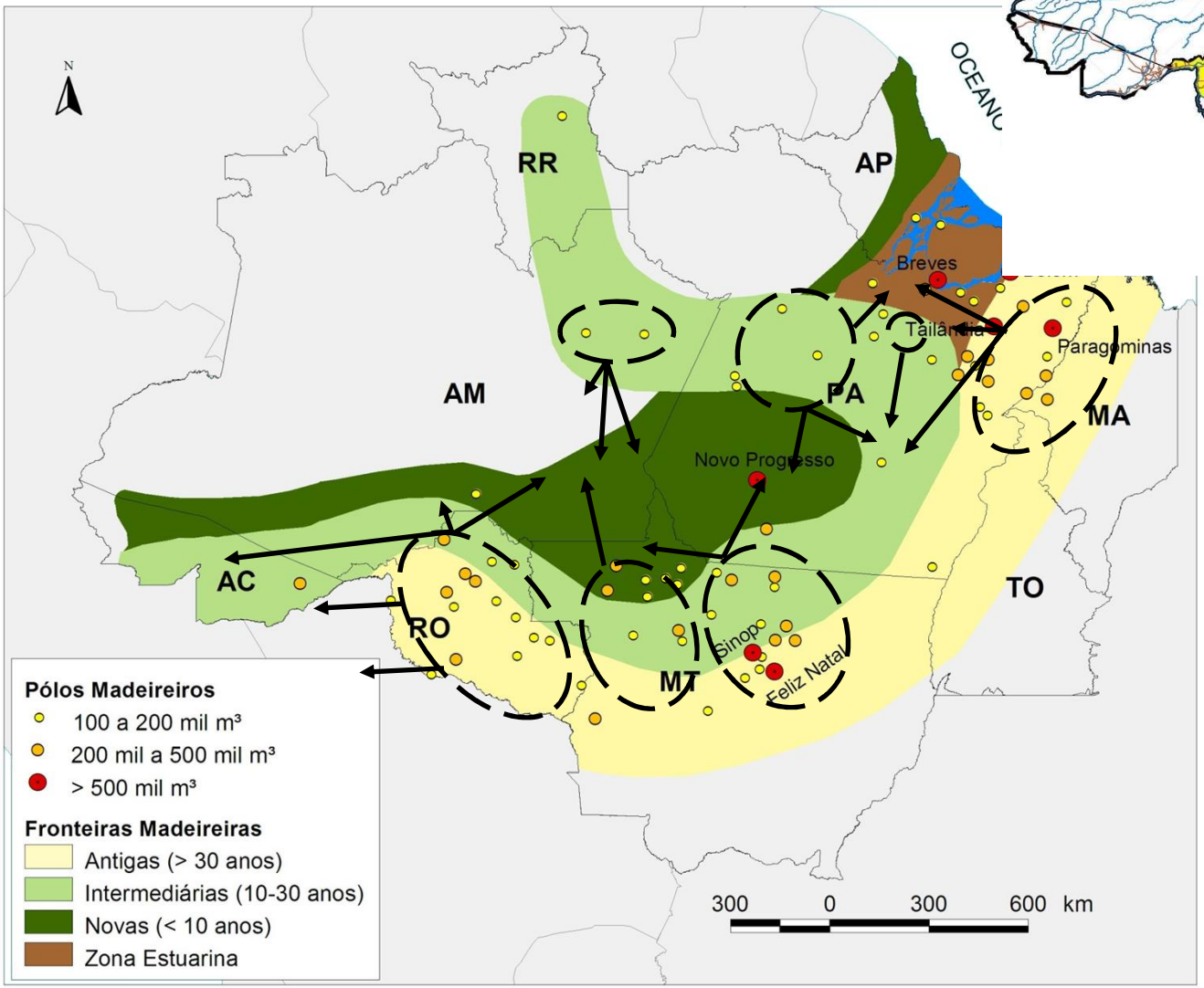
Logs *Sawnwood* *Finished products*

Better prediction of the logging sector evolution over time

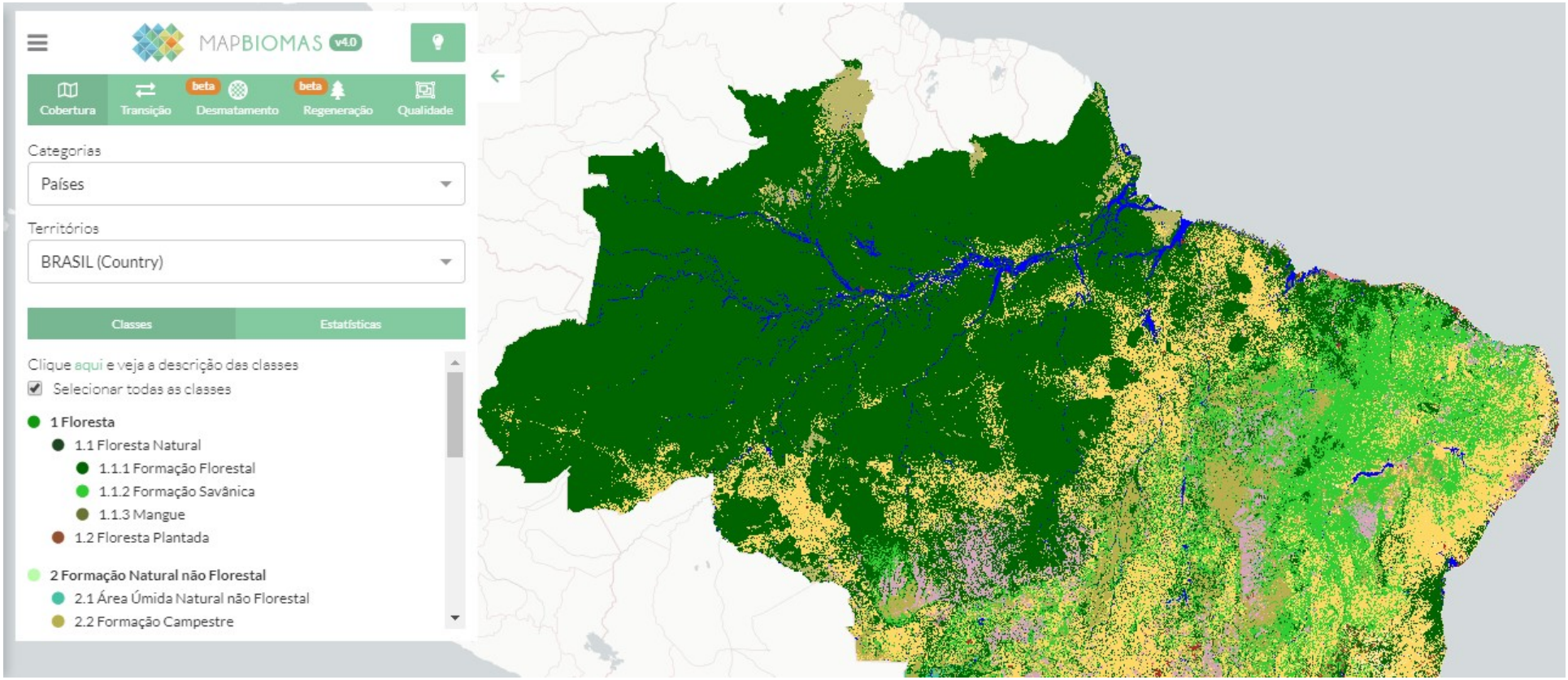


2019-20

Early 2000s

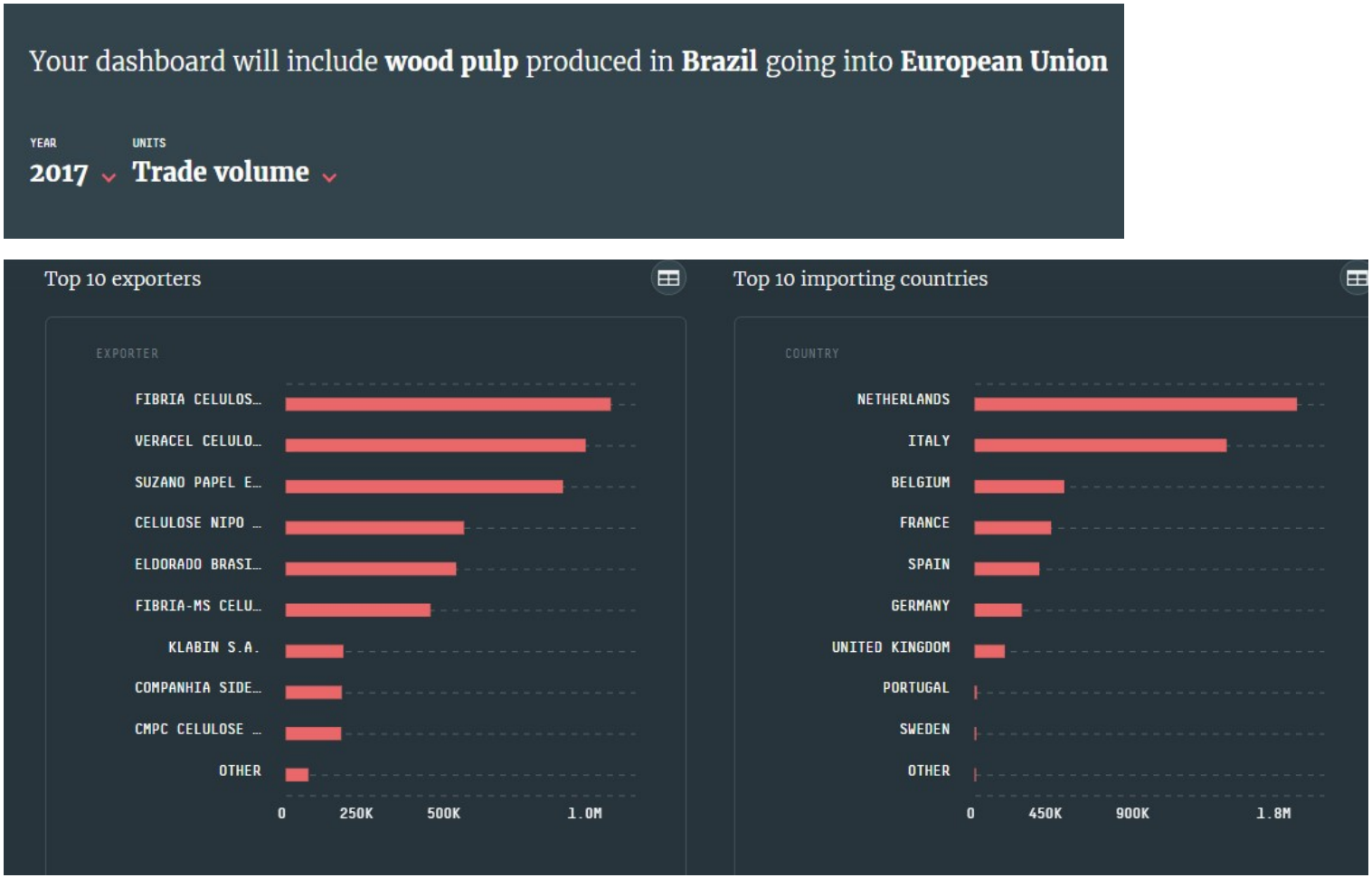


Improved integration of forestry transaction datasets with georeferenced data on land use and land use change



Other examples: Prodes, Simex (Imazon, ICV), public forest databases (protected areas and public forests)

Improved integration of forestry transaction datasets with data on trade for other commodities (e.g., Trase)



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"Soluções inovadoras para conservar o planeta e beneficiar pessoas que vivem do campo ou das florestas."

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