The Third United Nations Expert Group Meeting
on the Revision of the Principles and Recommendations for
Population and Housing Censuses

New York
4 -6 September 2024

Integration of census data with geospatial information

2022 Census - Brazil

Cayo de Oliveira Franco
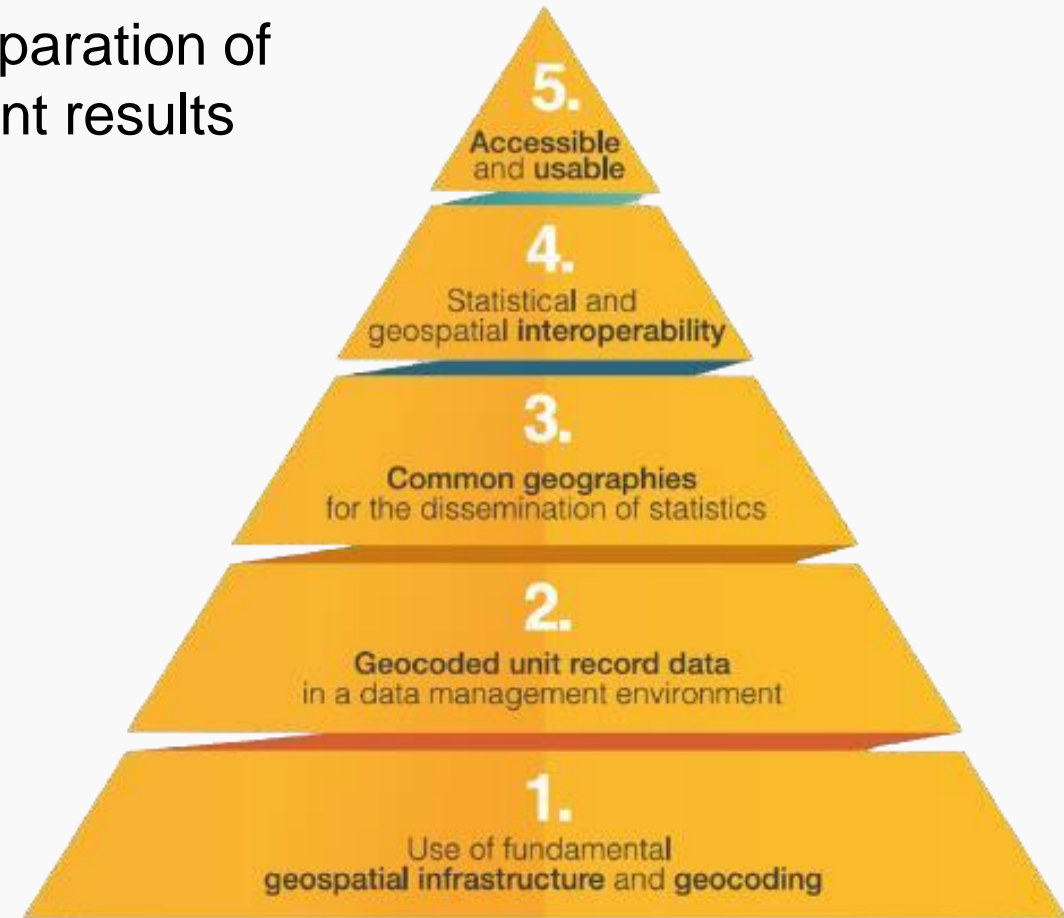Brazilian Institute of Geography and Statistics (IBGE)
Chair of Task Team 3

10th anniversary
UN·EG-ISGI
UNITED NATIONS • EXPERT GROUP
ON THE INTEGRATION OF STATISTICAL
AND GEOSPATIAL INFORMATION

Instituto Brasileiro de Geografia e Estatística IBGE

IBGE

The Global Statistical Geospatial Framework (GSGF) and its 5 principles

The **GSGF** is a fundamental framework in the preparation of an integrated census and will provide more efficient results at all stages of the census operation.
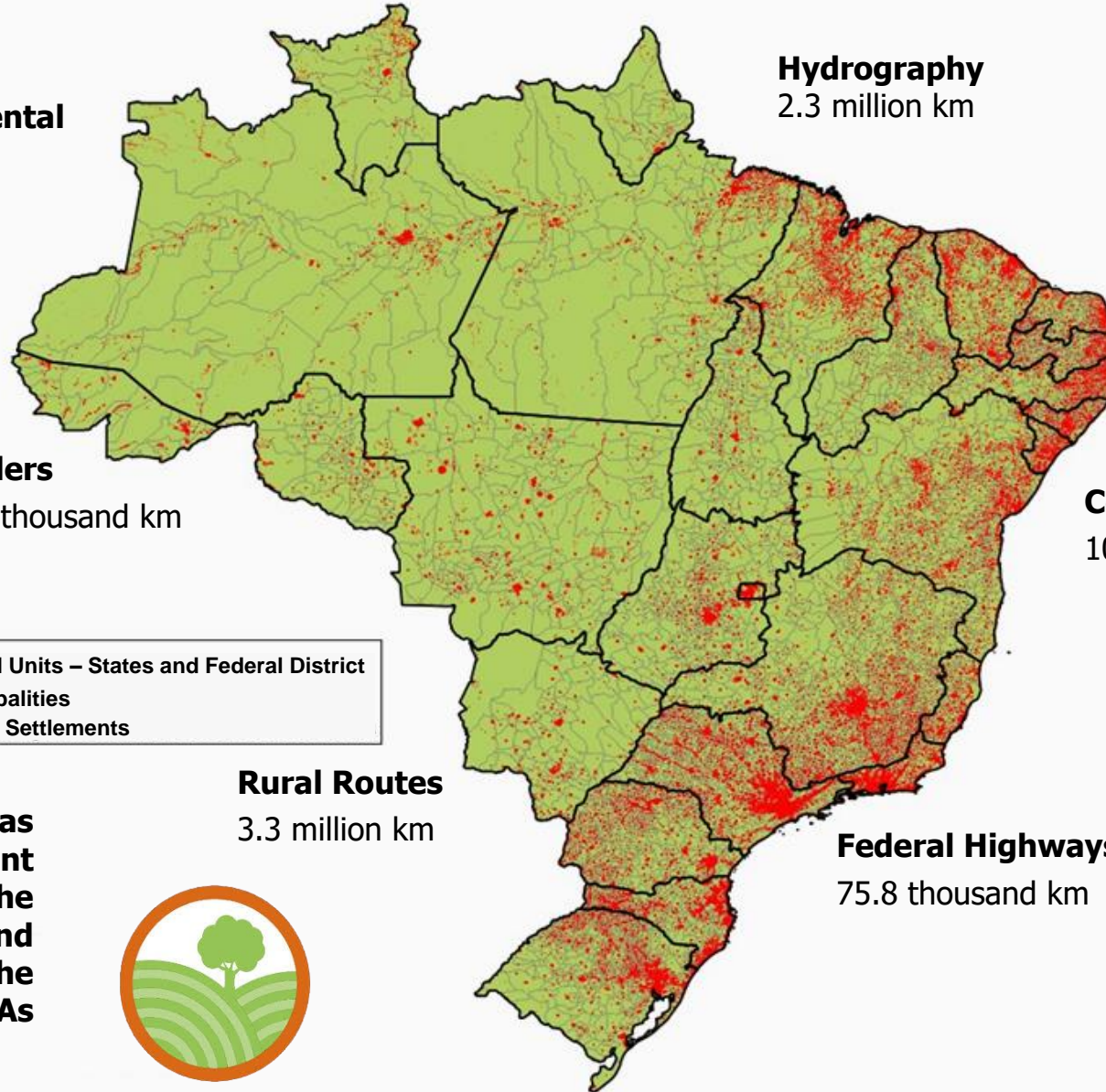

