Concept of Geographical Information System and its Application

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Definition:

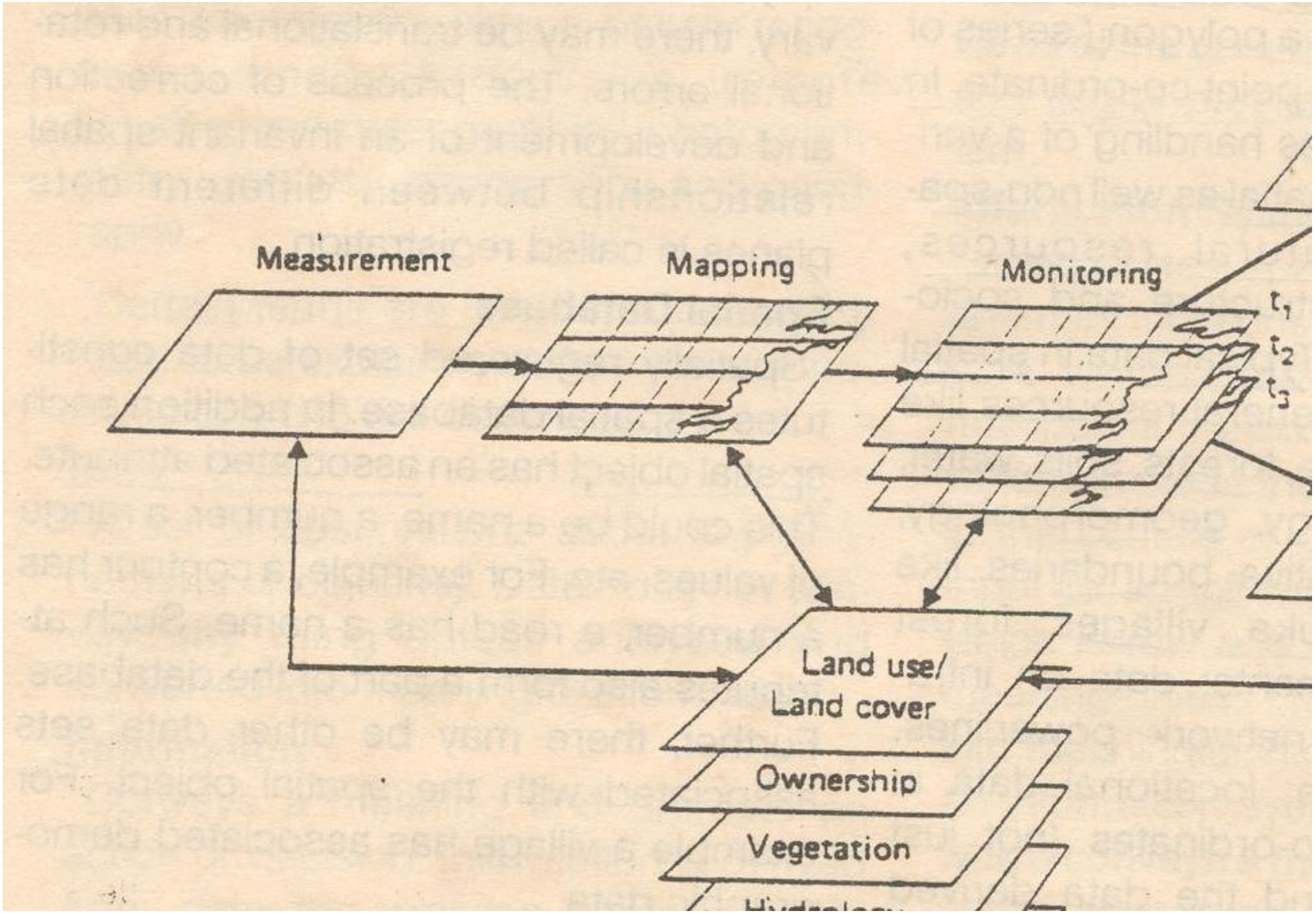
GIS is a decision support system of computer hardware, software, geographical data, and personal designed to efficiently capture, store, manipulation, analysis and display all forms of spatial data for better management of geographical area.

A Generic Definition of GIS:

Geographic= Spatially reference data.

Information= data process into a usable form.

System= A Framework for manipulating, querying, analyzing and dissemination information.


