Generation of a Coastal Flood Hazard Zonation Map of Midnapur-Balasore Coast in Eastern India using Integrated Remote Sensing and GIS Techniques

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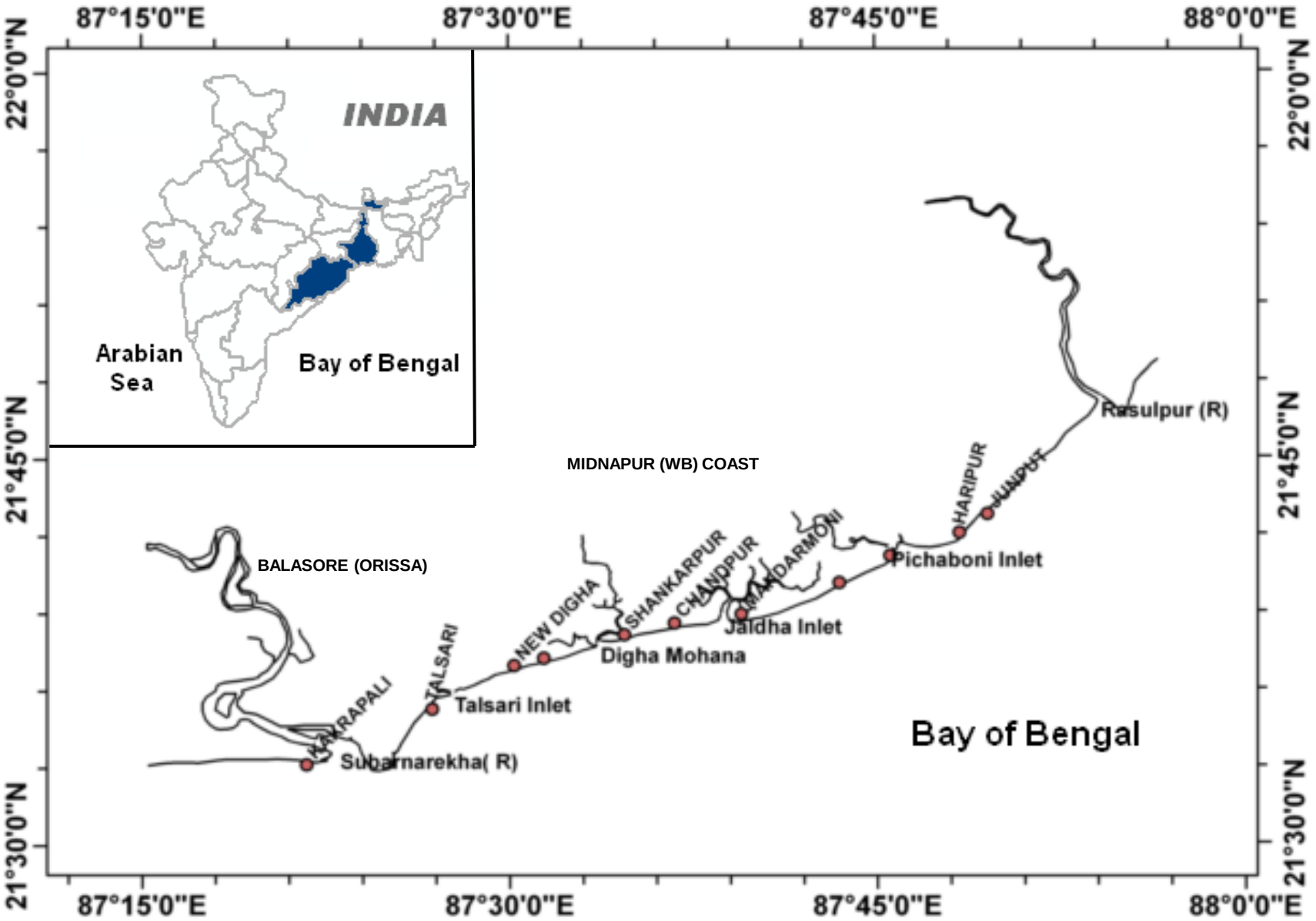


