Terrestrial Remote Sensing
@ Department of Remote Sensing
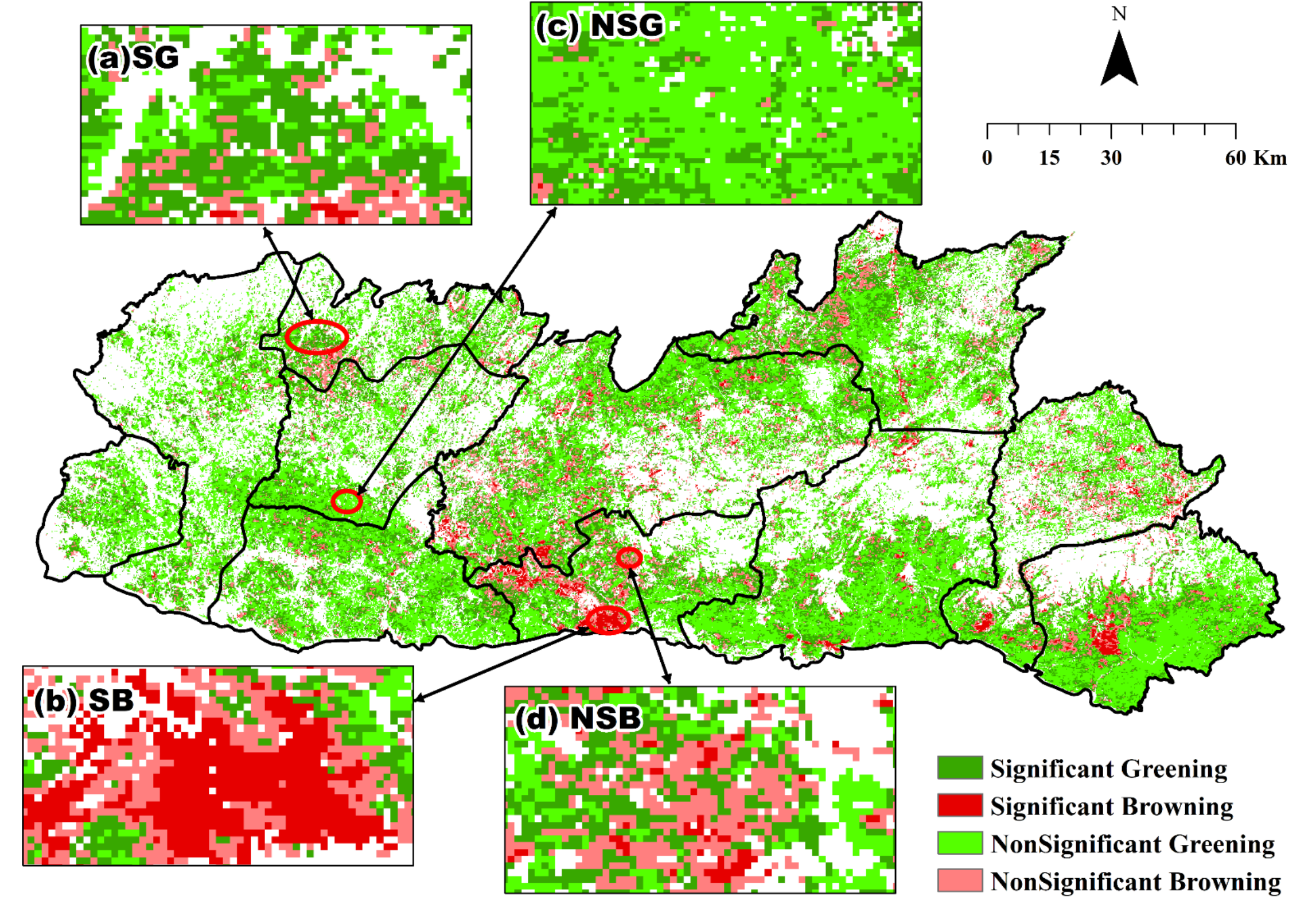
IRS-1A   IRS- P6   Cartosat-2