Measurement
Mapping
Monitoring
t_1
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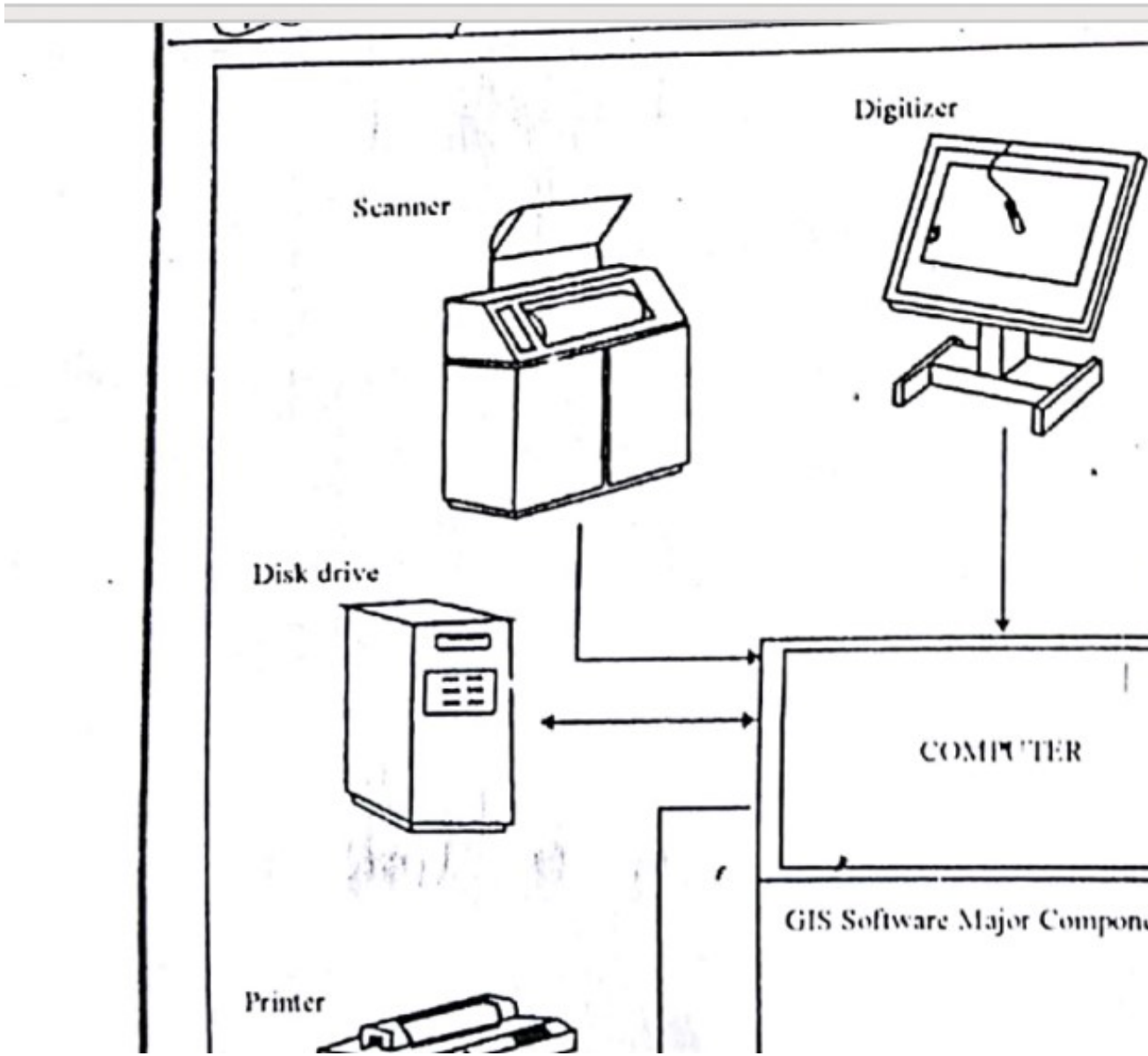
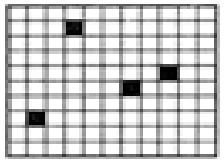
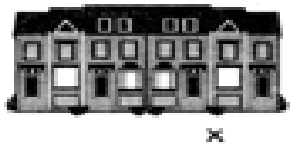
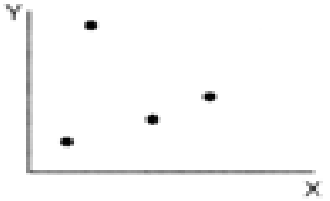
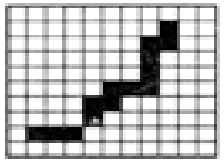
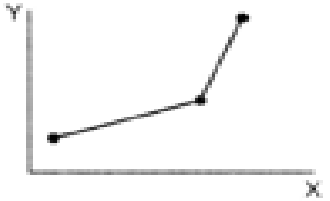
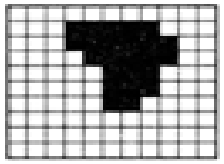
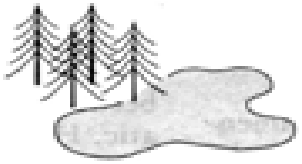
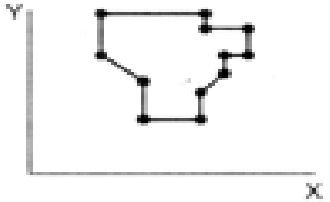
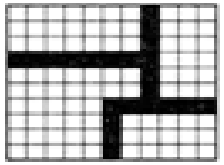
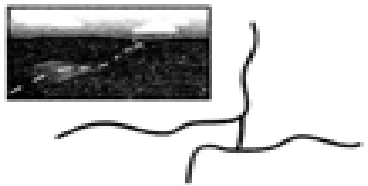
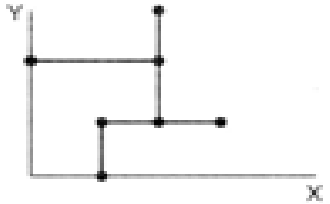
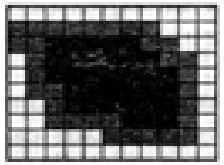
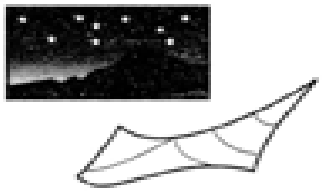
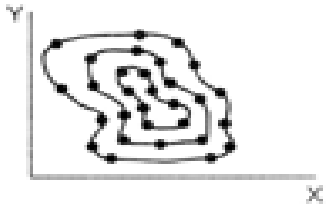
t_3
Land use/
Land cover
Ownership
Vegetation

ements of GIS:

1.Hardware
2. Software
3. Data
4. Live ware



Raster and vector spatial data models

The raster view of the world	Happy Valley spatial entities	The vector view of the world
	 Points: hotels	
	 Lines: ski lifts	
	 Areas: forest	
	 Network: roads	
	 Surface: elevation	

