Progress in implementing the Asia-Pacific Plan of Action on Space Applications for Sustainable Development (2018-2023)

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INDIA

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Content

- **Summary of Progress**
- **Good Practices**

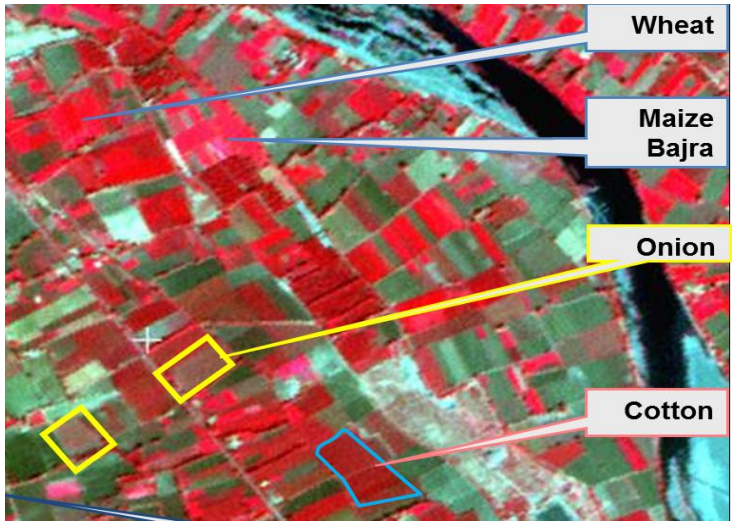
Progress in Implementation of the Asia-Pacific PoA on Space Applications for Sustainable Development (2018-2030)



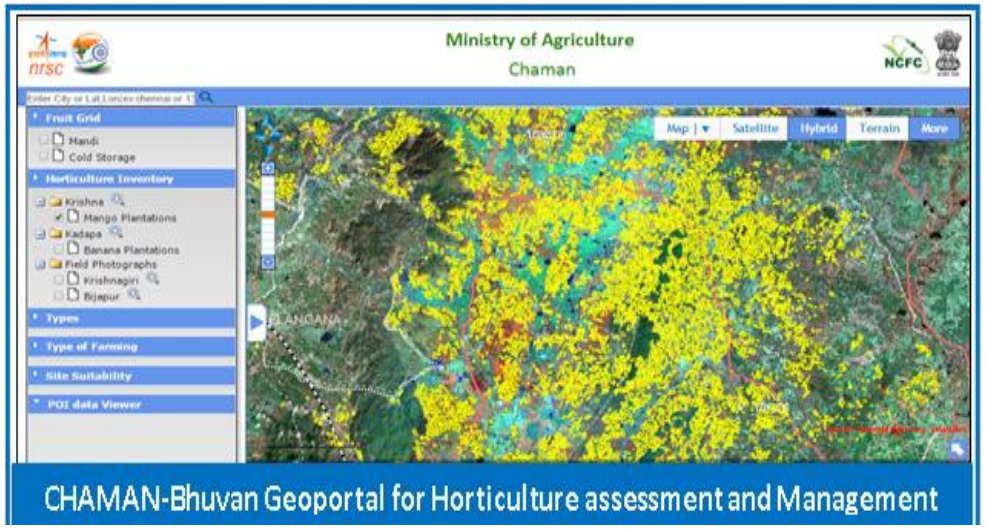
Priority Themes	*Action Area 1* *Research and knowledge-sharing*	*Action Area 2* *Capacity-building and technical support*	*Action Area 3* *Intergovernmental discussions and regional practices*	Total
Disaster Risk Reduction SDG: 2, 11, 13 & Sendai Framework for DRR	16/16	16/16	17/18	49/50
Management of Natural Resources SDGs: 6, 9, 11, 12, 14, 15	19/20	31/31	15/20	65/71
Connectivity SDGs: 3, 4, 9, 10, 11	4/8	5/7	3/7	12/22
Social Development SDGs: 1, 3	5/8	5/9	0/6	10/23
Energy SDGs: 7	5/5	3/3	1/1	9/9
Climate Change SDGs: 13	6/6	3/3	4/4	13/13
	55/63	63/69	40/56	158/188

Good Practices

Enabling Sustainable Development – Food

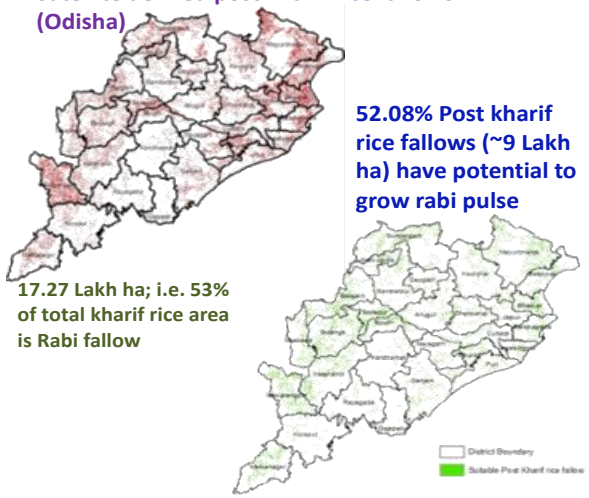


Multiple in-season **C**rop **A**creage and **P**roduction **E**stimation (**FASAL**)



Horticulture management: Acreage, production estimation, Expansion, Post harvest infrastructure

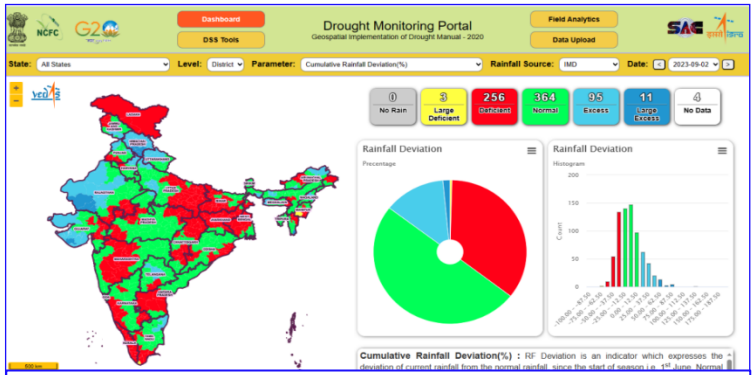
Satellite derived post kharif rice fallows (Odisha)



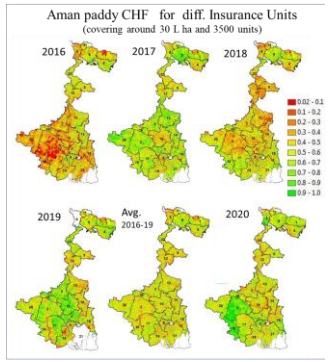
52.08% Post kharif rice fallows (~9 Lakh ha) have potential to grow rabi pulse

17.27 Lakh ha; i.e. 53% of total kharif rice area is Rabi fallow

Post-kharif rice fallows for growing pulses/ oil seeds



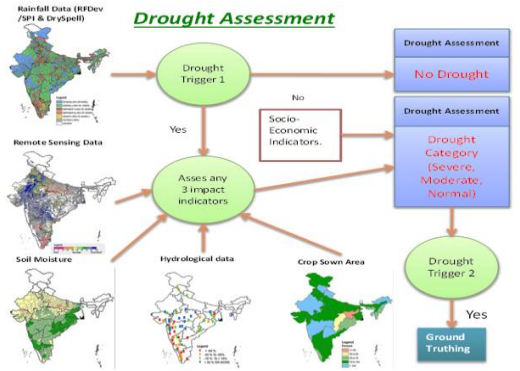
AgriDSS- Indian Digital Agriculture Solution- geospatial implementation of National Drought Manual



Automation tool for implementing Smart Sampling Technique



Crop Insurance Smart sampling- optimized Crop Cutting Experiment (CCEs), Proxies for crop yield, failed sowing, crop damage etc.



Agricultural Drought Assessment & Monitoring- 17 States

Space Technology support for operational roll-out of PMFBY

Yield Estimation based on Technology (YES-Tech) : PMFBY

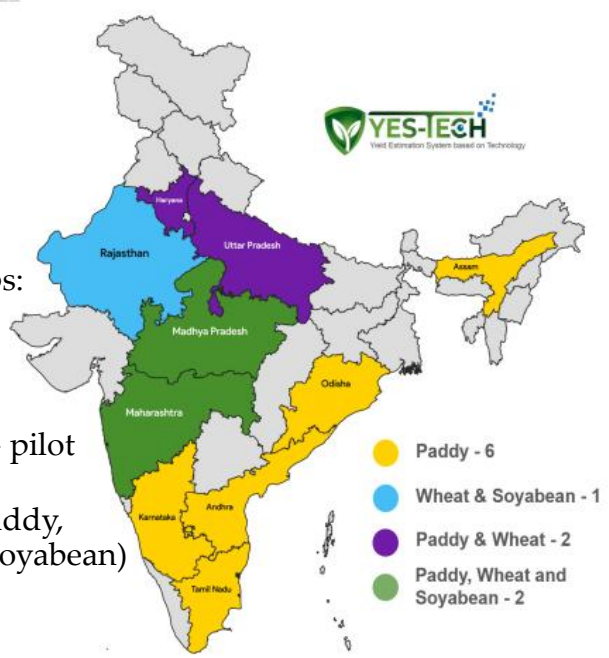
Blended use of modelled and Crop Cutting Experiment Yields for insurance claim assessment

Kharif 2023
- Operational rollout for Paddy crop
- 7 states

Rabi 2023-24
- Implemented for 2 crops: Paddy & Wheat
- 8 States

Kharif 2024
- Soyabean - pilot studies
- 3 crops (Paddy, Wheat & Soyabean)
- 10 states

Rabi 2024-25
- 11 States/UTs
- Paddy & Wheat



Models for yield estimation:
- Semi-physical
- AI/ML
- Crop simulation
- Ensemble
- Crop Health Factor

Prospective crops
Cotton
Mustard
Gram

Strengths and Achievements

- **Robust Framework:** Long-standing collaboration between DoA&FW and ISRO.
- **Indigenous Capabilities:** Development and deployment of dedicated Indian remote sensing satellites (e.g., Resourcesat series, RISAT series).
- **Operationalization of Services:** Successful transition of research projects (e.g., FASAL, Drought, YESTECH, WINDS, etc.) into operational systems.
- **Data Integration:** Integration of satellite data with Manual surveys i.e Digital crop survey.
- **Decision Support System:** Moving towards providing actionable insights for farmers and policymakers through Krishi-DSS.

