NRSC-DPPAWA-GWGSG-AUG-2015-TR-726

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BHUVAN GEOSPATIAL CONTENTS

www.bhuvan.nrsc.gov.in

National Remote Sensing Centre
Indian Space Research Organisation
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15.	**Abstract (with Keywords)**	Bhuvan content lists and describes major contents on Bhuvan portal. It describes Satellite data, Thematic maps, Vector base layers, NOEDA tiles ***Keywords:*** *Bhuvan, Geospatial, Thematic, Vecotor Base layers, NOEDA Tiles, POI information, Disaster Layers.*			

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1. Introduction

Bhuvan (the name is derived from the Sanskrit word which means Earth), a Geo-Platform of ISRO (http://bhuvan.nrsc.gov.in) was launched on 12 August 2009 by MoS, Prime Minister Office. Since its launch it has taken many steps forward to reach Users with wide range of contents. In this time frame, several content layers are made available with increase in resolution, scale and quality.

Bhuvan has rich and unique content, which varies from Satellite base layers to satellite derived products, thematic layers and Ocean & Atmospheric layers for scientific community and Point Interest information for common man.

The Bhuvan content is categorized into the following categories and the few examples are given under each category / class.

Satellite Base Layers 2.5m Color for Entire India 1m Color for Indian Cities & Tiles AWiFS Layers LISS-3 Layers LISS-4 Multi spectral Layers etc	**Vector Base Layers** Administrative layers Infrastructure layers Major Water bodies etc
Thematic Layers Land Use / Land Cover 250K to 10k Urban land use 10K (NUIS) Wasteland 50K (2008-09) Glacial Lakes \ Water bodies Geomorphology 50K (2005-06) Lineament 50K Flood hazard layer and Flood annual layers Erosion 50K (2005-06) Salt affected and water logging 50K (2005-06) Urban sprawl etc	**Ocean & Atmospheric Layers** OCM-NDVI- Global and Local Coverage, Vegetation Fraction, Albedo Ocean – Heat Content, TCHP Ocean Wind – Stress, Curl, Velocity etc **Point Of Interest Datasets** Over 35 Lakh Points
Free Data Download AWiFS - Ortho-rectified satellite images LISS-3 – Ortho-rectified satellite images DEM – CartoDEM at 30m resolution HySI–Hyper-spectral for Pan India.etc	**Derived Products** AWiFS – Snow Cover Fraction Water bodies fraction CartoDEM etc

Table 1:BhuvanContents

Bhuvan Geo-spatial Content Standards

Standards are fundamental requirement for any GIS to enable technologies including visualization – imaging, GIS, GPS and applications – thematic mapping, services and outputs etc to work together. Standards are important not only to facilitate data sharing and increase interoperability but also to bring a systematization and "automation" into the total process of mapping and GIS. Standards also ensure that geographical data are consistent and open to sharing, increase interoperability across platforms and enable uniform services for wide range of applications.

Following are the standards followed by different nations.

- Federal Geographic Data Committee (FGDC) is the key US interagency committee that promotes thev coordinated development, use, sharing, and dissemination of geospatial data.
- Europe-INSPIRE has excellent standards that define Metadata, Data Specifications, Network services, Data and Service sharing and Coordination and measures for monitoring & reporting.
- OGC standards are immensely popular and adopted by government and industry and bring about a high-level of focus on inter-operability and open-ness.
- ISO/TC 211 is a standard technical committee formed within ISO, tasked with covering the areas of digital geographic information and geomatics
- In India, NNRMS, an inter-agency programme of the Department of Space (DOS), has published NNRMS Standards in 2005.

Considering multi-date, multi-resolution, multi-sensor ortho image mosaic creation and improved reference base with increase in spatial resolution/scale, Bhuvan evolved its geospatial content standards. This largely followed NNRMS standards which were derived after consultation of international standards like FGDC, OGC,ISO/TC-211, Canadian standards etc. and but further improved using recent international standards.

Organization Structure

The document is organized as follows

Chapter 2 List outs the various satellite raster layers available in Bhuvan.

Chapter 3 List outs the various thematic layers displayed along with scales.

Chapter 4 List outs the vector base layers available in Bhuvan.

Chapter 5 List outs the Point of information for better interpreting the terrain.

Chapter 6 List outs the various products freely downloadable through NOEDA.

Chapter 7 List outs the various disaster services and its layers.

Chapter 8 List outs the various ocean services and its layers.

High Resolution Images – 2.5m Color

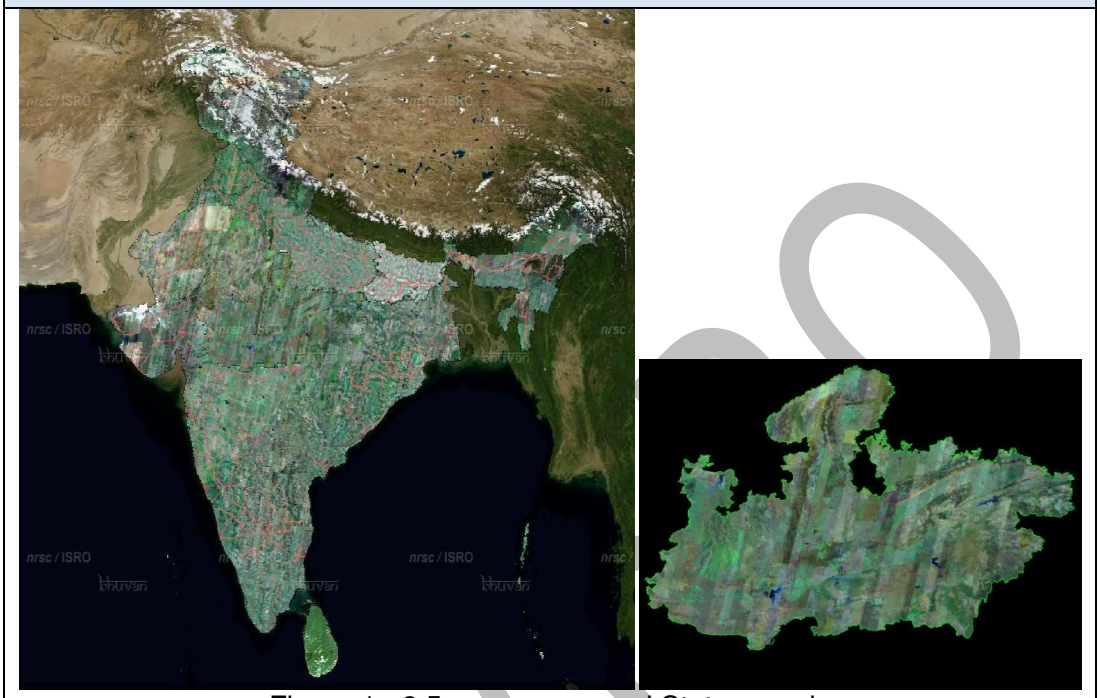


Figure 1 : 2.5m coverage and State mosaic

Cartosat-1 provides high resolution images in 2.5m spatial resolution. The fused 2.5m color Natural color images were made available using Resourcesat-1/2 LISS-4 Multispectral.

Geographical feature continued Pan India high resolution datasets were available on Bhuvan.

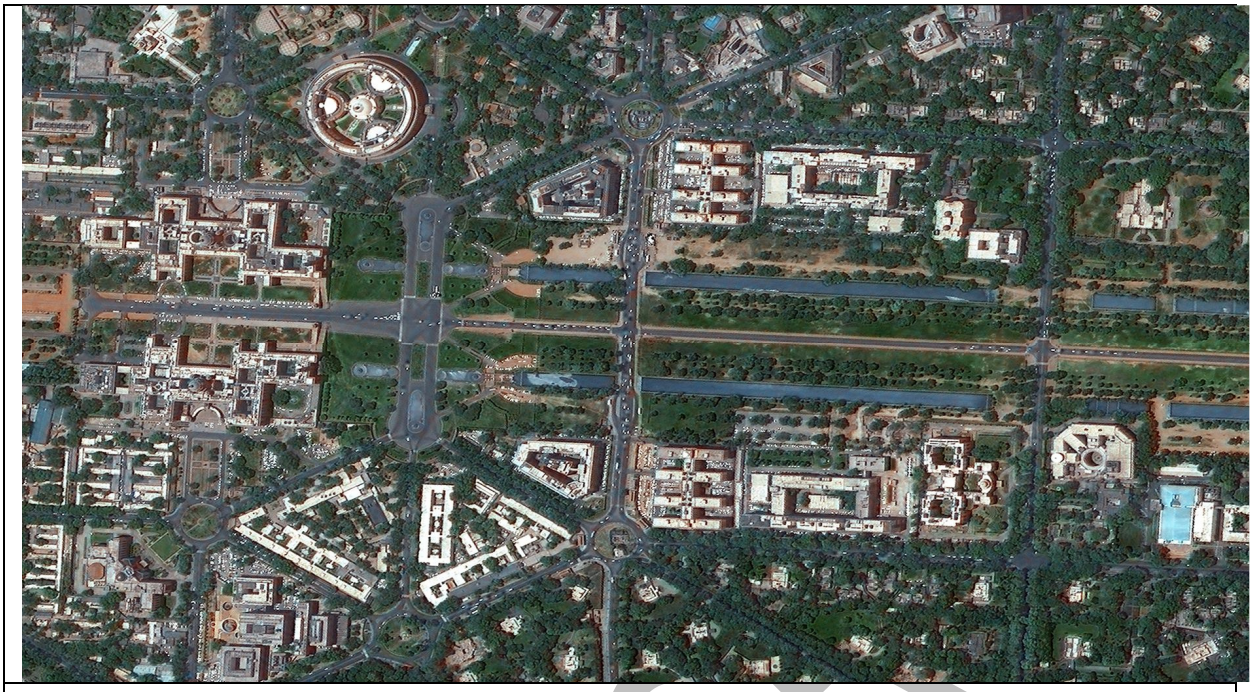
Spatial Resolution: 2.5m
Accuracy : Better than 15m
Coverage: Pan India.
Accessing Mechanism: Visualization through WMS layers

Frequency :

Layers	Number of Images	Acquired
State Mosaics	Pan India	2006-09
State Mosaics	**4**	**2012-13**
City Mosaics	120	

High Resolution Images - 1m Color

Figure 2: High Resolution(1m color) images



Cartosat-2/2A/2B provides high resolution images upto 1m spatial resolution. The natural color composite is made using Resourcesat-1/2 LISS-4 Multispectral by fusion. Total of **350** Indian cities high resolution images were available on Bhuvan.

