LEOConn Webinar

Geospatial Data Analytics and Applications

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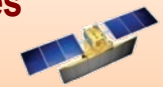
28 November, 2024

National Institute of Advanced Studies
Bengaluru

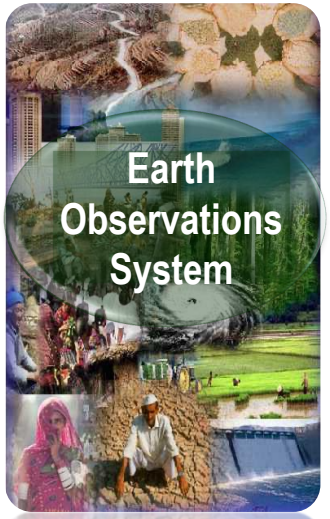
Indian Earth Observation Programme

Space Segment

Constellation of Satellites



- Land & Water
- Cartography
- Ocean, Weather & Climate



Ground Segment

- Data Acquisition & Processing
- Data Products Generation
- In-situ Observation Network
- Information Dissemination

Institutional Linkages

- Ministries / Departments
- State Remote Sensing Centres
- Industry & Academia
- International Cooperation

Space Applications

- National Imperatives / tech. develop.
- NR Management & Disaster Mgmt.
- Land-Ocean-Atm. Interactions
- Enabling Geospatial data & Applns.

- **Ensuring Data Continuity for Operational Applications**
- **Augment space & ground segment with enhanced capabilities**
- **Periodic inventory of natural resources to enable SDI**
- **Advanced models to meet evolving needs of stakeholders.**
- **Information systems with decision tools & citizen centric services.**
- **Maximize outreach, Startups/ Incubations for space applications**

Indian EO Capability

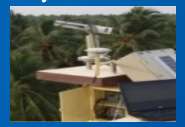
- 3 tier imaging
- High resolution imaging
- Hyper-spectral imaging
- Stereo imaging
- All weather imaging
- Ocean color
- Ocean altimetry
- Ocean surface wind
- Profiles of atmosphere
- Sea surface temperature
- Rain above the oceans
- Vertical humidity profile
- Earth's radiation budget

In-situ

Automatic Weather Station

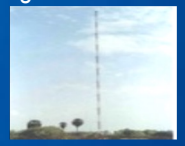
Micro Rain Radar

Sun Sky Photometer



Met and Ocean Buoy

Agro-met Station



Doppler Weather Radar

Flux Tower

GPS Sonde

Geospatial Analytics

- Concept: Intelligent use of GIS, IOT, Drones, Mobile data and Satellite images, including the GPS location info.
- Geospatial data-based analytics involves geolocation info. and the related attributes
- They are used to create geospatial models, data visualization, make quantitative measurements etc., to enable analysis and modelling.

Integration of IOT for field data analytics and smart decisions

Geospatial Analytics & e-Governance

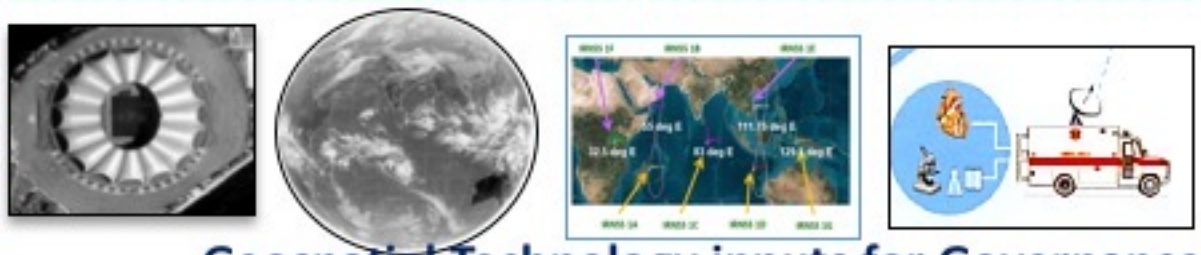
Decision Making and implementation towards societal Development

GOOD GOVERNANCE

- Accountability & Transparency
- Equitability and Inclusiveness
- Effectiveness and Efficiency
- Participatory

- ✓ Enables social transformation
- ✓ catalyst for economic development
- ✓ leap frog for development
- ✓ enhance quality of life

- Geoprocessing/ Boolean Algebra
- Object Tracking/ shortest path
- AI - ML / DL
- Geospatial Models



Geospatial Technology inputs for Governance

IOT, Drones, Cloud……..

Geospatial Technology for Development - Highlights

National level Institutionalisation

Agriculture - Mahalanobis National Crop Forecast Center, MOA

Water - India Water Resources Info. System ; MOWR

Forest - State of Forests in India : Biennial reports; MOEF CC

Ocean - INCOIS provides PFZ, Ocean State forecast, Tsunami warning and many more …… MOES

National level Geospatial data usage

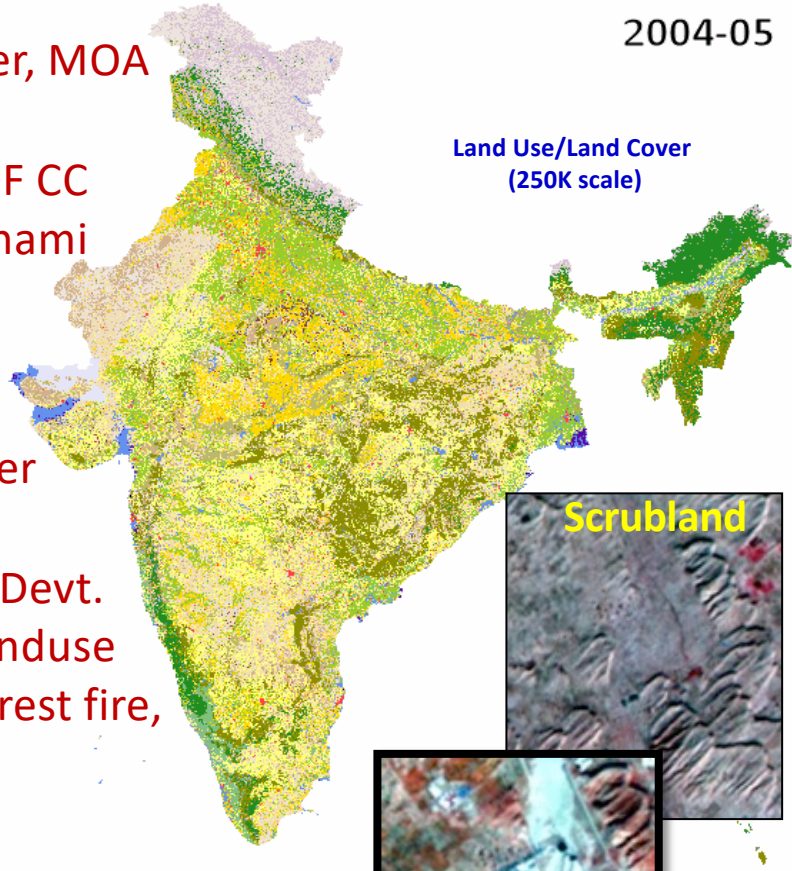
Rural Development - Wastelands, Land use & Land Cover Ground Water, Rural Roads……

Urban Development: NUIS, AMRUT, and Infrastructure Devt.

Land Resources - Watershed Development, National Landuse

Disaster Management - Floods, Cyclone, Landslides, Forest fire, Earth Quake, Drought……

. . . . . .



Governance Applications - Many Ministries

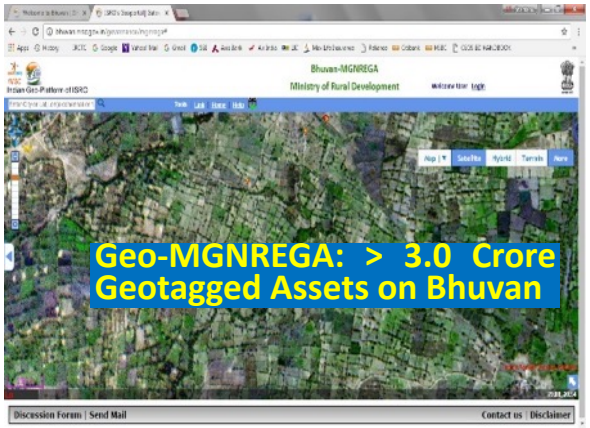
Continuous & Demand based Activities for Planning, Monitoring & Evaluation and Decision Support

- **Support to Flagship Programmes**
  - **SHC** : Soil Health Card Scheme
  - **PMFBY** : Improved Crop Insurance Services
  - **PMGSY** : Better Utilization of Irrigation Potential
  - **AMRUT** : Citizen friendly sustainable cities
  - Swatch Bharat & Ganga Rejuvenation
    - Clean India Mission
    - National Mission for Clean Ganga
  - Monitoring of Public Benefit & Rural Development Schemes