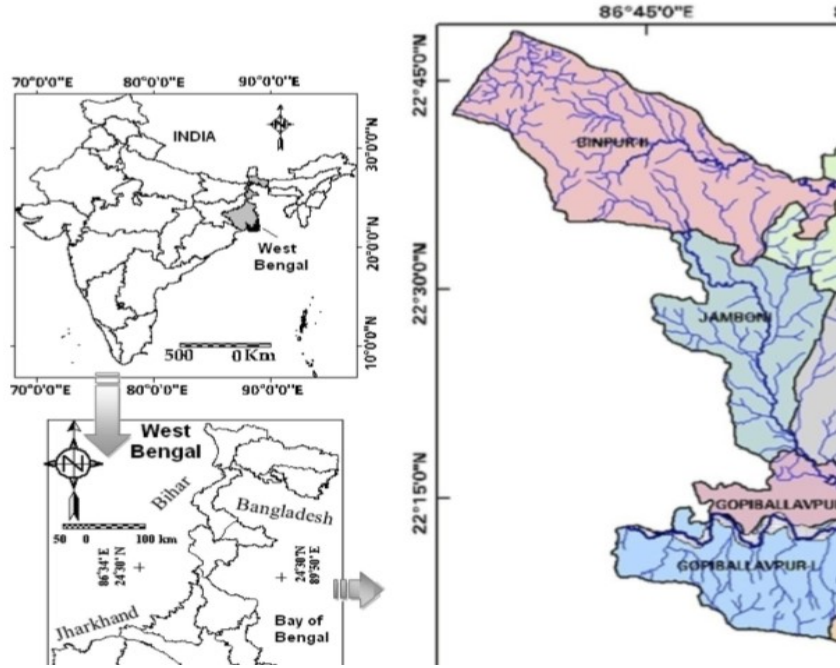
Function of GIS:

Data Sources	Maps: Aerial Photos, Satellite Images, GPS data, Field observation etc.
Data Input	Computer: Keyboards, Digitizers, Scanners etc.
Data Storage & Retrieval	Data storage in various file format like .tiff; img; .tnt ; .shp etc. and also retrieval and geometric and radiometric correction
Data Manipulation and Analysis	Data transformation, analysis in various statistics techniques and graphical representation.
Output	Soft copy or Hard copy

Application of GIS:

- **gricultural Applications**
- **oastal Development and Management**
- **isaster Management and Mitigation**
- **andslide Hazard Zonation using GIS**
- **etermine land use/land cover changes**
- **atural Resources Management**
- **ood damage estimation**
- **oil Mapping**
- **Vetland Mapping**
- **Tourism Information System**
- **Fisheries and Ocean Industries**
- **Reservoir Site Selection**
- **Deforestation**
- **Desertification**
- **Urban Planning**
- **Crime Analysis**
- **Regional Planning etc…..**

Case study-1: Soil erosion risk mapping



ellite data (Shit
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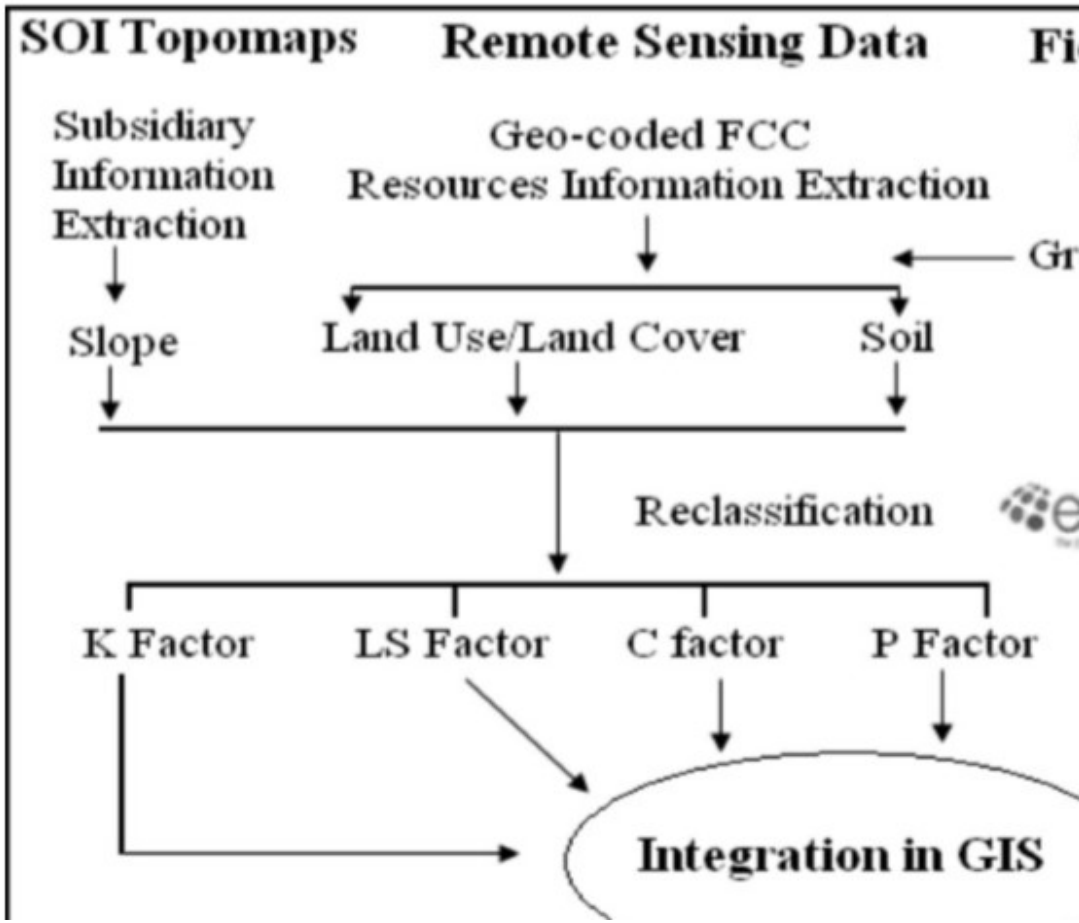
study area col-
Positioning Sys-
d shao 2002).

and cultivated land.