5.
Accessible
and usable

4.
Statistical and
geospatial **interoperability**

3.
Common geographies
for the dissemination of statistics

2.
Geocoded unit record data
in a data management environment

1.
Use of fundamental
geospatial infrastructure and geocoding

Brazil – Fundamental data themes

Country of continental extension
8,510,417.771 km²

Hydrography
2.3 million km

Water bodies represent 0.4% of the Territory in 0.2% of the EAs

Borders
16.9 thousand km

Coastline
10.9 miles

Federal Units – States and Federal District
Municipalities
Human Settlements

Rural Routes
3.3 million km

Rural Areas represent 98.1% of the Territory and 17.1% of the EAs

Federal Highways
75.8 thousand km

Human concentrations represent ≈ 125.7 thousand km² (1.5% of the Territory in 82.7% of EAs)

IBGE

Instituto Brasileiro de Geografia e Estatística IBGE
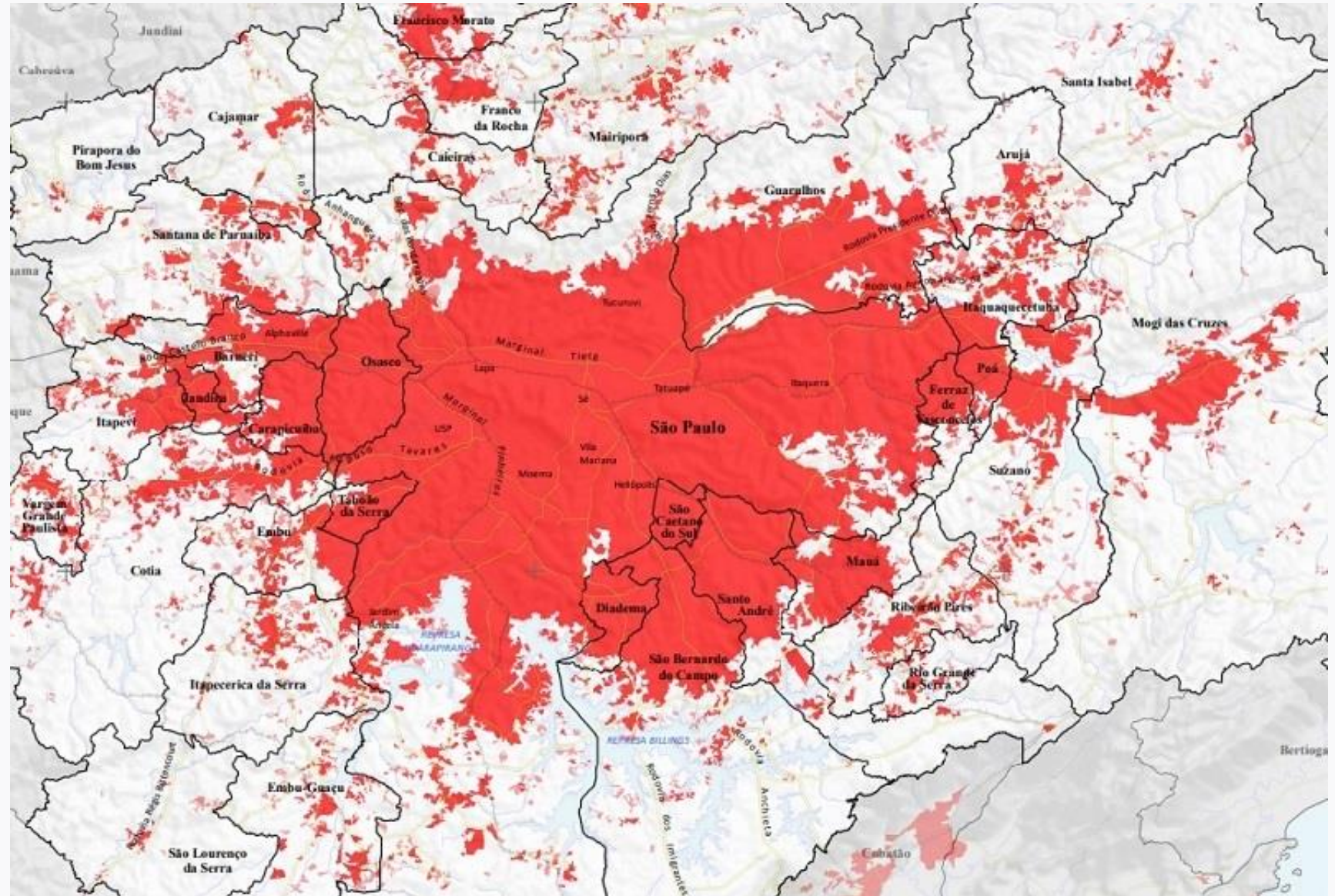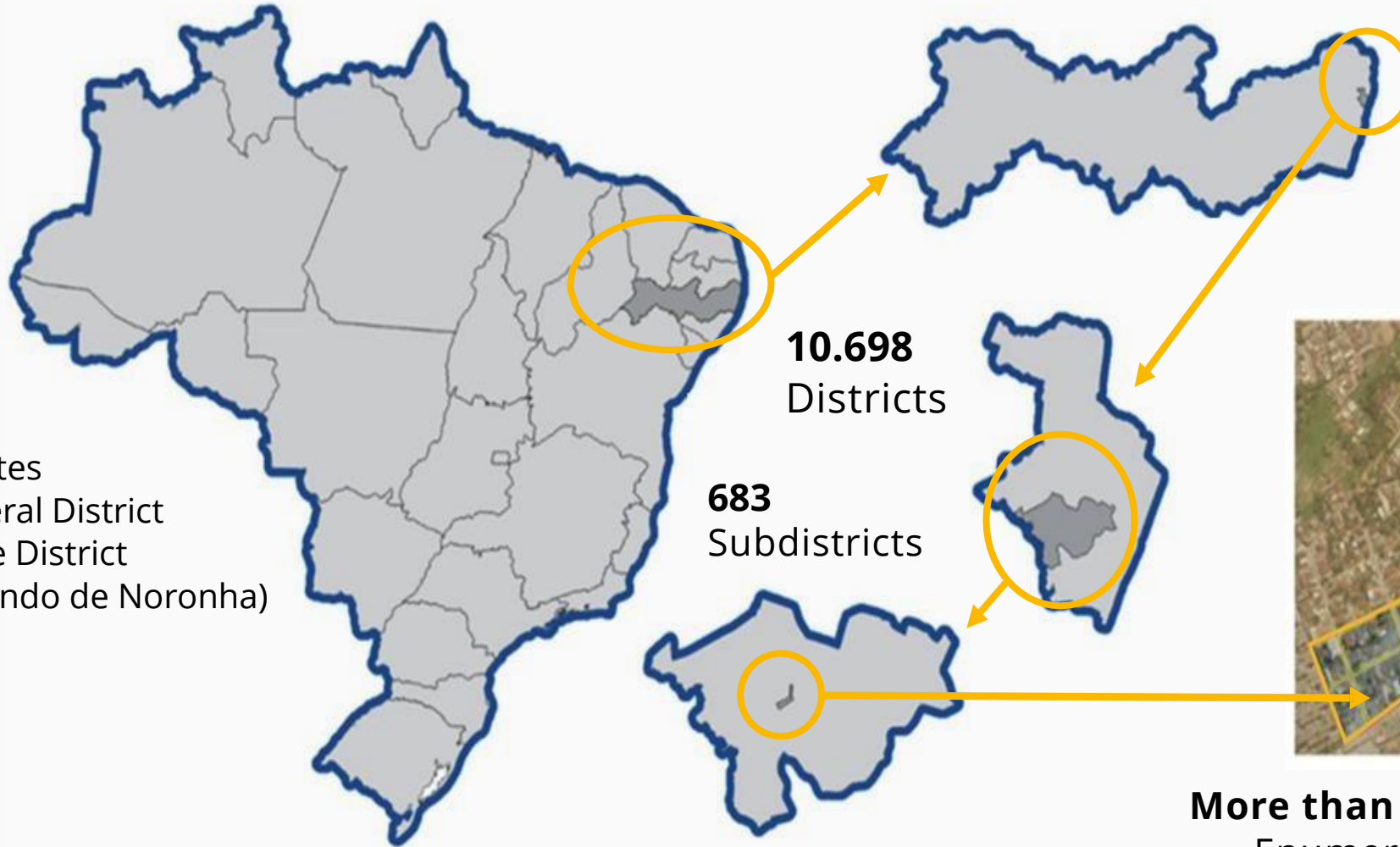
Brazil – Fundamental data themes

Mapping urban sprawl through the expansion of built-up areas

Urban Concentration of São Paulo (SP)