Krishi- Decision Support System (DSS): Digital Public Infrastructure

- Comprehensive geo-spatial platform to leverage emerging technologies and datasets to provide actionable insights, facilitating agriculture growth and productivity
- A system which brings hundreds of agriculture data layers at one place – capitalizes the power of data

Geospatial Data Hub

Integrated Agriculture Platform

Streamlined User Management for Enhanced Data Access

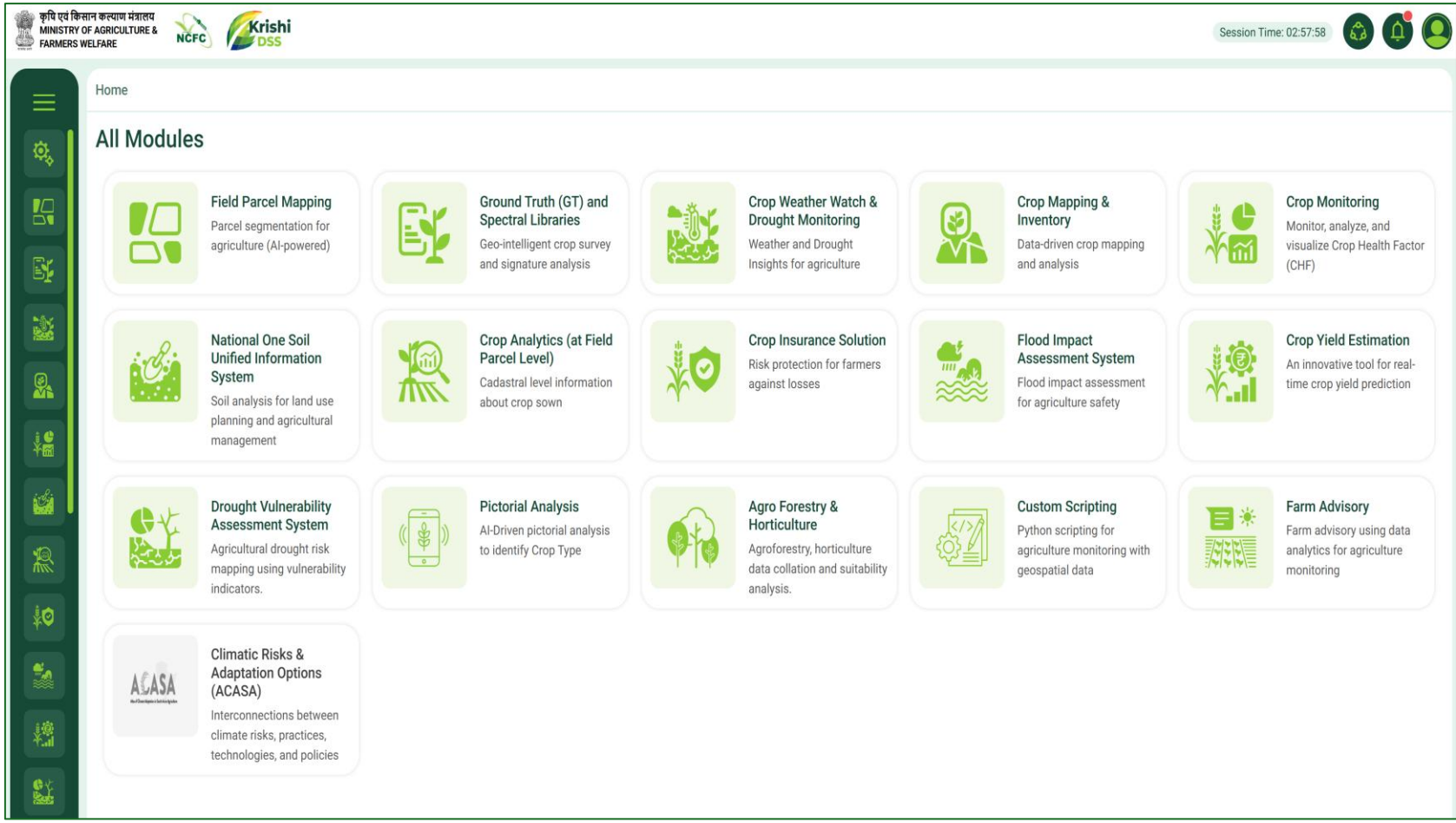
Collaboration and Interaction

Very Large Datasets

Data Analysis

Web/Mobile Application

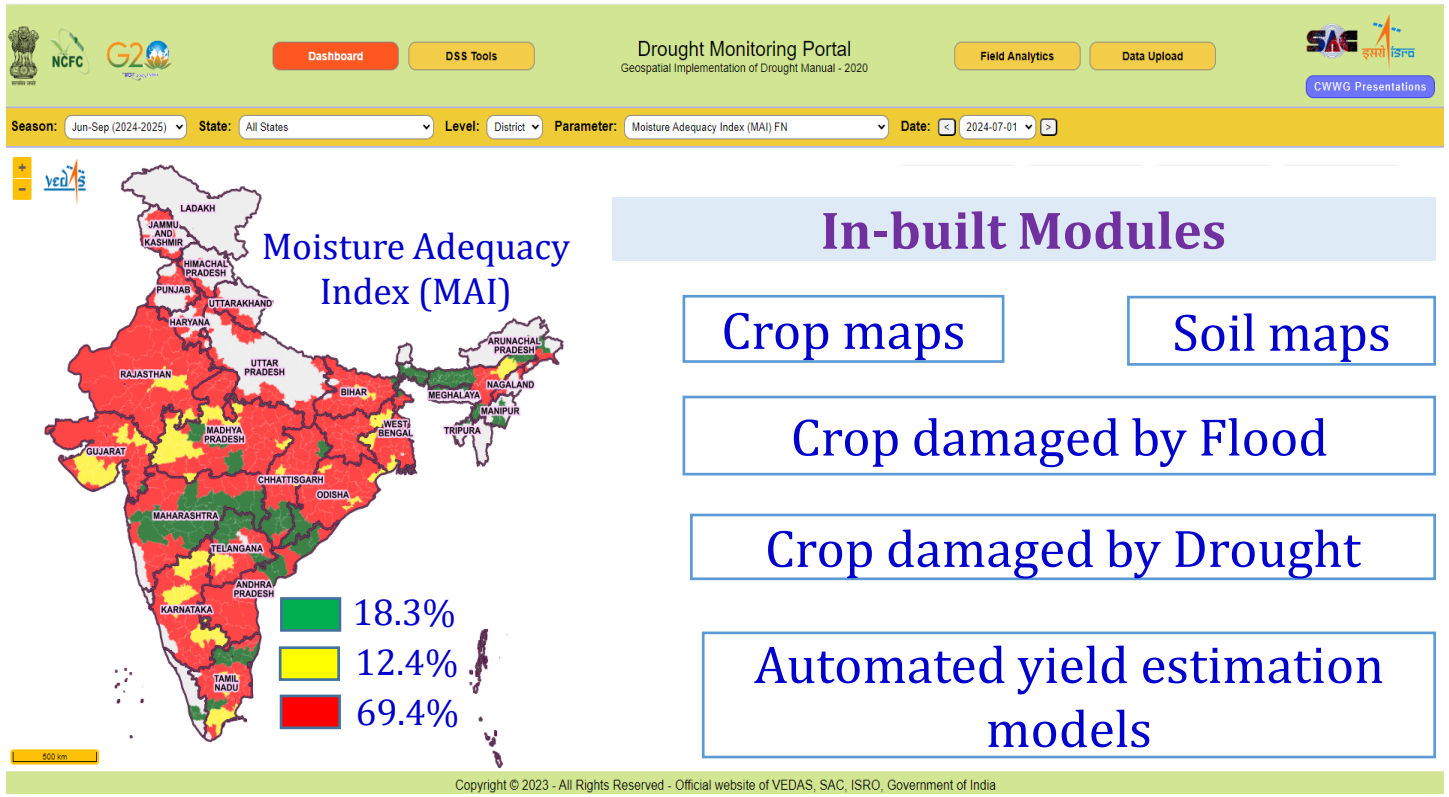
Algorithms & Models



Drought Monitoring Portal (Krishi – DSS)

Repository of Geospatial Data

- Aims to integrate and store geospatial and non- geospatial data pertaining to
  - Satellite data
  - Weather
  - Soil
  - Crop Signature
  - Reservoir
  - Groundwater
  - Data pertaining to Govt. schemes



In-built Modules

- Crop maps
- Soil maps
- Crop damaged by Flood
- Crop damaged by Drought
- Automated yield estimation models

Envisaged Benefits

Government

Evidence based Decision Making by Government

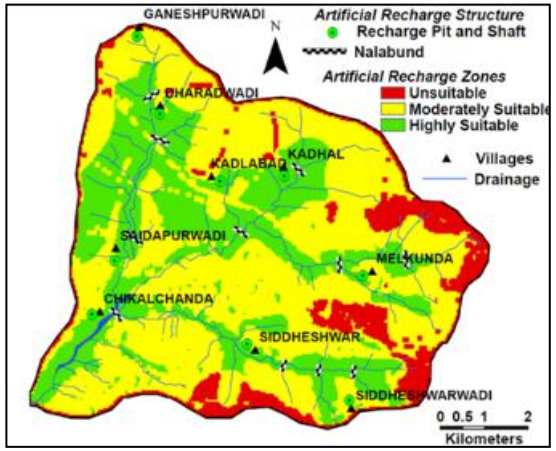
Agri-tech industry

Develop innovative digital solutions for the farmers and Agriculture sector

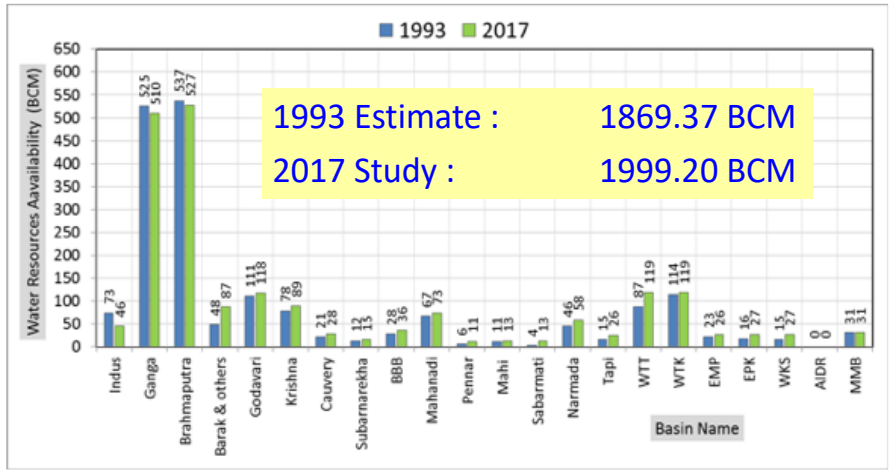
Research Groups

Create new digital tools for Agriculture

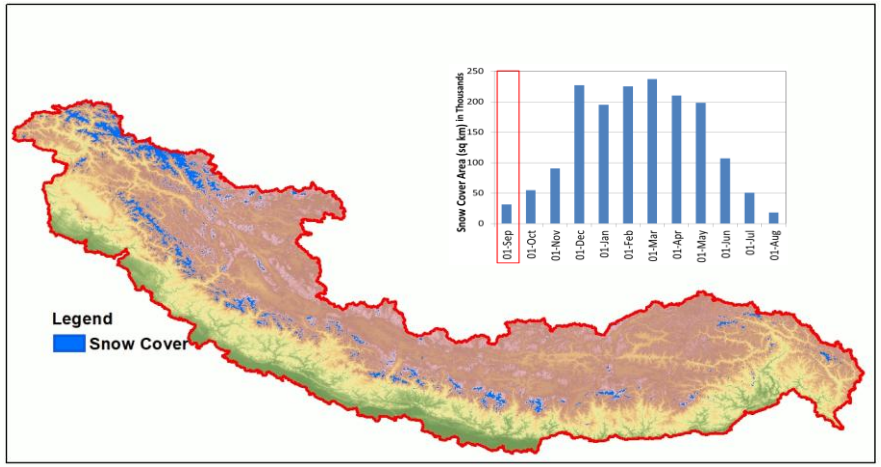
Enabling Sustainable Development - Water



