Session 7

Use of Geospatial Information in Support of Census Operations

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Introduction

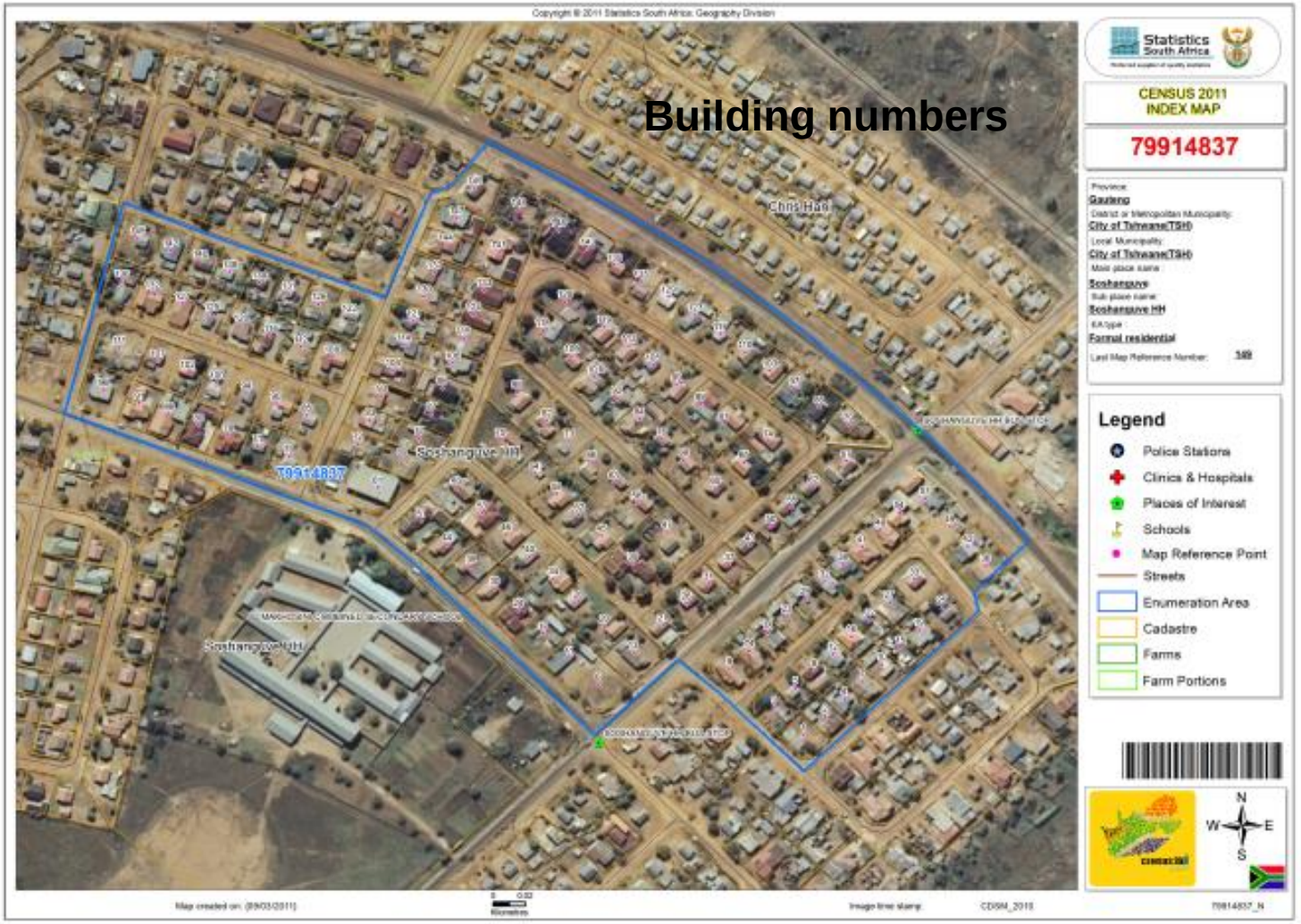
- Census maps are essential to plan and manage fieldwork as well as to report results

- New geospatial capabilities have enabled NSOs to collect more accurate and timely information about their populations as a result of technological advances in:
  - Global Navigation Satellite Systems (GNSS)
  - Geographic information systems (GIS)
  - Availability of affordable aerial and satellite imagery

