Towards Open source Geospatial data services and Applications

Why & How > Few Examples

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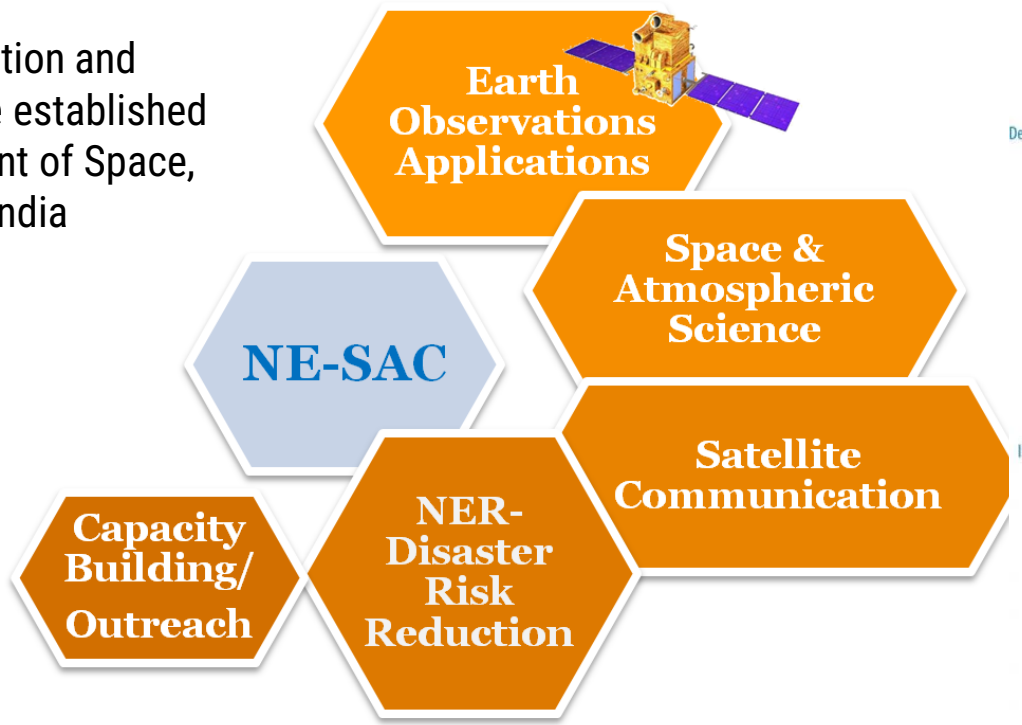
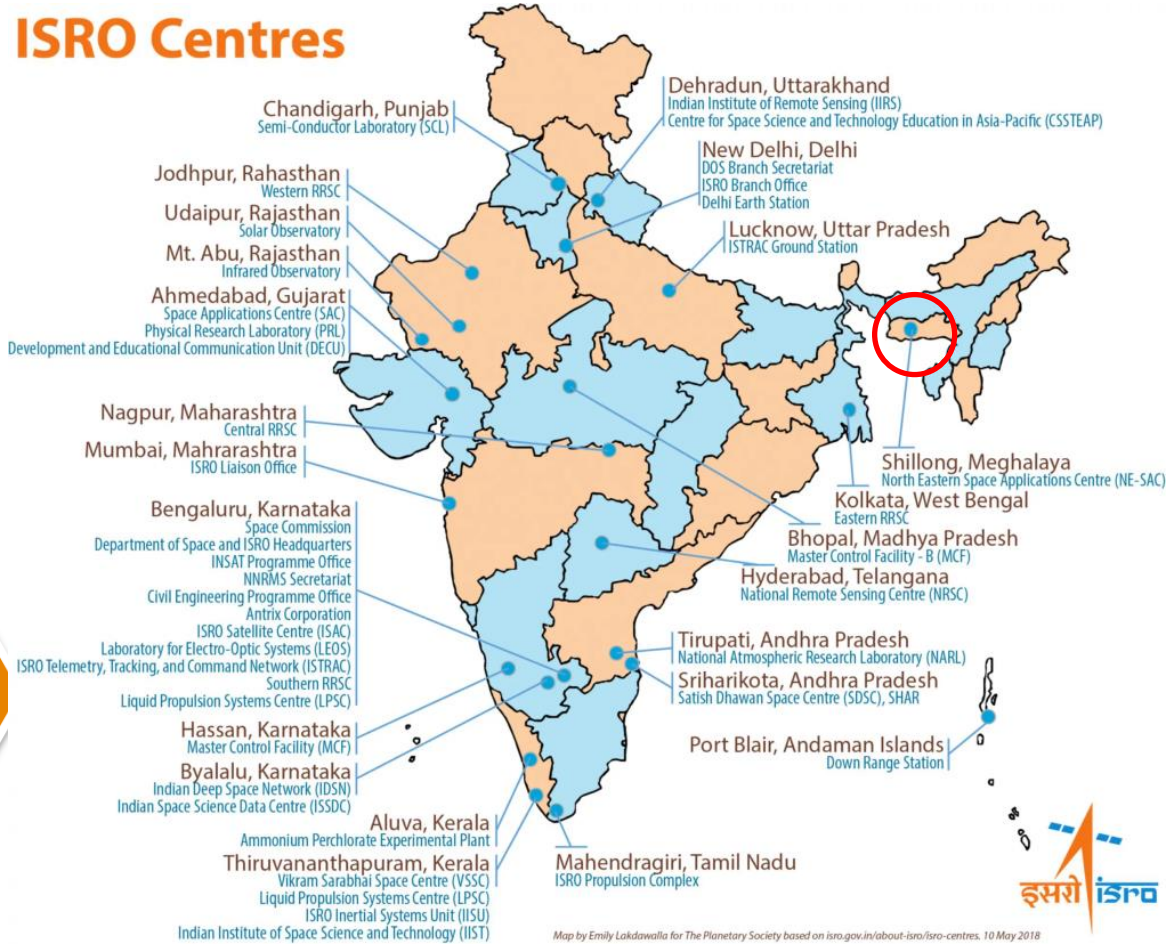
Research Areas

Geo-Spatial Analytics for eGov Solutions
3D Scene understanding
Computer vision algorithms for automatic feature extractions
3D Deep Learning in Computer Vision
VR for 3D Point Cloud

NESAC-ISRO

A Space Application and Research Centre established under Department of Space, Government of India





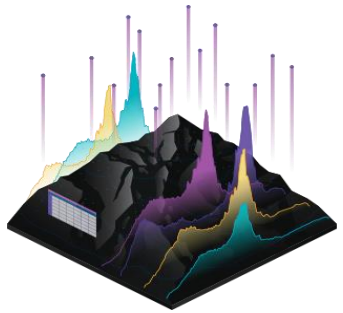
Main Campus

Outreach Centre

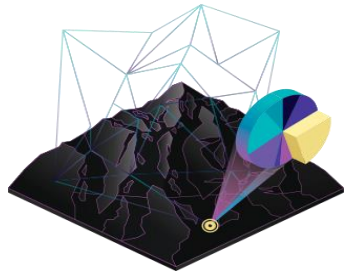
DWR Cherrapunji

Why GeoSpatial?

3 Key Benefits of effective geospatial ***analytics***



- **Engaging & Actionable insights** — Seeing data in the context of a visual map to see spatial patterns or relationship **>** makes it easier to understand how events are unfolding and how to react to those events.



- **Predictive & Prescriptive Analytics** — Using outputs of Prediction to forecast future outcomes > how spatial conditions are changing in real time can help an organization better prepare for change and determine future action.

- **Transformative Governance and Societal impactful applications:** Design of user oriented solutions — Understand the user's needs > collect the data->Define tools and techniques >Process and > deliver the final data and applications for immediate decision making

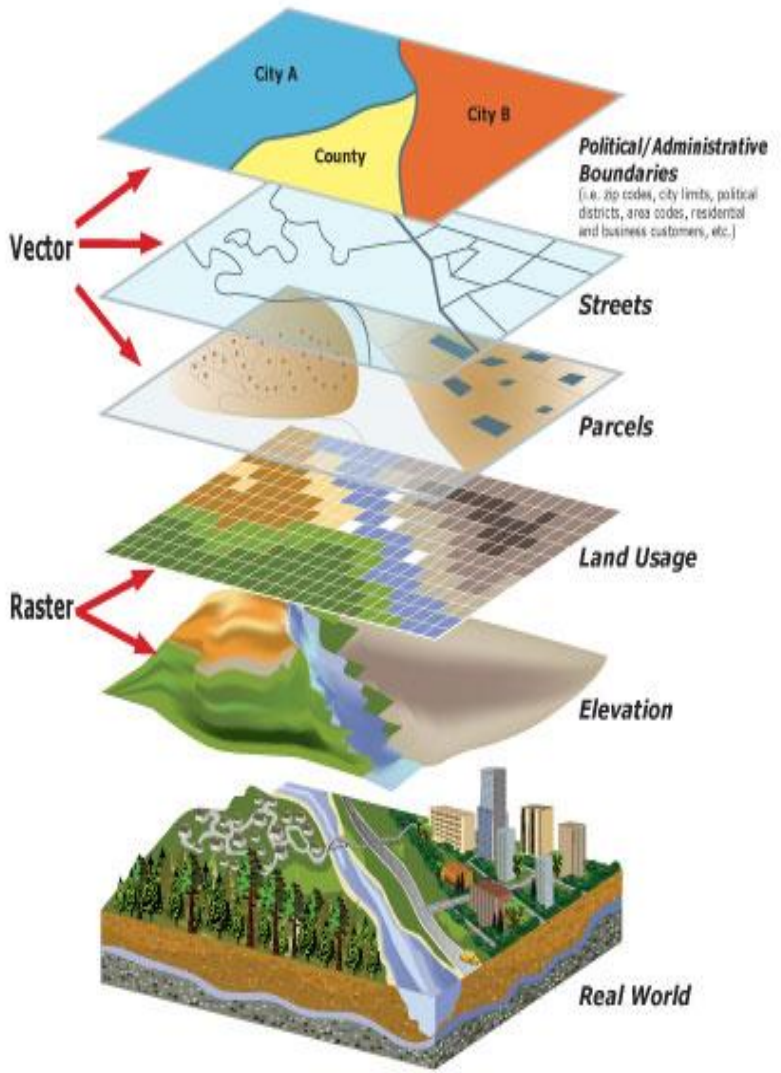
Towards Spatial Intelligence Applications From Sight to Action

Sight > Insight > Seeing > Understanding > Action

- **From Sight to Insight**: Satellites capture images of Earth (sight). We then interpret these images to identify patterns such as deforestation or urban expansion (insight).
- **From Seeing to Understanding**: Observing a significant increase in deforestation (seeing) leads to understanding the underlying causes, such as illegal cutting of trees or encroachments.
- **From Understanding to Action**: Based on this understanding, policymakers can implement regulations or conservation efforts to mitigate deforestation / encroachments etc (action).

Actionable Applications

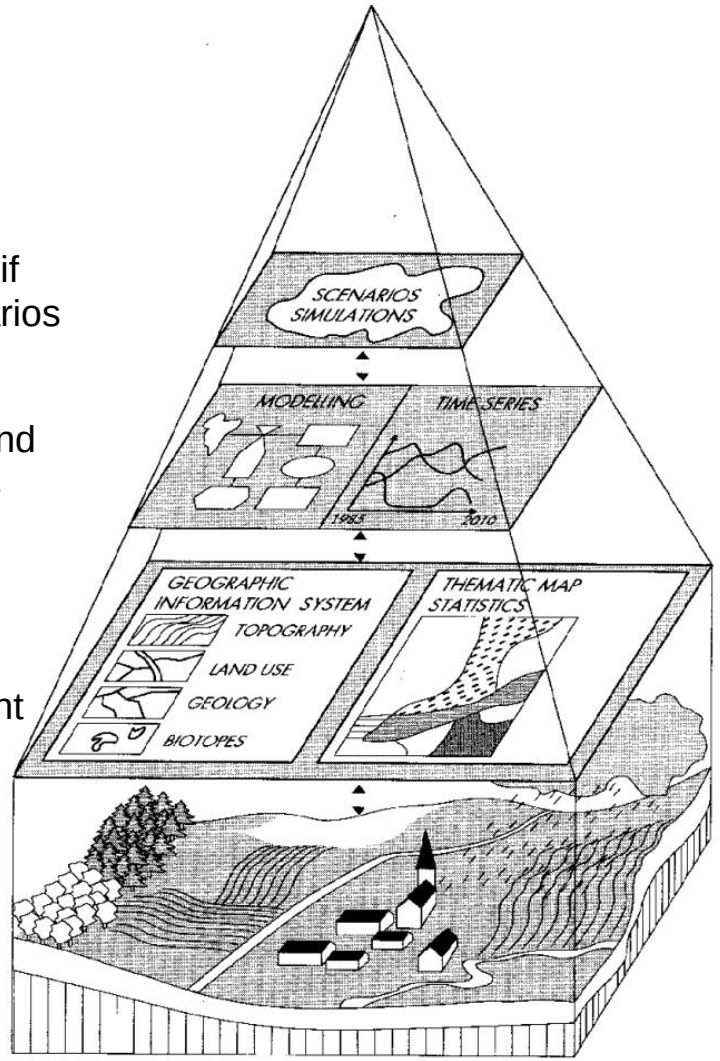
Solving Real world problems with real world geospatial data



What-if scenarios

Modelling and Time Series Analysis

Data Collection and management



Decision making

Analysis and refining of data

Real world

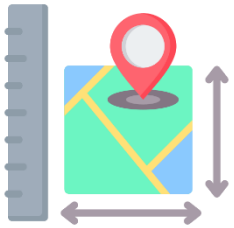
Science of Where?

Where?

Location (Lat/Long)

Eg.

- Where is deforestation happening?
- Where are the agricultural fields?
- Where is the urban growth occurring in the image?



What?

Characteristics of object / features on earth

Eg.

- What is the type of forest / agriculture present in the area
- What kind of infrastructure is present here?

Why?

Reasons or causes for changes or anomalies in the environment

Eg.

- Why is there a sudden increase in urban sprawl?
- Why are the forest fires more frequent in this area?

How?

Methods / approaches to tackle all 3

Eg.

- Better imaging techniques
- Better processing / analyzing
- Models to detect / predict / recommendations
- **Better Applications for decision makers**

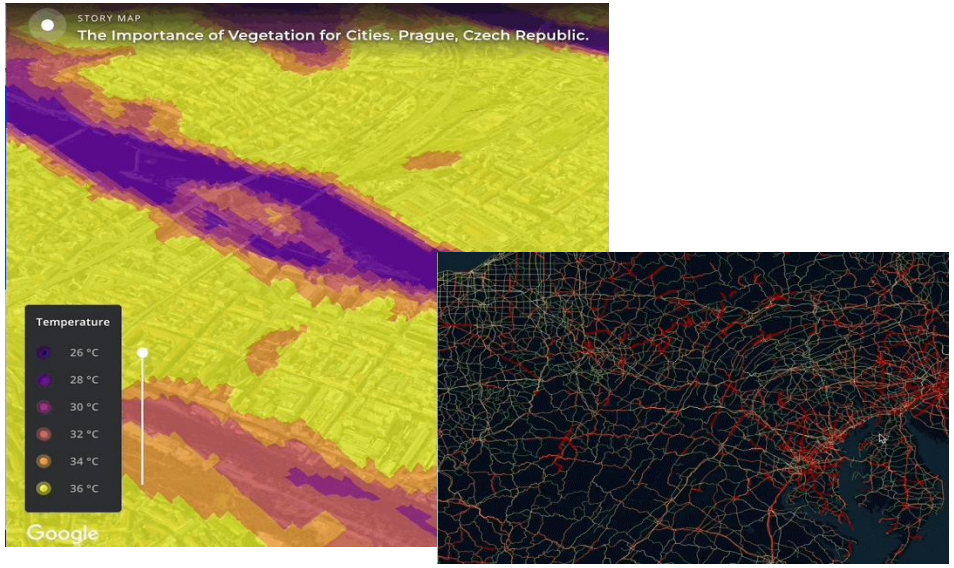
Why open-source tools in geospatial services

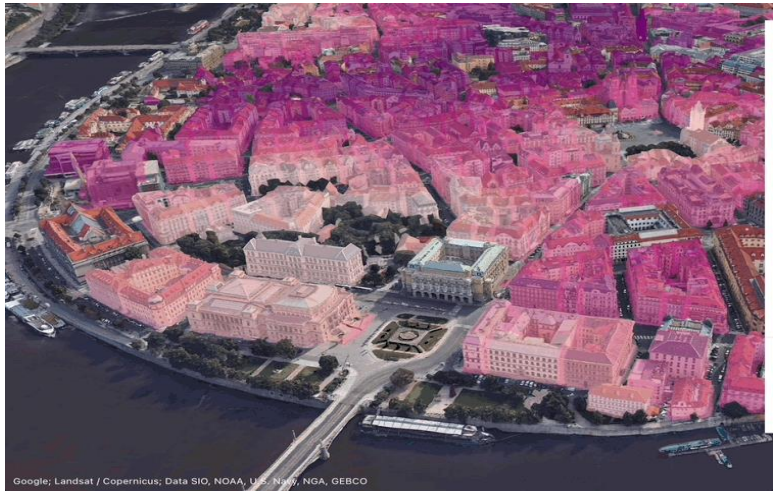
Features that makes open-source tools ideal for advancing geospatial research, analysis, and services.

