Biodiversity Observation and Data Sharing India

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Dehradun, India

www.iirs.gov.in
www.bisindia.org

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    - BIS (data, structure, metadata)
    - IBIN (data, structure, services)
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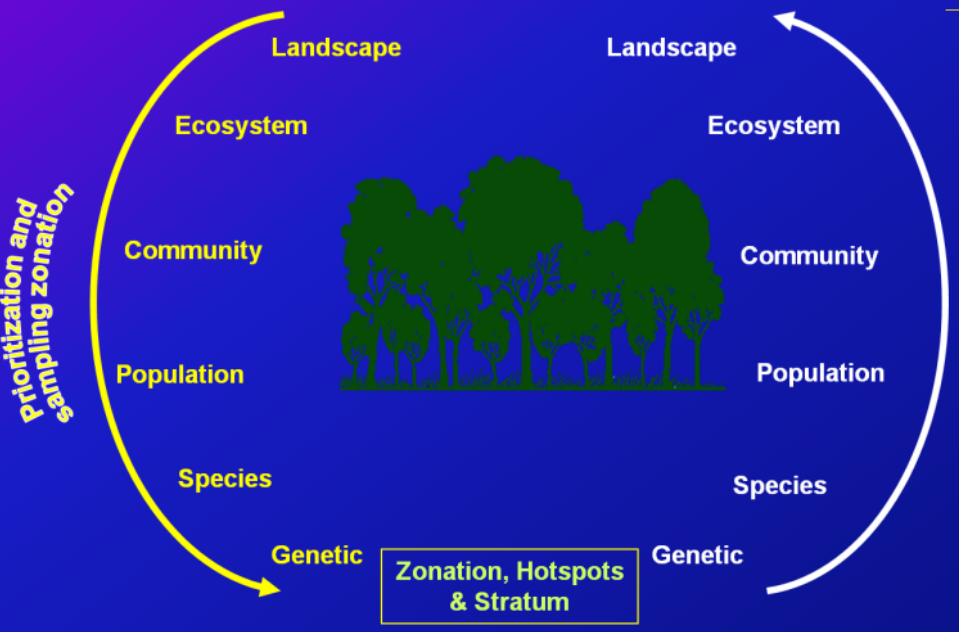
Biodiversity Characterization at Landscape Level

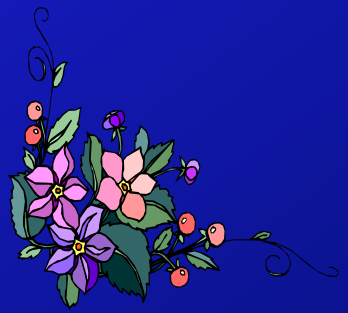
"Gene to Landscape Mission"

National initiative of Department of Space and
Department of Biotechnology under National Bio-resources Board



An effort of ..

- 61 Scientists
- 16 National Institutions
- 37 Universities/State level Institutions
- 56 Research Fellows



- **Wall-to-wall mapping of natural habitats** in compliance to several international conventions
- Identifying **ecologically vulnerable areas and to develop adaptation/ mitigation inputs** against the possible global and climate change impacts.

Collaborative effort of 13 Years with 53 Institutions

Contributors

National Level Organizations/Institutions

National Remote Sensing Centre (NRSC)
Indian Institute of Remote Sensing (IIRS-NRSC)
Regional Remote Sensing Centre- Kharagpur (RRSC-E - NRSC)
Regional Remote Sensing Centre- Bangalore (RRSC-S - NRSC)
Regional Remote Sensing Centre- Jodhpur (RRSC-W - NRSC)
Regional Remote Sensing Centre – Dehradun (RRSC-N - NRSC)
Space Applications Centre (SAC)
Advanced Data Processing Research Institute (ADRIN)
Botanical Survey of India (BSI)
Wildlife Institute of India (WII)
Indian Institute of Technology-Kharagpur (IIT-K)
GB Pant Inst. Himalayan Environment & Development
World Wildlife Fund- India (WWF)
Centre for Development of Advanced Computing (C-DAC)

State Level Organizations/Institutions

Assam Remote Sensing Applications Centre
Council of Science and Technology, Agartala
Manipur Remote Sensing Applications Centre
Maharashtra Remote Sensing Centre, Nagpur
Regional Remote Sensing Laboratory, Bhubaneshwar (RRL-B)
Orissa Remote Sensing Applications Centre (ORSAC)
Environmental Remote Sensing Centre (ERSC) J&K,
Department of Science & Technology, Imphal
Department of Science & Technology, Gangtok
Directorate of Agriculture & Minor Irrigation, Aizwal
Punjab State Council of Science & Technology, Chandigarh
Kerala Forest Research Institute (KFRI)

Universities/ Post Graduate Colleges

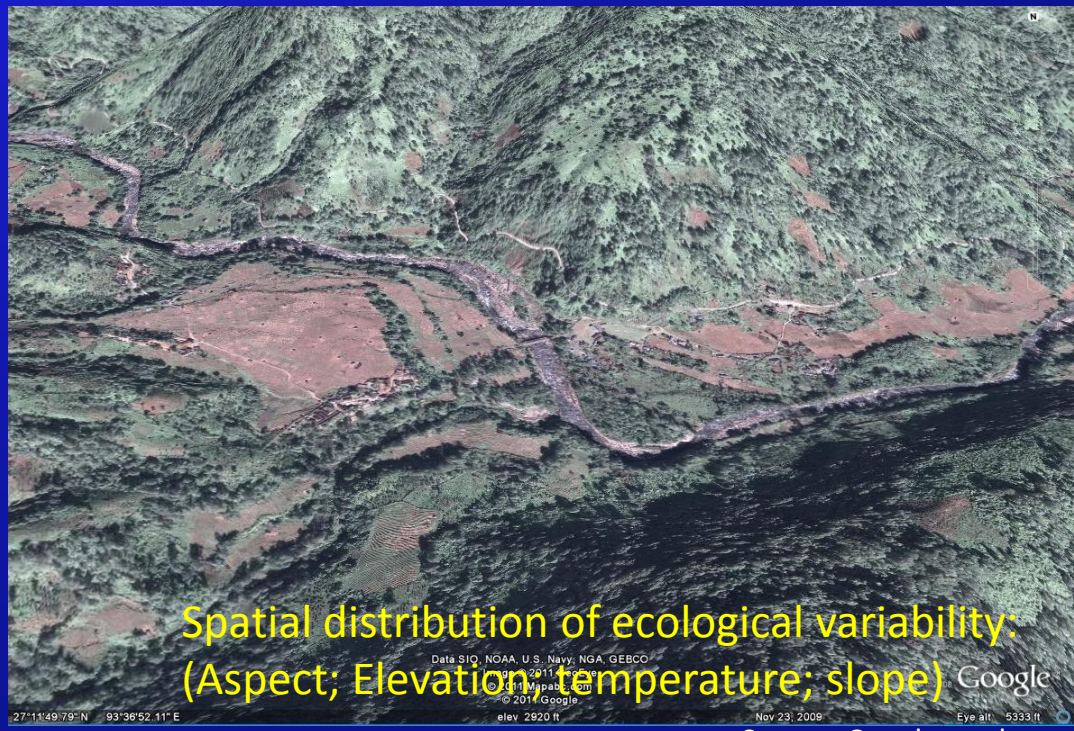
Andhra University, Vishakhapatnam
Annamalai University, Chidambaram
Assam University, Silchar
Berhampur University, Berhampur
Calcutta University, Kolkata
Goa University, Goa
Dr. HS Gaur Vishwavidyalaya, Sagar
Jammu University, Jammu
Kakatiya University, Warangal
Kashmir University, Srinagar
Sri Krishnadevaraya University, Anantpur
Kurukshetra University, Haryana
MGCG Vishwavidyalaya, Chitrakoot
MDS University, Ajmer
MLS University, Udaipur
MS University, Baroda
North Orissa University, Baripada
North Eastern Hill University, Shillong
Pondicherry University, Pondicherry
St Joseph College, Trichy
College of Forestry, Ponnampet
University of Agricultural Sciences, Bangalore
Utkal University, Bhubaneshwar

All State/UT Forest Departments

Landscape

Landscape comprises the visible features of an area of land, including the physical elements of landforms and human elements

- Different ecosystems make a landscape
- Landscape ecology deals with the spatial distribution of the different ecosystems, their dynamism over time and space and their interaction



Spatial distribution of ecological variability: (Aspect; Elevation; temperature; slope)

Source: Google earth

Structural Component: *Vegetation type/plant community, Biodiversity, distribution*

Functional Component: *Nutrient cycling, NPP, succession, influence of human activity*

Shaping of a landscape is influenced by → *dynamic landscape mosaics; resilience and thresholds; biocomplexity; adaptive cycles;*

Drivers of Biodiversity Losses

At least 40 per cent of the world's economy and 80 per cent of the needs of the poor are derived from biological resources. In addition, the richer the diversity of life, the greater the opportunity for medical discoveries, economic development, and adaptive responses to new challenges as climate change.

Land use:

- *Habitat degradation and depletion.*
- *Habitat fragmentation.*
- *Over-exploitation*

Climate Change:

- *Global warming*
- *Changes in precipitation regimes*

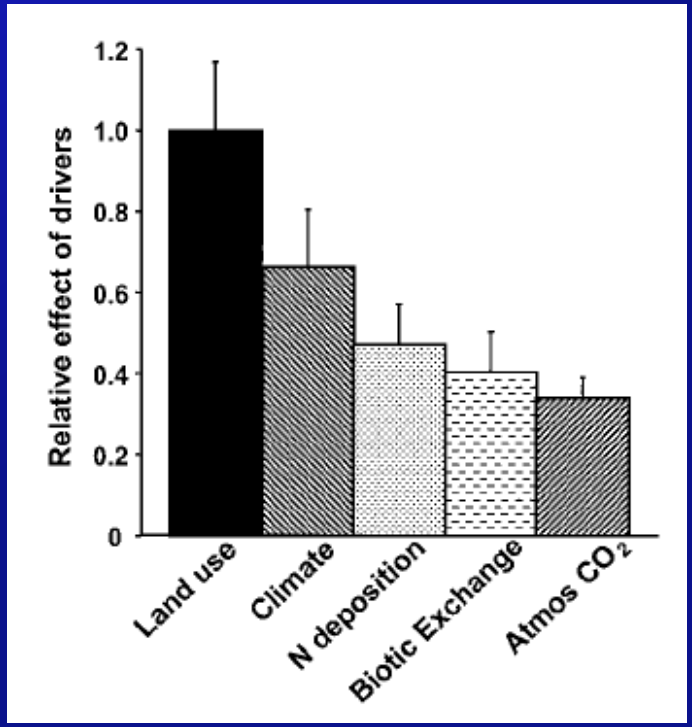
N deposition:

- *Selective growth of species with efficient N-utilization*

Biotic exchange:

- *Introduction of Invasive species*

Sala et al., 2000, *Science*



Land use is the major driver for biodiversity loss in most regions of India

Why Biodiversity Characterization?

"Biodiversity is not simply the number of genes, species, ecosystems, or any other group of things in a defined area...A definition of biodiversity that is altogether simple, comprehensive, and fully operational (i.e. responsive to real-life management and regulatory questions) is unlikely to be found. More useful than a definition, perhaps, would be a characterization of biodiversity that identifies the major components at several levels of organization.