Soil Erosion Estimation Mode

The revised universal soil loss
(Eq. 1) was adopted to assess th
Renard et al. (1997).

$$A = R \times K \times L \times S \times C \times P$$



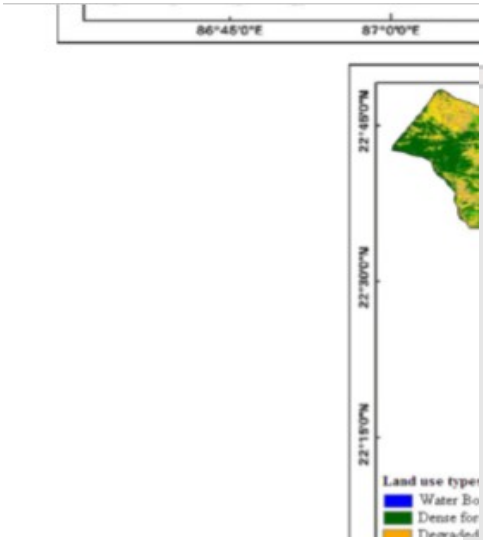
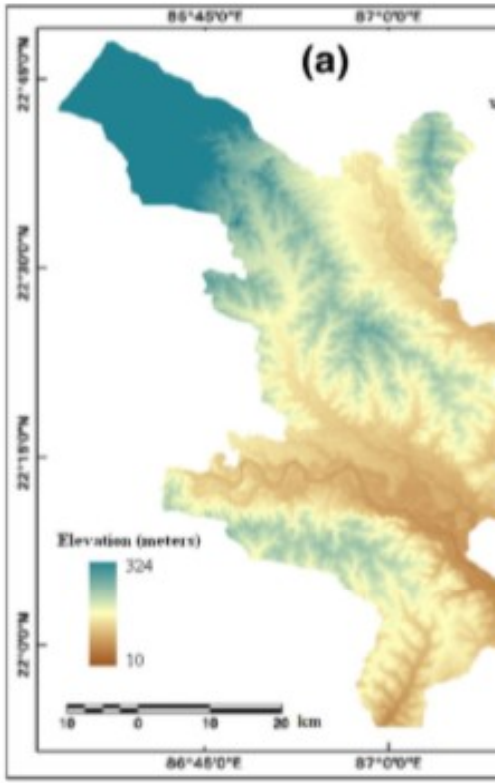
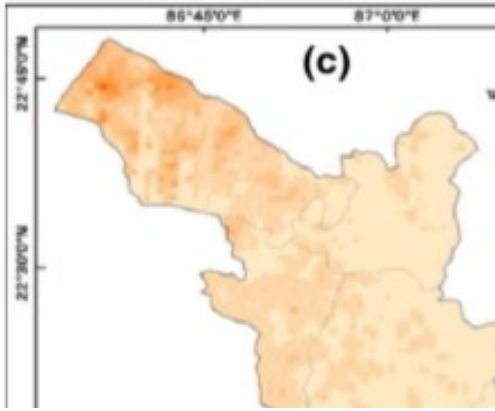


Fig. 3 Spatial distribution of factors of RUSLE model, **a** Digital elevation model (DEM); **b** K factor; **c** LS factor; **d** C factor; and **e** land use land cover (LULC)





ense forest, degraded forest, dry fallow land, agricultural fallow and c

oil Erosion Estimation Model

he revised universal soil loss equation (RUSLE) model (Eq. 1) was ad
rosion prescribed by Renard et al. (1997).

$$A = R \times K \times L \times S \times C \times P$$

here A is the soil loss in t ha^{-1} year^{-1}; K is the soil erodibility factor, R
rosivity factor; S is the slope steepness factor; L is the slope length fac
anagement factor; P is the conservation practices factor. The L, S, C a

Table 7 Average rate of soil loss of the study area

Erosion class	Rate of soil loss (ton ha^{-1} $year^{-1}$)	Area in hectare
Slight/low	<2.0	229,023.26
Moderate	2.1–5.0	44,135.03

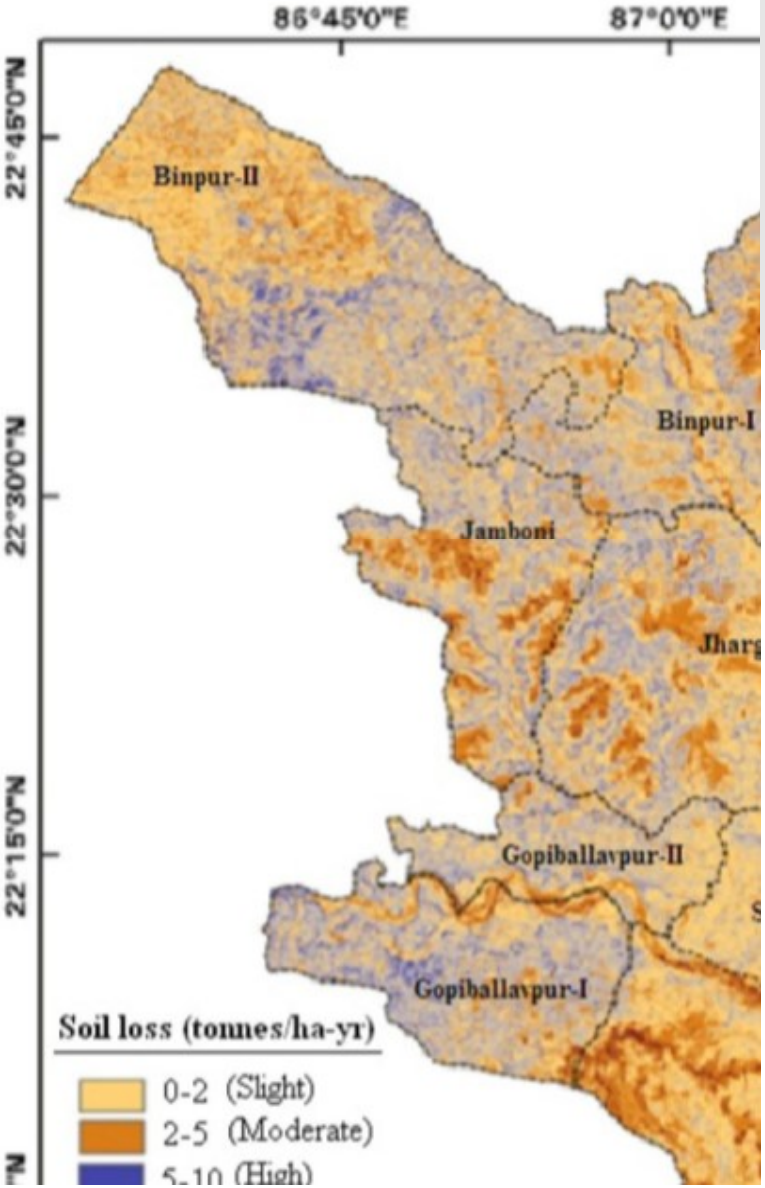
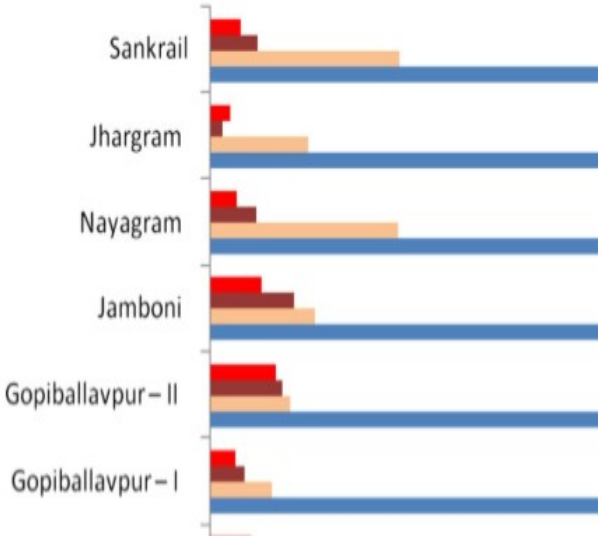