Pan India high resolution datasets is being generated and 60,000 Sq.Km data is already available.

Spatial Resolution: 1m
Accuracy : Better than 15m
Coverage:Cities & Entire India data is being uploaded.
Accessing Mechanism: Visualization through WMS layers

Coverage :

Poulation	Number of Cities
> 1 Lakh	**213**
< 1 Lakh	**138**
Tiles	Area in Sq.Km
4	**60,000**

AWIFS (50m Color)

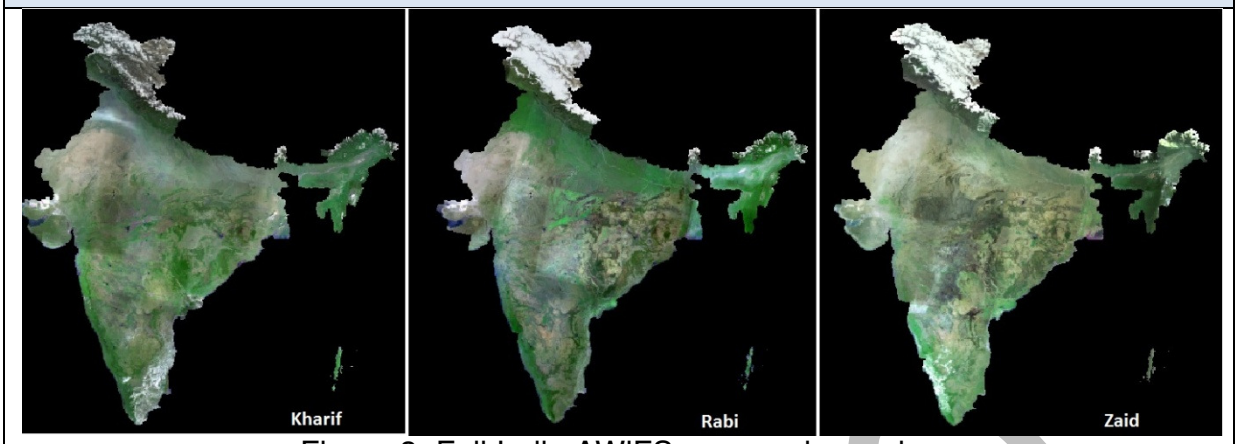


Figure 3: Full India AWiFS seasonal mosaics

ResourceSat-1 & 2 provides 56 m Color data from AWiFS (Advanced Wide Field Sensor). AWiFS full India mosaic is generated for three seasons (Kharif, Rabi and Zaid) of every year.

Spatial Resolution: 50m

Accuracy : Better than 100m

Coverage: For Entire India

Accessing Mechanism: Free data download through NOEDA and Visualization through WMS layers

Frequency :

Layer Number	Acquired Date	Season	Satellite
1	2006	-	IRS-1C/1D
2	2008	Kharif	ResourceSat-1
3	2008	Rabi	ResourceSat-1
4	2008	Zaid	ResourceSat-1
5	2009	Kharif	ResourceSat-1
6	2009	Rabi	ResourceSat-1
7	2009	Zaid	ResourceSat-1
8	2010	Kharif	ResourceSat-1
9	2010	Rabi	ResourceSat-1
10	2010	Zaid	ResourceSat-1
11	2011	Kharif	ResourceSat-1
12	2011	Rabi*	ResourceSat-2
13	2011	Zaid*	ResourceSat-1
14	2012	Rabi	ResourceSat-2

LISS-III Multispectral (25m Color)

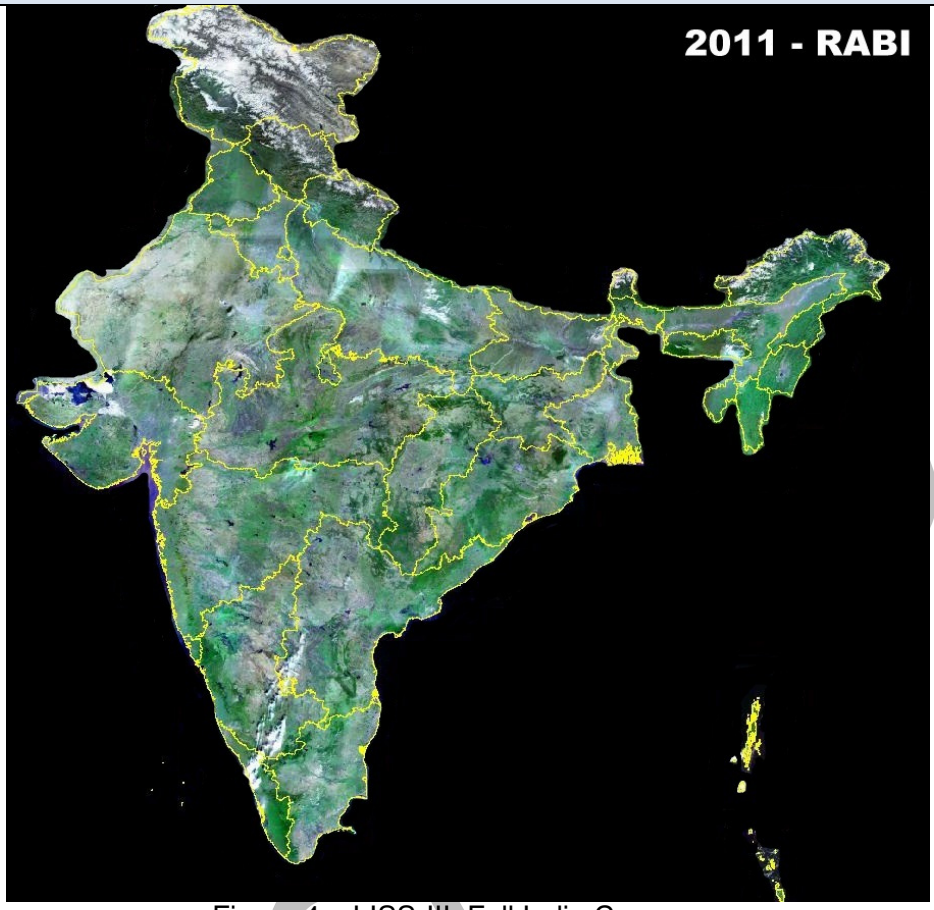


Figure 4 : LISS-III Full India Coverage

ResourceSat-1 & 2 and IRS-1C/1D provides 24.5m Color data from LISS-3 sensor.

Spatial Resolution: 25m
Accuracy : Better than 100m
Coverage: For Entire India
Accessing Mechanism: Free data download through NOEDA and Visualization through WMS layers

Frequency :

Layer number	Acquired Date	Season	Satellite
1	2006	Rabi	ResourceSat-1
2	2008	Kharif	ResourceSat-1
3	2011	Rabi	ResourceSat-2

LISS-IV Multispectral (5m Color)