- **Cost-Effectiveness**: They are typically free, reducing costs for individuals, organizations, and governments.
- **Customizability**: Open-source tools can be modified to meet specific users needs, making it flexible for various geospatial applications.
- **Community Support**: A large community of developers and users contributes to regular updates, improvements, and troubleshooting.
- **Transparency**: The open code ensures transparency, helping users understand how the tools work and fostering trust in their outputs.
- **Interoperability**: Open-source tools often support standard OGC geospatial data formats / services, enabling seamless integration with other tools and workflows.
- **Scalability**: They can be adapted for both small-scale projects and large-scale enterprise-level implementations.
- **Encourages Innovation**: Open-source fosters collaboration and innovation in the geospatial community, driving the development of new applications and features.

Current trends in geospatial data services and applications

- **Real-Time Tracking**: Tools like OpenLayers and Firebase enhance navigation, logistics, and emergency response.
- **Cloud Dashboards**: Platforms like GeoServer and MapServer enable scalable web-based geospatial dashboards.
- **Interactive 3D Mapping**: Libraries like CesiumJS ,Three.js, Potree support 3D dashboards for smart cities and urban planning.
- **Big Data Visualization**: Frameworks like D3.js, deck.gl, Kepler.gl process large geospatial datasets for analysis.
- **Field Data Collection / Mapping**: Design & Develop Mobile Ionic Framework based Mobile Apps for in-field mapping/geotagging and navigation applications.
- **AR/VR Apps**: Libraries like Mapbox AR / A-Frame / WebXR support immersive tourism and training experiences.
- **AI Integration**: TensorFlow and PyTorch provide predictive/prescriptive analytics in geospatial apps.





OGC > Enabling *Interoperable access* to geospatial data

Open GIS Consortium (OGC)

- Consortium of over 450+ organizations, agencies and universities - **make location information FAIR** – Findable, Accessible, Interoperable, and Reusable.
- "Develop encoding specifications that enable **interoperability** among diverse geospatial data stores, services, and applications"
- To Consume and not Store
- Reduces need to duplicate data, eases data updates
- Maximizes use of geospatial data
- Enables usage across diverse formats, projections

OGC APIs : *New* resource-centric APIs best for modern web development

- GeoAPI Implementation Specification
- OGC API – Environmental Data Retrieval
- OGC API – Maps
- OGC API – Processes
- OGC SensorThings API
- OGC API – Common
- OGC API – Features
- OGC API – Moving Features
- OGC API – Tiles

OGC Services

- 3D Portrayal Service
- Location Service (OpenLS)
- Web Coverage Processing Service (WCPS)
- Web Feature Service
- Web Map Service
- Web Processing Service
- Web Services Security
- Coordinate Transformation Service
- Table Joining Service
- Web Coverage Service
- Web Map Context
- Web Map Tile Service
- Web Service Common

Open Geospatial Consortium

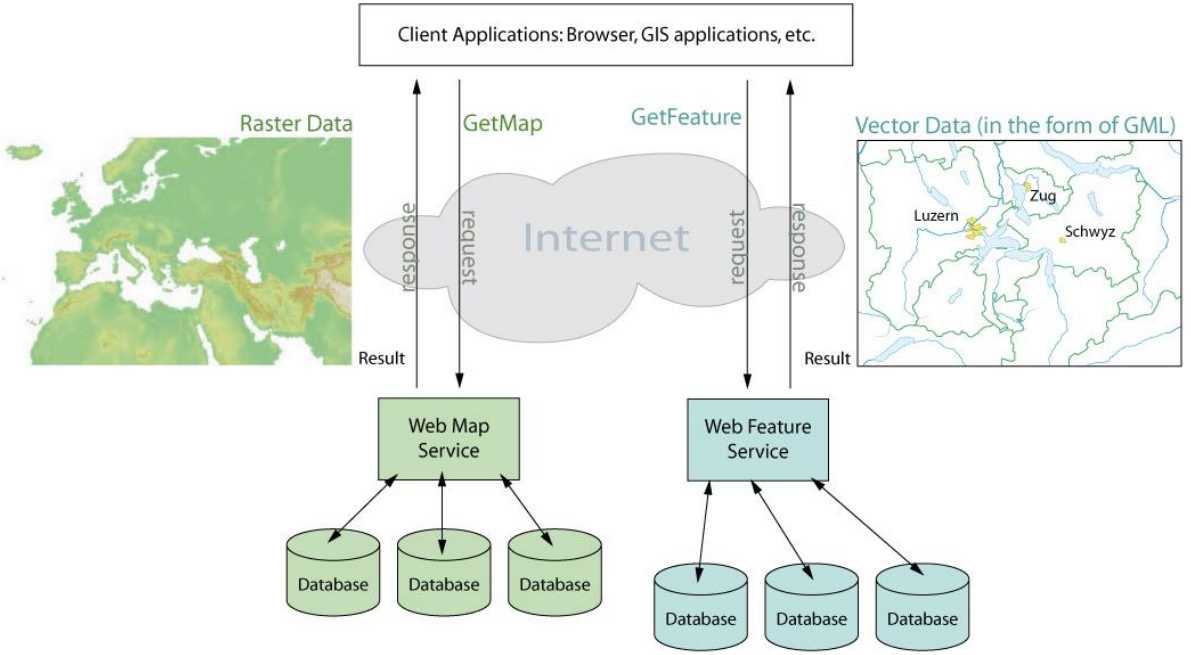
Developing Interoperable Service

- **Web Map Service (WMS)**

  A WMS request defines the geographic layer(s) and area of interest to be processed. The response to the request is one or more geo-registered **map images** (returned as JPEG, PNG, etc) that can be displayed in a browser application.

- **Web Feature Service (WFS)**

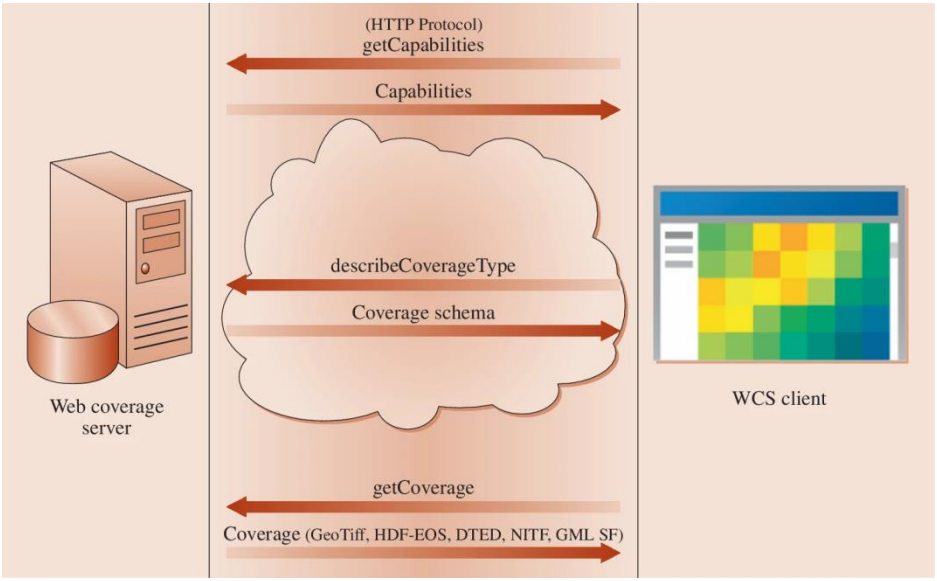
  The WFS operations provides an interface allowing requests for geographic features across the web using platform-independent calls. Response is geographic features as the "source code" behind a map, which end-users can **Query, Edit or spatially analyze**



Developing Interoperable Service

- **Web Coverage Service (WCS)**

  The WCS defines a standard interface and operations that enables interoperable access to geospatial "coverages". The term "grid coverage" typically refers to content such as satellite images, digital aerial photos, digital elevation data, and other phenomena represented by values at each measurement point.



- **Web Processing Service (WPS)**

  The WPS standard defines an interface that facilitates the publishing of geospatial processes and makes it easier to write software clients that can discover and bind to those processes. Processes include any algorithms, calculation or model that operates on spatially reference raster or vector data

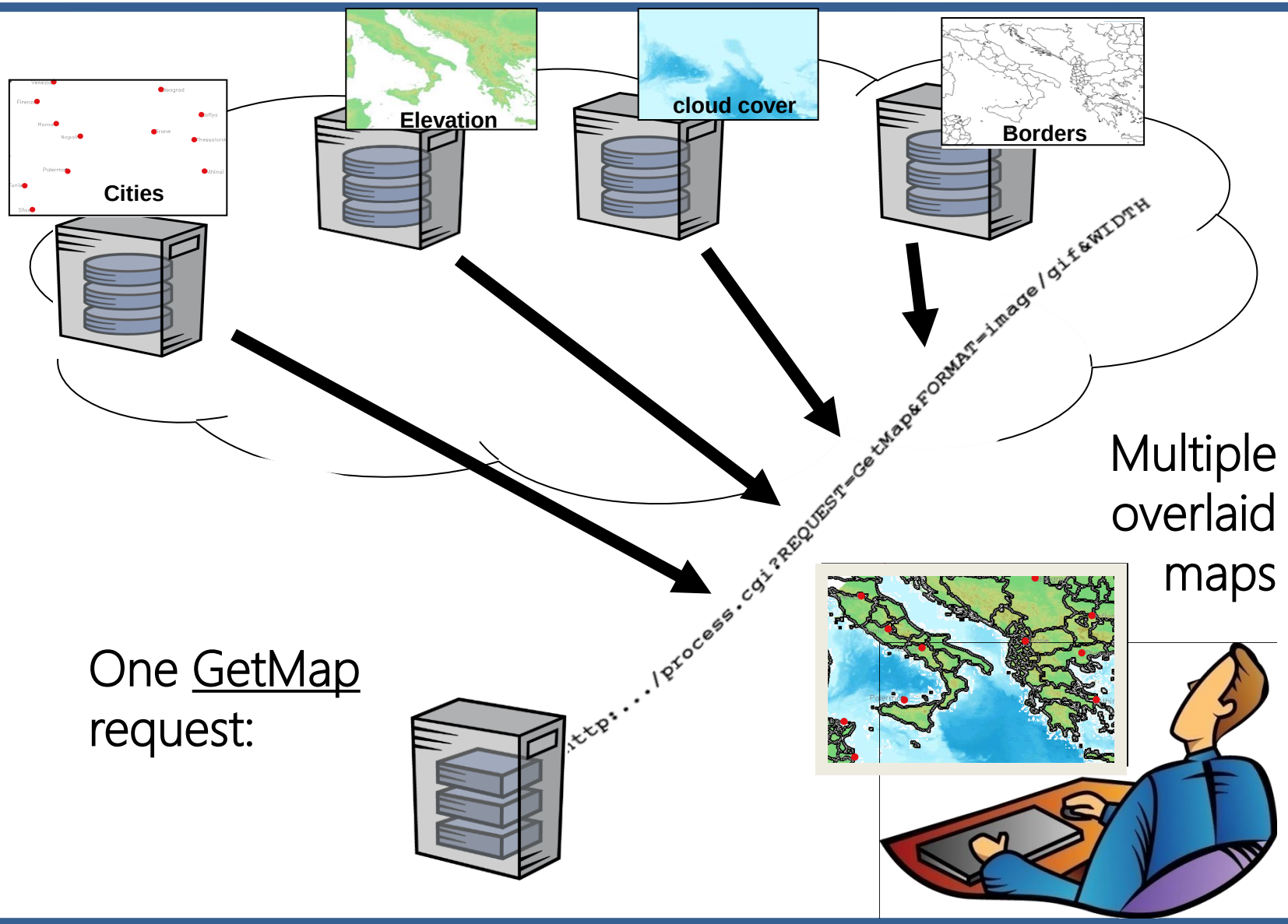
Open Source Geospatial Foundation

- Supports collaborative development of key community-led open source GIS projects
- Provides infrastructure, funding, other support
- Promotes freely available data
- Eg. Openstreetmap
- Supports annual conferences
- Organizes FOSS4G Annual International Gathering

Example projects:

- MapServer/Geoserver
- OpenLayers
- GeoNetwork
- GDAL/OGR
- PostGIS
- Quantum GIS
- GRASS GIS

Accessing WMS Maps



OGC Ready Services for Applications

NeSDR OGC WMS Server List (1397 Data Services) > Interoperable Map Service

Access data services and built **custom** applications

Base and Administrative layers
https://www.nesdr.gov.in/geoportal/../?IEG_PROJECT=QC_Pass_Base_Admin_StatewiseWS (80)
Road Network
https://www.nesdr.gov.in/State_QC_passed_RoadWS/wms/ (8)
Land Use Land Cover 50k 1st Cycle
https://www.nesdr.gov.in/State_QC_passedLULC_0506WS/wms/ (8)
Land Use Land Cover 50k 2nd Cycle
https://www.nesdr.gov.in/State_QC_passedLULC_1112WS/wms/ (8)
Land Use Land Cover 50k 3rd Cycle
https://www.nesdr.gov.in/State_QC_passed_LULC_1516WS/wms/ (8)
Land Use Land Cover 10K layers
https://www.nesdr.gov.in/NER_LULC10KV2WS/wms/ (8)
Derived layers from Land Use Land Cover 1st cycle
https://www.nesdr.gov.in/AR_Derived_LULC_05_06WS/wms/ (6)
Derived layers from Land Use Land Cover 2nd cycle
https://www.nesdr.gov.in/AR_derived_LULC_11_12WS/wms/ (6)
Derived Maps from Land Use 2015-16 Meghalaya
https://www.nesdr.gov.in/ML_Derived_LULC_15_16WS/wms
Derived layers from Land Use Land Cover 3rd cycle
https://www.nesdr.gov.in/AR_Derived_LULC_15_16WS/wms/ (6)
Derived layers from Land Use Land Cover 3rd cycle
https://www.nesdr.gov.in/Arunachal_Water_ResourceWS/wms/ (6)
Soil Ressources Map
https://www.nesdr.gov.in/SOIL_250KWS/wms (8)
List of Arunachal Pradesh 10K layers
https://www.nesdr.gov.in/QC_Pass_AR_10K_DerivedWS/wms/ (7)
Water Resource Layers
https://www.nesdr.gov.in/Arunachal_Water_ResourceWS/wms/ (4)
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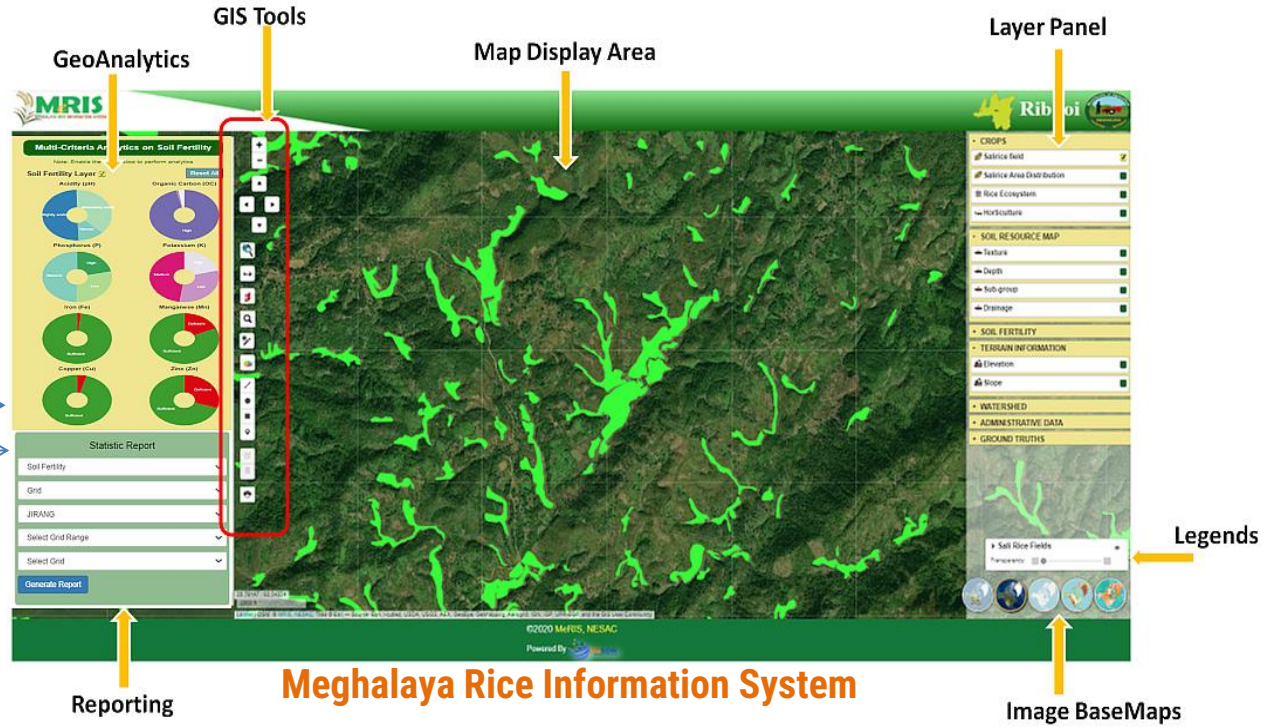
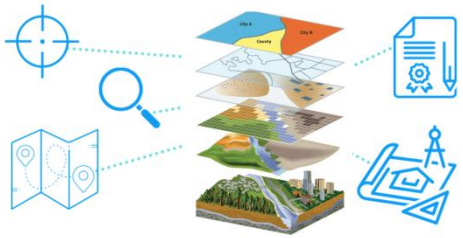