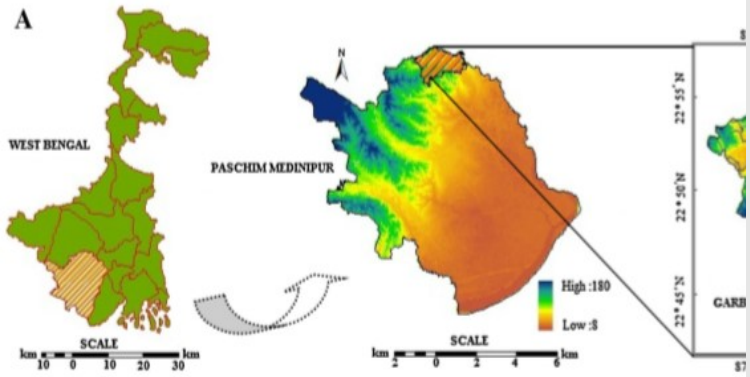
Fig. 4 Spatial distribution of soil erosion

erosion is observed i
documented from

Fig. 5 Block wise distribution of soil erosion risk

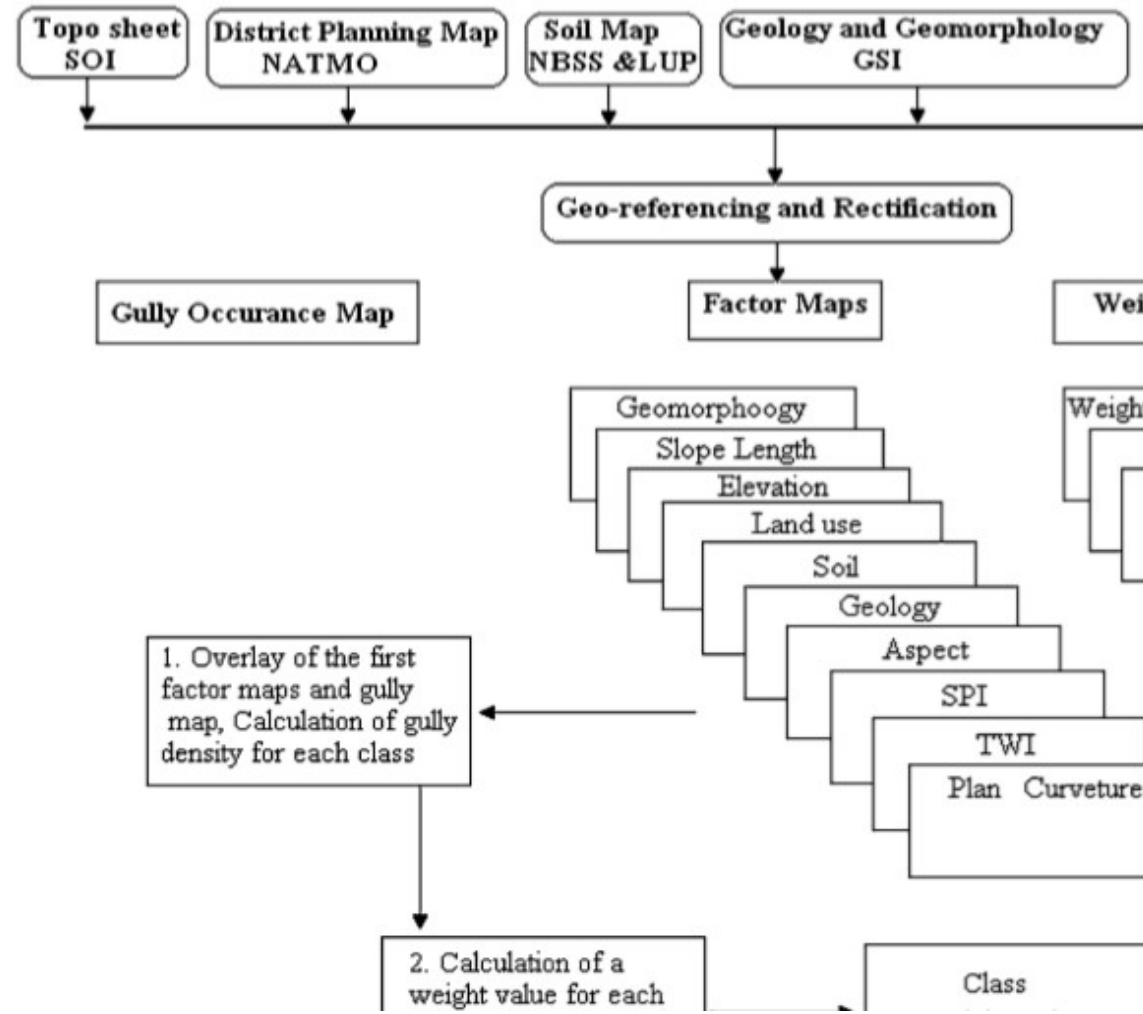


Case study-2: Gully erosion hazard using geo-spatial technology



B

Model. Earth Syst. Environ. (2015) 1:2



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parameter class was defined as th
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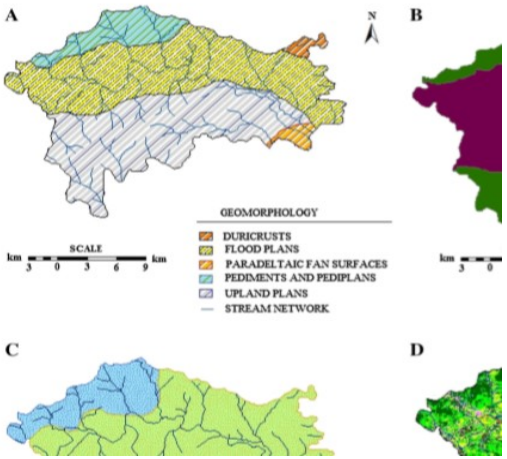
over the entire study area. In the p
for a parameter class was delineat
of the gullies density class divic
density over the entire study area
Westen 1993; Conforti et al. 201

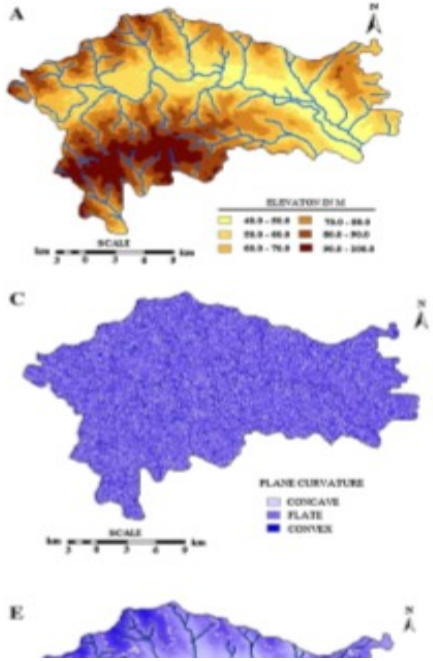
$$Wi = \ln \frac{DensClass}{DensMap} = \ln \frac{N_{pix}S_i}{\sum N_{pix}S_i}$$

in which Wi = weighting v
DensClass = density of the g
DensMap = density of the gullie