Census maps


No building number
SEA MAP
MAP LEGEND
FIELDWORK VERIFICATION SEA MAP

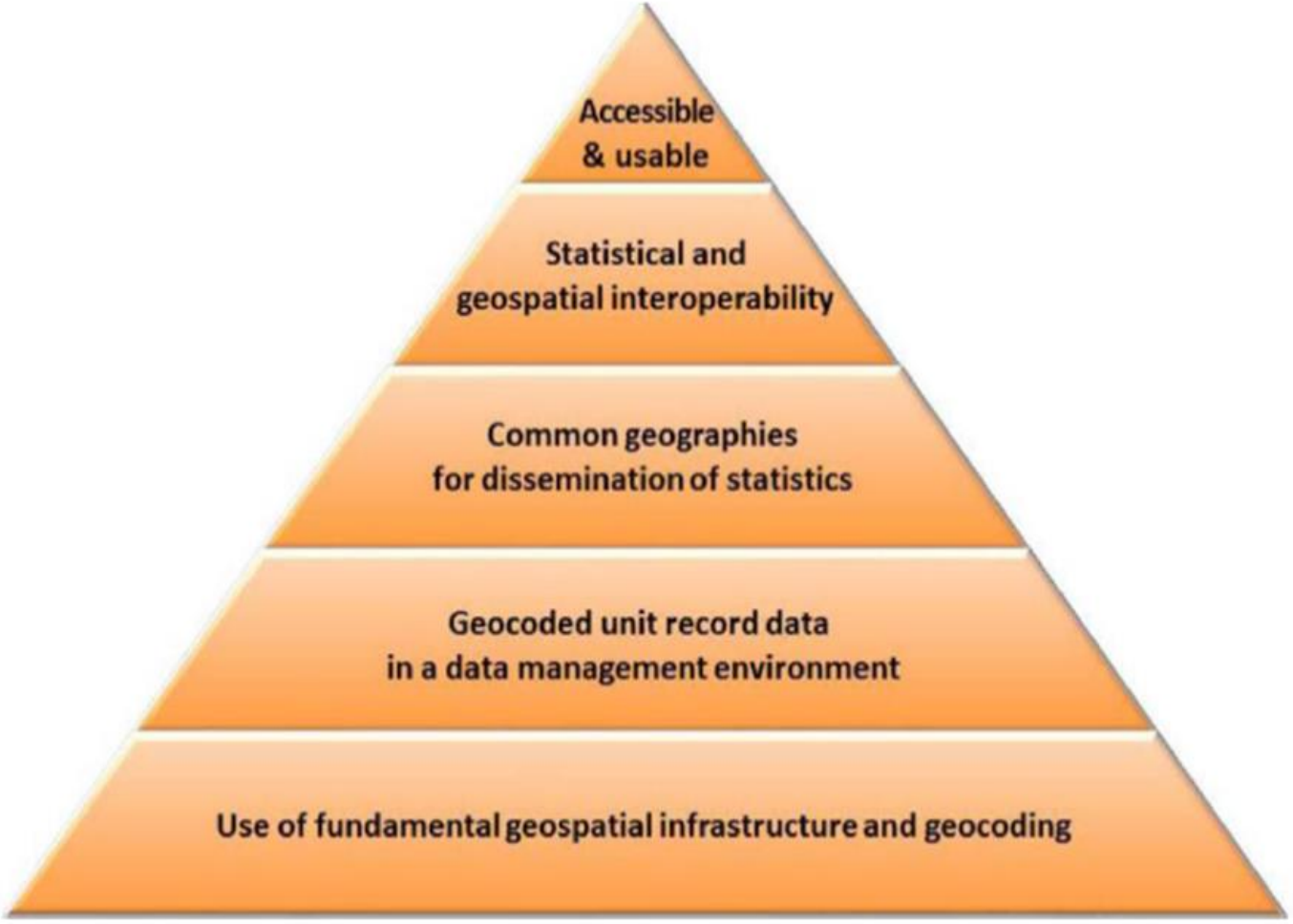
Census maps


Building numbers
Statistics South Africa
CENSUS 2011
INDEX MAP
79914837
Province
Gauteng
City of Tshwane(TSH)
City of Tshwane(TSH)
Soshanguve
Soshanguve HH
Formal residential
Legend
Police Stations
Clinics & Hospitals
Places of Interest
Schools
Map Reference Point
Streets
Enumeration Area
Cadastre
Farms
Farm Portions
N
W
E
S

The Global Statistical Geospatial Framework

- The GSGF framework consists of <u>five guiding principles for integrating statistical and geospatial data</u>
  - adopted in Augusts 2016 by the 6th Session of the UN Committee of Experts on Global Geospatial Information Management (Decision 6/107) – set up by UN Stat Comm and UN-GGIM
  - recognizes the 2030 Agenda & the 2020 WPHCP as important drivers for the integration of geospatial and statistical information

The Global Statistical Geospatial Framework



Five principles

- **Principle 1 Use of fundamental geospatial infrastructure and geocoding for integrating geospatial and statistical info**

  - Geocoding is the process of assigning geographic coordinates (e.g. X-Y values, latitudes& longitudes) to specific locations (such as street addresses & place names) so that they can be placed as points on the earth's surface (&therefore on a map)

  - Geocoding provides a common and consistent approach to establishing the location and
    - a “Geocode” for each unit in dataset, whether it is an enumeration area, census block, a building, or parcel/property unit

