Indian Space Research Organisation

Growth of EO Applications in Diverse Sectors

V Bhanumurthy
Associate Director, NRSC/ISRO

Geospatial & Statistics
Integration for Informed Decision Making
22 January 2017, Hyderabad

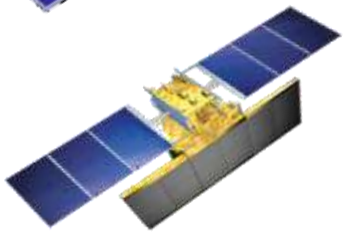
ISRO Earth Observation Satellites Infrastructure

Indian Space Research Organisation

LAND & WATER

RESOURCESAT-2

RISAT-1



HIGH RESOLUTION

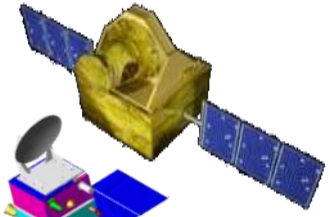
CARTOSAT-2S

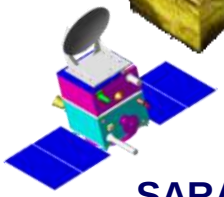
RISAT-2

CARTOSAT-1

OCEAN

OCEANSAT-2

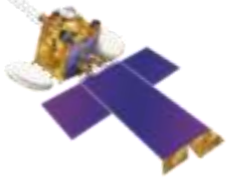




SARAL

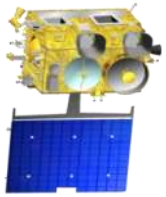
WEATHER:CLIMATE

INSAT-3A



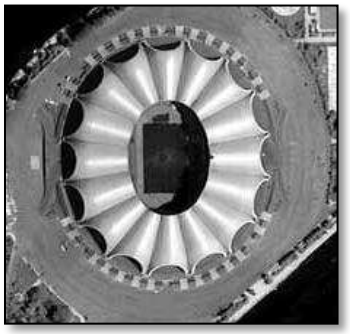
KALPANA

MEGHA-TROPIQUES



INSAT-3D

1 KM ⟵ **IMAGING CAPABILITY** ⟶ **0.8 M**

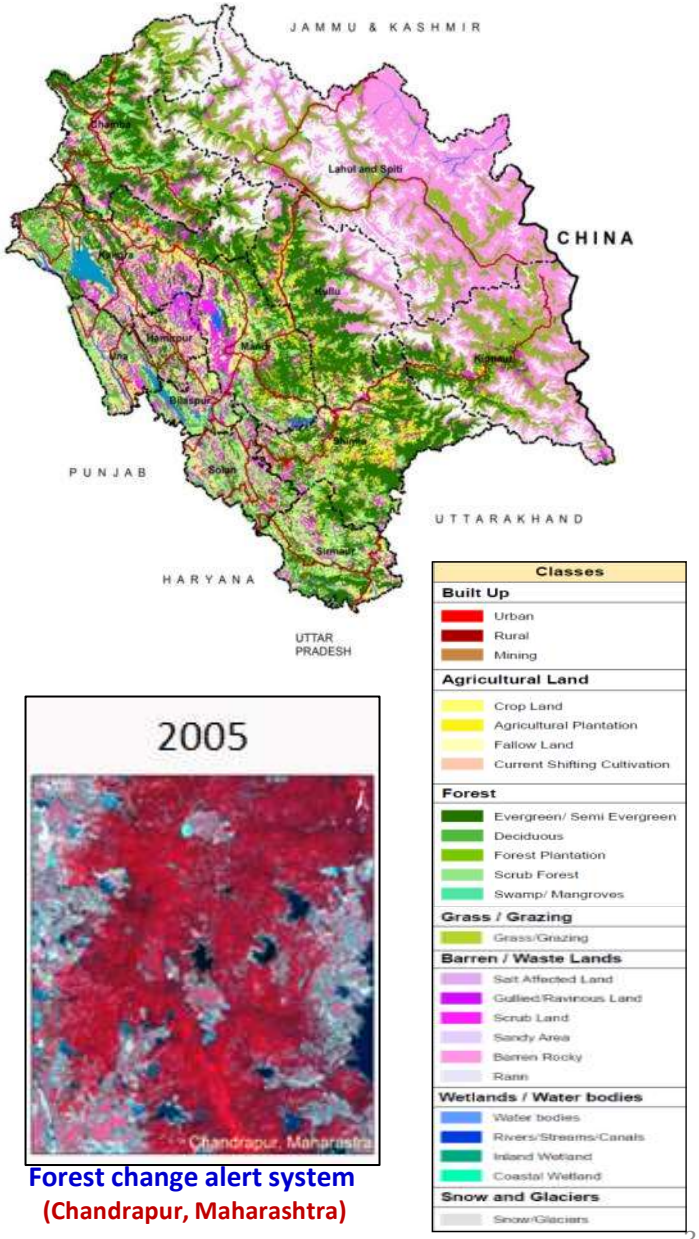


Cartosat 2E, Cartosat-3, Oceansat-3, GISAT being added for continuity of services and new capability.