Table 1 Weighting value (Wi) distribution for each class of the selected gully occurrence

Factors	Sub-category	N_{pix}
Soil	Lateritic soil	247
	Older alluvial soil	159
Geomorphology	Upland plains	170
	Paradeltaic fan surfaces	
	Duricrusts	
	Pediments and pediplans	39
	Flood plains	183
Plane curvature	Concave	81
	Flat	241
	Convex	83
Geology	Unconsolidated sands, silts and clay	100
	Fine and medium sands	29
	Fragments of pebbles, boulder and gravels	276
Elevation (meters)	40.0–50.0	71
	50.0–60.0	67
	60.0–70.0	69
	70.0–80.0	63
	80.0–90.0	94
	90.0–100.0	39
Stream power index (SPI)	0.0–0.50	21
	0.50–1.00	32
	1.00–1.50	107
	1.50–2.00	202
	2.00–2.50	33
	2.50–3.00	
Slope of length (LS)	0.01–0.07	210
	0.07–0.81	64
	0.81–2.50	50
	2.50–5.00	41





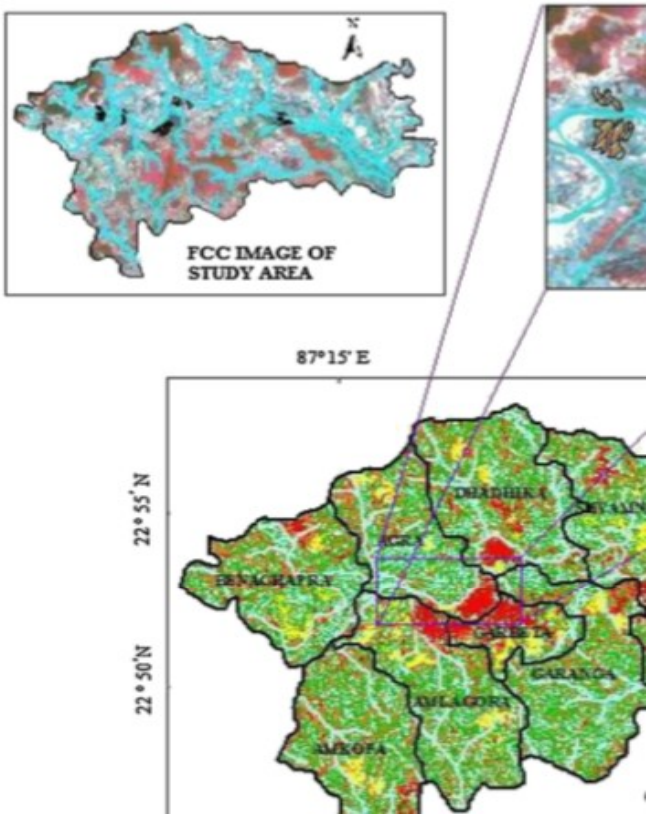
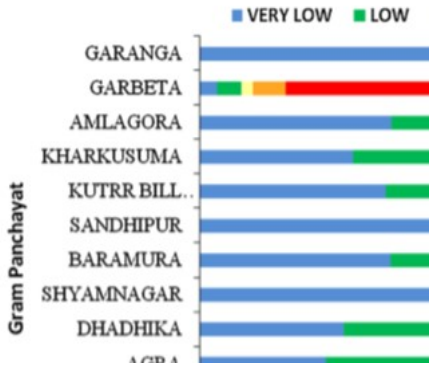
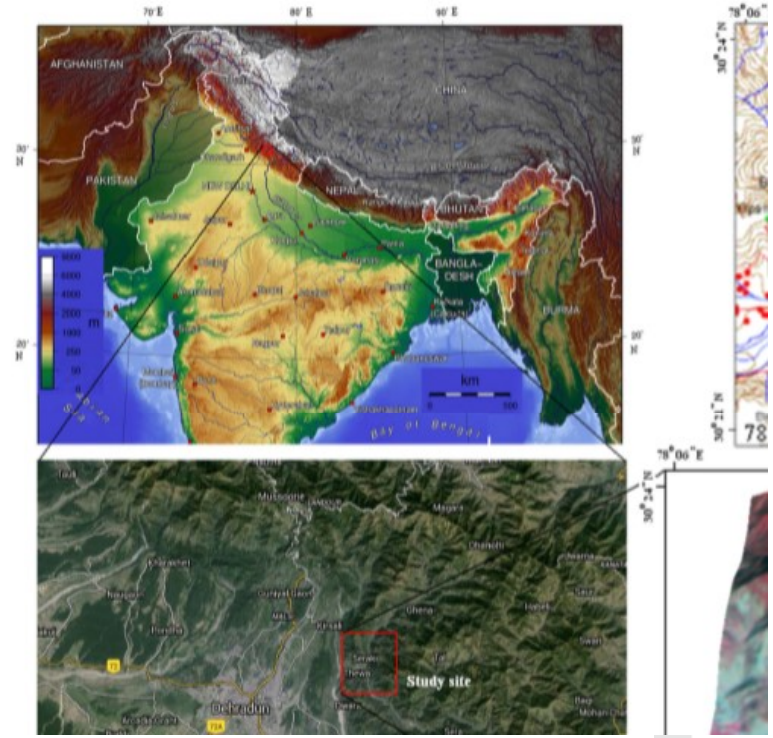