Five principles

- Geocoding is crucial for locating buildings and geographic features, especially **in areas lacking street infrastructure or a reliable address system**

- Geocoding is vital for **producing high quality maps and performing census tasks** such as:
  - delineating administrative and EA boundaries
  - point locations of census units: housing units& collective living quarters
  - locating other relevant geographic features such as roads, rivers and landmarks
  - supporting the dissemination, aggregation and disaggregation of data; aggregate data into new/customized units of analysis

Five principles

- **Principle 2 Geocoded unit record data in a data management environment**

  Storage of the unit record statistical data linked to a geocode within a data management environment will ensure flexibility over time and protect privacy and confidentiality

- **Principle 3 Common geographies for dissemination of statistics**

  A common set of geographies for the display, reporting and analysis of statistics to enable comparisons across datasets

Five principles

- **Principle 4 Statistical and geospatial interoperability**
  Greater interoperability to enhance the efficiency of creation, discovery, access and use of data

- **Principle 5 Accessible and useable geospatially enabled statistics**
  Identification and development of policies, standards and guidelines to support the release and use of geospatially enabled information

Geographic databases

- A comprehensive census database usually consists the following elements:
  - ***spatial boundary* database**, consisting of area features (polygons) that represent the census units (e.g. EAs and administrative/statistical divisions)
  - ***geographic attributes table***, a database file linked internally to the spatial database that contains one record for each polygon
    - This table contains the unique identifier for each census unit and possibly some additional static or unchanging variables, such as the unit's area in one km^2
  - ***census data tables*** containing non-spatial attributes, i.e., the census indicators for the spatial census units
    - Each of these files must contain the unique identifier of the census unit that provides the link to the corresponding polygon attribute table records
  - ***other vector (point or area) features,*** such as building/housing unit points, landmarks, roads, waterways, schools, health facilities or other buildings may be useful for orienting fieldworkers during the enumeration

Role of geospatial information in census operations

- Role of maps in the census process has expanded
  - Traditionally: to support enumeration, operations management and dissemination
  - Today, through use of modern GIS system, geospatial information helps to:
    - improve efficiencies and accuracy of the overall census project and products
    - optimize enumeration areas, workforce assignments and field offices
    - Possibility of saving cost (e.g. labour and transport) in census operations

Pre-enumeration

- Create/update Base Maps
- Create/update census geographic database
- Create or update enumeration areas (EAs)
  - Produce digital EA maps for fieldwork and operations
  - Integrate with geospatial data
- Validate EA's
- Ensure complete and balanced coverage (no omissions or duplications) through GIS analysis
- Integrate data collection applications with geospatial information

During enumeration: Workforce management

- Assigning work to individual enumerators, monitor their activities and provide necessary assistance

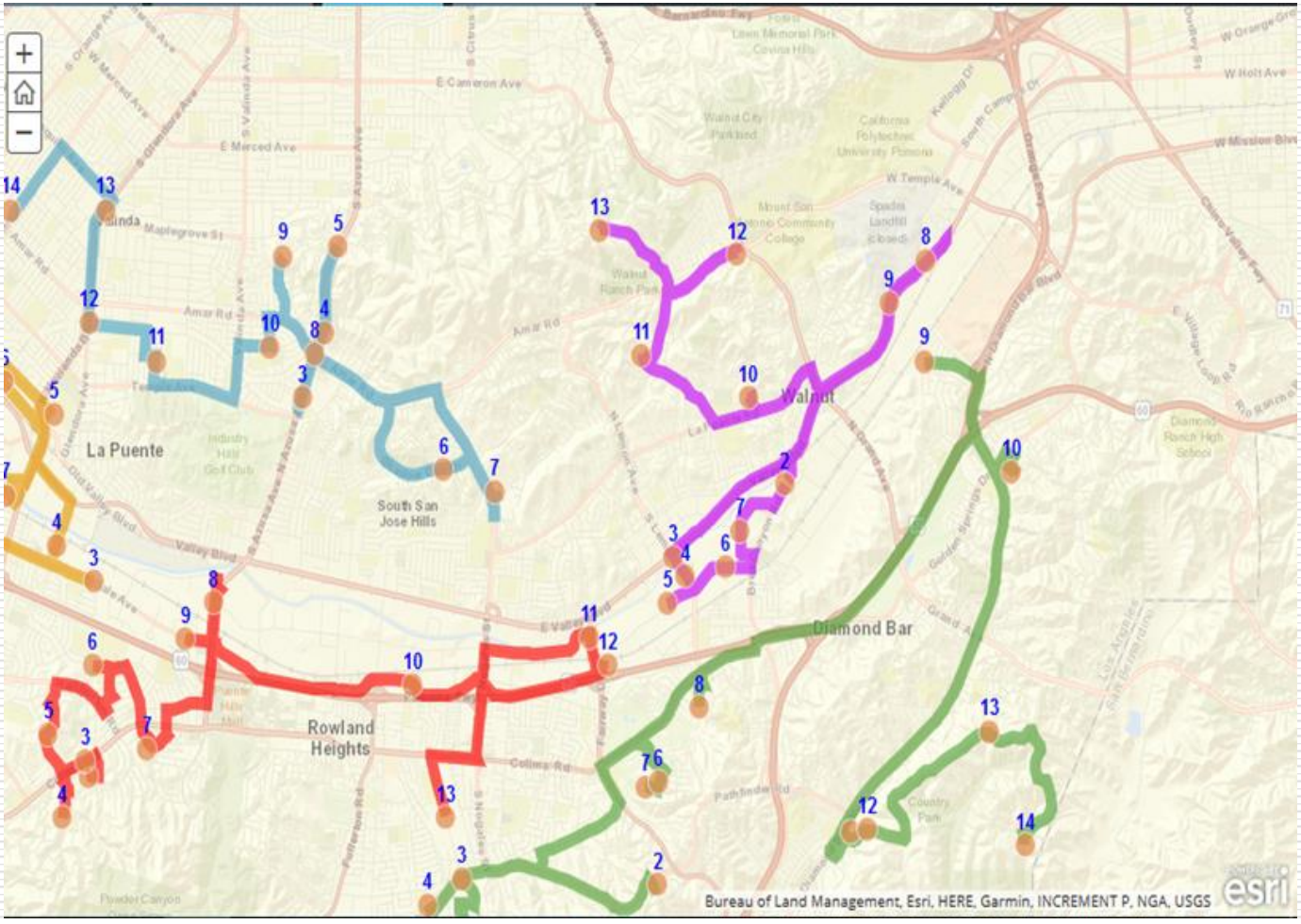
- Allowing complex scheduling analysis and assignments
  - optimize routes by determining quickest/shortest/most cost-effective route through EA
  - pre-plan routes, saving time, labour and fuel for transport

