

# Integration of Statistical and Geospatial Information

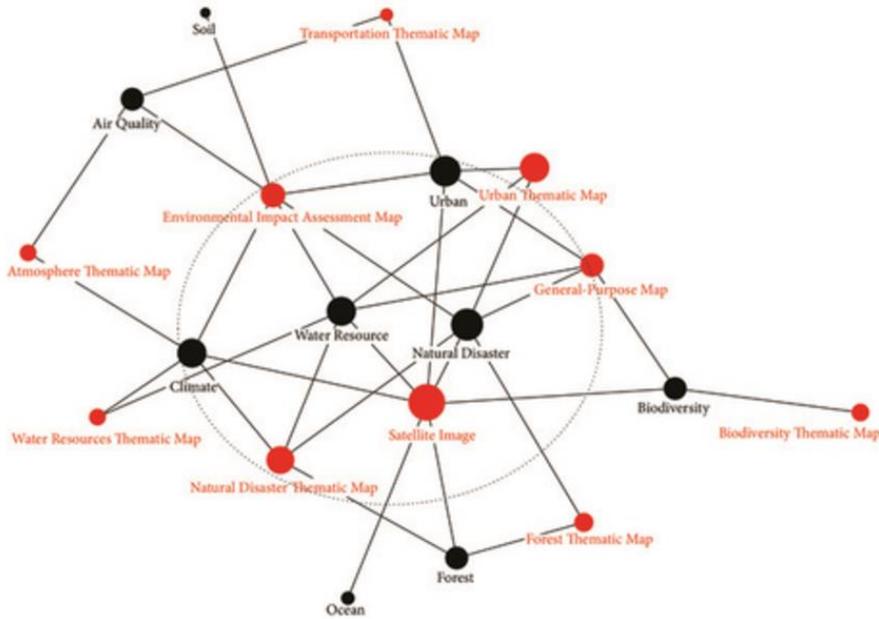
## A Case Study from India



National Statistics Office,  
Ministry of Statistics and Programme Implementation,  
Government of India



# Integration of Statistics and Geospatial Data



The integration of statistics and geospatial data

- Refers to the practice of incorporating and consolidating both kinds of sources into a single dataset.
- It has the potential to generate information far beyond the simple representation of data on a map.
- The ultimate goal is to provide users with consistent access to and delivery of information across the geographical, social, economic and environmental spectrums.



# Use of Integration of Statistical and Geospatial Data



The integration surpasses traditional statistics and enables innovative applications. For example

- Help in improving data quality and interoperability.
- Allowing spatial-temporal statistical analysis
- Enabling the visualization of non-geographical data in a spatial environment.
- Improving understanding of location-specific phenomena.
- To assist in evidence based policy making





## NATIONAL GEOSPATIAL

### ORGANIZATIONS: THEMATIC DATA

### THEMES/ SECTORS

|   |  |
|---|--|
| <b>National Atlas and Thematic Mapping Organization (NATMO)</b>                 | Roadmaps, Rail Maps, City Maps, Health Map etc   |
| <b>National Remote Sensing Centre</b>   | Satellite Images   |
| <b>Forest Survey of India</b>   | Forest Maps  |
| <b>Geological Survey of India</b>   | Geological Maps, District Mineral Resource Maps, Mineral Map of India, Geomorphological Maps, Seismotectonic Maps, Seismic Hazard and Landslide Zonation Maps, etc |
| <b>Centre Water Commission</b>  | River basins and Catchments Maps   |
| <b>Central Ground Water Control Board</b>                                       | Ground Water Maps  |
| <b>National Bureau of Soil Survey Landuse Planning; Soil and Landuse Survey</b> | Soil Maps and Landuse Maps   |
| <b>Town and Country Planning Organisation</b>                                   | Master Plan of the Cities  |
| <b>National Hydrographic Organisation</b>                                       | Hydrographic Maps  |
| <b>Central Pollution Control Board</b>  | Environment Zonation Maps  |