Fig. 6 Gram Panchayat (GP) wise spatial distribution of gully erosion



ase study-3: Landslide Risk mapping



Landslide inventory | Polygon coverage | IRS Resourcesat-1

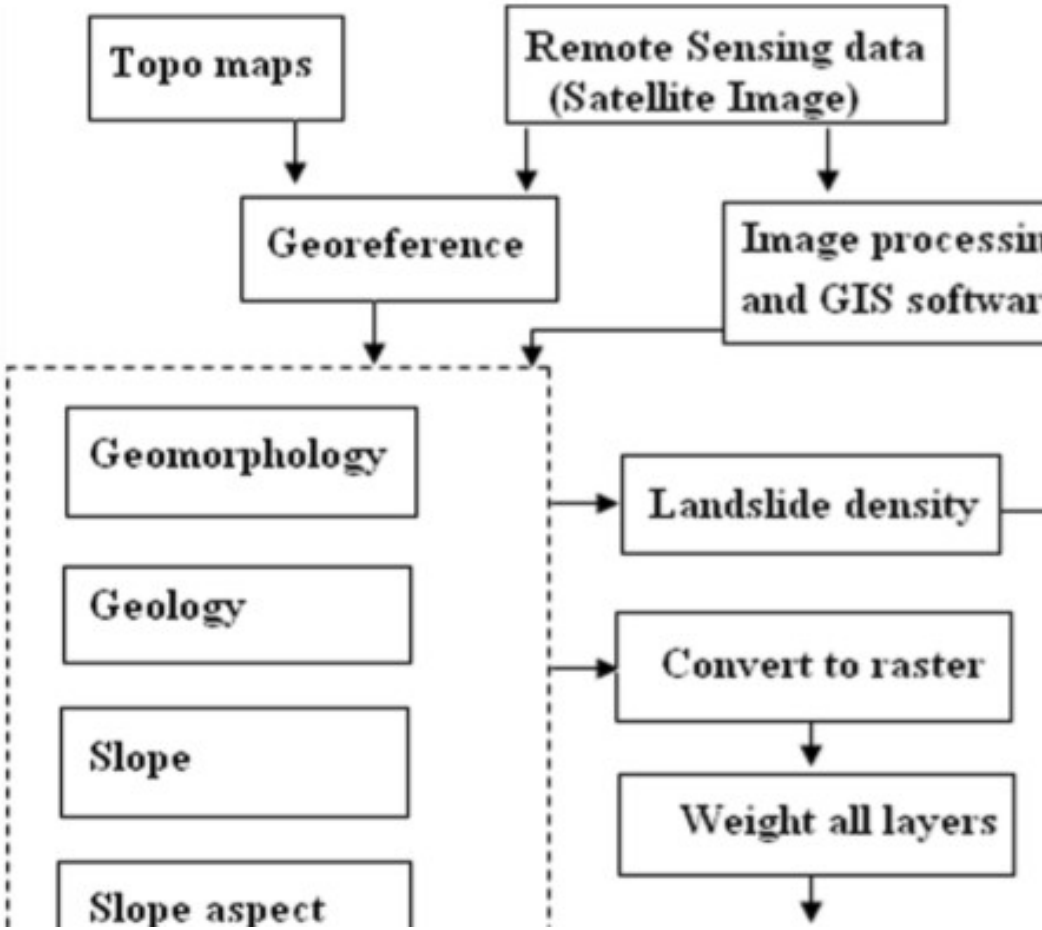
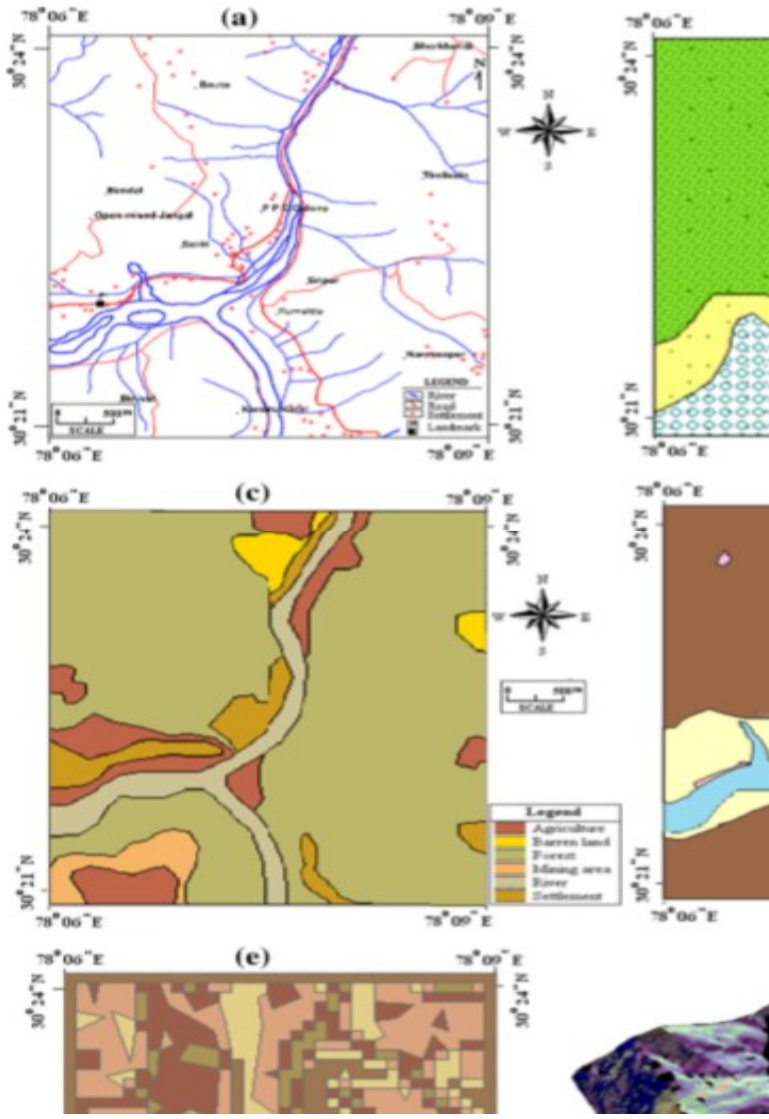
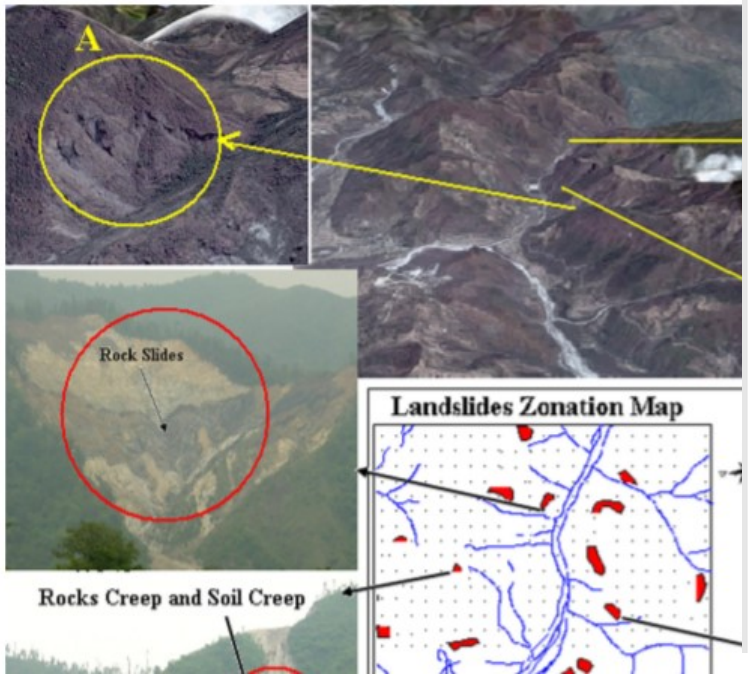


Table 2 Assignment of ranking and weig thematic layers

Parameter	Ranks	Category
Geomorphology	8.5	Structural Hi
		Flood plain
		Bank erosion
		Gully erosio
		River
		Scarp
Geology	9.3	Quartzite