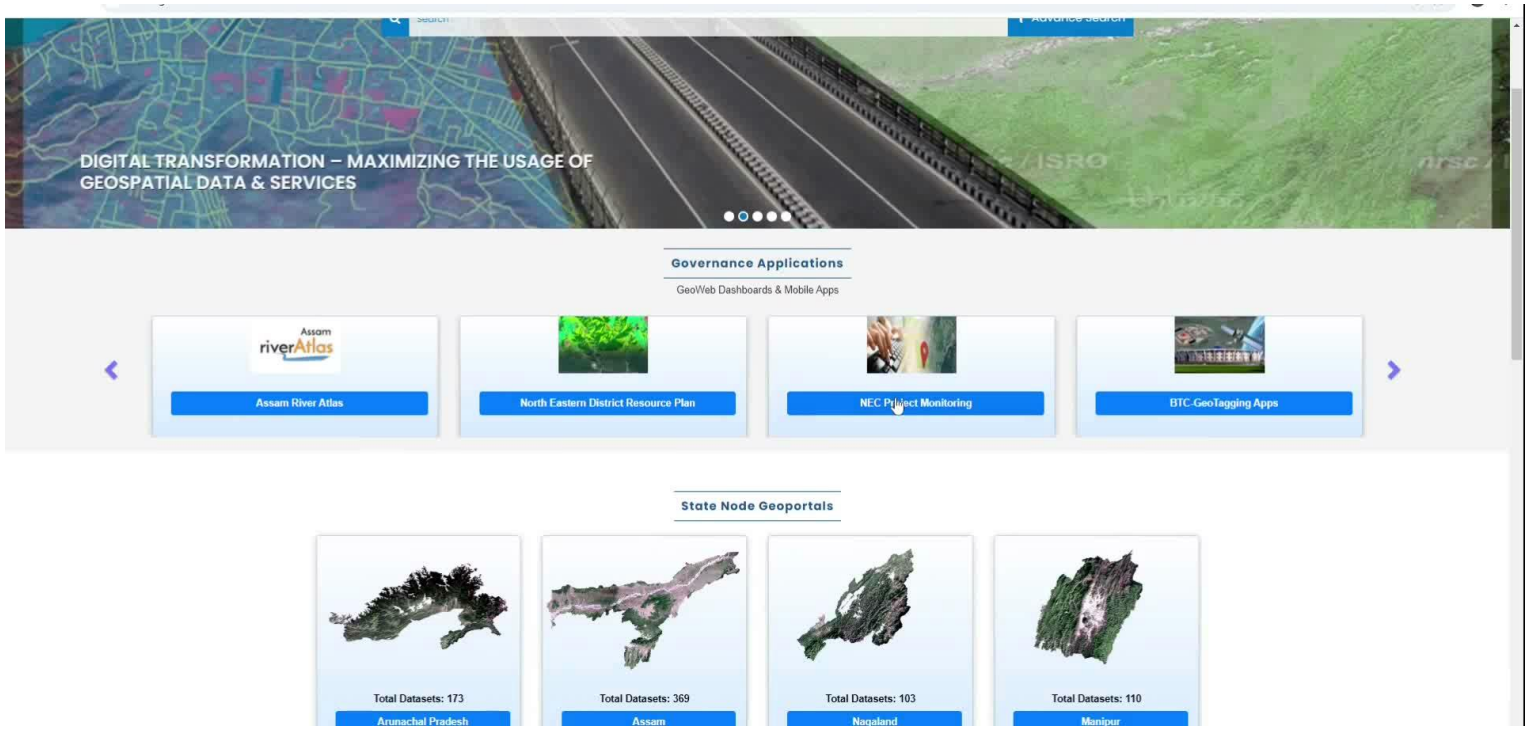
Build more eGovernance Applications using NeSDR Data and Services

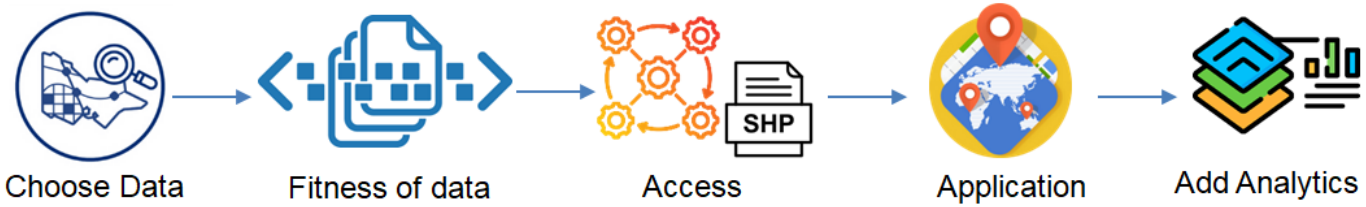
Getting to know your Data of Interest

https://www.nesdr.gov.in/



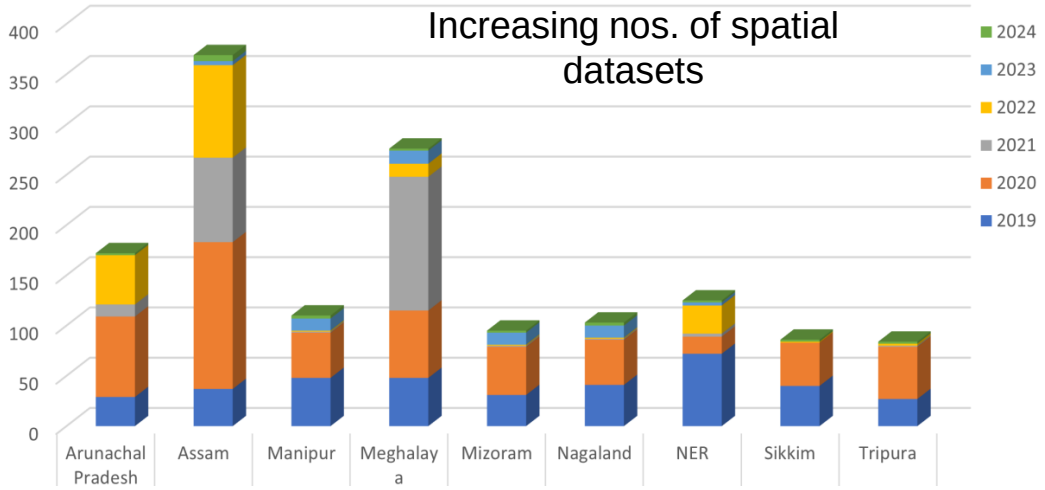
1. **Look for Data of Interest**: **Making Data FAIR > F**indable, **A**ccessible, **I**nteroperable, and **R**eusable
2. **Examine and Understand the Data**: Metadata, Interactive Visualization, Basic Analysis
3. **Access the Data** : As OGC Services / Physical Data
4. **Build Application and Host**: User Oriented Applications
5. **Advance Analytics** : Processing on-the-fly and generate user-centric products



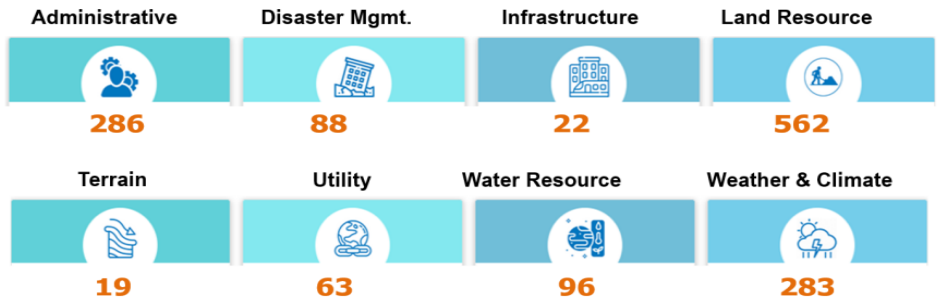


NeSDR – Ensuring Spatial Data Accessibility in NER

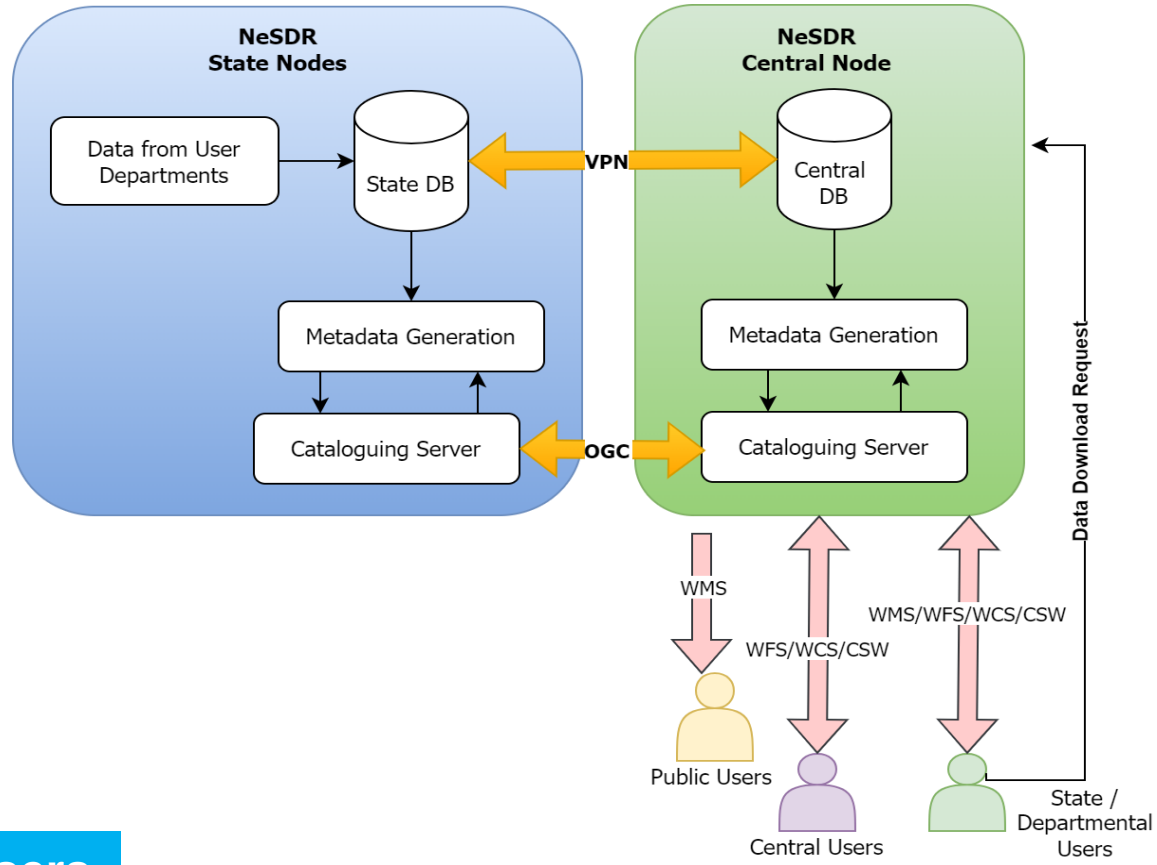
1. **Ensuring Accessibility and Usability of the data:** Interoperable Data Access: **Maximize** Use of Data **/ Reduce** Data Duplicity
2. **Systematic Cataloguing and Sharing :** Large numbers of ready to use datasets



About 1420 + Vector in different Categories



Different levels of users



Major users

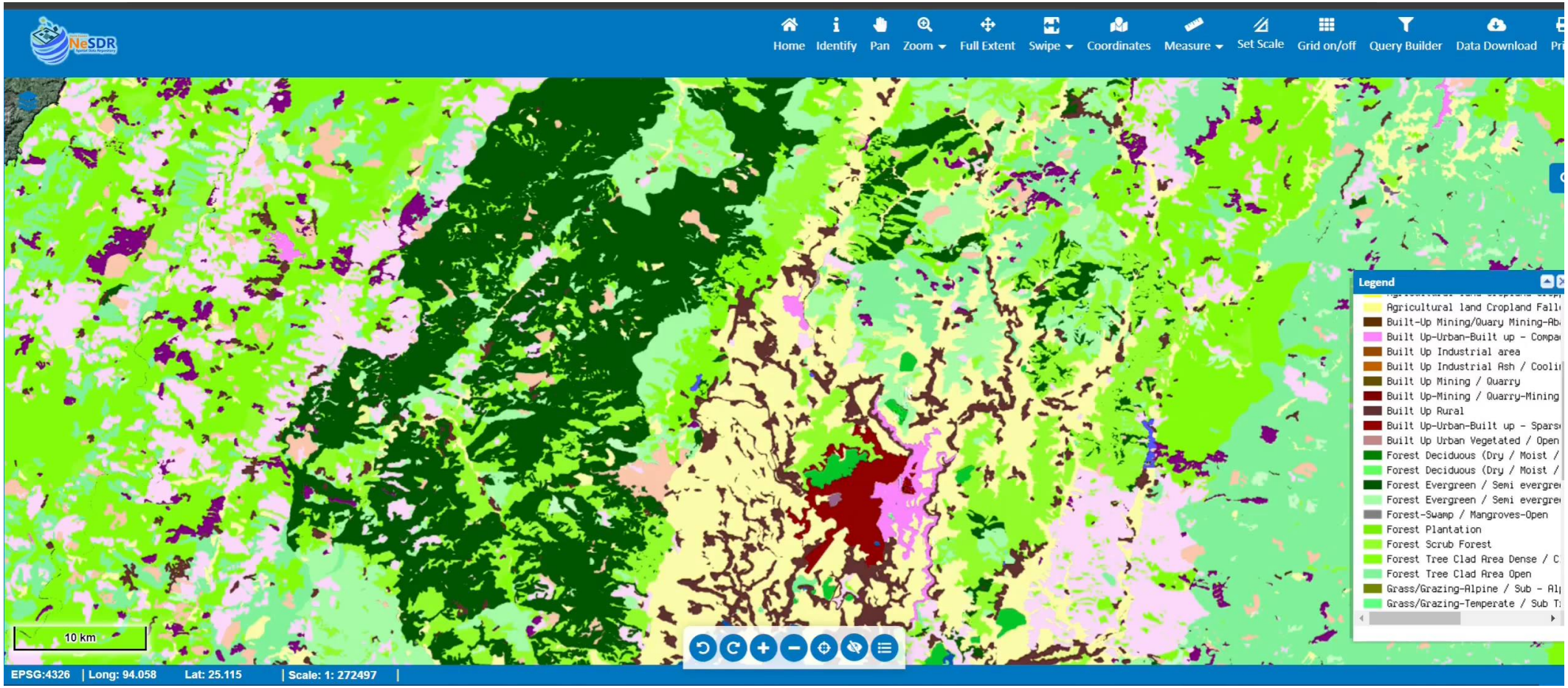
- **112 Departments / Ministries** utilizing NeSDR Data and Applications
- **33,456 Datasets shared** towards maximizing use of geospatial data