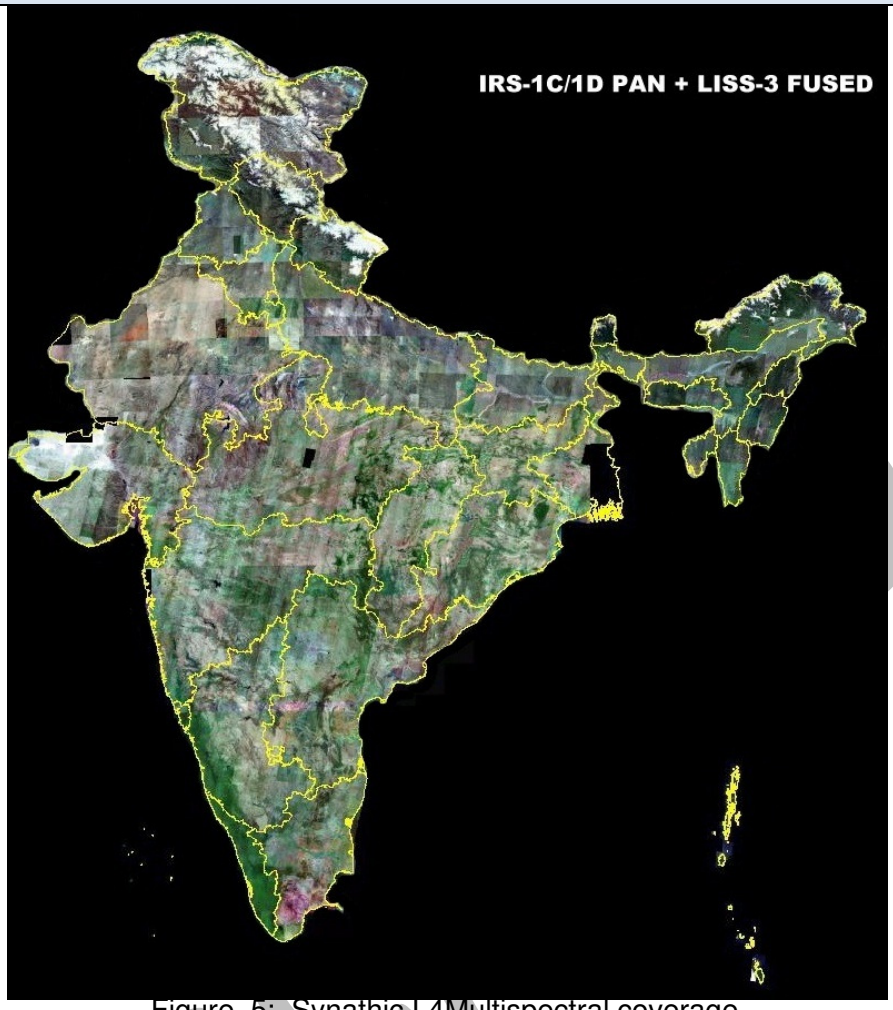


Figure 5: Synathic L4Multispectral coverage

ResourceSat-1 & 2 provides 5m Color data from LISS-4 Multispectral sensor. Apart from these satellites, IRS-1C/1D LISS-3 + PAN fused products also gives 5m Color.

Spatial Resolution: 5m
Accuracy : Better than 100m
Coverage: For Entire India
Accessing Mechanism: Visualization through WMS layers.

Frequency :

Layer number	Area	Sensor	Acquired Date
1	Full India	IRS-1C/1D PAN + MX	2000-2001
2	Full India	ResourceSat-1 L4 MX	2006-2009
3	Bhutan	ResourceSat-1 L4 MX	

3. Thematic Layers

Features

Bhuvan-Thematic Services facilitate the users to select, browse, view statistics, Metadata (Data about data) and query the LULC datasets from this portal. Users are facilitated to visualise and generate statistics up to state level. Users can consume these Thematic Datasets and integrate into their systems as OGC Web Services.

Land Use Land Cover

Land Use Land Cover Data – 1:250,000

The map service is on Land use/Land cover map of India on 1:250,000 scale and published under Bhuvan-Thematic Services of NRSC, ISRO. The LULC maps are generated using multi-temporal satellite data of IRS AWiFS sensor

1. Availability of Datasets
   10 cycles Data (2004-05 to 2013-14)

2. Data Accuracy
   The overall classification accuracy is found to be 90.07 % with a range of 86 to 95 % in different states.

Land Use Land Cover Data – 1:50,000

Scientific assessment of our land resources is a prerequisite for optimal planning of natural resources of the country. Land Use Land Cover mapping on 1:50000 scale for the entire country has been taken up with an objective of generating digital Land Use/Land Cover database using multi temporal Resourcesat Satellite terrain corrected Linear Imaging Self Scanning Sensor (LISS) - III data of (Resourcesat) data. Land use/land cover change analysis between 2005-06 and 2011-12 for areas of major change.

1. Availability of Datasets
   Land Use Land Cover (2005-06) – 35 States and UT's
   Land Use Land Cover (2011-12) – 35 States and UT'S

2. Data Accuracy

Overall accuracy of different LULC classes vary from 79% (like Agro-horticulture) to 97% (like water bodies).

Land Use Land Cover Data – 1:10,000

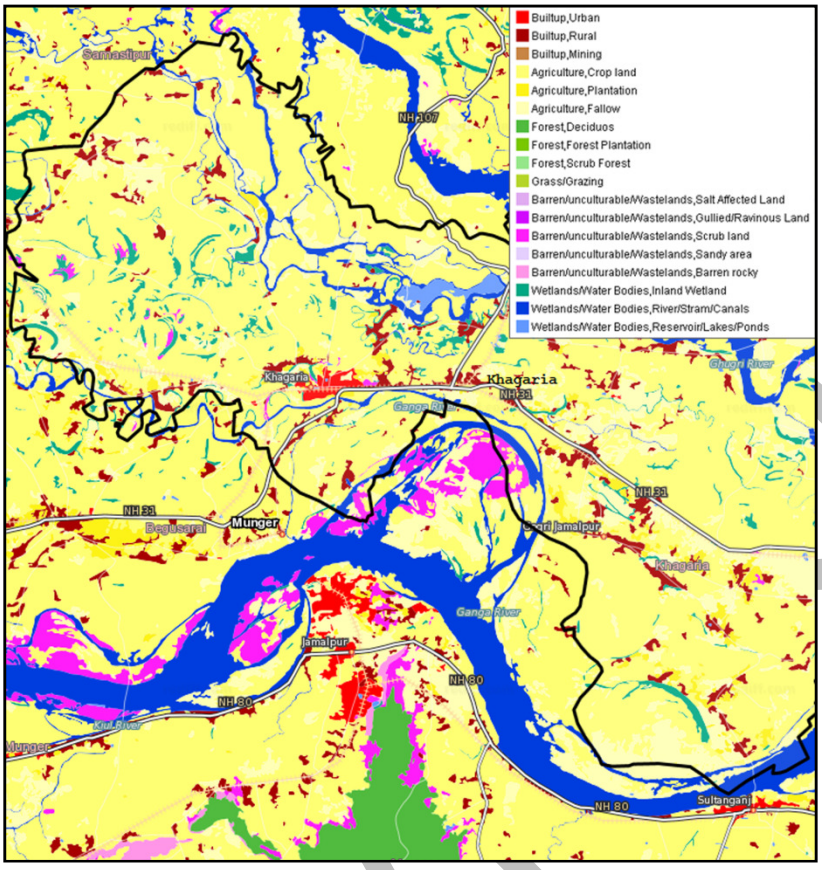


Figure 6: Land Use Land Cover data for Khagaria district of Bihar State

This layers generated under Space Based Information Support for Decentralized Planning (SISDP) Project

Space based Information Support for Decentralized Planning (SIS-DP) project was formulated by NRSC and is being implemented in partnership with State Remote Sensing Application Centres in the country. The SIS-DP Project outputs; Satellite image maps and thematic maps on 1:10k scale generated for the first time in the country, have great potential in meeting the current requirements and opportunities for spatial, participatory, integrated decentralized planning in the country.

1. Availability of Datasets
   Land Use Land Cover 10K – 238 districts

Urban Land Use – 1:10,000 - National Urban Information System (NUIS)

