The GSGF and beyond

The integration of statistics and geospatial information and Climate Change and Disasters Related Statistics

Mr. Claudio Stenner, IBGE, Brazil

Mrs. Lorraine McNerney, Ordnance Survey Ireland

Global Webinar on Strengthening Climate Change and Disaster-Related Statistics: Needs, Priorities, and Action - 04/05/2023

United Nations Expert Group on the Integration of Statistical and Geospatial Information

DO WE HAVE THE DATA WE NEED?

1 NO POVERTY
1.1.1 47.15 % · 1.2.1 16.06 % · 1.2.2 6.42 % · 1.3.1 23.75 % · 1.4.1 99.22 % · 1.4.2 0 % · 1.5.1 42.33 % · 1.5.2 27.83 % · 1.5.3 53.37 % · 1.5.4 43.70 % · 1.a.1 44.56 % · 1.a.2 60.10 % · 1.b.1 0 %

2 ZERO HUNGER
2.1.1 100.00 % · 2.1.2 100.00 % · 2.2.1 49.22 % · 2.2.2 33.94 % · 2.2.3 98.45 % · 2.3.1 100.00 % · 2.3.2 100.00 % · 2.4.1 0 % · 2.5.1 100.00 % · 2.5.2 100.00 % · 2.a.1 100.00 % · 2.a.2 90.91 % · 2.b.1 8.29 % · 2.c.1 100.00 %

3 GOOD HEALTH AND WELL-BEING
3.1.1 94.82 % · 3.1.2 52.33 % · 3.2.1 99.48 % · 3.2.2 99.48 % · 3.3.1 61.14 % · 3.3.2 99.48 % · 3.3.3 73.29 % · 3.3.4 24.35 % · 3.3.5 99.48 % · 3.4.1 94.82 % · 3.4.2 94.82 % · 3.5.1 7.77 % · 3.5.2 96.37 % · 3.6.1 94.82 % · 3.7.1 11.92 % · 3.7.2 58.03 % · 3.8.1 94.82 % · 3.8.2 4.15 % · 3.9.1 0 % · 3.9.2 0 % · 3.9.3 94.82 % · 3.a.1 81.35 % · 3.b.1 84.72 % · 3.b.2 90.91 % · 3.b.3 0.52 % · 3.c.1 73.58 % · 3.d.1 98.45 % · 3.d.2 27.72 %

4 QUALITY EDUCATION
4.1.1 45.60 % · 4.1.2 11.92 % · 4.2.1 0 % · 4.2.2 69.95 % · 4.3.1 8.29 % · 4.4.1 35.75 % · 4.5.1 28.58 % · 4.6.1 0.52 % · 4.7.1 0 % · 4.a.1 38.64 % · 4.b.1 90.91 % · 4.c.1 48.70 %

5 GENDER EQUALITY
5.1.1 26.94 % · 5.2.1 0 % · 5.2.2 0 % · 5.3.1 0 % · 5.3.2 0 % · 5.4.1 1.55 % · 5.5.1 77.55 % · 5.5.2 43.52 % · 5.6.1 0.52 % · 5.6.2 0 % · 5.a.1 4.15 % · 5.a.2 100.00 % · 5.b.1 29.02 % · 5.c.1 0 %

6 CLEAN WATER AND SANITATION
6.1.1 66.84 % · 6.2.1 72.19 % · 6.3.1 0 % · 6.3.2 21.37 % · 6.4.1 100.00 % · 6.4.2 91.19 % · 6.5.1 88.60 % · 6.5.2 100.00 % · 6.6.1 74.58 % · 6.a.1 89.51 % · 6.b.1 37.82 %

7 AFFORDABLE AND CLEAN ENERGY
7.1.1 100.00 % · 7.1.2 97.41 % · 7.2.1 98.96 % · 7.3.1 98.96 % · 7.a.1 65.80 % · 7.b.1 74.09 %

8 DECENT WORK AND ECONOMIC GROWTH
8.1.1 100.00 % · 8.10.1 87.05 % · 8.10.2 0 % · 8.2.1 92.23 % · 8.3.1 20.73 % · 8.4.1 0 % · 8.4.2 95.85 % · 8.5.1 20.21 % · 8.5.2 35.75 % · 8.6.1 51.30 % · 8.7.1 0 % · 8.8.1 21.76 % · 8.8.2 67.36 % · 8.9.1 27.98 % · 8.a.1 43.26 % · 8.b.1 52.33 %

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
9.1.1 0 % · 9.1.2 92.57 % · 9.2.1 98.96 % · 9.2.2 56.99 % · 9.3.1 27.46 % · 9.3.2 1.04 % · 9.4.1 72.54 % · 9.5.1 47.15 % · 9.5.2 41.97 % · 9.a.1 90.91 % · 9.b.1 76.17 % · 9.c.1 98.62 %

10 REDUCED INEQUALITIES
10.1.1 0 % · 10.2.1 32.64 % · 10.3.1 4.15 % · 10.4.1 92.23 % · 10.4.2 17.10 % · 10.5.1 65.66 % · 10.6.1 100.00 % · 10.7.1 0 % · 10.7.2 0 % · 10.7.3 100.00 % · 10.7.4 100.00 % · 10.a.1 99.48 % · 10.b.1 47.93 % · 10.c.1 34.37 %

11 SUSTAINABLE CITIES AND COMMUNITIES
11.1.1 60.62 % · 11.2.1 0 % · 11.3.1 0 % · 11.3.2 0 % · 11.4.1 0 % · 11.5.1 42.33 % · 11.5.2 21.97 % · 11.6.1 1.04 % · 11.6.2 99.48 % · 11.7.1 0 % · 11.7.2 0 % · 11.a.1 0 % · 11.b.1 53.37 % · 11.b.2 43.70 %

12 RESPONSIBLE CONSUMPTION AND PRODUCTION
12.1.1 0 % · 12.2.1 0 % · 12.2.2 95.85 % · 12.3.1 0 % · 12.4.1 91.71 % · 12.4.2 14.25 % · 12.5.1 10.88 % · 12.6.1 0 % · 12.7.1 0 % · 12.8.1 0 % · 12.a.1 74.09 % · 12.b.1 72.02 % · 12.c.1 65.11 %

13 CLIMATE ACTION
13.1.1 42.33 % · 13.1.2 53.37 % · 13.1.3 43.70 % · 13.2.1 0 % · 13.2.2 12.44 % · 13.3.1 0 % · 13.a.1 0 % · 13.b.1 0 %

14 LIFE BELOW WATER
14.1.1 65.46 % · 14.2.1 0 % · 14.3.1 11.40 % · 14.4.1 0 % · 14.5.1 88.20 % · 14.6.1 100.00 % · 14.7.1 100.00 % · 14.a.1 14.29 % · 14.b.1 100.00 % · 14.c.1 0 %

15 LIFE ON LAND
15.1.1 100.00 % · 15.1.2 88.86 % · 15.2.1 100.00 % · 15.3.1 0 % · 15.4.1 83.42 % · 15.4.2 100.00 % · 15.5.1 100.00 % · 15.6.1 100.00 % · 15.7.1 0 % · 15.8.1 66.58 % · 15.9.1 0 % · 15.a.1 43.01 % · 15.b.1 43.01 % · 15.c.1 0 %

16 PEACE, JUSTICE AND STRONG INSTITUTIONS
16.1.1 47.93 % · 16.1.2 0 % · 16.1.3 6.39 % · 16.1.4 8.29 % · 16.10.1 0 % · 16.10.2 0 % · 16.2.1 0 % · 16.2.2 27.46 % · 16.2.3 0 % · 16.3.1 4.32 % · 16.3.2 75.13 % · 16.3.3 0 % · 16.4.1 0 % · 16.4.2 0 % · 16.5.1 2.59 % · 16.5.2 1.04 % · 16.6.1 63.21 % · 16.6.2 0 % · 16.7.1 0 % · 16.7.2 0 % · 16.8.1 100.00 % · 16.9.1 0 % · 16.a.1 27.07 % · 16.b.1 4.15 %

17 PARTNERSHIPS FOR THE GOALS
17.1.1 76.68 % · 17.1.2 75.65 % · 17.10.1 72.02 % · 17.11.1 0 % · 17.12.1 98.60 % · 17.13.1 78.36 % · 17.14.1 0 % · 17.15.1 0 % · 17.16.1 0 % · 17.17.1 65.80 % · 17.18.1 0 % · 17.18.2 100.00 % · 17.18.3 100.00 % · 17.19.1 0 % · 17.19.2 76.68 % · 17.2.1 56.00 % · 17.3.1 96.89 % · 17.3.2 92.75 % · 17.4.1 59.59 % · 17.5.1 0 % · 17.6.1 97.41 % · 17.7.1 0 % · 17.8.1 97.93 % · 17.9.1 90.91 %

We are almost seven years to 2030 – the year when we should have realized the ambition of the 2030 Agenda – but we are far behind.