Reed Noss, "Indicators for Monitoring Biodiversity: A Hierarchical Approach," *Conservation Biology* 4(4):355-364. 1990:

Attributes (proxies) of Biological Richness

Climate;Terrain Complexity and Geomorphology

- Moisture availability
- Altitude
- Slope
- Aspect
- landscape

Studies have reported that if Altitude, slope, aspect do not vary much in a landscape then landscape variations like soil moisture account for more that 70% the vascular plant diversity

Nicholas et al (1998), Conservation biology, 12 (2), 371–379

National Programme
Spatial Biodiversity Characterization

REMOTE SENSING +Field

- Vegetation type map
- Community zonation
- Landscape Structure
- Spatial Habitat Definition

Spatial Biodiversity Characterization

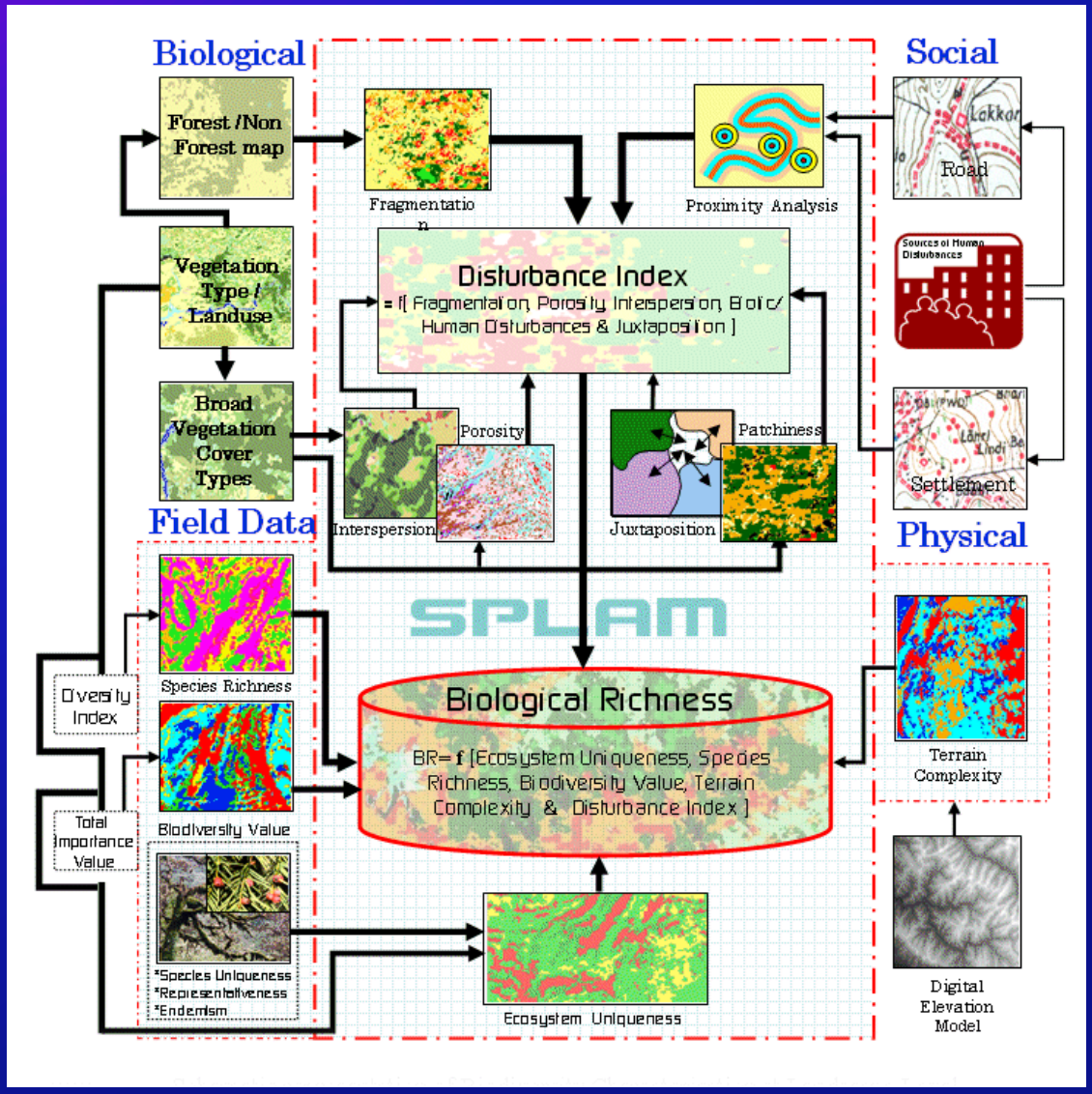
GIS

- Spatial Extent
- Landscape characteristics
  - Fragmentation
  - Patchiness
  - Juxtaposition
- Disturbance Regime
  - Road
  - Settlement

FIELD

- Habitat
- Vegetation (Natural Landscape)
  - Community composition
  - Species Inventory/Diversity index
  - Total Value Index
  - Environmental (Climate, topography
- Flora & Fauna (Taxonomic Evaluation)
- Knowledge Base

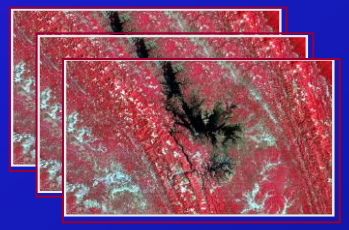
Geospatial Model: Biological, Ecological, Physical and Social



Vegetation Type Classification

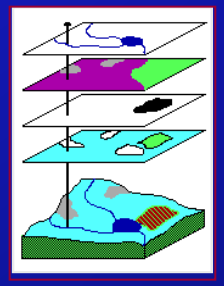
Vegetation Type = (Remote Sensing + Topography + Biogeographical Classification)

Spatial Description



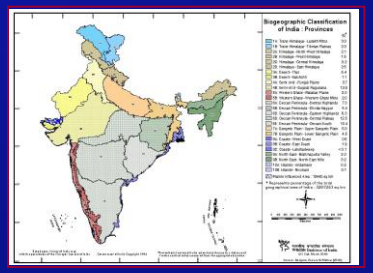
Satellite Remote Sensing

+



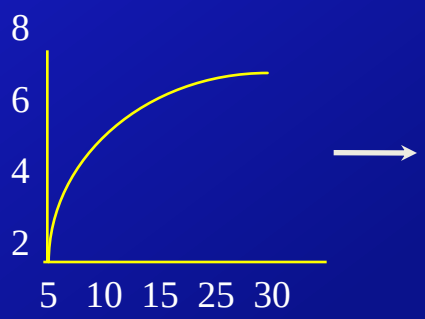
Topography

+

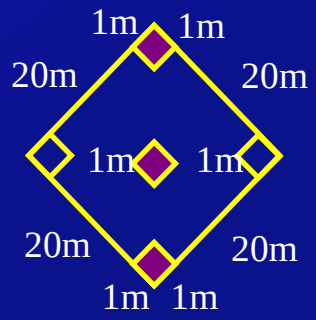


Biogeographical Zones

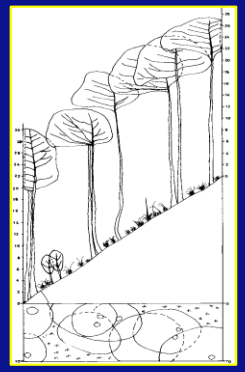
Non-Spatial Description



Species Area Curve



Lay Out of Plot

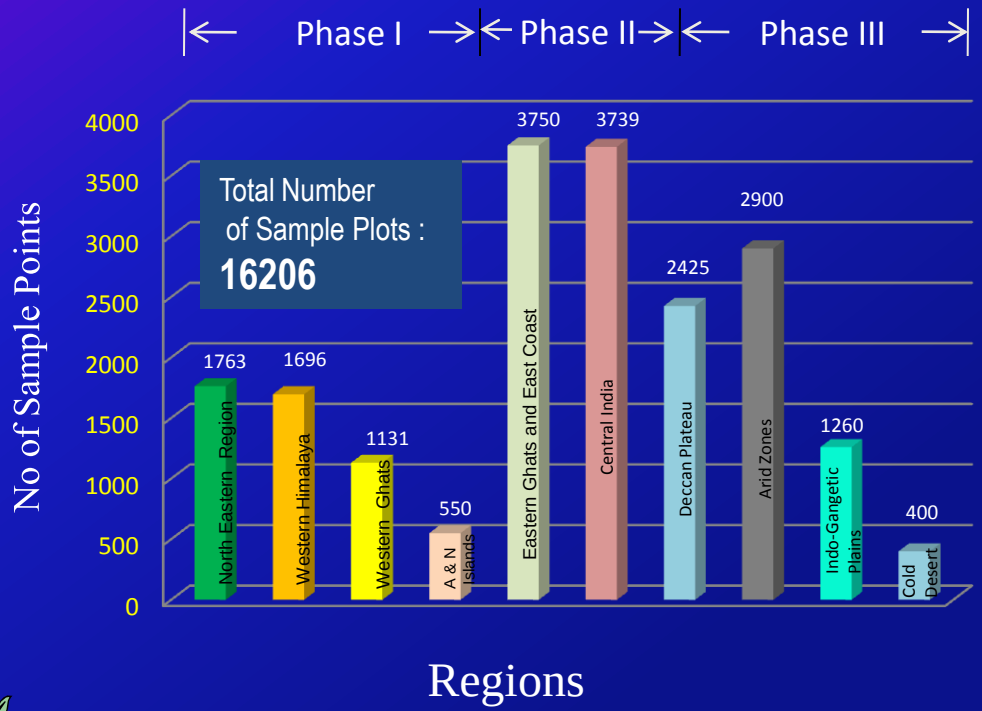


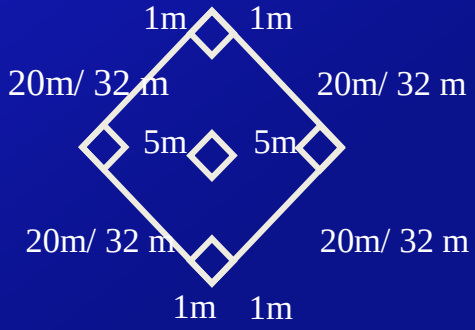
Profile of Plot

Ground Sampling

Knowledge Base

Distribution of Sample Points in each region





Lay Out of Plot

Information Acquired
First Cycle (1998-2010)

Trees : CBH, Species Name
Shrubs/Sapling : No., Species Name
Herbs/seedling : No., Species Name
Climber/Lianas/Epiphytes: No., Species Name

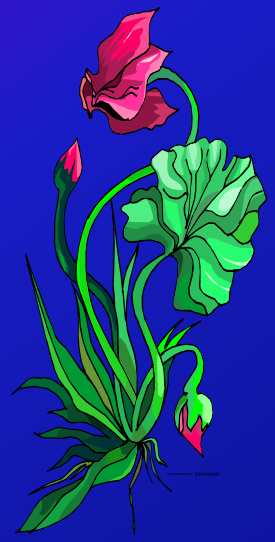
Future initiatives
Revisit to ~16000 sample plots
Microbial Organisms, Fauna (Birds & Amphibians)

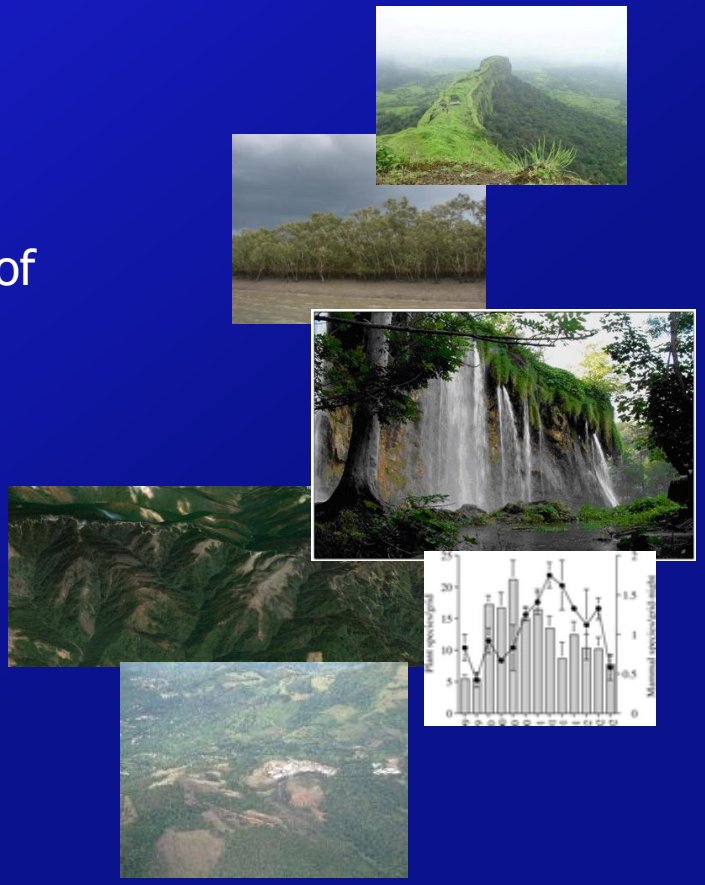
With GPS Point Locations

Biological Richness

Biological richness is computed as a function of

- Ecosystem Uniqueness
- Species Richness
- Terrain Complexity
- Disturbance Index
- Biodiversity Value (TIV)