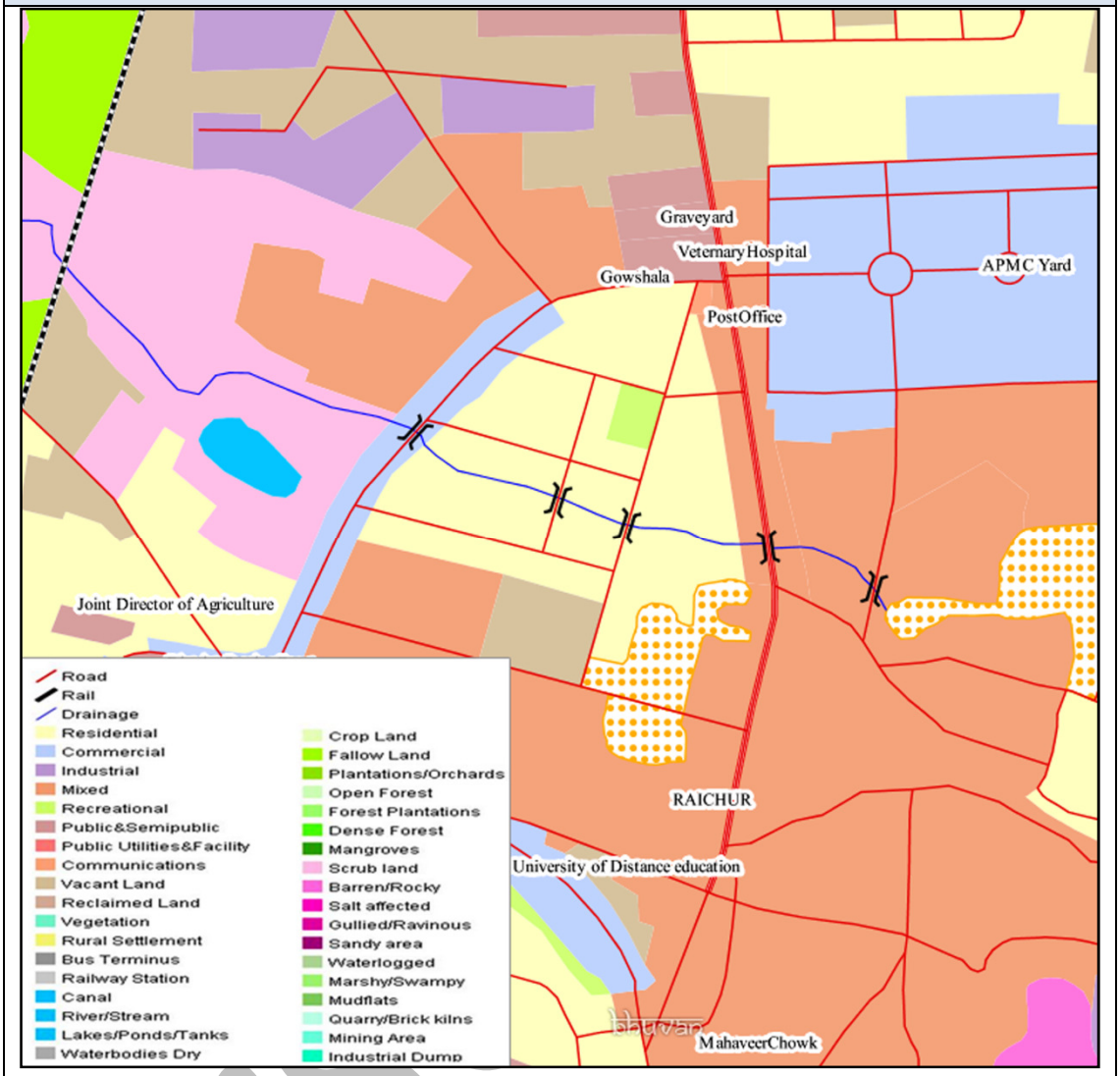


Figure 7: Urban Land Use information for Amritsar town in Punjab State.

An authentic geospatial database on 1:10,000 scale derived from remote sensing satellite data and GIS techniques is envisaged to monitor and manage the growth and development of urban landscape by the urban planners and civic authorities under NUIS scheme. This decisive task is being achieved today using the High resolution satellite data of Cartosat-1 and Resourcesat-1(LISS-IV) coupled with ground and collateral data congregated by NRSA and ISRO with the active participation of partner institutions in the country.

1. Availability of datasets
   GIS database is being created for 152 towns in the country. The database would be useful for Master Plan / Development Plan preparation, Planning and Monitoring.
2. Data Accuracy
   The overall classification accuracy is found to be 90 %.

Wasteland – 1:50,000

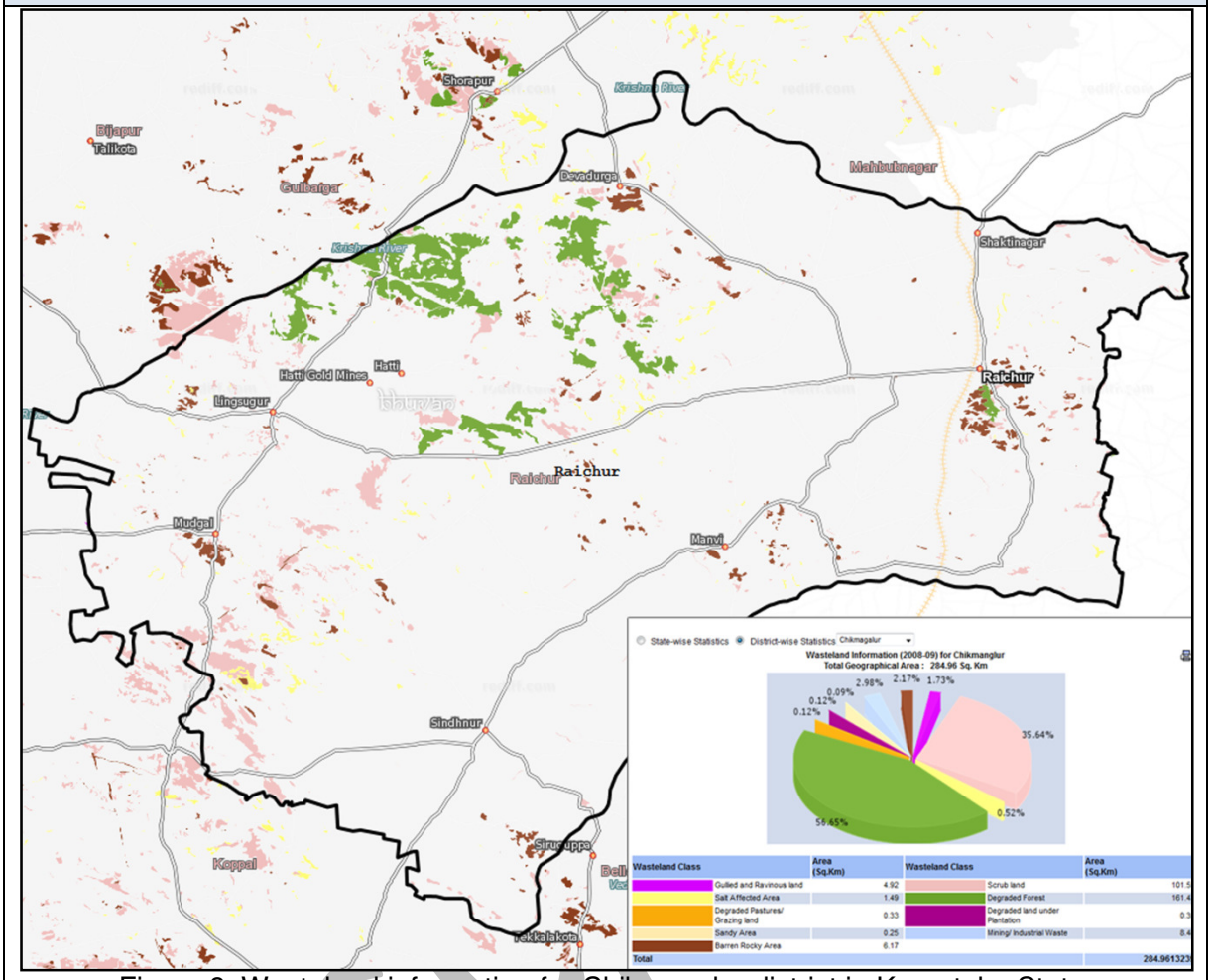


Figure 8: Wasteland information for Chikmagalur district in Karnataka State.

Wasteland database for 2008-09 has been generated under the wasteland change analysis Project of Department of Land Resources, Ministry of Rural Development on 1:50000 scale for the entire country using 3-seasons (Kharif, Rabi and Zaid seasons of 2008-09) Resourcesat-1 LISS-III data.

1. Availability of datasets
   Wasteland 1:10,000 (2008-09) – 27 States

2. Accuracy
   Overall accuracy of different Wasteland classes varies from 79% to 92%.

Glacial Lakes \ Waterbodies

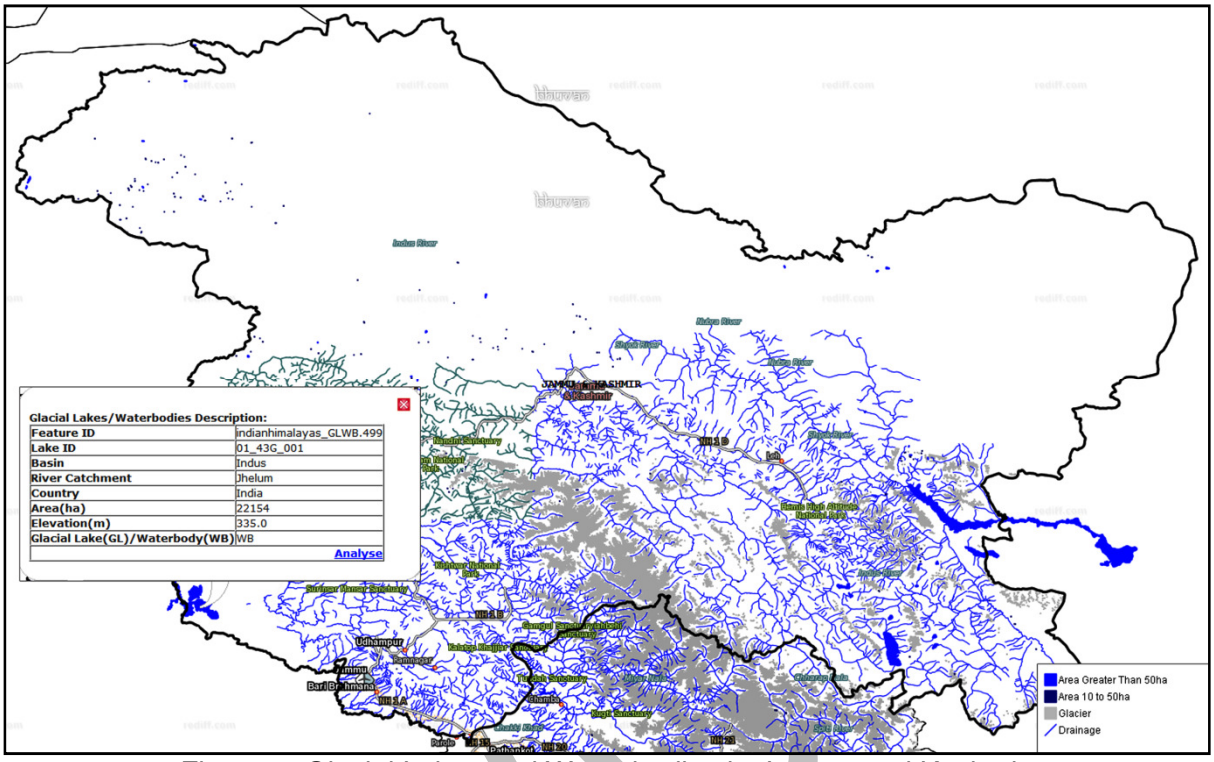


Figure 9: Glacial Lakes and Water bodies in Jammu and Kashmir

The inventory of glacial lakes and water bodies in the Himalayan (India) region of Indian river basins was carried out under the project of Central Water Commission, Ministry of Water Resources, Government of India on 1:250,000 scale for using satellite images Aug, Sep, Oct, Nov & Dec in 2009 by mapping those glacial lakes and water bodies that are more than 10 ha in size.