# Geospatial Portals

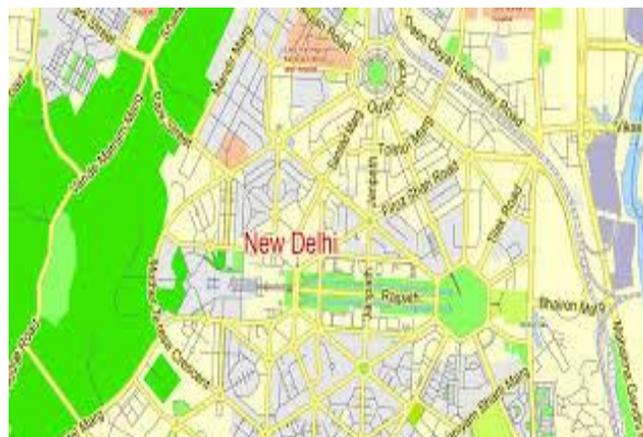


| GEOSPATIAL ACTIVITY                               | WEB REFERENCE   | BRIEF OVERVIEW  |
|---|---|---|
| <b><u>INDIA-PORTAL</u></b>                        | <a href="https://www.india.gov.in/">https://www.india.gov.in/</a>                                 | National Portal of India provides a single-window access to information and services that are electronically delivered from all Government Departments in India.  |
| <b><u>SURVEY OF INDIA TOPOGRAPHICAL MAPS</u></b>  | <a href="https://onlinemaps.surveyofindia.gov.in/">https://onlinemaps.surveyofindia.gov.in/</a>   | SoI Online Map Portal provides the online access to Digital Map & Products of Survey of India   |
| <b><u>ISRO-BHUVAN</u></b>                         | <a href="https://bhuvan.nrsc.gov.in/home/index.php">https://bhuvan.nrsc.gov.in/home/index.php</a> | BHUVAN - Geo Portal Developed by ISRO. BHUVAN, also called the Indian version of Google Maps, is a multi-purpose end-user satellite application platform. This software application allows the users to explore a 2D/3D representation of the surface of the Earth.   |
| <b><u>SDG INDIA DASHBOARD</u></b>                 | <a href="https://sdgindiaindex.niti.gov.in/#/">https://sdgindiaindex.niti.gov.in/#/</a>           | SDG INDIA Dashboard and Index with state wise and index wise reports and data   |
| <b><u>OPEN GOVT DATA (OGD) PLATFORM INDIA</u></b> | <a href="https://data.gov.in/">https://data.gov.in/</a>   | OGD Community Portal will help you to brainstorm ideas based on your interest. Keep visiting the section for Visualizations, Blog Posts, Infographics and updates in the Community section. You can also contribute your Visualizations, Blog Posts and Infographics. |
| <b><u>NIC BHARAT MAPS</u></b>                     | <a href="https://bharatmaps.gov.in/">https://bharatmaps.gov.in/</a>                               | Multi-Layer GIS Platform providing integrated base map service encompass 23 layers containing administrative boundaries, transport  |

| GEOSPATIAL ACTIVITY                      | WEB REFERENCE   | BRIEF OVERVIEW  |
|--|---|---|
|  |   | layers (roads & railways), forest layer, settlement locations, including terrain map services.  |
| <b><u>GSI-BHUKOSH</u></b>                | <a href="https://bhukosh.gsi.gov.in/Bhukosh/Public">https://bhukosh.gsi.gov.in/Bhukosh/Public</a>   | Bhukosh is gateway to all geoscientific gateway to Geological Survey of India   |
| <b><u>ISRO-IIRS PORTAL</u></b>           | <a href="https://www.iirs.gov.in/">https://www.iirs.gov.in/</a>                                     | The Indian Institute of Remote Sensing (IIRS) is a key player for training and capacity building in geospatial technology and its applications through training, education and research in Southeast Asia. This portal provides all details and access to their services. |
| <b><u>NATMO-THEMATIC MAPS PORTAL</u></b> | <a href="https://geoportal.natmo.gov.in/">https://geoportal.natmo.gov.in/</a>                       | National Atlas and Thematic Mapping Organisation is a specialized institution of its kind in the world. It carries out thematic cartography and geographical research at national level. This portal provides access to NATMO Products and services.                      |
| <b><u>INDIA-PORTAL</u></b>               | <a href="https://www.india.gov.in/">https://www.india.gov.in/</a>                                   | National Portal of India provides a single-window access to information and services that are electronically delivered from all Government Departments, ...   |
| <b><u>CENSUS INDIA-PORTAL</u></b>        | <a href="https://censusindia.gov.in/census.website/">https://censusindia.gov.in/census.website/</a> | The Indian Census data repository is the largest single source of various statistical information on demography, economics, anthropology, sociology, statistics and many other disciplines updated on decadal basis.  |

# Urban Frame Survey

An initiative to Integrate Geospatial and Statistical Information

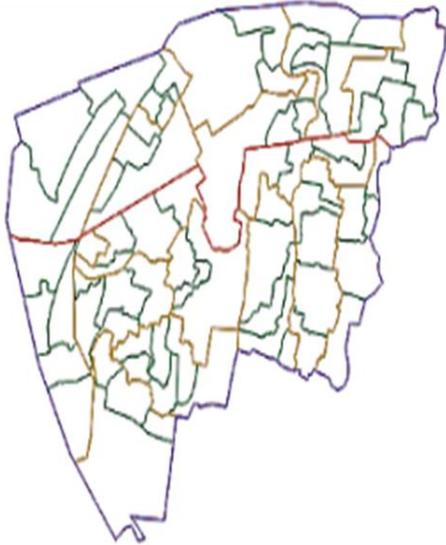


Case Study 1

# Urban Frame Survey

- Objective: To provide a frame for sample selection for Socio-Economic surveys in urban areas. For rural areas, list of census villages is used.
- OPERATION AREA: Towns of India.
- PERIOD OF OPERATION: One Phase of 5 years
  - (Present Phase: 2022-27, first phase: 1959-63)
  - Present Phase 8188 towns