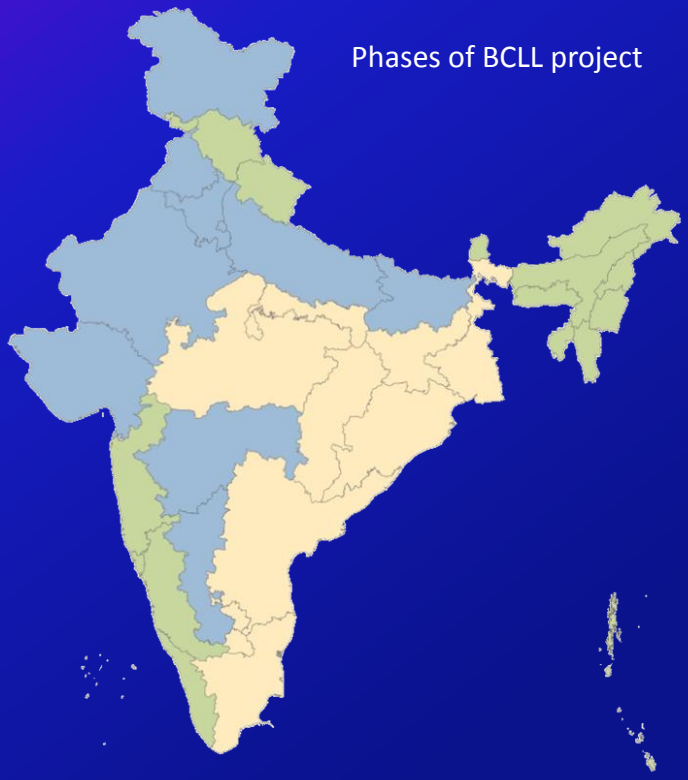


$$BR = \int(\mathrm{EU}, \mathrm{SR}, \mathrm{TC}, \mathrm{DI}, \mathrm{BV})$$

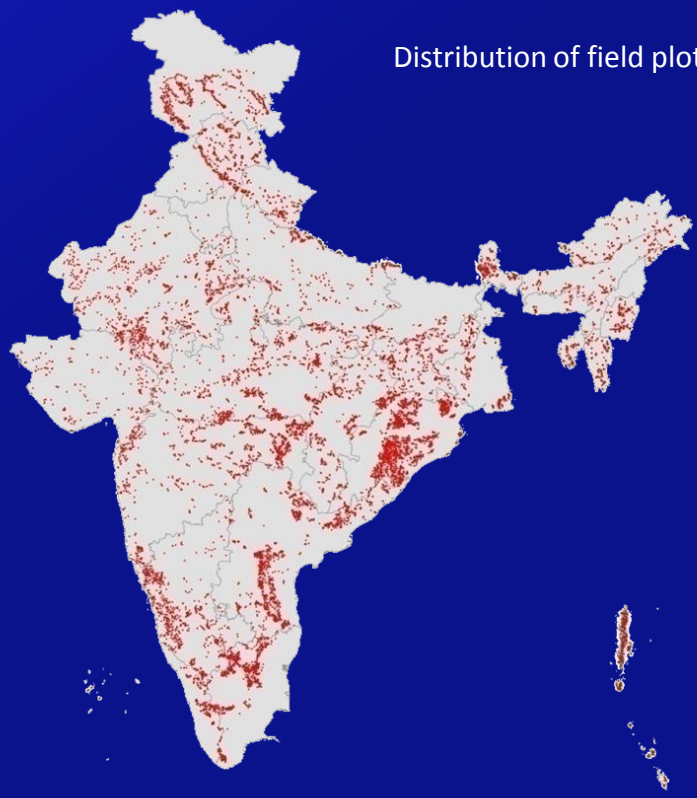
Biodiversity Characterization at Landscape Level

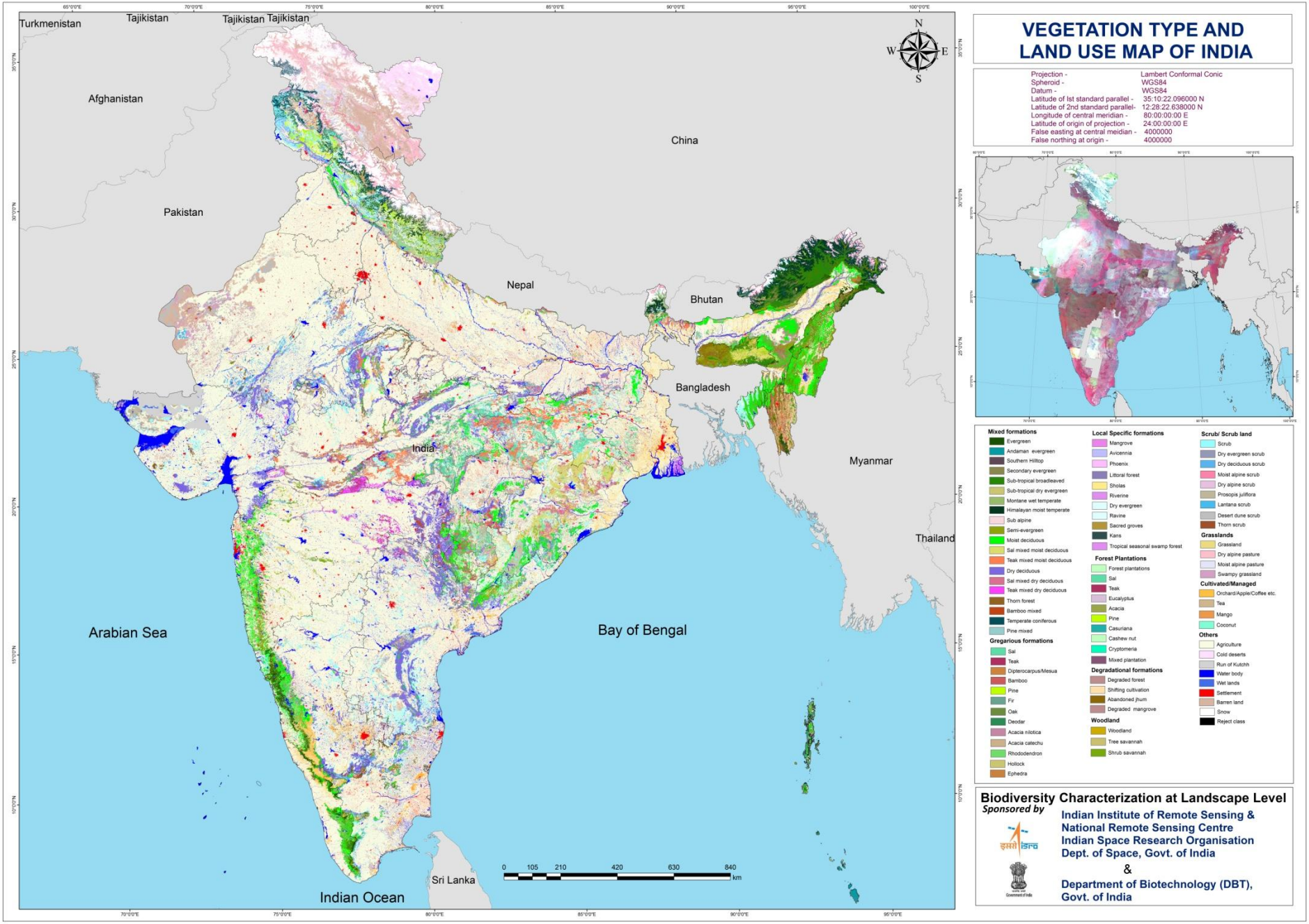
- **Hybrid Classification approaches followed using IRS LISS III**
- **16,206 field plot phytosociological data integrated**
- **120 Vegetation types/habitats mapped**

Phases of BCLL project



Distribution of field plots




VEGETATION TYPE AND LAND USE MAP OF INDIA
Projection - Lambert Conformal Conic
Spheroid - WGS84
Datum - WGS84
Latitude of Ist standard parallel - 35:10:22.096000 N
Latitude of 2nd standard parallel- 12:28:22.638000 N
Longitude of central meridian - 80:00:00:00 E
Latitude of origin of projection - 24:00:00:00 E
False easting at central meidian - 4000000
False northing at origin - 4000000
Turkmenistan
Tajikistan
Afghanistan
Pakistan
China
Nepal
Bhutan
Bangladesh
India
Myanmar
Thailand
Sri Lanka
Arabian Sea
Bay of Bengal
Indian Ocean
0 105 210 420 630 840 km
Mixed formations
Evergreen
Andaman evergreen
Southern Hilltop
Secondary evergreen
Sub-tropical broadleaved
Sub-tropical dry evergreen
Montane wet temperate
Himalayan moist temperate
Sub alpine
Semi-evergreen
Moist deciduous
Sal mixed moist deciduous
Teak mixed moist deciduous
Dry deciduous
Sal mixed dry deciduous
Teak mixed dry deciduous
Thorn forest
Bamboo mixed
Temperate coniferous
Pine mixed
Gregarious formations
Sal
Teak
Dipterocarpus/Mesua
Bamboo
Pine
Fir
Oak
Deodar
Acacia nilotica
Acacia catechu
Rhododendron
Hollock
Ephedra
Local Specific formations
Mangrove
Avicennia
Phoenix
Littoral forest
Sholas
Riverine
Dry evergreen
Ravine
Sacred groves
Kans
Tropical seasonal swamp forest
Forest Plantations
Forest plantations
Sal
Teak
Eucalyptus
Acacia
Pine
Casuriana
Cashew nut
Cryptomeria
Mixed plantation
Degradational formations
Degraded forest
Shifting cultivation
Abandoned jhum
Degraded mangrove
Woodland
Woodland
Tree savannah
Shrub savannah
Scrub/ Scrub land
Scrub
Dry evergreen scrub
Dry deciduous scrub
Moist alpine scrub
Dry alpine scrub
Prosopis juliflora
Lantana scrub
Desert dune scrub
Thorn scrub
Grasslands
Grassland
Dry alpine pasture
Moist alpine pasture
Swampy grassland
Cultivated/Managed
Orchard/Apple/Coffee etc.
Tea
Mango
Coconut
Others
Agriculture
Cold deserts
Run of Kutchh
Water body
Wet lands
Settlement
Barren land
Snow
Reject class
Biodiversity Characterization at Landscape Level
Sponsored by
Indian Institute of Remote Sensing &
National Remote Sensing Centre
Indian Space Research Organisation
Dept. of Space, Govt. of India
&
Department of Biotechnology (DBT),
Govt. of India

FRAGMENTATION AND LAND USE MAP OF INDIA

Projection -	Lambert Conformal Conic
Spheroid -	WGS84
Datum -	WGS84
Latitude of Ist standard parallel -	35:10:22.096000 N
Latitude of 2nd standard parallel-	12:28:22.638000 N
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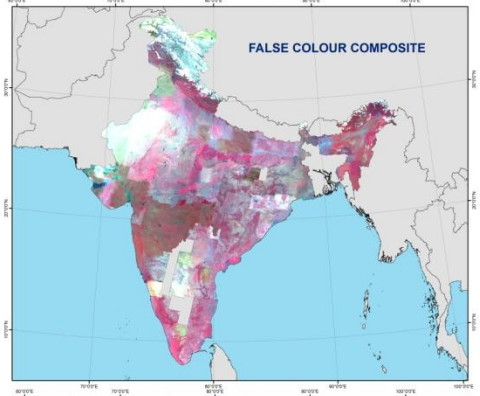
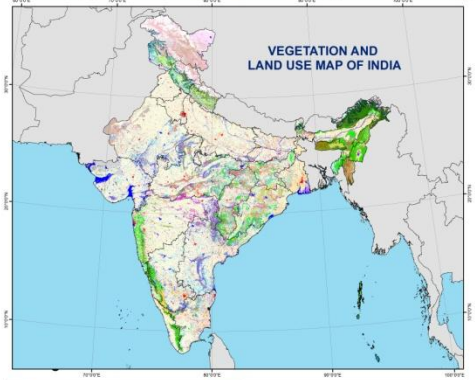
False northing at origin -	4000000





Low (1)	Abandoned jhum	Barren land
Medium (2)	Scrub	Water body
High (3-35)	Grassland	Wet land
	Orchard	Settlement
	Agriculture	River sand
	Cold desert	Snow

Biodiversity Characterization at Landscape Level

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Indian Space Research Organisation
Dept. of Space, Govt. of India