*This graphic visualizes the global data collected from the SDGs. We are off track from where we need to be in our global journey for sustainable development, **we must leave no-one behind**. We need data to make informed decisions…*

Legends: 0-25% · 25-50% · 50-75% · 75-100% · Not Applicable

Source: SDG Global Database https://unstats.un.org/sdgs/unsdg

United Nations Expert Group on the Integration of Statistical and Geospatial Information

What is the Data We Need:
The Global Fundamental Geospatial Data Themes

Global Geodetic Reference Frame

Addresses
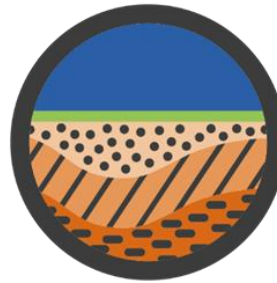
Buildings and Settlements

Elevation and Depth

Functional Areas

Geographical Names

Geology and Soils

Land Cover and Use
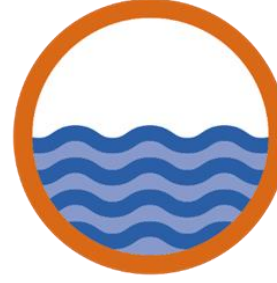
Land Parcels

Orthoimagery
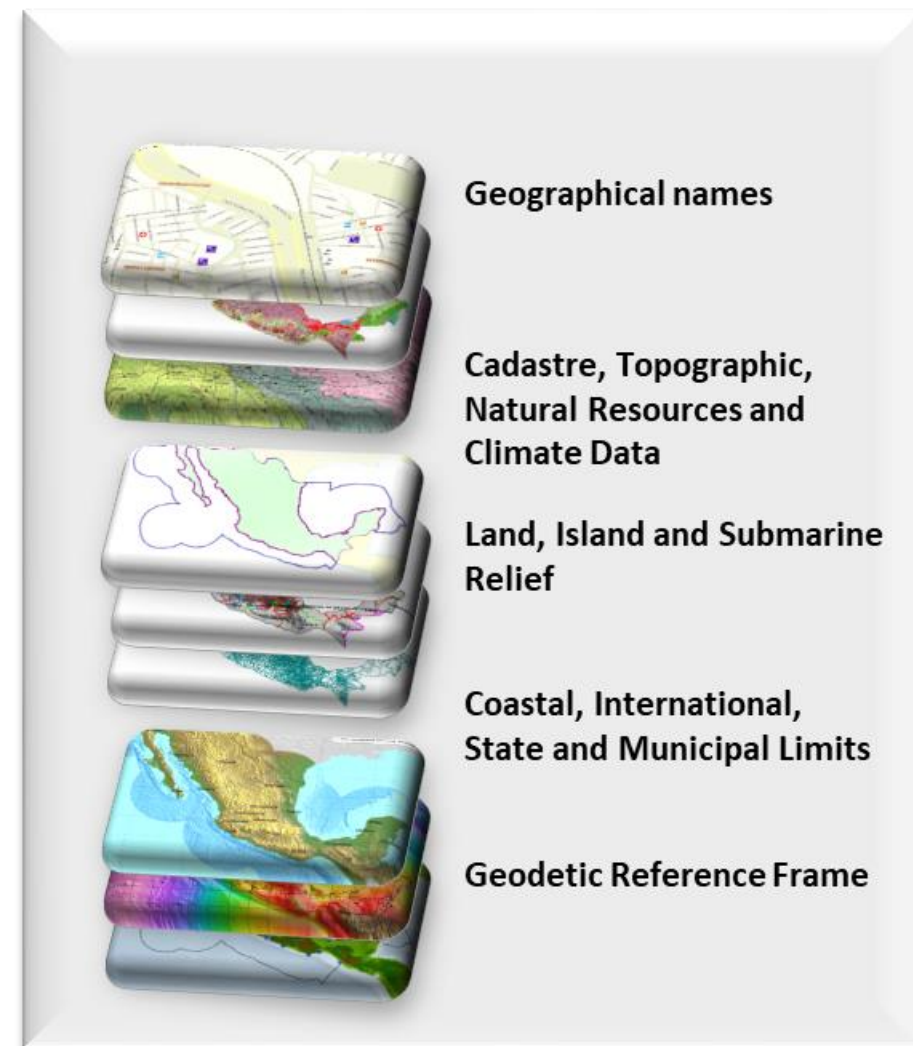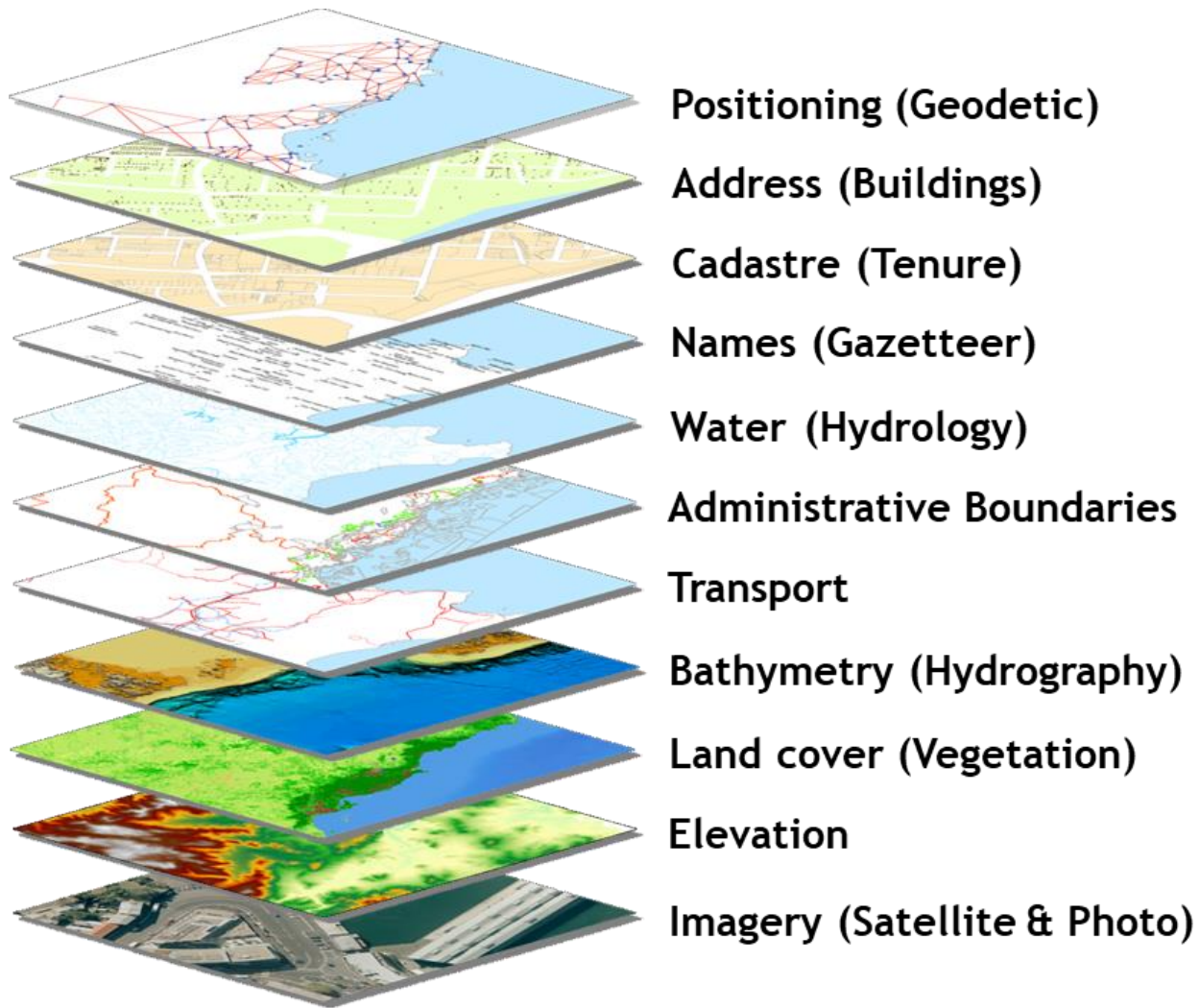
Physical Infrastructure

Population Distribution

Transport Networks

Water

THE GLOBAL FUNDAMENTAL GEOSPATIAL DATA THEMES

Positioning (Geodetic)

Address (Buildings)

Cadastre (Tenure)

Names (Gazetteer)

Water (Hydrology)

Administrative Boundaries

Transport

Bathymetry (Hydrography)

Land cover (Vegetation)

Elevation

Imagery (Satellite & Photo)

Geographical names

Cadastre, Topographic, Natural Resources and Climate Data

Land, Island and Submarine Relief

Coastal, International, State and Municipal Limits

Geodetic Reference Frame

THE SUSTAINABLE DEVELOPMENT GOALS REPORT 2022

The Sustainable Development Goals Report 2022

" We must rise higher to rescue the Sustainable Development Goals – and stay true to our promise of a world of peace, dignity and prosperity on a healthy planet...