Brazil – Administrative Geographies

26 States
1 Federal District
1 State District
(Fernando de Noronha)

10.698
Districts

683
Subdistricts

5568
Municipalities

More than 468 thousand
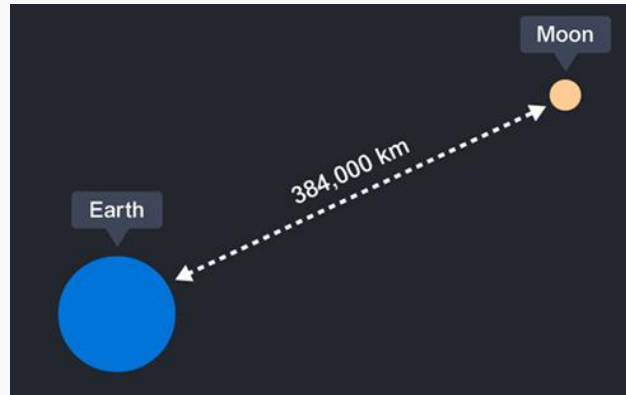Enumeration Areas
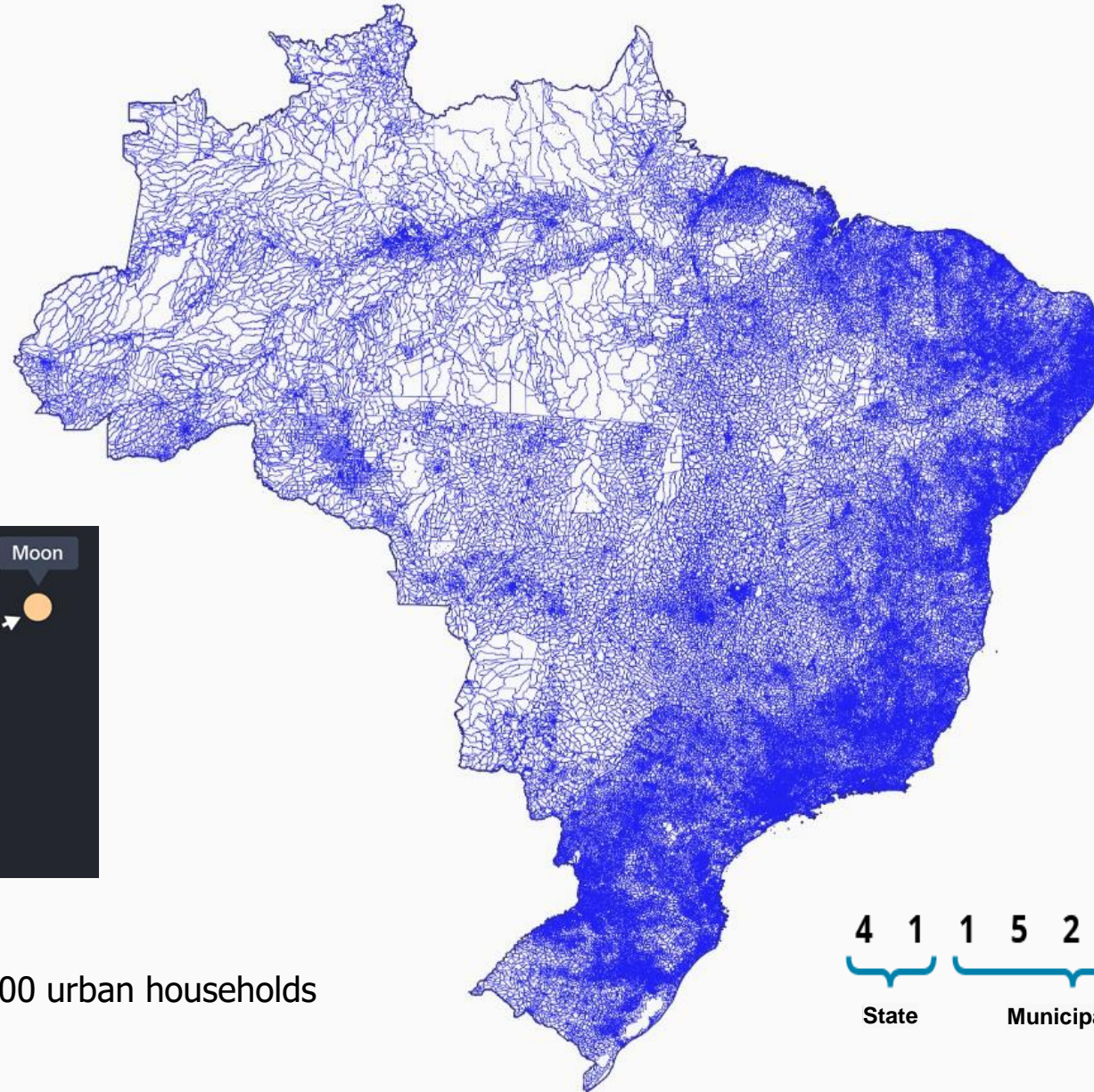
Brazil – Enumeration Areas

144.9 million characters of descriptions:

40x Bibles with 3,566,480 characters

15x "In Search of Lost Time, by Marcel Proust" - the largest published book in the world with 9,609,000 characters

2.3 million km of lines (boundaries) in 452,338 enumeration areas:

5x Earth-Moon distance

Moon

Earth

384,000 km

The average size of EAs is 51 to 400 urban households and 51 to 200 Rural households.

Geocode

4 1 1 5 2 0 0 0 5 0 6 0 0 1 0

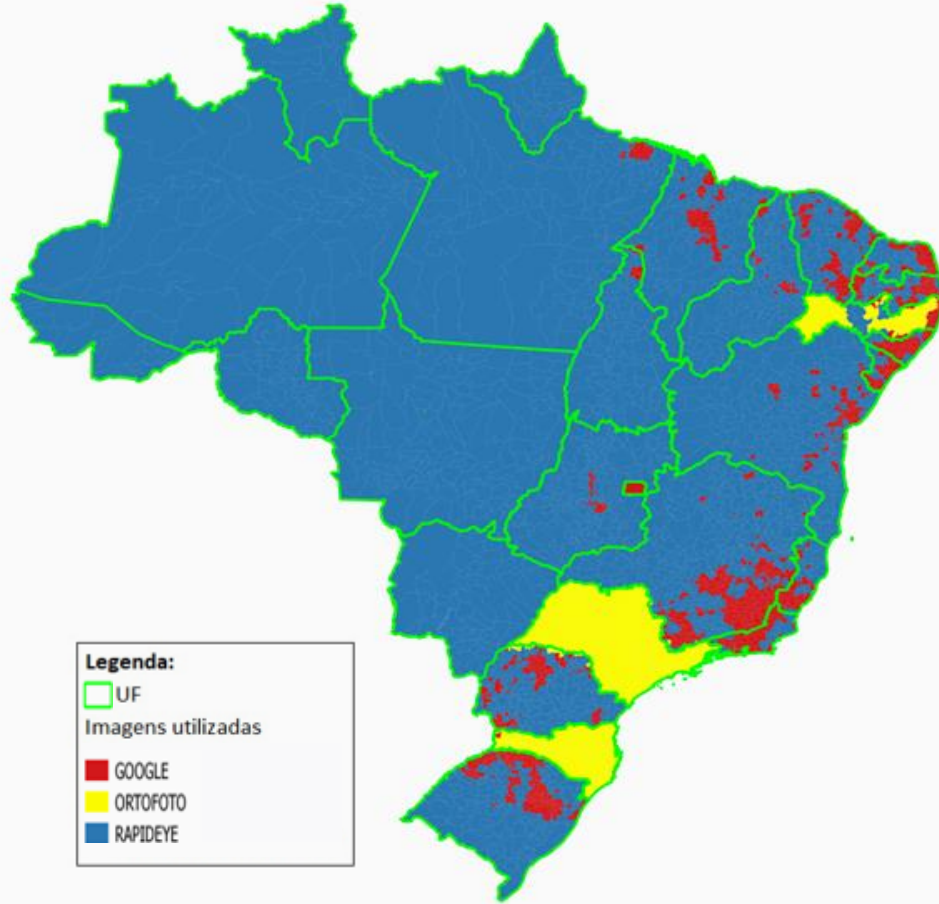State · Municipality · District · Subdistrict · Enumeration Area