&

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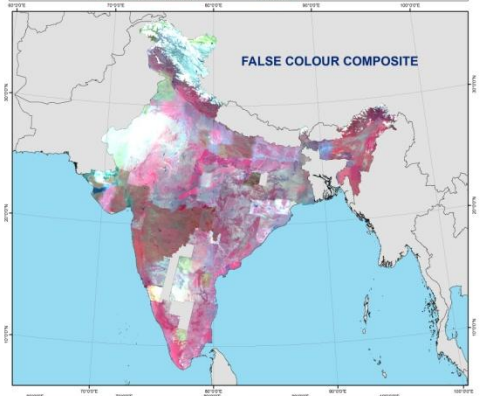
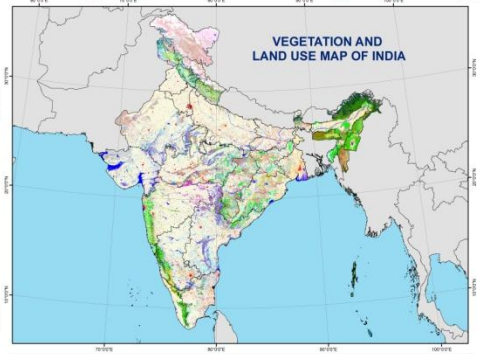
Govt. of India

DISTURBANCE INDEX AND LAND USE MAP OF INDIA

Projection -	Lambert Conformal Conic
Spheroid -	WGS84
Datum -	WGS84
Latitude of Ist standard parallel -	35:10:22.096000 N
Latitude of 2nd standard parallel-	12:28:22.638000 N
Longitude of central meridian -	80:00:00:00 E
Latitude of origin of projection -	24:00:00:00 E
False easting at central meidian -	4000000
False northing at origin -	4000000





Turkmenistan
Tajikistan
Tajikistan
Tajikistan
Afghanistan
China
Pakistan
Nepal
Bhutan
Bangladesh
India
Myanmar
Thailand
Arabian Sea
Bay of Bengal
Sri Lanka
Indian Ocean
N
S
E
W
0 105 210 420 630 840
km

Disturbance Index Classes

- Low (11 - 18)
- Medium (19 - 23)
- High (24 - 28)
- Very High (29 - 70)

Other Classes

- Abandoned jhum
- Scrub
- Grassland
- Orchard
- Agriculture
- Cold desert
- Barren land
- Water body
- Wet land
- Settlement
- River sand
- Snow

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&

Department of Biotechnology (DBT),
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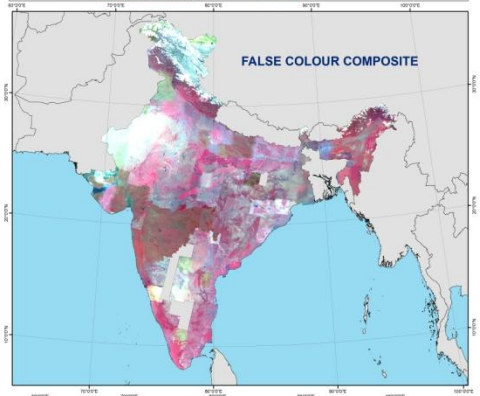
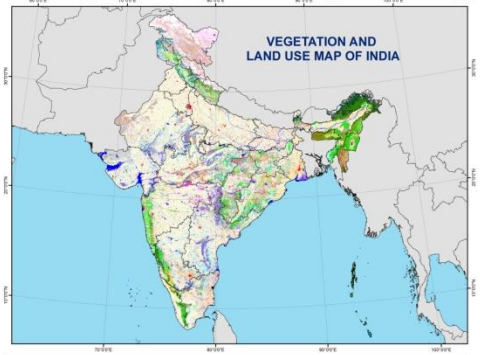
BIOLOGICAL RICHNESS AND LAND USE MAP OF INDIA

Projection -	Lambert Conformal Conic
Spheroid -	WGS84
Datum -	WGS84
Latitude of Ist standard parallel -	35:10:22.096000 N
Latitude of 2nd standard parallel-	12:28:22.638000 N
Longitude of central meridian -	80:00:00:00 E
Latitude of origin of projection -	24:00:00:00 E
False easting at central meidian -	4000000
False northing at origin -	4000000





Biological Richness Classes

- Low (17 - 33)
- Medium (34 - 49)
- High (50 - 69)
- Very High (70 - 90)

Other Classes

- Abandoned jhum
- Scrub
- Grassland
- Orchard
- Agriculture
- Cold desert
- Barren land
- Water body
- Wet land
- Settlement
- River sand
- Snow

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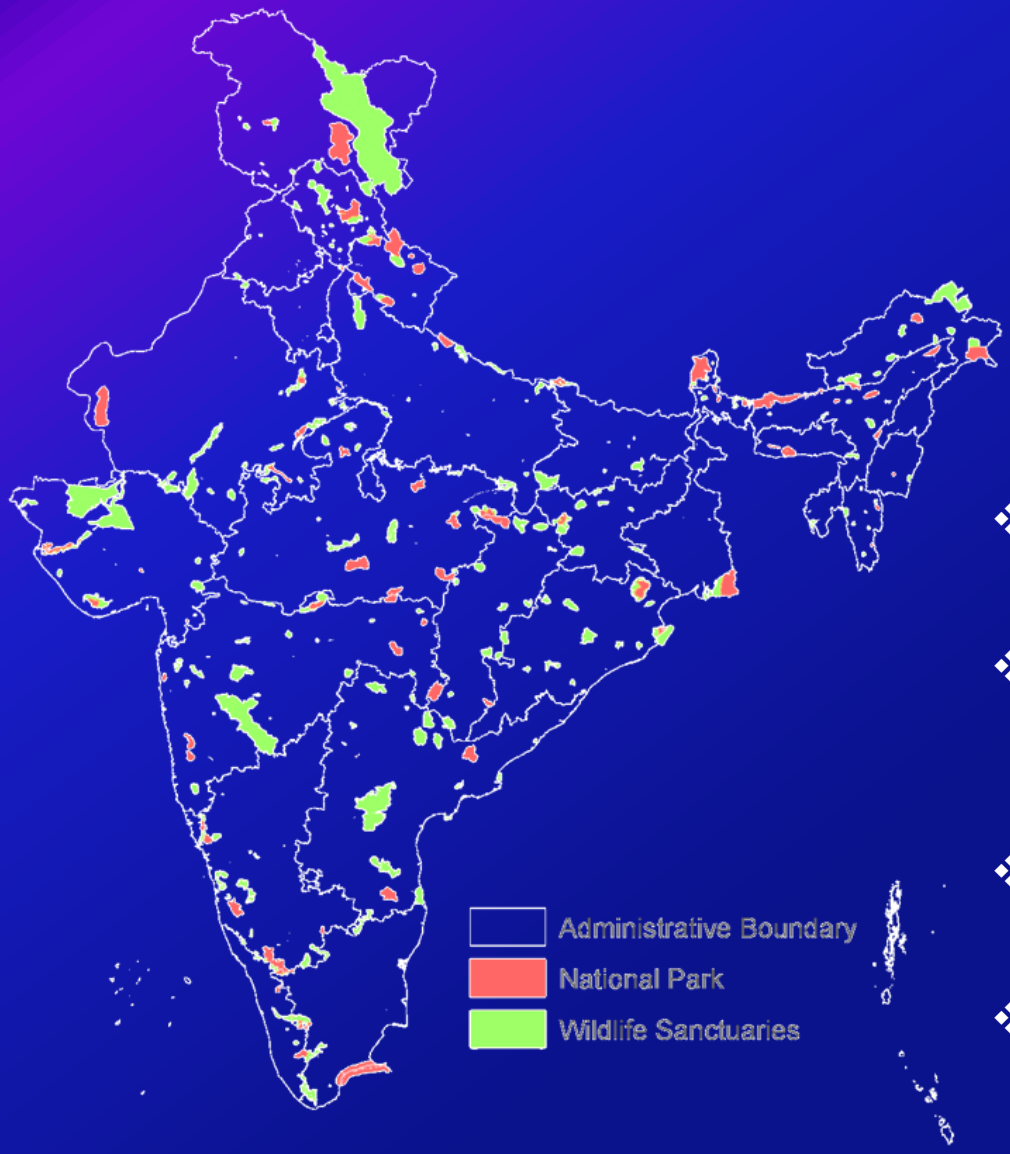
Protected Areas in India



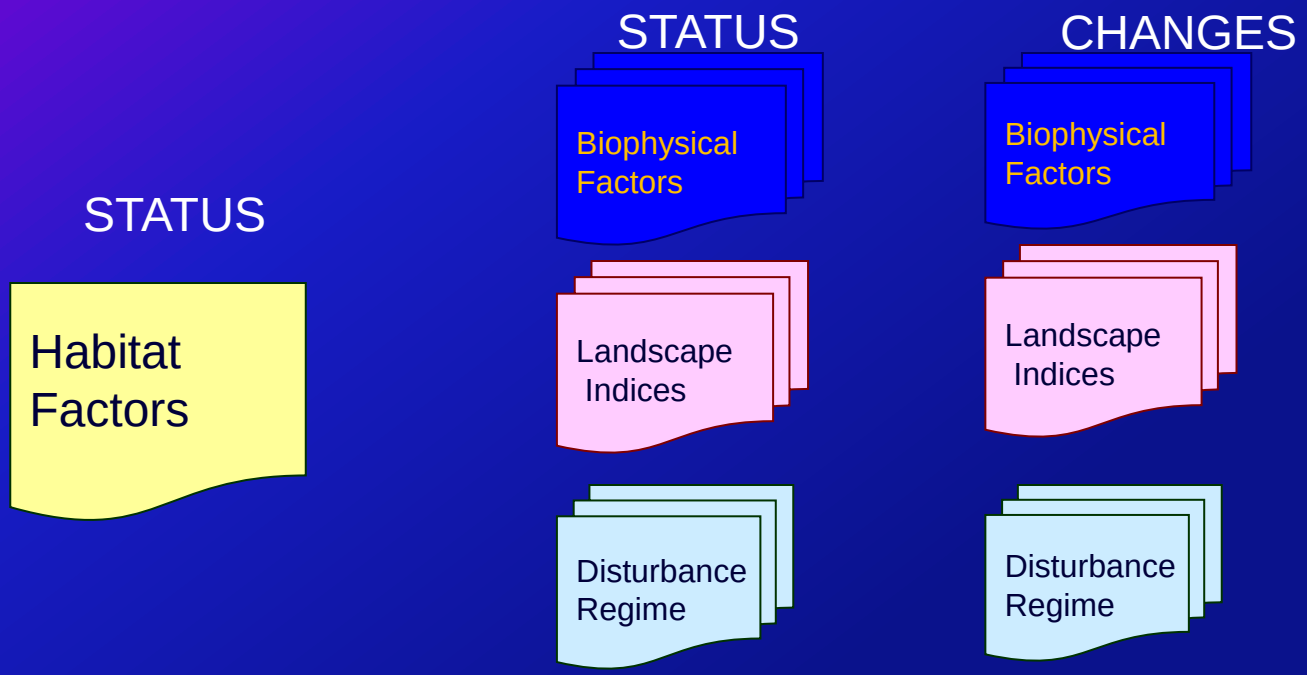
- As on April 2007, there are 96 national parks.
- The national parks constitutes 38,029.18 km² or 1.16% of India's Geographical area.
- A total of 166 national parks have been authorized.
- Number of wild life sanctuary is 441.