    (**MGNREGA, PMAY, IWMP, …..**)
  - De-centralized Planning: Participatory planning
  - Education and Health: Universal Access and Quality
- **Institutionalization / Internalization** (20 Implemented)

Integrated Geospatial portal

bhuvan.nrsc.gov.in

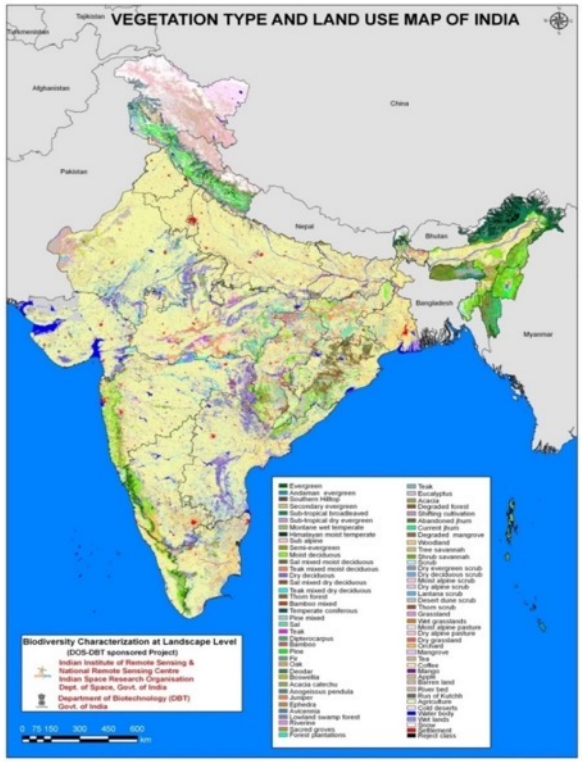


Biodiversity Characterization at Landscape Level

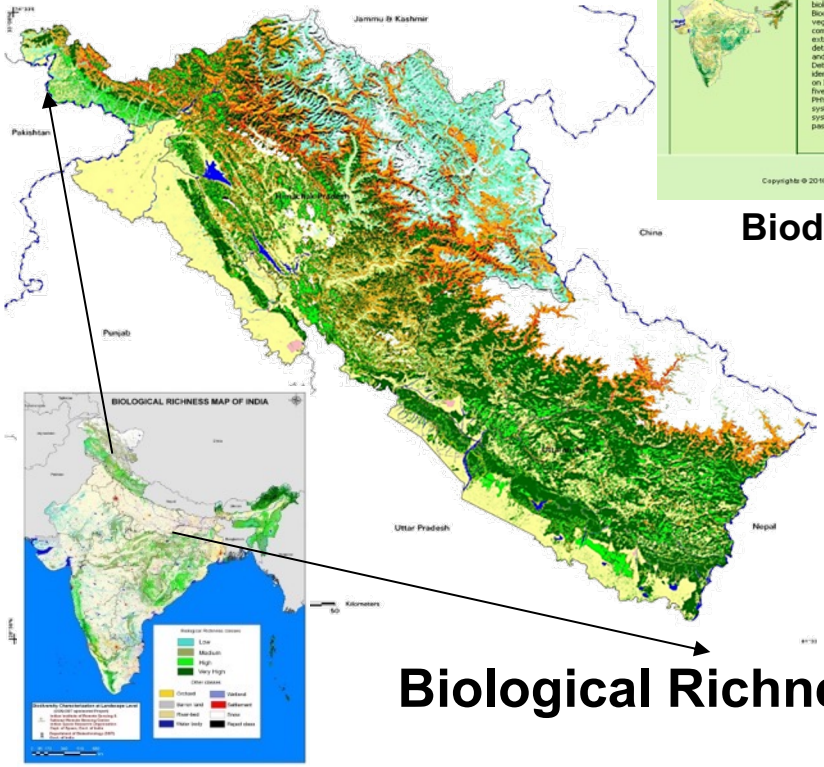
Major National Mission with DBT

- 125 vegetation types mapped in the country
- 6,000 species database generated.
- Biological richness & Disturbance regime are identified for conservation

Biodiversity Information System (BIS)



Vegetation type



Biological Richness

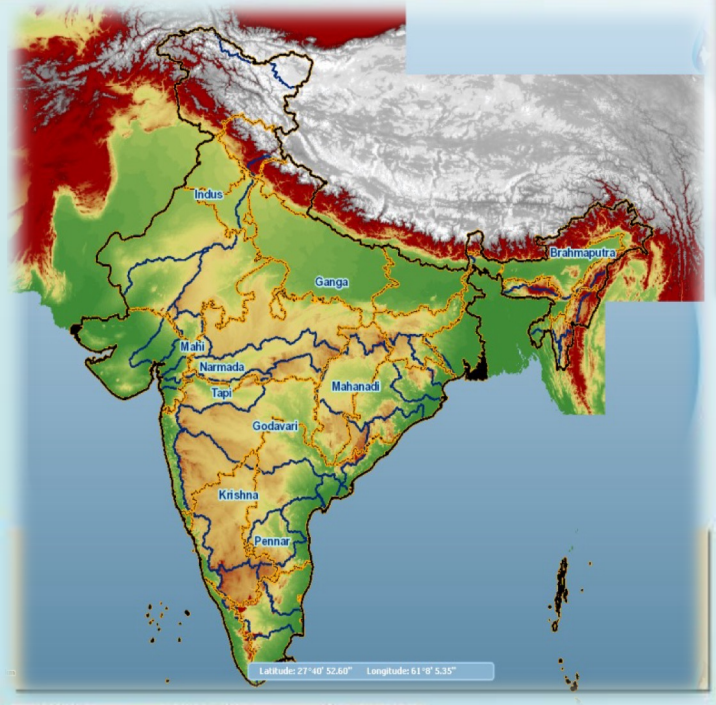
Towards BioD at Community level. . . . . .

Monitoring of MGNREGA

(Flagship Program for Rural Employment Generation)

- Monitoring of assets creation using Sat. Images & Geotags, through multistage observations.
- Support to plan NRM activities under Mission Water Conservation through Bhuvan
- More than 4.00 Cr Assets Geotagged and posted on to Bhuvan Geoportal

India-WRIS WebGIS

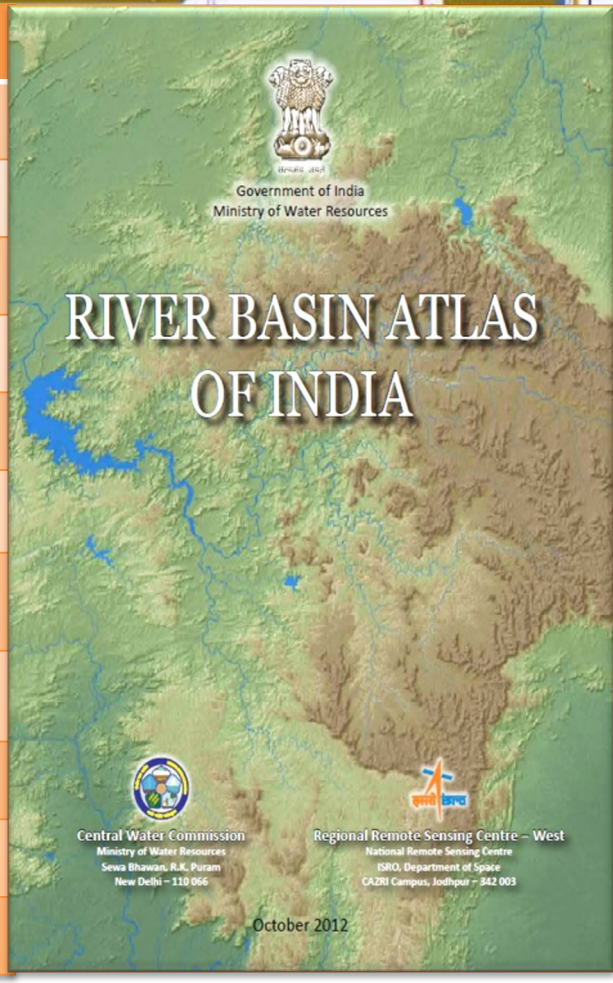


Geo-Visualization & Processed data

Joint effort of ISRO & CWC

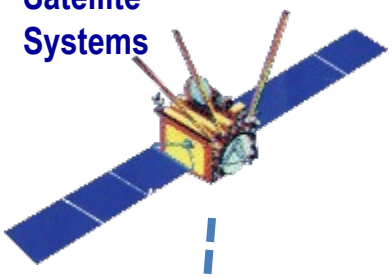
- 12 major info systems having 108 spatial layers with 5-100 years hydro-meteorological data.
- Basin-wise reports & Watershed atlas

I.	BASE DATA
II.	SURFACE WATER
III.	GROUND WATER
IV.	HYDRO – MET
V.	WATER QUALITY
VI.	SNOW COVER / GLACIER
VII.	INLAND WATERWAYS
VIII.	INTER-BASIN TRANSFER
IX.	HYDROLOGICAL EXTREMES
X.	LAND RESOURCES
XI.	WATER TOURISM
XII.	SOCIO – ECONOMIC



Potential Fishing Zone (PFZ) Mapping - Navic App

Satellite Systems



- Potential Fishing Zone based on Chlorophyll & Sea Surface Temperature.