Natural Resources Management

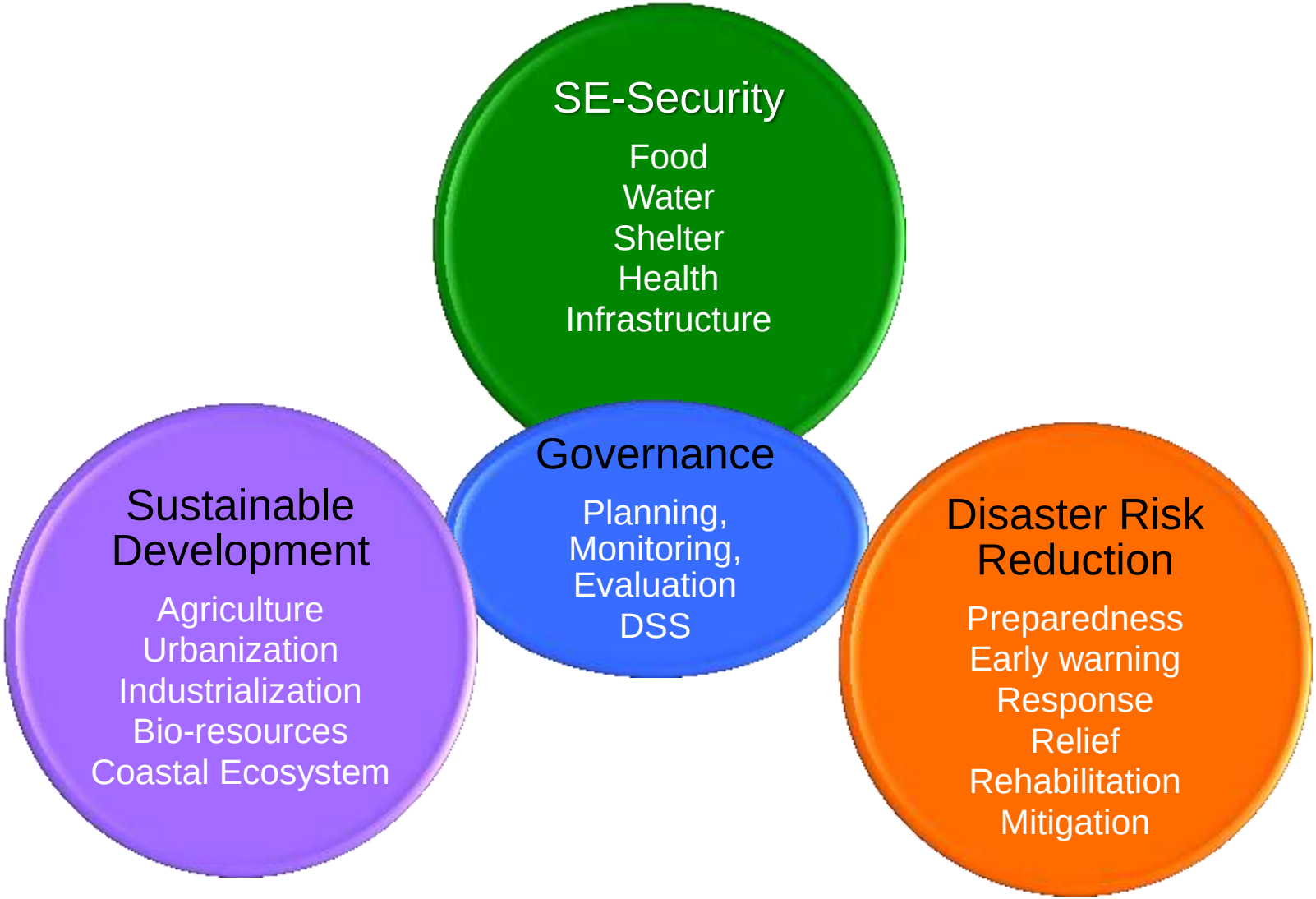
Indian Space Research Organisation

1. Agricultural Land Use / Land Cover mapping using Coarse Resolution satellite data during late 80s / early 90s
2. Land Use/Land Cover (1:250,000) – 11 Cycles
3. Land Use/ Land Cover (1:50,000) – 2 Cycles
4. Land Use/ Land Cover (1:10,000) – 1 Cycle
5. Land use Change Analysis & Hot Spot mapping
6. National Land Degradation mapping at 1:50,000 scale (2005 – 06)
7. National Geomorphology & Lineament mapping (50k) accomplished (jointly with GSI)
8. Annual/ sub-annual Forest Loss Alert System (Pilot and 14 States database completed; ready for operations)



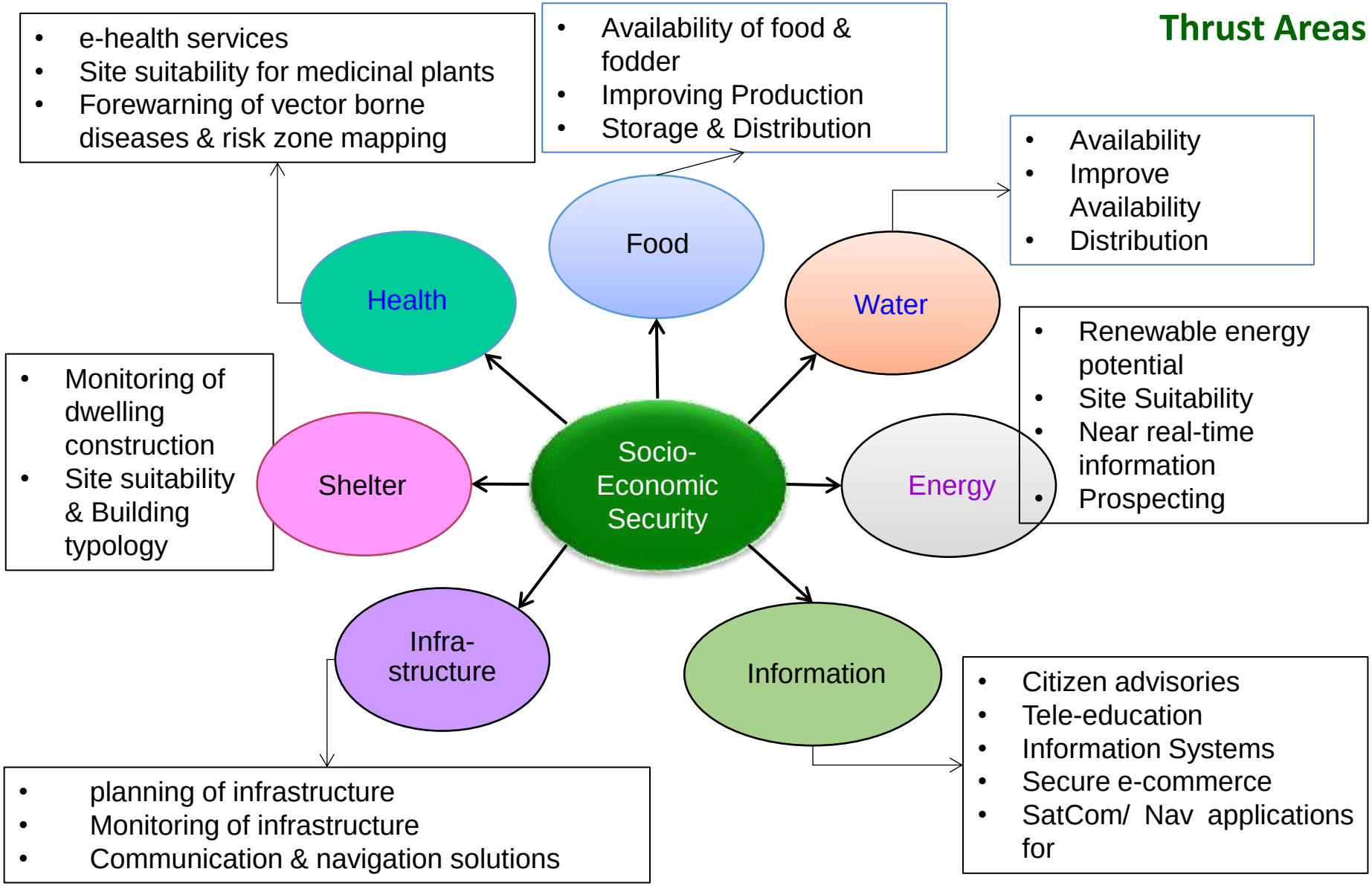
Forest change alert system
(Chandrapur, Maharashtra)