Location map of the study area

Objectives

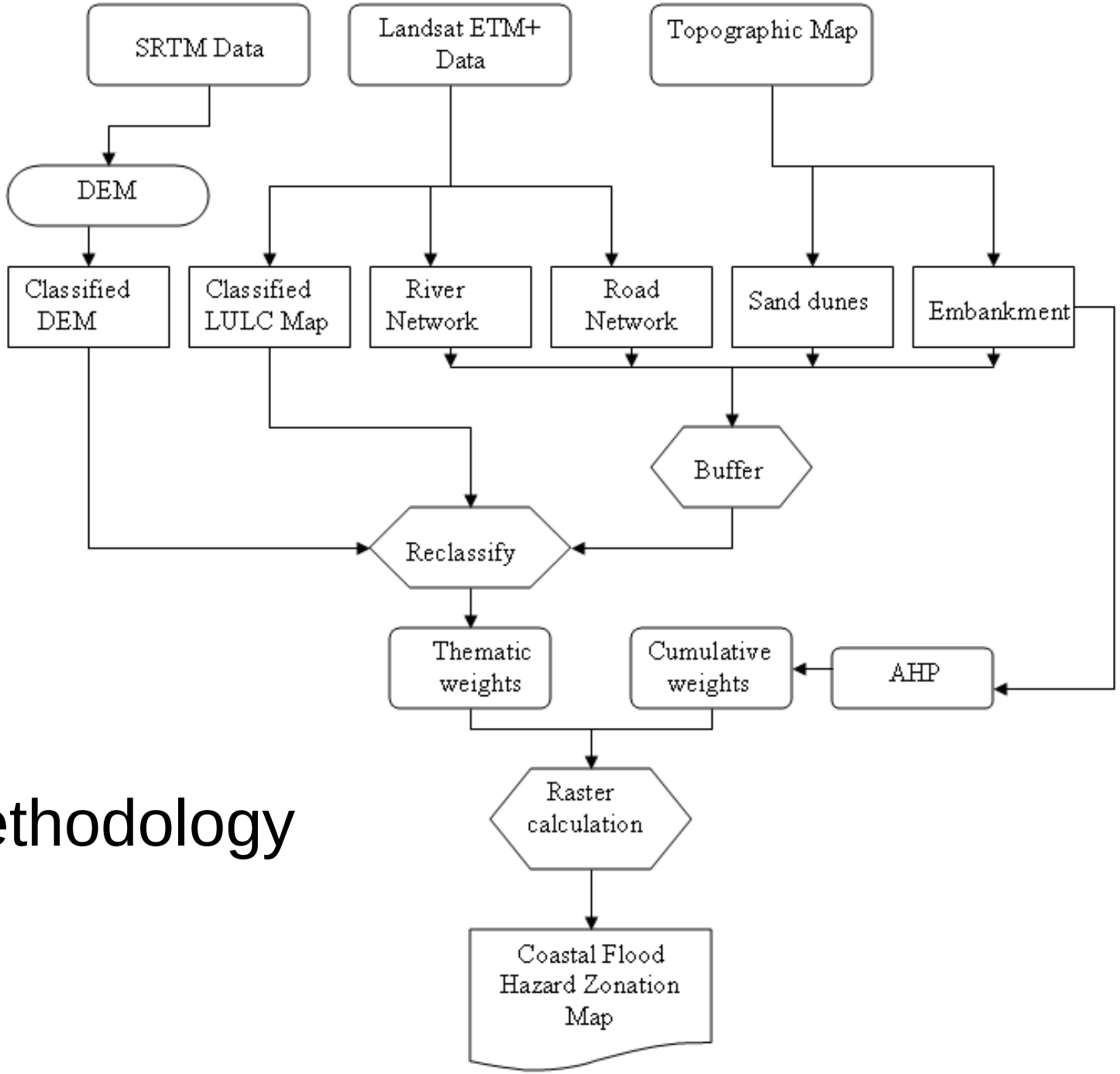
- To identify the causative and protective factors of coastal flood in the present study area.

- To prepare a coastal flood hazard zonation map of the present study area.