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2022 Census Maps

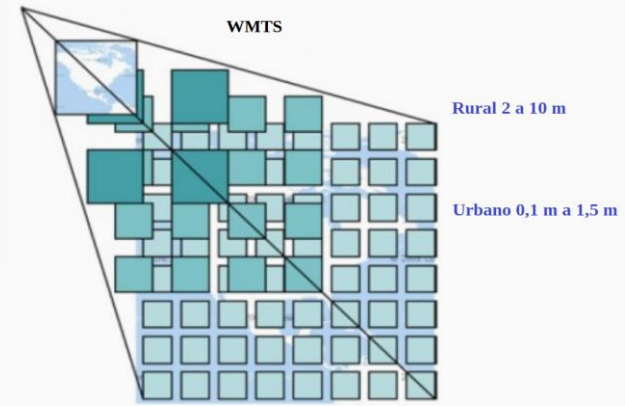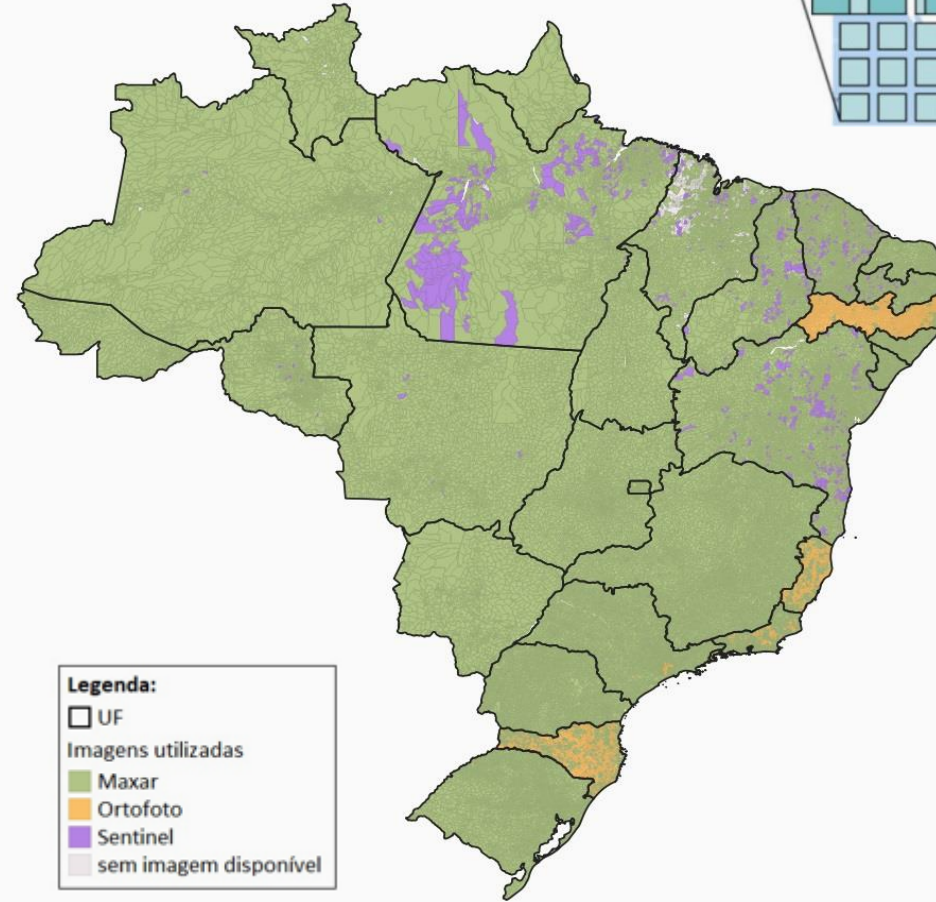| Map	Acronym	Main elements	Availability	Number and formats
Enumeration Area Map (Urban or Rural)	MSU or MSR	Boundaries of enumeration areas and main information	Enumerator's work instrument for use in the field	451.352 A3 GeoPDFs
Statistical Municipal Map	MME	Distribution of the municipality's enumeration areas and access information	Census collection office	5.934 A2, A1 and A0 GeoPDFs
Urban Statistical Map	MUE	Distribution of urban enumeration areas and access information	Census collection office	11.526 A2, A1 and A0 GeoPDFs
Map of Sectors of Indigenous Lands or Quilombola Territory	MTI or MTQ	Distribution of census sectors in ITs or QTs and information for access	Census collection office. Could be taken to the field for approach meetings	675 MTIs and 436 MTQs A2, A1 and A0 GeoPDFs

Fundamental geospatial infrastructure

2017 Agricultural Census

2022 Census

WMTS

Rural 2 a 10 m

Urbano 0,1 m a 1,5 m

Legenda:
☐ UF
Imagens utilizadas
🟥 GOOGLE
🟨 ORTOFOTO
🟦 RAPIDEYE

Legenda:
☐ UF
Imagens utilizadas
🟩 Maxar
🟧 Ortofoto
🟪 Sentinel
⬜ sem imagem disponível

Census Geospatial Monitoring

By **capturing coordinates** during a census operation, it is much easier to identify the parts of the city that have **already been visited** by enumerators and thus **correct possible omissions**.