Moving Towards…

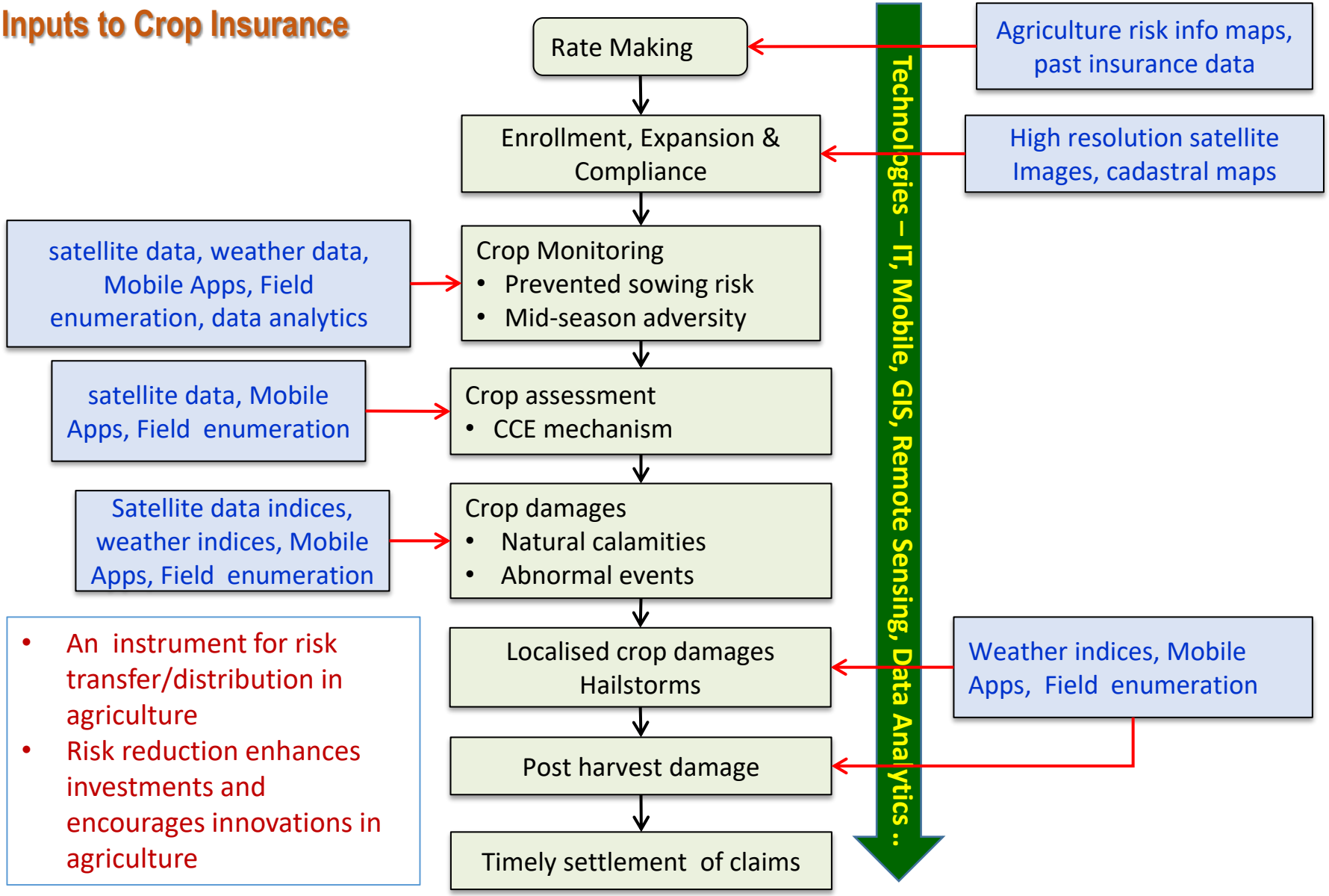


Geo-Spatial Technology Applications

Thrust Areas



Inputs to Crop Insurance

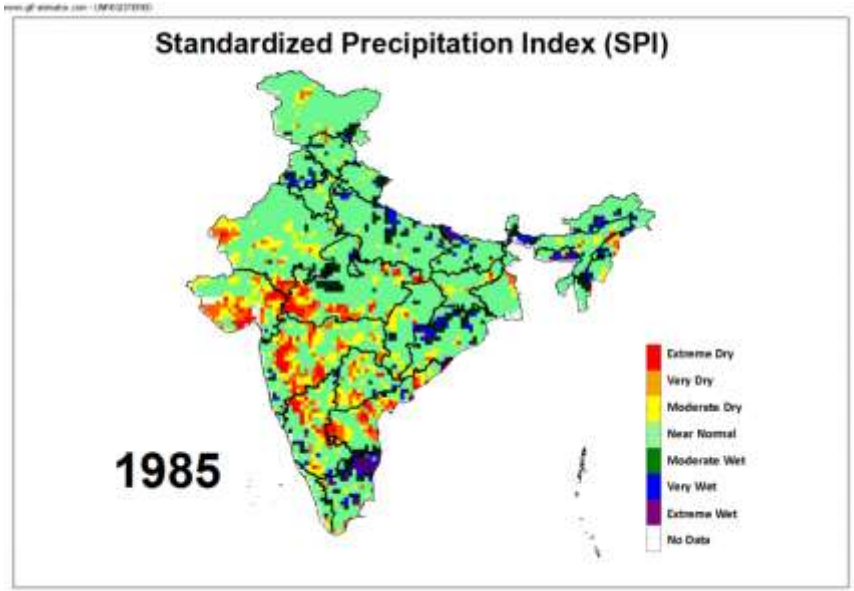


- An instrument for risk transfer/distribution in agriculture
- Risk reduction enhances investments and encourages innovations in agriculture