Search time reduction by 60-70%
Average catch per unit effort increased 2-4 times.
Net profit increase by 2-5 times

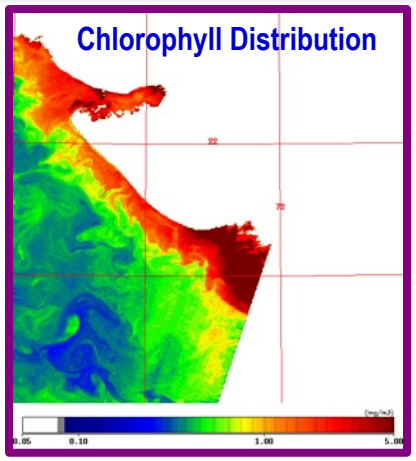
- Ground station established at INCOIS for enabling near real time generation of fishery forecasts.

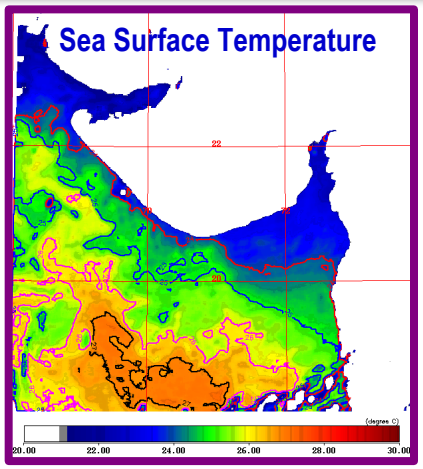
Services

Navigation

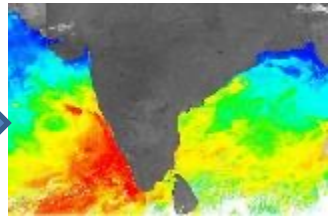
Dissemination

Data Reception

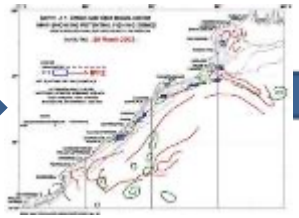




Data Processing



Parameter Retrieval

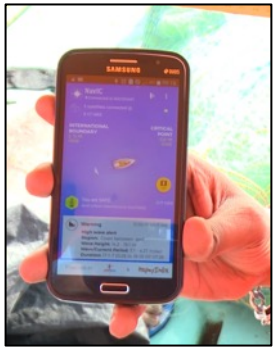


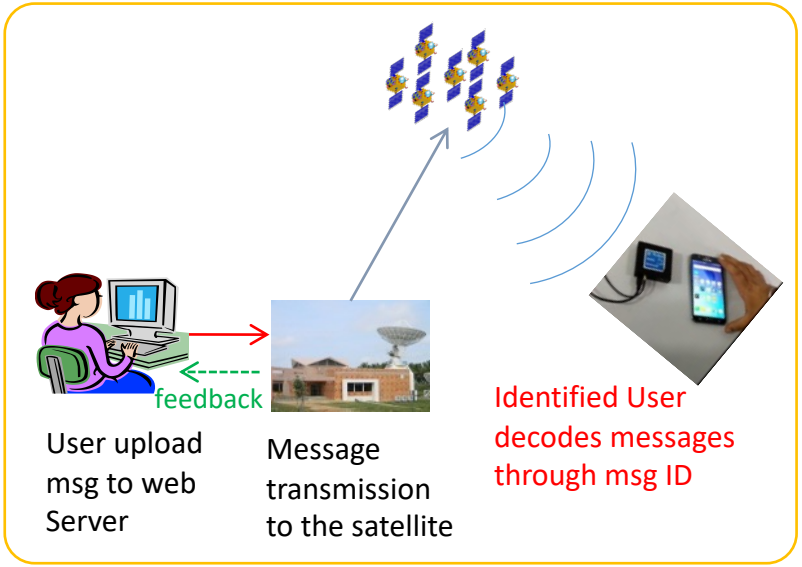
Integrated Product

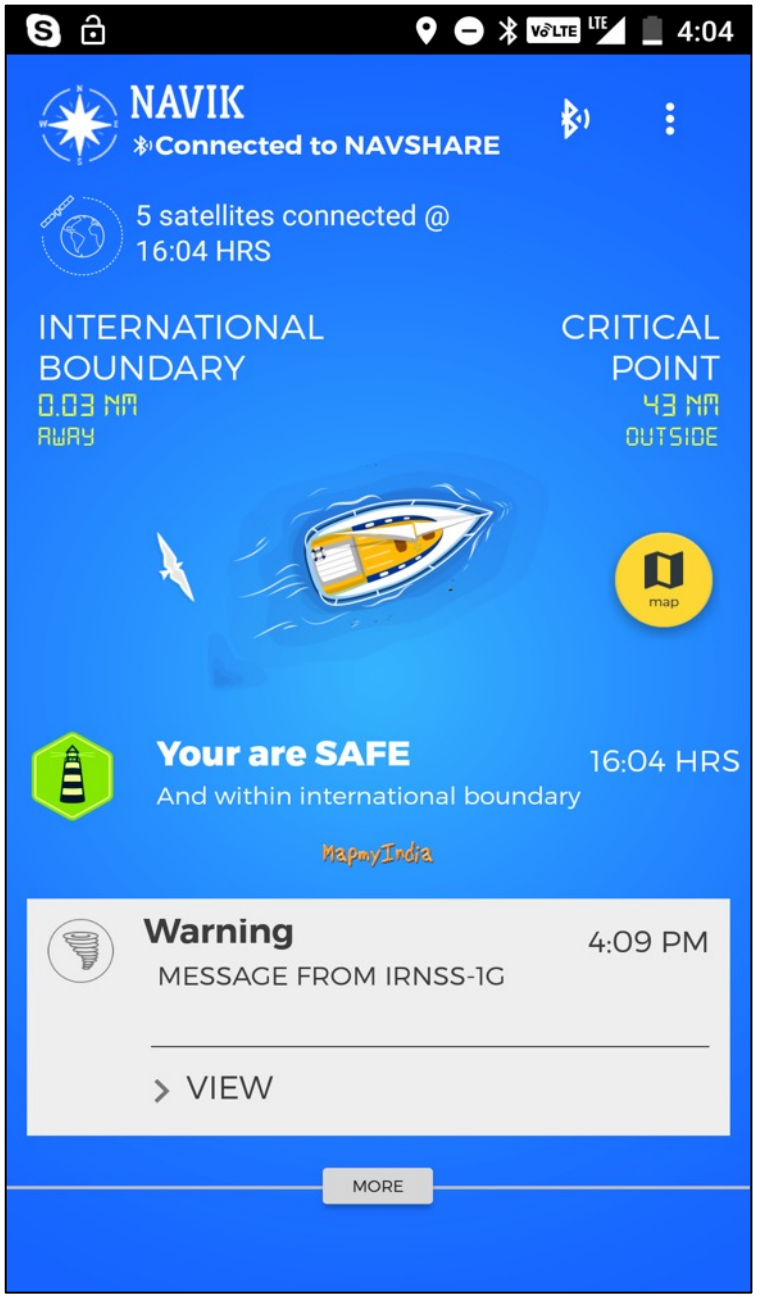
NavIC for Fishermen Community

NavIC based Mobile App Features

- **Location based information**
- **Maritime Intl. boundaries**
- **Online potential Fishing Zones**
- **Weather & Sea State Alerts**
- **Multi-language support**