# How UFS maps are prepared



Block Map



Ward Map



IV Map



Town Map

*(Not Applicable for Census Towns)*

- 1 Block ~ 120-150 Households
- 1 IV Unit ~ 20-40 Blocks

# Features of UFS



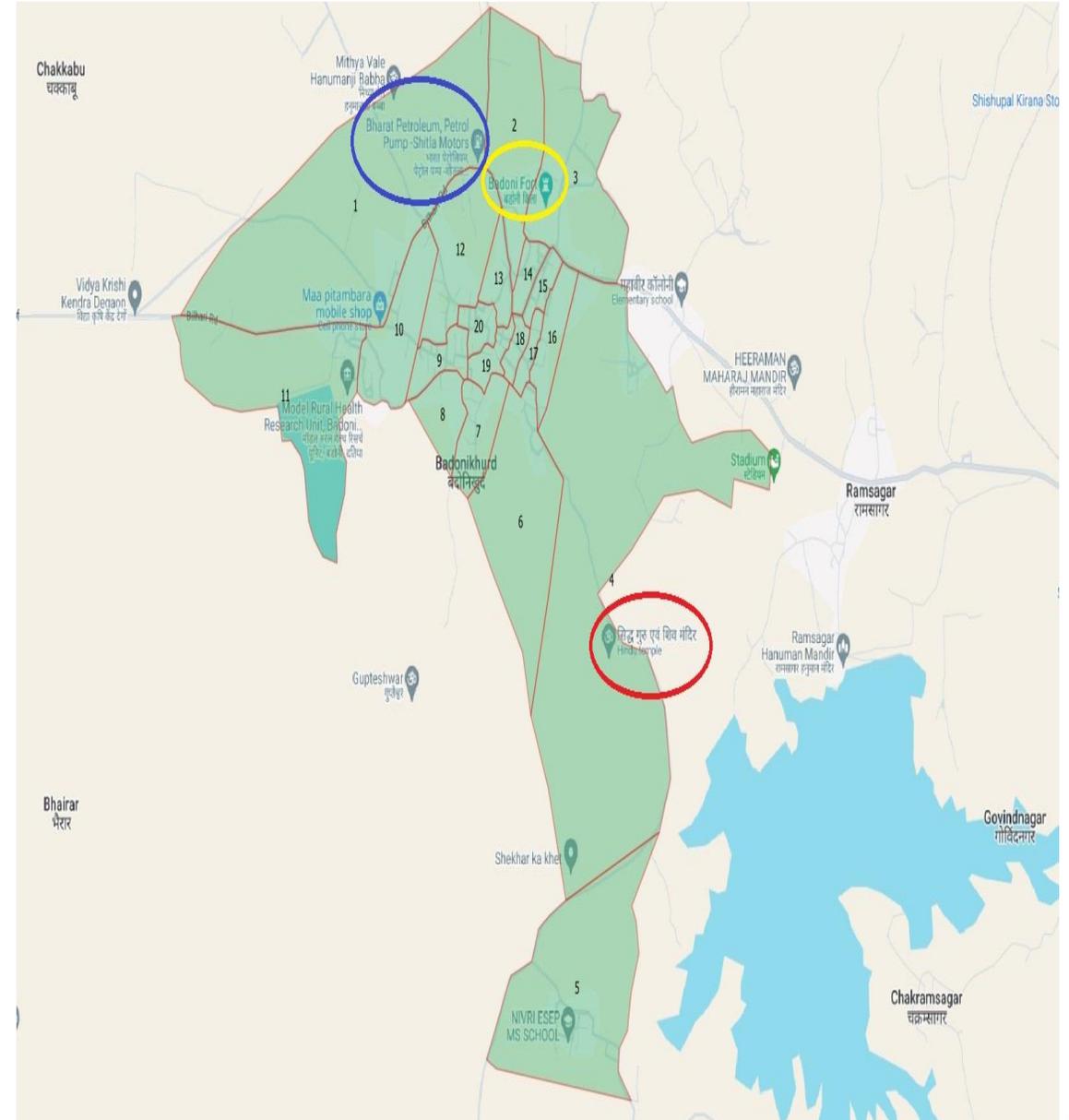
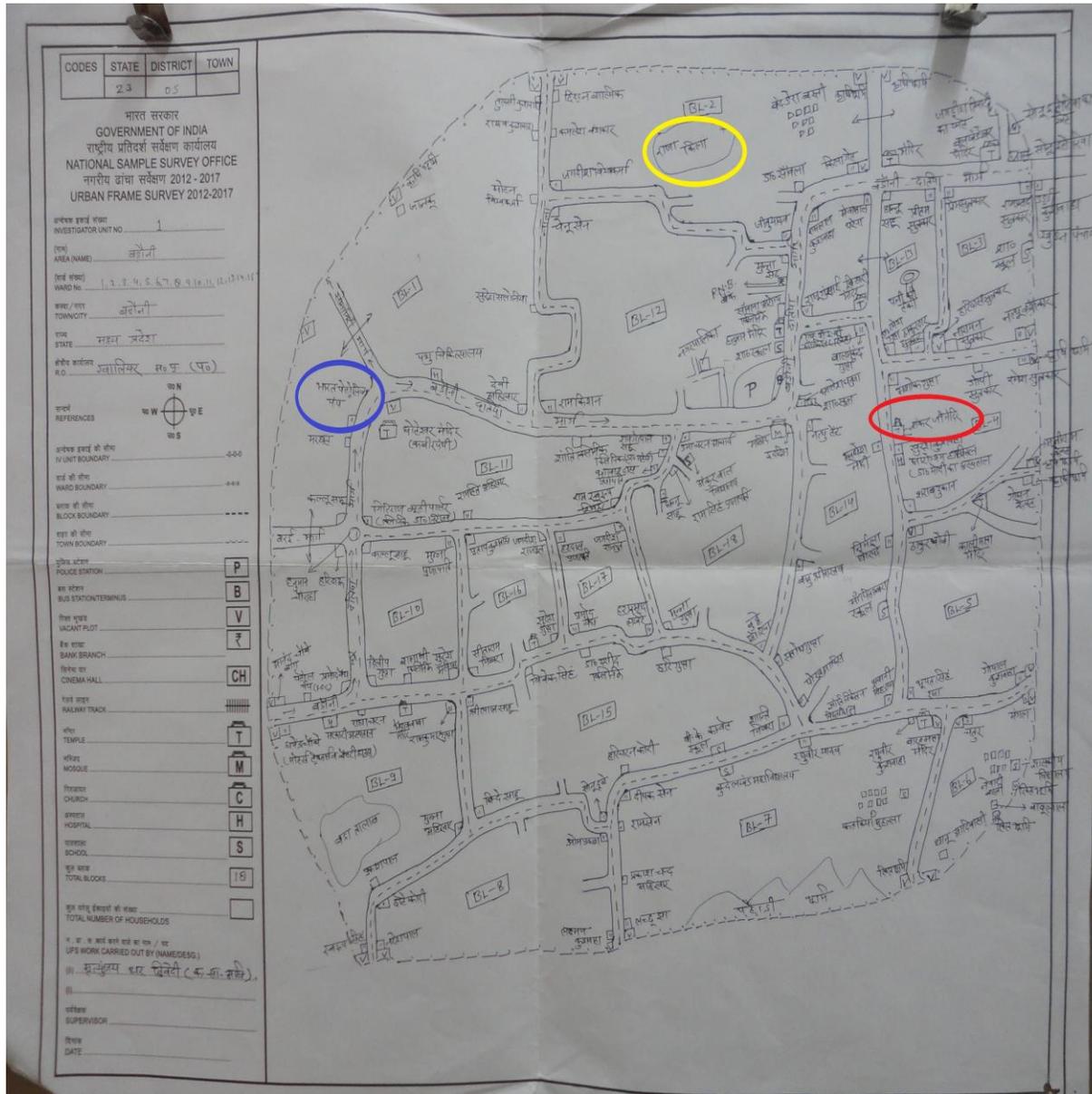
- UFS blocks are:-
  - mutually exclusive and exhaustive
  - compact area unit, with 120- 150 households
  - bounded by well-defined, clear-cut and natural boundaries to the extent possible
  - Depict permanent land marks and corner points
  - identifiable over time.
- Door to door physical visit for each and every structure in all the urban settlements.
- Smallest area unit within a town is UFS block.