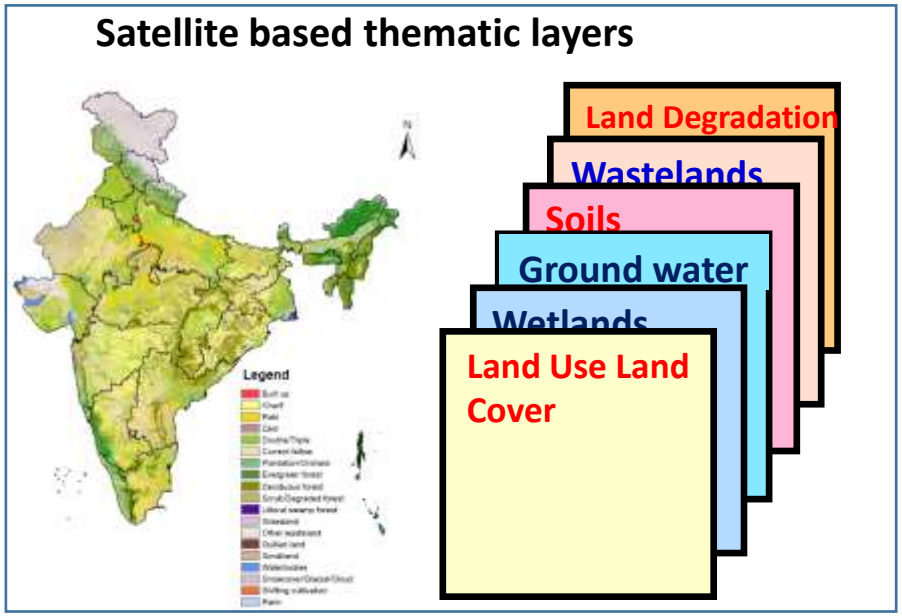
Crop Insurance – Geo-Spatial Products

Indian Space Research Organisation

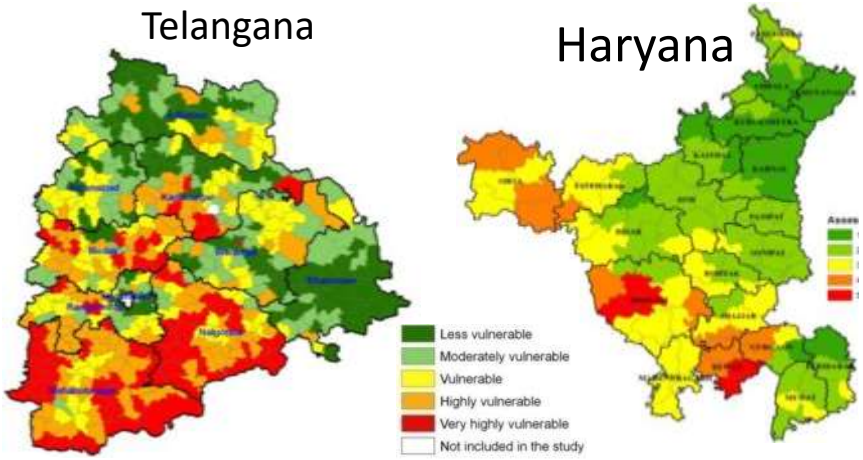
Meteorological drought hazard



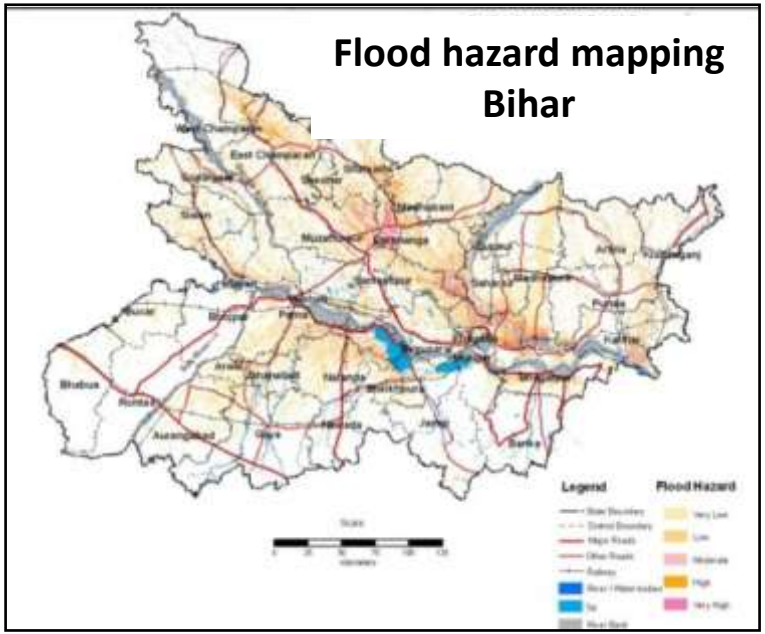
Satellite based thematic layers



Agricultural drought vulnerability mapping

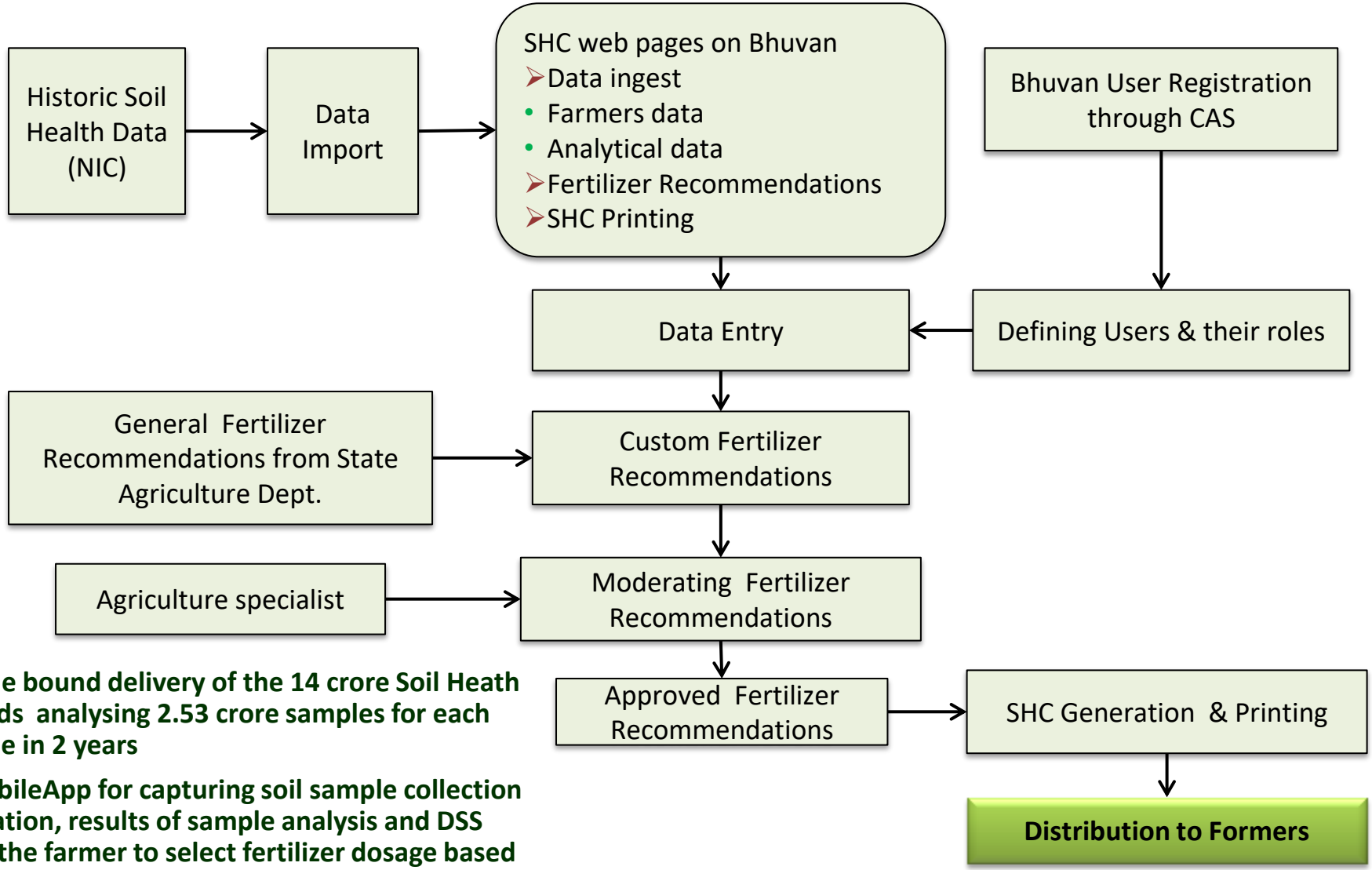


Flood hazard mapping Bihar



Soil Health Card

Indian Space Research Organisation



- **Time bound delivery of the 14 crore Soil Heath Cards analysing 2.53 crore samples for each cycle in 2 years**
- **MobileApp for capturing soil sample collection location, results of sample analysis and DSS for the farmer to select fertilizer dosage based on the stored location specific nutrient values**

Master Plan Preparation : g-Gov. Solution

GIS for mapping

Geo web App

Upload layers

Bhuvan services

Authenticatio n

Internet users

Main Features

Existing Data

- ❑ Town Specific databases
- ❑ Admin Boundaries
- ❑ Ancillary Data

Web App.

- ➢ Citizen View
- ➢ Town specific

Authentication

- Junior Level Officer
- Second Level officer
- Higher Level Officer

- ➢ State: Access all towns
- ➢ National : Access, state wise

Dharmashala – 118 sq. km
Mandi – 24 sq. km.
Nahan – 6 sq. km.
Shimla – 272 sq. km.
Solan – 30 sq. km

Software Tools

Creation and Updating Bhuvan - NUIS (Local GIS Tools)

- Point data management
- Client ⟷ Server
- Bhuvan data services
- Create, Update & link to Bhuvan Server
- Mobile App for Field data
- Final Data uplink to Bhuvan
- Serve WMS
- Help module
- Video lectures

EO Data utilisation: India's Sustainable Water Management

Irrigation

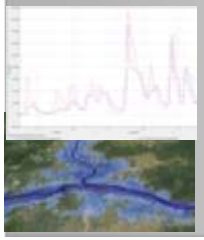
- 103 projects (2008-2012)
- Dedicated AIBP monitoring system deployed on BHUVAN
- 150 projects by 2017
- IP Utilisation studies

WR Info. Products

- Near real time pan India water & snow , 3x3 min,15 day products from RISAT-1& AWiFS
- NRT capacity assessment of major reservoirs

Operational Hydro. Services

- Modelling frame work at 9x9 min grids
- Daily basis run (1976-2005) & since June 2014
- Near Real Time Runoff, Soil Moisture, ET products since June 2014

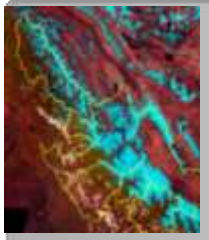


Hydrological Modelling & Flood Forecasting

- Godavari & Mahanadi – developed
- FF Development for 6 basins
- Spatial Flood Early Warning System
-

GL&WB Inventory

- Inventory (2009) completed : 2028 GL and WB's >10Ha .
- Monitoring(Jun-Oct):>50 ha (464 No's) 2010,11,12,13 & 14 completed .
- GL hazard threats /GLOF Early warning Sys.

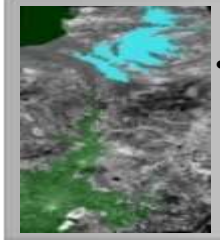


SM Runoff Modelling

- Seasonal Forecast(3months):2012,13, 14 & 2015
- Short term (16days) forecasts :2013, 2014 & 2015 in 5 Himalayan river basins
- Extension to Eastern Himalayan rivers

Water Resources Assessment

- Basin-wise WR Assessment- 2 basins
  Godavari * Baitarani-Brahmani
- Re-assessment of WR in 20 basins