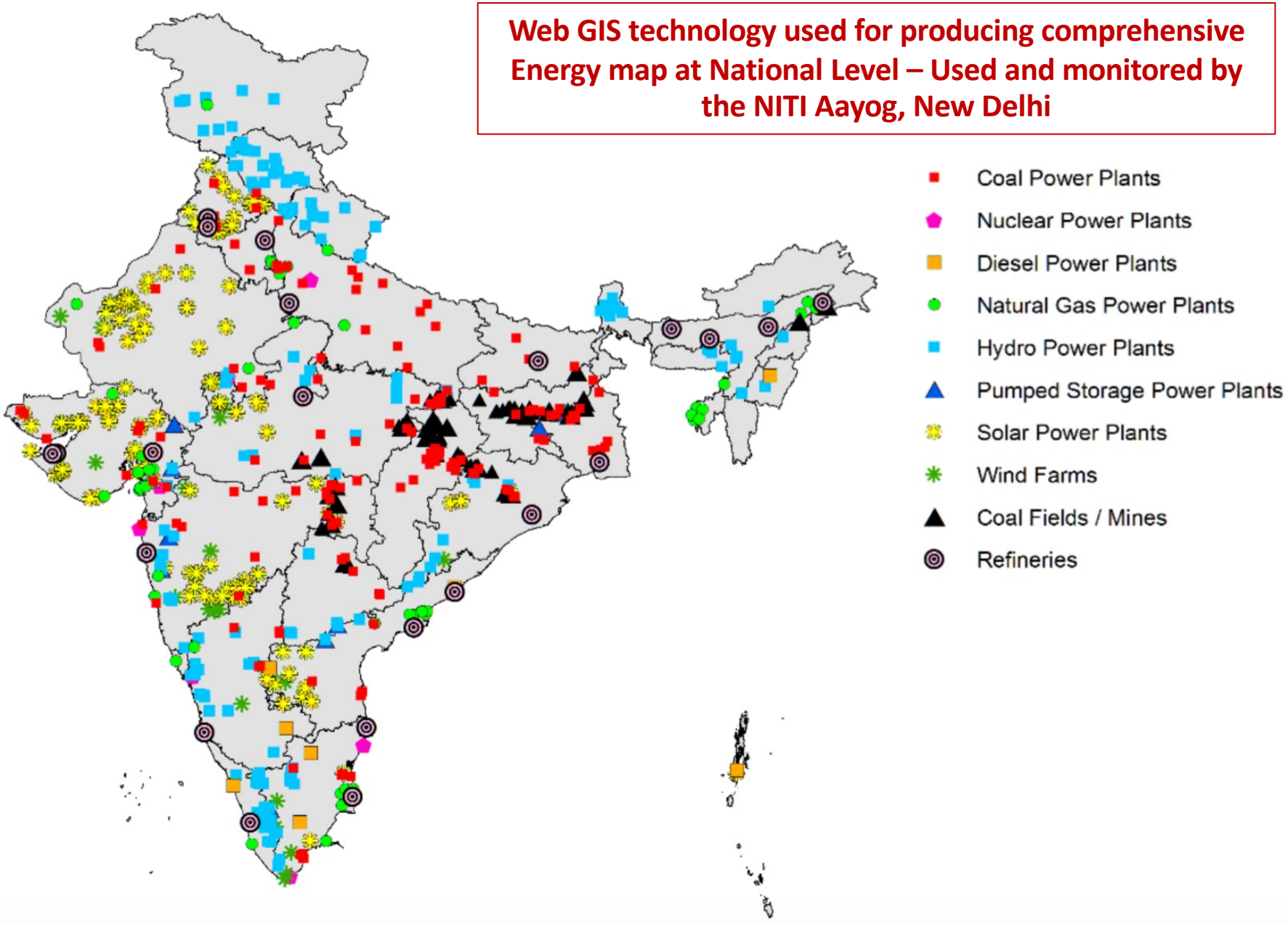




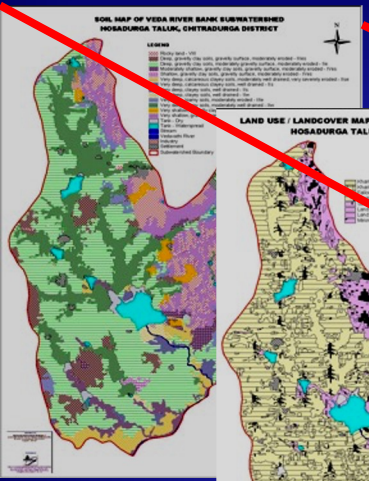


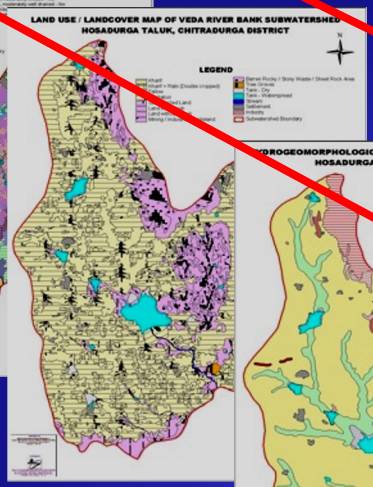
Energy Map of India

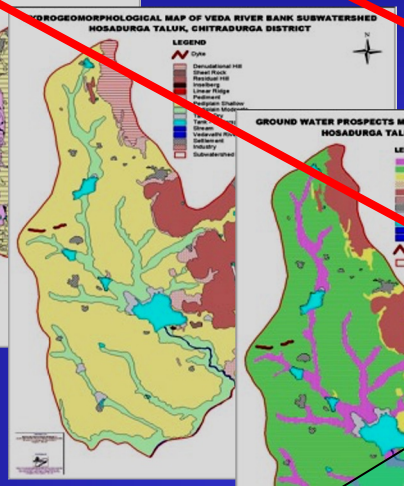
Web GIS technology used for producing comprehensive Energy map at National Level – Used and monitored by the NITI Aayog, New Delhi