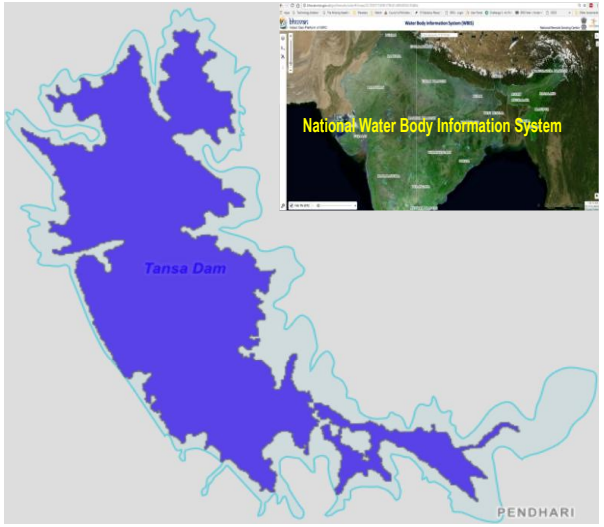
Sustainable GW Development



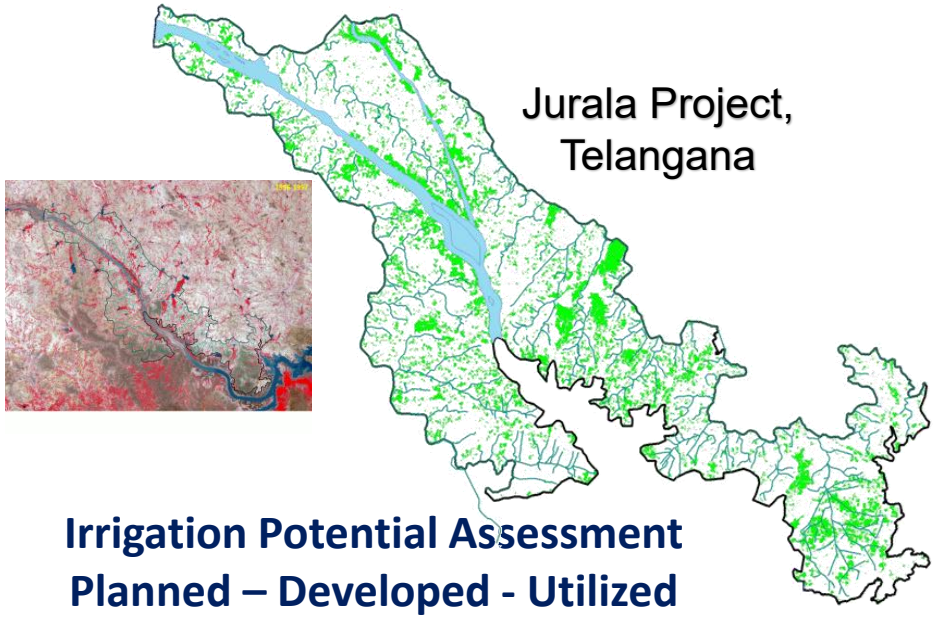
Re-assessment of Water Resources



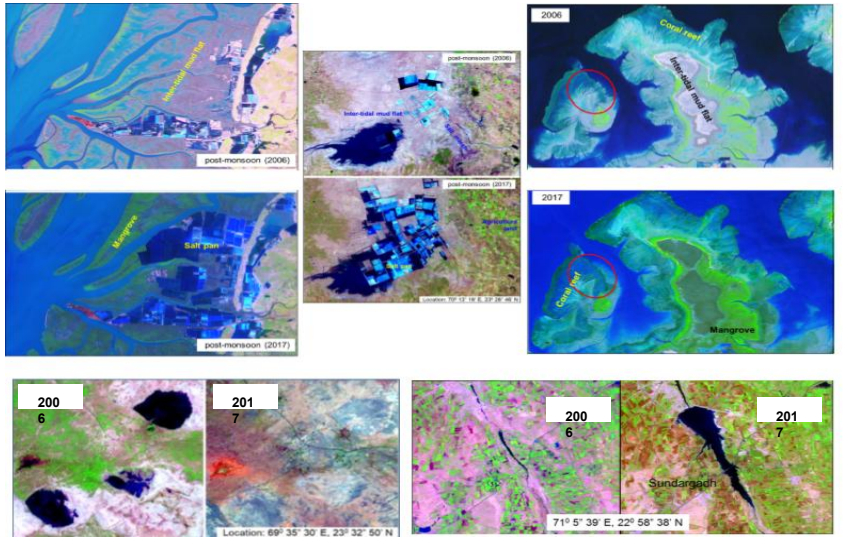
Snow cover Dynamics



Surface Spread dynamics, Storage, Quality



Irrigation Potential Assessment Planned – Developed - Utilized



Wetland Area and Dynamics

Enabling Sustainable Development – Water (cont…)

National Hydrology Project

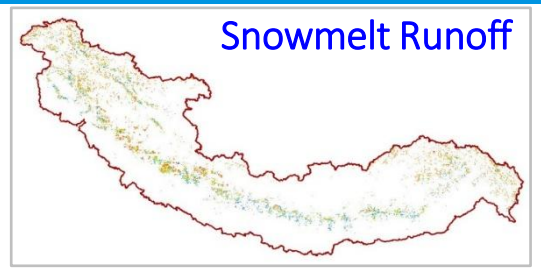
1. **Spatial Flood Early Warning** – Tapi and Godavari
2. **Evapotranspiration** – Daily Pan-India, Near-real-time
3. **Glacial Lake** – Inventory, Outburst Flood (GLOF) Risk
4. **Snowmelt runoff** - Entire Himalayas, Daily & 3-day forecast, 16 River sites
5. **National Hydrological Model** -Daily Water balance components
6. **Irrigation DSS** – Real-time irrigation scheduling in Narayanpur command
7. **Hydrological Drought** – Spatial, Pan-India Assessment
8. **Capacity Building**



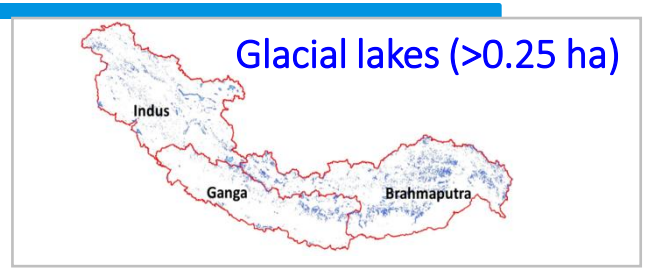
Hydrological fluxes observation network (ET, Soil moisture)

- ET Flux Towers
- Scintillometer
- Soil Moisture stations
- Cosmos soil moisture tower

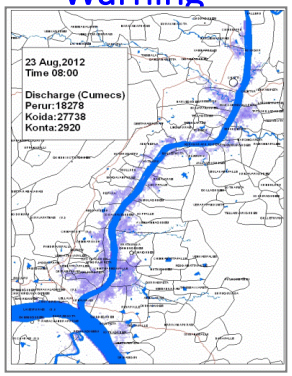
Snowmelt Runoff



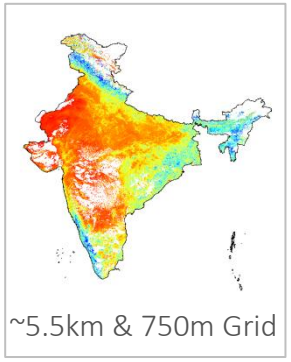
Glacial lakes (>0.25 ha)