TERRESTRIAL REMOTE SENSING

Hydrology
Soil
Forestry
Agriculture

Use of RS in Land Surface Studies done @ BIT Mesra
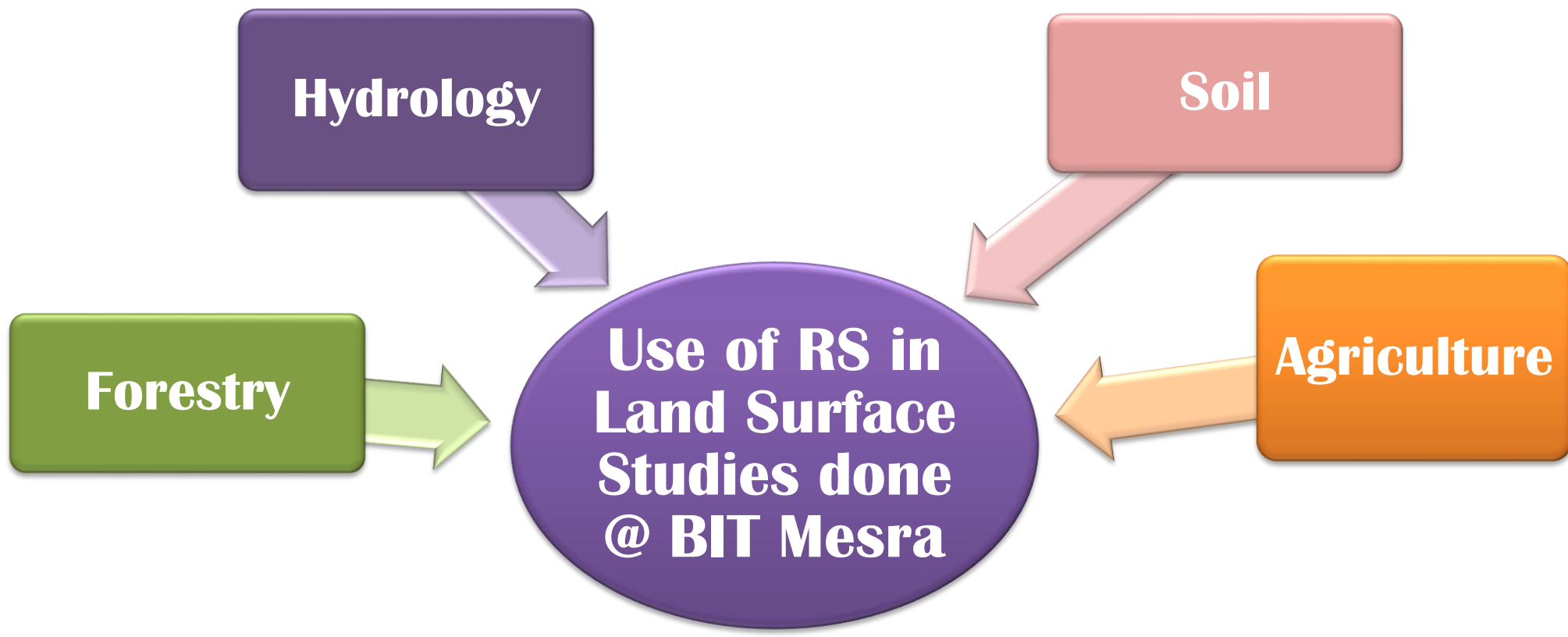
Major Research Areas

- Modelling Space-Time vegetation dynamics
- Land Surface Phenology
- Climate Change Impact Analysis
- Soil Moisture Studies
- Soil Erosion Risk Analysis
- Landscape Metrics and Modelling
- Morphometric analysis and Watershed management
- Landslide Susceptibility Assessment and Zonation