Monitoring of the glacial lakes and water bodies that area more than 50 ha in size was carried out for the months of Jun, Jul, Aug, Sep & Oct for the years 2011, 2012 and 2013 using cloud free satellite data.

1. Availability of Datasets
   Glacial Lakes and Water bodies(Indian Himalayan region) – For Three States

2. Accuracy
   Overall accuracy of identification of glacial lakes and water bodies vary from 90% to 95%.

Geomorphology – 1:50000 and Lineament – 1:50,000

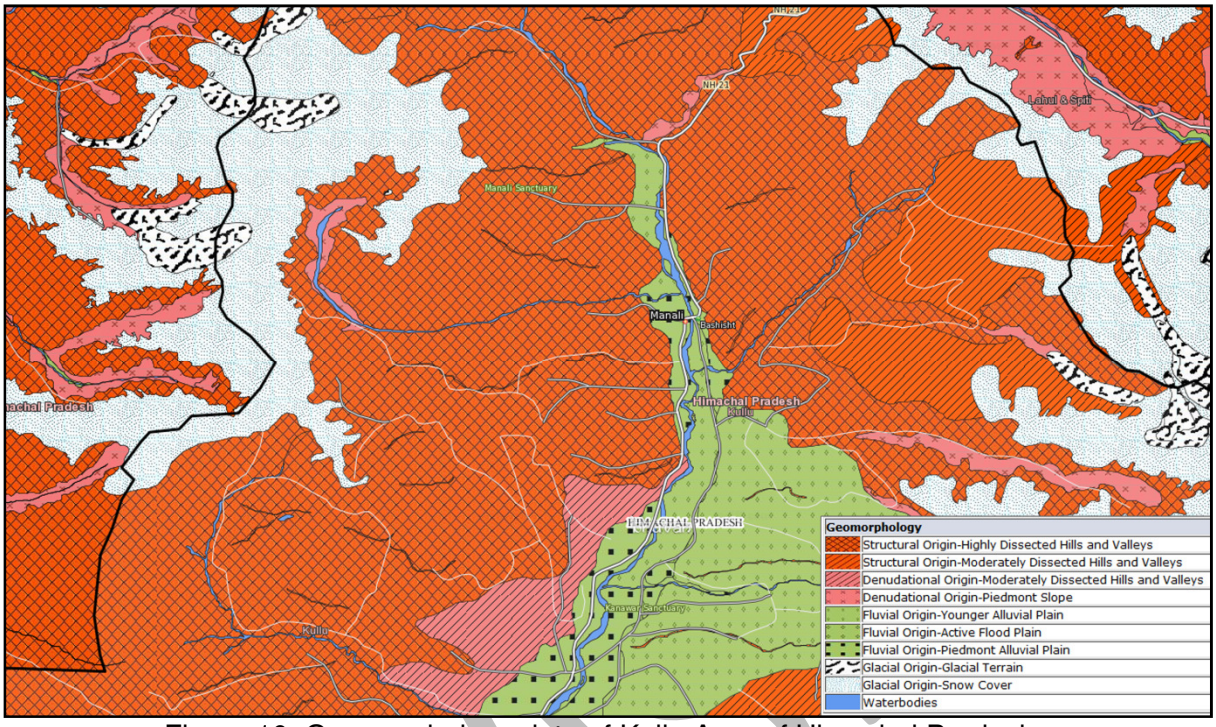


Figure 10: Geomorphology data of Kullu Area of Himachal Pradesh.

Geomorphology and lineament map is an important geo-scientific data for applied geological investigations such as mineral exploration, geo-hazard studies, geo-technical applications etc. Geomorphological and lineament mapping was taken up in association with Geological Survey of India under the NNRMS standing committee on geology activities. The geomorphology and lineament maps were prepared using satellite data and other collateral data sources with limited field work.

1. Availability of Datasets
   Geomorphology - 1:50,000(2005-06) and Lineament – 1:50,000 – 29 States

2. Accuracy
   Geomorphological boundaries are gradational nature. Therefore, collateral data (DEM, top sheets) were referred during the mapping to increase the confidence level.

Erosion 1:50,000

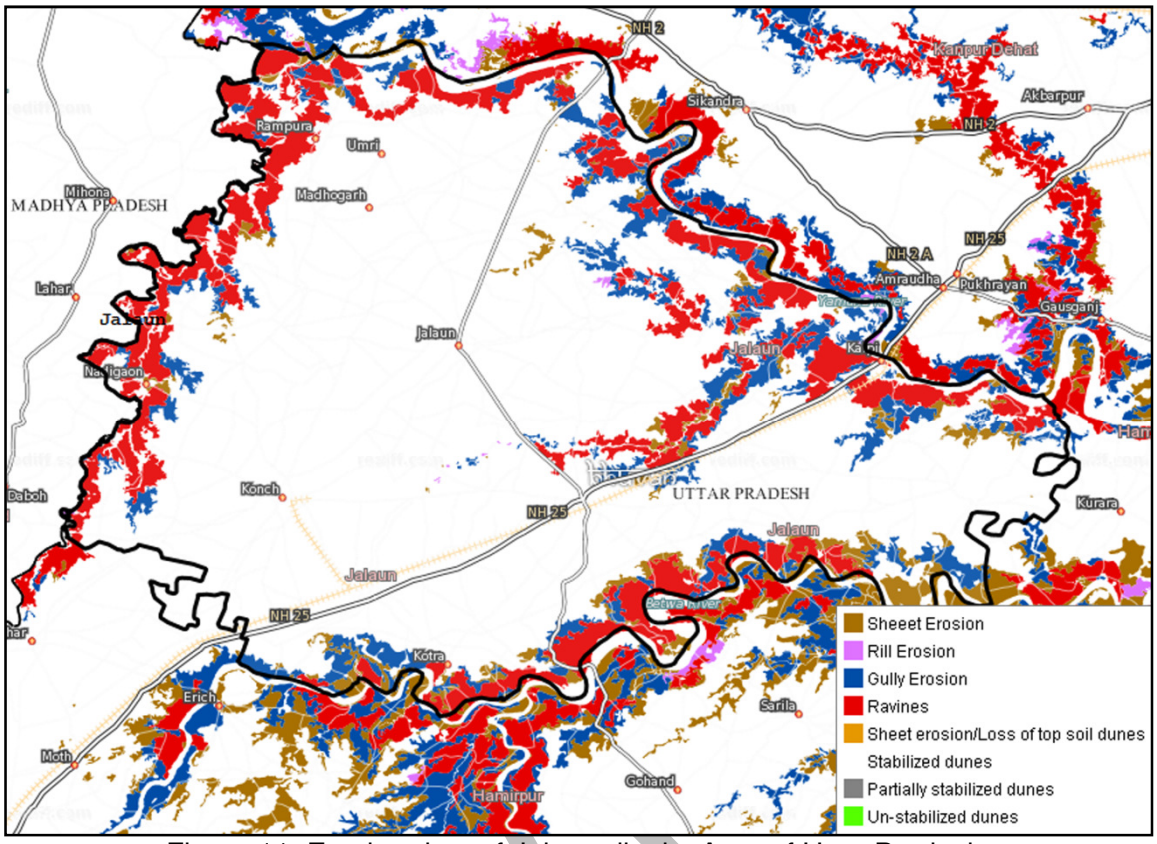


Figure 11: Erosion data of Jalaun district Area of Uttar Pradesh.

Mapping of erosion due to wind and water on 1:50,000 scale for the entire country has been has been carried out using 3-seasons LISS-III satellite data of 2005-06, SRTM / Carto DEM, Universal Soil Loss Equation, available soil and rainfall as well as land use/cover information. Adequate field checks were carried out for mapping and accuracy assessment.

Erosion by water and wind is the most important land degradation process that occurs on the surface of the earth. Rainfall, soil physical properties, terrain slope, land cover and land use.

1. Availability of Datasets

Erosion - 1:50,000(2005-06) – 21 States

2. Accuracy

Overall accuracy of different erosion classes vary from 82% to 90% depending on terrain conditions and supporting data availability.