Yellow dots are address coordinates collected in the 2022 Census in Brazil.

Source: IBGE, Brazil.

Census Geospatial Monitoring

It is possible to compare the **information collected** in the field with **administrative records**, and thus guarantee coverage of the operation. In **blue**, addresses provided by electricity companies through the **national electricity agency (ANEEL)**. In **yellow**, the households visited by the **2022 Census** (Brazil).

Source: IBGE, Brazil.

Census Geospatial Monitoring

General indicators
1. CNEFE addresses confirmed
2. Percentage of confirmed addresses without coordinates
3. Collection status by enumeration area
4. Percentage of estimated population registered by municipality
5. Residential energy consumers – ANEEL
6. Addresses with coordinates outside the municipality
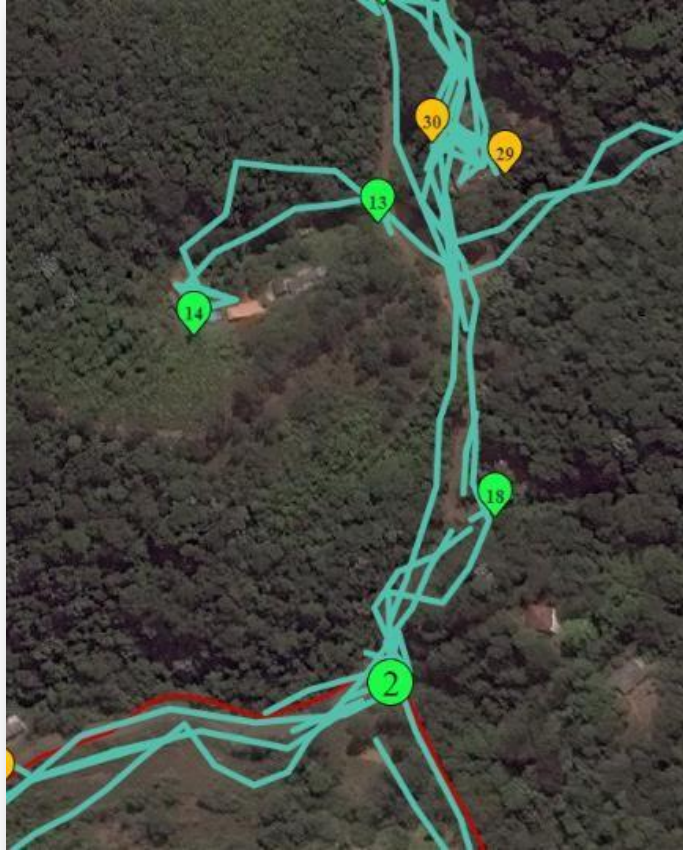
Households without resident or interview
7. Percentage of households refusing interview
8. Percentage of households with an absent resident
9. Percentage of vacant households
10. Percentage of homes with occasional use

Alert indicators
11. Addresses excluded without visit
12. Distant questionnaire opening (>700m)
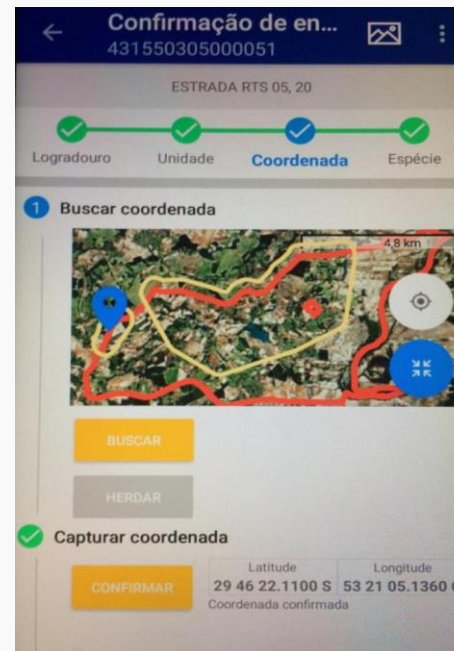
Census Geospatial Monitoring

Source: IBGE, Brazil.

On this map it is possible to see the households (**red** dots) that **refused to receive enumerators**, in the city of Rio Branco, state of Acre, Brazil.

This information was available in **real time** during the census operation, enabling the **development of strategies** that significantly **reduced the percentage of households that refused to respond** to the 2022 Census.

Census Geospatial Monitoring

Thanks to use of **geospatial information** during the 2022 Census operation, it was possible to **monitor the enumerators routes** in **real time** (through 3G, 4G networks), making it easy to **identify areas** of the territory **that had already been covered** and plan possible correction actions of coverage.

These tracks can be used to **improve road and waterway mapping**, especially in rural areas, after the Census.

Areas of Operational Interest

Geospatial base independent of the enumeration areas/census tracts where specific questions will be geo-enabled via GNSS (at the time of the interview).

It can be used to ask specific questions for specific population groups.

Administrative records
+
Mapping routine

Enumeration areas

Area of Operation Interest

Area in the enumeration area where the question will be location-activated

2022 Census

CENSO 2022

The Census visited **106.8 million addresses** scattered in **8.5 million km^2**

2022 Census

The Census visited
**106.8 million
addresses**
scattered in
8.5 million km²

Coordinates/Adresses

The **2022 Census** recorded **106.8 million coordinates**

- **81.5%** or **90.6 million** were private households
- **0.1%** or **104.5 thousand** are collective households
- **10.5%** or **11.7 million** of establishments for other purposes (stores, banks, public buildings, shopping malls, among others),
- **264.4 thousand** educational establishments
- **247.5 thousand** health establishments
- **579.8 thousand** religious establishments and
- **3.5 million** buildings under construction or renovation.

Each address has a coordinate. If in the same place there are two types of addresses, such as a private household and an agricultural establishment, then that same address will have two pairs of coordinates, with two different records.