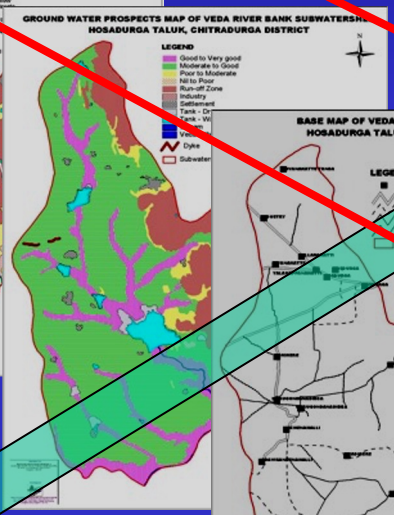


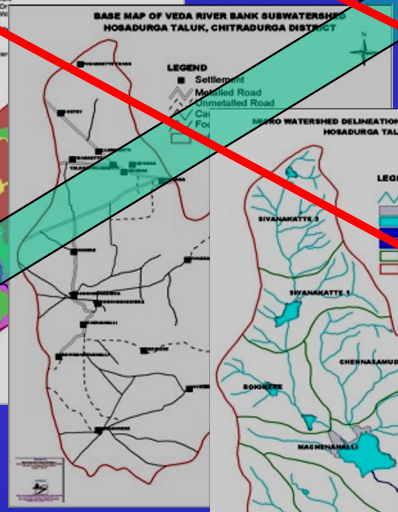
Rural Devt. - Watershed Development

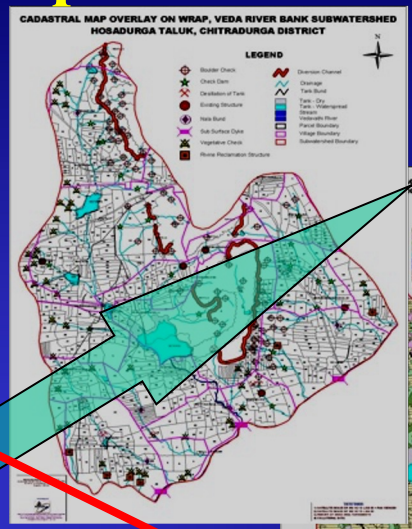


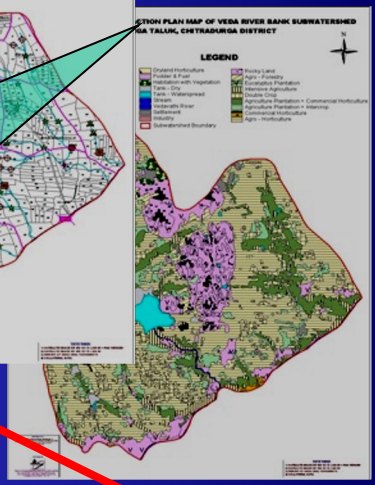


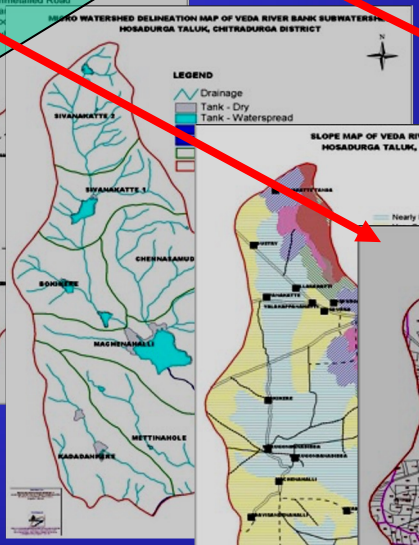


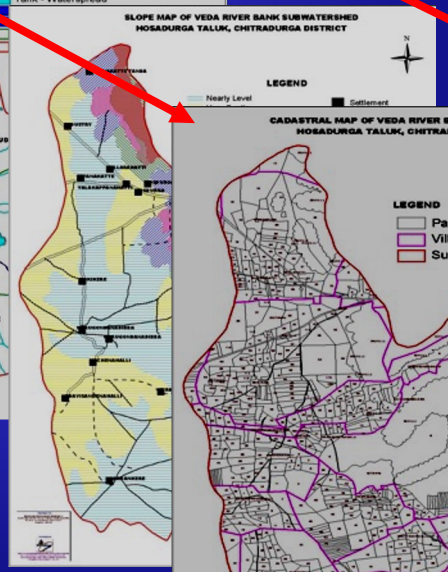


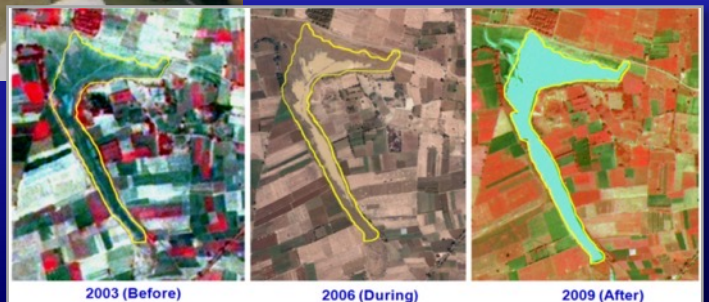






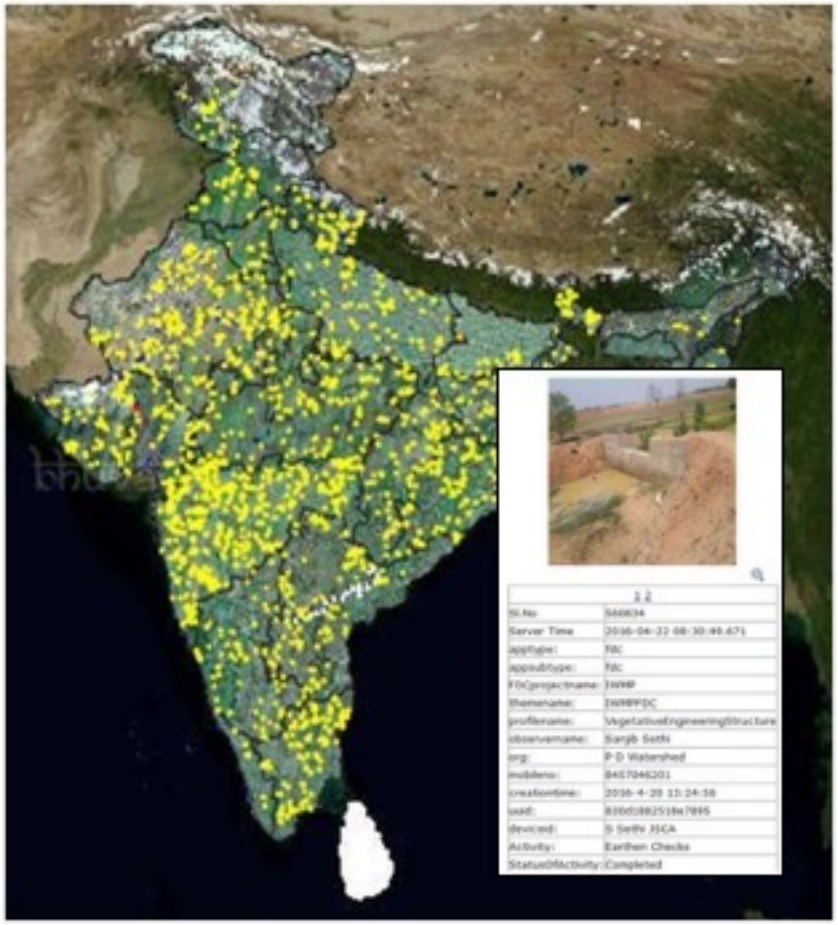






Geospatial Monitoring of Watersheds under IWMP - MORD

- 86,000 micro-watersheds (About 40 M Ha) being monitored under IWMP
- Judicious use of Space Technology - High Res Images, Bhuvan Geoportal, Mobile Applications
- Treatment at Ridge lines, Drainage line, Afforestation, Soil Conservation……..
- Over 11.00 Lakh interventions are geotagged and available on Bhuvan



CONTOUR TRENCH AND PLANTATION

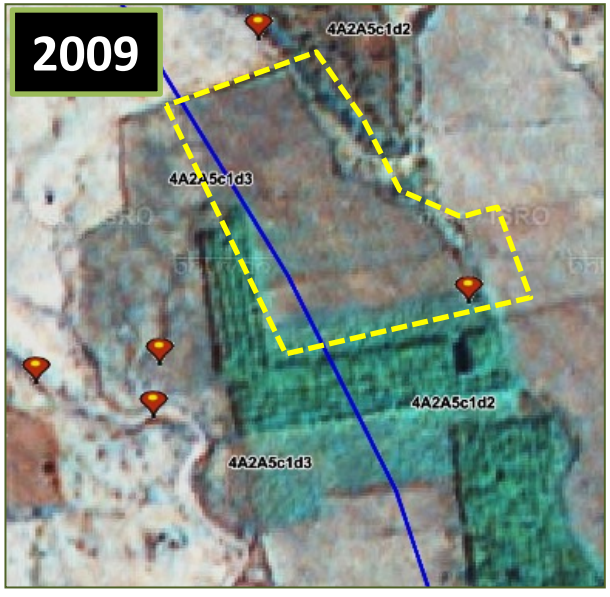
FARM POND

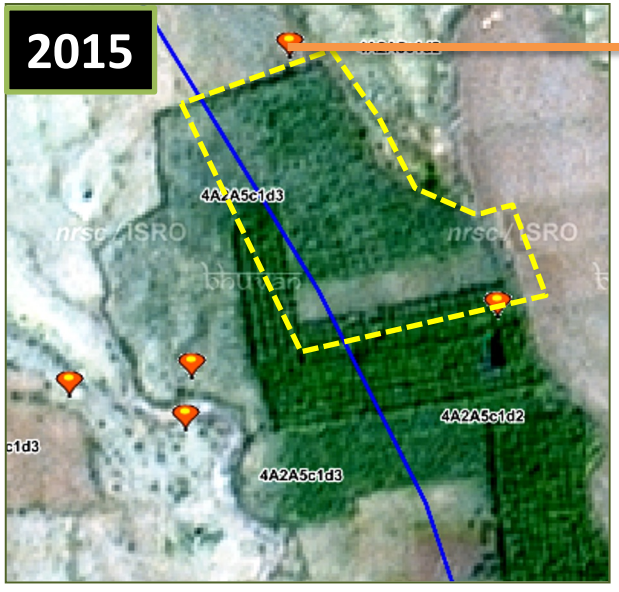
Land developmental activities in Bastar District , Chhattisgarh

MONITORING IMPLEMENTATION & IMPACT ASSESSMENT

- Mobile App (DRISHTI) for Geo-tagging of activities
- Web based Application (SRISHTI) for Change detection

86,000 Watersheds





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themename:	IWMPFDC
profilename:	CivilworkSM
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org:	DWDA theni
mobileno:	9788144483
creationtime:	2016-1-22 15:40:41
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deviceid:	bmurugan21878@gmail.com
CivilWorks:	Check Dam
StatusOfActivity:	Completed
Location:	Devangar polytechnic

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observername:	p.Rameshbapu
org:	dwdavpm
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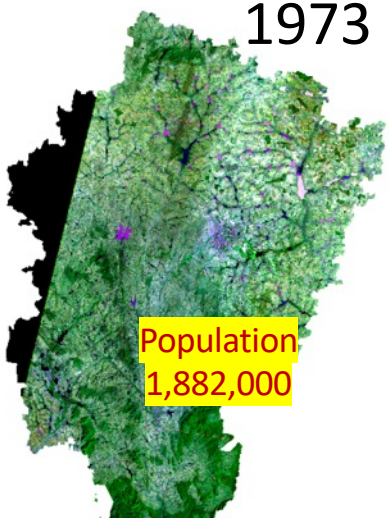
deviceid:	iwmp ix
Activity:	Others:- village pond
Category:	Newly Created
StorageCapacity:	1500

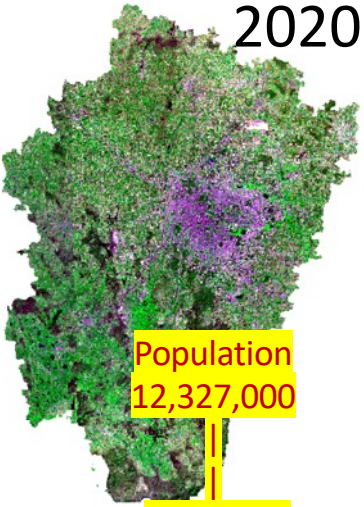
Impact of Urbanisation over a period of about 50 yrs