Flood Early Warning

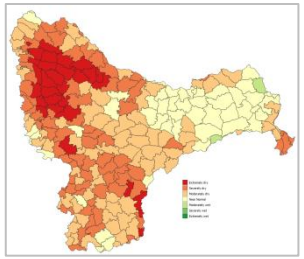


Daily Evaporative Flux

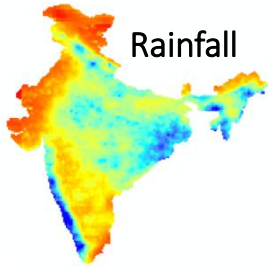


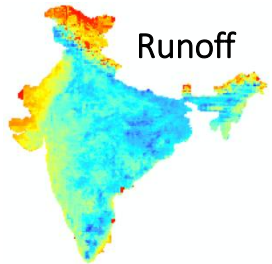
~5.5km & 750m Grid

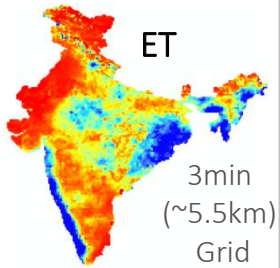
Hydrological Drought



Water Balance Components



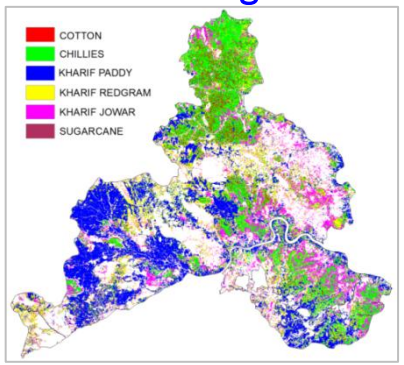




Capacity Building

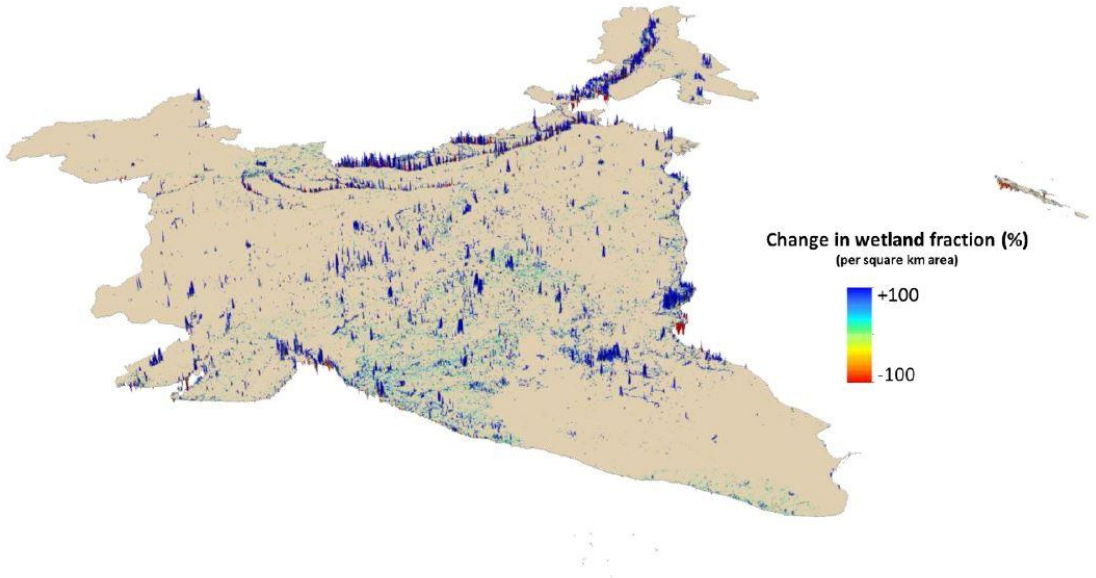


DSS for Irrigation

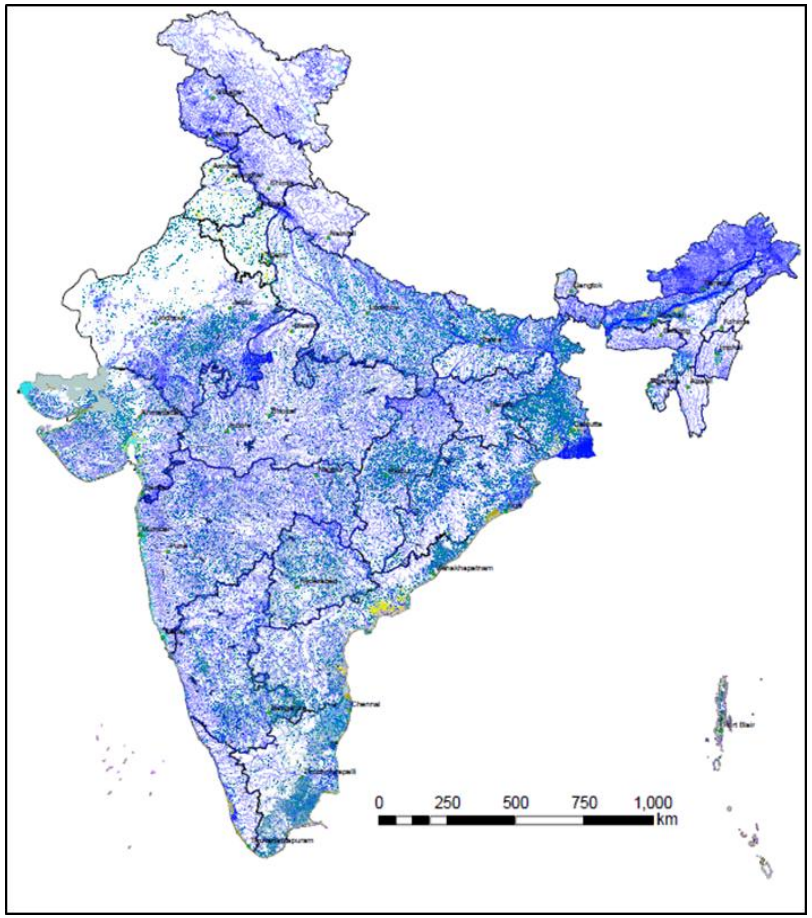


National Wetland Inventory & Assessment

- Wetland inventory of India at **1:50,000** using IRS LISS3 data for **2017-18** timeframe and change analysis wrt **2006-07** inventory
- Wetland inventory of India at **1:12,500** using IRS LISS4 data for **2018-19** timeframe
- National Wetland Atlas published at 50K scale and at 12.5K scale



Decadal change in the wetland fraction over India during 2006-07 to 2017-18



- Remote sensing Indices were used to assess the hydro-ecological conditions of **44 Ramsar Wetlands** in India.

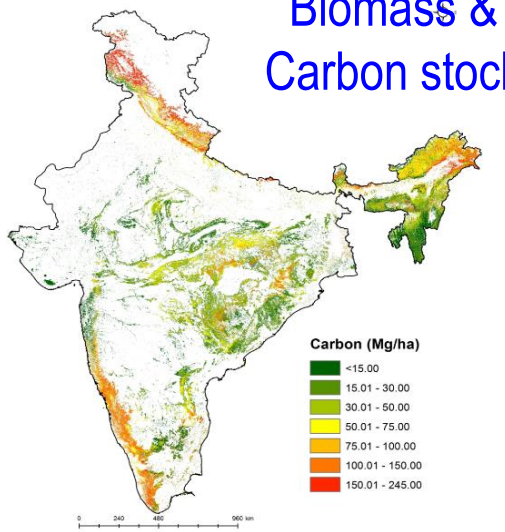
Sustainable Development – Monitoring Natural Resources

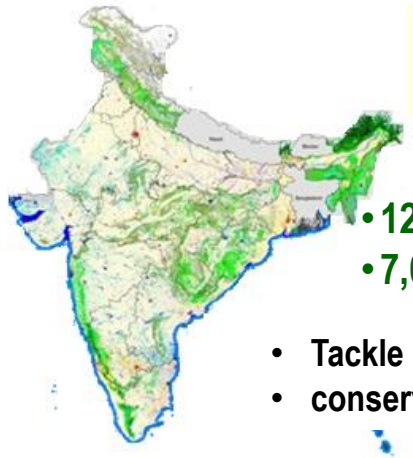


Land Use / Land Cover

Symbol	LU/LC Class
	Built up land
	Kharif crop land
	Rabi crop land
	Zaid crop land
	Double / Triple crop land
	Current fallow
	Plantation / orchard
	Evergreen / Semi-evergreen
	Deciduous Forest
	Shrub / degraded forest
	Littoral / Swamp / Mangrove
	Grassland & grazing land
	Other wasteland
	Gullied / Ravines
	Scrubland
	Water bodies
	Snow covered
	Shifting Cultivation

Biomass & Carbon stock

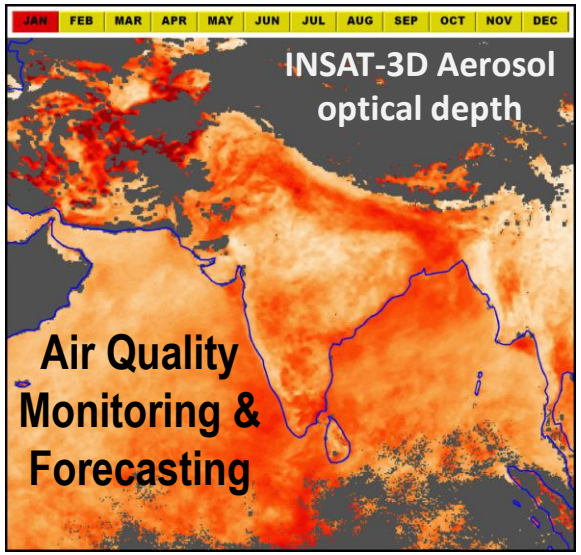




Biodiversity Characterization

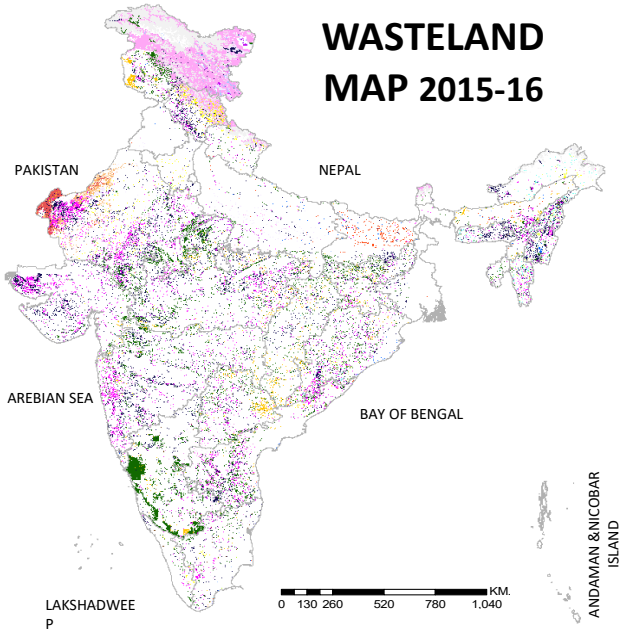
- 125 vegetation types
- 7,000 species

- Tackle climate change impacts
- conservation & prioritization.