NeSDR– In-Built Interactive Map Visualization / Query

Inbuilt GIS Tools

Interactive Visualize | Query - Analyze | Print | Download

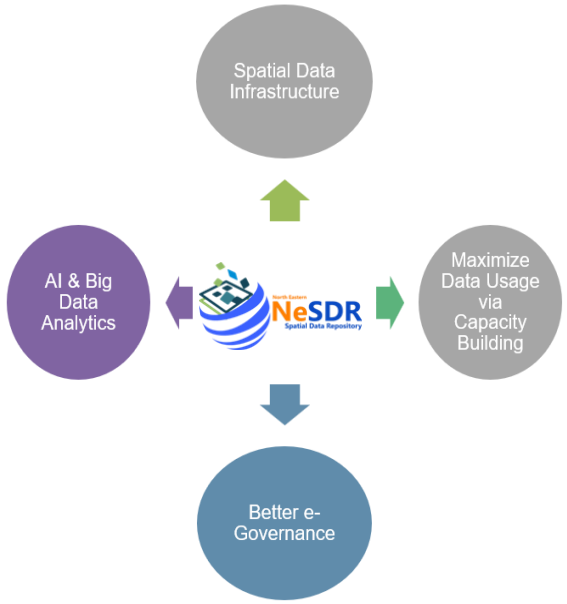
View of NeSDR as Public User



Satellite Imagery

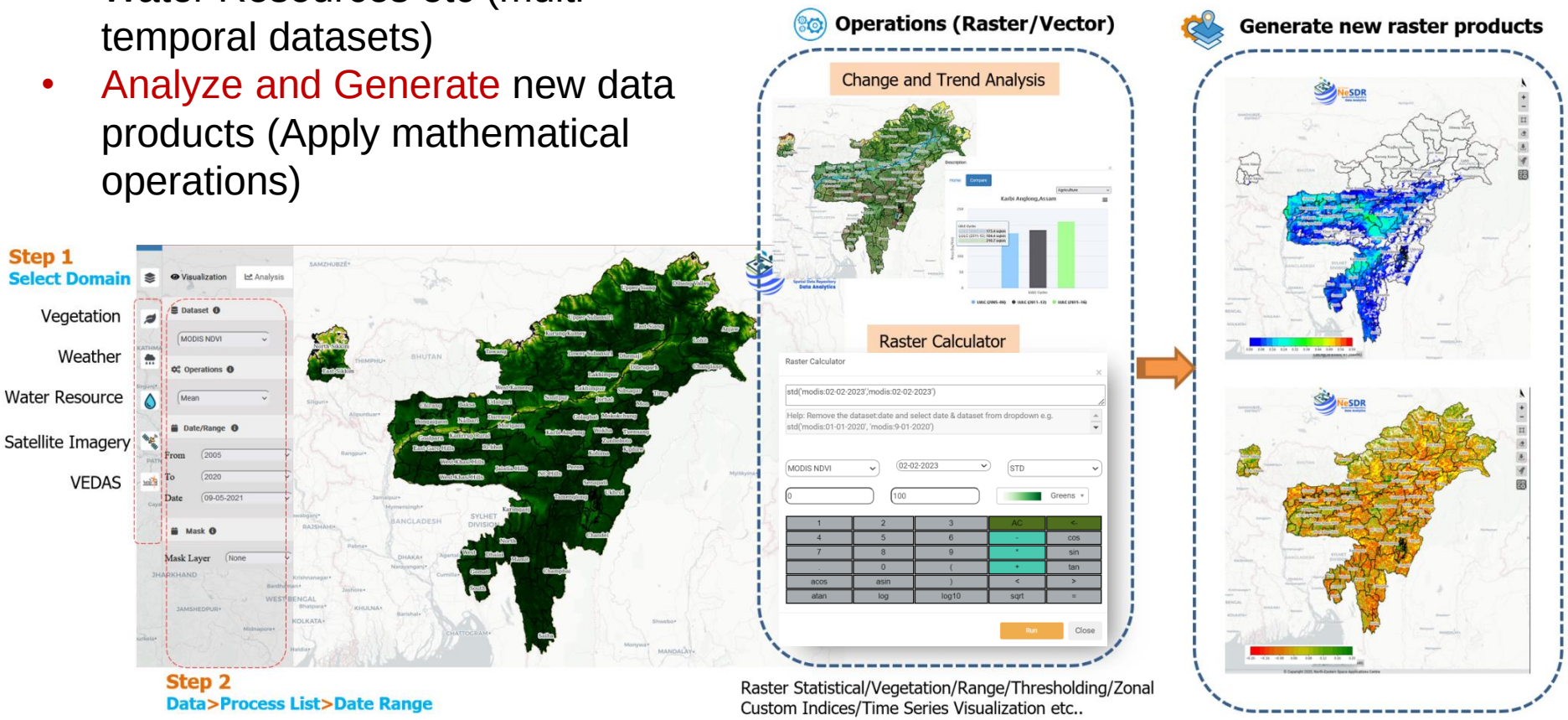
Extracted Land Use Features

NeSDR – From Serving Data to Start Processing and Analysis all in your browser



Big Data Analytics at NER Scale

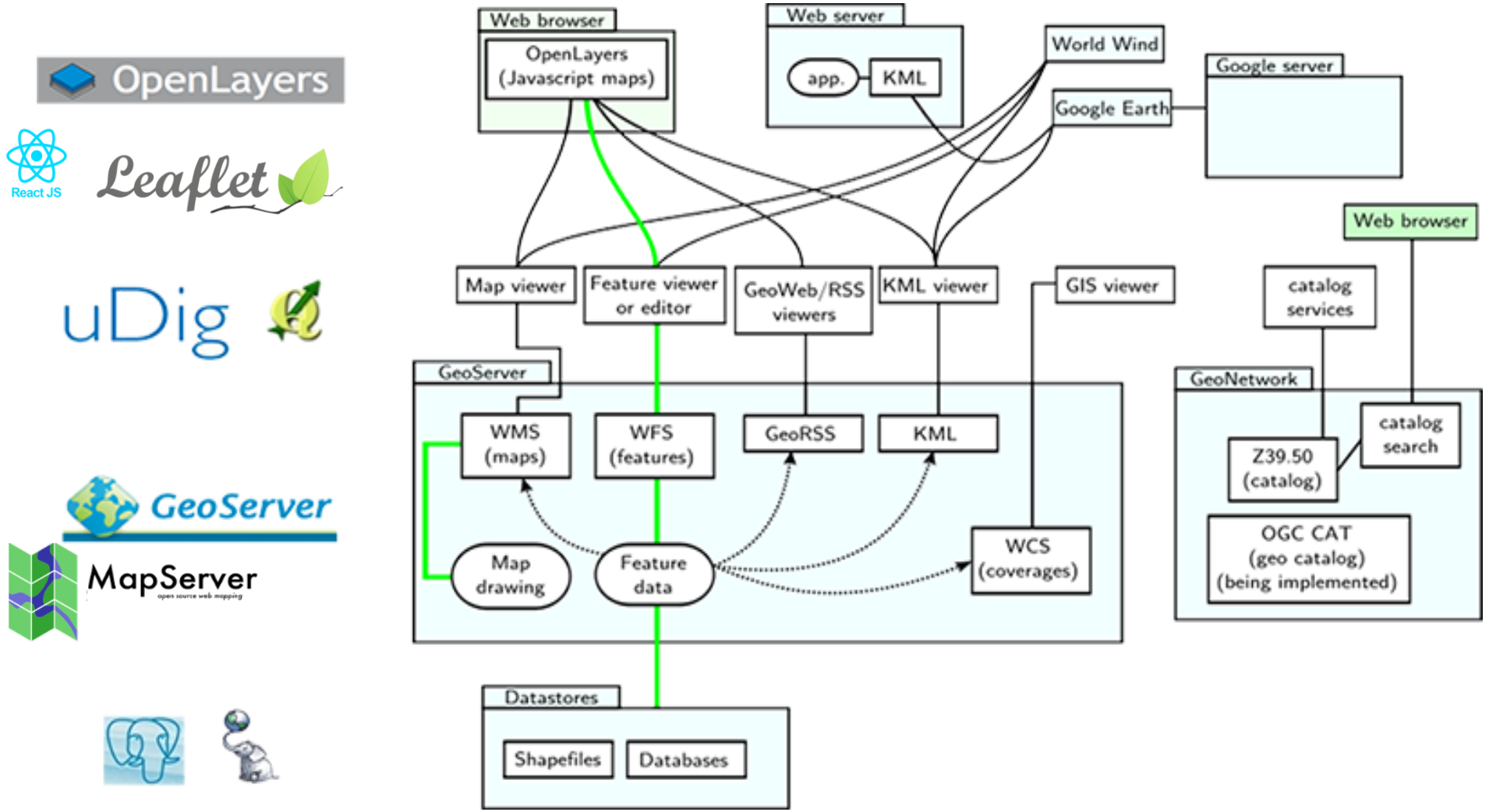
- Observe Changes in Vegetation Health, Soil Moisture, Weather, Water Resources etc (multi-temporal datasets)
- Analyze and Generate new data products (Apply mathematical operations)



Better and effective gGovernance Application

Build user oriented geospatial applications for planning and monitoring activities

Open Source Application Stack



From Data to Building *User Oriented* GeoSpatial Applications for eGovernance

Geospatial Applications for diverse User Departments

40 Operational User Governance Applications
designed and developed base on user needs

Empowering **Electoral process** in NER	• Mapping of Electoral Assets • Real time tracking of Alerts and Incidents during Elections
Ease of **Projects Monitoring**	• Physical Progress Monitoring via Mobile, Satellite, UAVs & IoTs
Better **Health** Surveillance	• Health Resource Optimization • Incidents reporting on diseases and hotspots identification
Early Warnings on **Disasters**	• Disseminating alerts and early warnings of weather, lightning, floods, landslides, earthquakes, forest fires
Smart **Agriculture for better** Productivity	• Drone based Agro-advisory • Rice Information Systems
Forestry resource management	• Forest Resource Monitoring and Alerts
Expanding **Tourism** in NER	• Expansion of Tourism: Tourism potential index
Accelerating Infrastructure Management	• Gap Area Assessment of health and education
GeoAI for better Governance	• AI in disaster management, environmental monitoring, and public health etc • Precision Agriculture | Change detection on Govt. lands

Problems in Electoral Process Planning & Monitoring

- Issues in Election Pre-Planning
- Issues in locating problems during Election
- **Slow response and resolving mechanism**

Official launching of Election tracking system
by Shri Prashant Kumar Singh, Chief Electoral Officer, Manipur
15th March, 2019

Solution: Space Technology for improved Electoral process planning, monitoring and tracking

e-ATLAS: Election - Advanced Tracking, Location based Alerts and Surveillance

- Analyze the sensitivity of the Polling Stations
- Real time alerts/events from 13,968 Polling stations along with location, geotag photographs/videos
- Real time tracking of officials' movement

Research

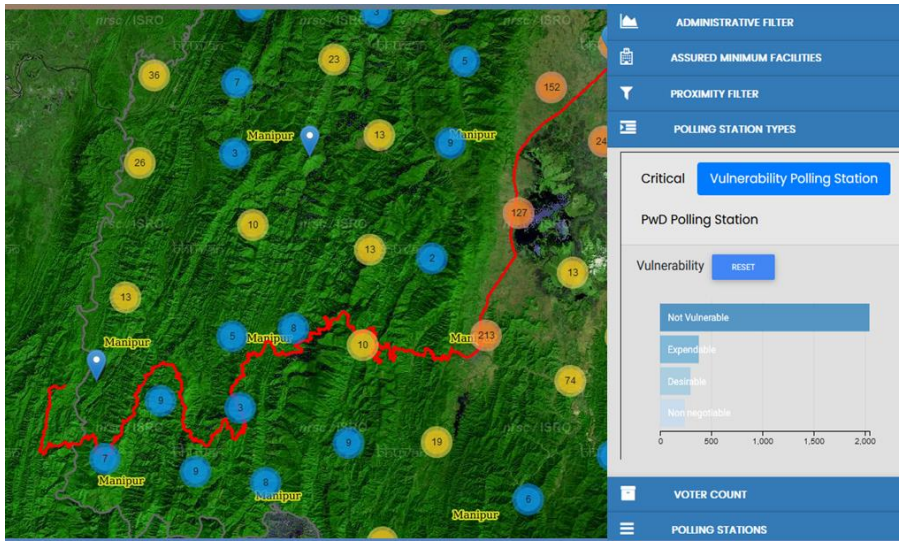
Build a cost effective tracking and monitoring system with locational intelligence

Geo-Intelligence in Effective Planning Monitoring and Tracking of Electoral Process

User States: Manipur, Meghalaya, Mizoram, Sikkim, Tripura, Nagaland

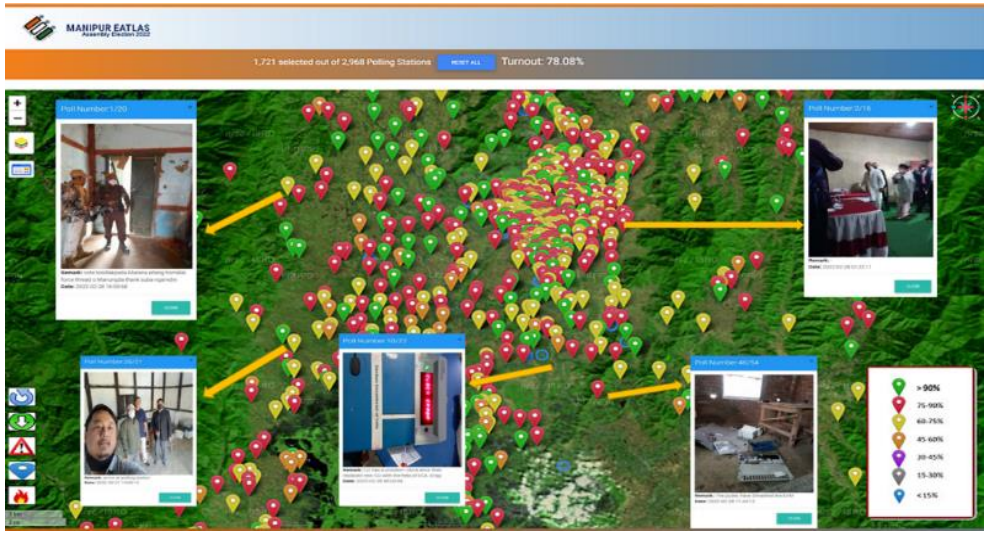
Impacts

- **Utilization during 2018, 2019, 2020, 2022, 2023, 2024 State Assembly / Lok Sabha Elections in 6 States:** Efficient Planning and management of election
- **13,968 Polling stations, track 18K officials :** Monitoring of alerts / incidents
- **Assisted in smooth resumption of election**: Alerting of issues and *"resumption of electoral process within minutes - CEO"*