BCLL Project Publications

Database Utilization

S No.	Usage	Organizations	Media	Application
1	NTFP abundance	Andhra Pradesh, Tamil Nadu, Jharkhand, Punjab and Orissa State Forest Departments	Reports, digital maps and inventory in digital forms	NTFP spp. maps with spatial distribution of its qualitative .abundance
2	Forest Working plan preparation	Orissa, Tamil Nadu, Punjab, Jharkhand and Andhra Pradesh, West Bengal, Uttaranchal and Andamans	Reports, digital maps and inventory in digital forms	For the preparation of working circles, inventory design, and inputs for chapters on biodiversity and disturbance.
3	Protected Area Management	Andhra Pradesh, Punjab, Meghalaya and Orissa State Forest Departments, Wild life Institute	Digital map data for Spatial Analysis	Corridor analysis for joining the PAs. "Nomination of Suitable Sites in Western Ghats under UNESCO's Natural World Heritage List"
4	Biodiversity Registers	Biodiversity boards of state and NGOs viz Kalpavriksh, ATREE.	Reports, digital maps and inventory in digital forms	For documentation of the Local biodiversity wealth.
5	Bioprospecting of chemical principles	Regional Research Labs, Bhubaneshwar	Reports, digital maps and inventory in digital forms	Screening and bioprospecting the plant for high value chemical extraction.
6	Niche Modeling and local habitat description.	Department of Space R&D projects, Research Organizations; FMR-CDF, Chennai (NGO);	Reports, digital maps and inventory in digital forms	For mapping the potential niche of the important or Key Species
7	Biodiversity change and fragmentation studies.	Uttar Pradesh, Madhya Pradesh, W.B., SFDs and Andhra Pradesh Biodiversity Board; SACON; MS Swaminathan Research Foundation (MSSRF), Chennai	Reports, digital maps and inventory in digital forms	For mapping the size class distribution of forest fragmentation patches for prioritization for conservation as well as base line data for future Biodiversity monitoring; Impact of climate change on lichen biodiversity
8	Economic & Ecosystem service Evaluation	SFDs	BCLL Reports & Geospatial data	Economic Evaluation inputs for working plans
9	Policy, Planning and Monitoring.	State Biodiversity Boards, SFDs and MOEF; Forest survey of India; Environment & Wildlife Management Department- Sikkim; Wildlife Research and Conservation Society (WRCS), Pune	Reports, digital maps and inventory in digital forms	For compliance to the communications to be made to CBD for 2010 and for Conservation & prioritization, Green India Mission, Sikkim Biodiversity Conservation and Forest Management Project, Conservation, wildlife management

Biodiversity Information System - Scientific Relevance



REMOTE SENSING CAPABILITIES

CROSS DISCIPLINARY INTERFACE

SCIENCE Questions

Species Distributions Habitat Relationships Models (eg. Gap Analysis)	Multivariate Modeling Long term Datasets	Extinction Models Multi-temporal Data (eg. Global Change)
Inventorying Patterns	Formulating and Testing Hypotheses	Monitoring and Forecasting Changes

Biodiversity Information System

www.bisindia.org

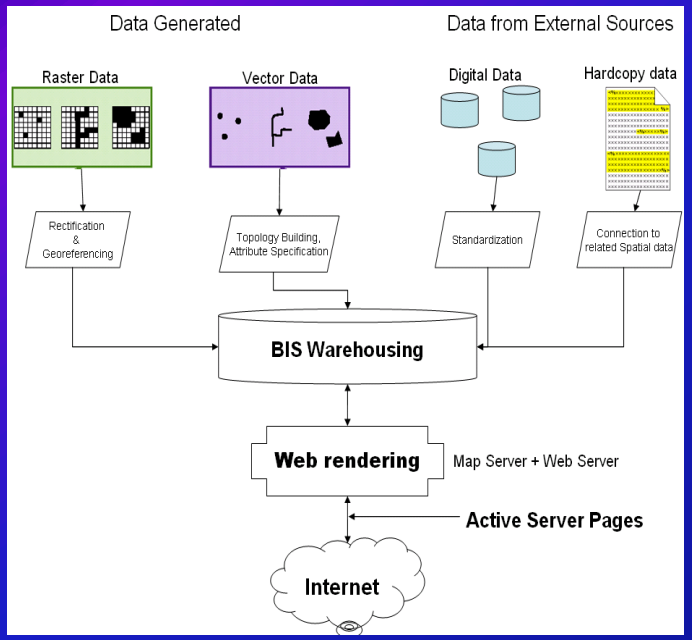
The motive of conceptualization of Biodiversity Information System (BIS) is collection and organization of the available but distributed spatial and non spatial database, into an interactive system which is capable of presenting a user friendly and easily accessible interface to its clients;

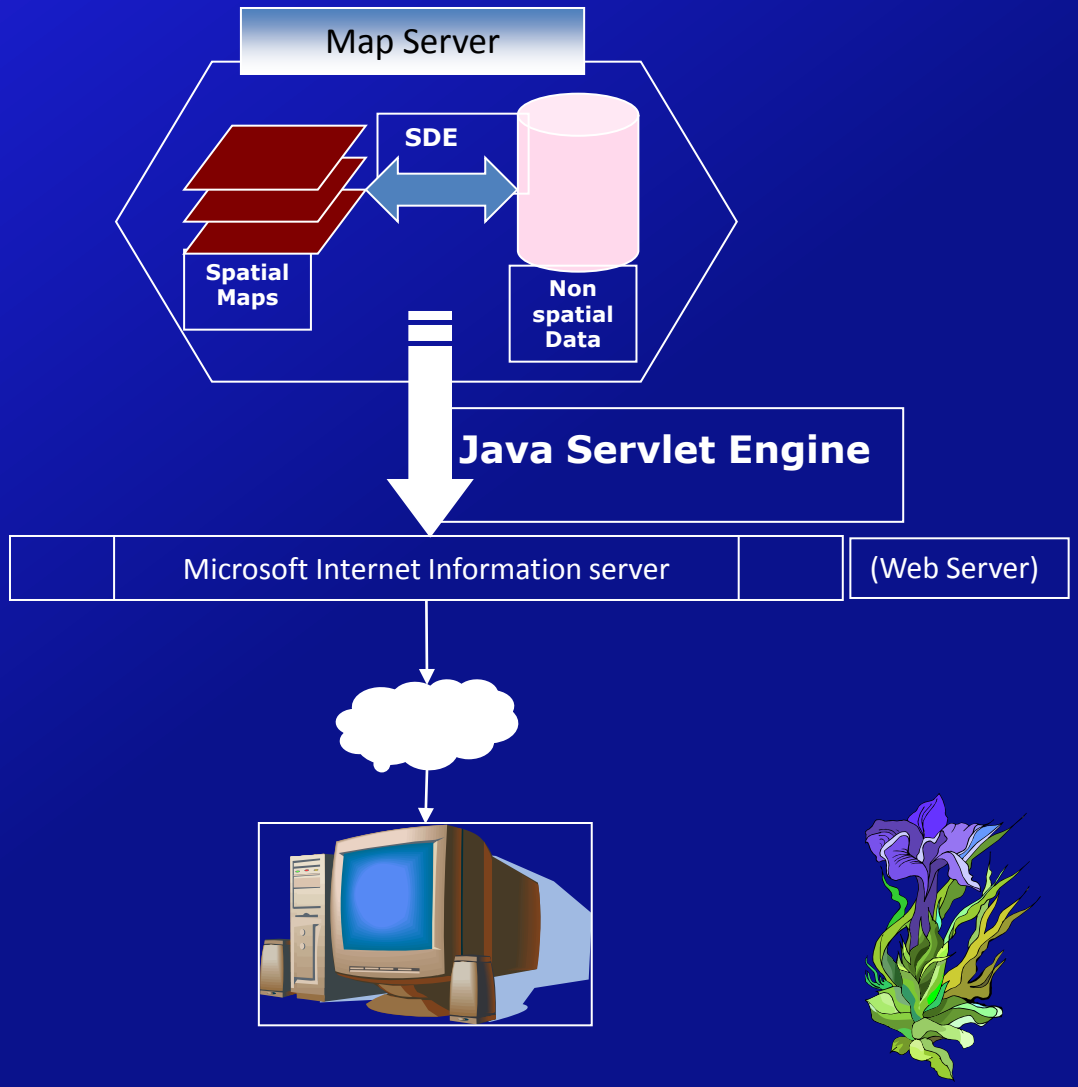
A Centralized repository of BCLL Phase I, II & III is available with interactive GUI for data access and dissemination.

Biodiversity information system (BIS) enables

- Interacting ,querying and region specific conservation planning
- Overlay of spatial products with administrative boundaries and base details
- Access and analyze ~16200 strong point phyto-sociology data against vegetation type and ecoregion
- Access to ecological categorization (rare, endangered ……..) of species studies

Approach and Architecture





Operating System :

Microsoft Windows 2003 standard server

Web Server :

IIS/ Apache

Internet GIS Software :

Arc GIS &UMN MapServer 4.X

Database engine :

Oracle 10G

Inputs to the Biodiversity Information System

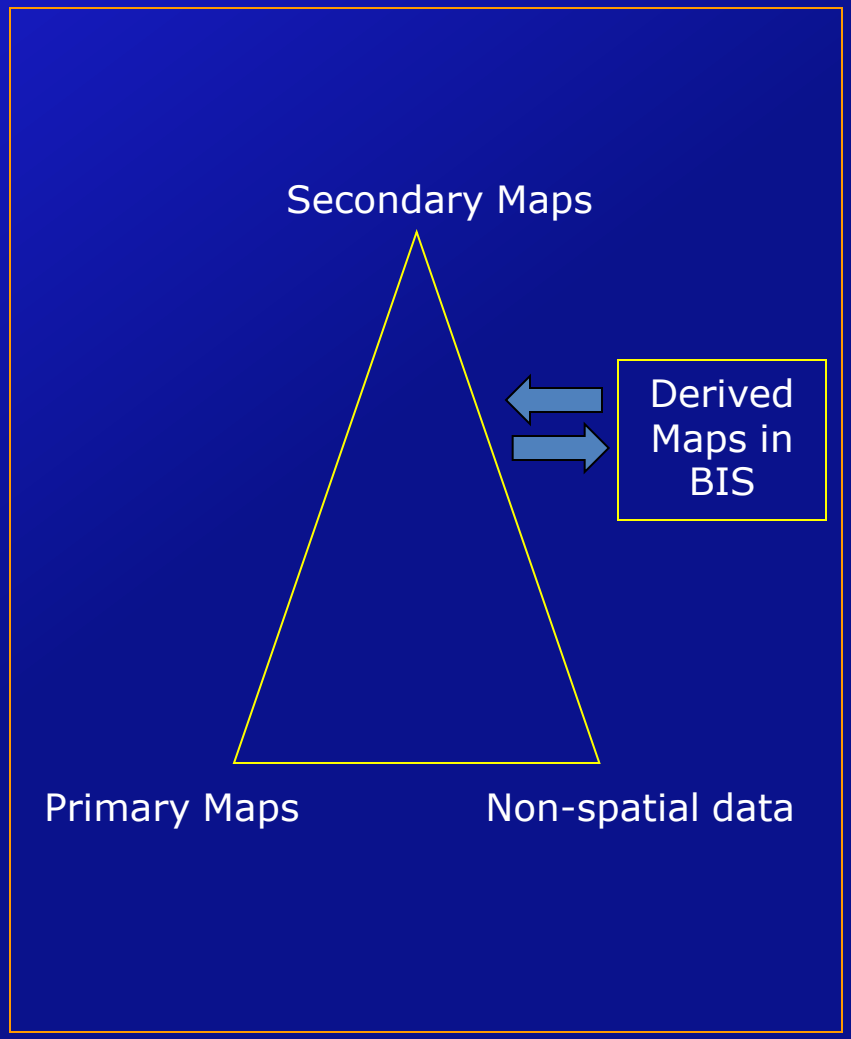
Primary data sets

1. Field Data
2. Vegetation Map
3. Fragmentation Map
4. Disturbance Regimes
5. Biological Richness

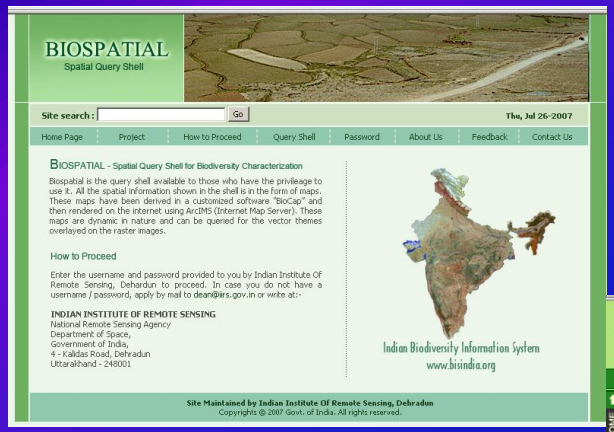
Additional data sets/ Secondary Maps

- Digital elevation models
- Village location, road network, drainage information ;
- Survey of India toposheets (1:250,000 & 1:50,000 scales)
- Biogeographical digital maps (WII, Dehradun)
- Climatic maps of NATMO on 1:1 million
- Agroclimatic maps for entire country

  (National Bureau of Soil and Landuse Survey, Nagpur)
- Socio economic data of national census 1991 & 2001
- Protected Area Network map (WII, Dehradun)
- Forest/ Vegetation Cover Maps (FSI, Dehradun)
- Administrative boundaries (SOI, Dehradun)
- High resolution climate data (1km resolution)
- High resolution DEM (10m)
- Land Use and Landcover Map
- Soil Map with profile attributes



Biodiversity Information System



BIOSPATIAL

Regional and State level maps of the Phase I & Phase II of BCLL on Vegetation Type, Fragmentation, Disturbance Regimes, Biological Richness in addition to the Satellite data used. Dynamic querying at any specified spot on maps is

PHYTOSIS

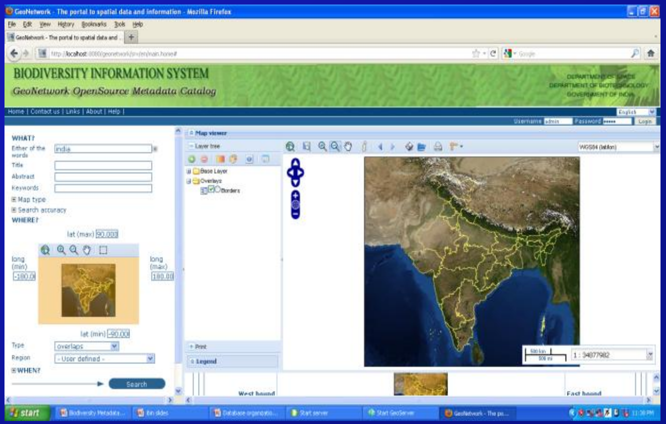
Non Spatial Information of the sampled species in the identified biodiversity hotspots. Contains Species dependent, Species independent (eg. Location wise) and Plot wise queries on the available database.