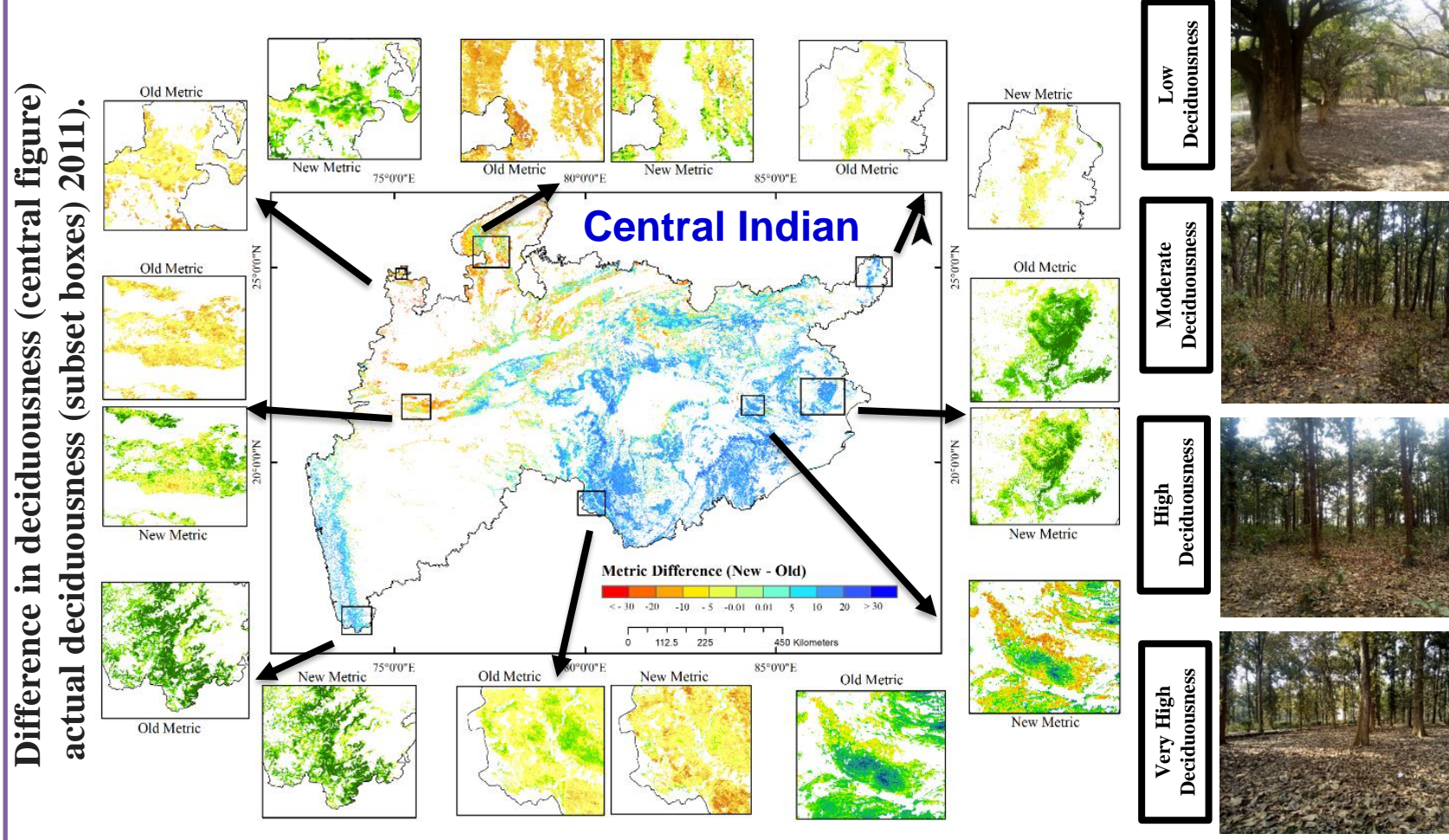## Monitoring and Modelling Vegetation Dynamics and Climatic Controls

(a) SG   (c) NSG
(b) SB   (d) NSB

0 15 30 60 Km

Legend:
- Significant Greening
- Significant Browning
- NonSignificant Greening
- NonSignificant Browning

Major findings

- 'Greening' **indicates positive** climate-vegetation feedback.
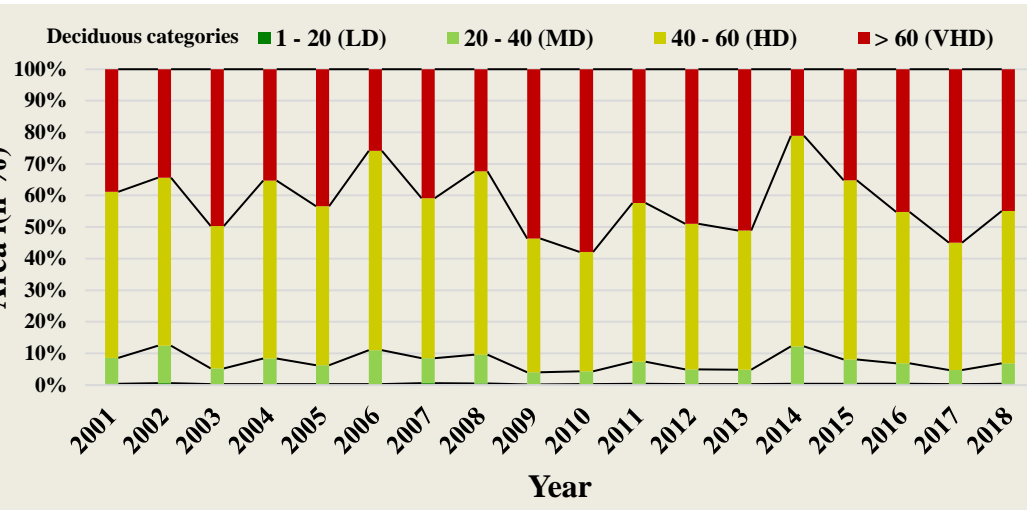- Temperature Controls the vegetation growth in **Meghalaya**

Bhuyan et al., 2022(Under Review)

Leaf-Fall Estimation from Satellite Data

Objective: Develop **metric and quantifying leaf-fall** using remotely derived Satellite data.

Old Metric / New Metric

Low Deciduousness
Moderate Deciduousness
High Deciduousness
Very High Deciduousness

Central Indian

Difference in deciduousness (central figure) / actual deciduousness (subset boxes) 2011.