1973



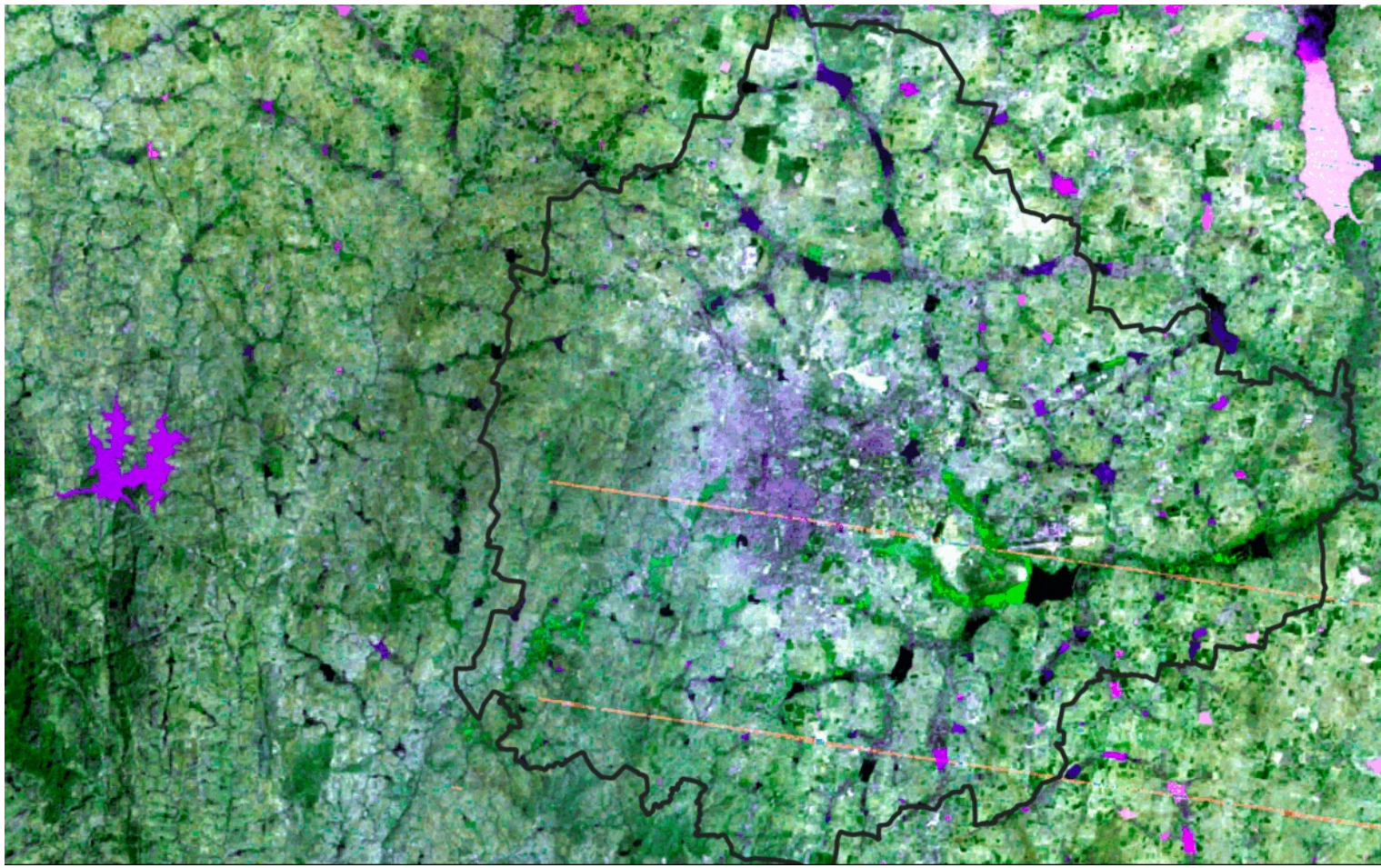
Population
1,882,000

2020



Population
12,327,000

For 2022:
13,193,000



Bengaluru has grown beyond BBMP boundary.....

Urban Development – Challenges & Need for Innovation

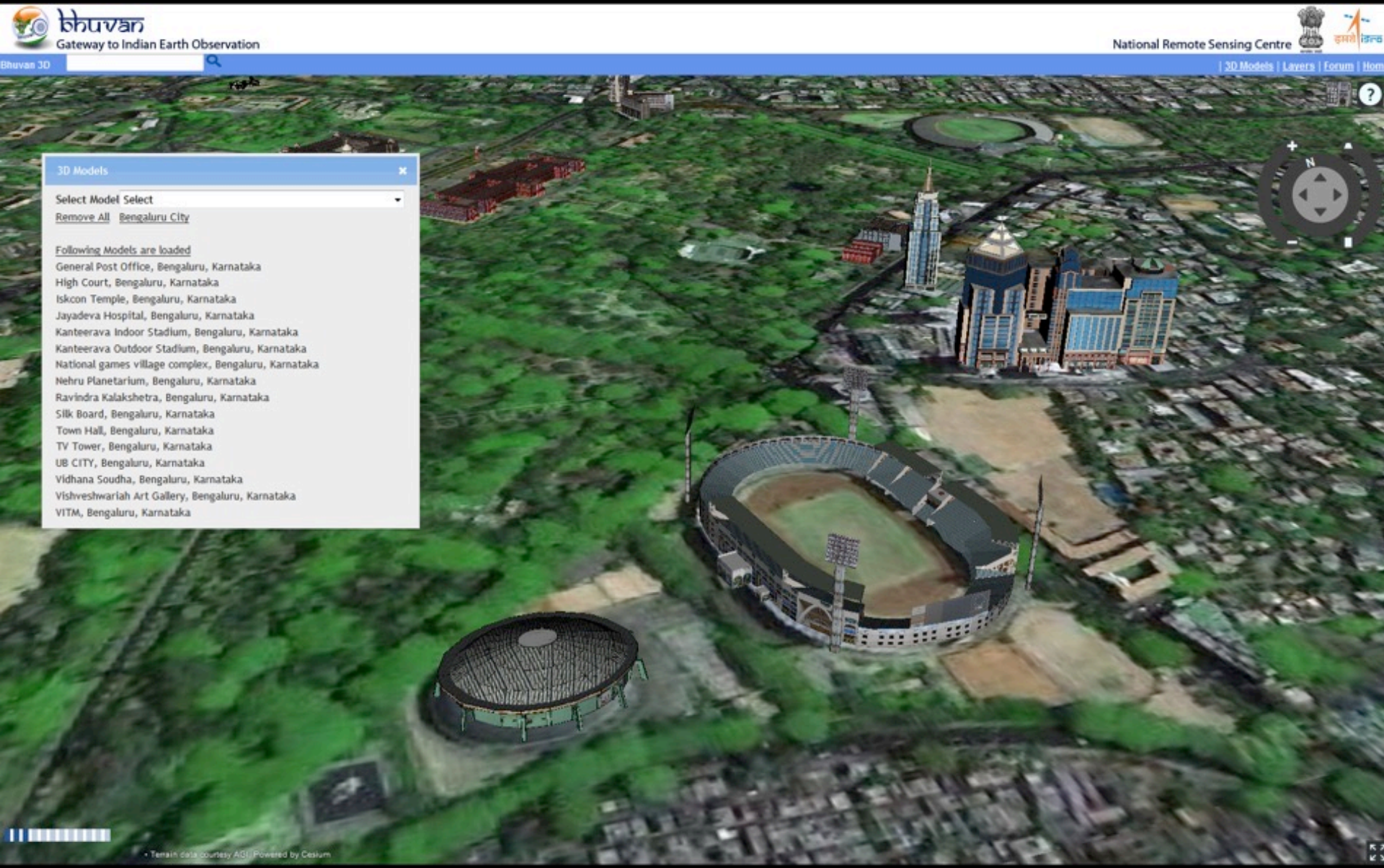
- **Poor local governance** is a common issue
- **Weak in using technology** for planning – insufficient finances
- **Inappropriate planning** leads to haphazard developments - high costs of housing and office space
- **Critical infrastructure shortages** and **major service deficiencies** - Erratic water and power supply, inadequate transportation systems and chaotic urban utilities
- Rapidly **deteriorating environment** and ecology
- **Poor living conditions** and Slums in many cities
- At least three out of world's 21 mega cities are in India

There is urgent need to look into new ways of urban development with improved data collection and effective use of new technologies, ... DIGITAL TWINS

Digital Twins mechanism

- The digital twin technology is data-driven. A network of sensors fetches the data for creating the virtual sibling of a physical world. The framework of digital twins consists of **three parts**:
  - **The physical object** – the real product
  - **The virtual object** – the digitally cloned product
  - **The connection between the physical and the virtual object** – the data that flows from physical to virtual product and the information that is supplied from the virtual to physical product