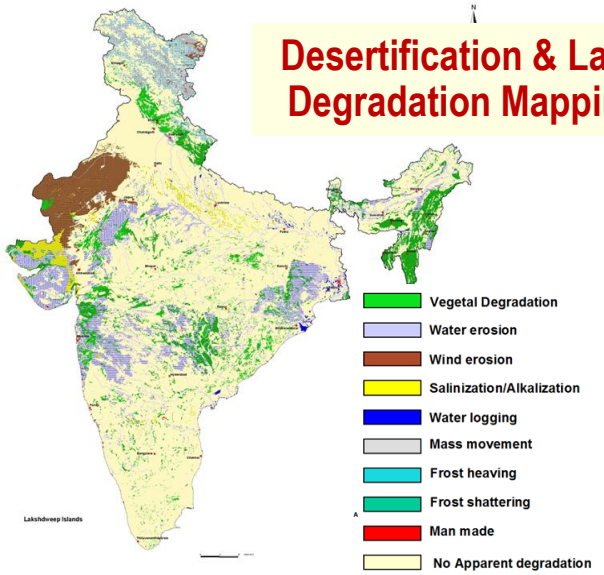


Air Quality Monitoring

WASTELAND MAP 2015-16



Desertification & Land Degradation Mapping

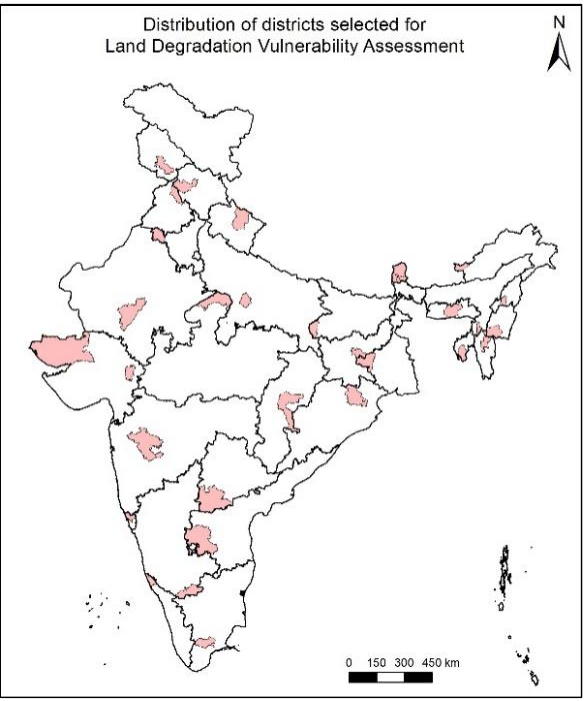


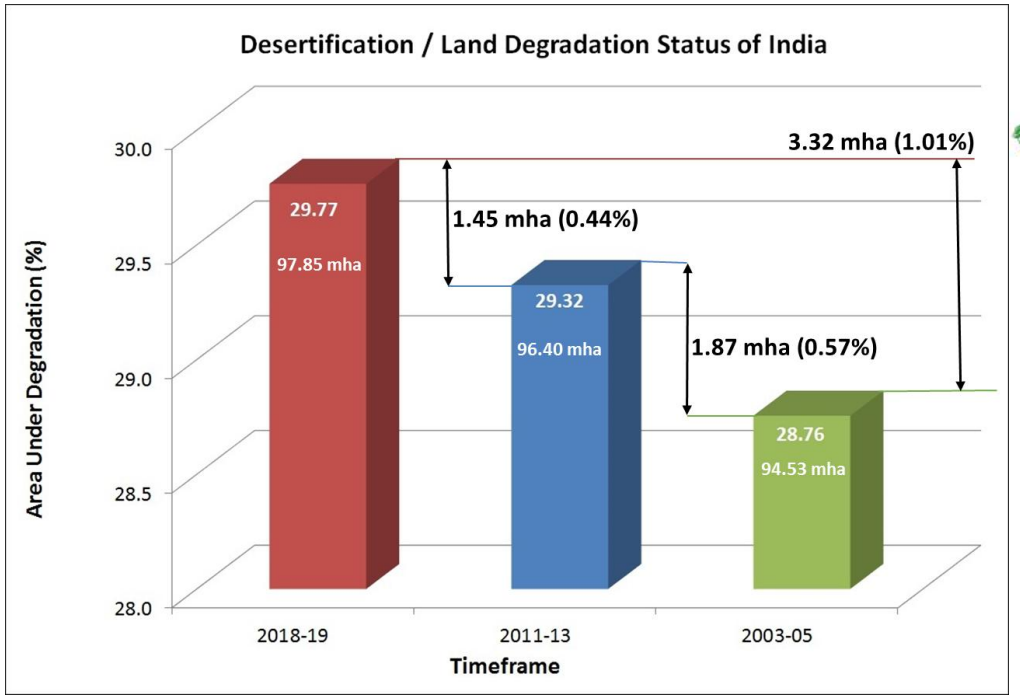
National Inputs to UNCCD

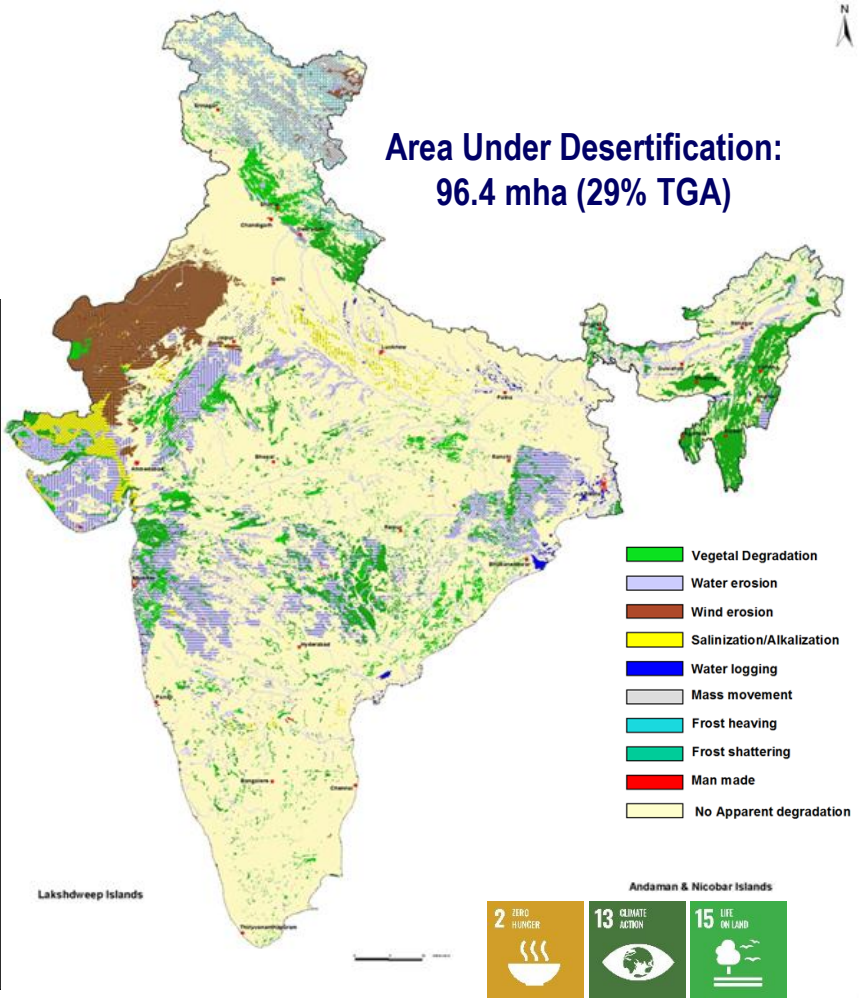
Desertification and Land Degradation Status Mapping

- Preparation of Land Degradation maps using Indian satellite data.
- Multi timeframe database generation: 2018-19, 2011-13 and 2003-05.
- Analysis of changes in the status of land degradation in the country.
- India's reporting to United Nations Convention to Combat Desertification (UNCCD).
- Considered as baseline data for country's land restoration program.

National Atlas on Desertification, published on **June 17, 2021** on the occasion of ***"Desertification and Drought Day - 2021"***







Disaster Risk Reduction

Floods



- Hazard & Forecasting
- Inundation
- Damage

Landslide



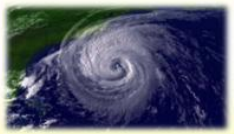
- Hazard
- Early warning
- Damage

Earthquake



- Pre-cursors
- Damage

Cyclone



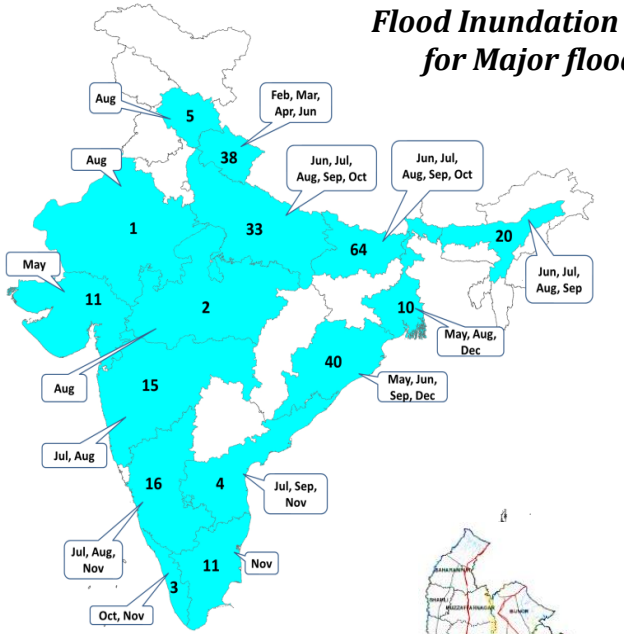
- Early Warning
- Monitoring
- Damage

Forest Fire

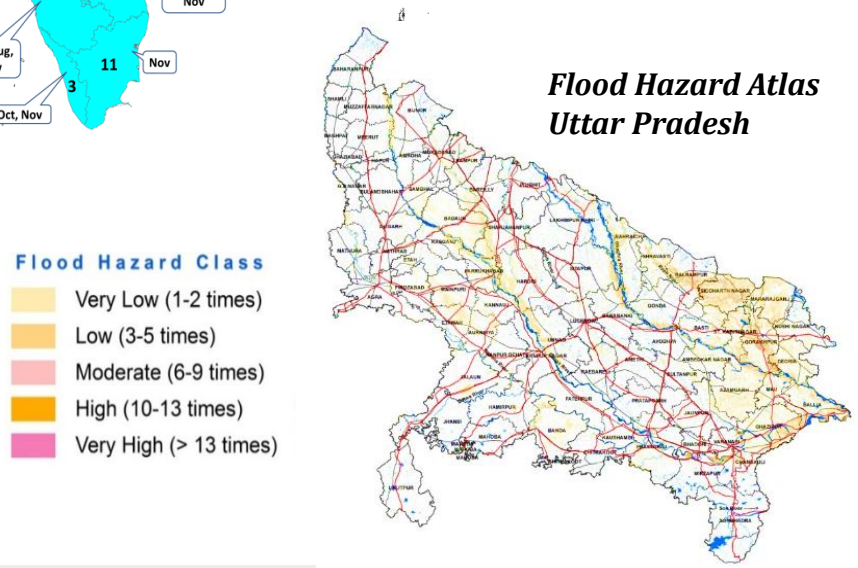


- Detection
- Impact

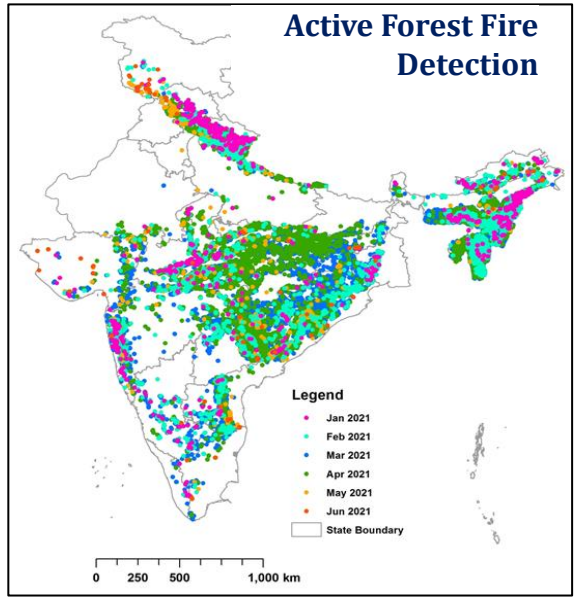
Flood Inundation maps for Major floods



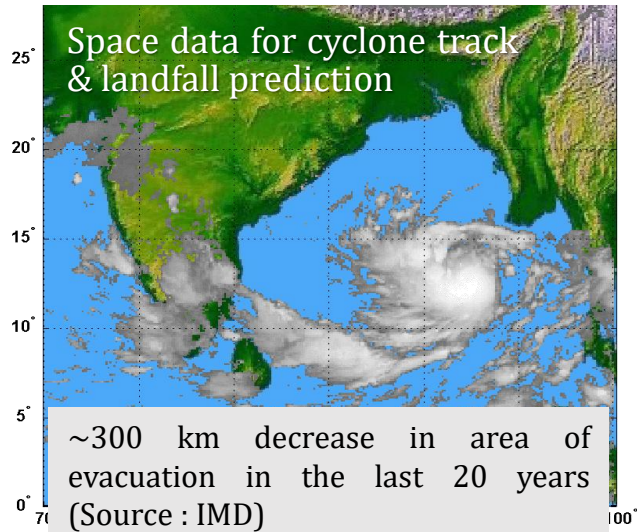
Flood Hazard Atlas Uttar Pradesh



Active Forest Fire Detection



Cyclone Intensity, Track & Landfall Forecasting



~300 km decrease in area of evacuation in the last 20 years (Source : IMD)