Pre-Planning : Assess, Analyze, Plan

@Command & Control Centre: Chief Electoral Office

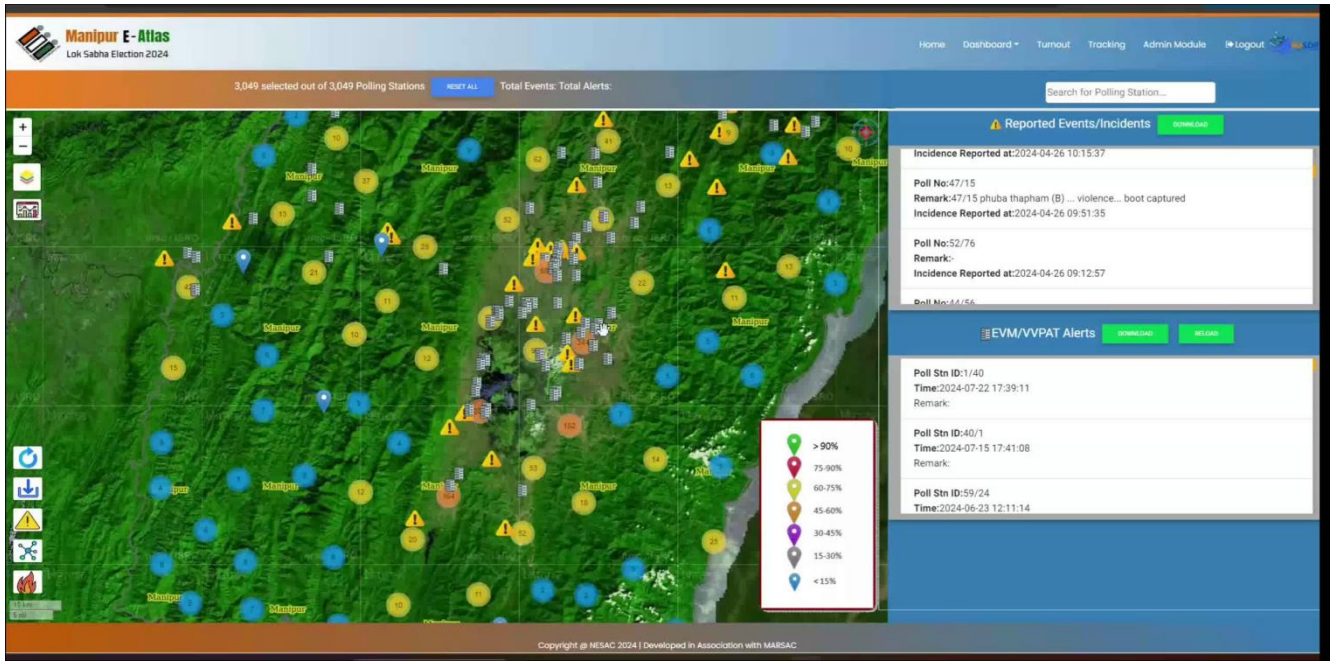


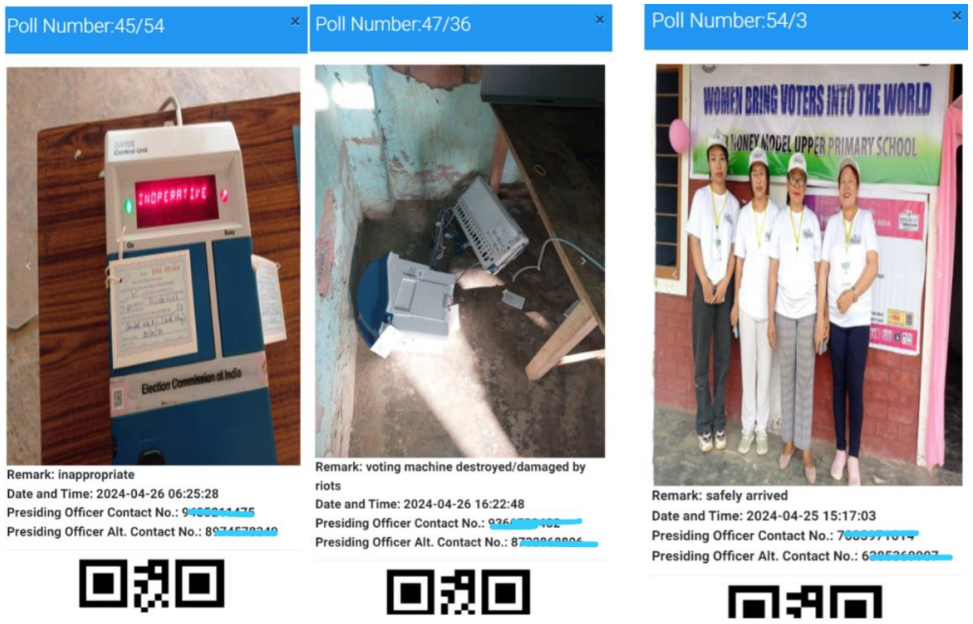
Poll Day : Real time alert/incident monitoring

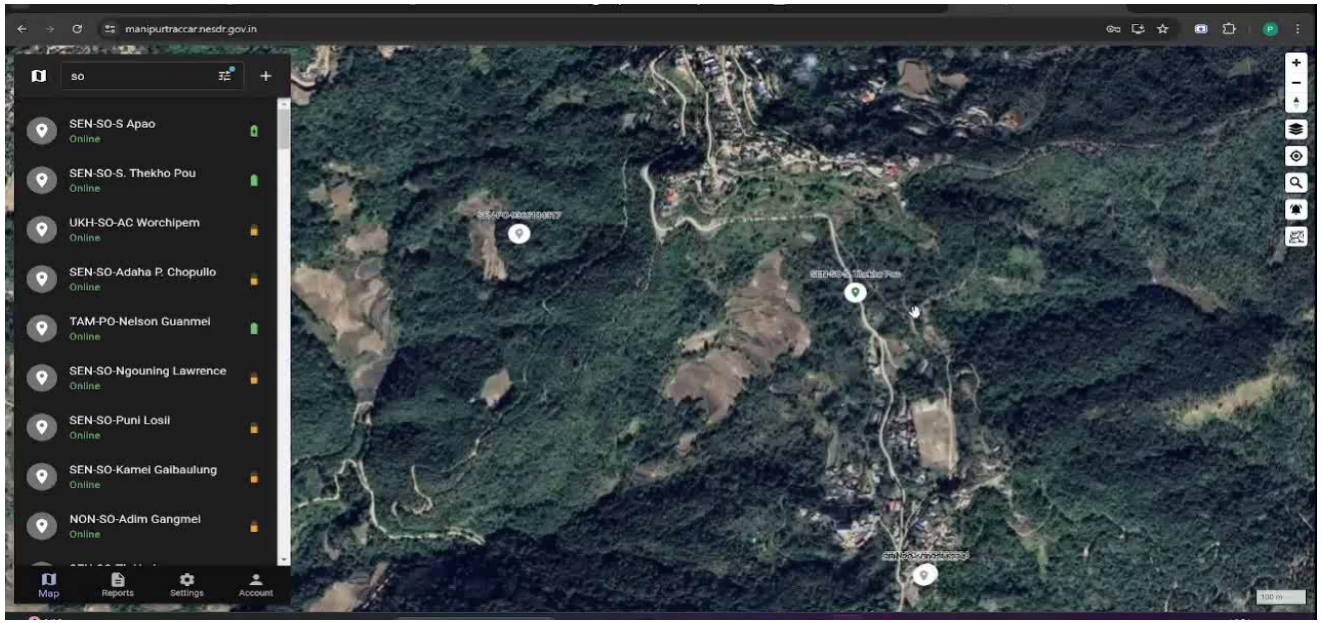
Facilitating smooth conduct of Elections in NER

Provides Instant view of all Events / Alerts with Location information

- Hourly Poll status %
- Safe Arrival of Polling Personnel
- Issues with EVM/VVPAT
- Mob Violence / Disruption of Poll







Problems in Project Monitoring Mechanisms

1700+ Project location in NER

- Multiple physical visits leads to High Cost > Low Return of Investment
- Limited Physical Monitoring : Complex Hilly Terrain with limited Physical Connectivity and localized sensitive conflict zones
- Difficulty in tracking Physical Progress : Lack of Precise Geotag Information
- Difficulty in quantifying the Progress : Delay in UC submission & timely completion of Projects

Solution: Space Technology for better project progress monitoring

- Multiple imaging technique: Mobile App + Drone Imaging + Satellite Technology for quantifiable progress monitoring
- Management and Monitoring with Location aware Map Intelligence
- Minimum Government & Maximum Governance : Monitor and Track Progress with a Single Window Dashboard Application

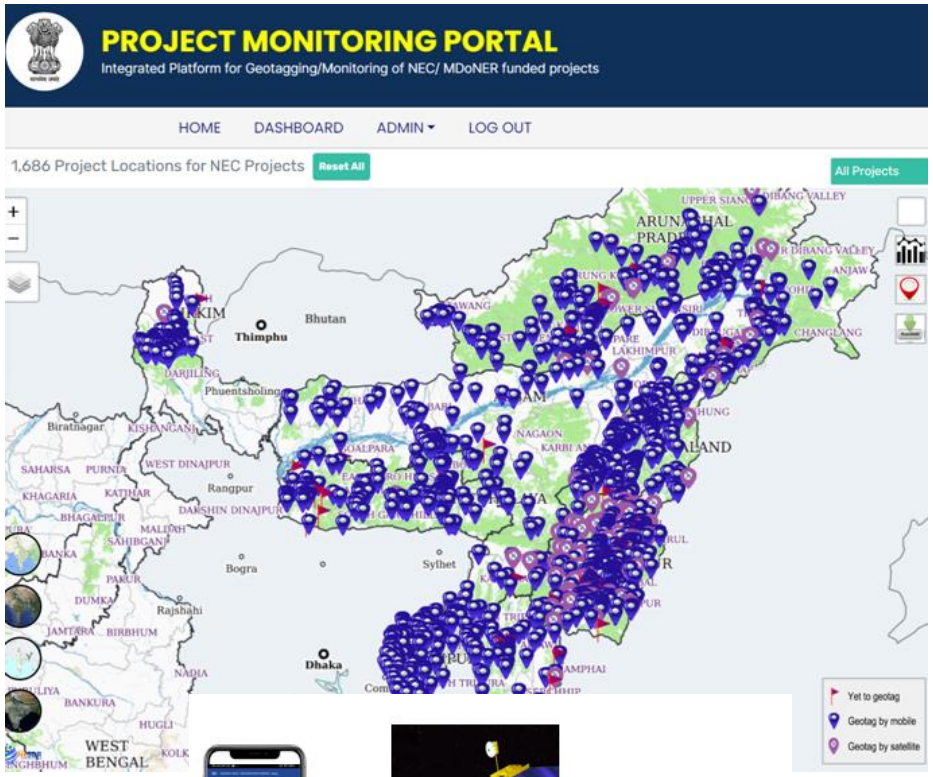
Research

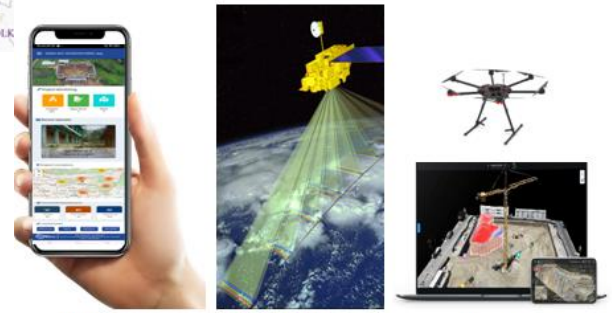
Build a solution to detect / quantify change in 2D/3D using images from App, Satellite and Drone

Space Technology for Project progress monitoring in NER : Multipronged Approach

User States: By NEC/MDoNER – All 8 States

637 Projects
1728 Sites





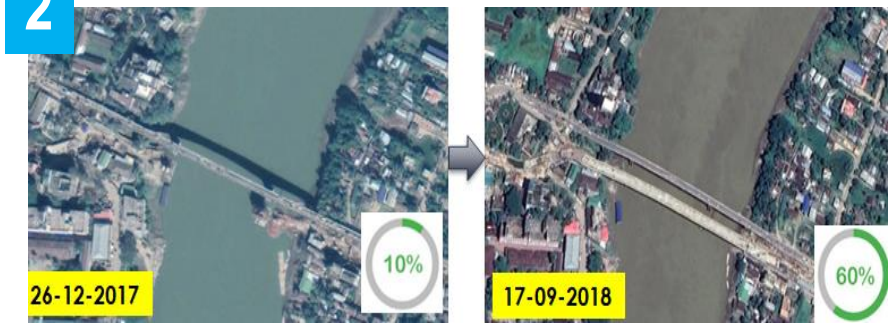
Physical progress tracking of **1728** project sites in NER

1

Geotag

AI based Road Quality Monitoring

2



Satellite Image

3

Drone Images

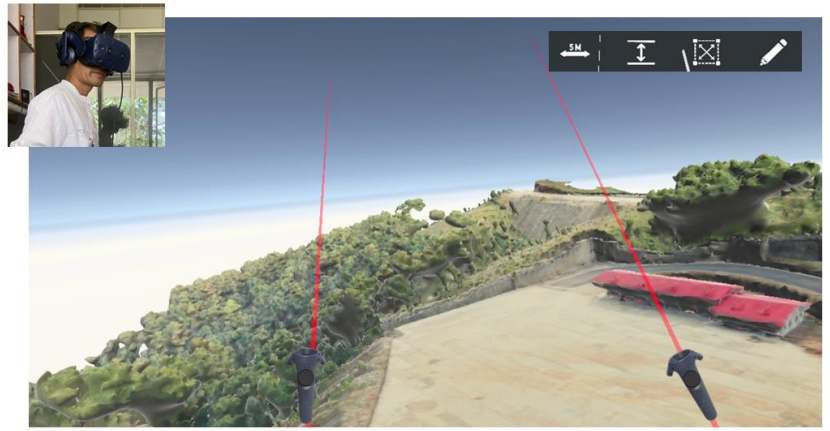
Impacts

- **Monitor – Track - Quantify** project progress monitoring – **2D & 3D**
- **Beneficiary and Gap analysis**
- Replication in 3 States

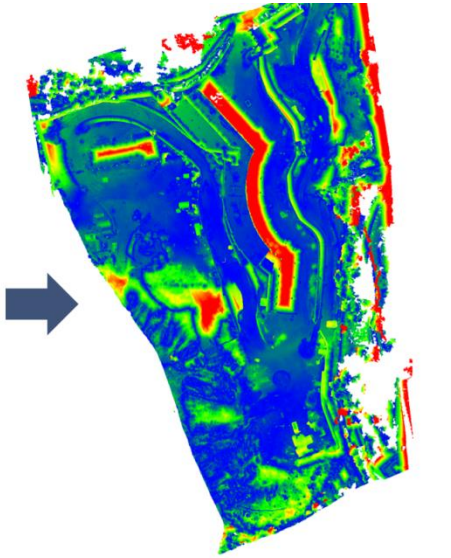
- Launched by Shri Ram Nath Kovind,Hon'ble President of India, 04th May, 2022

Measure 3D features of Structures & quantify the progress in 3D

Dense 3D Point Cloud: Perfect for geometric measurement of structures

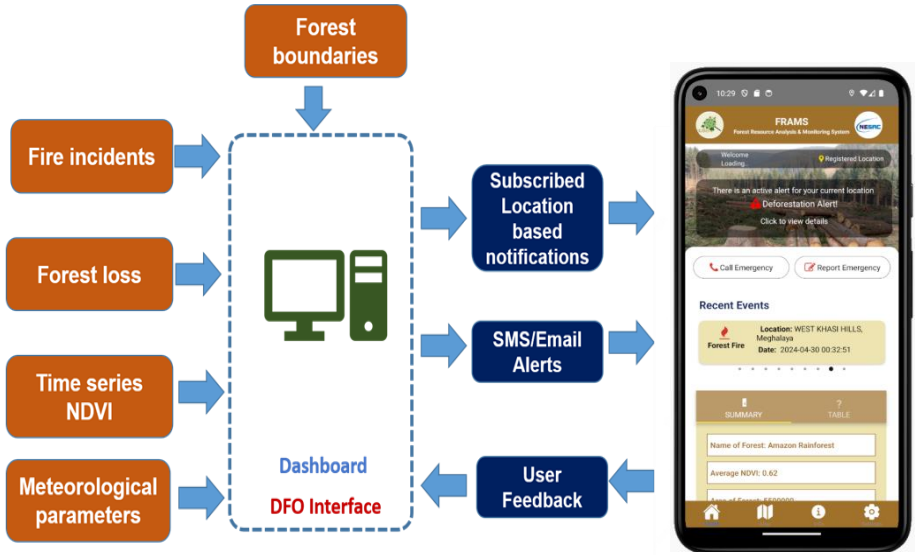


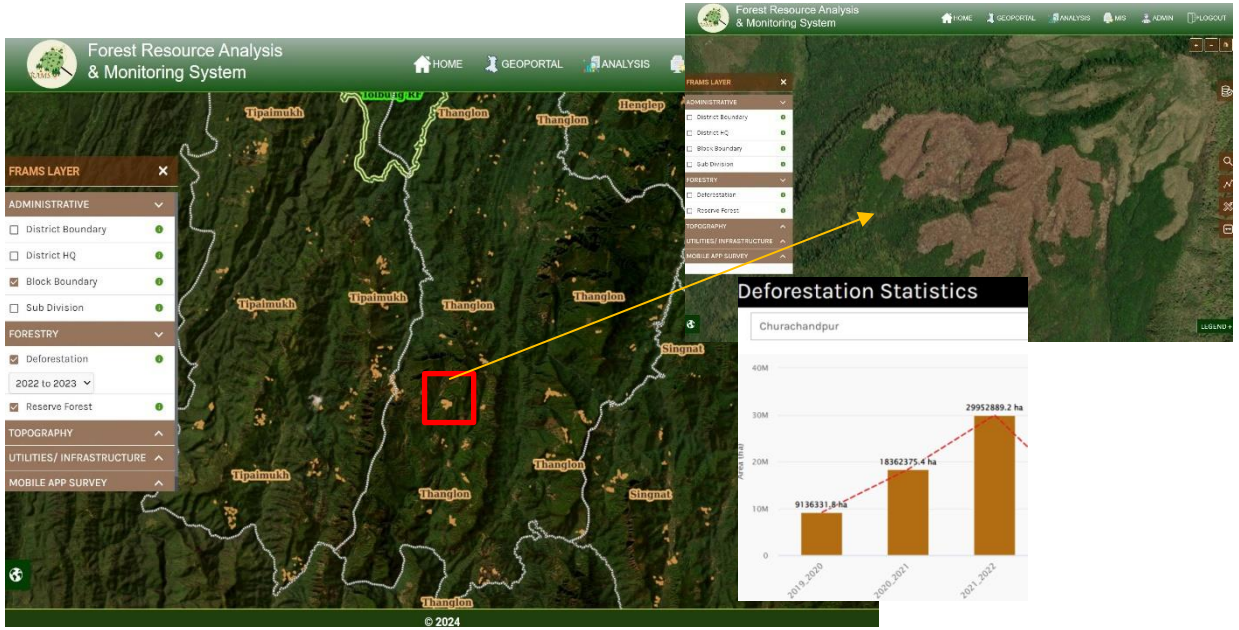
DroneScape VR : Immersive exploration and analysis of 3D Point cloud: Measure height, length, Area and Volume