Metric Difference (New - Old)

Performance of Old and New Improved Metric

Deciduous categories: 1 - 20 (LD)   20 - 40 (MD)   40 - 60 (HD)   > 60 (VHD)

Temporal variation in the percentage area of different categories of deciduousness
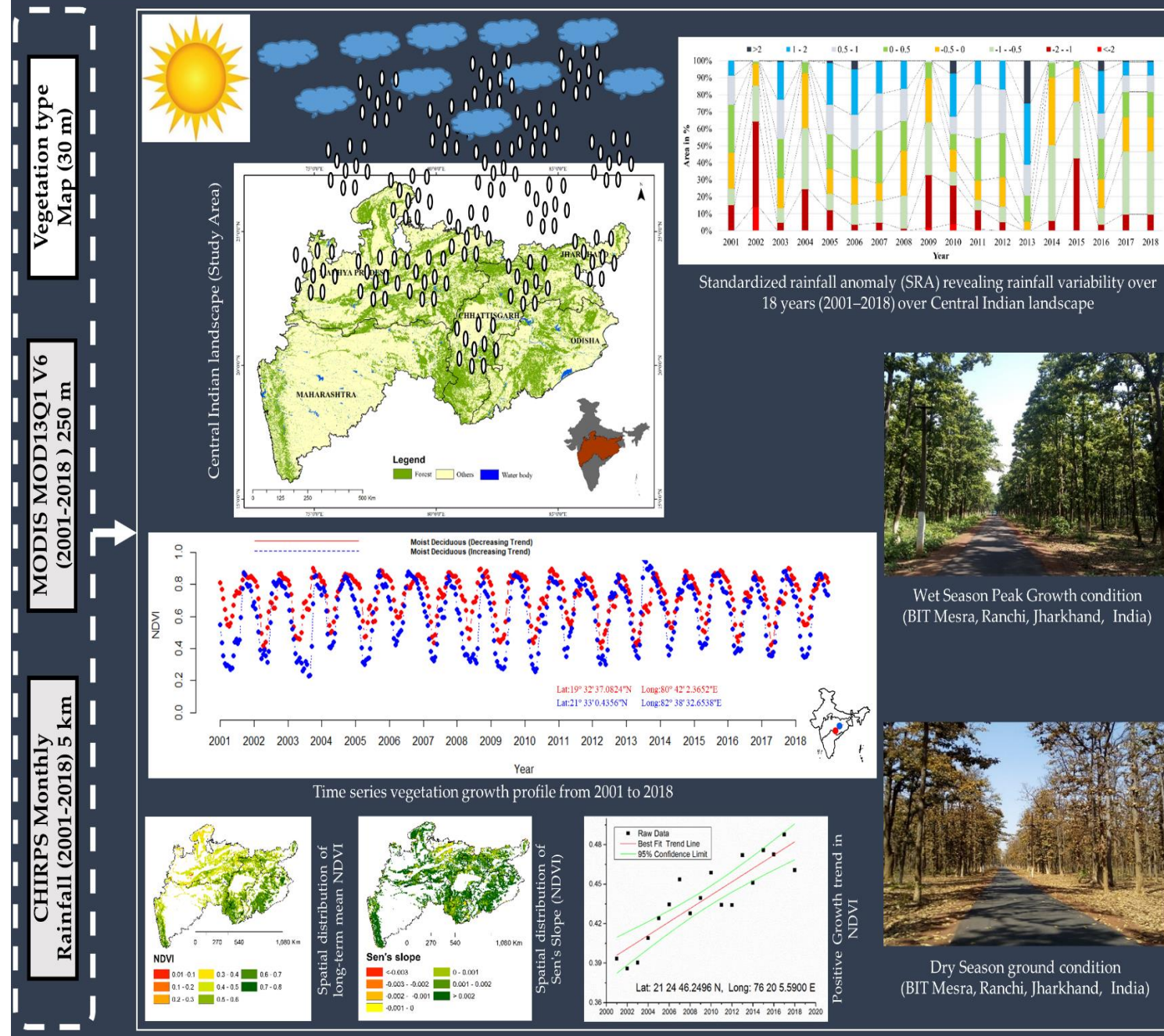
Major findings

- Quantity of leaf-fall was less in water scarce years
- Our metric showed clear relation to ground observation in different forest types and
- Differentiate the deciduous and non-deciduous characteristics of tropical forest.

Singh et al., (2020)

Resilience of Central Indian Vegetation to rainfall variability

Question: Is the central Indian landscape **resilient to rainfall** variability?