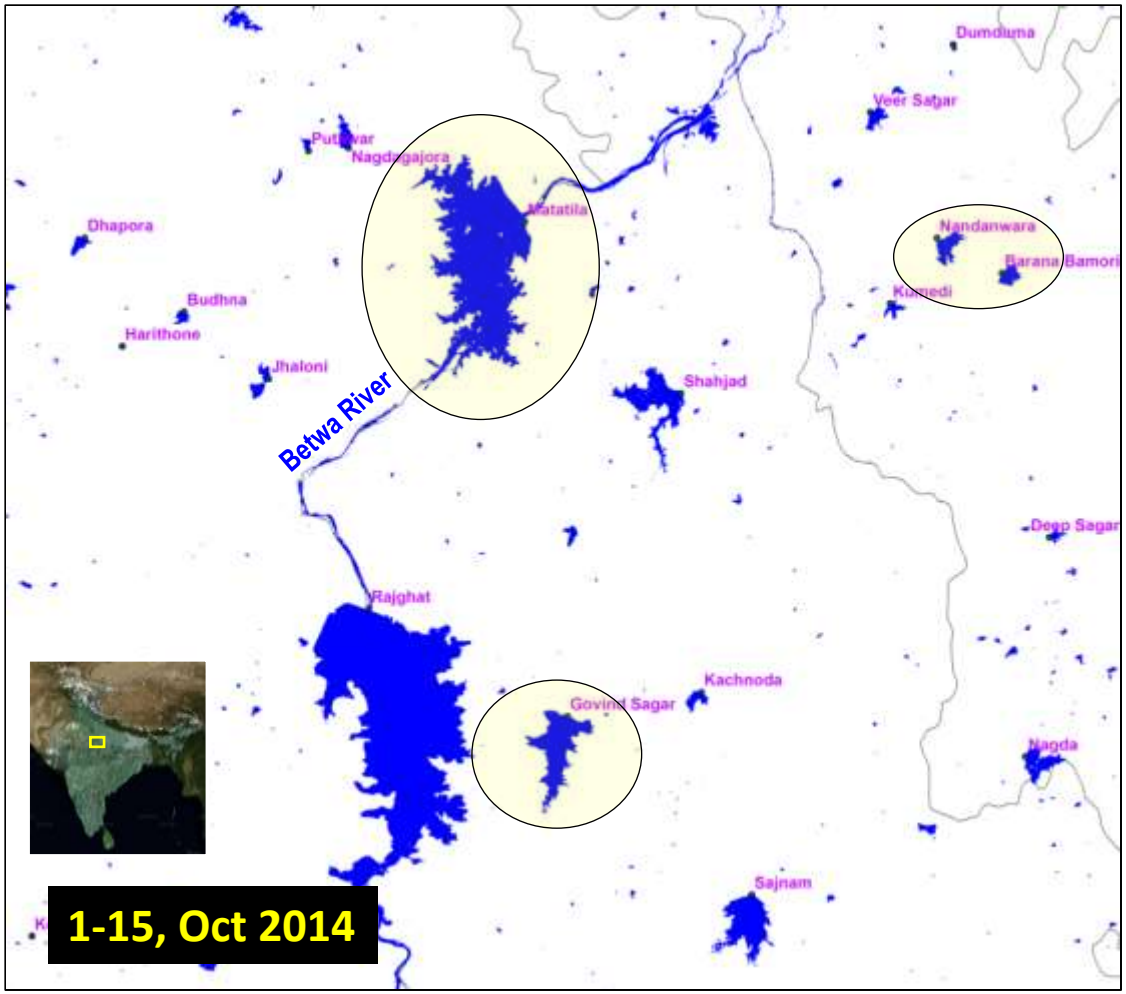


WR Project Planning

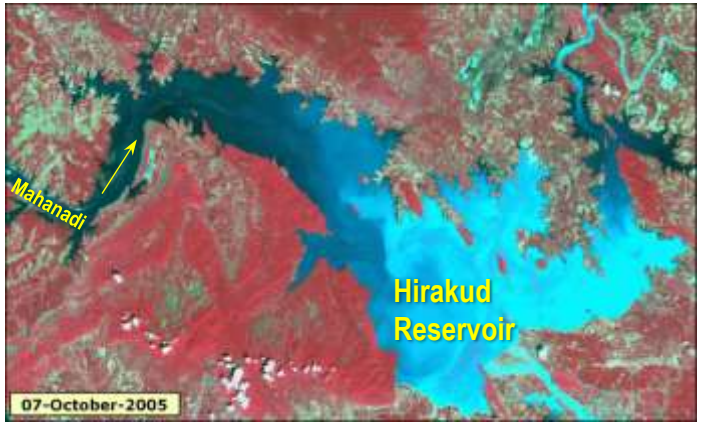
- Feasibility Studies: River linking Projects
  Ken-Betwa, Daman Ganga –Pinjal, Par Tapi Narmada

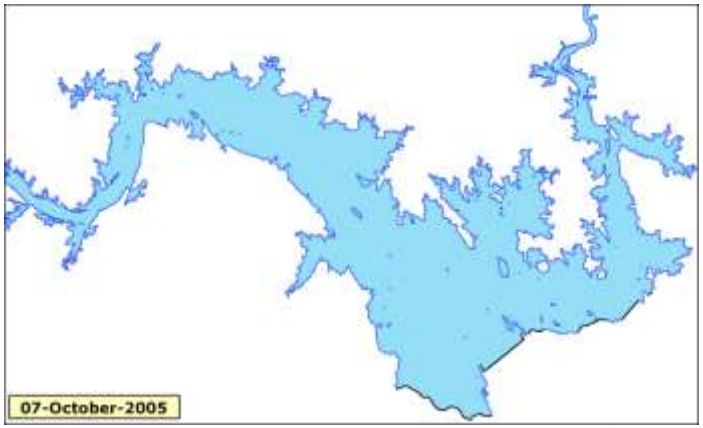
Surface Water Resources

- Surface water bodies layer at 15 day interval available at National level
- Surface Water monitoring, hydrological drought, sedimentation survey, …
- Enables multi-temporal geospatial analysis…..