		Sandstone (g
		Shale
		Slate
Slope	9.5	<10°
		10–20°
		20–30°
		30–40°
		>40°
Slope aspect	5	North-facing
		NE (22.5–67
		East-facing (
		SE (112.5–1
		South-facing
		SW-facing (
		West-facing



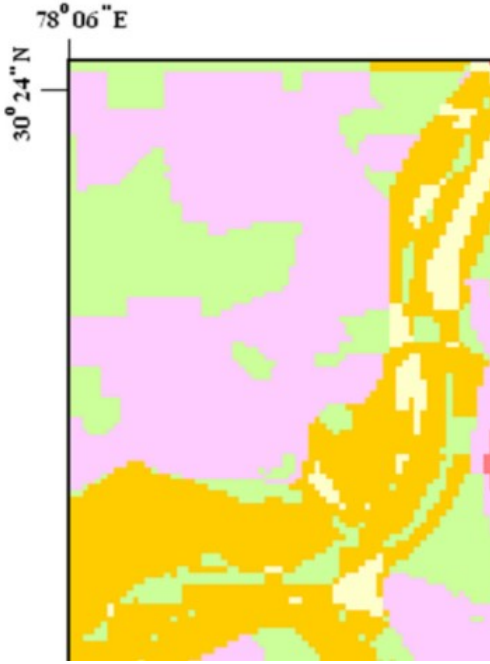


ig. 5 Landslide map of the study area

able 3 Percentage area of risk ones

Susceptibility class	Area (km^2)	Area percentage
Very low hazard zone	3.0	10
Low hazard zone	6.9	23
Medium hazard zone	7.5	25

Fig. 6 Landslide hazard zonation (LHZ) map



Thank You