# Methodology of UFS



- Till 2012-17 phase, UFS maps (which were notional in nature and not as per scale), and their boundaries, were prepared and recorded in pen & paper.
- From phase 2017-22, UFS is being conducted in digital mode using the mobile & web applications (developed in collaboration with NRSC, ISRO, Hyderabad) and QGIS software.

# Hand-made vis-a-vis Digital Map of a town in an Indian State



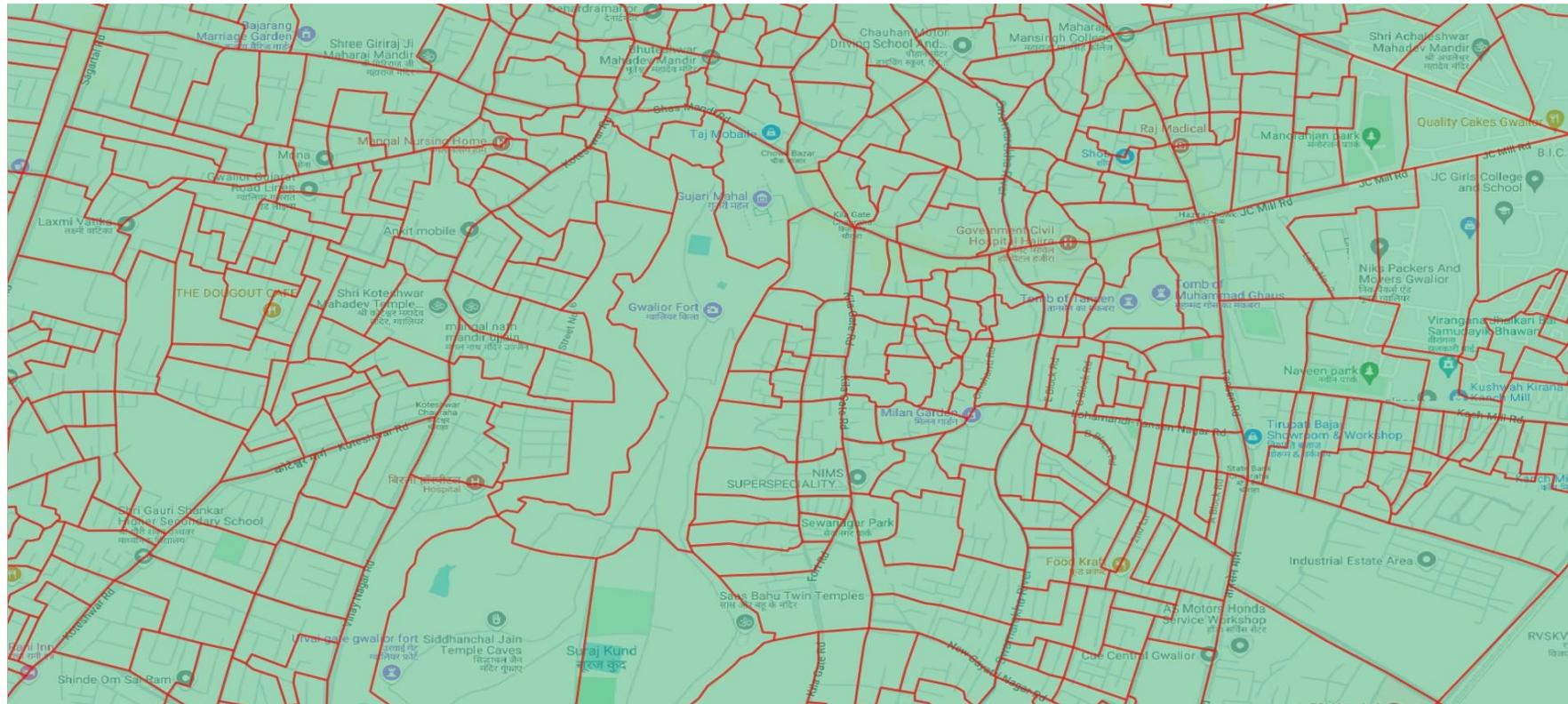
# Monitoring/Challenges

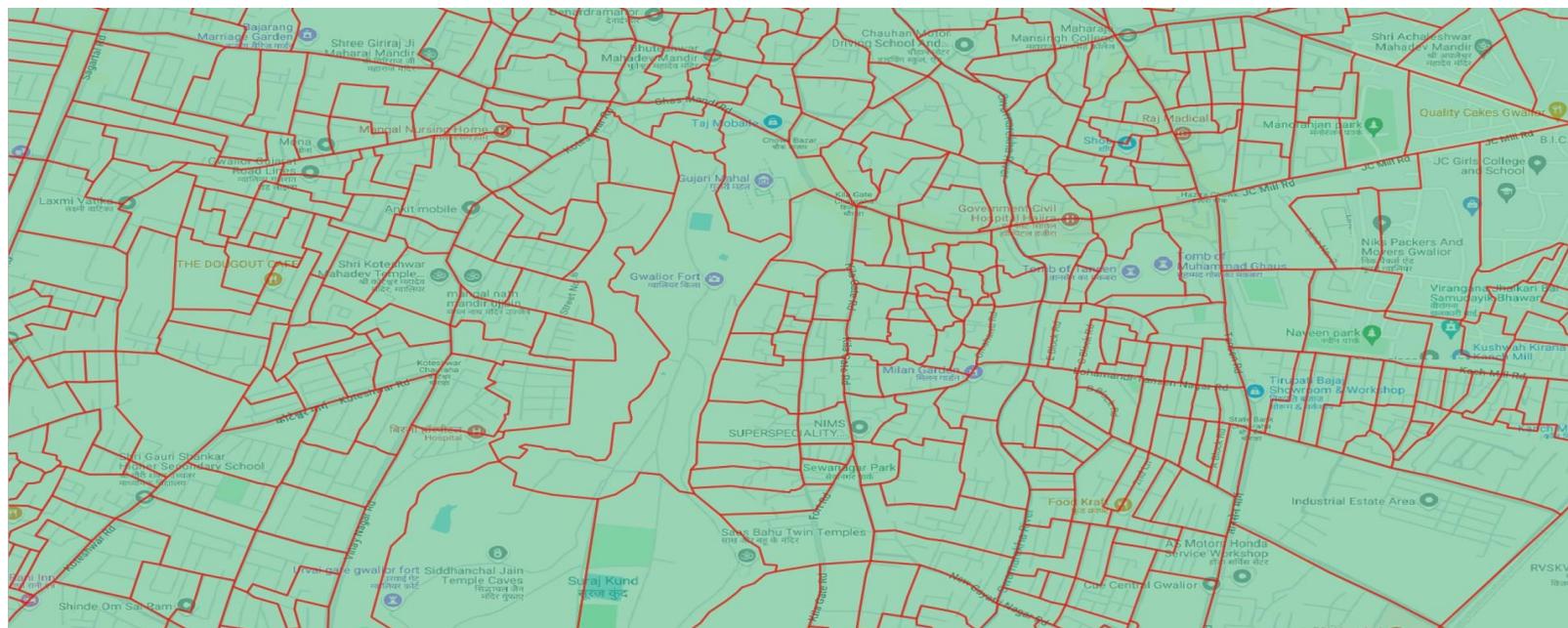
- Some times GPS is not accurate because of
  - It varies from 3.5 meter to 15 meter depending on the place
  - Urban environments with tall buildings, Cloudy sky etc are other reason