Reservoir Monitoring

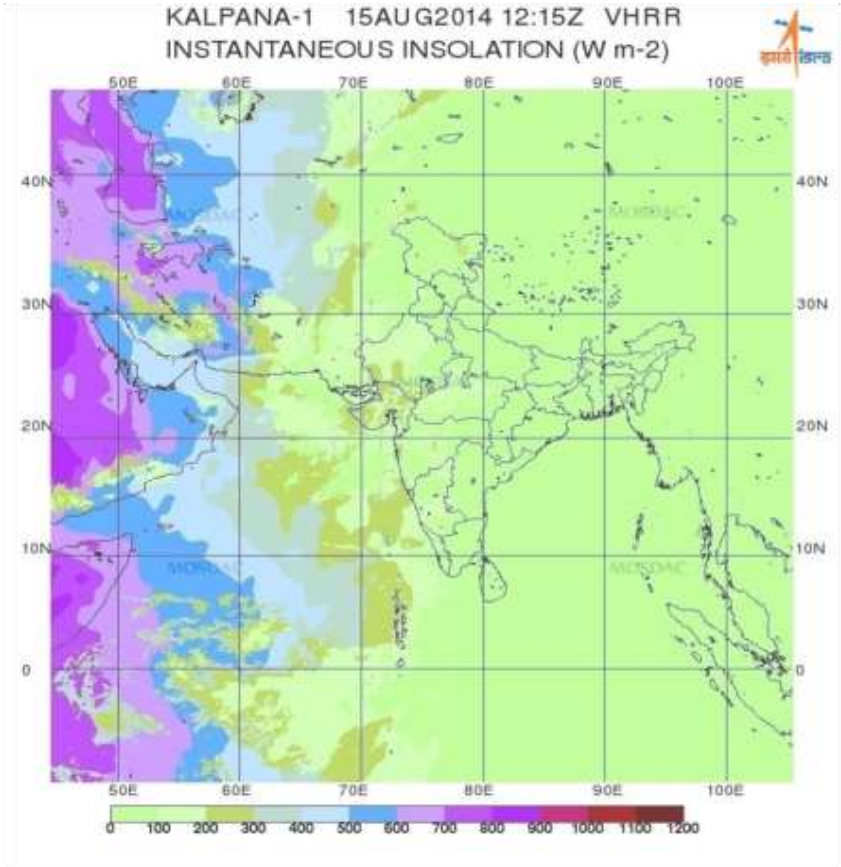


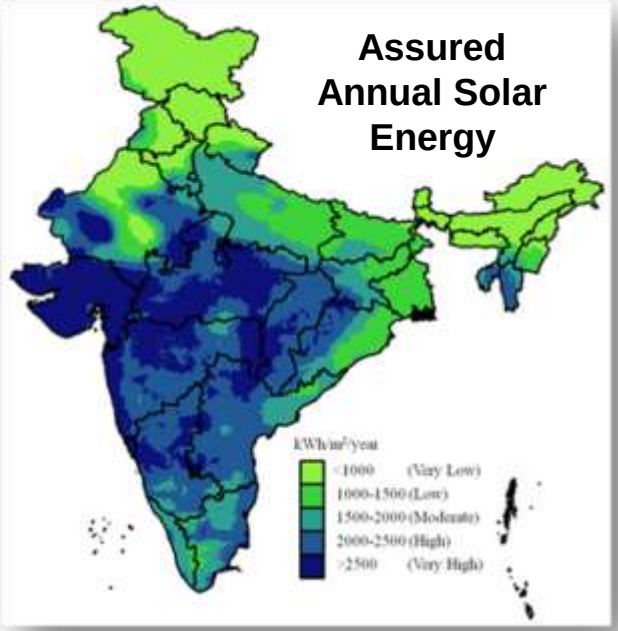


Energy Security

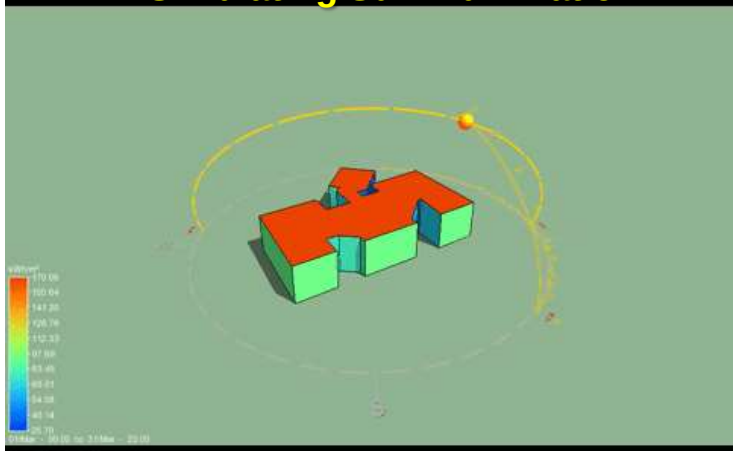
- **Real-time instantaneous & daily solar energy**
- **South-East Asia at 8 km spatial resolution using Kalpana-1, Terra MODIS, GTOPO5**
- **3D City Modelling for harnessing Solar Energy**

Solar Energy Monitoring



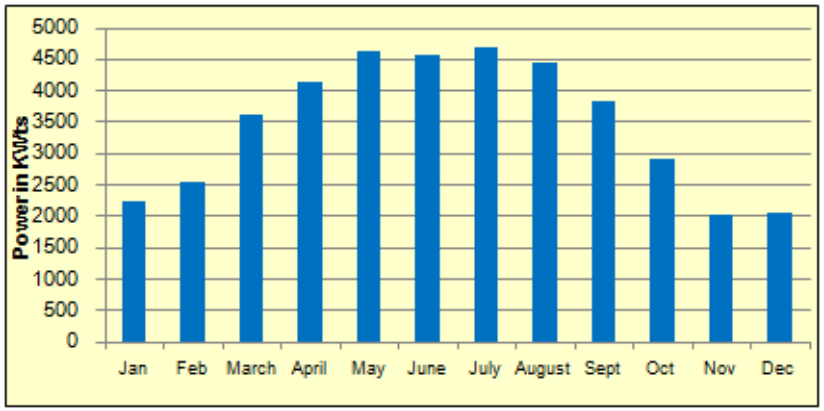


Simulating Sun Illumination



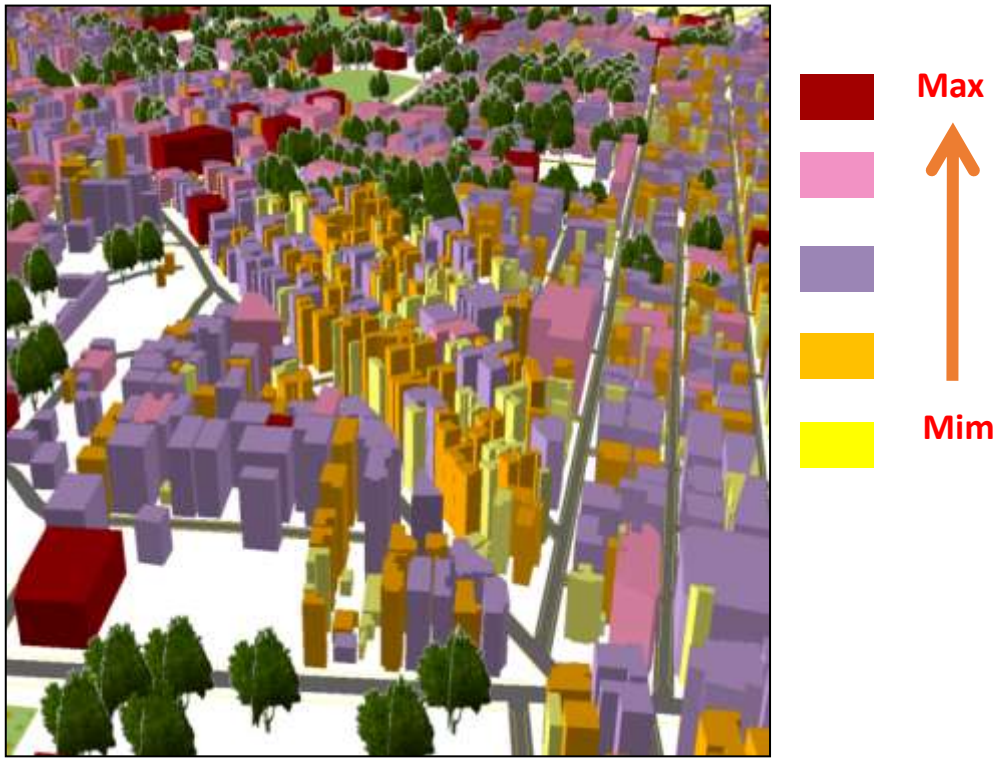
for Solar Energy Estimation

Determining the Potential of Solar Rooftop in Rajkot city from High Resolution Satellite data



Solar power infrastructure in Rajkot Municipal Corporation (RMC):

- Current generation in West zone is 70 kW and in East Zone is 50 kW.
- 5000 solar water heaters of capacity ranging 100 to 500 ltrs.
- 2000 solar street lights
- RMC has plans to install 100 kW more generation in its Central Zone.



Important Criteria for considering Potential rooftop for installation of Solar panels

- ✓ **All Buildings with rooftop area > 500 sq.m (AMRUT standards) -**
- ✓ **Building rooftop area > 200 sq.m can be considered if min. solar radation 150 wh/m2 in summer month**

- Development of methods/tools for generating 3D Building from existing 2D building foot prints and DEMs.
- Building shadow analysis for calculation each building wise potential area.
- Building wise feasibility analysis for installing Solar PVs.
- Study of different solar PV technologies and cost analysis

GIS Implementation of Mahatma Gandhi NREGA Assets

Web Portal

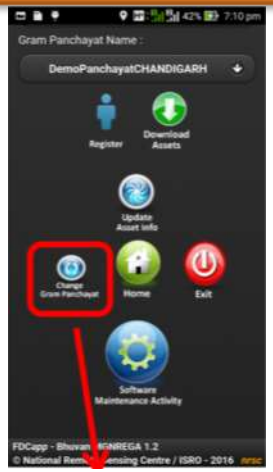
- Registration
- State GIS Nodal Officer
- District GIS Nodal Officer
- GIS Asset Supervisor (Block)