Related Systems

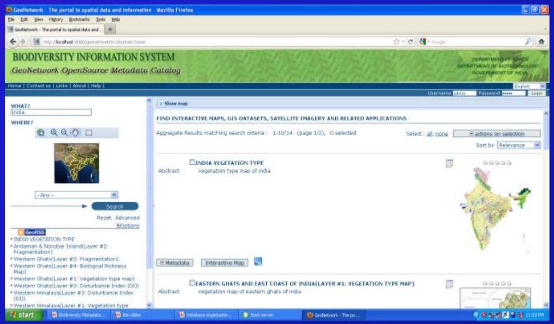
FRIS, BIOSPEC, BioConsSDSS are some of the related development where the BCLL project outputs are one of the critical and important inputs

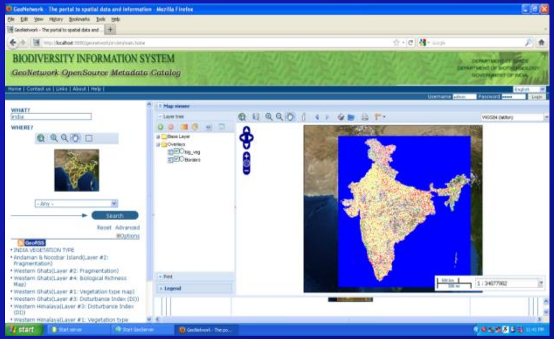
BIODIVERSITY METADATA CATALOGUE USING OPEN SOURCE

Biodiversity Metadata Catalogue Portal is a standard based and de-centralised spatial information management system, designed to enable access to geo-referenced biodiversity databases and from a variety of data providers through descriptive metadata, enhancing the spatial information exchange and sharing between organizations and their audience, using the capacities and the power of the Internet.



WHAT





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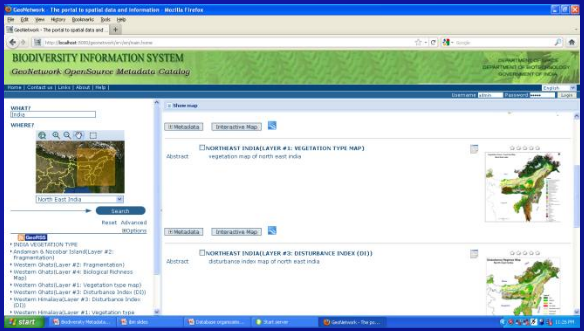
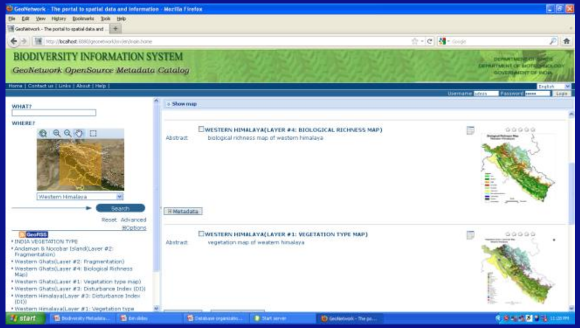
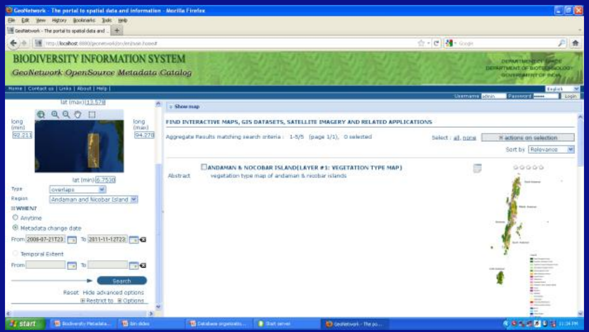
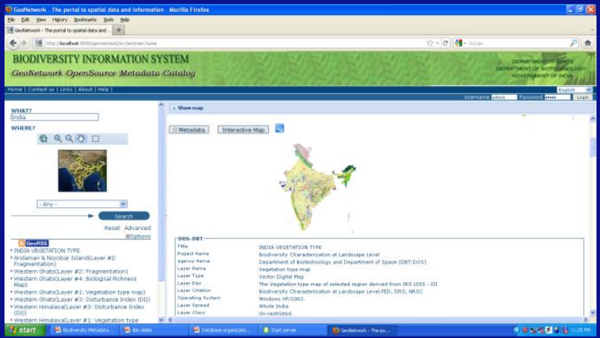




WHEN





Indian Bio-resource Information Network

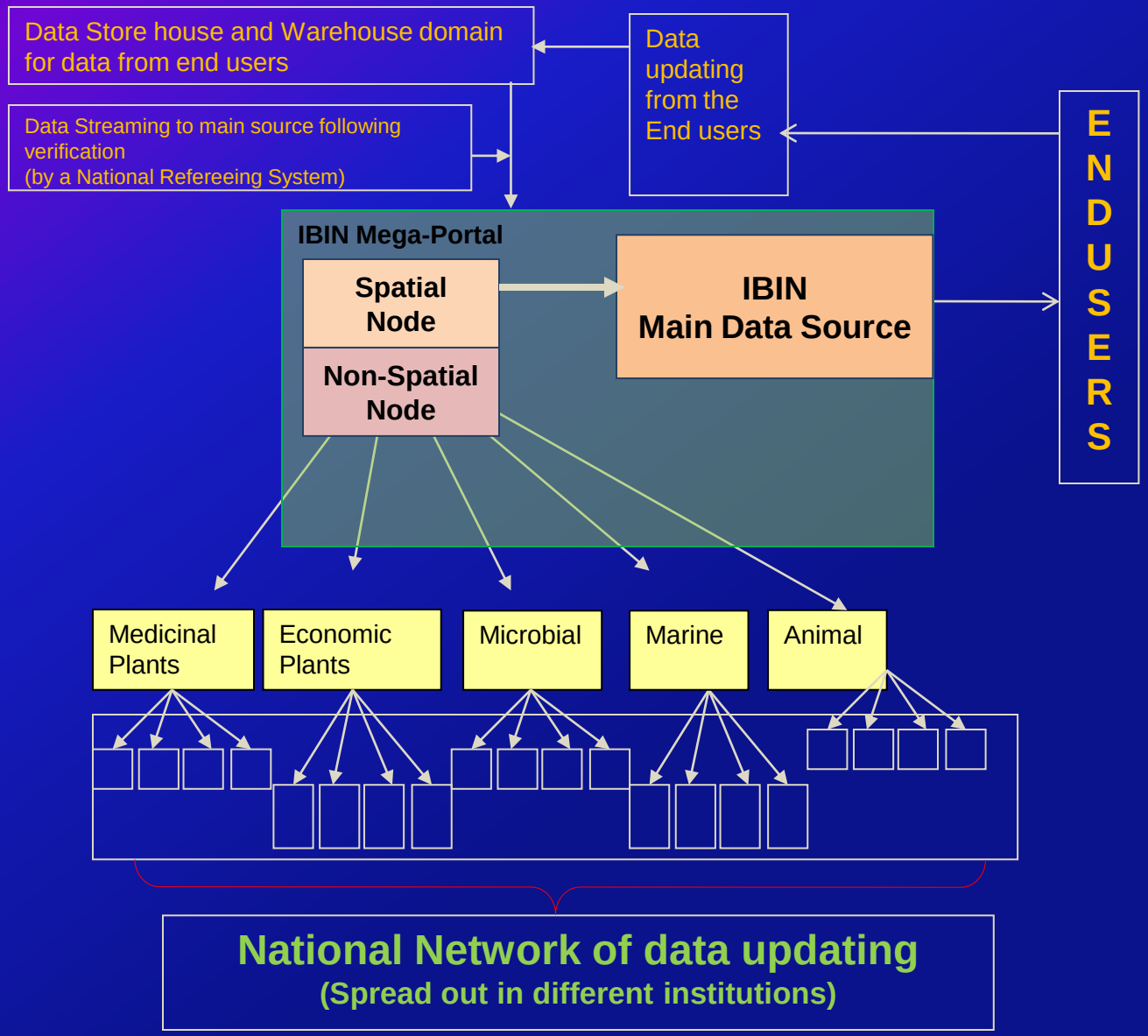
There is an urgent need to bring in one common platform the distributed information on biodiversity like :

- faunal data of Zoological Survey of India,
- Historical plant species and distribution database of Botanical Survey of India,
- other biodiversity related database of various other universities and institutions,
- traditional knowledge mostly unwritten about the medicinal properties and other economic uses of the plants and animals.

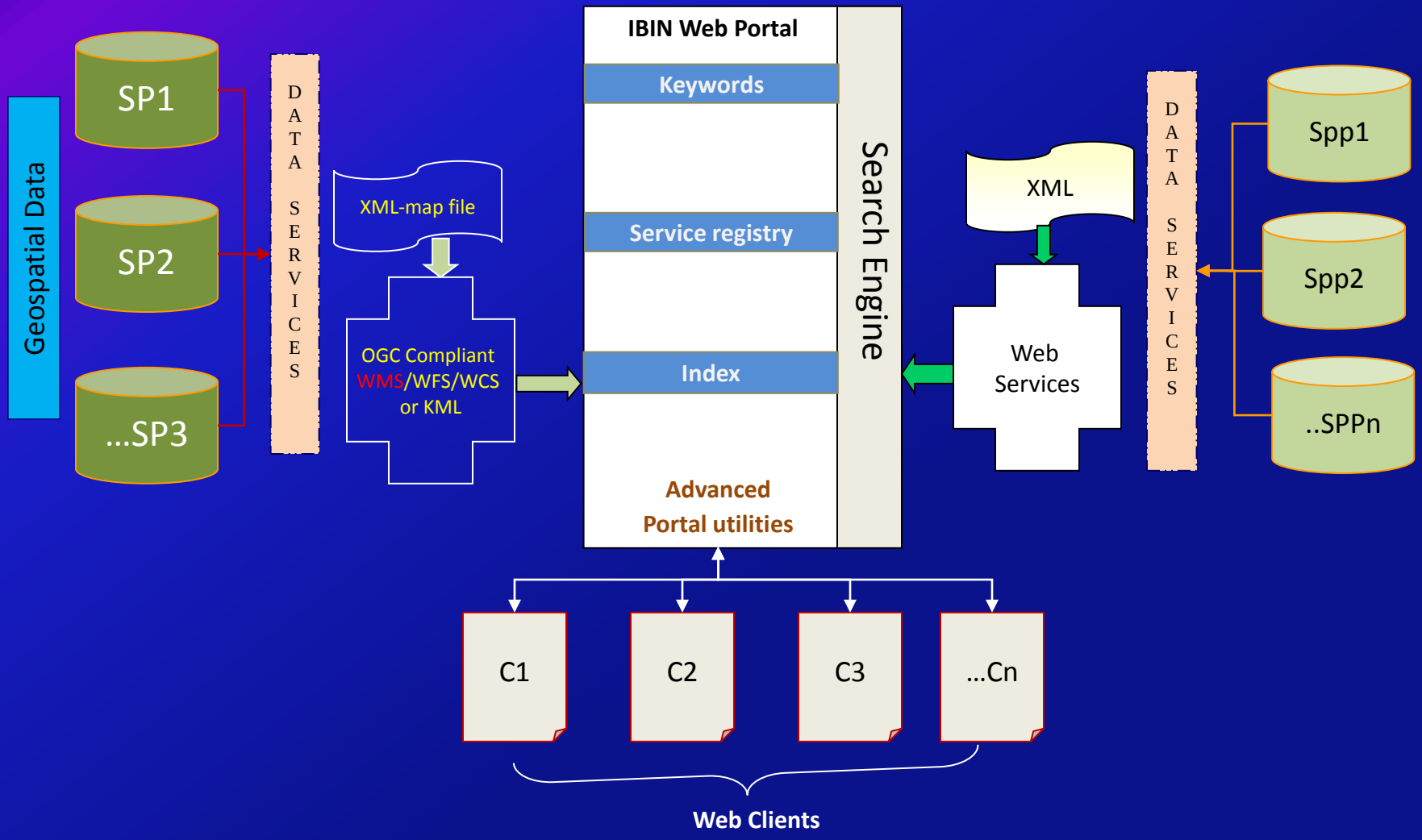
The web-portal enables data organization, services and dissemination wherein each data source of the parent institution will act as a node for web portal in form of Indian Bio-resource Information Network (IBIN).