... However, *significant data gaps still exist in terms of geographic coverage, timeliness and level of disaggregation, making it difficult to fully comprehend the pace of progress towards the realization of the 2030 Agenda, differences across regions and who is being left behind... "*

António Guterres
Secretary General, United Nations

United Nations

United Nations Expert Group on the Integration of Statistical and Geospatial Information

THE NEED TO STRENGTHEN THE INTEGRATION OF STATISTICAL AND GEOSPATIAL INFORMATION IS DEMANDED BY MANDATES

ECOSOC Resolution E/RES/2022/3: *Ensuring that the work in the field of statistics and data is adaptive to the changing statistical and data ecosystem*

- *"Emphasizes the importance for Member States to build resilient, agile, relevant, responsive and robust statistical and data systems adhering to the Fundamental Principles of Official Statistics that fully integrate geospatial information and to seek improved coordination across national statistical and data systems through an expanded role of the national statistical offices in the changing data landscape, where they are increasingly assigned data stewardship responsibilities in the national statistical and data systems"*

ECOSOC Resolution E/RES/2022/24: *Enhancing global geospatial information management arrangements*

- *"Reiterates the importance of strengthening and enhancing the effectiveness of the Committee of Experts, particularly for the achievement of its operations focused on the Sustainable Development Goals and the Integrated Geospatial Information Framework, to strengthen and ensure its continued effectiveness and benefits to all Member States"*

https://ggim.un.org/Mandates/

The Expert Group on the Integration Of Statistical and Geospatial Information (EG-ISGI)

Composed of Experts in Statistical and Geospatial Integration from NSOs and NGIAs with:

- **29** Member States,
- **5** UN Regional Commissions,
- **3** UN Agencies and
- **4** International Organizations

It reports to both the UN Statistical Commission and the UN Committee of Experts on Global Geospatial Information Management (UN-GGIM) and is guided by their mandates.

THE EXPERT GROUP ON THE INTEGRATION OF STATISTICAL AND GEOSPATIAL INFORMATION (EG-ISGI)

UN-GGIM Decision 9/106 (2019): *[Encouraged the Expert Group]* *"...to continue its work to develop guidance on and support the promotion, awareness-raising and implementation of the GSGF*, and its work on statistical geospatial integration and *coordination,* in particular with regard to the Sustainable Development Goals and the 2020 round of population censuses, and encouraged Member States and other stakeholders to participate in, and contribute to, these important elements"*

Statistical Commission Decision 51/123 (2020): *"...welcomed [the Expert Group's] continuing efforts to provide guidance to Member States to support the adoption and implementation of the Global Statistical Geospatial Framework (GSGF)"*

Statistical Commission Decision 53/127 (2022): *endorsed the GSGF Implementation Guide as a practical means to implement the GSGF and to create, disseminate, and utilise geospatially enabled statistics, and welcomed the many use cases and good practices describing how the GSGF has been implemented and operationalized within national and regional contexts;*
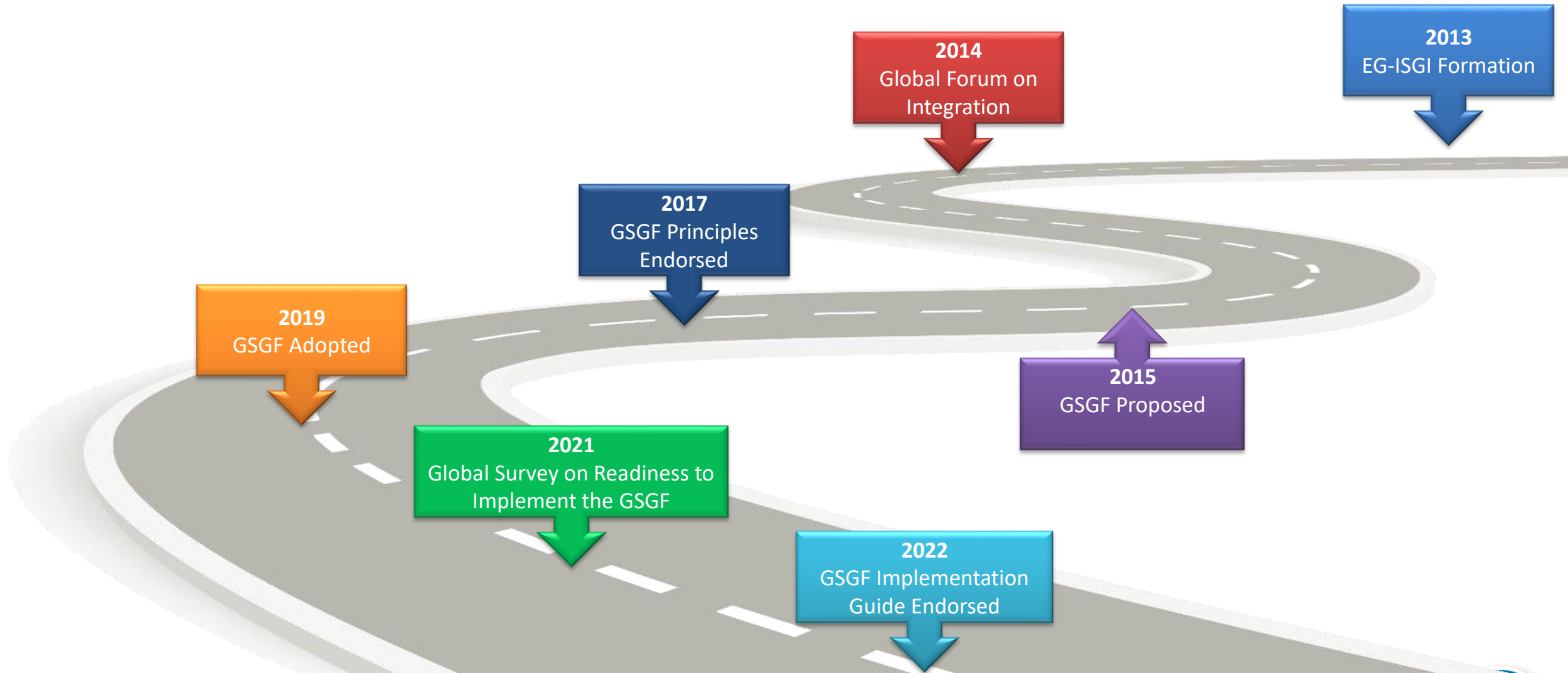
Bridging the Geospatial Digital Divide Through Integration