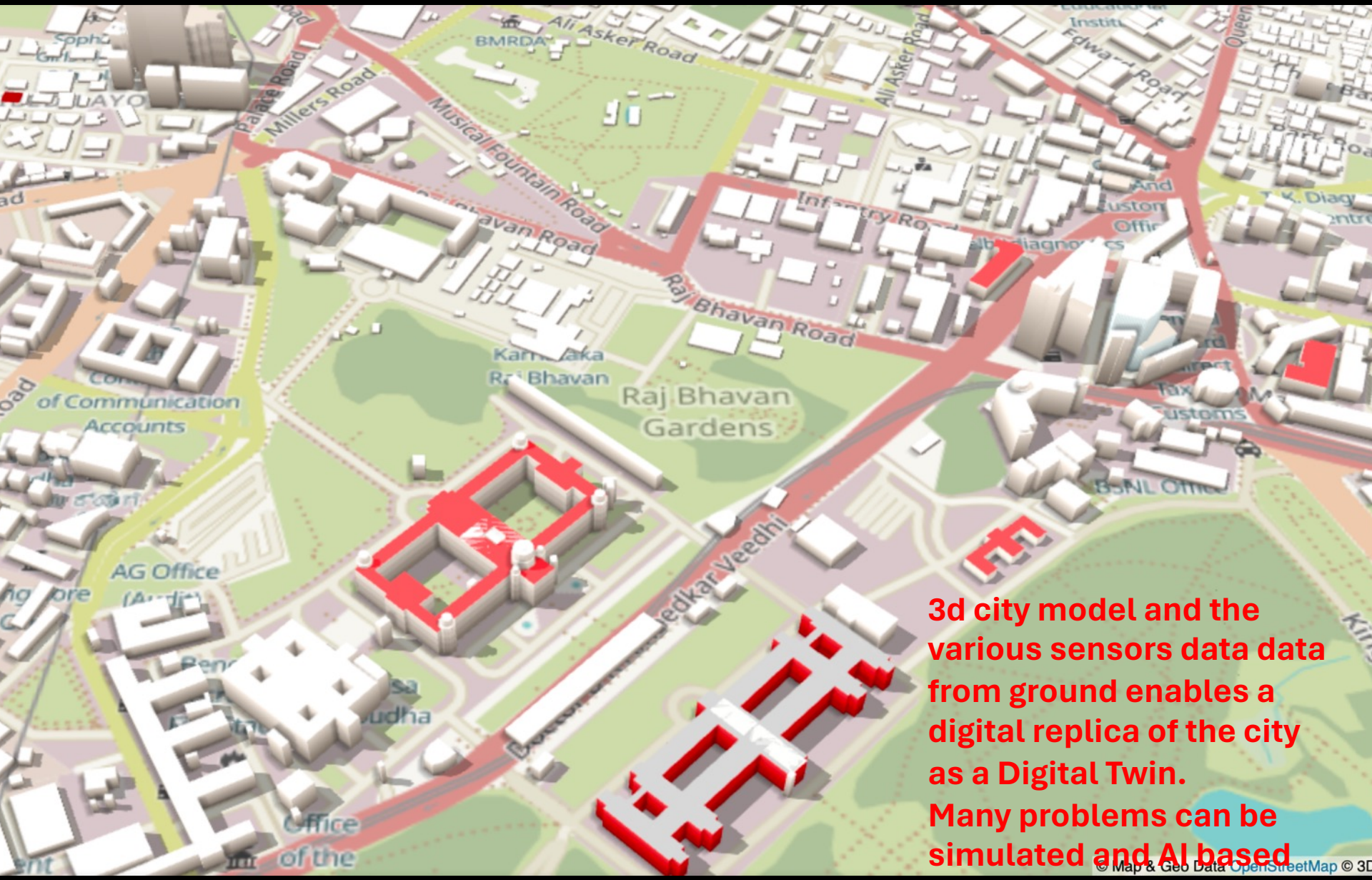
3D City Models – use of CityGML Tool



Digital Twins for improved urban planning & Management

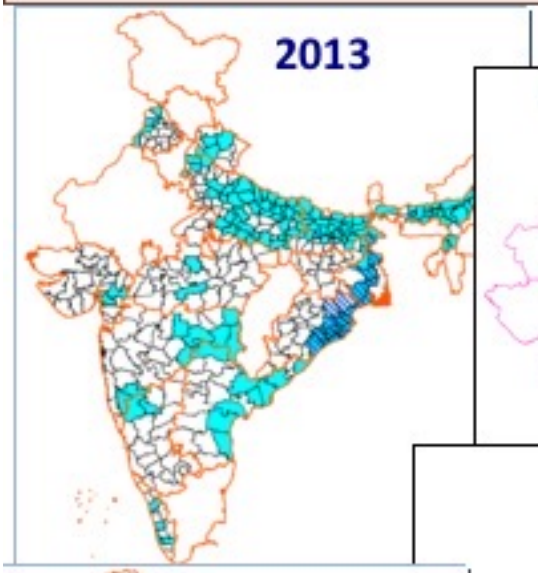
- Can revolutionize how cities are designed, operated, maintained, and sustained to enhance the quality of life
- Reduced environmental impacts
- Improved resource utilization & better economy
- Easy to simulate issues/ build scenarios to take decisions in time
- Disaster prevention and greater credibility
- identify potential bottlenecks and traffic congestions for advance action
- Helps in quick response to any extreme situations

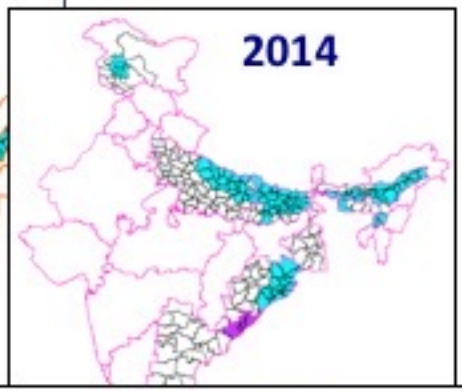
3D Open Street Map of Vidhana Sowda

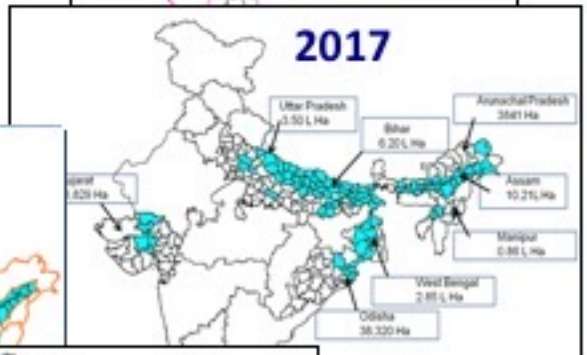


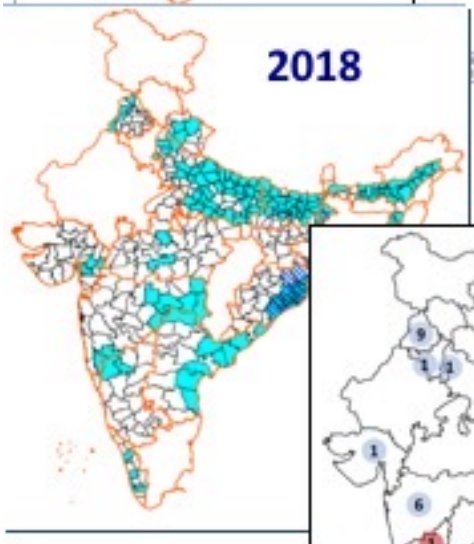
3d city model and the various sensors data data from ground enables a digital replica of the city as a Digital Twin.
Many problems can be simulated and AI based solutions can be found

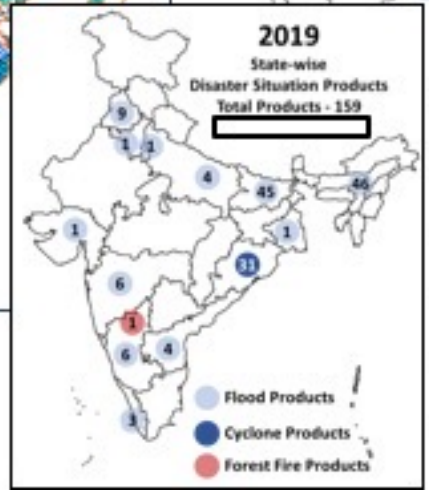
Disaster Management Support

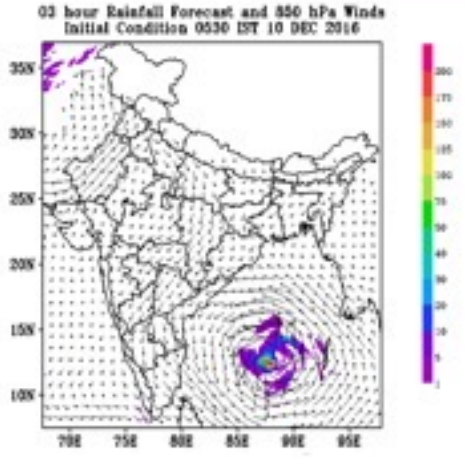












FLOODS
- Inundation Mapping
- Hazard Zonation
- Early Warning

FOREST FIRE
- Fire Detection
- Fire Alert (within 30 min. of acquisition)