Data used

- Landsat ETM+ (Enhanced Thematic Mapper Plus) imagery of 29th October, 2002 (Path 139, Row 45)
- Topographic maps (scale 1: 50,000)
- SRTM (Shuttle Radar Topography Mission) data with 90m×90m resolution.

Methodology



Causative and Protective Factors

- Causative factors
  - River
  - Wetland
  - Road
  - Settlement
  - Mud flat
- Protective factors
  - DEM
  - Embankment
  - Vegetation
  - Sand dunes
  - Agricultural land
  - Fallow land

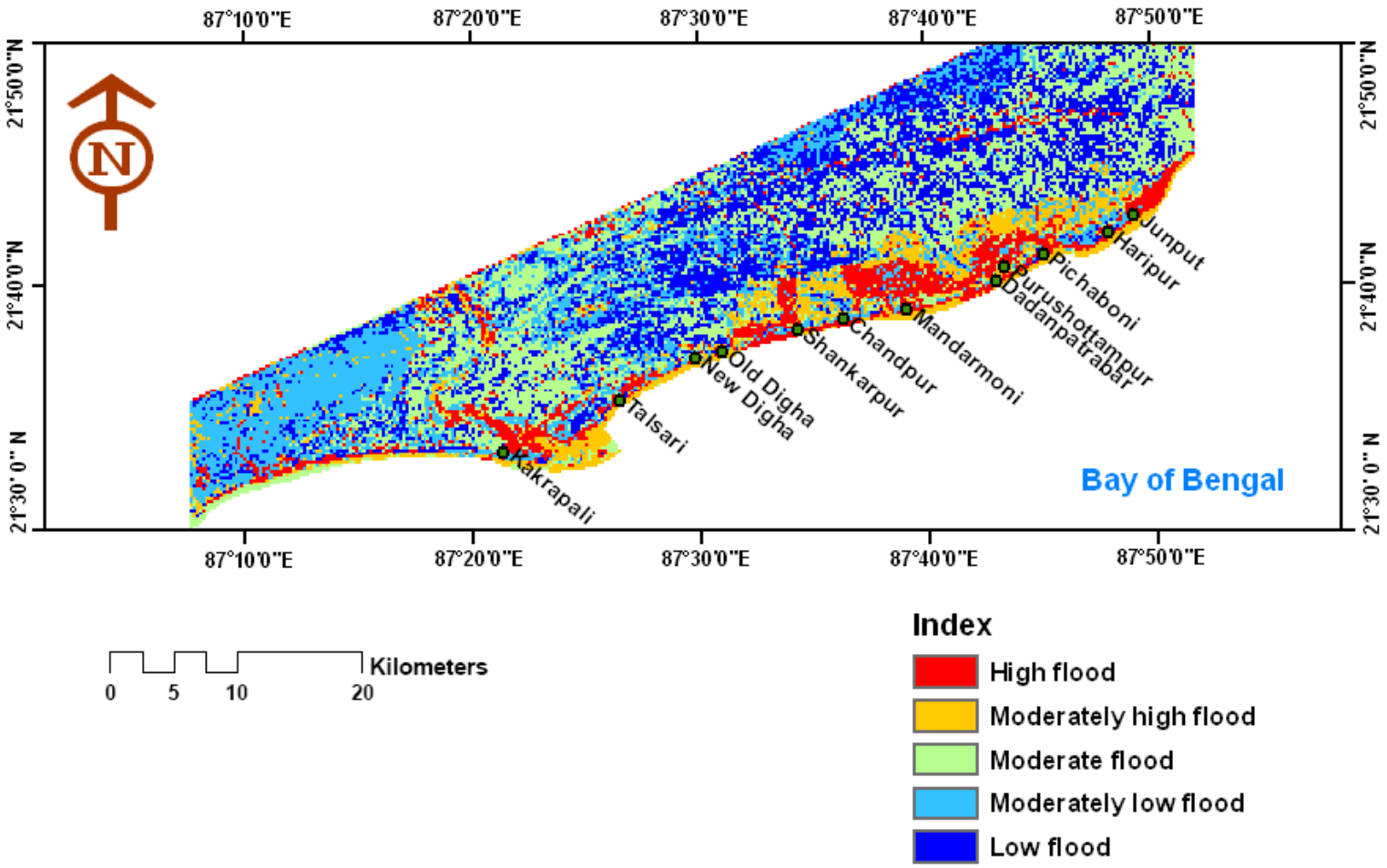
Pair-wise comparison matrix weights of the causative and protective factors