Vegetation type Map 250 m
MODIS MOD13Q1 V6 (2001-2018) 250 m
CHIRPS Monthly Rainfall (2001-2018) 5 km

Standardized rainfall anomaly (SRA) revealing rainfall variability over 18 years (2001-2018) over Central Indian landscape

Wet Season Peak Growth condition (BIT Mesra, Ranchi, Jharkhand, India)

Time series vegetation growth profile from 2001 to 2019

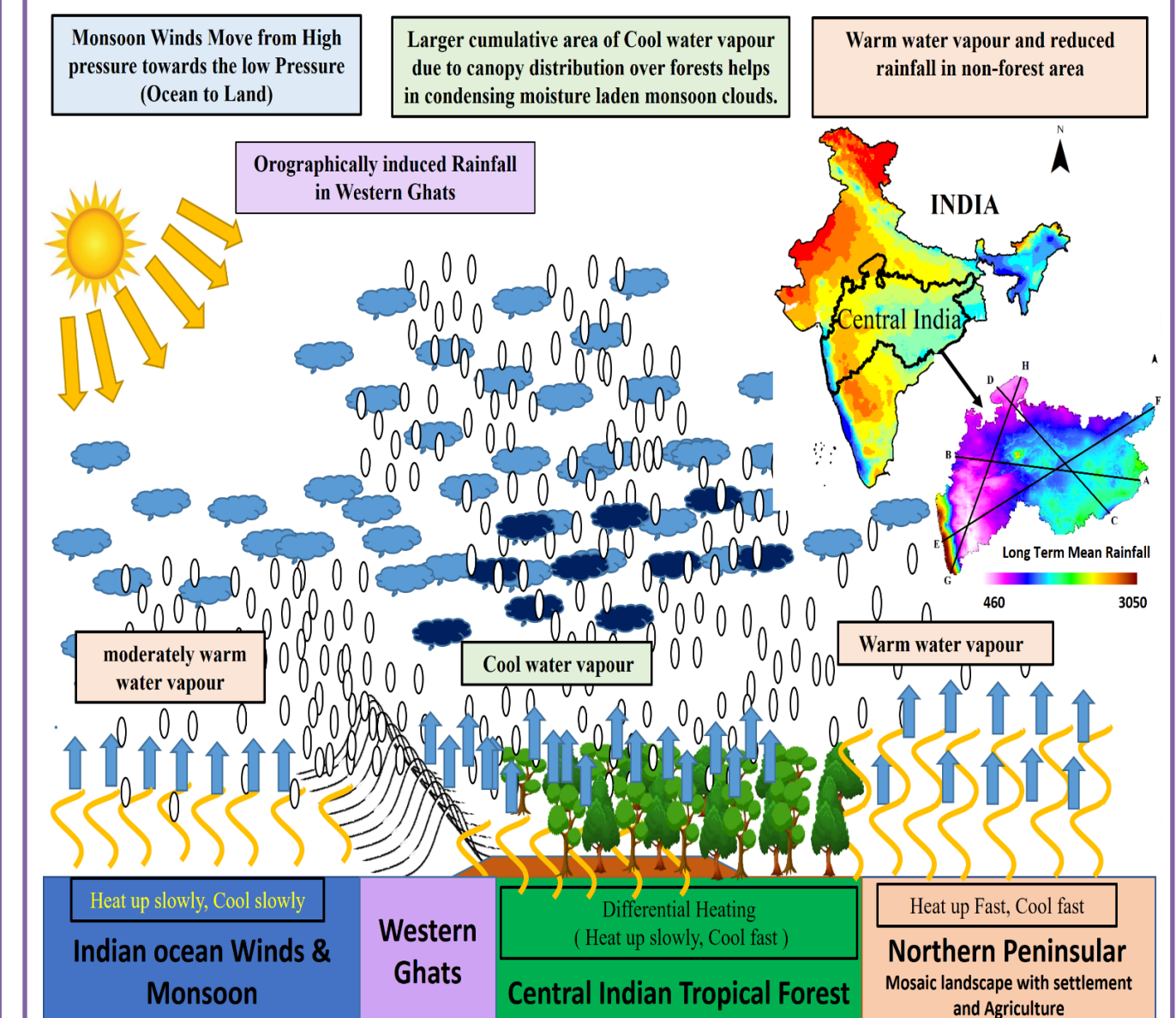Dry Season ground condition (BIT Mesra, Ranchi, Jharkhand, India)

Major findings

- Rainfall is the key climate variable in Central India
- Resistance to dry spells and water scarcity was Observed
- High **resilience** to rainfall variability **and High water use efficiency** relative to climatic oscillations.

Singh et al., (2021)

Influence of Central Indian forests on Rainfall

Question: Do central Indian Forest have influence on regional rainfall pattern?

Monsoon Winds Move from High pressure towards the low Pressure (Ocean to Land)
Larger cumulative area of Cool water vapour due to canopy distribution over forests helps in condensing moisture laden monsoon clouds.
Warm water vapour and reduced rainfall in non-forest area

Orographically induced Rainfall in Western Ghats

INDIA
Central India

Long Term Mean Rainfall

moderately warm water vapour   Cool water vapour   Warm water vapour

Heat up slowly, Cool slowly   Heat up slowly, Cool fast   Heat up Fast, Cool fast

Indian ocean Winds & Monsoon   Western Ghats   Differential Heating   Central Indian Tropical Forest   Northern Peninsular Mosaic landscape with settlement and Agriculture