(www.ibin.co.in)

INTEGRATION OF BRICS AND CORE DATA SETS INTO IBIN PORTAL



SYSTEM ARCHITECTURE FOR IBIN PORTAL



Database contributed by nodes and brics

IIRS - Spatial Node

BCLL National Spatial Database

- Vegetation Type
- Fragmentation Type
- Disturbance Index
- Biological Richness

BCLL Sample Plot Grids:
16518 Sample Plots

- Grid Based field plots
- Sample Plot Info
- Species Info
- Species Diversity Info
- Medicinal Info
- Economical Info
- Endemic Info

UAS - Non Spatial Node

Databases of biodiversity and bioresources in India

Digitized inventory of Plant and Animal Resources

- **Plant Resources of Karnataka**
- **Sasya Sahyadri:** 6,100 species of plants of Western Ghats,
- **Sasya Bharathi:** 13, 000 species plants of South India
- **Crotalaria – Sesbania:** 175 species of genera *Crotalaria* and *Sesbania* of India
- **Sahyadri Pathangam:** 300 species of butterflies in Western Ghats
- **Pathanga Suchya:** 120 species of butterflies of the Bangalore region
- **Bird database**: 1200 species of birds
- **Other Insect databases**: Tiger, Beetle and Ants
- **Sasya Sampada:** Medicinal and Economic Plants of India

BRICS

FRLHT: Medicinal plant database especially Ayurveda / Sidhdha Unani

Swarigpa and Folk data Nomenclature corrélation, taxonomy, images etc

NBRI: 7520 Herbarium specimens 1977 Plant sps Morphology Distribution and Legumes

NEHU: Spatial and non-spatial data on Helmenth parasites, mosquitoes, fish and insects Plants Microbes, Fermented food and beverages Nematodes (AICOPTAX)

IHBT: High altitude plants (1000)-Taxonomy, distribution, uses of plants and images. Spatial data and geo-reference data

ATREE: Bird data, Plant database, Ants database and Public domain data captured on IBIN Portal

CASCCR, KOLKATA: Cytogenetics data, karyotypes and chromosome images of Plants 2015 species:

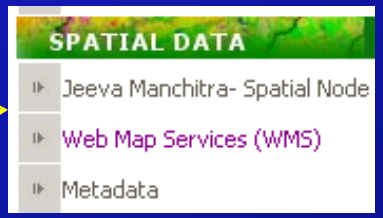
UAS, Bangalore

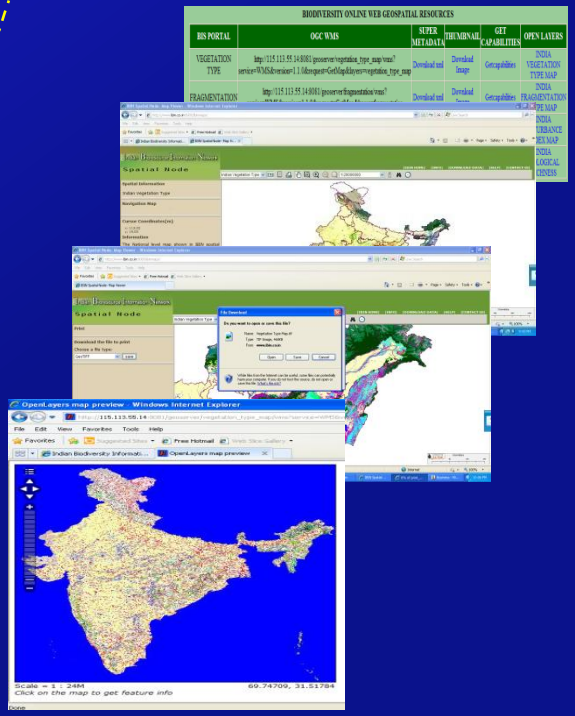
Distributed Searching Portal

Service Registry Catalogue
- Spatial Data
- Species Data

(www.ibin.co.in)

IIRS, Dehradun





INDIAN BIORESOURCE INFORMATION NETWORK

Species Data Browsing
- Jeevsampada
- Plants of India
- Western Ghats Plants
- Butterfly Conservation and Outreach

Spatial Data Browsing
- OGC WMS Services
- Open Layers APIs
- Spatial Data Visualization
- Spatial Data Downloading

Prospective Users and Dissemination

Biodiversity Boards

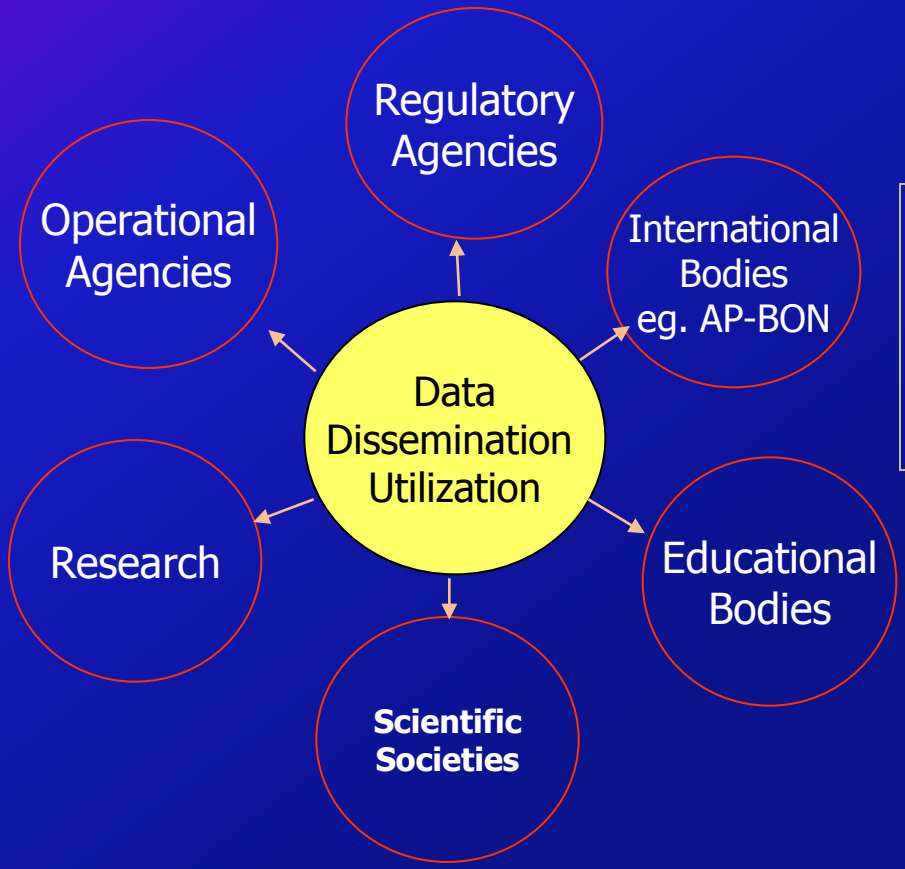
Forest Departments

Wildlife Agencies

Pollution control Boards

NGOs

State & Central Ministries



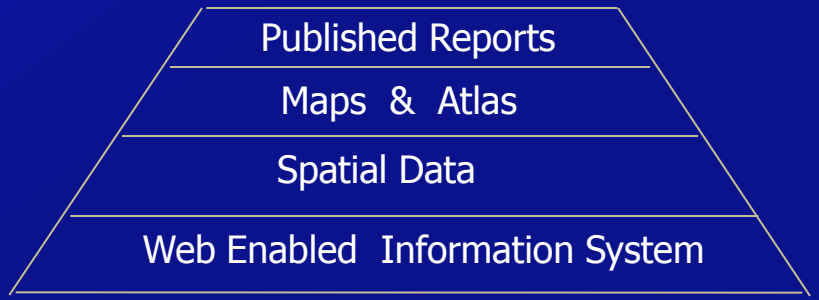
Research Institutions

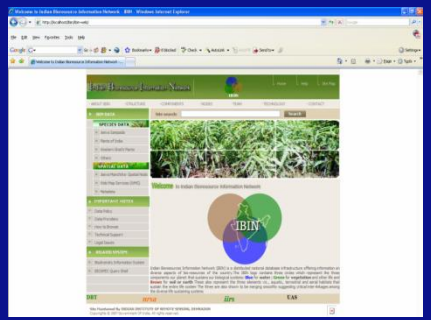
Colleges

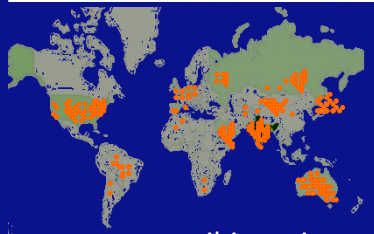
Schools

Scientific bodies

Biodiversity Information System (BIS)
www.bisindia.org







www.ibin.co.in

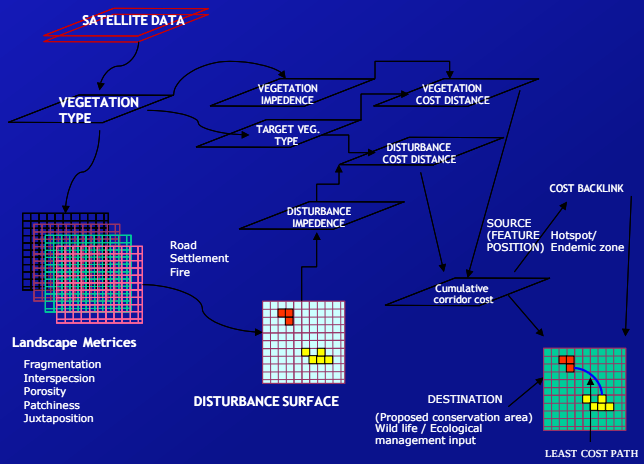
Indian Bioresources Information Network (IBIN)

Ongoing, proposed and future research directions

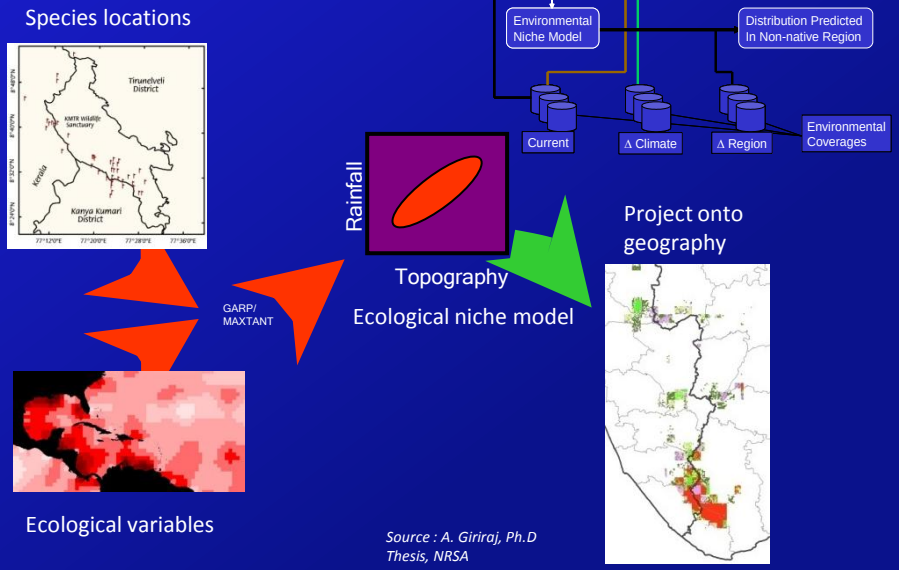
High altitude ecosystem studies in Indian Himalayas