Factors	Settlement	Mudflat	Wetland	River network	Road network	Agricultural land	Vegetation	Embankment	DEM	Fallow land	Sand dune	Weights
Settlement	1											0.1130
Mudflat	2	1										0.0881
Wetland	3	5	1									0.1703
River network	5	5	3	1								0.2378
Road network	4	4	1/3	1/3	1							0.1376
Agricultural land	1/2	1/2	1/2	1/2	1/3	1						0.0377
Vegetation	1/3	1/3	1/3	1/3	1/4	1/3	1					0.0320
Embankment	1/5	1/4	1/4	1/5	1/5	5	3	1				0.0523
DEM	1/6	1/5	1/5	1/7	1/6	5	4	3	1			0.0590
Fallow land	1/3	1/2	1/2	1/2	2	1/5	1/3	1/5	1/6	1		0.0279
Sand dune	1/4	1/3	1/3	1/5	1/5	4	3	1/3	1/3	4	1	0.0442

Relative importance weightage (RIW) for different causative and protective factors

Landuse landcover	River network	Road network	DEM	Embankment	Sand dune
0.4690	0.2378	0.1376	0.0590	0.0523	0.0442

Coastal Flood Hazard Zonation Map of the study area



Accuracy assessment

(Based on comparison of the result of the study with the published record of Dartmouth Flood Observatory (DFO) map)

Class Name	Reference Totals	Classified Totals	Number Corrects	Producers Accuracy	Users Accuracy
High flood	4	1	1	25.00%	100.00%
Moderately high flood	2	8	2	100.00%	25.00%
Moderate flood	16	22	16	100.00%	72.73%
Moderate low flood	10	6	6	60.00%	100.00%
Low flood	6	1	1	16.67%	100.00%
Totals	38	38	26		

Results and Discussions

- **The resulted map has been qualitatively ranked into five categories, namely, high, moderately high, moderate, moderately low, and low flood hazard zone.**
- **The results show that several places, viz., around Subarnarekha River, and inlets and marshy areas around Digha, Shankarpur, Mandarmoni, Purushottampur and Haripur, fall on 'high' flood hazard zones occurring over 7.98 % of the total study area**
- **The 'moderately high' hazard zones are near the high hazard zones, predominantly adjacent to the embankments (25.77%).**
- **'Moderate' flood hazard zones are the flood plains of Subarnarekha River and Rasulpur River, and other lowland areas of inter-dunal spaces (32.62%).**
- **The 'moderately low' hazard zones cover the areas of inter-chenier depressions and west of Subarnarekha River (25.25%).**
- **The 'low' hazard zone is the middle part of the study area which are mainly covered by the elevated Chenier plains (8.38 %).**
- **Comparing with the yearly flood inundation maps from Dartmouth, the potentiality of the adopted technique has been proved in the present study.**
- **An accuracy value of 68.42 % and overall 'kappa statistics' value 0.5467 have been obtained after comparison of the result of the study with the published record of Dartmouth Flood Observatory (DFO) map.**

Conclusions

- **The present study represents a simple and cost effective way to use Remote Sensing and Geographical Information System (GIS) for creating a flood hazard zonation map.**
- **Some man made constructions (Groins, Revetments, Jetties, Bulkheads sea walls) are needed to protect the coast against damage by wave action. If no action is taken to protect the land, this area will be affected by high tidal wave. The analysis shows that urbanization within Digha and the surrounding areas have significant hazard potentiality.**
- **Results of the study can be improved by considering some other causative factors, such as, cyclone track, daily rainfall, hydrograph, river and stream gradient within the watershed, soil type in watershed, daily discharge data etc. These have been excluded due to unavailability of these data.**
- **The flood hazard and land development maps in digital form can be used as a database, which can be shared among the various government and non-government agencies, responsible for the construction and development of flood protection measures.**