Areas with significant change

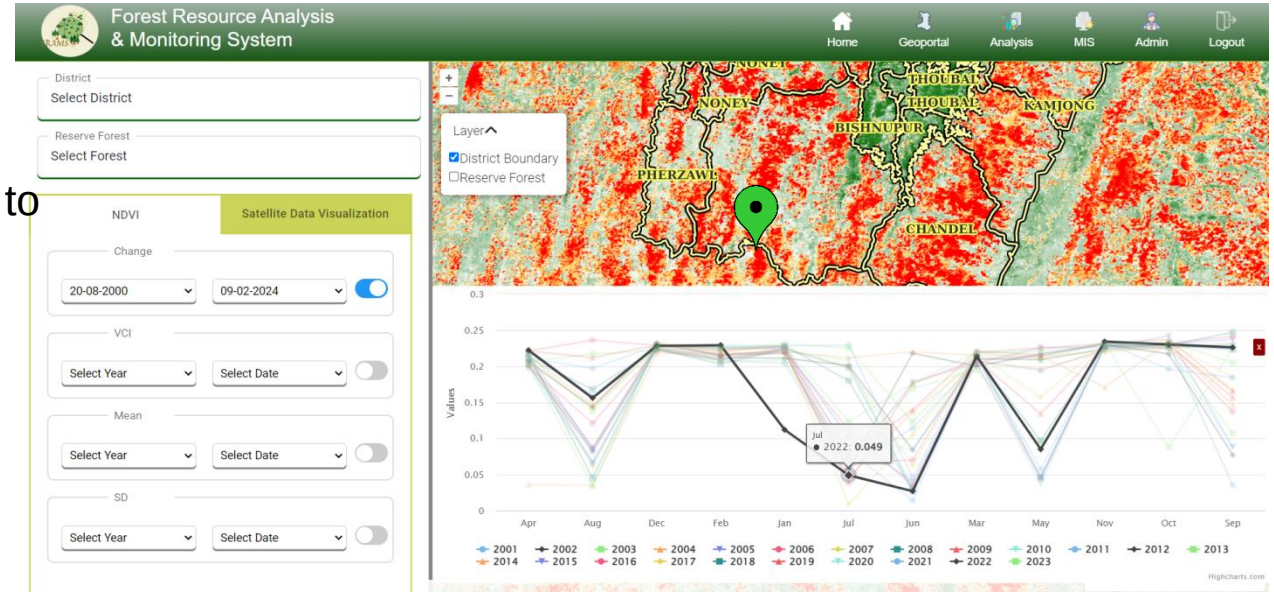
Forest Resource Analysis and Monitoring System (FRAMS) for Manipur





- Monitors reserved **deforestation** trends and **vegetation vigour** variations

- **Alerts** System about **forest loss**, enabling quick responses to threats like forest fires, illegal logging, or encroachments via mobile apps, SMS, and email.

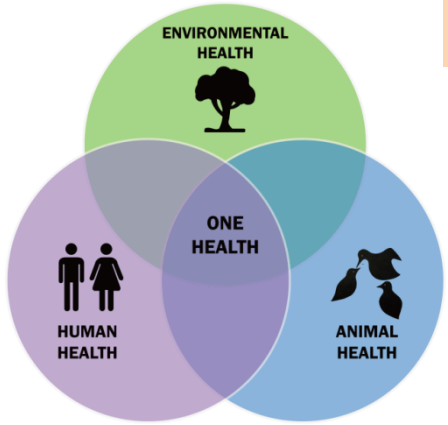


Research

Better Algorithms for Forest Changes Analysis, Identification of deforestation/degradation, Suitability Analysis for site plantation

Space Technology towards better health of people, animal and environment

User States: Meghalaya, Tripura, Arunachal Pradesh



One Health

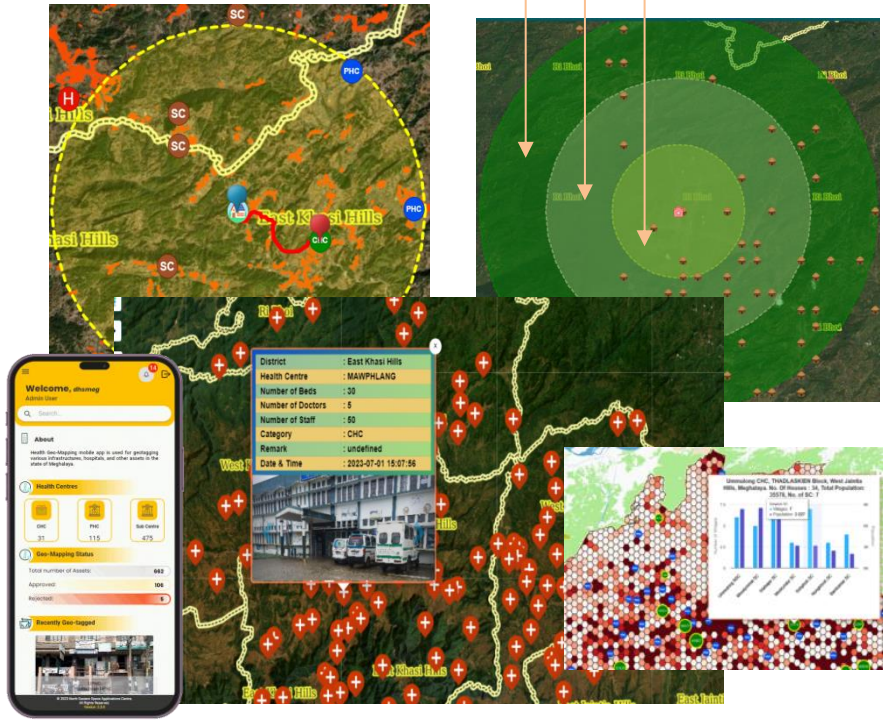
1. Equitable Health Care Access
2. Prevent, Predict, Detect and Respond *to multiple health threats*

1

Ensure maximum accessibility

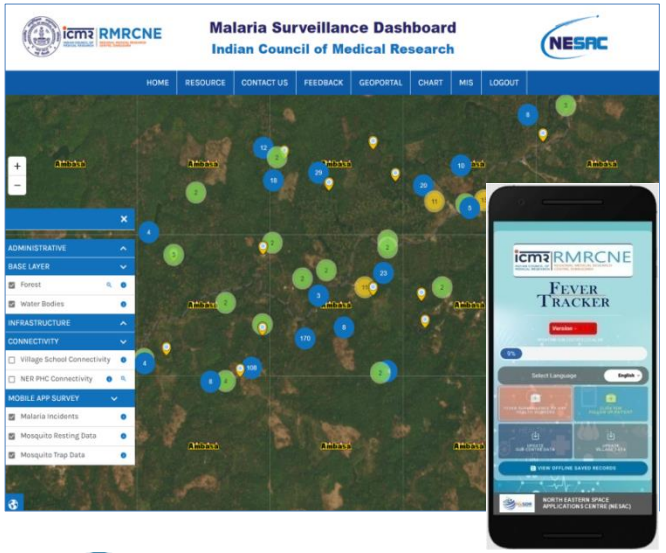
to health resources **and plan better health care** across states

Better health care in rural areas



2

Surveillance system for early diagnosis and treatment of malaria



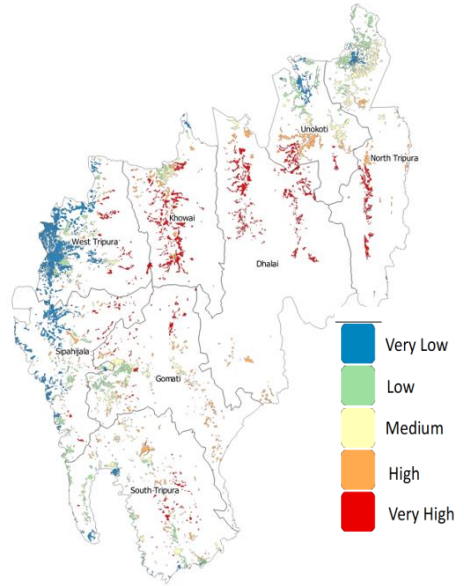
9261 test samples collection
Available in local languages

Hotspot Analysis -> Response Analysis -> Action

3

Adopt AI based disease risk map generation

- Uses Space based data and apply AI based predication models to predict and identify hazard/risk zones



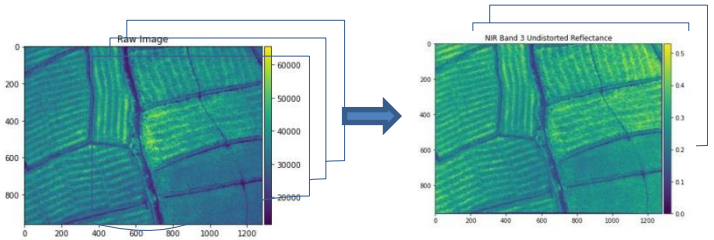
Malaria risk map of Tripura

Drones for Precision Agriculture: Towards Ensuring 5 Rs of PA are: Right Input, Amount, Place, Time, Manner

Build better data process pipeline

Multispectral Images (Micasense RedEdge MX)

Alignment & Transformation -> Image Corrections



Preprocess

Indices Calculator

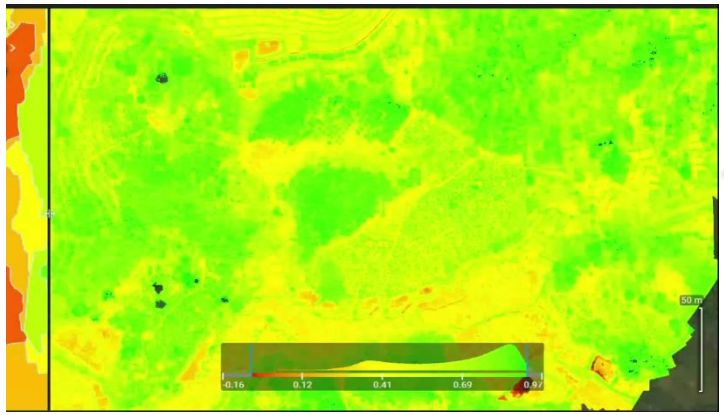
Health Indices maps after masking Soil, Shadows, Water etc

Prescriptive Analytics

How much and where

Zones (7)

Indices

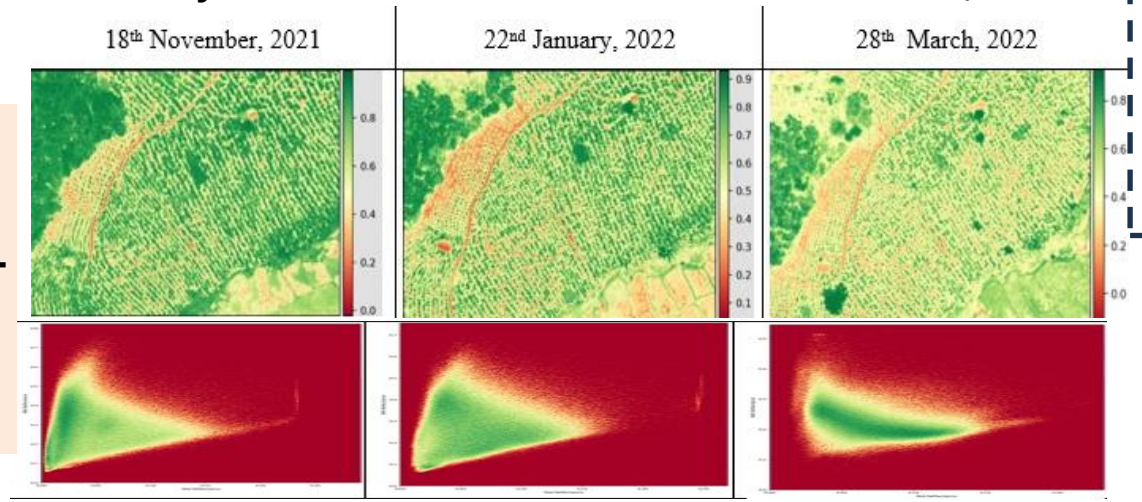


Average value	Area [ha]	Rate [units/ha]	Amount [units]
0.21	0.13	130.00	17.05
0.27	0.33	110.00	36.14
0.41	2.57	90.00	230.89
0.58	3.77	80.00	301.36
0.69	4.32	65.00	280.72
0.80	8.43	30.00	252.87
0.88	14.12	22.00	310.65
Total	33.66		1,429.68

Estimate fertilizer requirement

Identify Zones for fertilizer treatment

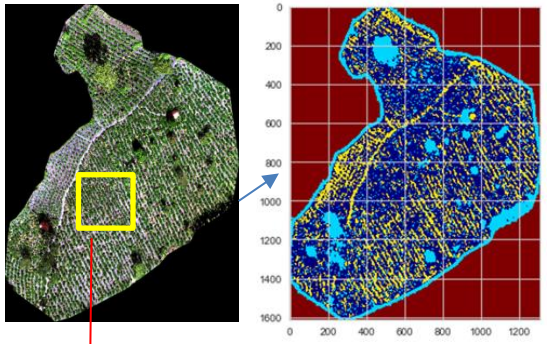
Track crop health



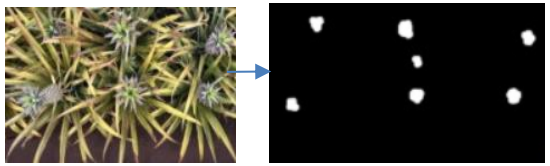
Crop health tracking with NIR/R Tasseled Cap trajectories