Detalhe da cobertura territorial da coleta em Brasília (DF)

- Estabelecimento agropecuário
- Estabelecimento de ensino
- Estabelecimento de saúde
- Estabelecimento religioso
- Estabelecimento de outras finalidades
- Edificação em construção
- Domicílio particular
- Domicílio coletivo

Fonte: Censo Demográfico 2022: Coordenadas Geográficas dos Endereços

Common Geographies

They provide greater **meaning** to statistical information and allow **integration** between different types of information such as **remote sensing** and **demographic data**.

Legal geographies published by IBGE

IBGE Geographies

Quadro Geográfico de Referência para Produção, Análise e Disseminação de Estatística

Recortes legais publicados pelo IBGE

Divisão político-administrativa	Divisão regional	Tipologias geográficas
Grande Região	Recorte Metropolitano	Área Urbana
Estado	Categoria Metropolitana	Área Rural
Distrito Federal	Subcategoria Metropolitana	Terra Indígena
Município	Aglomeração Urbana	
Distrito	Amazônia Legal	
Subdistrito	Área de Atuação da SUDENE	
Bairro	Semiárido	
	MATOPIBA	
	Municípios Costeiros	
	Municípios Defrontantes com o Mar	
	Municípios da Faixa de Fronteira	

Recortes Institucionais do IBGE

Unidades de coleta e divulgação de pesquisa	Tipologias geográficas	Divisão regional
Área de Ponderação	Área Urbana de Alta Densidade de Edificações	Região Geográfica
Área de Divulgação da Amostra para Aglomerado Subnormal	Área Urbana de Baixa Densidade de Edificações	Mesorregião e Microrregião Geográficas
Grades de Referência Estatística	Aglomerado Subnormal	Divisão Urbano Regional
Setor Censitário	Núcleo Urbano	Região Rural
Face	Demais Tipos de Setores Censitários	
Endereço	Aldeia Indígena	Recortes Específicos
	Aglomerado Rural	Bioma
	Área Rural (exceto aglomerados)	
	Agrovila do Projeto de Assentamento	
	Concentração Urbana	
	Arranjo Populacional	
	Hierarquia Urbana	

Amostra / Divulgação / Universo / Coleta

Áreas Urbanas / Áreas Rurais

- Recortes compostos por agregados de Setores Censitários
- Recortes compostos por agregados de Municípios

Fonte: IBGE, Diretoria de Geociências, Coordenação de Geomática

New Common Geographies?

Census Blocks or Census subsectors

New Geographies – Intra-urban localities

São Lourenço (MG)

Possible new common geographies using **neighborhoods** established by municipal law and **areas recognized by their inhabitants** through the response of the 2022 Census.
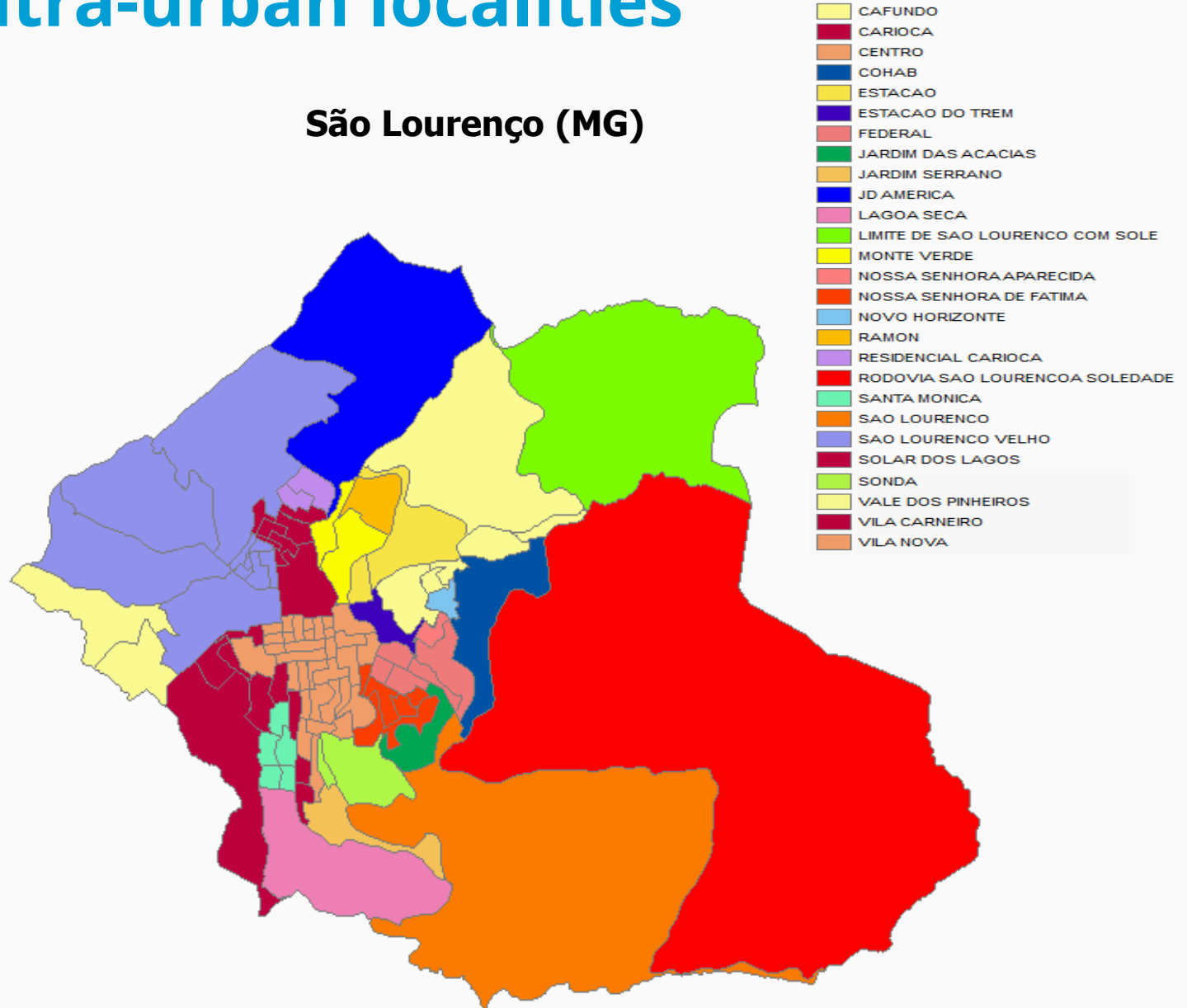
Legend:
- CAFUNDO
- CARIOCA
- CENTRO
- COHAB
- ESTACAO
- ESTACAO DO TREM
- FEDERAL
- JARDIM DAS ACACIAS
- JARDIM SERRANO
- JD AMERICA
- LAGOA SECA
- LIMITE DE SAO LOURENCO COM SOLE
- MONTE VERDE
- NOSSA SENHORA APARECIDA
- NOSSA SENHORA DE FATIMA
- NOVO HORIZONTE
- RAMON
- RESIDENCIAL CARIOCA
- RODOVIA SAO LOURENCOA SOLEDADE
- SANTA MONICA
- SAO LOURENCO
- SAO LOURENCO VELHO
- SOLAR DOS LAGOS
- SONDA
- VALE DOS PINHEIROS
- VILA CARNEIRO
- VILA NOVA