- **Improving the overall quality of the census**

During enumeration: Workforce management

- **Example of daily optimized routes for one enumerator**

  - the routes for each day are depicted in different colours and include the optimal stop sequence number for each site visit

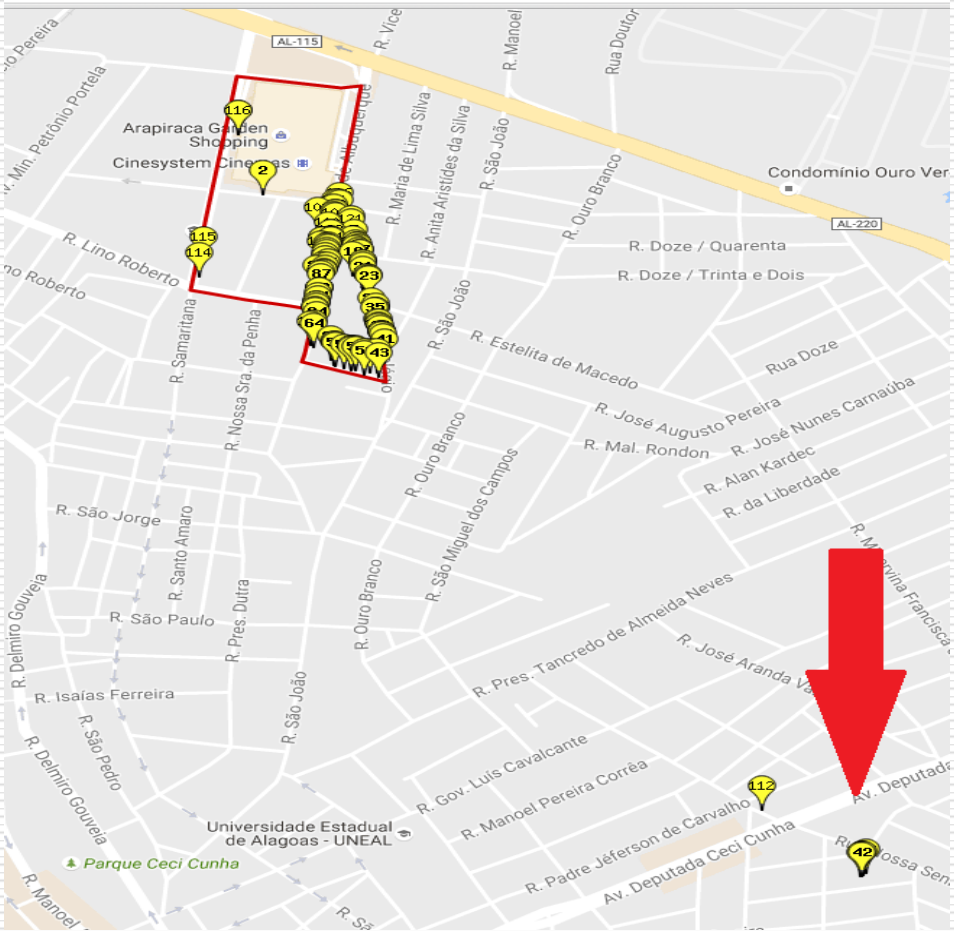


During enumeration: Monitoring and operation management

- Support planning and control tasks by supervisors
  - make assignments, reallocate tasks, with the aim of ensuring a smooth and timely completion of the enumeration
  - real-time transmission of geo-data of enumerator route and household locations enable the supervisor to monitor the progress of the census enumeration locally
  - identify problem areas and implement remedial action quickly