AI/Machine Learning	Cloud Computing	Internet of Things
Big Data	Earth Observations	Statistics
Geospatial Data	Frontier Technology	Digitization
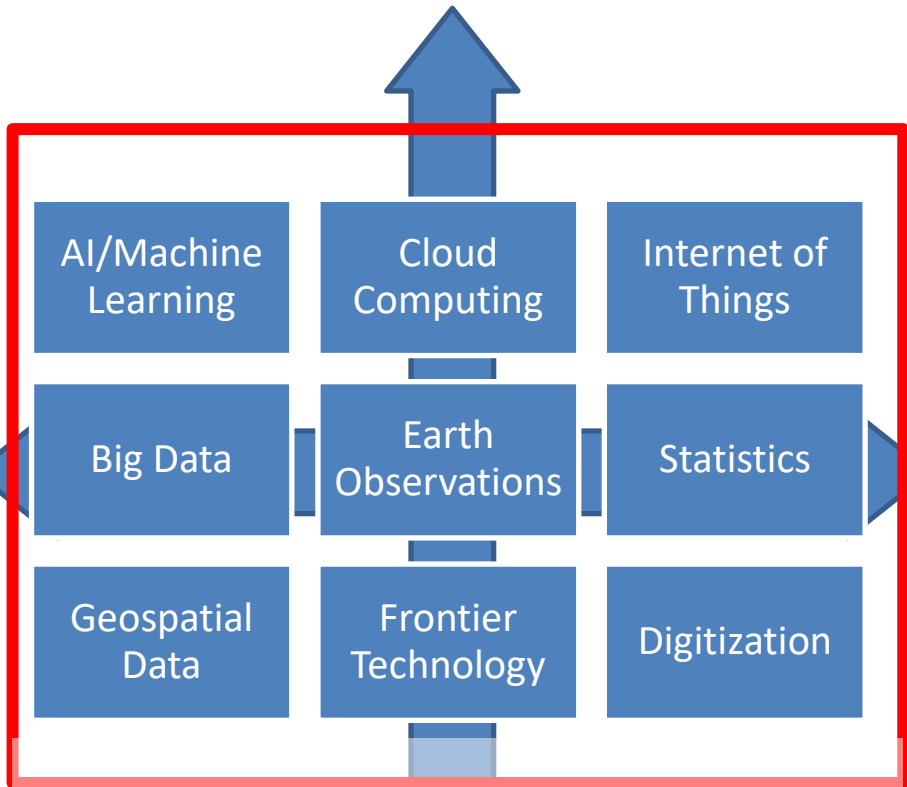
Integration
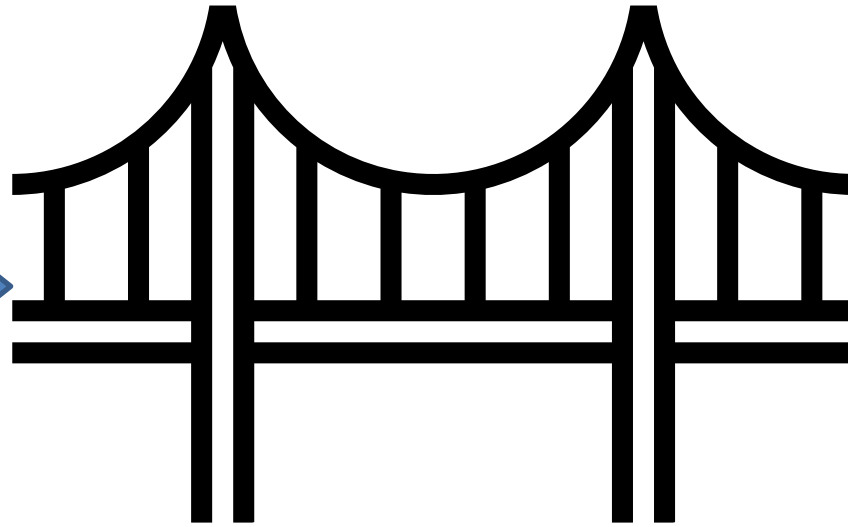
SUSTAINABLE DEVELOPMENT GOALS
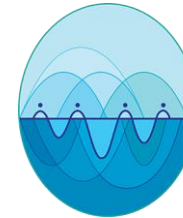
ISLAND VOICES GLOBAL CHOICES

TOGETHER TOWARDS HABITAT III

SENDAI FRAMEWORK
Scope and Purpose
1 Global Outcome
1 Goal
7 Global Targets
13 Guiding Principles
4 Priorities for Action
at 4 Levels
Local, National, Regional and Global
Role of Stakeholders
International Cooperation and Global Partnerships

SENDAI FRAMEWORK
FOR DISASTER RISK REDUCTION 2015-2030

Statistical Commission
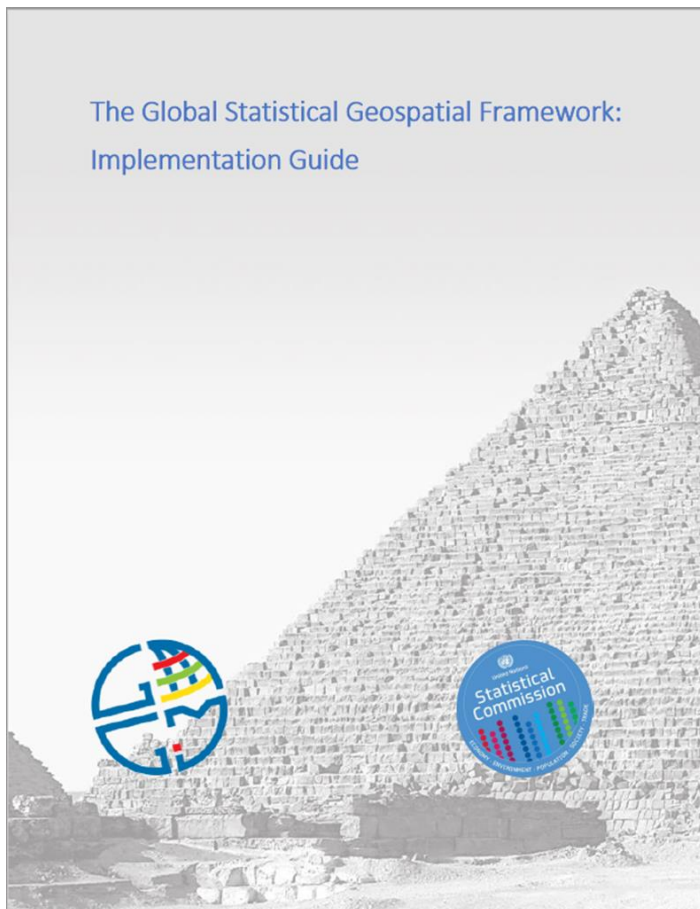
United Nations Expert Group on the Integration of Statistical and Geospatial Information

THE GLOBAL STATISTICAL GEOSPATIAL FRAMEWORK

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**
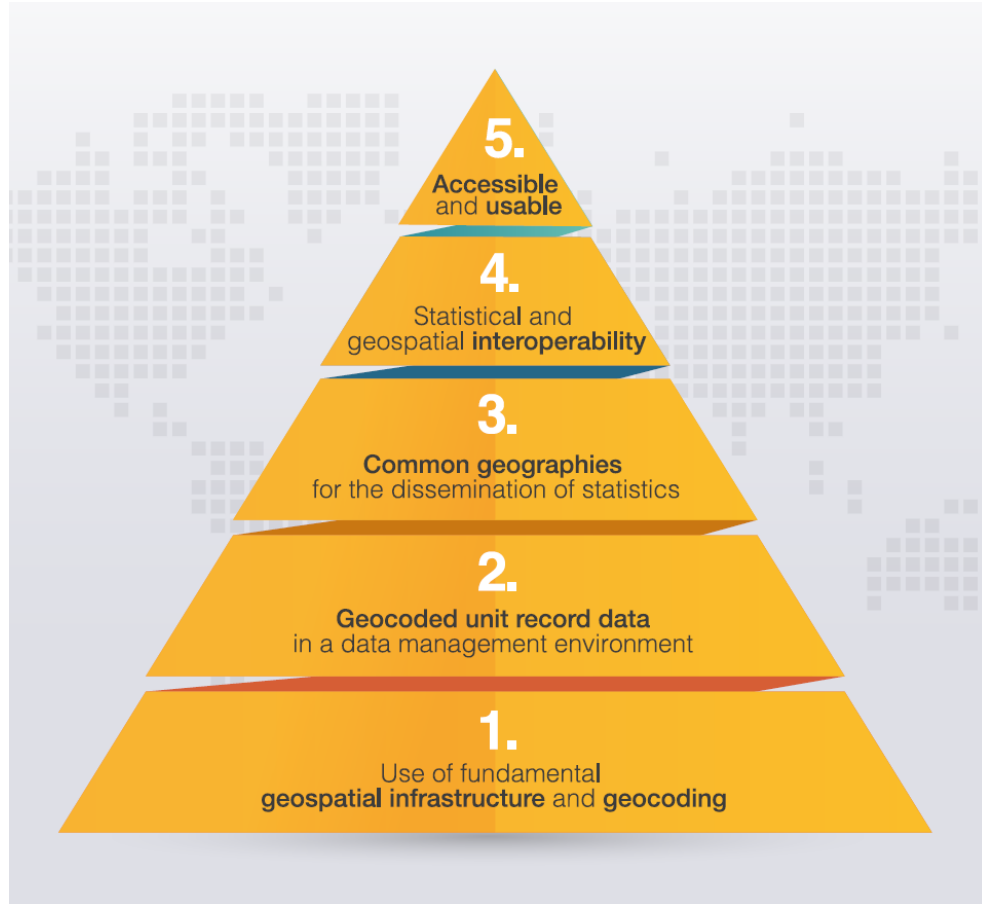
The Global Statistical Geospatial Framework (GSGF) facilitates the integration of statistical and geospatial information.