https://censo2022.ibge.gov.br/panorama/index.html

Crescimento populacional
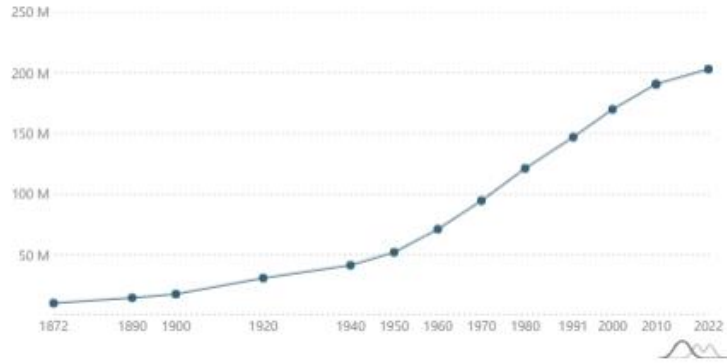
Território
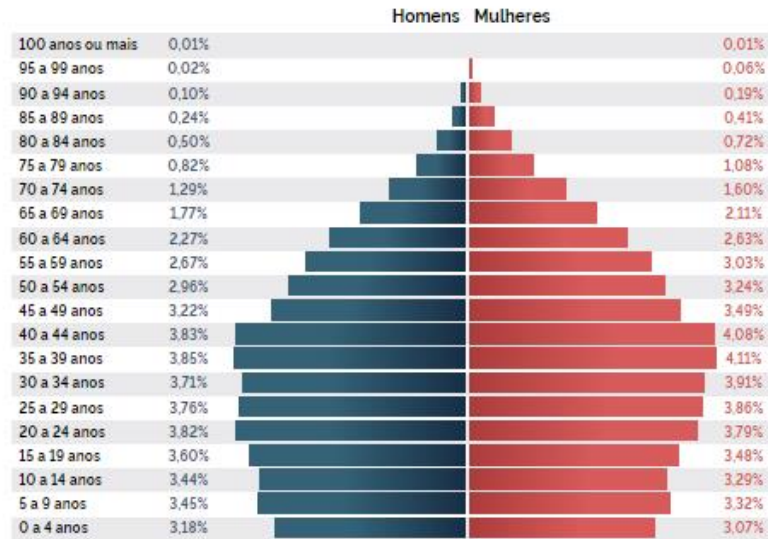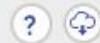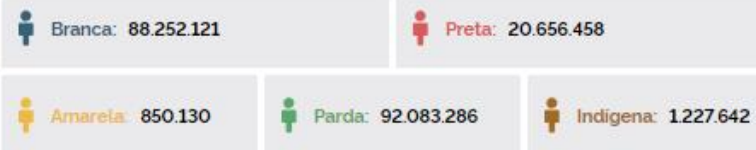
Área: 8.510.417,77 km2

Densidade demográfica: 23,86 hab/km2

- Mais de 20 milhões de pessoas
- 10 milhões a 20 milhões de pessoas
- 5 milhões a 10 milhões de pessoas
- 1 milhão a 5 milhões de pessoas
- Menos de 1 milhão de pessoas

Pirâmide etária

Idade	Homens	Mulheres
100 anos ou mais	0,01%	0,01%
95 a 99 anos	0,02%	0,06%
90 a 94 anos	0,10%	0,19%
85 a 89 anos	0,24%	0,41%
80 a 84 anos	0,50%	0,72%
75 a 79 anos	0,82%	1,08%
70 a 74 anos	1,29%	1,60%
65 a 69 anos	1,77%	2,11%
60 a 64 anos	2,27%	2,63%
55 a 59 anos	2,67%	3,03%
50 a 54 anos	2,96%	3,24%
45 a 49 anos	3,22%	3,49%
40 a 44 anos	3,83%	4,08%
35 a 39 anos	3,85%	4,11%
30 a 34 anos	3,71%	3,91%
25 a 29 anos	3,76%	3,86%
20 a 24 anos	3,82%	3,79%
15 a 19 anos	3,60%	3,48%
10 a 14 anos	3,44%	3,29%
5 a 9 anos	3,45%	3,32%
0 a 4 anos	3,18%	3,07%

Cor ou Raça (cada bloco = 0.5%)

- Branca: 88.252.121
- Preta: 20.656.458
- Amarela: 850.130
- Parda: 92.083.286
- Indígena: 1.227.642

https://censo2022.ibge.gov.br/apps/pgi

Interactive Geographic Platform - PGI

https://censo2022.ibge.gov.br/apps/pgi/#/home/

Join us!

Next event: *Eighth meeting of the Expert Group on the Integration of Statistical and Geospatial* will be held in Nairobi, Kenya, from 17 – 19 September 2024.