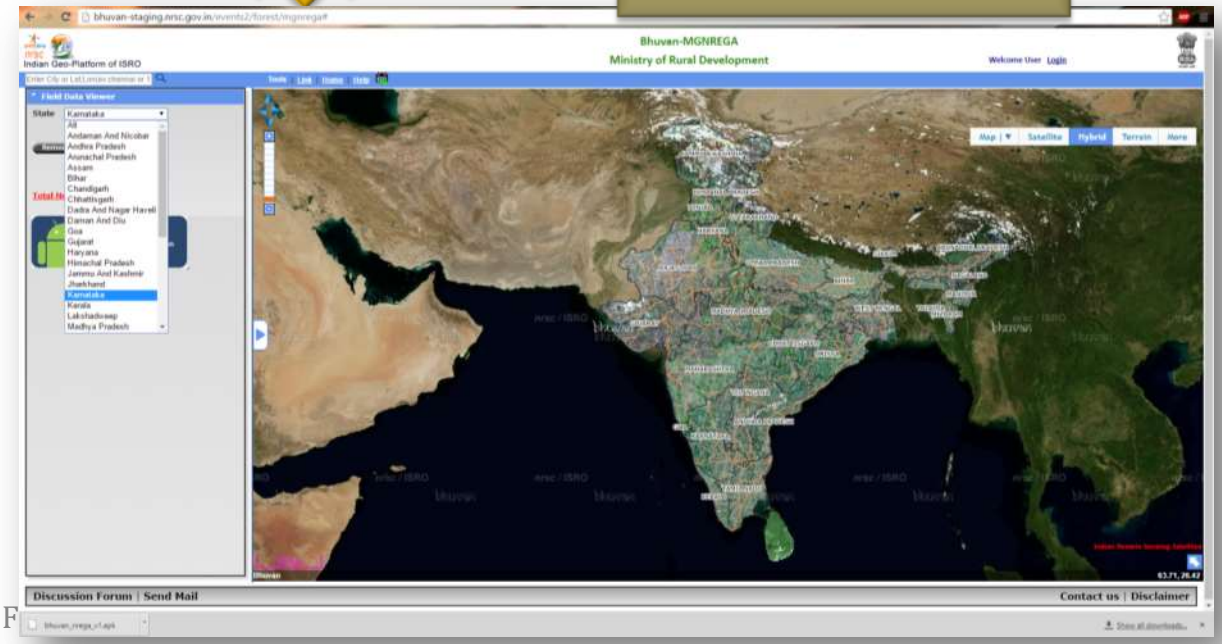
3.2 million Assets Geotagged 10K Assets/ hours

12Jan2017

MGNREGA Spatial Enumerator

Mobile App





Mobile Smartphones Apps for Crowd Sourcing

- Time stamped and geo-tagged Information
- Transparent & consistent monitoring system
- Ground reality on Bhuvan platform
- Multiple data sets for monitoring progress

- A.P. State Housing Corporation Ltd. -monitoring of housing scheme at various stages of construction.
- **Pradhan Mantri Awas Yojana - Housing for all program**

Many new Geotagging Applications

- Watersheds monitoring IWMP, NABARD
- Geo-tagging of all Post Offices in the country
- Damage assessment during Disasters
- Geo-tagging Higher Education Institutions - MHRD
- Crowd sourcing for pollution monitoring in river Ganga.