National Database - for Emergency Management (NDEM)

International Cooperation- Charter on Space & Major Disasters, Sentinel Asia

National Database for Emergency Management (NDEM) Version 5.0

Geoportal hosting multi-scale geospatial database, decision support tools and early warning for emergency response & disaster management support by nodal agencies

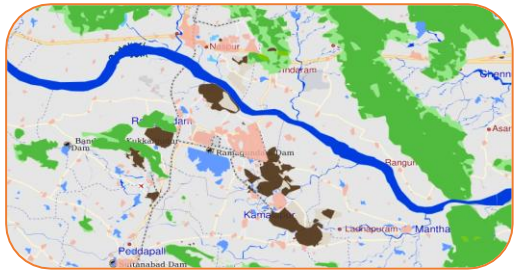
- Visualization of current national disaster scenario and alerts & warnings from national disaster forecasting organizations (CWC, IMD, INCOIS, GSI, DGRE, NCS)
- Sub-meter resolution satellite data, multiscale geospatial database (National @50K, for 350 multi-hazard prone districts @10K and for metros @2K scale)
- Decision support tools for dynamic route planning; proximity analysis, and statistics generation for disaster affected areas
- Serves as disaster recovery site & data/ service provider for the Integrated Control Room for Emergency Response (ICR-ER)



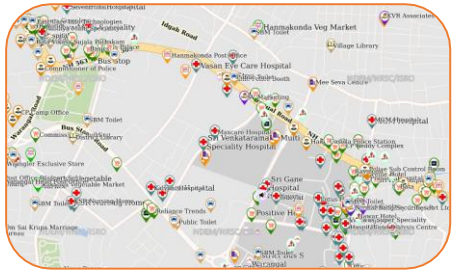
Base data



Infrastructure data



Thematic data



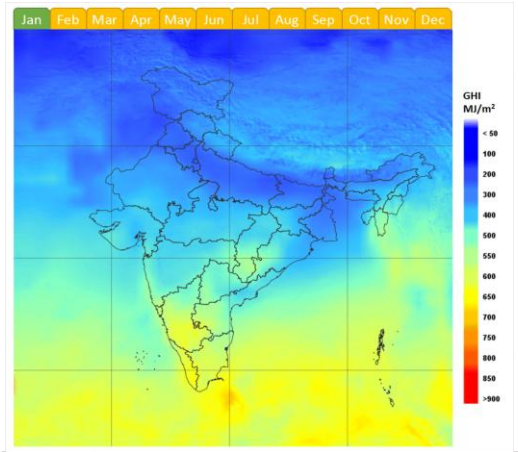
Points of interest



Satellite data

https://ndem.nrsc.gov.in

Sustainable Development – Assessing Renewable Energy

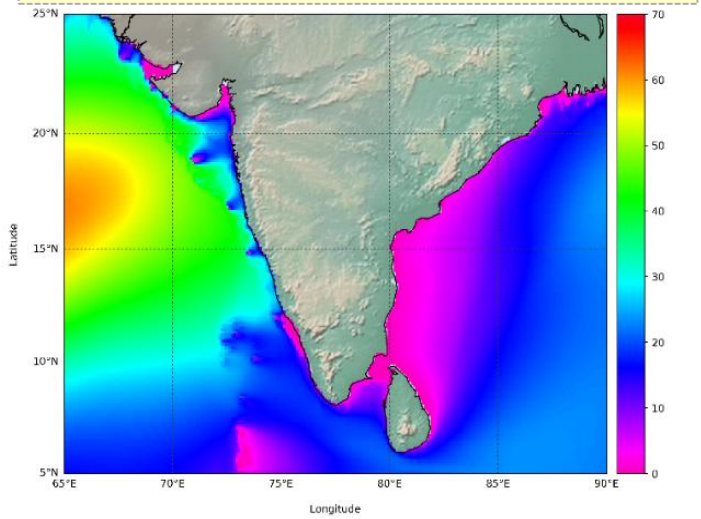


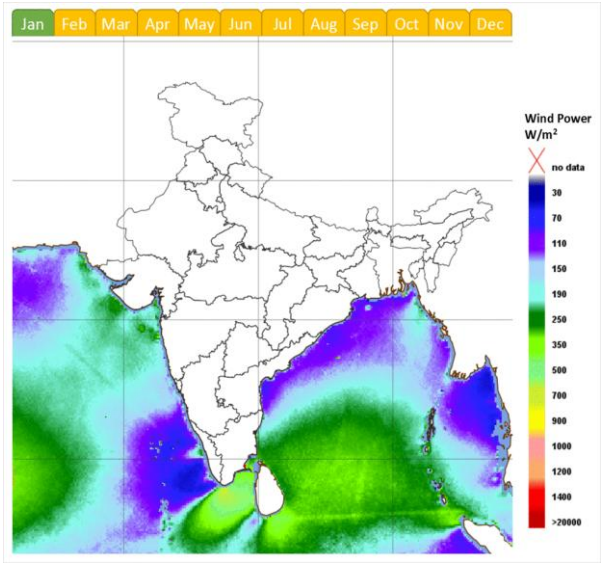
Solar Energy Potential

Aims to achieve target of 500 GW by 2030

- Digital Energy Atlas
- 48 Hour forecast for solar insolation & wind speed - for plant operators
- Development of Geo-spatial Energy portal & Apps

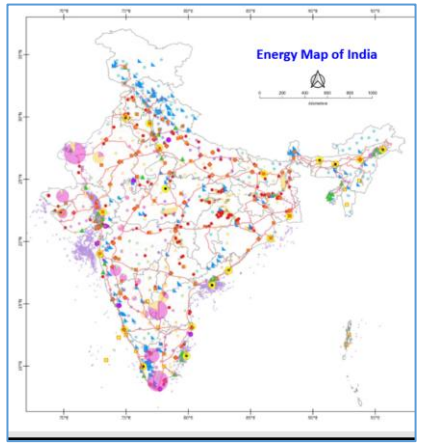
Ocean Wave



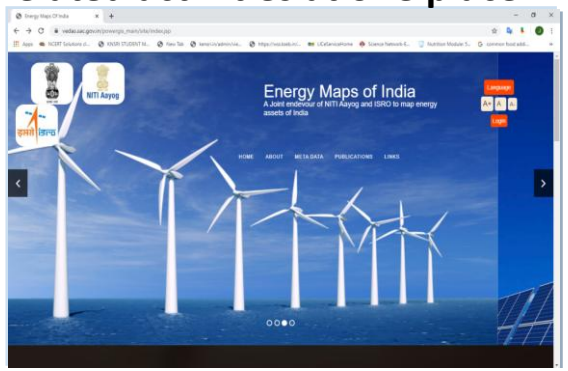


Offshore Wind Energy Potential

Geospatial Energy Map of India

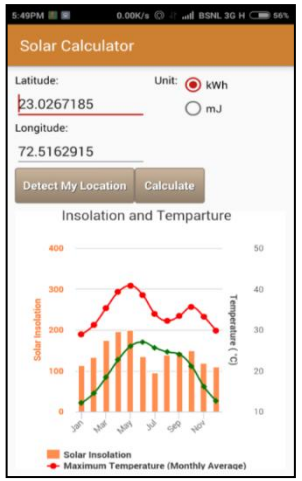


holistic view of all energy related activities at one place



in association with

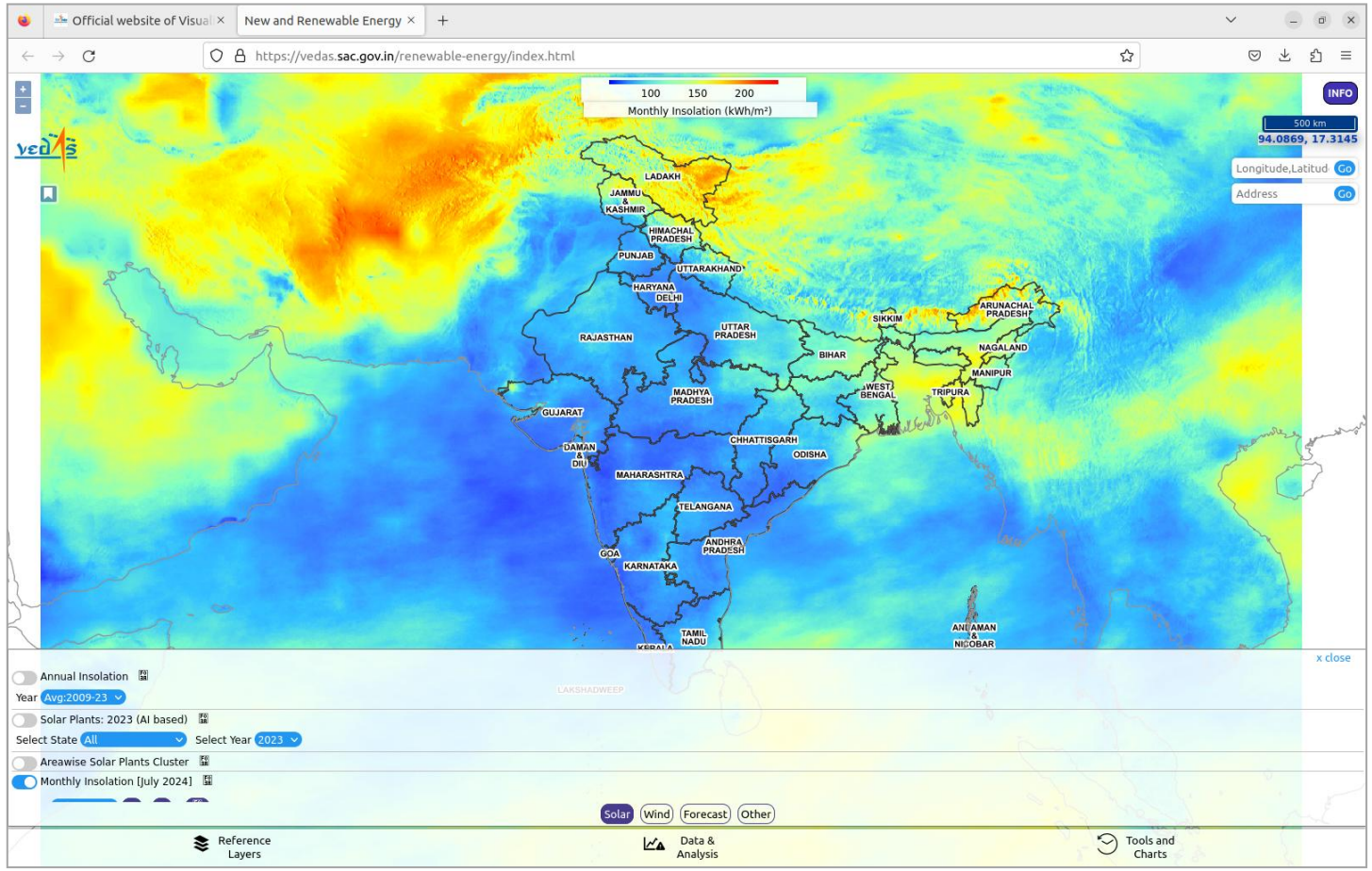
Ministry of Power	Ministry of New and Renewable Energy	Ministry of Coal	Ministry of Petroleum and Natural Gas	Department of Atomic Energy