Average Rainfall   2002   2011   2013   Forest Density
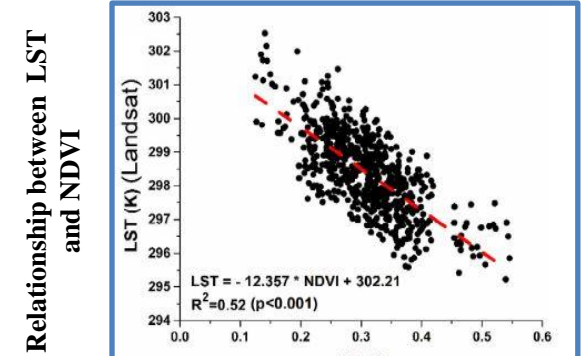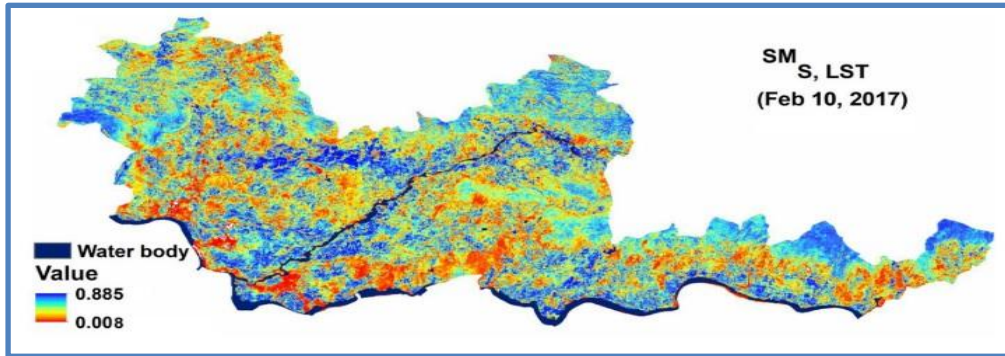
Major findings

- **Reduction in rainfall as we move away** from the forest patches.
- **Dependence of rainfall on forests** which act as condensation machine for central Indian landscape
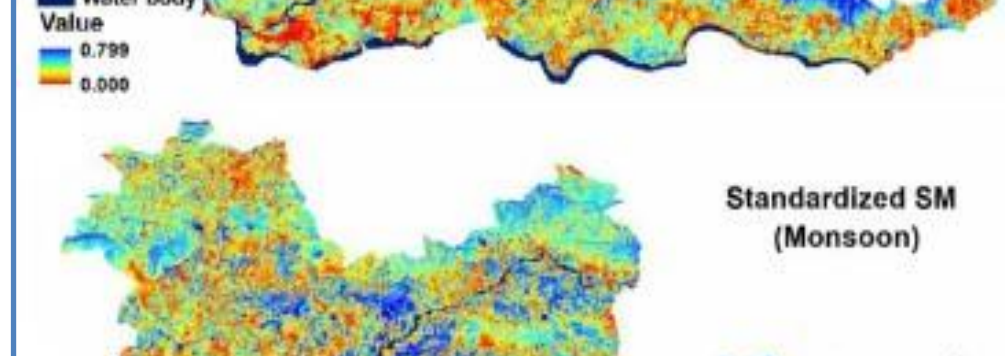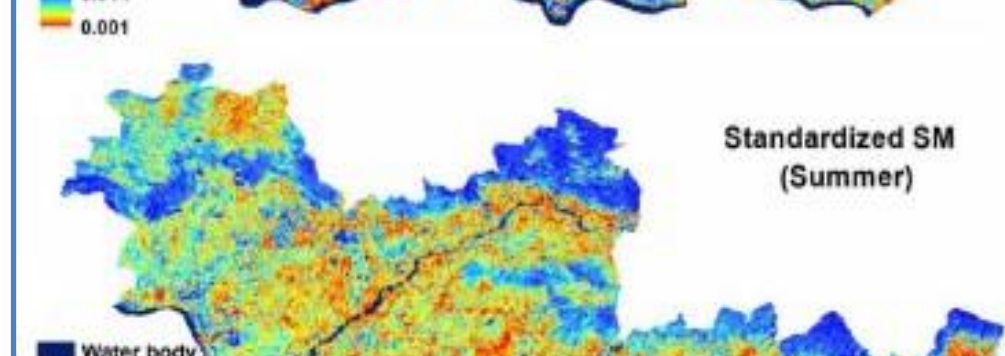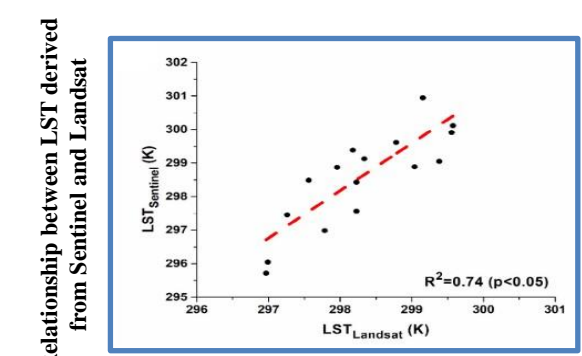
Singh et al., 2022 (Submitted)

Estimation of surface soil moisture

Objective: To derived soil moisture from High resolution Satellite data.