Salt Affected and Waterlogging 1:50,000

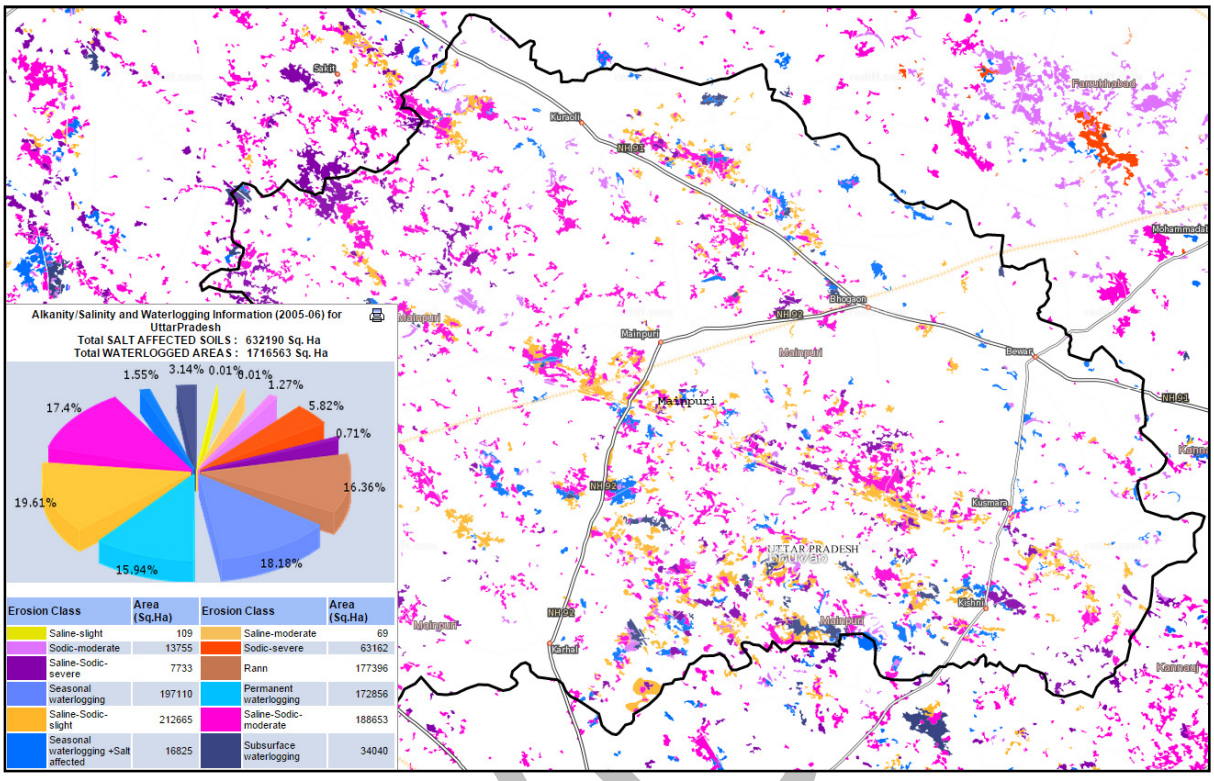


Figure 12: Salt Affected and Waterlogged data of Mainpuri district in Uttar Pradesh State

Assessment of salt-affected and water logged areas is an important pre-requisite for planning reclamation and improving land productivity. Mapping of Salt-affected and water logged areas on 1:50,000 scale for the entire country has been has been carried out using 3-seasons LISS-III satellite data of 2005-06, available soil and land use/cover information. **Salt affected areas** are one of the most important degraded areas where soil productivity is reduced due to either salinization (high soil electrical conductivity) or sodicity (high sodium on soil complex) or both.

Water logging is considered as physical deterioration of land. It is affected by excessive ponding/logging of water for quite some period and affects the productivity of land or reduces the choice of taking crops

.

1. Availability of Datasets

   Salt Affected and Water logging- 1:50,000(2005-06) – 19 States

2. Accuracy

   Overall accuracy of different salt-affected and water logged areas vary from 85% to 95% depending on terrain conditions and supporting data availability.

Other Thematic Layers

Flood Hazard Layers 1:250,000

Information on frequently flood affected areas is important for mitigation of flood disaster. Flood Hazard Layer derived from data acquired during 1998-2007 Floods and data is available for Assam State.

Flood Annual Layers 1:250,000

The flood inundation layer was delineated from optical and microwave satellite data by applying suitable classification techniques. Flood Annual Layers are available (1999-2010) for Assam and Bihar States.

Water Bodies Area

Water Bodies consists of all surface water bodies viz. reservoirs, irrigation tanks, lakes, ponds, and rivers / streams. Data sets available for 52 months (2004-2015).
Overall accuracy is 93.5% with Kappa coefficient 0.821.

Urban Sprawl

Characterization and Monitoring of the urban growth patterns using Multi temporal and multi spectral satellite data and datasets available for 5 States (2005-2006, 2011-12).

4. Vector Base Layers

Administrative Layers

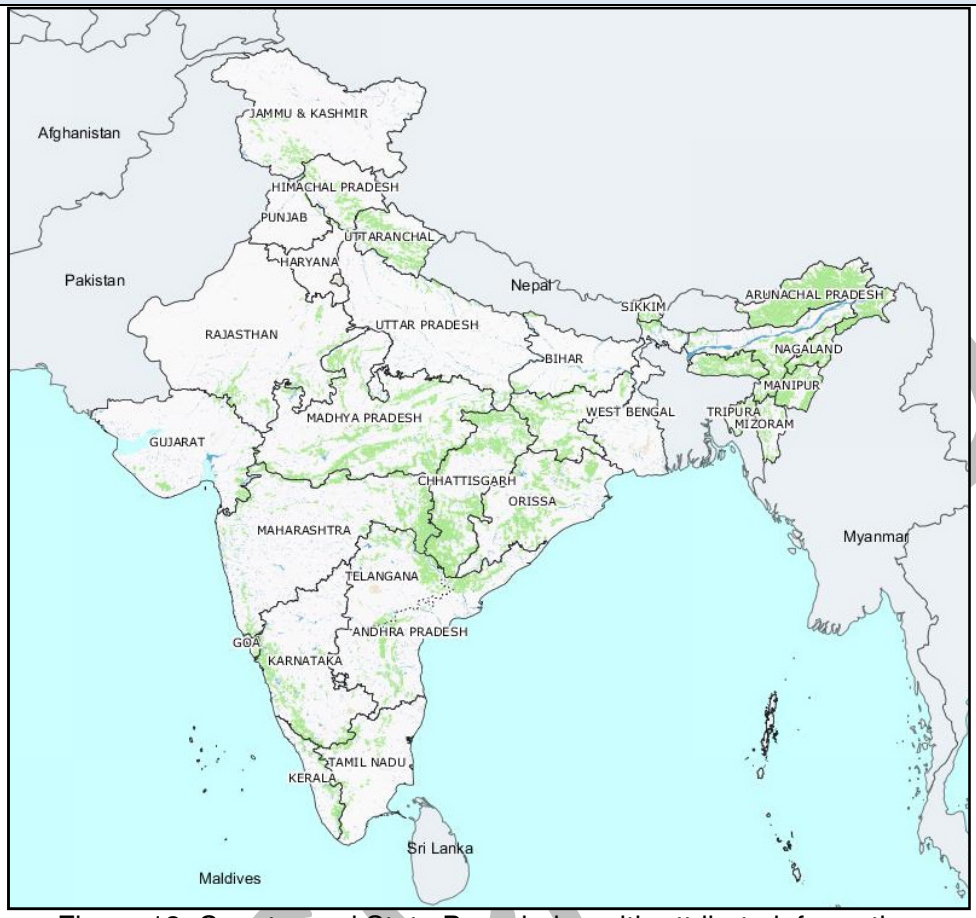


Figure 13: Country and State Boundaries with attribute information

Bhuvan is having administrative boundaries from Country boundary to Town Location.

Table 1: Boundaries available at Bhuvan and their sources.

Sl.No	Theme	Scale	Survey Year	Remarks/Source
01	Country Boundary	1:1 Million		Survey Of India
02	State Boundary			
03	Taluk Boundary			
04	Village Boundary (AP, AS, CH, GJ, HR, JH, KA, KL, MP, MH, RJ, SK, TN, TP, UK, UP,WB) – 17 States	1.250,000		Reproduced by permission of Surveyor General of India on behalf of Govt. Of India
05	Town Locations			Area level information from Open Street Map

Infrastructure Layers

Figure 14: Infrastructure layers like Road and Rail with attribute information

Infrastructures layers like Road, Rail datasets that are available at Bhuvan.