Yield : Crop **Counting**

Pineapple crop, Mawphrew, Meghalaya



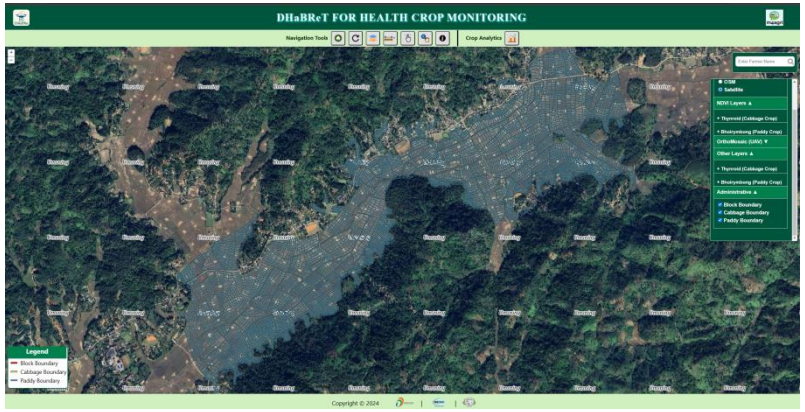
Segmenting Pineapple Plants

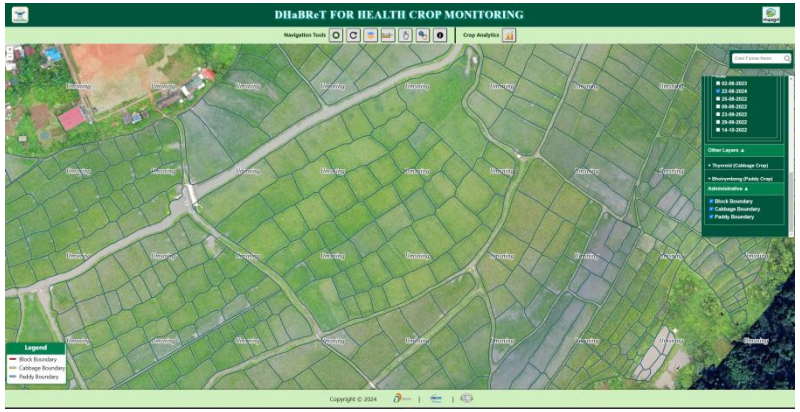


Segmenting Individual Crops

Impact: Agro-advisory services for **5 Crops, 600 farmers, Megh**

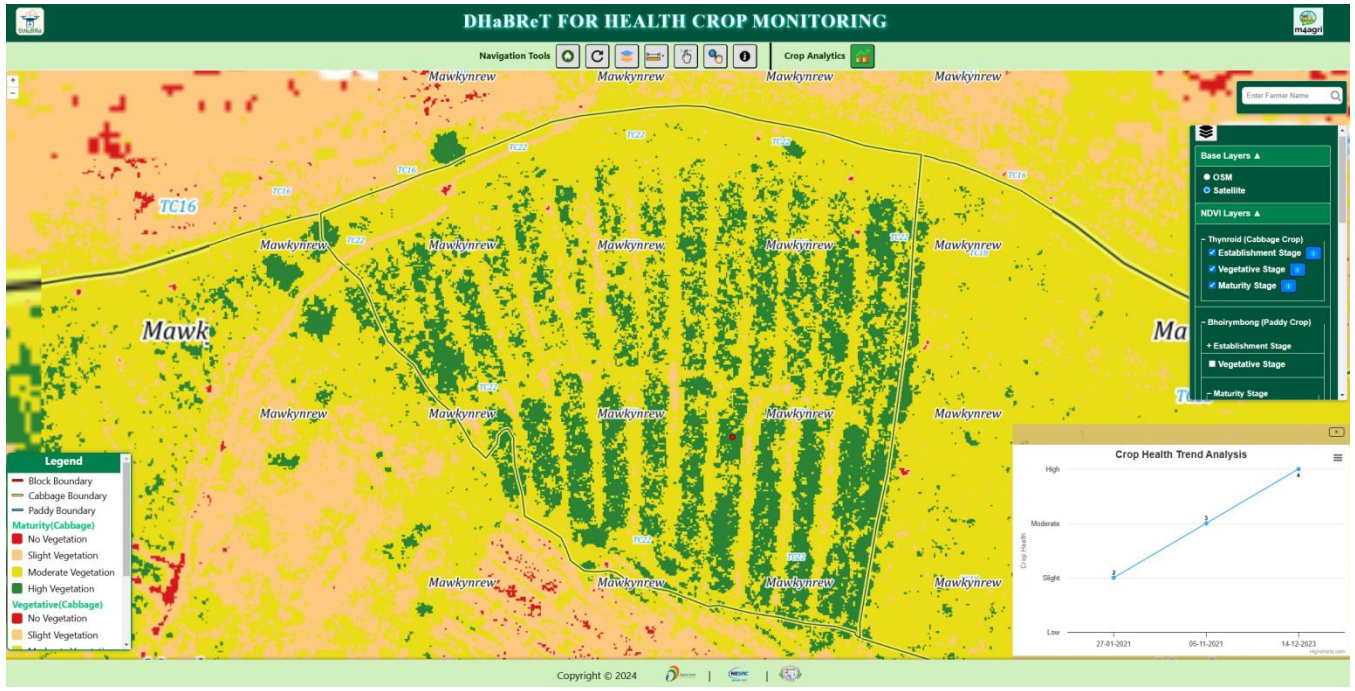
Drone based Agro-Advisory Services Geo-portal, DIC, MeiTY

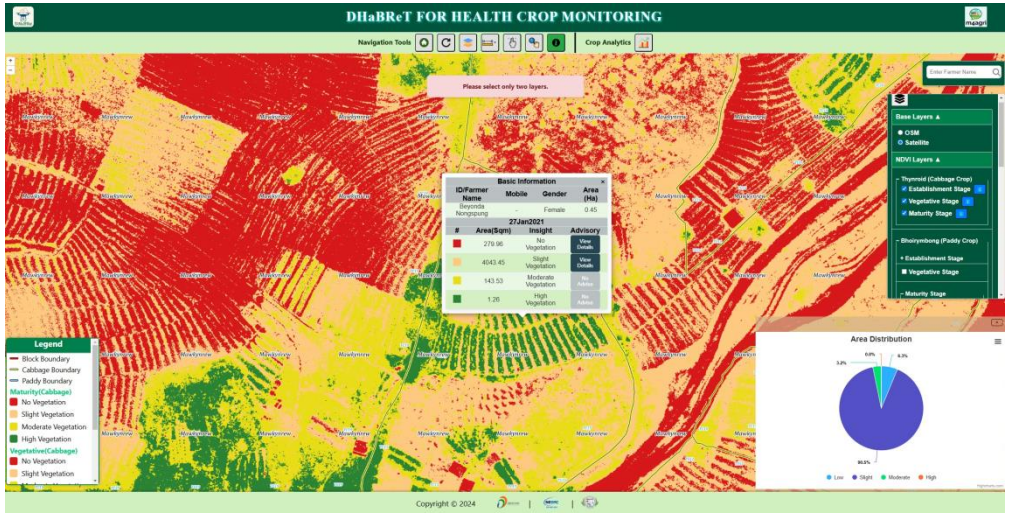




Farm Boundary Demarcation

Enhanced Visualization & Analytics



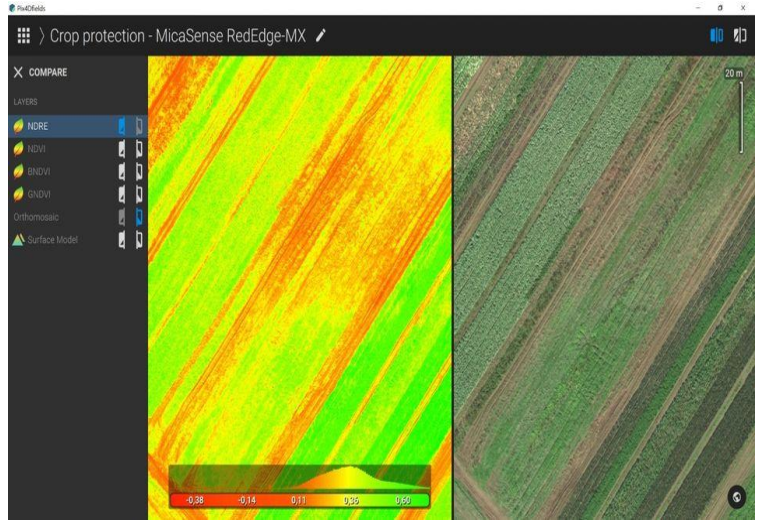


Better Crop health zonation and monitoring for advisory

Better resolution spatio-spectral-temporal drone data > Better & Variety of Applications

Multispectral

Spectral Bands: Blue, Green, Red, Red Edge, Near-IR
Ground Sample Distance (GSD): 8 Cm Per Pixel (Per Band) At 120 M (~400 Ft) AGL (Dual Mica Sense with 10 bands)



Thermal

➢Thermal Imager
➢Pixel Pitch: 17 µm
➢Spectral Band:7.5-13.5 µm

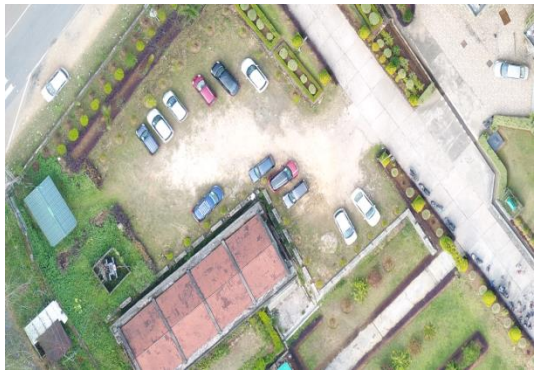
Optical

Zenmuse X3
Effective Pixels: 12.4M

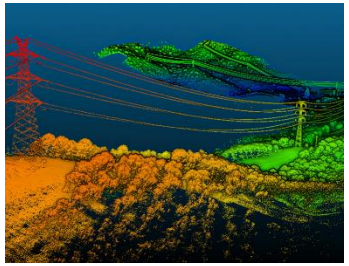
Zenmuse X3 Zoom
Optical Zoom. 3.5 x

Zenmuse X4S
Effective Pixels: 20M

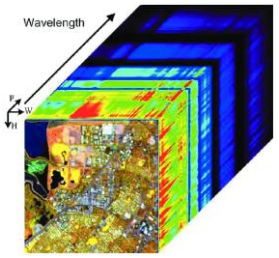
42MP, Sony RX1



LiDAR



HyperSpectral



1000 spectral bands

Terabytes of 2D / 3D / *n*D data

Precision Agriculture with AI driven drone imagery

- The **comparison** of RGB, multispectral and hyper-spectral imaging
- The assessment of the estimated prediction models from training data to **estimate crop parameters**
- **Monitoring the chlorophyll** content
- **Detecting trees** with similar symptoms to trees infected
- Introducing an **object-based vegetation and tree detection method** using NDVI and Deep Learning (DL) techniques
- **Detection of plant diseases** using a classification model in the training phase for specific labeled data.
- **Identifying tree crowns** and their **widths**
- Measuring tree crowns with Using **Faster R-CNN, YOLO and SSD algorithms** to develop models of measurements
- **Automated field-based detection of plant disease symptoms** using different data capture ways and camera mounting
- Developing a **pre-processing pipeline to segment and geo-reference** crop rows

Advanced imaging and AI techniques to monitor crop health, detect plant diseases, and measure tree/plant parameters for precision agriculture

Forest Protection with Drone AI

- Automated **detection of individual animals** for **monitoring** the presence and the distribution of threatened and **invasive species** using: Two deep CNN object detection methods: the Faster-RCNN and YOLO
- Automated animal detection: **Illegal poaching of wildlife animals** using models based on pre- trained instances of AlexNet
- Automatic **counting of the number of** animals/bird using thermal cameras at night and visible light cameras during the day
- Pile **burn detection** based on Fire Luminosity Airborne-based ML Evaluation by: Proposing a DL-based image (normal and thermal) segmentation method for pixel-wise fire masking
- **Detection of wildfires** using a DL fire detection approach for aerial images
- **Burn detection** Using Mobile NetV2 pre-trained on the Imagenet database

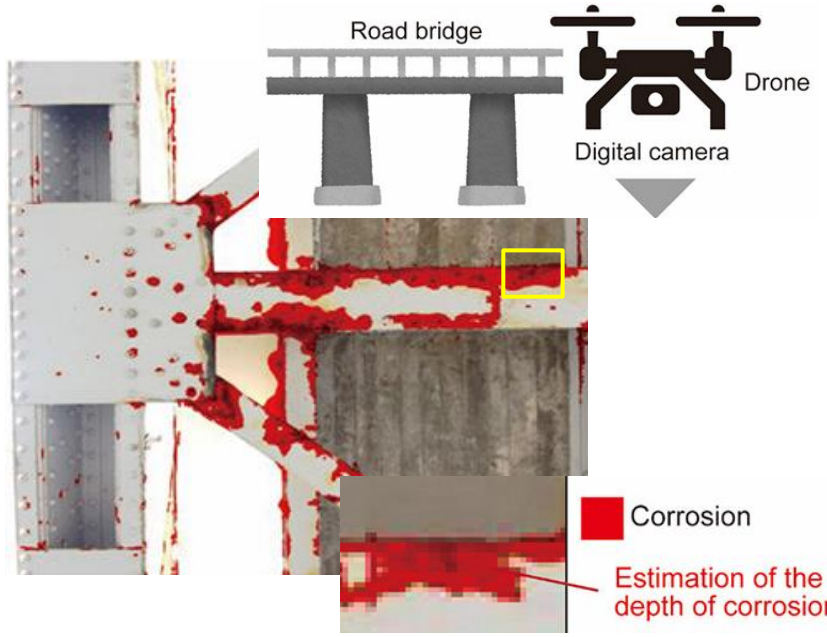
AL/Deep learning models for automated animal detection, poaching prevention, wildlife monitoring, fire detection, and burn detection through thermal and visible light cameras.

Improved Infrastructure Inspection Using AI and Drone Imagery

Research in Drone**AI**

- **Structural corrosion monitoring** using CorrDetector with a 4-layer architecture by Combining two **DL models**: one model to recognize the industrial structure targeted from the background and another model to **identify corrosion in localized regions**
- **Detection of cracks on the surface** of infrastructures using methods improving the features extracted from the crack pattern
- **Pavement aging and damage monitoring** by: Combining multi-scale segmentation, CNN and SVM algorithms to **extract potholes and cracks** on pavement surfaces
- **Estimating buildings with roof damage** during earthquakes based on airborne images using DL
- Long **linear infrastructure detection**: The high **power transmission electric** line using two different approaches; Google Net pre-trained model as feature extractor and developing a new architecture
- **Infrastructure Change Detection** : Registration, Alignment and Distance

AI and deep learning techniques for monitoring structural corrosion, detecting cracks/potholes, assessing pavement damage, estimating roof damage, identifying linear infrastructure, and detecting changes in infrastructure using imagery and advanced models.



Space AI Based Land Use Change Intelligent System

Problem

Guwahati has **expanded significantly** in recent years with **increased population** inducing **growth of built-up areas**

Encroachments on forests, water bodies other government lands has become a **serious concern for the government.**

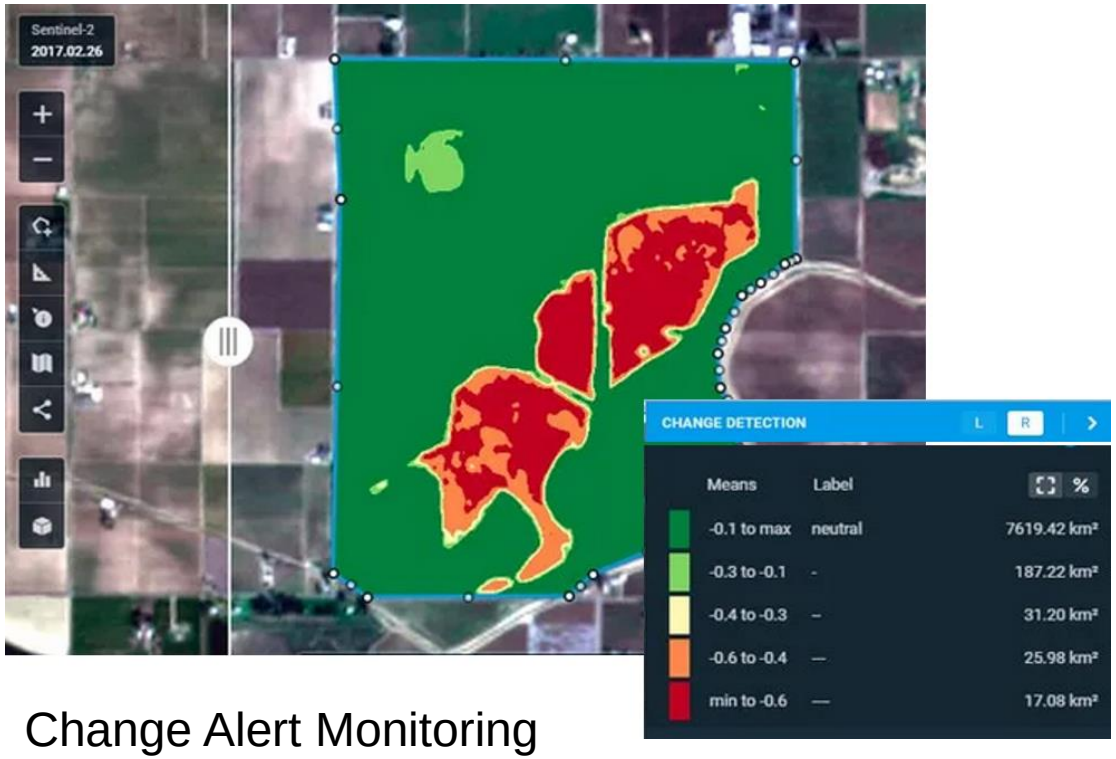
Action on Encroachment

Aerial Observation with frequent Data: Very High Resolution Data - Satellite Imagery and Drone.

Process and Extract: Advanced algorithms to analyze very high resolution geospatial data

Automate Change Detection: Automatic detection and classification of Land Use/ground feature on monthly basis using advanced AI/ML approach.