SPATIAL VARIATION

$SM_{S, LST}$ (Feb 10, 2017)

Relationship between LST and NDVI
$LST = -12.367 * NDVI + 302.21$

Water body
Value

TEMPORAL VARIATION

Standardized SM (Winter)
Standardized SM (Summer)
Standardized SM (Monsoon)

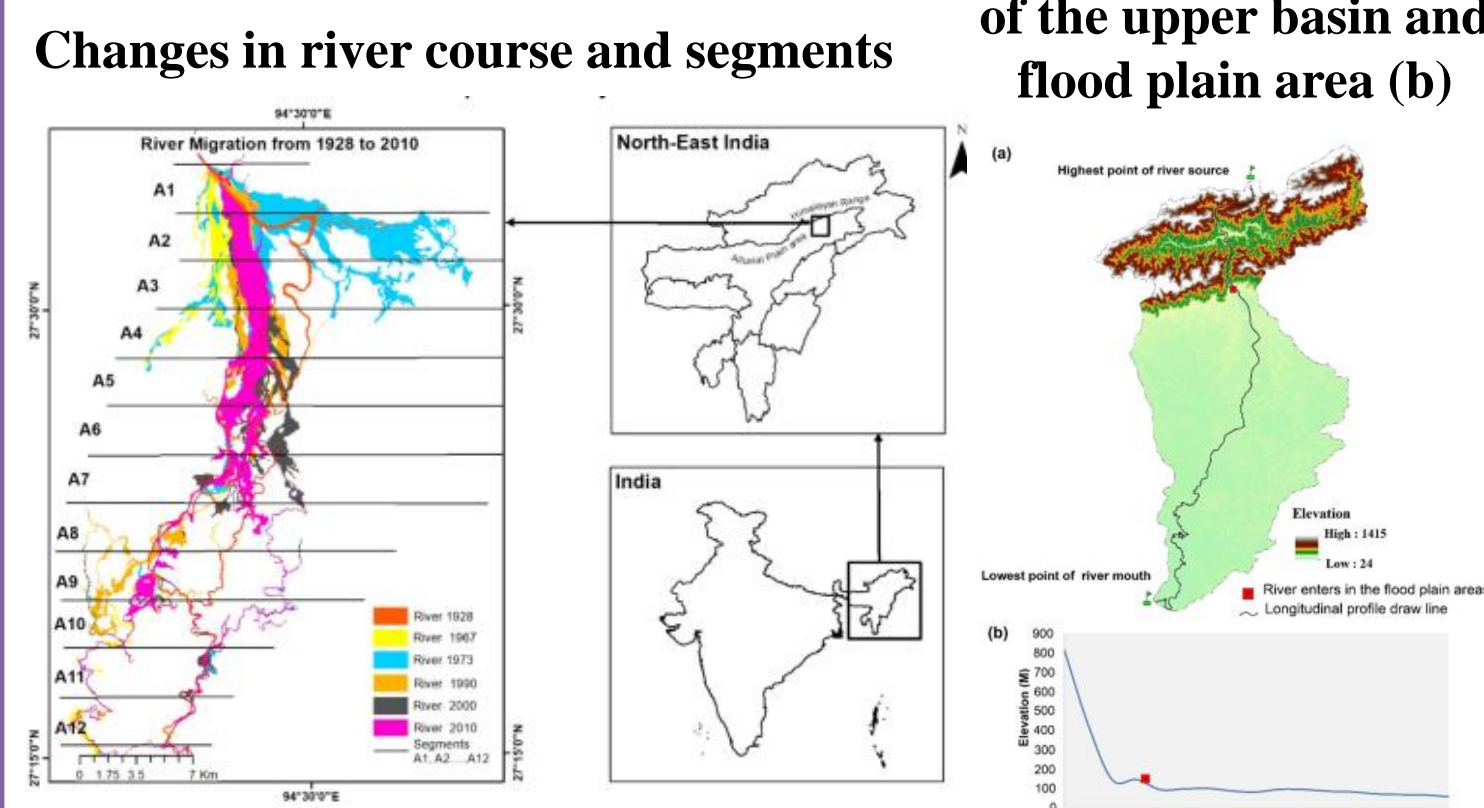Relationship between LST derived from Sentinel and Landsat

Major findings

- Volumetric surface soil moisture was estimated (0-5 cm)
- End-members would vary with spatial and temporal variation.
- Standardization method gives higher temporal accuracy.