During enumeration: Monitoring and operation management

- Example of an attempt to complete a questionnaire at a location beyond the boundary of an enumerator's EA

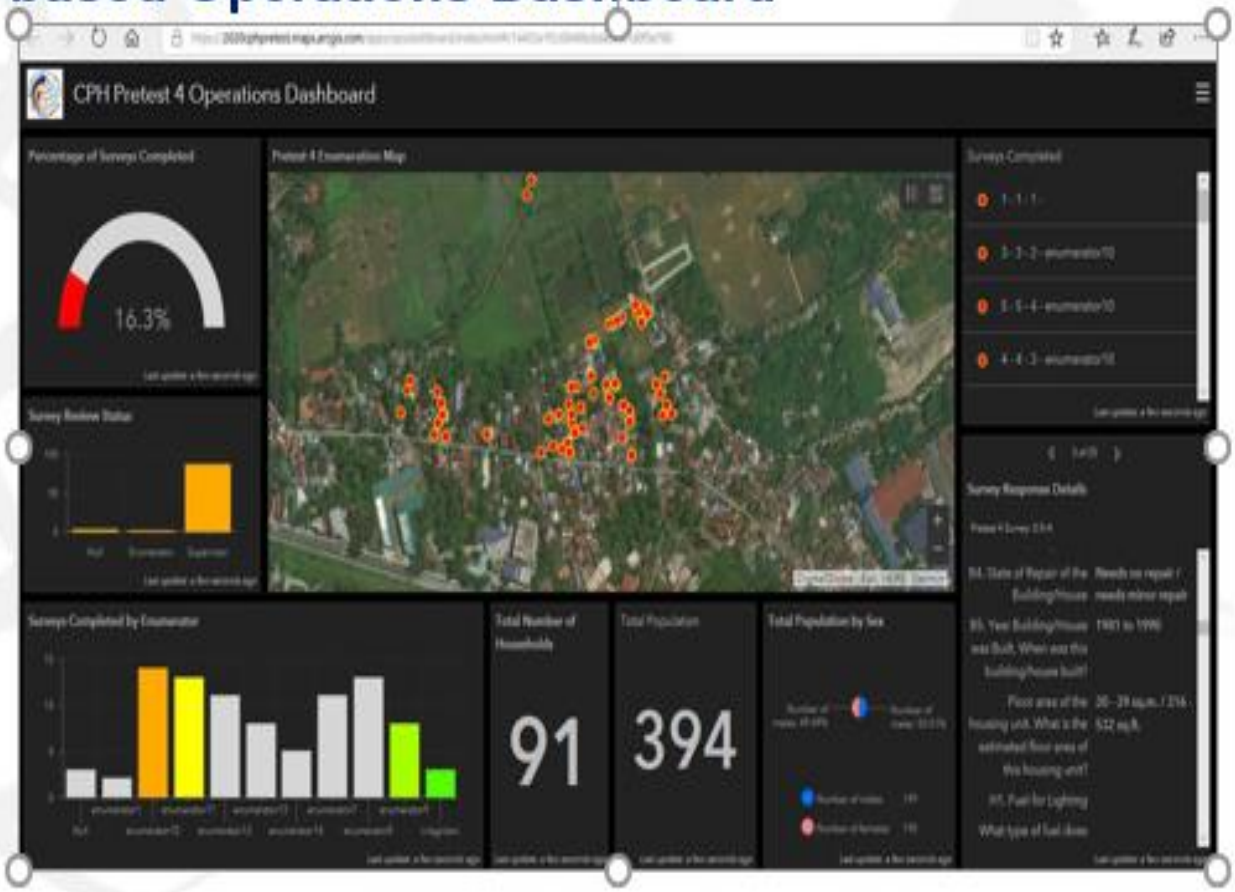


During enumeration: Monitoring and operation management

- Progress of the enumeration through GIS operational dashboards
  - allow for monitoring of real-time data feeds for day-to-day operations
  - monitor progress at any level of geographic aggregation
  - provide information at different hierarchal level for identifying problematic areas