Prepare Actionable Report: To generate actionable alerts and information dissemination

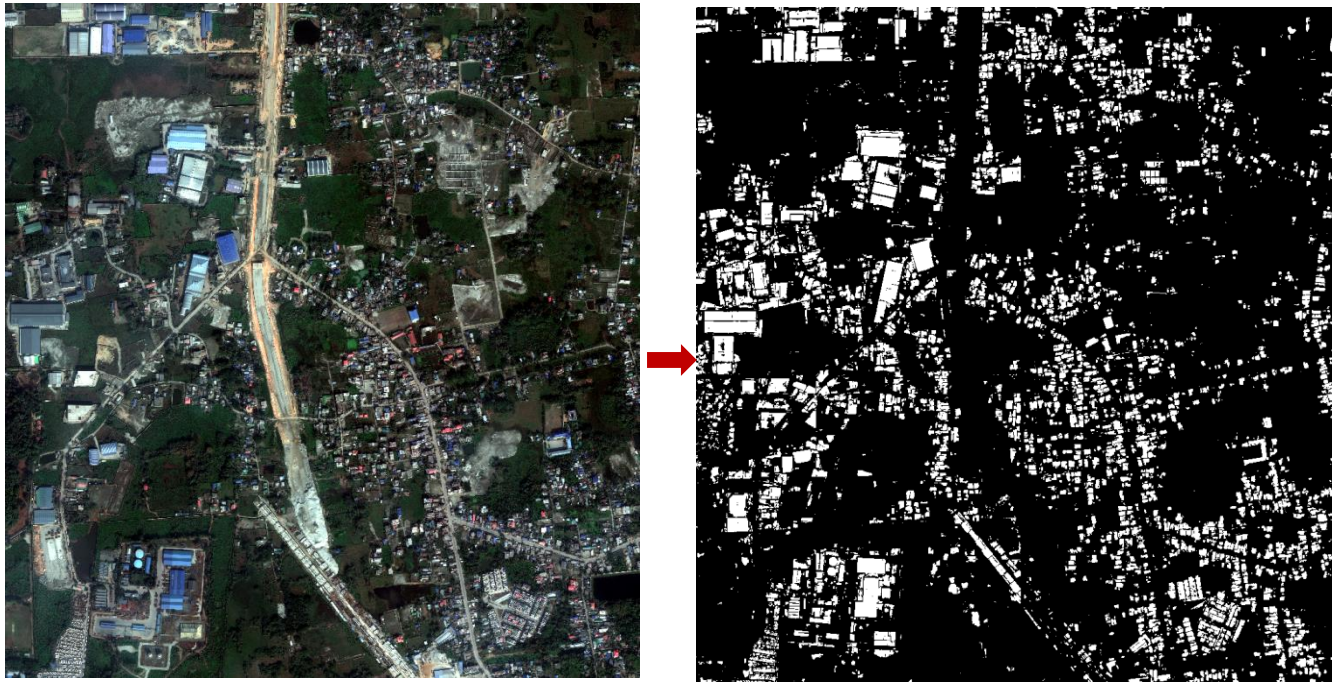


Change Alert Monitoring

Space Based Land Use Change Intelligent System

AI based automatic Change Analysis

- Detect all land feature changes (30 cm)
- Quarterly change detection
- Quantification of area change



Step 1: Building footprint detection

AI Model for change Detection

Output
Changes (New Activities)

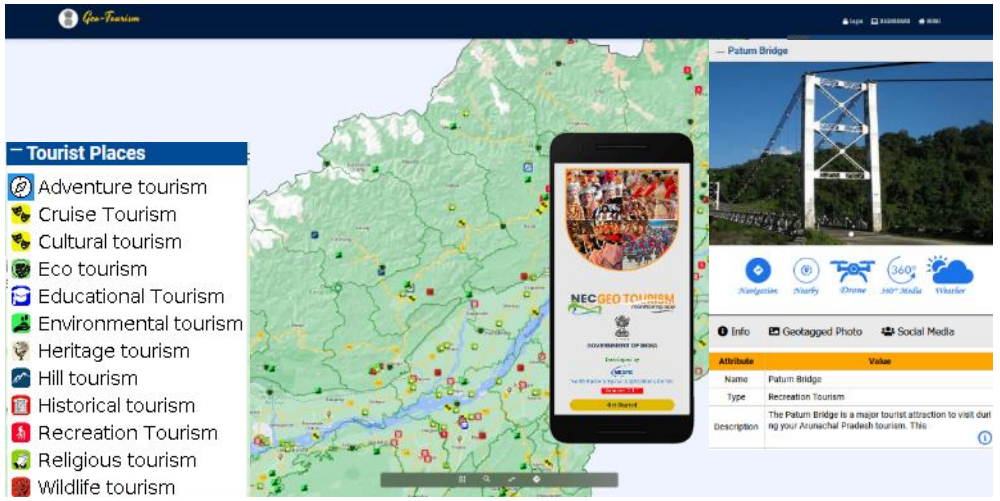
Step 2: Detect Changes

Research

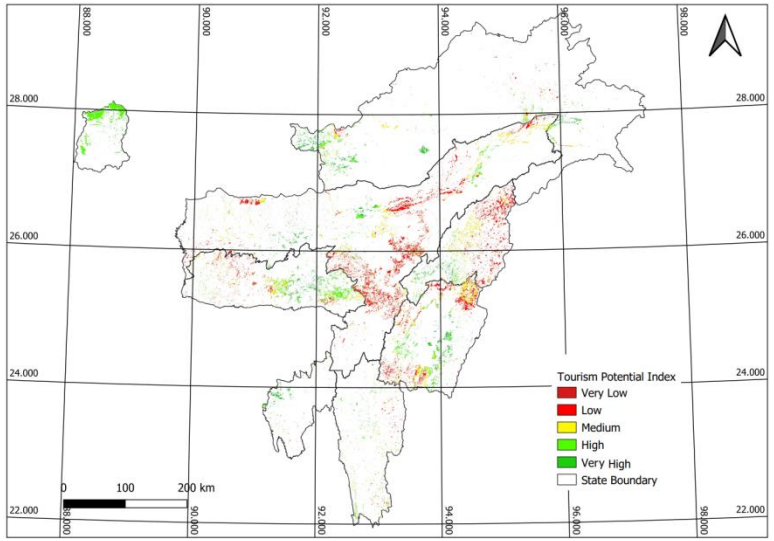
AI Algorithms for Detect/localize changes in all land features : buildings, vegetation, waterbodies

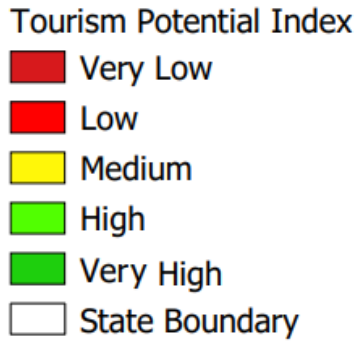
Geotourism Application for Planning, Managing and Expansion of Tourism

- **Better Tourism Management:** Geospatial Database of Precise Tourist Location Infrastructure and its associated attributes.
- **Expansion of Tourism in NER**: Generation of tourism potential index for expansion and prioritize the preparation of Tourism Development Plan, generated based on available infrastructure and natural resources
- Immersive Experience of Major Tourist Attraction in VR



Part of Assam showing Tourist points of different categories





3D Flythrough UI Framework showing reconstructed 3D Model from Drone Images of a place in Shillong

Open Source Software Ecosystem

Desktop GIS: General GIS Viewing, editing and **analysis on the desktop**

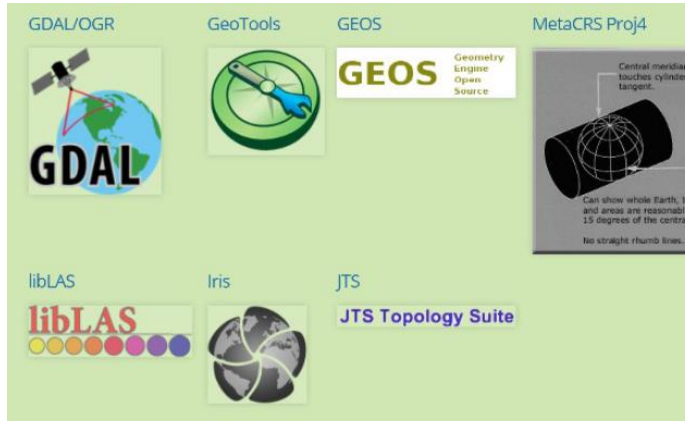
Browsing Facing GIS: General GIS Viewing, editing and **analysis in the browser**

Web Services: **Publishing spatial** data to the internet

Data Store: Storing Spatial Data

Specific Spatial Analysis Tools

Geospatial **Libraries**



Thank You

ss.puyam@nesac.gov.in

Indian Space Policy 2023

To **enhance space capabilities**, foster commercial presence, drive technology development, support international relations, and establish an ecosystem for space applications

to advance socio-economic development, security, environmental protection, and peaceful space exploration.

EO Satellite Data Commercial Products

- ***Yellow tagged products are priced for all users,***
- ***White are Free for GE and Priced for NGE***

SATELLITE	SENSOR	GSD	PRODUCT TYPE	SCENE SIZE	Scene Price (Rs) - NGE	Scene Price (Rs) - GE
CARTOSAT-3	PAN	0.28m	GEO Orthokit	17km x 17 km	3,860	Free data
		0.28m	Ortho Rectified (without GCP)	17km x 17 km	4,810	Free data
		0.45m	Ortho Rectified (without GCP)	17km x 17 km	4,810	Free data
	Mx	1.10m	GEO Orthokit	17km x 17 km	3,860	Free data
		1.10m	Ortho Rectified (without GCP)	17km x 17 km	4,810	Free data
		1.10m	Ortho Rectified (without GCP)	10km x 10km	1,700	Free data
		1.10m	NCC & FCC (Ortho Rectified-without GCP)	10km x 10km	1,700	Free data
	PAN+MX	0.45m	Pan-sharpened	10km x 10km	2,400	1400
		0.45m	NCC & FCC (Pan-sharpened)	10km x 10km	2,400	1400
CARTOSAT-2S	PAN	0.60m	GEO Orthokit	9.8km x 9.8km	2,060	Free data
		0.60m	Ortho Rectified(without GCP)	9.8km x 9.8km	3,400	Free data
	Mx	1.60m	GEO Orthokit	9.8km x 9.8km	2,060	Free data
		1.60m	Ortho Rectified(without GCP)	9.8km x 9.8km	3,400	Free data
		1.60m	Ortho Mosaic (Min:2,Max : 4)	9.8km x 9.8km	3,400	2060
		1.60m	NCC & FCC (Ortho Rectified-without GCP)	9.8km x 9.8km	3,400	Free data
	PAN+MX	0.60m	Pan-sharpened	9.8km x 9.8km	6,190	3650
		0.60m	Pan-sharpened Mosaic (Min:2, Max:4)	9.8km x 9.8km	6,190	3650
		0.60m	NCC & FCC (Pan-sharpened)	9.8km x 9.8km	6,190	3650

Indian Space Policy 2023

How are the users categorized?

User are categorized under following 3 categories:

- **Government Entities (GE)** – Government Entities (GE): Following declaration form (GE Declaration Form) is to be submitted to data[at]nrsc[dot]gov[dot]in for Indian government users to declare status as GE.
- **Non-Government Entities (NGE)** – All Indian users other than GE are tagged as NGE users.
- **Foreign Entities (FE)** – All non-Indian users are tagged as Foreign Entities.

KOMPSAT-3/3A	PAN & MX	0.5, 2.2m	Geo Orthokit, Bundled	15km x 15km	11,470	7930
CARTOSAT-1	PAN	2.5m	Ortho Rectified(without GCP)	27.5km x27.5km	6,450	Free data
	Stereo	2.5m	RAD Ortho kit	27.5km x27.5km	5,110	Free data
	CartoDEM	10m Posting	DSM	14km x14km	6,290	4070
	CartoDEM	2.5m Posting	DSM	14km x14km	6,290	4070
CARTOSAT-2	PAN	1m	GEO Orthokit	9.8km x 9.8km	2,440	Free data
		1m	Ortho Rectified(without GCP)	9.8km x 9.8km	2,890	Free data
RISAT-1	SAR FRS1 FRS2	3m	Geometrically Terrain Corrected	25km x 25km	4,890	Free data
		3m	Single Look Complex	25km x 25km	4,890	Free data
		3m	Multi Look Ground Range	25km x 25km	4,890	Free data
EOS-04	SAR FRS1 FRS2	3m	Geometrically Terrain Corrected	20km x 25 km	4,890	Free data
		3m	Single Look Complex	20km x 25 km	4,890	Free data
		3m	Multi Look Ground Range	20km x 25 km	4,890	Free data
		3m	Covariance	20km x 25 km	4,890	Free data
		3m	Polarimetric Decomposed	20km x 25 km	4,890	Free data
NOVASAR-1	All modes	6-33 m	Geometrically Terrain Corrected	13-400km x 13-400km	6,340	Free data
		6-33 m	Single Look Complex Slant range	13-400km x 13-400km	6,340	Free data
		6-33 m	Multi Look Ground range	13-400 km x 13-400km	6,340	Free data

Satellite Data Availability at ISRO

- As per Indian Space Policy 2023, satellite data of 5m and coarser is now free & open for all users.
- Data finer than 5m (except DEM, merged, mosaicked and customized products, etc) is open for Government Entities and priced for Non-Government Entities.

How many products can be downloaded at a time?

On a given day a user can download 100 products, at a time only 5 products can be downloaded concurrently.

Which satellite imagery is available free and open to users?

The following satellites data are available as free and open to users (except those marked with ₹)

Satellite	Availability	Resolution
Aqua	31-Dec-2003 - 31-Dec-2019	500 m
CartoSat-1 (₹)	8-May-2005 - 19-Feb-2019	2.5 m
CartoSat-2 (₹)	14-Apr-2007 - 23-May-2019	0.8 m
CartoSat-2E (₹)	25-Jun-2017 - till date	0.65 m - 1.6 m
CartoSat-3 (₹)	10-Jun-2020 - till date	0.28 m - 1.1 m
EOS-04	23-Mar-2022 - till date	3.0 m - 33.0 m
EOS-06	1-Apr-2023 - till date	360 m
IRS-1A	4-Apr-1988 - 28-May-1991	36.0 m - 73 m
IRS-1B	2-Oct-1991 - 9-Sep-2001	36.0 m - 73 m
IRS-1C	14-Nov-1996 - 20-Sep-2007	5.8 m - 56.0 m
IRS-1D	1-Jan-1998 - 20-Sep-2007	5.8 m - 56.0 m
JPSS1	15-Jan-2021 - till date	375.0 m - 750.0 m
KompSat-3 (₹)	1-Jan-2018 - 29-May-2020	0.55 m
KompSat-3A (₹)	1-Jan-2018 - 31-May-2020	0.55 m
LandSat-8	1-Jan-2017 - till date	30 m
LandSat-9	1-Apr-2022 - till date	30 m
NOAA-11	25-Aug-1994 - 13-Sep-1994	1000 m
NOAA-12	14-Sep-1994 - 4-Nov-1995	1000 m
NOAA-14	3-Apr-1995 - 22-Sep-2010	1000 m
NOAA-16	20-Jun-2001 - 11-Aug-2005	1000 m
NOAA-17	20-Sep-2005 - 13-Apr-2010	1000 m
NOAA-18	1-Oct-2005 - 9-Oct-2009	1000 m
NOAA-19	29-Apr-2010 - 29-Oct-2014	1000 m
Novasar-1	1-Oct-2019 - till date	6.0 m - 30.0 m
OceanSat-1	1-Jul-1999 - 29-Jul-2009	360 m
OceanSat-2	31-Dec-2009 - 3-May-2023	360 m
RISAT-1	1-Jul-2012 - 30-Sep-2016	3.0 m - 30.0 m
ResourceSat-1	7-Dec-2003 - 18-Nov-2023	5.8 m - 56 m
ResourceSat-2	8-May-2011 - till date	5.8 m - 24.0 m
ResourceSat-2A	18-Dec-2016 - till date	5.8 m - 56 m
Sentinel-1A	9-Oct-2019 - till date	20 m
Sentinel-1B	4-Oct-2019 - 23-Dec-2021	20 m
Sentinel-2A	1-Oct-2019 - till date	10 m
Sentinel-2B	1-Oct-2019 - till date	10 m
Suomi-NPP	15-Jan-2021 - till date	375.0 m - 750.0 m
Terra	1-Oct-2002 - 31-Dec-2019	500 m