Koley & Jeganathan (2020)

Remote Sensing based estimations of river channels migration

Question: Do Jiadhal river changes it course during 1928 to 2010?

Elevation variation (a) of the upper basin and flood plain area (b)

Changes in river course and segments

River Migration from 1928 to 2010
North-East India
India

River channel migration

East Direction bank migration
West Direction bank migration

1928-1967   1967-1973   1973-1990
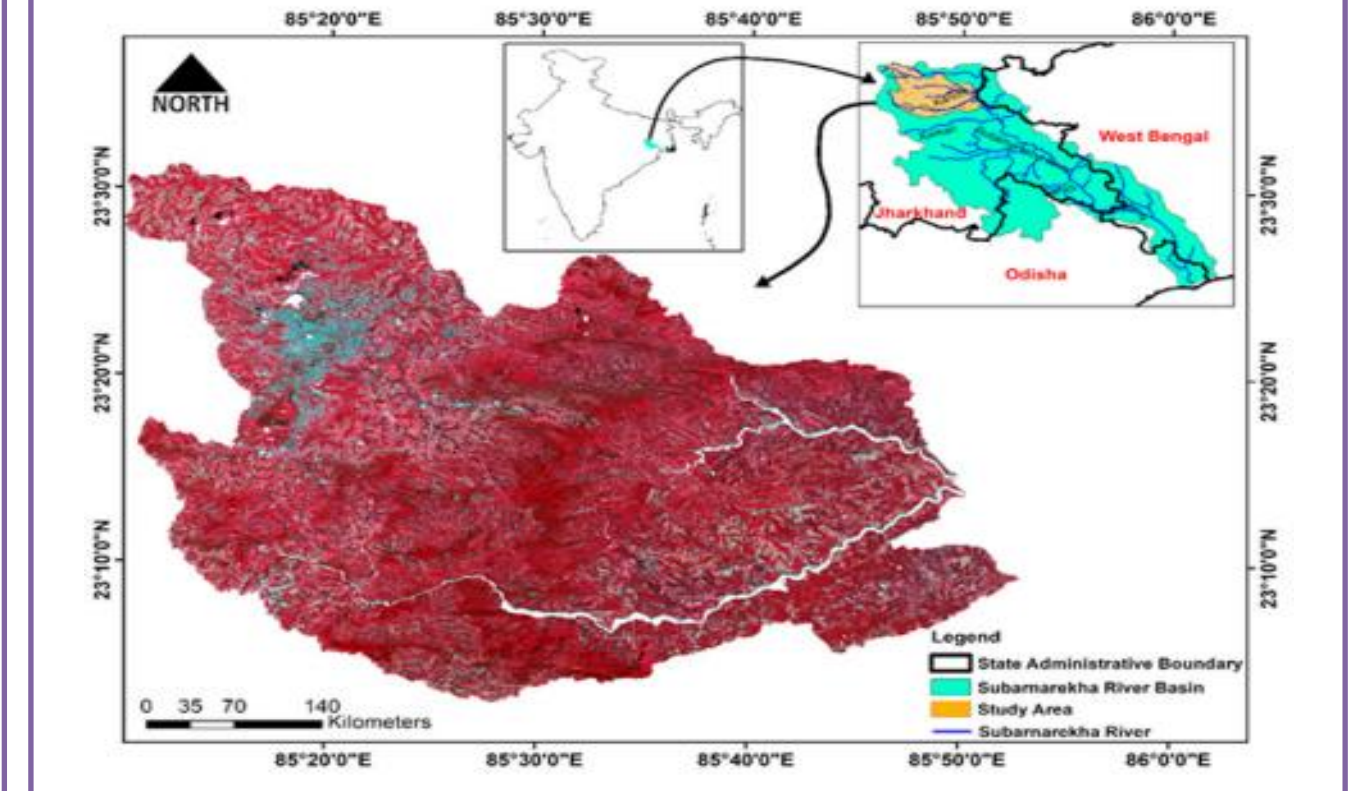1990-2000   2000-2010   A1, A2...River Segments

Major findings

- River bank line frequently migrated upto 20.56 km in segment A5 during 1967–1973. River thalweg migrated 45.6 and 52.6 m/year in segments A11 and A12 from 1928 to 2018.
- Significant LULC changes occurred during 1967–1973 and 1990–2000.

Saur & Rathore (2022)

Geomorphic Control On Soil Erosion

Question: Do Universal Soil Loss Equation (USLE) have potential to determine different geomorphological landforms?

NORTH
West Bengal
Odisha

Legend:
- State Administrative Boundary
- Subarnankha River Basin
- Study Area
- Subarnankha River

Geomorphology Map

Major findings

- Correlation analysis revealed the occurrence of highest and negative correlation of the erosion estimate with PC5.
- Topography factor is found to be pre-dominant among all factors.
- Structural Hill exhibits significantly different erosion estimate with the maximum landform units.

Kathwas & Patel (2021)