*A Framework for the world, the GSGF enables **a range of data to be integrated from both statistical and geospatial communities** and, through the application of its five Principles and supporting key elements, permits the production of harmonised and standardised geospatially enabled statistical data. **The resulting data can then be integrated with statistical, geospatial, and other information to inform and facilitate data-driven and evidence-based decision making***

https://ggim.un.org/meetings/GGIM-committee/9th-Session/documents/The_GSGF.pdf

United Nations Expert Group on the Integration of Statistical and Geospatial Information

THE GLOBAL STATISTICAL GEOSPATIAL FRAMEWORK

PRINCIPLES

Accessible & usable

Statistical and geospatial **interoperability**

Common geographies for dissemination of statistics

Geocoded unit record data in a data management environment

Use of fundamental **geospatial infrastructure** and **geocoding**

INPUT

Geospatial
- **Fundamental** data
- **Supplementary** data
- **New data** sources

Statistical
- **Censuses**
- **Surveys**
- Administrative **data records**
- **Big data** and other sources

KEY ELEMENTS

- **Standards** and **Good Practices**
- **National Laws** and **Policy**
- Technical **Infrastructure**
- Institutional **Collaboration**

OUTPUT

- Integration
- **Harmonised** and **standardised** information
- **Interoperability Comparability**
- Analysis
- Diffusion
- **Decision** making

https://ggim.un.org/meetings/GGIM-committee/9th-Session/documents/The_GSGF.pdf

United Nations Expert Group on the Integration of Statistical and Geospatial Information

12

What are the main resources that we already have available?

THE GLOBAL STATISTICAL GEOSPATIAL FRAMEWORK
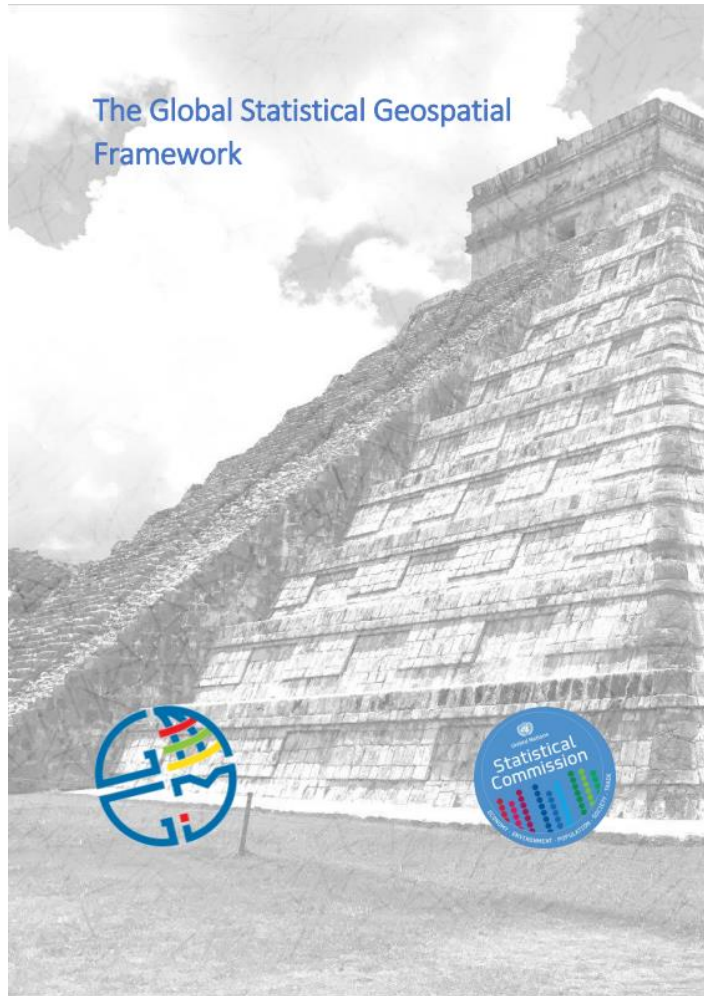
The Global Statistical Geospatial Framework: a 46 pages document that shows and explains the foundations of the GSGF. It is available in six languages:

- English
- Spanish
- French
- Portuguese
- Mandarin
- Arabic

https://ggim.un.org/UNGGIM-expert-group/

THE GLOBAL STATISTICAL GEOSPATIAL FRAMEWORK

Contents

THE GLOBAL STATISTICAL GEOSPATIAL FRAMEWORK

The Global Statistical Geospatial Framework: Implementation Guide

The Global Statistical Geospatial Framework Implementation Guide: A 149-page document detailing the implementation of the GSGF, including country-level experience from 30 countries. Available in English.

https://ggim.un.org/documents/EG-ISGI-GSGF-Implementation-Guide-E.pdf

THE GSGF IMPLEMENTATION GUIDE

The Global Statistical Geospatial Framework: Implementation Guide

The GSGF Implementation Guide is composed of three main 'chapters' to help the implementation of the GSGF.

Implementation Guidance
Implementing Geocoding
Implementing Common Geographies
Fostering Interoperability
Ensuring Privacy and Confidentiality

Terminology of the Integration of Statistical and Geospatial Information

Experiences of Implementation
30 National Experiences
5 Regional Experiences

https://unstats.un.org/unsd/statcom/53rd-session/documents/BG-3x-EG-ISGI-GSGF-Implementation-Guide-E.pdf

United Nations Expert Group on the Integration of Statistical and Geospatial Information

- Geocoding is generally defined as the process of **geospatially enabling statistical unit records** or other nonspatial data (such as address lists or housing unit records) by creating **x- and y- (and potentially z) coordinates** and **linking them to each record."**

- Once geocoding is performed on individual statistical unit records can be **aggregated into larger geographic units** (e.g., states, provinces, municipalities, or neighborhood) for statistical analysis.

THE GSGF IMPLEMENTATION GUIDE: GEOCODING

- Such statistical unit records are then ready for further applications such as methodologies to ensure *confidentiality even in small area data disclosure*.

- The GSGF Implementation Guide enables the implementation of the recommendation: *"All statistical unit records should include or be linked to a precise geographic reference (an x- and y- coordinate), and if not, the smallest geographic area possible"*

THE GSGF IMPLEMENTATION GUIDE: COMMON GEOGRAPHIES
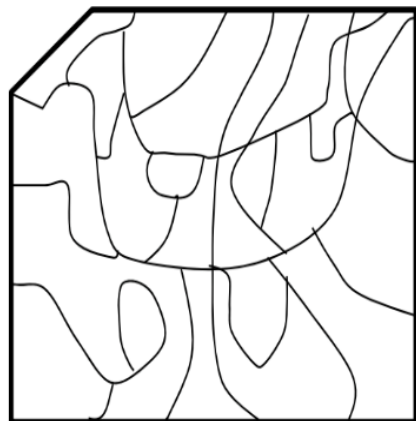
Administrative Geographies

Statistical Geographies
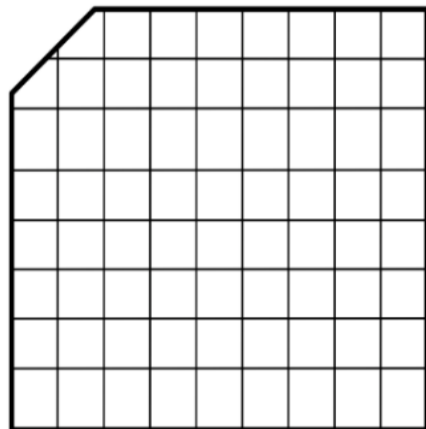
Common geographies are an agreed set of geographic areas for the **display, storage, dissemination, and analysis** of social, economic and environmental comparisons across statistical datasets from different sources. They enable the production and dissemination of integrated statistics and geospatial information within a country to support informed decision-making.

THE GSGF IMPLEMENTATION GUIDE: COMMON GEOGRAPHIES
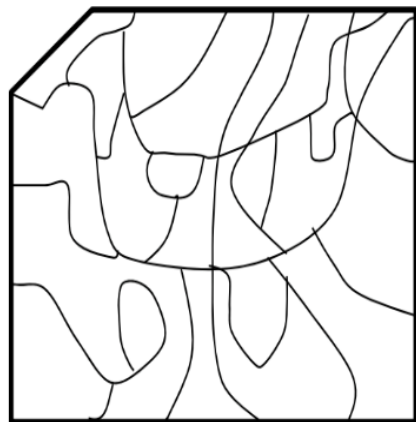
Administrative Geographies

Statistical Geographies
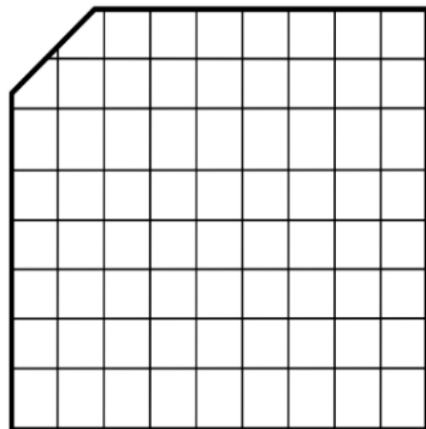
The broad types of *Common Geographies*:

- Geographies defined in law, regulations or constitution - examples include sub-national major political regions, electoral districts and local municipalities. This type of geographic area is often termed Administrative.