Mobile Apps for assessing Solar & Wind energy potential

VEDAS: Renewable Energy



The renewable energy application on VEDAS portal provides:

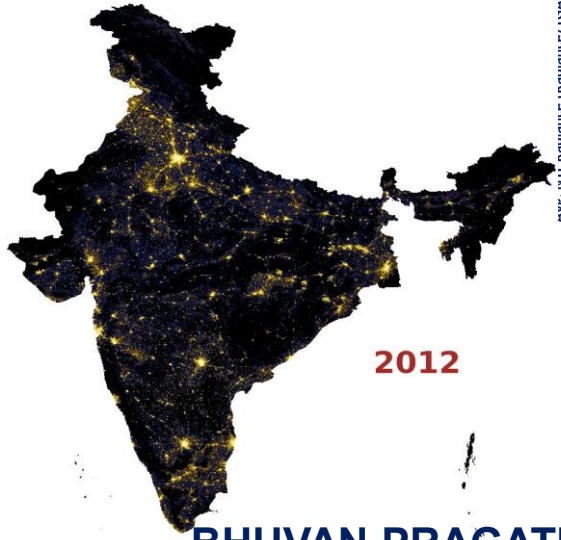
- Inventory of Renewable Energy (RE) resource potential in India;
- Tools for Identifying potential sites for harnessing RE;
- 72-hour Forecasts of solar and wind energy from Numerical Weather Prediction (NWP) models;
- Web Map Service (WMS) & APIs of datasets for interoperability;
- AI/ML application demonstrations such as insolation forecast, building shadow analysis and solar panel extraction.

https://vedas.sac.gov.in/renewable-energy/index.html

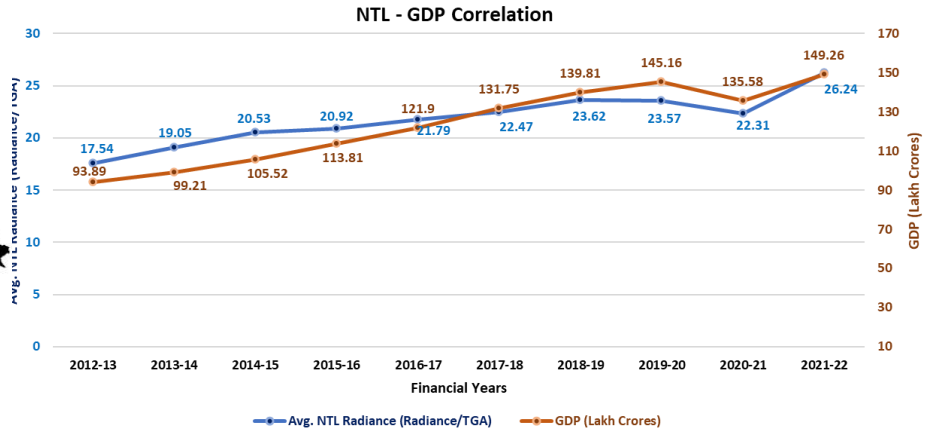
GeoAI in Bhuvan for Advanced Insights

- Hybrid PAN India level AI Models to extract Solar Farm, Farm Bund, Tree Outside Forest, Road Network, Building Footprint.
- Decadal Trend analysis on Night Time Lights : Socio-economic indicator.
- Support to PRAGATI
  - Geospatial connotation of text information to map. (350+ projects)
- Hotspots over a decade using LULC 1:250K.

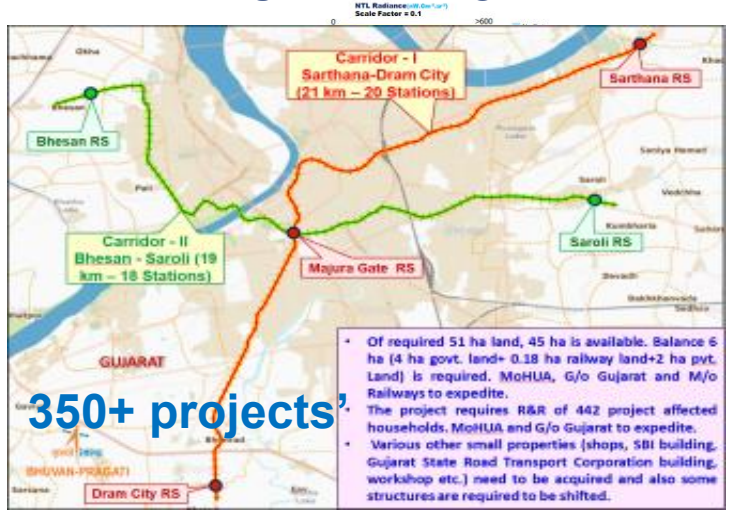
Decadal Change of Night Time Light



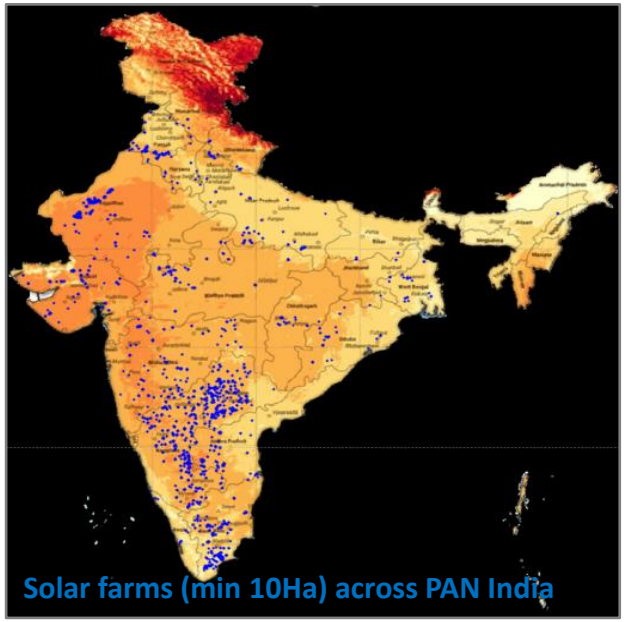
Correlation of NTL with GDP



BHUVAN PRAGATI

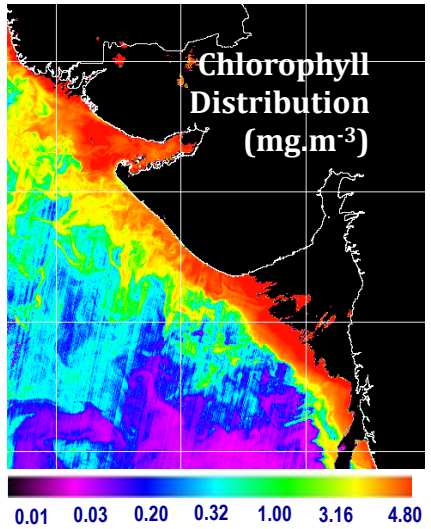


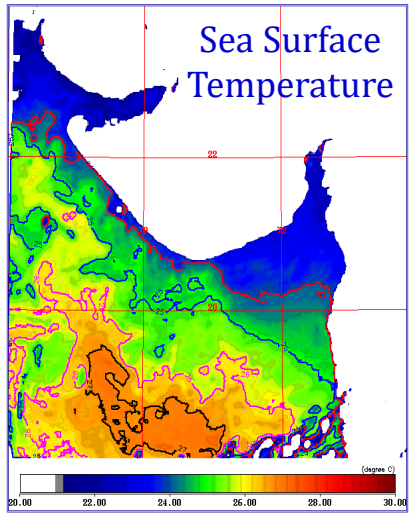
Solar Farm Inventory of India from Space

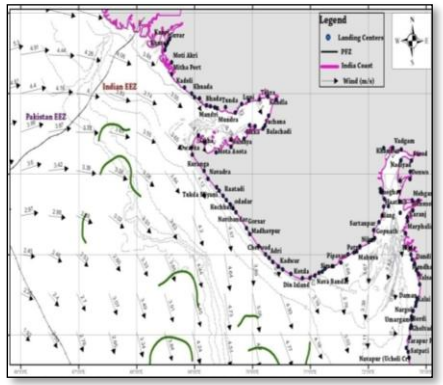


Potential Fishing Zone & NavIC services for Fishermen

- ~8100 km coastline
- > 7 M people dependent on fishing





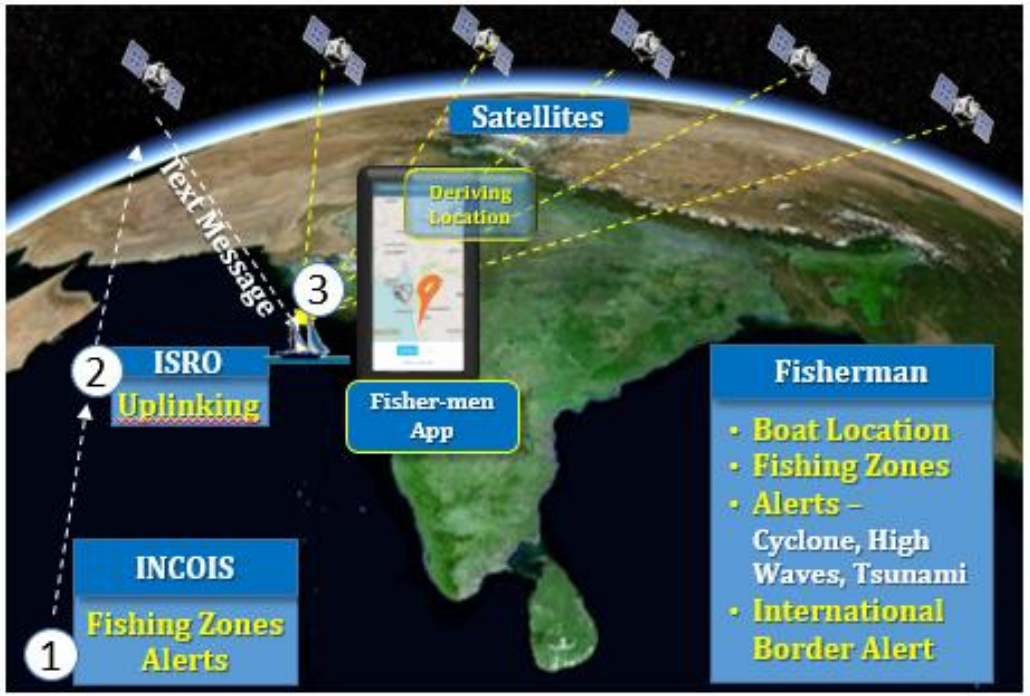


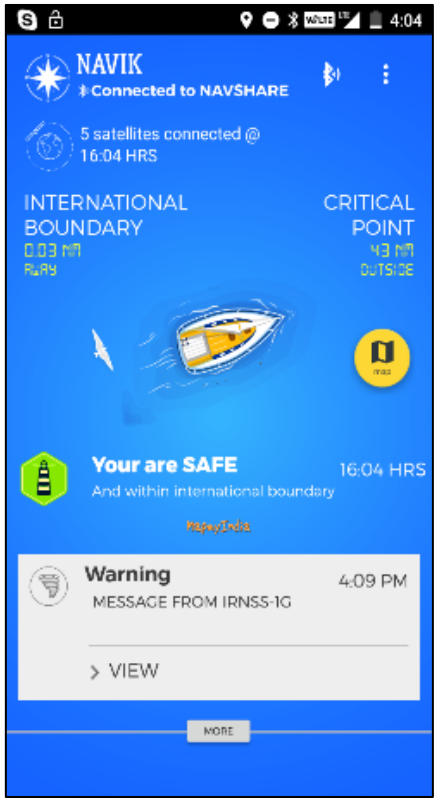
Fish Landing Centers >1200



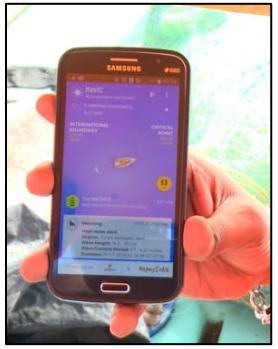
- **Increased Fish catch per unit effort -** by 2-4 times.
- **Reduced Search time by 60-70% -** saving of fuel
- **Improved welfare of community –** Better livelihood