# How do we overcome the challenges

- Using google earth, fetch the latitude and longitude
- Manually insert the same and complete the polygon
- Upload the same to Bhuvan portal





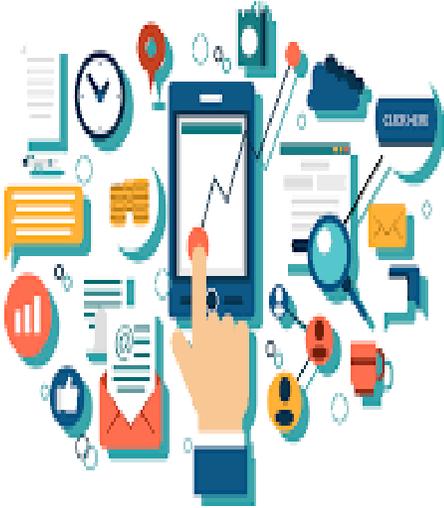
# Collect once - use for multiple tasks



## • Use of UFS Blocks by other organisations

- **Ministry of Health and Family Welfare** uses the UFS maps in National Family Health Survey(NFHS), Global Adult Tobacco Survey (GATS), National Mental Health Survey (NMHS)
- **Forest Survey of India (FSI)** uses UFS maps for National Forest Inventory.
- **Urban Frame Survey (UFS)** summary along with metadata is available on MoSPI's Website in public domain which is used for various research purposes.

# Digital tools for UFS



## Bhuvan Mobile Application

- For capturing boundaries with geo-coordinates
- To capture the attribute data

## Bhuvan UFS Portal

- To edit data captured through Bhuvan Mobile App
- To download schedules

## QGIS Plugin

- To draw & finalise the maps as vector shapefiles
- To view captured polygons in QGIS

## QGIS Upload tool

- To upload QGIS drawn maps to Bhuvan Portal

# Environmental Economic Accounting Using Geospatial Technologies

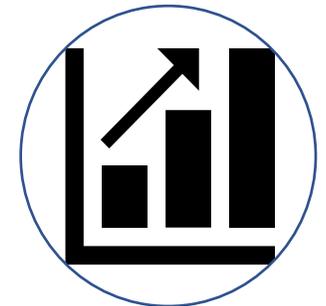
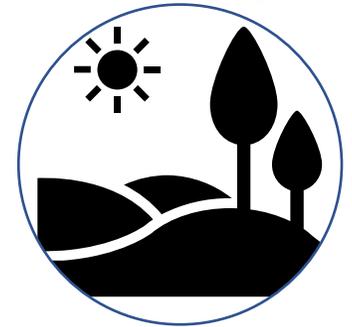


## Case study 2

- Environment Economic Accounting are integrated statistics that highlight the relationship between environment and the economy.
- The System Environmental-Economic Accounting (SEEA) is the accepted international standard for environmental-economic accounting, providing a framework for organizing and presenting comparable statistics in an internationally agreed set of concepts, definitions, classifications, accounting rules and tables.
- NSO India began compiling environment accounts in 2018 as per the SEEA framework, supported by Inter-Ministerial Group representing various Ministries/ Departments.