Different stages of House construction

Disaster/Emergency Management Concept

Event Reporting

Real-time Field Info

Situation Assessment

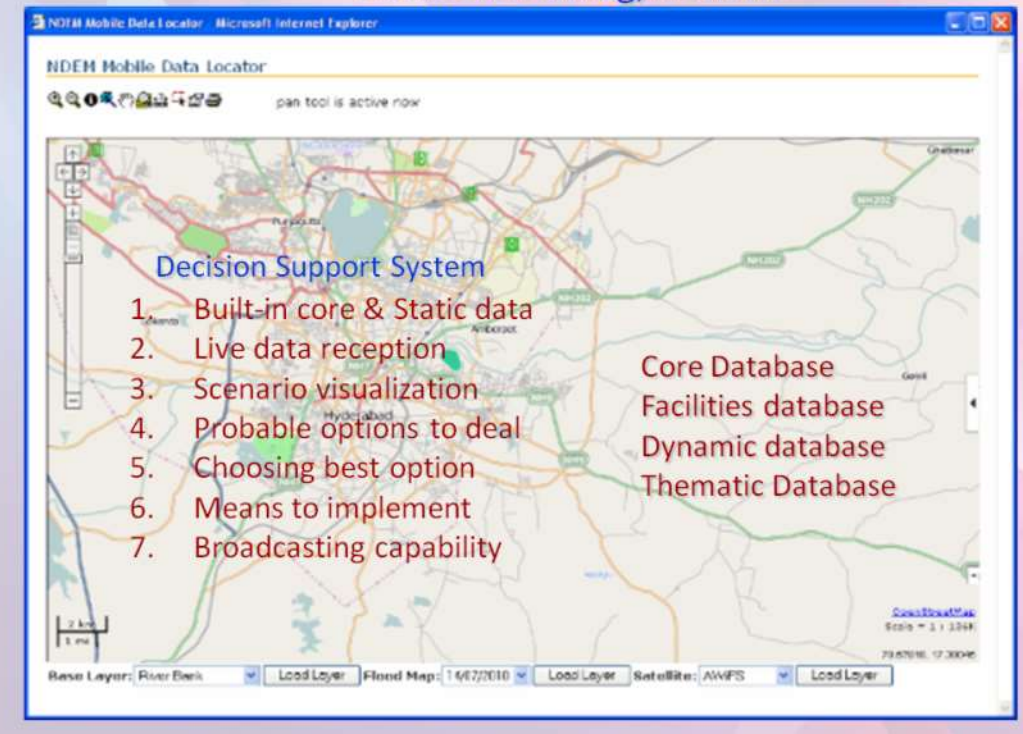
Resource Identification

Mobilization

Nodal Depts
+

Commn Channels
+

Database integration, Visualization
Decision Making, Actions

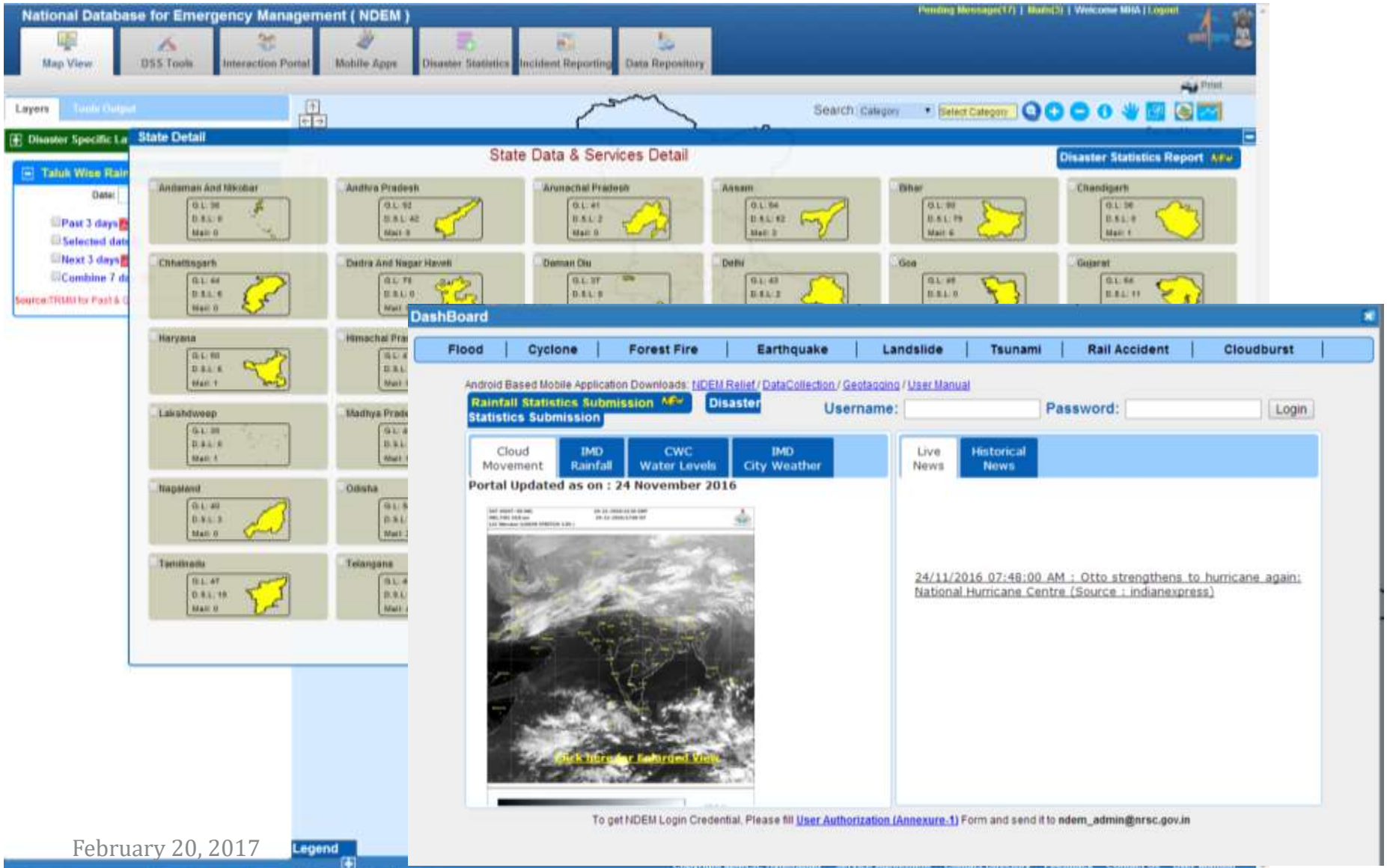


Type of Emergency

Evacuation,
Rescue & Relief
Medical,
Contingency Operations

National Database for Emergency Management Portal

National Disaster Management Command Centre



Disaster Risk Reduction

Indian Space Research Organisation

Daily Fire Alert

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

EARTHQUAKE

- Damage Assessment

Kedarnath - 2013

Kashmir Floods - 2014

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

Cyclone VARDAH - Damage to Roof Top, Varadharajanagar (Kamal Steel Plant)

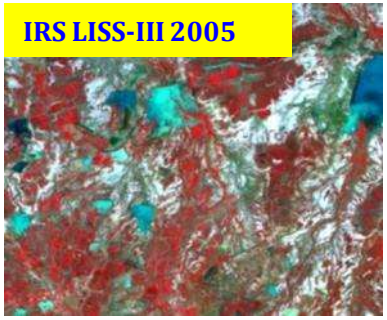
Pre-Event

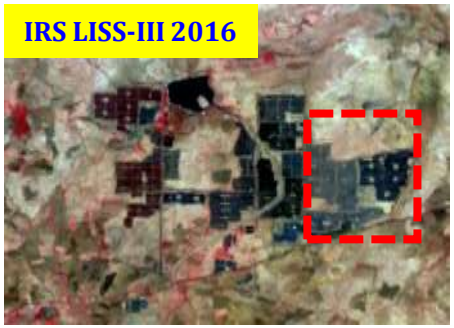
Post-Event 14-Dec-2016

Sustainable Development

Indian Space Research Organisation

Waste Land Development



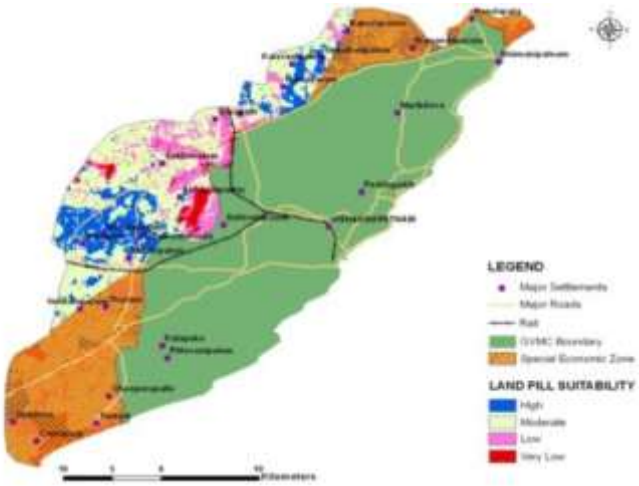


- Wasteland to solar power generation,
- Charanka solar park Radhanpur,
- one among 44 such projects in Gujarat State

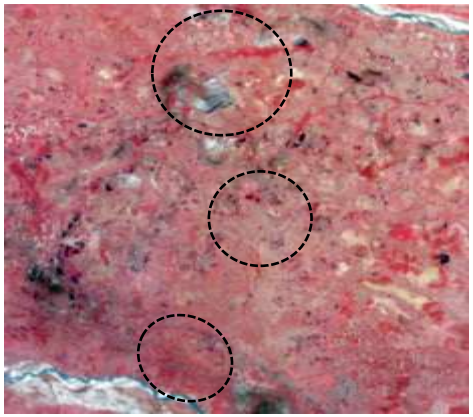
M&E of IWMP Water Shades

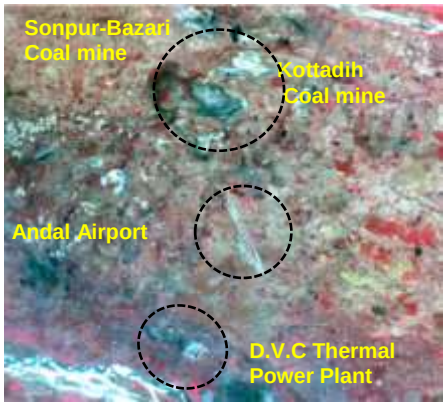
- Mobile App for Geo-tagging
- Web based Change detection & Impact Assessment

Site Suitability Analysis Map For Solid Waste Disposal



Monitoring LULC Change Trajectories in Hotspots of India





Vision and Strategy for 2017-2030

Security

Food
- Estimation of food & fodder availability
- Improving agricultural production on sustainable basis
- Efficient storage and distribution of the produce

Water
- Water resources assessment
- Efficient rain water harvesting
- Improving irrigation efficiency
- Conjunctive use of surface & ground water
- Water quality monitoring

Energy
- Assessment of potential renewable resources
- Prospecting of non-renewable energy resources
- Site suitability for exploiting renewable energy resources

Health
- e-health services to remote locations
- Models for forewarning of diseases
- health risk zonation for enabling control/management measures

Shelter
- Habitation suitability and safety for the dwellings
- Monitoring of dwelling construction
- Site suitability & Building typology

Infrastructure
- Space inputs for infrastructure planning (site suitability, route alignments, etc.)
- Monitoring of infrastructure development
- Environmental impact assessment

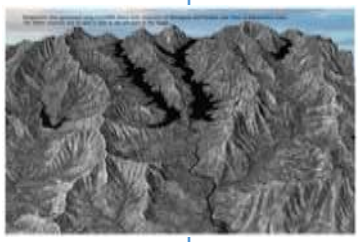
Sustainable Development
- Space inputs for suitable management plans preparation and conservation and optimal management of natural resources & ecosystems.
- Environment impact assessment of developmental actions
- Climate change and biosphere & geosphere studies

Disaster Risk Reduction
- Integrated Disaster Management Support (DMS) system for all phases of disasters
- Early earning systems
- Near real time geospatial products and services
- Communication and navigation support for relief management

Geospatial Governance
- Use of space technology in governance and development
- Technology support for Planning, M&E of development programmes
- Decision Support Tools

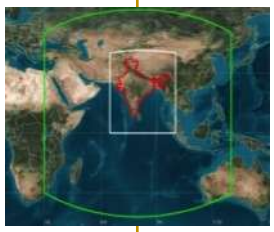
Towards Integrated Space Technology Solutions

Digital Elevation Model

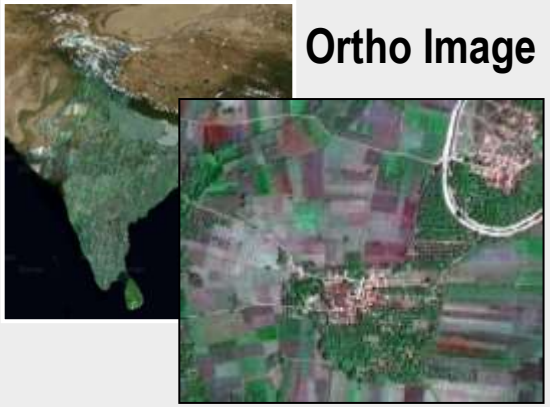


Optical & Microwave (Multi-Spectral Multi-Spatial, Multi-Temporal)

GAGAN enabled solutions



In-situ measurements



Mobile Data Collection

Geo-Platforms - Suite of Applications for Governance

Thank You

Thank You