- Geographies defined by a set of rules, or a methodology meant to represent a geographic concept such as metro regions, statistical grids and small area dissemination geographies. This type of geographic area is often termed **Statistical** or Geo-Statistical.

THE GSGF IMPLEMENTATION GUIDE: COMMON GEOGRAPHIES

Common Geographies – Administrative – Example of Brazil

Mantendo recortes geográficos relevantes

Common Geographies – Statistical Geographies – Example of Brazil
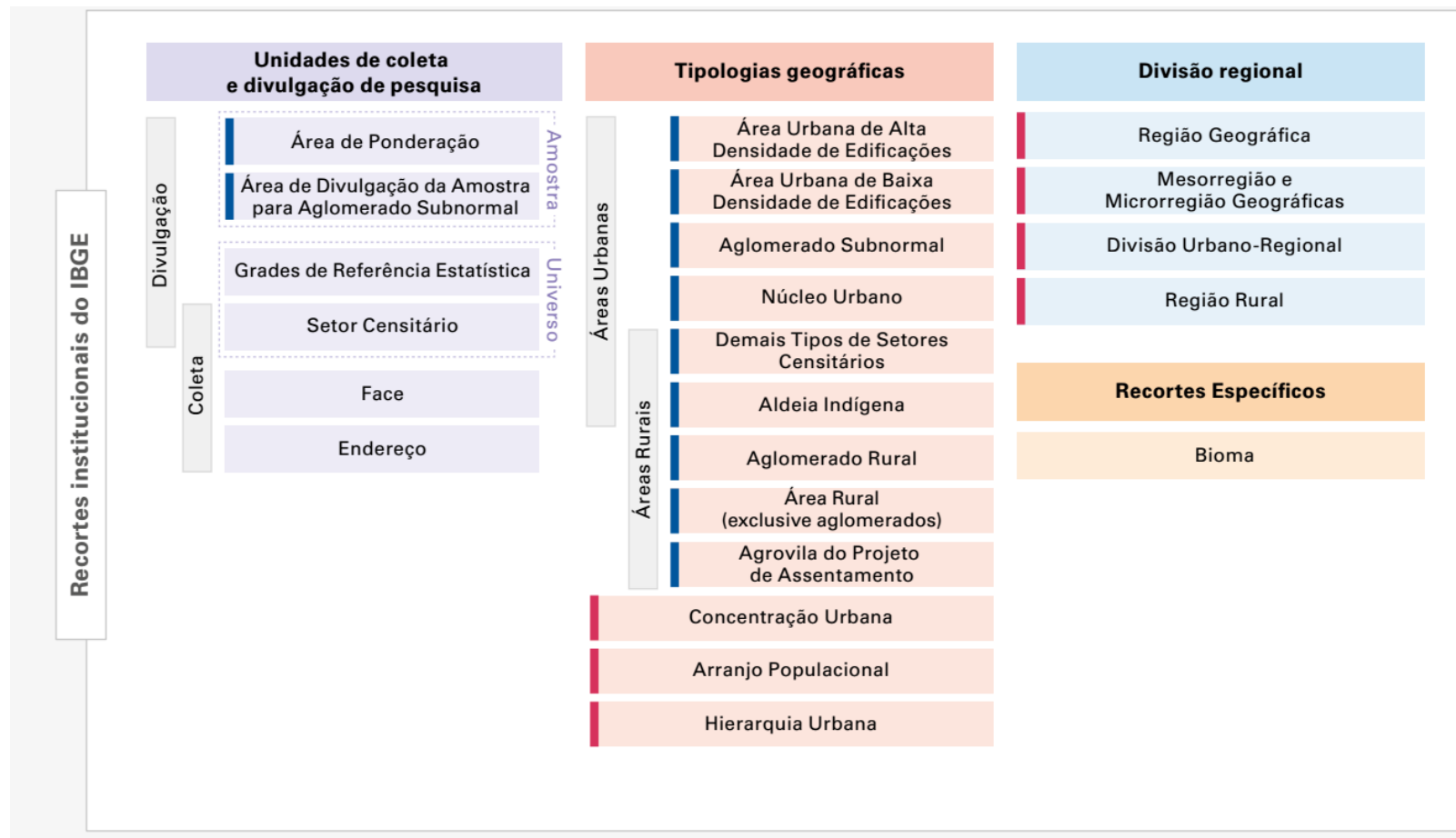
United Nations Expert Group on the Integration of Statistical and Geospatial Information

The GSGF Implementation Guide: Interoperability

Contextualizes the modern needs of NSOs and NGIAs in fostering interoperability, privacy and confidentiality when advancing their use of geospatially enabled statistical data, provides definitions and advice on how **to avoid data disclosure pitfalls:**
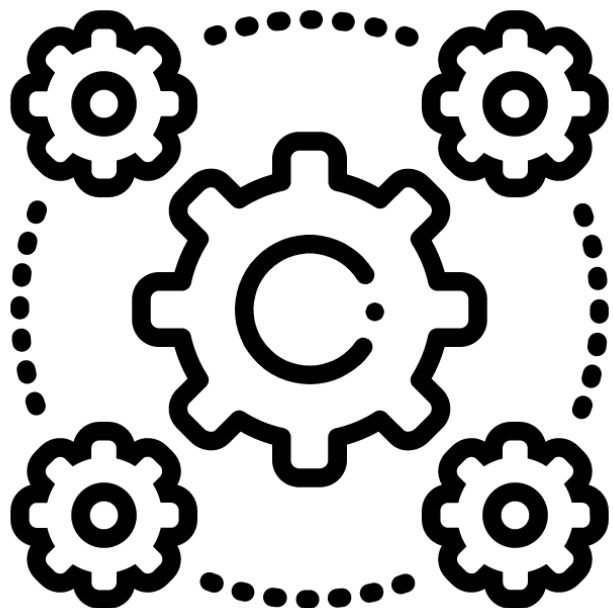
- **Identity disclosure** refers to finding a direct identifier of a statistical unit from the data (for example, name or address);

THE GSGF IMPLEMENTATION GUIDE: INTEROPERABILITY

Contextualizes the modern needs of NSOs and NGIAs in fostering interoperability, privacy and confidentiality when advancing their use of geospatially enabled statistical data, provides definitions and advice on how **to avoid data disclosure pitfalls:**
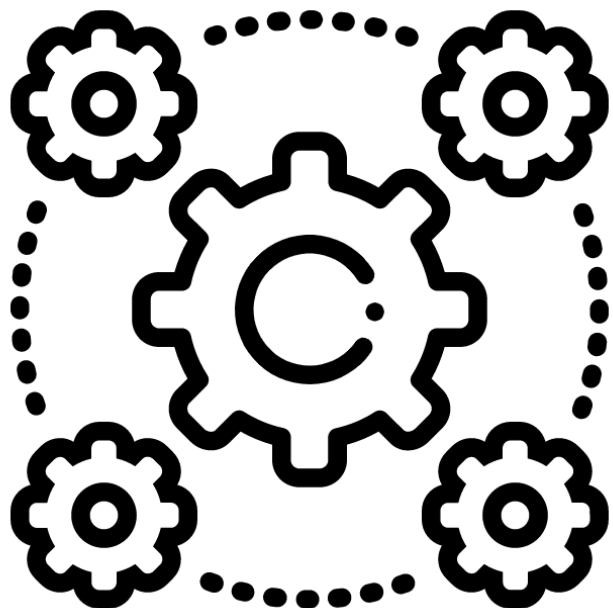
- **Attribute disclosure** refers to revealing an association between a statistical unit and its sensitive features. For example, the user knows someone is living in an area, while the data show that all the inhabitants of this area share a common characteristic, such as income; and,

The GSGF Implementation Guide: Interoperability

Contextualizes the modern needs of NSOs and NGIAs in fostering interoperability, privacy and confidentiality when advancing their use of geospatially enabled statistical data, provides definitions and advice on how **to avoid data disclosure pitfalls:**
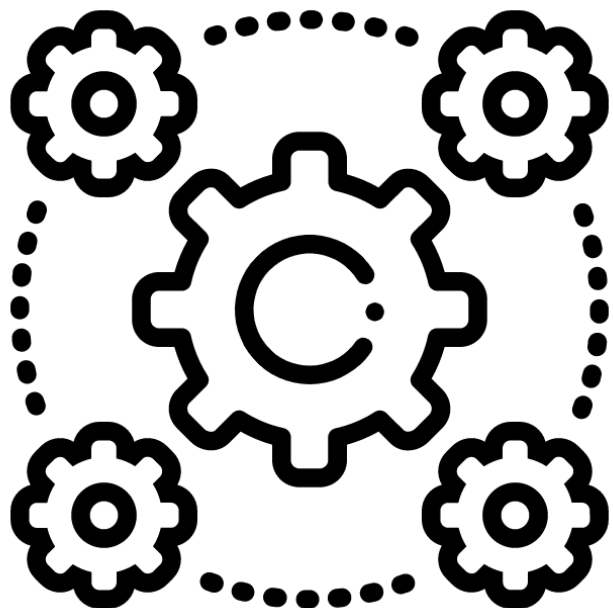
- **Inferential disclosure** refers to inferring some attribute with a high confidence level, where increasing confidence levels is a desirable outcome for statistical data users.