Philippines

GIS-based Operations Dashboard

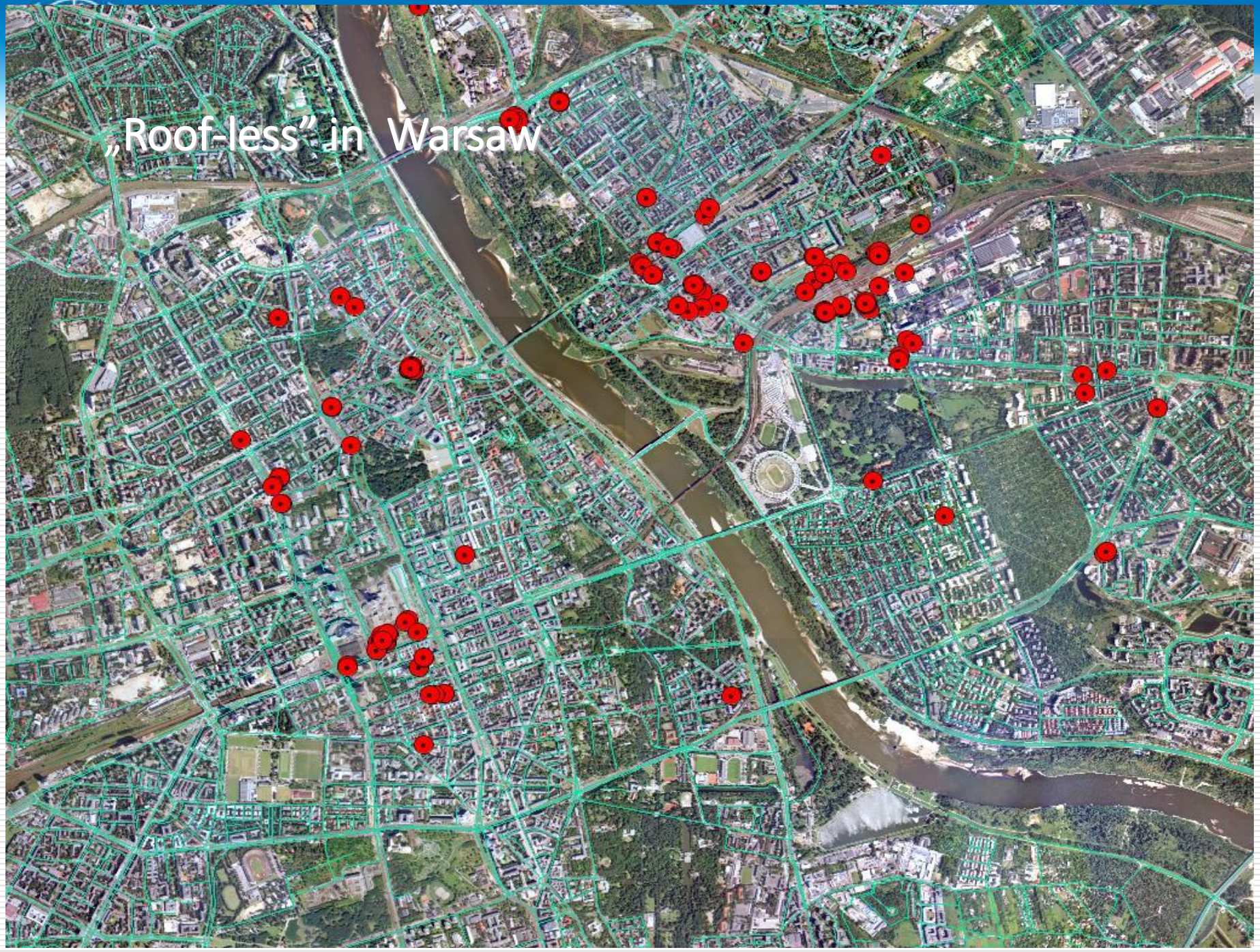


During enumeration: Updating and correction of EA maps during enumeration

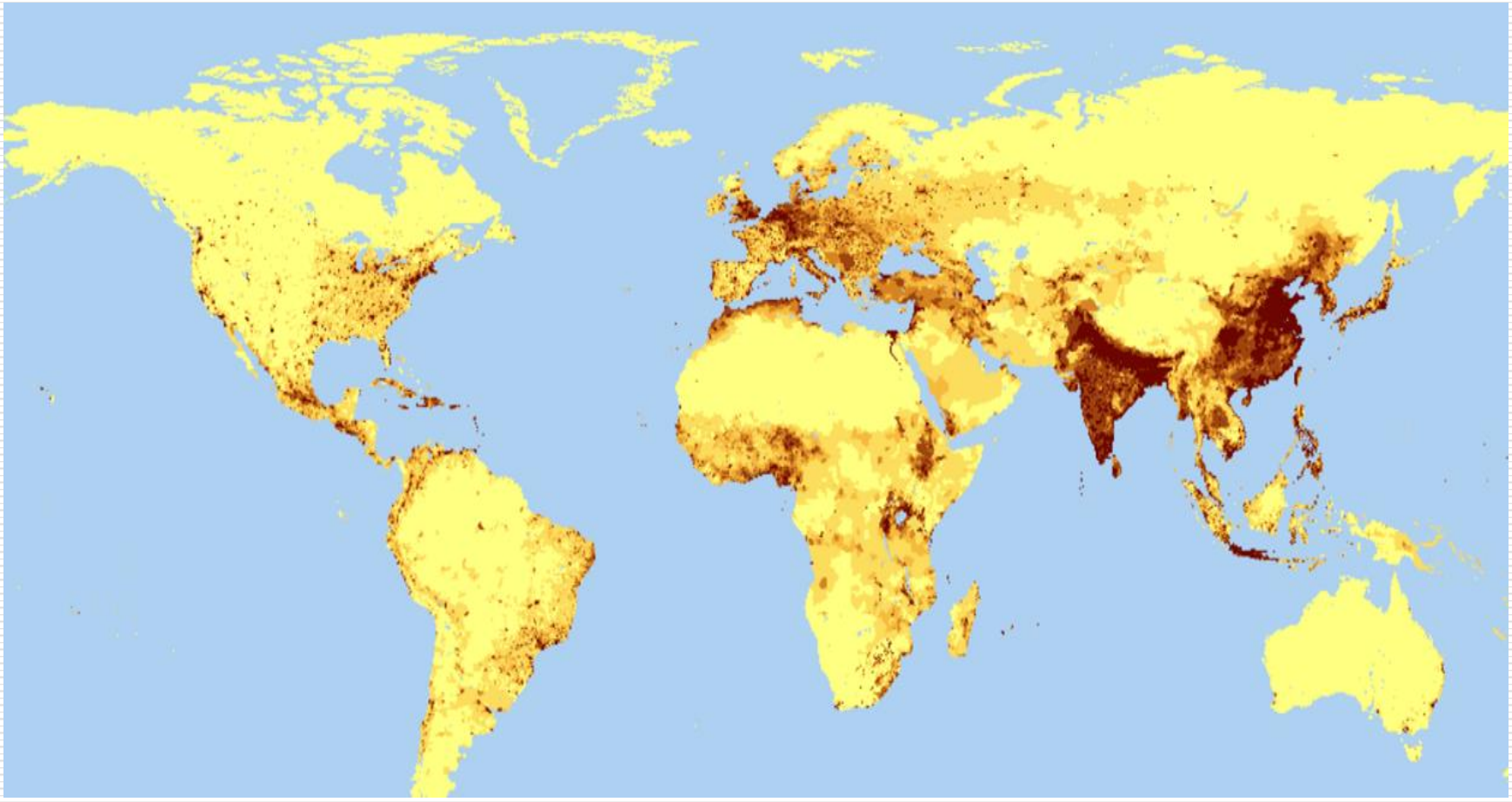
- Census maps are usually prepared several months, or even years, ahead of the actual enumeration
  - new constructions and infrastructure developments may not be shown in the EA maps
  - census maps may contain errors that may lead to either under- or over-coverage
- It is usual practice to verify EAs and units to be covered just prior to the actual enumeration

Role of geospatial information in census operations: Post-enumeration

- GIS & interactive mapping make it easier to present, analyse and disseminate census results at various levels of geographical areas
- Provide a powerful means for visualizing the results of a census & for identifying patterns among demographic and social indicators
- Allow data at census unit level to be aggregated to new units of analysis (such as climatic zones or ethnic regions)
- Make accessible vast amounts of spatial information to users through the Internet
- Link information from many different subject areas (data sources) , leading to a much wider use of statistical information