Enriched Information Support to fishermen





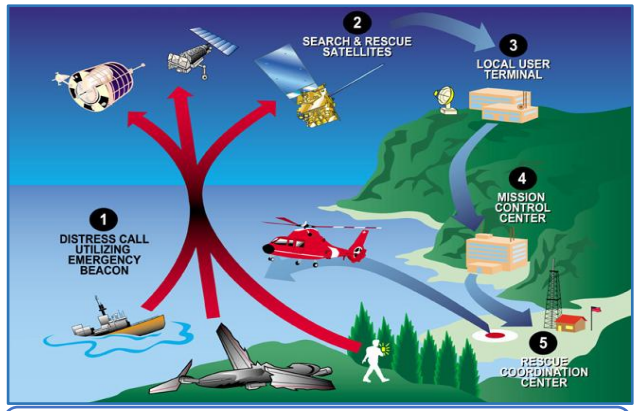
- Potential Fish Catch
- Navigation Support
- Rough Weather Alerts
- Approaching international boundary





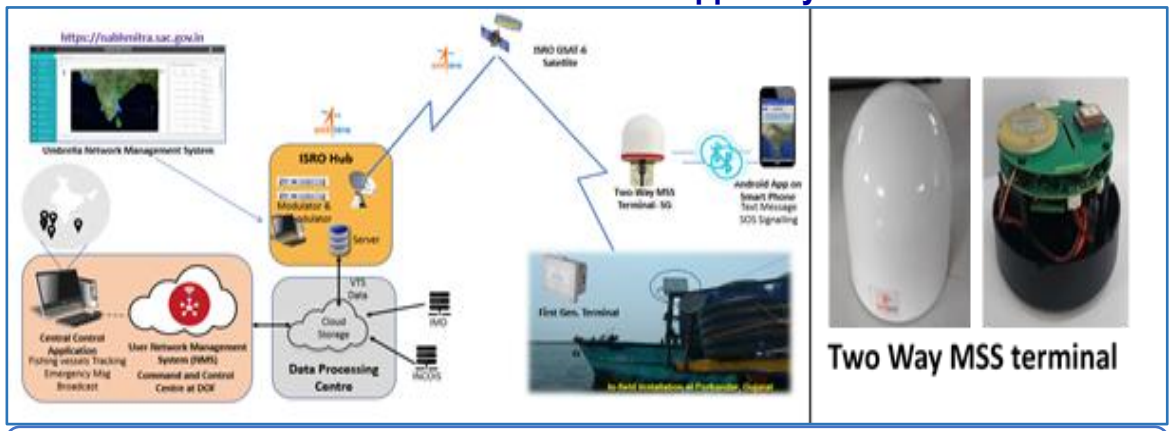
Societal SATCOM / SATNAV Applications

Search & Rescue



~2450 lives saved in 196 incidents

Vessel Communication & Support System



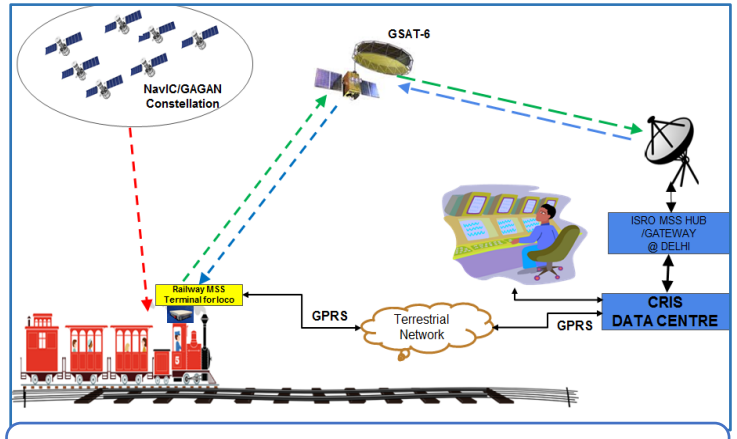
20000+ Vessels Covered. 89000 by End 2025 – Dept of Fisheries.

Data Relay Transponder



6000+ In-situ Data Collection platforms – IMD, SASE, CWC, ISRO, BARC, NIOT/INCOIS

Real-Time Train Tracking System



8000+ Locomotives Covered - Railways

Tele-medicine Connectivity



~180 Active TM Nodes

Tele-education Channels



200+ Under PM e-Vidya Prog – Min of Education

ISRO's Geoportals



Bhoonidhi Portal : 18 Services, 49 satellite missions,6.5PB storage, ~67000 users, ~16000 user in 2024, 8.0Lakh products download since the launch of geospatial policy



Bhuvan : ~35 portals were created after 2015, 194 unique data layers, 1.2PB storage, ~4.75Lakh logins, ~71 Lakh visitors, 1.8 Lakh product downloads in 2024



NDEM : 40 Services for enabling Daily / event based disaster information , 120TB storage



MOSDAC :4 PB storage , 13,000 users , 4 lakh products per month



VEDAS : High end online image analytics is facilitated; 1PB storage, 3000 users / month



NICES: Multi-institutional initiative for Bio-geophysical parameter retrieval. ECVs: 13; Products: 66; > 5000 GB Data

Capacity Building (Training & Education): Key Achievements



On-Campus Programs

- Regular Courses [M.Tech., PGD, MSc, etc.]
- Courses for Decision Makers, Faculty, Students, etc.
- Customised/Special courses
- International Participants [ITEC, ASEAN, etc.]
- Advanced Courses [Data Assimilation, Predictive Soil Mapping, Land Deformation Studies, etc.]

Course Name/ Type	Participants
M.Tech.	582/57
M.Sc.	239/07
PGD/PGD-GI	1,966/36
Special Courses (Indian participants)	10,789/647
Special Courses (Foreign participants)	1,567/45
Total	**15,143/793**



Distance Learning Programs

- In-house developed Electronic Collaborative Learning and Knowledge Sharing System (E-CLASS) platform
- Basic [RS, GIS, GNSS] Course
- Special Courses/ Workshops [AI/ML/DL, Disaster Risk Reduction, Planetary Exploration, Atmosphere studies, etc.]

- **Total Courses**: 223/25
- **Benefitted Participants :** 9,03,226/1,66,513 (live and interactive Programs)

- **Network Institutions**: 3773/417
- **MOOC:** 42,885/3652 participants

International Cooperation through Geospatial Platforms

Geo-Platform Support through Bhuvan

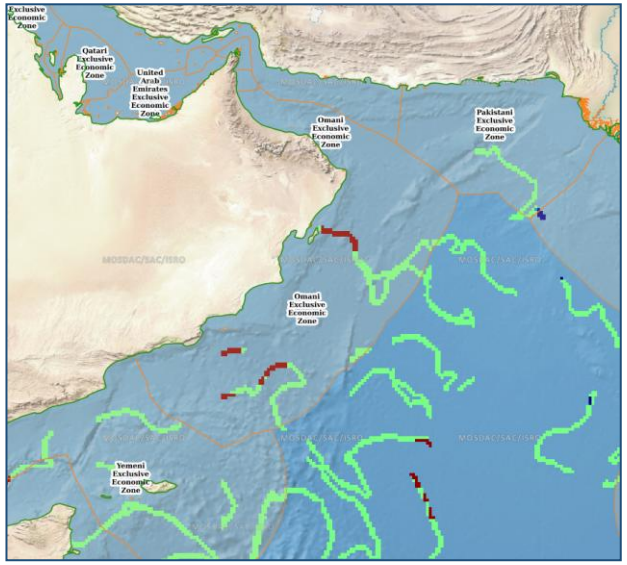
1. 14 FIPIC Countries – DWEPIC portal – Operational, Released by Hon'ble PM
2. India – Oman Space Platform - Operational.
3. India – Kenya Space Platform - Demonstrated to Users.
4. Bhutan Portal - Completed (Landslide, Forest Fire).
5. Mauritius Portal - Development is in progress.



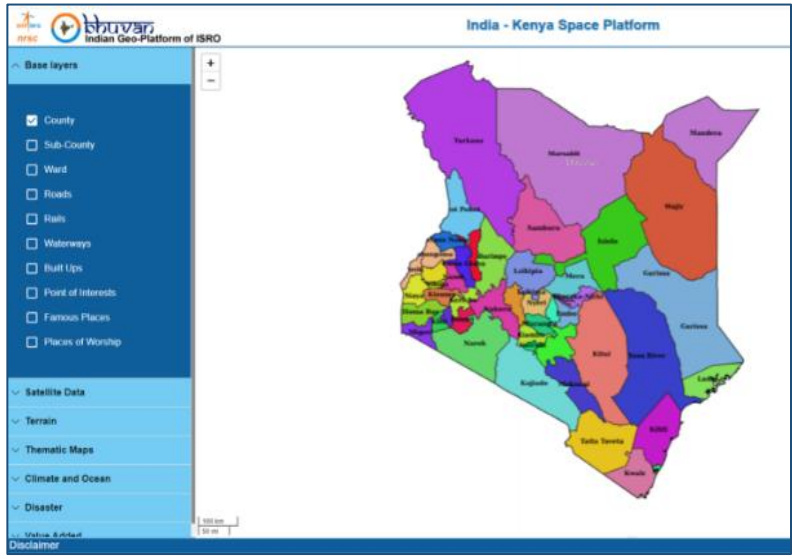
Hon'ble PM Released DWEPIC portal

Areas of Cooperation

1. IRS Data Sharing
2. Comprehensive EO portal
3. Development of Applications
   a) Natural Resource Inventory
   b) Ocean products, PFZ,
   c) Disaster mitigation support
   d) Early warning support



PFZ Near Oman



India-Kenya Space Platform

Thank you….

bhaskarnikam@isro.gov.in