Table 2: Infrastructure layers like Road and Rail are available at Bhuvan and their sources

Sl.No	Theme	Accuracy	Remarks/Source
01	Road (National Highway, State Highway, District Roads and City Roads (Major and Minor)	Positional accuracy Urban : +/- 5m and Rural : +/- 10m	Map My India
02	Rail (Railway route and Railway Station Locations)		

Hydrology Layers

SNo	Application	Layers Available	Service	Remarks/Availability
1	Basemap	Basin Boundary	WMS/WMTS	
2		Sub Basin Boundary	WMS/WMTS	
3		Watershed Boundary	WMS/WMTS	
4		River	WMS/WMTS	
5		Reservoirs and Lakes	WMS/WMTS	
6		Drainage Network	WMS/WMTS	
7	IWMP	Drainage Network	WMS/WMTS	Available for 21 States, 333 Districts
8	AIBP (Phase1 and Phase2)	Canal Network	WMS/WMTS	For 99 Projects
9		Structures	WMS/WMTS	For 91 Projects
10		Canal Boundary	WMS/WMTS	For 97 Projects
11	Hydrological Science Products	Surface Runoff	Visualization, Time series Animation, Trend Analysis	Jan 2014 to till date
12		Surface Soil Moisture	Visualization, Time series Animation, Trend Analysis	Jan 2014 to till date
13		Evapotranspiration	Visualization, Time series Animation, Trend Analysis	Jan 2014 to till date
14	Bhuvan-NOEDA	Water Body Fraction	Visualization, Download	2004 to 2013 (39 Months) 2014 to 2015 (Every Fortnight upto June)
15		Snow Cover Fraction	Visualization, Download	2014 to 2015 (Every Fortnight upto June)
16		Snow Melt and Freeze	Visualization, Download	2009 to 2013 (2 Day Repetitivity)
17		OCM: Surface Water Layer Products_2Day Repeativity	Visualization, Download	2013 November to 2015 February
18	MWRDS	Maharashtra Water Bodies	WMS/WMTS	
19		Reservoir Information	Geo-tagged through Bhuvan Mapper	Available for 204 Reservoirs

Major Water Bodies

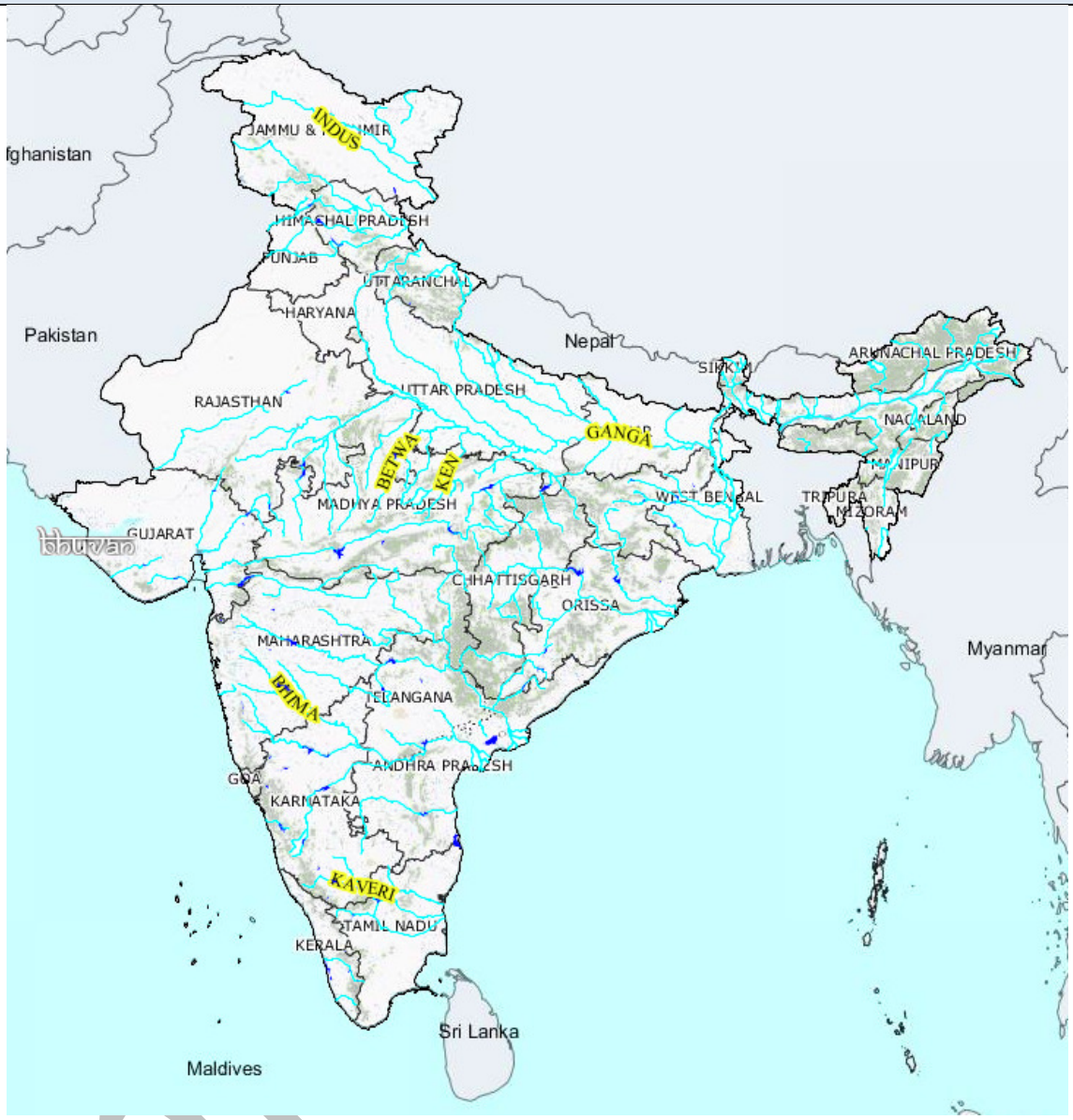


Figure 15: Major Water bodies like River and Reservoir are available at Bhuvan

Major Water bodies like River and Reservoir that are available at Bhuvan.

Table 3: Major Water bodies like River and Reservoir and their sources.

Sl.No	Theme	Scale	Survey Year	Remarks/Source
01	River	1:250,000	2008	Captured using Resourcesat – 1 LISS III (24m) and AWiFS (56m) datasets.
02	Reservoir			

Crowd Sourced

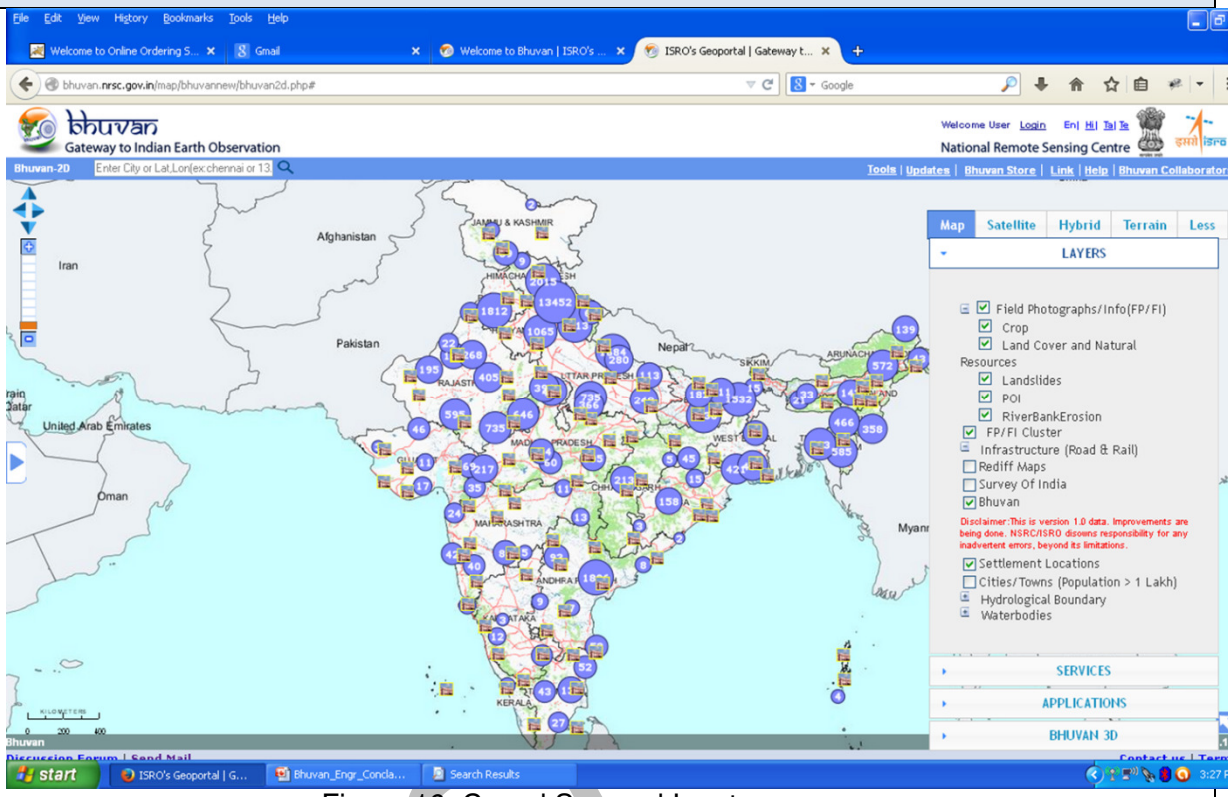


Figure 16: Crowd Sourced Inputs coverage

Over 5 million Point of Interest Locations:

For building any applications catering to Urban, Tourism, Location based Service applications, Disaster specific rich Point of Interest data is the prime requirement. Bhuvan has base of more than 5 million POI location information for visualization. This POI is diversified in nature ranging from place names, localities, municipal, tourism information and information derived from various projects on diversified themes. Bhuvan provides rich place name search can help building large number of applications.