CYCLONE
- Damage Assessment
- Landfall Prediction
- Early Warning

LANDSLIDE
- Inventory
- Early Warning

Agri. DROUGHT
- Monitoring & Assessment

EARTHQUAKE
- Damage Assessment

Disaster Communication Network
Decision Support Centre
National Database for Emergency Management
North Eastern Regional Node for Disaster Risk Reduction

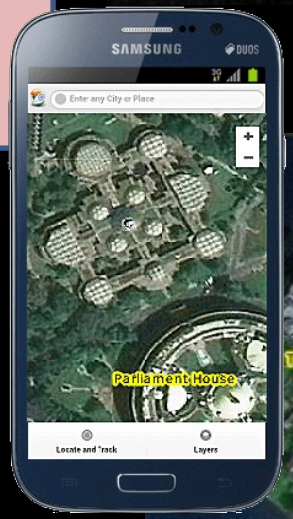
BHUVAN Geoportal – A National Geospatial Engine

- Visualisation
- Thematic Maps (WMS)
- Open Data (for download)
- User Data Site
- Crowdsourcing

2D, 3D and Mobiles

Data Downloads
LISS_III, AWIFS, CartoDSM (30m)

- Online Disaster Support
- Central/ State Ministries
- Crop Pest Surveillance



Bhuvan Collaboration Portal

User Statistics

- No. Hits / month : 8 Million (on average)
- Unique IP : 19000 / month
- Free Data download : > 200,000 / month
- Daily data transfer : > 2.4 GB

Bhuvan Services

WMS Services

Satellite Images

WMS Services

Base Maps
Thematic Maps

WMS Services

Terrain

Application Enabled →

Bhuvan Centric

User Centric

Bhuvan Centric :
Application Development for Users

Visualize
through browser

Services

MapServer +
TileCache &
GeoServer +
GeoWebCache

PUBLISH SERVICES

Bhuvan
As Service Cloud

DB
STORE

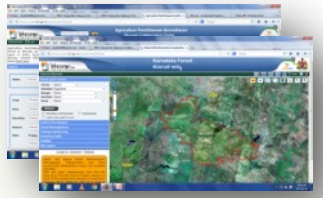
- Prepare
- Process
- Style

- Cadastral Maps
- City Survey Maps
- Ward boundaries

User data upload:
- By FTP
- Mobile/Physically

User

Develop User Centric Applications Using Bhuvan Services

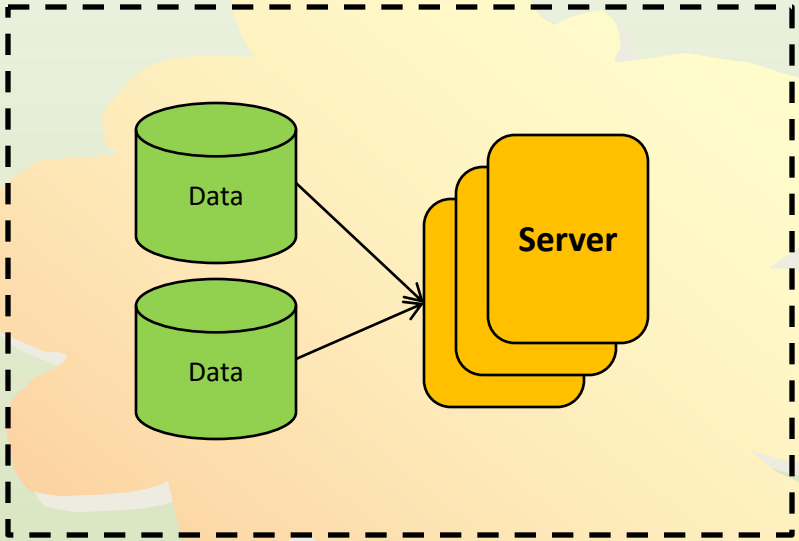


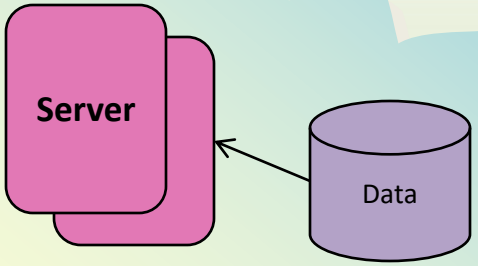
User Client

Visualize through browser

Bhuvan Services (WMS/WMTS)

User's Services

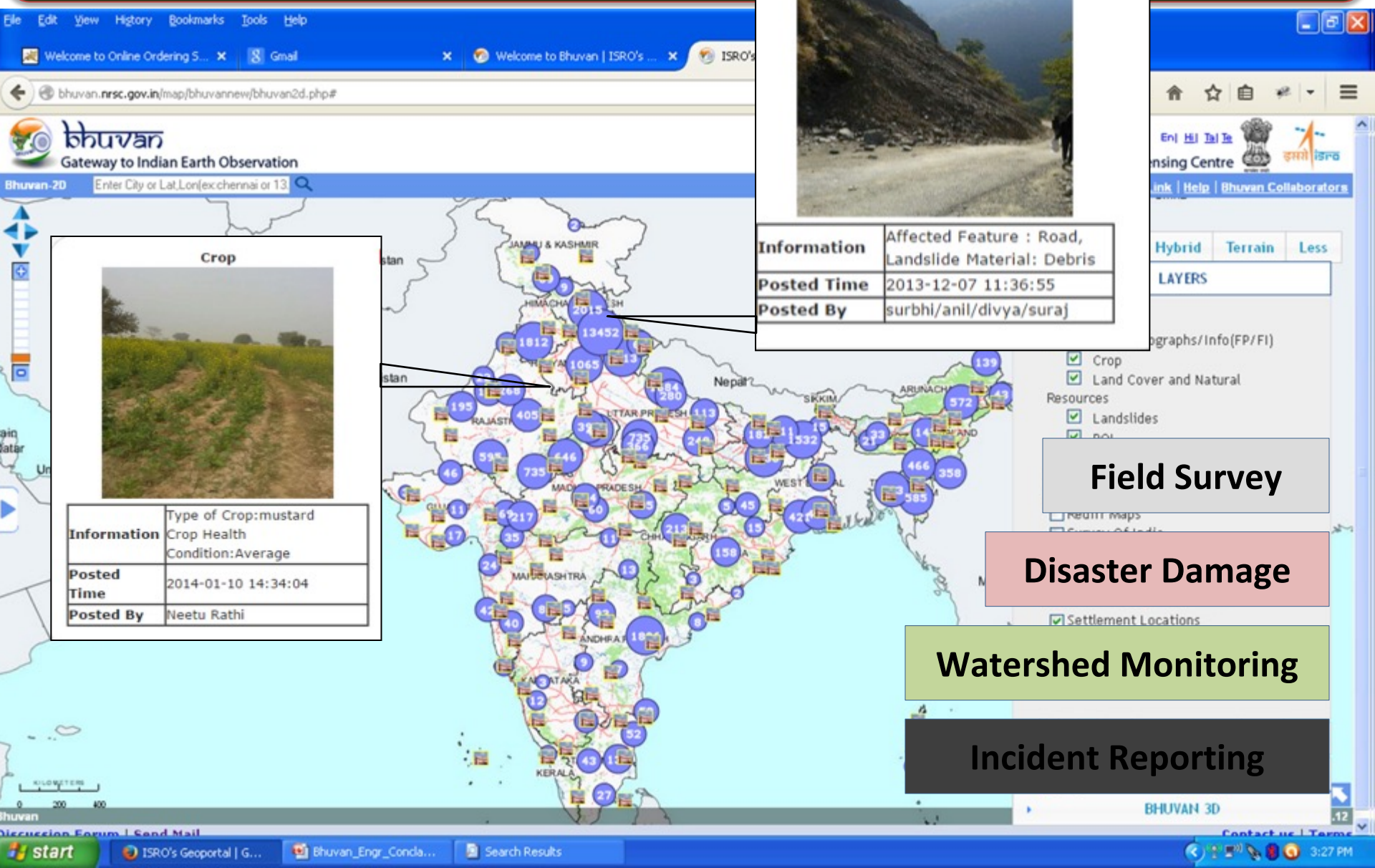




Data Centre- USER

- City Portal
- Property Tax and LBT portal
- Solid Waste Management Appls

Bhuvan Crowd Sourcing




ThankYou
Activate Windows
CARTOSAT 2S