- Ecosystem service valuation
- Carbon sequestration and stock
- Disturbance
- Fragmentation

Geospatial Modeling of Ecological Corridor

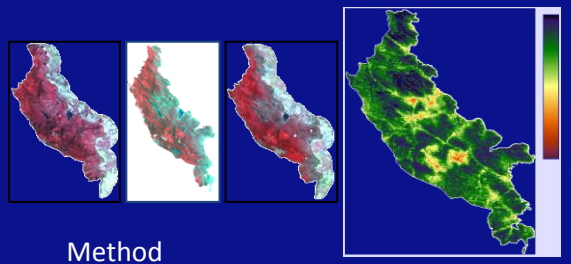


Species niche modeling

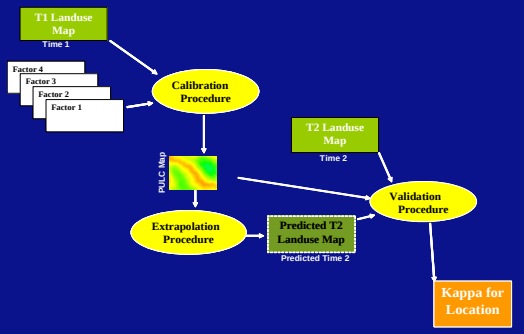


Source : A. Giriraj, Ph.D Thesis, NRSA

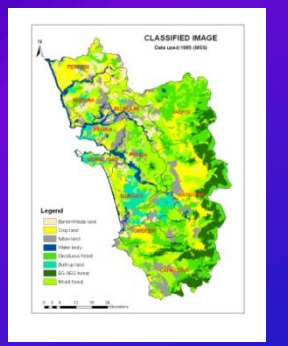
Land cover change simulation

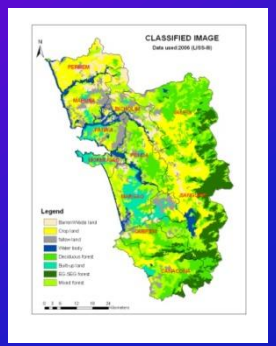


Method



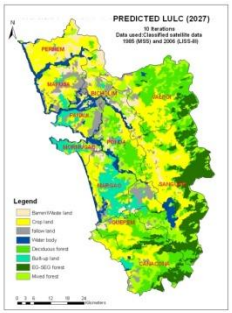
Ongoing proposed and future research directions





AGENT BASED MODELING

Habitat Change Modeling



Potential Niche Modeling

- Historical Herbarium collection
- Primary Data collection
- Climate Sensitive species
- Rule based Optimization techniques
- Species specific Bioclimatic envelop
- POTENTIAL NICHE SURFACE

Future Climate Scenario (From GLCs)

Species loss Model

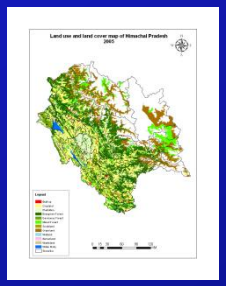
- Potential Niche Surface
- Habitat Change Maps
- Modified Niches
- Habitat Shifts
- Potential Invasive niches

PROJECTED SPATIAL SPECIES LOSS/ SPECIES COMPOSITION

Habitat change Modeling

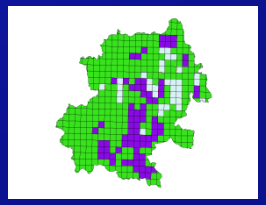
- Temporal Habitat Map (t1, t2, t3)
- Biotic Disturbance data
- Species data
- Geospatial Analysis
- Identification/ Quantification of Driving factors
- Habitat Change Proneness Map (T1, T2, T3)
- Validation with existing data
- PREDICTED CHANGE MAP

species loss modeling



Future Scenario (2025, 2050)

IPCC climate change Scenario

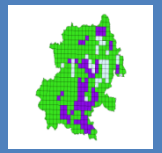


Potential Areas of Species vulnerability

- Time 1
- Time 2
- Time 3

SPATIAL MODELING

GRADIENT OF CHANGE



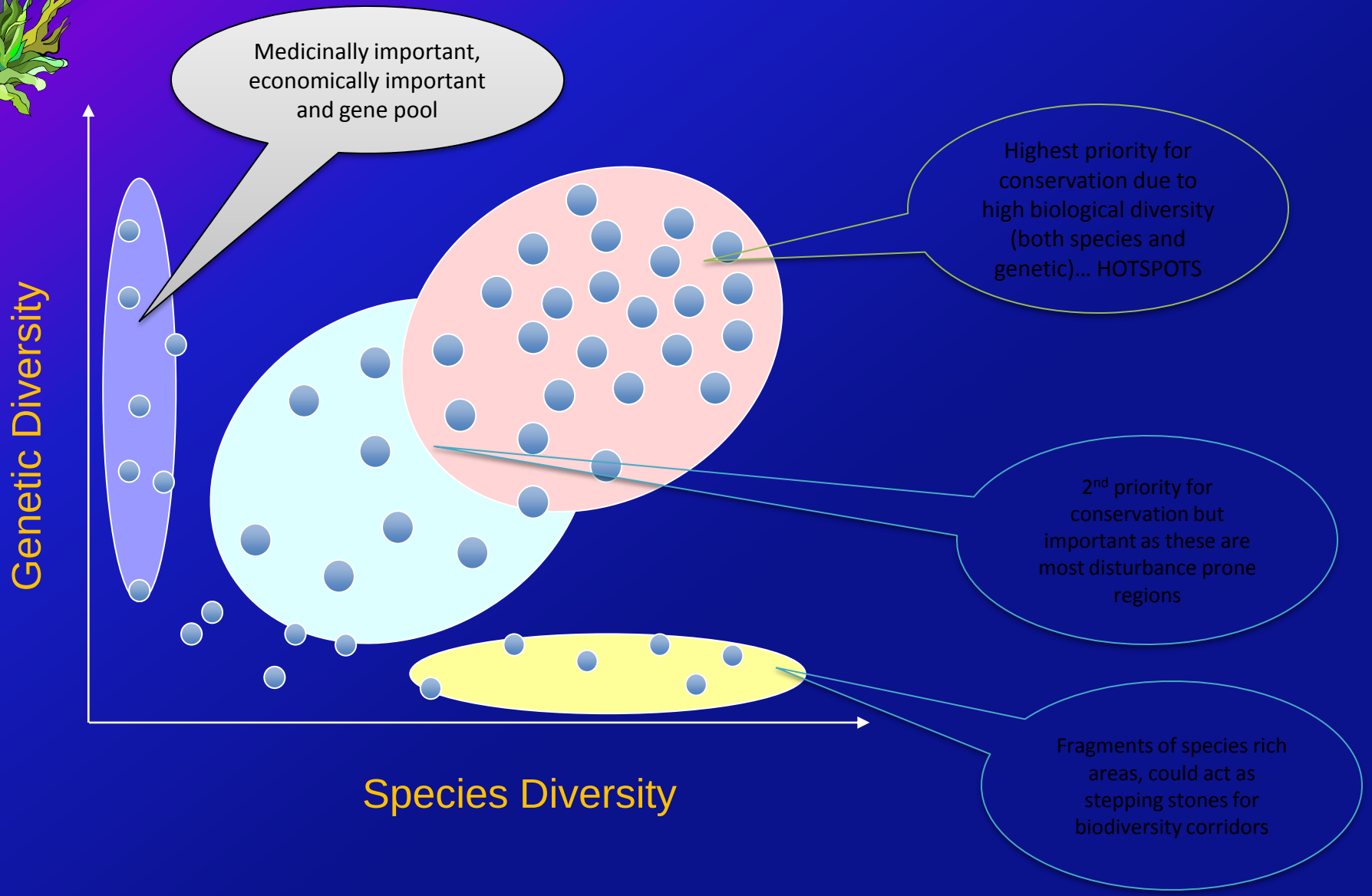
HOTSPOTS OF CHANGE

FIELD WORK

Phyto-sociological data collection for niche modeling & species loss modeling

Modeling change hotspots

Approach for Prioritization









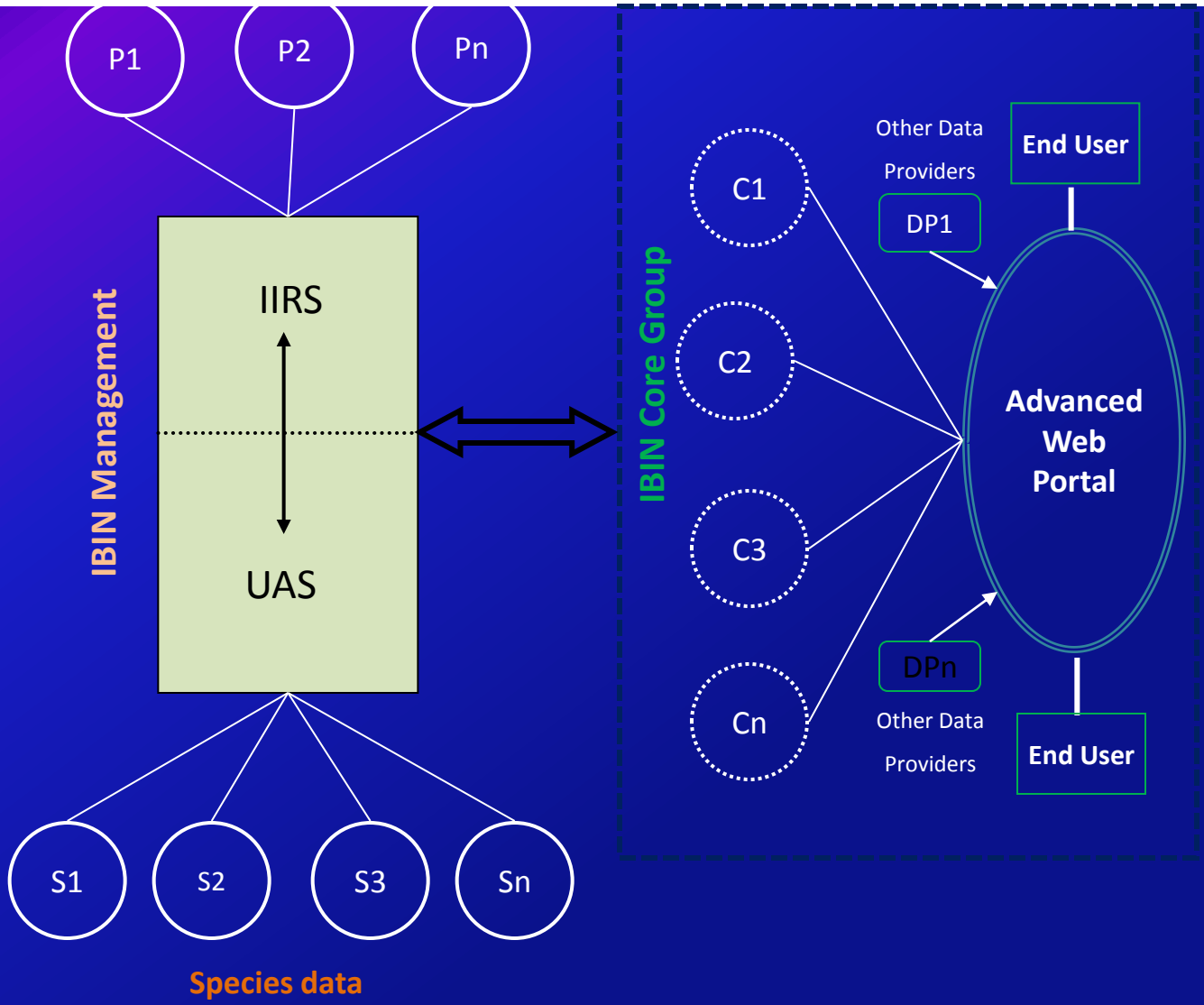

Decade of biodiversity signifies

value of biodiversity to all our lives

Space provides vantage point for monitoring and studying biodiversity as a complete system.....

Thank you.....

Spatial data from National Projects



- **Level 1– *The core contributors* :**

  Consortium of DBT, IIRS, UAS and primary line departments, institutions with core strength, Industries and NGOs

- **Level 2 – Data contributors**

  The individual scientists, users and other NGOs