„Roof-less” in Warsaw

Global Population Disribution



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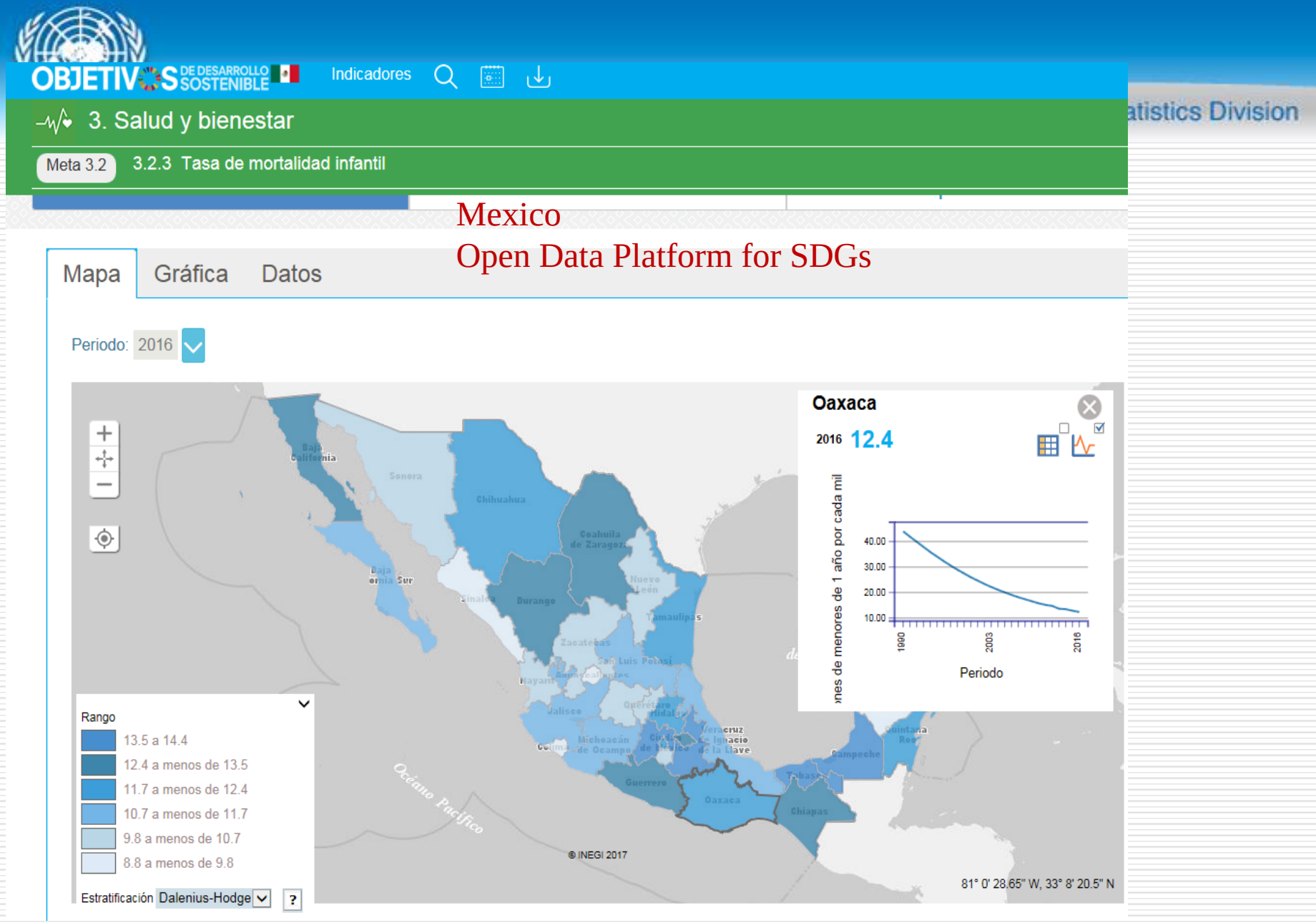
OBJETIVOS DE DESARROLLO SOSTENIBLE
Indicadores
atistics Division
3. Salud y bienestar
Meta 3.2
3.2.3 Tasa de mortalidad infantil
Mexico
Open Data Platform for SDGs
Mapa
Gráfica
Datos
Periodo: 2016
Oaxaca
2016 12.4
40.00
30.00
20.00
10.00
1990
2003
2016
Periodo
Rango
13.5 a 14.4
12.4 a menos de 13.5
11.7 a menos de 12.4
10.7 a menos de 11.7
9.8 a menos de 10.7
8.8 a menos de 9.8
Estratificación Dalenius-Hodge
?
Océano Pacífico
© INEGI 2017
81° 0' 28.65" W, 33° 8' 20.5" N

Planning considerations for developing a census geographic program

- Key considerations include:
  - **Needs assessment –**understanding user needs through consultation for both geographic content and products
  - **Inventory of existing data sources-** identifying available maps and cooperation with national mapping agency

Planning - Identification of geographic products and services

- Identify the types of maps and map services needed in all phases of the census operation
- Range of geographic outputs and products include:
  - digital maps for EA, administrative units & dissemination areas;
  - geographic boundary files in digital format for all statistical reporting units
  - listings of all statistical and administrative reporting units, including geographic X-Y coordinates;
  - vector layers containing feature data, such as buildings, landmarks, roads, schools, hospitals, etc
- New products: map services available on the web
- Proper documentation, including coding and metadata

Planning - Staff skills and capacity

- Technical capacity and skills held by GIS staff critical
- Increased use of GIS packages requires considerable training
- Developing GIS capacity may entail reorganization and expanding the existing “cartographic unit”
- Skills needed include:
  - planning and project management;
  - systems administration.
  - geographical data conversion;
  - map scanning and digitizing;
  - field work for collecting location information and validation of EA boundaries;
  - Integration of census data with geospatial information

Planning - Outsourcing

- Goal of outsourcing should be to gain temporary access to skills otherwise not available within the NSO or to augment the amount of staff available with a certain set of skills

- The following guidelines should be considered if outsourcing:
  - Responsibility for the ultimate success or failure of the geographic operation must remain with the NSO, not the vendor
  - Do not let technology drive the design of the geographic system
  - NSOs must take into consideration future maintenance, expandability, and staff skills when considering a vendor