Further, the guide summarises the current state of relevant academic literature and highlights good practices in Privacy and Confidentiality, including within the IGIF.

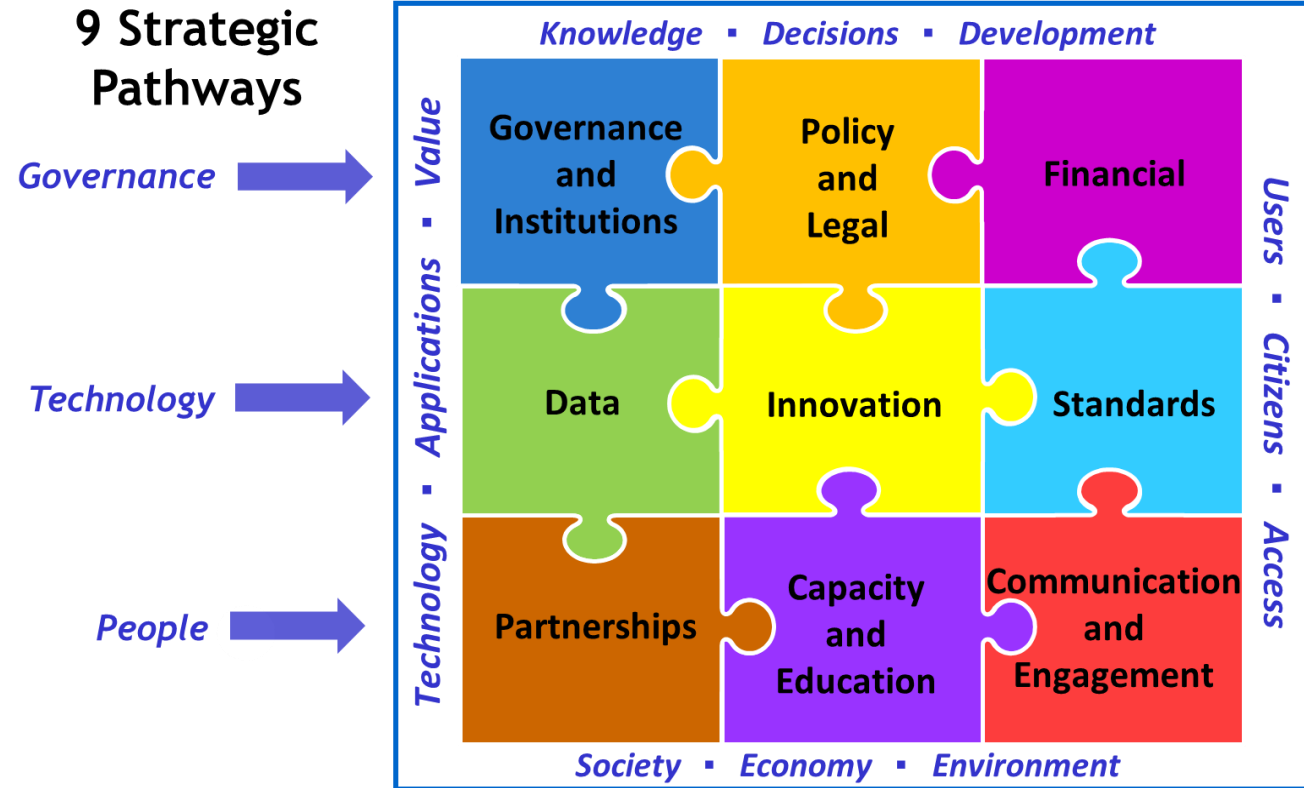# THE GSGF IMPLEMENTATION GUIDE: THE ENABLING ENVIRONMENT

Bridges must have a strong foundation and pillars either side. Geospatially, the Integrated Geospatial Information Framework is a key enabling framework for the GSGF:

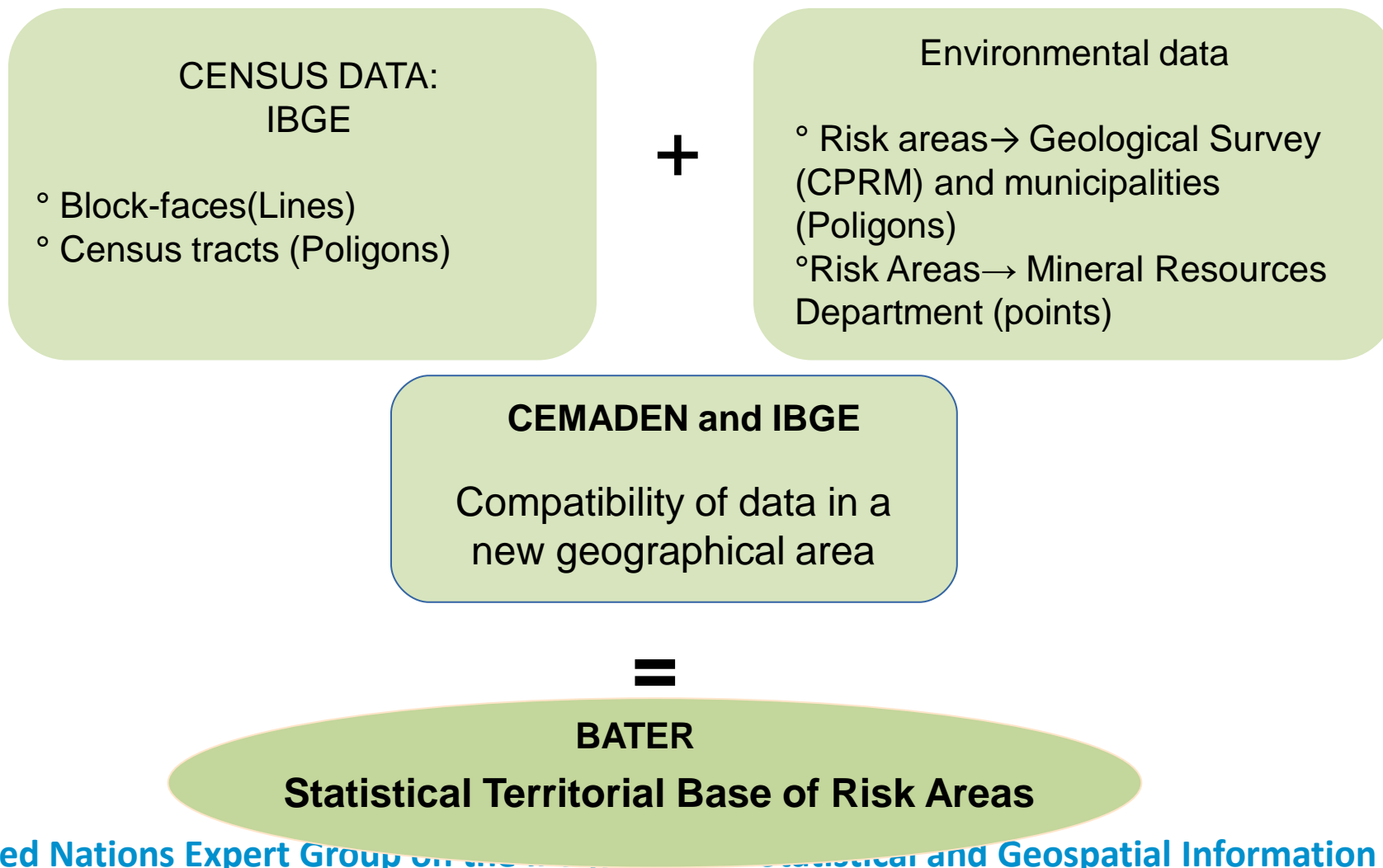**Principle 1: Fundamental geospatial infrastructure**
- The **means of implementing the GSGF is the IGIF**
- The 9 strategic pathways of the IGIF have a strong relevance across the GSGF
- Conversely, the GSGF is a key enabler for Strategic Pathway 4: Data