Over 3.5 Million Crowd sourced data:

Through Bhuvan various tools and applications are brought for the Crowd sourcing data from the community. Exclusive Mapper application for creating detailed maps, Add Content option to contribute POI data, customized Android applications for Field data collection. Bhuvan with its proven platform and architecture could already obtain more than 3.5 million crowd sourced data.

Applications with the requirement of Asset Mapping and Field data collection need these Crowd sourced tools and concurrent users participating in these Applications will be more. Such examples are APSHCL, MANU, NCFC etc where amount of data gather through customized android applications for Asset mapping, disaster management, crop study etc. 3 million houses are geo-tagged, under the Bhuvan -APSHCL portal.

Satellite Products

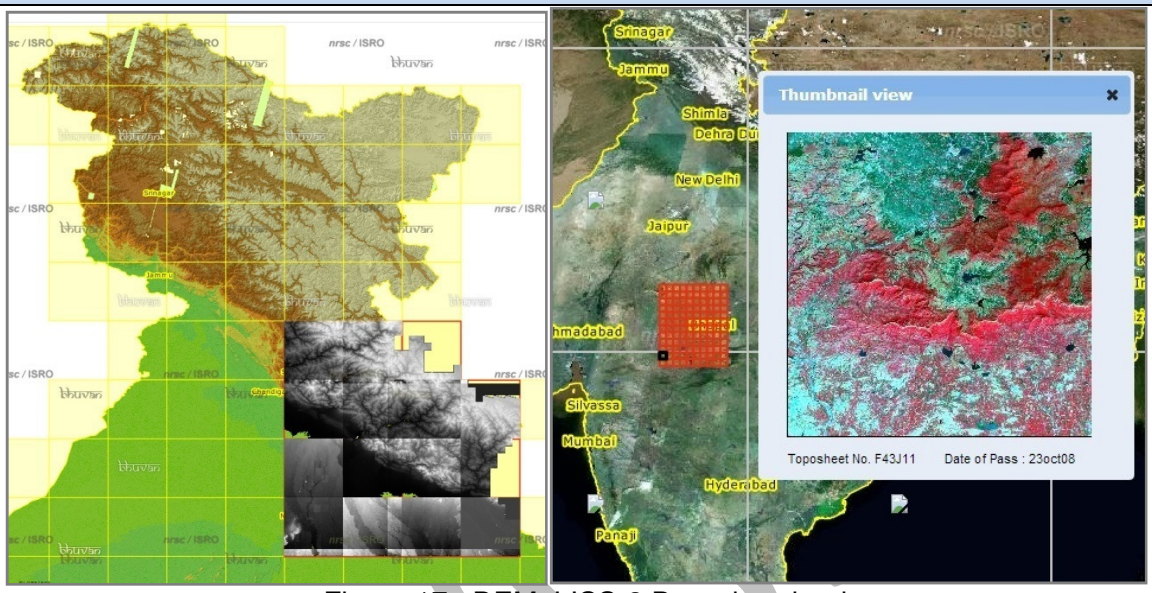


Figure 17: DEM, LISS-3 Data download

S.No.	Product	Resolution	Availability	Coverage: Tile Extent/Spatial Extent	Tiles/Files
1	Cartosat all versions -1 DEM (All versions)	1 arc Sec (~ 32 m)	2005-14	India: 1°X1°	1376
2	IMS-1:Hyper spectral Imager	Spectral Binned Data(17 bands)	2008-12	India: Scene Based	306
3	Resourcesat-1:AWiFS Ortho	56 m	2008, 2009 (2 seasons), 2010 (2 seasons)	India: 1°X1°	1648
4	Resourcesat -1:LISS III Ortho	24 m	2008-09, 2011	India: 15'X15'	9636

Satellite Derived - Ocean & Atmospheric Layers

S.No.	Product	Resolution	Availability	Coverage: Tile Extent/Spatial Extent	Tiles/Files
1	Oceansat-2:OCM: NDVI	1 Km	2011(Monthly), 2012 and 2013 (Fortnight)	India	44
2	Oceansat-2:OCM: Vegetation Fraction	1 Km	2011(Monthly), 2012 and 2013 (Fortnight)	India	44
3	Oceansat-2:OCM: Albedo	1 Km	2013 (Fortnight)	India	7
4	Tropical Cyclone Heat Potential	0.25°	Jan 1998 – till date	North Indian Ocean (30S – 30N; 30-120E)	~6000
5	Ocean Heat Content	0.25°	Jan 2002 – till date	North Indian Ocean (30S – 30N; 30-120E)	~4400
6	Model Derived Depth of 26℃ Isotherm	0.5° x 0.5°	July 2013 – till date	30° S - 30° N; 30° E - 120° E	~200
7	Model Derived Tropical Cyclone Heat Potential	0.5° x 0.5°	July 2013 – till date	30° S - 30° N; 30° E - 120° E	~200
8	OCM2: NDVI - Global Coverage	8 Km	2013	Global Coverage	5
9	Water Bodies Fraction	3' X 3' Grid	2004-2013(39Months), Jan-2014 (Fortnight)	India	~40
10	Ocean Wind Stress	0.5° x 0.5°	January 2010 – December 2013	90° S - 90° N; 0° E - 360° E	~1450
11	Ocean Wind Curl	0.5° x 0.5°	January 2010 – December 2013	90° S - 90° N; 0° E - 360° E	~1450
12	Ocean Wind Velocity	0.5° x 0.5°	January 2010 – December 2013	90° S - 90° N; 0° E - 360° E	~1450

7. Disaster Services (NDEM Public)

To provide timely information on various disasters for better decision making

7.1 Cyclone 2014

01	Hudhud	1 Event	Derived from RADARSAT and RISAT-2/1, Spatial Overlay- Roads, School Locations, Hospitals, Bridges, Power Lines, Tanks, Cadastral Boundary etc., Cyclone Track-IMD, JTWC, Crowd sourced data, Cyclone Track-IMD, JTWC.
02	Nilofer	1 Event	

7.2 Drought

01	Normalized Differential Vegetation Index (NDVI)	2008 to 2012	Derived under National Agricultural Drought Assessment and Monitoring System (NADAMS)
02	Normalized Differential Water Index (NDWI)		
03	Soil Moisture Index		
04	Short Wave Angle Slope Index (SASI)		

7.3 Earthquake

01	Recent Seismicity	2015 ,2013	4 events –USGS, 3 events - USGS Magnitude greater than 6 - IMD
02	Historic Seismicity	1819 to 2011	Significant Earthquakes in and around India(Magnitude > 6), India Meteorological Department(IMD)
03	Heat Index	2009 to 2013	Derived based on Temperature and Humidity obtained from AWS stations

7.4 Flood

01	2015 (Assam, Gujarat, Jammu and Kashmir, Madhya Pradesh, Manipur, Odisha, West Bengal).	25 events	Derived from RADARSAT and RISAT-2/1 Maximum Flood Inundation extent observed in that year Assessment of frequency of inundation.
02	2014 (Andhra Pradesh, Assam, Bihar, Jammu and Kashmir, Meghalaya, Odisha, Uttar Pradesh, West Bengal)	56events	
03	2013 (Andhra Pradesh, Assam, Bihar, Delhi, Gujarat, Maharashtra, Uttarakhand, Uttar Pradesh, West Bengal)	42 events	

04	2012 (Andhra Pradesh, Assam, Bihar, Tamil Nadu)	27 events	
05	2011 (Assam, Bihar, Odisha, Uttar Pradesh, West Bengal)	46 event	
06	2010 (Punjab)	1 event	
07	2008 (Bihar)	1 event	
08	Flood Annual Layer (Assam, Bihar)	1999 to 2010(12 Years)	Maximum Flood Inundation extent observed in that year
09	Flood Hazard Layer (Assam ,Bihar and Odisha)	1998 - 2007 1998-2010And 2001-2013	Assessment of frequency of inundation

7.5 Forest Fire

01	Nagaland (2015)	1 event	INFFRAS Rapid Response based on IRS- P6 AWiFS Satellite data Indian Forest Fire Response and Assessment System (INFFRAS) Updated on daily basis (Day and Night) during Feb to June.
02	Bandipur, Nagarhole - Karnataka(2014)	1 event	
03	Tirumala - Andhra Pradesh(2014)	1 event	
04	Forest Fire Alert	2008 to tilldate	
05	Forest Fire Regime	2003 to 2012	Based on three inputs – Average fire density, Fire period duration and Annual fire

7.6 Landslide

01	Landslide Inventory	4 (3 Events + 1 Route)	Jammu & Kashmir, Kedarnath, Okhimath, Sikkim&Amarnath
02	Hazard Zone	2 (Uttarakhand & HP)	Sector wise (8 sectors)

8. Ocean Services

Potential Fishing Zone (PFZ) Advisories are generated using Sea Surface Temperature (SST) and Chlorophyll derived from satellite imagery to serve the Fishing Community to increase catch per unit effort.

01	Potential Fishing Zone (PFZ) PFZ & Coast location (Point-KML) Chlorophyll and Sea Surface Temperature (TIFF imagery)	Mar 2010 to till date	Integrated in collaboration with Indian National Centre for Ocean Information Services (INCOIS).
02	PFZ lines (Line – Shape)	Updated daily.	