# Application of Geospatial Technologies

- The compilation of ecosystem accounts using the SEEA framework requires the availability of geospatial data that describes the distribution and condition of ecosystems as well as different ecosystem services.
- NSO India uses Geospatial data as input for compiling several environment accounts. For instance,
  - Compiling extent accounts and asset accounts for land and forest
  - Accounts for wasteland, degraded land, wetlands, biodiversity etc. have also been derived.
  - Several ecosystem services such as soil erosion prevention service uses geospatial layer.
  - Some of the SDG indicators are also being derived by using Geospatial data (e.g. forest cover)

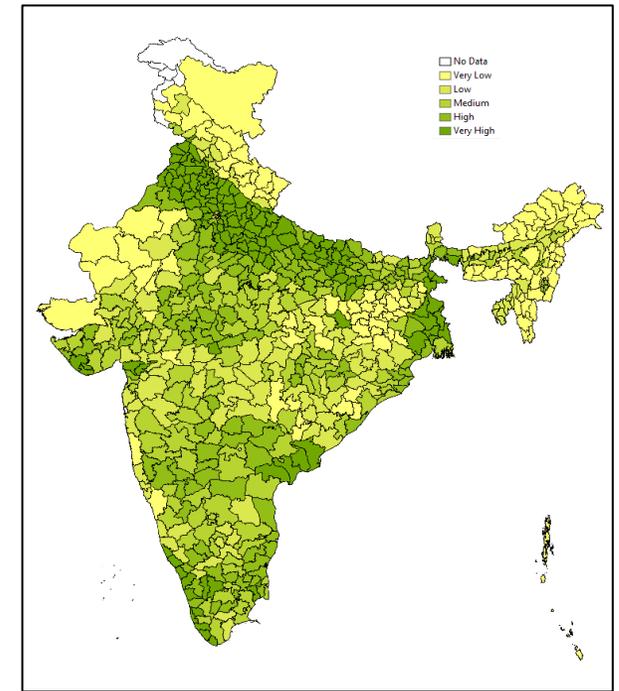
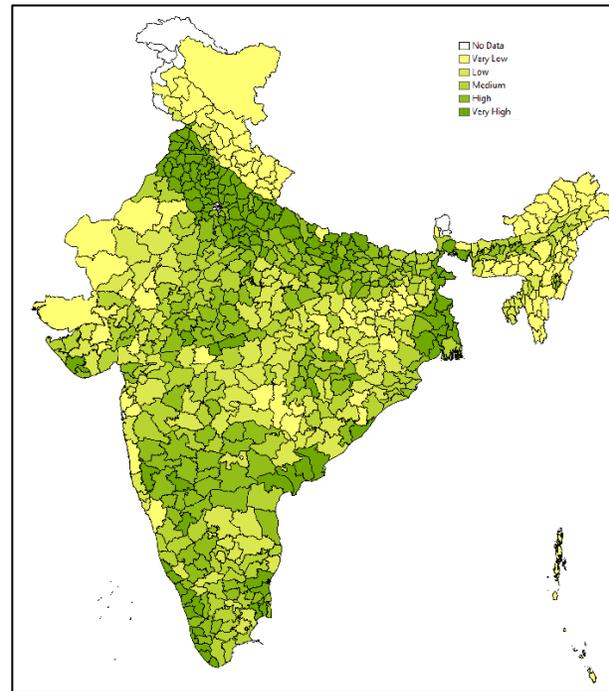


# Land Use and Land Cover Accounts

## NRSC: India's LULC Map and quintile distribution of Cropland Ecosystem Services

(2011-12 and 2014-15)

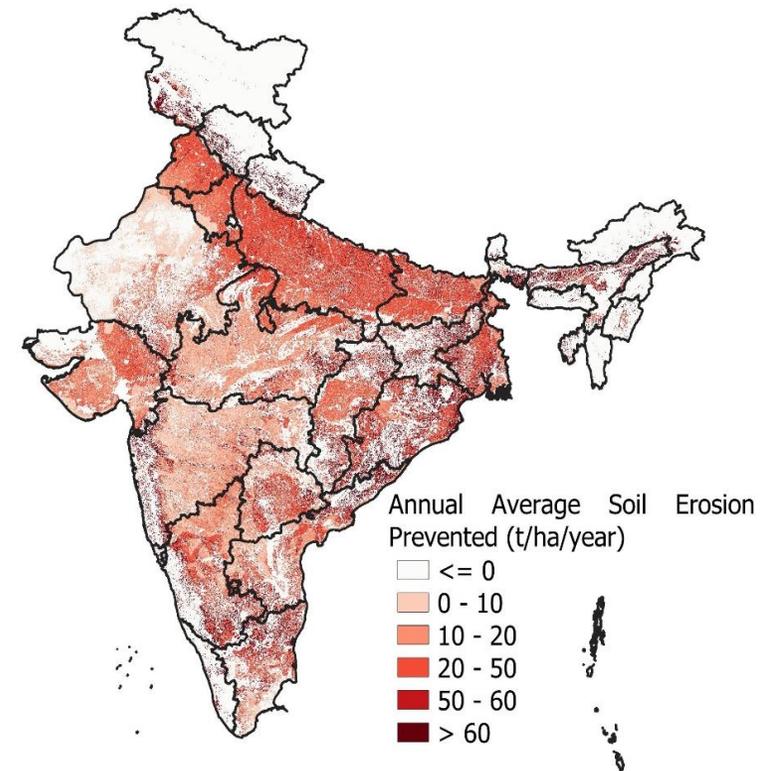
- Land-use and land-cover (LULC) change is an important indicator for monitoring environmental changes and a vital input for informed decision making in the context of land management.
- Spatial LULC datasets by NRSC are used to compile Asset Accounts for Land Use.
- The asset accounts and change matrix show land cover gains and losses over time and can inform policy action on the main land use processes.