Principle 5: Accessible and Usable
- Promoting the availability of geospatially enabled **_statistical_** data … *and other forms of data?*
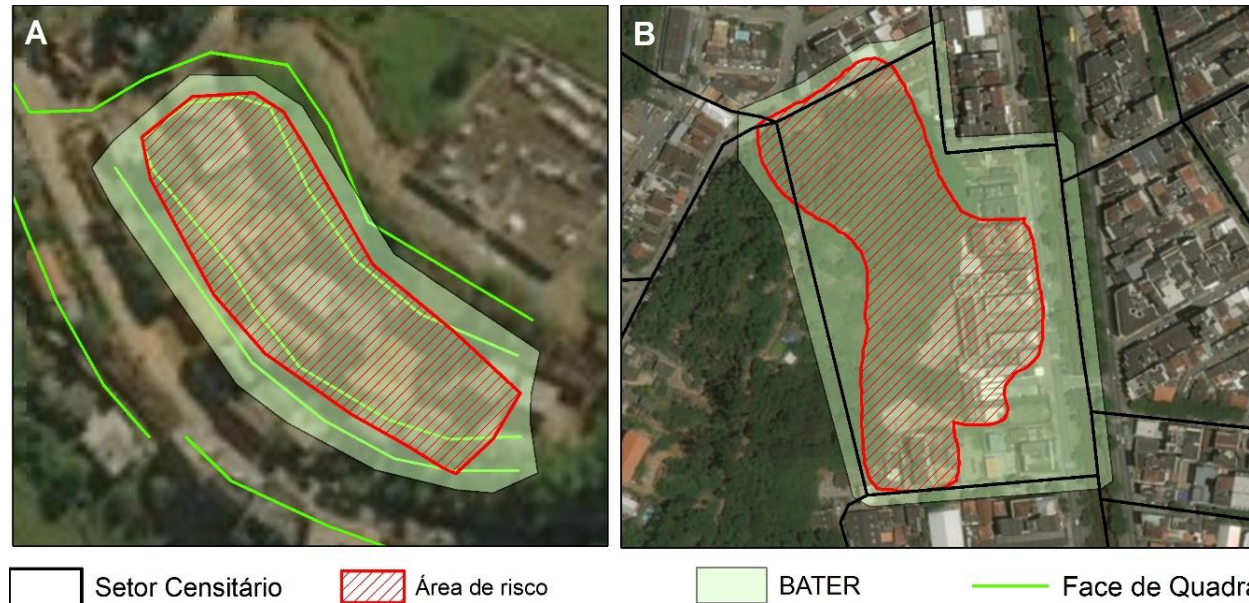
9 Strategic Pathways

Governance →

Technology →

People →

CENSUS DATA:
IBGE

° Block-faces(Lines)
° Census tracts (Poligons)

+

Environmental data

° Risk areas→ Geological Survey (CPRM) and municipalities (Poligons)
°Risk Areas→ Mineral Resources Department (points)

CEMADEN and IBGE

Compatibility of data in a new geographical area

=

BATER
Statistical Territorial Base of Risk Areas

Methodological Issues

- Sociodemographic data were associated with areas at risk of flooding, and landslides for 872 Brazilian municipalities, through **BATER**.

- **BATER** - new geography; smallest possible area resulting from the intersection of risk areas with the census features most adherent to the objectives of the work.

| Setor Censitário | Área de risco | BATER | Face de Quadra |

Fonte: IBGE. Diretoria de Geociências, Coordenação de Geografia

NATIONAL EXPERIENCE: HOW MANY PEOPLE LIVE IN AREAS AT RISK OF LANDSLIDES OR FLOODING IN BRAZIL?

RIO DE JANEIRO (RJ)
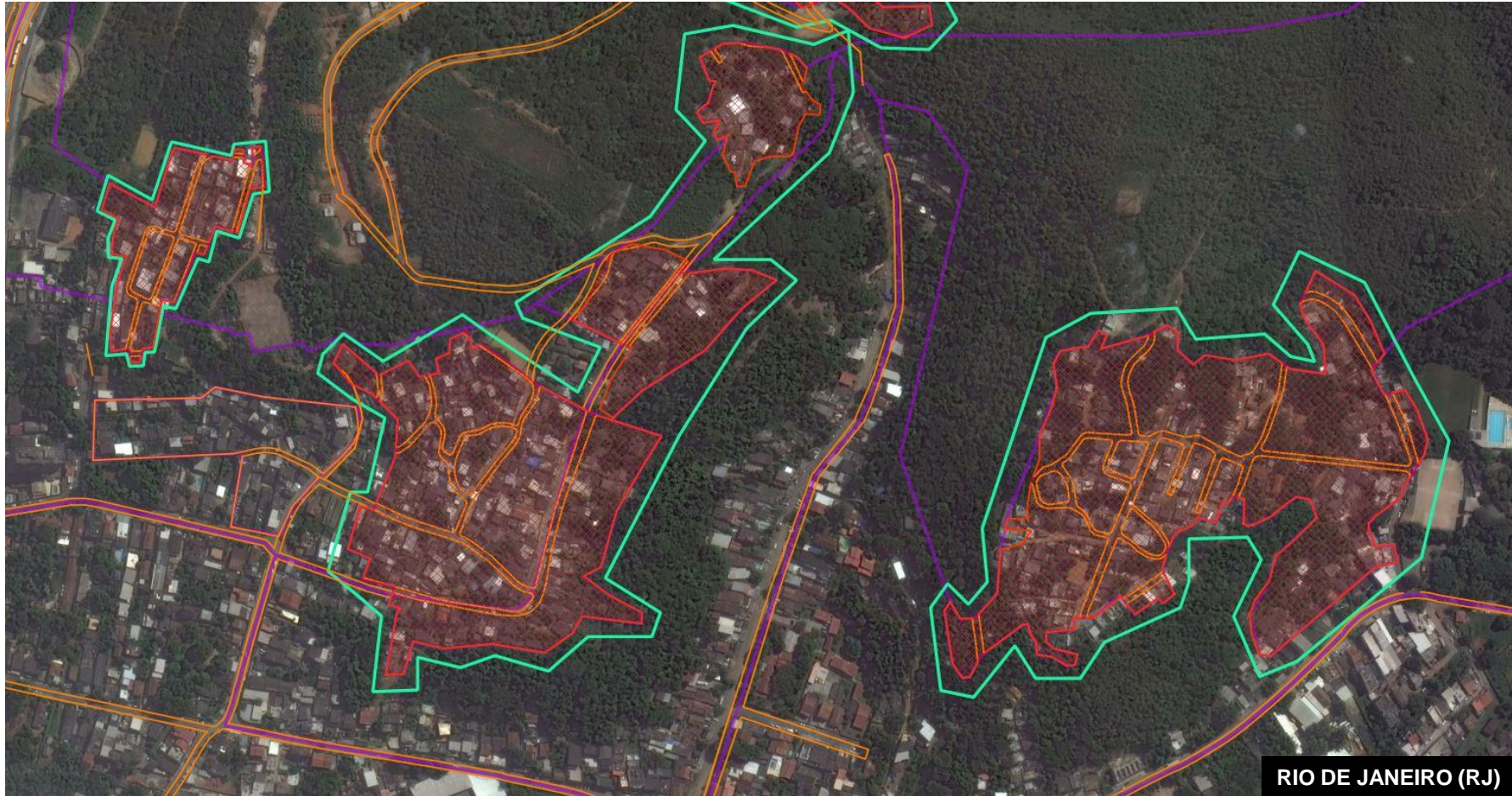
BATER —— SQUARE FACES CENSUS TRACTS

RISK AREAS

United Nations Expert Group on the Integration of Statistical and Geospatial Information

Household Geocoded: possibilities in the horizon

- With the expansion of the georeferencing coverage of the 2022 Census, new possibilities are in the horizon using greater precision and accuracy of coordinates to generate risk information;

- The integration of census data with risk area mapping data can be done in a more automatic/organic way due to the granularity of the information, possibly reducing the percentage of areas that used census tracts and also those without associated demographic data, improving the quality of information;

- Small areas have more possibility to have information about risk, observing confidentiality (possibly including random noise).

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POSSIBLE BENEFITS OF IMPLEMENTING THE GSGF TO CLIMATE CHANGE AND DISASTERS RELATED STATISTICS

- Possibility of producing more accurate statistics for populations affected by climate change or subject to natural disasters, with guarantee of confidentiality.

- possibility of generating statistics more adherent to the needs of decision makers.

- Possibility of integration and intersection between different data sources, such as demographic censuses, soil mapping, geological mapping, rainfall data, etc.

- Presentation of statistics in a friendly way, using interactive maps.

- Possibility of creating new knowledge by crossing different themes in the territory and using spatial analysis tools.

Thank you very much!

claudio.Stenner@ibge.gov.br