# Soil Erosion Estimates

- Owing to the impacts of soil erosion on decline in productivity of arable and nonarable lands, estimation of soil erosion is of utmost importance.
- NSO India has estimated soil loss prevention services provided by croplands for years 2005-06, 2010-12 and 2015-16.
- The map shows the spatial distribution of Soil Erosion prevention services by Croplands, which is the amount of soil loss that could be prevented when land cover is croplands instead of bare soil, in 2015-16.

## Soil Erosion Prevention Services-2015-16

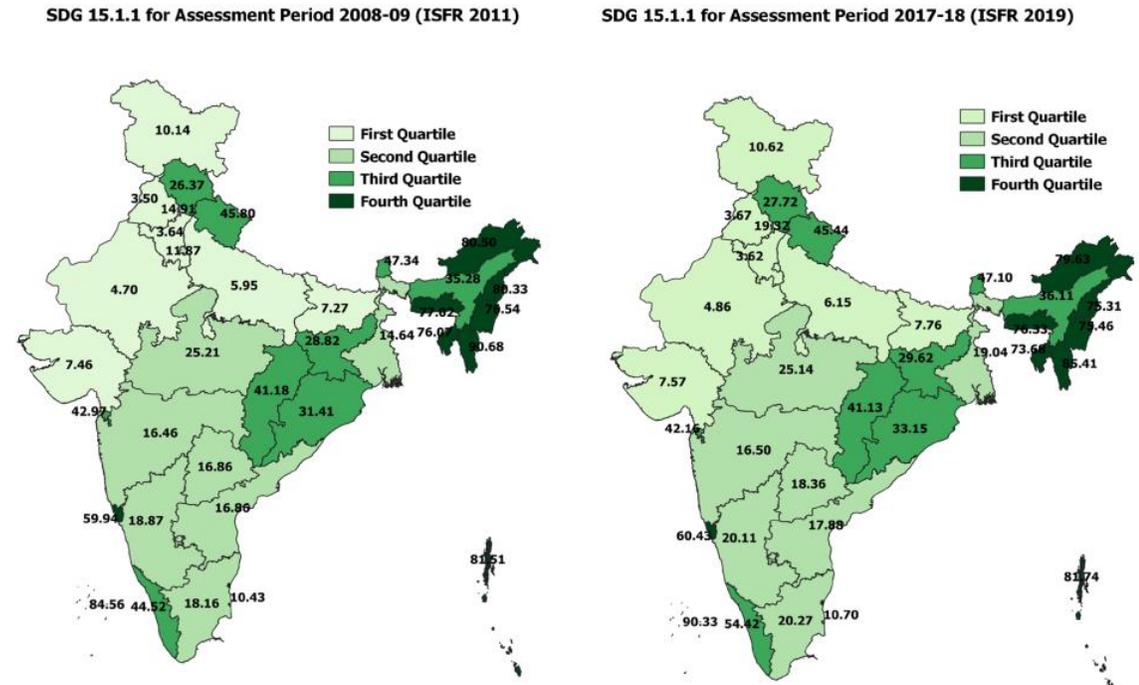


# Other Environment Accounts



- India State of Forest Report (ISFR) by the Forest Survey of India (FSI), is available with a periodicity of two years. Satellite images are used to get this information.
- Forest cover data are used for computing many SDG indicators. One such indicator is SDG indicator 15.1.1 which is Forest area as a proportion of total land area. The indicator is expressed as percentage and is calculated using the extent account for forests.
- The maps show the SDG indicator 15.1.1 for the states of India for years 2008-09 and 2017-18.

## Extent Accounts using Geospatial Data



Source: MoSPI

# Way forward



- **Policy Framework and Governance**
  - Institutional Coordination: Strengthen collaboration among agencies.
- **Capacity Building**
  - **Training Programs:** Organize workshops and training for statisticians and GIS professionals to understand each other's tools and methodologies.
- **Data Collection and Integration**
  - Satellite and Survey Data: Combine satellite imagery with census and administrative data for enhanced spatial insights.
- **Applications and Use Cases**
  - **Disaster Management:** Use integrated data for mapping vulnerable areas, planning evacuation routes, and post-disaster assessments.
  - **Urban Planning:** Combine data for planning infrastructure, managing land use, and monitoring urban sprawl.
  - **Environmental Monitoring:** Analyze deforestation, pollution levels, and climate change impacts by linking statistical and geospatial data.
  - **Healthcare and Social Services:** Map health indicators and social welfare schemes to identify underserved regions.



# Thank You

